MISO Futures Report

SERIES 2

JUNE 2026

Highlights

- Electric utilities in the MISO region continue to respond to the energy transition with proactive resource planning, forming the foundation of the Futures. Additional resources will be required to meet rising load, continuing the transformation of the resource mix.
- The four Series 2 Futures provide insights to the potential resource mix the MISO system could see 20 years into the future, considering federal, state, and member goals, projected demand increases, and supply chain constraints.
- The Series 2 scenarios are an update to the Series 1A MISO Futures developed in 2022-2023 and will serve as the core scenarios MISO uses for long-term planning.
- Key elements of Series 2 include an updated load forecast and a comprehensive resource adequacy assessment with seasonal, Direct Loss of Load (DLOL)-based accreditation.

MISO

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Executive Summary

The MISO footprint is undergoing a fundamental and accelerating resource transition driven by evolving resource economics, load growth projections, environmental targets, technological advancements, public policy, and consumer choices. Approximately 90% of MISO's load is served by member utilities with announced decarbonization and/or clean energy goals; conversely, federal policy and tax incentives have shifted with the One Big Beautiful Bill Act (OB3A). These and numerous other factors increase the complexity of long-term resource planning.

Because member and state plans often do not extend across the full 20-year planning horizon, MISO performs capacity expansion analysis to build on the foundation of member plans and define options for that members may use to address any potential gaps. To hedge uncertainty and "bookend" a range of economic, political, and technological possibilities over the 20-year study period, MISO develops multiple planning scenarios called the MISO Futures. The resulting capacity expansion analysis seeks an optimal set of resource buildouts to minimize overall system cost while meeting reliability and policy requirements under each scenario. Subsequent resource adequacy analysis ensures that each of these planning scenarios provides adequate capacity on an hourly basis. Each Future scenario is based on a pillar set of definitions and further refined by core data assumptions, which are outlined in the following figure.

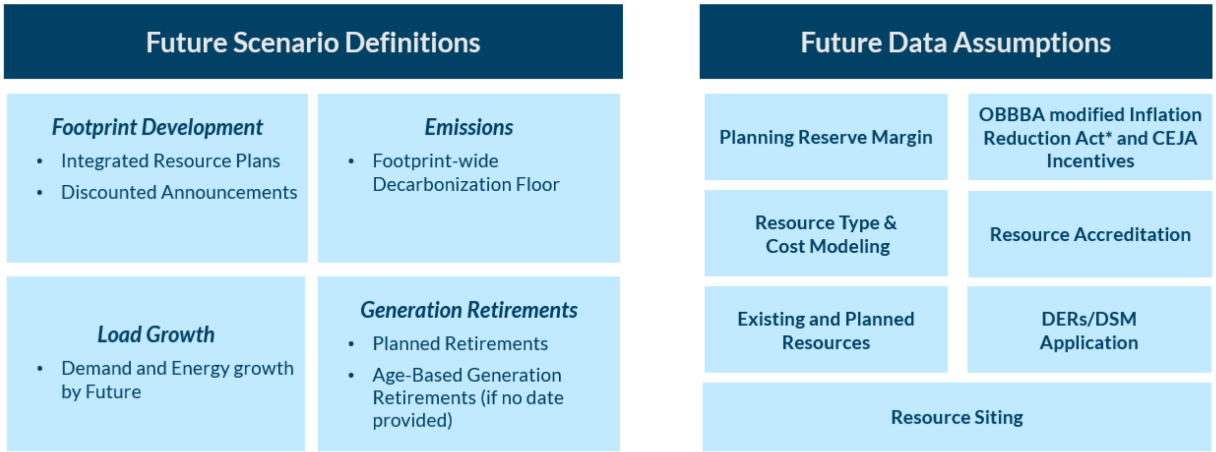
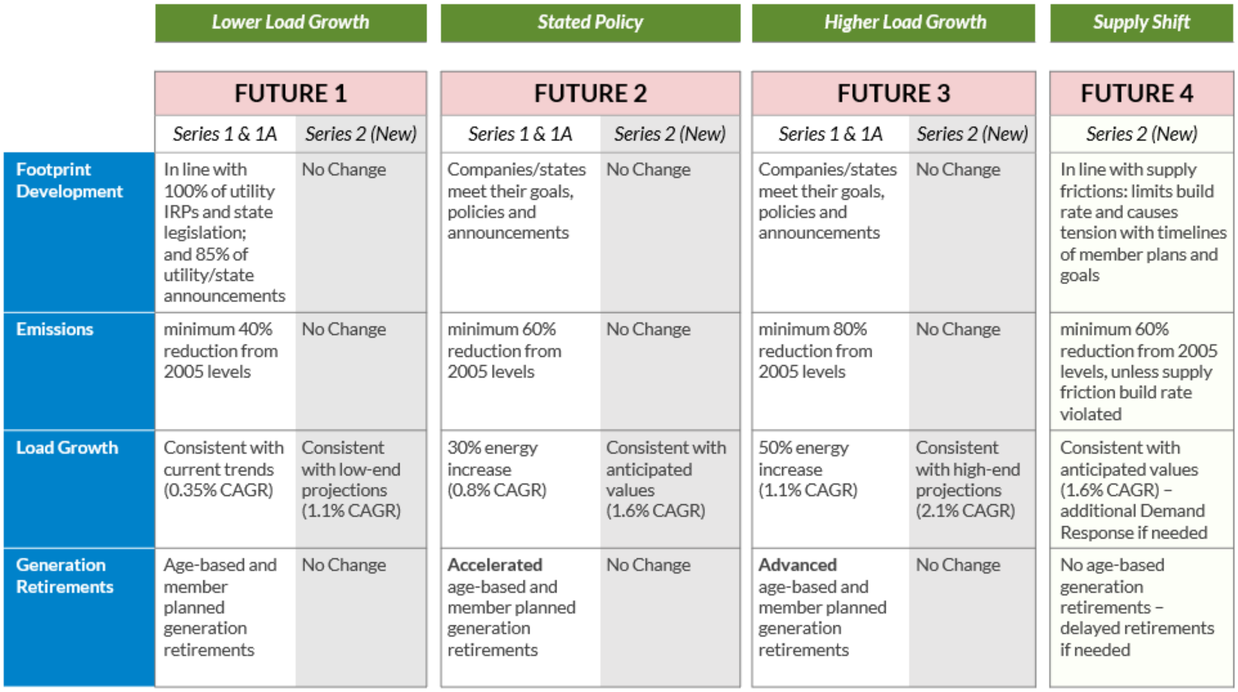


Figure 1: Scenario Definitions & Data Assumptions

Assumptions Summary

The Series 2 Futures were designed with key assumptions that build upon the assumptions and definitions established as precedent by Futures Series 1A.



	Lower Load Growth		*Stated Policy*		*Higher Load Growth*		*Supply Shift*
	FUTURE 1		FUTURE 2		FUTURE 3		FUTURE 4
	Series 1 & 1A	*Series 2 (New)*	*Series 1 & 1A*	*Series 2 (New)*	*Series 1 & 1A*	*Series 2 (New)*	*Series 2 (New)*
Footprint Development	In line with 100% of utility IRPs and state legislation; and 85% of utility/state announcements	No Change	Companies/states meet their goals, policies and announcements	No Change	Companies/states meet their goals, policies and announcements	No Change	In line with supply frictions: limits build rate and causes tension with timelines of member plans and goals
Emissions	minimum 40% reduction from 2005 levels	No Change	minimum 60% reduction from 2005 levels	No Change	minimum 80% reduction from 2005 levels	No Change	minimum 60% reduction from 2005 levels, unless supply friction build rate violated
Load Growth	Consistent with current trends (0.35% CAGR)	Consistent with low-end projections (1.1% CAGR)	30% energy increase (0.8% CAGR)	Consistent with anticipated values (1.6% CAGR)	50% energy increase (1.1% CAGR)	Consistent with high-end projections (2.1% CAGR)	Consistent with anticipated values (1.6% CAGR) – additional Demand Response if needed
Generation Retirements	Age-based and member planned generation retirements	No Change	**Accelerated** age-based and member planned generation retirements	No Change	**Advanced** age-based and member planned generation retirements	No Change	No age-based generation retirements – delayed retirements if needed

Figure 2: Summary of Scenario Assumptions

Series 2 Future 1 Assumptions

Future 1 incorporates utility Integrated Resource Plans (IRPs) and state legislation at 100% of their stated target. Non-legislated state governor goals or non-IRP utility goals are modeled at 85% to hedge against potential non-attainment. While Future 1 assumes a minimum 40% decarbonization floor from 2005 levels, including member IRPs and state legislation and discounting other goals by 15% produces an effective decarb input of 78.4% in the model. F1 assumes peak load growth with a 1.1% compound annual growth rate (CAGR) and a 34% increase in energy demand. Future 1 includes member-planned and age-based retirements.

Series 2 Future 2 Assumptions

Future 2 fully incorporates announced state and utility goals within their timelines. While this scenario assumes a minimum 60% decarbonization floor, including member state and utility policy and goals at face value produces an effective decarb input of 79.6% in the model. F2 assumes a 56% increase in energy demand, reflecting a 1.6% peak load CAGR. Future 2 includes member-planned and accelerated age-based retirements. Load growth assumptions account for current EV adoption trends and policy incentives, and increased demand from data centers and domestic manufacturing expansion.

Series 2 Future 3 Assumptions

Future 3 also aligns 100% with announced state and utility goals within timelines but assumes faster load growth. Future 3 also models a minimum 80% decarbonization floor and a 74% increase in energy demand, reflecting a 2.1% peak load CAGR. Future 3 includes member-planned and advanced age-based retirements. Load growth assumptions reflect accelerated EV adoption and expanded buildouts of data centers and domestic manufacturing facilities.

Series 2 Future 4 Assumptions (Supply Shift)

Future 4 represents a supply friction scenario that accounts for constraints such as construction delays, labor shortages, interconnection bottlenecks, policy uncertainties, and economic shifts. While maintaining alignment with 100% of utility IRPs and announced goals, this scenario simulates build-rate limitations that create tension with planned timelines. With the exception of stringent build limits and the removal of age-based retirement assumptions, Future 4's assumptions match those used in Future 2, including decarbonization and load growth.

Series 2 Future 3+ Assumptions (Sensitivity, LRTP Upper Bound)

MISO must limit data ingestion at key milestones in the analysis timeframe to facilitate a practical Futures build. In building Series 2, the 2024 Long-Term Load Forecast was used to define the projected bookends of project load increases. However, in 2026, MISO released a new Long-Term Load Forecast. To ensure the bookends for further Long-Range Transmission Planning (LRTP) were adequate, Future 3+ was created. Future 3+ maintained all Future 3 assumptions and definitions, but increased load by 10% each year over the study period from the Futures 3 load forecast assumption. Further information on Future 3+ can be found in the sensitivity section of the report.

Series 2 Results Summary

Results from the Series 2 Futures indicate a significant ongoing transition in electric power production over the next two decades. Despite substantial policy revisions, most notably, the One Big Beautiful Bill Act (OB3A), which removed the Inflation Reduction Act (IRA) tax credit extension for wind and solar resources with post-2027 in-service dates—the MISO system continues to transition its resource fleet, with storage in member plans alongside non-emitting resources such as wind, solar, and nuclear. Capacity expansion, energy adequacy (EA), and resource adequacy (RA) results demonstrate that all Futures are resource- and energy-adequate while ensuring member state and utility goals are met.

Future 1 Results Summary

Future 1 is shaped by existing economic factors, with a 1.1% peak load CAGR from baseline assumptions. The model results in 65 GW of retirements and 269 GW of additions. F1 observes a summer peak, with September and October displaying fall peaks that exceed its winter peak.

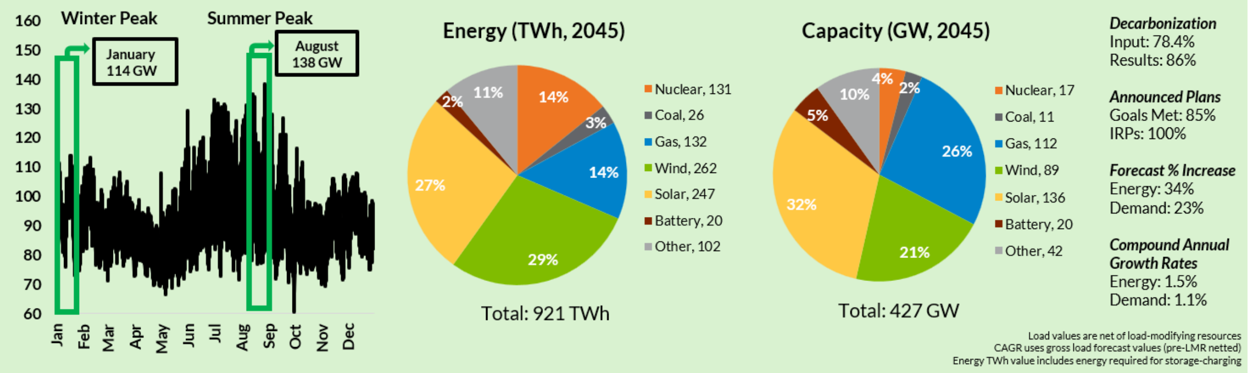


Figure 3: Future 1 Results Summary

Future 2 Results Summary

Future 2 incorporates higher electrification and load growth assumptions. Modeling shows 74 GW of retirements and 299 GW of additions. Future 2's summer and winter peaks are closer together than those of Future 1, but the system overall remains summer-peaking.

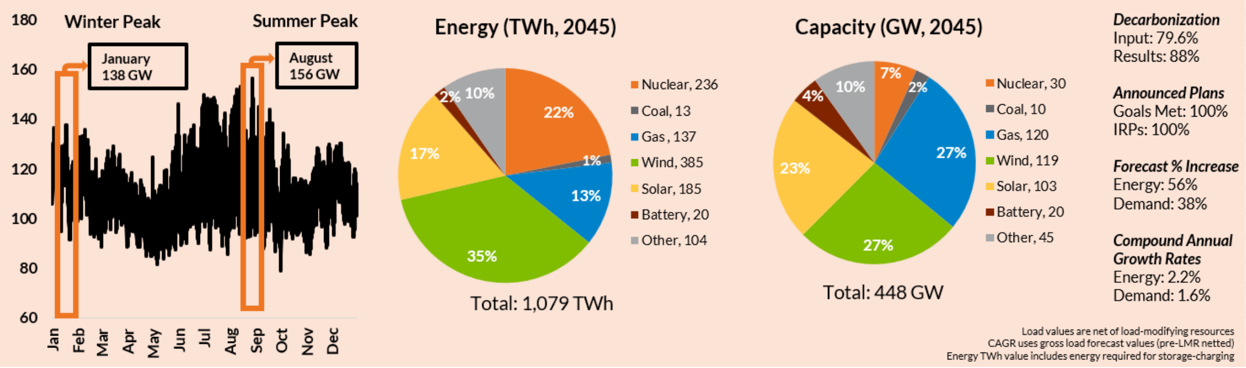
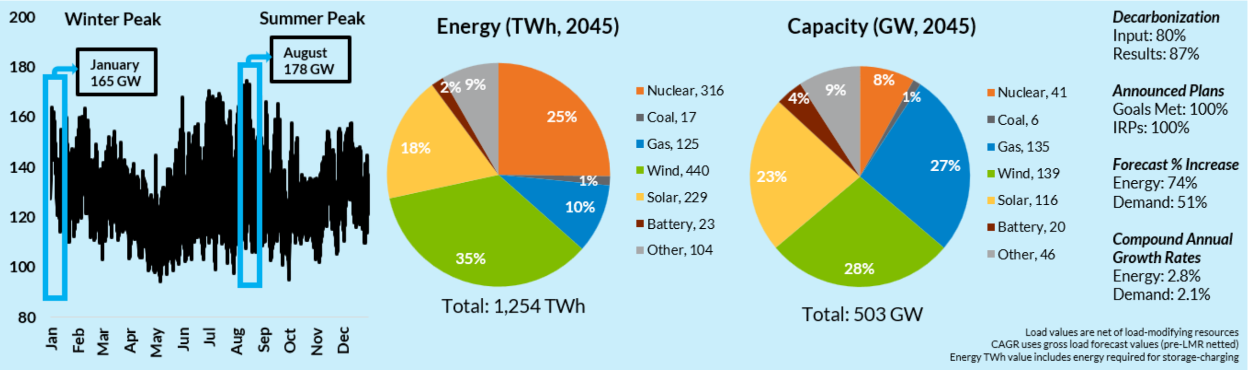


Figure 4: Future 2 Results Summary

Future 3 Results Summary

Future 3 represents an accelerated scenario with rapid electrification, emerging technologies, and greater load growth. Results show 93 GW of retirements and 373 GW of additions. In Future 3, the system is more dual-peaking than the other scenarios, with summer and winter peaks differing by less than 8%.

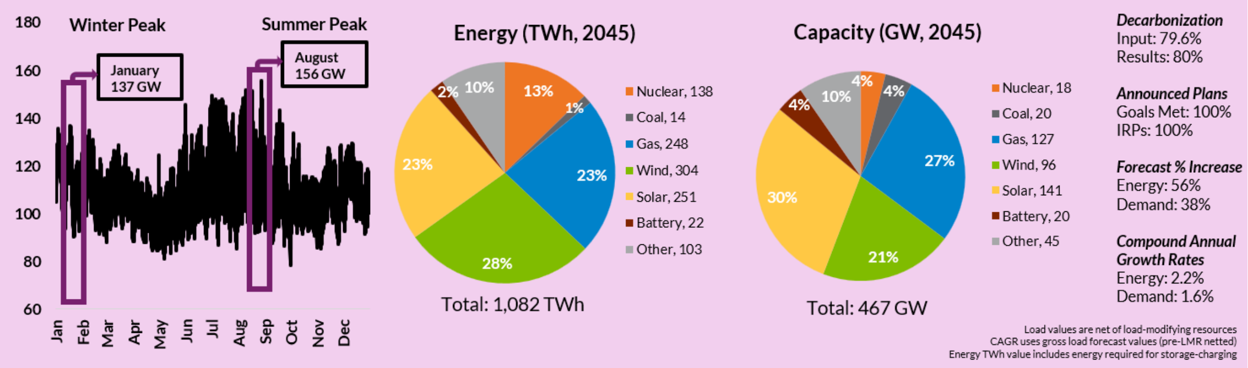


Load values are net of load-modifying resources
CAGR uses gross load forecast values (pre-LMR netted)
Energy TWh value includes energy required for storage-charging

Figure 5: Future 3 Results Summary

Future 4 Results Summary

Future 4 largely mirrors Future 2 while incorporating supply chain frictions, which include more stringent restrictions on annual buildout and a significant reduction in retirements. Future 4 has 49 GW of retirements (member-supplied dates only) and 293 GW of additions.



Load values are net of load-modifying resources
CAGR uses gross load forecast values (pre-LMR netted)
Energy TWh value includes energy required for storage-charging

Figure 6: Future 4 Results Summary

Sensitivities Summary

MISO conducted six total sensitivity or benchmarking exercises, specifically using Futures 2 and 3 to analyze the effects that changes in cost, policy, or other factors could have on the expansions. One of the sensitivities, a high-load sensitivity known as Future 3+, is described in detail in the results section of the report and will be carried forward into Long Range Transmission Planning processes.

1. MISO Futures Purpose & Assumptions

The purpose of the Futures' process redesign is to continue MISO's transmission planning and inform state and Load-Serving Entity (LSE) planning for resource adequacy by reissuing a series of long-term resource and load outlooks that reflect the most up-to-date knowledge on key drivers affecting the long-term planning horizon.

This report documents the process and results of Series 2, which continues to support the diverse plans and goals of MISO's members and states by using four Future scenarios that establish reasonable bookends for the potential load and generation mix of the MISO footprint over the next two decades. Future 1 reflects a trajectory driven by state and member plans with a 15% discount for non-legislated, non-Integrated Resource Plan (IRP) goals, and accounts for demand and energy growth shaped by existing economic factors. Future 2 builds upon this foundation by fully representing those plans and adding substantial load growth. Future 3 advances from Future 2 by examining the impacts of greater load growth, decarbonization, and penetration of renewables. Future 4 mirrors Future 2 in most respects while also simulating stringent supply chain constraints facing the energy industry by incorporating strict annual build limits and removing age-based retirements. The Series 2 Futures collectively capture ongoing transformation within the MISO footprint, incorporating updates that form the foundation for upcoming MISO initiatives, including LRTP.

MISO developed the current MISO Futures framework in Series 1 (2019-21) and used it to support Tranche 1 of the Long Range Transmission Planning (LRTP) initiative. The next Futures cohort, Series 1A (2022-23), refreshed data assumptions from Series 1 and was used for Tranche 2.1 planning. As new load growth projections began to exceed that of Series 1A, MISO began development of the current generation of Futures. The Series 2 Redesign was a 2025-26 initiative, shaped both by MISO transmission planning requirements and the long-term resource planning needs of members. The updated framework provides a more coordinated view of resource planning while offering additional insights into how resource mix changes may affect capacity accreditation and resource adequacy needs.

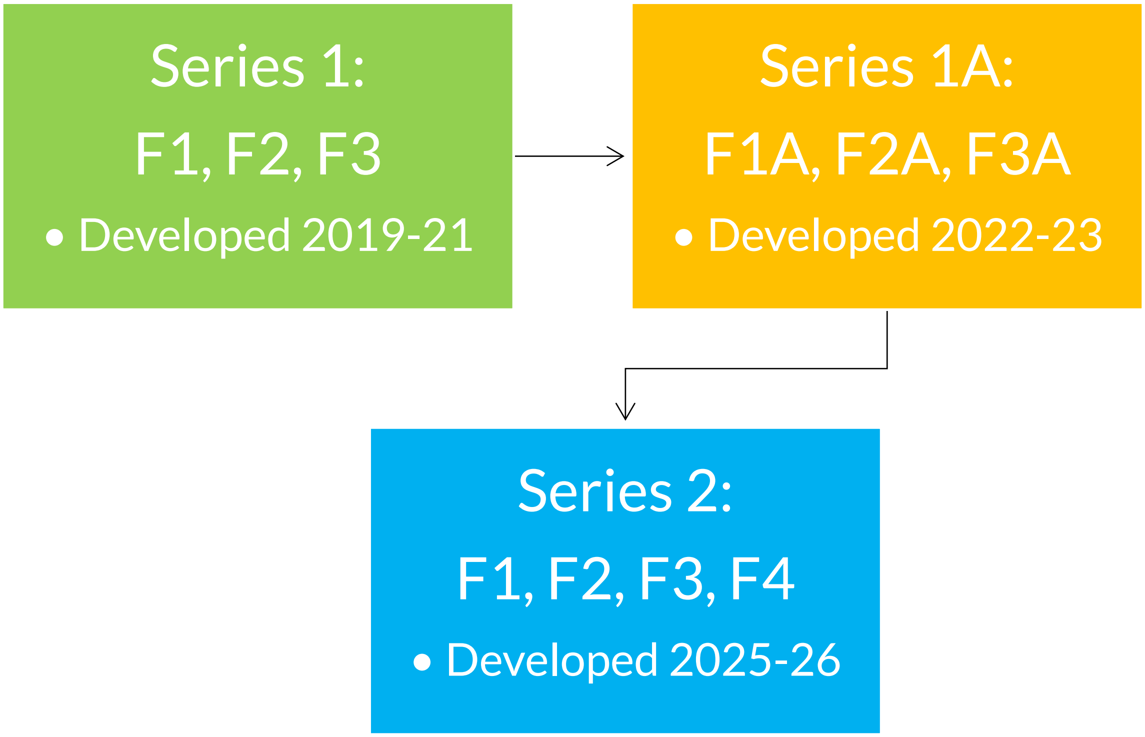


Figure 7: MISO Futures Development Over Time

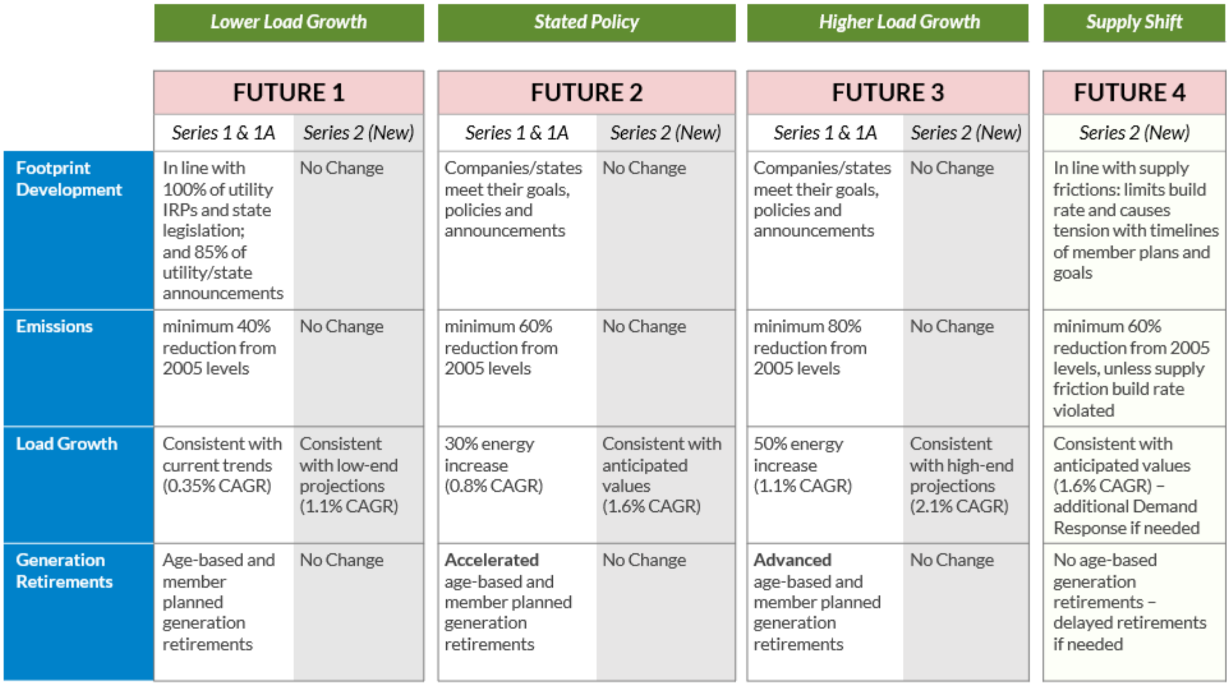
1.1 Assumptions

In building Series 2, the 2024 Long-Term Load Forecast was used to define the range of projected load growth for the scenarios. To complete each set of Futures, MISO must cease additional changes to model data at key points during the analysis. To ensure the bookends for further Long Range Transmission Planning (LRTP) were adequate, MISO performed various sensitivities, or changes to one assumption at a time in the model; one of those sensitivities was a high-load sensitivity, currently known as Future 3+ (F3+). The F3+ sensitivity maintained all Future 3 assumptions and definitions except for load, which was increased by 10% over the entire study period from F3's load forecast assumption. Further information on Future 3+ can be found in the sensitivity section of the Futures Report. This sensitivity was done partly in response to the 2026 new Long-Term Load Forecast which incorporated additional large loads provided by members.

Series 2 utilized member survey responses, announced goals, and other input assumptions through September 2025 to capture all legislated changes and the first round of Expedited Resource Addition Study (ERAS) additions. Additional member-planned capacity shared after September 2025 could not be incorporated in the initial capacity expansion. However, it was incorporated as member-planned generation into the siting process for F1-4 and F3+.

	Future 1	**Future 2**	**Future 3**	**Future 4**
Additions	**269 GW**	**299 GW**	**373 GW**	**293 GW**
Retirements	**65 GW**	**74 GW**	**93 GW**	**49 GW**
Net Peak Load	**138 GW - August**	**156 GW - August**	**178 GW - August**	**156 GW - August**
CO_2 Emissions	**↓86%** **79M tons CO_2**	**↓88%** **68M tons CO_2**	**↓87%** **71M tons CO_2**	**↓80%** **115M tons CO_2**

Table 1: Summary of Futures Scenario Impacts (Dec. 31, 2045)



	Lower Load Growth		*Stated Policy*		*Higher Load Growth*		*Supply Shift*
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Figure 8: Summary of Scenario Assumptions

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1.1.2 Series 2 Future 2 Assumptions

Future 2 fully incorporates announced state and utility goals within their timelines. While this scenario assumes a minimum 60% decarbonization floor, including member state and utility policy and goals at face value produces an effective decarb input of 79.6% in the model. F2 assumes a 56% increase in energy demand, reflecting a 1.6% peak load CAGR. Future 2 includes member-planned and accelerated age-based retirements. Load growth assumptions account for current EV adoption trends and policy incentives, and increased demand from data centers and domestic manufacturing expansion.

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Future 3 also aligns 100% with announced state and utility goals within timelines but assumes faster load growth. Future 3 also models a minimum 80% decarbonization floor and a 74% increase in energy demand, reflecting a 2.1% peak load CAGR. Future 3 includes member-planned and advanced age-based retirements. Load growth assumptions reflect accelerated EV adoption and expanded buildouts of data centers and domestic manufacturing facilities.

1.1.4 Series 2 Future 4 Assumptions (Supply Friction)

Future 4 represents a supply friction scenario that accounts for constraints such as construction delays, labor shortages, interconnection bottlenecks, policy uncertainties, and economic shifts. While maintaining alignment with 100% of utility IRPs and announced goals, this scenario simulates build-rate limitations that create tension with planned timelines. With the exception of stringent build limits and the removal of age-based retirement assumptions, Future 4's assumptions match those used in Future 2, including decarbonization and load growth.

1.2 Changing Energy Across MISO

▨ States with legislated decarbonization policy
- *Illinois*
- *Michigan*
- *Minnesota*

▨ States with stated decarbonization goals
- *Wisconsin*

🟦 MISO footprint without goals

🟩 Utilities with 80%+ targets

🟩 Utilities with 50%+ targets

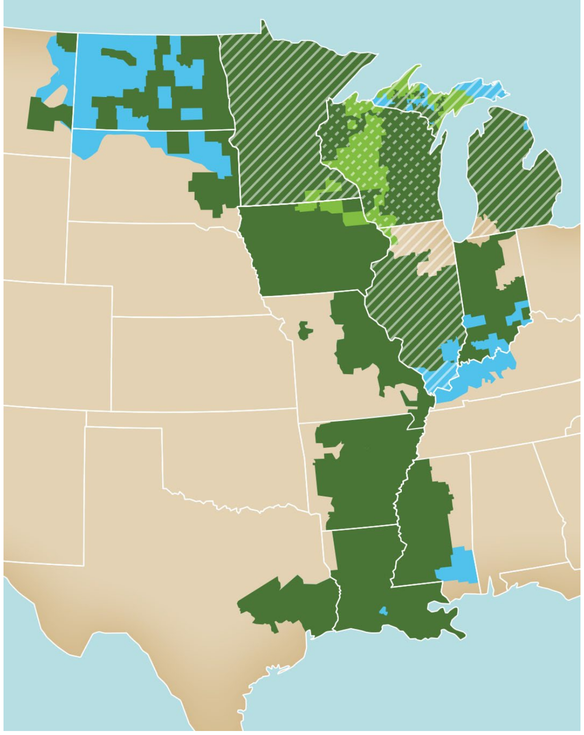


Figure 9: MISO Footprint Decarbonization Overview

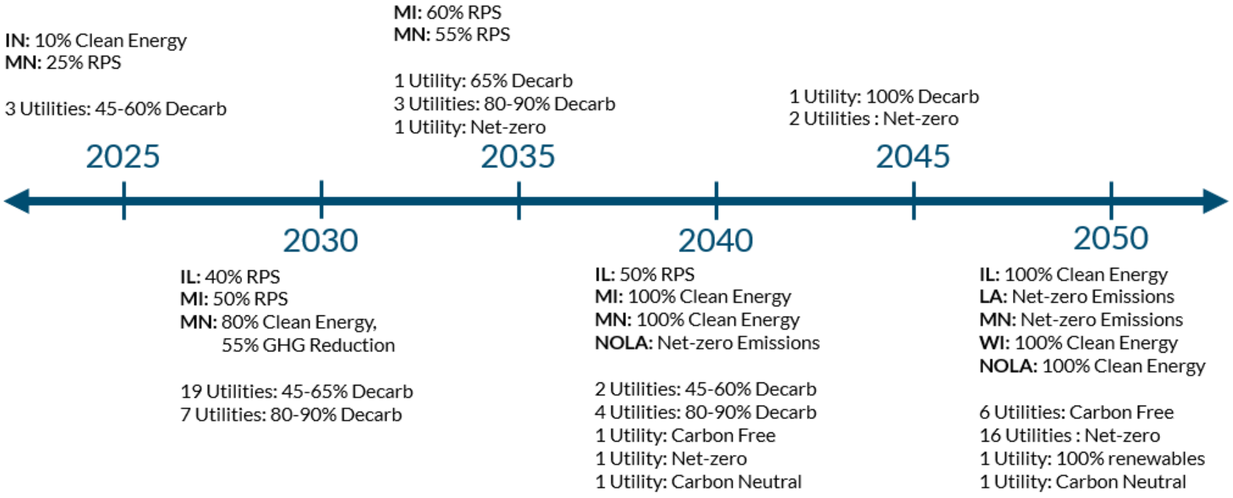


Figure 10: State and Utility Clean Energy Goal Timeline

Cities, states, large commercial and industrial entities, and utilities are setting decarbonization goals that often include reaching 100% clean energy supply or net-zero carbon emissions by 2050. In 2005, electric power generation in the MISO footprint emitted about 533 million tons of carbon dioxide. Since then, MISO's power generation has decarbonized by 43%, with member utilities representing 90% of MISO's load now aiming for decreased emissions over the planning horizon. Additionally, states have various policies that support large load additions, further driving the need for a cost-effective resource blend to meet member needs. Although not all states and utilities share these large load preferences or clean energy goals, a fleet transition of this magnitude has implications on what transmission will be needed across the MISO footprint to ensure reliability of the grid. The role of MISO is to remain resource-agnostic and to ensure a reliable and economic bulk electric system in an ever-changing environment.

To produce each Future scenario's expansion, MISO incorporated specific state and utility goals relative to carbon emissions and clean energy percentages into the models. First, member utility goals were collected by the Futures survey and updated in model data as necessary. Utility decarbonization goals were then converted into relative percentages of MISO's load and aggregated into systemwide emissions reduction trajectories. Additionally, state-specific decarbonization trajectories were developed based on generating resource locations. MISO used these decarbonization goals to create both systemwide and state-specific trajectories over the 20-year study period, determining the quantity of emissions PLEXOS is permitted to reach in each model, consistent with member utility and state goals and each Future's scenario definitions. To capture the impacts of the Climate and Equitable Jobs Act (CEJA), unit-specific emissions were modeled for eligible units in Illinois.

Similarly, renewable and clean energy goals were modeled by converting utility and state goals into relative percentages of MISO load on an annual basis and taking the sum of these values to create systemwide and state-specific trajectories. Resources were assigned to their respective areas in the siting process.

Thermal retirements, load additions, public decarbonization announcements, and evolving IRPs support MISO's preparation for a broad range of Future scenarios, enabling continuous adaptation to the evolving energy landscape while ensuring better grid reliability.

1.2.1 State & Utility Clean Energy Goals

State and utility policies related to decarbonization, renewable or clean energy, and unit retirements continued to evolve rapidly throughout the Series 2 process. To account for these changes, MISO captured goals through the close of the Series 2 stakeholder feedback window in February 2025. During the planning period, MISO staff incorporated new legislation as it became available, including updated battery targets of 3 GW by 2030 for Illinois and 2.5 GW by 2030 for Michigan, which were reflected in the resource adequacy final capacity expansion model runs in February 2026. In alignment with their scenario definitions, each Future's model meets requirements for states that have clean energy or decarbonization policies on an annual basis. Additionally, MISO modeled clean energy or decarbonization goals for utilities in parallel, at an aggregated, footprint-wide level. In this way, both member state and utility goals are honored in modeling.

When collecting goal announcements, MISO staff examined utilities' IRPs, state publications, and member-planned additions, retirements, and goals from the Futures Survey. Once this information was compiled, MISO compared unit addition announcements with signed Generation Interconnection Agreements (GIAs) to ensure units would not be double-counted. MISO then added planned units into the base model to account for MISO members' and states' plans. Examples of incorporated state policies include:

Minnesota – Clean Electricity Standard (2023): Requires 55% of all electricity sold in the state by 2035 to be generated by renewable resources. Investor-owned utilities are required to be 80% carbon-free by 2030, and all electric utilities must be 90% carbon-free by 2035, reaching 100% by 2040. The law encourages building new generation in communities where fossil fuel generating plants have been or are scheduled to be retired.

Michigan – Public Act 235 (2023): This law establishes a clean energy standard of 80% by 2035 and 100% by 2040. It also sets a statewide energy storage target of 2,500 MW by December 31, 2029, and a renewable energy standard of 50% by 2030 and 60% by 2035.

Illinois – Clean and Reliable Grid Affordability (CRGA) Act (2025): This law requires 3 GW of battery storage by 2030 and repeals the moratorium on new nuclear construction.

1.2.2 Climate & Equitable Jobs Act (CEJA)

Public Act 102-0662, signed into law in 2021, sets the goal for Illinois to have 100% clean energy economy-wide by 2050.

Phasing out fossil fuels in the energy sector: This CEJA provision requires Illinois to achieve a 100% zero-emissions energy sector by 2045, with significant emission reductions before then. Although the law does not spell out any annual statewide carbon emissions cap trajectory to attain the 100% zero-emission mark by 2045, it does provide guidelines on phasing out CO_2 emissions from power generation, with interim milestones applicable to certain units. These guidelines consider a unit's ownership and fuel category and prioritize environmental justice in enabling Illinois to achieve carbon-free power by 2050. All natural gas facilities must eliminate greenhouse gas emissions (GHG) by 2045, and all coal facilities must eliminate emissions by 2035. Private oil and coal generating facilities must phase out by 2030. Public oil and coal facilities are allowed to continue operation until 2045. Any source or plant with such units must also reduce their carbon dioxide equivalent (CO2e) emissions by 45% from existing emissions by no later than January 1, 2035. Public natural gas facilities must phase out by 2045.

The phaseout of private natural gas facilities is more complex in accelerating emissions reductions and the retirement of resources that produce higher levels of criteria pollutants and that are near environmental justice communities. In addition to the phaseout depicted below, private natural gas facilities may not emit CO_2 or co-pollutants more than that unit's existing emissions for those pollutants in any 12-month period. The specifications for fossil fuel phaseout required by CEJA are illustrated below.

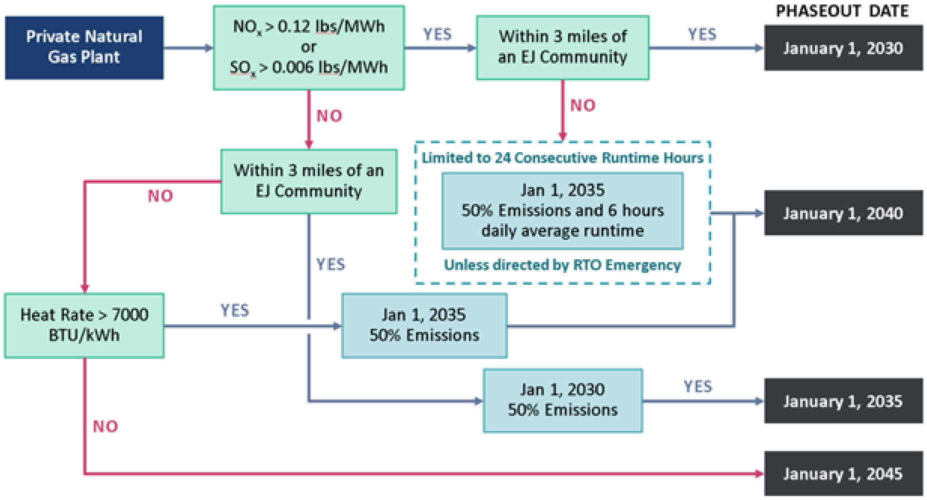


Figure 11: CEJA Decarbonization Guidelines for Private Natural Gas Facilities

Grow renewable energy generation: CEJA targets a transition to 40% of electricity from renewable energy by 2030, 50% by 2040, and 100% from carbon-free sources by 2050. These provisions were modeled in the Series 2 Futures. In the study, all Illinois coal-, oil-, and gas-fired generation facilities were set to reduce their emissions based on their fuel type, ownership, heat rates, NO_x and SO_x emissions, and proximity to environmental justice communities per the CEJA guidelines mentioned above. The emission caps for all Illinois greenhouse gas (GHG) units were implemented in MISO and PJM models by utilizing unit emissions constraints in PLEXOS. The CEJA-mandated RPS goals for Illinois were also used in the study to satisfy the state's targeted transition to 40% of electricity being provided by renewable energy by 2030, and 50% by 2040.

State/City Clean Energy Goals & RPS (source linked)	State or City	Utility	Utility Decarbonization Goals (2005 Baseline)	Utility Clean/Renewable Energy Goals
-	**Arkansas**	**Entergy**	50% x 2030, Net Zero x 2050 (2000 baseline)	-
100% Clean Energy x 2050 RPS: 25% x 2025, 40% x 2030, 50% x 2040 3,000 MW of battery storage x 2030	**Illinois**	**Ameren Illinois**	60% x 2030, 85% x 2040, Net Zero x 2045	40% x 2030, 50% x 2040, 100% x 2050
		Prairie Power, Inc.	45% x 2038, 100% x 2045	-
		Southern Illinois Power Cooperative	Carbon Free x 2050[1]	40% x 2030, 50% x 2040, 100% x 2050[1]
		Springfield, Illinois City Water Light & Power	Carbon Free x 2050[1]	100% x 2050[1]
		MidAmerican Energy	Net Zero x 2050	40% x 2030 50% x 2040, 100% x 2050[1]
Voluntary incentivized Clean Energy Portfolio Standard: 10% x 2025	**Indiana**	**Duke Energy**	50% x 2030, Net Zero x 2050	-
		Hoosier Energy	-	10% x 2025
		Southern Indiana Gas & Electric	Net Zero x 2035	-
		Wabash Valley Power Association	50% x 2031, 70% x 2040, Net Zero x 2050	-
		NIPSCO	90% x 2030, Net Zero x 2040	-
RPS: 105 MW	**Iowa**	**Alliant West – Interstate Power and Light**	50% x 2030, Net Zero x 2050	25% x 2033
		Cedar Falls Utilities	45% x 2030 (2010 Baseline), Carbon Neutral x 2050	-
		Dairyland Power	50% x 2030	12% x 2026
		MidAmerican Energy	Net Zero x 2050	40% x 2030 50% x 2040, 100% x 2050[1]
		Muscatine Power & Water	65% x 2030	-
-	**Louisiana**	**Cleco Power**	37.8% x 2030, Net Zero x 2050 (2011 Baseline)	-
		Entergy	50% x 2030, Net Zero x 2050 (2000 baseline)	-
Carbon Neutral x 2050 (Governor) 100% Clean Energy x 2040 RPS: 50% x 2030, 60% x 2035 2,500 MW of Storage x 2030	**Michigan**	**Consumers Energy**	Net Zero x 2040	50%/60% x 2030/2035
		DTE Energy	85% x 2035, 90% x 2040, Net Zero x 2050	50% x 2030, 60% x 2035
		Lansing, Michigan Board of Water & Light	Carbon Neutral x 2040	50% x 2030, 80% x 2035, 100% x 2040
		Michigan Upper Peninsula	80% x 2030, Net Zero x 2050	30% x 2028
		Upper Peninsula Power Company	80% x 2035, 100% x 2040	50% x 2030, 80% x 2035, 100% x 2040
Carbon Free x 2040 RPS: 55% x 2035	**Minnesota**	**Great River Energy**	90% x 2035, 100% x 2040	72% x 2037
		Minnesota Power	50% x 2035, Carbon Free x 2040	70% x 2030
		Missouri River Energy Services	38% x 2045 (multi-state; weighted average x load and goal)	21%, 47% x 2035
		Otter Tail Power Company	50% x 2030, 100% x 2050	55% x 2030
		Southern MN Municipal Power Agency	90% x 2030	64% x 2033
		Xcel Energy	80% Reduction x 2030, Carbon Free x 2040	71% x 2045
-	**Mississippi**	**Entergy**	50% x 2030, Net Zero x 2050 (2000 baseline)	-
RPS: 15% (2% Solar)	**Missouri**	**Ameren Missouri**	60% x 2030, 85% x 2040, Net Zero x 2045	30% x 2045
		Columbia, Missouri Water & Light Department	2015 Baseline: 35% x 2035, 80% x 2050	100% x 2050
-	**Montana**	**Montana-Dakota Utilities Co.**	45% x 2030	-
Net Carbon Neutrality x 2040 100% Carbon-Free x 2050	**New Orleans**	**Entergy**	50% x 2030, Net Zero x 2050 (2000 baseline)	-
-	**North Dakota**	**Great River Energy**	90% x 2035, 100% x 2040	72% x 2037
		Minnesota Power	50% x 2035, Carbon Free x 2040	70% x 2030
		Missouri River Energy Services	38% x 2045 (multi-state; weighted average x load and goal)	21%, 47% x 2035
		Montana-Dakota Utilities Co.	45% x 2030	-

State/City Clean Energy Goals & RPS (source linked)	State or City	Utility	Utility Decarbonization Goals (2005 Baseline)	Utility Clean/Renewable Energy Goals
		Otter Tail Power Company	50% x 2030, 100% x 2050	55% x 2030
		Xcel Energy	80% Reduction x 2030, Carbon Free x 2040	71% x 2045
-	**South Dakota**	**Missouri River Energy Services**	38% x 2045 (multi-state; weighted average x load and goal)	21%, 47% x 2035
		Montana-Dakota Utilities Co.	45% x 2030	-
		Otter Tail Power Company	50% x 2030, 100% x 2050	55% x 2030
		Xcel Energy	80% Reduction x 2030, Carbon Free x 2040	71% x 2045
-	**Texas**	**Entergy**	50% x 2030, Net Zero x 2050 (2000 baseline)	-
Carbon Free by 2050 (Governor) RPS: 10% x 2020	**Wisconsin**	**Alliant East – Wisconsin Power and Light Company**	50% x 2030, Net Zero x 2050	25% x 2033
		Dairyland Power	50% x 2030	12% x 2026
		Madison Gas & Electric	80% x 2030, Net Zero x 2050	8%
		WEC Energy Group	80% x 2030, Net Zero x 2050	10%
		WPPI Energy	100% Carbon Free x 2050	100% x 2050[2]

Table 2: Modeled State & Utility Goals – Service Area Overlay

[1] IL CEJA Legislation

[2] WI Clean Energy Plan (Governor Goal)

1.3 One Big Beautiful Bill Act (OB3A)

The One Big Beautiful Bill Act (OB3A), signed into law in July 2025, introduced several changes to the tax credit structure established under the Inflation Reduction Act (IRA). Wind and solar projects remain eligible for the full Production Tax Credit (PTC) if they are placed in service on or before December 31, 2027, with qualifying projects receiving ten years of credits tied to their generation even if those years extend beyond 2027. Wind or solar projects placed in service in 2028 or later lose PTC eligibility entirely. Small Modular Reactors (SMRs) maintain their tax credits through the study period, with SMR buildout beginning in MISO capacity expansion models in the late 2030s due to modeled supply constraints in earlier years.

For technologies that benefit from the Investment Tax Credit (ITC), such as battery storage, the OB3A preserves full ITC value for projects installed through 2037 before credits relax in 2038 and 2039 and are eliminated completely beginning in 2040. The legislation also states that wind and solar projects already under construction by the end of 2024 are fully grandfathered and therefore unaffected by new constraints.

A structural change introduced by the OB3A tightened the eligibility window for receiving full IRA credits. Projects can qualify by beginning construction before July 5, 2026, or by being placed in service by the end of 2027. Under these rules, projects starting construction in 2025 will have until 2029 to reach commercial operation and those beginning construction in 2026 have until 2030.

OB3A integrates domestic content requirements across the PTC and ITC. While the IRA originally held the ITC domestic content requirement at 40%, OB3A raises that threshold to match the PTC's annually increasing schedule. Projects beginning construction before June 16, 2025, may still satisfy the prior 40% standard, but those beginning later must meet a 45% threshold, which then escalates over time.

These OB3A modifications narrow the timing flexibility originally built into the IRA by shortening the window in which projects can qualify for full tax credits. This shift can affect how developers schedule construction starts and commercial operation dates. This is reflected in the Futures expansions, as renewable generation is incentivized to come online in the early years of the study period. Concurrently, OB3A creates greater alignment across credit programs by standardizing domestic content requirements for the PTC and ITC and establishing more consistent eligibility rules. These changes influence clean energy investment patterns with credit availability tied to earlier milestones, so resource developers may accelerate near-term builds and favor technologies with more predictable construction timelines.

1.4 Member Survey 2025

At the beginning of the Futures Redesign cycle in Q1 2025, MISO sent members a survey to report on their existing and future generation plans, along with decarbonization and renewable energy plans and goals. Respondents reported a total of 151 GW of planned generation over the next 20 years, spanning a variety of resource types. Members representing over 80% of MISO's generating capacity responded to the survey.

Additionally, in 2025, MISO began its Expedited Resource Addition Study (ERAS), providing easier interconnection for qualifying generation projects. During Cycle 1 of ERAS in September 2025, members announced a total of 20 GW of additional planned generation; primarily but not exclusively gas. These additional resources were included in final capacity expansion models.

1.4.1 Additions

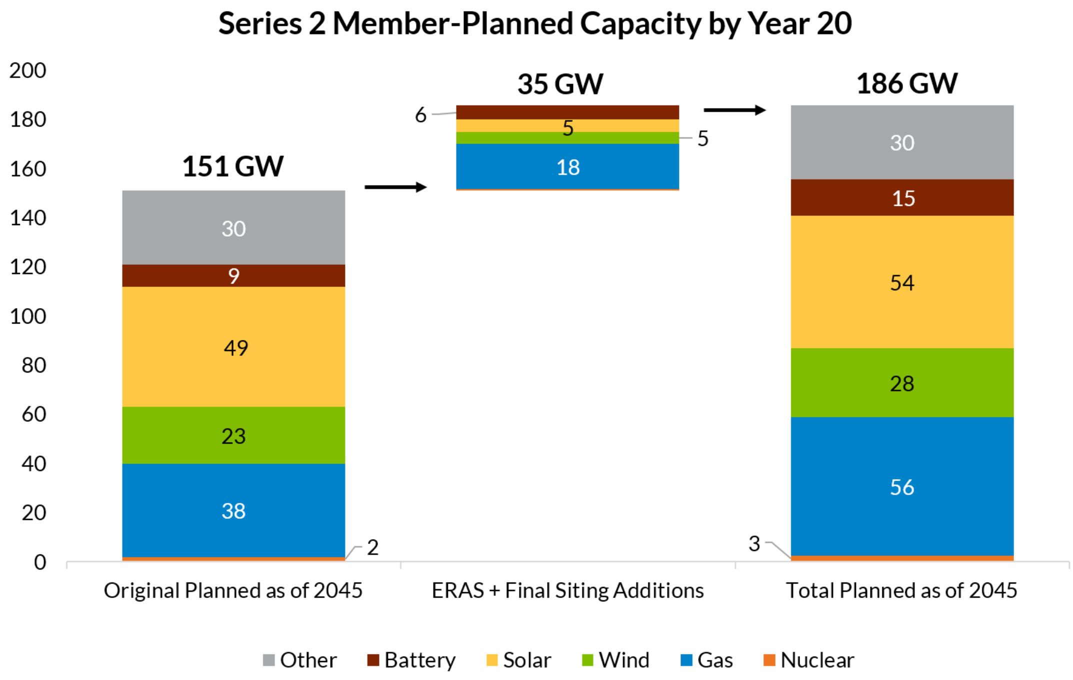
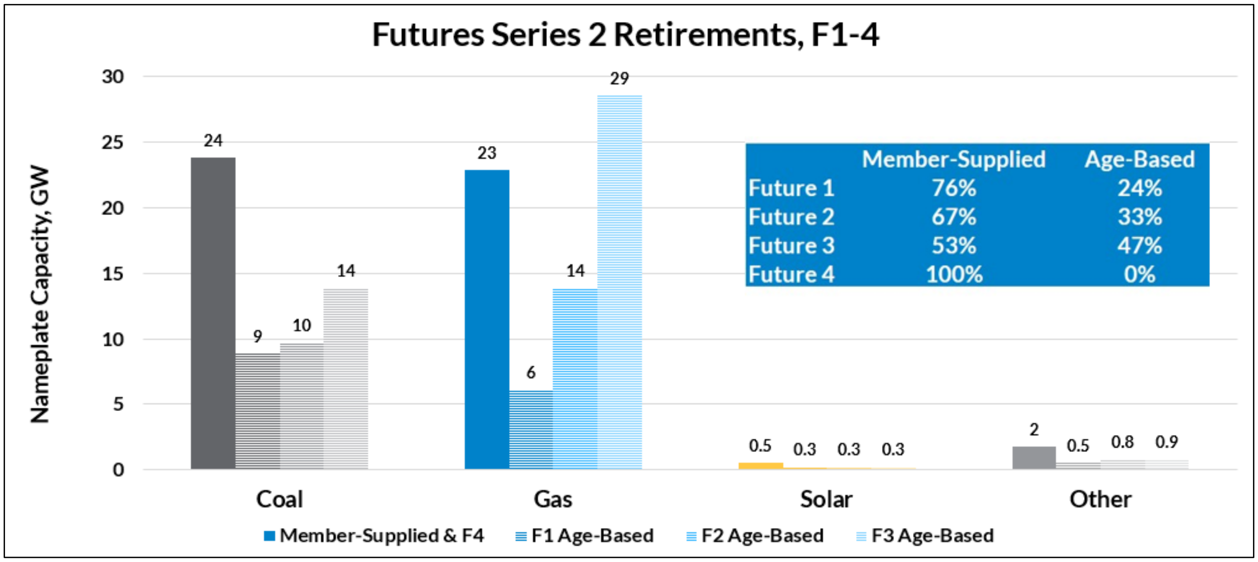


Figure 12: Total Member-Planned Capacity by 2045, All Futures

1.4.2 Retirements

For Futures 1-3, MISO utilized age-based retirement assumptions for resources for which members did not provide planned retirement dates. Future 4 assumed no age-based retirements, using only member-provided retirement dates. Retirements in the Futures are explored in more detail in the Retirement and Repowering Assumptions section. The figure below compares member-supplied and age-based retirements by Future. Note: The age-based numbers for F1-3 are in addition to the member-supplied numbers.



	Member-Supplied	Age-Based
Future 1	76%	24%
Future 2	67%	33%
Future 3	53%	47%
Future 4	100%	0%

Figure 13: Series 2 Futures Retirements by Source and Fuel

1.5 New Resource Additions

Model-built (or candidate) units are various resource types that are defined in and selected by MISO's capacity expansion tool, PLEXOS, to achieve each of the Futures scenarios. The candidate unit generating technologies used in MISO Futures are discussed in further detail below.

1.5.1 Wind

Vibrant Clean Energy (VCE) 2018 hourly profiles were used as the base data for wind units. Model-built units assume 100m hub height throughout the study period. Existing units used representative wind profiles developed from 2018 historical data.

1.5.2 Solar

Vibrant Clean Energy (VCE) 2018 hourly profiles were used as the base data for solar units. Existing units used representative solar profiles developed from 2018 historical data.

1.5.3 Lithium-Ion Battery (4- and 12-hour)

Lithium-ion battery units modeled in capacity expansion were 4-hour and 12-hour durations. Units were sited with a minimum capacity of 50 MW and a maximum capacity of 300 MW across all Future scenarios.

1.5.4 Iron-Air Battery (100-hour)

100-hour iron-air batteries employ a slow chemical process known as reversible rusting, in which iron oxidizes to release energy and is then reduced during charging. This process allows the battery to discharge over a period of multiple days.

1.5.5 Distributed Energy Resources (DERs)

For Series 1 and 1A, MISO commissioned Applied Energy Group (AEG) to develop new DER technical and economic data. AEG developed estimates of DER impacts through survey of load-serving entities (LSE) and secondary research. For Series 2, MISO extrapolated AEG's data through 2045.

Previously referred to as demand-side additions or demand-side management (DSM), these resources were modeled as program blocks in three main categories: demand response (DR), energy efficiency (EE), and distributed generation (DG). Programs fall into two sectors: residential and commercial.

All Futures contain a baseline level of distributed energy resources by default, referred to as the Future 1 "level." Futures 2, 3, and 4 also include incremental additions of specific program types. These additions were selected by PLEXOS based on whether they reduced total system cost.

1.5.6 Nuclear/Small Modular Reactors (SMRs)

Companies are focused on SMR production that reduces costs and construction timelines, with reduced unit sizes (20-300 MW) in contrast to traditional nuclear plants (500-2,000 MW). The OB3A maintained tax credits for nuclear energy production and MISO members have plans to build new nuclear/SMR facilities.

1.5.7 Gas

Combined cycle (CC), combustion turbine (CT), and reciprocating internal combustion engine (RICE) were the three gas resource types modeled. Site priority levels for these units remained the same when selecting a site. CC units were given highest priority, followed by CT, then RICE units. However, RICE units were sited in configurations of a multiple of 18.8 MW units, to a maximum of seven at the same location.

1.6 Load Assumptions

1.6.1 MISO Load Forecast Development

MISO updated its load forecasting methodology[1] to employ end-use modeling, refining load growth drivers including EVs, data centers, industrial sites, green hydrogen development, and DERs. These new developments expand upon metrics used in previous studies to account for an increasing pace of change and short-term load growth on the MISO footprint. The load forecast incorporates stakeholder input, historic Expedited Project Reviews, and third-party expertise to align trajectories with observed developments in the industry.

Three scenarios—Low, Current, and High—were constructed to bookend load growth potential over the 20-year study period, 2026-2045. The base trajectory predicts peak load growth at 1.6% CAGR, rising from 122 GW to between 152 and 186 GW. MISO forecasts that coincident peak load will grow at 1-2% CAGR under the current scenario, significantly higher than 0.4-1.1% assumed in Series 1A.

1.6.2 Future-Specific Forecasts & Load Shapes

Each of the Futures employs a unique load forecast, with Future 4 utilizing the same forecast as Future 2. These distinct projections capture a broad and resilient range of potential load growth, including varying levels of electrification, EV adoption, and data center buildout. Each forecast features its own annual peak load by year and hourly load shape throughout the 20-year planning period.

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[1] MISO Long-Term Load Forecast Whitepaper, December 2024

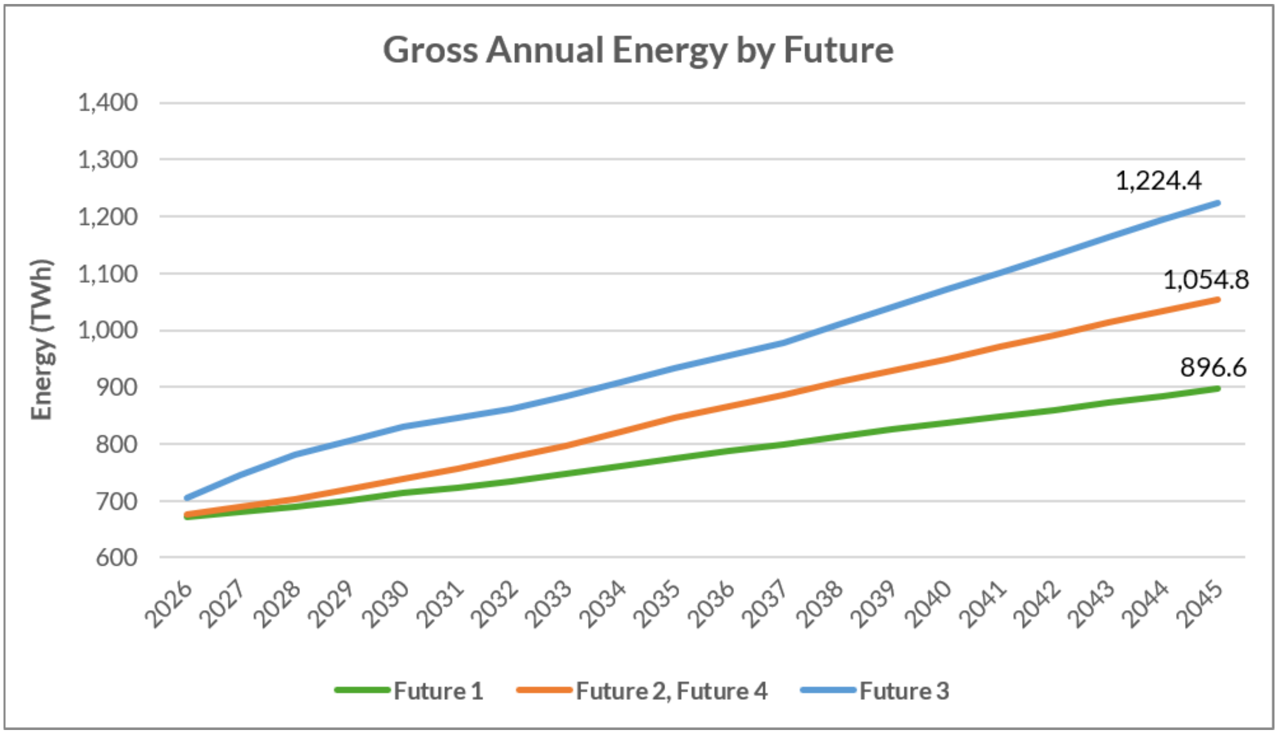


Figure 14: Series 2 Future 1-4 Gross Annual Energy, TWh

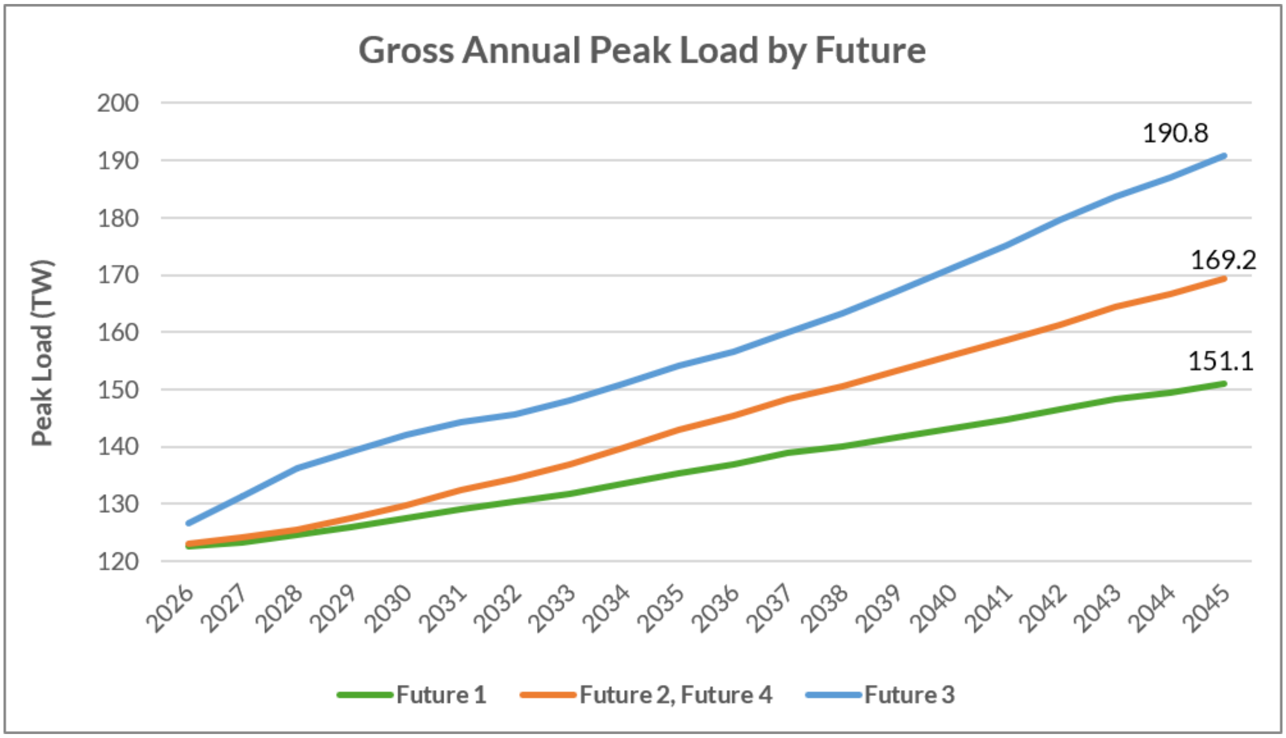
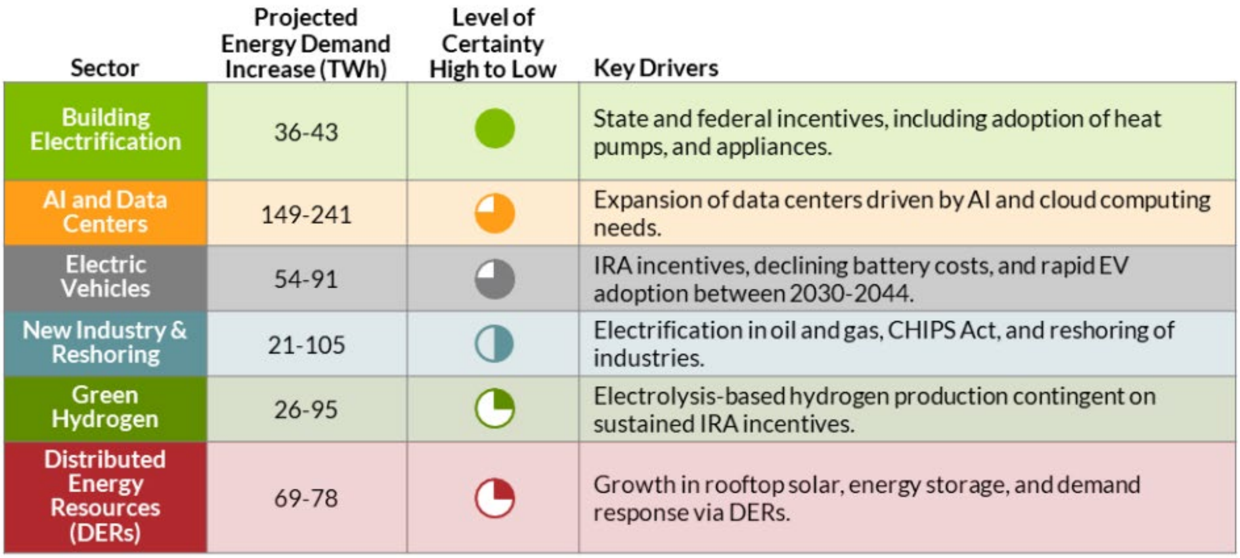


Figure 15: Series 2 Future 1-4 Gross Peak Load by Year, TW

1.6.3 Forecast Growth Assumptions

Driver-specific methodologies include:

- Building electrification: Incentivized through state and federal-level policies which aim to increase efficiencies and lower carbon emissions. The electrification of heating systems and other building appliances is expected to increase energy demand by 36-43 TWh by the end of the study period.
- Artificial Intelligence (AI) and data centers: Demand for enhanced computing power arising from the adoption of AI and cloud-based applications is resulting in a rapid expansion of data centers. These facilities are expected to increase MISO's energy demand by 149-241 TWh.
- Electric Vehicles (EVs): The growth of EVs, driven by federal incentives and declining battery costs, is projected to add 54-91 TWh of demand, with rapid adoption between 2030-2040.
- New industry development and reshoring: Electrification of oil and gas industries and reshoring efforts are expected to increase energy demand by 21-105 TWh.
- Green hydrogen: Green hydrogen production, supported by federal incentives, could increase MISO's energy demand by 26-95 TWh, contingent on sustained policy support.
- Distributed energy resources (DERs): Increased adoption of rooftop solar, energy storage, and other DERs is expected to contribute 69-78 TWh of capacity to MISO's system.



Sector	Projected Energy Demand Increase (TWh)	Level of Certainty High to Low	Key Drivers
Building Electrification	36-43	●	State and federal incentives, including adoption of heat pumps, and appliances.
AI and Data Centers	149-241	◕	Expansion of data centers driven by AI and cloud computing needs.
Electric Vehicles	54-91	◕	IRA incentives, declining battery costs, and rapid EV adoption between 2030-2044.
New Industry & Reshoring	21-105	◑	Electrification in oil and gas, CHIPS Act, and reshoring of industries.
Green Hydrogen	26-95	◔	Electrolysis-based hydrogen production contingent on sustained IRA incentives.
Distributed Energy Resources (DERs)	69-78	◔	Growth in rooftop solar, energy storage, and demand response via DERs.

Figure 16: Expected Segmented Energy Growth Increase by 2044 with Level of Certainty

1.6.4 Forecast Evolution

Between 2009 and 2024, MISO's peak load increased at an average annual growth rate of 0.5%. Throughout this period, load forecasting was primarily econometric. However, continuing to use these methods implies that the relation between economic variables and energy demand will continue relatively unchanged. Correlation between economic growth and load may become unstable or shift as the result of rapid technological and industrial developments within the energy sector or due to economic instability, both of which have occurred during the current Futures development cycle. Therefore, a reinvestigation of MISO's load forecasting process became necessary.

For the 2024 updated load forecast, MISO utilized a comprehensive approach that combined multiple data sources and stakeholder outreach to forecast future demand. Additionally, MISO engaged a range of third-party consultants, academic institutions, and data providers to contribute specialized expertise and industry insights, lending depth and validation to MISO's forecasts. Common themes throughout stakeholder feedback indicated the need to update its forecasts to account for the impacts of large load additions on total near-term load. CAGR has increased to a projected 1% from 2023-33, up from the 0.25% projected in 2019, while Expedited Project Review submissions have grown rapidly in number.

Climatic changes in MISO's footprint will likely result in significant fluctuations in cooling and heating demands arising from shifts in temperature patterns. Warming trends in MISO's footprint are expected to increase weather-sensitive loads, particularly among residential and commercial air conditioning and data centers, which have high cooling needs. Conversely, in the near term, milder winters may reduce the need for heating, resulting in lower electricity demand during winter. Climate models predict an increase in average temperatures across MISO regions, leading to higher cooling degree days and a potential decrease in heating degree days.

To account for anticipated climatic changes, MISO's updated load forecast approach integrates climate change impacts by adjusting demand projections for key sectors such as residential and commercial cooling and heating and data centers. These adjustments account for expected regional temperature increases, allowing MISO to better consider weather sensitivities over the forecast period.

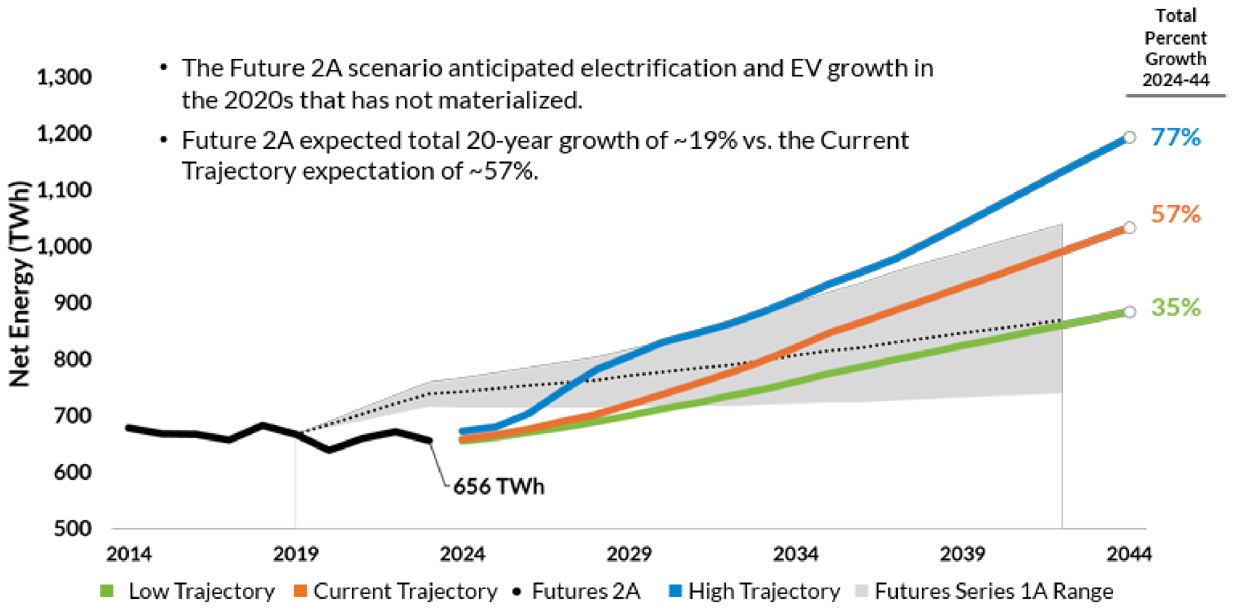


Figure 17: Series 2 Load Growth Compared to Series 1A Precedent

1.6.5 MISO Futures Load Forecast

The Series 2 load forecast encompasses the 20-year study period 2026-45, with increasing load growth by Future. The graphic below contrasts annual growth rates from Series 1A to Series 2, with the Low, Current, and High load growth scenarios corresponding to Future 1, Futures 2 and 4, and Future 3, respectively.

AI-driven acceleration in data center loads, reshoring of industry, and electrification are materially increasing expectations for load growth. The MISO Futures respond to increased load growth by proposing additional generation to supplement current member announcements.

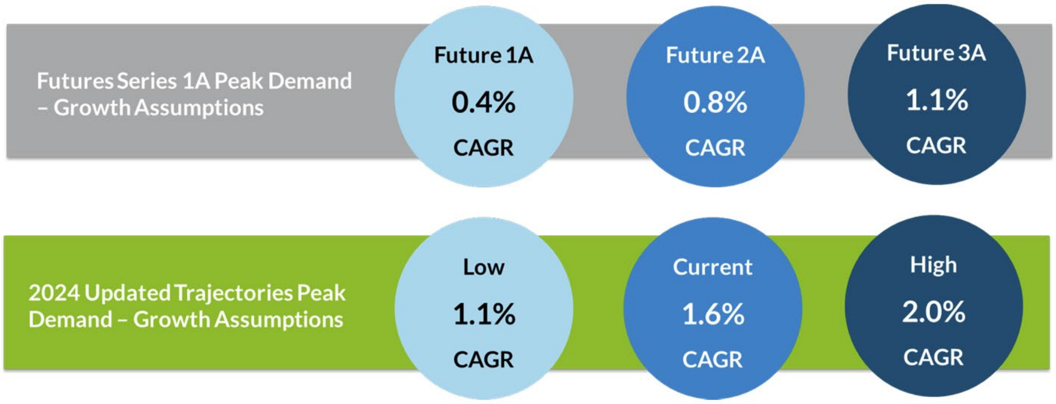
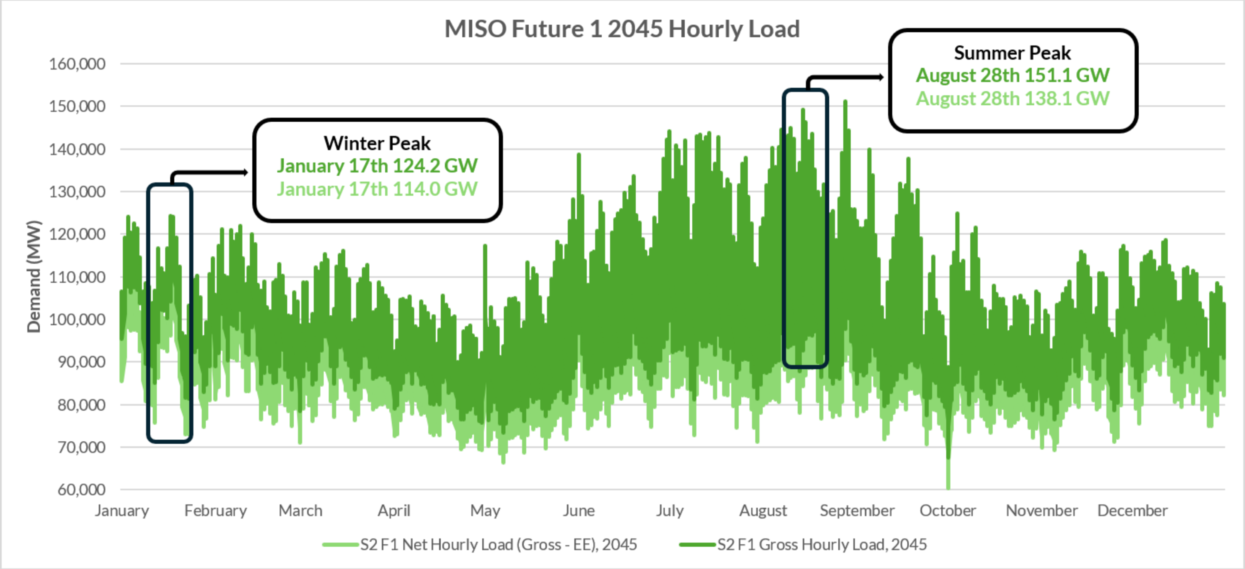


Figure 18: Series 2 CAGR Percentages

1.6.6 Final Net Load Shapes

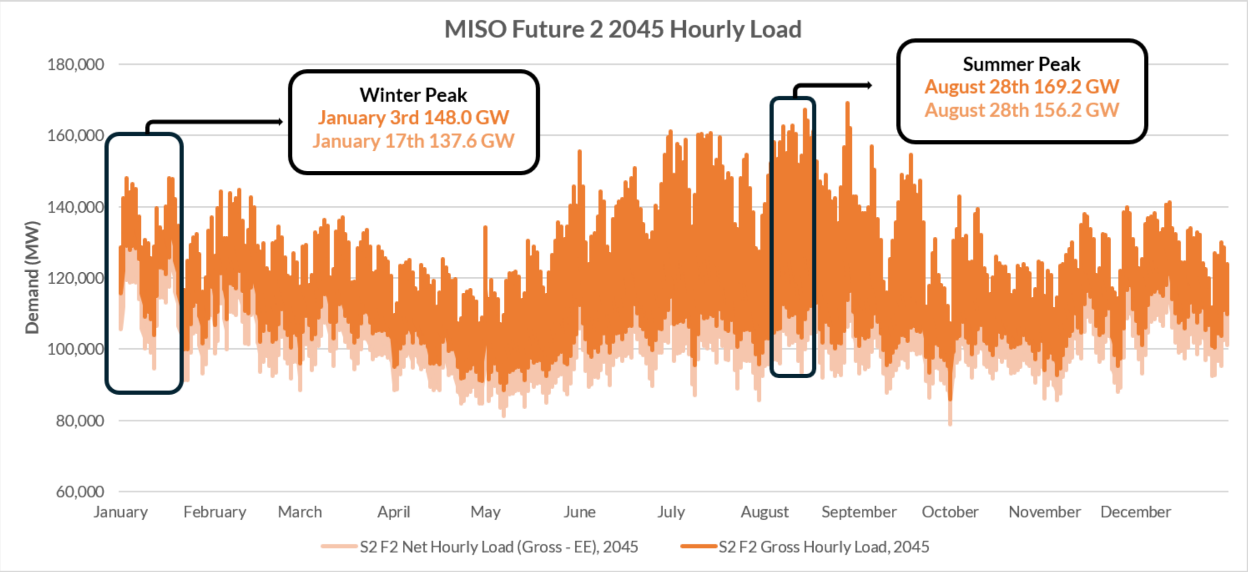
Upon conclusion of the PLEXOS analysis, MISO removed energy proportional to selected energy efficiency (EE) programs in each Future scenario's load shape to produce final net load shapes.



Winter Peak
January 17th 124.2 GW
January 17th 114.0 GW

Summer Peak
August 28th 151.1 GW
August 28th 138.1 GW

Figure 19: Hourly Net Load Shape for Series 2 Future 1, 2045



Winter Peak
January 3rd 148.0 GW
January 17th 137.6 GW

Summer Peak
August 28th 169.2 GW
August 28th 156.2 GW

Figure 20: Hourly Net Load Shape for Series 2 Future 2, 2045

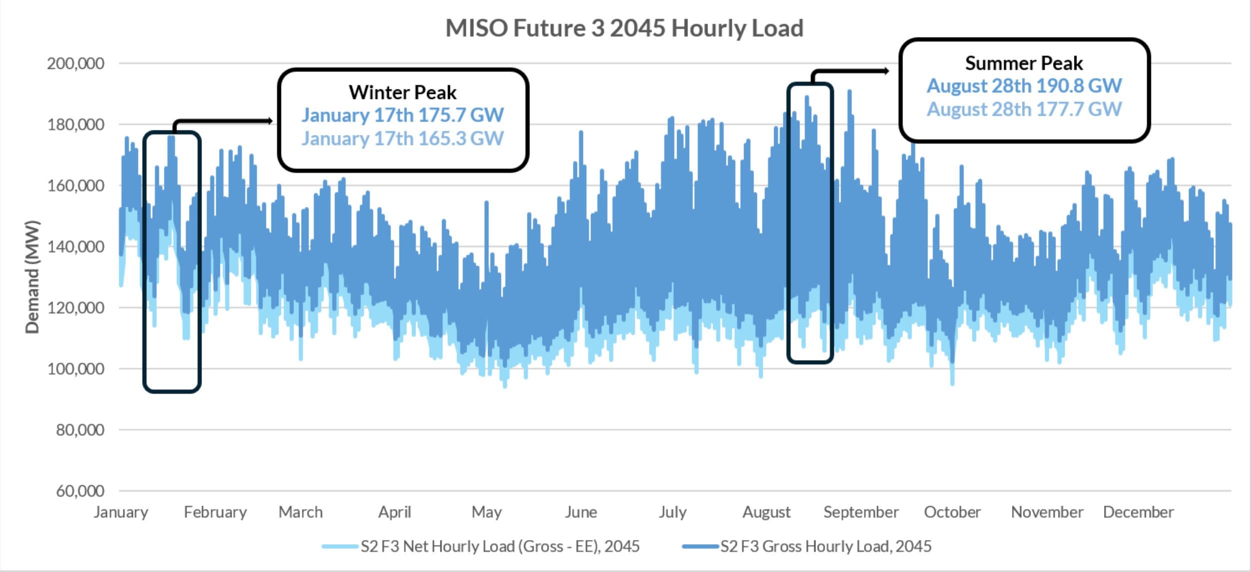


Figure 21: Hourly Net Load Shape for Series 2 Future 3, 2045

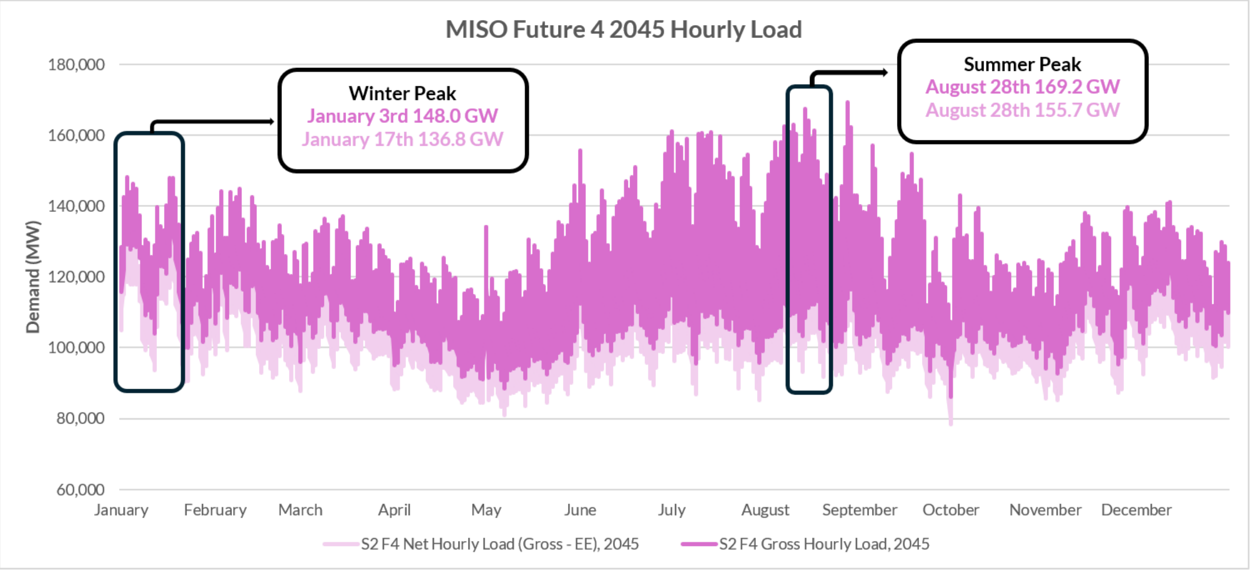


Figure 22: Hourly Net Load Shape for Series 2 Future 4, 2045

1.7 Supply Constraints & Frictions

MISO assessed the future capacity of supply chains and manufacturing for both mature and emerging technologies, factoring in expected constraints from supply chains, import tariffs, and labor availability. Mature and emerging technology types were analyzed to create a realistic build limit that could be used to highlight situations where frictions cause bottlenecks in generation. Mature technologies include solar, wind, short-duration (4-hour) battery, CC gas, CT gas, and RICE. New technologies evaluated include SMRs, long-duration (12-hour) battery, and multi-day (100-hour) battery. Annual capacity build limits and lead times were evaluated and implemented into the Future 4 model. Business-as-usual technological (production) constraints were accounted for in Futures 1-3 modeling.

Future 4 Market Depth Analysis
Market Limits (GW)

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Solar	4.8	5.0	5.1	5.3	5.5	5.6	5.8	5.9	6.0	6.2	6.3	6.4	6.6
Wind	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.3	2.4	2.6	2.6	2.7	2.7
Batteries (4-Hour)	0.7	0.8	0.9	1.1	1.2	1.4	1.6	1.9	2.2	2.6	2.7	2.7	2.7
Batteries (12-Hour)	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Batteries (100-Hour)	-	-	-	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
SMR	-	-	-	-	-	-	-	-	-	-	-	-	-
Gas Combined Cycle	2.0	2.2	2.4	2.7	2.9	3.0	3.1	3.3	3.4	3.6	3.8	4.0	4.2
Gas Combustion Turbine	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Gas RICE	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6

	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Solar	6.7	6.8	7.0	7.1	7.2	7.4	7.5	7.7	7.8	8.0	8.2	8.3	8.5
Wind	2.8	2.8	2.9	2.9	3.0	3.1	3.1	3.2	3.3	3.3	3.4	3.5	3.5
Batteries (4-Hour)	2.7	2.8	2.8	2.8	2.9	2.9	2.9	3.0	3.0	3.0	3.1	3.1	3.1
Batteries (12-Hour)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Batteries (100-Hour)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4
SMR	-	0.5	0.9	1.4	1.8	2.3	2.7	3.2	3.6	4.1	4.5	5.0	5.4
Gas Combined Cycle	4.3	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4
Gas Combustion Turbine	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Gas RICE	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8

Figure 23: Supply Chain Constraints Modeling Values in GW

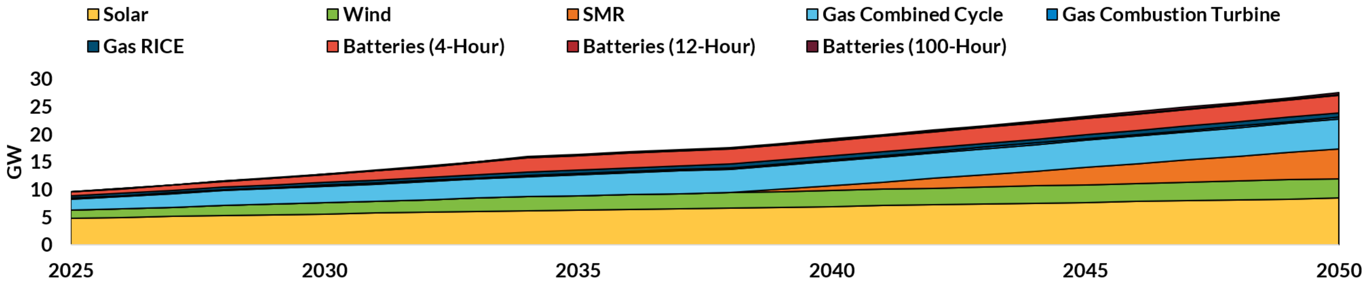


Figure 24: Supply Chain Market Depth

1.7.1 Tariff Impacts

Throughout 2025 and the first half of 2026, federal tariff policy has exhibited high-magnitude shifts at a rapid pace. High-percentage tariffs targeted at key international trade partners began in January 2025 and continued throughout much of the year. Additionally, industry-specific tariffs have targeted materials such as steel and aluminum, key inputs to many facets of energy infrastructure. While some of these tariffs have since been reduced and others have been challenged judicially, tariff policy continues to evolve rapidly, creating significant short- and mid-term uncertainty for the availability and cost of key construction and manufacturing materials.

1.7.2 Supply Chain & Manufacturing Readiness

From 2022 to 2025, the Inflation Reduction Act provided billions of dollars in funding and incentives for the growth of domestic supply chains for energy manufacturing, especially for clean and renewable sources such as solar, wind, and battery. During this period, solar manufacturing investment increased significantly while similar investments in battery manufacturing continued, although investment in domestic wind supply chains lagged other clean energy sectors over the same period. However, subsequent legislative and regulatory changes to IRA-related incentives in 2025 altered the economic outlook for portions of the domestic energy manufacturing sector for domestic supply chains. Even with these incentives in place, demand for new clean energy infrastructure continues to exceed available manufacturing capacity in several sectors, with a majority of solar, wind, and battery manufacturing remaining reliant on foreign supply chains. Simultaneously, access to said foreign supply chains remains volatile and uncertain, as tariffs and other trade policies hamper the availability of foreign-sourced materials and goods.

1.7.3 Labor Availability

Throughout the first half of the 2020s, Congress passed legislation including the Bipartisan Infrastructure Law, Inflation Reduction Act, and CHIPS Act—three laws intended to expand domestic manufacturing capacity, infrastructure development, and industrial investment. However, while appreciable levels of investment in domestic industry persist, the extent to which these policies will meaningfully expand labor availability remains uncertain. Several provisions have been modified, delayed, or repealed, while others, particularly those associated with the CHIPS Act, remain in effect, creating ambiguity regarding their long-term influence on workforce participation and labor supply. Particularly within the construction and manufacturing industries, labor demand is expected to outpace the availability of qualified workers, creating workforce constraints that may delay project development and limit the pace of industrial expansion. These pressures may be further compounded by stricter domestic labor requirements and constraints on immigration, both of which are expected to reduce the pool of available construction and skilled trade workers during a period of elevated project activity. Labor availability was incorporated into the technical availability assumptions for Series 2.

1.7.4 Resource-Specific Impacts

Solar: Ongoing and potential future tariff actions introduce a degree of uncertainty that could impact future availability of solar capacity. Solar development is generally more sensitive to equipment cost changes than many other generation technologies because of its modular and scalable nature. Currently, around 80 percent of U.S. solar inputs are imported, making import tariffs a significant factor in shaping supply. At the same time, recent legislative changes are expected to alter demand conditions across portions of the domestic clean energy supply chain. The repeal of the Inflation Reduction Act's Sections 45Y and 48E tax credits are expected to reduce incentives for new solar development, creating a demand-side constraint for manufacturers of solar panels and other solar-related components. As a result, investment and capacity expansion within portions of the domestic solar manufacturing sector may slow. Together, evolving trade policies and changing federal incentives introduce uncertainty for both the supply and demand outlook of the U.S. solar industry.

Wind: In the past five years, shifting market dynamics and supply chain realignments have caused regional plant closures that have affected U.S. blade availability. The U.S. sources most of the wind generation equipment from domestic manufacturers. Due to recent closures of manufacturing facilities, the blade segment remains the most critical bottleneck in the U.S. wind supply chain. Recent legislative changes may further affect the sector's outlook. The repeal of the Inflation Reduction Act's Sections 45Y and 48E tax credits is expected to reduce incentives for new wind project development, while the phaseout of Section 45X manufacturing credits for wind components may weaken incentives for domestic production. Together, these changes could place additional pressure on investment in both wind generation and the domestic manufacturing supply chain that supports it.

Gas: The global gas turbine manufacturing industry is experiencing dramatic growth in demand, leading to order backlogs. The supply chain for natural gas generation is driven by global turbine orders. Following a period of contraction, the turbine market has surged, resulting in turbine delivery lead times that can approach three years for some projects. About 71 percent of turbines designated for the U.S. market are now imported.

Small Modular Reactors: SMR projects have faced a stop and start trajectory, marked by cost overruns and project cancellations due in part to challenges securing sufficient offtake commitments. Long-term commercialization of SMRs faces several key challenges: developing a viable High-Assay Low-Enriched Uranium (HALEU) fuel market, proving the operability of licensed designs, and demonstrating reliable cost containment. Broad deployment of SMRs is not expected until after 2035.

Lithium-Ion Battery: The availability and diversity of lithium-ion battery options are expected to expand as domestic cell and pack manufacturing efforts are reshored. Short-term energy storage solutions are maturing as a generation technology, and U.S. manufacturing is growing to accommodate future needs. Intermediate storage solutions, like 12-hour batteries, are still emerging. Long-duration energy storage (LDES) is not anticipated to be commercially mature until the 2030s. However, they will face fewer trade constraints as iron is widely available.

1.8 Retirement & Repowering Assumptions

1.8.1 General Retirement Assumptions

For Futures 1-3, MISO utilized age-based retirement assumptions for resources for which members did not provide planned retirement dates. Future 4 assumed no age-based retirements, using only member-provided retirement dates and keeping units without retirement dates active throughout the study period.

Nuclear & Hydroelectric - Nuclear and hydroelectric units retired in the model when they had a publicly announced retirement date or were listed to retire in an IRP. Otherwise, these units remained active throughout the study across all Futures.

1.8.2 Age-Based Retirement Assumptions

In Futures 1-3, units that did not have a member-provided retirement used age-based assumptions as described in the categories below.

Coal - Retirement ages of coal units progressively decrease with each Future. The coal retirement ages modeled in the three Futures respectively are: 46 (F1), 36 (F2), and 30 (F3) years.

Gas - Retirements for gas units were split into two categories, combined cycle (CC) and other gas (CT and all other non-CC). Both units were given retirement ages that decreased across the Futures scenarios; retirements ages for CC gas units are: 50, 45, 35 years and retirements for Other gas units are: 46, 36, and 30 years for F1, F2, and F3 respectively.

Oil - Retirement ages of oil units decrease across each Future scenario and are 45 (F1), 40 (F2), and 35 (F3) years respectively.

Wind & Solar - Utility-scale wind and solar units are assumed to retire at 25 years of age. However, the Futures process assumes that wind units will be repowered the year after retirement. Rather than model repowerments as separate units, wind units that reach the end of their operational life within the 20-year study period instead have their retirement date extended beyond the end of the study period.

	FUTURE 1	FUTURE 2	FUTURE 3	FUTURE 4
Fuel Category	**Age-Based Retirements**	**Accelerated Age-Based Retirements**	**Advanced Age-Based Retirements**	**Delayed Retirements**
Coal	46	36	30	Retire only if publicly announced unless resource is needed for adequacy reasons
Natural Gas-CC	50	45	35	
Natural Gas-Other	46	36	30	
Oil	45	40	35	
Nuclear, Hydro	Retire if publicly announced	Retire if publicly announced	Retire if publicly announced	
Solar	25	25	25	
Battery	25	25	25	
Wind	Repowered unless retired in member data	Repowered unless retired in member data	Repowered unless retired in member data	

Figure 25: Series 2 Age-Based Retirement Assumptions

1.9 Resource Siting Process

1.9.1 Universal Siting Criteria

To help improve siting measures, the following criteria underlie all resource-specific siting processes.

1. The same sites were used for each Future and site differences only occurred due to Future-specific renewable capacity needs and expansion timing. This included only using sites that were found in both the Year 5 and Year 10 MTEP Powerflow models.
2. Radial lines and associated buses were identified in the MTEP Powerflow models and excluded from potential resource sites.
3. Sited capacity could not exceed a site's N-1 capacity amount. This means the summation of all the transmission elements, excluding the highest rated capacity element, could not have a lower capacity than the resource capacity. Exceptions apply to units sited at buses selected by direct stakeholder feedback or site-specific planned resources.
4. Stakeholders had the opportunity to review and provide feedback on preliminary resource siting. Usability of bus and alternatives provided by stakeholders were considered and referenced for final siting of planned and model-built capacity.
5. Greenfield or midpoint buses were included as options for siting to alleviate constraints on existing buses, especially where they aligned with queue sites.
6. Wind and solar as well as nuclear/SMRs were sited on greenfield sites at existing or midpoint buses as necessary for Future-specific expansions. Nuclear/SMRs closely aligned with thermal siting assumptions.

1.9.2 Wind & Solar

Resources of these types were modeled as collector systems, representing an aggregated capacity potential that can be installed within 10-30 miles of each site. Renewable capacity was first allocated to address member state and utility RPS and CES goals for each 5-year milestone (2030, 2035, 2040, and 2045), with the remaining model-built capacity sited according to the following site priorities:

- Member-provided sites;
- Generator Interconnection Queue (GIQ) projects
  - Ranked based on GIQ status, with existing buses before midpoint buses
- Vibrant Clean Energy (VCE) or midpoint sites
  - Collector buses represent a 20- to 30-mile aggregated capacity potential

1.9.3 Distributed Generation PV (DGPV) Solar

Distributed generation PV (DGPV) solar resources siting methodology utilized the National Renewable Energy Laboratory's (NREL) Distributed Generation Market Demand Model (dGen) and consisted of the following:

- Used dGen to identify top 25 counties by DGPV potential within each LRZ.
- Identified (up to) top 30 load buses for each county.
- Distributed county capacity using dGen results weighting.
- DGPV sites were capped at a maximum capacity of 25 MW.
- Additional DGPV/solar-eligible sites were used as needed for remaining capacity.

1.9.4 Battery (All Types)

- Sited capacity for 4- and 12-hour lithium-ion and 100-hour iron-air battery used the same method.
- After member-provided siting, the following priorities apply:
  - 80% of battery capacity sited close to generation, with the remaining 20% close to high load centers.
- In many cases, high-load and generation-proximate counties/sites were the same.

1.9.5 Demand Response

Demand response programs were sited at member-provided buses, consistent with Series 1A. Remaining capacity was sited among LBAs at top load buses per LBA.

1.9.6 Thermal Resources (Gas CC, CT, RICE, & Nuclear/SMR)

After member-provided siting, gas and nuclear generators were sited at:

- Active Definitive Planning Phase (DPP) Phase 1-3 in the GIQ
- Brownfield: existing and retired sites
- Greenfield sites

SMR or planned nuclear sites were sited at or near water sources and, if possible, at existing nuclear sites.

1.10 Resource Adequacy

MISO has added a resource adequacy (RA) check into the Futures Redesign Series 2 to reflect the seasonal RA construct and confirm Futures capacity expansions meet a target Loss-of-Load Expectation (LOLE) of 1 day in 10 years. In 2024, an update to MISO's Tariff changed the RA construct to an adaptable process due to the growing relationship between resource mix and system adequacy. Variable and energy-limited resources create a condition in which system adequacy is a function of the resource mix, not only of total installed capacity (ICAP).

These changes drive the need to consider and update specific RA metrics into the Futures Redesign. Changes include moving from an annual Planning Reserve Margin Requirement (PRMR) to a seasonal PRMR. Following that logic, MISO switched from annual to seasonal resource class accreditation using the Direct Loss of Load (DLOL) method. A set of forward-looking PRMR and DLOL assumptions are used in resource forecasting, including member resource planning and MISO Futures. The ultimate goals of this analysis are to ensure the final Futures capacity expansion meets the PRMR and to consolidate the RA and energy adequacy findings.

Objective 1:

- Develop input assumptions, consistent with MISO's seasonal construct and DLOL-based accreditation, to be used in the resource expansion model
- Calculate DLOL-based PRMR seasonally
- Replace existing ICAP curves with seasonal class-level DLOL-based accreditation values

Objective 2:

- Calibrate resource expansion if seasonal PRM requirements are not within tolerance
- Synchronize findings from energy adequacy and adjust DLOL/PRMR as needed
- Verify if new expansion meets seasonal PRMR

Objective 3 (as needed):

- Repeat Objective 2 goals for subsequent capacity expansion iterations

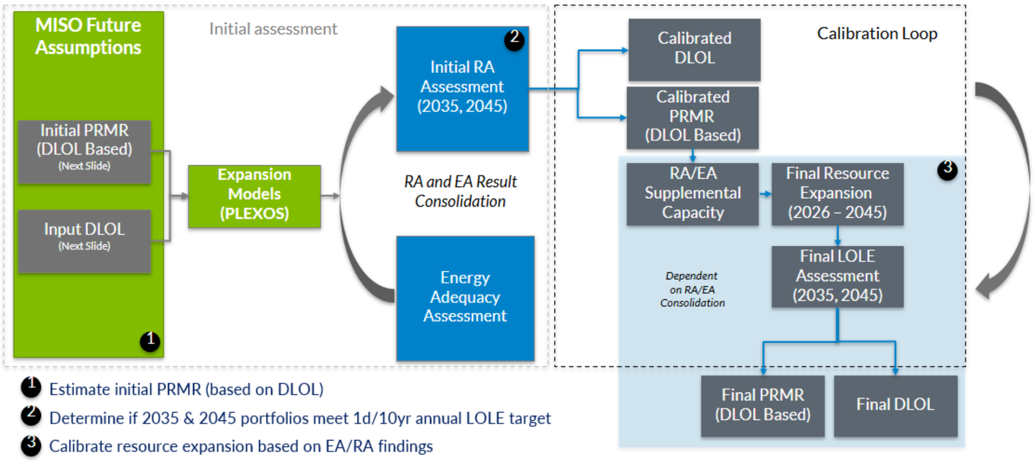


Figure 26: Resource Adequacy Feedback Loop

1.11 Energy Adequacy

In developing Series 2 Futures, MISO performed an energy validation of the resource expansion results. PROMOD, a production cost modeling tool, provided hourly (annual) chronological security-constrained unit commitment and economic dispatch, to identify any Energy Adequacy (EA) shortfalls that may not have been captured during capacity expansion modeling in PLEXOS. Series 2 was the first time Resource Adequacy checks were performed on the Futures scenarios. Resource adequacy is a more complex check of the model than Energy Adequacy; however, to verify first-time accuracy, EA checks were also performed on the final scenarios.

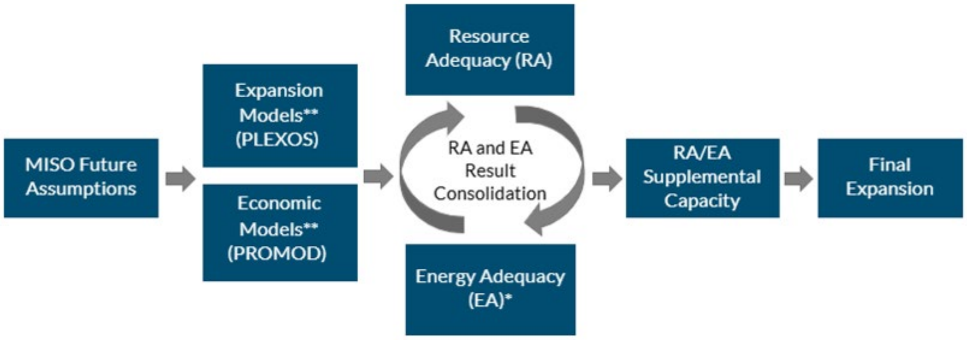


Figure 27: PROMOD Energy Adequacy Check

2. Modeling Results

2.1 Capacity Expansion Results & Siting

2.1.1 Overview

Capacity expansion results for each Future build upon one another as load and retirements of thermal units increase. Futures 1, 2, and 3 have a similar resource mix, while Future 4 has the most solar of any of the expansions due to the relatively lower supply constraints on solar generation compared to other carbon-free resources. All four Futures can meet state renewable and decarbonization requirements after the first few years of the study period.

MISO appreciated the robust feedback from member states and utilities regarding siting of member-planned and model-built resources, resulting in more than 250 changes to the preliminary siting. MISO implemented member siting feedback as much as practicably possible. Resources were also sited based on priority given to member-provided sites, queue sites, and existing over midpoint or greenfield buses, as well as site suitability for various generating technologies.

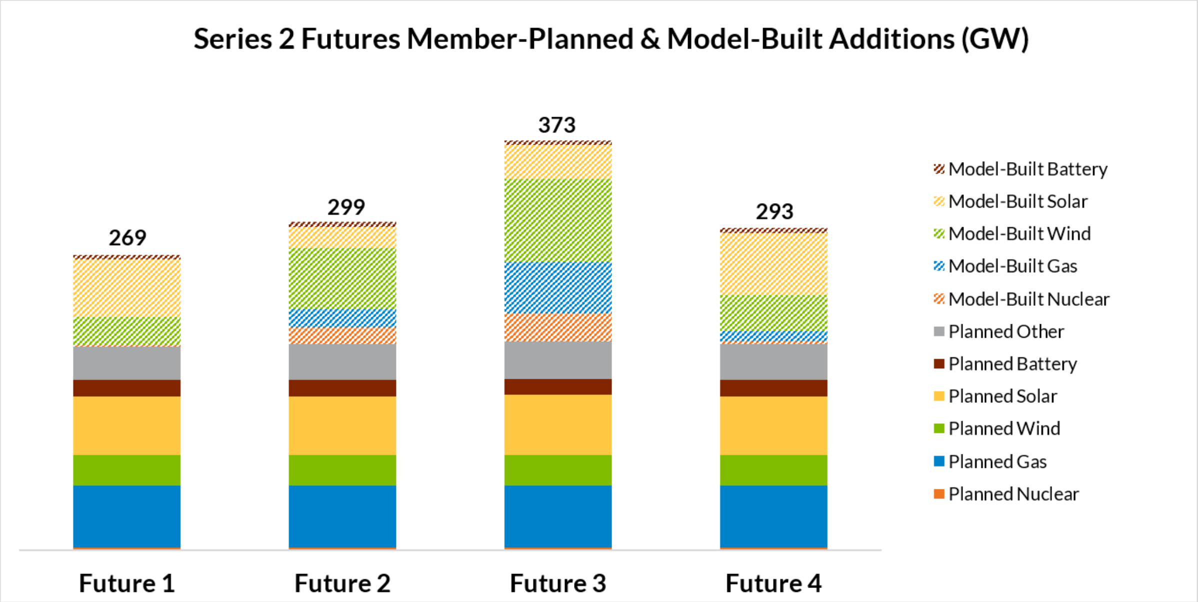


Figure 28: Series 2 Futures Total Expansions as of 2045, GW

Future Resource Additions (MW)				
	Future 1	**Future 2**	**Future 3**	**Future 4**
Nuclear	3,937	17,358	27,524	4,845
Gas	56,369	73,025	102,847	65,412
Wind	53,697	83,782	104,083	61,110
Solar	105,885	72,911	85,361	110,277
Battery	18,907	18,907	18,907	18,907
Other	30,182	32,773	34,201	32,773
Totals	**268,976**	**298,756**	**372,923**	**293,323**

Future Resource Retirements (MW)				
	Future 1	**Future 2**	**Future 3**	**Future 4**
Nuclear	0	0	0	0
Coal	32,674	33,564	37,742	23,815
Gas	29,024	37,182	51,819	23,282
Wind	0	0	0	0
Solar	798	798	798	528
Battery	10	10	10	10
Other	2,245	2,561	2,674	1,773
Totals	**64,750**	**74,115**	**93,044**	**49,408**

Table 3: MISO Resource Additions & Retirement Totals

2.1.2 Future 1

The Future 1 capacity expansion buildout reflects the diverse resource mix currently planned across the MISO footprint. The resulting portfolio largely follows member utility resource plans, with primary model-driven additions consisting of battery, solar, wind, and SMR. MISO member utilities continue to plan to meet their company and state goals while maintaining reliability in key events, resulting in continued reliance on member-planned gas generation to complement growing levels of renewable and intermittent generation. Resource additions are primarily driven by member plans and policy requirements, with expansion limits influencing build timing in select years (see Appendix, Future 1).

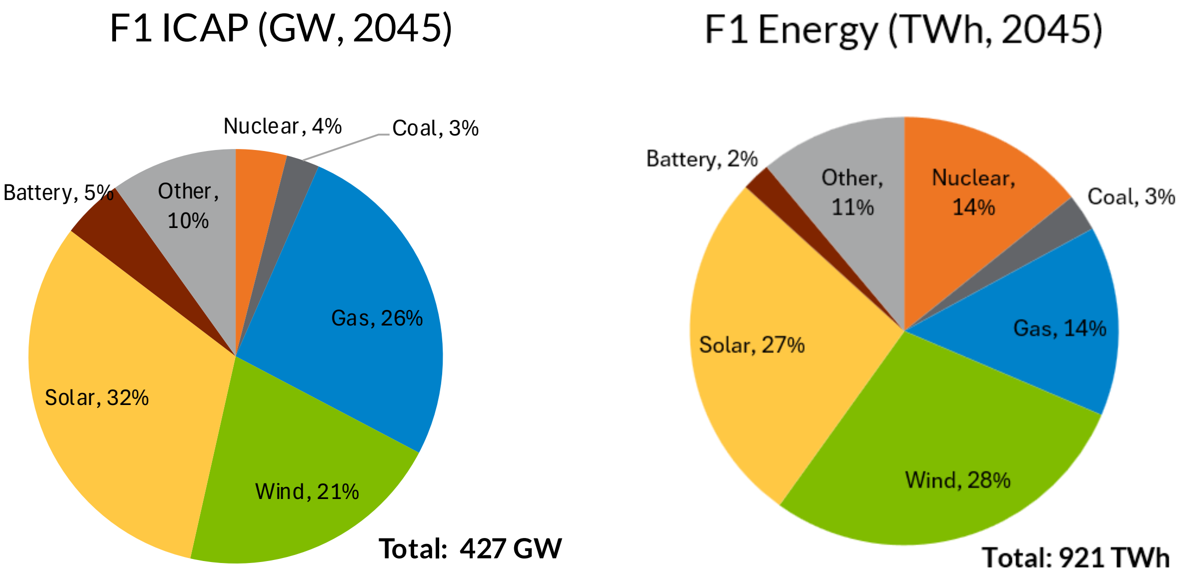


Figure 29: Future 1 Total ICAP & Energy by Resource Type, 2045

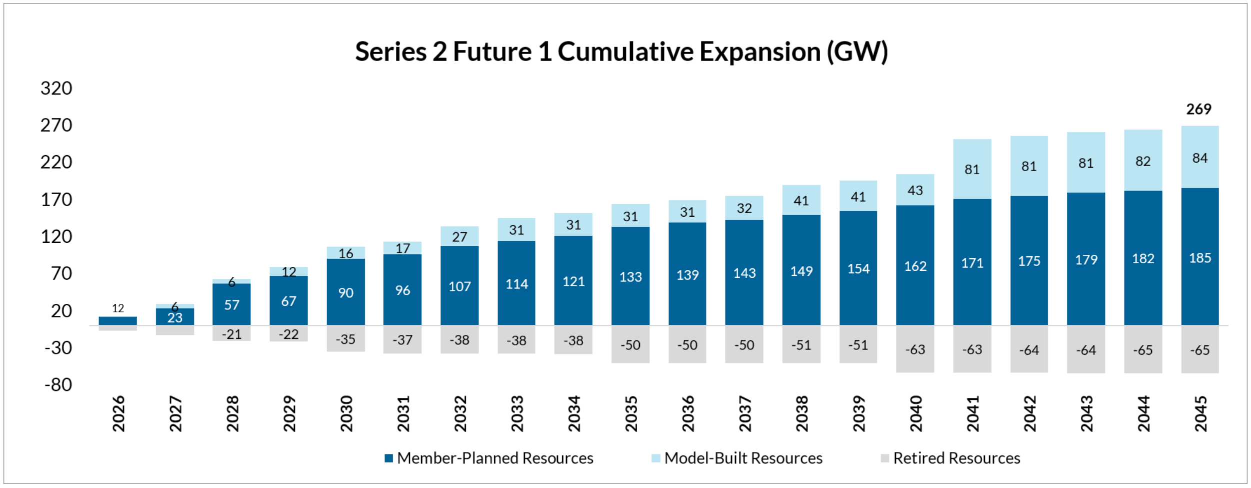


Figure 30: Future 1 Year-Over-Year Resource Additions by Source

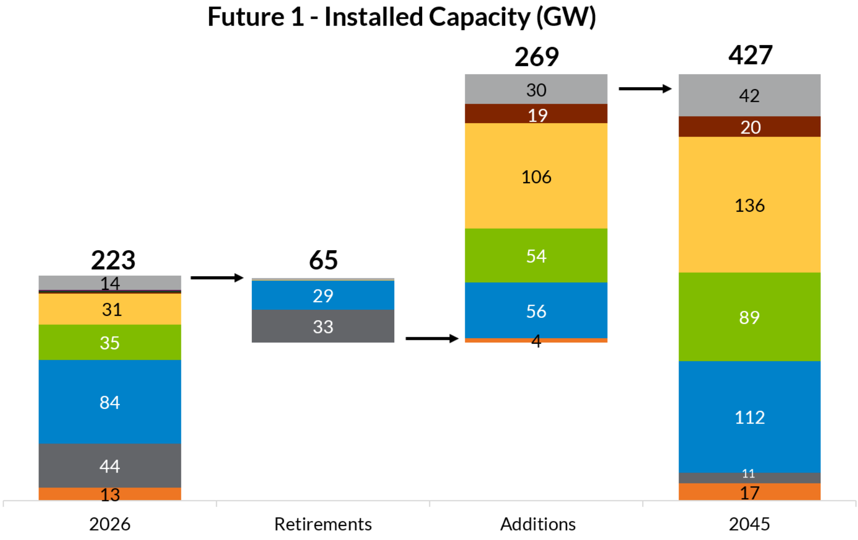


Figure 31: Future 1 ICAP Retirements & Additions, GW

Future 1 Siting

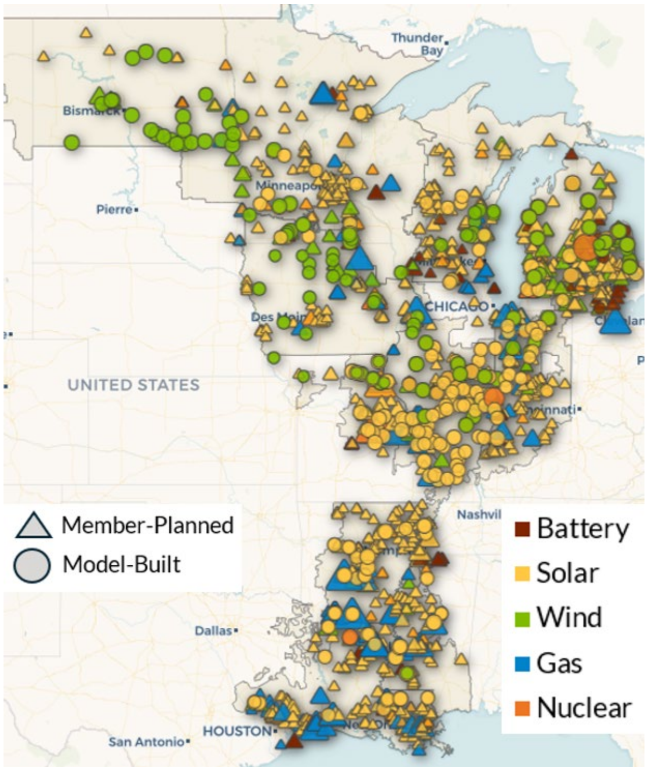


Figure 32: F1 Total Expansion Siting, 2045

Relative to Future 2 or Future 3, Future 1 built more solar than wind. Generally, sites further south are more suitable for solar, and sites further north and west are more suitable for wind. This Future also saw SMR buildout in Indiana, Louisiana, and Michigan.

With over 52 GW of model-built solar and over 25 GW of wind, the Future 1 siting map shows a higher concentration of model-built capacity in the southern footprint, driven by resource suitability of available sites.

State	Tech	Y20 MW
AR	Battery	673
	DGPV	2,875
	DR	304
	Gas	6,481
	Solar	9,660
	Wind	600
IA	DGPV	1,450
	DR	594
	Gas	3,415
	Nuclear	676
	Solar	450
	Wind	3,155
IL	Battery	3,005
	DGPV	1,325
	DR	142
	Solar	13,443
	Wind	5,790
IN	Battery	2,008
	DGPV	1,892
	DR	844
	Gas	6,876
	Nuclear	540
	Solar	5,940
	Wind	2,120
LA	Battery	1,891
	DGPV	1,225
	DR	185
	Gas	14,480
	Nuclear	320
	Solar	10,462
	Wind	1,250

State	Tech	Y20 MW
MI	Battery	3,980
	DGPV	2,050
	DR	1,383
	Gas	2,556
	Nuclear	1,700
	Solar	24,063
	Wind	15,269
MN	Battery	1,539
	DGPV	3,025
	DR	825
	Gas	1,925
	Solar	4,385
	Wind	6,612
MO	Battery	1,800
	DGPV	1,125
	DR	934
	Gas	6,124
	Nuclear	1,500
	Solar	8,495
	Wind	2,510
MS	Battery	1,150
	DGPV	1,700
	DR	5
	Gas	4,699
	Solar	4,190
	Wind	250

State	Tech	Y20 MW
ND	Battery	445
	DGPV	200
	DR	63
	Gas	738
	Solar	292
	Wind	8,633
SD	DGPV	100
	DR	70
	Gas	293
	Solar	50
	Wind	400
TN	DR	156
TX	Battery	400
	DGPV	825
	DR	73
	Gas	4,588
	Solar	2,061
	Wind	600
WI	Battery	2,189
	DGPV	1,825
	DR	851
	Gas	4,310
	Solar	5,941
	Wind	2,312

Table 4: Future 1 Siting Breakdown by State

2.1.3 Future 2

Future 2 builds upon Future 1, reflecting a planning scenario characterized by greater change: 30% load growth over 20 years, non-discounted state and utility goals, and accelerated decarbonization and thermal retirements. Compared to Future 1, the resulting buildout includes greater additions of dispatchable gas and nuclear generation to meet the needs of increased load growth. Battery additions remain largely consistent with Future 1.

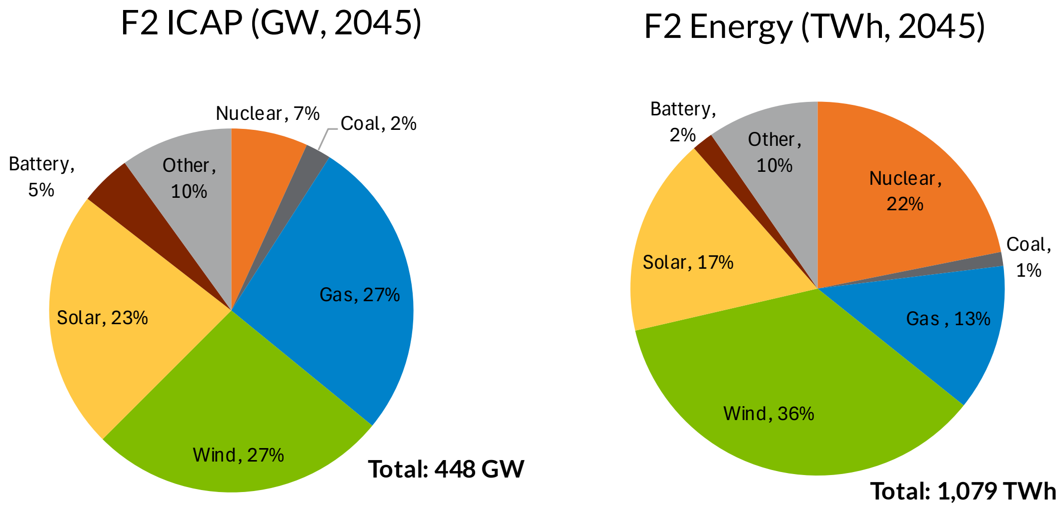


Figure 33: Future 2 Total ICAP & Energy by Resource Type, 2045

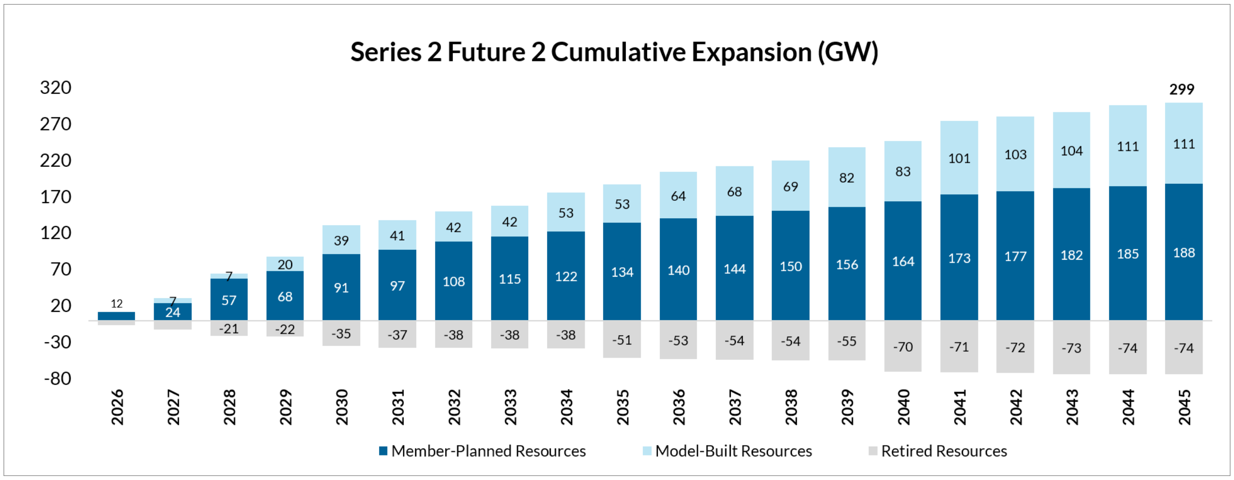


Figure 34: Future 2 Year-Over-Year Resource Additions by Source

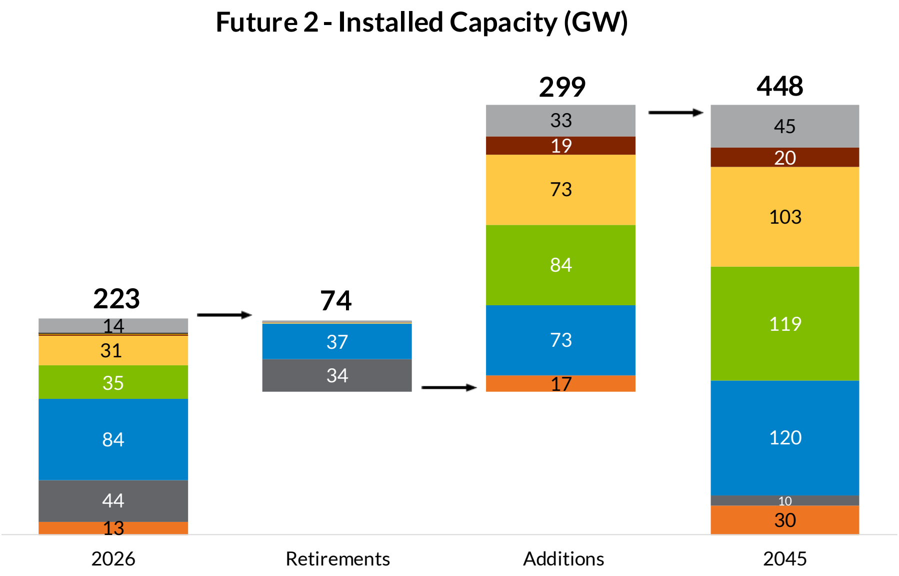


Figure 35: F2 ICAP Retirements & Additions, GW

Future 2 Siting

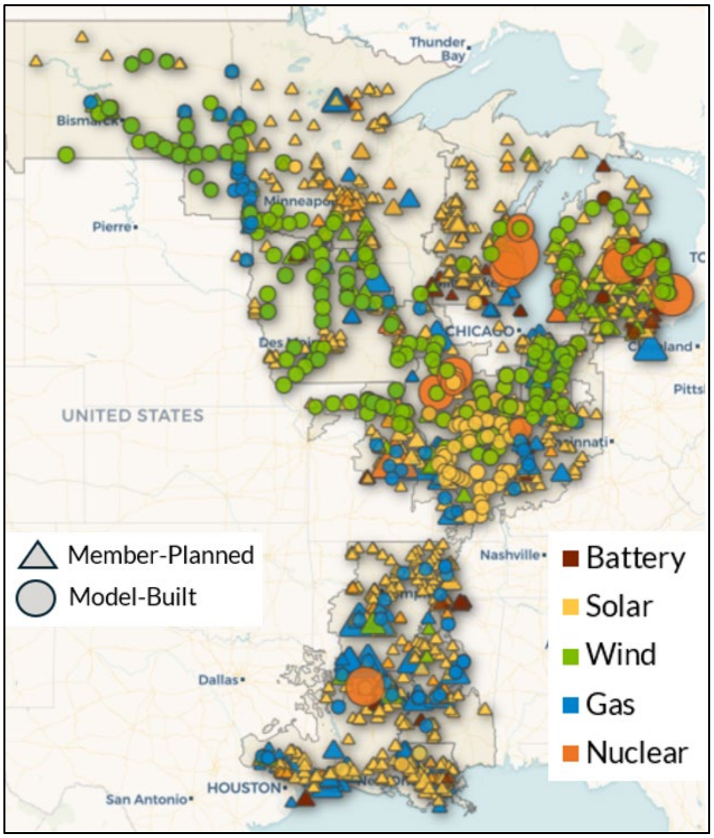


Figure 36: F2 Total Expansion Siting, 2045

Compared with Future 1, Future 2 built more wind and less solar as a percentage of total buildout. Future 2's buildout also included a substantial increase in SMRs, with additional model-built capacity sited in Illinois and Wisconsin, joining that of Indiana, Louisiana, and Michigan, totaling over 15 GW of model-built nuclear.

With over 55 GW of model-built wind and 19 GW of solar, the Future 2 siting map shows a higher concentration of model-built capacity in the northern footprint, driven by resource suitability of available sites, while the southern footprint needs are being addressed through additional gas resources as well as some nuclear and solar.

State	Tech	Y20 MW
AR	Battery	673
	DGPV	2,875
	DR	304
	Gas	8,192
	Solar	2,240
	Wind	600
IA	DGPV	1,450
	DR	594
	Gas	5,389
	Nuclear	676
	Solar	450
	Wind	8,636
IL	Battery	2,996
	DGPV	1,325
	DR	142
	Nuclear	3,080
	Solar	18,562
	Wind	10,330
IN	Battery	2,008
	DGPV	1,892
	DR	844
	Gas	8,718
	Nuclear	600
	Solar	1,175
	Wind	7,745
LA	Battery	1,891
	DGPV	1,225
	DR	185
	Gas	15,533
	Nuclear	1,360
	Solar	7,410
	Wind	1,250

State	Tech	Y20 MW
MI	Battery	3,977
	DGPV	2,050
	DR	1,383
	Gas	2,556
	Nuclear	6,320
	Solar	16,993
	Wind	22,799
MN	Battery	1,539
	DGPV	3,025
	DR	825
	Gas	1,925
	Solar	915
	Wind	9,091
MO	Battery	1,800
	DGPV	1,125
	DR	934
	Gas	7,910
	Nuclear	1,500
	Solar	2,150
	Wind	5,350
MS	Battery	1,150
	DGPV	1,700
	DR	5
	Gas	6,673
	Solar	790
	Wind	250

State	Tech	Y20 MW
ND	Battery	445
	DGPV	200
	DR	63
	Gas	3,941
	Solar	292
	Wind	8,433
SD	DGPV	100
	DR	70
	Gas	2,624
	Solar	50
	Wind	1,400
TN	DR	156
TX	Battery	400
	DGPV	825
	DR	73
	Gas	5,378
	Solar	1,311
	Wind	600
WI	Battery	2,189
	DGPV	1,825
	DR	851
	Gas	4,310
	Nuclear	4,620
	Solar	4,141
	Wind	3,106

Table 5: Future 2 Siting Breakdown by State

2.1.4 Future 3

Future 3 builds on Future 2, representing the greatest transition of the planning scenarios analyzed: 50% load growth over 20 years, non-discounted state and utility goals, and accelerated decarbonization and thermal retirements. Meeting these requirements results in even larger additions of wind, solar, nuclear, and gas resources. The resulting buildout reflects a balance of factors related to member state and utility goals, reliability, and growing demand while maintaining resource adequacy across the planning horizon.

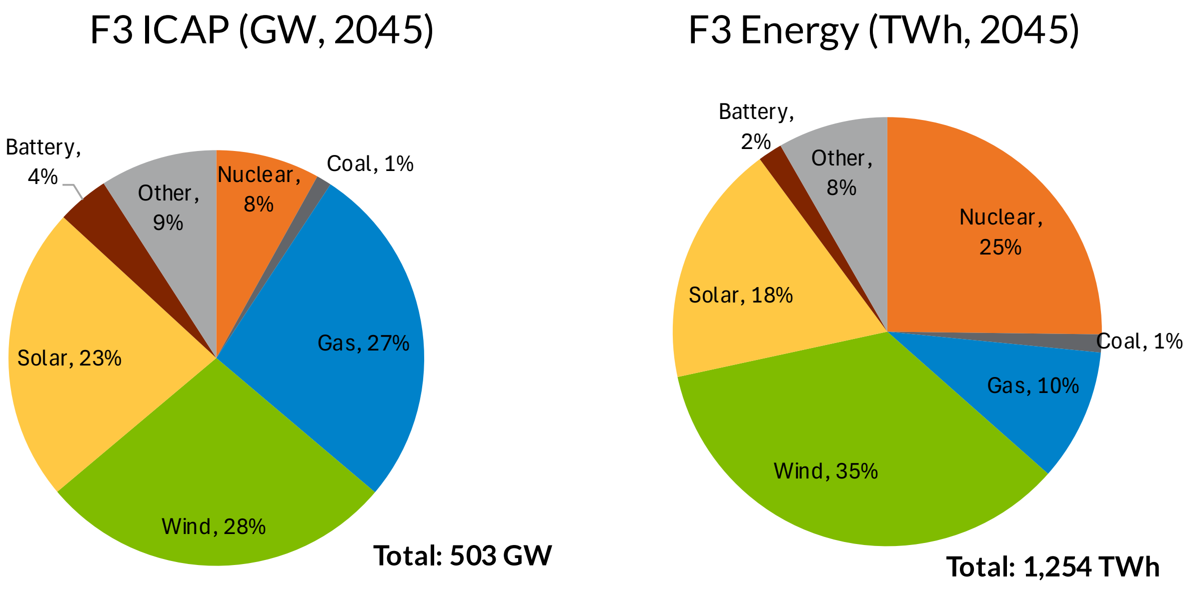


Figure 37: Future 3 Total ICAP & Energy by Resource Type, 2045

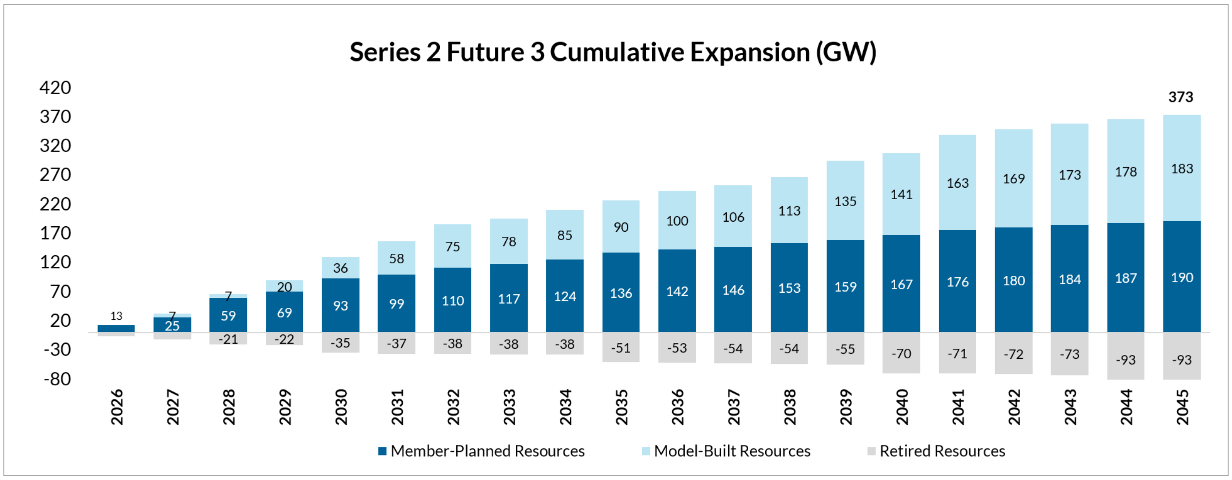


Figure 38: Future 3 Year-Over-Year Resource Additions by Source

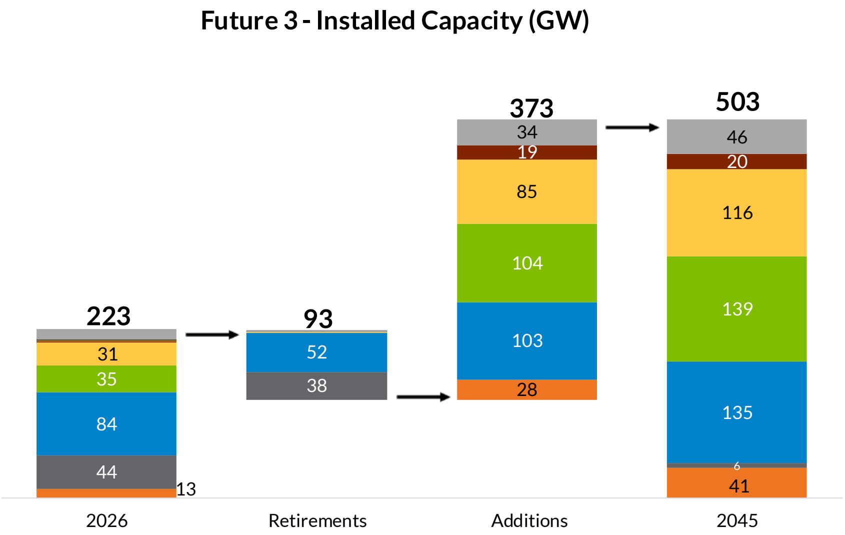


Figure 39: F3 Installed Capacity Retirements & Additions

Future 3 Siting

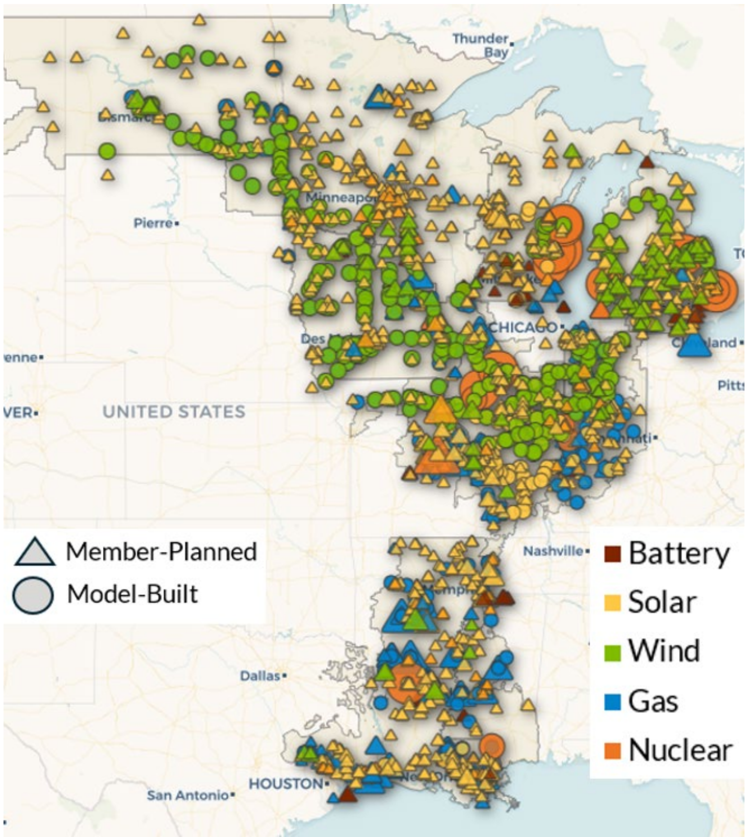


Figure 40: F3 Total Expansion Siting, 2045

Future 3 has the largest capacity expansion of the Series 2 Futures, owing to its higher load. Future 3's map shows the greatest amounts of wind, SMR, and model-built gas capacity.

While solar model-built generation does not reach the amounts seen in Futures 1 or 4, Future 3's solar model buildout exceeds that of Future 2 and includes over 75 GW of wind and 5 GW of gas.

Demonstrating the model's optimized capacity expansion to meet 74% energy growth and an 80% decarbonization floor by 2045, Future 3 also builds 25 GW of nuclear/SMRs in Illinois, Indiana, Louisiana, Michigan, and Wisconsin.

State	Tech	Y20 MW
AR	Battery	673
	DGPV	1,618
	DR	304
	Gas	12,666
	Solar	2,240
	Wind	600
IA	DGPV	2,100
	DR	594
	Gas	13,356
	Nuclear	676
	Solar	450
	Wind	17,375
IL	Battery	2,997
	DGPV	1,375
	DR	142
	Nuclear	4,900
	Solar	24,174
	Wind	15,383
IN	Battery	2,008
	DGPV	1,817
	DR	844
	Gas	14,245
	Nuclear	1,160
	Solar	2,850
	Wind	10,164
KY	Gas	395
LA	Battery	1,891
	DGPV	1,125
	DR	185
	Gas	17,243
	Nuclear	2,200
	Solar	7,230
	Wind	1,250
MI	Battery	3,977
	DGPV	1,698
	DR	1,383
	Gas	2,556
	Nuclear	10,550
	Solar	17,877
	Wind	23,070
MN	Battery	1,539
	DGPV	4,400
	DR	825
	Gas	1,925
	Solar	1,495
	Wind	10,591
MO	Battery	1,800
	DGPV	1,650
	DR	934
	Gas	12,610
	Nuclear	1,500
	Solar	3,046
	Wind	5,513
MS	Battery	1,150
	DGPV	475
	DR	5
	Gas	7,331
	Solar	790
	Wind	250
MT	DGPV	75
ND	Battery	445
	DGPV	1,475
	DR	63
	Gas	8,326
	Solar	292
	Wind	8,433
NE	DGPV	25
SD	DGPV	300
	DR	70
	Gas	2,624
	Solar	50
	Wind	3,550
TN	DR	156
TX	Battery	400
	DGPV	650
	DR	73
	Gas	5,378
	Solar	1,311
	Wind	600
WI	Battery	2,189
	DGPV	2,125
	DR	851
	Gas	4,310
	Nuclear	7,350
	Solar	5,837
	Wind	3,106

Table 6: Future 3 Siting Breakdown by State

2.1.5 Future 4

Future 4 utilized the same assumptions as Future 2 in terms of member goals as well as load growth; key differences included severely restricted offshore manufacturing supply chains and implementing only member-submitted retirements. Given these differences, Future 4 has a higher installed capacity of coal. However, the energy mix by 2045 is like Future 2 due to member state and utility goals. Future 4 has the highest solar buildout due to the reduced supply constraints on domestically produced solar resources.

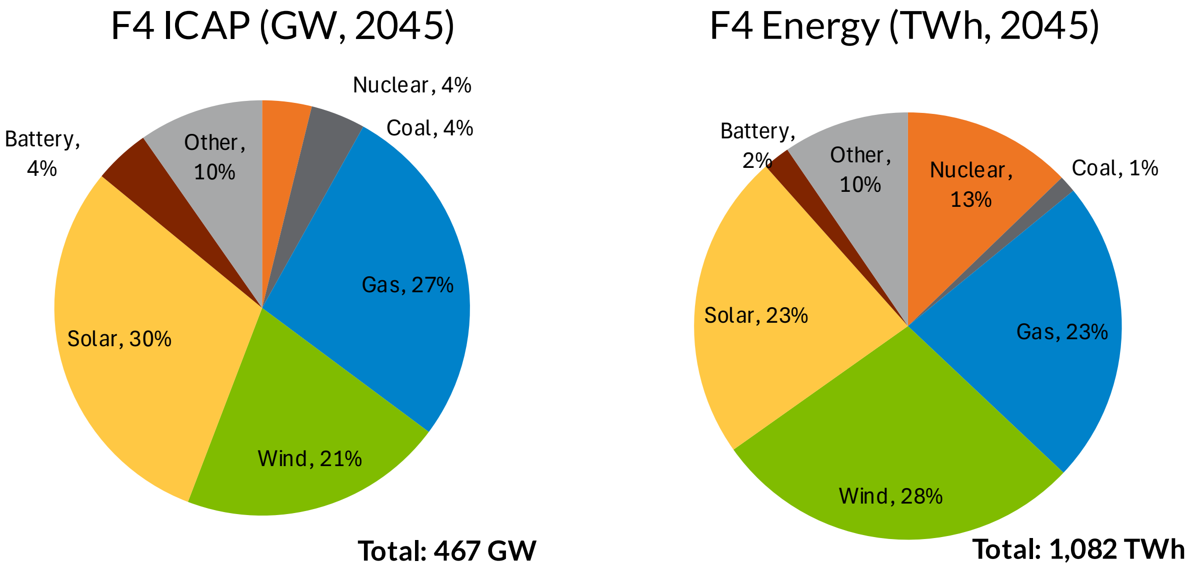


Figure 41: Future 4 Total ICAP & Energy by Resource Type, 2045

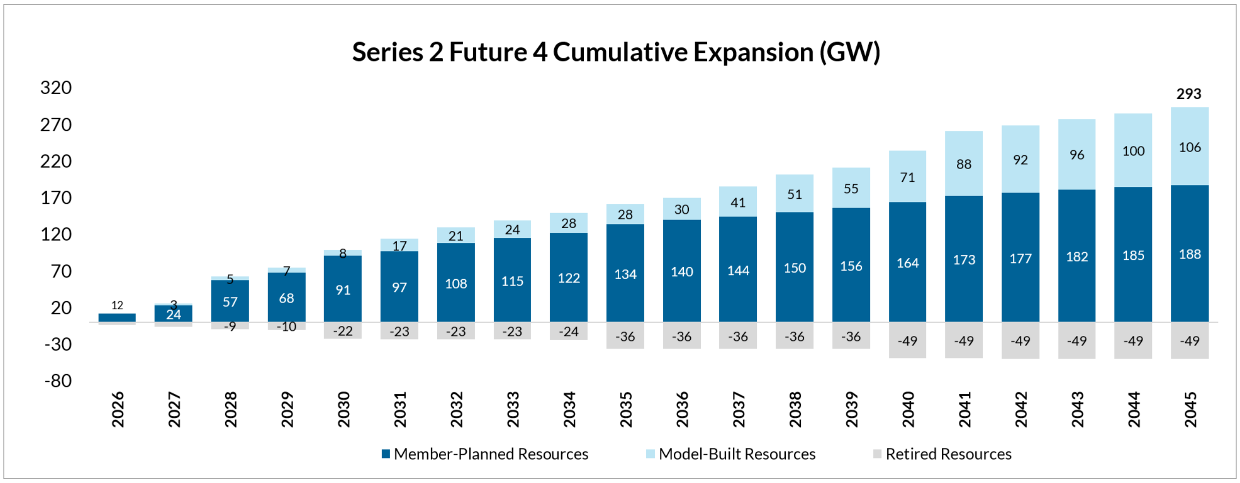


Figure 42: Future 4 Year-Over-Year Resource Additions by Source

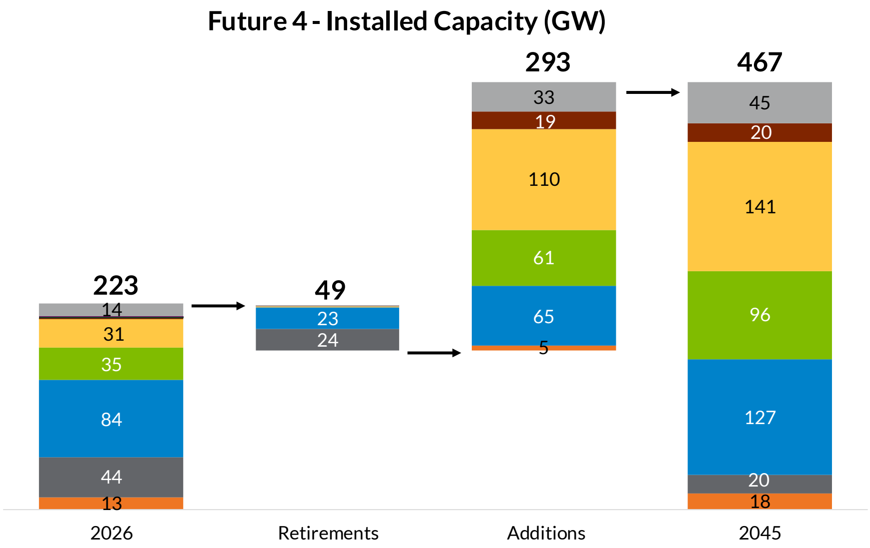


Figure 43: F4 Installed Capacity Retirements & Additions

Future 4 Siting

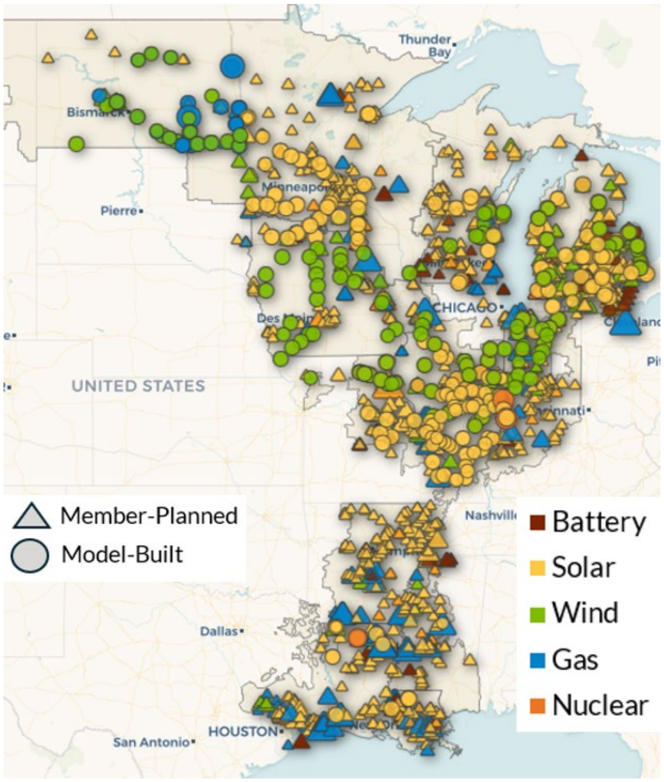


Figure 44: F4 Total Expansion Siting, 2045

Future 4 results show a hybrid between Future 1 and Future 3's modeled capacity expansions.

Future 4's expansion incorporates stringent supply constraints as part of its scenario design. The model considered these strict, simulated build limits along with limited retirements, and the same load and goals as Future 2.

This yielded a capacity expansion with the most model-built solar of any Future, at nearly 57 GW. That capacity includes 33 GW of wind, nearly 3 GW of SMRs in Indiana and Louisiana, and 9 GW of gas.

State	Tech	Y20 MW
AR	Battery	673
	DGPV	2,875
	DR	304
	Gas	6,481
	Solar	2,240
	Wind	600
IA	DGPV	1,450
	DR	594
	Gas	3,415
	Nuclear	676
	Solar	450
	Wind	7,204
IL	Battery	2,996
	DGPV	1,325
	DR	142
	Solar	18,442
	Wind	7,855
IN	Battery	2,008
	DGPV	1,892
	DR	844
	Gas	6,876
	Nuclear	1,160
	Solar	4,414
	Wind	5,863
LA	Battery	1,891
	DGPV	1,225
	DR	185
	Gas	14,480
	Nuclear	450
	Solar	9,937
	Wind	1,250
MI	Battery	3,946
	DGPV	2,050
	DR	1,383
	Gas	2,556
	Nuclear	1,860
	Solar	30,840
	Wind	15,381
MN	Battery	1,539
	DGPV	3,025
	DR	825
	Gas	1,925
	Solar	11,395
	Wind	2,571
MO	Battery	1,800
	DGPV	1,125
	DR	934
	Gas	6,124
	Nuclear	1,500
	Solar	6,650
	Wind	3,587
MS	Battery	1,150
	DGPV	1,700
	DR	5
	Gas	4,699
	Solar	890
	Wind	250
ND	Battery	445
	DGPV	200
	DR	63
	Gas	9,782
	Solar	292
	Wind	8,243
SD	DGPV	100
	DR	70
	Gas	293
	Solar	50
	Wind	400
TN	DR	156
TX	Battery	400
	DGPV	825
	DR	73
	Gas	4,588
	Solar	1,311
	Wind	600
WI	Battery	2,189
	DGPV	1,825
	DR	851
	Gas	4,310
	Solar	6,941
	Wind	3,106

Table 7: Future 4 Siting Breakdown by State

2.2 Resource Adequacy (RA) & DLOL-Based Accreditation Results

Results of the resource adequacy (RA) analysis demonstrate that all four MISO Futures are resource adequate. LOLE analysis showed that no Future in any study year (2030, 2035, and 2045) had an unacceptable level of expected unserved energy. To reach the 1-day-in-10-years LOLE target, MISO calibrated years 5, 10, and 20 of all Futures. DLOL analysis was performed on each Future and study year, resulting in DLOL-based accreditation values for each Future and study year vary marginally but generally align with expected values based on Planning Year (PY) 25-26 indicative DLOL analysis results. **Please note that these tables are placeholder tables only and will be updated when storage accreditation is complete.**

Final LOLE Results		**F1**		**F2**		**F3**		**F4**	
(First Attempt)		**MW Adj.**	**LOLE**	**MW Adj.**	**LOLE**	**MW Adj.**	**LOLE**	**MW Adj.**	**LOLE**
2030	**Annual**		**0.102857**		**0.134286**		**0.107143**		**0.118571**
	Winter	35,500	0.022857	32,000	0.027143	21,000	0.02	31,500	0.014286
	Spring	33,500	0.027143	27,500	0.017143	16,250	0.015714	31,500	0.032857
	Summer	20,500	0.031429	13,000	0.041429	-2,500	0.025714	18,500	0.035714
	Fall	13,500	0.021429	5,500	0.048571	-3,000	0.045714	10,500	0.035714
2035	**Annual**		**0.112857**		**0.104286**		**0.112857**		**0.108571**
	Winter	32,000	0.025714	21,500	0.021429	14,000	0.02	33,000	0.031429
	Spring	24,000	0.032857	18,000	0.028571	11,250	0.015714	22,000	0.034286
	Summer	7,500	0.031429	3,500	0.018571	-3,500	0.041429	6,000	0.024286
	Fall	10,500	0.022857	3,500	0.035714	-3,500	0.035714	12,000	0.018571
2045	**Annual**		**0.115714**		**0.117143**		**0.107143**		**0.115714**
	Winter	29,000	0.017143	7,000	0.014286	-11,000	0.025714	22,000	0.018571
	Spring	26,500	0.027143	3,850	0.015714	-15,000	0.025714	22,000	0.04
	Summer	7,500	0.03	-11,000	0.051429	-26,000	0.027143	6,000	0.027143
	Fall	4,000	0.041429	-13,000	0.035714	-30,000	0.028571	4,000	0.03

Table 8: Loss of Load Expected Values

2.2.1 Future 1

Fuel Type	Year	PY 25-26 Indicative DLOL Results				Future 1 Accreditation Results			
		Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring
Solar	**PY25-26**	45%	28%	19%	28%	45%	28%	19%	28%
	2030	4%	2%	1%	2%	9%	3%	1%	5%
	2035	4%	3%	0%	2%	4%	1%	0%	3%
	2045	2%	1%	0%	1%	5%	2%	1%	3%
Wind	**PY25-26**	8%	15%	23%	15%	8%	15%	23%	15%
	2030	12%	12%	12%	11%	17%	17%	22%	21%
	2035	11%	15%	16%	10%	15%	18%	20%	15%
	2045	9%	9%	11%	11%	12%	14%	18%	15%
Combined Cycle	**PY25-26**	95%	92%	77%	78%	95%	92%	77%	78%
	2030					84%	76%	85%	74%
	2035					83%	78%	85%	73%
	2045					84%	78%	87%	75%
Gas	**PY25-26**	88%	85%	64%	68%	88%	85%	64%	68%
	2030					83%	76%	78%	71%
	2035					85%	78%	78%	74%
	2045					87%	80%	82%	76%
Oil	**PY25-26**	77%	75%	74%	73%	77%	75%	74%	73%
	2030					82%	75%	74%	73%
	2035					83%	77%	78%	77%
	2045					92%	88%	77%	84%
Hydro	**PY25-26**	89%	82%	76%	70%	89%	82%	76%	70%
	2030					88%	87%	85%	81%
	2035					87%	85%	85%	83%
	2045					88%	84%	88%	82%
Nuclear	**PY25-26**	94%	91%	90%	81%	94%	91%	90%	81%
	2030					92%	86%	88%	76%
	2035					91%	84%	90%	76%
	2045					86%	84%	87%	82%
Coal	**PY25-26**	89%	85%	76%	72%	89%	85%	76%	72%
	2030					80%	74%	76%	69%
	2035					78%	72%	73%	75%
	2045					83%	76%	73%	71%

Table 9: Series 2 Future 1 Accreditation

2.2.2 Future 2

Fuel Type	Year	PY 25-26 Indicative DLOL Results				Future 2 Accreditation Results			
		Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring
Solar	**PY25-26**	45%	28%	19%	28%	45%	28%	19%	28%
	2030	4%	2%	1%	2%	6%	2%	1%	4%
	2035	4%	3%	0%	2%	3%	1%	0%	2%
	2045	2%	1%	0%	1%	5%	3%	1%	3%
Wind	**PY25-26**	8%	15%	23%	15%	8%	15%	23%	15%
	2030	12%	12%	12%	11%	10%	10%	11%	14%
	2035	11%	15%	16%	10%	9%	10%	12%	11%
	2045	9%	9%	11%	11%	6%	8%	10%	7%
Combined Cycle	**PY25-26**	95%	92%	77%	78%	95%	92%	77%	78%
	2030					86%	74%	84%	73%
	2035					82%	76%	87%	74%
	2045					84%	77%	88%	72%
Gas	**PY25-26**	88%	85%	64%	68%	88%	85%	64%	68%
	2030					81%	76%	77%	67%
	2035					82%	76%	79%	76%
	2045					85%	77%	82%	76%
Oil	**PY25-26**	77%	75%	74%	73%	77%	75%	74%	73%
	2030					82%	74%	77%	73%
	2035					84%	77%	82%	78%
	2045					92%	86%	84%	83%
Hydro	**PY25-26**	89%	82%	76%	70%	89%	82%	76%	70%
	2030					89%	80%	83%	82%
	2035					89%	83%	86%	80%
	2045					86%	85%	88%	84%
Nuclear	**PY25-26**	94%	91%	90%	81%	94%	91%	90%	81%
	2030					90%	85%	83%	76%
	2035					89%	86%	85%	80%
	2045					91%	81%	89%	76%
Coal	**PY25-26**	89%	85%	76%	72%	89%	85%	76%	72%
	2030					80%	75%	78%	65%
	2035					81%	76%	78%	69%
	2045					82%	72%	82%	71%

Table 10: Series 2 Future 2 Accreditation

2.2.3 Future 3

Fuel Type	Year	PY 25-26 Indicative DLOL Results				Future 3 Accreditation Results			
		Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring
Solar	**PY25-26**	45%	28%	19%	28%	45%	28%	19%	28%
	2030	4%	2%	1%	2%	11%	4%	1%	5%
	2035	4%	3%	0%	2%	4%	1%	1%	3%
	2045	2%	1%	0%	1%	4%	1%	1%	2%
Wind	**PY25-26**	8%	15%	23%	15%	8%	15%	23%	15%
	2030	12%	12%	12%	11%	14%	17%	20%	19%
	2035	11%	15%	16%	10%	14%	15%	15%	14%
	2045	9%	9%	11%	11%	15%	14%	17%	16%
Combined Cycle	**PY25-26**	95%	92%	77%	78%	95%	92%	77%	78%
	2030					84%	79%	84%	77%
	2035					85%	77%	87%	77%
	2045					82%	76%	91%	75%
Gas	**PY25-26**	88%	85%	64%	68%	88%	85%	64%	68%
	2030					83%	77%	76%	73%
	2035					82%	77%	81%	75%
	2045					83%	79%	87%	79%
Oil	**PY25-26**	77%	75%	74%	73%	77%	75%	74%	73%
	2030					80%	75%	77%	73%
	2035					83%	78%	81%	76%
	2045					92%	88%	66%	80%
Hydro	**PY25-26**	89%	82%	76%	70%	89%	82%	76%	70%
	2030					89%	86%	85%	84%
	2035					87%	86%	89%	81%
	2045					85%	83%	90%	84%
Nuclear	**PY25-26**	94%	91%	90%	81%	94%	91%	90%	81%
	2030					90%	86%	86%	82%
	2035					89%	84%	88%	79%
	2045					87%	84%	87%	79%
Coal	**PY25-26**	89%	85%	76%	72%	89%	85%	76%	72%
	2030					77%	75%	77%	72%
	2035					79%	77%	82%	68%
	2045					80%	83%	76%	79%

Table 11: Series 2 Future 3 Accreditation

2.2.4 Future 4

Fuel Type	Year	PY 25-26 Indicative DLOL Results				Future 4 Accreditation Results			
		Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring
Solar	**PY25-26**	45%	28%	19%	28%	45%	28%	19%	28%
	2030	4%	2%	1%	2%	9%	3%	1%	4%
	2035	4%	3%	0%	2%	4%	1%	1%	2%
	2045	2%	1%	0%	1%	2%	1%	0%	1%
Wind	**PY25-26**	8%	15%	23%	15%	8%	15%	23%	15%
	2030	12%	12%	12%	11%	15%	18%	19%	18%
	2035	11%	15%	16%	10%	14%	18%	20%	15%
	2045	9%	9%	11%	11%	15%	15%	19%	17%
Combined Cycle	**PY25-26**	95%	92%	77%	78%	95%	92%	77%	78%
	2030					86%	78%	81%	74%
	2035					84%	77%	81%	75%
	2045					84%	78%	89%	73%
Gas	**PY25-26**	88%	85%	64%	68%	88%	85%	64%	68%
	2030					81%	74%	77%	74%
	2035					83%	77%	76%	77%
	2045					85%	77%	83%	77%
Oil	**PY25-26**	77%	75%	74%	73%	77%	75%	74%	73%
	2030					82%	74%	77%	74%
	2035					84%	78%	81%	76%
	2045					89%	82%	79%	80%
Hydro	**PY25-26**	89%	82%	76%	70%	89%	82%	76%	70%
	2030					89%	84%	84%	83%
	2035					87%	84%	85%	80%
	2045					87%	83%	89%	78%
Nuclear	**PY25-26**	94%	91%	90%	81%	94%	91%	90%	81%
	2030					86%	85%	88%	78%
	2035					90%	83%	88%	81%
	2045					87%	88%	89%	80%
Coal	**PY25-26**	89%	85%	76%	72%	89%	85%	76%	72%
	2030					78%	75%	76%	71%
	2035					80%	75%	76%	72%
	2045					84%	72%	76%	73%

Table 12: Series 2 Future 4 Accreditation

2.3 Energy Adequacy (EA) Results - Chronological Energy Validation

MISO performed energy adequacy (EA) tests on all four Futures in PROMOD. MISO Series 2 Futures are energy adequate and do not require emergency energy. Emergency energy identifies hours where capacity may be limited. Supplemental capacity needs are calculated based on the gap between available generation and demand during these hours. EA tests spanning the entire study period show that all energy needs are met, even 20 years out, at the peak load hour of the year. The figure below shows example results for each Future on August 28, 2045, the calendar day around the peak load hour of the year.

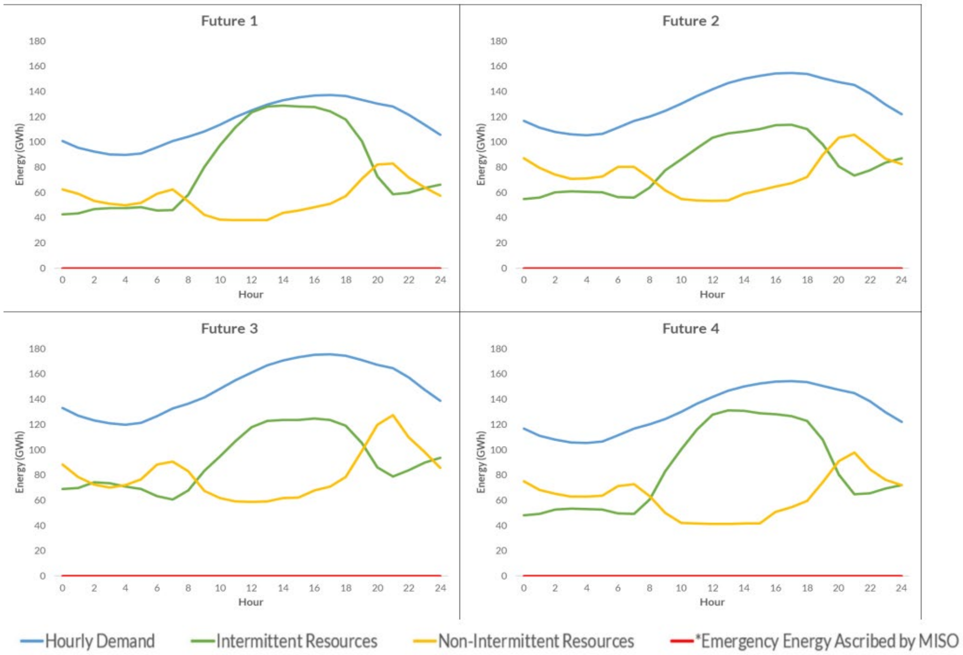


Figure 45: Series 2 Hourly Demand vs. Available Generation, PROMOD EA Check, August 28, 2045

2.4 Sensitivities

MISO conducted six total sensitivity or benchmarking exercises, specifically using Future 2 and Future 3, to analyze the effects that changes in cost, policy, or other external factors could have on future generation needs.

2.4.1 Future 2 Sensitivities

Lower Long-Duration Storage Price

Capital costs of long-duration (100-hour) battery were reduced by 11%. Thermal ramp rates and associated costs were introduced to the model. The capital cost reduction was determined using the 2024 National Laboratory of the Rockies Annual Technology Baseline (2024 NLR ATB).

The model built more 100-hour battery than 4-hour battery due to the lower costs. Total battery buildout, however, remained the same while solar marginally increased. Battery buildout depends on curtailed energy. The Series 2 Futures exhibits lower renewable curtailment than the IRA case, primarily because the early phaseout of OB3 tax credits results in less wind and solar development. As a result, excess renewable generation is reduced, limiting the economic need for additional storage resources.

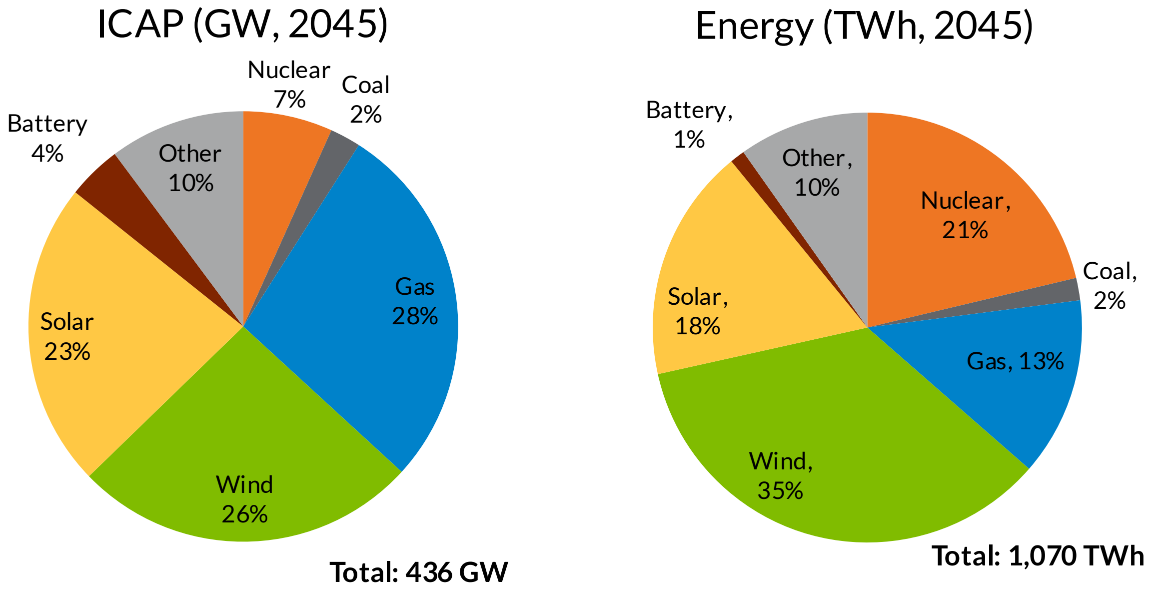


Figure 46: Series 2 Future 2 Lower Long Duration Storage Price Sensitivity

Lower Long-Duration Storage, SMR & MISO Gas Prices

This scenario incorporated the lower long-duration storage costs and thermal ramp rates from the previous sensitivity. In addition, gas fuel prices were reduced by 23%, and SMR capital costs were reduced by 14%. Capital cost reductions were determined using the 2024 NLR ATB. Fuel price reductions were determined using the U.S. Energy Information Agency (EIA) price database.

Existing thermal generation was more economic for a longer period, reducing the need to build renewables. This resulted in fewer RICE units as well. SMR buildout increased to meet state decarbonization goals and demand instead of renewables. Because SMRs offer clean generation and firm capacity while benefitting from IRA tax credits, the overall need for wind and solar is reduced.

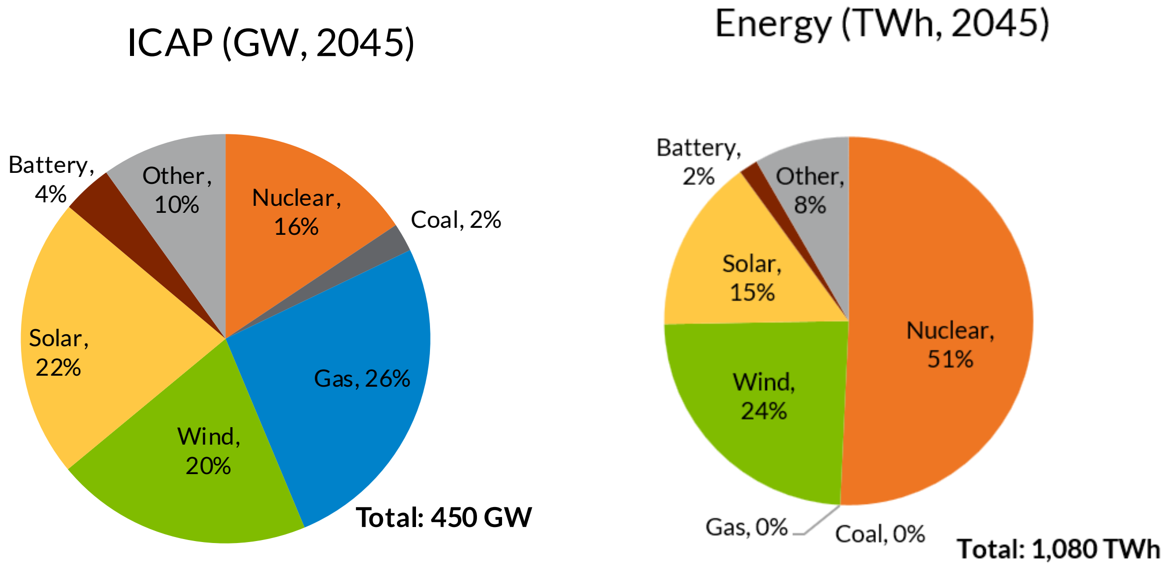


Figure 47: Series 2 Future 2 Lower Long Duration Storage, SMR, & MISO Gas Prices Sensitivity

Lower Long-Duration Storage & SMR Prices, & Higher MISO Gas Prices

Similarly to the previous sensitivity, this scenario again incorporated the lower long-duration storage costs, thermal ramp rates, and a 14% SMR capital cost reduction. Gas fuel prices were increased every year, with a specific 78% increase in the final year. Capital cost reductions were determined using the 2024 NLR ATB. Fuel price increases were determined using the U.S. EIA price database.

The higher gas fuel price resulted in increased SMR buildout and modest gas buildout reductions. All other resource types were like those in the final Future 2 expansion. Overall, it is a balanced mix of renewables and clean firm capacity. Gas units offer peaking ability.

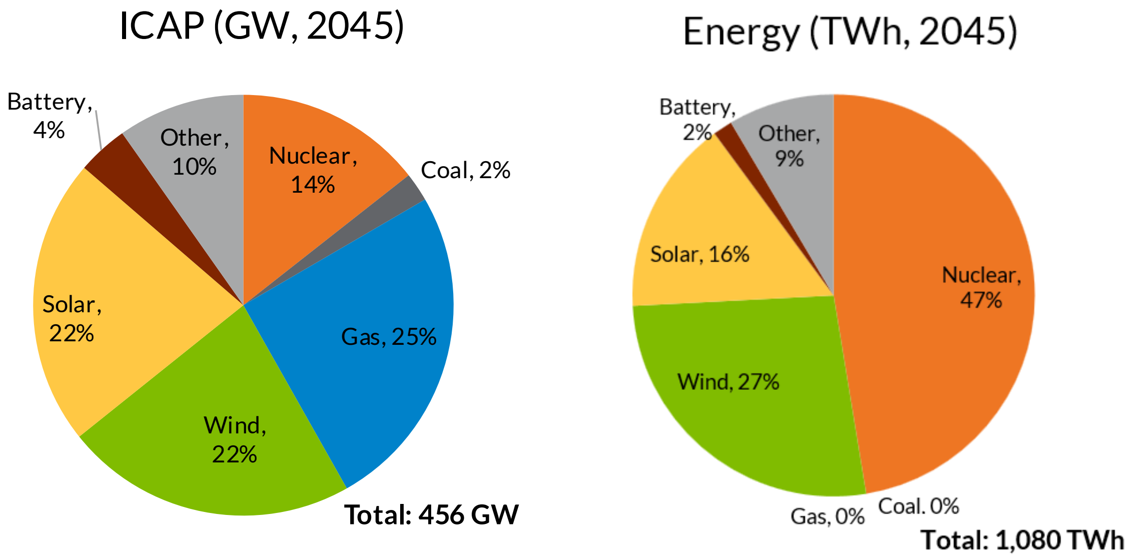


Figure 48: Series 2 Future 2 Lower Long Duration Storage & SMR Prices, & Higher MISO Gas Prices Sensitivity

2.4.2 Future 3 Sensitivities

Cost Abatement

This sensitivity applied a $40/ton penalty to CO_2 production for the MISO Future 3 decarbonization constraint, which is aggregated from member utility goals. MISO chose Future 3 for this sensitivity because it has the highest overall buildout in Series 2 capacity expansions and the largest incidence of binding to member goals.

The model violates emissions limits in early years by changing unit dispatch order. It is cheaper to run existing higher-emitting units than it is to build RICE and CT units, unless they are needed for PRM or demand in later years. SMR units eventually take over as baseload generation. There is overall less gas buildout because existing, cheaper thermal generation is dispatched in earlier years.

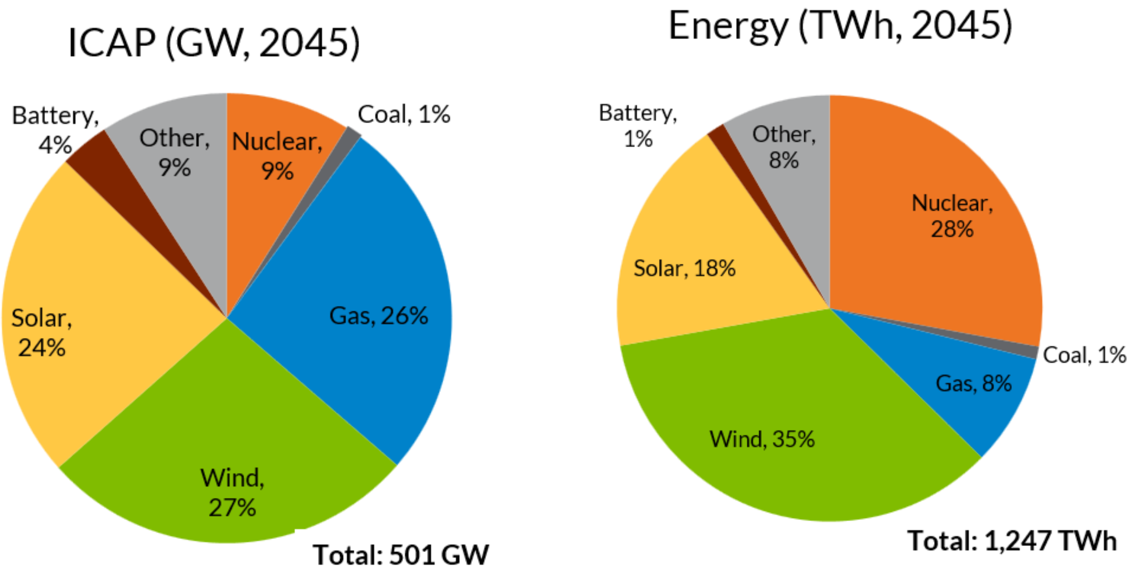


Figure 49: Series 2 Future 3 Cost Abatement Sensitivity

10% Load Increase: Future 3+

This is MISO's high-end bookend test. Starting with Future 3, the load forecast was increased by 10% to match higher load growth trends. Expected results would be greater buildout across all technology types.

The overall breakdown of the buildout remains similar to the final Future 3 resource mix. There was a general increase in all generation types, with ICAP increasing by 9% overall. The model built CC units to accommodate the increased load. Solar sees a slightly higher buildout, due to having the least stringent build limits of all resource types. Battery buildout remains at a similar level but sees a greater proportion of 4-hour units and relatively fewer 100-hour units.

Due to the 2026 load forecast projections, F3+ will be utilized in the LRTP process along with Future 2.

For comparison purposes, F3+ expansion values are shown side by side with F3 final expansion numbers.

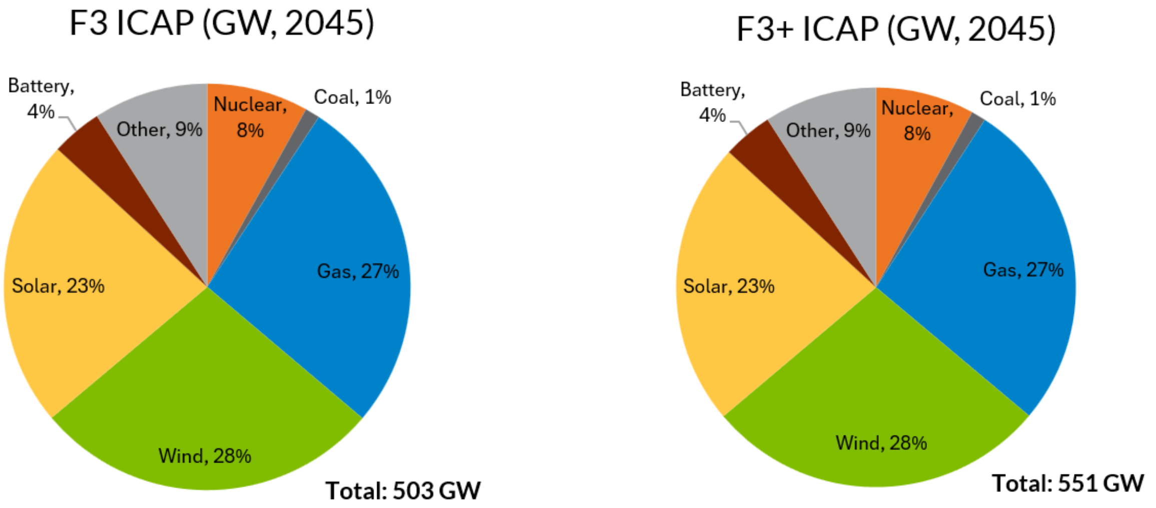


Figure 50: F3 Base Case & F3+ Sensitivity ICAP by Resource Type, 2045

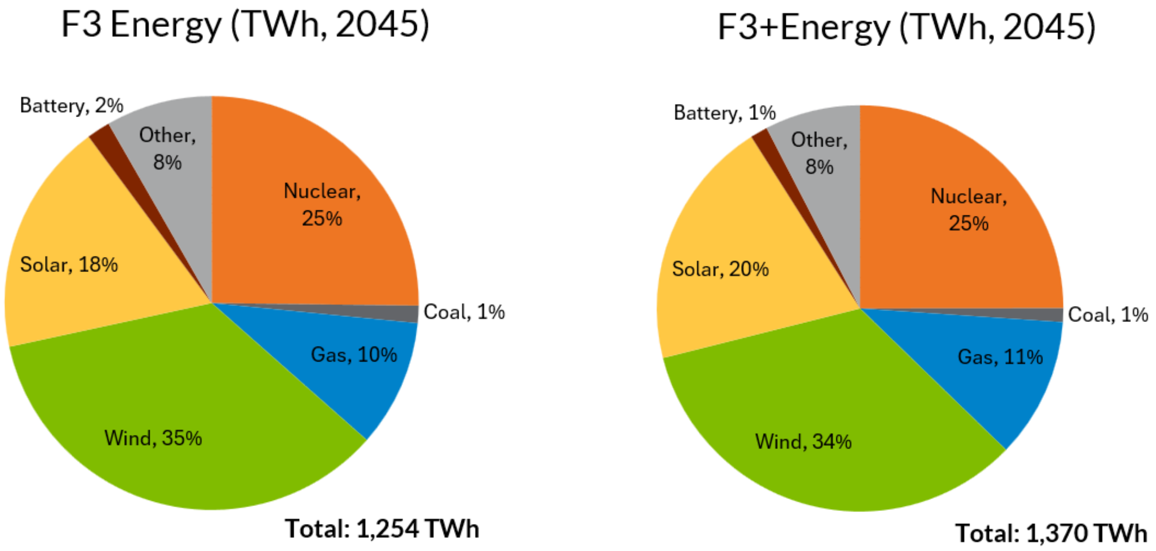


Figure 51: F3 Base Case & F3+ Sensitivity Energy by Resource Type, 2045

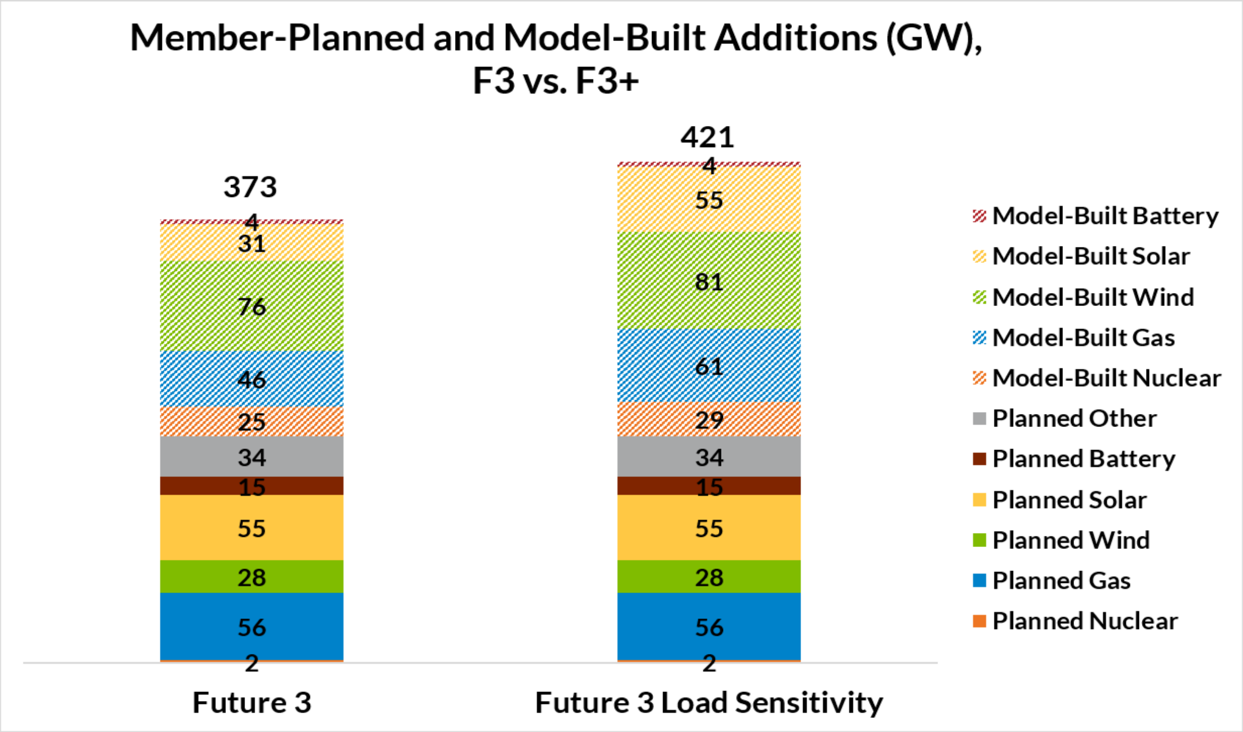


Figure 52: Comparison of Total Cumulative Additions Between Base F3 and F3+ Load Sensitivity, 2045

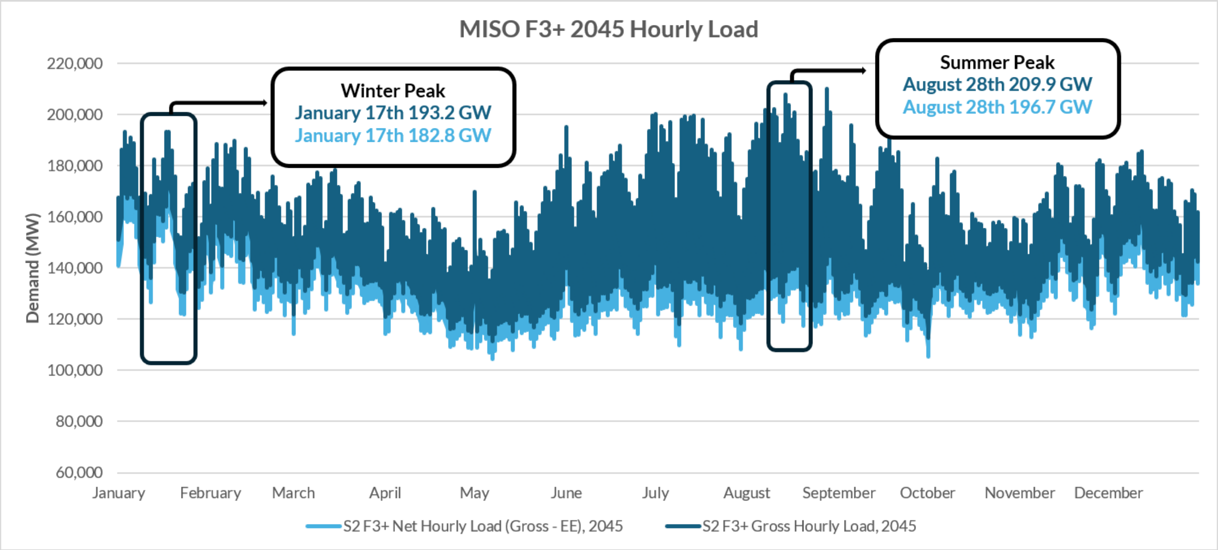


Figure 53: Hourly Net Load Shape for F3+ Sensitivity, 2045

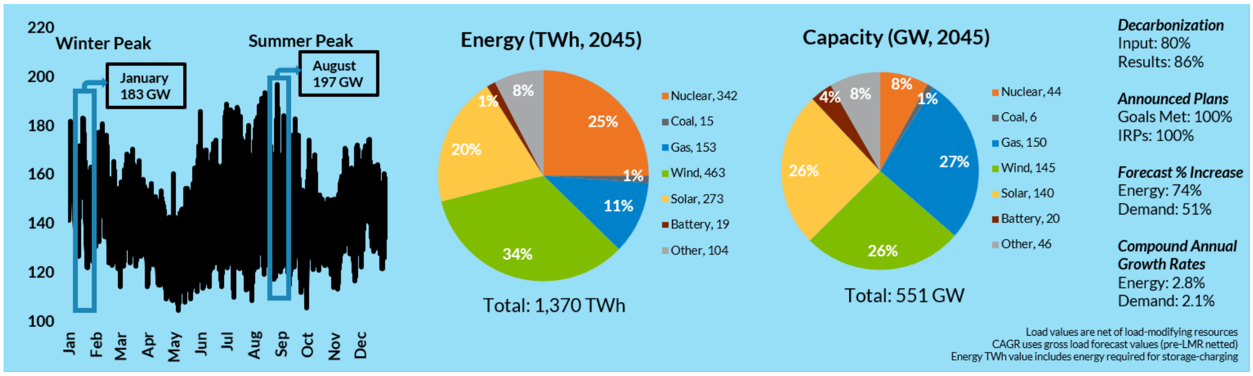


Figure 54: Figure 3: F3+ Sensitivity Results Summary

Future 3+ Siting

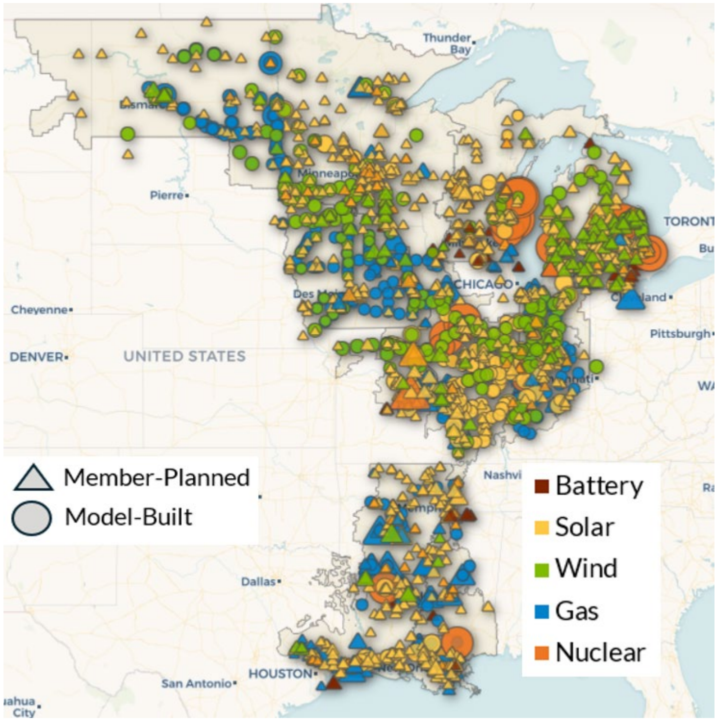


Figure 55: F3+ Total Expansion Siting, 2045

The F3+ sensitivity, with 10% greater load, includes 48 GW more capacity than Future 3, with additional resources throughout the footprint.

F3+ results see model-built solar and/or wind increases in Illinois, Indiana, Louisiana, Michigan, Minnesota, Missouri, and Wisconsin. SMR buildout increases in Illinois, Indiana, Louisiana, Michigan, and Wisconsin.

State	Tech	Y20 MW
AR	Battery	673
	DGPV	1,618
	DR	304
	Gas	11,614
	Solar	2,240
	Wind	600
IA	DGPV	2,100
	DR	594
	Gas	18,007
	Nuclear	676
	Solar	450
	Wind	3,810
IL	Battery	2,997
	DGPV	1,375
	DR	142
	Nuclear	5,550
	Solar	27,149
	Wind	16,487
IN	Battery	2,008
	DGPV	1,814
	DR	844
	Gas	22,228
	Nuclear	1,350
	Solar	7,122
	Wind	16,909
KY	Gas	1,101
LA	Battery	1,891
	DGPV	1,125
	DR	185
	Gas	17,191
	Nuclear	2,500
	Solar	11,060
	Wind	1,250
MI	Battery	3,977
	DGPV	1,698
	DR	1,383
	Gas	2,556
	Nuclear	11,850
	Solar	23,017
	Wind	24,768
MN	Battery	1,539
	DGPV	4,400
	DR	825
	Gas	1,926
	Solar	3,295
	Wind	21,424
MO	Battery	1,800
	DGPV	1,650
	DR	934
	Gas	13,625
	Nuclear	1,500
	Solar	7,566
	Wind	7,168
MS	Battery	1,150
	DGPV	475
	DR	5
	Gas	6,279
	Solar	790
	Wind	250
MT	DGPV	75
ND	Battery	445
	DGPV	1,475
	DR	63
	Gas	11,390
	Solar	292
	Wind	8,433
NE	DGPV	25
SD	DGPV	300
	DR	70
	Gas	3,320
	Solar	50
	Wind	1,650
TN	DR	156
TX	Battery	400
	DGPV	650
	DR	76
	Gas	4,722
	Solar	1,311
	Wind	600
WI	Battery	2,190
	DGPV	2,125
	DR	851
	Gas	4,311
	Nuclear	8,270
	Solar	7,751
	Wind	1,863

Table 13: Future 3+ Siting Breakdown by State

A. Appendix

A.1 Additional MISO Assumptions

A.1.1 Capital Costs

Where possible, MISO sources capital cost data from the National Laboratory of the Rockies (NLR, previously known as NREL) Annual Technology Baseline (ATB), which provides projected costs for capital, fuel, and O&M, and other technical data for various resource types over multidecadal horizons. For resources that have multiple technology types and costs, an approximation is made for the most common version within the MISO footprint. All future values are converted into nominal dollars.

For the Futures Redesign, the 2024 vintage of the NREL ATB was utilized, as it is the most recent version of the study currently available.

Capital cost estimates for 100-hour iron air-battery, which was not included in the 2024 NREL ATB, were developed based on information from Form Energy.

A.1.2 Production Tax Credits & Investment Tax Credits

In previous Futures studies, including Series 1A, various resource types benefitted from either a Production Tax Credit (PTC) or an Investment Tax Credit (ITC), both of which were extended via the 2022 Inflation Reduction Act. Many of the provisions of the Inflation Reduction Act, including the extension of the PTC and ITC for renewables, were shortened or curtailed during the Futures Redesign process, leading to an earlier phaseout of several key economic benefits; the Series 2 models reflect this truncation.

Model-built wind and solar generation no longer have the PTC applied. Generation credits are provided to member-planned units of both resource types that remain eligible for the PTC based on their projected in-service date. Nuclear small modular reactors (SMRs) are also eligible for a PTC.

The ITC is provided to model-built battery in the form of a 30% reduction in up-front capital cost; eligibility is determined based on a battery unit’s in-service date.

A.1.3 Gas Price Forecasting

MISO incorporated the Gas Pipeline Competition Model (GPCM) base price forecast across the Futures, utilizing LBA-specific pricing for eligible units by location. As part of the Series 2 Futures, the 20-year gas price forecasts utilized GPCM 2025 Q1 data. Gas candidates for model-built resources (i.e., CC, CT, and RICE) used the average MISO price from all LBA prices for planned and existing gas resources.

A.2 Additional Expansion Results

Series 2 modeling employed build limits for all four Futures. The first three Futures utilized higher build limits based on MISO's research of resource potential as of early 2025. In contrast, Future 4 represented an aggressive supply friction scenario with assumptions for construction delays, labor shortages, interconnection bottlenecks, policy uncertainties, and economic shifts.

A.2.1 Future 1

Future 1 Binding Build Limit Constraints							
	Solar	Wind	CC	CT	RICE	SMR	Battery
2026							
2027							
2028							
2029							
2030							CONSTRAINT
2031							
2032							
2033							
2034							
2035							
2036							
2037							
2038							
2039							
2040							
2041							
2042							
2043							
2044							
2045							

Table 14: S2 F1 Binding Build Limit Constraints by Resource Type & Year

Simulated supply chain limitations only created binding constraints in Future 1 for battery in 2030. In other words, while PLEXOS would have selected additional battery capacity in 2030 in the absence of modeled build limits, those build limits did not prevent PLEXOS from selecting any other resources it would have otherwise built in Future 1.

State & Local Decarbonization Limits & Results

Michigan

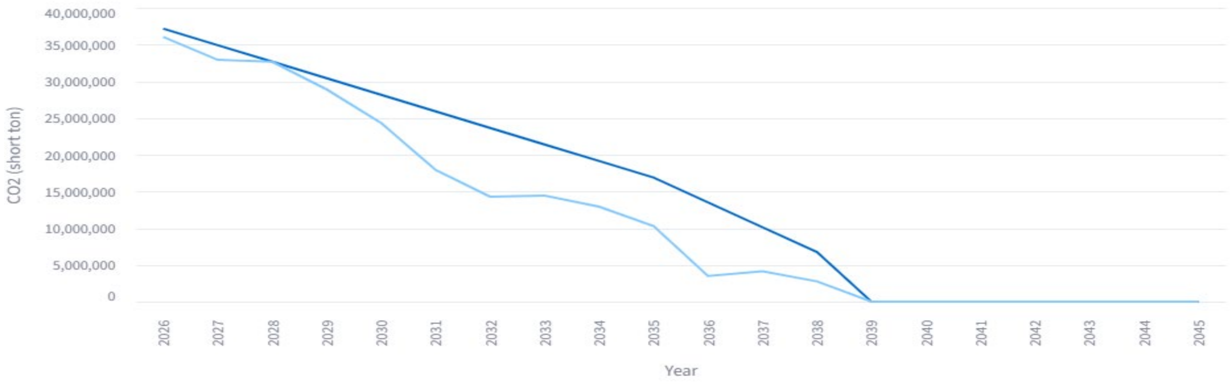


Figure 56: Michigan Decarbonization Limits & Results

Minnesota

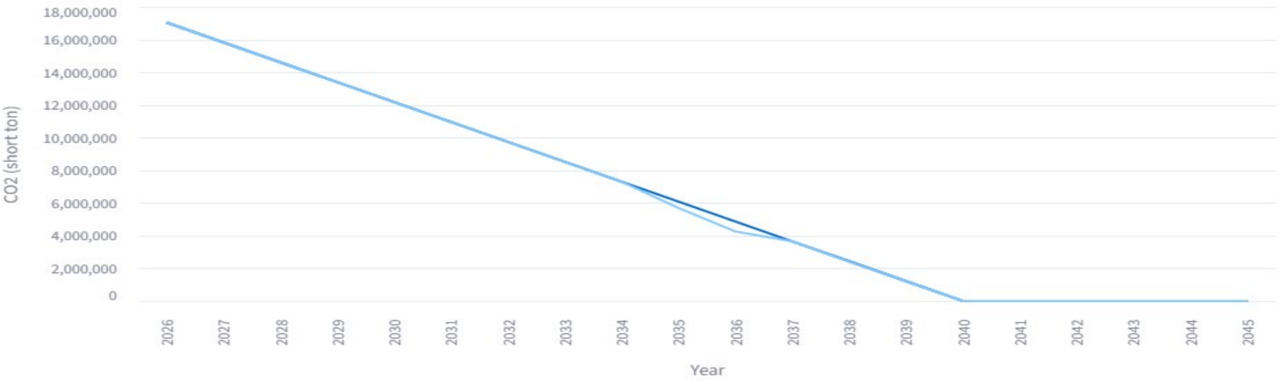


Figure 57: Minnesota Decarbonization Limits & Results

Wisconsin

Figure 58: Wisconsin Decarbonization Limits & Results

Utility Member Decarbonization Goals & Results

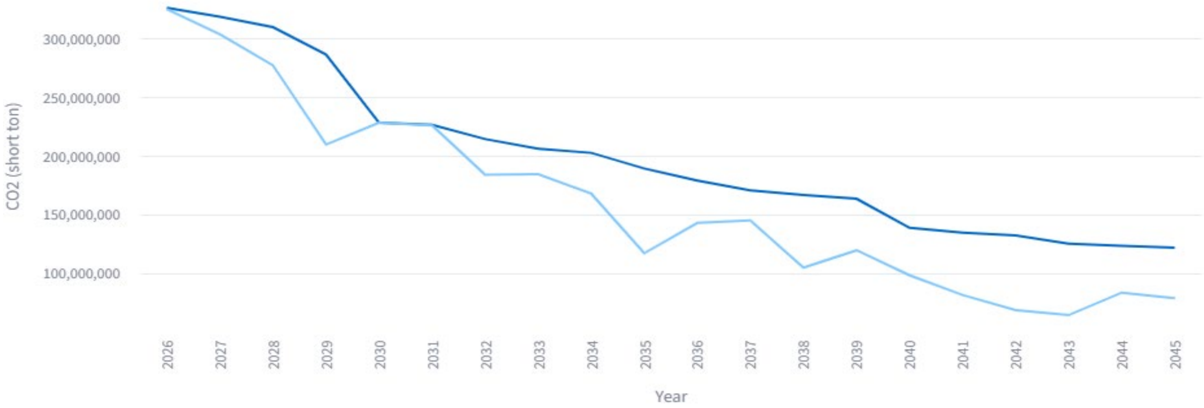


Figure 59: Utility Member Decarbonization Goals & Results

State & Local RPS Limits & Results

Illinois CEJA

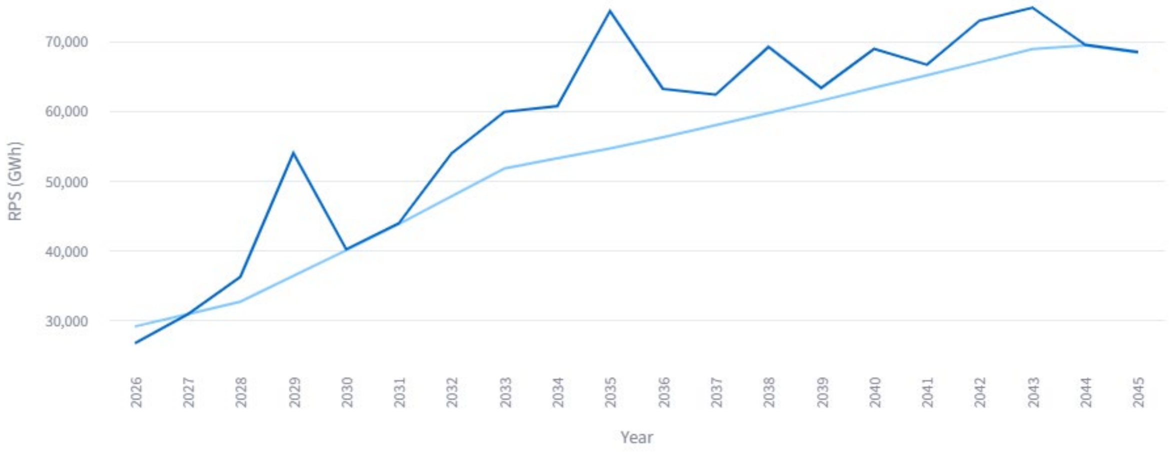


Figure 60: Illinois CEJA RPS Limits & Results

Illinois CEJA Wind

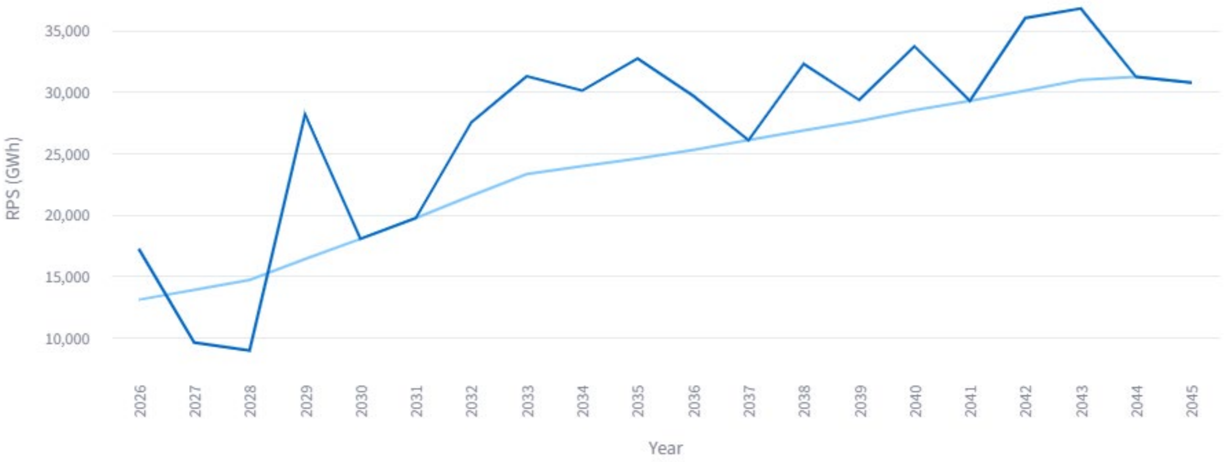


Figure 61: Illinois CEJA Wind RPS Limits & Results

Illinois CEJA Solar

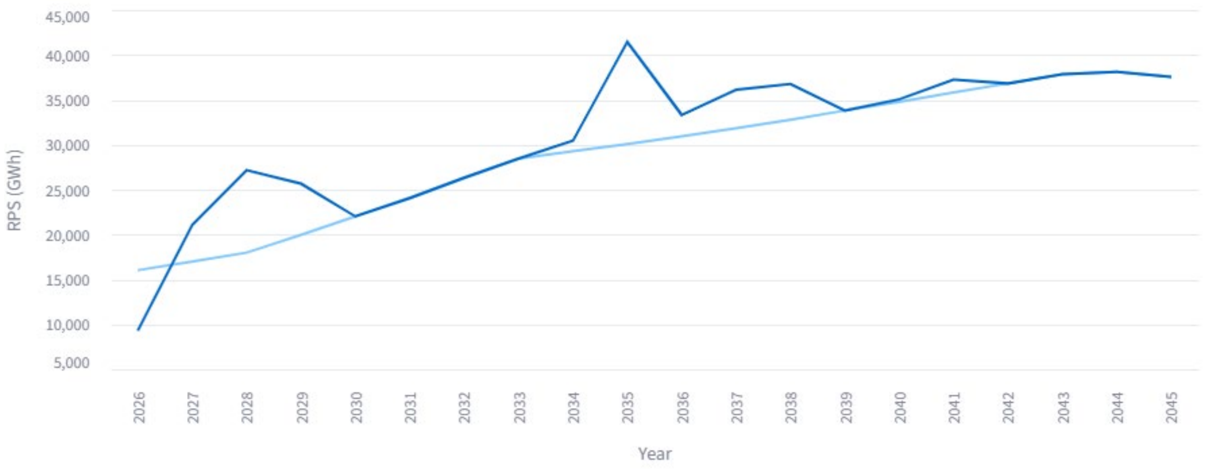


Figure 62: Illinois CEJA Solar RPS Limits & Results

Michigan

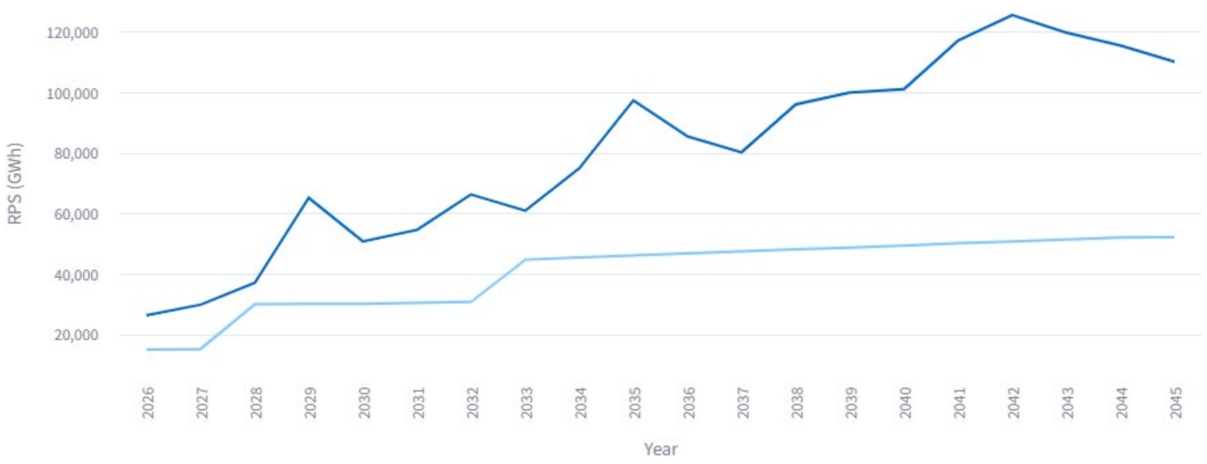


Figure 63: Michigan RPS Limits & Results

Michigan Clean Energy Standard

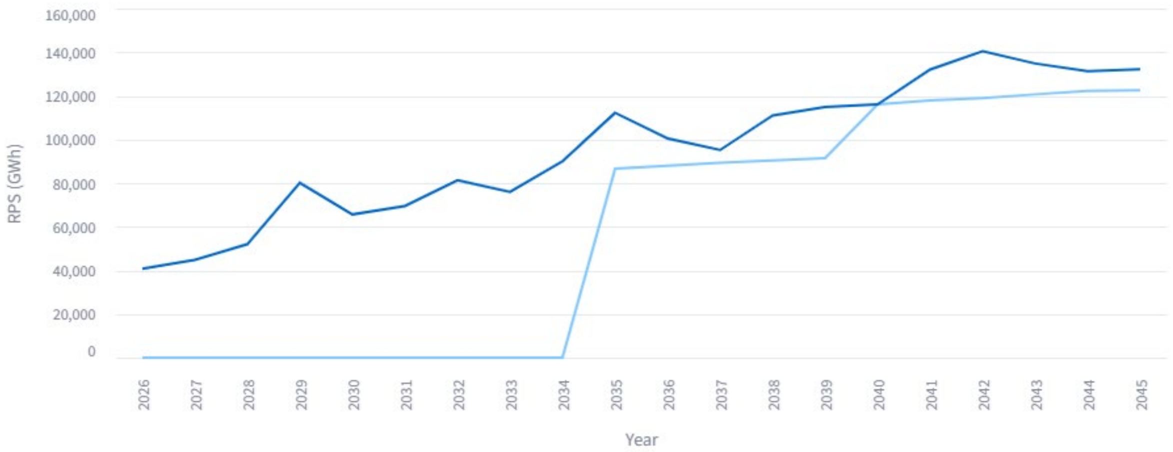


Figure 64: Michigan Clean Energy Standard Limits & Results

Indiana

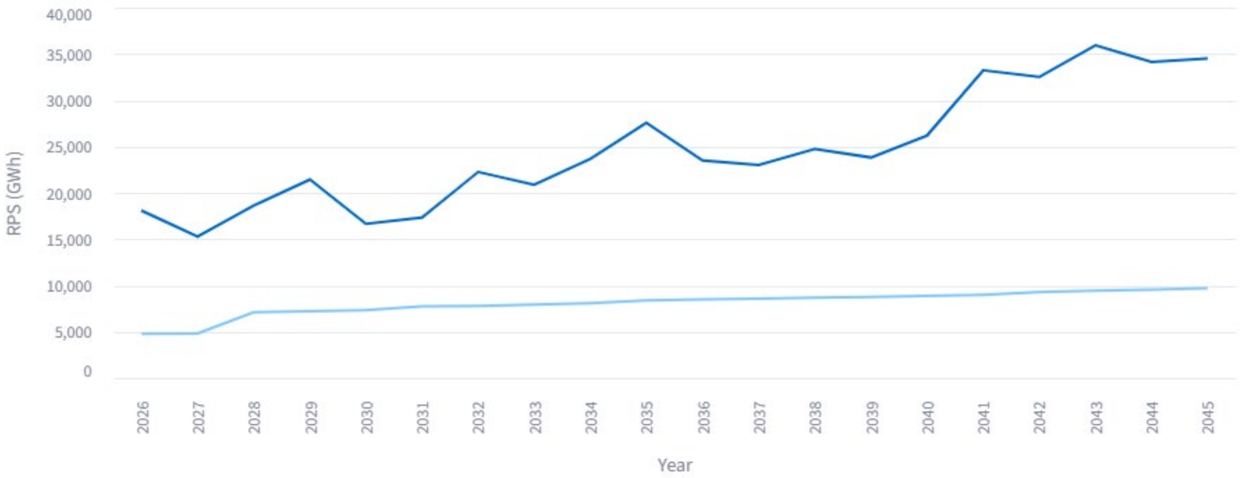


Figure 65: Indiana RPS Limits & Results

Missouri

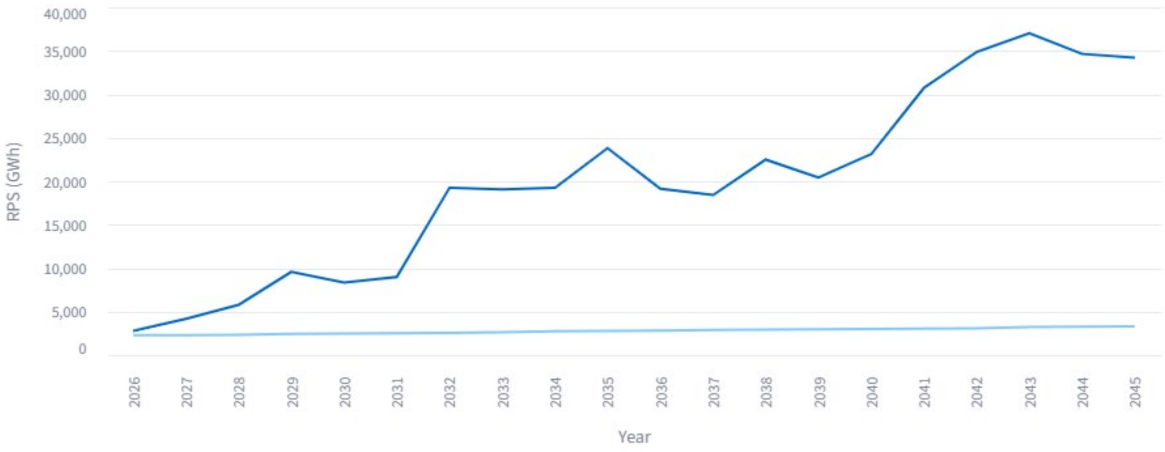


Figure 66: Missouri RPS Limits & Results

Minnesota

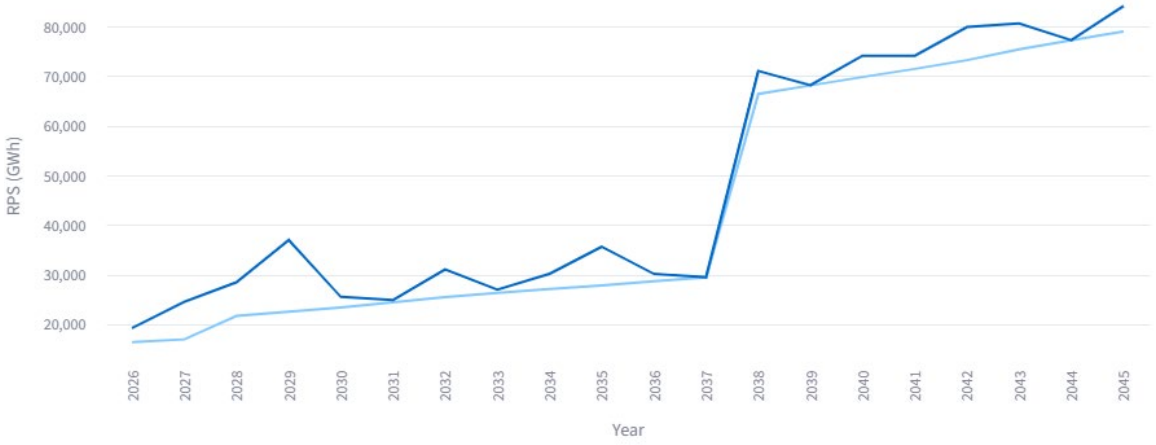


Figure 67: Minnesota RPS Limits & Results

NOLA

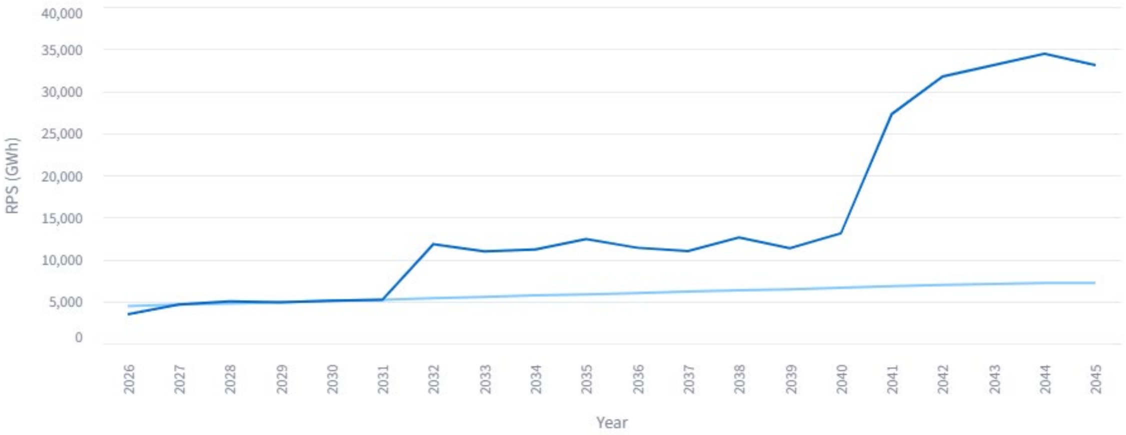


Figure 68: NOLA RPS Limits & Results

Utility Member RPS Goals & Results

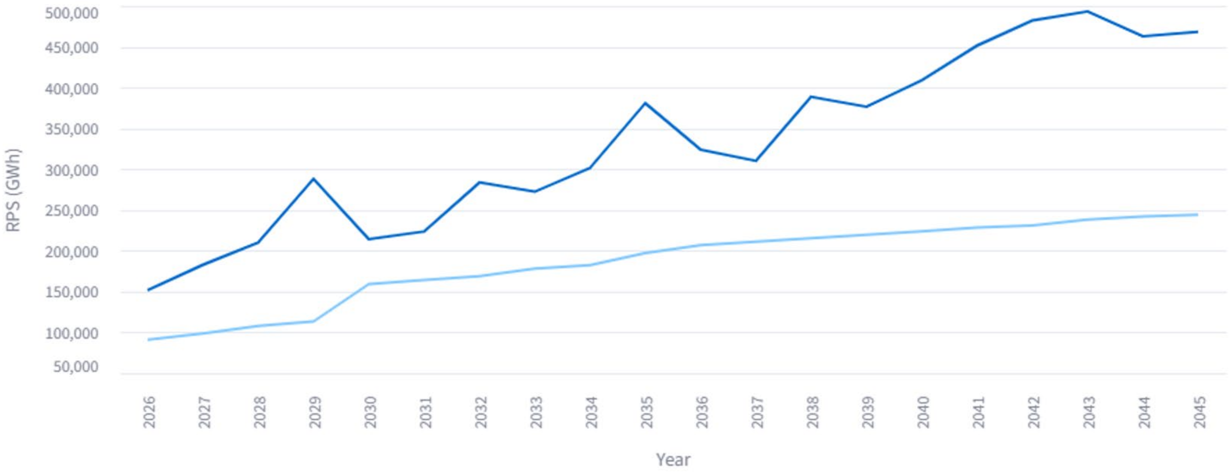


Figure 69: Utility Member RPS Goals & Results

A.2.2 Future 2

Future 2 Binding Build Limit Constraints							
	Solar	Wind	CC	CT	RICE	SMR	Battery
2026							
2027							
2028							
2029		CONSTRAINT					
2030		CONSTRAINT					CONSTRAINT
2031							
2032							
2033							
2034							
2035							
2036					CONSTRAINT		
2037							
2038							
2039							
2040							
2041					CONSTRAINT	CONSTRAINT	
2042							
2043							
2044							
2045							

Table 15: S2 F2 Binding Build Limit Constraints by Resource Type & Year

In Future 2, simulated build limits constrained the model's selection of wind in 2029 and 2030, RICE in 2036 and 2041, SMR in 2041, and battery in 2030. PLEXOS determined that more of these resources in each of these years would have been more cost-effective but was prevented from selecting them due to the build constraints.

State & Local Decarbonization Limits & Results

Michigan

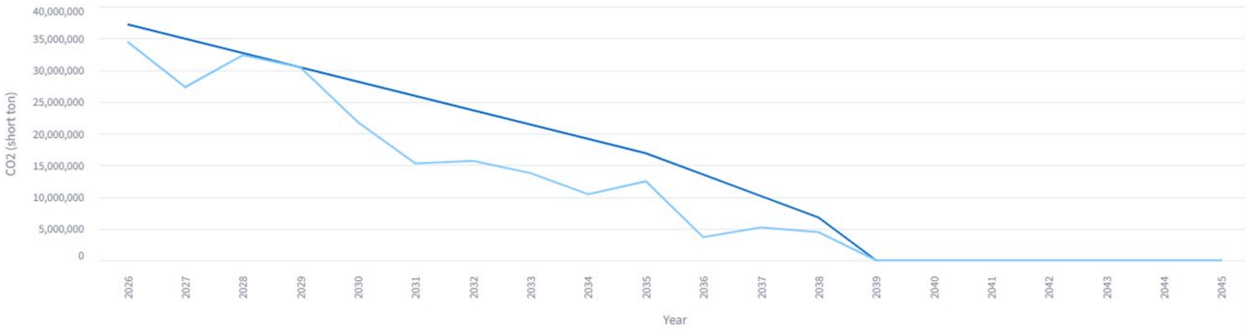


Figure 70: Michigan Decarbonization Limits & Results

Minnesota

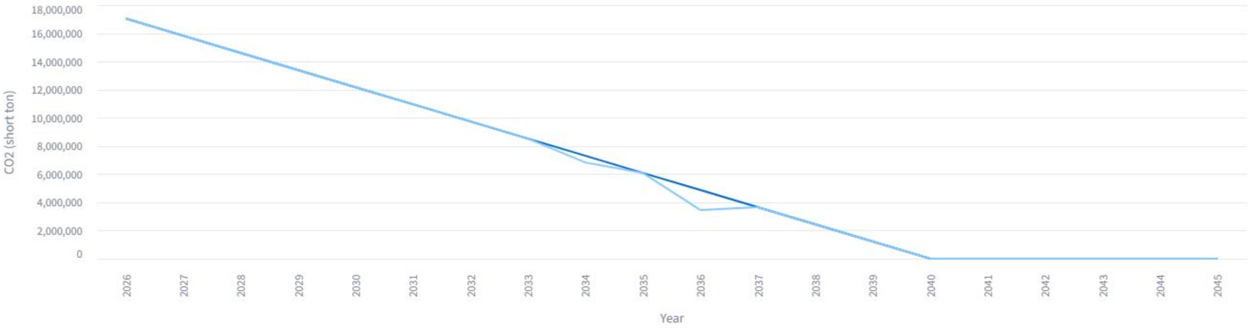


Figure 71: Minnesota Decarbonization Limits & Results

Wisconsin

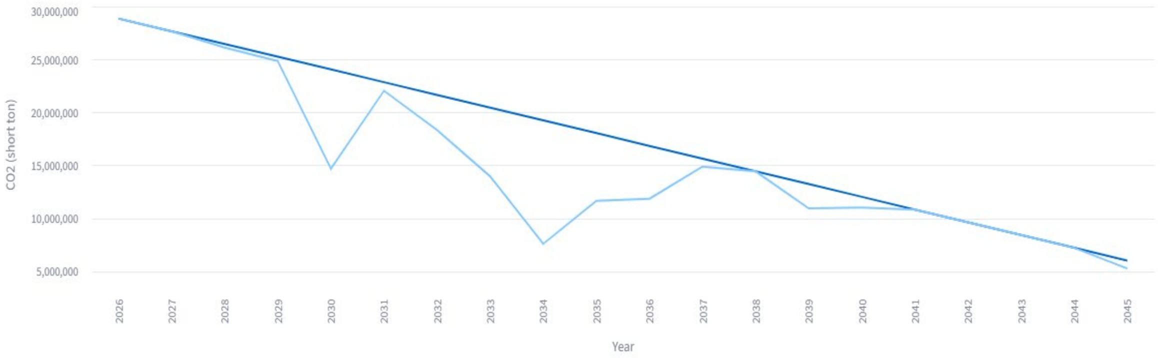


Figure 72: Wisconsin Decarbonization Limits & Results

Utility Member Decarbonization Goals & Results

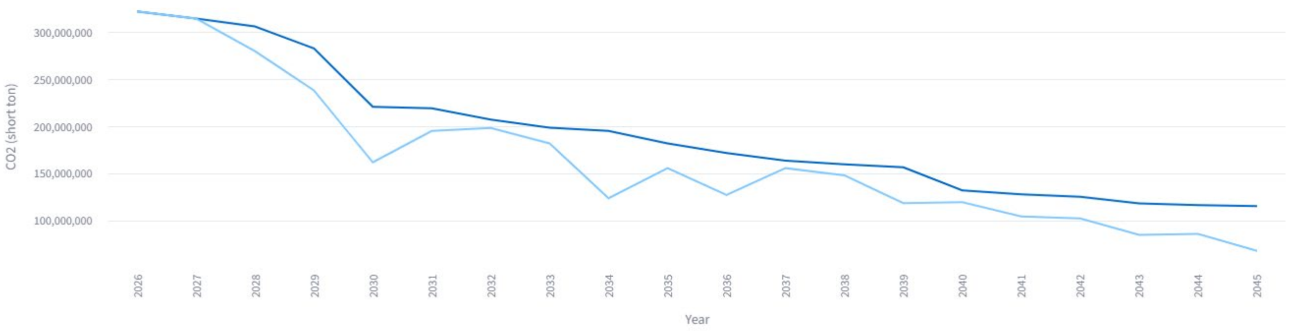


Figure 73: Utility Member Decarbonization Goals & Results

State & Local RPS Limits & Results

Illinois CEJA

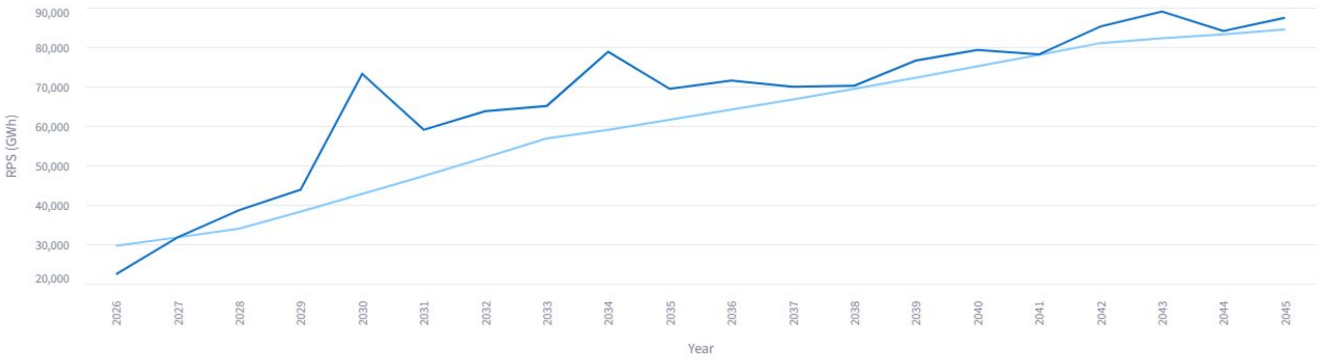


Figure 74: Illinois CEJA RPS Limits & Results

Illinois CEJA Wind

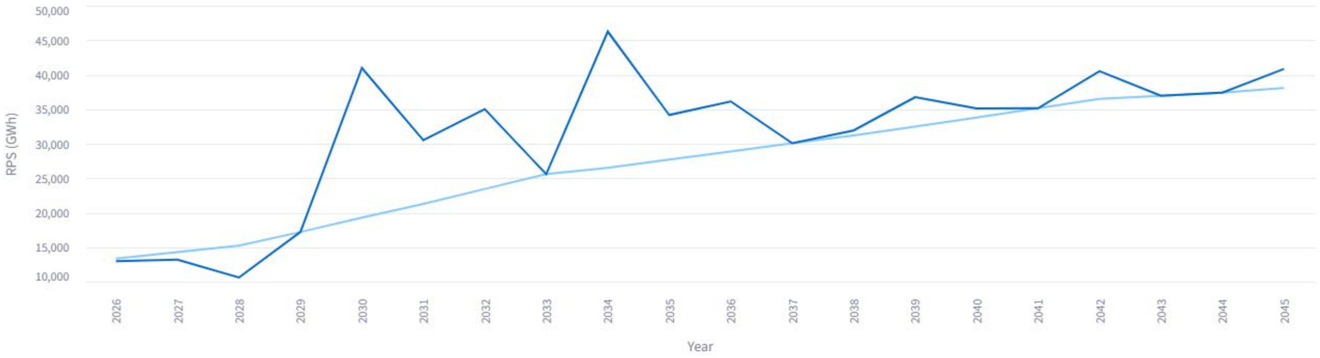


Figure 75: Illinois CEJA Wind RPS Limits & Results

Illinois CEJA Solar

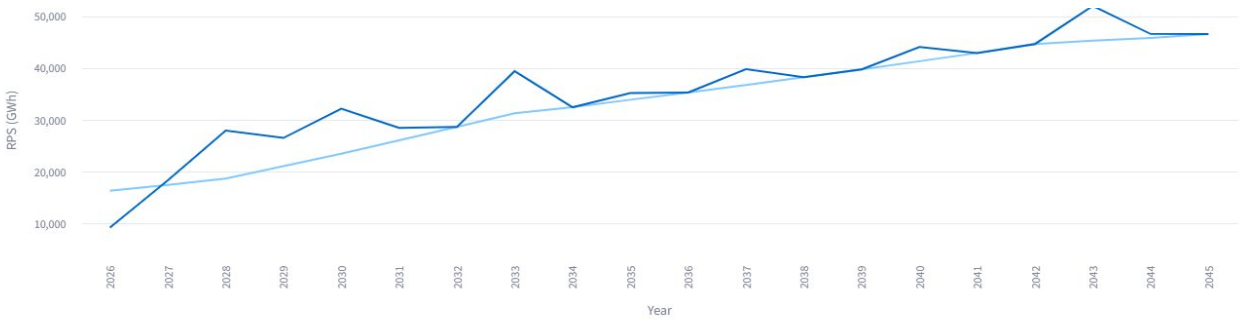


Figure 76: Illinois CEJA Solar RPS Limits & Results

Michigan

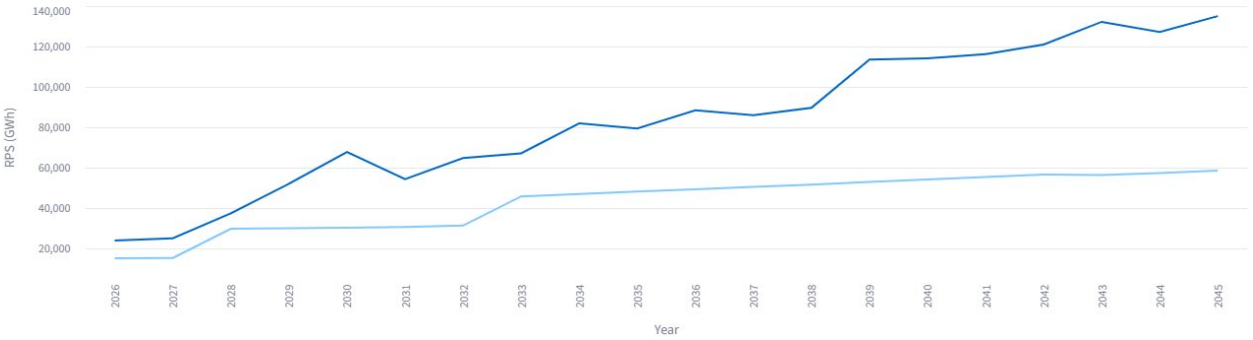


Figure 77: Michigan RPS Limits & Results

Michigan Clean Energy Standard

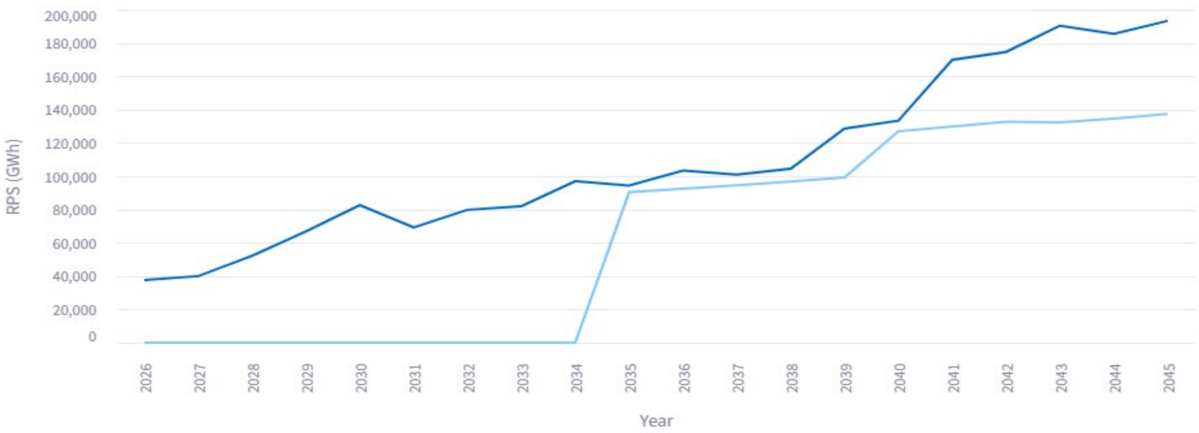


Figure 78: Michigan Clean Energy Standard Limits & Results

Indiana

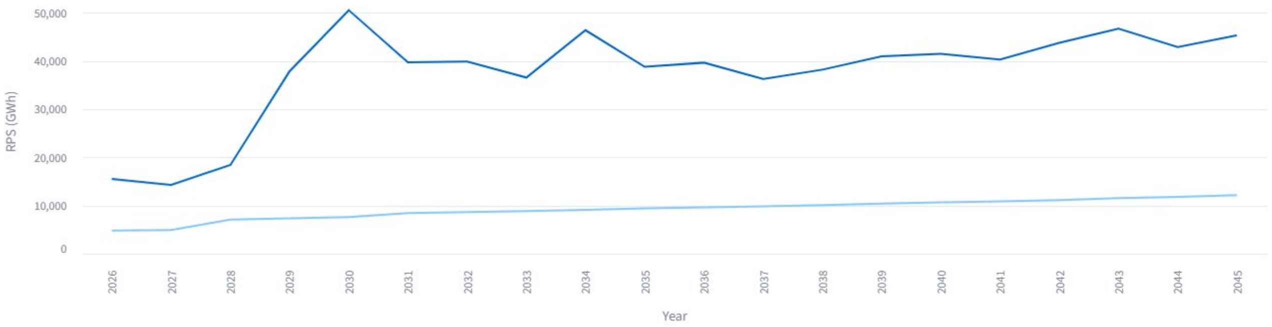


Figure 79: Indiana RPS Limits & Results

Missouri

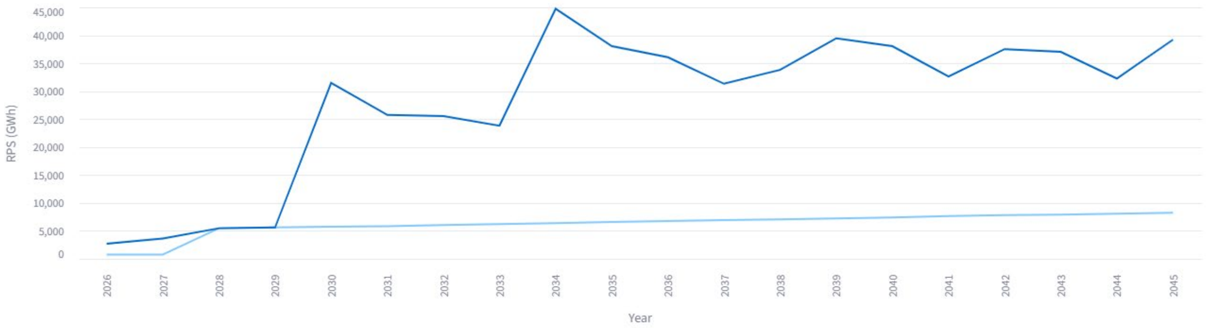


Figure 80: Missouri RPS Limits & Results

Minnesota

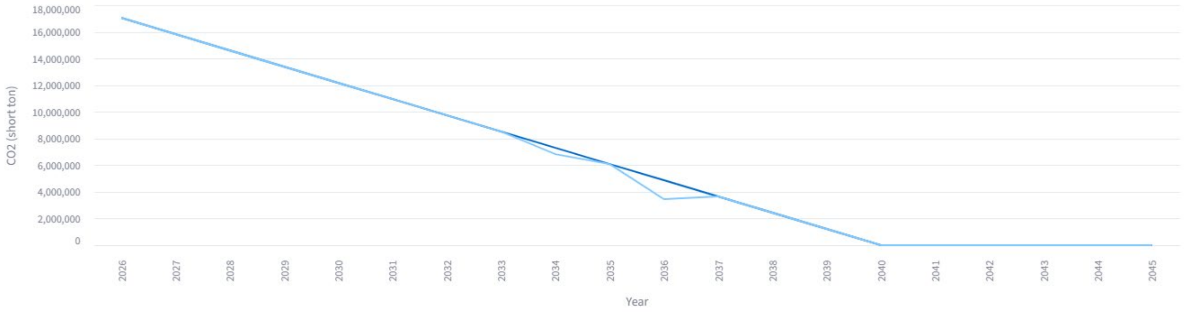


Figure 81: Minnesota RPS Limits & Results

NOLA

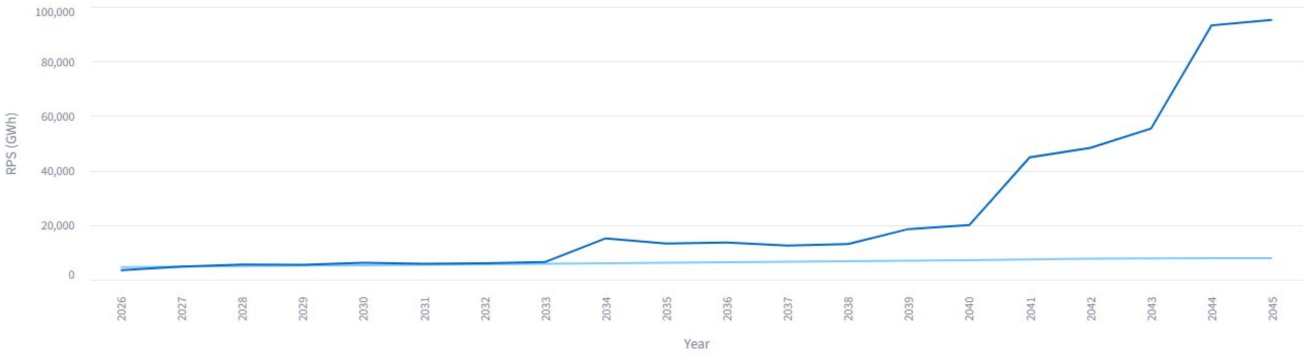


Figure 82: NOLA RPS Limits & Results

Utility Member RPS Goals & Results

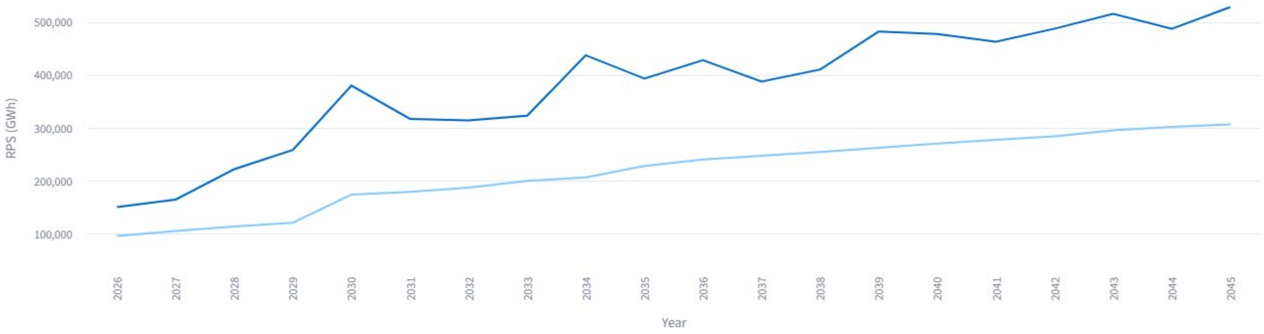


Figure 83: Utility Member RPS Goals & Results

A.2.3 Future 3

Future 3 Binding Build Limit Constraints							
	Solar	Wind	CC	CT	RICE	SMR	Battery
2026							
2027							
2028							
2029		CONSTRAINT					
2030		CONSTRAINT					CONSTRAINT
2031		CONSTRAINT			CONSTRAINT		
2032		CONSTRAINT					
2033							
2034					CONSTRAINT		
2035				CONSTRAINT	CONSTRAINT		
2036				CONSTRAINT	CONSTRAINT		
2037					CONSTRAINT		
2038					CONSTRAINT		
2039				CONSTRAINT	CONSTRAINT		
2040					CONSTRAINT		
2041					CONSTRAINT	CONSTRAINT	
2042							
2043							
2044							
2045							

Table 16: S2 F3 Binding Build Limit Constraints by Resource Type & Year

Due to increased load, Future 3 saw a higher level of binding constraints than the previous two Futures. The following resources were constrained by simulated build limits in these years: wind 2029-2032, CT gas 2035-36 and 2039, RICE 2031 and 2034-41, SMRs 2041, and battery 2030. In any of these cases, building more of these resources would have been more economically efficient, but for the effect of simulated build limits.

State & Local Decarbonization Limits & Results

Michigan

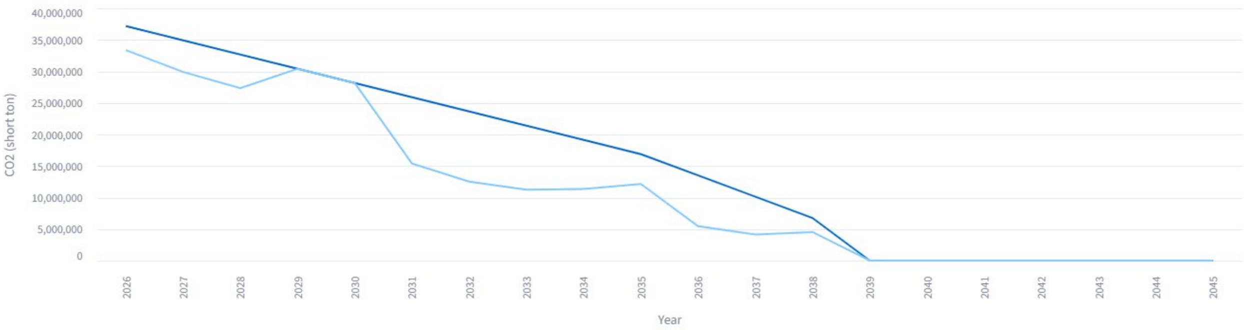


Figure 84: Michigan Decarbonization Limits & Results

Minnesota

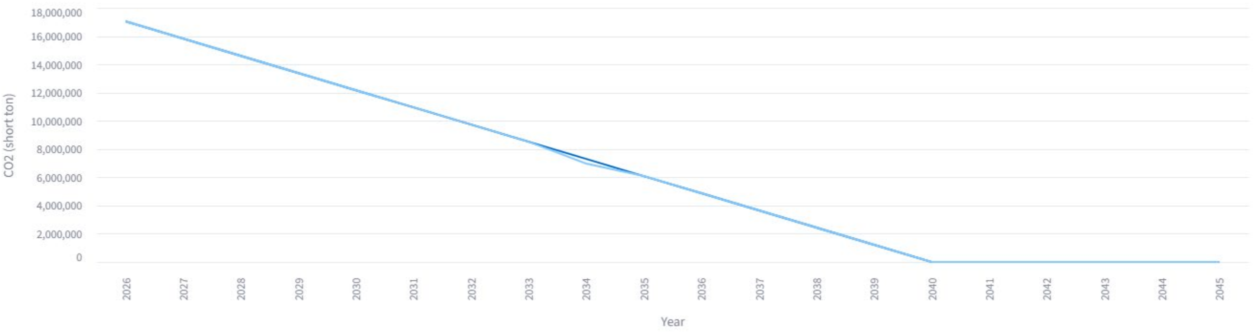


Figure 85: Minnesota Decarbonization Limits & Results

Wisconsin

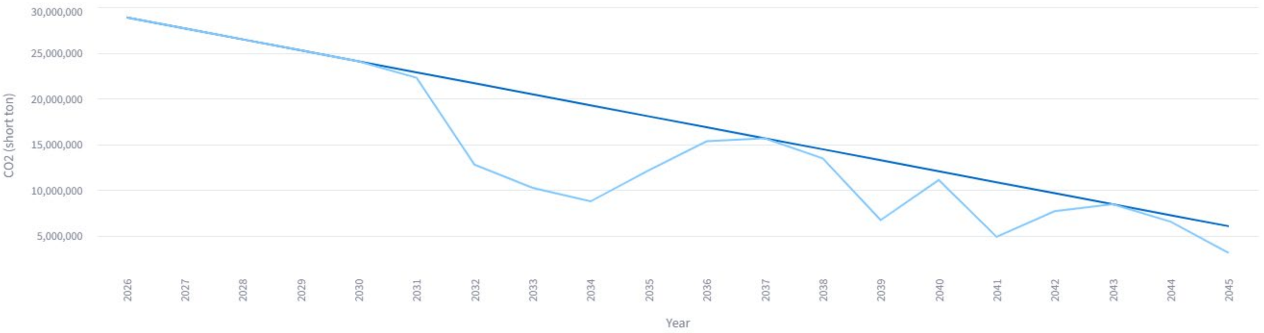


Figure 86: Wisconsin Decarbonization Limits & Results

Utility Member Decarbonization Goals & Results

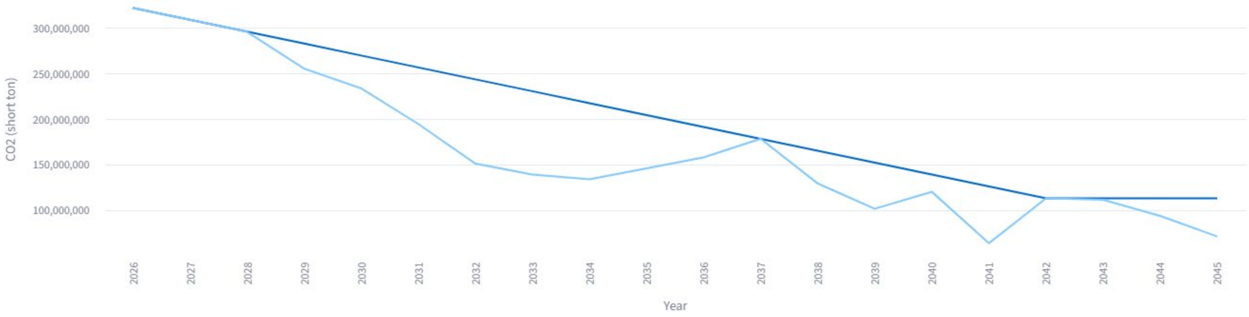


Figure 87: Utility Member Decarbonization Goals & Results

State & Local RPS Limits & Results

Illinois CEJA

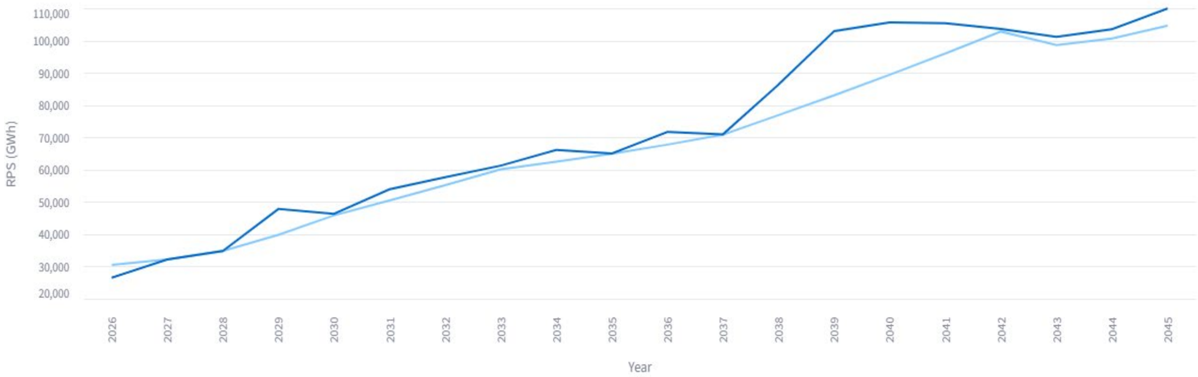


Figure 88: Illinois CEJA RPS Limits & Results

Illinois CEJA Wind

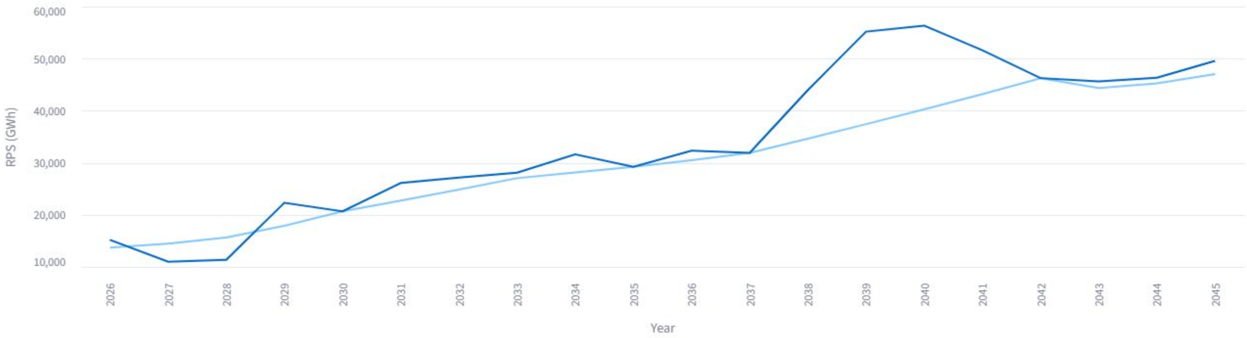


Figure 89: Illinois CEJA Wind RPS Limits & Results

Illinois CEJA Solar

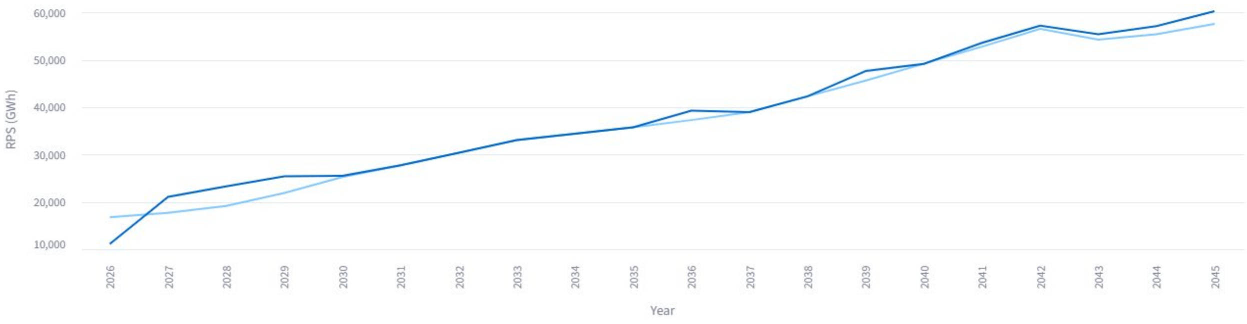


Figure 90: Illinois CEJA Solar RPS Limits & Results

Michigan

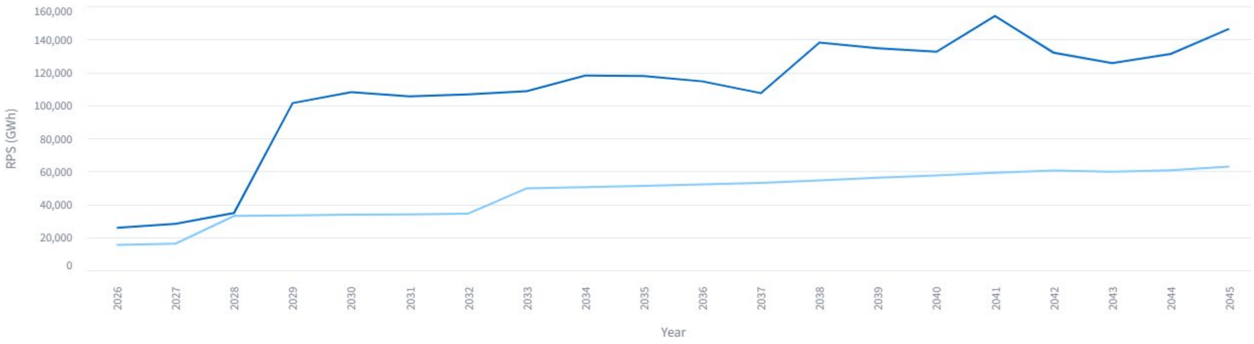


Figure 91: Michigan RPS Limits & Results

Michigan Clean Energy Standard

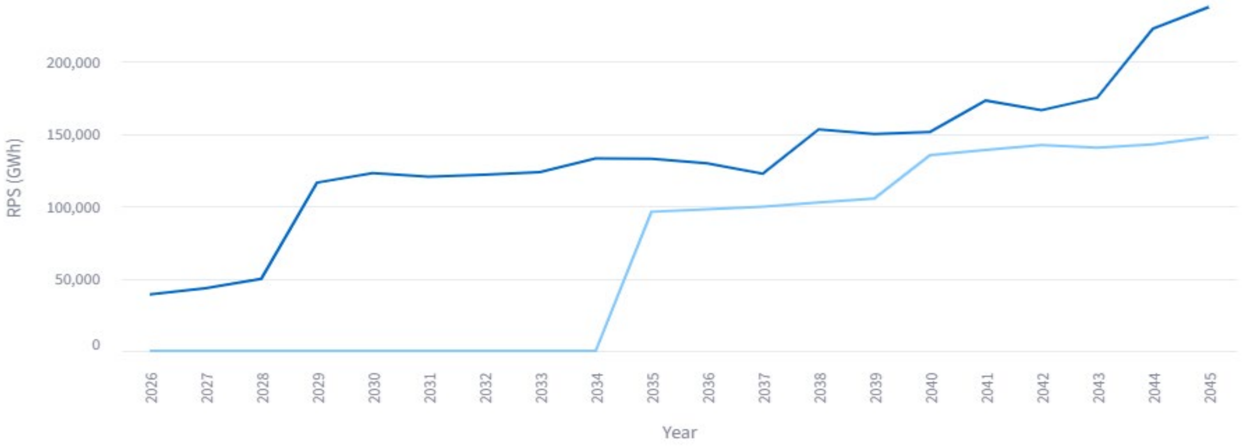


Figure 92: Michigan Clean Energy Standard Limits & Results

Indiana

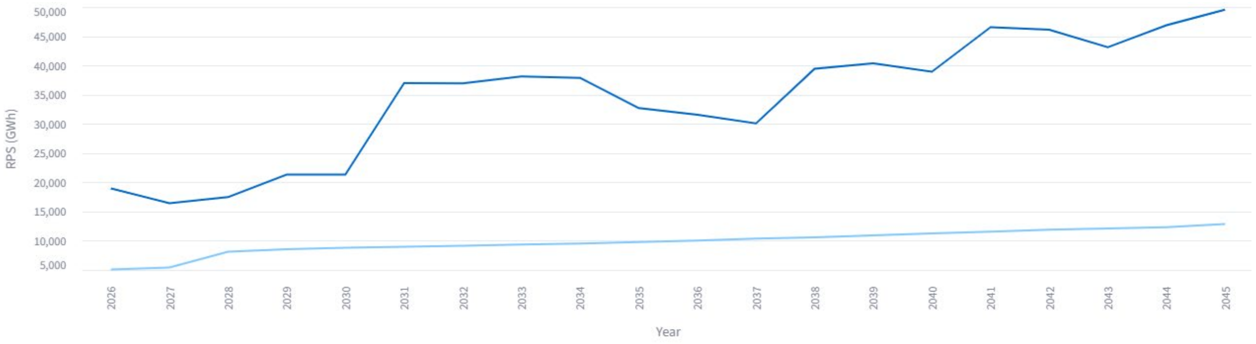


Figure 93: Indiana RPS Limits & Results

Missouri

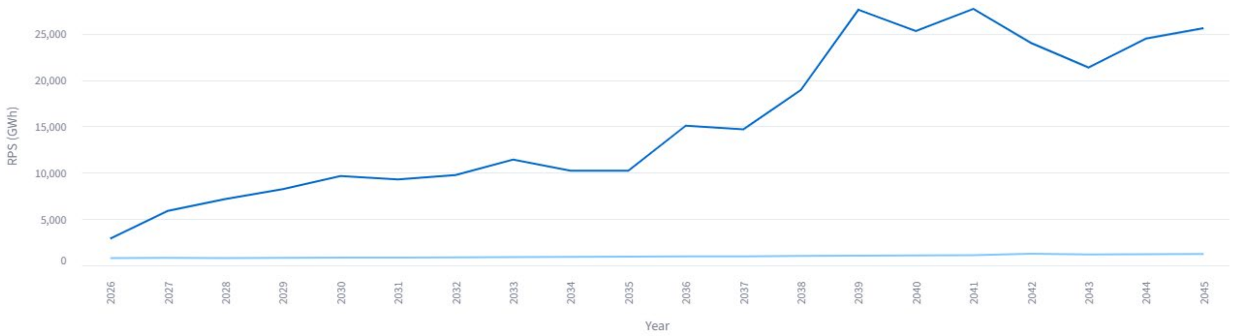


Figure 94: Missouri RPS Limits & Results

Minnesota

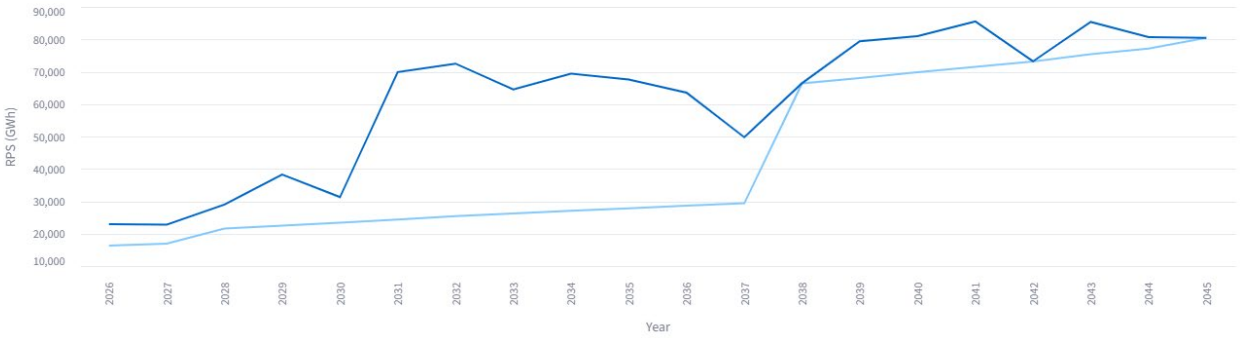


Figure 95: Minnesota RPS Limits & Results

NOLA

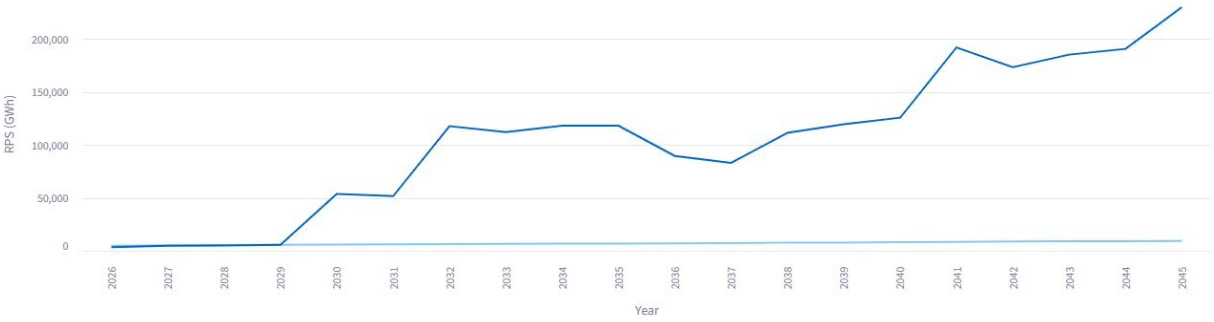


Figure 96: NOLA RPS Limits & Results

Utility Member RPS Goals & Results

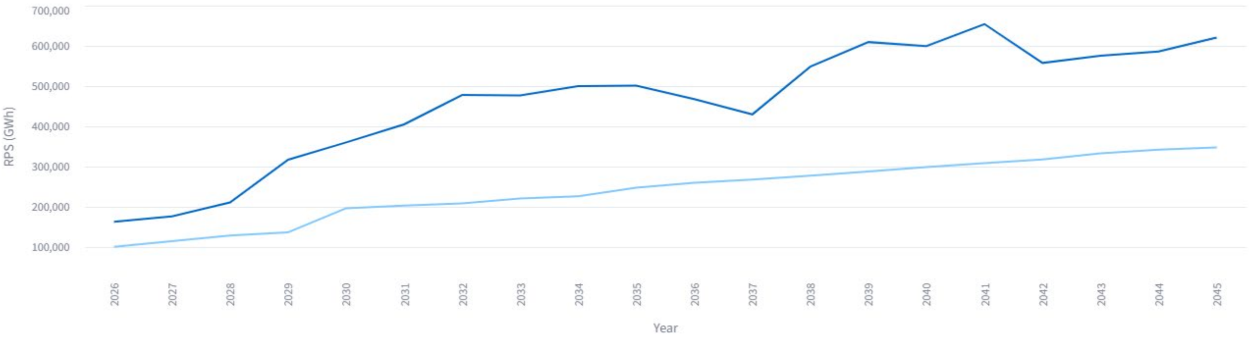


Figure 97: Utility Member RPS Goals & Results

A.2.4 Future 4

Future 4 Binding Supply Chain Constraints							
	Solar	Wind	CC	CT	RICE	SMR	Battery
2026							
2027	CONSTRAINT						CONSTRAINT
2028							CONSTRAINT
2029		CONSTRAINT					CONSTRAINT
2030		CONSTRAINT					CONSTRAINT
2031		CONSTRAINT					CONSTRAINT
2032		CONSTRAINT					
2033		CONSTRAINT					
2034		CONSTRAINT					
2035		CONSTRAINT					
2036		CONSTRAINT					
2037	CONSTRAINT	CONSTRAINT					
2038		CONSTRAINT			CONSTRAINT	CONSTRAINT	
2039		CONSTRAINT			CONSTRAINT	CONSTRAINT	
2040	CONSTRAINT	CONSTRAINT	CONSTRAINT		CONSTRAINT	CONSTRAINT	
2041	CONSTRAINT	CONSTRAINT	CONSTRAINT	CONSTRAINT	CONSTRAINT	CONSTRAINT	
2042		CONSTRAINT			CONSTRAINT	CONSTRAINT	
2043		CONSTRAINT			CONSTRAINT	CONSTRAINT	
2044		CONSTRAINT			CONSTRAINT	CONSTRAINT	
2045		CONSTRAINT			CONSTRAINT	CONSTRAINT	

Table 17: S2 F4 Binding Build Limit Constraints by Resource Type & Year

A unique aspect of Future 4 is its set of aggressive supply chain assumptions, simulated as highly stringent build limits in its model for the entire 20-year study period. Future 4 saw the greatest level of binding constraints for build limits, with every generator candidate type limited in at least one year of the study.

Wind was the most highly constrained resource compared to its economically optimal buildout potential, with PLEXOS selecting the maximum permitted capacity in every year after 2029. RICE and SMR were also severely constrained during the final four years of the study period, and solar, CC, and CT gas buildout also periodically ran up against build limits.

State & Local Decarbonization Limits & Results

Michigan

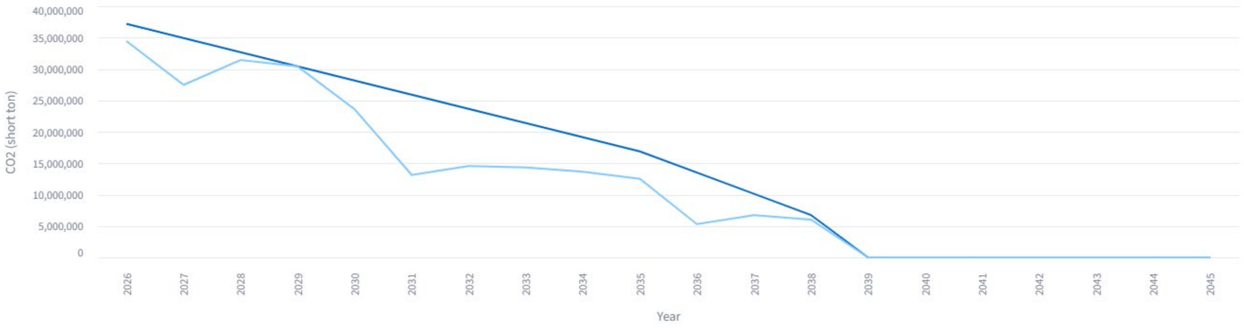


Figure 98: Michigan Decarbonization Limits & Results

Minnesota

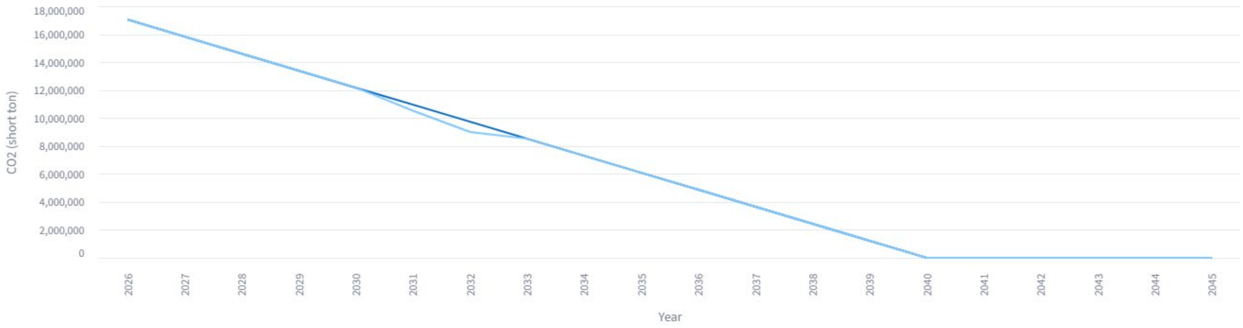


Figure 99: Minnesota Decarbonization Limits & Results

Wisconsin

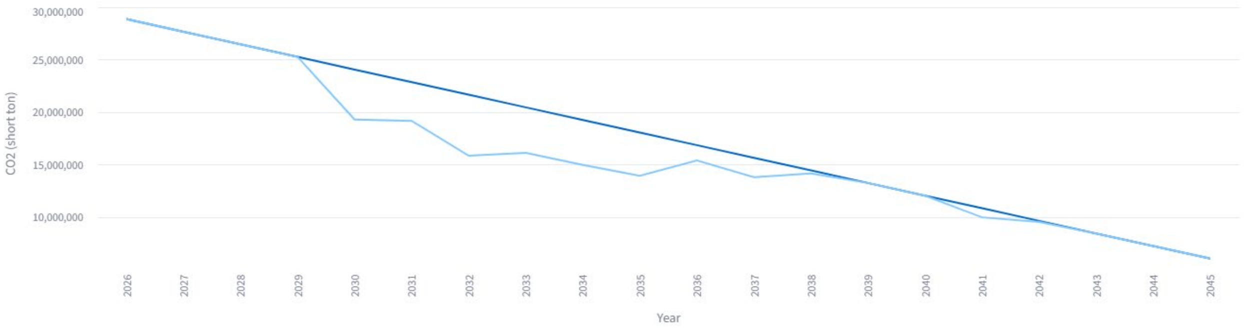


Figure 100: Wisconsin Decarbonization Limits & Results

Utility Member Decarbonization Goals & Results

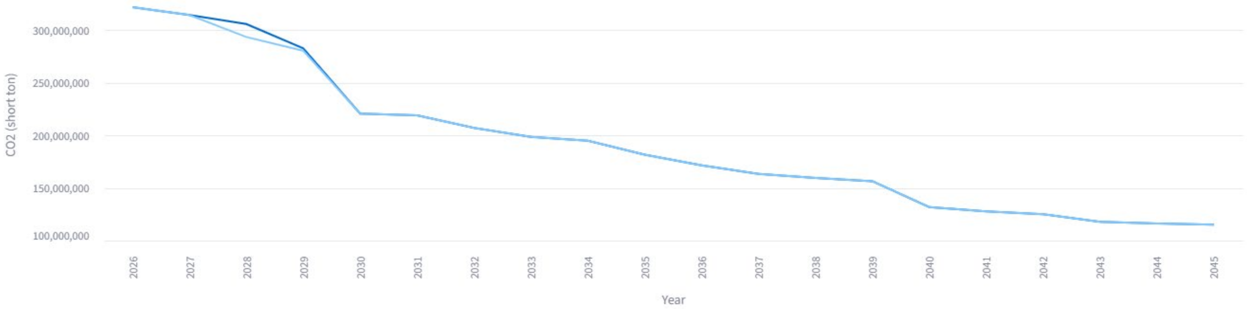


Figure 101: Utility Member Decarbonization Goals & Results

State & Local RPS Limits & Results

Illinois CEJA

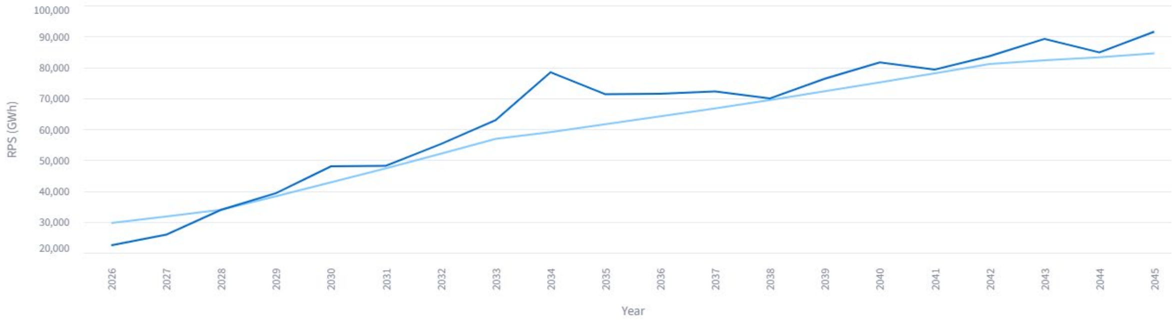


Figure 102: Illinois CEJA RPS Limits & Results

Illinois CEJA Wind

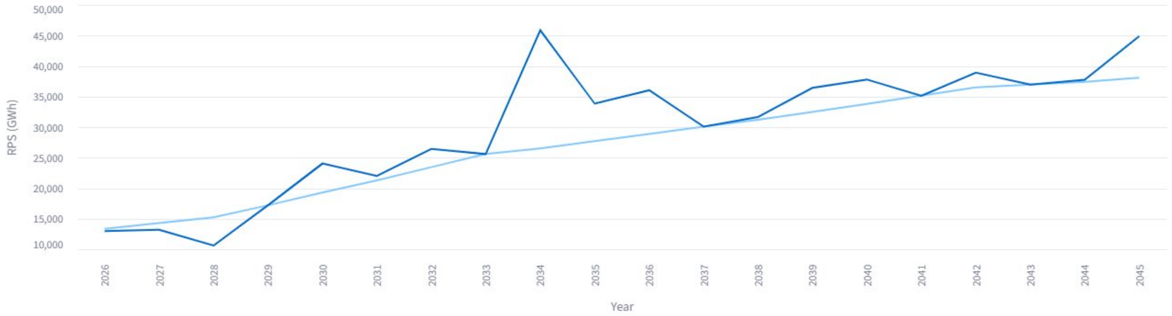


Figure 103: Illinois CEJA Wind RPS Limits & Results

Illinois CEJA Solar

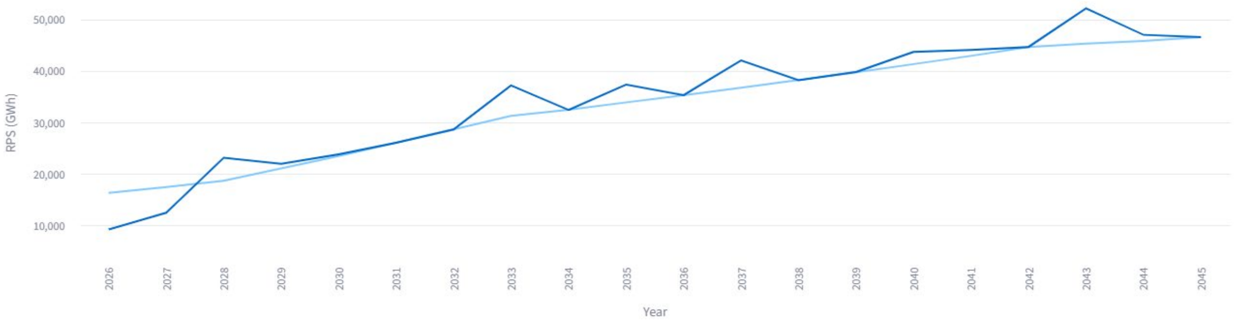


Figure 104: Illinois CEJA Solar RPS Limits & Results

Michigan

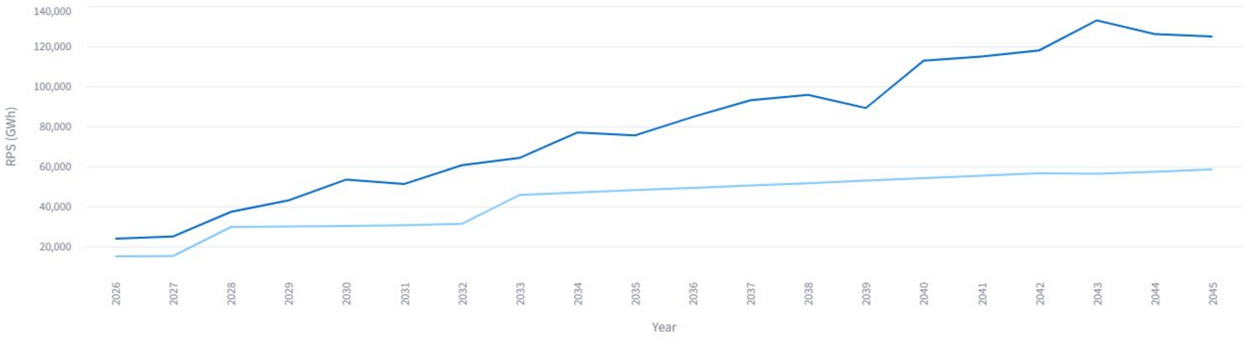


Figure 105: Michigan RPS Limits & Results

Michigan Clean Energy Standard

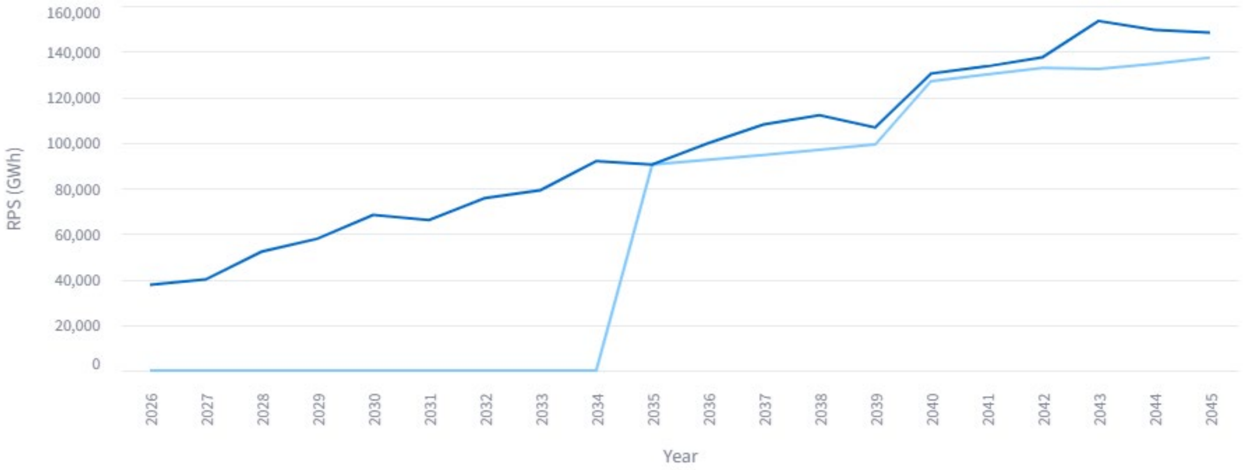


Figure 106: Michigan Clean Energy Standard Limits & Results

Indiana

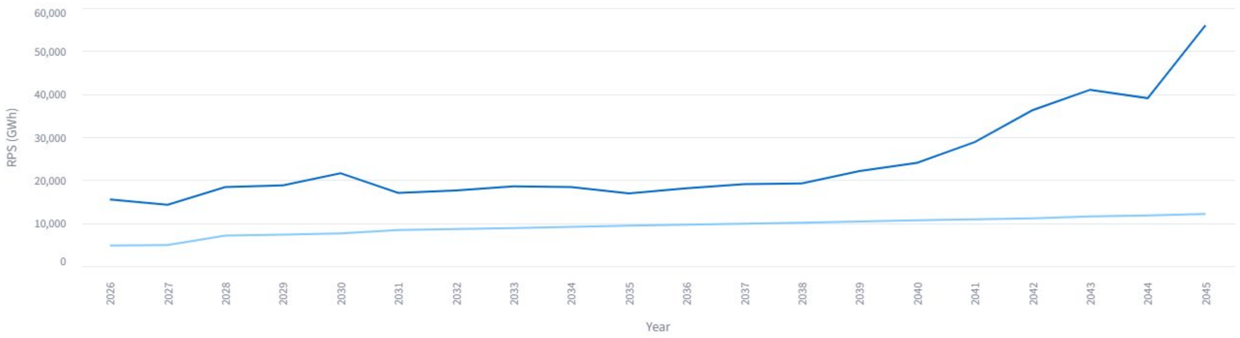


Figure 107: Indiana RPS Limits & Results

Missouri

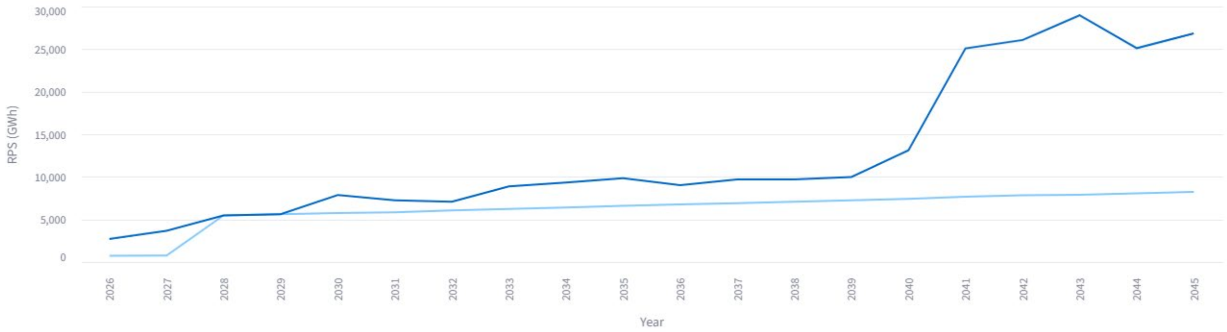


Figure 108: Missouri RPS Limits & Results

Minnesota

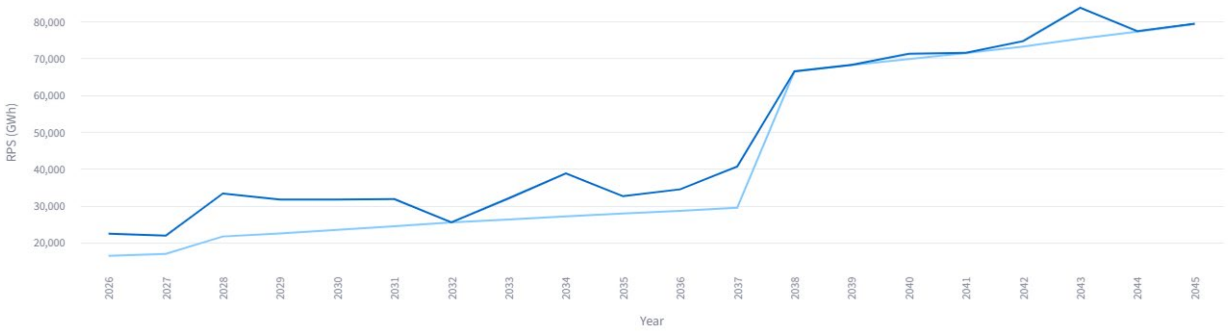


Figure 109: Minnesota RPS Limits & Results

NOLA

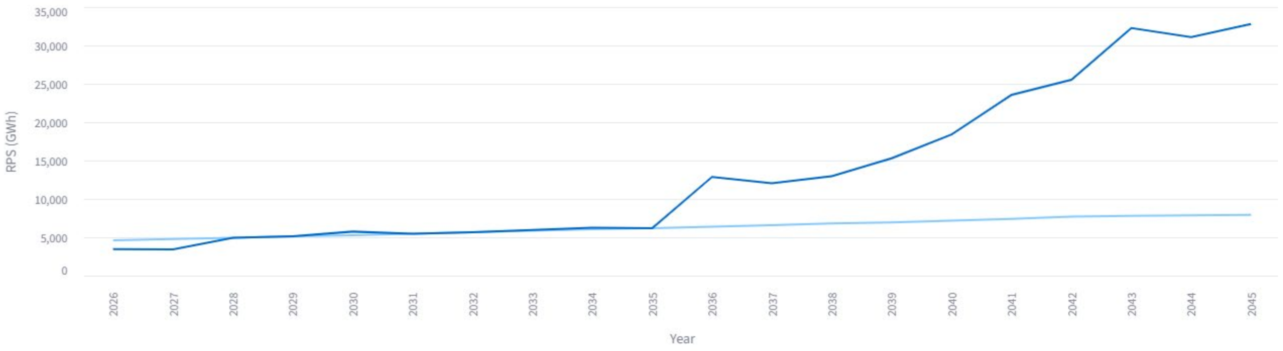


Figure 110: NOLA RPS Limits & Results

Utility Member RPS Goals & Results

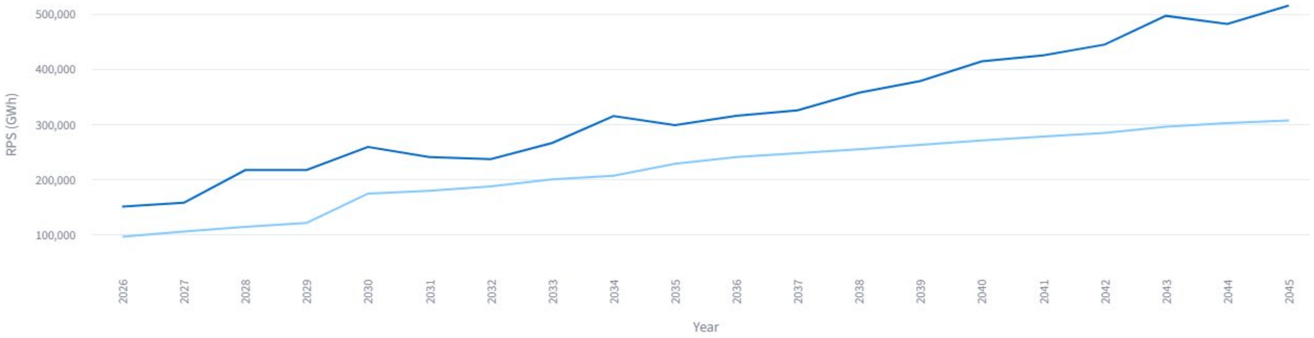


Figure 111: Utility Member RPS Goals & Results

A.3 External Assumptions & Modeling

External areas are modeled for energy adequacy check purposes to ensure no emergency energy is needed for energy adequacy. It is carried into the Long Range Transmission Planning (LRTP) production cost modeling as well.

A.3.1 General Assumptions

Study Areas

For purposes of resource expansion, the areas being analyzed with the Futures assumptions are:

- Midcontinent Independent System Operator (MISO)
- PJM Interconnection (PJM)
- Southwest Power Pool (SPP)
- Southeast (which includes the following)
    - Duke Energy Carolinas (Duke)
    - Progress Energy Carolinas East (CPLE)
    - Progress Energy Carolinas West (CPLW)
    - South Carolina Electric & Gas Company (SCEG)
    - Santee Cooper (SC)
    - Alabama Power Company [SOCO]
    - Georgia Power [SOCO]
    - Gulf Power Company
    - Mississippi Power Company [SOCO]
    - PowerSouth Energy Coop
- TVA-Other (which includes the following)
    - Associated Electric Cooperative Inc. (AECI)
    - Louisville Gas & Electric/Kentucky Utilities (LG&E/KU)
    - Tennessee Valley Authority (TVA)

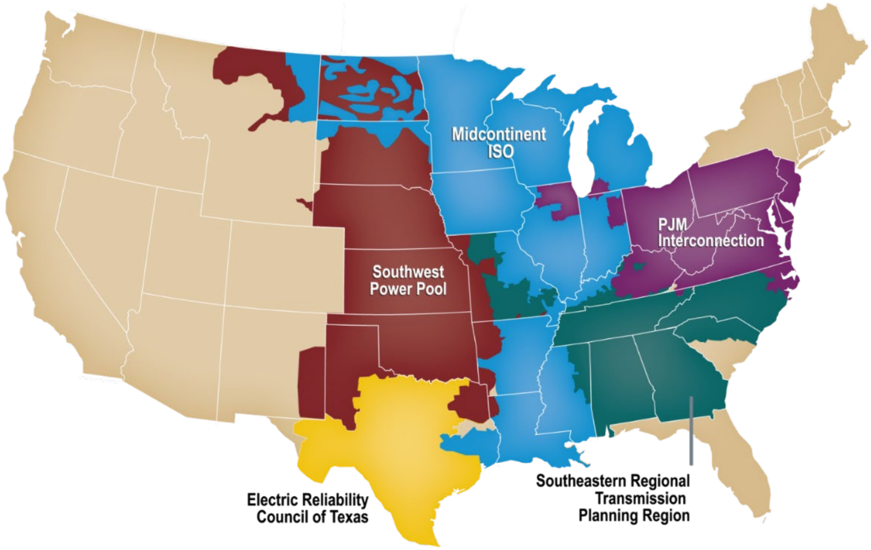


Figure: 112 MISO Footprint & Neighboring Systems

A.3.2 External Areas Forecast Development

In Series 2, load forecasts for external areas used similar methodology and driver analysis to that of MISO, representing a step change in the level of load growth anticipated across the industry and nationwide.

A.4 External Expansion Results

While comparing the expansion results of the external regions across each Future scenario, there are several key findings of note:

- All scenarios have very different expansions; this is due to large contrasts among the regions with respect to geography, resource retirements, and current resource mixes.
- For the external areas, Future 3 sees more buildout of most resource types, with notably larger increases in wind and PV; this is primarily due to an increase in projected load, as well as increased decarbonization goals.
- Wind, and solar capacity expansion is largely driven by decarbonization and each underlying load shape. The step change in load growth also manifests in substantial gas buildouts, especially in PJM and TVAO.
- Age-based retirement assumptions for nuclear, wind, solar, and "other" resources remain the same across areas. Additionally, all retired wind is repowered and reflected in the resource addition totals.
- As with the MISO footprint, DER programs included in each of the external areas in Future 1 are considered the minimum and were included across all three Futures, while incremental additions of each program were offered in Future 2 and Future 3. PJM and SPP each incorporated ten DER programs in their base assumptions, while TVA-other incorporated six.

On the following page, Table 21 and Table 22 outline the detailed expansion results of each external Future scenario. Each table details retirements and additions (R&A) capacities applicable for each region by the end of the study period, year 2045.

External Area Future Resource Additions (MW) – *Cumulative Year 2045*									
Area	**PJM**			**SPP**			**TVA - Other**		
	Future 1	**Future 2**	**Future 3**	**Future 1**	**Future 2**	**Future 3**	**Future 1**	**Future 2**	**Future 3**
Solar	44,419	83,265	145,898	28,447	66,984	84,847	35,608	83,175	136,058
Wind	48,643	69,848	175,872	0	6,523	18,757	0	0	104,433
Nuclear	0	0	0	0	0	0	0	0	0
CC	17,063	51,413	62,281	0	0	0	0	18,397	64,691
CT	0	1,317	6,900	0	0	1,300	0	2,900	3,863
RICE	0	20,288	36,763	5,475	8,906	16,005	14,829	50,385	31,284
Total	110,125	226,131	427,714	33,922	82,413	120,909	50,437	154,857	340,329

Table 18: External Area Future Resource Additions (MW) by Year 2045

External Area Future Resource Retirements (MW) – *Cumulative Year 2045*									
Area	**PJM**			**SPP**			**TVA - Other**		
	Future 1	**Future 2**	**Future 3**	**Future 1**	**Future 2**	**Future 3**	**Future 1**	**Future 2**	**Future 3**
Coal	3,503	3,503	3,503	9,003	9,003	9,003	29,256	29,256	29,256
Gas	2,273	2,273	2,273	3,692	3,692	3,692	4,715	4,715	4,715
Nuclear	7,078	7,078	7,078	1,971	1,971	1,971	0	0	0
Oil	1,377	1,377	1,377	527	527	527	166	166	166
Other	11	11	11	239	239	239	0	0	0
Solar	190	190	190	20	20	20	917	917	917
Wind	80	80	80	101	101	101	0	0	0
Total	14,512	14,512	14,512	15,553	15,553	15,553	35,053	35,053	35,053

Table 19: External Area Future Resource Retirements (MW) by Year 2045

A.5 Presentation Materials: Series 2 Futures Workshops & MISO Stakeholder Presentations

February 28, 2025: Futures Redesign Workshop – https://www.misoenergy.org/engage/committees/futures/

March 19, 2025: Futures Redesign Workshop – https://www.misoenergy.org/engage/committees/futures/

April 14, 2025: Futures Redesign Workshop – https://www.misoenergy.org/engage/committees/futures/

May 15, 2025: Futures Redesign Workshop – https://www.misoenergy.org/engage/committees/futures/

July 25, 2025: Futures Redesign Workshop – https://www.misoenergy.org/engage/committees/futures/

August 29, 2025: Futures Redesign Workshop – https://www.misoenergy.org/engage/committees/futures/

September 24, 2025: Futures Redesign Workshop – https://www.misoenergy.org/engage/committees/futures/

October 29, 2025: Futures Redesign Workshop – https://www.misoenergy.org/engage/committees/futures/

November 18, 2025: Futures Redesign Workshop – https://www.misoenergy.org/engage/committees/futures/

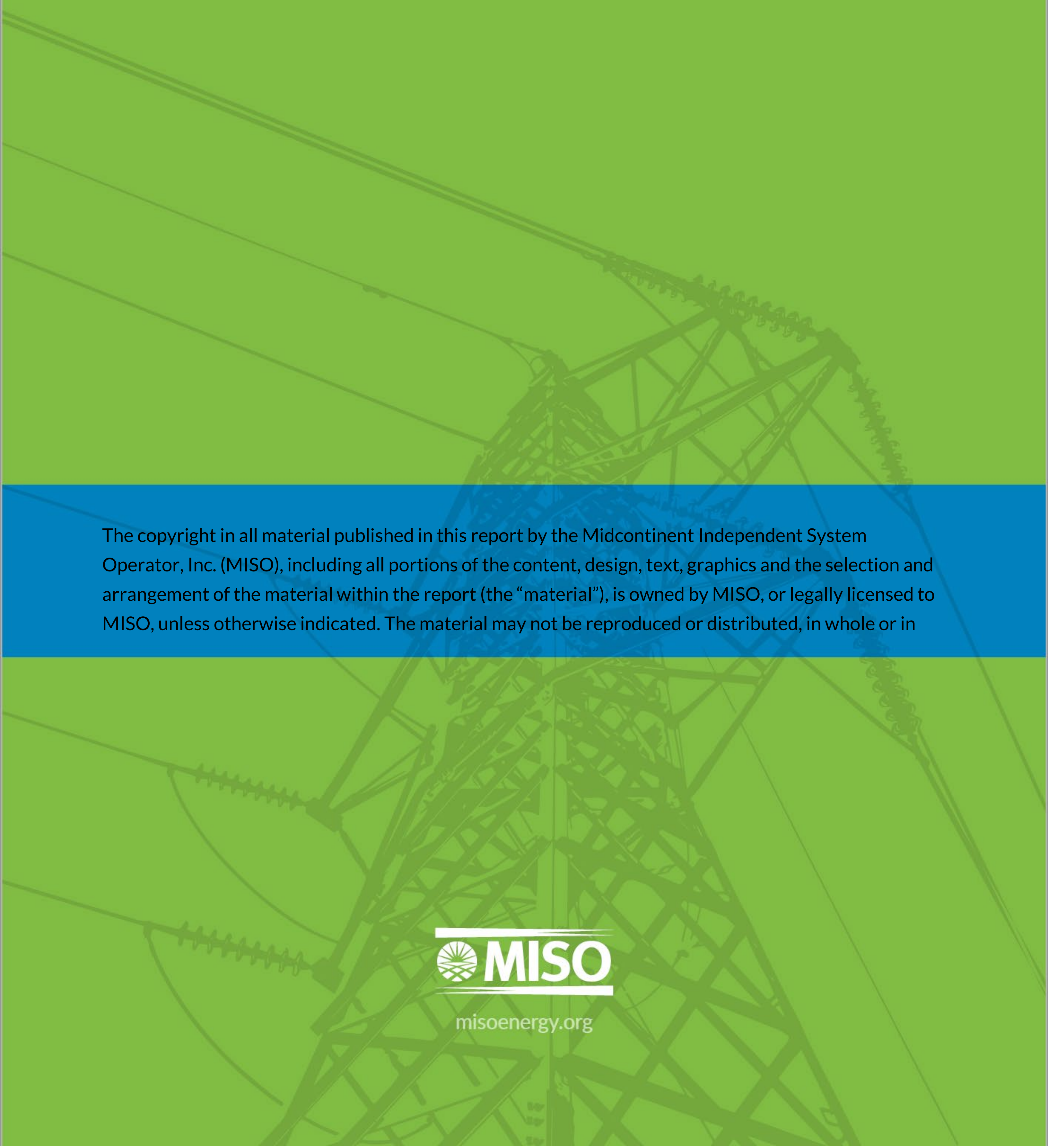
December 17, 2025: Futures Redesign Workshop – https://www.misoenergy.org/engage/committees/futures/

February 26, 2026: Futures Redesign Workshop – https://www.misoenergy.org/engage/committees/futures/

April 9, 2026: Futures Redesign Workshop – https://www.misoenergy.org/engage/committees/futures/

May 8, 2026: Futures Redesign Workshop – https://www.misoenergy.org/engage/committees/futures/

Full Futures Material, including Series 1, Series 1A, and Series 2 results and development, available at: https://www.misoenergy.org/planning/futures-development/



MISO

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