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Minnesota Rural Electric Association Energy Issues Summit

High Voltage Transmission Expansion Cost

August 11, 2011

Content of Presentation

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August 11, 2011

Agenda

1 » Overview of Regional Sources of Renewable Power

2 » Impact on Transmission Grid

3 » Potential Costs of Integrating Renewable Power

4 » Allocation of Transmission Costs

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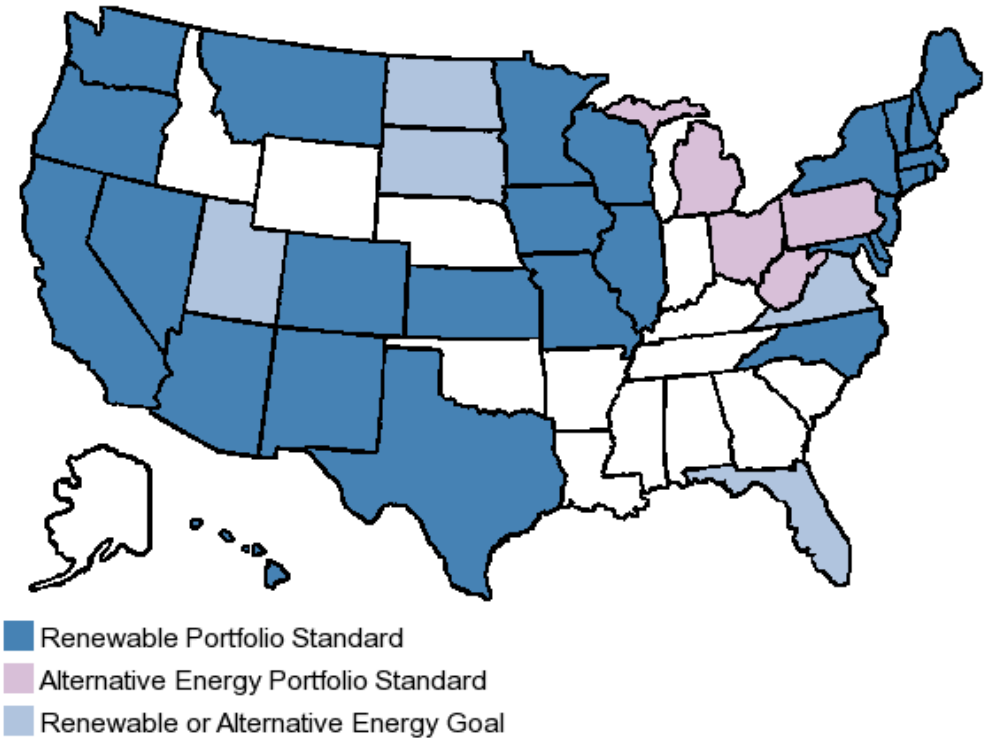
Renewable Portfolio Standards

» Some states have a goal of 20% renewable by 2020, others have a goal of 25% by 2025. The most aggressive is California, which has a goal of 33% by 2020.

» What qualifies as renewable:
- Wind
- Photovoltaic
- Hydro
- Tidal
- Biomass
- Biofuel
- Landfill gas
- Geothermal
- Fuel cells
- Others (e.g., anaerobic digester)



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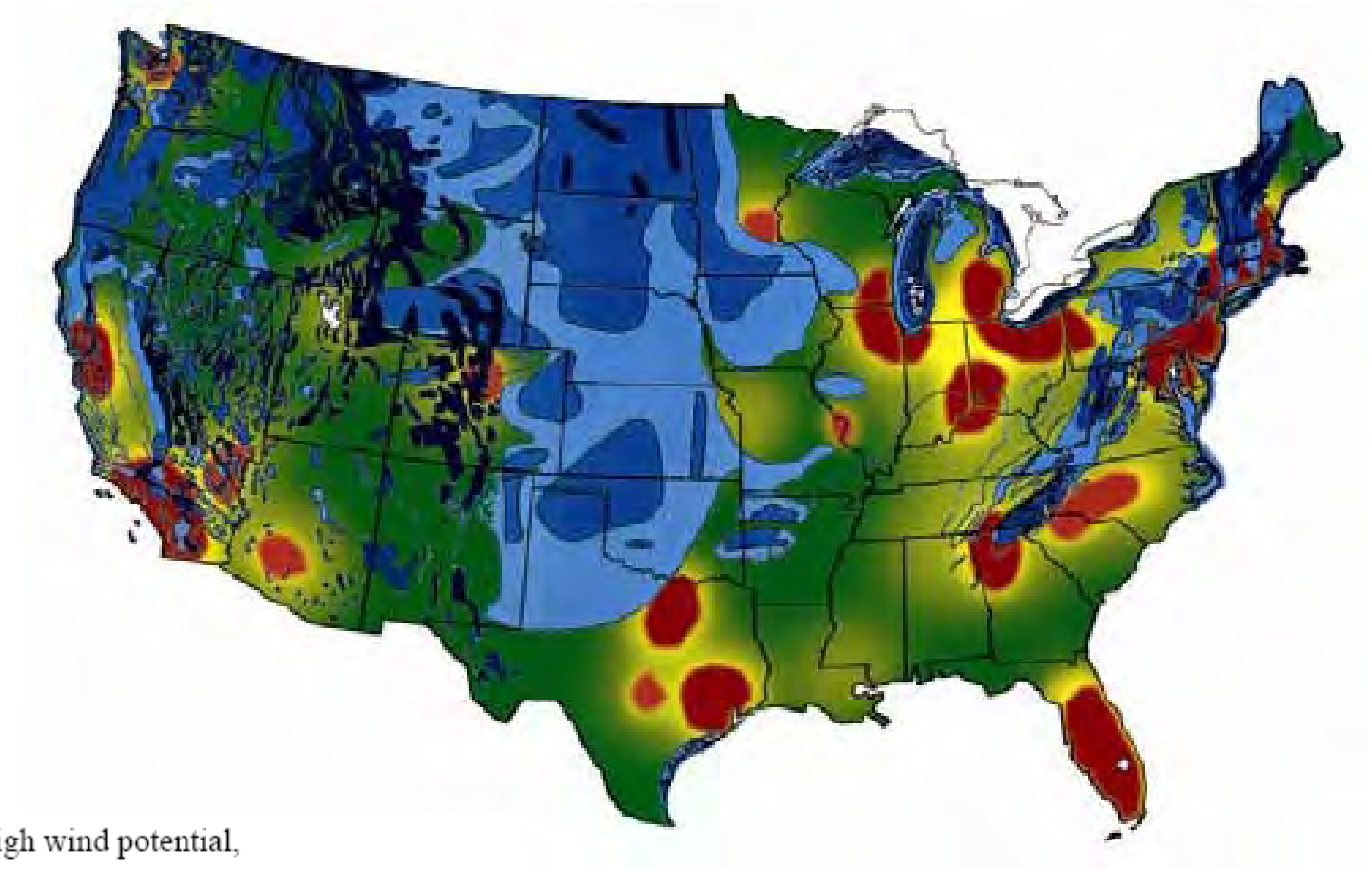
Let the wind blow ...

Wind Potential and Load Centers



Blue - high wind potential,
Brown - large demand centers, and
Green - little wind and smaller demand centers.

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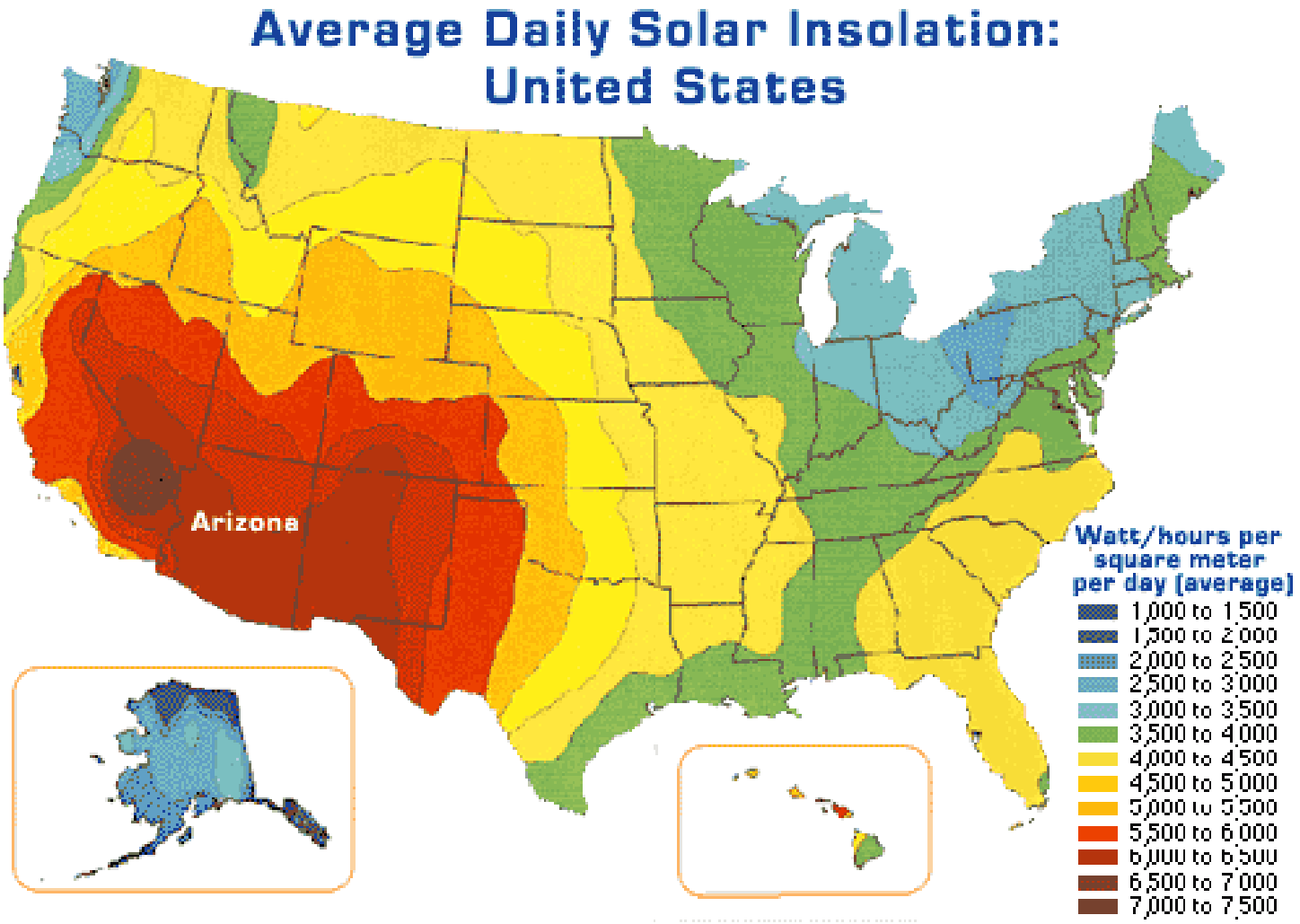
… and the sun shine!



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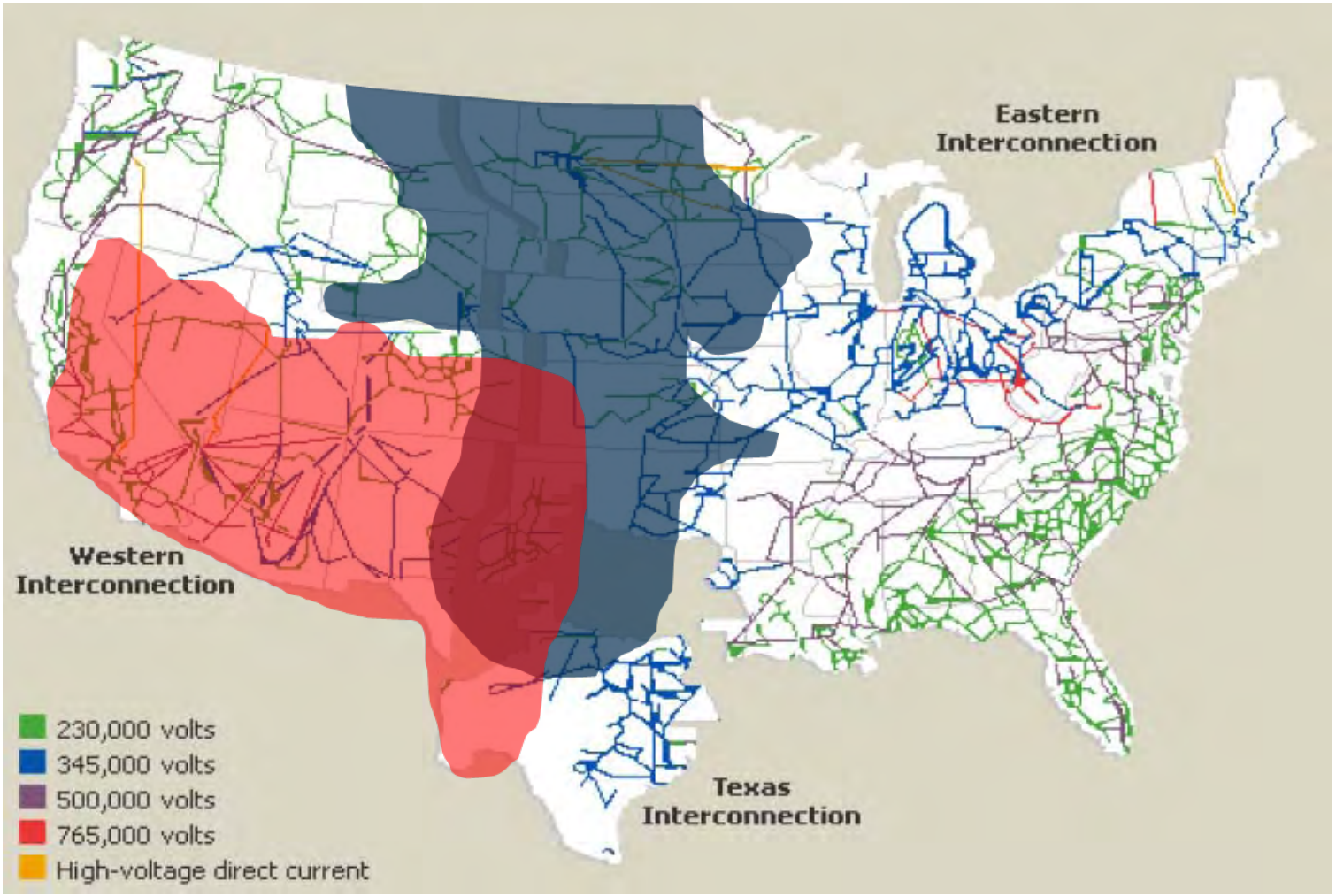
Rough Overlay of Wind & Solar Potential



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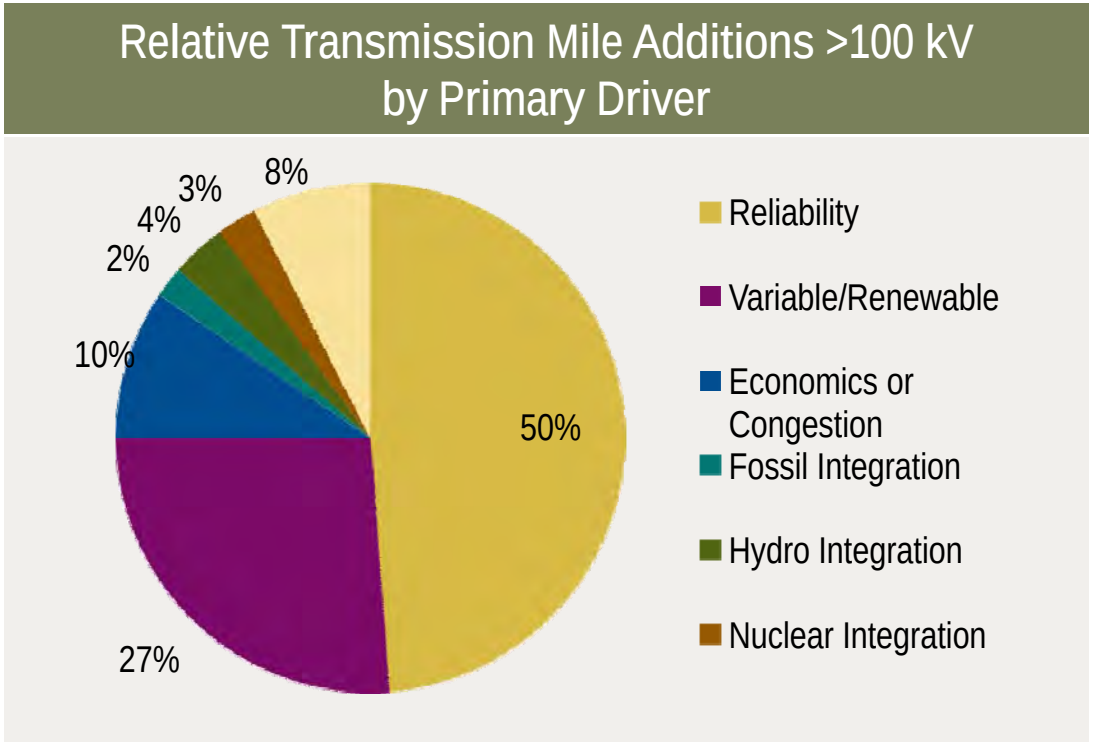
Transmission Development to Integrate Technologies

» Over 16,000 miles of 100 kV and above transmission are planned for the next 5 years, according to NERC's 2010 Long Term Reliability Assessment.
  – 50% is estimated to ensure reliability
  – 27% is estimated to integrate renewable (and variable) resources.



Source: NERC, 2010 Long-Term Reliability Assessment, 2010-2019, October 2010.

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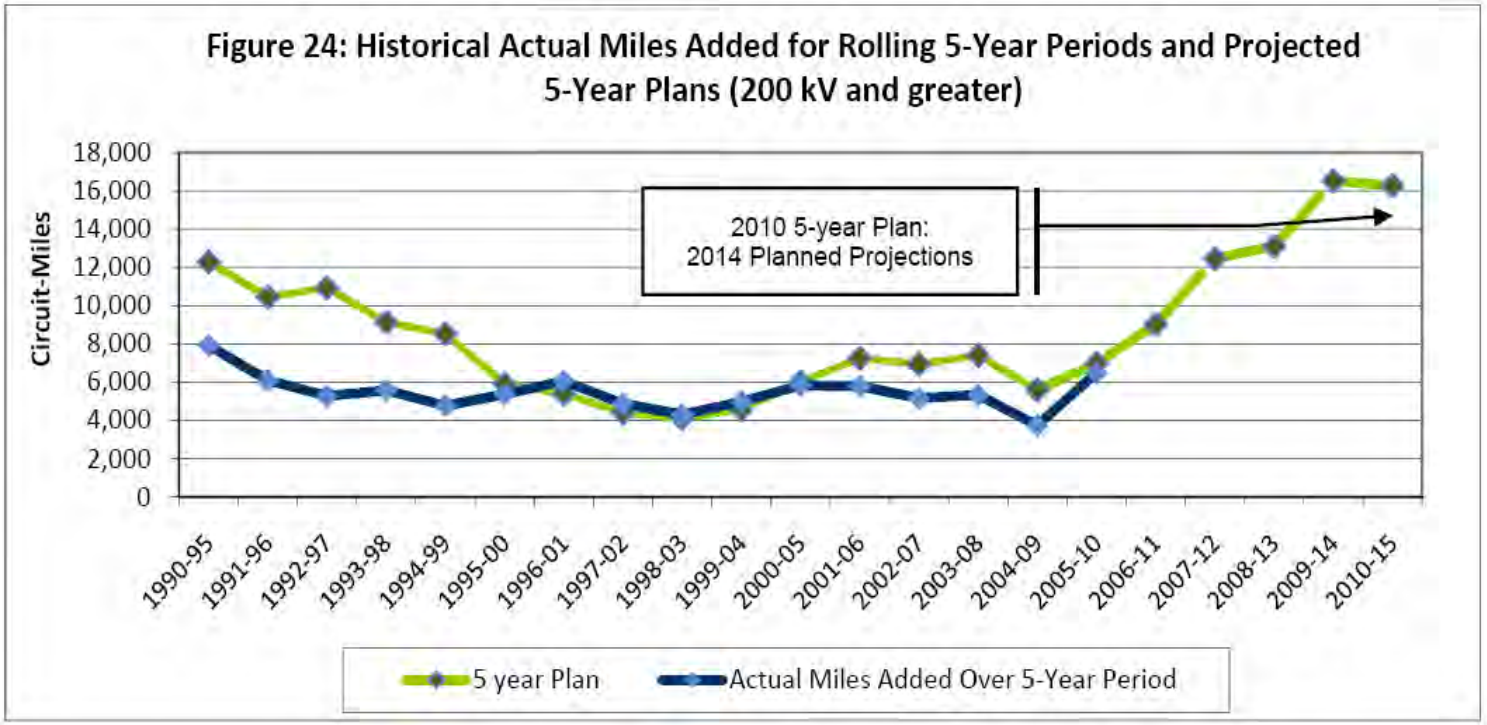
Planned Transmission is Ramping Up Quickly

» During the next five years (2010-15) over 16,000 miles of transmission (200 kV and above) are planned.

» This would nearly triple the average miles that has historically been constructed during five-year periods (about 6,000 miles).



Source: NERC, 2010 Long-Term Reliability Assessment, October 2010

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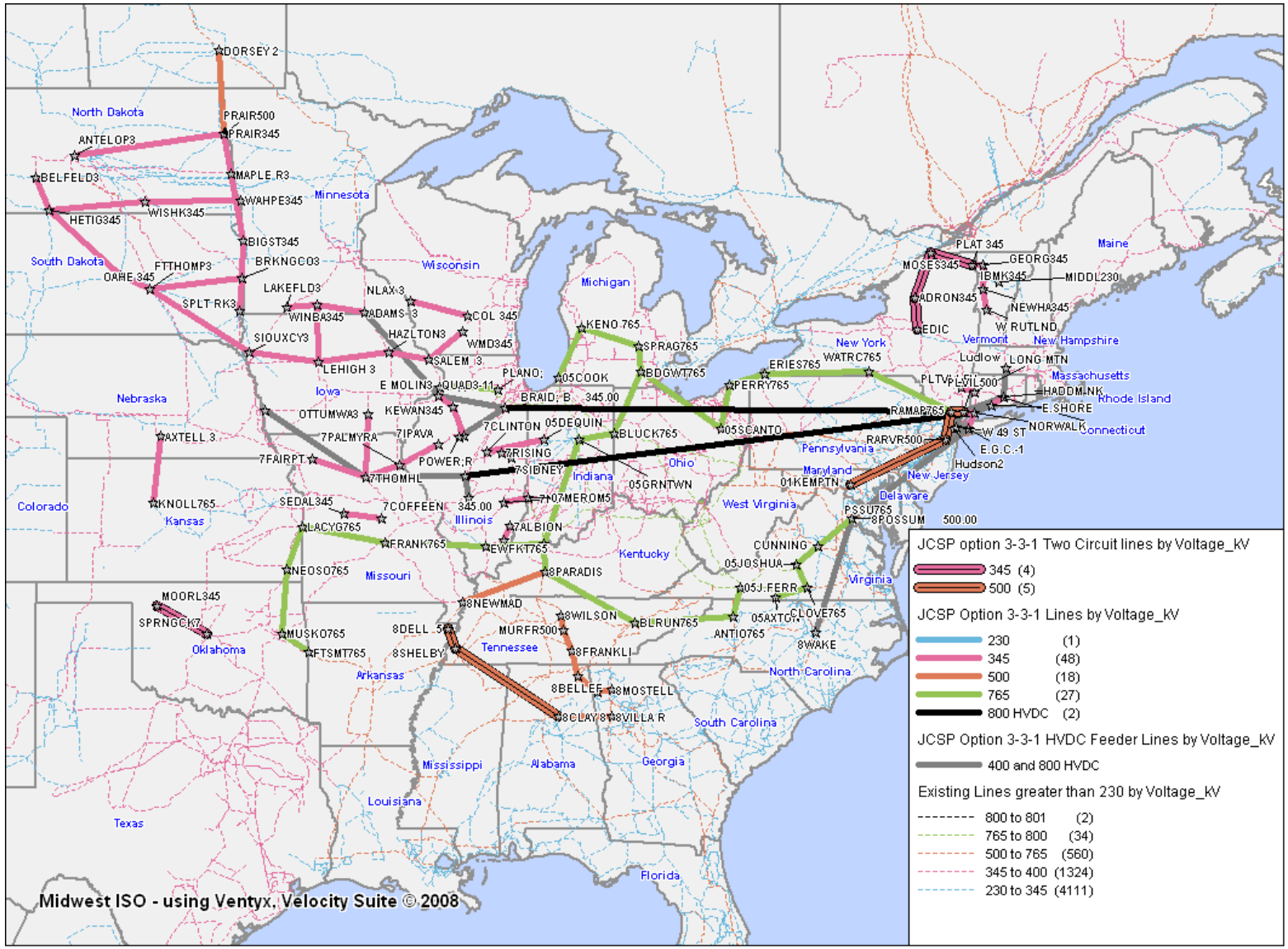
Findings of the Joint Coordinated System Plan (2008)

- 2008 study of the Eastern Interconnection through 2024
- Reference Scenario -- 5% Wind Energy
  - New generation at a cost of $674B, including:
    - 58,000 MW of wind (6% of energy)
    - 77,000 MW of base load steam (54%)
    - 49,000 of gas CT (5%)
  - 10,000 miles of new extra high voltage (345 kV+) transmission at a cost of approximately $50B.
  - Total energy production costs in 2024 of $104B.
- 20% Wind Energy Scenario in support of DOE's Eastern Wind Integration and Transmission Study.
  - Assumes a 20% national RPS requirement met by U.S. on-shore wind development.
  - New generation at a cost of $1,050B, including:
    - 229,000 MW of wind capacity (18% of energy)
    - 37,000 MW of base load steam (42%)
    - 70,000 MW of gas CT (7%)
  - 15,000 miles of new EHV transmission at a cost of approximately $80B.
  - Total energy production costs in 2024 of $85B.

5% Wind Energy Conceptual Transmission



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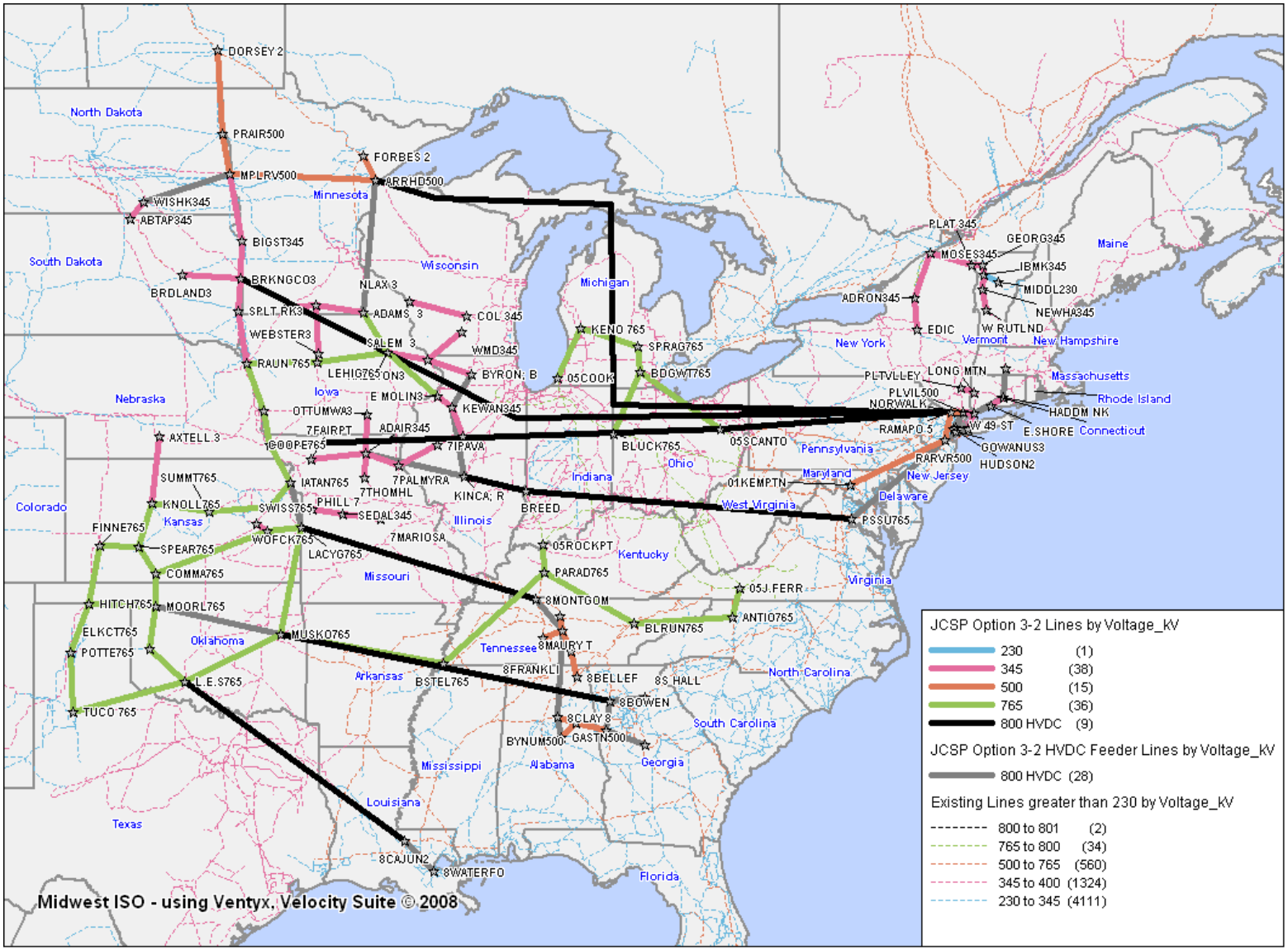
20% Wind Energy Scenario Conceptual Transmission Overlay



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What Did the JCSP Tell Us?

Impacts of the 20% scenario in 2024:

Transmission	• About 5,000 miles of additional EHV transmission • $30B of added transmission investment
Generation	• In addition to added wind, about 20,000 MW of new gas CT • Reduction of 40,000 MW in base load plants • Net added investment of $376B for generation • Reduction of $19B in annual production costs

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Transmission Cost Allocation Methodologies

- What do you hear?
  - But for
  - Cost causation
  - Beneficiaries pay
  - Socialization
- FERC principles require:
  - Costs are fairly assigned among participants, including those who cause the need and those who benefit from the project
  - Adequate incentives must be provided to construct new transmission
  - Generally supported by state authorities
- Interpretation of these principles has led to a wide variety of cost allocation methods.

Primary Transmission Cost Allocation Methodologies

Energy

- Allocates costs by consumed or generated energy (MWh)
- Could be system-wide or localized
- Form of socialized cost allocation

Peak Demand

- Allocates costs based on peak demand (MW)
- Could be based on system coincident or non-coincident peak
- Form of socialized cost allocation

Flow Based

- Allocates costs based on relative impact that participants have on the transmission facilities
- Derived from power flow models
- Form of beneficiary pays

Monetary Metrics

- Allocates costs to those expected to receive a monetary gain
- Based on production/market simulations before and after the project COD
- Form of beneficiary pays

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Overview of MISO Transmission Cost Allocation

Baseline Reliability Projects

- Allocated to load
- 100kV to 345kV
  - 100% allocated based on load flow methodology in the sub-region percentage share for a given pricing zone calculated as relative zonal share of the sum of absolute values
- 345kV and above:
  - 20% based on average monthly coincident peaks across MISO
  - 80% on flow-based methods

Generation Interconnection Projects

- Less than 345kV are 100% allocated to the interconnection customer.
- 345 kV and above
  - 90 percent allocated to the interconnecting customer
  - 10 percent allocated system-wide based on monthly coincident peaks,
  - Except customer is allocated no cost for upgrades for interconnecting to American Transmission Company, International Transmission Company, Michigan Electric or ITC Midwest pricing zones

Market Efficiency Projects

- Regionally Beneficial Projects over $5M are based on monetary metric
- Benefits are calculated using a 70% weight on production cost changes and 30% on LMP changes
- Costs are based on revenue requirements of the project
- Benefits-Costs are based on 10 year period with 1.2:1 after year 1 increasing to 3:1 in year 10.
- 20% of the costs allocated based on average monthly coincident peaks and remaining 80% allocated to three sub-regions based on relative value of annual benefits

Multi Value Projects

- 100 percent of the annual revenue requirements Multi Value Projects (MVP) are allocated on a system-wide basis to Transmission Customers.

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Bottom Line: Impact on Typical Distribution Utilities

- Transmission members in MISO will get an allocation of transmission costs based on a mixture of approaches (cost causation, socialization, etc.) depending on how each project is characterized (e.g., reliability, economic or MVP).
- In MISO, transmission projects to interconnect renewables are likely to be considered Multi-Value Projects (MVP).
- Distribution utilities (transmission dependent utilities in MISO language) will incur costs related to MVP Projects (as CapX2020) directly or indirectly through their G&T supplier.

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