# Futures Redesign
# Generation Siting Assumptions

Siting Updates from Series 1A to Series 2

May 15, 2025

# Purpose & Key Takeaways

## Purpose

To review generation siting assumptions for Series 2 Futures Redesign

## Key Takeaways

- Siting assumptions remain largely the same from Series 1A
- MISO is requesting any planned or preferred site data from members as a data request by May 29, 2025
- Some greenfield bus sites are being considered to alleviate siting constraints on existing buses
- An additional formal feedback request on preliminary siting will be requested when initial siting results are released near August

# Because the energy landscape continues to evolve, MISO is making changes to Candidate Resource Type assumptions from Series 1A to Series 2

FUTURES

**Minimize the resource fleet's cost while respecting constraints**

## SERIES 1A

- Combined Cycle
- Combustion Turbine
- Solar
- Wind
- 4-hour lithium-ion battery
- Hybrid solar/battery
- Flex units *(added post-Energy Adequacy check)*

## SERIES 2

- Continue Series 1A resource types with hybrid update
  - Co-located resources modeled as independent resources in same location
- New Resource Types
  - SMRs "New" nuclear
  - 12-hr lithium-ion battery
  - 100-hr iron-air battery
  - RICE units (small scale)

# Series 2 siting builds upon Series 1A with updates to siting options and preferences

## SERIES 1A

- Model-built resources address local priorities

| | |
|---|---|
| **Capacity** | • Sited at 5-year milestone intervals (2030, 2035, 2040, 2045) |
| **Wind and Solar** | • 80% at queue priority sites<br>• 20% at VCE sites & available N-1 buses split among LBAs |
| **Battery** | • 80% close to high load centers<br>• 20% close to generation |
| **Thermal** | • Sited at DPP/Queue |
| **Flex (If needed)** | • At brownfield |

## SERIES 2

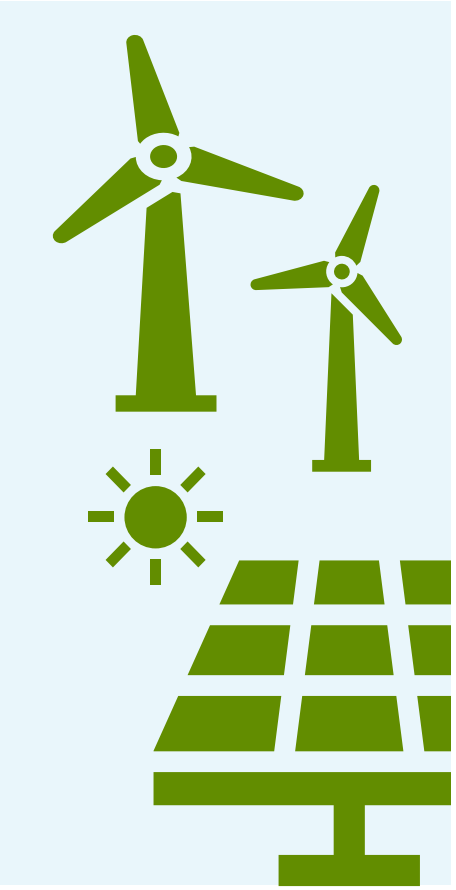
- Continue Series 1A assumptions with modifications
- Request member data on planned and preferred sites
- Greenfield buses included as options for siting to alleviate constraints on existing buses
- Wind and Solar as well as Nuclear/SMRs may be sited on greenfield sites at existing or midpoint buses as necessary for Future-specific expansions
- Nuclear/SMRs will closely align with thermal siting assumptions

# The same sites will be used for each Future; site differences may occur due to Future-specific capacity needs

- Member-provided planned and preferred sites will be given priority, then queue, then greenfield, with VCE sites for Wind and Solar considered prior to greenfield
- Previous Series 1A sites will also be referenced
- Additional sites will be added for each Future as needed
- Radial lines and associated buses identified in Powerflow models will be excluded from potential resource sites
- Sited capacity cannot exceed a site's N-1* capacity amount
    - The summation of all transmission elements, excluding the highest rated capacity element, cannot have a lower capacity than the resource capacity
- MISO capacity will be sited on MISO-operated transmission unless in a designated IRP or other member plans

*N-1 capacity means how much generation a bus can handle if one transmission line fails

# Wind and Solar are modeled as a collector system, representing an aggregated capacity potential that can be installed within 10-30 miles of each site



**After utilizing member-provided sites the following sites will be used in order of priority:**

- Compilation of Generator Interconnection Queue (GIQ) projects
  - Ranked based on GIQ status and grouped by project state location
  - Combined into a collector system when within 10 miles of each other
- Vibrant Clean Energy (VCE)
  - VCE sites and greenfield midpoint buses will likely receive much of the remaining Future-determined capacities
  - Collector buses represent a 20- to 30-mile aggregated capacity potential

# For Battery resources, member-provided sites are given priority

**After member-provided siting priority, the following priorities apply:**

- Battery is planned to be sited 80% close to high load centers, 20% close to generation
- Battery will also be sited to create geographical distribution for each local balancing authority (LBA)
    - Each LBA's load ratio share (LRS) will be determined using Future-specific forecast data
        - LRS will then be used to determine each LBA's Battery Capacity (MW) allocation
    - If an LBA needs more than one Battery site, the next existing or greenfield bus selected would be at least 10-20 miles away from the previously used bus to maintain geographical distribution

# Member-provided sites for thermal – Combined Cycle, Combustion Turbine and SMRs – will be given priority

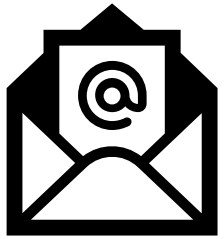
**After member-provided siting priority, thermal and nuclear generators are planned for siting at:**

- Active Definitive Planning Phase (DPP) Phase 1, 2, 3 in the GIQ
- Brownfield – Existing and Retired Sites
    - Retired sites ranked by earliest commission date
    - Retired sites had to be 50 MW and greater
- System Planning and Analysis (SPA) or Canceled/Postponed GIQ
- Greenfield sites
- SMR or planned Nuclear sites will be sited at or near water sources and if possible, at existing Nuclear sites

# The Series 2 Futures redesign will utilize the Stakeholder Feedback Tool and team email for stakeholder communications and data requests

**Stakeholder Feedback Tool***
(Click here)

| | |
|---|---|
| Formal | • Used by MISO to seek targeted feedback from stakeholders |
| Informal | • Used by stakeholders to provide informal feedback of non-technical information: policy, process or other<br>• Stakeholders can select feedback to be publicly posted or not posted |



| | |
|---|---|
| ★ Data | • Used to provide MISO Futures team members technical information only: e.g., modeling, analytical<br>• Futures@misoenergy.org |



* Stakeholder Feedback Tool: https://www.misoenergy.org/stakeholder-engagement/stakeholder-feedback

# To better align with member plans and preferences the Futures team is requesting planned and preferred member generation sites for the Series 2 Futures siting

- Please email all planned or preferred generation sites to: Futures@misoenergy.org no later than **May 29, 2025**

Proposed sites will be shared for formal feedback in August, after expansion plans are complete

# Questions?

# Appendix

# Series 2 assumptions and key model inputs that may impact capacity expansion opportunities have been established

**Future Scenario Definitions**

| | *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 |

IRP – Integrated Resource Plan
CAGR – Compound Annual Growth Rate
Series 2 (New) load growth CAGR starts from 2024. Series 1A Futures load growth CAGR starts from 2019

# Series 2 age-based retirement assumptions

| | FUTURE 1 | FUTURE 2 | FUTURE 3 | FUTURE 4 |
|---|---|---|---|---|
| | 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 – Utility-Scale | 25 | 25 | 25 | |
| Wind – Utility-Scale | 25 | 25 | 25 | |

# The use of Flexible Attribute Units (Flex) — high-availability, high-accreditation, low- or no-emission and long-duration resources — will continue for Series 2

## SOME POTENTIAL FLEX UNITS

- Demand response*
- Combined-cycle with carbon capture and sequestration
- Long-duration battery (>100 hours)
- Green hydrogen
- Future peaking resources
- Enhanced geothermal systems
- Other emerging technologies

Economic modeling will utilize CT costs and technical parameters, with refinements as needed to maintain consistency of economic dispatch in PROMOD

*Additional Demand Response may be used in the near-term as Flexible Attribute Units.