Repowering the Midwest: **Overview of Findings**

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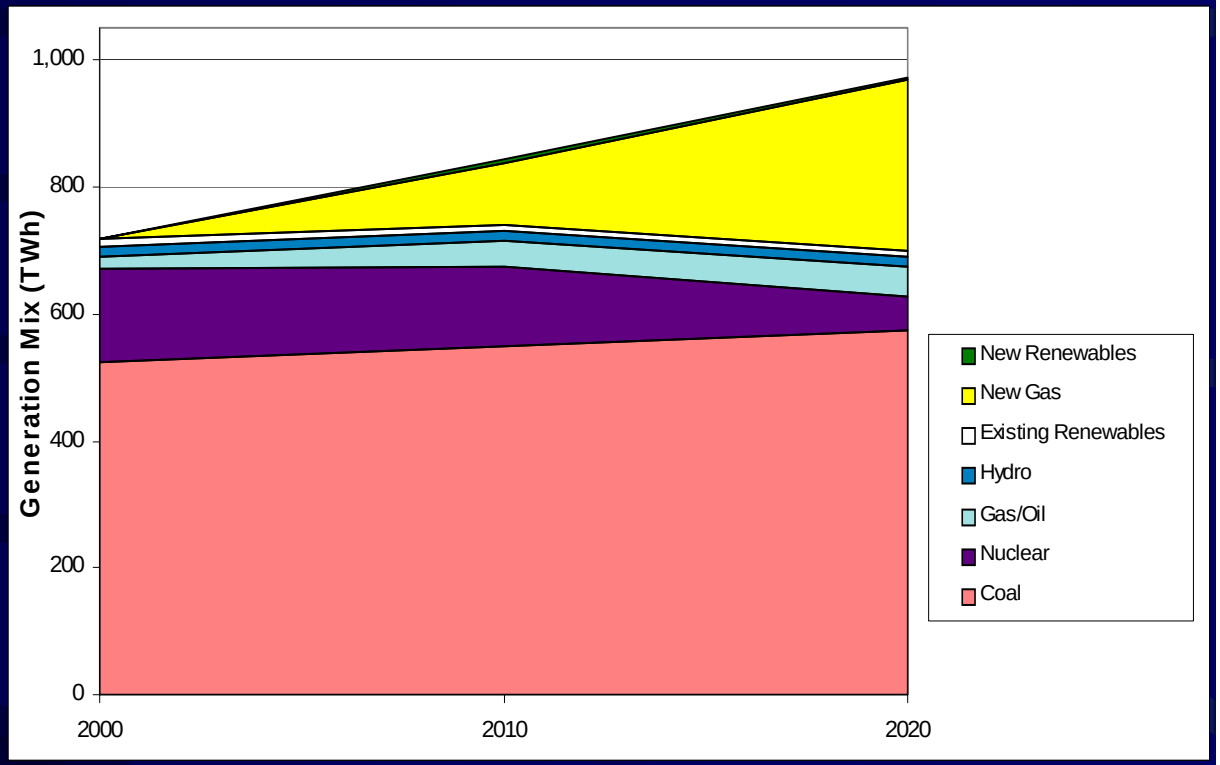
The Study's Objectives

- Identify opportunities for energy efficiency, renewable resources, and efficient gas technologies in the Midwest.
- Integrate these resources into a "Clean Energy Development Plan" for 2010 and 2020.
- Present the benefits and costs of this Plan.
- Recommend policy changes necessary to achieve the Clean Energy Development Plan.

Business as Usual (BAU)

- Electricity demand increases steadily.
- Large additions of new natural gas plants to meet demand growth.
- Coal plants increase output as demand grows.

Midwest Region



Consequences of Business-as-Usual

- Increased health and environmental impacts:
  - SO_2 (acid rain)
  - NO_x (smog, respiratory illnesses)
  - CO_2 (global warming)
  - Mercury (fish contamination)
- Increased regulatory compliance costs.
- Lost economic development opportunity.

Energy Efficiency: Using Energy Wisely

- Energy efficiency means using new technologies, practices, and processes to reduce electricity demand, while maintaining or improving electricity services.
- Energy efficiency does **not** mean doing without, or making sacrifices in electricity services.

Energy Efficiency is Abundant and Readily Available

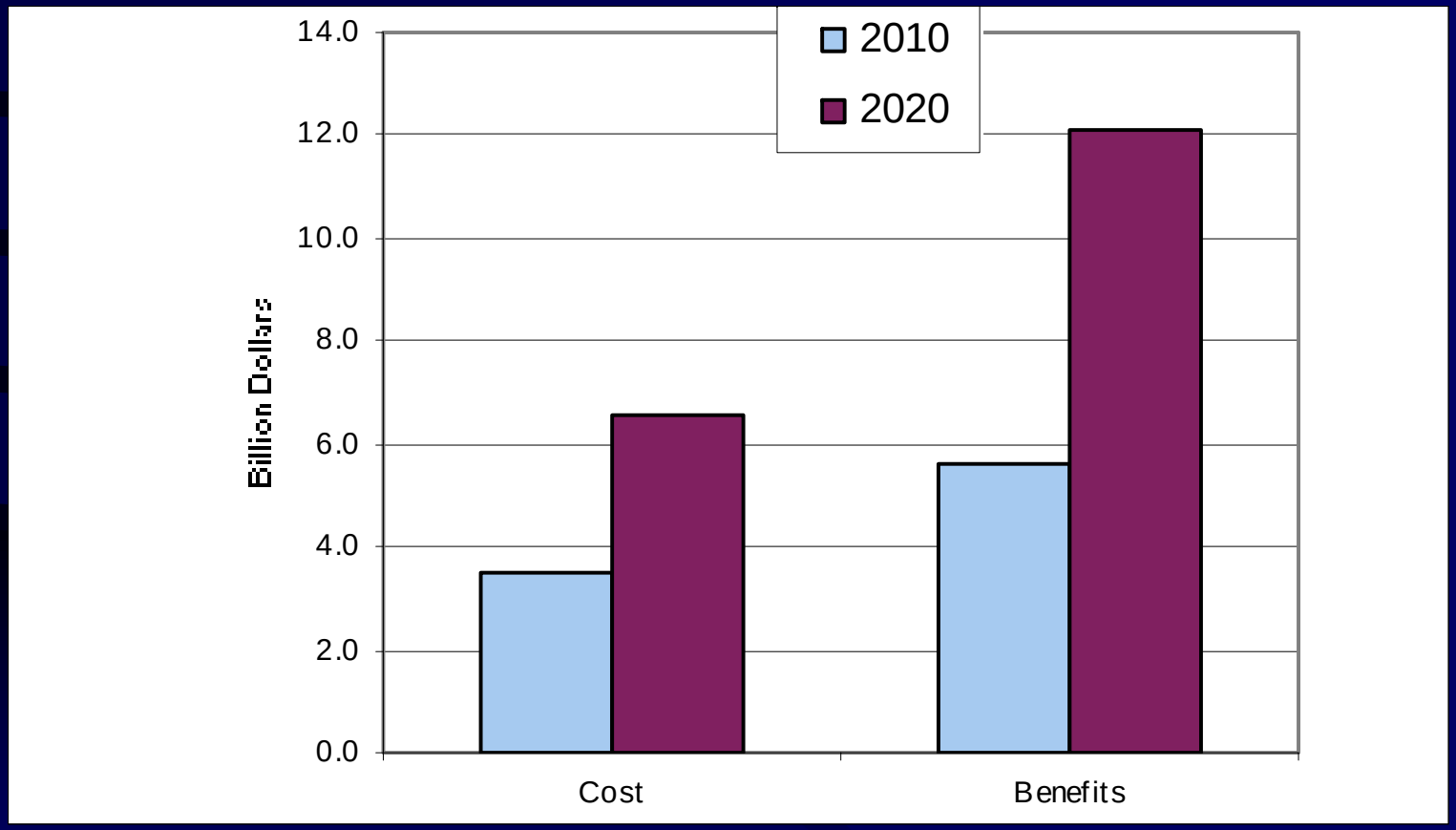
- The Midwest has enough cost-effective energy efficiency to eliminate load growth for the next twenty years.
- Under the Business-As-Usual scenario, load grows steadily at over 1% per year, which results in a 26% increase over twenty years.

Energy Efficiency is Very Cost-Effective

- At 2.3 ¢/kWh, energy efficiency costs less than generating, transmitting and distributing electricity.
- Benefit-cost ratio = 1.8
- For every $1.00 invested in energy efficiency, $1.80 in electricity cost is avoided.

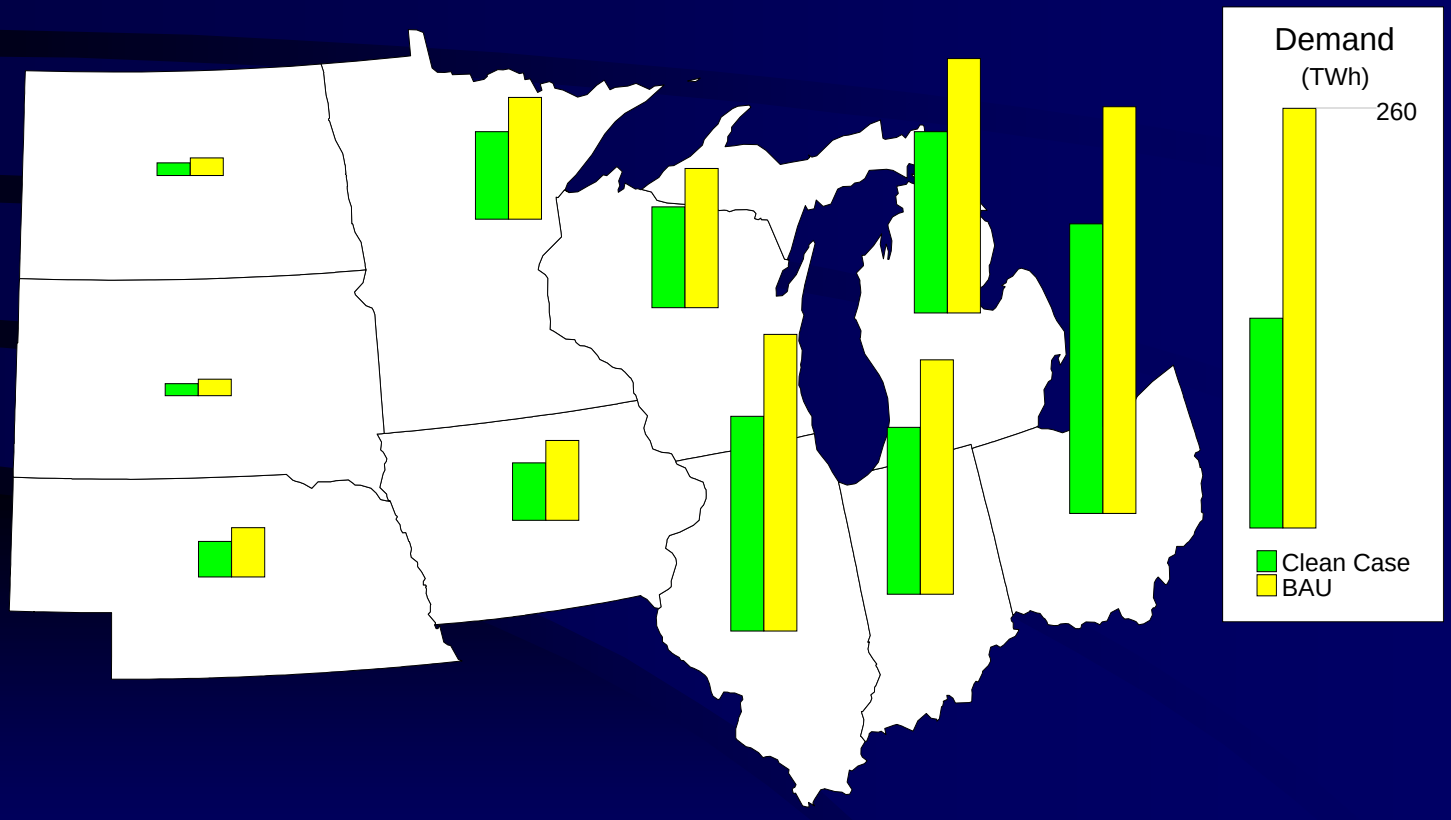
Energy Efficiency Saves Money

Midwest Region



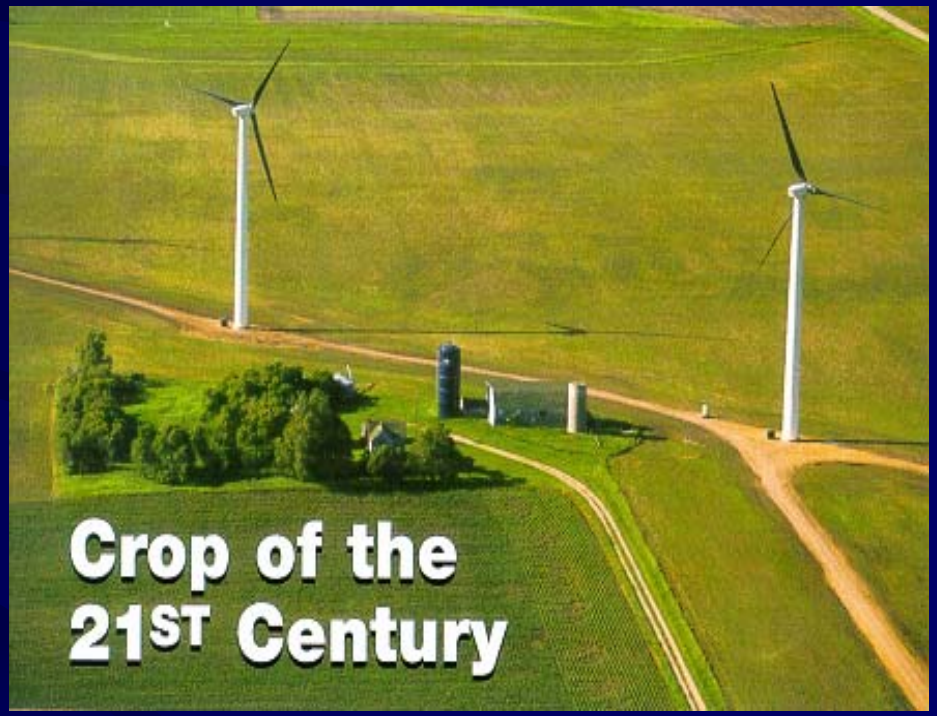
Energy Efficiency Saves Energy

State by State - 2020

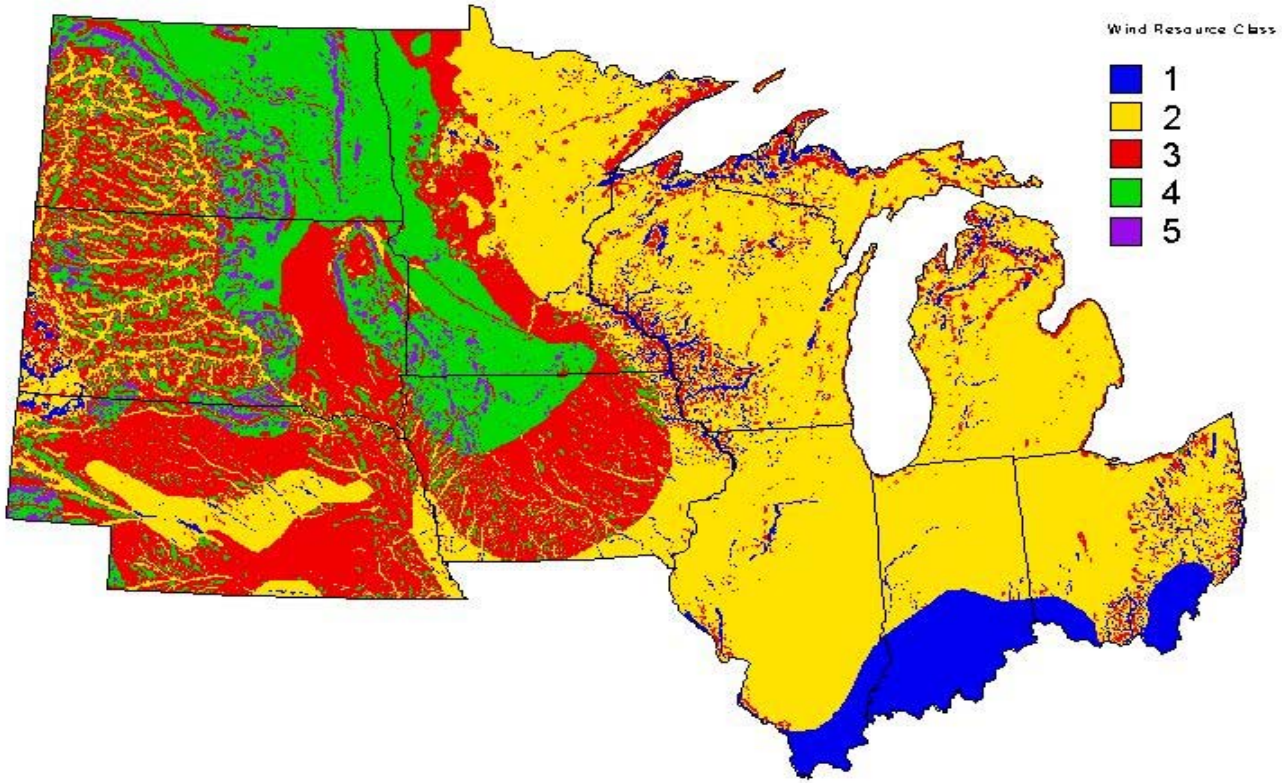


Renewable Energy

- Tremendous untapped potential in the Midwest.
- Wind turbines.
- Biomass: co-firing, CHP and gasification.
- Solar: photovoltaic cells.



Midwestern Wind Resources

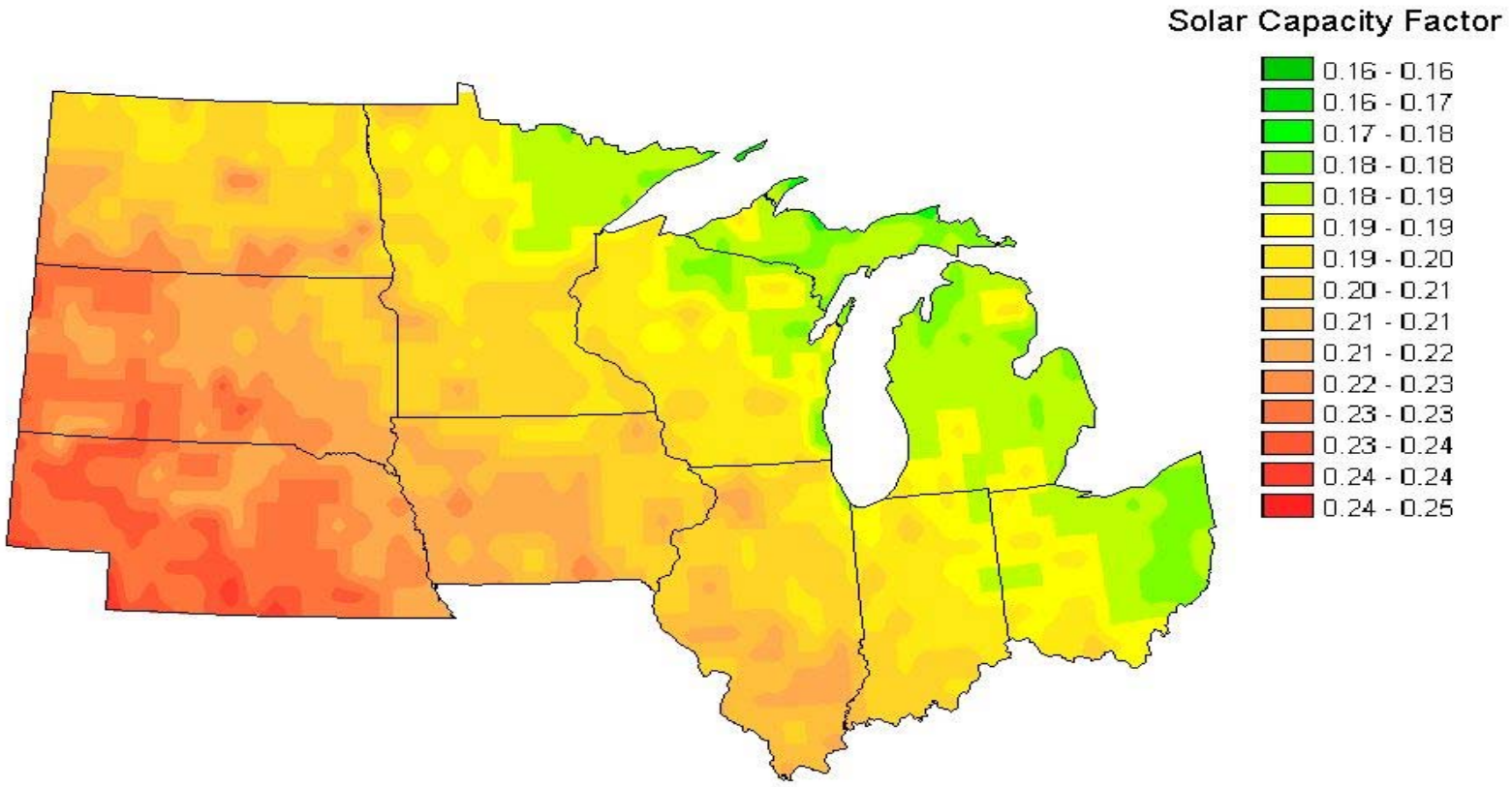


Biomass Energy

Native crops, such as switch grass, can be harvested for energy, yielding more income for farmers

Midwestern Solar Resources

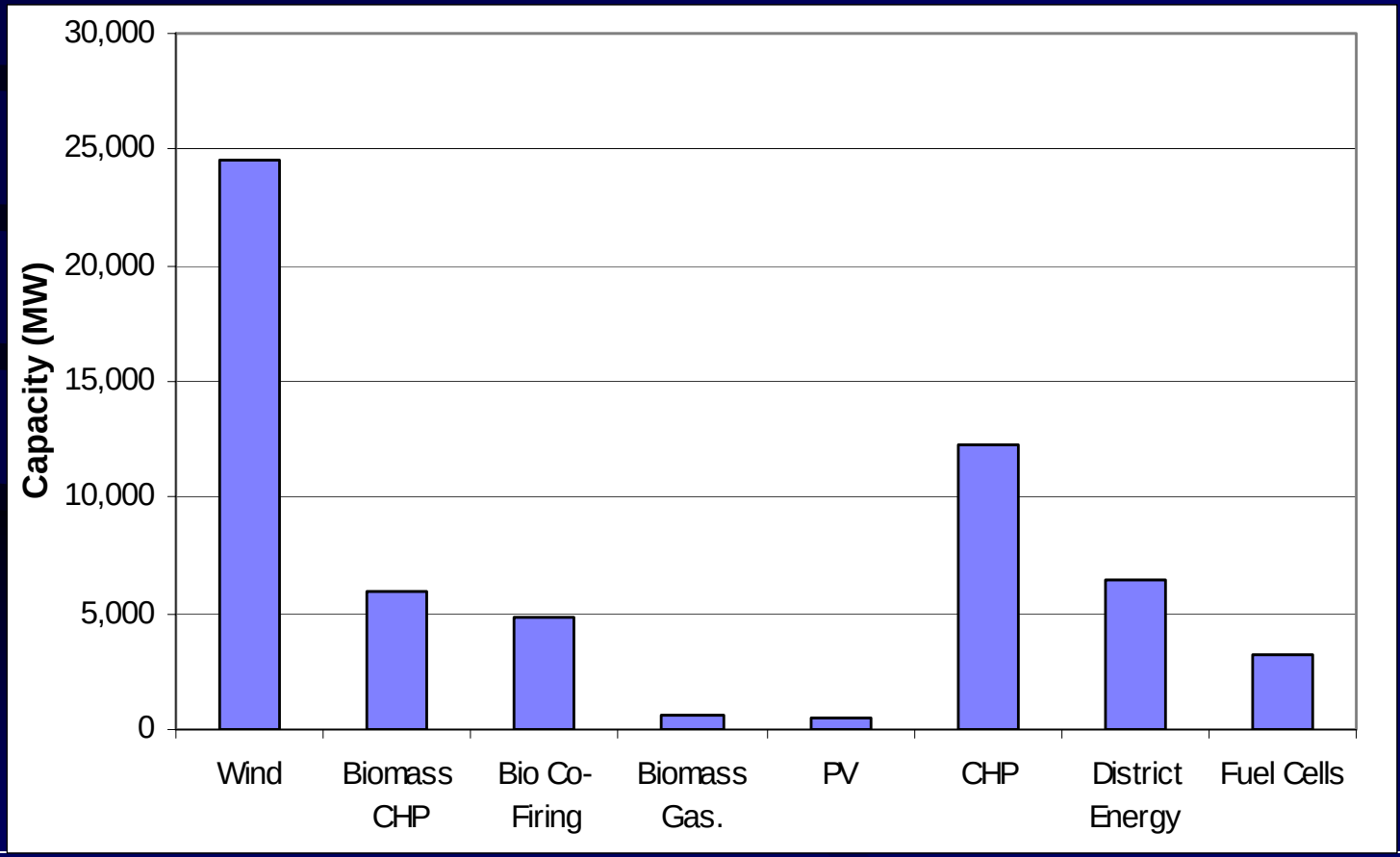
Photovoltaics (PVs) can be especially cost effective in remote or rural areas with high electricity distribution costs



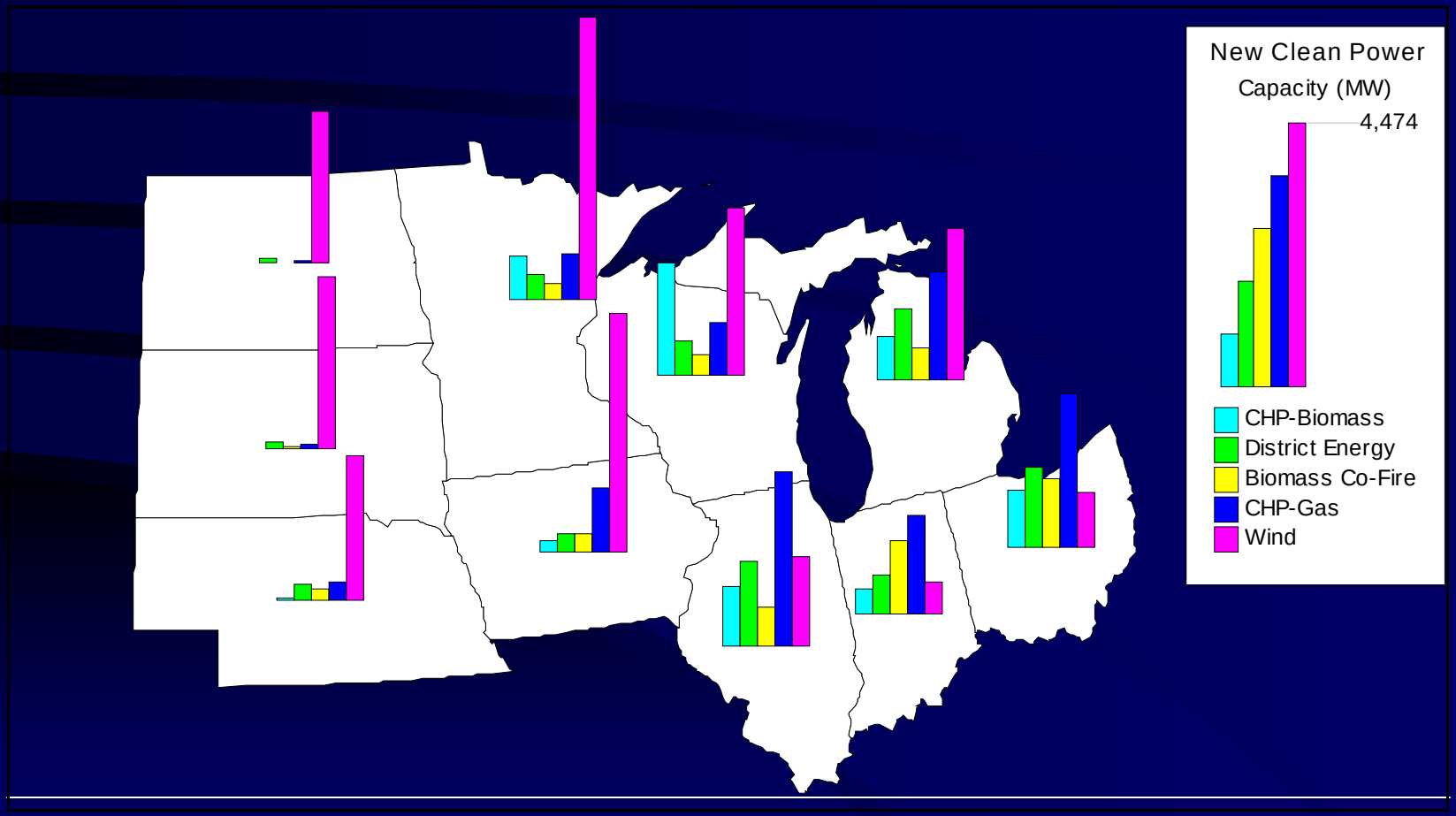
Efficient Generation: Making the Most of Natural Gas

- Natural gas expected to play an important role in any future scenario.
- Natural gas has risks associated with availability, price increases and carbon reduction policies.
- Use gas efficiently in key niches: e.g. fuel cells, combined heat and power, district energy systems.
- Many opportunities exist in the Midwest, especially in heavily industrialized eastern states of the region.

New Renewable and Efficient Gas Capacity in the Midwest in 2020



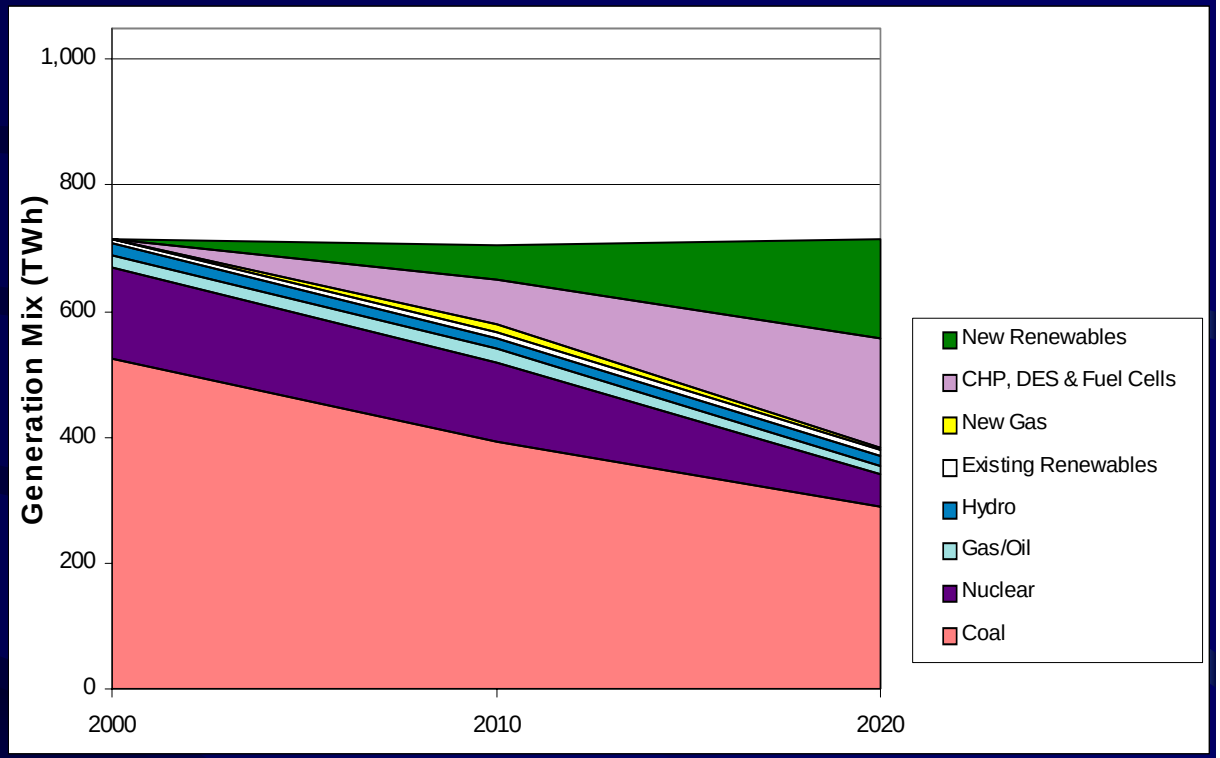
New Clean Power Plants:
State by State - 2020



Generation Under the Clean Energy Development Plan:

- No new growth in electricity demand.
- New renewables:
  - 8% of gen. by 2010
  - 22% by 2020
- New efficient gas:
  - 10% of gen. by 2010
  - 24% by 2020
- Coal generation reduced.

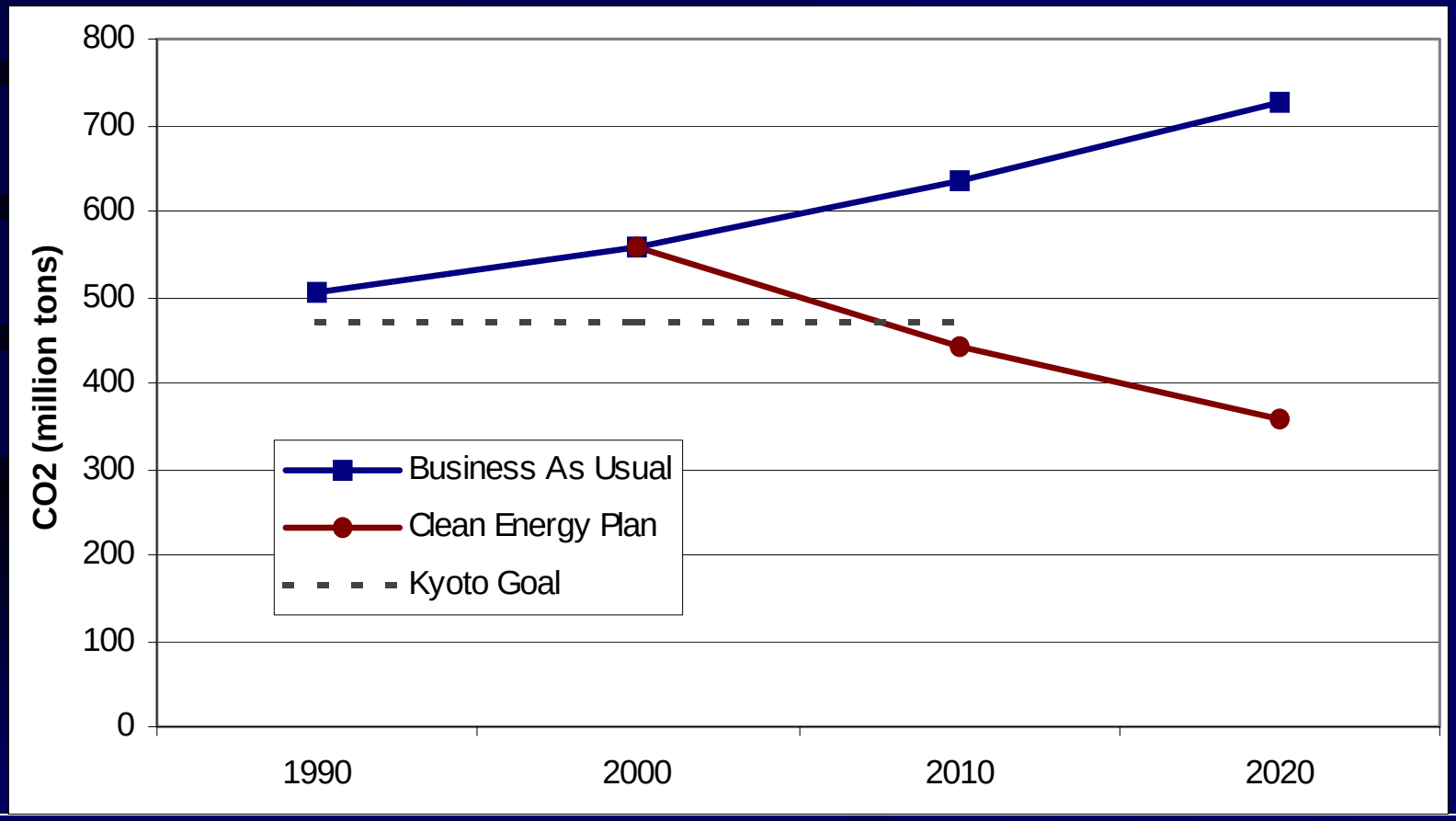
Midwest Region



Significant Reductions in Air Emissions (relative to BAU)

- SO2 emissions reduced by 56%.
- NOX emissions reduced by 71%.
- CO2 emissions reduced by 51%.
- Comparable reductions in mercury and particulates.

CO2 Reductions Sufficient to Meet Kyoto Goal



Clean Energy Costs

- The Clean Energy Development Plan Can be Achieved With Minimal Cost:
  - 1.5% increase in total electricity costs in 2010.
  - 3.4% increase in total electricity costs in 2020.
- With recent fuel price increases, the Clean Energy Plan is even more cost-effective.

Clean Energy Benefits

- Improved electricity services.
- Increased fuel diversity and electricity reliability.
- Reduced pollution, fewer health and environmental impacts.
- Economic development and stimulation of new products, technologies and services.
- Wind turbines provide “cash crop” for farms.

Conclusion

- Clean energy resources are readily and abundantly available in the Midwest.
- Clean energy resources should be the **centerpiece** of energy policies:
  - Local level
  - State level
  - Federal level