Long Range Transmission Planning

Fall Meeting: Energy Systems Integration Group

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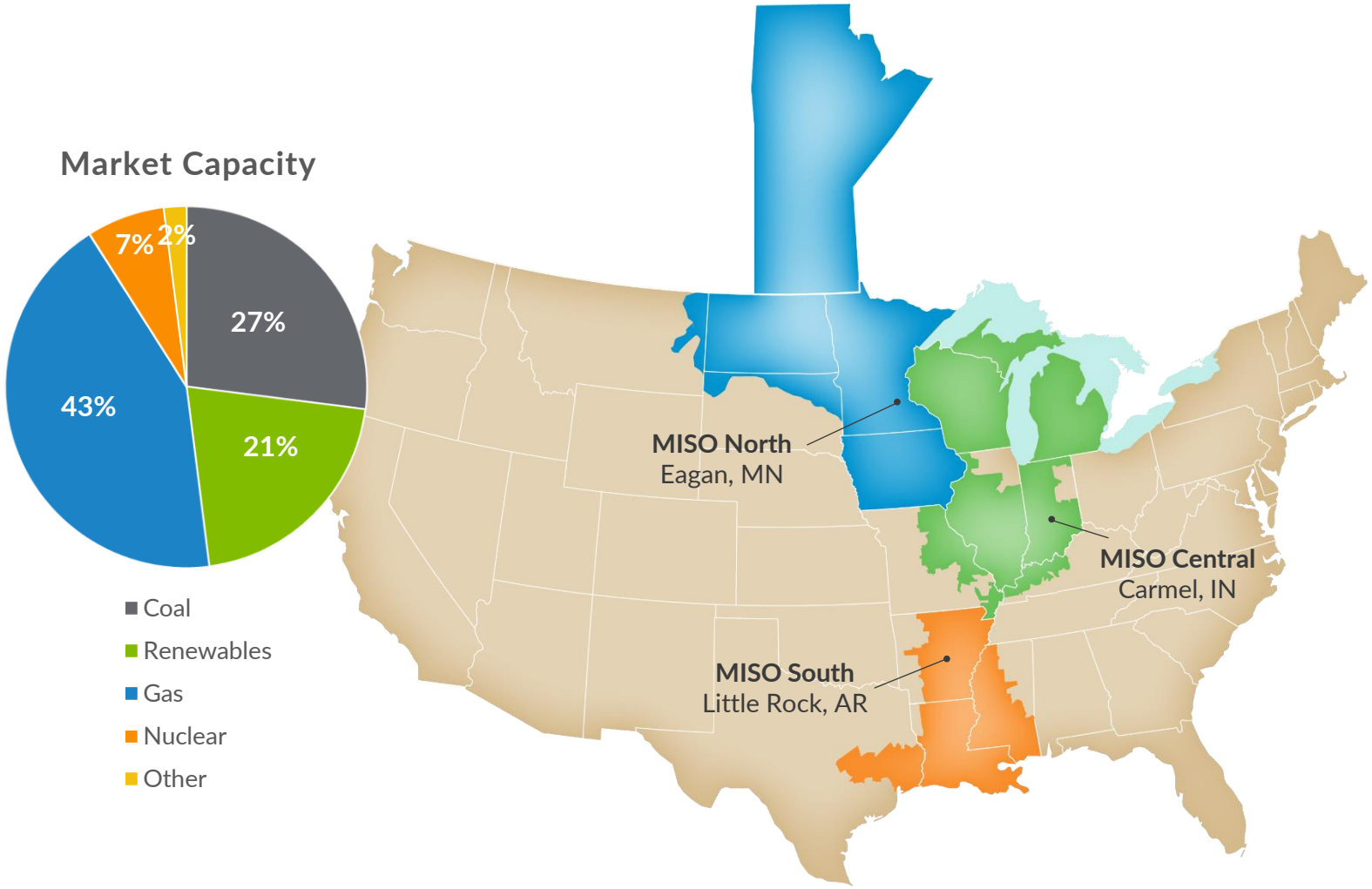
Aubrey Johnson,
Vice President of System Planning,
Modeling & Competitive Transmission

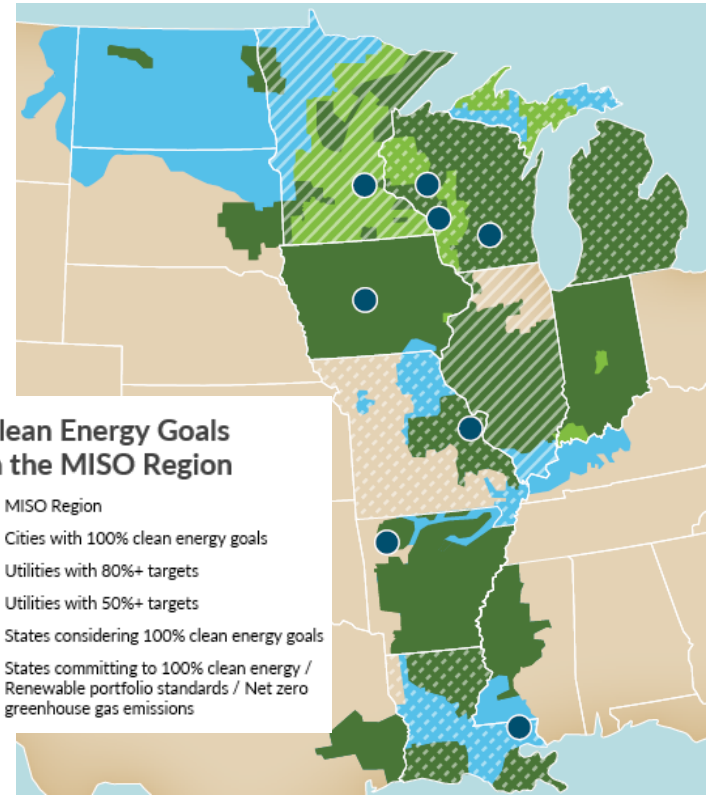
MISO works collaboratively and transparently with stakeholders to enable the reliable delivery of low-cost energy through efficient, innovative operations and planning



- 15 states + Manitoba
- 42 million customers
- $22 billion market
- 6,800+ generation units with 189,000+ MW generation capacity
- 72,000 miles of high voltage transmission lines
- 180+ member utilities
- 471+ market participants

The system is evolving and will continue to evolve toward a more complex and less predictable future for the region

Ambitious decarbonization goals



Past

- Primarily controllable resources
- Predictable resource outages
- Relatively predictable weather
- Focus on providing energy in *the worst peak load hour* during the summer

Present

- Transitioning resource mix
- Less predictable resource outages or unavailability
- Growing uncertainty in weather
- Greater interdependence between utilities, states and RTOs
- Focus on providing energy on *the worst day in each season*

Future

- Primarily weather-dependent resources
- Less predictable resource outages or unavailability
- Less predictable weather
- Increasing scarcity of essential reliability attributes
- Increasing electric load
- Increasing importance of accurate load and renewable forecasting
- Focus on providing energy for *the worst week in each season*

Through its Reliability Imperative, MISO is positioning the region to reliably support and enable the future fleet

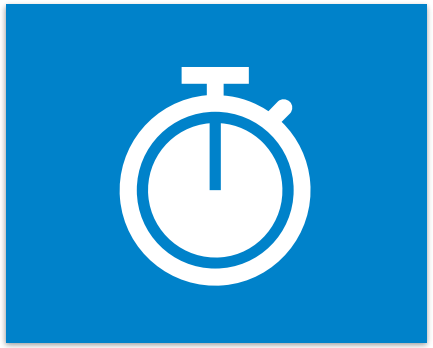
Market Redefinition
Aims to ensure that resources with needed capabilities and attributes will be available in the highest risk periods across the year

Transmission Evolution
Assesses future transmission needs holistically, reflecting utility/state plans for new generation; considers potential cost-allocation changes

System Enhancements
Transforms MISO's legacy platform into a flexible, upgradeable, and secure system that can evolve for years to come; will also integrate advanced technologies to process increasingly complex information

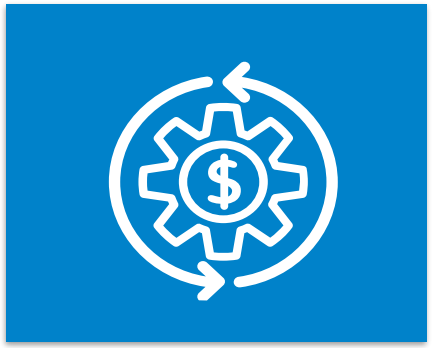
Operations of the Future
Focuses on the skills, processes, and technologies needed to ensure MISO Operations can effectively manage the grid into the future under increased complexity

Long Range Transmission Planning is a regional planning effort focused on expanding transmission given the changing resource portfolio



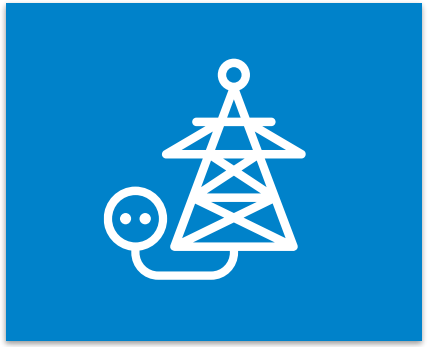
Reliable System

Maintain robust and reliable performance in future with greater uncertainty and supply variability



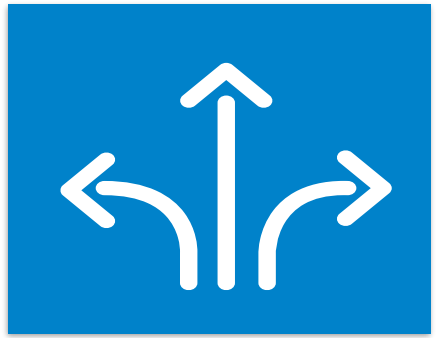
Cost Efficient

Enable access to lower-cost energy production



Accessible Resources

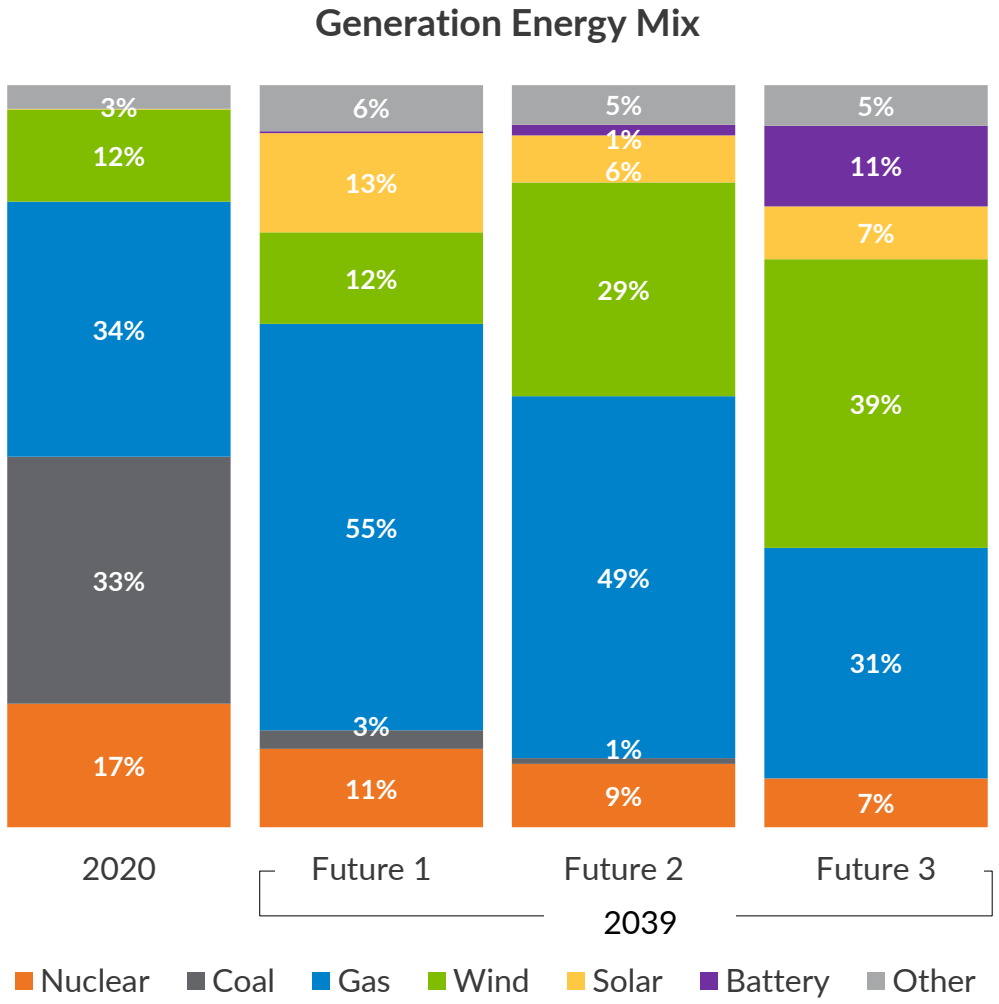
Provide cost-effective solutions allowing the future resource fleet to serve load across the footprint



Flexible Resources

Allow more flexibility in the fuel mix for customer choice

The Futures incorporate and build upon member plans to inform the resource transition and changing demand patterns



Future 1

TRANCHE 1

- Footprint develops in line with 100% of utility IRPs and 85% of utility/state announcements
- Emissions decline as an outcome of utility plans
- Load growth is consistent with pre-2019 trends

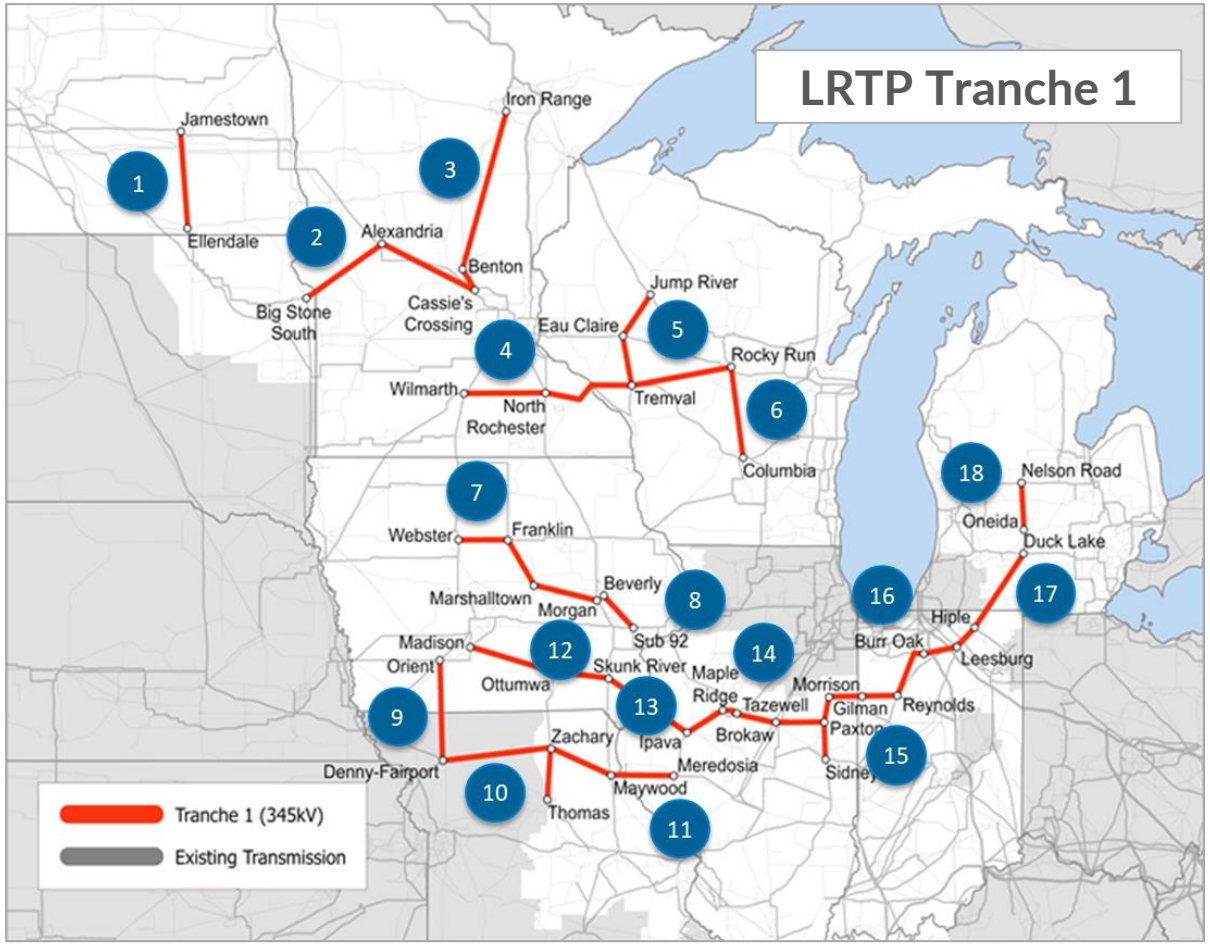
Future 2

- Companies/states meet their goals, mandates
- Footprint-wide carbon reduction of 60%
- Energy increases 30%, driven by electrification

Future 3

- Changing federal and state policies support footprint-wide carbon reduction of 80%
- Increased electrification drives a footprint-wide 50% increase in energy demand

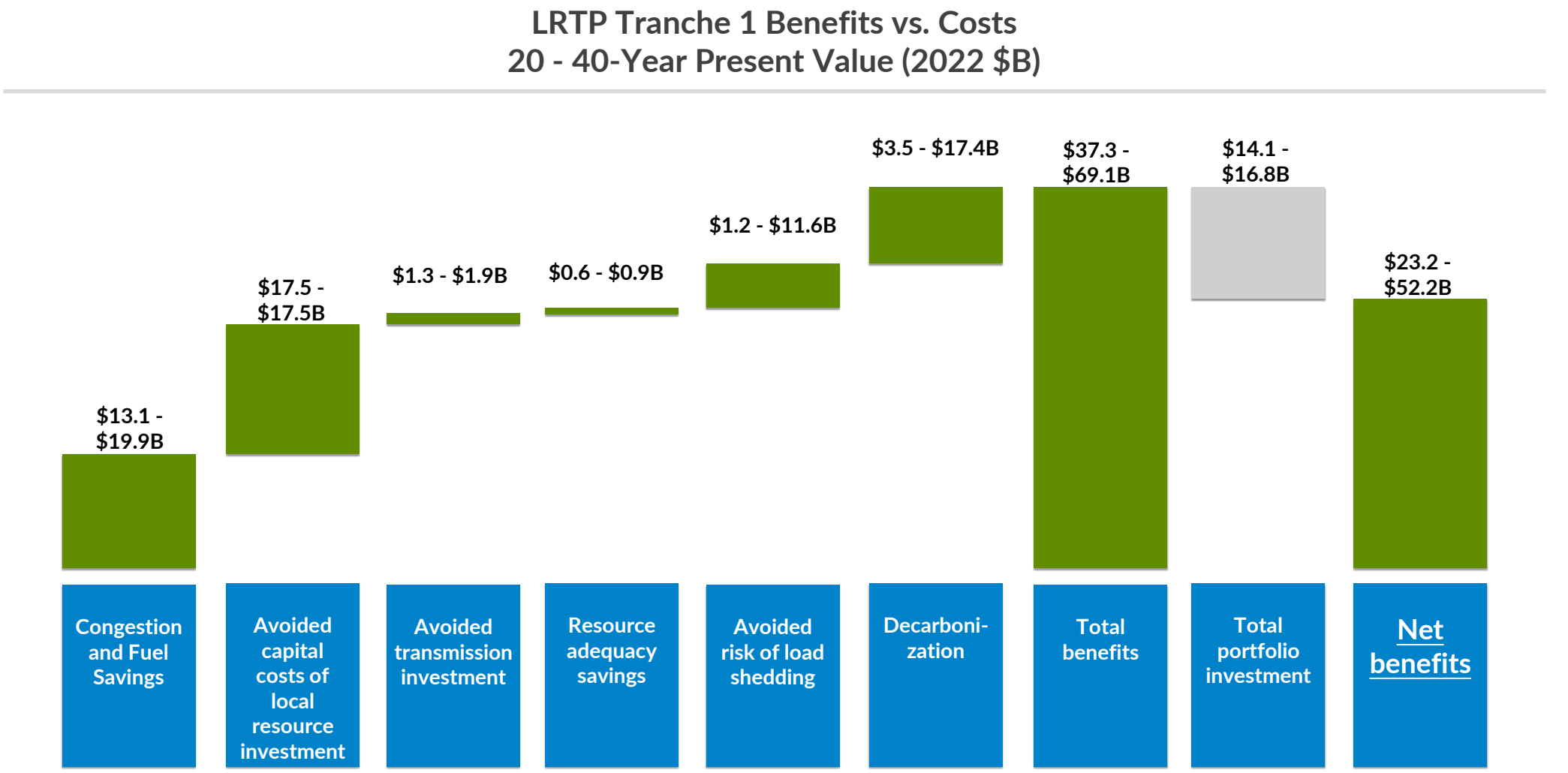
Tranche 1 is the culmination of more than two years of planning activities and includes 18 projects across the MISO Midwest subregion estimated at $10.3B



ID	Project Description	Est. Cost ($M, 2022)
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 Clair – 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 – Paxson 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**

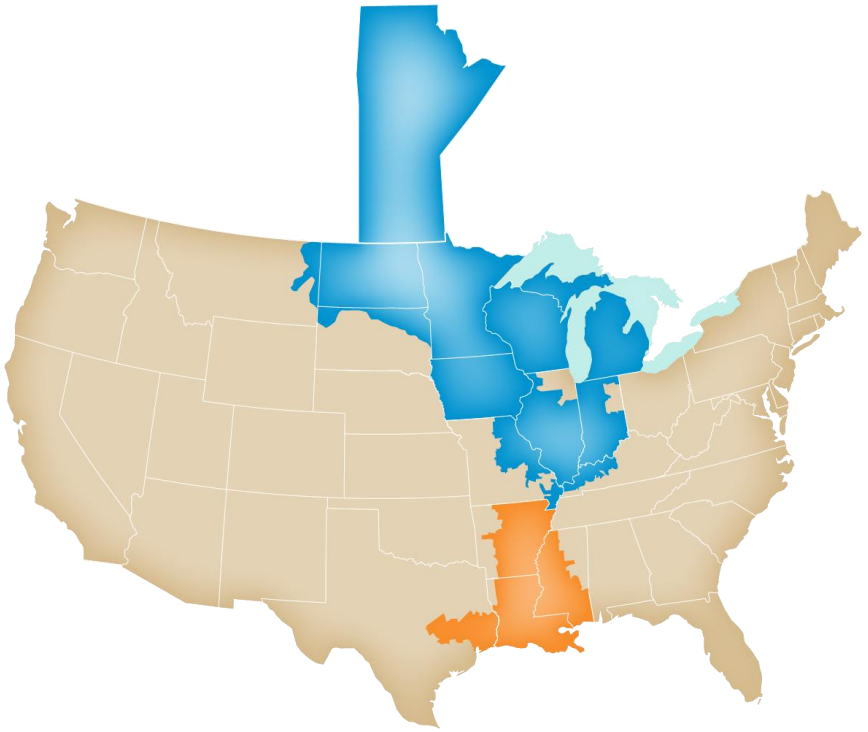
Assumption on all in-service dates is by 2030
Costs as of 6/1/2022, and are subject to change (costs represent "overnight" costs)

Current analysis indicates Tranche 1's total economic benefits significantly exceed costs



Calculations are generally based on conservative assumptions including the analysis period and discount rate

A Multi-Value Project (MVP) subregional cost allocation approach will apply to Tranches 1 and 2, and evolve with future tranches



- Consistent with FERC's "costs roughly commensurate with benefits" requirement
- Project portfolio must have benefits spread broadly within a subregion (Midwest or South)

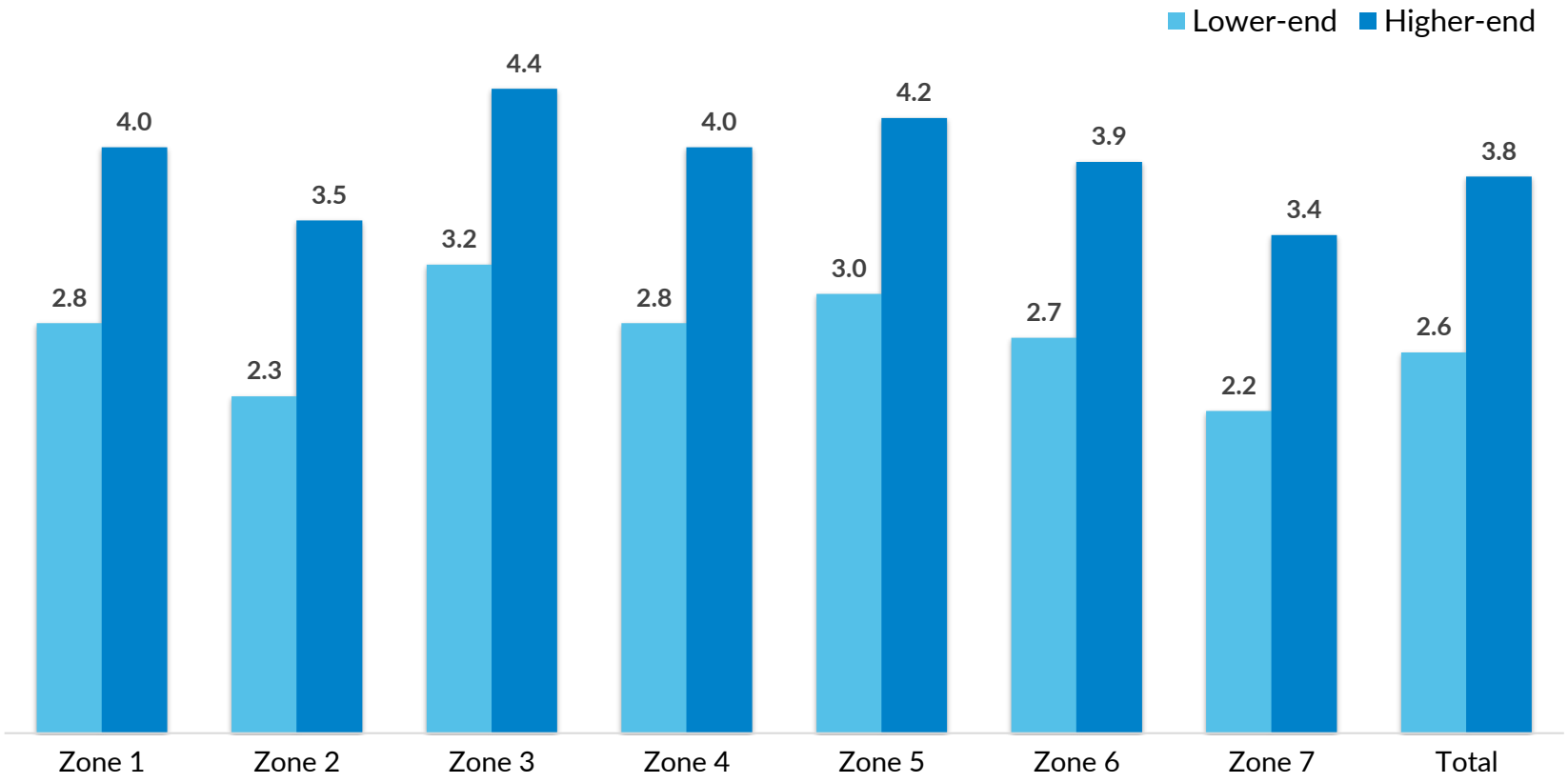
Allows uniform, subregional MVP postage stamp rates in Midwest and South Subregions

Cost of subregional portfolios allocated entirely to the subregion where benefits are broadly spread

Retains MISO-wide cost allocations for MVP portfolios that benefit the entire footprint

Benefits will be broadly distributed across the Midwest subregion and deliver a benefit-to-cost ratio of at least 2.1 for all zones

Range of Benefit/Cost Ratio by Cost Allocation Zone
(20-year present value, 6.9% Discount Rate)



The next step in Long Range Transmission Planning is to develop Tranche 2, which begins with a refresh of key Futures data inputs

EXISTING DEFINITIONS

Future 1

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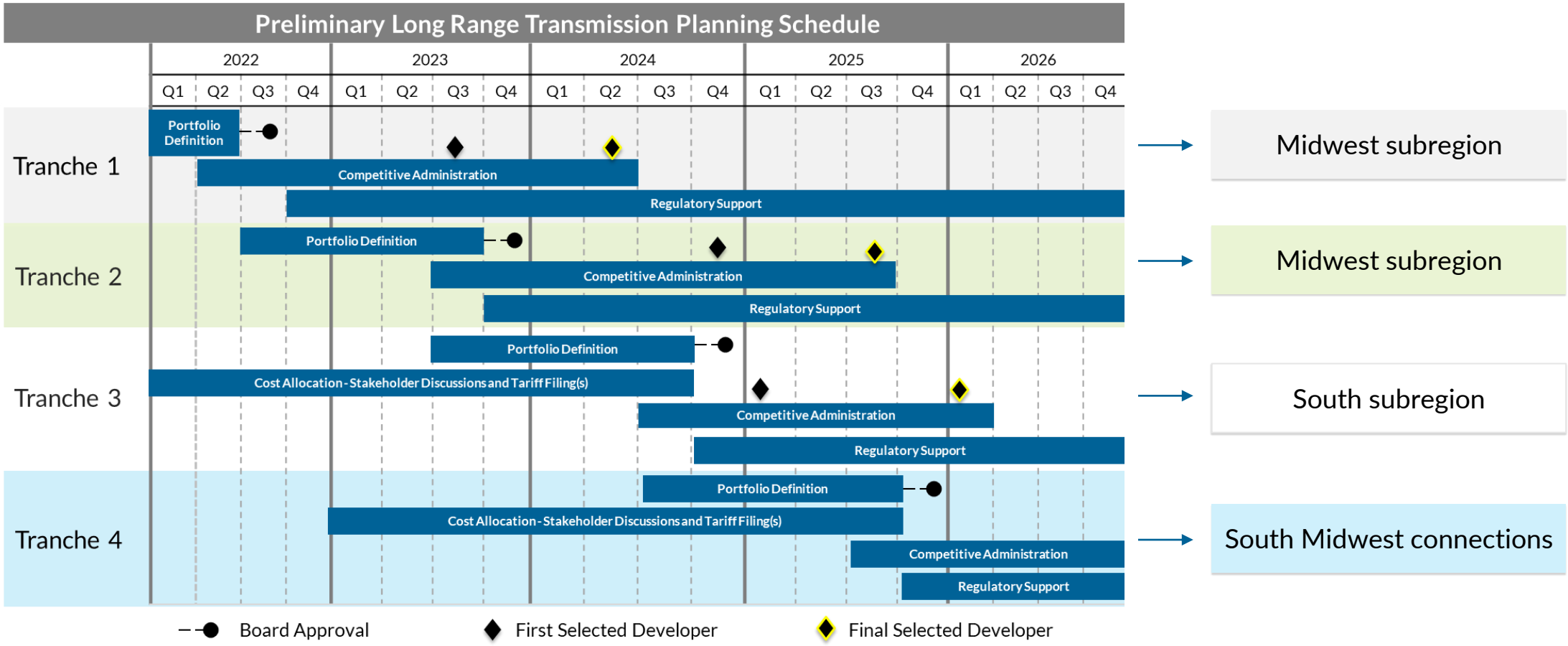
UPDATES

- State and member plans
  - Announced additions, retirements, carbon goals, renewable targets
  - Updated Integrated Resource Plans
- Capital, operating and fuel costs
- Planning Reserve Auction data
- Additions and retirements from MISO's Generator Interconnection Queue and FERC retirement process reforms
- Generation fleet changes influenced by the Inflation Reduction Act

MISO is adapting to an iterative, ongoing planning approach as it delivers solutions for one or more tranches while planning for subsequent tranches in parallel



Represents earliest potential Board approvals
Timelines for Tranches 2, 3 and 4 may exceed durations shown

The first of its kind, the SPP-MISO Joint Targeted Interconnection Queue (JTIQ) study overlapped with Tranche 1 and demonstrated exemplary interregional coordination

- Addresses evolving resource mix of both RTOs and transmission capacity along the SPP-MISO seam
- Improves reliability by fully resolving targeted transmission constraints identified in the study
- Increases interregional transfer capability
- Enhances ~28.6 GW in combined system interconnection capacity
- Aligned MISO-SPP interconnection processes (Relative Queue Priority: First-Ready, First-Served)