Customized Energy Solutions

City of Naperville

Energy Procurement Options

March 2025

Customized Energy Solutions

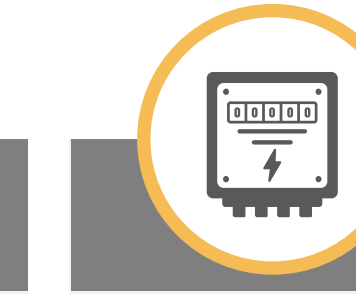
Established in 1998, Customized Energy Solutions (CES) is a global energy advisory, software and services company that works with clients to navigate the wholesale and retail electricity markets across the United States and globally. CES offers software solutions, back office operational support, advisory and consulting services focused on emerging technologies, asset optimization and wholesale energy market participation. CES is headquartered in Philadelphia, USA with other global offices in India, Japan, Vietnam.

Wholesale Services

Our 24-hour Market Operations Center provides full- service scheduling coordinator and asset monitoring services to over 25 GW of assets across wholesale markets

Market Intelligence

Our flagship informational product MarketIQ provides crucial analysis of wholesale market rules changes & stakeholder activities in a timely and cost- effective manner



Retail Services

Our hosted platforms provide specialized services for market entry, registration, EDI data management, billing, forecasting and scheduling and reduce bill-to-cash cycle

Demand Response

Our services support clients with demand response, peak load management, and bidding for energy and capacity in major ISOs/RTOs in North America

Consulting

Our consulting services help clients understand complex market rules, forecast project revenues and optimize investments in energy storage, e-mobility, and clean hydrogen projects

6 Global Offices | 350+ Associates | 1000+ Global Clients | Best-in-Class Software | 24x7 Market Operations | Consulting & Advisory

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CES Consulting

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CES Consulting is focused on providing industry leading advisory and services for the three pillars of energy transition
Energy Storage, E-Mobility and Green Hydrogen
We have an integrated ecosystem spanning market intelligence, policy expertise, modeling and optimization software platforms, technical capabilities and market operations to provide spectrum-wide consulting services to our clients

Market Overviews, Rules and detailed intelligence from across all North American ISO/RTO regions to help clients navigate through competitive markets

Power Market Fundamentals, Research, Production Cost Modeling, Market Price Forecasts, Asset Dispatch Optimization using CES CoMETS

Financial Modeling, Project Valuation, Technical and Commercial Due Diligence and Bid support services to help clients compete in solicitations

Market Research, Assessment, Value Chain Analysis, Business Planning, Strategy Consulting, Collaborations, Expert Advisory and Partnerships

Technical Due Diligence, Testing, Performance Validation, Expert Recommendations for battery cells, packs and associated systems

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Naperville Electric Utility Mission Statement

- Supply the residents and businesses of Naperville with **consistent** and **cost-effective** power source to meet the community's power needs while exploring more sustainable energy sources.

- Why now?
  - Advancing towards the State's CEJA
  - IMEA requested a decision by April 30, 2025 to manage existing and future contracts
  - All alternative options would require 5-10 years of preparation, including staffing, PJM market entry, contracting with resources, or building new resources.

To Be Part of a JAA, or Not to Be (Part of a JAA), That Is the Question.

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More autonomy, more risk

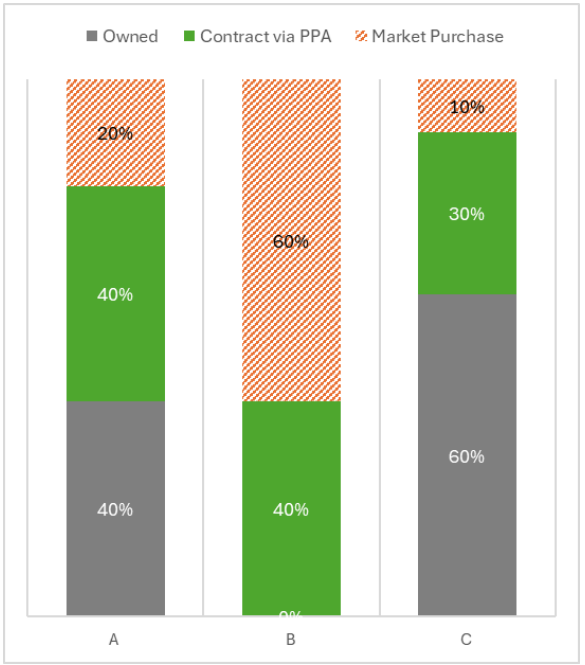
Outside of a Joint Action Agency

Naperville will determine its own energy supply from the following mix and **will need staff of different skillsets** to execute each.

Market Purchase with PJM
The wholesale market is flexible and the energy is ready when demanded. But the market price fluctuates, making rate unstable.

Contracted, e.g. Power Purchase Agreements
Prices are stable throughout the contracted years, but need to manage both contracting and execution of the projects.

Owned, e.g. city-owned generation
Prices are stable if fuel and operational risks are well managed, but the need to manage ownership and operation of the assets.



Less autonomy, less risk

Part of a Joint Action Agency

Naperville outsources energy procurement and participates in discussion of resource procurement but does not have sole autonomy.
The three options are mutually exclusive.

- Stay with IMEA
- Join a different JAA
- Start a new JAA

No autonomy, maybe more risk?

Sell the Utility to ComEd

The sale of the utility to an investor-owned or private entity was not exhaustively researched by CES and is not explicitly covered in this presentation. It is expected that costs would go up similar to the ComEd bill shown later in the presentation and Naperville would give up all control over future rates and service levels.

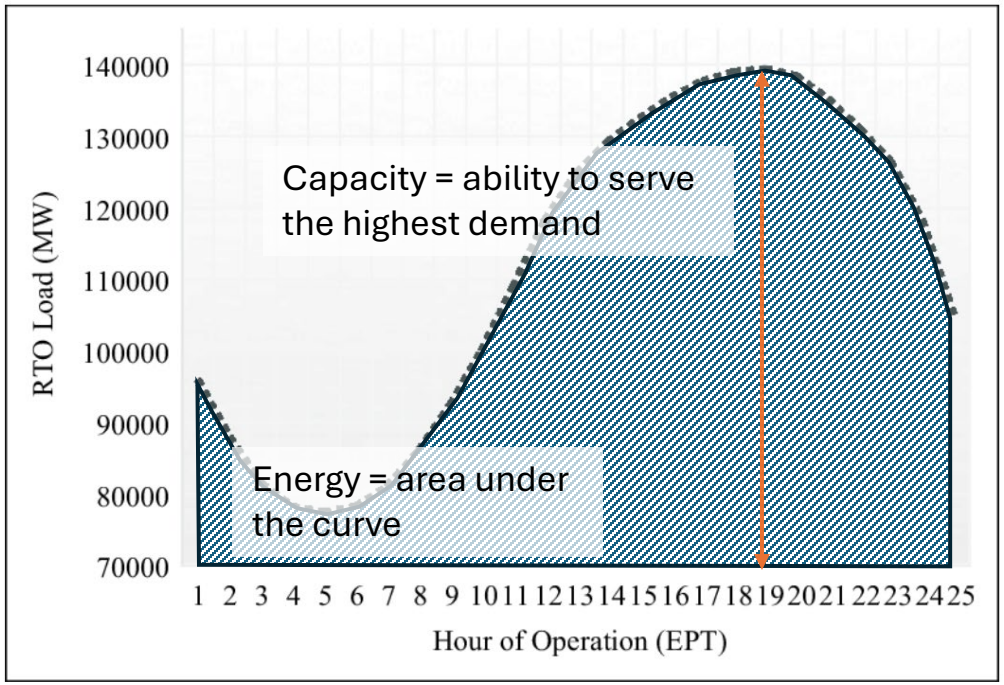
Primer Knowledge: Energy versus Capacity

A utility needs both energy and capacity to serve load customers.

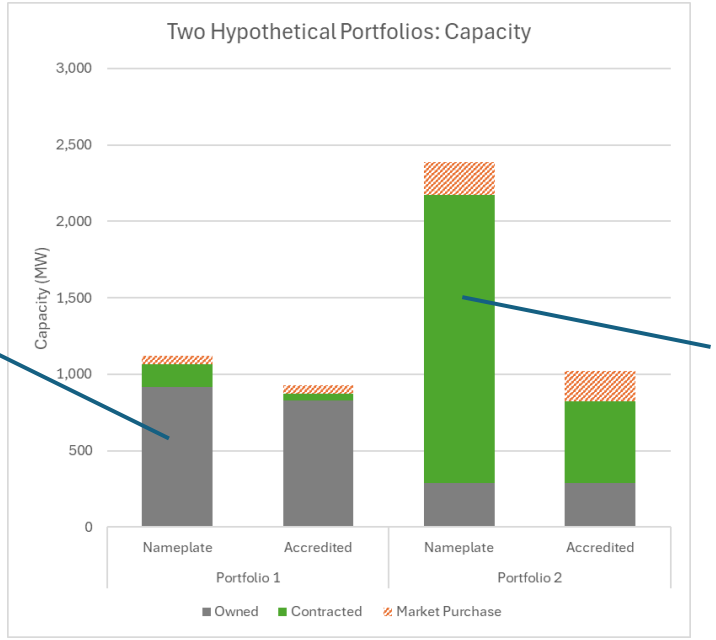
- Energy, in MWh or kWh, flows through the wires to meet customers' electricity needs.
- Capacity, in MW or kW, ensures that electricity is there whenever a customer needs it. Capacity is a reserve in case many customers decide to turn on their lights at the same time.

A generator can provide both energy and capacity, but different types of generators have different abilities to provide energy and capacity. For example,

- A gas power plant can ramp up or down to follow the load, providing energy unless it is unavailable. It can also be turned on or ramped up to meet peak demands (Hr 19) and therefore has a high value in providing capacity.
- A solar power plant can not ramp up or down to follow the load but still provide energy when the sun is shining. When the load is at peak, the solar plant is unlikely to be available, therefore has a low value in providing capacity.



Portfolio 1 has much more fossil-fueled generation with high values in capacity



Portfolio 2 has much more renewable generation with low values in capacity

Source: Burnett, J., Zhao, X., Spatially Explicit Prediction of Wholesale Electricity Prices, retrieved from Research Gate, CES analysis

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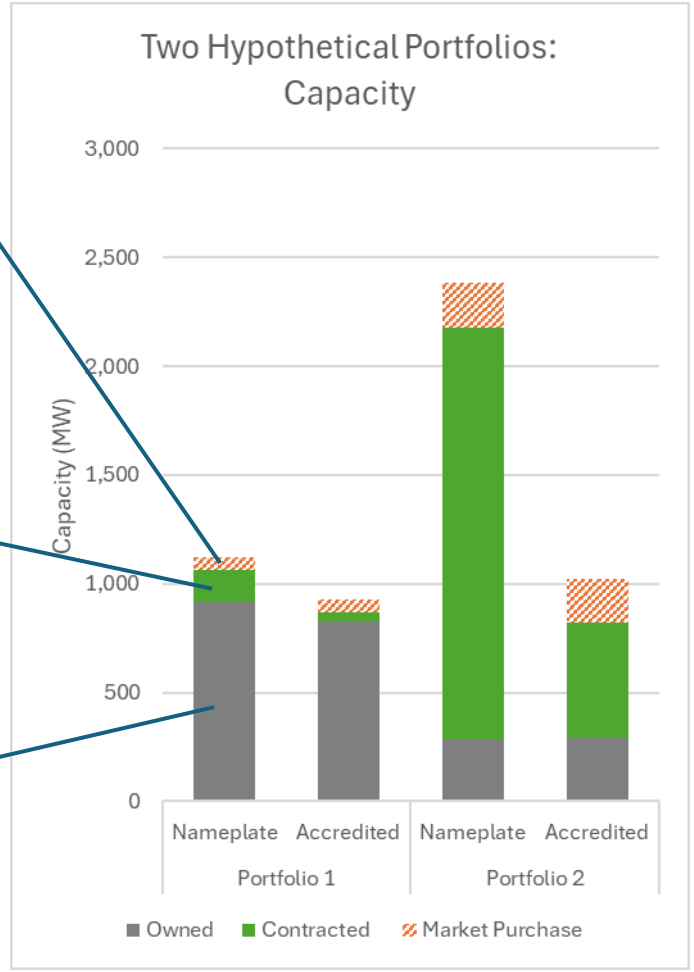
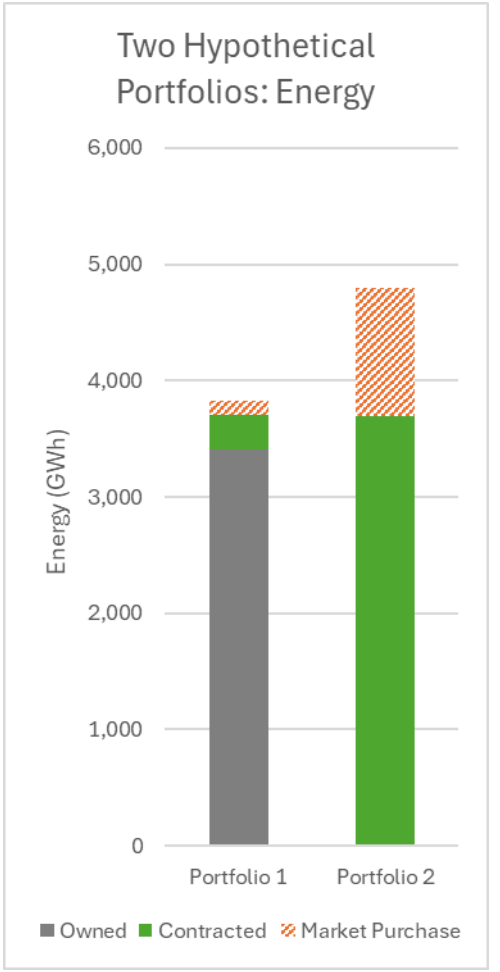
Outside of a JAA: Options for Utilities to Serve Loads

Market Purchase, e.g. PJM
Pros: flexible; ready when demanded.
Cons: market fluctuates; prices are unstable.

Contracted, e.g. Power Purchase Agreements
Pros: stable prices throughout the contracted years. The buyer chooses what types of resources to contract with.
Cons: competition with other buyers may drive up prices. Risk of project delivery and operation.

Owned, e.g. city-owned generation
Pros: stable prices if fuel and operational risks are well managed. The buyer can choose what types of resources to own, but resources are also often legacy.
Cons: risk of project operation lies with the utility; utility may therefore be less willing to own newer technologies.





The various types of generation in each portfolio result in various capacity and energy attributes. The utility makes procurement decisions to fulfill both the energy and capacity needs based on load certainty, state policy goals, customer preferences, but ultimately strives to achieve a stable and reasonable electricity rate of its customers.

Market Purchase from PJM

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Market Purchase - Summary

- One way for Naperville to supply its energy and capacity needs are through the **purchase of power through the PJM Wholesale Markets.**
- To become a market participant in the PJM Wholesale Markets, Naperville must:
  - Assume additional **personnel as well as a financial obligation**
  - Execute several agreements and forms required to participate in the market
- As a market participant, Naperville will be responsible for the functions currently being executed by IMEA, including:
  - Market scheduling functions
  - Long term planning
  - Regulatory compliance
  - Energy Efficiency program management
- As a market participant, Naperville will be responsible for several operational costs including **energy procurement, capacity costs, and ancillary services**
  - The pricing of these services will be dependent on the clearing prices in the market and will impact the rate that consumers will see on their bill. As an example, residential bill can vary from -11% to +22%, corresponding to 0.5x – 1.5x of current prevailing energy prices, in addition to the upfront cost to set up as a market participant.
  - PJM is currently seeing high volatility in the capacity market, which Naperville will be subject to as a market participant. As an example, residential bill can vary from -10% to +14%, corresponding to $30 - $300/MW-Day on capacity prices. There are some options to reduce this risk, but they are limited.
- If Naperville elects to procure energy and capacity from the PJM Wholesale Market, they will have **more visibility to the market but will be exposed to fluctuations in clearing price** which will lead to less stable rates for the consumer.

Naperville Becoming a PJM Market Participant, or a Load Serving Entity

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To transact with PJM, Naperville needs to set up as a PJM Load Serving Entity (LSE). Here are high-level steps and specific requirements:

- **Membership Application:** Naperville must apply for PJM membership. This involves submitting a written application to the President of PJM, detailing their qualifications and agreeing to supply necessary data and information.
- **Membership Requirements:** Naperville must qualify as one of the PJM categories: Transmission Owner, **Generation Owner**, Other Supplier, **Electric Distributor**, or End-Use Customer. They must also accept the obligations set forth in the PJM Operating Agreement and cure any defaults, including paying outstanding obligations.
- **Reliability Assurance Agreement:** As a Load Serving Entity, Naperville must execute the Reliability Assurance Agreement to ensure they will coordinate planning and sharing of Capacity Resources, assisting other LSEs during emergencies, etc. the reliability standards set by PJM.
- **Network Transmission Service:** Naperville must have arrangements in place for Network Transmission Service or Point-To-Point Transmission Service for all PJM Interchange Energy (via ComEd).
- **Economic Load Response Participation:** If Naperville intends to participate in the PJM Interchange Energy Market or Ancillary Services Market, they must complete the necessary registration forms and comply with the requirements of the applicable regulatory authorities. The participation means that Naperville will reduce load via various technologies to respond to PJM wholesale market price signals.

  Potential: Demand Response within Naperville can be used to offset capacity obligation and providing wholesale services. Naperville needs to differentiate between the two. Limited upside in the wholesale market based on offer price.

- **Credit Requirement:** The key requirement is to have either a minimum tangible net worth of $1 million or tangible assets worth $10 million. This means one can meet the requirement through assets rather than just cash. PJM's credit policy allows for various forms of financial security, including cash, letters of credit, and other liquid assets. This flexibility helps ensure that participants can meet the necessary creditworthiness standards without needing to rely solely on cash. There is inherent financial risk in participating in a market construct.

These steps ensure that Naperville can effectively serve load within the PJM region while maintaining compliance with PJM's standards and regulations.

Naperville's Operational Costs as a PJM Load Serving Entities

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Operational costs for a PJM Load Serving Entity (LSE) include several key components:

- **Energy Procurement:** LSEs need to purchase energy to meet their customers' demand. This involves participating in PJM's day-ahead and real-time energy markets, where prices can fluctuate based on supply and demand.
- **Capacity Costs:** LSEs must secure capacity to ensure they can meet peak demand. This is typically done through PJM's capacity market, where LSEs pay for capacity commitments obtained through auctions.
- **Ancillary Services:** These are services necessary to support the transmission of electricity while maintaining reliable operation of the grid. LSEs must procure ancillary services such as frequency regulation, spinning reserves, and voltage support.
- **Congestion and Losses:** LSEs incur costs due to congestion on the transmission network and energy losses during transmission. These costs are managed through Financial Transmission Rights (FTRs) and Auction Revenue Rights (ARRs), which help hedge against congestion costs.
- **Administrative and Compliance Costs:** LSEs must comply with PJM's operational and regulatory requirements, which involve administrative expenses, reporting, and compliance activities.
- **Metering and Settlement:** Accurate metering and settlement processes are essential for tracking energy usage and ensuring proper billing. This includes costs for metering infrastructure, data management, and settlement services.

These operational costs ensure that the LSE can reliably serve its load while maintaining compliance with PJM's standards and regulations.

Current Functions Performed by IMEA (35 FTE)

The functions below are grouped by how they can be outsourced to different parties if Naperville were to take on these tasks. If outsourcing, Naperville staff is also needed to manage such activities.

Market Scheduling Functions (e.g. CES, or 3-5 FTE if internal to Naperville)	Longer-Term Planning (Naperville in-house, can outsource PPA procurement, 4-7 FTE)	Regulatory Compliance (compliance firms)	Energy Efficiency Program Management (e.g. EE provider)
• Securing capacity as required by PJM. • Securing ancillary services as required by PJM. • Load Scheduling and adjustments 24x7 x365 • Generation Scheduling and adjustments 24x7x365. Including PURPA Qualifying Facilities wi thin the City of Naperville. • Transmission usage and charges • Short-term load forecasting • Ancillary Services Scheduling and Compliance • Settlement and Billing • Load Shed Response • Actions in the Day Ahead and Real Time markets • Demand response opportunity identificat ion (market based and cost based) • Perform required reporting to authorities within the region, ComEd, FERC, etc. • Including all metering and telemetry values required for billing and settlements. • Representation and documentation support for all required audits.	• Long-term load forecasting • Forecasting and other market planning functions • Securing energy supply, negotiating terms, and managing the energy supply portfolio of the City of Naperville for a firm service level without interruptions for all hours of all days in the year. • Drafting, negotiating and enforcing of power supply contracts for all resource types including renewable and emerging technologies.	• Compliance with all rules and regulations. • PURPA Advice and Regulatory Review • Advice and assistance in electric utility policy creation that is in compliance with all applicable rules and laws. • Legal representation with advanced knowledge of electric industry including power supply, transmission, transmission rate formulas and wholesale distribution in PJM interconnection and before FERC. • Continual monitoring and participation in stakeholder process at PJM, FERC, NERC, Illinois General Assembly, US Congress, state regulatory agencies, etc. • Familiarity with and advise on compliance with NERC and Reliability First Corporation reliability standards and compliance with same standards. Monitoring of both entities for new standards. • Monitoring of and advocacy before FERC on filings by various providers regarding rate changes, formula rates and market rules.	• Design and administer rate-based Electric Energy Efficiency Programs, e.g. Thermostats, LED lighting, HVAC, Refrigeration.

If Naperville Buys All Energy Directly from PJM

The table below compares ComEd's current residential electricity rate (pink) to Naperville's (blue). The monthly bill is based on average household energy use of 844kWh. CES then estimated the monthly bill if Naperville purchase all energy directly from PJM (green) using our retail pricing model.

- Energy efficiency program charge is added because it is currently an IMEA function.
- RPS charge comparable to ComEd based on IPA purchases. IPA's current RE penetration is 6% compared with IMEA's 11%.

ComEd Residential			Naperville Residential			If Naperville buys from PJM			
Line Items	Fixed or $/kWh	Monthly Bill	Line Items	Fixed or $/kWh	Monthly Bill	Line Items	Fixed or $/kWh	Monthly Bill	% from current Naperville bill
Monthly Customer Charge	$12.97	$13.18	Monthly Customer Charge	$19.27	$19.27	Monthly Customer Charge	$19.27	$19.27	
Metering Charge	$3.52000	$3.52	kWh Charge	$0.11392	$96.15				
Distribution Facilities Charge	$0.04994	$42.15	Purchase Power Adjustment 01/2025	$0.00623	$5.26	Distribution Facilities Charge	$0.02792	$23.56	
Illinois Electricity Distribution Tax Charge	$0.00124	$1.05				Illinois Electricity Distribution Tax Charge	$0.00000	$0.00	
Transmission Services Charge	$0.01526	$12.88				Bundled rate including energy supply and all PJM transmission charges	$0.09174	$77.42	
PEA (PPA) 01/2025	**($0.00542)**	($4.57)							
Electricity Supply Charge	$0.05092	$42.98							
Energy Efficiency Programs	$0.00366	$3.09				Energy Efficiency Programs	$0.00366	$3.09	
Renewable Portfolio Standard	$0.00502	$4.24				Renewable Portfolio Standard	$0.00502	$4.24	
Environmental Cost Recovery Adjustment	$0.00033	$0.28				Environmental Cost Recovery Adjustment		$0.00	
Zero Emission Standard	$0.00880	$7.43				Zero Emission Standard		$0.00	
Carbon free resource adjustment	$0.00880	$7.43				Carbon free resource adjustment		$0.00	
Transition Assistance Charge	$0.00072	$0.61				Transition Assistance Charge		$0.00	
Total		**$133.64**			**$120.68**	**Total**		**$127.58**	**5.7%**

Do not include upfront cost in the previous slide

Based on existing IMEA Schedule B rate
Power Supply Charge: $9.50/kW
Delivery Service Charge: $7.48/kW
Energy Charge: $0.035/kWh

Residential class rate from CES retail pricing model run in early Feb. 2025 for 24 months based on Naperville's actual 2023 loads by classes.

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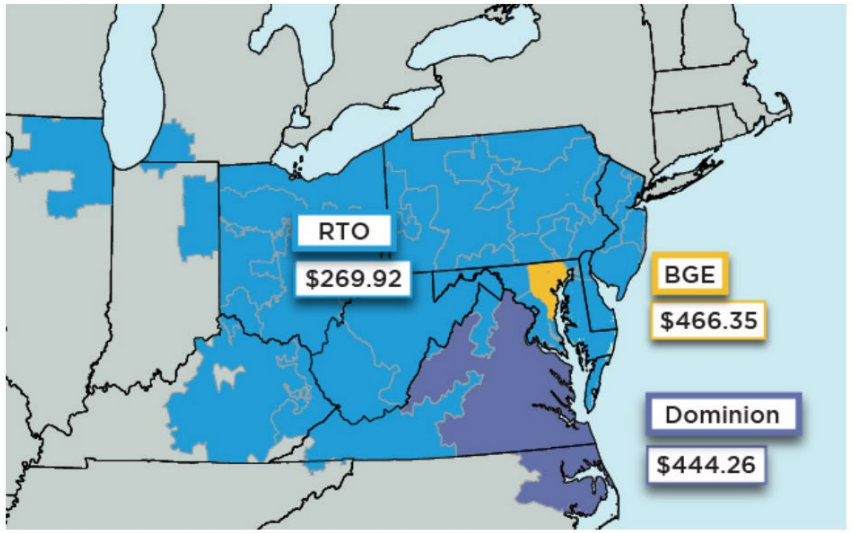
PJM Capacity Price Fluctuations Would Impact Procurement Cost

- On 7/30/24, PJM released the auction results for the 2025/26 Base Residual Auction (BRA), which showed clearing prices that far exceeded those seen in 2024/25, with the highest Rest of RTO pricing ever at $269.92.
- PJM attributed the change in pricing to the following factors.
  - Increased Load – there was a 3,243 MW increase in forecasted load.
  - IRM Increase – The Installed Reserve Margin (IRM) increased from 14.7% to 17.8%.
  - Retirements – There was a significant number of MWs that retired or removed themselves from being capacity resources.
  - CIFP Changes – There were a number of changes resulting from the Critical Issue Fast Path (CIFP) – Resource Adequacy (RA) process
  - Dominion FRR – Dominion Energy reentered the Capacity Market for 25/26, which added capacity demand and generation resources to the market.
  - CONE – Net CONE values used to determine the VRR Curve changed significantly in some LDAs.
- There are several pending & recently approved reforms that may add additional uncertainty to future pricing:
  - Tariff revisions which would count qualified RMR resources in the capacity supply stack (FERC approved)
  - $235/MW-day price cap and $175/MW-day floor for its 2026/27 and 2027/28 delivery year capacity auction (pending FERC approval)

Delivery Year	Resource Clearing Price	Total Cost to Load ($ billion)
2018/19	$164.77	$10.9
2019/20	$100.00	$7.0
2020/21	$76.53	$7.0
2021/22	$140.00	$9.3
2022/23	$50.00	$3.9
2023/24	$34.13	$2.2
2024/25	$28.92	$2.2
2025/26	$269.92	$14.7

2025/2026 Capacity Prices



Source: pjm.com

Impact of Capacity Price Fluctuations to Naperville's Residential Bill

Capacity price is baked into the bundled rate. The capacity obligation is based on Naperville's demand during the 5 Coincidental Peaks of the PJM system.

Naperville Residential			If Naperville buys from PJM				High Capacity Price			Low Capacity Price		
Line Items	Fixed or $/kWh	Monthly Bill	Line Items	Fixed or $/kWh	Monthly Bill	% from current Naperville bill	Line Item	Monthly Bill	% from current Naperville bill	Line Item	Monthly Bill	% from current Naperville bill
Monthly Customer Charge	$19.27	$19.27	Monthly Customer Charge	$19.27	$19.27		$19.27	$19.27		$19.27	$19.27	
kWh Charge	$0.11392	$96.15										
Purchase Power Adjustment 01/2025	$0.00623	$5.26	Distribution Facilities Charge	$0.02792	$23.56		$0.02792	$23.56		$0.02792	$23.56	
			Illinois Electricity Distribution Tax Charge	$0.00000	$0.00			$0.00			$0.00	
			Bundled rate including energy supply and all PJM transmission charges	$0.09174	$77.42		$0.10304	$86.97		$0.06907	$58.29	
			Energy Efficiency Programs	$0.00366	$3.09		$0.00366	$3.09		$0.00366	$3.09	
			Renewable Portfolio Standard	$0.00502	$4.24		$0.00502	$4.24		$0.00502	$4.24	
			Environmental Cost Recovery Adjustment		$0.00			$0.00		$0.00000	$0.00	
			Zero Emission Standard		$0.00			$0.00		$0.00000	$0.00	
			Carbon free resource adjustment		$0.00			$0.00		$0.00000	$0.00	
			Transition Assistance Charge		$0.00			$0.00		$0.00000	$0.00	
		$120.68	Total		$127.58	5.7%	Total	$137.13	13.6%	Total	$108.45	-10.1%

Assuming capacity price at $300/MW-day.

Assuming capacity price at $30/MW-day.

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Capacity Risk Mitigation

- As a member of IMEA, Naperville is shielded from this volatility as IMEA has ownership of assets that produce capacity and only needs to procure capacity from the market is when their demand is greater than expected.
  - For example, if IMEA's actual demand is 50 MW greater than that was forecasted, IMEA will need to go to the PJM capacity market and procure that capacity at the market price.
- If Naperville is not a member of a JAA, they will be responsible for procuring capacity to meet their own obligation and would be exposed to the price volatility. Naperville will want to explore ways to reduce this risk as volatile capacity pricing will have a direct impact on rate payer's bill.
- Naperville's opportunities to reduce risk from capacity market:
  - Develop generation assets that will **satisfy capacity obligation**. However, this would require additional personnel to develop, own, and operate these resources and likely would still not be sufficient to cover obligation. Due to ELCC (Effective Load Carrying Capacity) values, resources like **solar and wind do not have significant capacity value**.
  - Secure bilateral contracts for capacity from generation assets. As opposed to owning energy resources outright, Naperville can work with generation owners to negotiate a contract to fulfil their capacity obligation.
    - Since Naperville's capacity obligation is smaller than IMEA's, **Naperville may not be able to negotiate as competitive a rate**.
  - Negotiate hedge contracts: under a hedge contract, Naperville would sign an agreement with an entity that would establish a reference capacity price. If the market capacity price exceeds the reference price, the hedge provider would then pay the difference and if the market price is less than the reference price, the hedge provider will retain the savings.
    - This is still a nascent industry and there may not be many hedge providers available and therefore **hedges may come at a premium**.

Impact of Energy Price Fluctuations to Naperville's Residential Bill

Energy price is baked into the bundled rate.

- Below are examples of impact to residential bills if energy price is 1.5x today's rate (High Energy Price) or half of today's rate (Low Energy Price):

Naperville Residential			If Naperville buys from PJM				High Energy Price			Low Energy Price		
Line Items	Fixed or $/kWh	Monthly Bill	Line Items	Fixed or $/kWh	Monthly Bill	% from current Naperville bill	Line Item	Monthly Bill	% from current Naperville bill	Line Item	Monthly Bill	% from current Naperville bill
Monthly Customer Charge	$19.27	$19.27	Monthly Customer Charge	$19.27	$19.27		$19.27	$19.27		$19.27	$19.27	
kWh Charge	$0.11392	$96.15					$0.00			$0.00		
Purchase Power Adjustment 01/2025	$0.00623	$5.26	Distribution Facilities Charge	$0.02792	$23.56		$0.02792	$23.56		$0.02792	$23.56	
			Illinois Electricity Distribution Tax Charge	$0.00000	$0.00			$0.00			$0.00	
			Bundled rate including energy supply and all PJM transmission charges	$0.09174	$77.42		$0.11590	$97.82		$0.06757	$57.03	
			Energy Efficiency Programs	$0.00366	$3.09		$0.00366	$3.09		$0.00366	$3.09	
			Renewable Portfolio Standard	$0.00502	$4.24		$0.00502	$4.24		$0.00502	$4.24	
			Environmental Cost Recovery Adjustment		$0.00			$0.00			$0.00	
			Zero Emission Standard		$0.00			$0.00			$0.00	
			Carbon free resource adjustment		$0.00			$0.00			$0.00	
			Transition Assistance Charge		$0.00			$0.00			$0.00	
		$120.68	Total		$127.58	5.7%	Total	$147.98	22.6%	Total	$107.19	-11.2%

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Contract via Power Purchase Agreements

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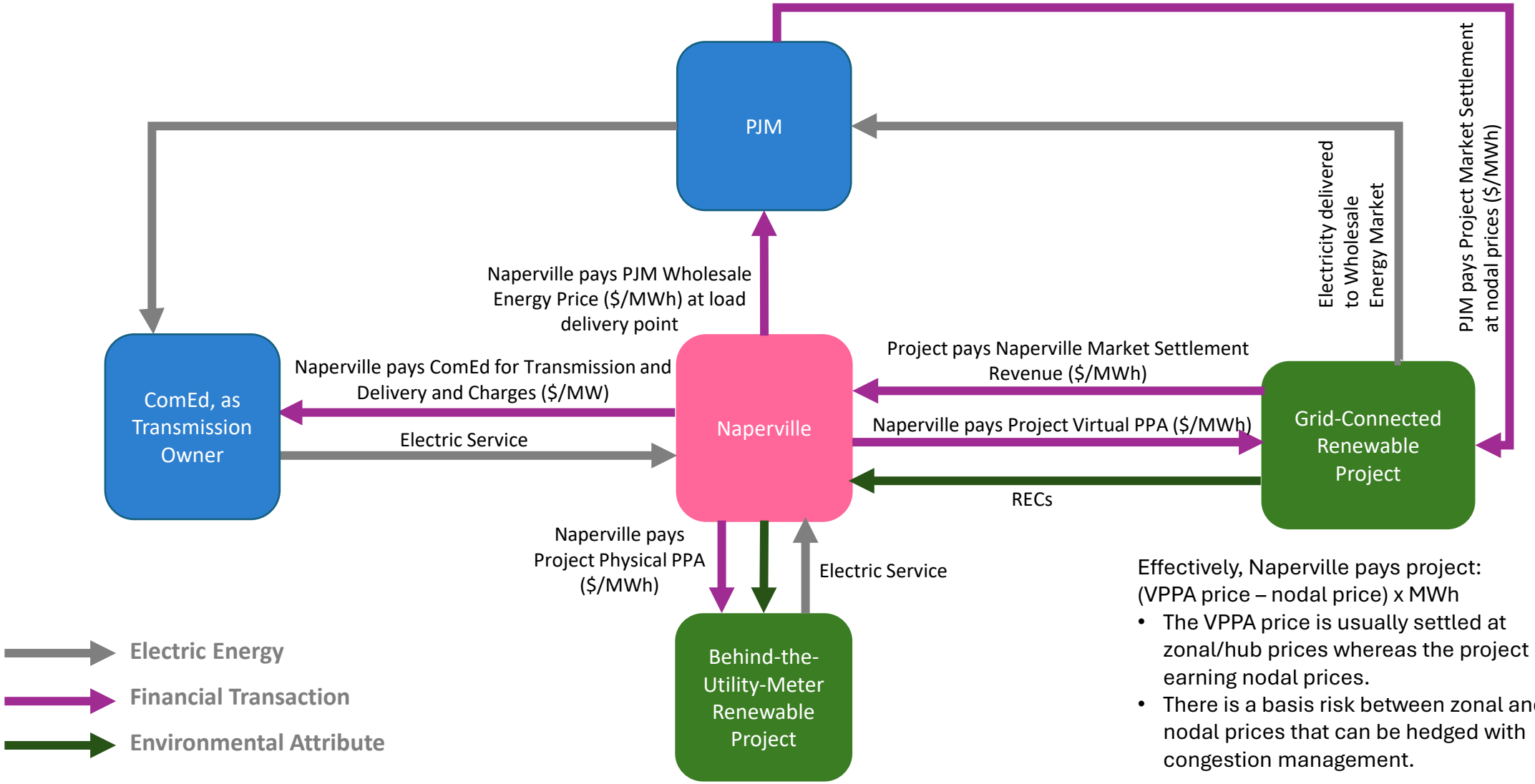
Power Purchase Agreements - Summary

- Power Purchase Agreements, or PPAs, are contractual mechanisms that allow a customer like Naperville to purchase electricity at a **pre-negotiated price** and is one way for Naperville to **reduce exposure** to the Wholesale Market.
- For example, Naperville could sign a PPA with a generator such as a gas turbine which would guarantee a certain quantity of energy and/or capacity at a rate that both parties agree.
  - PPAs allow cities like Naperville to benefit from **stable energy pricing without the resource burden** of owning and operating assets.
- To increase percentage of renewable energy, Naperville may choose to sign a PPA with a renewable source, such as solar. However, since solar will only contribute energy during certain portions of the day, Naperville will need to purchase additional energy supporting their remaining load.
  - To make economic sense, Naperville would need to contract a solar PPA for **less than the cost of current IMEA costs**. However, current solar PPA market pricing is consistently higher than the IMEA rate.
- To enter a PPA, Naperville will require **additional administrative and legal functions** to support the drafting and negotiation of the document.
- The primary benefits of a PPA is securing consistent, stable energy pricing. However, there are certain risks that Naperville will be exposed to:
  - Resource's failure to supply energy at the agreed upon price. Supply constraints or cost overrun may cause a project's developer to have to cancel or renegotiate the PPA at higher rates.
  - Project may not generate the volume of energy expected.
  - In both cases, Naperville would be forced to supplement the power shortfall at Wholesale Market prices.

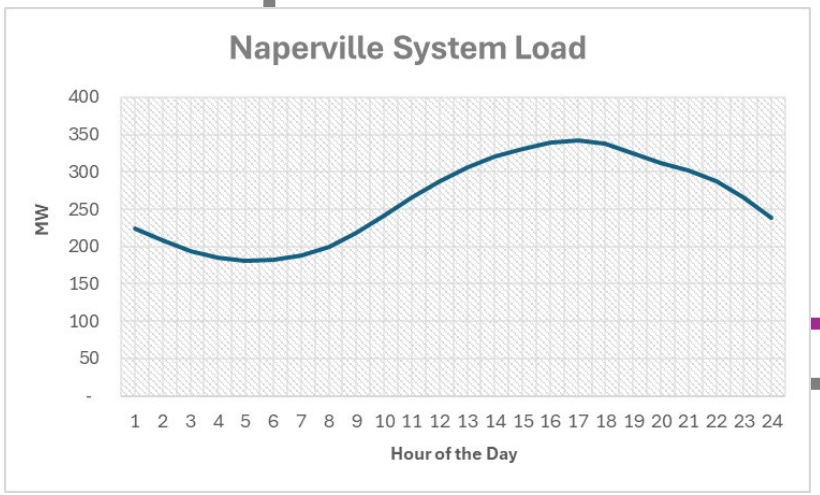
What is a Power Purchase Agreement



Effectively, Naperville pays project:
(VPPA price – nodal price) x MWh

- The VPPA price is usually settled at zonal/hub prices whereas the project is earning nodal prices.
- There is a basis risk between zonal and nodal prices that can be hedged with congestion management.

What is a Power Purchase Agreement



PJM

Naperville

Grid-Connected Renewable Project

Behind-the-Utility-Meter Renewable Project

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What is a Power Purchase Agreement

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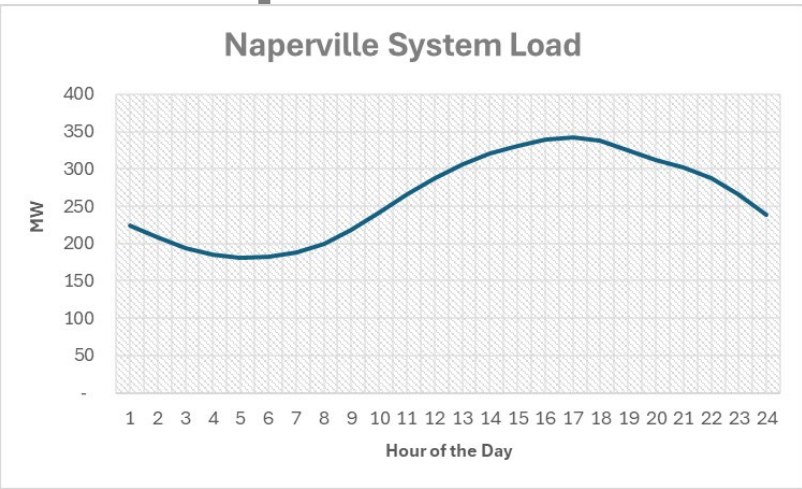
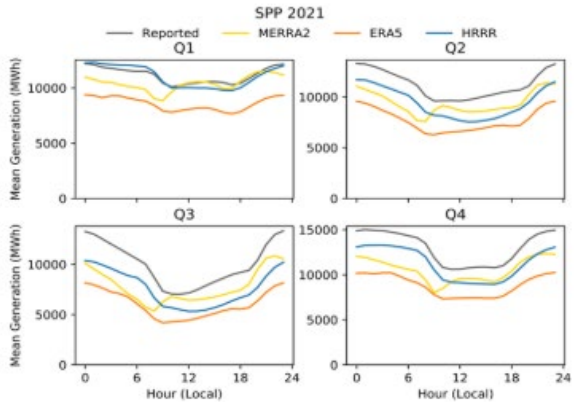
PJM

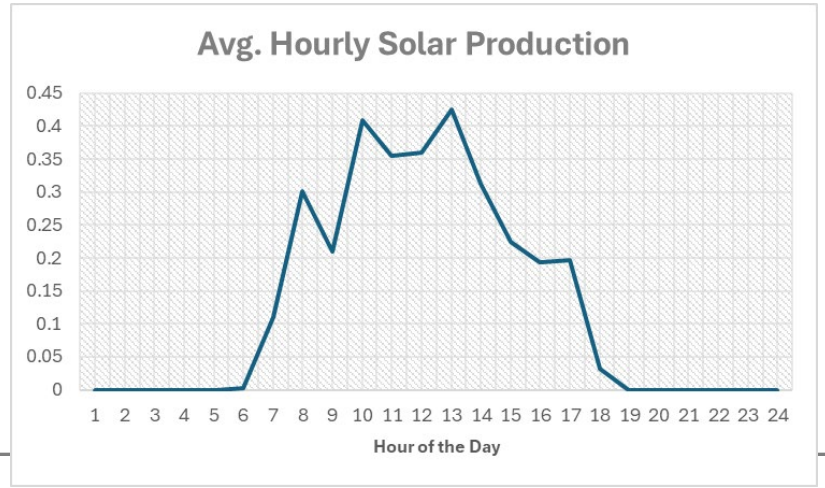
Naperville

Grid-Connected Renewable Project

Behind-the-Utility-Meter Renewable Project







Sources: wind

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What is a Power Purchase Agreement

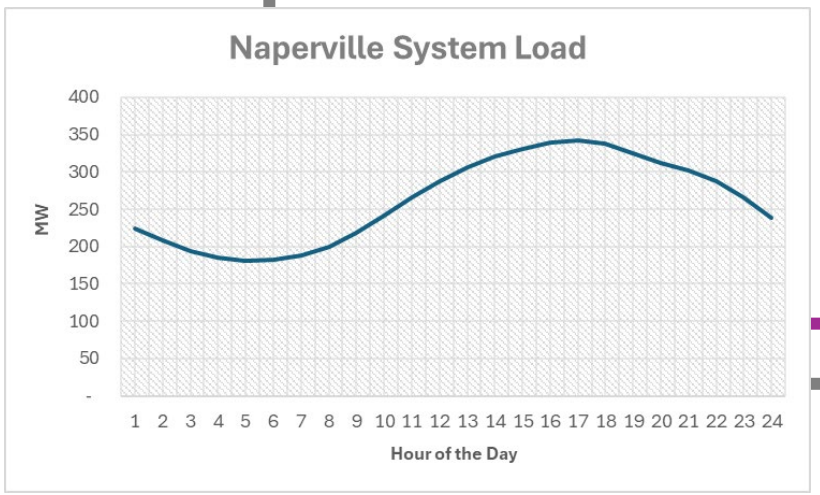
RE procured through physical or virtual PPAs will NOT meet 100% of load, Naperville still needs to buy remaining energy and capacity from the PJM market or other sources.

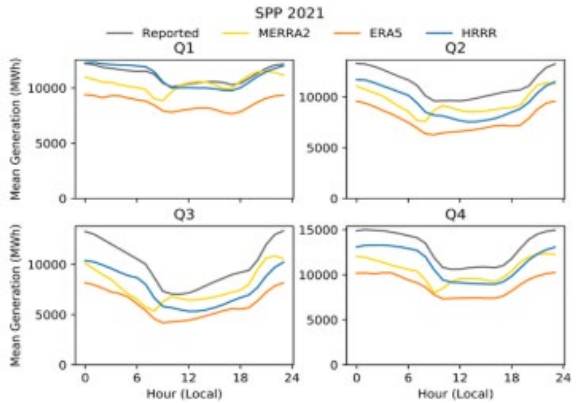
PJM

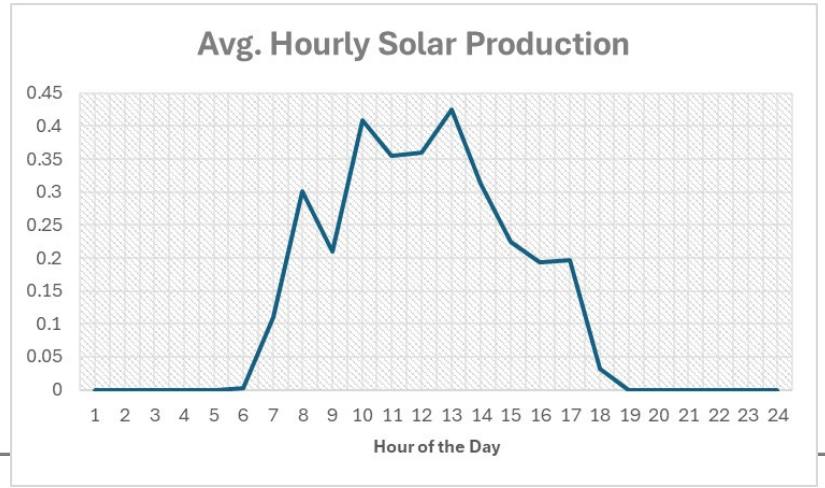
Naperville

Grid-Connected Renewable Project

Behind-the-Utility-Meter Renewable Project







Sources: wind

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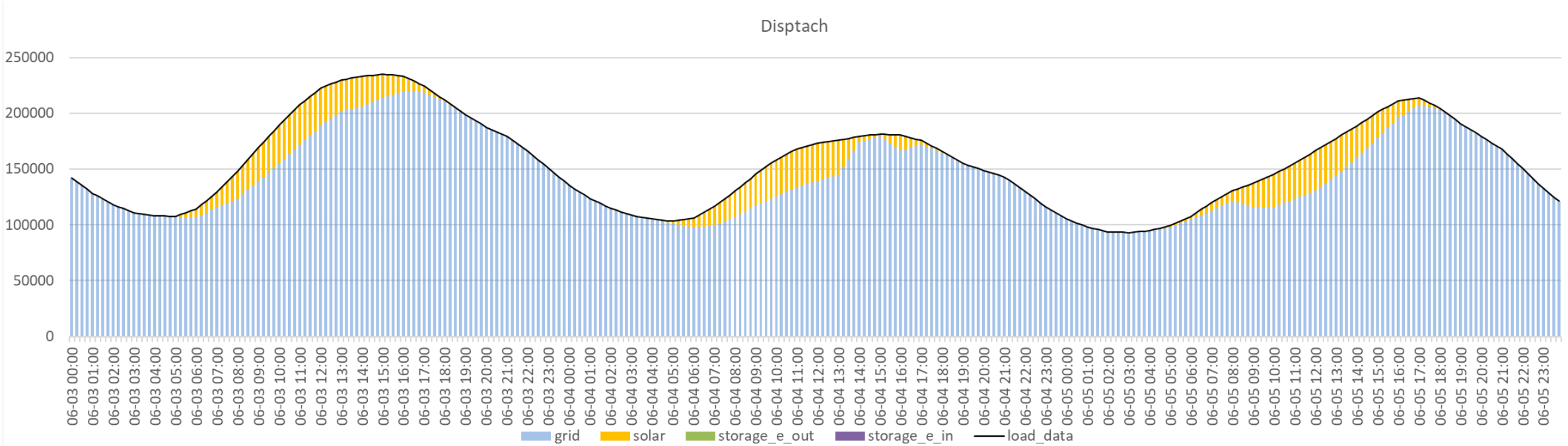
If Naperville Procures Solar via PPAs…

- Solar production can offset part of Naperville's energy use. The table below shows the size of the solar project corresponding to % of load served by solar.

% of load served by solar	5%	10%	15%	20%
Solar project size (MW)	50	100	140	190

- In these cases, the solar energy offsets the energy supply from IMEA at $35/MWh. In other words, the solar PPA has to be cheaper than $35/MWh for such procurement to make economic sense.



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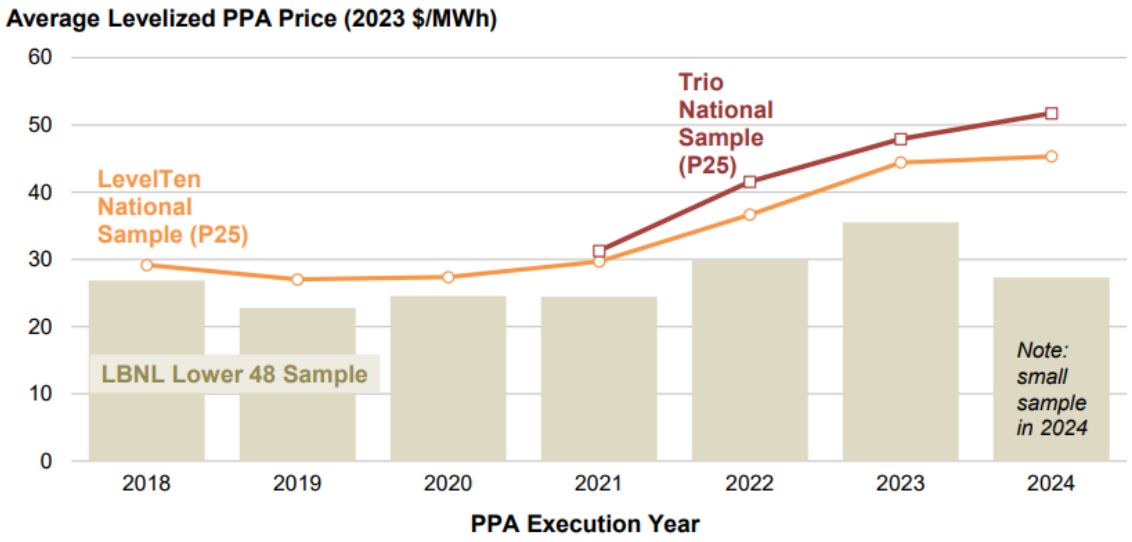
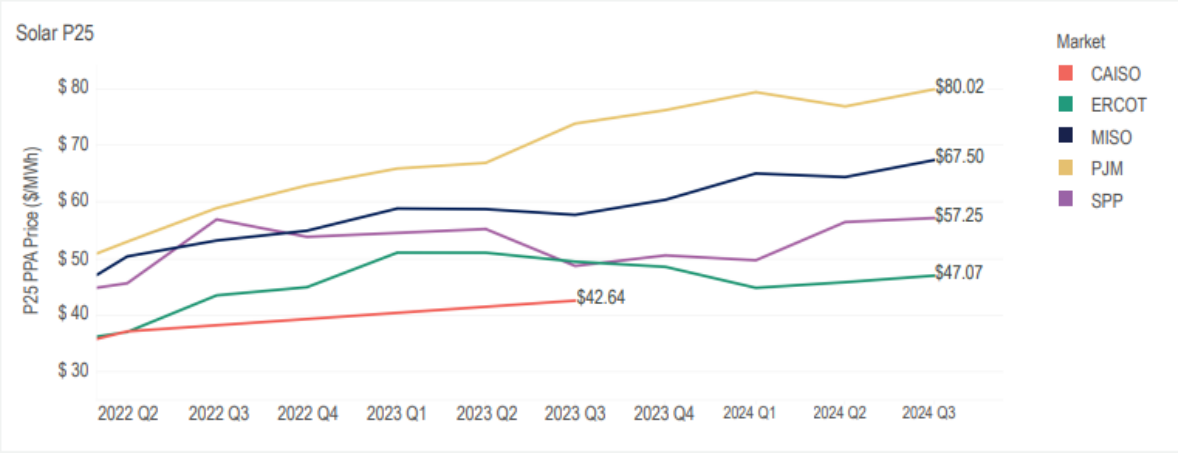
PPA Price Trends

- Utility-scale solar PV PPA price dropped slightly from 2019 to 2021, but have since increased, with projects in PJM priced above those in other regions. The higher PPA prices came from:
  - High interest rate leading to higher financing costs.
  - High demand from corporates and utilities to meet 2025 and 2030 emission targets.
  - Long lead times for high- and medium-voltage equipment.
  - Supply constraints by equipment lead times and long interconnection and permitting timelines.
- More recently, utility scale solar PPA prices in PJM are in the mid $80/MWh price range with COD in late 2027 or early 2028, 10-15% higher than last year.





Reference: LBNL Utility-Scale Solar, 2024 Edition, Trio Global Renewables Market Updates Q3 2024

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Potential PPA Risks

A 10 to 20-year PPA contract will provide price stability to Naperville but can also expose the City to the risks of:

1. Developer unable to deliver on promised PPA prices.
    - For example, El Paso Electric (EPE) in NM procured 3 projects in 2019: two solar projects and one solar + storage. The PPA contract had specific language to ensure output during peak summer hours.
        - Despite contracting with a reputable and experienced developer, the PPA price for Buena Vista solar + storage was **later renegotiated and the project delayed due to supply chain cost increase and disruption**. This matter was hotly contested at NM PRC with **advocates protesting that there is no consequence for EPE or the developer on fall-out of the contract, and the rate payers had to foot the bills**. The Hecate solar project is still delayed, likely abandoned, and EPE is looking to terminate the PPA.
    - If the same were to happen for Naperville's contract, Naperville has to:
        - Renegotiate PPA price, impacting customer rates;
        - Re-run the PPA solicitation process to find replacement projects; and
        - In both (1) and (2), Naperville will have to procure more energy and capacity directly from the PJM market to bridge the gap for project delays or solicitation re-runs, again creating rate uncertainties.
2. Project availability or delivered energy less than forecasted
    - Naperville will have to procure more energy directly from the PJM market to bridge the gap between the load and the lower RE generation, similar to what IMEA is doing today charging members with Energy Cost Adjustment (ECA).
3. Basis risk for a Virtual PPA, if the project is at a location further away from Naperville.

Owning Assets

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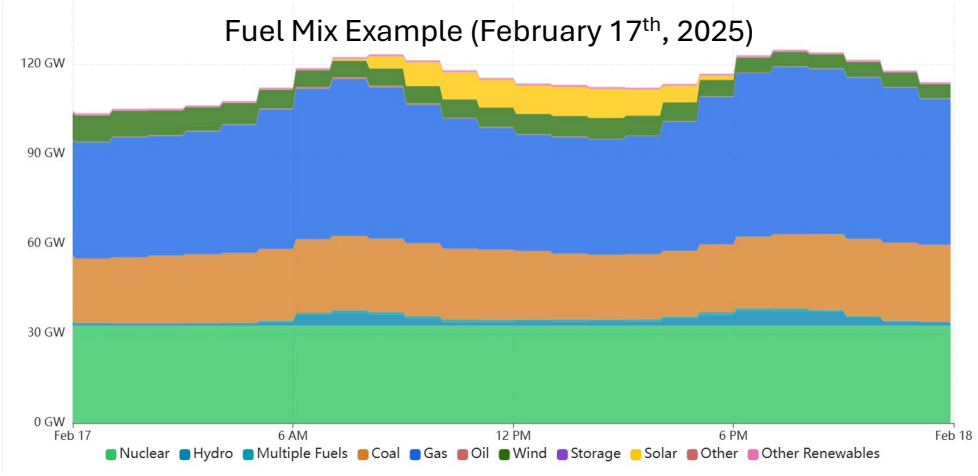
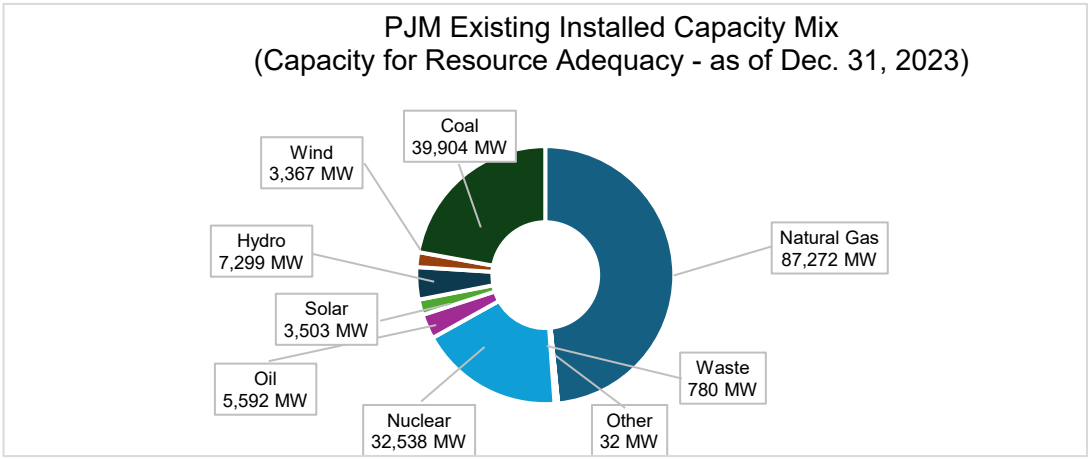
Asset Ownership - Summary

- Naperville may elect to own and/or operate its own generation projects. In this scenario, Naperville would have **complete control over the operation of these resources**.
- There are several different technologies that can support Naperville's energy goals including gas turbines, solar farms, and wind projects. Each of these resources have varying operation and maintenance responsibilities as well as costs and development timelines.
  - Own and operating generation would **require building up a team of experienced operators and developers** (if new generation)
  - Wind and solar, as intermittent resources, would require substantial capacity to support Naperville load.
- Gas turbines currently make up a near majority of the current installed capacity in PJM. If Naperville were to develop a gas project, it would be able to support a substantial portion of their energy load but would also require substantial development costs as well as a considerable timeline.
  - As an Illinois entity, **any gas project would be subject to CEJA mandates** which require all gas projects to reduce all emissions to zero by 2045.
- Majority of utility-owned assets in Illinois are legacy coal-unit.
- While generation ownership allows for considerable autonomy and potentially stable pricing, Naperville would be exposed to potential risks such as:
  - Construction risks such as cost overrun or project delays
  - **Fuel risks** (exposed to volatility of Natural Gas pricing)
  - Performance risks

Can Naperville Own Gas Generation?

- PJM produces a significant amount of its energy from gas resources, including Combined Cycle and Combustion Turbine technologies.





Source: Gridstatus.io

- But CEJA mandates reduction of GHG emissions from gas units.
  (j) All EGUs and large greenhouse gas-emitting units that use gas as a fuel and are public GHG-emitting units shall permanently reduce all CO2e and copollutant emissions to zero, including through unit retirement or the use of 100% green hydrogen or other similar technology that is commercially proven to achieve zero carbon emissions by January 1, 2045.

Gas units that are not public have to comply at earlier dates depending on the nature of emissions and location (whether they are located within 3 miles of environmental justice community).

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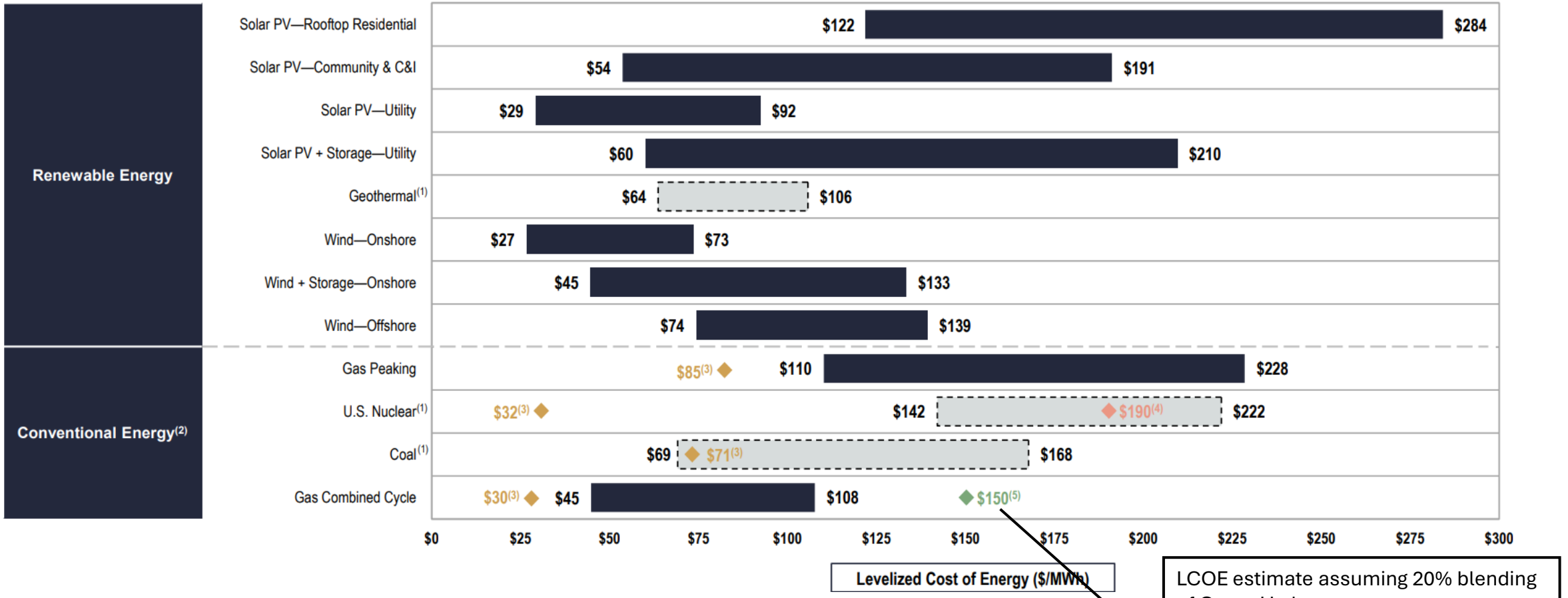
Source: CEJA; Lazard LCOE 2024

Can Naperville Own Gas Generation?

- Lazard estimated Levelized Cost of Energy (LCOE) as following (not IL-specific):



LCOE estimate assuming 20% blending of Green Hydrogen.
No plant modifications are assumed beyond a 2% increase to the plant's heat rate. The corresponding fuel cost is $6.66/MMBTU, assuming ~$5.25/kg for green hydrogen (unsubsidized PEM).

- Verdict: Not likely given the cost of new-built and CEJA restrictions.

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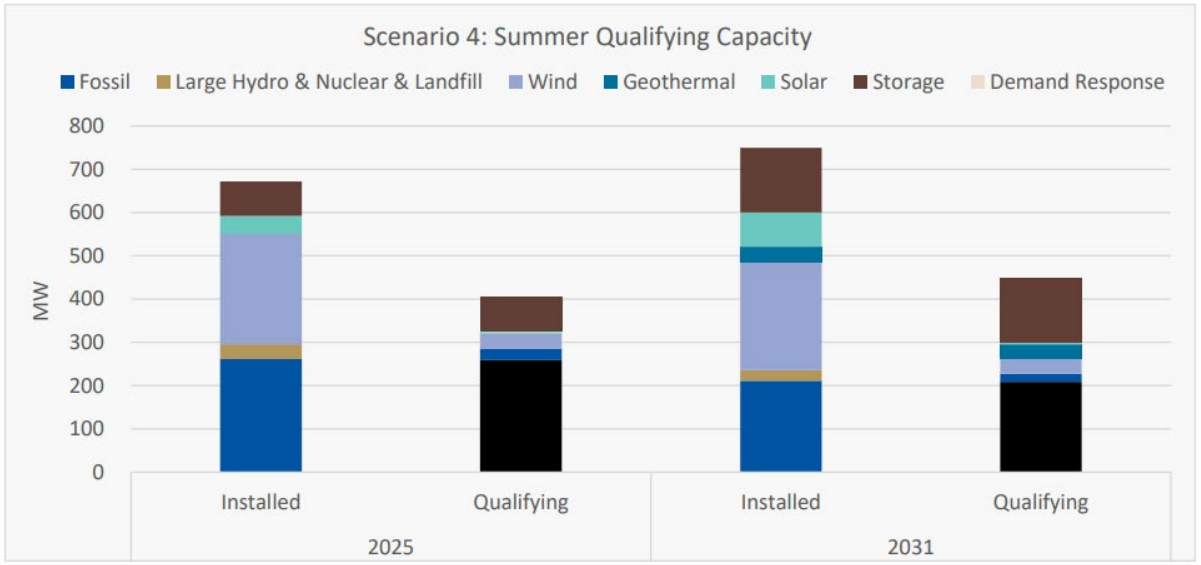
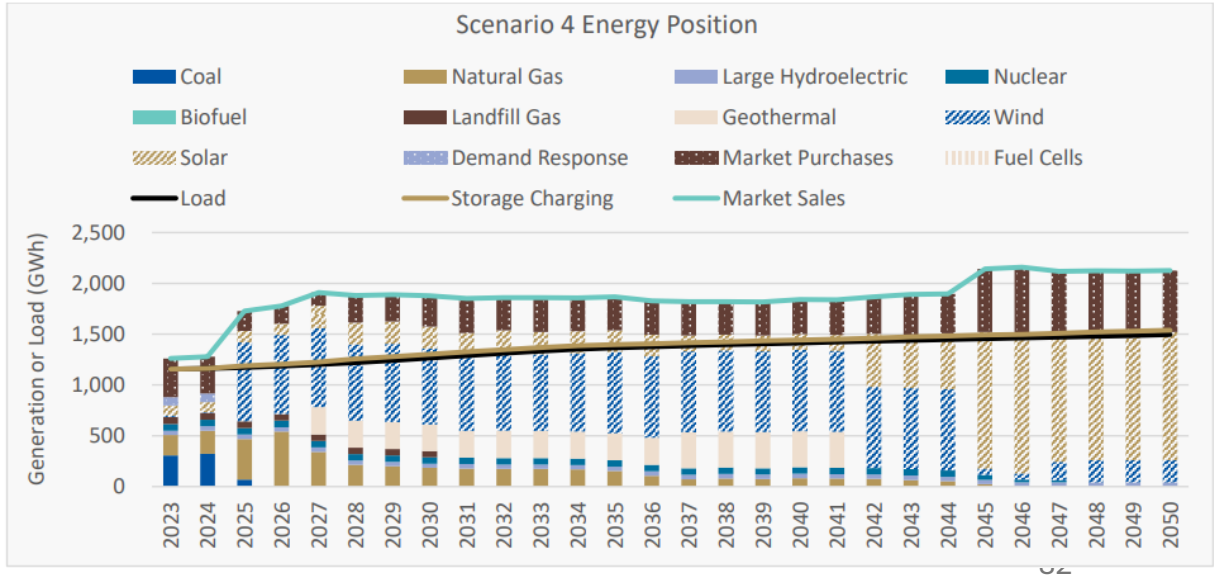
Source: CEJA; Lazard LCOE 2024

Example of Other Municipal Utilities

- In the Midwest, most utility-owned generation are legacy coal units, which the utility operated to supply local load and sell into the wholesale markets, if available.
- City of Pasadena in California plans to achieve 60% RPS by 2030 and 100% RE and zero-carbon by 2045 with the following resource plan.
  - Owns and operates natural gas units that will be gradually retired. Emissions from gas units can be offset by other means post-2045.
  - Contracts with coal, natural gas CC and small solar and wind, and will transition to geothermal, solar, wind and storage. The contract with coal is through Intermountain Power Agency for the 1800MW unit in Utah, of which 80% of the energy is exported to Munis in southern CA. IPP plans to convert the project to burn NG in 2025 and Green Hydrogen at a later time.
  - Purchases remaining energy from CAISO wholesale markets

* Capacity accreditation and capacity market rules are significantly different between CAISO and PJM.





Source: Pasadena Water and Power 2023 IRP

Potential Ownership Risk

- Risks of project delay or cost overruns are similar to the contracted option.
- Build-Own-Transfer (BOT) contracts can assign the risk during development and construction to project developers while some risks such as permitting and interconnection are outside of the developers' control.
  - Pasadena released a BOT RFP for 25MW BESS in 2023 to be sited at their existing Glenarm Power Plant with available interconnection. The RFP was not awarded (maybe for later reissuing) but Pasadena has moved forward to other site evaluations.
  - Naperville can also consider option to purchase the project after a fixed contracted period.
- Fuel risks depending on the type of the owned resource.
- Depending on the size of the owned resource, Naperville may not be able to diversify its power supply, over-relying on a single unit.
- Naperville will need to build an operations team to own and operate the project(s).

Customized Energy Solutions

Stay with IMEA

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Stay with IMEA - Summary

- Naperville may elect to remain an IMEA member and **continue to have all energy and capacity requirements supported by IMEA**.
- IMEA has outlined its current energy portfolio roadmap which includes **retiring all existing coal generation** and replacing with wind and solar resources by 2050.
  - Due to lower capacity accreditation values for resources like solar and wind, IMEA will need to procure large volumes of renewable generation and storage to maintain reliable service.
  - This may result in an overall higher revenue requirement for IMEA
- IMEA's current roadmap is similar to other public power entities, having to find replacement capacity and energy sources to gradually phase out natural gas and coal assets.
- As a member of IMEA, Naperville may have additional options to increase the renewables serving their load or reduce the cost to serve:
  - Through the Member-Directed Resource (MDR) clause of the contract extension which allows IMEA members to develop their own generation
  - By installing Behind-the-Meter (BTM) energy storage, Naperville can shave both its own peak as well as the overall IMEA's peaks and, as a result, reduce demand charges
  - Implement green tariffs which would allow resident to opt-in to an incremental charge that would purchase RECs or renewable energy from specific projects under the MDR clause
- If Naperville elects to remain an IMEA member, they will **continue to have reduced exposure to market risks and ownership risks but will have less autonomy of their generation portfolio**.

Status Quo

- The City of Naperville has a peak load of 350-400MW with an annual consumption of 1.2M MWh.
- The City currently procures its energy needs from Illinois Municipal Electric Agency (IMEA), a Joint Action Agency that procures power on behalf of its members.
  - 78% of IMEA's current generation is coal, mainly from Prairie State and Trimble County units.
  - 11% of IMEA's current generation comes from solar and wind resources under PPA contracts.
  - IMEA has aggressive RE integration plan (see next 3 slides) and coal retirements.

Nameplate vs Projected Accredited Capacity

Projected PY25/26*	Nameplate Capacity (MW)	Summer Accredited Capacity (MW)
Prairie State	246	224
Trimble County	153	145
Member Generation**	296	290
Wind	120	30
Solar	33	16
Hydro**	10	10
Bilateral Purchases	100	100
Total	957	815

Totals may not sum due to rounding
Accreditation in PJM and MISO are different,
PJM's is ELCC, MISO's is DLOL
*Final accreditation values are subject to the determination of each RTO prior to the delivery year.
**Behind The Meter resources get a higher accreditation based on the current RTO rules that allow for adjustments (losses and reserves).

Source: IMEA presentation to Naperville, Oct. 2024

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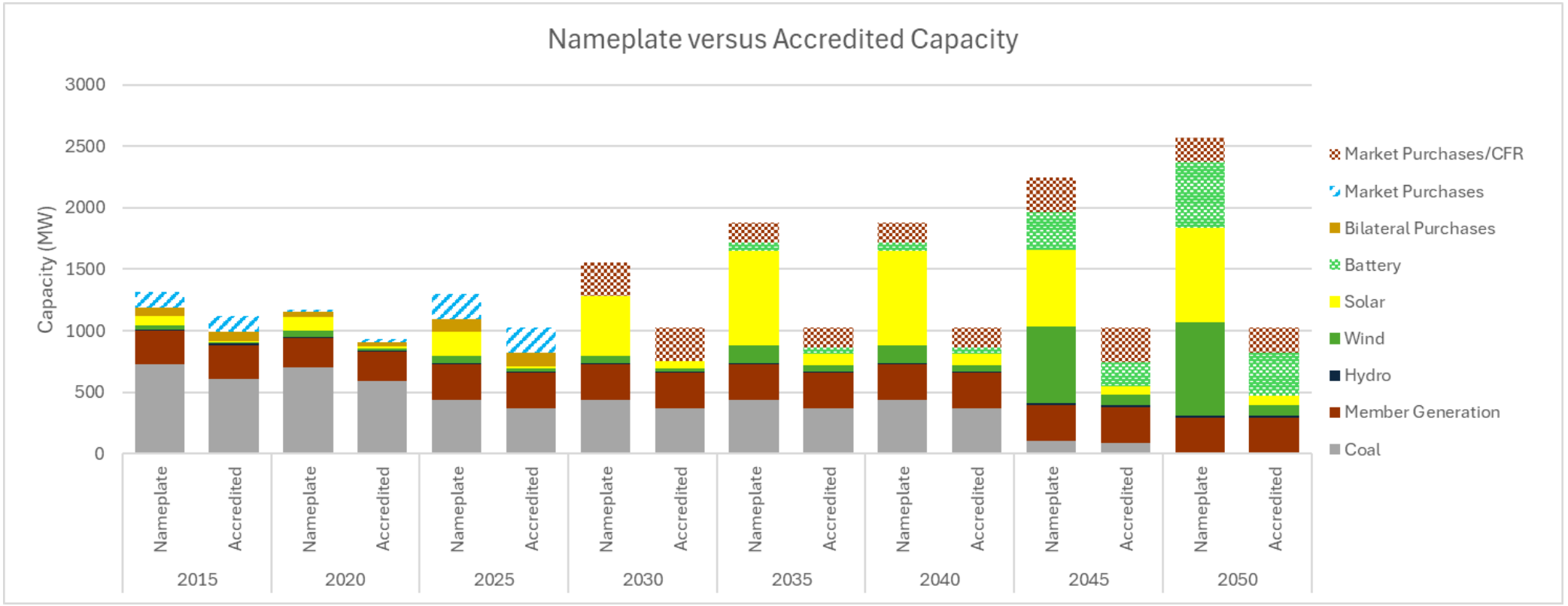
Projected IMEA Capacity Additions

IMEA's procured capacity must increase significantly to account for the much lower accredited capacity of Renewables and BESS.

- Based on IMEA's presentation to Naperville for nameplate versus accredited capacity.
- BESS nameplate capacity was adjusted based on PJM's ELCC.



Source: IMEA presentation to Naperville, Oct. 2024, CES Analysis

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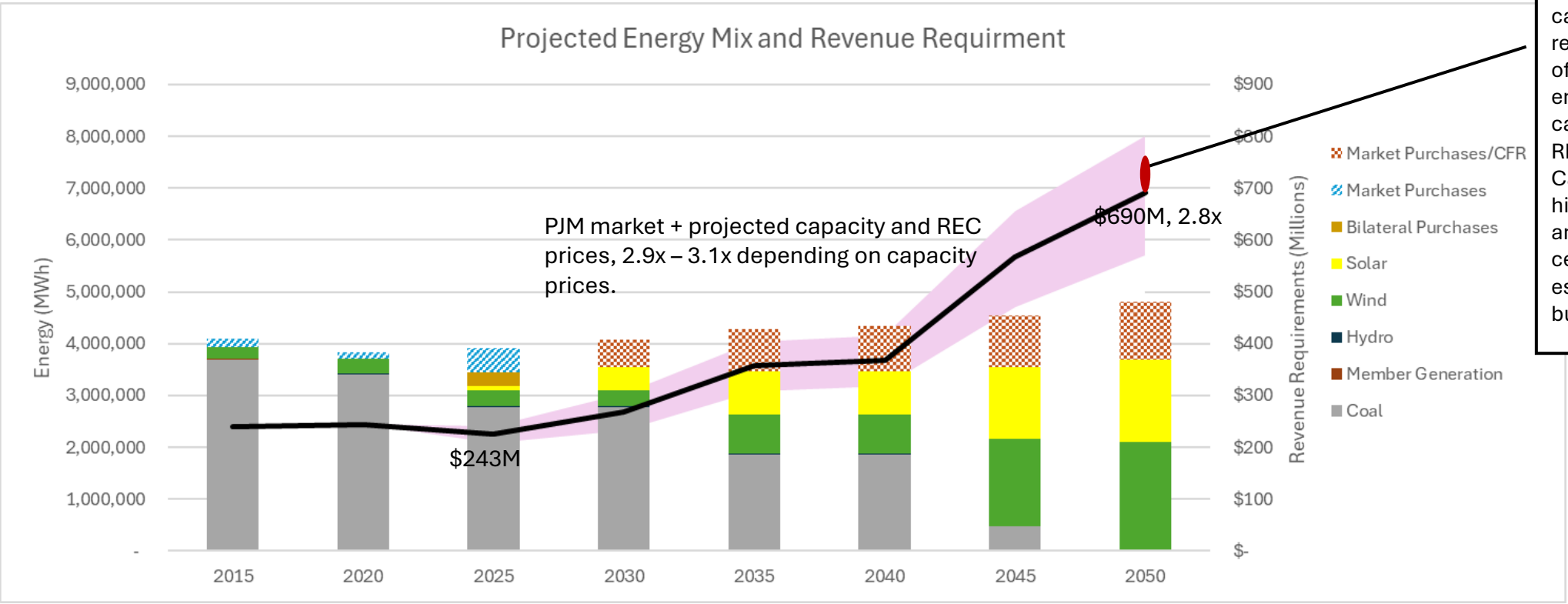
Projected IMEA Revenue Requirements

IMEA's revenue requirement will increase by 2.6x from 2025 to 2050 following the projected trajectory

- Solar PPA @ $80+8/MWh, including energy, RECs and capacity (accounting for solar capacity factor and capacity accreditation) at 1% escalation.
- Wind PPA @ $85+10/MWh, including energy, RECs and capacity (accounting for solar capacity factor and capacity accreditation), at 1% escalation.
- Battery capacity contract @ $9/kW-month at 1% escalation; market purchase of capacity also included @ $150/MW-day
- Market purchases vary with average PJM DA LMP forecast by CES



IMEA: 80% of supply stack from solar, wind and storage.

PJM market: CES's projects that 45% of capacity from RE resources at 2.9x – 3.1x of today's average energy price plus capacity prices plus REC purchases. Capacity price based on historical fluctuation and recent price ceilings. REC prices estimated based on IPA budget forecast.

Source: IMEA presentation to Naperville, Oct. 2024, CES Analysis, IPA's estimate that RPS costs to increase at least 3x by 2043.

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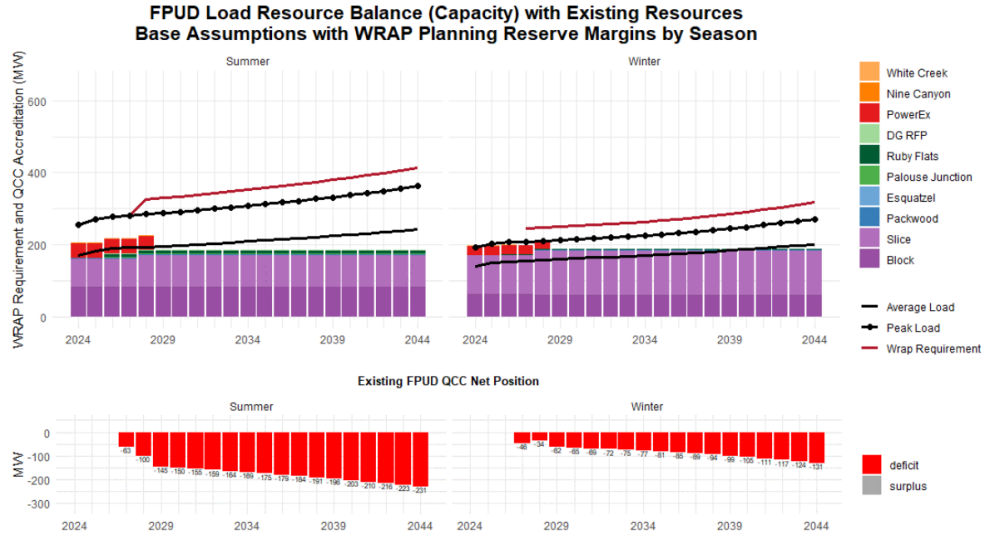
How feasible, fast/slow is IMEA's Plan?

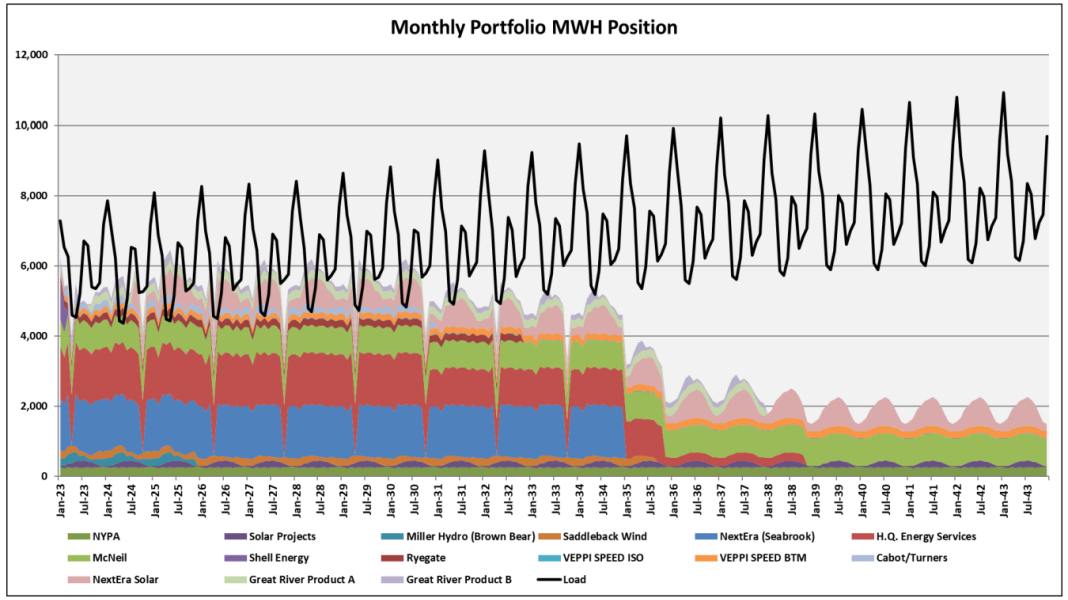
- In general, public power entities are facing the issue of finding replacement capacity AND energy as fossil resources are retired through 2045/2050. However, very few public power entities with similar load size do Integrated Resource Planning to discuss load forecast and supply dynamics. Resource choices highly dependent on local resource availability and market access.
- NIMPA members currently don't have a plan for CEJA compliance.
- City of Sikeston, MO owns a gigantic legacy coal plant and is just in the process of figuring out what to do. Their IRP started in 2023 but is still on going; so no results yet.

Franklin, WA
Large gap in capacity position after contracts expire and unit retirements, starting from 2029.



Source: Franklin PUD 2024 IRP

Stowe, VT
Large gap in energy position after contracts expire and unit retirements, starting from 2035.



Source: Stowe Electric in VT, 2023 IRP

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Member-Directed Resources

As a member, Naperville can execute the Member-Directed Resources Option of the contract extension if they want to directly procure electric power while remaining a full member of IMEA.

- Under this provision in the contract extension, members may elect to self-direct a portion of the power supply.
- This is a voluntary program – there is no obligation to participate.
- Total maximum amount is **10%** of member's rolling 5-year average annual peak demand (potential to be >10% in the future). For Naperville, this would be ~30 MW
- The resource must be in the same delivery zone of the RTO region or Balancing Authority area as the member making the election.
- Members would be responsible to contract for, develop, own and operate qualifying resources or alternatively to contract with a provider for a portion of large qualifying resource
- Restrictions:
  - **Cannot use a MDR to peak shave a member's load without shaving IMEA's demand as a whole**
  - Member still will be required to purchase it full requirements from IMEA
  - Member shall pay all costs associated with the Member Directed Resource and shall be credited or paid back for the actual RTO clearing price for capacity and day-ahead price for energy and any actual ancillary services revenues received by IMEA for the attributes used by IMEA from the Member Directed Resource to serve the participating Member.
- Member will own any RECs but IMEA will have first right of refusal if they decide to sell
- **Potential options for Naperville under MDR**, if the contract is extended**:**
  - PPA with nuclear, supplying base load
  - PPA with a BESS project (but must also shave IMEA's peak), see next slide
  - Challenge MDR language preventing peak shaving restrictions

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Customized Energy Solutions

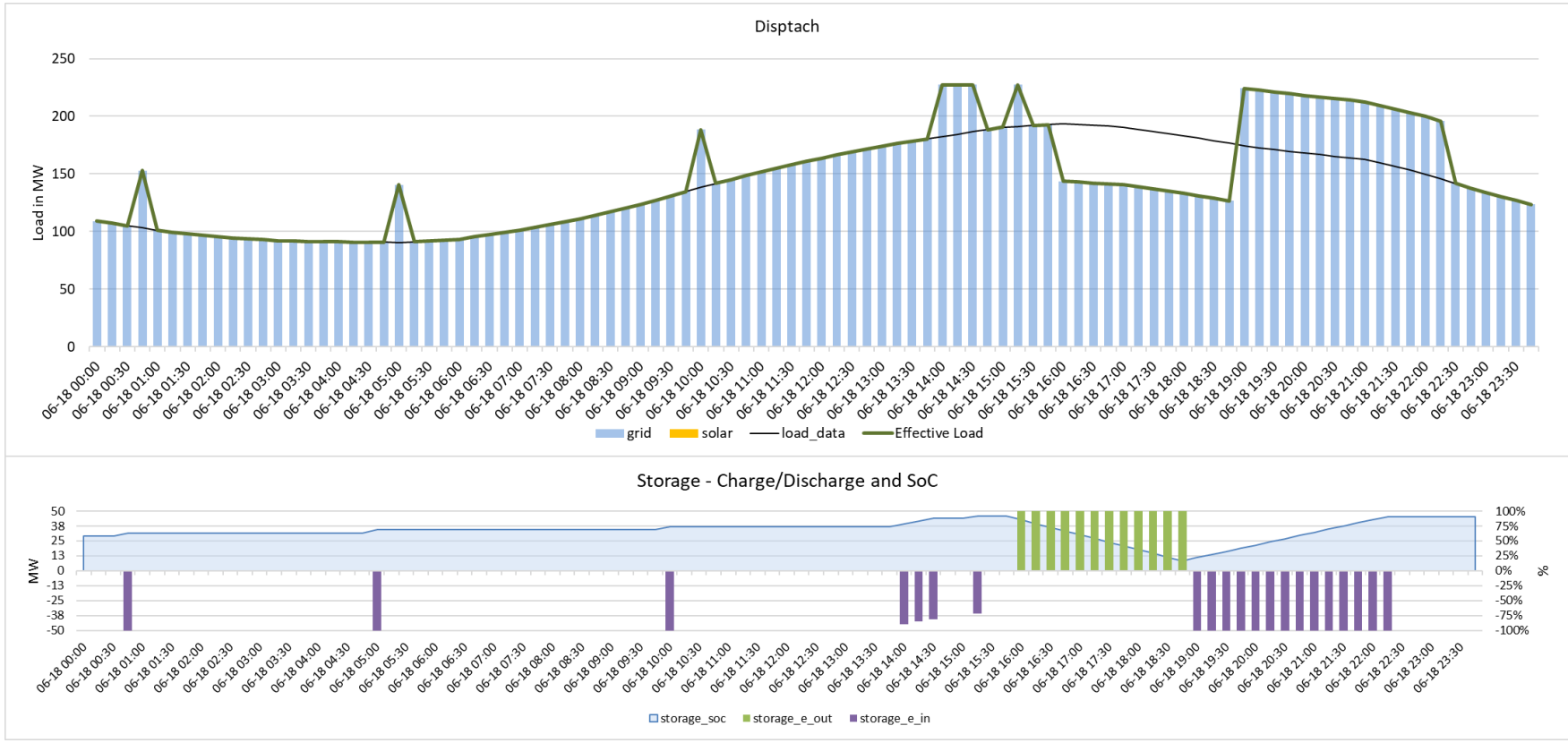
If a storage is connected at behind-the-utility-meter in Naperville territory to:

1) Reduce Coincidental Peak (CPs) for IMEA so that IMEA can reduce its capacity and transmission charges from PJM
2) Reduce monthly peak demand for Naperville

What would be the impact on charges?

The storage could effectively save on Power Supply Charge ($9.5/kW) and Delivery Service Charge ($6.53/kW at 2024 rate).

For a 50MW/4hr storage considering charging energy using IMEA rate (or a solar resource), the saving amounts to $11.9/kW-month, a reasonable contracted price if the storage is allowed to participate in the PJM wholesale markets plus incentives.



Other Mechanisms to Increase RE Content

- There are green tariffs available in some PJM states such as Virginia, North Carolina & Kentucky. These tariffs allow larger commercial and industrial customers to purchase renewable electricity from specific projects through a special utility tariff rate.
- Virginia offers green tariffs through utilities like Appalachian Power and Dominion Energy.
- Appalachian Power provides two green pricing options:
    1. **100% Renewable Energy (Wind, Water, Sunlight) Program:** Customers can choose to purchase their entire energy needs from renewable sources. This option is available at an additional cost of $0.12297/kWh above the regular electricity rate ($0.0762/kWh). The option is a direct sourcing of RE, not just for RECs, hence the higher pricing.
    2. **Renewable Energy Credit (REC) Program:** Customers can support renewable energy by purchasing RECs. This program allows customers to offset their electricity usage with renewable energy credits at an additional cost of $0.0145/kWh.
- Dominion Energy offers green pricing to customers in Virginia through its Green Power Program:
    1. **Green Power Program:** Dominion Energy's Green Power Program allows customers to match their electricity usage with RECs, supporting renewable energy development. This program is available to both residential and commercial customers at an additional cost of $0.012/kWh.

Source: Appalachian Power green tariff , residential tariff for Virginia.

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Join a Different JAA

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Different JAA - Summary

- If Naperville does not want to stand up the functions to become a PJM market participant and/or to develop their own generation but would prefer to no longer be an IMEA member, they may elect to join a different Joint Action Agency (JAA).
- Considering the location and size of Naperville, there are **limited options for JAA's** for Naperville to join.
  - Northern Illinois Municipal Power Agency (NIMPA) is another JAA in the state but unlike IMEA, allows its members to retain local control of resource planning. Therefore, it would look and feel more similar to Naperville securing its own power through the means discussed in previous slides.
  - American Municipal Power (AMP) assists its members in developing and implementing power supply strategies to ensure reliable and cost-effective electricity.
  - Both JAA's have ownership in legacy coal assets so joining these agencies will likely not result in having a considerably larger amount of renewables in its generation portfolio.
- Naperville **may also elect to stand up its own JAA**. However, this would require all of the activities and functions including in "procure own energy" option.
  - As a smaller entity, the total size of this new JAA may not have the same leverage to negotiate PPA rates and capacity contracts.

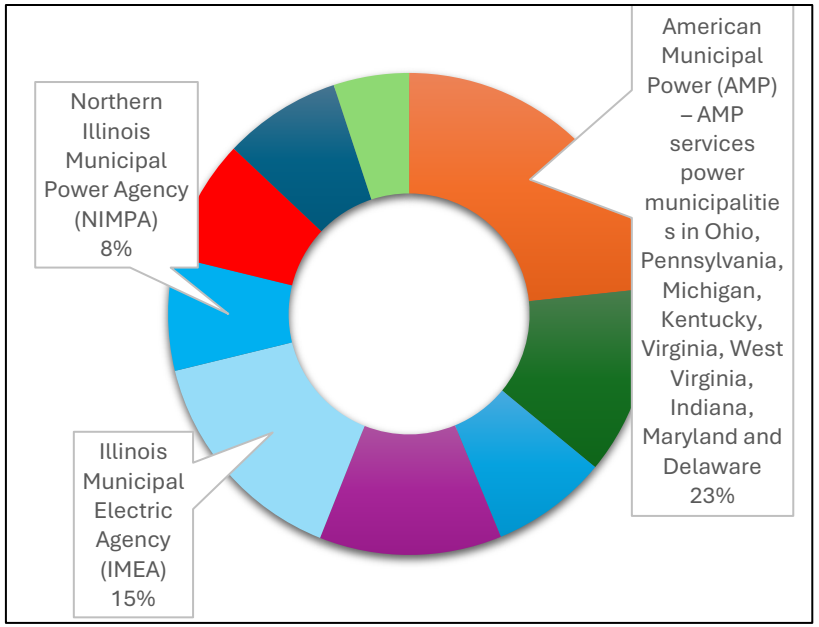
Northern Illinois Municipal Power Agency (NIMPA)

- NIMPA consists of Batavia, Geneva, Rochelle. While under state law NIMPA has the authority to engage in electric resource planning or other administrative services on behalf of its members, the agency has never performed those roles. Instead, each community member of NIMPA elected to **retain local control of resource planning** and administration of their own respective electric utilities. Therefore, NIMPA has no projection of a future resource plan.
- For example, Batavia executed a Power Sales Agreement with NIMPA in 2006 to purchase 50 MW of power on a 24/7/365, later increased o 55MW. Through the PSA, NIMPA is obligated to supply Batavia with 55 MW of power. NIMPA's total ownership share of PSEC is 7.6%, or 120 MW. NIMPA designates 55/120ths of its power from PSEC to meet its supply obligation to Batavia. When PSEC is not generating power, due to some type of outage, NIMPA is obligated to procure replacement power from the wholesale market to serve Batavia. Based on historical data, and Batavia's projected energy needs, it is not anticipated that Batavia will require additional energy resources for at least the next decade.
- The PSA between NIMPA and Batavia obligates Batavia to pay all expenses associated with its 55 MW supply. **Expenses include PSEC generation costs, wholesale energy market costs, transmission and congestion costs and NIMPA bond obligations**. Batavia is also obligated to pay its proportional share of NIMPA's legal, administrative, financial, advisory and government relations costs.

Evaluating this Option:

- If Naperville joins NIMPA, it is akin to Naperville determining its resource plans but asking NIMPA to execute the plan.
  - Naperville still bears the risk of individual project and the fluctuation of wholesale markets depending on the share of Prairie State that Naperville decides to take on.
  - NIMPA's operational costs are outsourced;
- Benefits, costs and risks of this option are similar to being outside of a Joint Action Agency.

Share of Prairie State by JAA



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American Municipal Power (AMP)

- American Municipal Power (AMP) Ohio has more than 132 members across nine states, including Indiana, Kentucky, Maryland, Michigan, Ohio, Pennsylvania, Virginia, West Virginia, and the Delaware Municipal Electric Corporation. AMP assists its members in developing and implementing power supply strategies to ensure reliable and cost-effective electricity. This includes forecasting demand, evaluating power supply options, and optimizing resource portfolios. It also oversees the development of joint projects, such as hydroelectric plants and wind farms, to provide members with diverse and sustainable power sources.
- Additionally, AMP performs administrative roles like regulatory compliance, provides financial management services and offers technical support for its members.
- AMP has several Power Purchase Agreements (PPAs) in place to diversify their energy portfolio and ensure a reliable supply of renewable energy. Recently, AMP has signed a Power Purchase Agreement (PPA) with Avangrid for energy from the Blue Creek Wind Farm, which will supply reliable wind energy to Ohio homes and businesses.

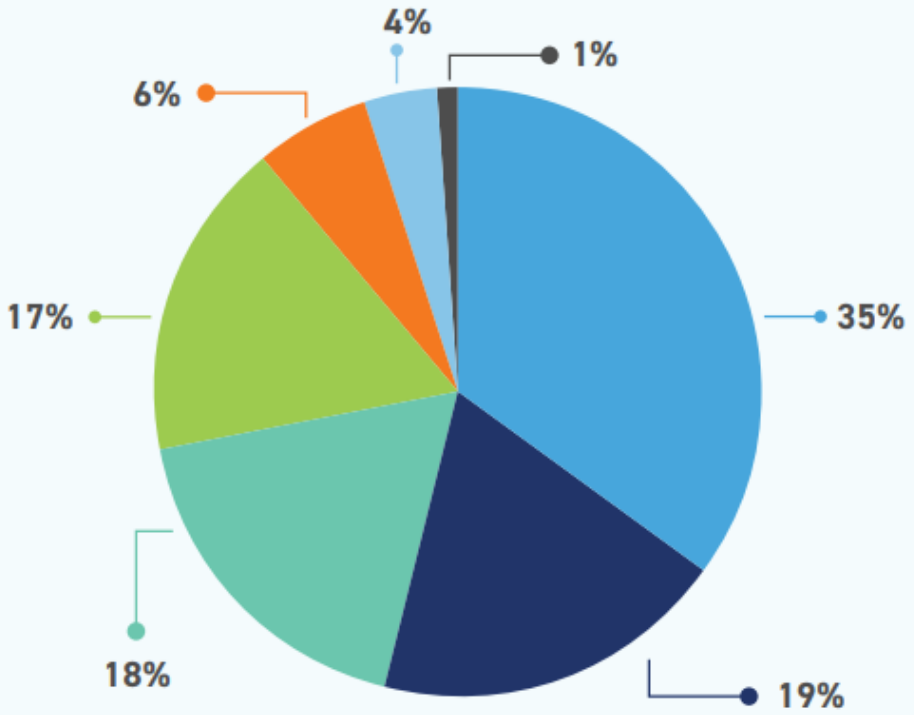
Evaluating this Option:

- AMP Ohio has a larger membership base, which can lead to greater economies of scale and potentially lower costs for power generation and procurement.
- AMP offers access to various renewable energy projects, such as hydroelectric plants and wind farms, helping Naperville meet its sustainability goals. However, AMP Ohio often requires **long-term power purchase agreements (PPAs)**, which can lock Naperville into fixed rates for extended periods. This could be a risk if market prices for energy decrease.
- Other risk is regarding **debt obligations**. AMP Ohio has substantial debt from various projects, and member communities may share in these financial obligations. This includes potential increases in costs if other members default on their payments.
- Also, there may be significant **upfront costs** associated with joining AMP Ohio, including membership fees and investments in infrastructure to integrate with AMP's systems.

AMP Member Power Supply Resource Mix (2023)

Total megawatt-hours (MWh): 16,065,128 MWh

35%	Purchased Power	6%	Member Coal
19%	AMP Fremont Energy Center	4%	Wind and Solar
18%	Prairie State Energy Campus (PSEC)	1%	Landfill
17%	Hydro		



- The Wind and Solar percentage includes Member-owned solar.
- The Member Coal figure includes the participation of AMP Members Paducah and Princeton in PSEC through the Kentucky Municipal Power Agency.
- The Hydro percentage includes Member-owned hydro and New York Power Authority.
- AMP, on behalf of its Members, sells all or a portion of the renewable energy certificates created by its renewable energy projects, power purchase agreements and joint ventures to help reduce its wholesale power costs.

DRAFT

Conclusion

Customized Energy Solutions

More autonomy, more risk

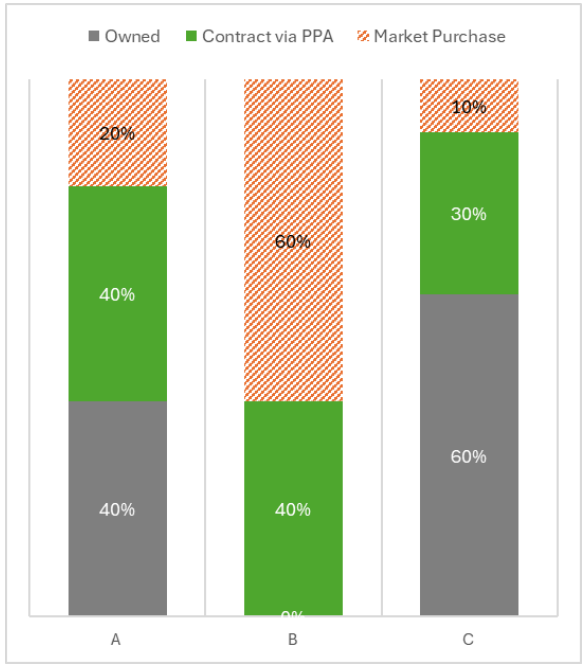
Outside of a Joint Action Agency

Naperville has **more autonomy** to choose the resource mix, including Naperville-owned generation, contracting and market purchases. Naperville will also need to **staff up in each of the three functions**. There is a **significant risk** of rate uncertainty given the small size of Naperville load.

Market Purchase with PJM

Contracted, e.g. Power Purchase Agreements

Owned, e.g. city-owned generation



Less autonomy, less risk

Part of a Joint Action Agency

Naperville outsources energy procurement and participates in discussion of resource procurement but does not have sole autonomy.
The three options are mutually exclusive.

Stay with IMEA	Join a different JAA	Start a new JAA
Predictable but increasing rates to comply with CEJA, proven track record, return on 30 years pay for capacity investment	Predictable rates with new upfront cost. Potential option to customize portfolio just for Naperville with cost risk born by the city. Loss of 30-year capacity investment in IMEA resources.	Similar autonomy, costs and risks to being outside of a JAA.

Thank You

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