Planning For Wind



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Topics

- Prioritizing wind sources
  - Where we've been
  - Where we are
- Planning for the integration of wind
  - Incremental vs. Aggregate

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Challenges We Faced – 2008

- First in first out was the rule…but each generator had a lot of flexibility
  - Creates uncertainty for the next project
  - Uncertainty grows exponentially with each subsequent project
- Sheer volume
- Location of the sheer volume
  - Continual requests for service in the same location, especially after we inform the developer that massive upgrades are needed based on higher queued projects
  - Resembles the rush on dot-com stocks in the late 90's
- Not a lot of transmission in the location of the sheer volume
  - 6-10 years to get a transmission line permitted

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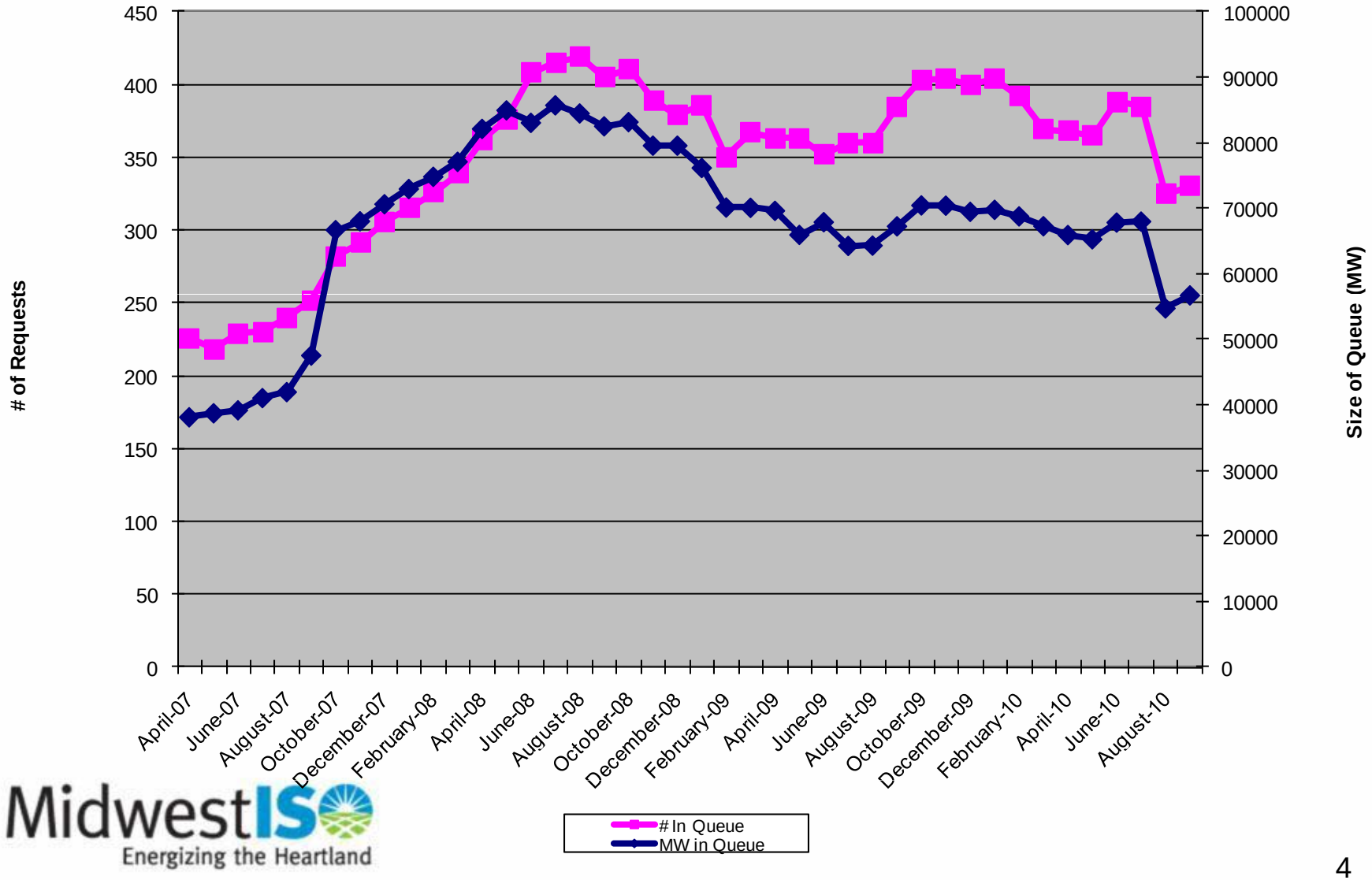
Generator Queue



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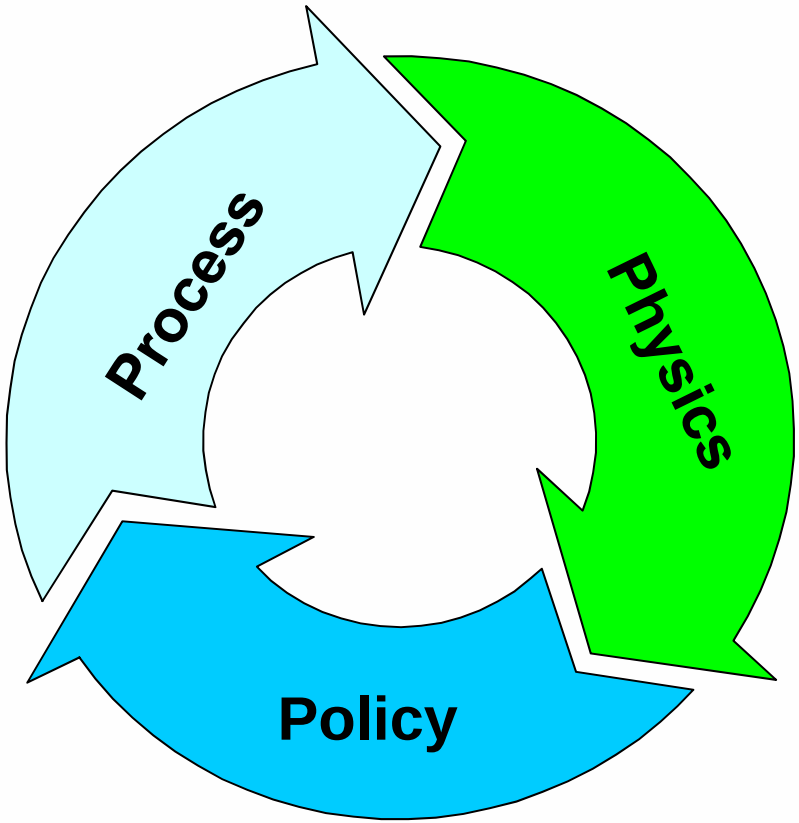
3 P's of Queue Reform



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Success in queue reform rests on 3 P's

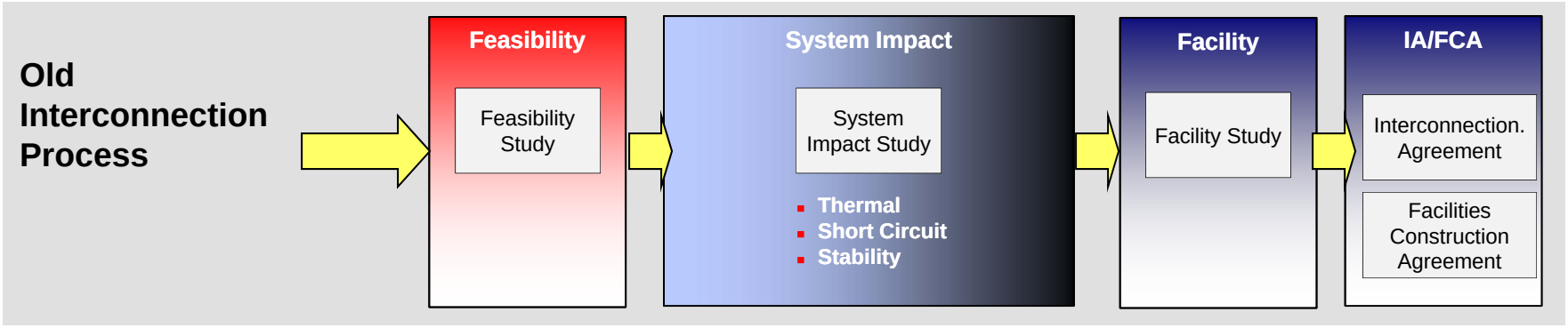
Process: changed from First In-First Out to First Ready-First Served

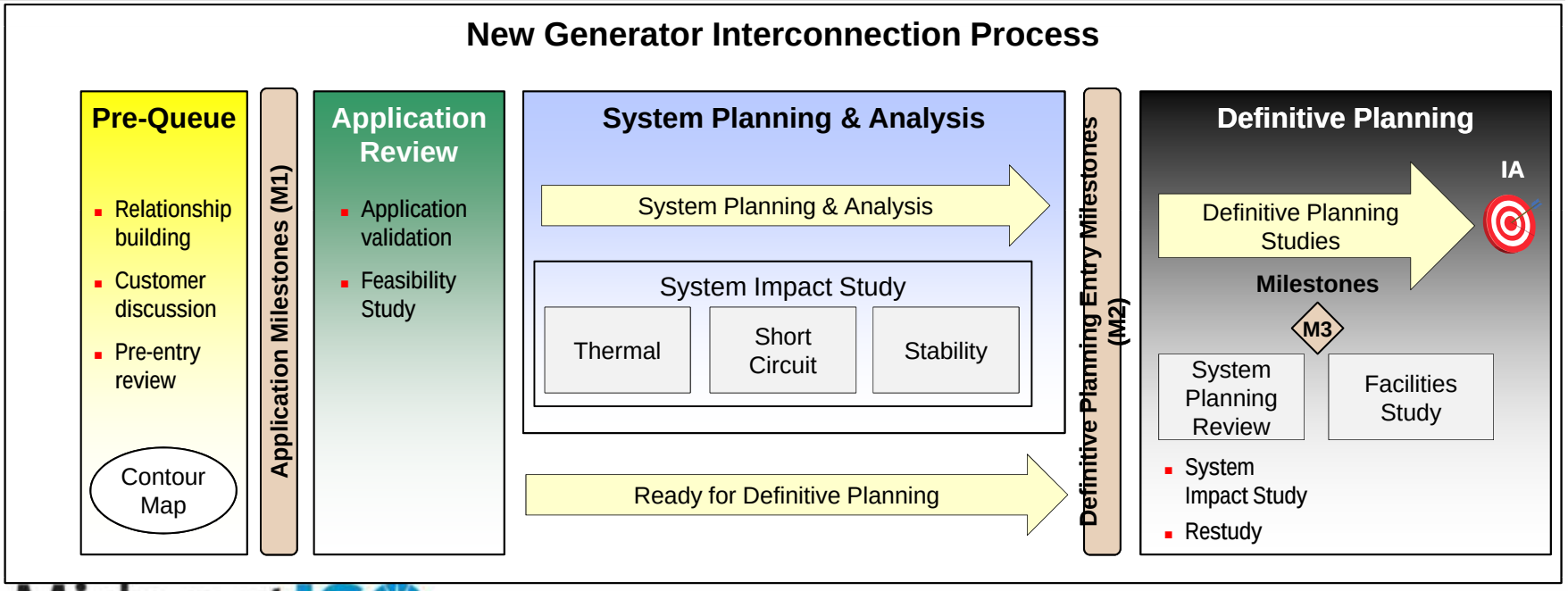
- Enforce results of Feasibility Study as binding
- Create fast lane
- Modify study deposit levels and timing
- Introduce milestones to proceed through process
- Reduce flexibility associated with suspension

Physics: Regional Generation Outlet Study is the first step in using alternative planning methods to identify network upgrades to support interconnection of large quantities of generation in remote areas

Policy: Filed methodology for cost sharing and recovery

Process





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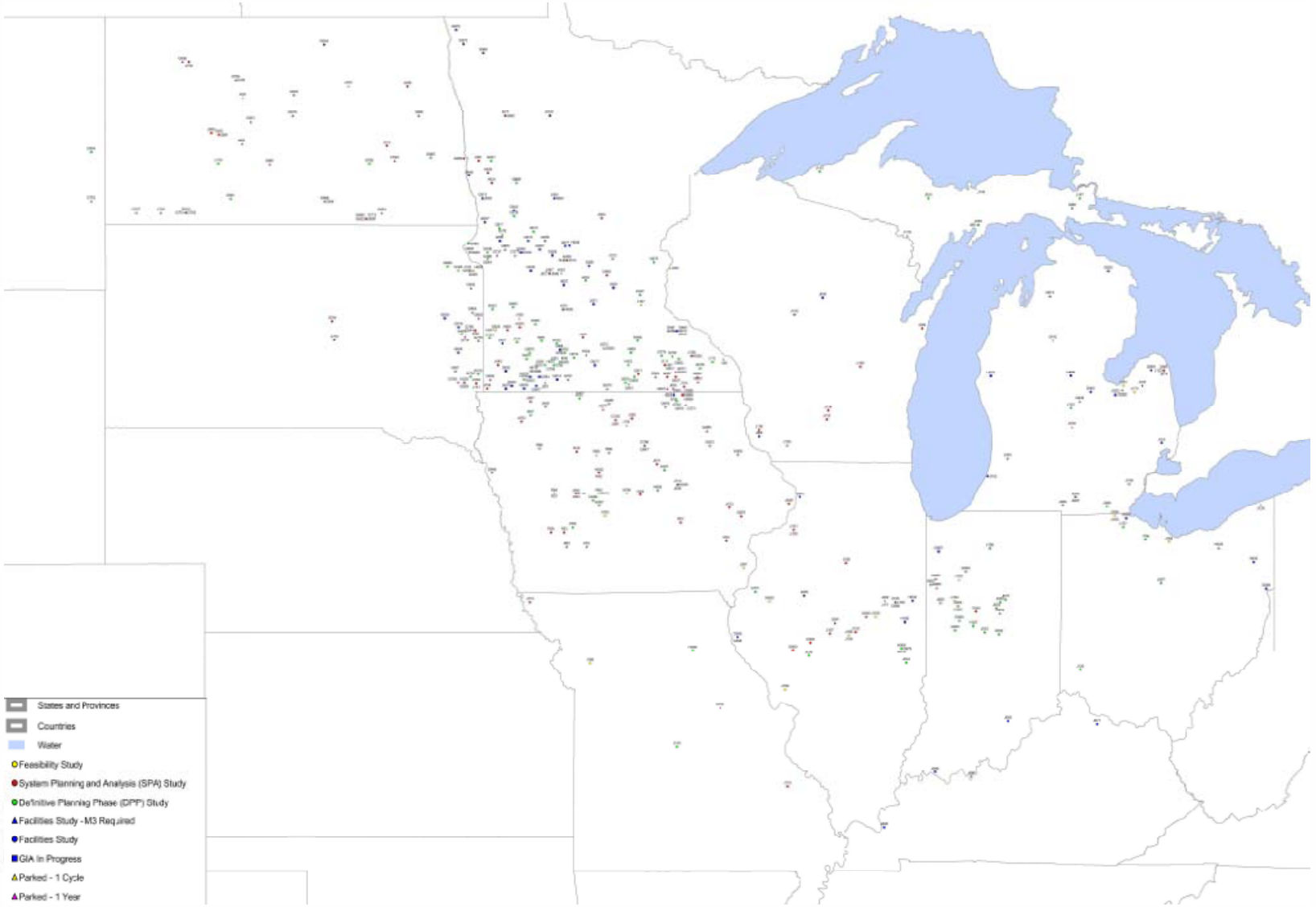
Physics—Where The Generators Are



Challenges We Face Now

- Aligning the “physics” with “policy”
  - Unbounded supply fighting for rights to finite capacity to meet a finite demand
  - How and how far to expand the transmission capacity
  - Who pays and how do they recover
- Melding wind resources into the Energy Market

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The Physics Question

Incremental Planning

- Study each wind generator as they are proposed
- Develop the transmission build-out on a generator by generator basis
- This was the bulk of our pre-queue reform process

Aggregate Planning

- Develop expected demand
- Determine likely sources
- Determine the transmission needed to deliver the energy

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Planning Model Evolution

In order to achieve its planning objectives , the Midwest ISO has transformed its transmission expansion planning model; this process will continue to mature as experience is gained

Reliability-Based Model

- Focused primarily on grid reliability
- Typically considers a short time horizon
- Seeks to minimize transmission build

Value-Based Model

Focused on value while maintaining reliability

Reflects appropriate project time scales

Seeks to identify transmission infrastructure that maximizes value

Identifies the comprehensive value of projects

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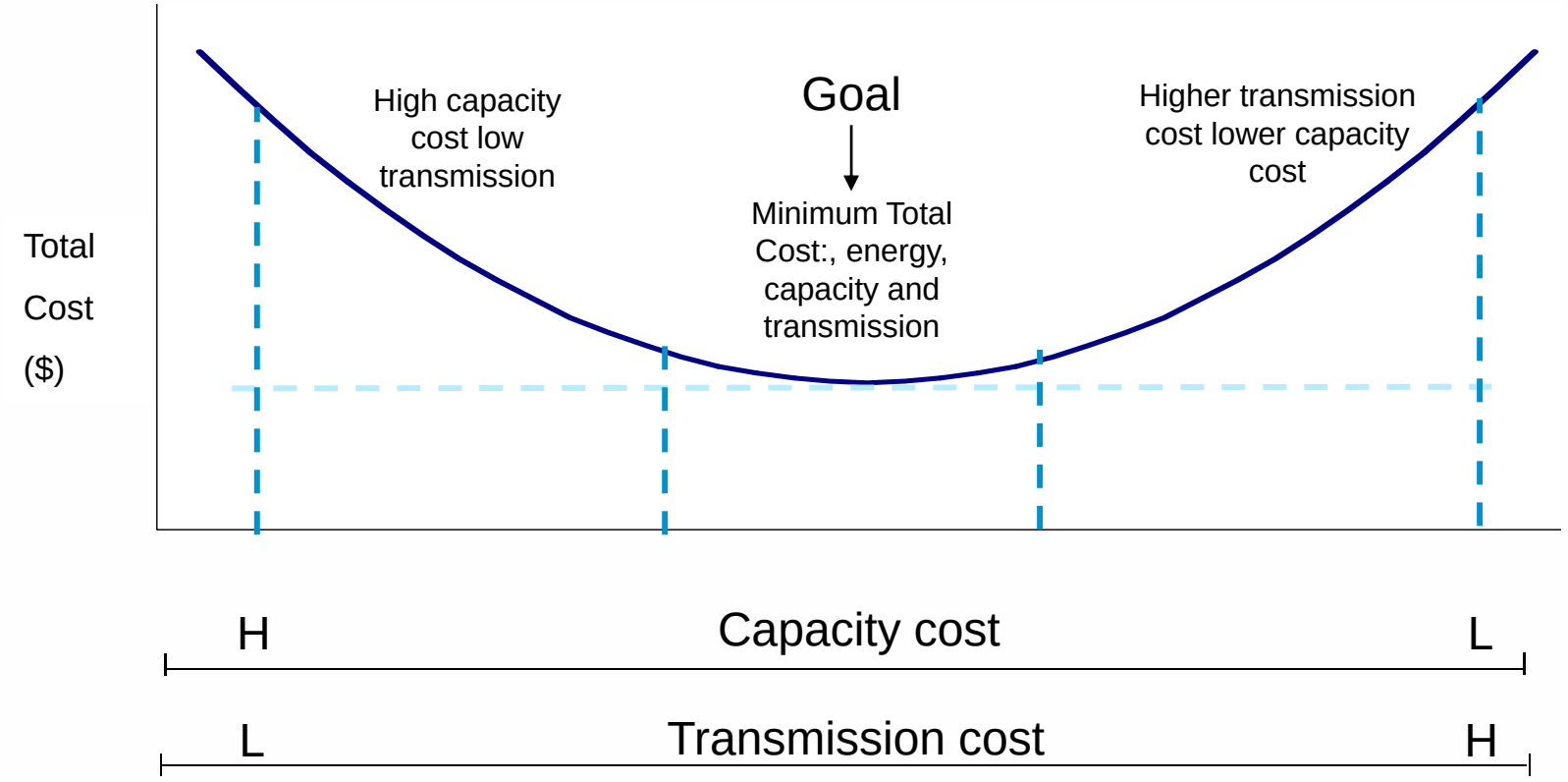
The Transmission Solution

Balancing Generation and Transmission Investment



- In 2009 and 2010 undertook the Regional Generation Outlet Study to meet current Midwest ISO Renewable Portfolio Standards of ~15%

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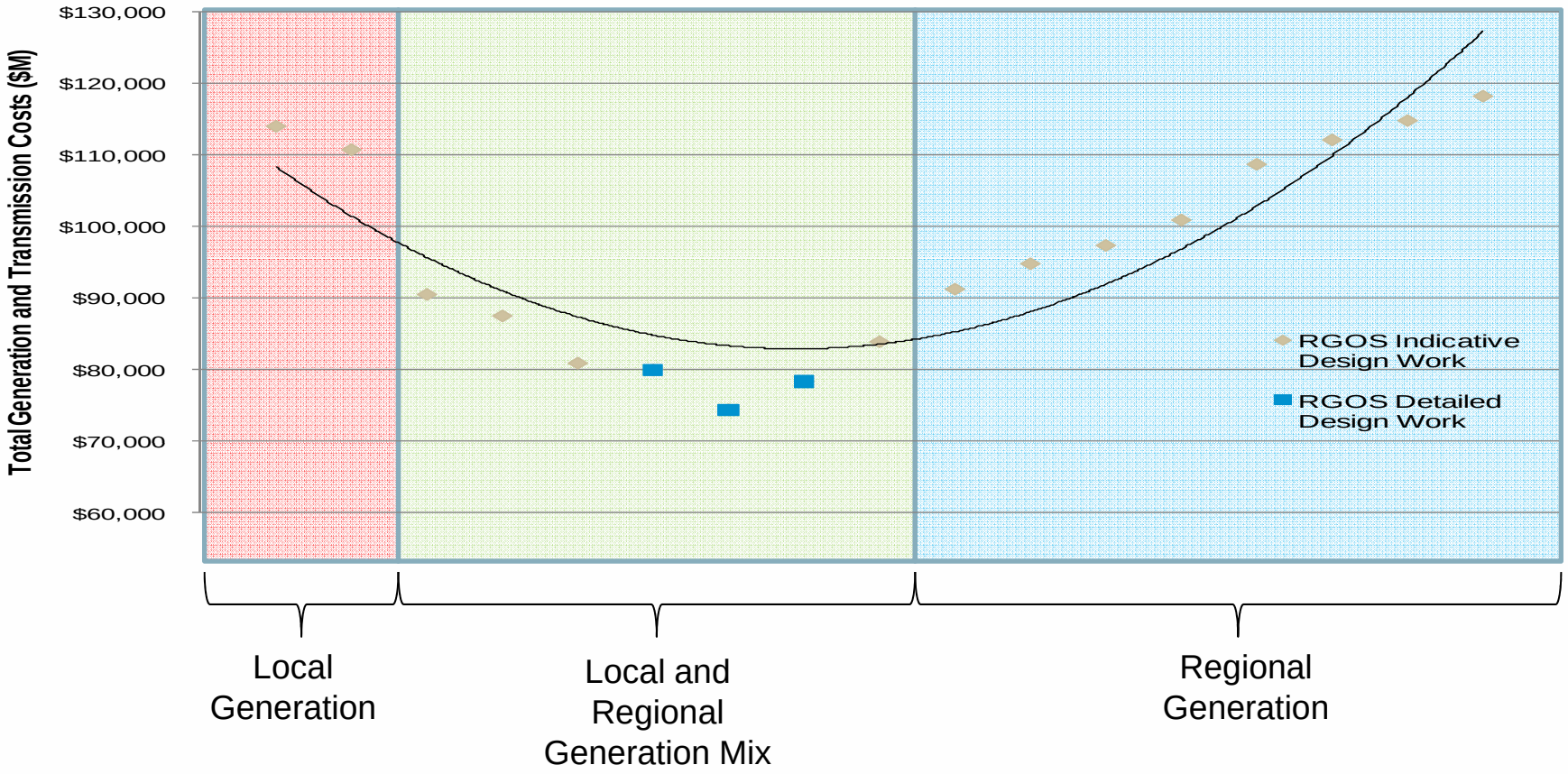
Regional Generation Outlet Study Cost To Achieve



- The best fit solution appears to be a transmission overlay premised on a combination of wind zones in all Midwest ISO states
  - 345 kV and 765 kV scenarios are under consideration
  - Transmission costs are similar between the two scenarios with current estimates of $13 to $14 billion

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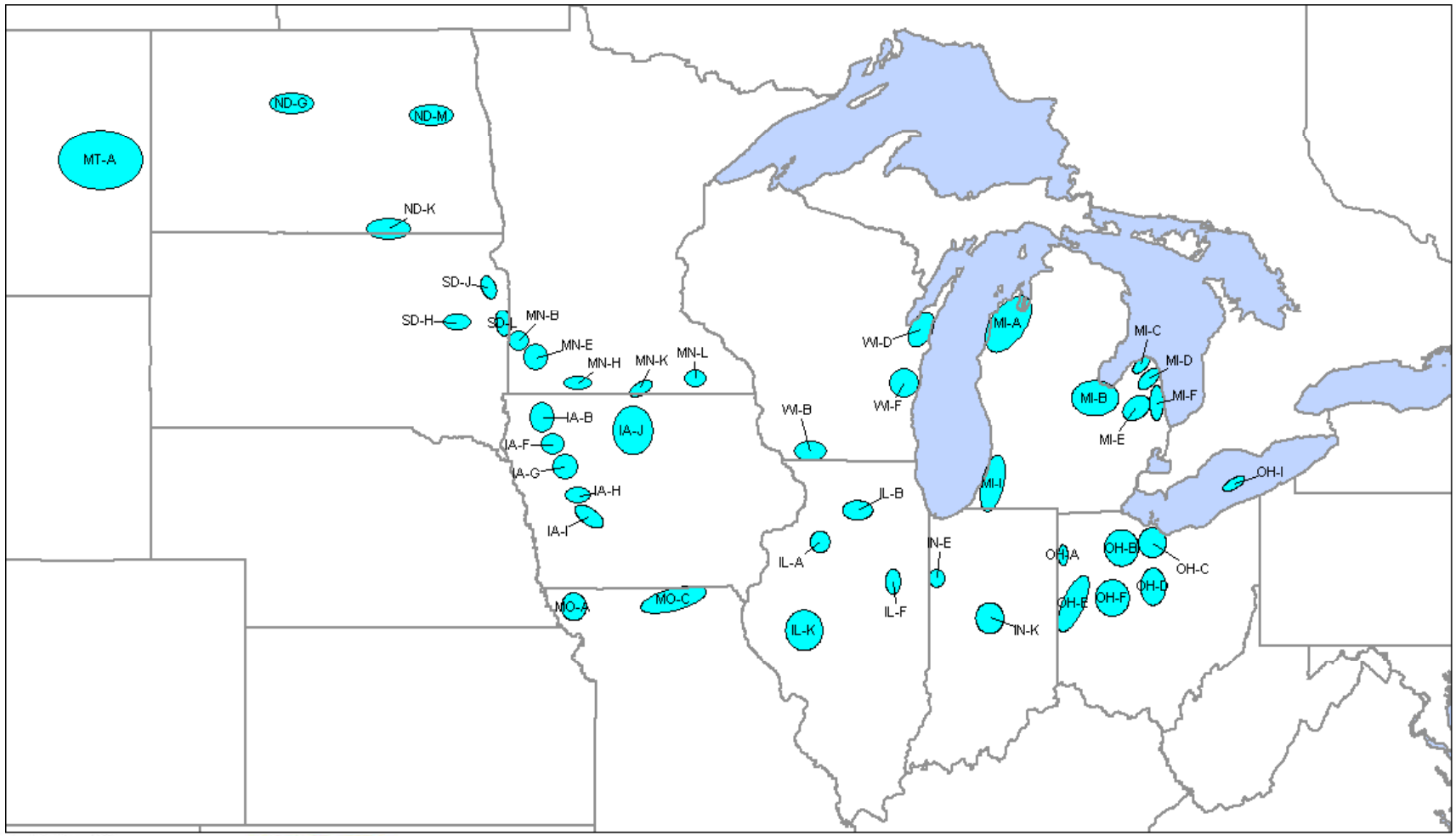
Regional Generation Outlet Study
Renewable Energy Zones



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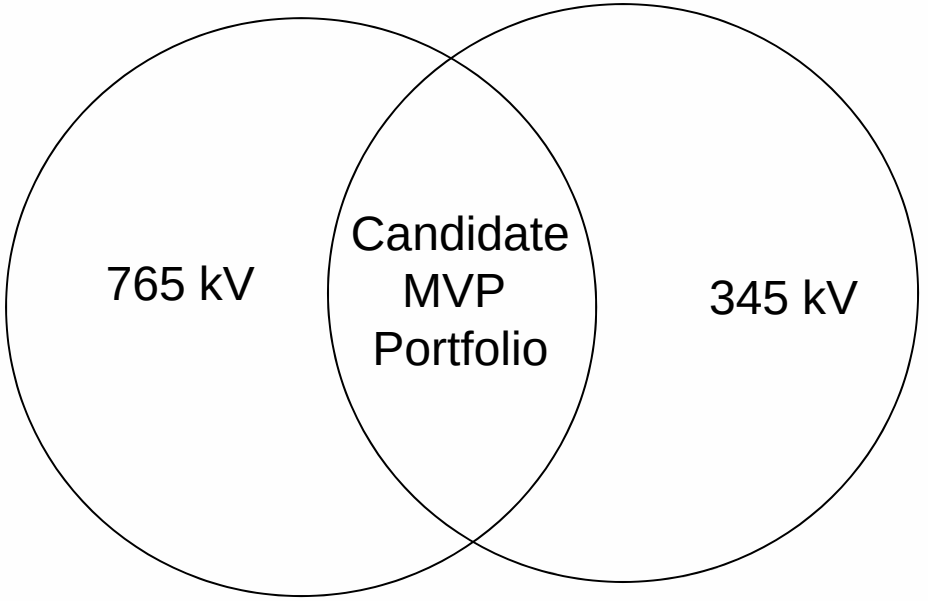
Should We Wait to Build Until Consensus on Voltage Strategy is Achieved?

- No - we can delay decision – for a bit - by making a set of investments with relatively low risk/reward ratio
- Candidate MVP Portfolio would meet criteria such as the following:
  - Support renewable integration at a level likely to still be required under future policy shifts
  - Retain the flexibility to support the choice of 345 kV or 765 kV as the overall strategy
  - Provide sufficient value to be in the public interest on a stand alone basis



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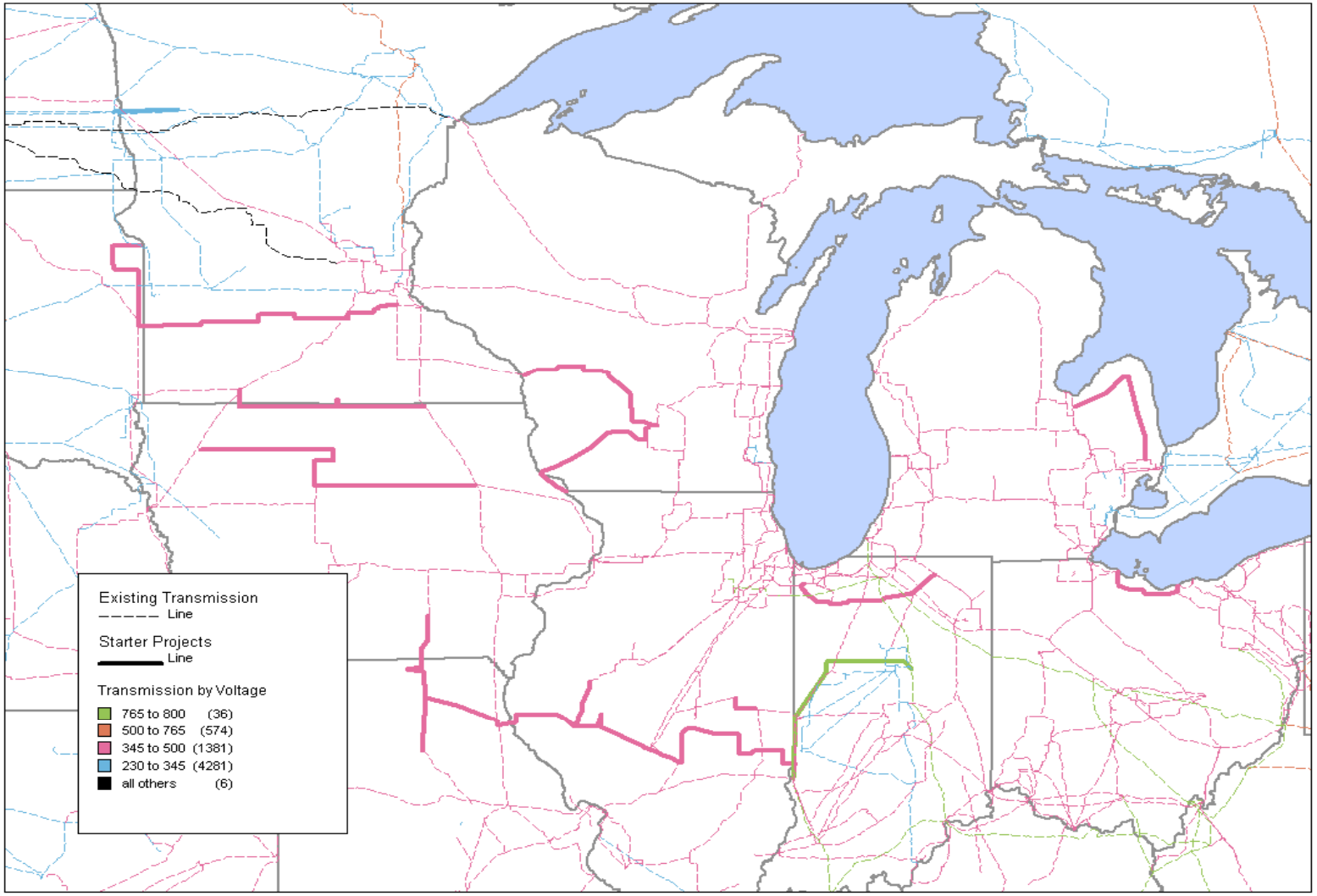
Candidate Multi Value Project Portfolio Map



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Dispatchable Intermittent Resources

- New method of modeling wind and other forecast dependent resources
  - "Forecast Max Limit" sent in Real-Time allows MISO to know the Resource's true max
- Allows for full market participation of wind
  - Economic offers in Real-Time, able to set prices, be dispatched as needed
- Minimize manual wind curtailment process
  - Current manual process used on average 6 times per day
  - This process not needed for each wind that becomes DIR

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Thank You!

- Questions?

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