In this MISO Transmission Expansion Plan, MISO staff recommends $3.3 billion of new transmission enhancement projects for Board of Directors’ approval.

Highlights

- 442 new projects for inclusion in Appendix A
- $19.1 billion in projects constructed in the MISO region since 2003
- Over 4,467 MW of generation enabled by new network upgrades that will be included in MTEP18
- Recommendation to approve two interregional projects with PJM
MISO looks to the future

Driven by changing economics, energy policies, and customer preference the MISO landscape is changing dramatically. Analysis indicates continued increases in renewable energy, additions of demand-side resources, and additional conventional resource retirements across the footprint. Future expectations reveal continued trends toward “Three Ds” – Decentralization from large stations to smaller distributed resources, Digitalization of electricity consuming devices and the internet of things, and Demarginalization of resource costs. This evolution will necessitate changes in the transmission system to allow more flexibility and integration of diverse resource types.

While no one knows exactly how quickly this transition will occur, or exactly what the fleet will look like in 15 years, MISO knows that the transmission system needed to economically and reliably support the future resource mix will be different from that which exists today. And the incremental, bit-by-bit approach to system planning is expensive and inefficient.

MISO’s charge is to build an efficient and economic plan for a robust, flexible, no-regrets grid that can effectively meet future system needs. Developing such a grid that can accommodate future resource fleet changes requires a long-term system view with an increased emphasis on planning to meet demand every hour of the year, not just the summer peak. Projects in MTEP18 continue to support local reliability and market efficiency, as MISO continues to work with its stakeholders to plan for the future.
The 10 largest projects represent 23 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.

MTEP18 Appendix A Overview

MTEP Appendix A projects are vetted by MISO through the planning process and are ready for execution. The 442 new Appendix A projects in MISO’s 2018 Transmission Expansion Plan (MTEP18) represent $3.3 billion in transmission infrastructure investment and fall into the following categories:

- **81 Baseline Reliability Projects (BRP)** that are required to meet standards for both North American Electric Reliability Corporation (NERC) and regional reliability
- **16 Generator Interconnection Projects (GIP)** needed to reliably connect new generation to the transmission grid
- **341 Other projects** that address a wide range of needs, such as those that support lower-voltage transmission systems or replacement of existing, but do not meet the threshold to qualify as Market Efficiency Projects
- **3 Other projects**, totaling $29 million, that specifically provide local economic benefit
- **2 Transmission Deliverability Service Projects (TDSP)** that enable power delivery
- **2 interregional Targeted Market Efficiency Projects** with Pennsylvania-based PJM, that address congestion along the MISO-PJM seam

As the MISO region experiences changes and growth, the MTEP also reflects analysis of specific issues to ensure the region is well-positioned to meet future electricity demand and regulatory mandates. Notable work efforts performed during this planning cycle include:

- Ongoing evaluation of transmission needs and identification of solutions through Market Congestion Planning Studies
- Providing transparency around the Resource Adequacy outlook in the MISO Region
- Greater interregional planning collaboration along MISO’s seams
- Updating MTEP18 Futures and adding a fourth planning future - Distributed & Emerging Technologies - to consider emerging technology trends
- Improving understanding of increased renewable penetration impacts through the Renewable Integration Impact Assessment (RIIA)
- Increasing alignment of project benefits and costs through a cost allocation proposal, anticipated FERC filing timeline of Q4 2018, which was the culmination of over three years of stakeholder process, and is the first to integrate cost allocation rules for the region as a whole following the South region integration period

Top 10 proposed MTEP18 projects
(In descending order of cost)
Reliability planning, including age and condition upgrades, at the local level constitutes the majority of the overall projects recommended for Board approval in each cycle.

Regional conversations lead to interregional planning that affects the Eastern Interconnection. All of these decisions must remain compliant with mandates such as FERC’s Order 1000. MISO’s interregional planning process covers the collaboration between MISO and neighboring grid operators SPP and PJM, but it doesn’t stop there. Coordination happens beyond those borders to include IESO of Ontario and Southeastern Regional Transmission Planning region. MISO and all its stakeholders stand to benefit not only from the efficiencies inherent in collaboration, but also the economic enhancements of potential future projects.

Provide MISO members the most value

It’s not enough to have a strong set of operating values that ensure communication and inclusive planning practices. The evolving generation fleet and changing system conditions also require an integrated approach. For example, in the MTEP18 cycle, MISO combined the Market Congestion Planning Study with Sub-regional Planning Meetings to allow greater coordination between both MISO and stakeholder reliability and economic planning processes.

FERC Order 1000 opened up opportunities for more providers to participate in building transmission in the MISO footprint on regionally cost-shared projects. As a result, MISO created a Competitive Transmission Process to evaluate and select...
a developer for these eligible projects. This year’s planning process did not identify a project eligible for competitive selection. However, the process to select a developer for the Hartburg-Sabine Junction 500 kV Economic Project, identified in MTEP17, is proceeding according to schedule, and will result in the announcement of a selected developer by the end of 2018.

In general, MTEP18 shows lower congestion across the footprint relative to previous transmission planning cycles. This result is due in large part to mitigating the top congested elements, competitive fuel prices and stagnant net demand growth – though congestion in specific areas of the footprint is on the rise driven by fleet change and renewable additions. MTEP18 includes several projects to meet local economic needs, reducing congestion and increasing access to lower-cost generation in those areas.

In addition to improving planning processes, MISO is also carefully incorporating resource adequacy considerations and cost allocation improvements. The footprint has sufficient resources for 2019. However risks exist in subsequent years as generation retires and is replaced by often lower-capacity resources like wind and solar.

Further, MISO is moving towards a more granular cost allocation methodology for regional and interregional economic projects. This new methodology will improve the alignment of who benefits with who pays given the scope of the MISO footprint and nature of the projects in question.

**MTEP18 - a plan to support future grid needs and beyond**

As the electrical industry evolves, MISO plans for a future system designed to achieve reliable, cost-effective electricity, providing value to customers over the long term. MISO’s planning processes ensure that the grid is well-positioned for challenges posed by a changing resource fleet by considering a broad range of potential future scenarios to identify robust, beneficial transmission investments.

MTEP18 studies what the grid could look like for the next 20-plus years as energy sources shift, policy changes, and emerging technology becomes a larger player. This report takes a hard look at potential future grid needs that will need to be addressed in subsequent planning efforts. MISO’s MTEP18 process also examines current efforts to manage its largest interconnection queue ever – 80,000-plus MW, mostly wind and solar generation – in addition to the early emergence of storage interconnection requests, on a system that today totals 175,000 MW of installed capacity.

**MISO’s current interconnection queue consists of 483 projects totaling 81.5 GW**

Ongoing studies explore the implications of integrating increasing penetrations of renewables on the grid; retirements in conventional energy sources; and the current emphasis on energy-based planning, such as integrating intermittent and distributed energy resources.
MTEP18 is organized into four books and a series of detailed appendices.

**BOOK 1**
**TRANSMISSION STUDIES**
Summarizes this cycle’s projects and the analyses behind them.

**BOOK 2**
**RESOURCE ADEQUACY**
Describes annual and targeted analyses for Resource Adequacy.

**BOOK 3**
**POLICY LANDSCAPE**
Presents the policy landscape with a summary of regional and interregional studies.

**BOOK 4**
**REGIONAL ENERGY INFORMATION**
Presents additional regional energy information.

**APPENDICES A-F**
Provides detailed assumptions, results, project information and stakeholder feedback.

MISO’s current generator interconnection queue consists of 483 projects totaling over 80 GW

**MISO Active Queue by Study Area**

- **West**: 27.8 GW, 173 Requests
- **East (ATC/UP)**: 6.7 GW, 46 Requests
- **East Area (ITC)**: 12.5 GW, 64 Requests
- **Central Area**: 20.5 GW, 108 Requests
- **South**: 14.1 GW, 92 Requests

**Total Queue: 81.5 GW**

- **Fuel Type**: WIND, GAS, SOLAR, OTHER

MISOenergy.org
In this MISO Transmission Expansion Plan, MISO staff recommends $3.3 billion of new transmission enhancement projects for Board of Directors’ approval.
The MTEP18 cycle proposes 442 new projects and $3.3 billion of new transmission investment — but how did MISO get there? Transmission studies, featuring robust reliability and economic analyses, help MISO members make prudent planning and investment decisions to continue delivering reliable, least-cost energy. Reliability projects, including age and condition upgrades, a vital part of MTEP planning, account for the majority of all recommended projects.

BOOK HIGHLIGHTS

- Congestion across the footprint is lower relative to past cycles as the result of previously approved projects mitigating the top congested elements, competitive fuel prices, and stagnant net demand growth — though congestion in specific areas of the footprint is on the rise driven by fleet change and renewable additions
- MISO has its largest interconnection queue ever of more than 80 GW, mostly wind and solar generation, in addition to the early emergence of storage interconnection requests
- MISO’s move towards a more granular cost allocation methodology for regional and interregional economic driven projects will improve the alignment of who benefits with who pays given the scope of the MISO footprint and nature of the projects in question. This proposal is the product of over three years of discussion and stakeholder engagement, and is the first to integrate cost allocation rules for the region as a whole following the South region integration period.
- Updated MTEP18 futures model Limited Fleet Change, Continued Fleet Change, and Accelerated Fleet Change scenarios. Additionally, a Distributed and Emerging Technologies future was added to reflect the emergence of new technologies.
- This book provides an overview of MTEP18 project proposals and a status update of projects approved in prior MTEP cycles
In this MISO Transmission Expansion Plan, MISO staff recommends $3.3 billion of new transmission enhancement projects for Board of Directors’ approval.

BOOK 2
Resource Adequacy
Summary

Resource Adequacy requires enough capacity be available to meet the needs of all consumers in the MISO footprint to meet peak load serving needs. To achieve this, MISO supports its states and load-serving entities by providing projected risks and continuously works to improve transparency into near and long-term resource requirements.

A convergence of trends, including an aging generation fleet and growth of variable energy resources, has required MISO to look at existing processes to support states' and load-serving entities' efforts to satisfy their Resource Adequacy requirements. Improvements in MISO processes will benefit the system through ensuring sufficient energy is able to meet operational needs in all times of the year.

BOOK HIGHLIGHTS

- The footprint has sufficient resources to meet peak load for 2019. Risks exist in subsequent years as generation retires and is replaced by often lower-capacity resources like wind and solar, as well as Load Modifying Resources currently accessible only through the declaration of emergency operations.
- MISO is currently investigating how to ensure the efficient conversion of capacity cleared in the Planning Resource Auction into energy needed by real time operations through its Resource Availability and Need (RAN) effort.
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BOOK 3
Policy Landscape
Summary

MISO’s generation fleet continues to evolve, and MISO is studying the impacts of increasing levels of renewable resources on the system. MISO also continues to follow federal and state policy as well as monitor industry trends. Additionally, interregional planning is critical to maximize the overall value of the transmission system and deliver savings for customers. Interregional studies conducted jointly with MISO’s neighboring planning regions are based on an annual review of transmission issues at the seams. Depending on the outcome of those reviews, studies are scoped out and performed.

BOOK HIGHLIGHTS

- MISO and the Ontario-based Independent Electricity System Operator (IESO) have mutually agreed to updates of joint Transmission Planning Studies Instruction to guide future collaborative planning efforts
- MISO began a Renewable Integration Impact Assessment (RIIA) to methodically find system integration inflection points driven by increasing levels of renewable generation with focus areas of resource adequacy, energy adequacy and operating reliability
- Initial RIIA results indicate that as renewable penetration increases, risk of losing load compresses into a small number of hours and shifts to later in the day. As a result, the available energy from a combination of wind and solar decreases during the new high-risk window.
- The MTEP18 MVP limited review demonstrates that MVPs provide benefits in excess of costs, with a total benefit-to-cost ratio ranging from 2.0 to 3.1, and creates $8.9 to $40.6 billion in net benefits over the next 20 to 40 years. This is the fifth such review that reaffirms the business case established in 2011.
- MISO and PJM are making interregional process enhancement changes to the Joint Operating Agreement in a continuation of efforts to remove undue hurdles to interregional projects
- MISO and PJM are performing a two-part Coordinated System Plan Study for 2018-2019 consisting of a 2018 TMEP Study and a 2018-2019 IMEP Study
- MISO is proposing process improvements with SPP in the form of Joint Operating Agreement changes that include removing the interregional project criteria of $5 million, eliminating the joint model requirement and adding additional benefit metrics for all interregional project drivers. These changes should improve the interregional process with SPP and allow for more successful outcomes.
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BOOK 4
Regional Energy Information
Summary

The MISO footprint is not a monolithic area, but a dynamic region made up of different geographies, different generation mixes, varied pricing and conditions that affect load. Book 4 presents additional regional energy information to show a more complete picture of the regional energy system.

BOOK HIGHLIGHTS

- With its 50 Transmission Owner members, MISO has more than $37.9 billion in transmission assets under its functional control
- Planned generation additions and retirements in the U.S. from 2017 to 2021, separated by fuel type, shows the increased role natural gas and renewable energy sources will play in the future
- Load varies per time of year and geographic location. For calendar year 2017, the highest instantaneous peak load occurred on July 20 at 120,644 MW; the lowest load happened April 9 at 51,898 MW.