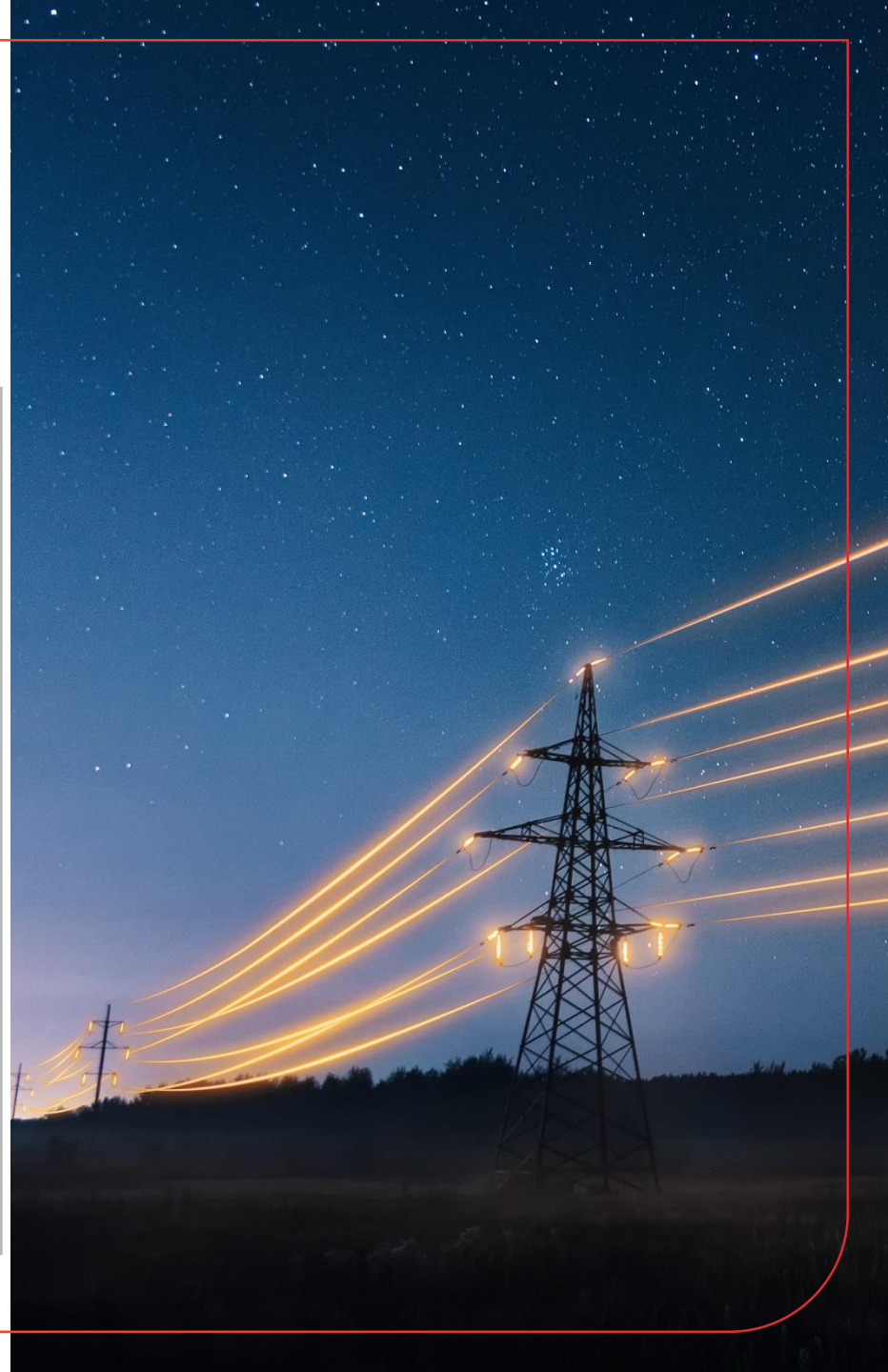
2023 RPU Resource Plan Update

RPU Board Presentation

August 10, 2023

Mike Borgstadt
John Christensen



Meeting Agenda

01	About 1898 & Co.
02	Power Supply Planning Overview
03	Industry Overview & Trends
04	Planning Input Assumptions
05	Analysis & Results
06	Key Takeaways

About 1898 & Co.

1898 & Co. | Part of Burns & McDonnell - 125 years of consulting, engineering, and constructing critical infrastructure

- Business strategy
- Business transformation
- Corporate innovation
- Strategic asset planning
- Asset due diligence
- Business intelligence & analytics
- Capital planning
- Financial analysis & rate design
- Electrification & EV Planning

- Enterprise system integration & cloud strategy
- Software solution development
- Spatial applications & consulting
- PMIS Technology Consulting (Oracle Primavera, IBM Maximo, etc.)
- Geographical Information System Integration

- Executive Advisory
- Critical Infrastructure Cybersecurity
- Business Outcome Solutions
- Managed Security Services
- Risk Management & Compliance

Where We Are

● 225+ Planners & Consultants

Our Ranking Nationally

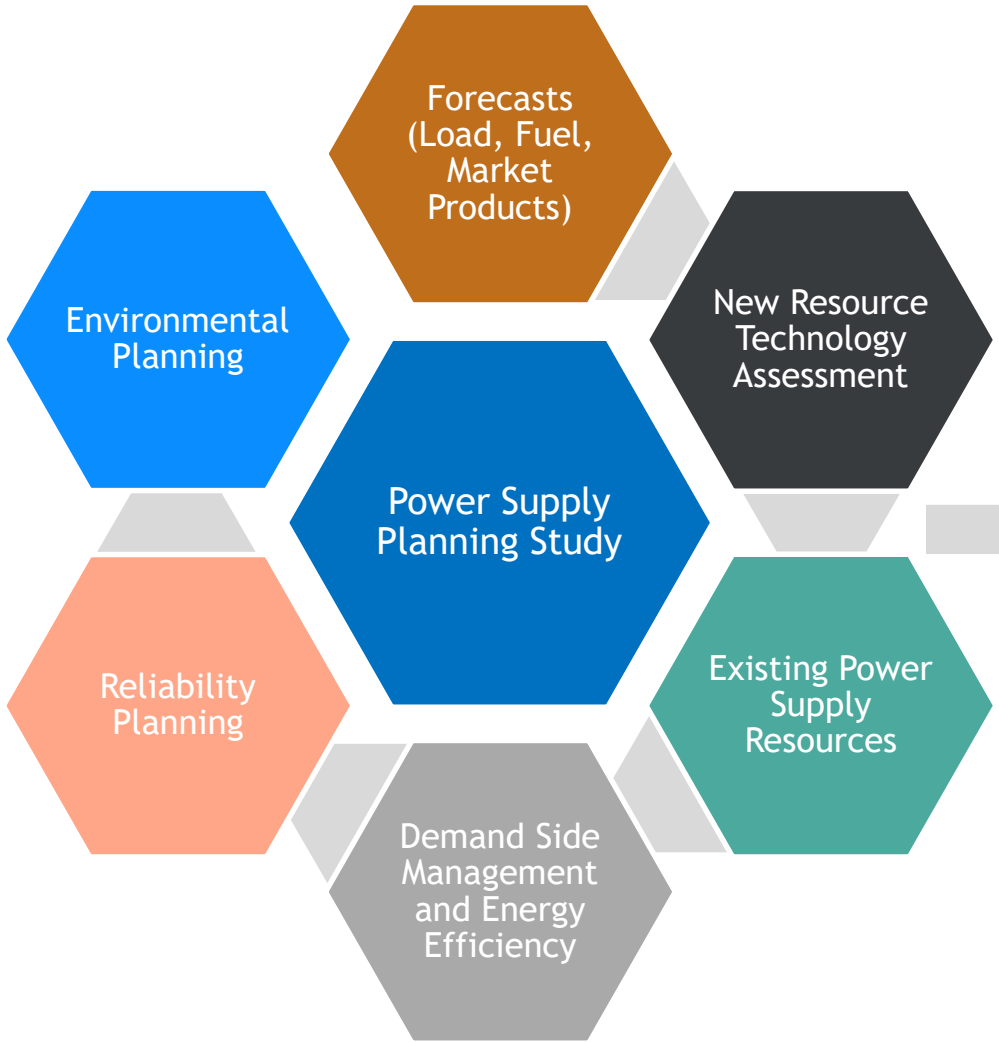
Engineering News-Record (2022 Rankings)

1	Power
1	Transmission and Distribution
4	Wind
3	Fossil Fuel
9	Cogeneration
7	Petroleum
8	Clean Air Compliance
10	Assessment Compliance
12	Chemical and Soil Remediation
6	Overall

Clients We Serve

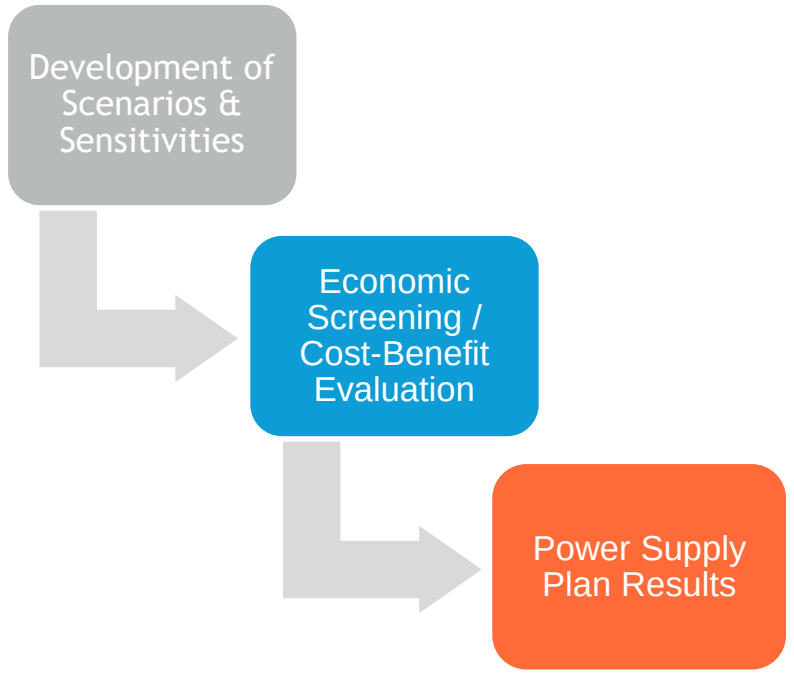
Power Supply Planning Overview

Power Supply Planning Study Foundations



Primary goal of a power supply planning study is to provide an economic evaluation of a utility's power supply portfolio over both short-term and long-term planning horizons.

Focus on short-term decisions that position utility for long-term success.



Power Supply Plan Highlights

- RPU will need to replace both energy and capacity.
  - The Southern Minnesota Municipal Power Agency (SMMPA) contract (CROD) will expire in March of 2030.
- Dramatically reduces fossil-based energy supply.
  - Provides a pathway to drastically reduce RPU's current use of fossil-fueled energy by shifting most of the energy production to renewable resources.
- Greatly exceeds goals for environmental friendliness.
  - Positions RPU to exceed City's and State's goals regarding environmental attributes and compliance.
- Provides RPU flexibility, resiliency, and diversity.
  - Provides RPU a diverse power supply portfolio implementing wide-range of resources and technologies.
  - Allows RPU to adapt to new seasonal capacity requirements from MISO.

Industry Overview & Trends

Power Industry Trends

- Energy transition is still occurring, the pace differs by region (within MISO and across the U.S.).
- Generation interconnection requests continue to flood the independent system operators (ISO).
- New generation and retirements present challenging transmission constraints that are impacting power market prices.
- Shifting away from baseload plants to quick-start, flexible resources to accommodate renewables.
- Increased interest in firm peaking capacity
  - Required to integrate increasing amounts of renewable power
  - Firm, dispatchable resources especially after Winter Storm Uri
  - Renewed interest in dual fuel capabilities (fuel oil, LNG) in constrained areas
- Industry is focusing on seasonal reliability as the system experiences fossil-based retirements, becomes more reliant on renewables, and evaluates impacts from significant weather events.
- Continued electrification of the economy and higher rates of electric vehicle (EV) penetration.
- Research continues in emerging technology such as long-duration battery storage, hydrogen, and small modular nuclear reactors (SMR) as carbon-free sources of capacity to balance the intermittency of renewables.
  - The Inflation Reduction Act (IRA) provided many incentives for emerging technologies as well as tax breaks for renewables.

Industry Wrestling with Capacity Accreditation

- Power supply resources have two major components for satisfying customer load: 1) Energy and 2) Capacity.
- Power supply resources have different attributes: Renewable resources are great for energy, but not as great for capacity.
- The industry historically had planned to the highest peak during the year: Summer.
- The industry across the country is determining how to accredit resources for their ability to provide capacity across the different seasons.
  - Wind: Production is high during spring and fall months, lower in the summer.
  - Solar: Production is great during summer, but winter has short days and less direct sunlight.
  - Gas units: Some areas of the country can be constrained for fuel in winter with heating demand.
- Many studies are being completed to assess the "right" value for seasonal capacity:
  - Xcel – Filed a request with the Commission that 50 hours of energy storage be the minimum capability.
  - PJM (ISO located east of MISO) – Currently 4-hours of storage gets 80% accreditation.
  - MISO – 2022 Regional Resource Assessment (November 2022)
  - Takeaway: This is a moving target, the industry has a lot of work to do to assess risks with intermittent resources and a grid more reliant on renewables.

Industry Wrestling with Capacity Accreditation

- Projection of MISO's 2031 hourly load profile

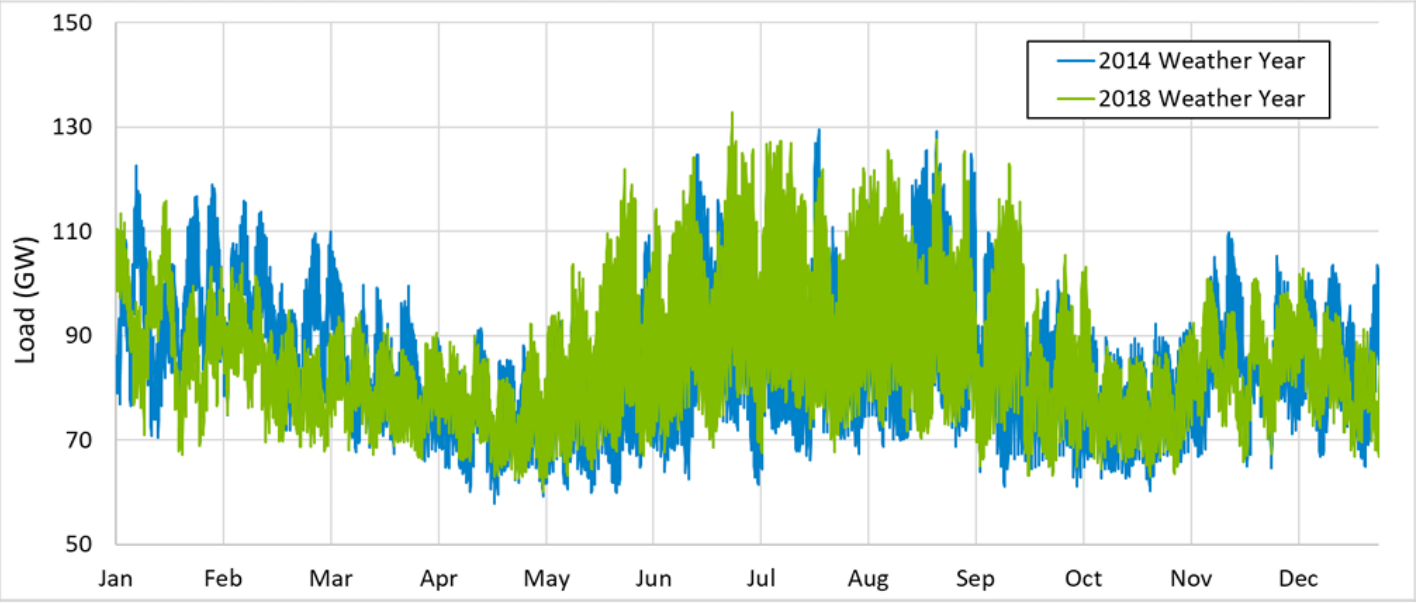
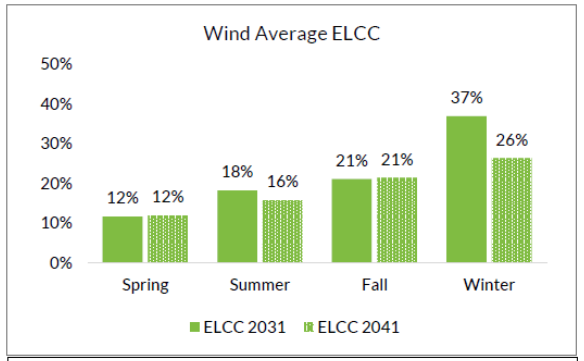
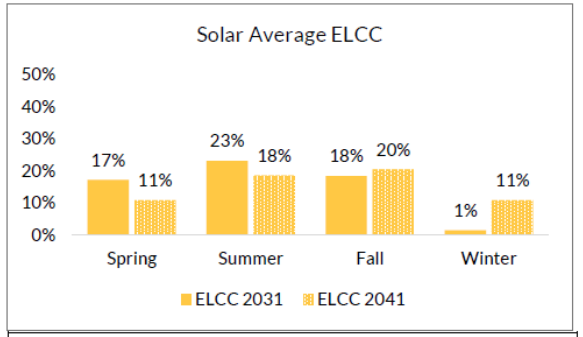


Figure 8: Sample MISO-wide load profile for Year 2031



2031 Installed Capacity: 56 GW 2041 Installed Capacity: 87 GW



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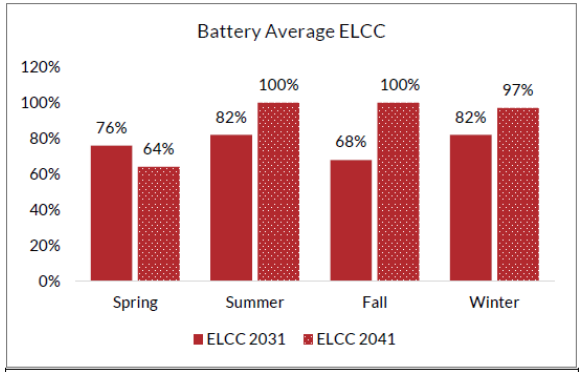
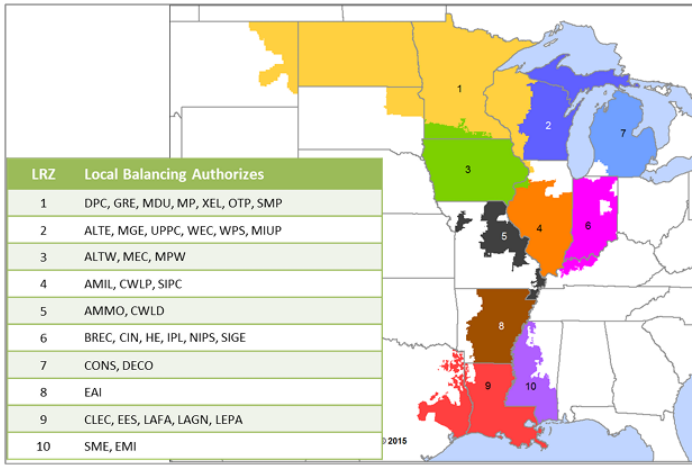


2031 Installed Capacity: 2 GW 2041 Installed Capacity: 11 GW

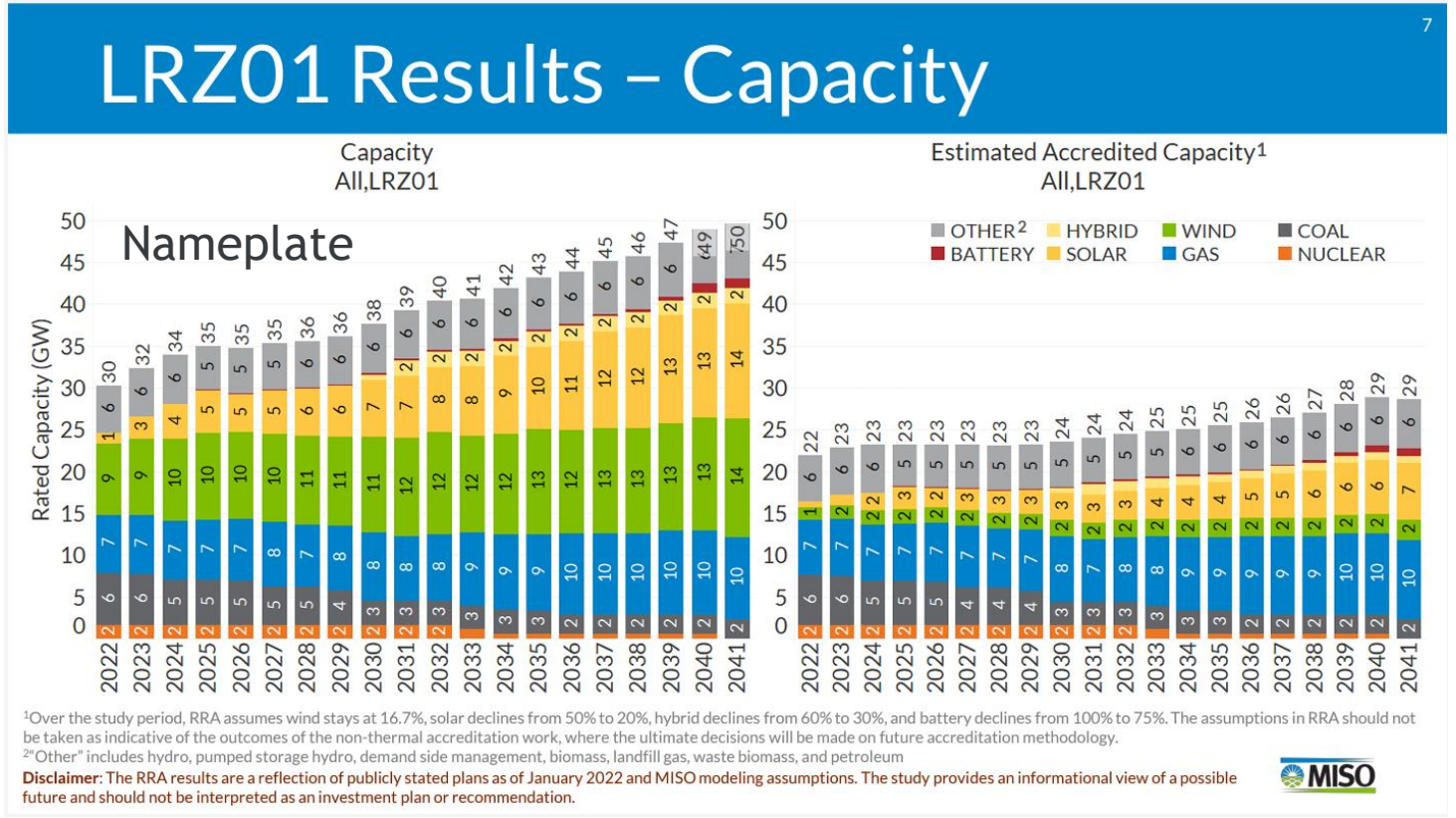
Source: MISO – 2022 Regional Resource Assessment (November 2022)

Industry Wrestling with Capacity Accreditation

MISO's capacity projections for Load Resource Zone 1, which RPU is located



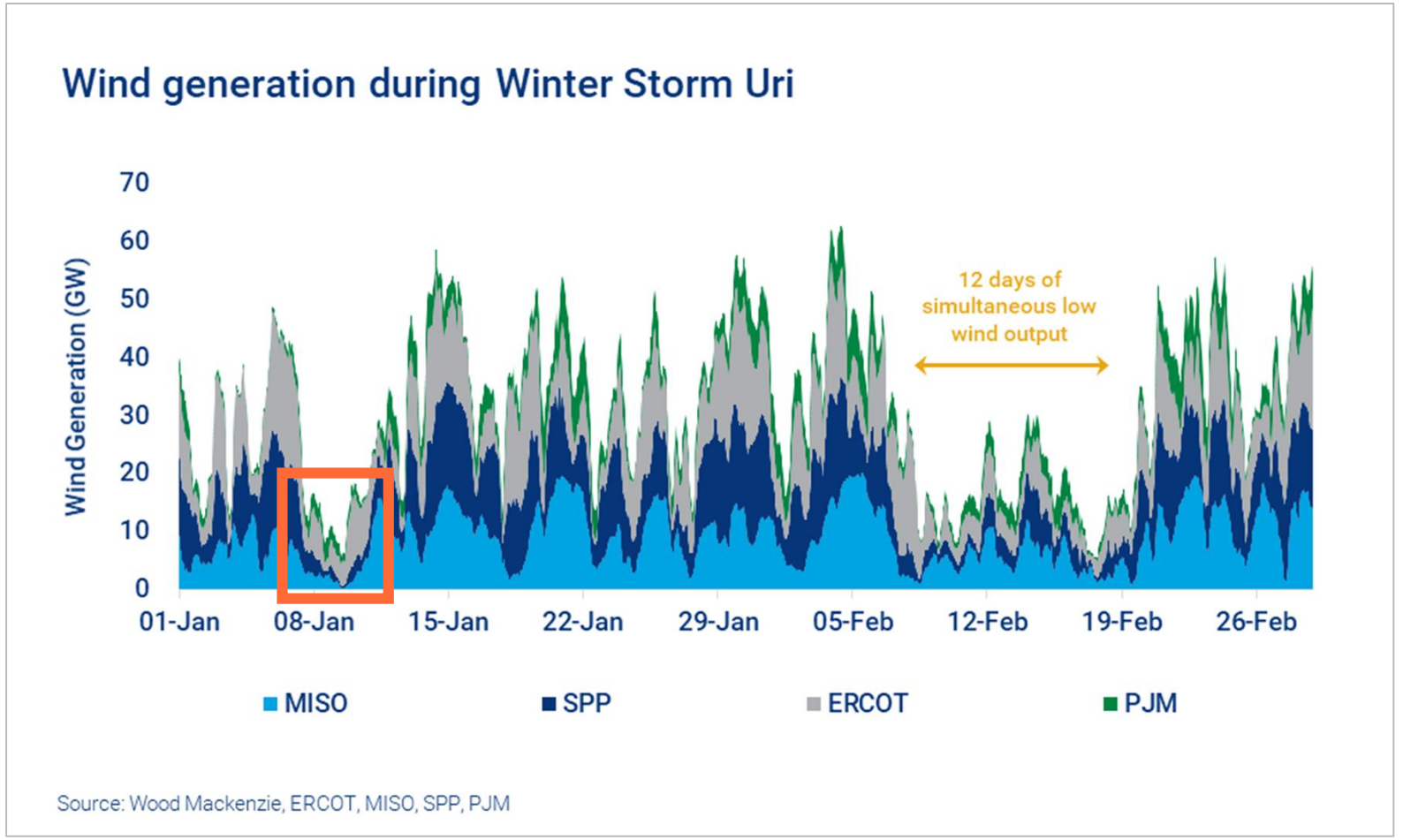
LRZ	Local Balancing Authorizes
1	DPC, GRE, MDU, MP, XEL, OTP, SMP
2	ALTE, MGE, UPPC, WEC, WPS, MIUP
3	ALTW, MEC, MPW
4	AMIL, CWLP, SIPC
5	AMMO, CWLD
6	BREC, CIN, HE, IPL, NIPS, SIGE
7	CONS, DECO
8	EAI
9	CLEC, EES, LAFA, LAGN, LEPA
10	SME, EMI



Source: MISO – 2022 Regional Resource Assessment (November 2022) Technical Appendix: RRA Assumptions and Methodology

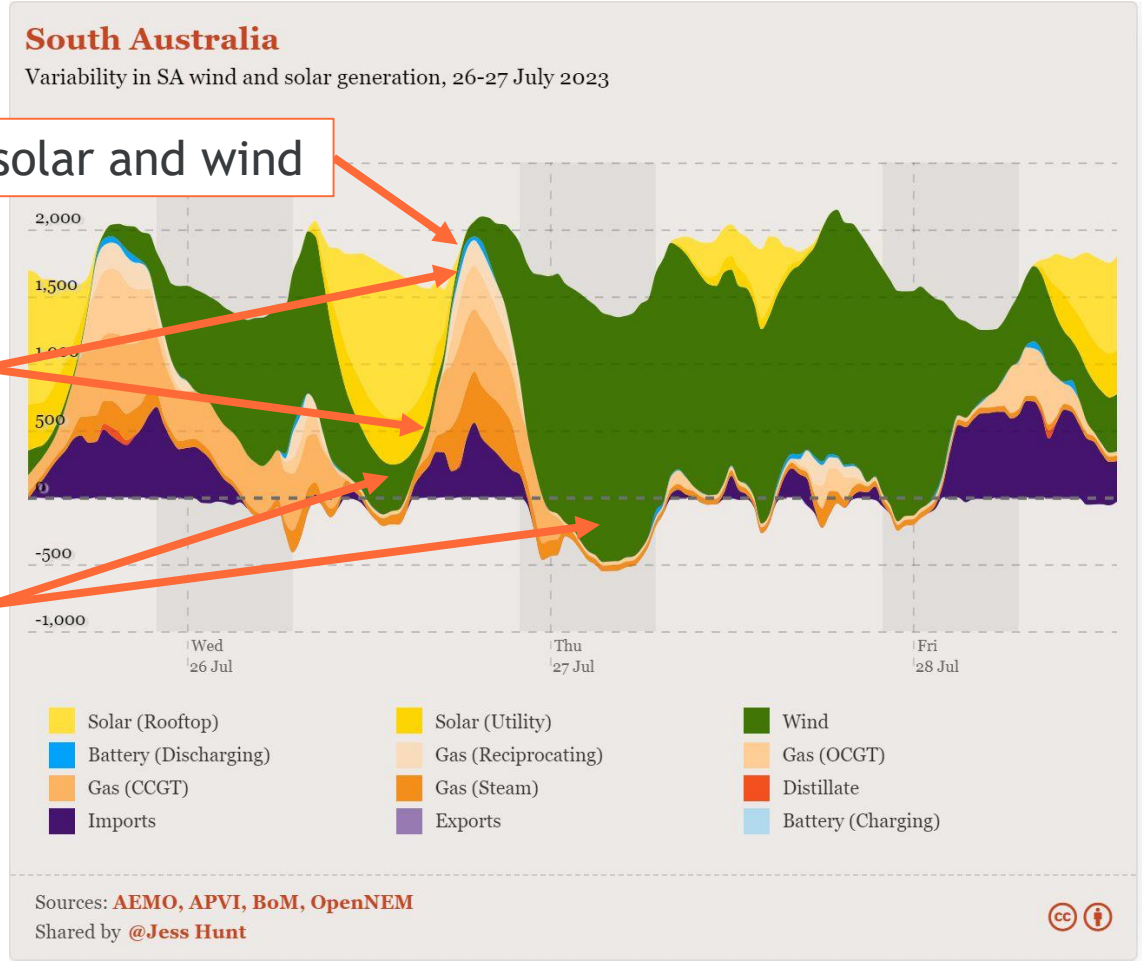
Challenges of Reliability with Intermittent Resources

- Intermittent generation: Wind and solar production during extreme weather may be reduced.
- Long-duration resources, with firm energy supply, are needed to incorporate more renewables



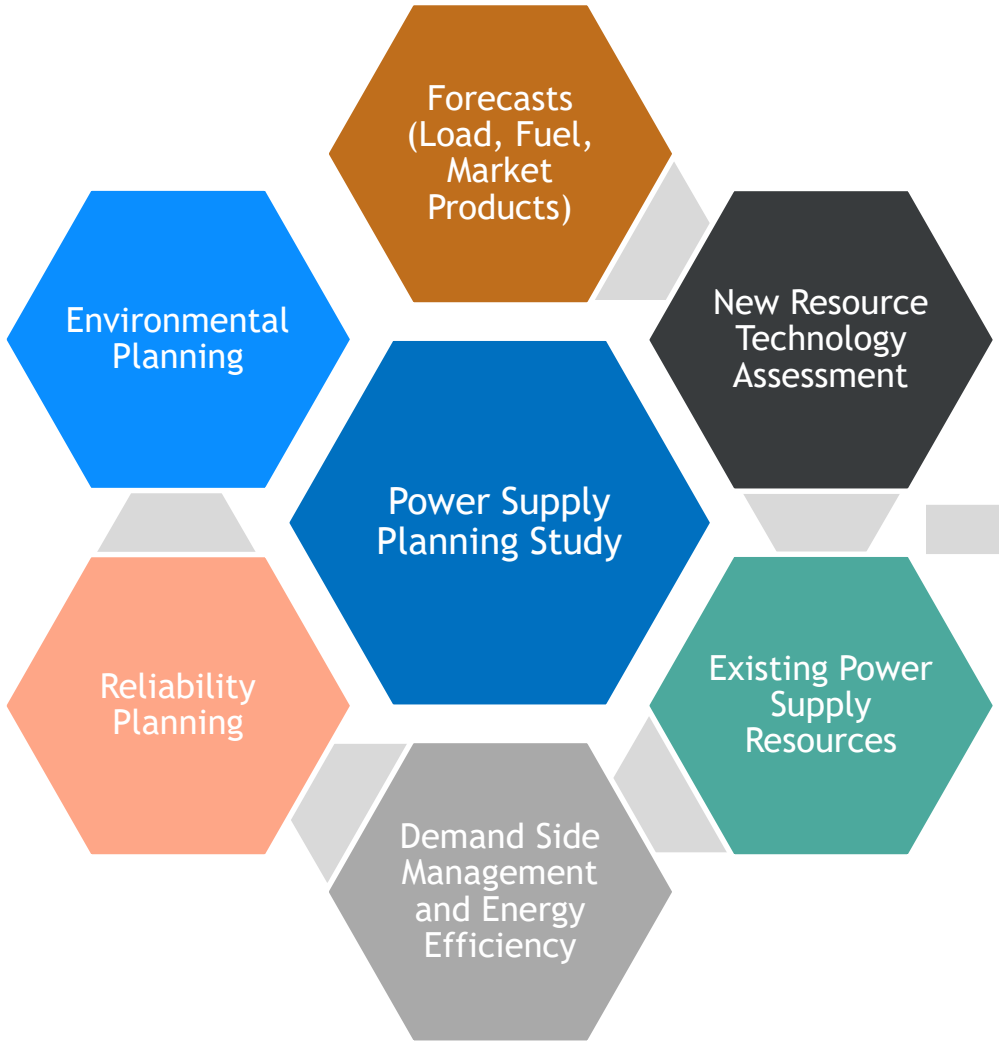
Industry Wrestling with Managing Energy

- The power industry has the need for firm, dispatchable, flexible, reliable generation to integrate large amounts renewable resources



Planning Input Assumptions

Power Supply Planning Study Foundations



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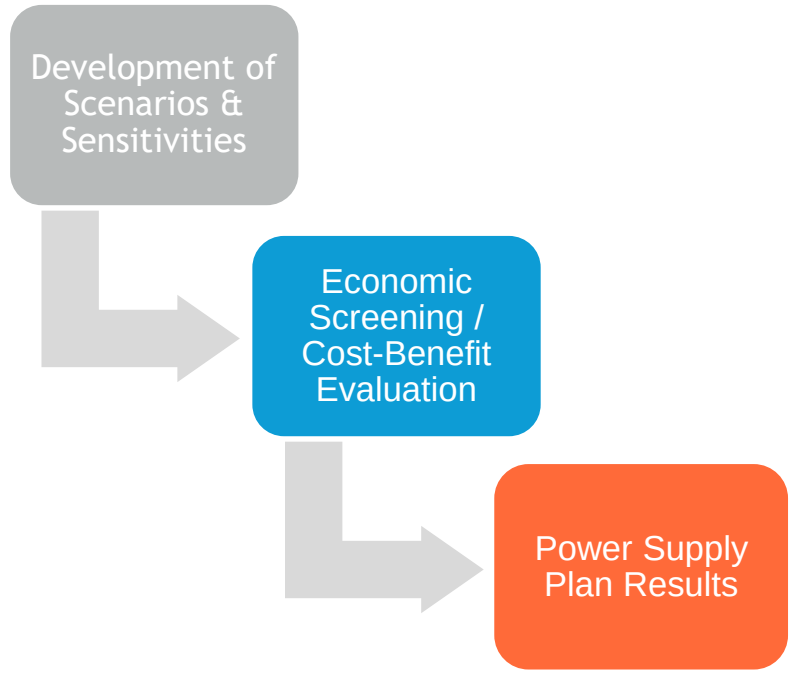
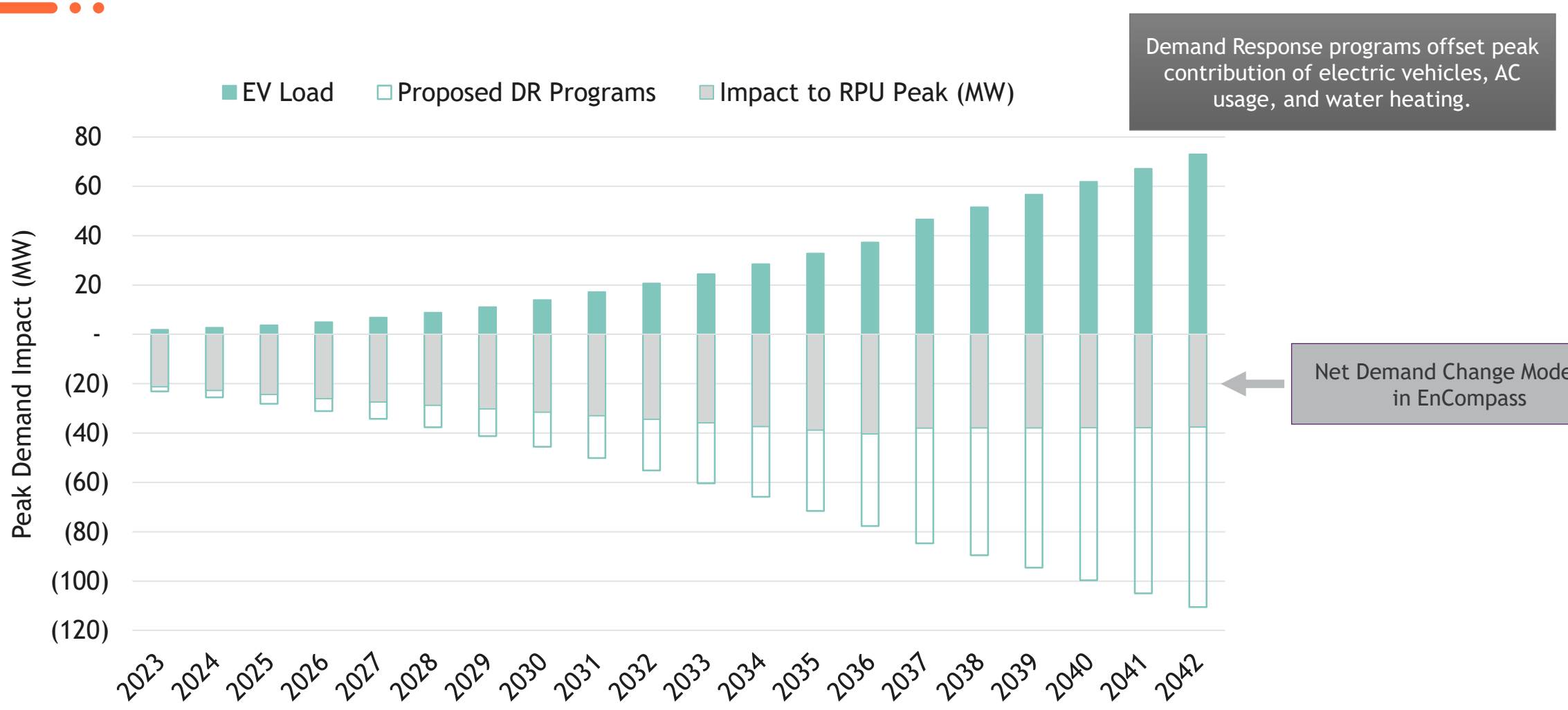
Focus on short-term decisions that position utility for long-term success.



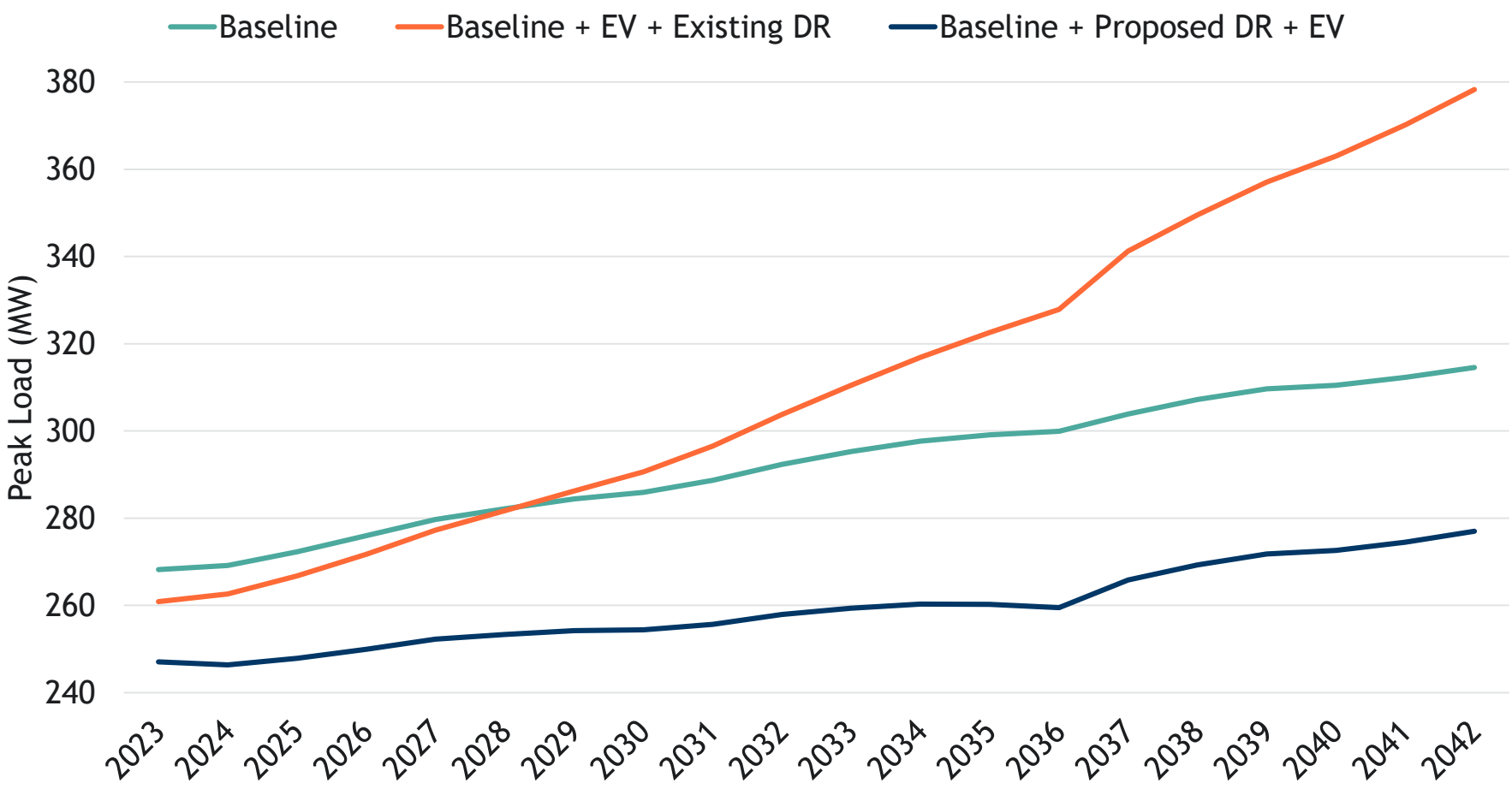
Peak Load (Electric Vehicles & Demand Response)



Demand Response programs offset peak contribution of electric vehicles, AC usage, and water heating.

Net Demand Change Modeled in EnCompass

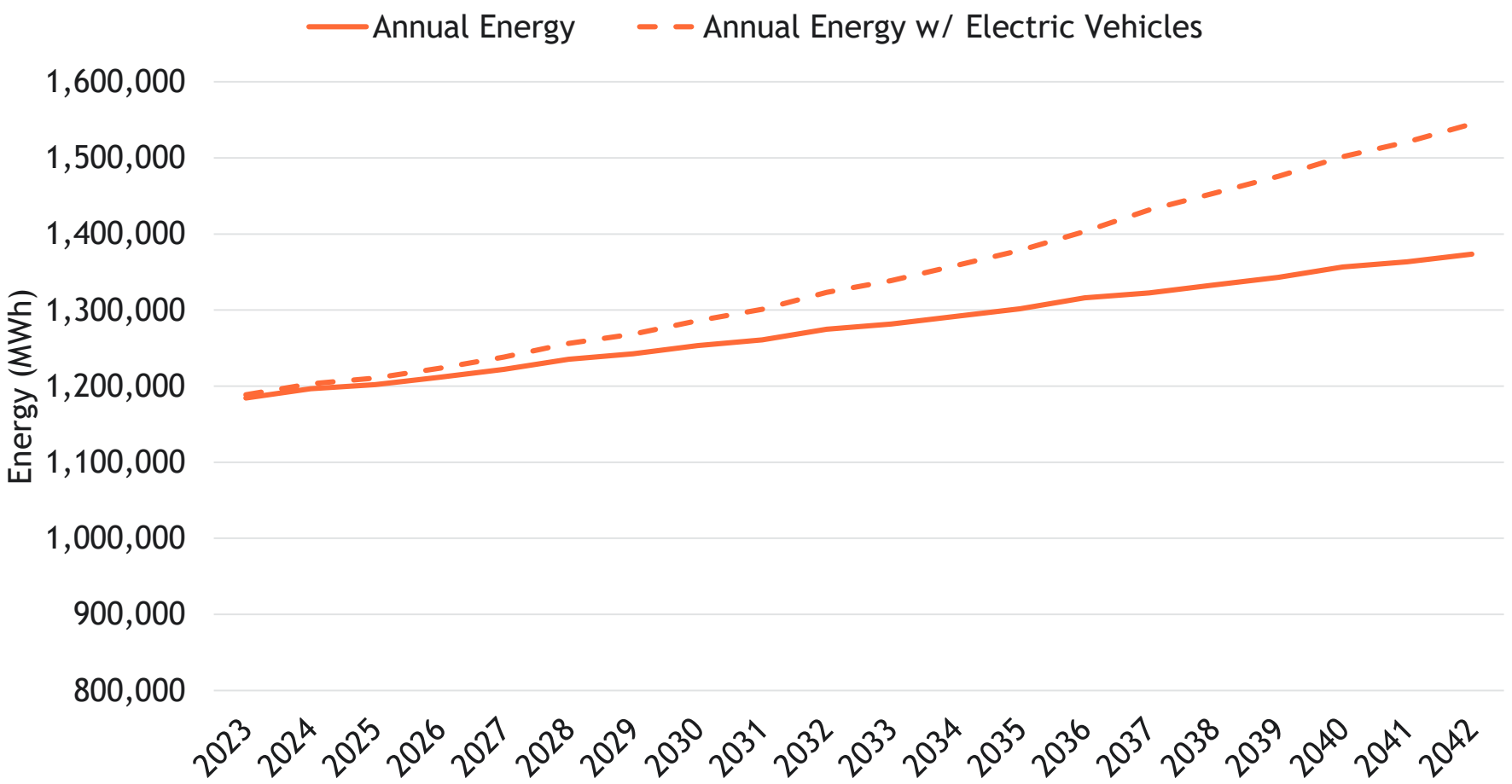
Peak Load (Electric Vehicles & Demand Response)



Proposed Demand Response programs can negate EV effects on peak with ~100 MW offset by 2042.

Utilized the Proposed DR forecast for modeling

Energy Forecast (Electric Vehicle Base)

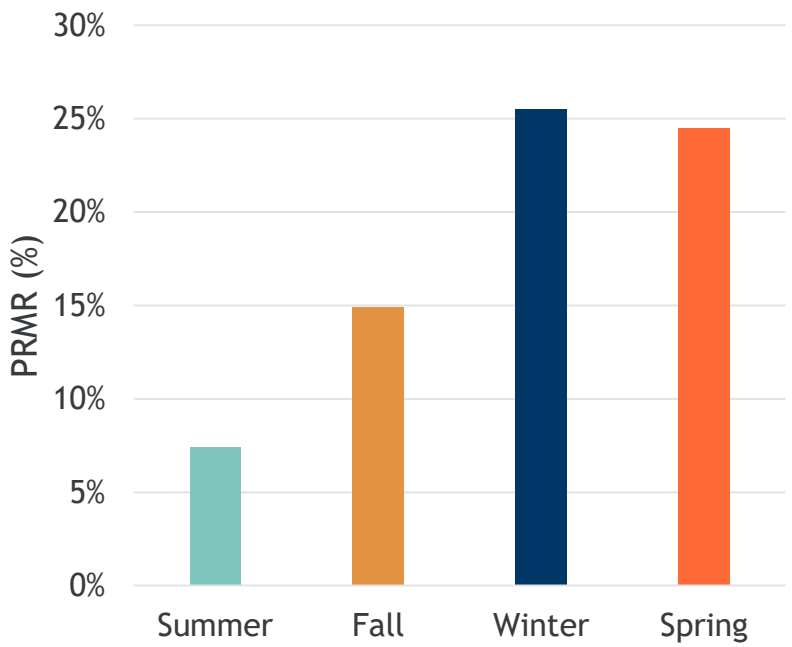


The model accounted for the increase in energy demand due to EV charging.

MISO Seasonal Resource Adequacy Construct

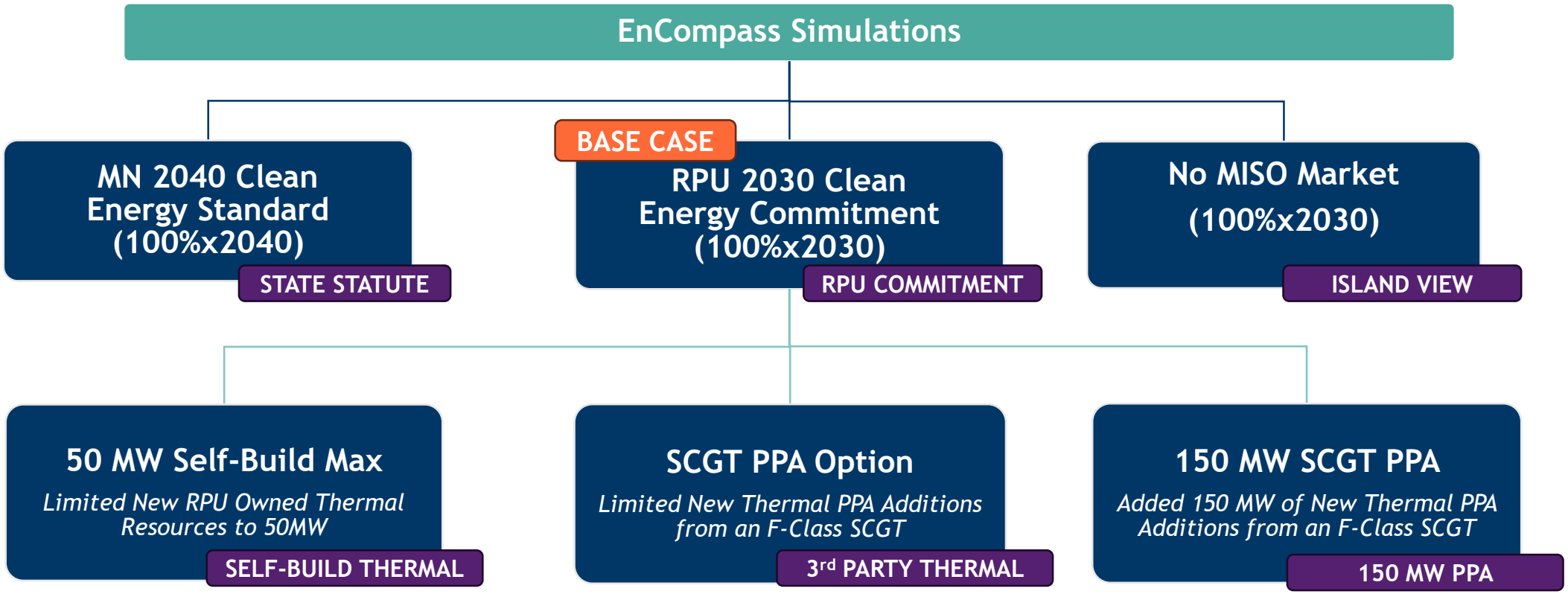
- MISO has moved to a four-season resource adequacy construct
- Market entities are required to demonstrate sufficient reserves on a quarterly basis
- Unplanned unit outages – which occur during peak hours – carry an increased penalty toward future accreditation

- Reserve Margin Requirements vary by season…



Analysis & Results

Scenario Summary



Resource Selection

Year	100x2030 Base Case	100x2030 50 MW Self-Build Max	100x2030 SCGT PPA Option	100x2030 150 MW SCGT PPA	100x2030 No MISO Market	100x2040
Storage →	4-Hr Storage (100 MW)	4-Hr Storage (100 MW)	4-Hr Storage (50 MW)	⊘	4-Hr Storage (100 MW)	4-Hr Storage (100 MW)
Wind →	Wind (350 MW)	Wind (350 MW)	Wind (350 MW)	Wind (400 MW)	Wind (400 MW)	Wind (200 MW)
2030 Solar →	Solar (50 MW)	Solar (50 MW)	Solar (50 MW)	Solar (50 MW)	Solar (50 MW)	Solar (50 MW)
Thermal →	Aeroderivative (50 MW)	Aeroderivative (50 MW)	F-Class SCGT PPA (100 MW)	F-Class SCGT PPA (150 MW)	Aeroderivative (50 MW)	Aeroderivative (50 MW)
2031			Wind (50MW)			
2033	Wind (100 MW)	Wind (100 MW)	Wind (50 MW)	Wind (50 MW)	Solar (50 MW)	Wind (250 MW)
2042			Wind (50 MW)		Wind (50 MW)	
Total	4-Hr Storage (100 MW) Wind (450 MW) Solar (50 MW) Aeroderivative (50 MW)	4-Hr Storage (100 MW) Wind (450 MW) Solar (50 MW) Aeroderivative (50 MW)	4-Hr Storage (50 MW) Wind (500 MW) Solar (50 MW) F-Class SCGT PPA (100 MW)	Wind (450 MW) Solar (50 MW) F-Class SCGT PPA (150 MW)	4-Hr Storage (100 MW) Wind (450 MW) Solar (100 MW) Aeroderivative (50 MW)	4-Hr Storage (100 MW) Wind (450 MW) Solar (50 MW) Aeroderivative (50 MW)
Total NPV ($)	**$479 Million**	**$479 Million**	**$500 Million**	**$449 Million**	**$639 Million**	**$459 Million**
Delta from Base ($)			**-$29 Million**	**-$30 Million**	**$159 Million**	**-$21 Million**
Delta from Base (%)			**-3%**	**-3%**	**15%**	**-2%**

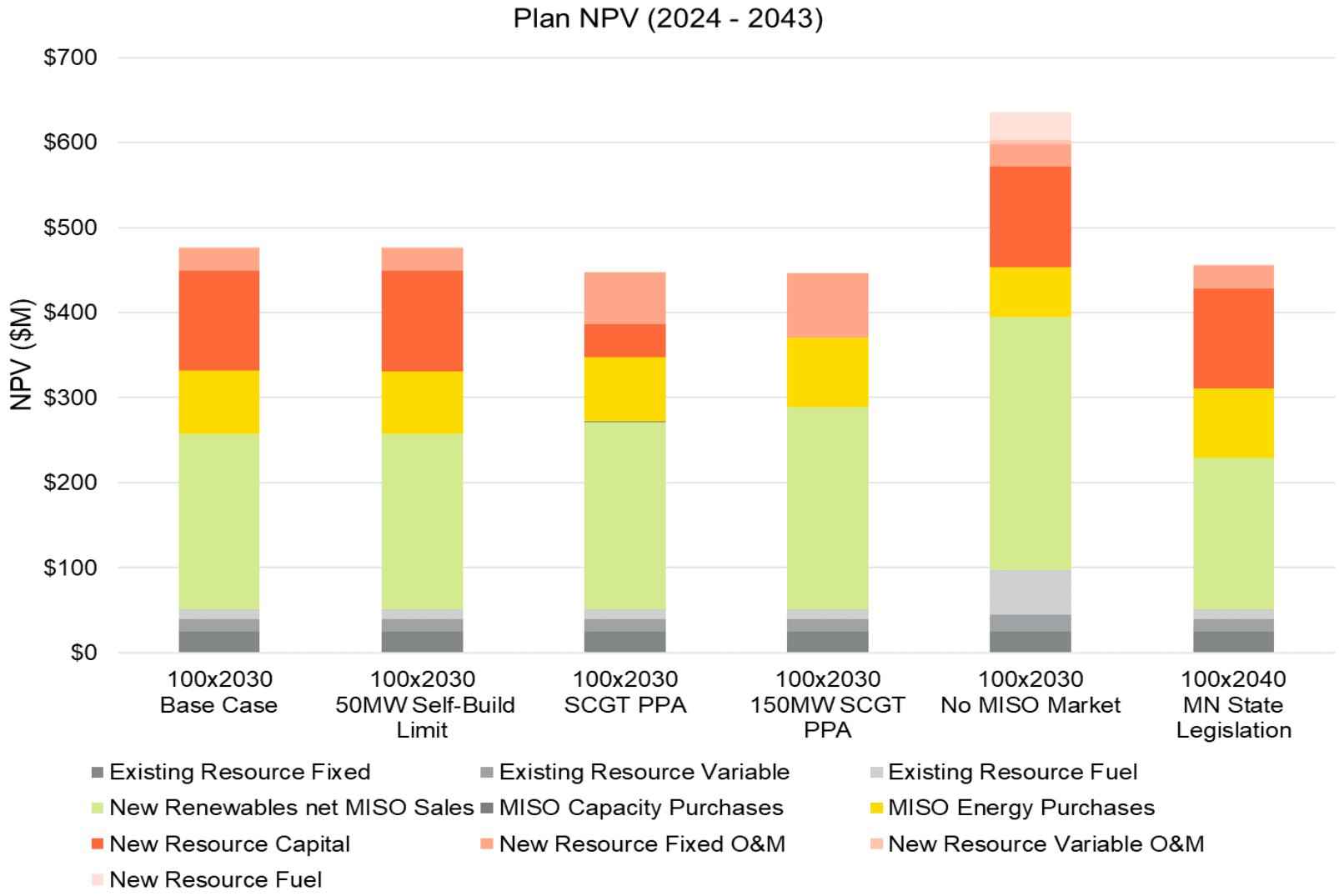
Removed from consideration.

These were evaluated for sensitivity impacts.

Base Case and Self-Build Case have the same plan

Storage may require overbuild for accreditation

NPV Summary



In all Cases: MISO Transmission Charges, FTRs, ARRs, Energy Hedging, and other Power Market Participant Costs are excluded from the modeling

Detailed Summary Analysis

BASE CASE

RPU 2030 Clean Energy Commitment (100%x2030)

RPU COMMITMENT

&

50 MW Self-Build Max

Limited New RPU Owned Thermal Resources to 50MW

SELF-BUILD THERMAL

Base Case (100x2030)

BASE CASE

RPU 2030 Clean Energy Commitment (100%x2030)

RPU COMMITMENT

50 MW Self-Build Max

Limited New RPU Owned Thermal Resources to 50MW

SELF-BUILD THERMAL

Case Description

The Base Case and 50 MW Thermal Self-Build Case have different resource options for meeting our RPU's commitment to 100% Net Renewable energy by 2030.

Case Summary

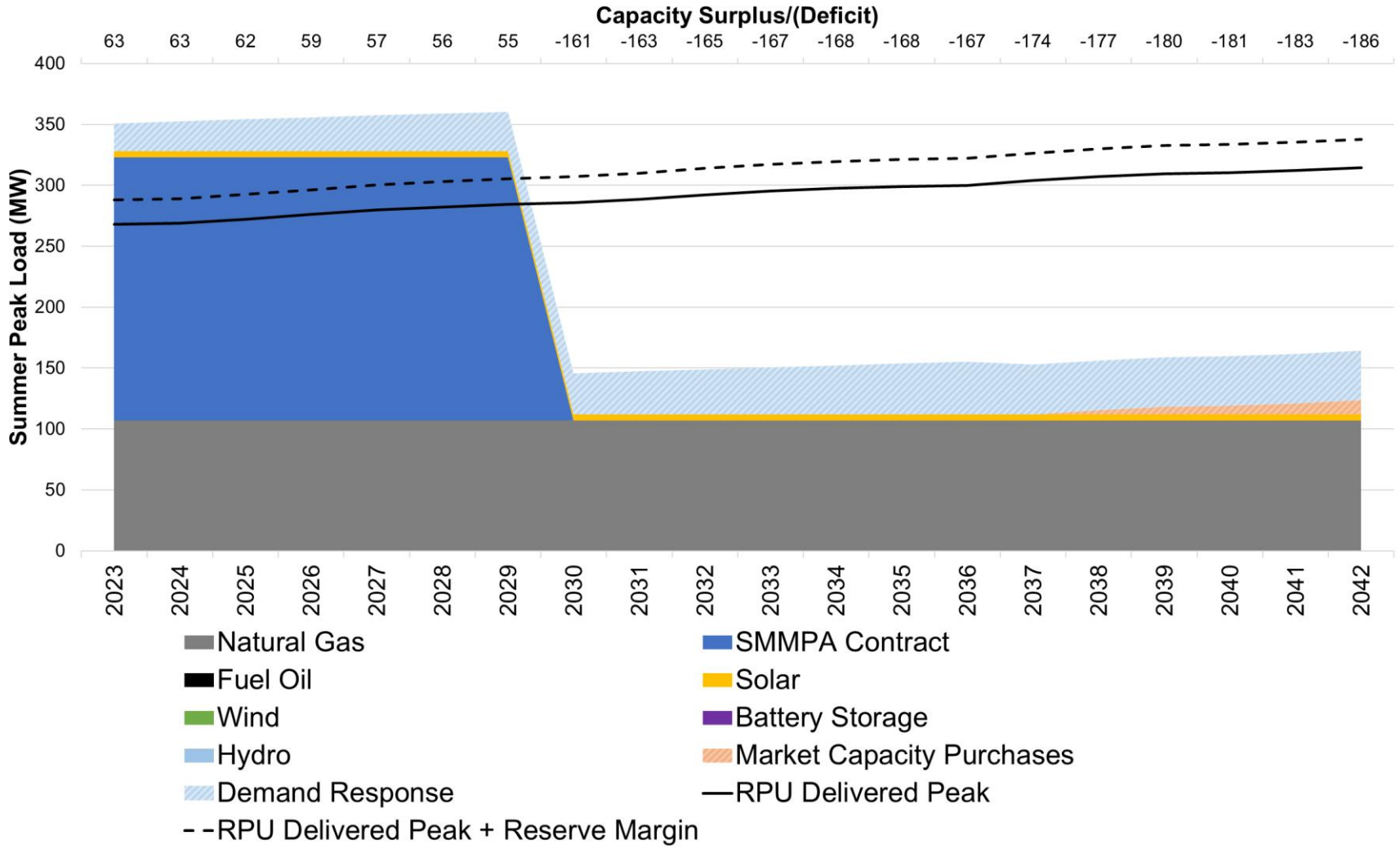
The Base Case and 50 MW Thermal Self-Build Case select the same resource plans from the alternatives even though the Base Case includes the option to select a full-sized F-Class SCGT.

The resource plan includes a diverse mix of small thermal, storage, wind and solar. The solar is included to reach compliance with the Minnesota Solar Energy Standard.

Year	100x2030 Base Case	Capital Costs
2030	4-Hr Storage (100 MW) Wind (350 MW) Solar (50 MW) Aeroderivative (50 MW)	$180M* $600M $98M $100M^
2031		
2033	Wind (100 MW)	$187M
2042		
Total	4-Hr Storage (100 MW) Wind (450 MW) Solar (50 MW) Aeroderivative (50 MW)	
Total NPV ($)	**$479 Million**	
Delta from Base ($)		
Delta from Base (%)		

* Energy storage considers overbuild to account for capacity accreditation.
^ Allowances include for costs such as transmission and gas upgrades, back-up fuel.

BLR after CROD Expiration (Summer)



Summer BLR

BASE CASE

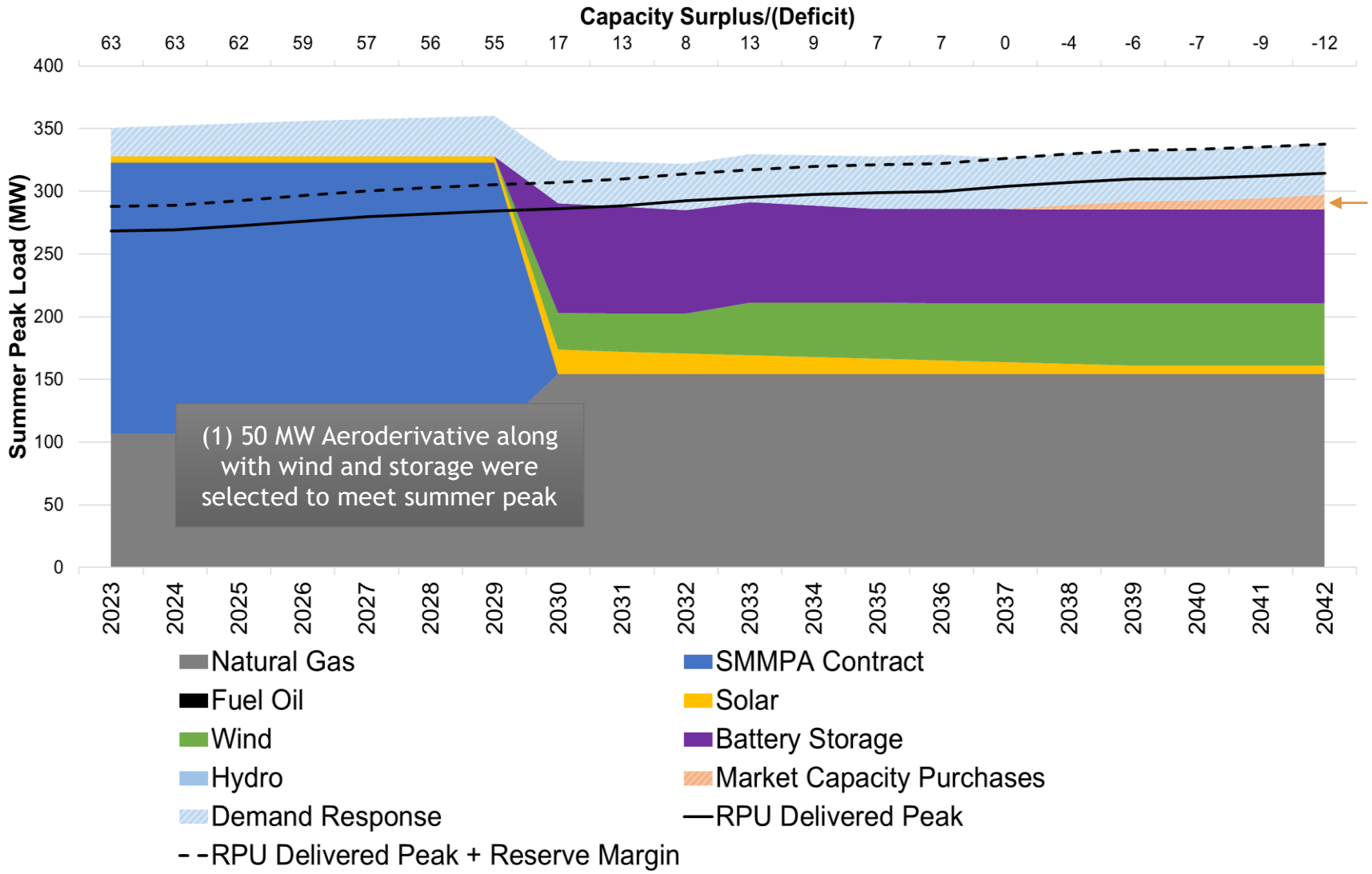
RPU 2030 Clean Energy Commitment (100%x2030)

RPU COMMITMENT

50 MW Self-Build Max

Limited New RPU Owned Thermal Resources to 50MW

SELF-BUILD THERMAL



Minor shortfall projected by late-2030s: could be addressed by storage augmentation depending on MISO Rules at the time

Spring BLR

BASE CASE

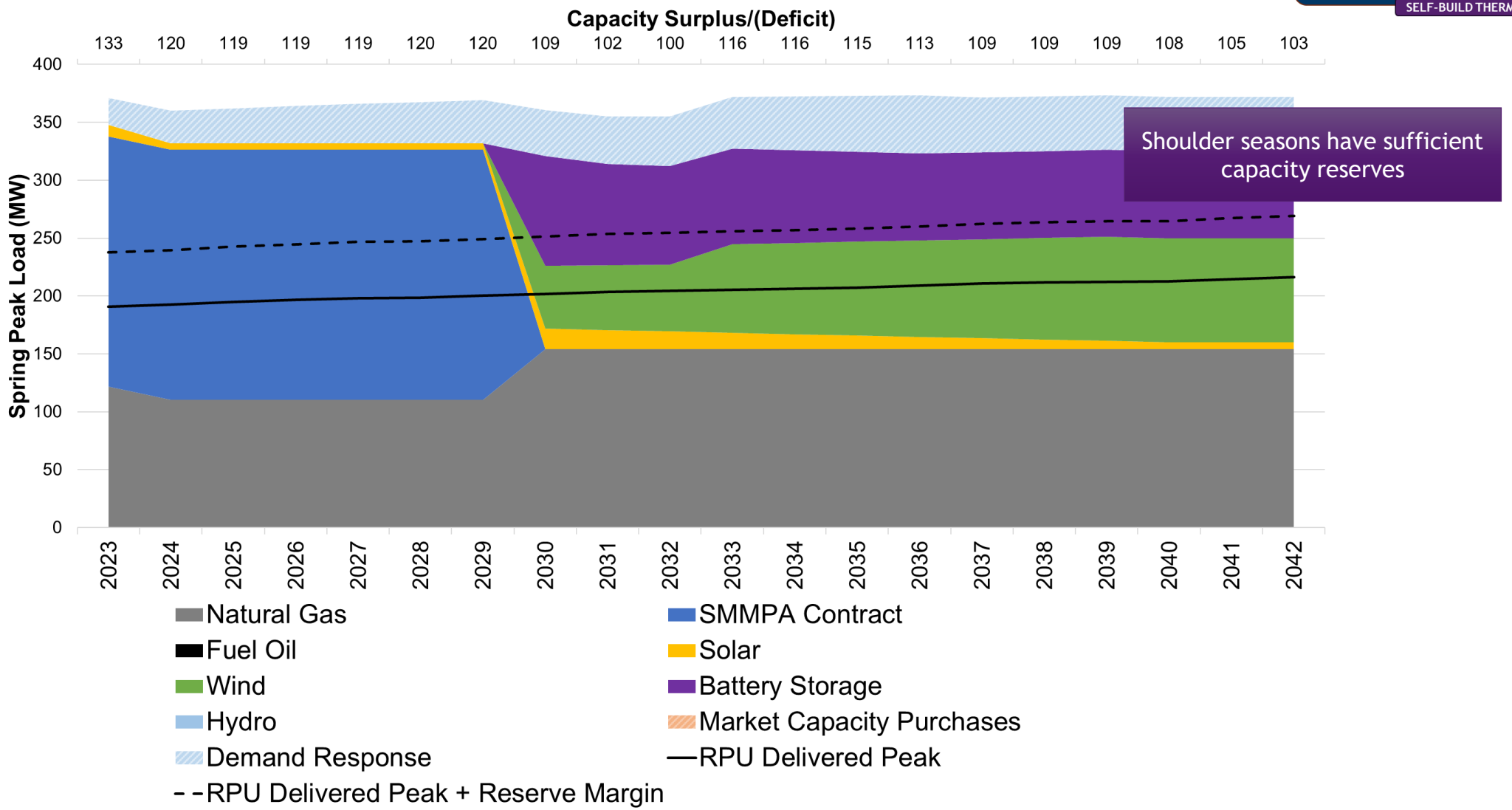
RPU 2030 Clean Energy Commitment (100%x2030)

RPU COMMITMENT

50 MW Self-Build Max

Limited New RPU Owned Thermal Resources to 50MW

SELF-BUILD THERMAL



Shoulder seasons have sufficient capacity reserves

Fall BLR

BASE CASE

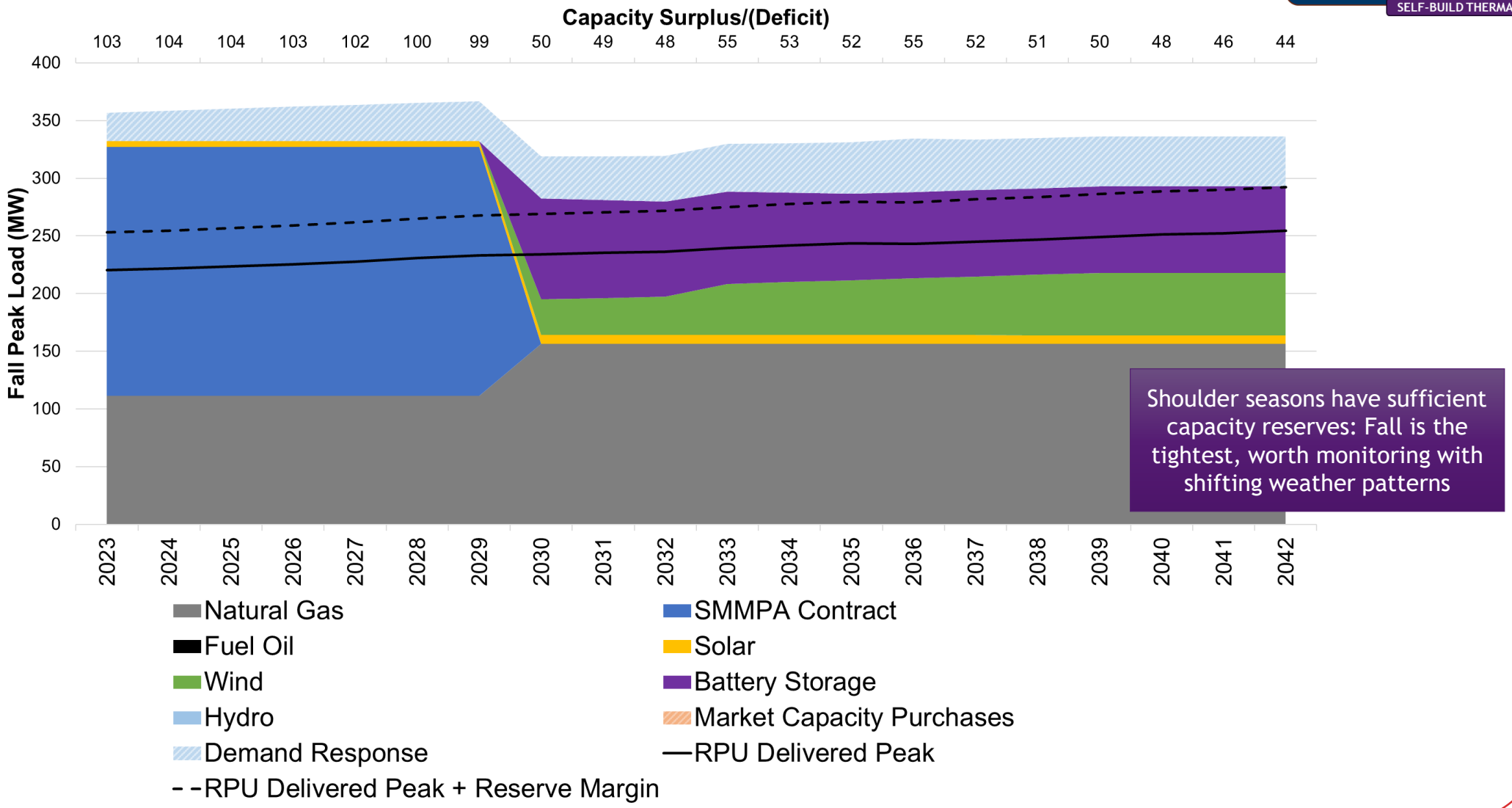
RPU 2030 Clean Energy Commitment (100%x2030)

RPU COMMITMENT

50 MW Self-Build Max

Limited New RPU Owned Thermal Resources to 50MW

SELF-BUILD THERMAL



Shoulder seasons have sufficient capacity reserves: Fall is the tightest, worth monitoring with shifting weather patterns

Winter BLR

BASE CASE

RPU 2030 Clean Energy Commitment (100%x2030)

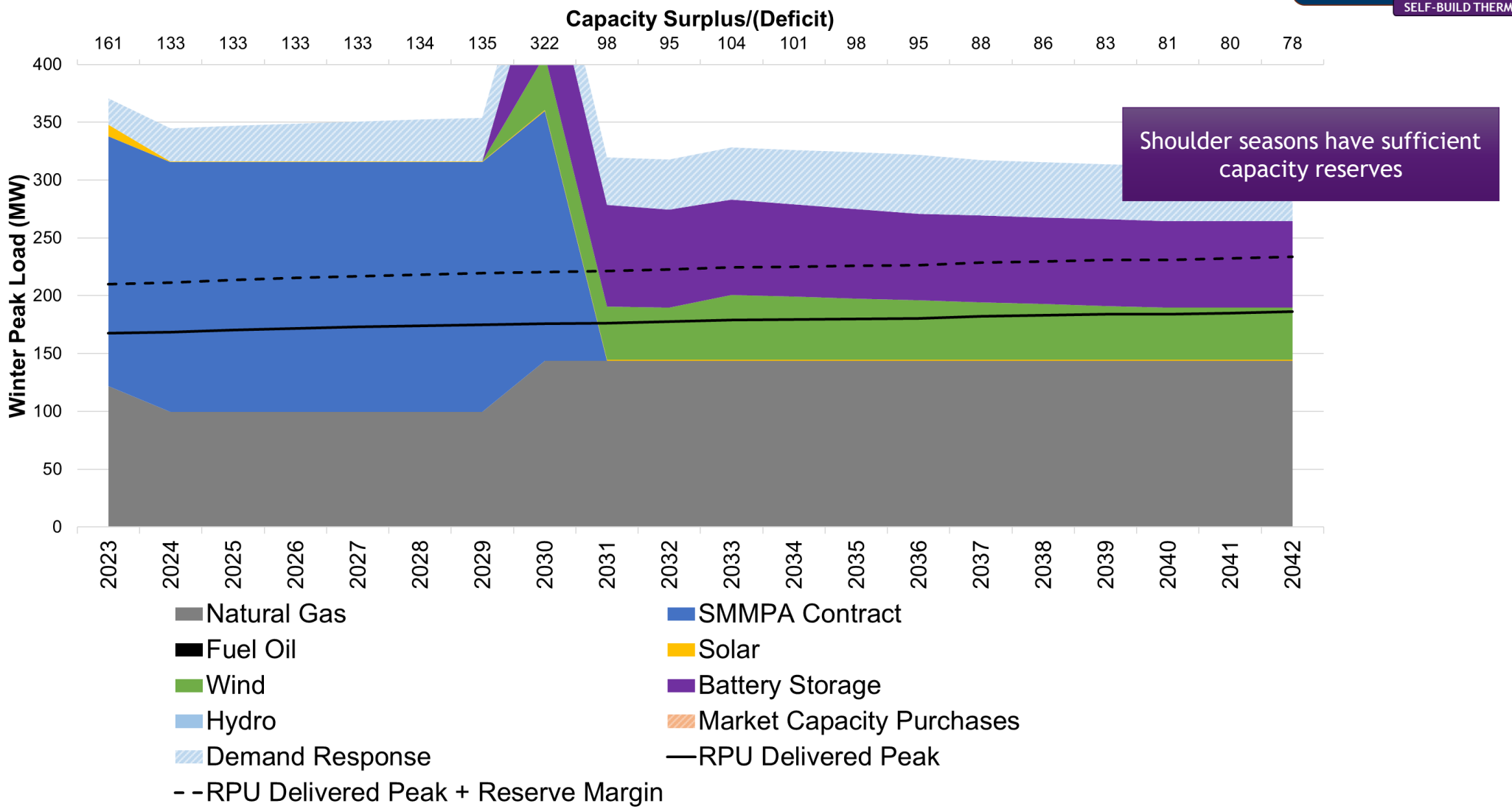
RPU COMMITMENT

50 MW Self-Build Max

Limited New RPU Owned Thermal Resources to 50MW

SELF-BUILD THERMAL

2030 Spike caused by resource timing



Shoulder seasons have sufficient capacity reserves

Energy from RPU Generation Resources

BASE CASE

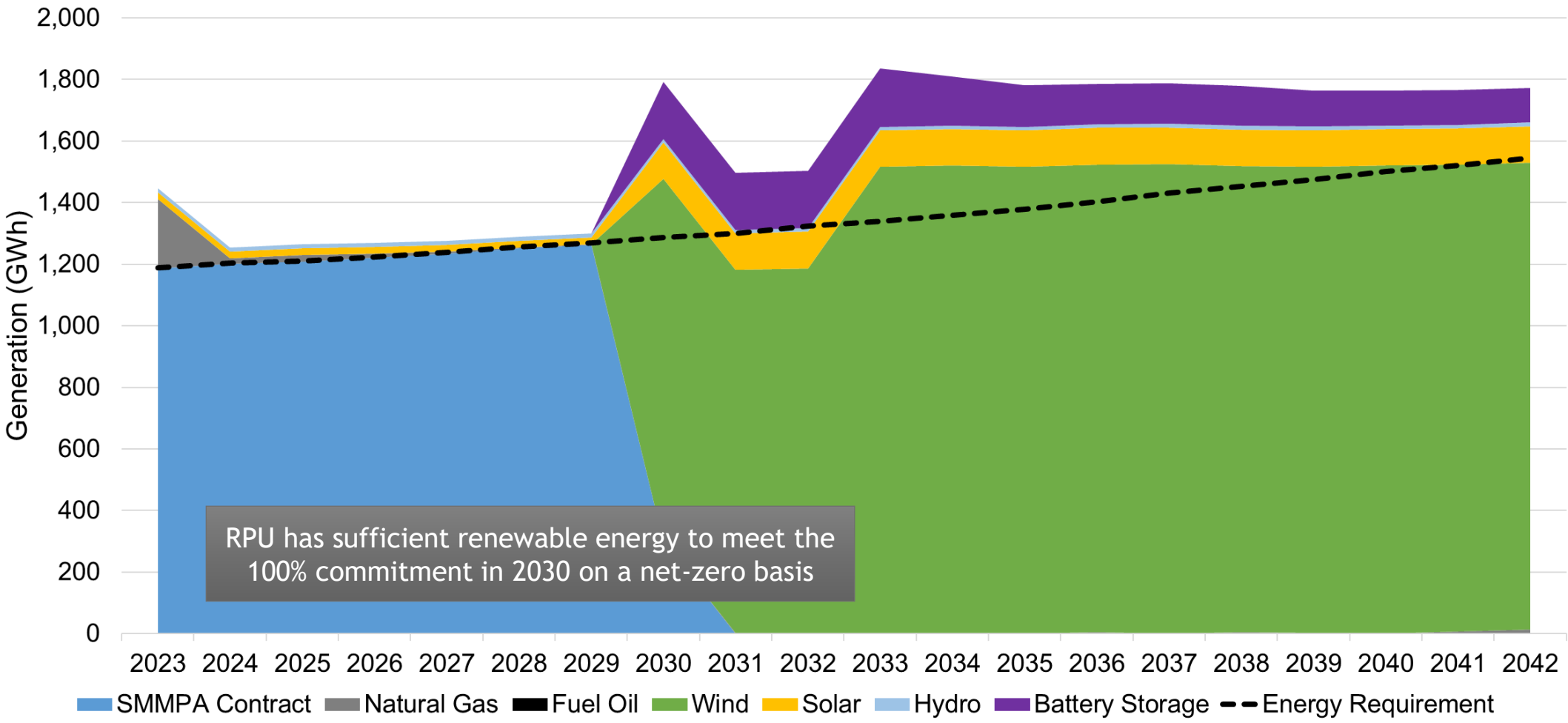
RPU 2030 Clean Energy Commitment (100%x2030)

RPU COMMITMENT

50 MW Self-Build Max

Limited New RPU Owned Thermal Resources to 50MW

SELF-BUILD THERMAL



Annual Cost Summary

BASE CASE

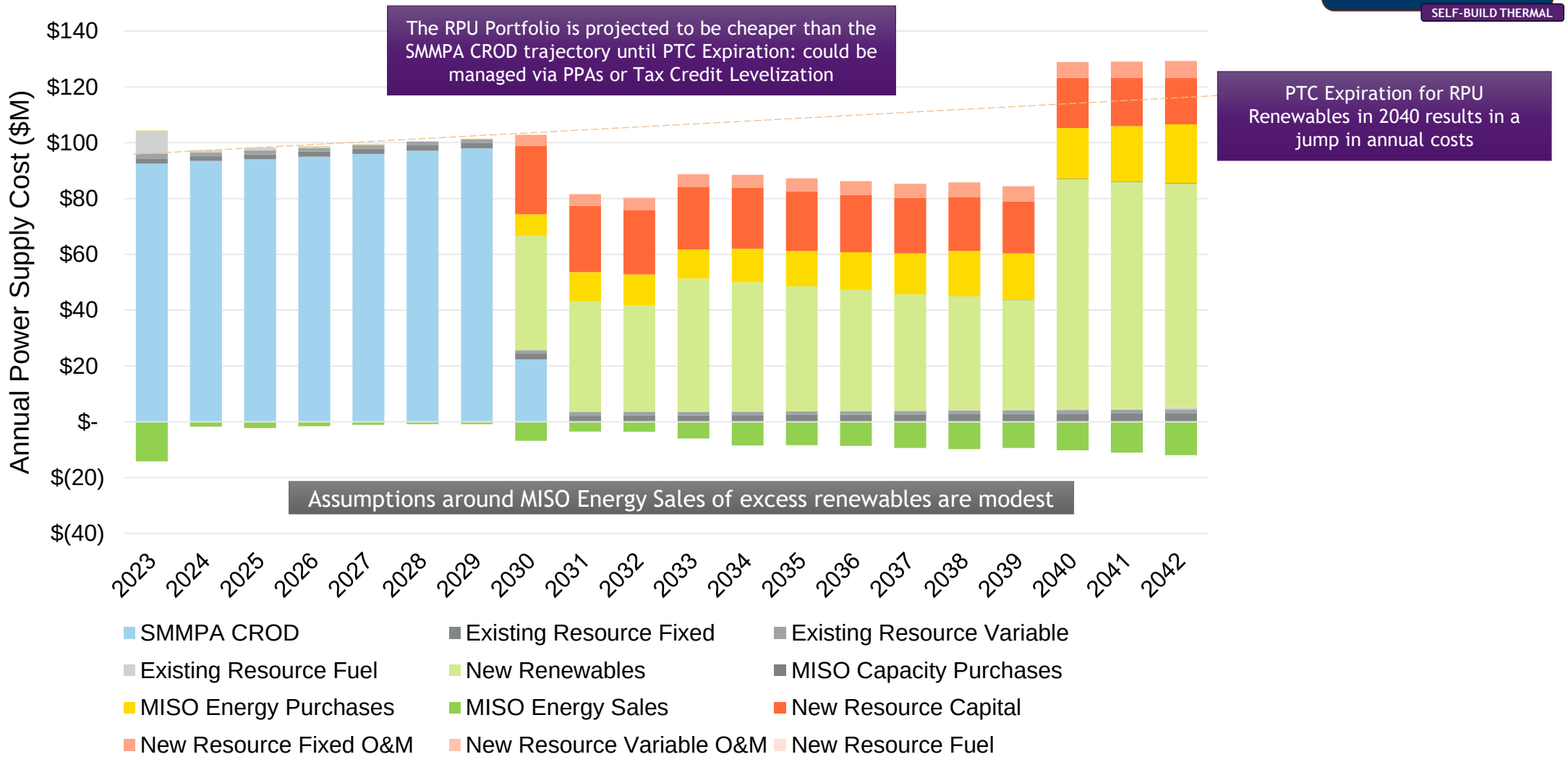
RPU 2030 Clean Energy Commitment (100%x2030)

RPU COMMITMENT

50 MW Self-Build Max

Limited New RPU Owned Thermal Resources to 50MW

SELF-BUILD THERMAL



Renewable Portfolio Standard

BASE CASE

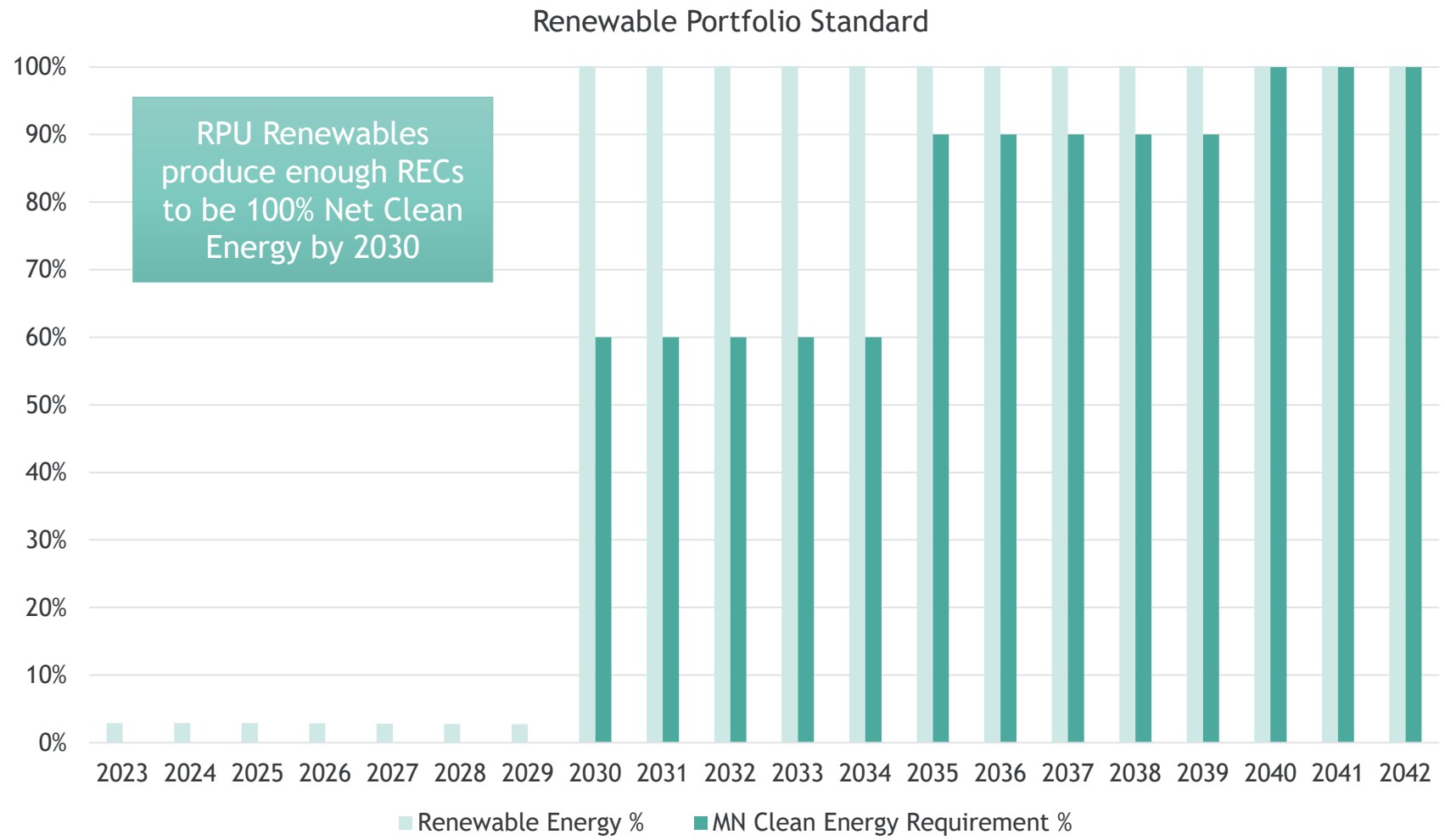
RPU 2030 Clean Energy Commitment (100%x2030)

RPU COMMITMENT

50 MW Self-Build Max

Limited New RPU Owned Thermal Resources to 50MW

SELF-BUILD THERMAL



Detailed Summary Analysis

SCGT PPA Option

Limited New Thermal Additions to PPA from F-Class SCGT

3rd PARTY THERMAL

150 MW SCGT PPA

Added 150 MW of New Thermal PPA Additions from an F-Class SCGT

150 MW PPA

SCGT PPA Case (100x2030)

SCGT PPA Option
Limited New Thermal Additions to PPA from F-Class SCGT
3rd PARTY THERMAL

Case Description

The SCGT PPA Case forces in 50 MW of 4-hr Storage while allowing the model to select a PPA for capacity and energy from an F-Class SCGT in 50MW blocks.

Case Summary

The SCGT PPA Case selects more wind and less storage than the Base Case along with 100 MW of PPA F-Class SCGT. The reduction in Storage is driven by a reduced need for capacity (caused by the SCGT). The increase in Wind is attributable to less storage for energy shifting.

The resource plan is the cheapest of the plans considered but relies on finding a majority partner willing to finance an F-Class SCGT for RPU.

CHANGE FROM BASE CASE

Year	100x2030 SCGT PPA Option	Capital Costs
2030	4-Hr Storage (50 MW) ↓ Wind (350 MW) NO AERODERIVATIVE Solar (50 MW) F-Class SCGT PPA (100 MW) ↑	$90M* $600M $98M
2031	Wind (50 MW) ↑	$88M
2033	Wind (50 MW) ↓	$94M
2042	Wind (50 MW) ↑	$123M
Total	4-Hr Storage (50 MW) ↓ Wind (500 MW) ↑ Solar (50 MW) F-Class SCGT PPA (100 MW) ↑	
Total NPV ($)	**$500 Million**	
Delta from Base ($)	**-$29 Million**	
Delta from Base (%)	**-3%**	

* Energy storage considers overbuild to account for capacity accreditation.

150 MW SCGT PPA Case (100x2030)

150 MW SCGT PPA

Added 150 MW of New Thermal PPA Additions from an F-Class SCGT

150 MW PPA

Case Description

In this case, the model selects a 150 MW PPA for capacity and energy from an F-Class SCGT along with renewable additions in the early 2030s.

Case Summary

The 150 MW SCGT PPA Case selects more wind than the Base Case, no battery storage, and 150 MW of a F-Class SCGT PPA. Due to the SCGT PPA driving no need for storage, the model selects an increase in Wind which can be attributed to less storage for energy shifting.

The resource plan is only slightly more expensive than the SCGT PPA Case (100 MW SCGT PPA) but they both rely on finding a majority partner willing to finance an F-Class SCGT for RPU.

CHANGE FROM BASE CASE

Year	100x2030 SCGT PPA Option	Capital Costs
2030	No Storage Wind (400 MW) ↑ NO AERODERIVATIVE Solar (50 MW) F-Class SCGT PPA (150 MW) ↑	$685M $98M
2031		
2033	Wind (50 MW) ↓	$94M
2042		
Total	No Storage Wind (450 MW) ↑ Solar (50 MW) F-Class SCGT PPA (150 MW) ↑	
Total NPV ($M)	**$449 Million**	
Delta from Base ($)	**-$30 Million**	
Delta from Base (%)	**-3%**	

Key Takeaways

Key Takeaways

	KEY CONSIDERATIONS
• Base Case & 50MW Self-Build Case: most cost-effective plans for RPU to shoulder independently	• Provides RPU an independent path and local control for developing firm capacity and energy storage for resiliency
• Thermal PPA Case: lower cost than the Base Case, but the margin is heavily dependent on a 3rd-Party cost of capital	• Will require finding a partner on a large combustion turbine project
• State Statute Case: lower cost than the Base Case by timing the addition of wind	• RPU has already publicly committed to being 100% Net Renewable by 2030

Considerations for Path Forward

- RPU's power supply portfolio path remains largely unchanged from previous efforts.
  - Net 100% renewable after 2030
  - Addition of firm, dispatchable capacity
  - Consideration of energy storage
- Continue exploring multiple resources options in parallel to provide flexibility.
- Consider capacity expansion project at West Side.
  - Site selection assessment indicated West Side as a preferred location against alternatives (the site provides better options for gas supply and transmission interconnection).
- Continue exploring partnership opportunities for participation in:
  - Renewable projects and power purchase agreements
  - Large firm, dispatchable unit to capture economies of scale
  - Energy storage projects
  - Leveraging tax credit opportunities and structures
- Continue to develop programs to mitigate impacts associated with EV adoption and electrification.

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