Grid Michigan: Infrastructure, Impacts and Options

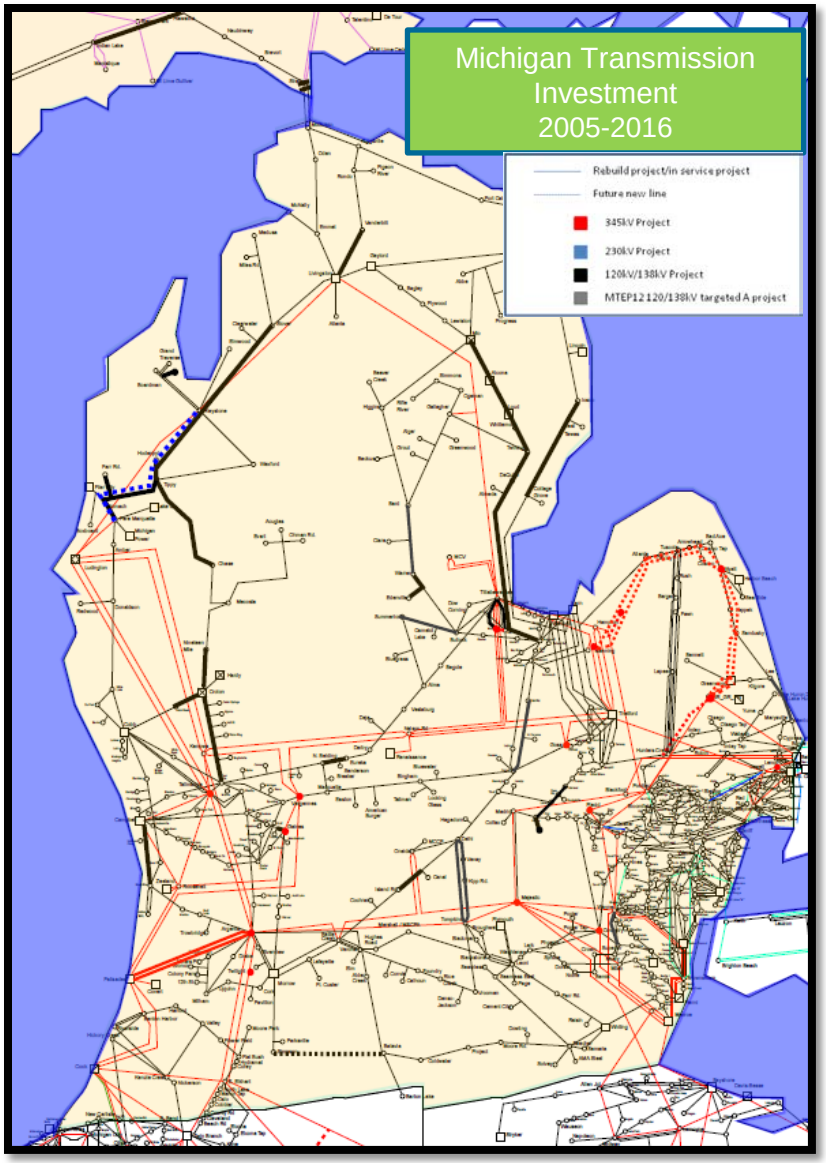
January 27, 2012

Jennifer Curran

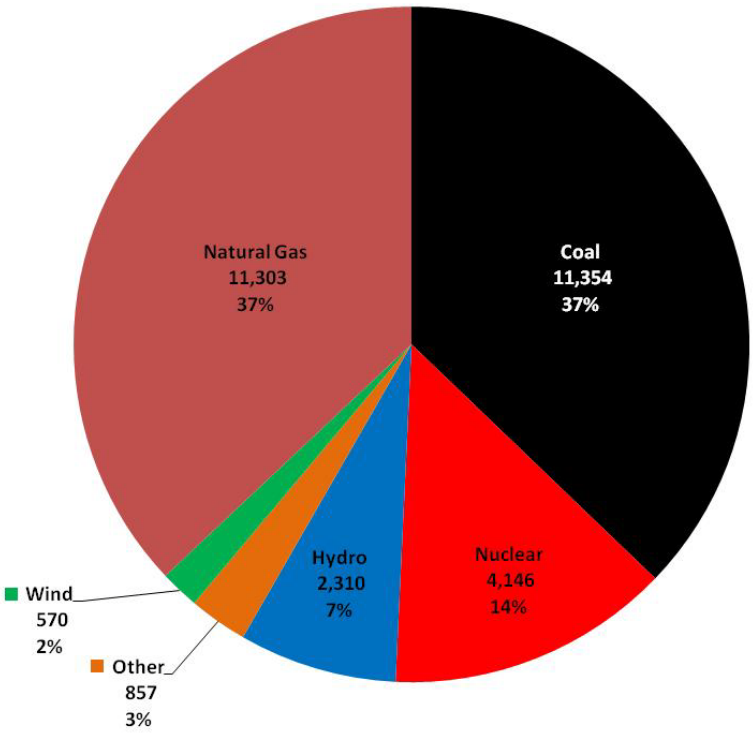
Executive Director Transmission Strategy, MISO

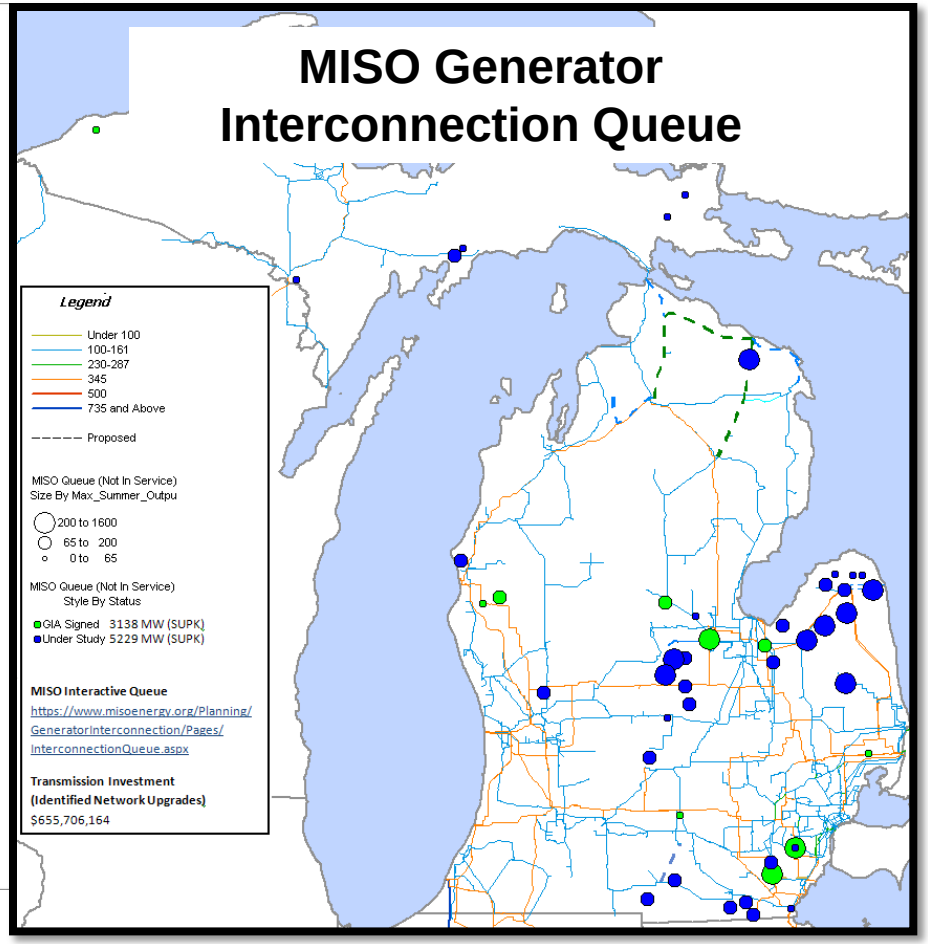
Investment in Transmission is Ongoing

- 778 Projects totaling ~2.4 billion investment approved since 2003
- Additional projects totaling > 1 billion under evaluation in current MISO Transmission Expansion Plan
- Synchrophasors being installed



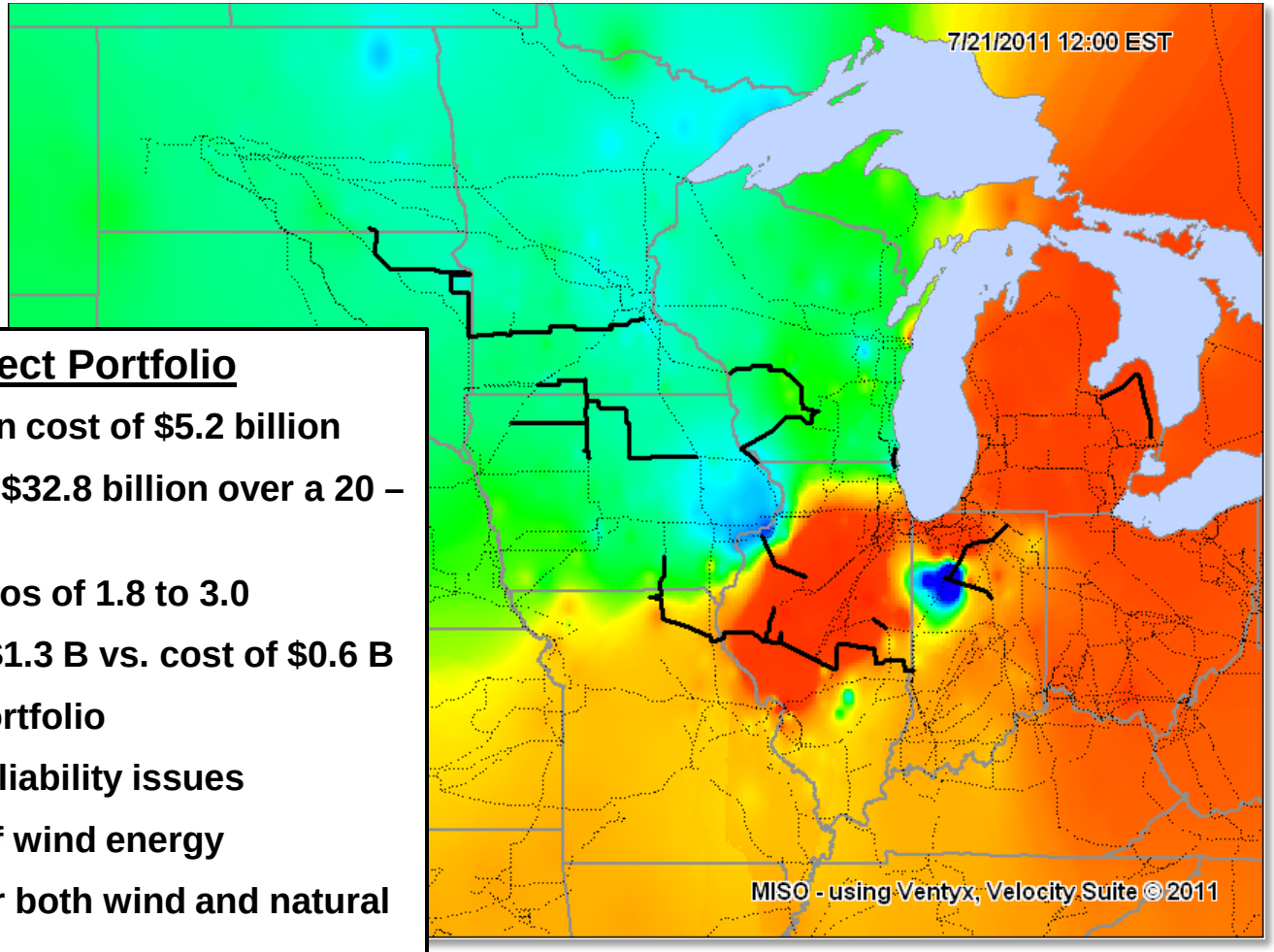
Generation Mix Is Changing





- 4,000 MW of wind, 600 MW of coal, and 360 MW of hydro in the queue
- >3000 MW requesting retirement

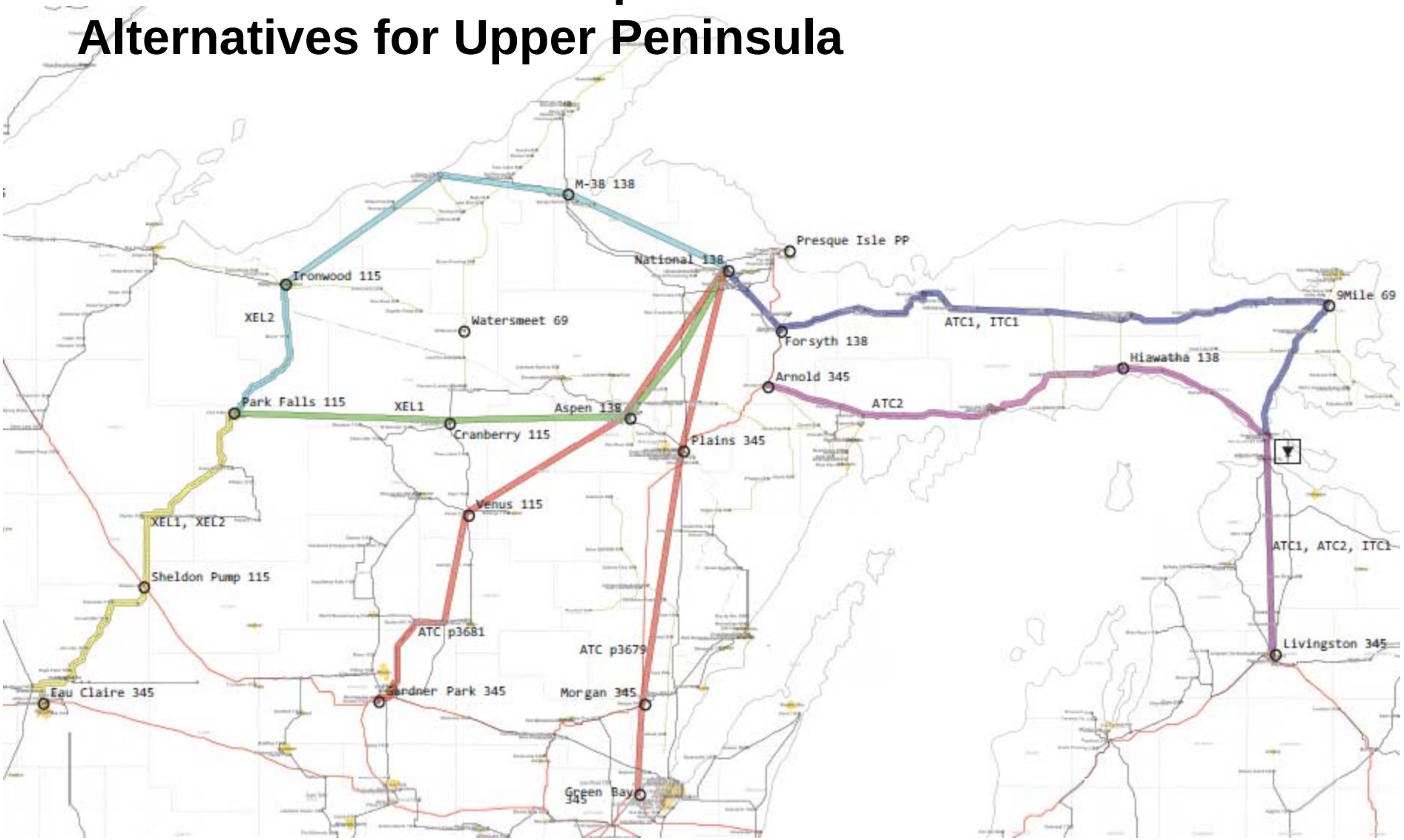
Multi-Value Projects Reflect a Regional View: The elements identified in the portfolio of Multi-Value Projects (MVPs) will work together with existing lines to relieve current constraints and allow delivery of low cost energy



Multi-Value Project Portfolio

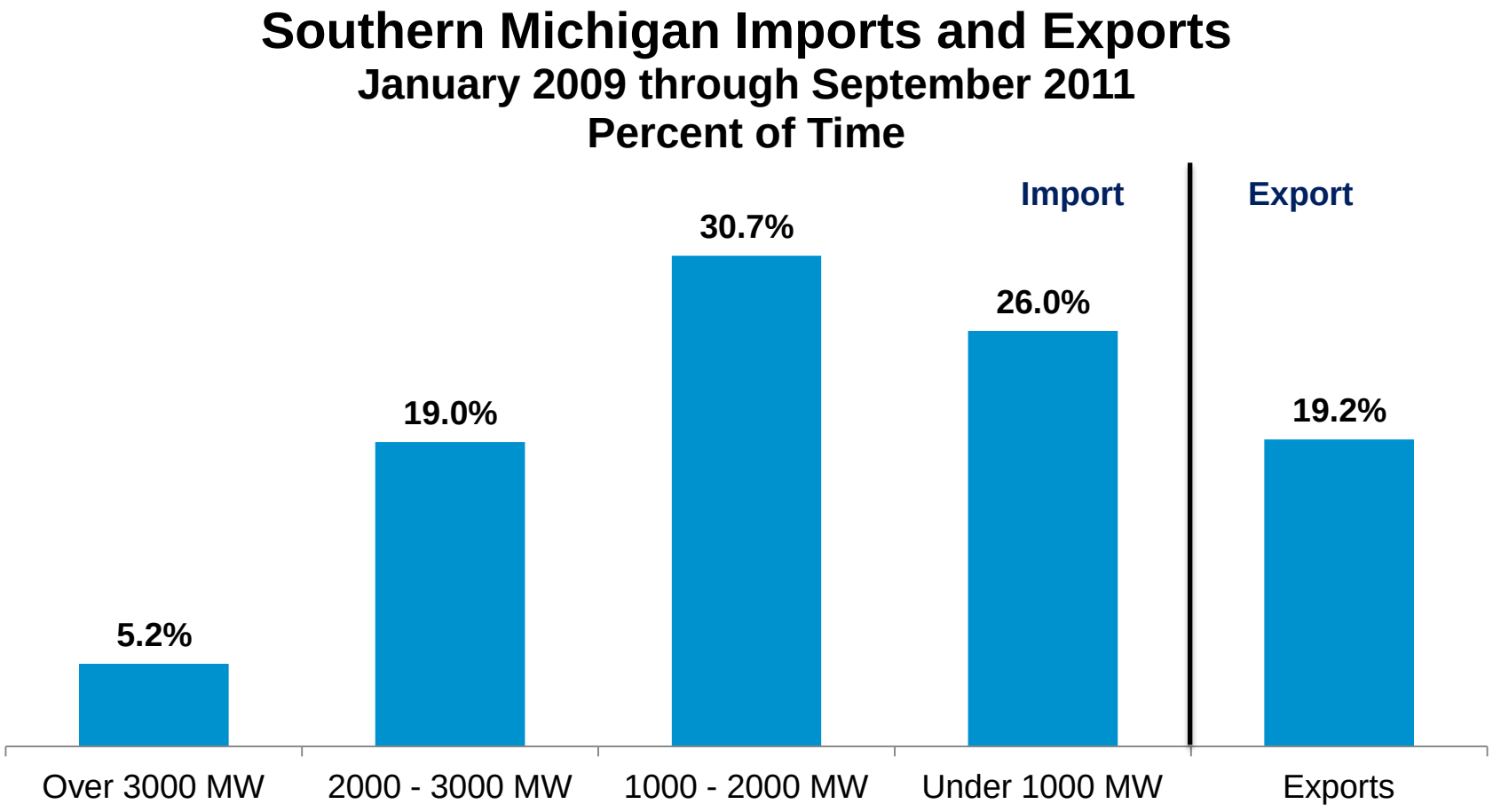
- Total portfolio construction cost of $5.2 billion
- Total net benefit of $6.7 to $32.8 billion over a 20 – 40 year life
- Provides benefit / cost ratios of 1.8 to 3.0
- Provides annual value of $1.3 B vs. cost of $0.6 B
- 17 elements in the MVP portfolio
- Resolves 650 elemental reliability issues
- Enables 41 million MWh of wind energy
- Supports energy zones for both wind and natural gas

MISO Transmission Expansion Plan 2012 – Potential Alternatives for Upper Peninsula

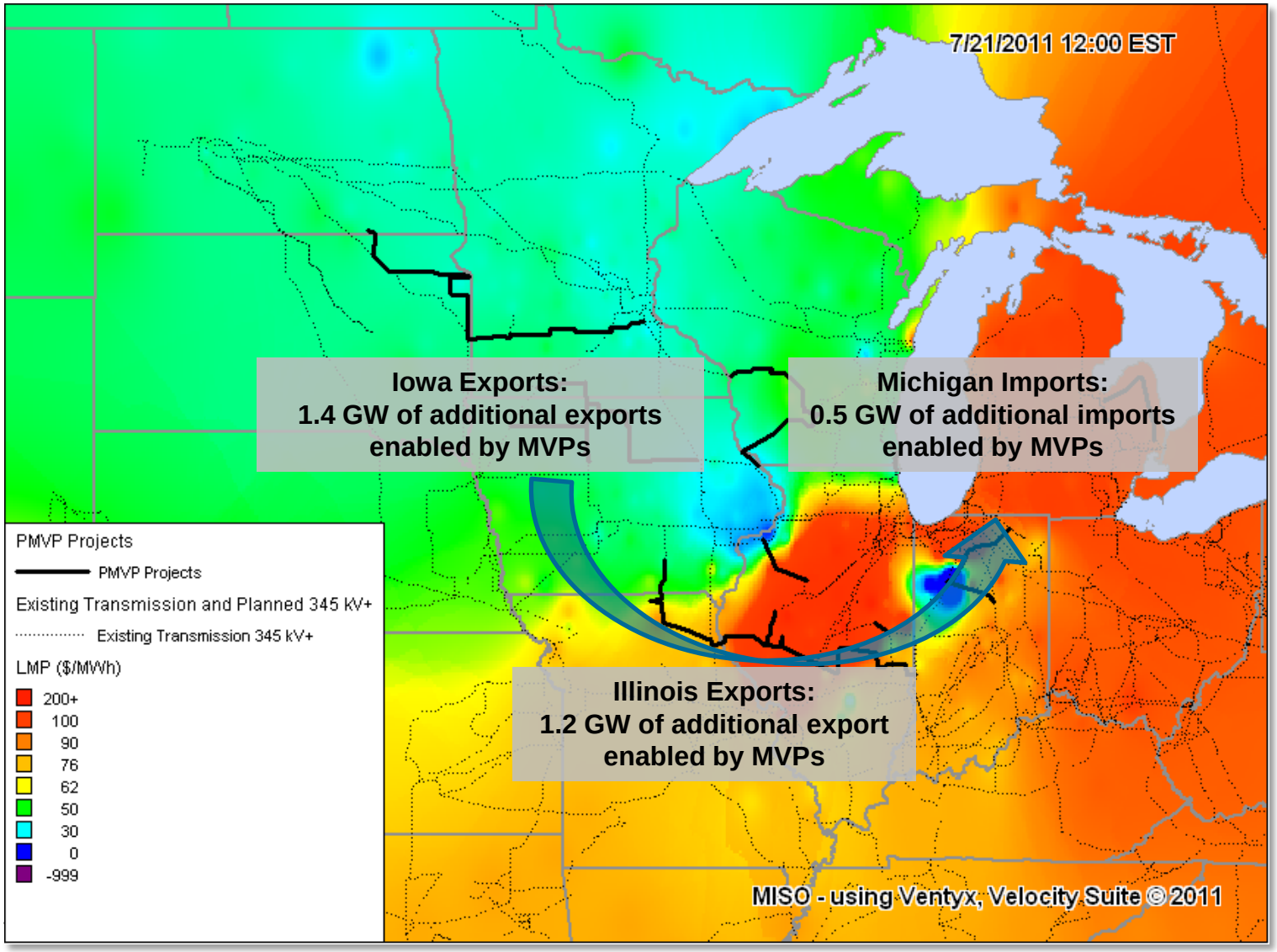


APPENDIX

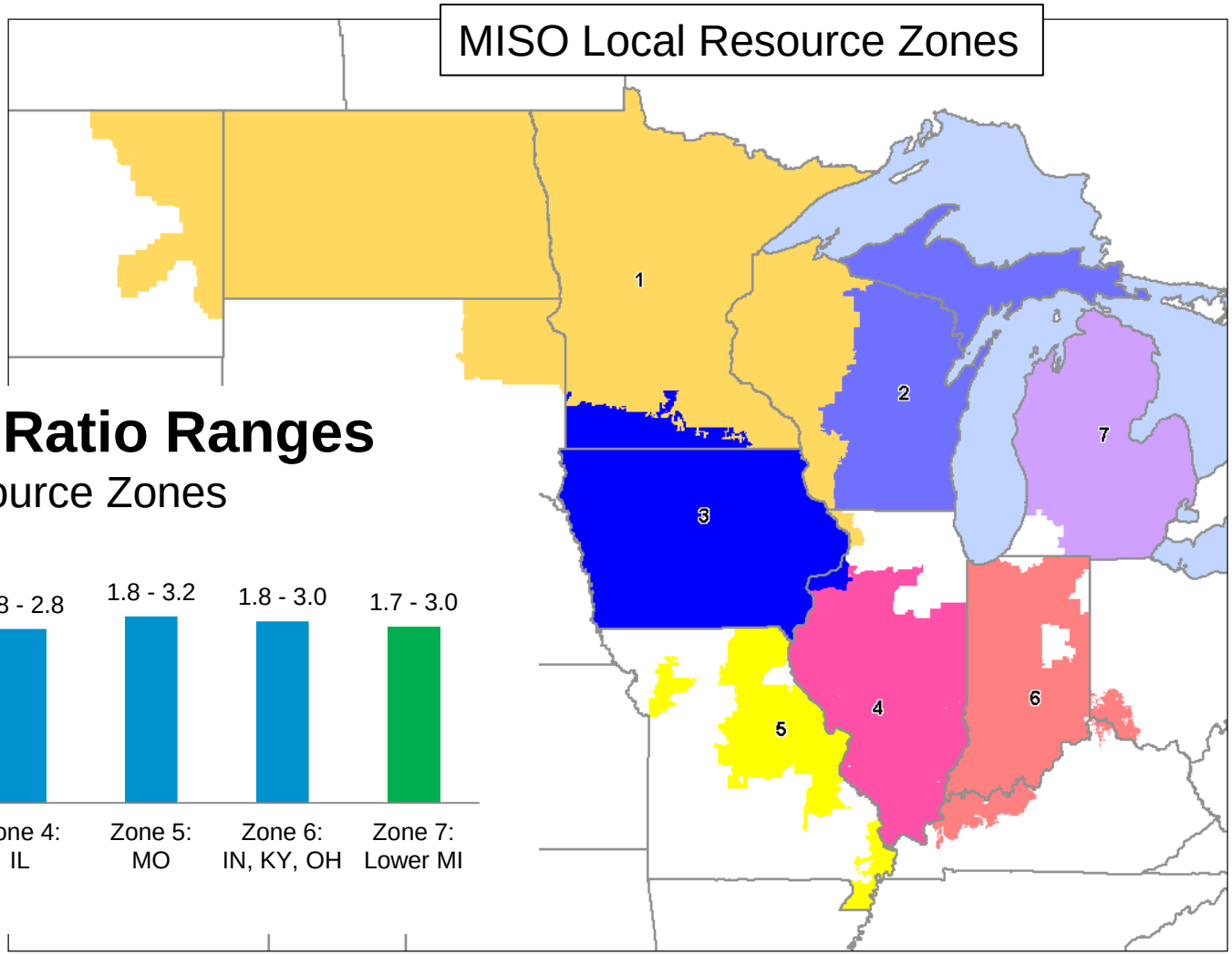
Over 55% of the time, Michigan is importing more than 1,000 MW



The benefits from low cost energy imports is enabled by relieving constraints that limit the flow of economic energy from the Western MISO regions.



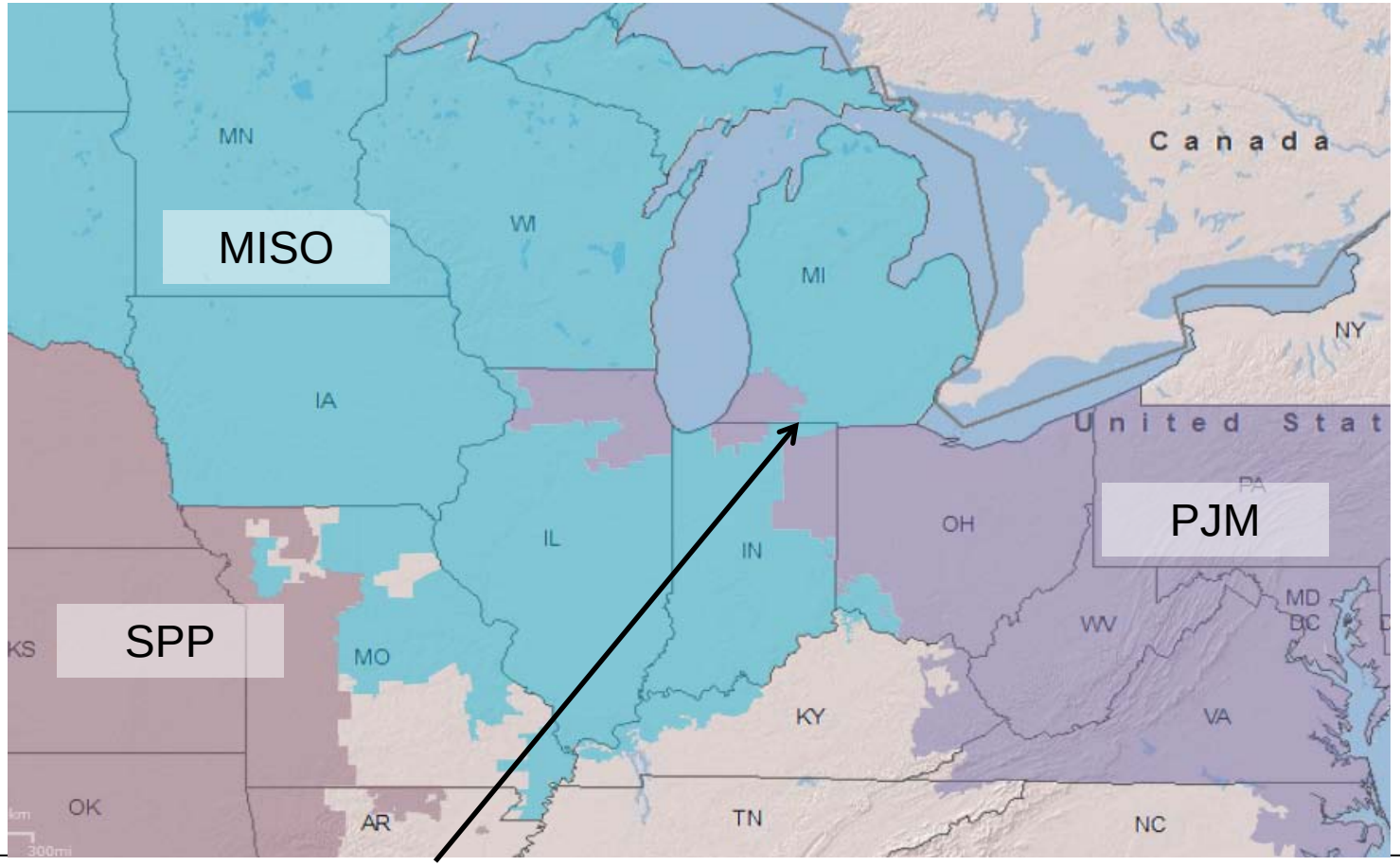
Benefits (and costs) from the MVP portfolio are distributed throughout MISO and local resource zones



Benefit/Cost Ratio Ranges

Local Resource Zones

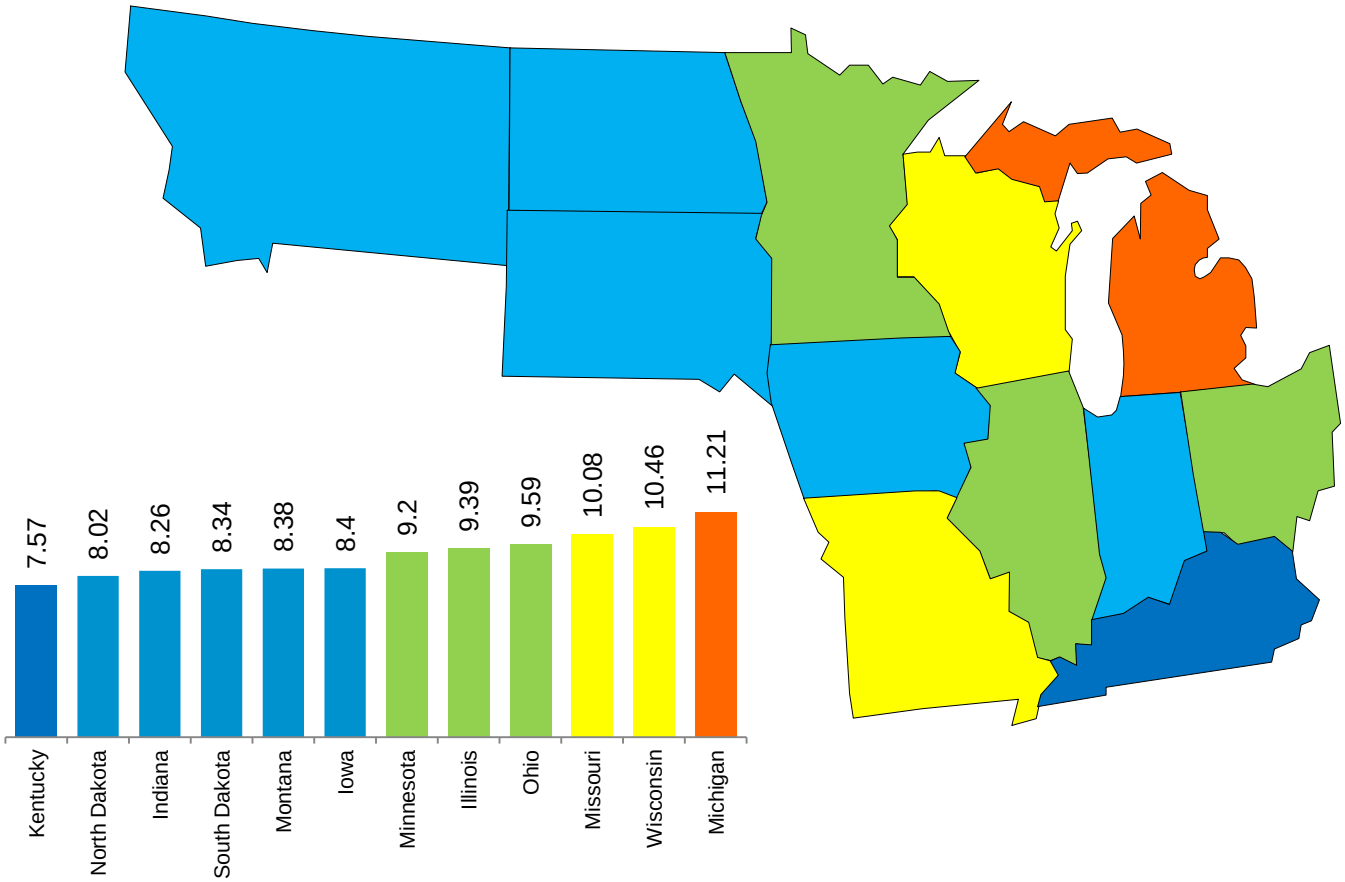
MISO's Use Agreement with PJM allows joint use of transmission capacity enabling thousands of MW of flows into Michigan



- There is only a 215 MVA contractual transmission path in the MISO between Northern Indiana (NIPSCO) and Michigan (ITC).
- The Joint Operating Agreement (JOA) with PJM allows the MISO to utilize PJM's transfer capability to Michigan.
- Therefore, thousands of MW of physical transfer capability exist – the vast majority on the transmission systems of PJM members.

Michigan's retail electric rates are the highest of any MISO state.

Average Retail Price of Electricity to Ultimate Customer – All Sectors
August, 2011
(Cents per Kilowatthour)



Source: U.S. Energy Information Administration, Form EIA-826, "Monthly Electric Sales and Revenue Report with State Distributions Report."

MISO regularly works with Michigan utilities and PJM to use that transmission capacity to reliably manage generation outages through significant imports

- **Spring 2009 – Managing Overlapping Michigan Generation Outages totaling over 4,800 MW**
  - Nuclear refueling
    - Cook Unit 2 (PJM facility) – 1,100 MW
    - Palisades – 750 MW
    - Fermi – 1,100 MW (started a month early than originally planned)
  - Equipment Failure
    - Cook Unit 1 – 1,050 MW
  - Coordination included efficiently managing occurrence of largest contingency
    - Campbell Unit 3 – 830 MW (tripped during period of overlapping outages)
- **Spring 2010 – Managing Overlapping Transmission Outages**
  - During a planned 345 kV bus outage in SW Michigan, a parallel 345 kV bus was inadvertently tripped
  - MISO started 2,000 MW of generation within minutes and avoided control issues