In the 2022 MISO Transmission Expansion Plan, staff recommends $4.3 billion of new transmission enhancement projects for Board of Directors' approval.

Highlights

- 382 new projects for inclusion in Appendix A to address reliability and aging infrastructure
- $31 billion in projects constructed in the MISO region since 2003
- Generator Interconnection queue grew to a record 956 projects totaling 170.8 GW

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Contents

A CALL TO ACTION

Rapid changes in generation fleets (retirements and additions), load recovery to pre-COVID levels (and beyond with electrification) and increasing incidence of severe weather events creates new challenges which must be mitigated through transmission planning. These changes require MISO, regulators and stakeholders to work in concert to ensure system reliability amidst the industry's paradigm shift.

MISO's MTEP22 report proposes 382 new projects with $4.3 billion in investment that address current reliability needs while aligning with large-scale, regional backbone upgrades that improve reliability, are cost-effective and meet the goals of utilities and states.

Mind the Gap: Managing Today's Resource Transition Challenges

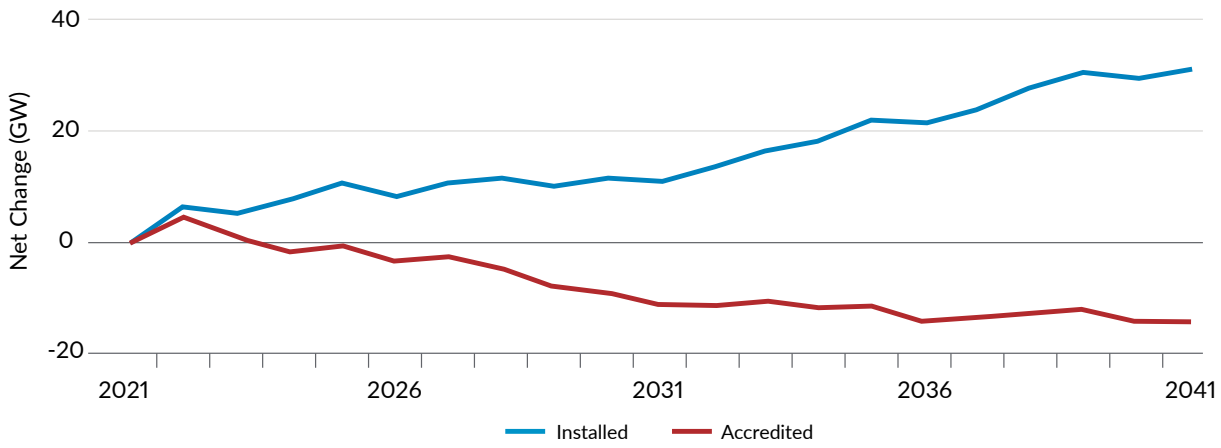
MISO is fuel- and technology-neutral. But MISO is focused on reliability, and that means it is focused on ensuring the resource portfolio has the necessary capabilities and attributes. Yet, due to decarbonization goals, economics and customer preferences, key existing resources will retire. Some plans to build new resources with the needed attributes are delayed or abandoned, and other technologies are not ready for broad deployment. Proposed replacement capacity has shown to be lacking key traits given current technologies. The gap between retirements and replacement capabilities and attributes is a growing reliability concern.

The ways that power is generated and delivered to consumers continues to shift in important ways. First, the number and frequency of severe weather events is increasing. Second, legacy plants are growing older and retiring, while more recent, intermittent technologies, like wind and solar, are increasingly becoming part of the mix. Moreover, different generating technologies bring various attributes and capabilities required to maintain grid reliability. For instance, weather-dependent renewables tend to offer faster installation and less downtime for maintenance than conventional generators, which have quicker ramp-up and output sustainability. Not all resources need to have all attributes, but a mixture of these characteristics is needed to keep the grid running reliably and efficiently.

Further, while the amount of installed capacity increases, the overall amount of capacity that can respond during times of high demand — such as the hottest days of summer or the coldest days of winter — is in decline. These declines result from decreased performance of some units, retirements of existing units and additions of weather-dependent generators. And, while this transition has been taking place over time, MISO is concerned the trend may be accelerating.

While installed capacity is projected to increase, accredited capacity - or capacity that is available on peak demand hours - is projected to decline, reflecting the resource attributes of new capacity additions

Projected Capacity Change Based on Member-Announced Plans
(From Preliminary 2022 Regional Resource Assessment Survey Results)



A Regional Reliability Imperative

All parties in the power industry need to move as fast or faster than the rapid change already taking place in the MISO region. MISO, stakeholders and regulators share responsibility — a Reliability Imperative — to address the immediate and long-term challenges presented by fleet changes and increases in extreme weather in its region. MISO's role within the Reliability Imperative is to act as a facilitator between its members and regulators, as well as see the big picture of transmission planning in its region.

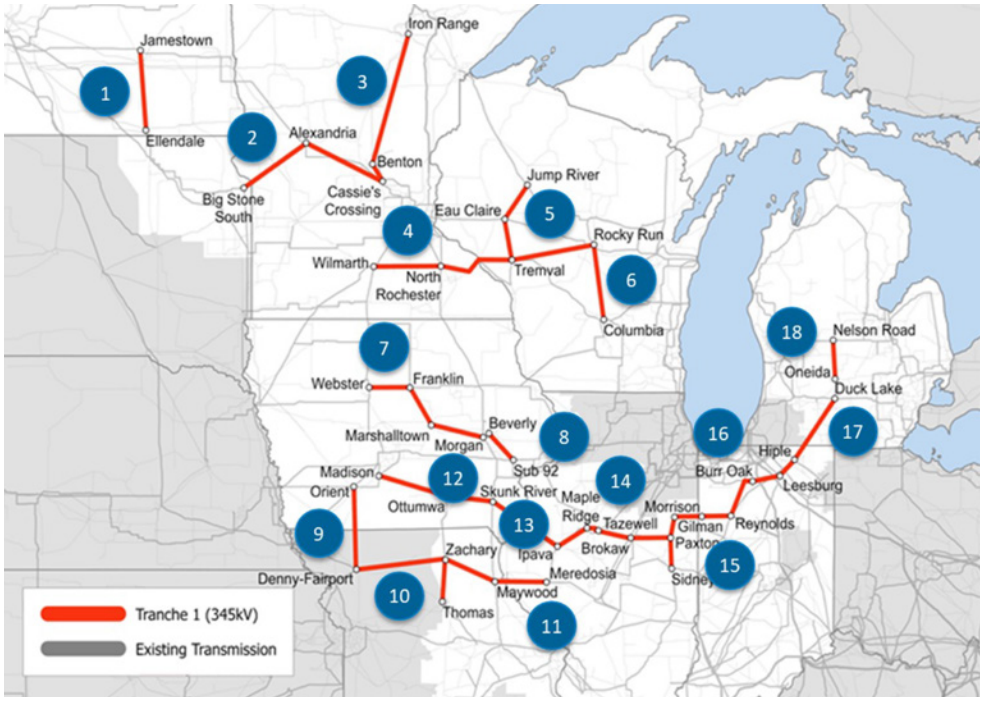
MISO developed four major initiatives to monitor and address the Reliability Imperative: Long Range Transmission Planning (LRTP); Market Redefinition; Operations of the Future; and Market Systems Enhancement. The efforts of MISO, regulators and other stakeholders will help mitigate the challenges within the MISO region, while also enabling MISO members and states to achieve their policy objectives — many of which relate to decarbonization.

First Tranche of Long Range Transmission Planning Regional Projects is an Important First Step to Meet Current and Future Needs

LRTP holistically considers the needs of MISO's footprint and identifies solutions needed to maintain system reliability throughout the unprecedented rate of change in the resource mix. To address these transformational needs, MISO developed an indicative 'roadmap' of potential transmission expansions throughout the region, which provides, among other things, an indication of the transmission magnitude of expansions that may be needed to maintain reliable and efficient operations under the expected 'Futures', or planning scenarios used to guide transmission planning. Importantly, this indicative roadmap is not itself a plan, and does not represent any particular study efforts, but instead provides a basis for considering solutions to transmission issues expected in LRTP study efforts.

In July, the MISO Board of Directors approved Tranche 1 of the LRTP projects as an addendum to MTEP21. This 18-project portfolio represents $10.3 billion in investment with benefit-to-cost ratios ranging from 2.2 to 4.4. These projects complement existing member plans, providing least-regret options to ensure adequate infrastructure to handle resource fleet changes planned by MISO members and approved by state regulators. Meeting the criteria for Multi-Value Projects, portfolio benefits cover a wide range of value streams, including congestion and fuel savings, avoided capital costs of local resources, avoided transmission investments, resource adequacy savings, avoided risk of load shedding, and decarbonization. Further, it was shown that these benefits spread across the Midwest portion of the MISO footprint. Costs of these projects are allocated according to benefits.

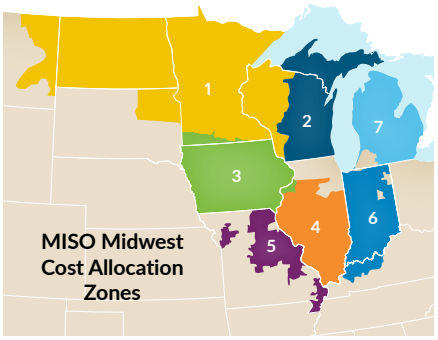
LRTP Tranche 1 portfolio includes 18 projects in MISO's Midwest Subregion, with an investment cost of $10.3 billion



ID	DESCRIPTION	EST COST ($2022M)
1	Jamestown – Ellendale	$439
2	Big Stone South – Alexandria – Cassie's Crossing	$574
3	Iron Range – Benton County – Cassie's Crossing	$970
4	Wilmarth – North Rochester – Tremval	$689
5	Tremval – Eau Claire – Jump River	$505
6	Tremval – Rocky Run – Columbia	$1,050
7	Webster – Franklin – Marshalltown – Morgan Valley	$755
8	Beverly – Sub 92	$231
9	Orient – Denny – Fairport	$390
10	Denny – Zachary – Thomas Hill – Maywood	$769
11	Maywood – Meredosia	$301
12	Madison – Ottumwa – Skunk River	$673
13	Skunk River – Ipava	$594
14	Ipava – Maple Ridge – Tazewell – Brokaw – Paxton East	$572
15	Sidney – Paxton East – Gilman South – Morrison Ditch	$454
16	Morrison Ditch – Reynolds – Burr Oak – Leesburg – Hiple	$261
17	Hiple – Duck Lake	$696
18	Oneida – Nelson Rd.	$403
	TOTAL PROJECT PORTFOLIO COST	$10.3B

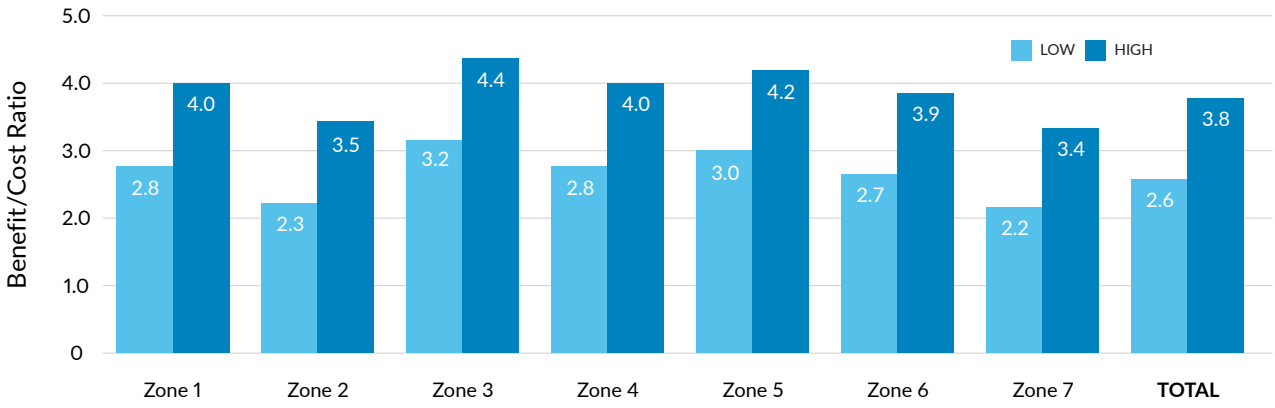
All projects assumed to be in-service by 2030

Benefits will be broadly distributed across the Midwest subregion and deliver a benefit to cost ratio of at least 2.2 for all zones



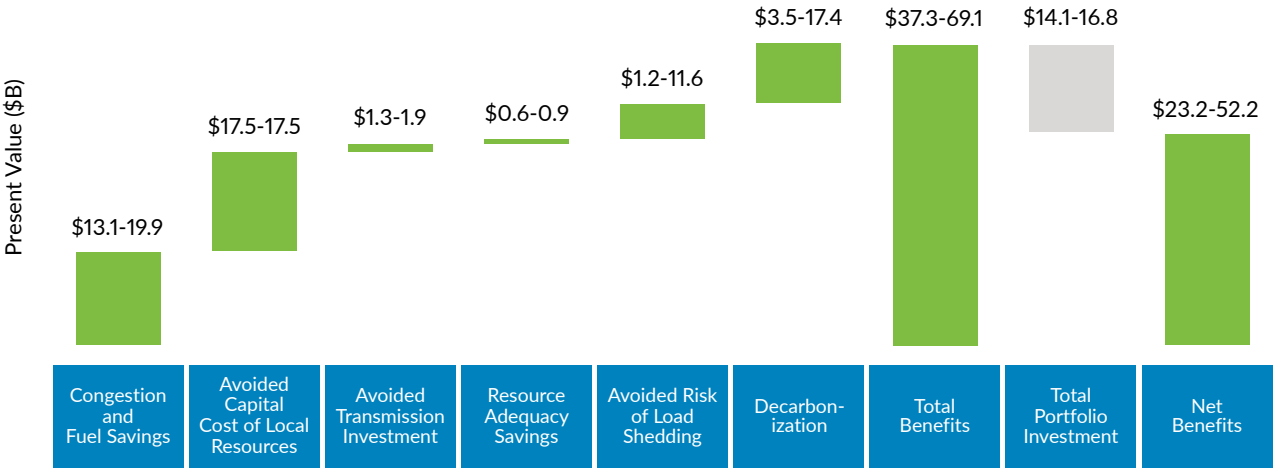
Range of Benefit/Cost Ratio by Cost Allocation Zone

(20-yr Present Value, 6.9% Discount Rate)



Tranche 1 portfolio benefits span a variety of value streams and greatly exceed costs

LRTP Tranche 1 Benefits vs. Costs 20 — 40-Year Present Value ($B, 2022)



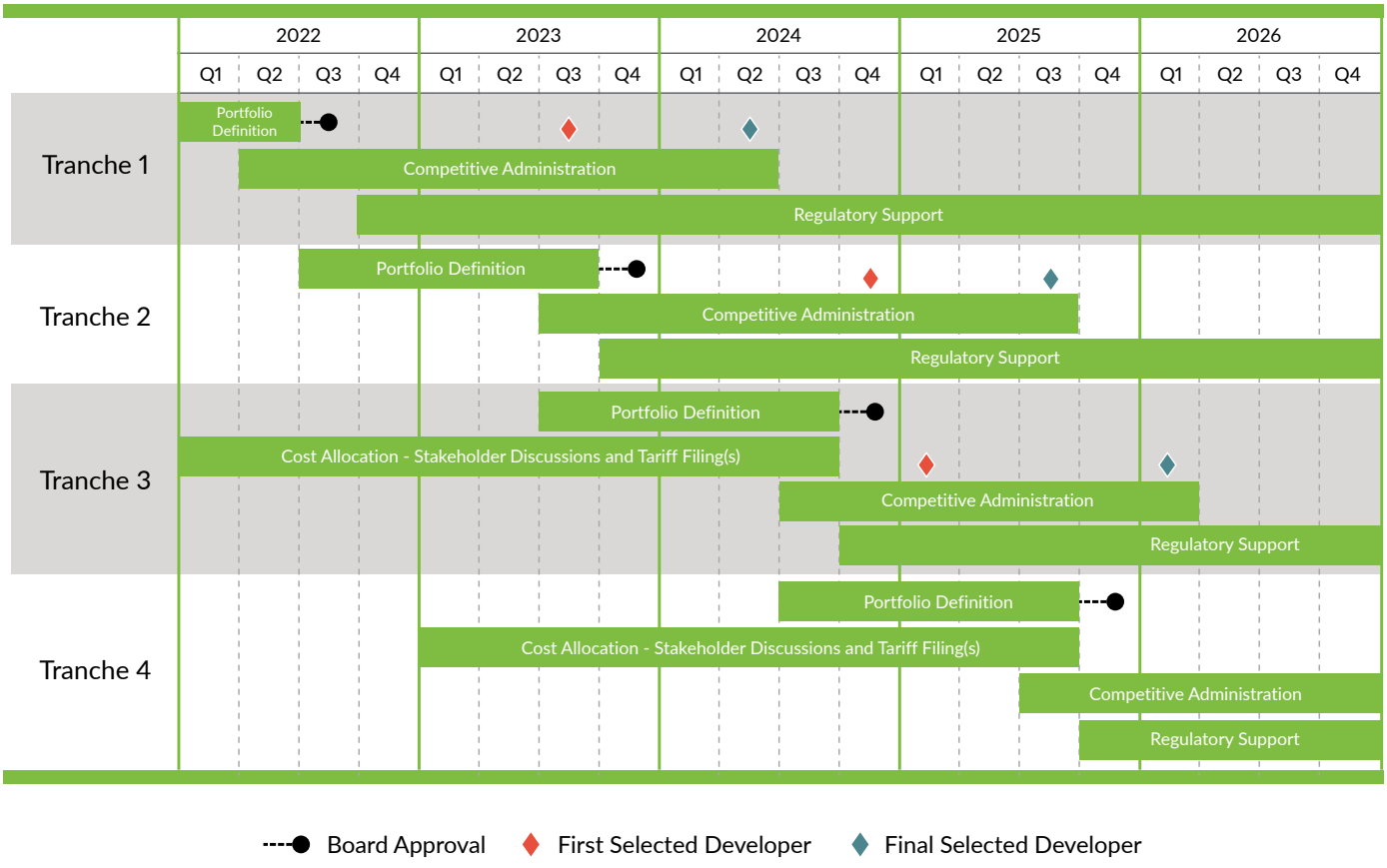
Calculations are generally based on conservative assumptions including the analysis period and discount rate
See LRTP Tranch 1 Business Case document for details

The LRTP effort consists of four tranches. With the first tranche approved by the MISO Board in July, efforts now turn to Tranche 2. Focused again on the Midwest portion of the MISO footprint, this tranche will continue to focus on enabling resources planned by member utilities, and is currently planned to conclude in Q4 2023. Tranche 3 will focus on the South subregion, and Tranche 4 will be dedicated to improving flow between MISO's Midwest and South subregions.

The LRTP effort will iterate over time as conditions change. In contrast to MISO's annual MTEP cycle, which focuses primarily on local needs and results in recommendations each year, the LRTP is a multi-year effort that considers a regional perspective. Long-range planning is periodically used as needed to address the many complex issues associated with the transitioning resource fleet underway. To keep pace with this rapid evolution, MISO will seek to recommend projects identified in the LRTP effort over several cycles as LRTP progresses.

Plans for subsequent LRTP tranches, needed solutions to current and future challenges, are underway

Long Range Transmission Planning Schedule and Milestones



Represents earliest potential Board approvals; preliminary timelines for Tranches 2 and 3, may exceed durations shown

The 2022 Planning Resource Auction (PRA), which allows utilities to demonstrate sufficient capacity to meet demand over the coming year, gives a stark example of the challenges posed by this divergence. This year, for the first time ever, four of MISO's 10 Local Resource Zones fell short of their capacity requirement, or the amount of power needed during times of highest demand. This caused zones in MISO's Midwest Subregion footprint to clear at the highest available auction price. The joint Organization of MISO States (OMS)/ MISO 2022 survey, which gathers Load-Serving Entities' supply and demand expectations for the forward five-year period, reported that the shortfall will likely increase. It is within this broader picture that MTEP22 is situated. Transmission is critical to ensure broad access to the resources in the footprint.

The remainder of this executive summary examines MTEP22 Appendix A from a "local roads" perspective along with process improvements in adding resources and retiring generators in an orderly fashion.

Different resource types each bring a unique mix of attributes — while every resource does not need to bring all attributes, the system will need an adequate supply of each attribute

Informed Initial Hypothesis Matrix

	Rotating Machine				Inverter-based			Demand-Side[2]	
Attribute/Resource Type (illustrative list of attributes)	Coal	Gas	Nuclear	Hydro	Solar	Wind[1]	Battery	Load Control	Energy Efficiency
Capacity	●	●	●	◕	◔	◔	◕	◕	●
Fuel Assurance	◕	◑+	●	◕	◑	◔	◑	◔	●
Long Duration Energy at High Output	●	●	●	◕	◑	◑	◔	◔	●
Voltage Stability	◕	◕	◕	◕	◑+	◑+	◑+	◔+	○
Ramp Up Capability	◕	●	◔	●	◔	◔	●	●	○
Rapid Start-Up	◑	●	◔	●	◑	◔	●	●	○
Black Start Capability	○	●	○	●	○+	○+	◑+	○	○

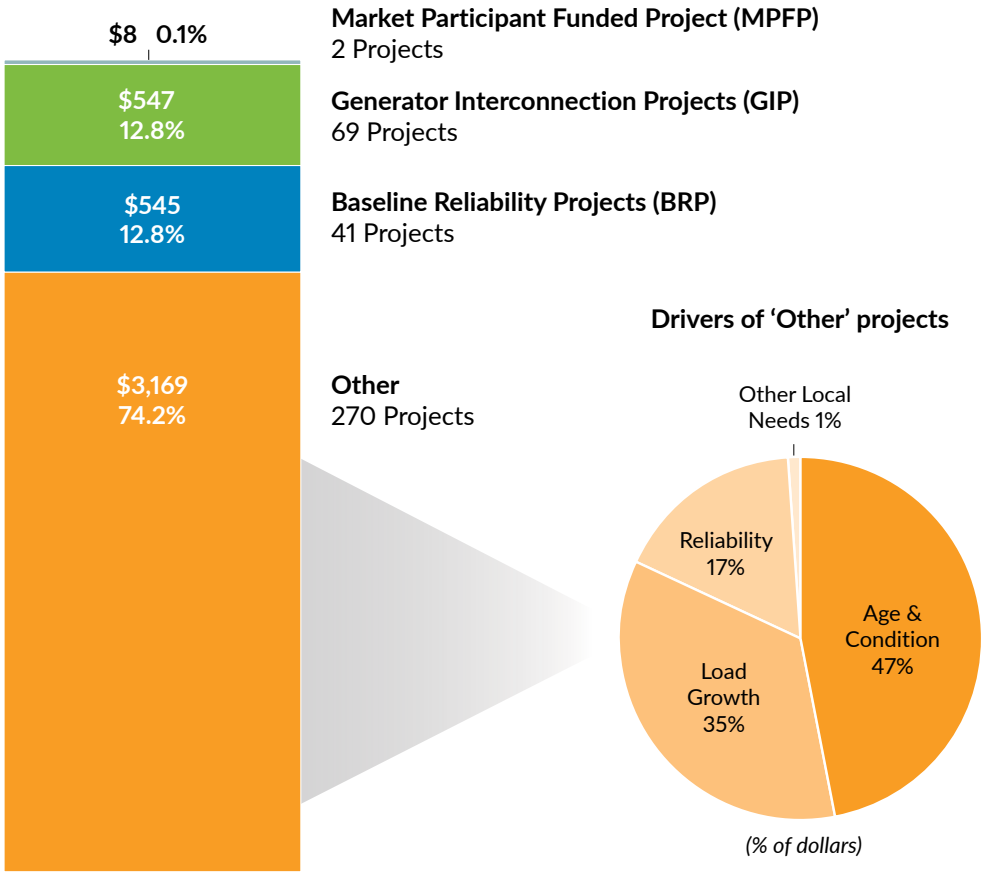
+ Attribute strength may increase in the future through technology advancements and/or standards development
[1] Wind power conversion technology has largely moved to Type 4 machines for new deployments, which are inverter-based, though deployed technology includes synchronous machines and doubly fed induction generator technologies, affecting characteristics.
[2] Distributed Energy Resource industry definitions often consist of 1) distributed generation, 2) distributed storage, 3) load control, and 4) energy efficiency. These are usually considered "demand-side" from the MISO perspective. For the above table, distributed storage and distributed generation are assumed to have characteristics consistent with bulk system resource counterparts (i.e., distributed battery and bulk system battery have same attributes) unless otherwise noted. Load Control and Energy Efficiency are called out separately.

MTEP22 APPENDIX A PROJECTS MEET IMMEDIATE, LOCALLY FOCUSED SYSTEM NEEDS

As MISO plans high voltage superhighways, it must also maintain its "local roads," or the local transmission infrastructure that supports delivery of power to distribution systems. This year, the MTEP22 cycle proposes 382 new Appendix A projects as justified in this MISO Transmission Expansion Plan and represents $4.3 billion in transmission infrastructure investment for the MISO region. In keeping with previous years, the bulk of projects are in the "Other" category, meaning they do not qualify as Baseline Reliability Projects, Generator Interconnection Projects, Market Efficiency Projects, Targeted Market Efficiency Projects or Multi-Value Projects.

"Other" Projects make up most MTEP22 Appendix A projects

MTEP22 Appendix A Project Quantity, Investment and Types ($M, % of dollars)

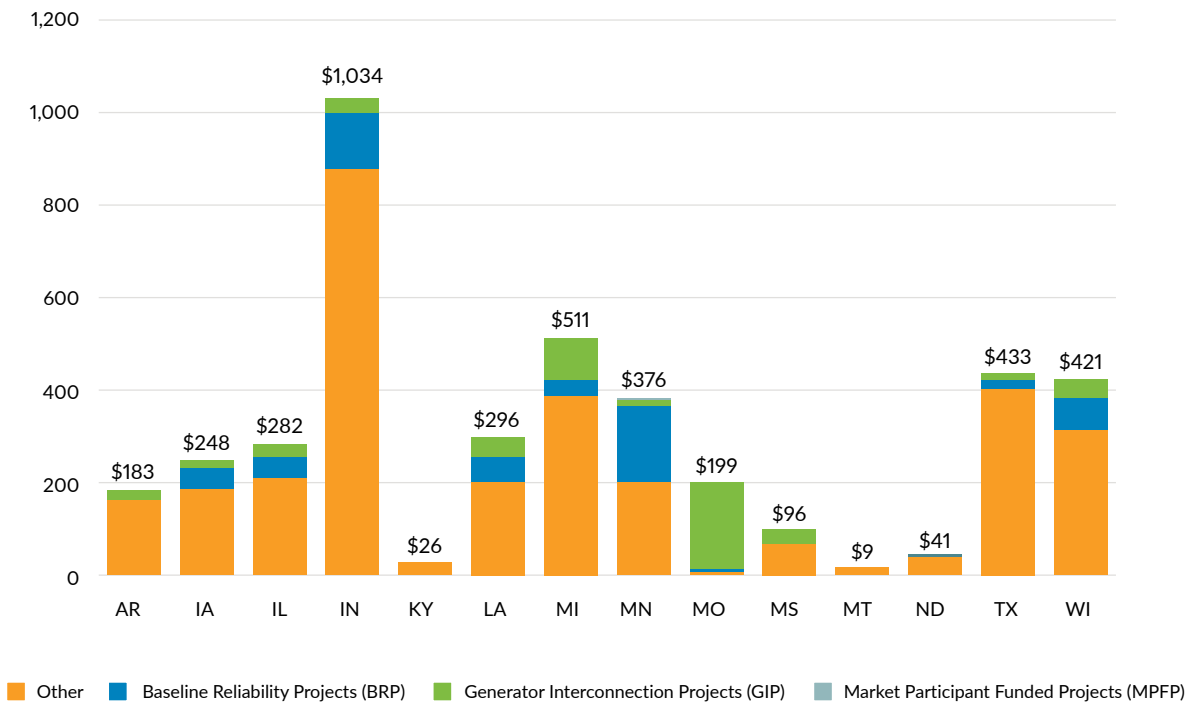


Of the new MTEP22 projects, 2 are Market Participant Funded projects; 69 are Generator Interconnection Projects; 41 are Baseline Reliability projects; and 270 are in the Other project category. These numbers represent percentages which are similar to MTEP21 (without LRTP Tranche 1). The majority of Other projects address localized issues due to aging transmission infrastructure or local non-baseline reliability needs that are not dictated by NERC and regional reliability standards. The drivers for Other projects are also in line with MTEP21.

New Appendix A projects are spread over 14 states, with eight states scheduled for more than $200 million in new investment. These geographic trends vary greatly year to year as previous local planning requirements in other parts of the system are consumed and new build becomes necessary.

Each MTEP project is composed of one or more facilities, where each facility represents an individual element of the project. Examples of facilities include substations, transformers, voltage devices, circuit breakers or various types of transmission lines.

MTEP22 Project Type Investment by State ($M)

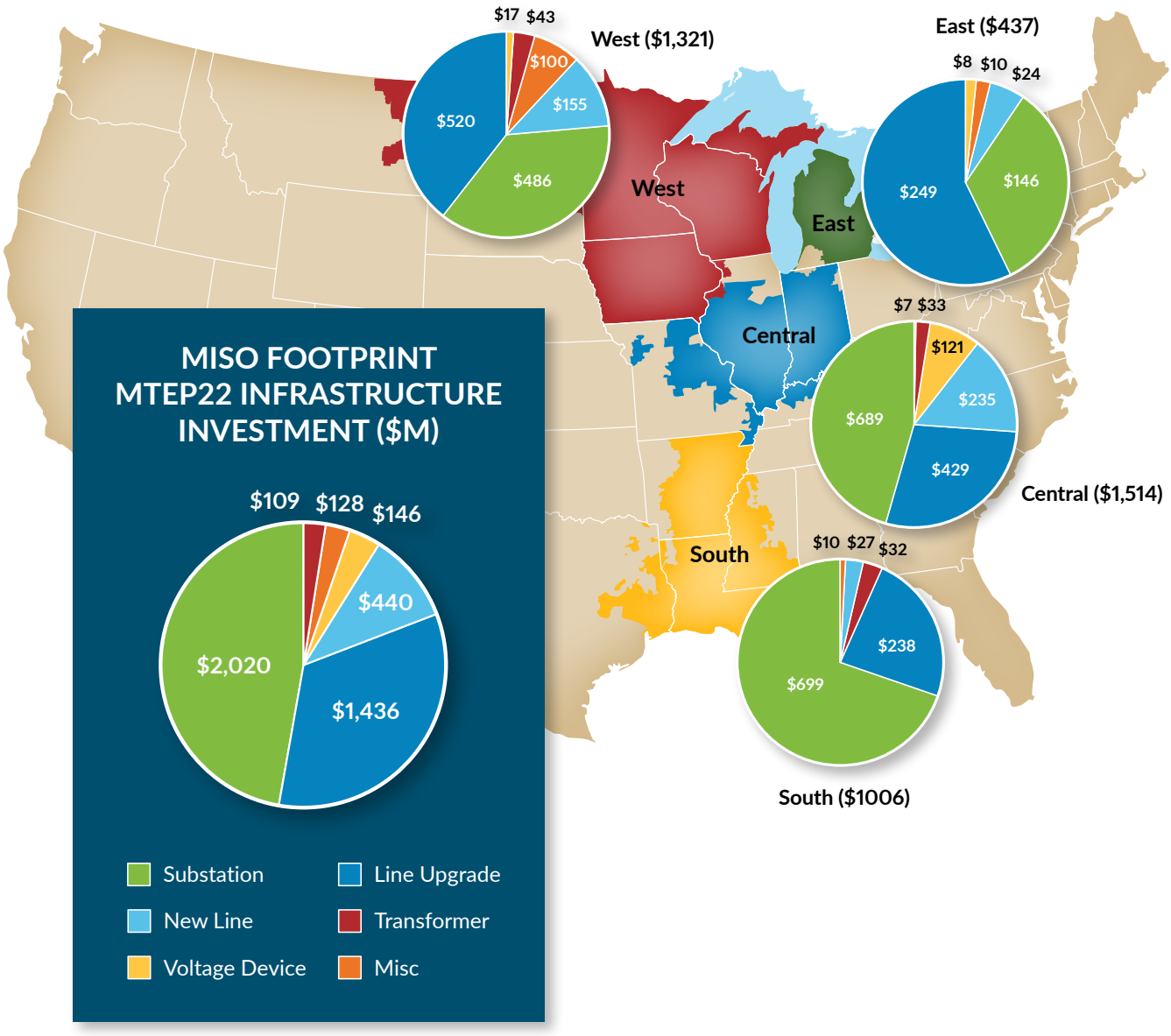


MTEP22 Appendix A investment categorized by state, excludes multi-state blanket programs

The majority of facility investment in the MTEP22 cycle, 48 percent, is dedicated to substation or switching station related construction and upgrades. This includes completely new substations as well as terminal equipment work, circuit breaker additions and replacements or new transformers. 35 percent is dedicated to line upgrades, which includes rebuilds, conversions, and relocations. Facility costs have 10 percent dedicated to new lines on new right-of-way across the MISO footprint.

MTEP22 includes a total of 33 new cost-share eligible Generator Interconnection Projects (GIPs) for Appendix A. GIP costs are primarily paid for by the interconnecting customer (generator), however, a portion of the costs for certain network upgrades are eligible for regional cost allocation under Attachment FF of the MISO Tariff, which describes project types, criteria and associated cost allocation methodology.

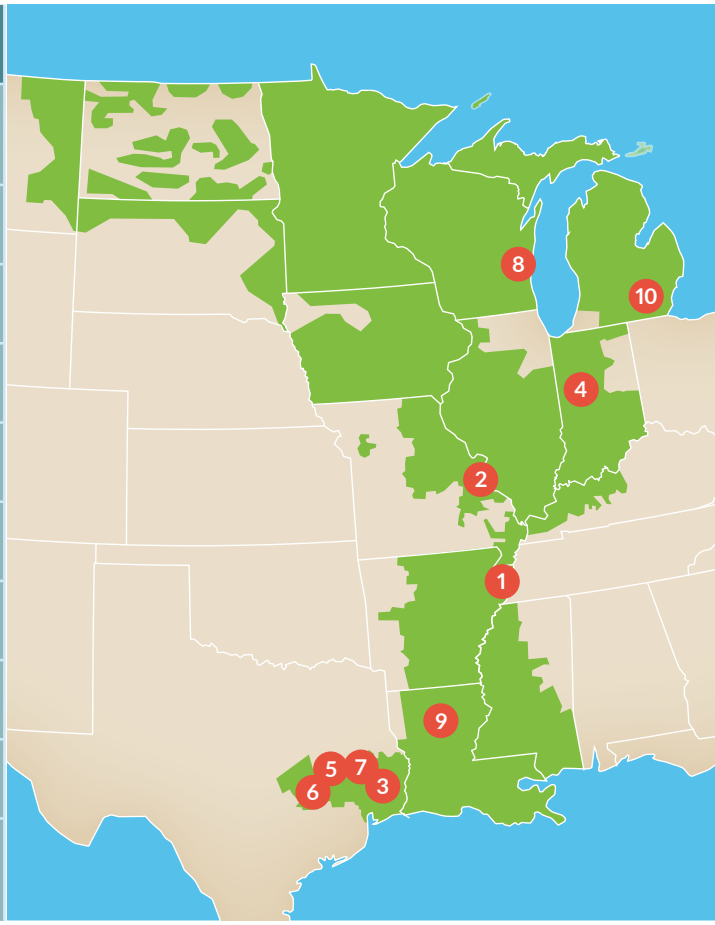
MTEP22 Infrastructure Facility Type Investments in Total and by Planning Region



TOP 10 PROPOSED MTEP22 PROJECTS

(In descending order of cost)

Rank	Project Name	Project Driver	Cost ($millions)
1	Sandy Bayou 500/230kV: New substation	Other – Load Growth	$122
2	New Rush Island Area Statcoms	Other – Reliability	$120
3	Falcon: New 138 kV Distribution Station	Other – Load Growth	$114
4	New West Lafayette Substation	Other – Load Growth	$100
5	District: New 138 kV Distribution Station	Other – Load Growth	$85
6	Texas 138 kV: New Distribution Station	Other – Load Growth	$69
7	Galaxy: New 138 kV Distribution Station	Other – Load Growth	$66
8	WisDOT I-94 Stadium Group of Projects	Other – Age & Condition	$64
9	Calhoun: New Distribution Substation	Other – Load Growth	$57
10	Parr Road-Whiting 138kV Rebuild	Other - Reliability	$54



Blanket Asset Renewal Projects excluded from ranking.

The 10 largest projects represent 20 percent of the total cost and are distributed across the MISO region. These projects support safe, reliable transmission to enable load and generation interconnection, NERC reliability compliance and other local needs.

CONTINUED PROCESS IMPROVEMENTS TO MANAGE FLEET CHANGE

While the LRTP effort continues across MTEP cycles with stakeholders, MISO has continued to work to improve the various processes focused on retiring existing generation and adding new generation to the resource mix. These processes have become increasingly important as the resource shift accelerates and intensifies.

Enhancements Lead to Shortest Queue Process Duration in U.S.

Over the last several years, the Generator Interconnection queue has experienced extremely high volume. In 2021, MISO received 487 individual project requests; the 2022 cycle ended September 15, at a record 956 project requests representing more than 170.8 GW of capacity. Solar and battery requests, along with hybrid applications, are expected to make up the bulk of these requests.

In March 2022, FERC approved MISO's latest queue reform, which is expected to reduce the MISO queue timeline schedule from 505 days to either 382 or 463 days, depending on whether a Network Upgrade Facilities Study (NUFS) is conducted in parallel with or prior to the Generator Interconnection Agreement (GIA). MISO's queue process undergoes constant assessment and refinement with eight substantive reforms since being first instituted in 2002. These reforms make the queue process more expedient and efficient for MISO members. In fact, MISO has the shortest end-to-end queue time among its peer Regional Transmission Operators (RTO).

MISO is also addressing several related issues that will further streamline the Generator Interconnection process and MISO's need to bring new resources online quickly. Effective January 1, 2022, fuel changes are not allowed once the Definitive Planning Phase (DPP) I study has begun. This will encourage more thought-out projects and reduce the need for model changes during the study period.

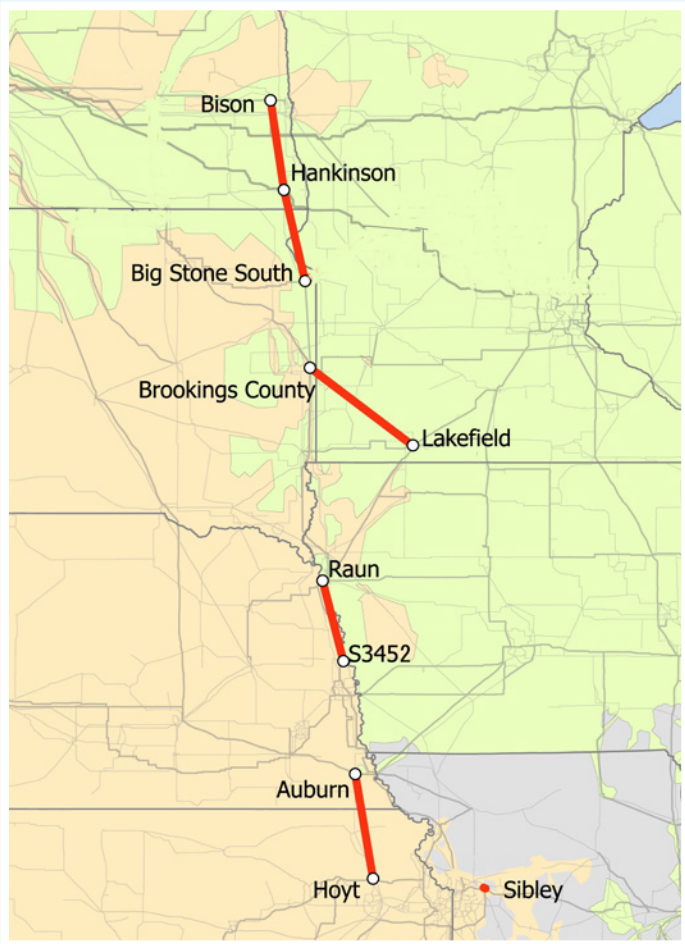
Interregional Cooperation Expected to Shorten Queue Study Time

Additionally, in 2022, MISO and Southwest Power Pool (SPP) continued work on the Joint Targeted Interconnection Queue (JTIQ) study. Through collaboration between the MISO and SPP, the study identified a seven-transmission project portfolio with a planning level estimated cost of $1.65 billion. This original portfolio has since been reduced to $1 billion representing five transmission projects. Two lines identified in JTIQ were also identified through the parallel Long Range Transmission Planning process and approved in Tranche 1 as an addendum to MTEP21. The remaining portfolio continues to address the significant transmission limitations restricting the opportunity to interconnect new generating resources near the MISO-SPP seam. In particular, the remaining JTIQ Portfolio enables a significant amount of new resource interconnection on both sides of the seam on top of what Tranche 1 enables within the MISO footprint. The approval of Tranche 1 does however reduce the future economic benefit of the JTIQ Portfolio to load. The recommended JTIQ Portfolio continues to address the set of transmission constraints evaluated in the JTIQ study as being significant barriers to the development of new generation along the MISO-SPP seam. An estimated 28 GW of interregional generation would be enabled to new generator interconnection projects near MISO's western seams.

Currently, the time between interconnection request and signed Generator Interconnection Agreement (GIA) is impacted by delays (regularly exceeding 100 days) due to the important and necessary Affected Systems Study process. MISO is actively working with both SPP and PJM to streamline and expedite the process.

Further, reforms to the Joint Operating Agreement with SPP to improve the efficiency and timeliness of the interconnection process by changing the queue prioritization to a "first ready, first served" model between MISO and SPP queue resources was approved by FERC in June.

JTIQ Portfolio



JTIQ Portfolio	Location by RTO	Cost ($M)
Bison – Hankinson – Big Stone South 345 kV	MISO	476
Brookings Co – Lakefield 345 kV	MISO	331
Raun – S3452 345 kV	MISO - SPP	144.4
Auburn – Hoyt 345 kV	SPP	90.5
Sibley 345 Bus Reconfiguration	SPP	18.8
Total Cost of Portfolio of Projects	**MISO - SPP**	**1,060.7**

Right-Sizing Generator Retirement Study Time

In the spring of 2022, MISO proposed improvements to the Attachment Y generation retirement process. If accepted, these improvements will extend the advance notice timeline from 26 to 52 weeks, allowing MISO more time to process the increased number of Attachment Y requests. MISO further proposed a quarterly study period to better allow for forecasting workload internally. This extended advance notice timeline will allow for additional studies as necessary. MISO wants to offer transparency and maintain confidentiality while reporting the number of requests received each quarter and the number of megawatts requesting suspension or retirement.

The Generation Facility Replacement process, approved by FERC in 2019, allows the owners of an existing generating facility to utilize their existing generator interconnection for a new generating facility at the same injection point without going through the MISO Generator Interconnection queue. Since 2020, MISO has received 10 replacement requests to replace a total of 2,314 MW of existing generation, which would otherwise have been retired through the traditional resource retirement process.

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