Grid Scarcity in the Era of Renewable Energy Penetration: Michigan and Texas Case Study

Dan Scripps
Michigan Public Service Commission

Meeting of ERRA Member Chairmen, Presidents and Commissioners
October 28, 2024 | Tirana, Albania

Hosted by:

Overview of presentation

- Texas Case Study
  - Overview of Texas regulatory framework and ERCOT market structure
  - Lessons learned from Competitive Renewable Energy Zone (CREZ) initiative
- Michigan/ MISO Case Study
  - Overview of Michigan/ MISO regulatory and market structures
  - MISO transmission initiatives
    - Multi-Value Projects (MVPs)
    - Long-Range Transmission Planning (LRTP) initiative
    - MISO-SPP Joint Targeted Interconnection Queue (JTIQ) initiative
  - Challenges associated with the MISO Generation Interconnection Queue
  - Michigan efforts to expand transmission availability/ ease interconnection
- Summary of Key Considerations and Lessons

Jurisdictional Issues: States, the federal government (and Texas!)

- In US, Federal Power Act allotted jurisdiction between states and federal government
- US grid split into three interconnections – Eastern, Western, and Texas
- In 1996, Federal Energy Reg. Commission (FERC) issued two landmark orders:
  - Order 888: requires electric utilities to provide nondiscriminatory access to transmission system
  - Order 889: requires Tx owners to share information via Open Access Same-time Information System (OASIS)
- FERC subsequently encouraged utilities to join Regional Transmission Organizations (RTOs)
- BUT: Texas Interconnection sits outside of FERC jurisdiction

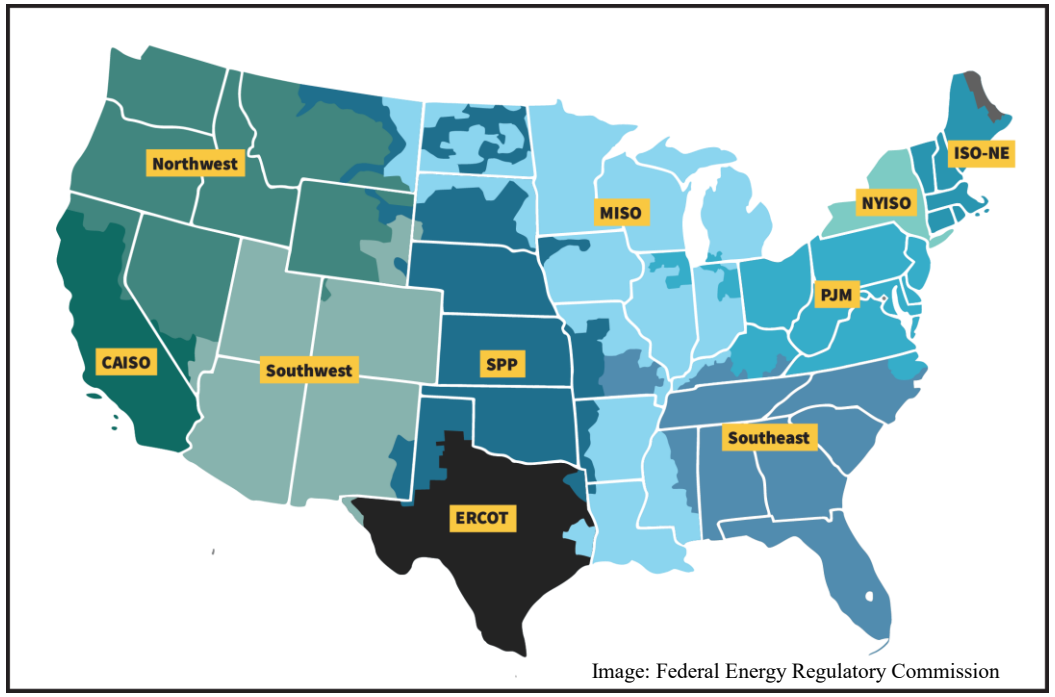
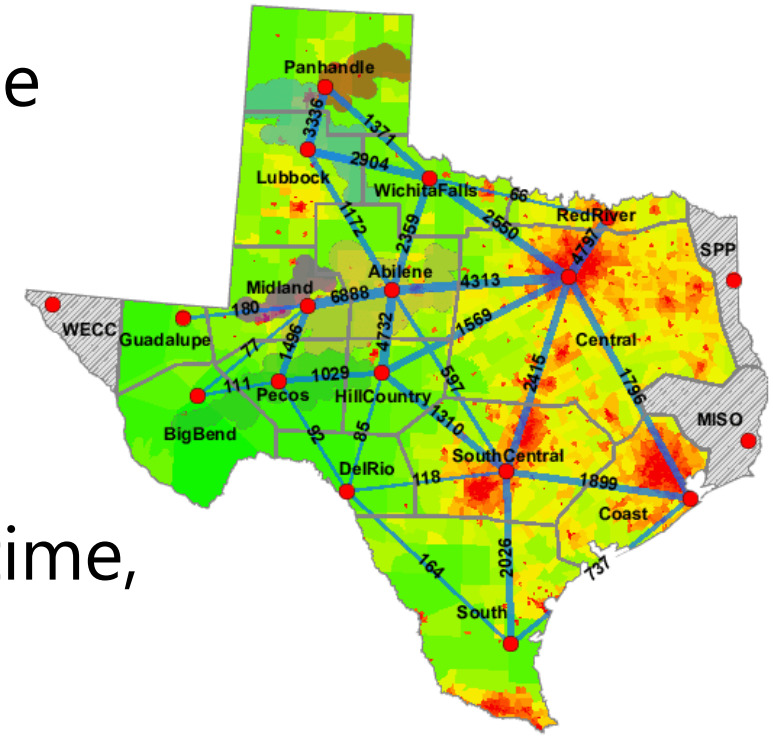


Image: Federal Energy Regulatory Commission

Texas Case Study

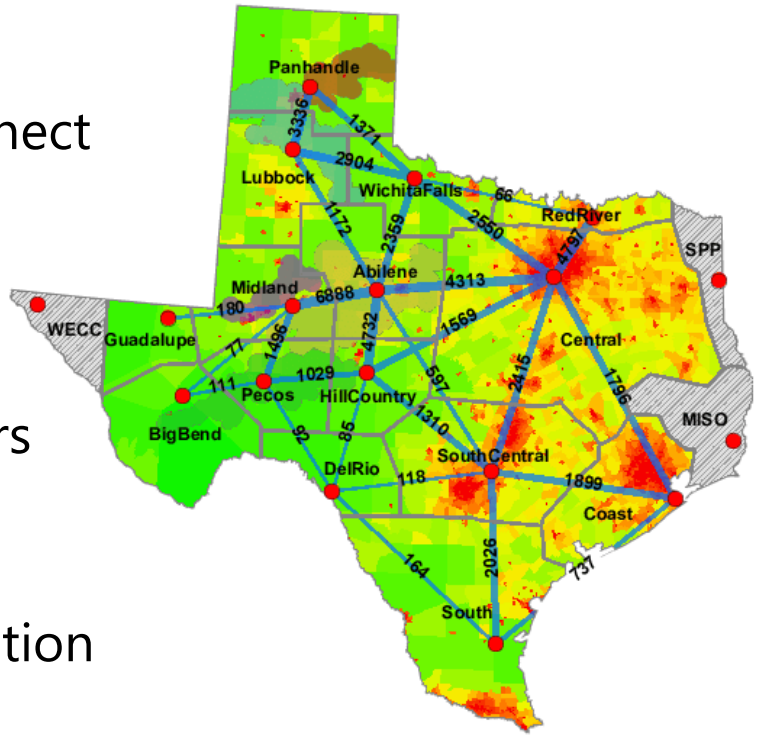
Texas Regulatory and ERCOT Market Overview

- Electric Reliability Council of Texas (ERCOT) is the independent system operator in TX, managing:
  - Approx. 75,000 kilometers of transmission lines
  - Covering 440 generating units
  - Serving 24 million customers (90% of Texas's load)
- ERCOT manages energy-only market with real-time, day-ahead, and ancillary services markets
  - After Winter Storm Uri, significant focus on boosting reliability and ensuring adequate capacity
- Governed by Board of Directors, subject to oversight from the Public Utilities Commission of Texas



Texas Case Study

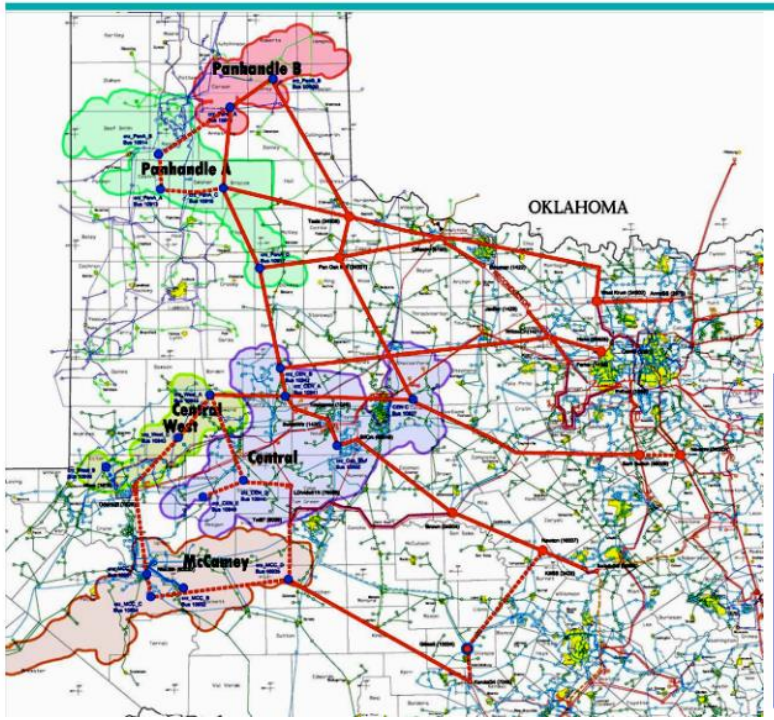
- ERCOT only US grid operator to use 'connect and manage' approach for transmission interconnections
  - Focuses only on what local upgrades are needed to interconnect
  - Does not consider need for broader network upgrades
  - ERCOT manages any resulting congestion through market redispatch and curtailment
    - Curtailment not capped (unlike in Europe), so plant owners need to assess curtailment risk
  - ERCOT manages bottlenecks through congestion pricing mechanism, charging utilities for cost of dispatchable generation to meet demand when wind or solar is curtailed
- Enables ability to quickly add generation to the grid
- Challenge is significant risk of curtailment if grid operators fail to identify and build needed transmission



Competitive Renewable Energy Zones

- In 2005, Texas Legislature ordered PUCT to designate CREZ and develop associated transmission plans
- CREZ focused on large-scale wind resources that would justify grid expansion/ upgrades
- Costs shared among customers, regardless of location of load or gen.
- Core achievements of CREZ:
  - 83,000 km^2, unlocking 23GW of new wind
  - 6,100 km of new, high-voltage transmission lines
  - Reduced wind congestion from 17% to 1.2%
  - Wholesale prices fell to US$24.62/MWh
- BUT congestion rising again (nearly doubling from 2020 to 2021)

CREZ Ruling – 2,376 Miles of New ROW



Zone	New Wind Capacity (MW)
Panhandle A	3,200
Panhandle B	2,400
Central	3,000
Central West	1,100
McCamey	1,900

Red lines are new 345-kV double circuit ROW

Dotted red lines are new 345-kV single circuit ROW

Planning cost estimate: $4.9 B (based on straight-line routing)

Plan development details available at: http://www.ercot.com/content/news/presentations/2008/ERCOT_Website_Posting.zip

Michigan Case Study: Framework

- Vertically integrated utilities, with two caveats:
  - 10% of load eligible for retail open access/ energy choice
  - Transmission service spun out as part of 2000 energy reforms; now provided by unaffiliated utilities
    - As a peninsular state, Michigan is transmission constrained
- Michigan recently enacted significant energy legislation
  - Requires 50% renewable energy by 2030, 60% by 2035
    - Up from 15% today
  - 100% "clean energy" by 2040, interim target of 80% by 2035
  - Increases to energy efficiency requirements, allocation for distributed generation, a new energy storage target, and more
- Michigan participates in two regional transmission organizations (RTOs) and has links to Ontario IESO
  - Approx. 90% of load in Midcontinent ISO (MISO); 10% in PJM

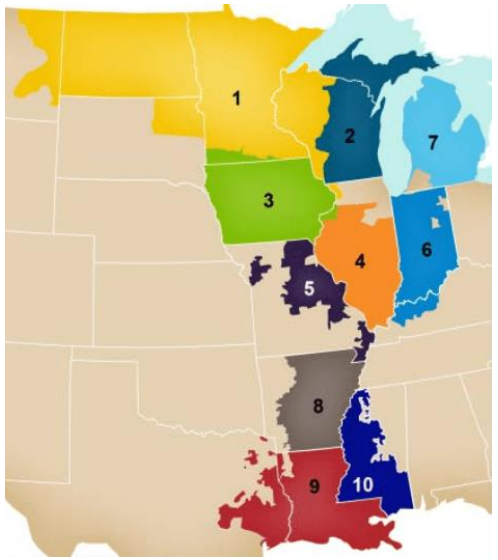
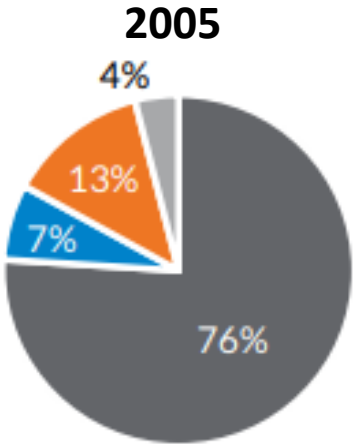


Image: Organization of MISO States

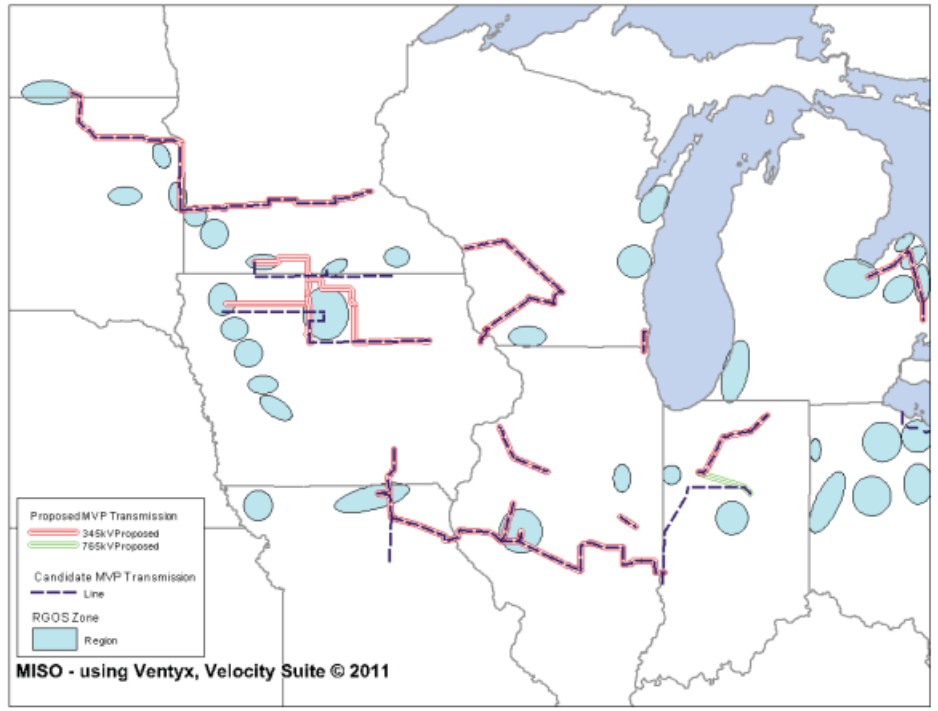
MISO: An overview

- About MISO
  - MISO became first FERC-approved RTO in 2001
  - Day-ahead and Real-Time markets added in 2005
    - Ancillary Services market added in 2009
  - Facilitates US$40+ billion in annual transaction
  - Manages high-voltage power grid across 15 US states and province of Manitoba (CA), serving 45 million people
- Key facts and statistics
  - 77,000 miles (124,000 km) of transmission lines
  - 2956 generating units; 191 GW of installed capacity
  - Record demand of 127.1 GW, set in July 2011
  - Approx. 32% reduction in carbon emissions since 2014



MISO's Multi-Value Projects (MVPs)

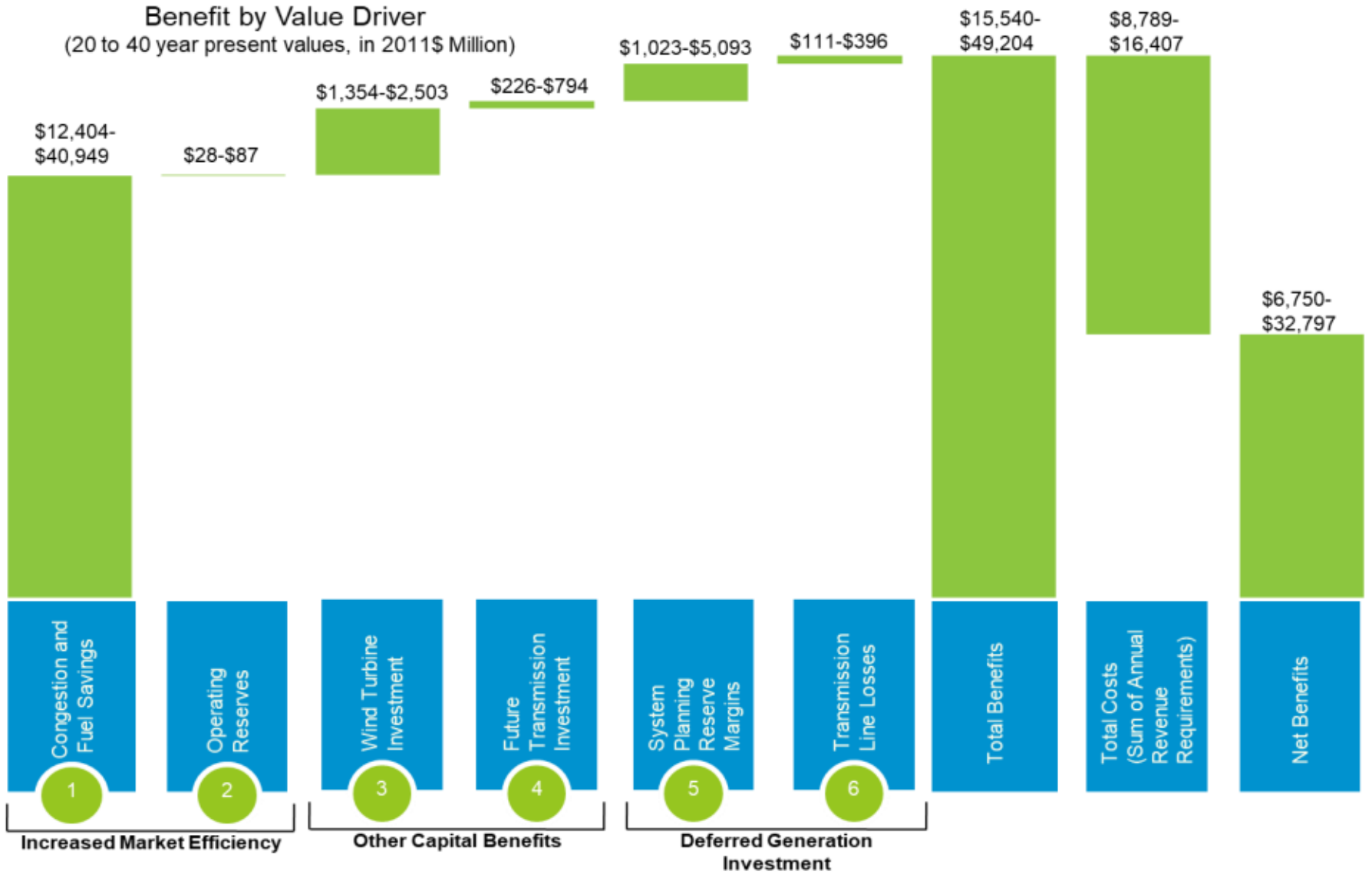
- In the late 2000s, many states within MISO adopted renewable energy mandates
- To identify transmission needs, MISO conducted a Regional Generator Outlet Study (RGOS) based on regional wind zones
- Final MVP portfolio approved in 2011 included 17 projects at an estimated cost of US$5.1 billion to support 25 GW of new wind generation
- MISO forecasted benefit-to-cost ratio of 1.8 to 3.0, with benefits exceeding cost in each of MISO's local resource zones



MVPs considered:

- Economic benefits
- Reliability benefits
- Public policy benefits around renewable energy goals

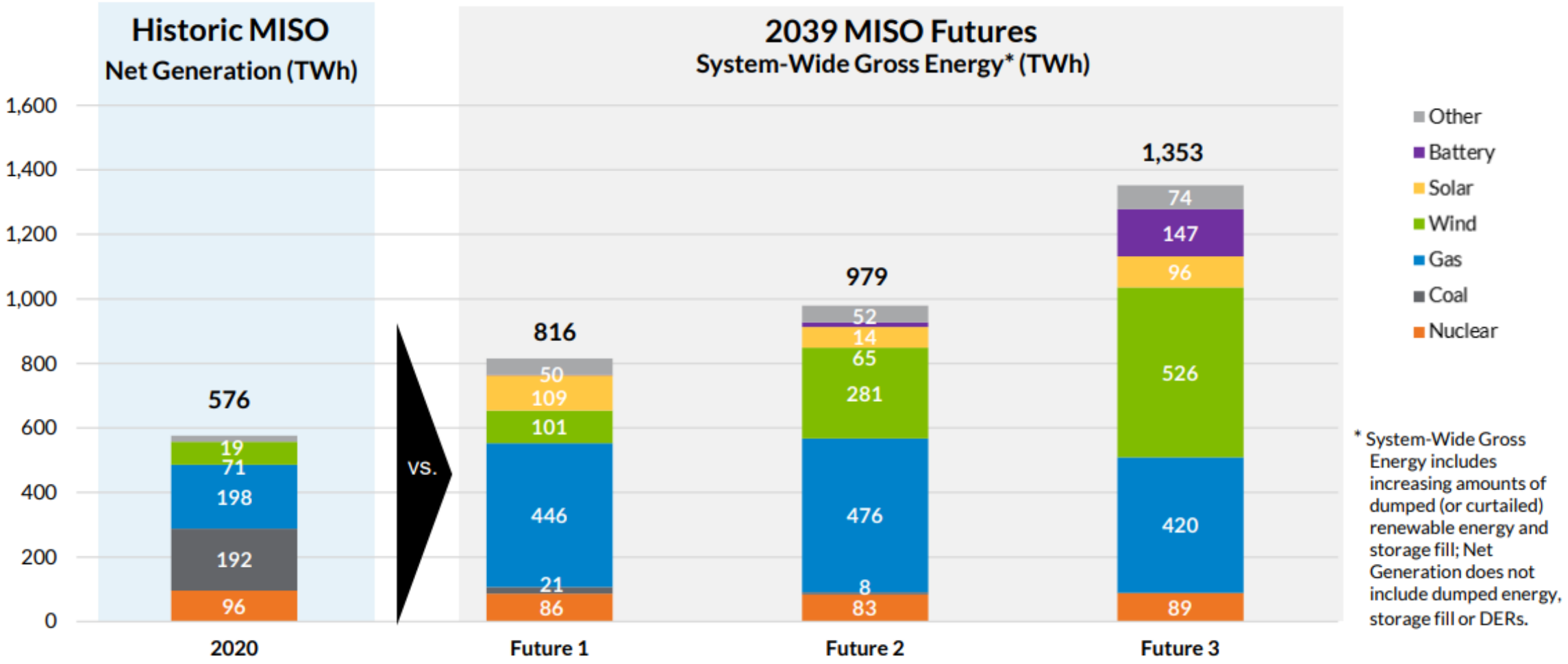
MISO's Multi-Value Projects (MVPs)



MISO Futures Report

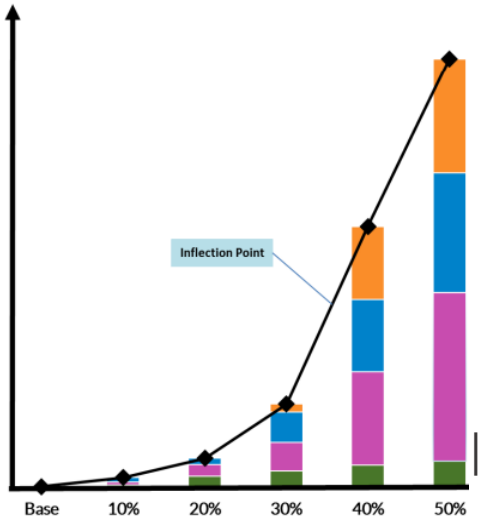
- In April 2021, MISO produced its "Futures Report"
  - Futures refreshed in Nov. 2023 – growth rate only accelerating
- Recognized that future was uncertain, so created three scenarios to "hedge uncertainty and 'bookend' a range of possibilities"
  - Future 1: Low-base, EV growth
    - Projects 77 GW of retirements, 130 GW of resource/ DSM additions (largely gas and renewables), and annual energy growth rate of 0.5% through 2039; 40-63% CO2 reduction
  - Future 2: Increased load growth and stronger carbon reduction goals
    - Projects 80 GW of retirements, 179 MW of additions (more heavily skewed towards renewables), and energy growth rate of 1.1%; 60-65% CO2 reduction
  - Future 3: High electrification, carbon reduction
    - Projects 112 GW of retirements, 319 GW of additions (inc. minimum of 50% wind and solar), and 1.7% annual energy growth rate through electrification 80% CO2 reduction

MISO Futures



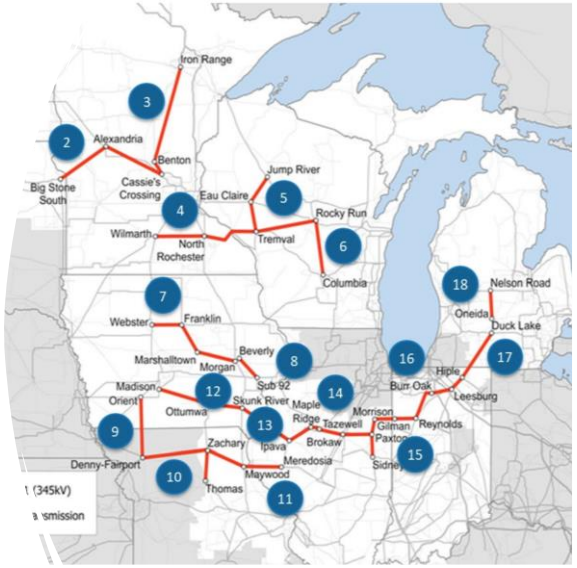
Renewable Integration Impact Assessment

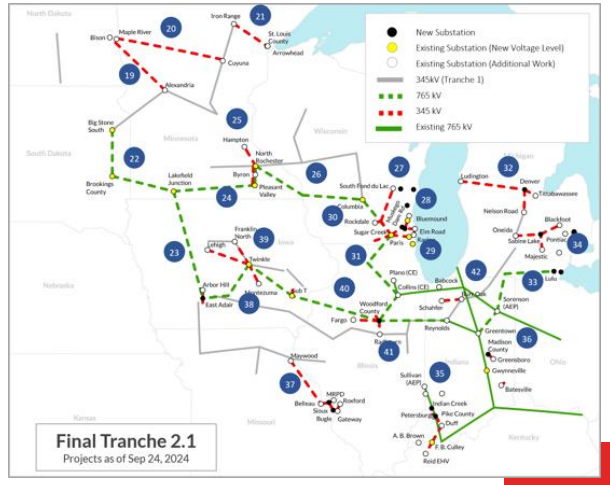
- In Feb. 2021, MISO issued Renewable Integration Impact Assessment to understand impacts of renewable energy growth over the long term
- Considered various operational challenges
  - Resource Adequacy – having sufficient resources
  - Energy Adequacy – "every hour matters"
  - Operating Reliability (both steady state and dynamic)
- Core finding: as RE increases, so does the range and magnitude of system needs and risks
  - Not insurmountable challenge, but will require "transformational change in planning, markets, and operations"
  - Below 30% RE penetration: New transmission and tweaks to framework
  - Beyond 30%: Transformative thinking and coordinated action between MISO and its members



MISO's Long-Range Transmission Planning

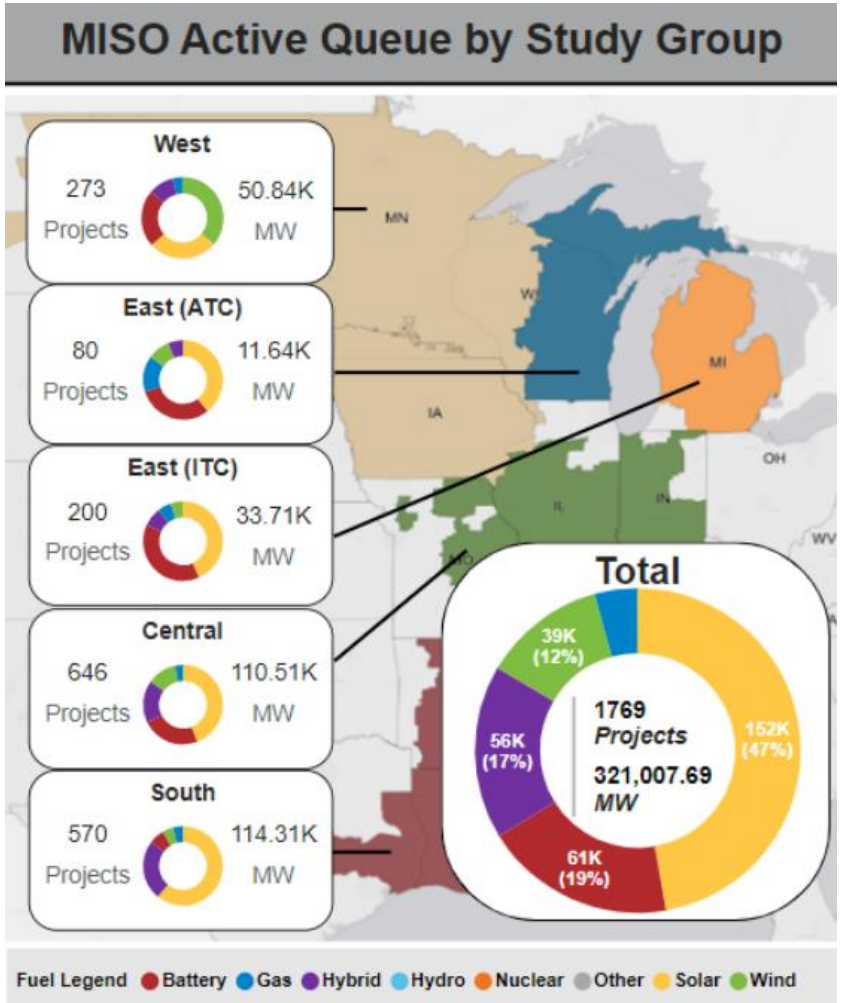
- To meet transmission needs identified in Futures and consistent with RIIA, MISO undertook Long-Range Transmission Planning (LRTP) initiative
- Tranche 1 of LRTP, approved in 2022, includes 18 projects totaling US$10.3 billion
  - Will enable 53 GW of new wind, solar, and energy storage
- Tranche 2.1, set to be approved in December, includes 24 projects totaling US$21.8 billion
  - Will facilitate approx. 130 GW of new generation resources
- Additional project tranches are expected in future years





MISO Queue Challenges

- MISO's current queue consists of 1769 projects totaling 321 GW
  - Up from 787 projects,122.4 GW in August 2022
  - More than 2.5x of MISO's all-time peak load of 127.1 GW
- MISO uses affected systems study process to identify needed upgrades and costs
  - Upgrades often too costly, contributing to withdrawals
  - Withdrawals can change affected systems analysis, causing delays
- MISO currently pursuing reforms, including queue caps, similar to other RTOs
- Best answer may be the most obvious: reduce congestion (and queue backlog) through buildout of backbone transmission

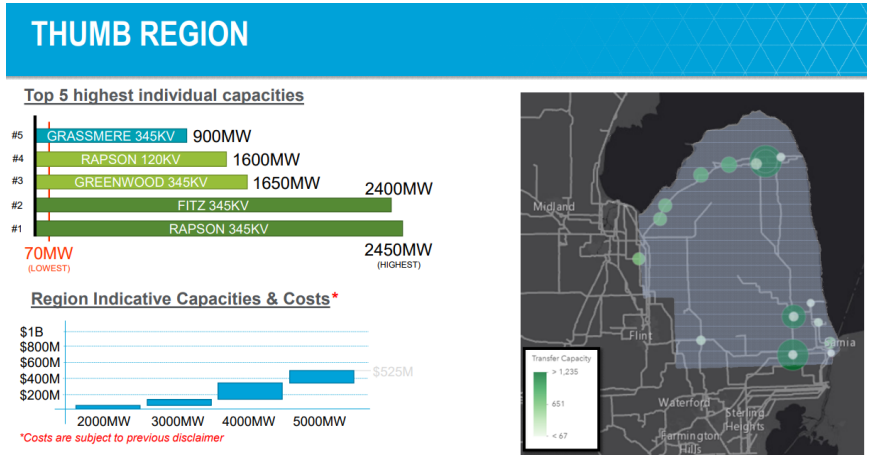


Joint Targeted Interconnection Queue

- MISO/ Southwest Power Pool both struggling with lack of interconnection capacity at the seam
- The two RTOs partnered over last several years to develop Joint Targeted Interconnection Queue (JTIQ) proposal
- Under JTIQ, total cost split between developers (90%) and load (10%), with developers paying a per-MW charge to cover share of upgrades
- JTIQ includes 5 projects totaling US$1.7 billion
  - Supported with US$464.5 million in DOE funding
- Projected to unlock up to 30 GW of generation in queues for projects along MISO/ SPP seam

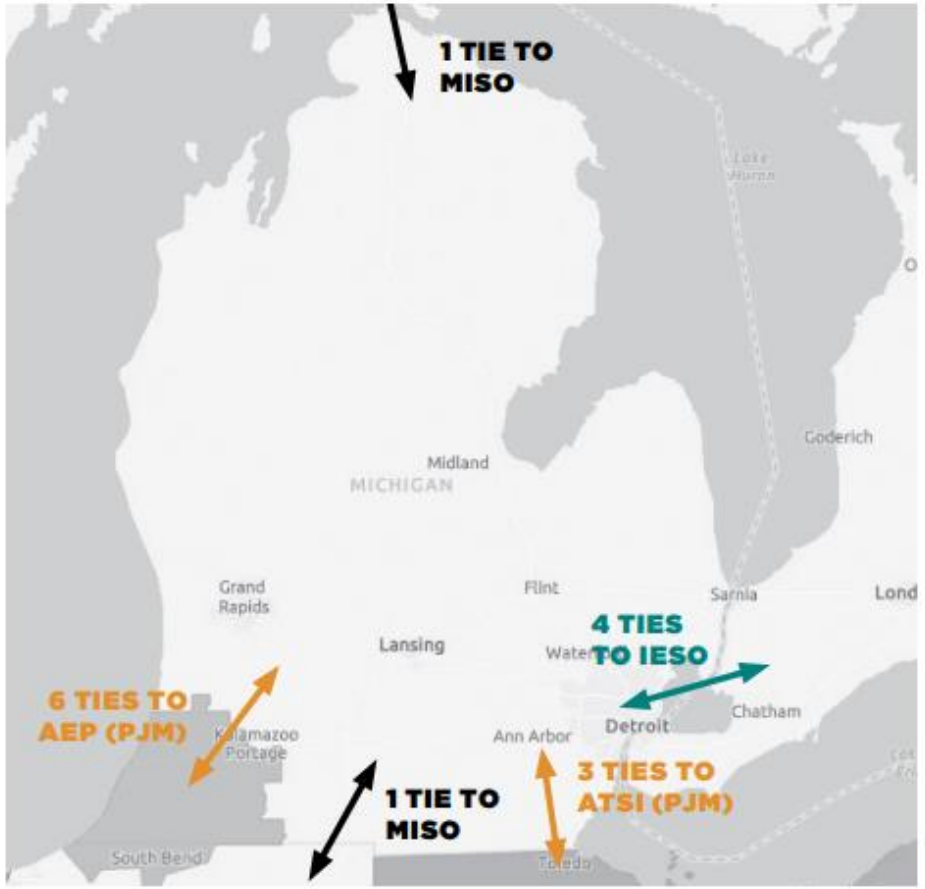
Michigan Hosting Capacity Study

- As in other places, lack of transparency on transmission capacity forces project developers into submitting multiple queue requests to identify most cost-effective locations to interconnect
- In 2021, Michigan PSC partnered with ITC (transmission utility for most of Michigan) on hosting capacity study
- Study focused on 7 regions in Michigan and examined 225 points of interconnection
  - For each region, identified top 5 interconnection points, available capacity, and indicative costs



Leveraging Michigan's transmission links

- In 2019, MPSC requested MISO to study options to increase imports and exports of electricity into/ out of Michigan
- Resulting study considered three options:
  - Near-term: opportunities to boost imports by 1500 MW
  - 10+ year outlook on options to boost imports by 3000 MW
  - 15 year, high renewables outlook, also 3000 MW
- Options ultimately rolled in to LRTP process
- In June 2022, MPSC asked parties for ideas on leveraging Michigan's transmission, including MISO, as well as PJM and Ontario
  - 9 of 10 grid connections on southern border connect with PJM, not MISO
  - Underutilized opportunity to import 2 GW via existing links with Ontario



Transmission connections to the Lower Peninsula of Michigan

Key considerations and lessons

- Importance of long-term transmission planning cannot be overstated
  - Key to Texas CREZ projects, MISO MVP and LRTP portfolios
  - Represents change to traditional transmission planning approach
- Challenges with queue processes exacerbate grid scarcity issues
  - In US, different RTOs approach queue issues differently
  - No perfect option, often representing trade-off between risk of curtailment and burdensome (and time consuming) planning process
- Linkages with neighboring systems can have significant benefits
  - This includes interregional approaches to addressing queue issues (e.g., JTIQ)
  - Joint planning is essential, but often challenging due to market structure and business model considerations of RTO members/ participants
- Pausing energy transition not an option; need to keep pace

MPSC
MICHIGAN PUBLIC SERVICE COMMISSION

ERRA
ENERGY REGULATORS REGIONAL ASSOCIATION

THANK YOU FOR YOUR ATTENTION!

Dan Scripps
scrippsd1@michigan.gov

https://erranet.org/