



# CHAPTER 1: MTEP OVERVIEW

## 1.1 MISO Overview

Midcontinent Independent System Operator (MISO) is an independent, not-for-profit organization that delivers safe, cost-effective electric power across 15 U.S. states and the Canadian province of Manitoba. MISO is committed to reliable, nondiscriminatory operation of the bulk power transmission system and collaborating with all stakeholders to create cost-effective and innovative solutions for our changing industry.

### Scope of Operations

#### Generation Capacity

- 183,693 MW (market)
- 198,600 MW (reliability)

#### Historic Summer Peak Load (set July 20, 2011)

- 127,125 MW (market)
- 130,917 MW (reliability)

#### Historic Winter Peak Load (set January 6, 2014)

- 109,336 MW (market)
- 117,903 MW (reliability)

#### Transmission

- Approximately 72,000 miles (Reliability Footprint)

#### Balancing Authorities

- 38 Local Balancing Authorities in MISO

#### Network Model

- 293,671 SCADA data points
- 6,692 generating units

Registered Wind	25,974 MW
Registered In-Service Wind Generation Capacity	22,082 MW
Registered Solar Generation Capacity	464 MW
Registered In-Service Solar Generation Capacity	464 MW

### Markets Overview

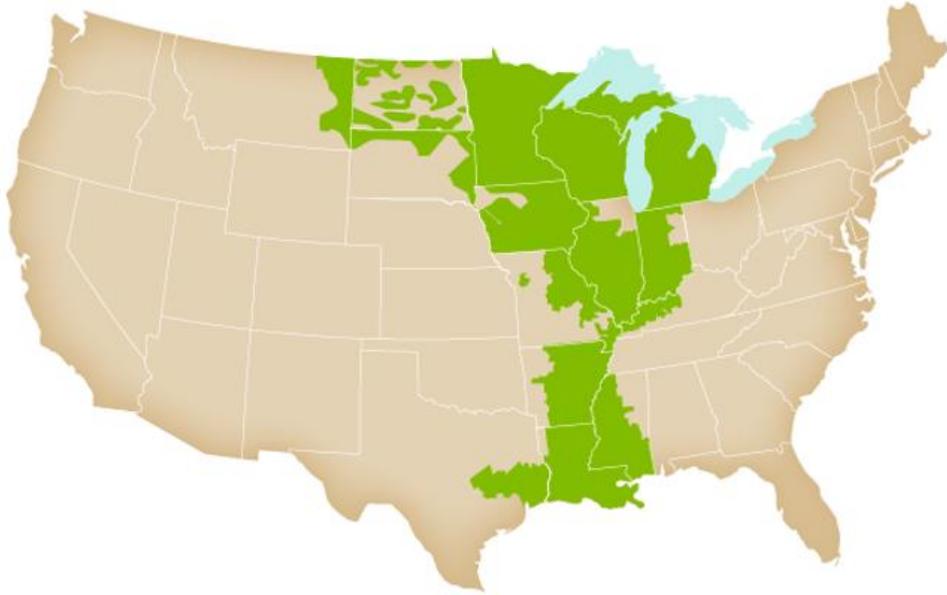
MISO manages one of the world’s largest energy and operating reserve markets using security-constrained economic commitment and dispatch of generation.

The Energy and Operating Reserves Market includes a Day-Ahead Market, a Real-Time Market, and a Financial Transmission Rights market. These markets are operated and settled separately.

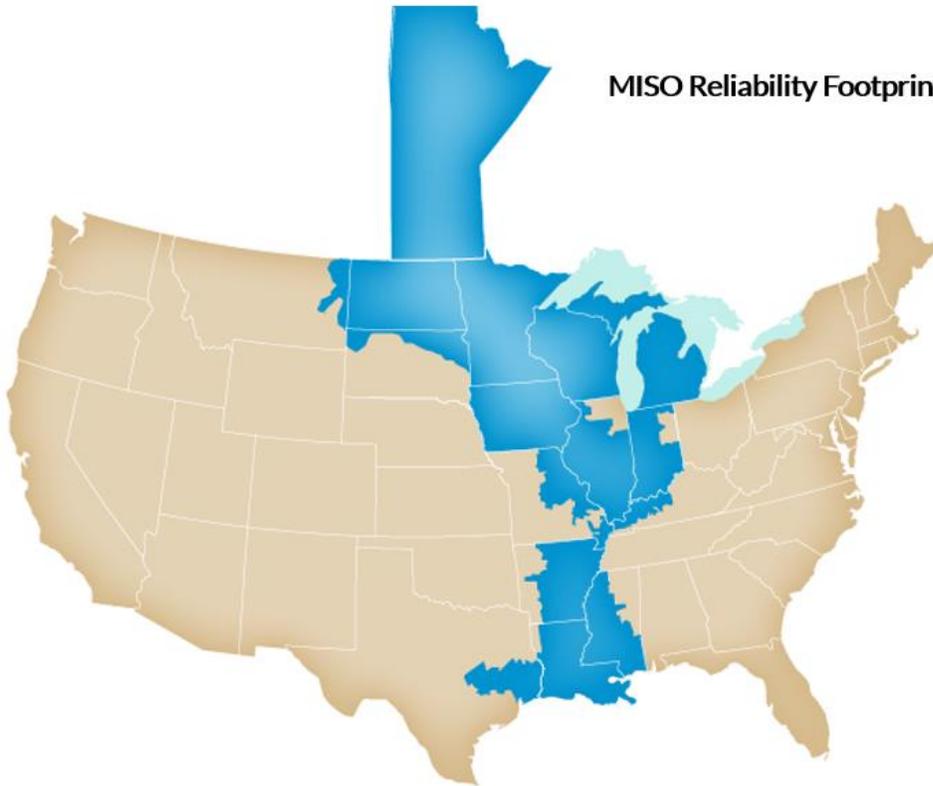
- \$24.7 billion annual gross market charges (2019)
- 471 Market Participants that serve approximately 42 million people

*Corporate data as of July 2020*

### MISO Market Footprint



### MISO Reliability Footprint



## MISO Transmission Infrastructure Investment

MISO is a not-for-profit organization; it does not own any generation or transmission facilities. MISO strictly manages the generation and flow of electricity across the high-voltage lines within its territory. Through the collaborative efforts of a diverse group of industry participants, MISO manages approximately 72,000 miles of transmission lines across 15 states and the Canadian Province of Manitoba.

This iteration of the MTEP report, MTEP20, builds and expands on the 16 prior years of projects since 2003 for a total of over \$42 billion of investment. The last ten cycles are illustrated below (Figure 1.1-1). MISO's proposed new projects for this MTEP cycle are detailed in Section 1.3, Chapter 4 and Appendix A of this report.

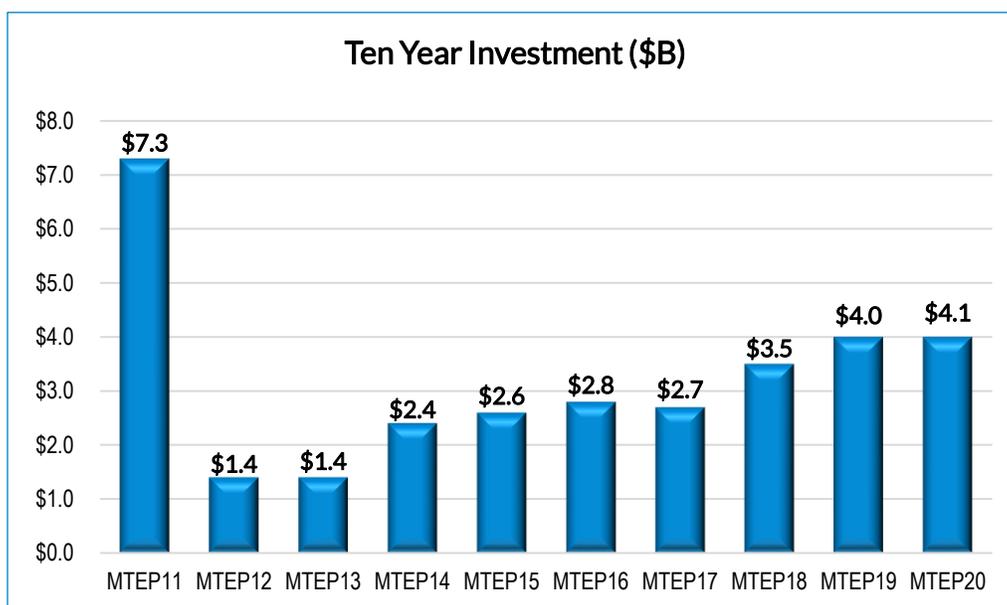


Figure 1.1-1: MTEP investment over the last 10 cycles (\$billion), data as of 10-5-2020

MTEP11 reflects the approval of 17 Multi-Value Projects discussed later in this section and MTEP14 saw an initial rise in investment with the first full year of the South region joining as a MISO member. Consistent growth in infrastructure investment in the MISO footprint over the last several years reflects the predominance in Transmission Owner-driven upgrades to improve efficiency, reliability, and safety in outdated system designs and replace aging assets to make the system more resilient.

MISO's transmission planning responsibilities include the monitoring of previously approved Appendix A projects. MISO surveys all Transmission Owners and Selected Developers every quarter to determine the progress of each project. These [status updates](#) are reported to the MISO Board of Directors and posted quarterly to the MISO Transmission Expansion Plan page at [misoenergy.org](http://misoenergy.org)<sup>1</sup>.

Full archived files of all [previous MTEP Reports](#) can be accessed via the MISO Transmission Expansion Plan page at [misoenergy.org](http://misoenergy.org).

<sup>1</sup> MISO Transmission Expansion Plan website address: <https://www.misoenergy.org/planning/planning/>

## Transmission Facility Investment

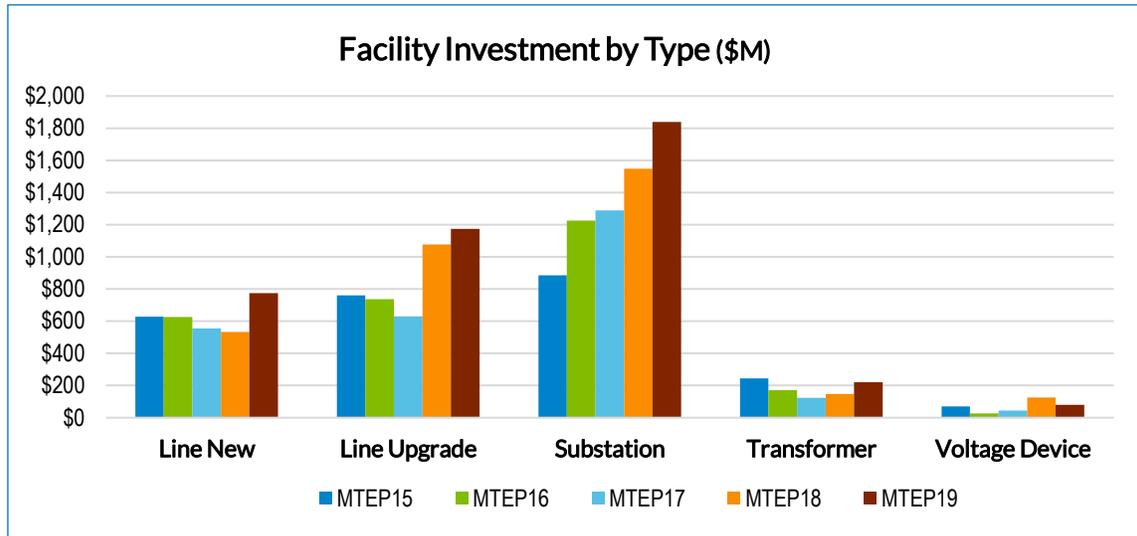


Figure 1.1-2: Appendix A Project data for previously approved five MTEP cycles

## MTEP20 Nameplate Fuel Capacity

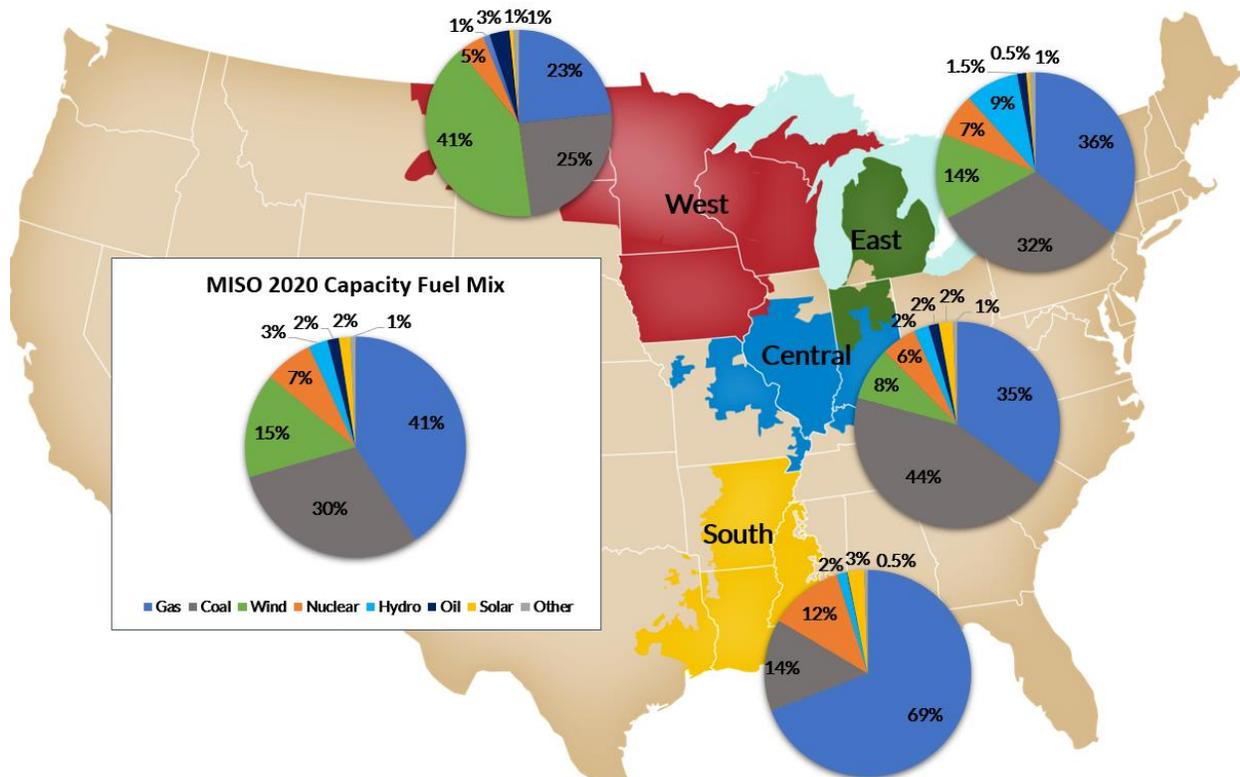


Figure 1.1-3: MTEP20 Nameplate dispatchable capacity (MW) by fuel type in year 2020

## Line Miles Summary

MISO has approximately 68,000 circuit-miles of transferred functional control transmission lines serving as the backbone of the footprint (Figure 1.1-4) in the United States. Currently, the West region holds 40% of total footprint line miles, the South region holds 24%, the Central region holds 20%, and the East at 16%.

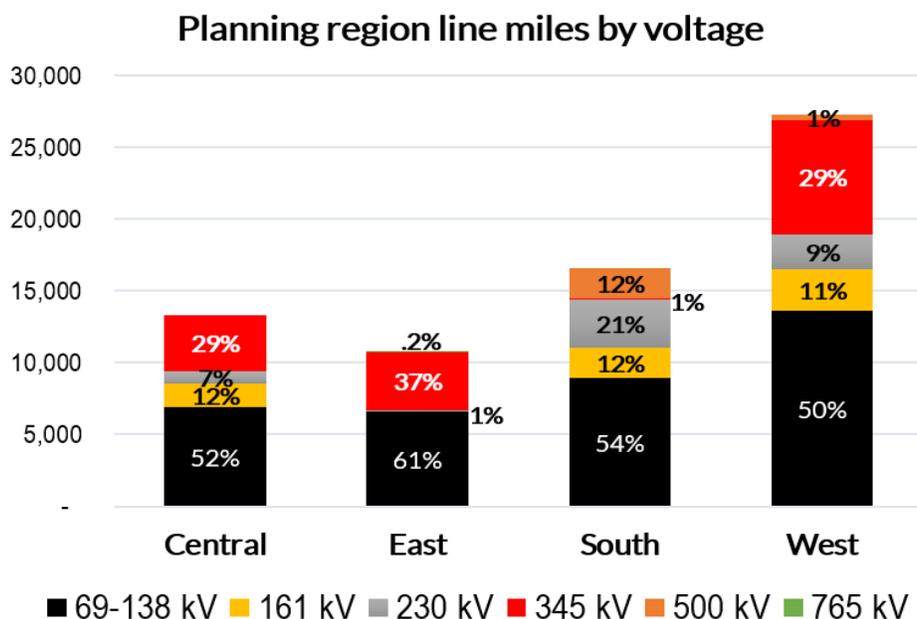


Figure 1.1-4: 2020 in-service transferred circuit miles by voltage class (kV)

## Multi-Value Project Portfolio Status Update

The 17 Multi-Value Projects (MVP) are a regional portfolio of high voltage transmission projects, developed and approved in MTEP11 to support public policy, reliability and economic needs throughout the MISO footprint<sup>2</sup>. The cost and schedule of the MVP portfolio is monitored and reported quarterly (see: [MVP Dashboard](#) at [misoenergy.org](#)). As of the second quarter of 2020, 15 MVPs have gone into service.

In accordance with Attachment FF of the Tariff, MISO provides an updated annual view into the projected benefits of the MVP portfolio by recreating the analysis performed for the original business case. MTEP20 will feature a full ‘triennial’ review, where all the benefit metrics calculated in the original business case are reassessed using the latest MTEP20 system planning information and models. The MVP Review report and detailed business case spreadsheet will be available on the MISO public website (see: [Multi-Value Projects](#) at [misoenergy.org](#)), with an expected completion and posting in Q4 2020.

<sup>2</sup> When the MVP portfolio was approved, the MISO footprint did not include MISO South

## Planning Guiding Principles

- Make the benefits of an economically efficient electricity market available to customers by identifying transmission projects which provide access to electricity at the lowest total electric system cost.
- Develop a transmission plan that meets all applicable NERC and Transmission Owner planning criteria and safeguards local and regional reliability through identification of transmission projects to meet those needs.
- Support state and federal energy policy requirements by planning for access to a changing resource mix.
- Provide an appropriate cost allocation mechanism that ensures that costs of transmission projects are allocated in a manner roughly commensurate with the projected benefits of those projects.
- Analyze system scenarios and make the results available to state and federal energy policy makers and other stakeholders to provide context to inform choices.
- Coordinate planning processes with neighbors and work to eliminate barriers to reliable and efficient operations.

## 1.2 MISO Transmission Planning Process

A goal of the MTEP report is to satisfy the regulatory requirements as specified in Federal Energy Regulatory Commission Orders and the ISO Agreement. The report provides an annual snapshot with results and recommendations from the continuous planning processes MISO undertakes. MISO's planning process follows established guiding principles to ensure reliability, support policy requirements, and enable a competitive market to benefit all customers (see figure 1.2-1 planning regions).

MISO will continue to follow federal and state policy as well as monitor fuel prices, plant retirements, and announced member plans for any changing industry trends. The ability not only to meet peak demand, but to move bulk power from resource areas to load centers across the footprint in all hours of the day will be needed to maintain system reliability and improve efficiency with the evolving resource fleet. Regional planning solutions will play an essential role in optimizing the natural and geographic diversity of these resources.

Periodically, the System Planning Committee of the Board of Directors provides input into MISO's Planning Guiding Principles. The most recent review and approval occurred in March 2019.

### Planning Functions

The planning process includes these functions, which are described in detail in the [Transmission Planning Business Practices Manual](#)<sup>3</sup>.

- Model development
- Generator interconnection planning
- Transmission service planning
- Cyclical regional expansion planning activities
- Interregional coordination with neighboring transmission planning regions
- System Support Resource studies for unit suspension or retirement
- Transmission-to-Transmission interconnection
- Load interconnections
- Focus studies

<sup>3</sup> <https://www.misoenergy.org/legal/business-practice-manuals/>

MISO addresses current dramatic changes in the projected resource mix in its current strategic vision, which focuses on the key trends of de-marginalization, decentralization and digitalization.

Furthermore, MISO identified the critical themes to address the associated challenges and opportunities: availability, flexibility and visibility. Understanding these resource characteristics will be key to understanding the characteristics that will directly influence the composition and volume of new interconnection requests.

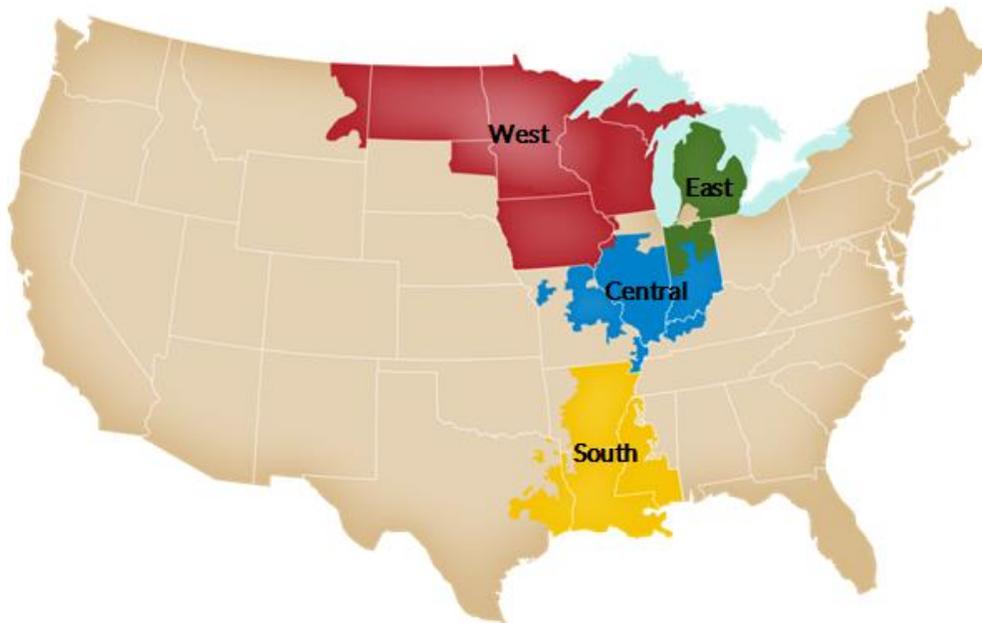


Figure 1.2-1: MISO footprint planning regions

## Project Input and Stakeholder Coordination

Each planning cycle commences with regional model development; identification of potential expansions from the local planning processes of the Transmission Owners; identification and selection of transmission needs driven by public policy requirements to be included as transmission issues; and identification by stakeholders or MISO staff of potential expansions that address the transmission issues. Each cycle concludes with recommendations to the MISO Board of recommended solutions to the transmission issues evaluated.

Transmission Owner plans developed through local planning processes are included in the beginning of each regional planning cycle as potential solutions to local transmission issues identified by the Transmission Owners.

MISO's regional planning process makes evaluations – with stakeholder input from the Sub-regional Planning Meetings, the Planning Subcommittee, and the Planning Advisory Committee – throughout the cycle to develop expansion plans to meet the needs of the system. This multi-party collaborative process allows analysis of all projects with regional and inter-regional impact for their combined effects on the Transmission System. Moreover, the design of this collaborative process ensures that the MTEP addresses transmission issues within the applicable planning horizon in an efficient and cost-effective manner, while considering the input of stakeholders.

## MISO's planning process ensures local needs are integrated with regional requirements

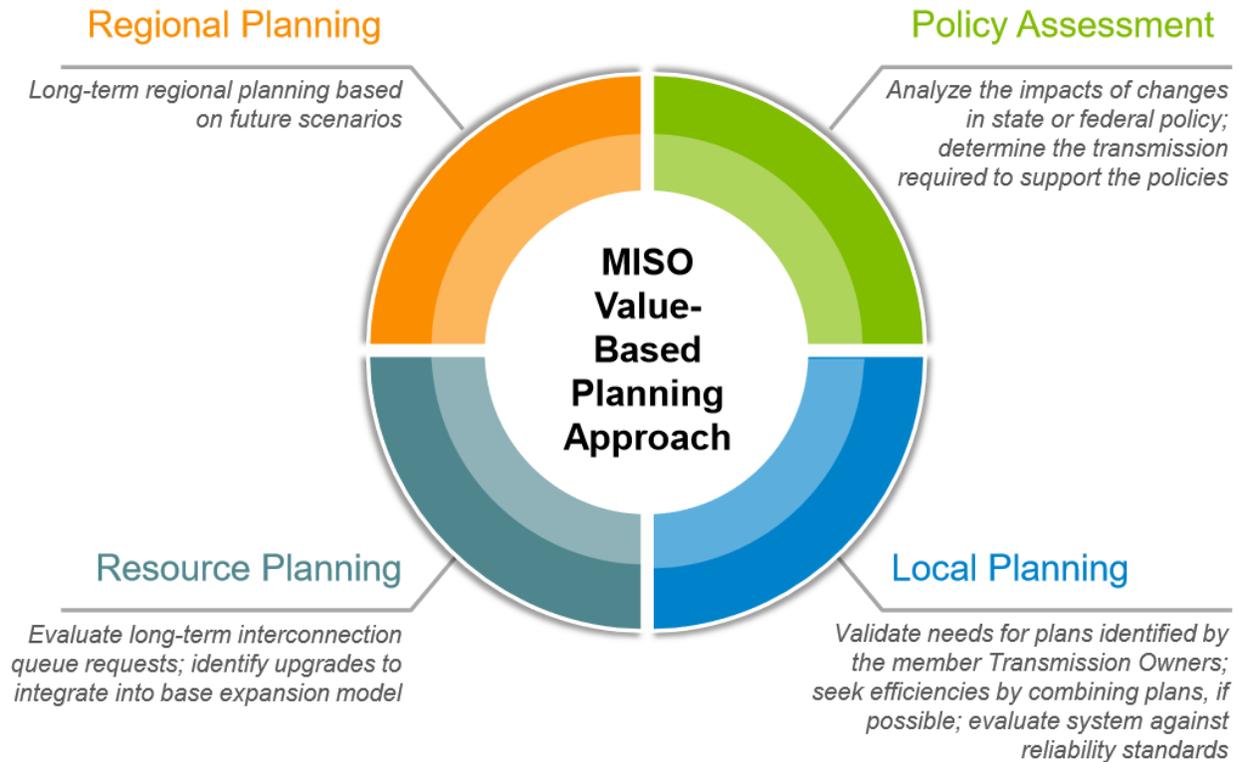


Figure 1.2-2: The MISO Value-Based Planning approach

### Key Planning Cycle Milestones

While following the MISO value-based planning approach (Figure 1.2-2), key milestones in the typical MTEP development process include requirements and timelines for data submittal, review, and comment at each of these milestone points as described in the [Transmission Planning Business Practices Manual](#) posted on the MISO public website.

- Model development
- Identification and selection of transmission needs driven by public policy requirements to be included as transmission issues
- Testing models against applicable planning criteria
- Development of possible solutions to identified transmission issues
- Selection of preferred solution
- Determination of funding and cost responsibility
- Monitoring progress on solution implementation

## Planning Analysis Methods

Planning analyses performed by MISO test the transmission system under a wide variety of conditions using standard industry applications to model steady state powerflow, angular and voltage stability, short-circuit, and economic parameters, as determined appropriate by MISO to be compliant with applicable criteria and the Tariff. MISO collaborates with Transmission Owners, other transmission providers, transmission customers, and other stakeholders to develop appropriate planning models that reflect expected system conditions for the planning horizon.

[Models](#) are available to stakeholders with security measures as provided for in the Transmission Planning Business Practices Manual. MISO provides opportunity for stakeholders to review and comment on the posted models before commencing planning studies.

## Project Approval

MISO staff formally recommends a set of projects to the MISO Board of Directors for review and approval after MISO completes an independent review of all proposed projects and addresses any stakeholder feedback received. These projects make up Appendix A of the MTEP report and represent the preferred solutions to the identified transmission needs of the MISO transmission planning process.

Proposed transmission upgrades with sufficient lead times are included in Appendix B for further review in future planning cycles.

Details of the project proposal process and transmission projects reviewed this cycle are summarized in Section 1.3 and Chapter 4 of the MTEP20 report.

## Interregional Coordination and Planning Studies

On an annual basis MISO works with neighboring transmission planning regions Southwest Power Pool (SPP) and PJM Interconnection (PJM) to identify issues on the seams, perform studies, and jointly evaluate transmission solutions that may be more efficient or effective than a corresponding regional solution. While MISO has a separate Joint Operating Agreement (JOA) with both SPP and PJM that details specific processes and criteria, the high-level interregional coordination activities are similar on each seam:

- 1) Exchange modeling data and other system information (typically performed in Q4).
- 2) Review identified issues on the seam (typically performed in Q1).
- 3) Evaluate whether to perform an interregional study based on the identified issues.

MISO performs joint coordinated system plan (CSP) studies with SPP and PJM on a regular basis, in accordance the timelines and frequencies dictated in their respective JOAs. A CSP study may have a targeted scope or a more complex scope requiring a longer study period, and can include reliability, economic and/or public policy issues. All interregional issues and CSP study efforts are coordinated through a public Interregional Planning Stakeholder Advisory Committee (ISPAC) consisting of representatives and interested parties from each RTO community.

In addition to the joint study efforts with SPP and PJM, MISO performs studies as needed with neighboring entities of the Southeastern Regional Transmission Planning (SERTP) group and the Independent Electricity System Operator of Ontario (IESO). While the study process is less formal, MISO and these entities still meet regularly to review interregional issues and possible areas of collaboration.

Details on planning procedures, on-going studies and stakeholder meetings can be found on the [Interregional Coordination](#) page of the MISO public website (misoenergy.org).

# 1.3 MTEP20 Investment Summary

The MTEP20 cycle proposes 515 new Appendix A projects as justified in this MISO Transmission Expansion Plan and represents \$4.159 billion in transmission infrastructure investment for the MISO region.

## Overview of Tariff-defined Project Types

- **Baseline Reliability Project (BRP)** - Projects are Network Upgrades identified in the base case as required to ensure that the Transmission System is in compliance with applicable national Electric Reliability Organization reliability standards and reliability standards adopted by Regional Reliability Organizations, and applicable within the Transmission Provider Region. Baseline Reliability Project costs are allocated to the local Transmission Pricing Zone(s) and recovered through Attachment O by the Transmission Owner(s) developing the projects.
- **Generator Interconnection Project (GIP)** - Projects are New Transmission Access Projects that are associated with interconnection of new generation or the capacity modification of existing generation. Costs are primarily paid for by the interconnection customers with certain exceptions as specified in Attachment FF. Costs of network upgrades rated at 345 kV and above are eligible for 10 percent cost recovery on a system-wide basis.
- **Market Efficiency Project (MEP)** - Projects meet Attachment FF requirements for reduction in market congestion and are eligible for regional cost allocation. Projects qualify as Market Efficiency Projects based on cost and voltage thresholds and are developed to produce a benefit-to-cost ratio of 1.25 or greater. Costs are distributed to benefiting pricing zones, in accordance with Attachment FF of the Tariff.
- **Targeted Market Efficiency Project (TMEP)** - Projects are designed to alleviate historical market-to-market congestion between MISO and PJM Interconnection, while meeting certain cost and construction requirements. The costs of Targeted Market Efficiency Projects are allocated first between MISO and PJM Interconnection by the ratio of each RTO's Day-Ahead and Excess Congestion Fund congestion, offset by historical market-to-market payments. The MISO share of costs for the project is then allocated to beneficiaries using historical nodal load congestion contribution data.
- **Multi-Value Project (MVP)** - Projects meet Attachment FF requirements to provide regional public policy, economic and/or reliability benefits. Costs are shared with loads and export transactions in proportion to metered MWh consumption or export schedules.
- **Other** - Projects included in MTEP20 which do not qualify as Baseline Reliability Projects, New Transmission Access Projects, Targeted Market Efficiency Projects, Market Efficiency Projects, or Multi-Value Projects.
- **Transmission Delivery Service Project (TDSP)** - Projects are required to satisfy a transmission service request. The costs are generally assigned to the requestor.
- **Market Participant Funded Project (MPFP)** - Projects are defined as Network Upgrades fully funded by one or more market participants but owned and operated by an incumbent Transmission Owner.

# Overview of MTEP20 Projects

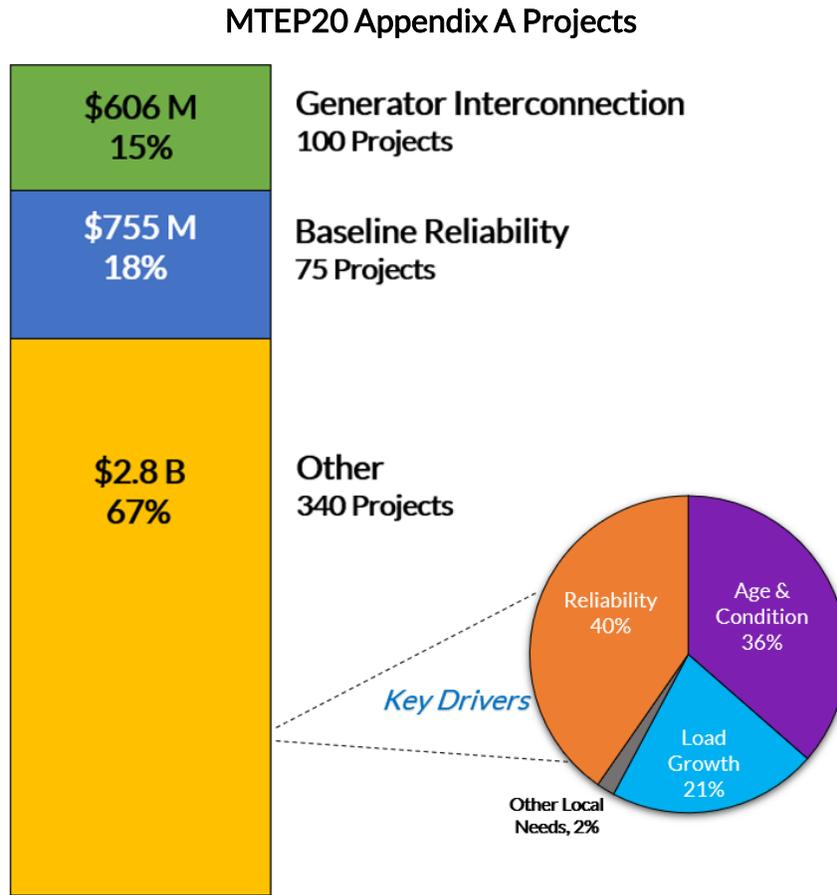


Figure 1.3-1: Appendix A New Project Investment (data as of 10-5-2020)

Of the 515 new Appendix A projects proposed in MTEP20 (Figure 1.3-1), 75 of them are Baseline Reliability; 100 are Generator Interconnection, and 340 are in the Other project category. Investment dollars in the Generator Interconnection category are over double that in the MTEP19 cycle. The remaining categories are similar to MTEP19 investment dollars.

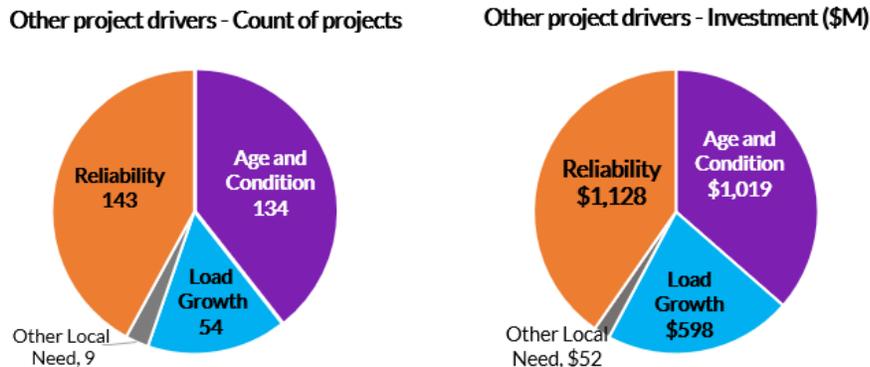


Figure 1.3-2: MTEP20 Appendix A Other category by project count and investment

The majority of Other projects address localized reliability issues, either due to aging transmission infrastructure, which increased from 29% last cycle to 37%, or local non-baseline reliability needs that are not dictated by NERC and regional reliability standards (Figure 1.3-2). Of the 56 projects in MTEP20 that cost \$20 million and above in all categories, 50% of those are categorized as Other to specifically address localized reliability issues.

The remaining projects mostly address distribution concerns, with a small percentage of projects targeting localized economic benefits or line relocations to accommodate other infrastructure.

Breakdown of each project category by planning region (Figure 1.3-3).

### MTEP20 Regional Investment by Project Category

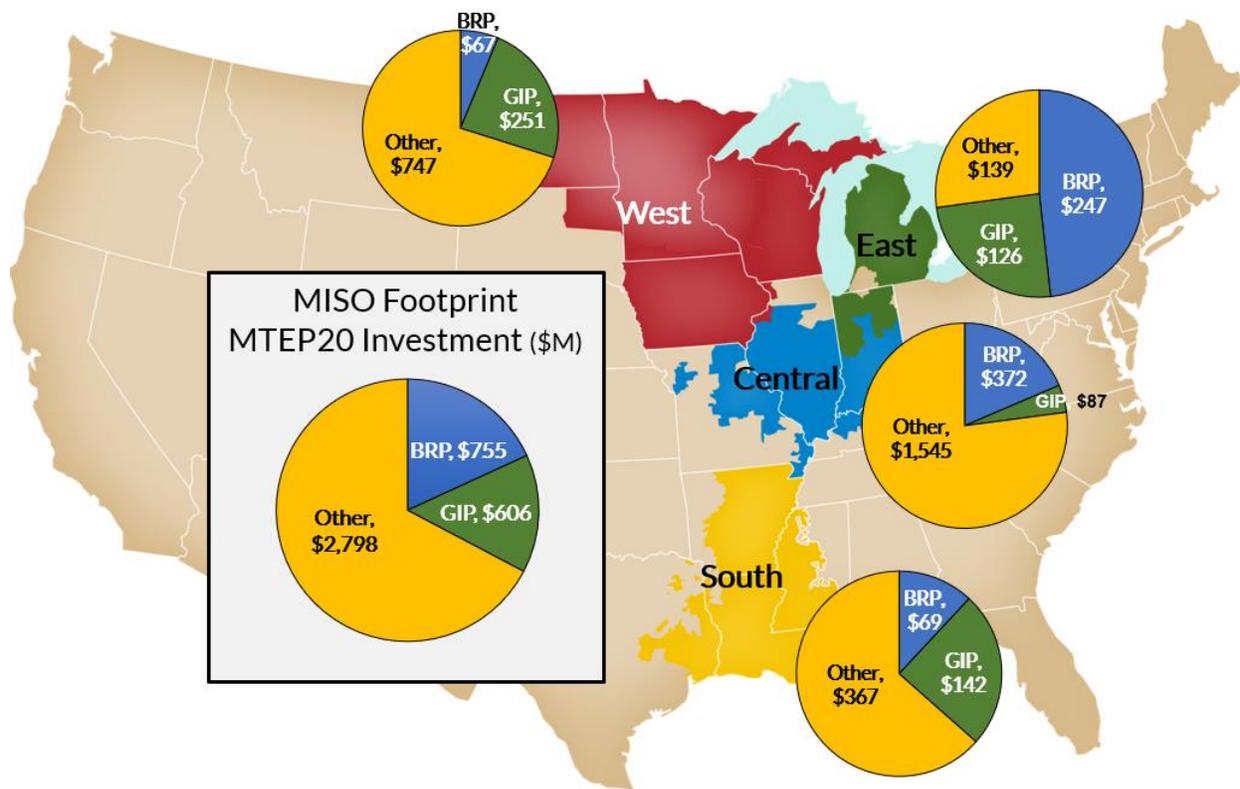


Figure 1.3-3: Regional MTEP20 investment by project category (data as of 10-5-2020)

The new projects recommended for approval in MTEP20 Appendix A are broken down by region and project type (Table 1.3-4).

MISO Region	BRP	GIP	Other	Total
Central	\$371,790,400	\$86,772,496	\$1,545,274,295	\$2,003,837,191
East	\$246,713,000	\$125,980,263	\$138,600,389	\$511,293,652
South	\$69,027,329	\$142,104,417	\$366,891,001	\$578,022,747
West	\$67,333,852	\$251,220,351	\$747,268,406	\$1,065,822,609
<b>Grand Total</b>	<b>\$754,864,581</b>	<b>\$606,077,527</b>	<b>\$2,798,034,091</b>	<b>\$4,158,976,200</b>

Table 1.3-4: MTEP20 Appendix A new project investment by category and planning region (data as of 10-5-2020)

New Appendix A projects are spread over 15 states, with nine states scheduled for more than \$150 million in new investment (Figure 1.3-5; Figure 1.3-6). These geographic trends vary greatly year to year as existing transmission capacity in other parts of the system is consumed and new build becomes necessary.

Consistent with MTEP19, MTEP20 Other projects reflect significant asset replacement in the Central region that implement updated system designs in order to operate more efficiently and reliably. Updating systems from straight buses to ring buses and breaker and a half are a priority for safety and reliability. See Chapter 4 and Appendix A for a detailed list of these projects.

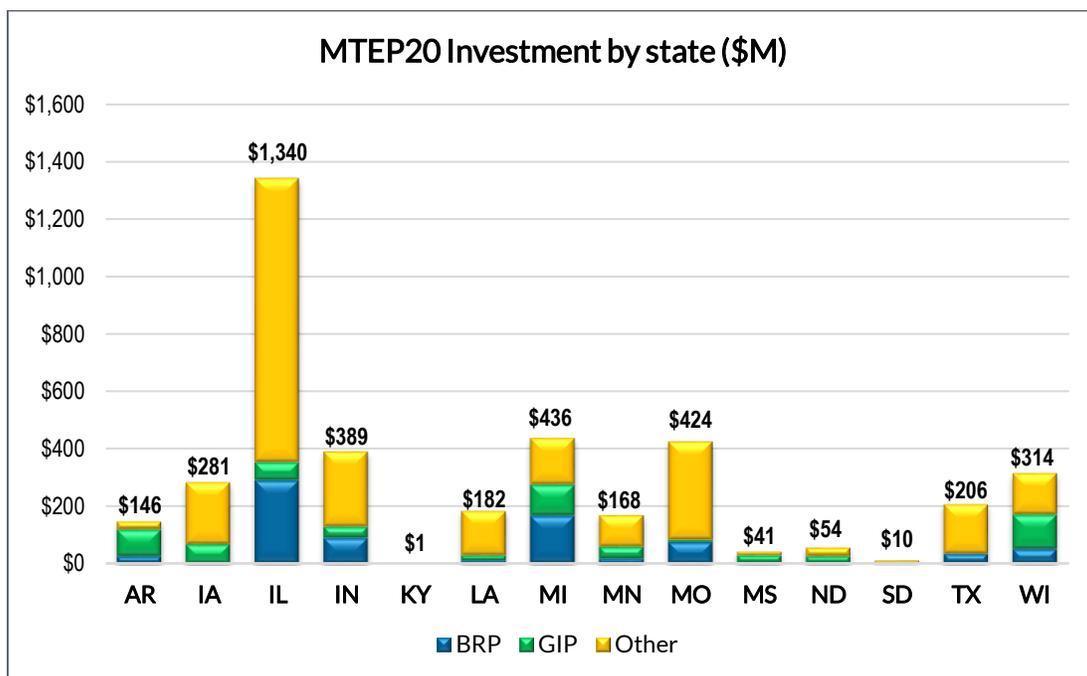


Figure 1.3-5: MTEP20 Appendix A investment categorized by state - (excludes multi-state blanket projects)

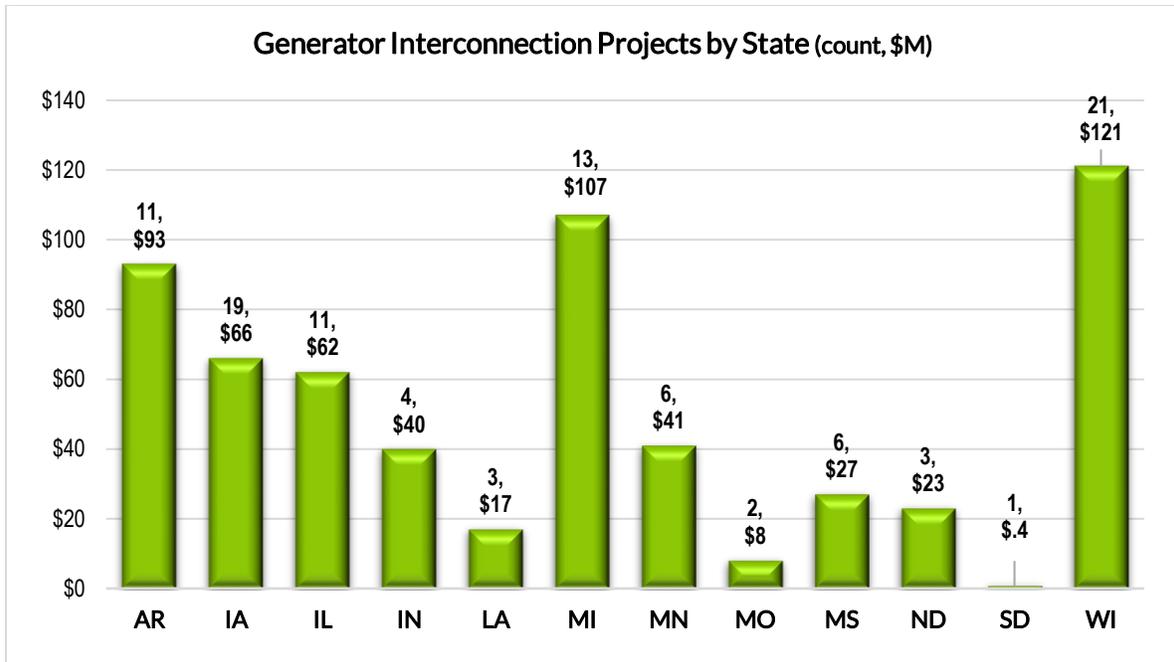


Figure 1.3-6: MTEP20 Appendix A Generator Interconnection projects by state

## Facility Type

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, circuit breakers or various types of transmission lines (Figure 1.3-7).

The majority of facility investment in the MTEP20 cycle, 45%, is dedicated to substation or switching station related construction and maintenance. This includes completely new substations as well as terminal equipment work, circuit breaker additions and replacements, or new transformers. Thirty-seven percent of MTEP facility costs go toward line upgrades, which include rebuilds, conversions and relocations. Eleven percent of facility costs are dedicated to new lines on new right-of-way across the MISO footprint.

Eighty-six percent of MTEP20 projects are declared to go into service by the end of 2023, ninety-five percent by the end of 2024.

## MTEP20 Transmission Investment by Facility Type

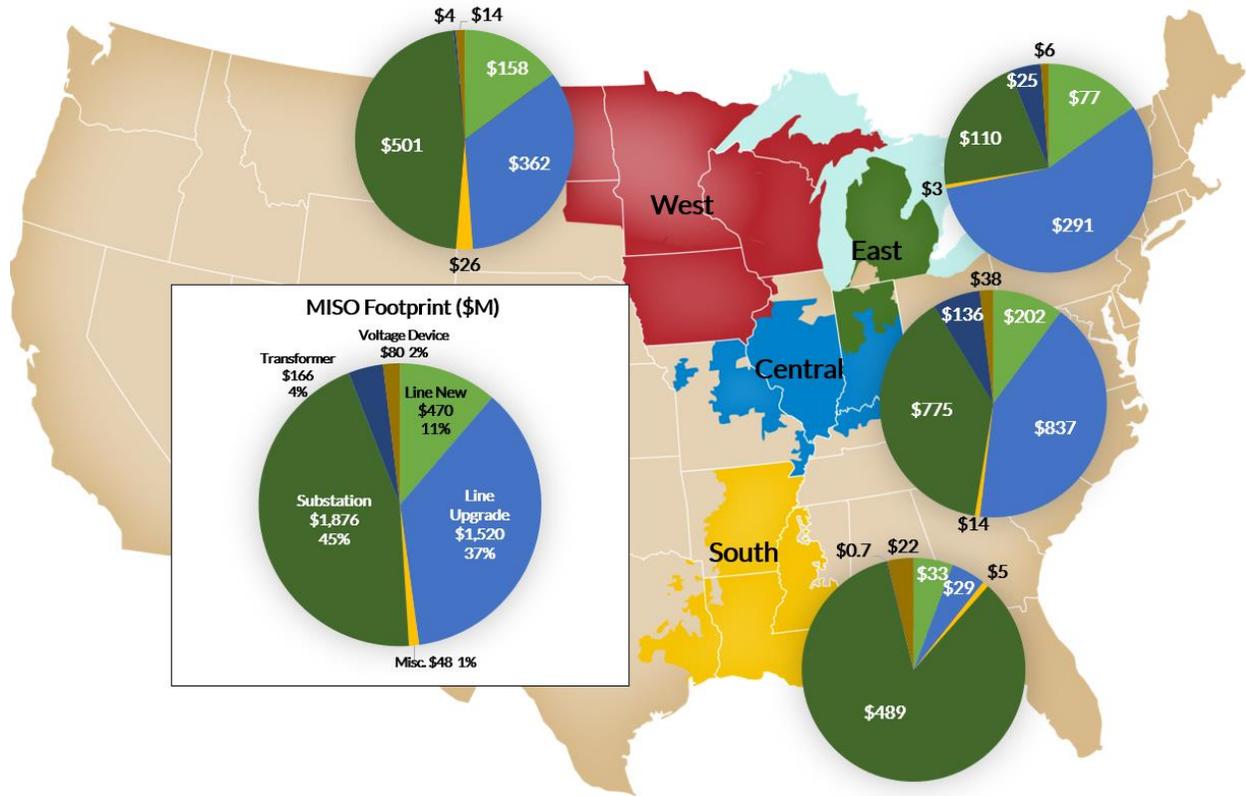


Figure 1.3-7: Facility type for new MTEP20 Appendix A projects by planning region

## Allocation of Costs

MTEP20 includes a total of 39 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. Detailed allocations by pricing zone are provided in Appendix A1.

Indicative rates related to past MTEP cost-shared projects are calculated on an annual basis. Please refer to the reports posted on the MISO public website<sup>4</sup> [here](https://www.misoenergy.org/planning/planning/schedule-26-and-26a-indicative-reports/).

<sup>4</sup> Cost Allocation updates web address: <https://www.misoenergy.org/planning/planning/schedule-26-and-26a-indicative-reports/>

## MTEP Appendix B

MTEP Appendix B contains all projects that have been validated by MISO as the preferred solution to address an identified system need based on current information and forecasts, but where it is prudent to defer the final recommendation of a solution to a subsequent MTEP cycle.

This generally occurs when the preferred project does not yet need a commitment based on anticipated lead-time and there is still some uncertainty as to the prudence of selecting this project over an alternative project given potential changes in projected future conditions. MTEP Appendix B is limited to Baseline Reliability Projects and Other Projects and will be reviewed by MISO in subsequent cycles.

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