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# The Upper Midwest's Transition to a Sustainable Energy System – Features & Challenges –

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# Izaak Walton League's Energy Program

- National Conservation Organization with 40,000 members
- Renewables & Energy-Efficiency
- Greenhouse Gas Markets
- Midwest Renewable Energy Tracking System
- Power Plant Campaign
- Regulatory & Legislative Strategies

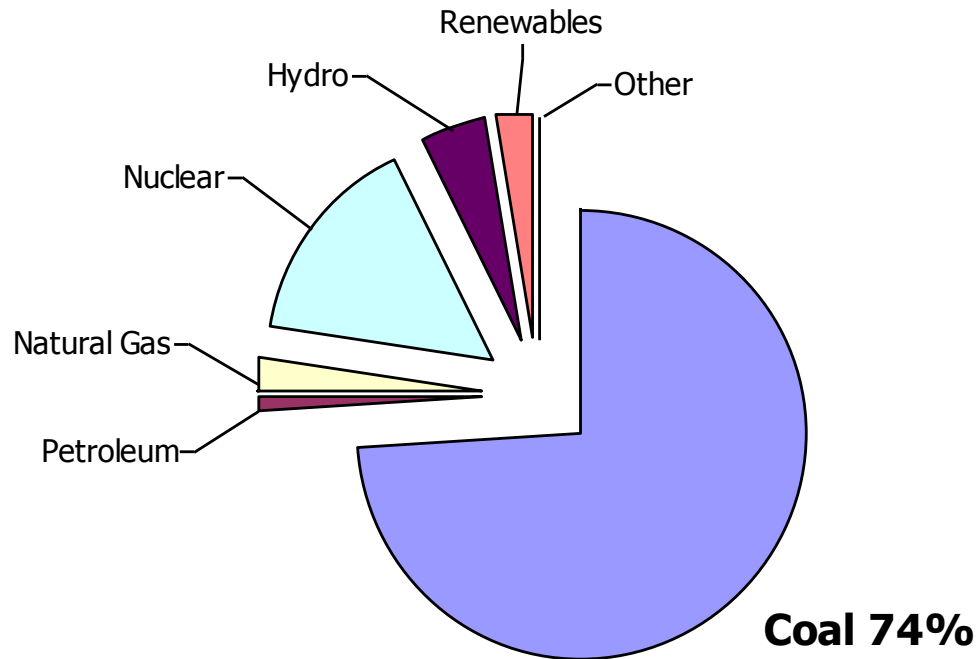


# Presentation Outline

- Upper Midwest Energy System Features
  - Focus on Electric System
- Challenges & Barriers
  - Policy and Technical
- Policies for Moving Forward
  - To overcome Barriers and achieve a Sustainable Energy System in the Upper Midwest



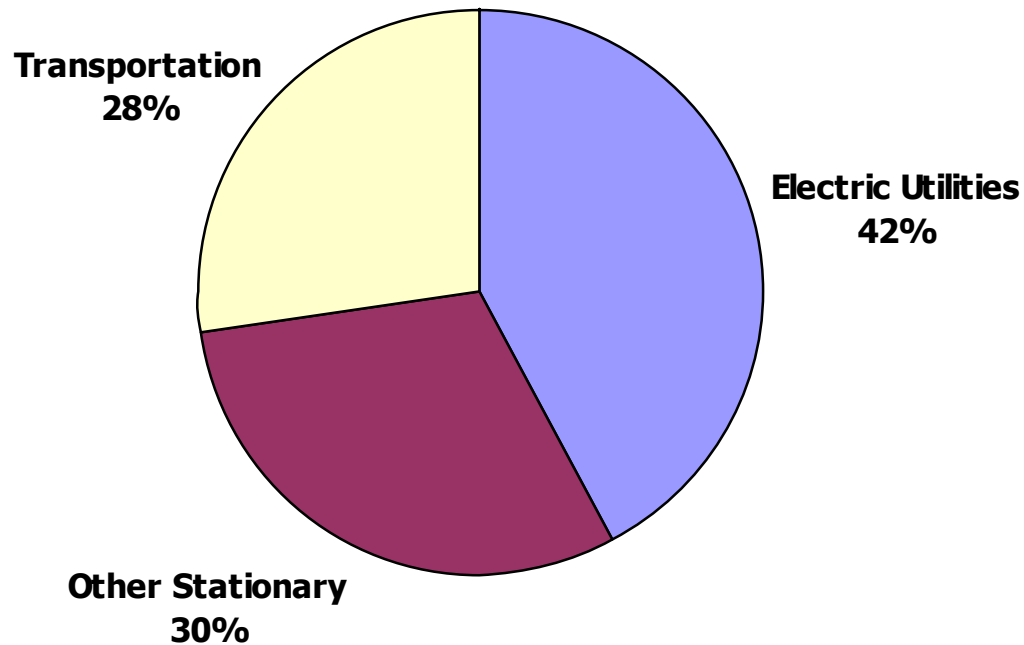
# Upper Midwest: 2004 Fuel Use in the Electric Power Sector



Upper Midwest : 2004 Fuel Use by Electric Power Sector  
Source: Energy Information Agency, US DOE, 2004 State Generation  
Includes Minnesota, Iowa, Wisconsin, South Dakota, North Dakota



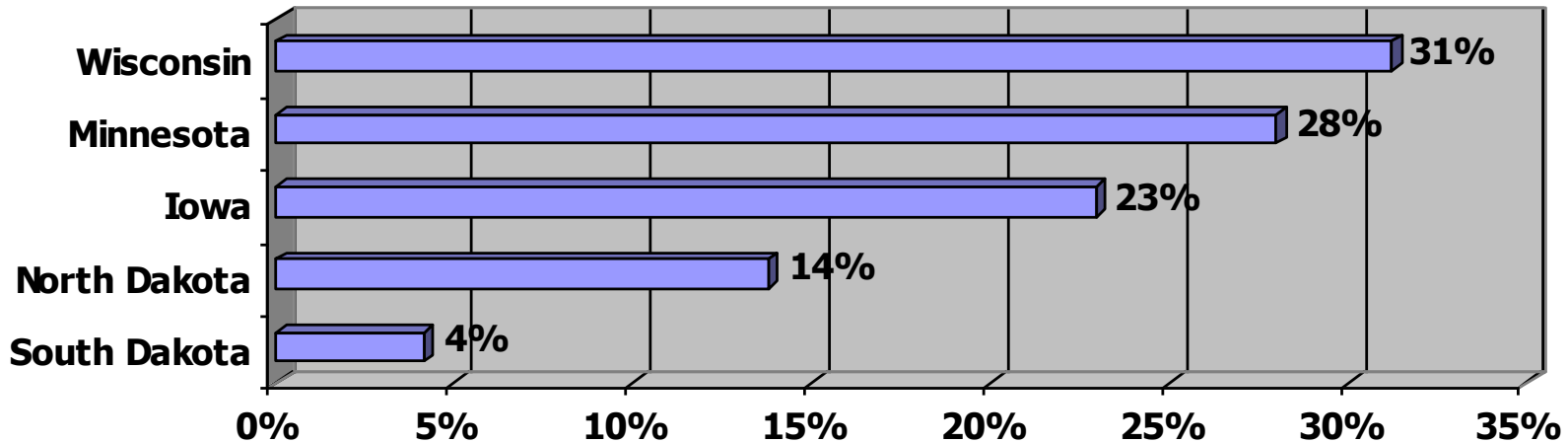
# Upper Midwest: CO2 Emissions by Sector



Source: EPA 2000, PCO2R Partnership June 2005 Report  
Includes Iowa, Minnesota, North Dakota, South Dakota, and Wisconsin



# Upper Midwest: CO2 Emissions by State

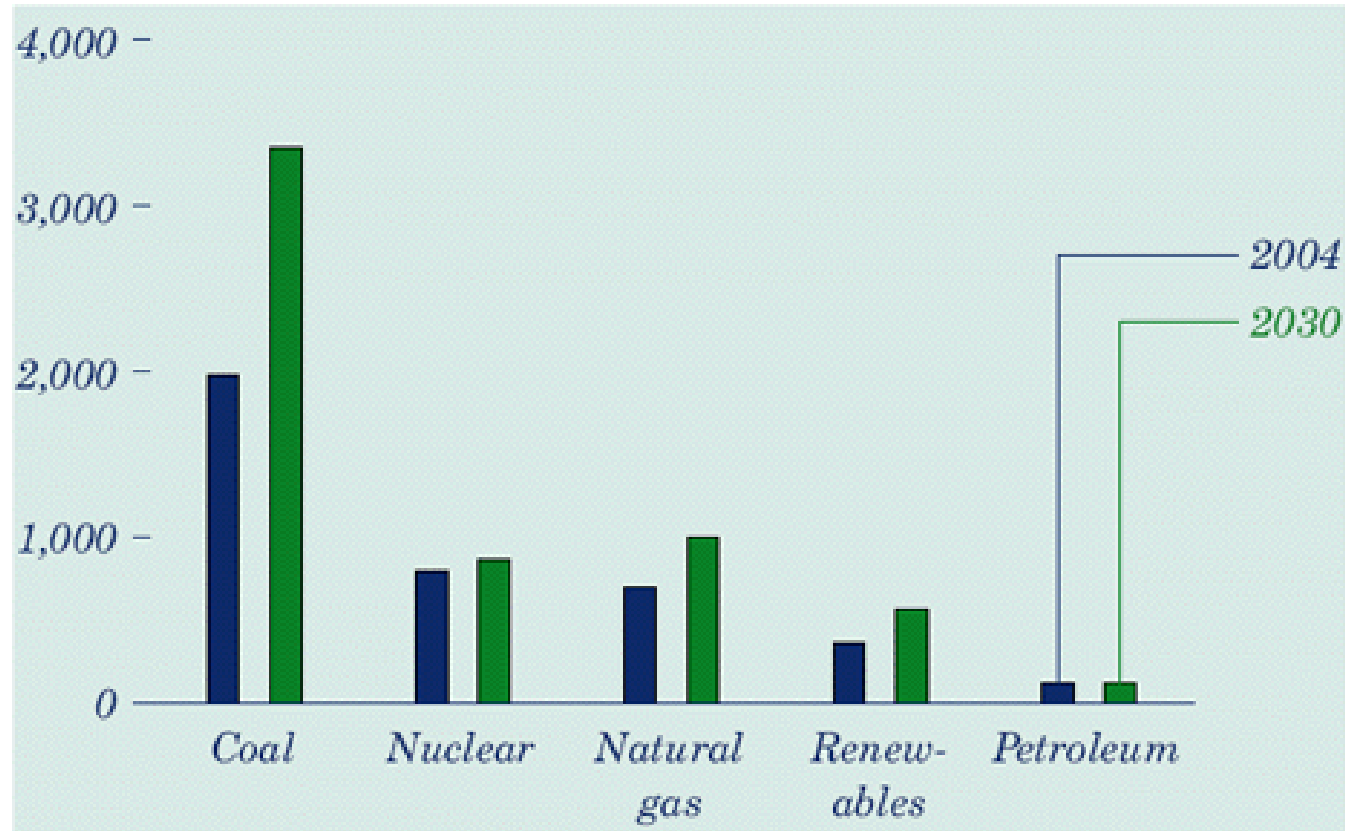


Upper Midwest: CO2 Emissions by State  
Source: EPA 2000, PCO2R Partnership June 2005 Report  
Includes Iowa, Minnesota, North Dakota, South Dakota, and Wisconsin



# 2004 and 2030 DOE Generation Projections

*Figure 62. Electricity generation by fuel, 2004 and 2030 (billion kilowatthours)*



Source: US Department of Energy, Energy Outlook 2006



# Environmental Impacts of Current Electric System/Fuel Sources

- **Air pollution:** Burning coal causes smog, soot, acid rain, global warming, and toxic air emissions.
- **Wastes generated:** Ash, sludge, toxic chemicals, and waste heat create more environmental problems.
- **Fuel supply:** Mining, transporting, and storing coal levels mountains and pollutes the land, water, and air.
- **Water use:** Conventional coal plants need billions of gallons of cooling water and harm wildlife.

Source: Union of Concerned Scientists

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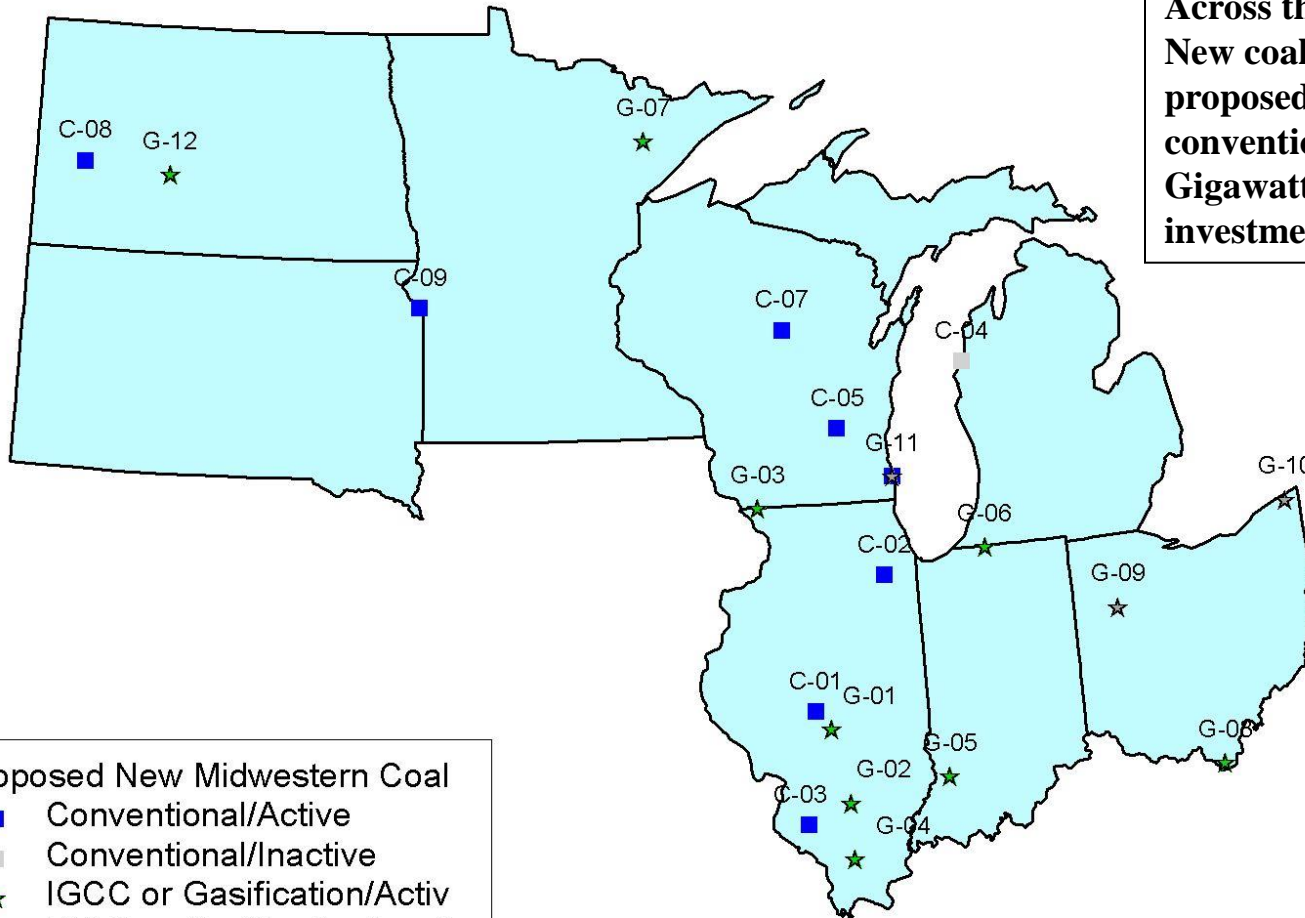


# Upper Midwest Energy System: Challenges/Barriers

- Several thousand megawatts of conventional coal proposed for region; beginning to see some IGCC, but little carbon capture & storage (CCS).
- Existing coal plants are dirty, inefficient; clean-up poses “CO2 conundrum”.
- Development of carbon capture and storage not in phase with coal rush; EOR opportunities will be exploited first; CO2 costs not internalized.
- Transmission grid needs massive investment, particularly for wind and/or coal (IGCC w/ CCS) from the Dakotas.
- Efficiency (DSM) investment levels do not capture nearly all cost-effective opportunities.



# Proposed Midwest Coal Plants



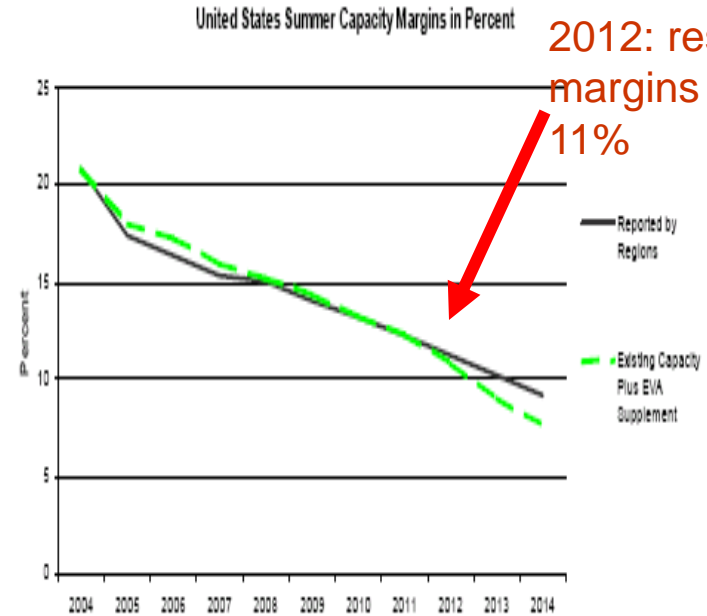
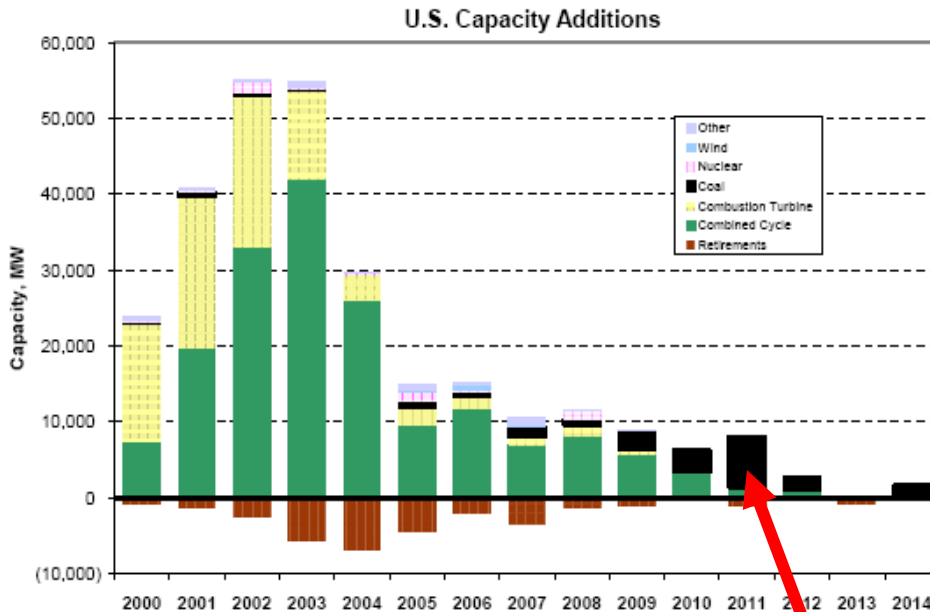
Across the United States 135 New coal plants are being proposed; most using conventional technology (80 Gigawatts, \$108 billion in investment)

Proposed New Midwestern Coal

- Conventional/Active
- Conventional/Inactive
- ★ IGCC or Gasification/Active
- ★ IGCC or Gasification/Inactive



# Coal Plant Surge Likely After 2010 as Reserve Margins Thin



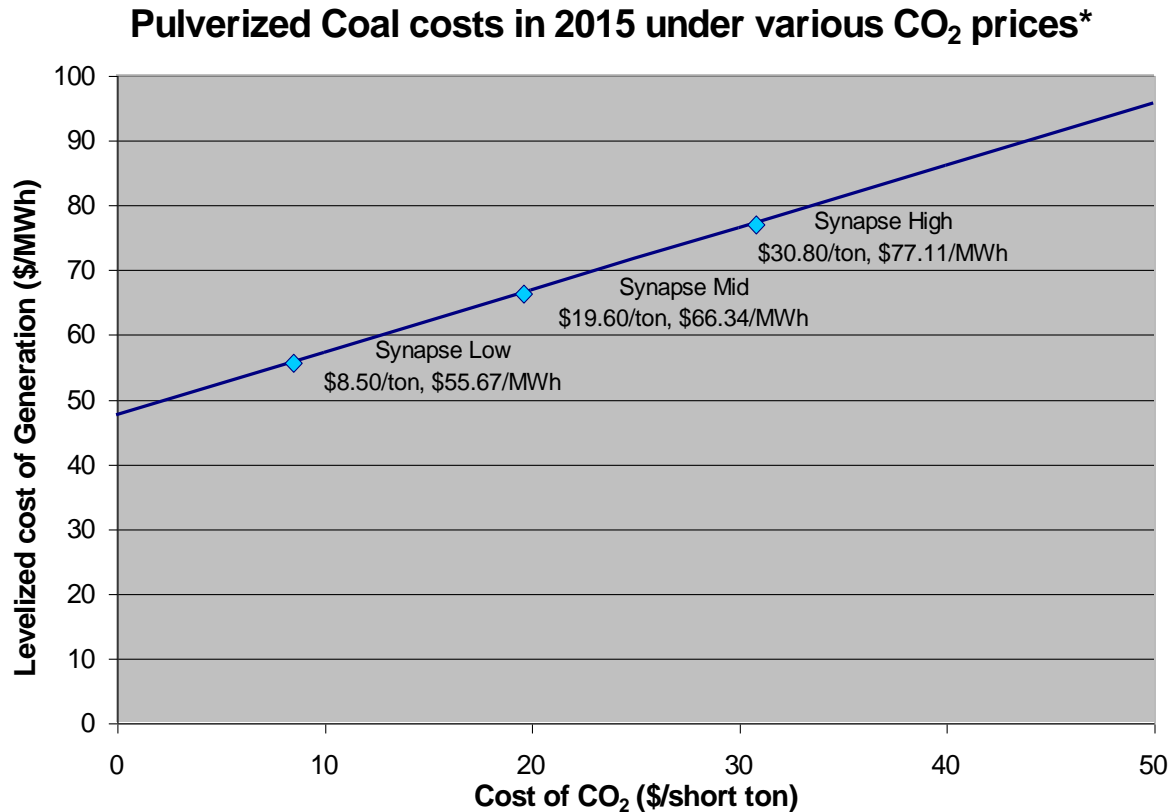
2012: reserve margins hit 11%

Source: North American Electric Reliability Council, September 2005; CATF Slide

2011: NERC projects significant coal build



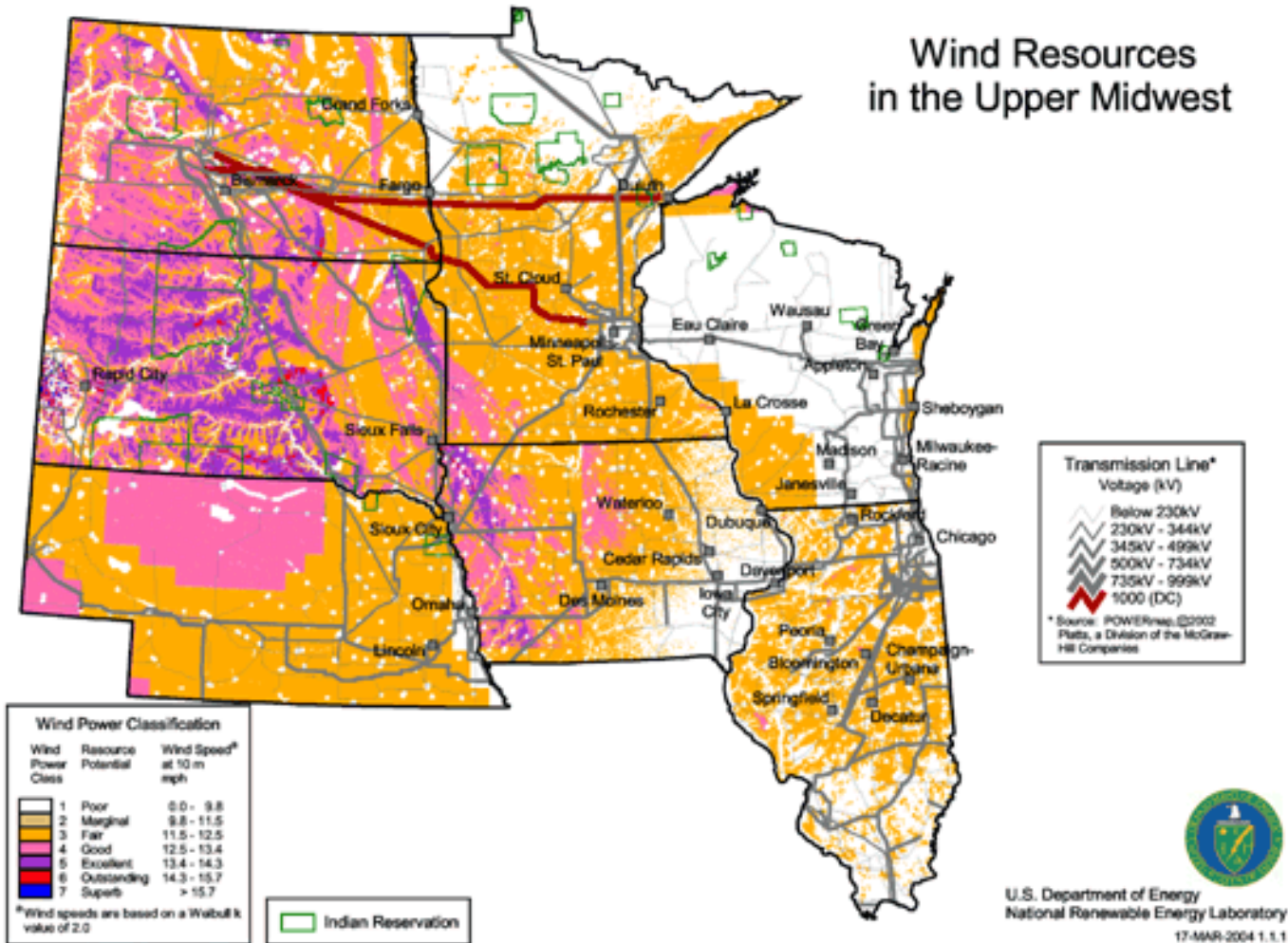
# Coal Costs Will Rise w/ Carbon Regulation



Source: EIA, "NEMS EMM Factors for AEO06," spreadsheet, 2006, and Johnston et al., 2006. The costs are representative of a new coal plant built in the Midwest. Chart taken from UCS, Gambling with Coal, September 2006.

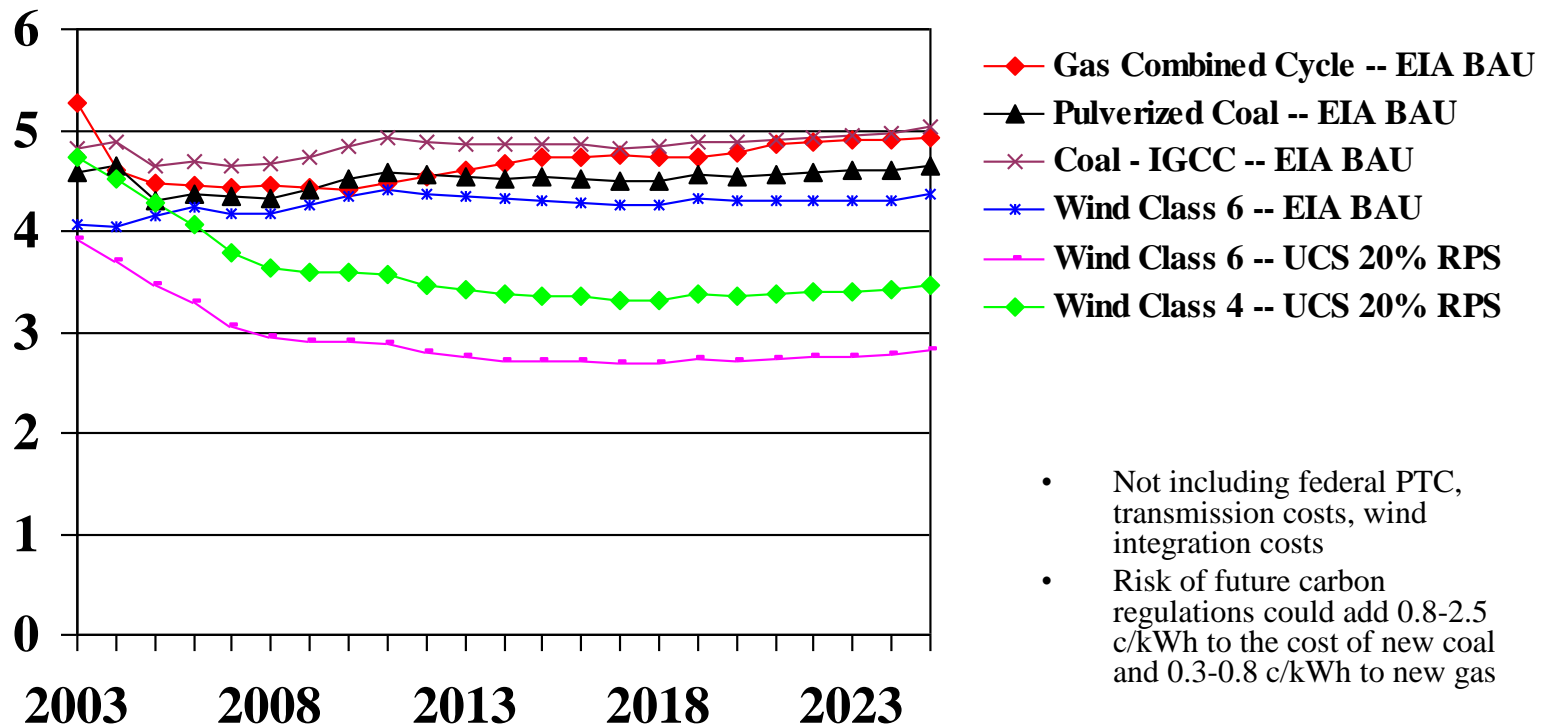


# Wind Resource in the Upper Midwest



# New Wind Cheaper than New Coal and Gas

**Cost of Electricity from New Wind and Fossil Plants**  
(20-year Levelized Cost -- 2002 cents/kWh)

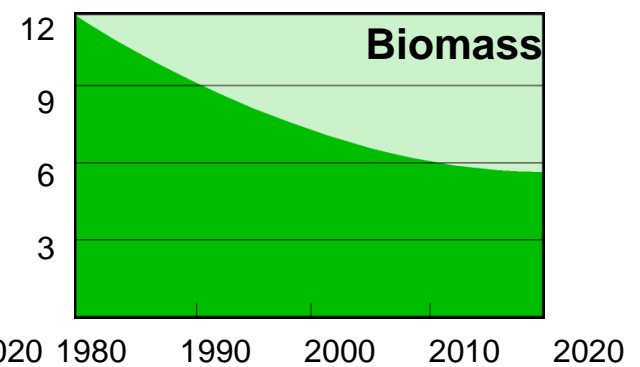
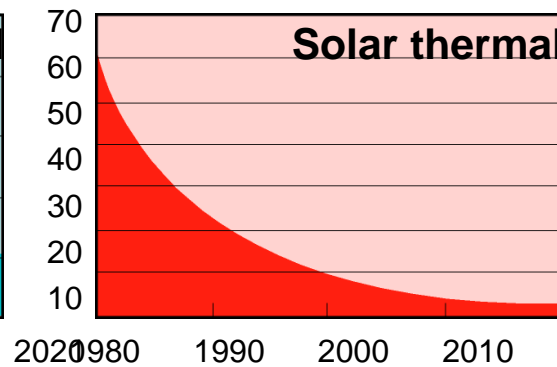
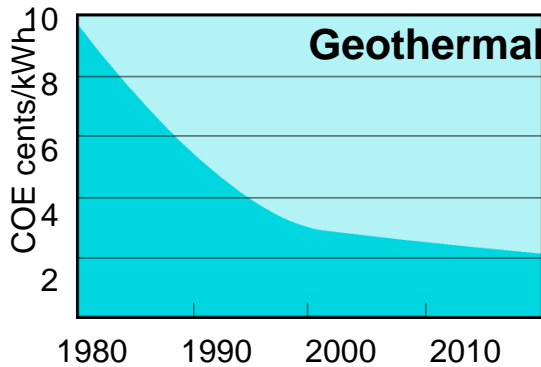
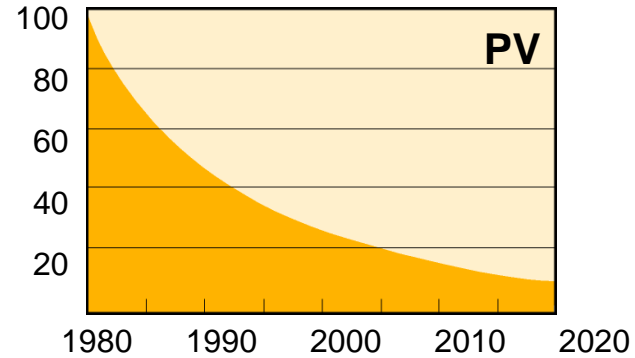
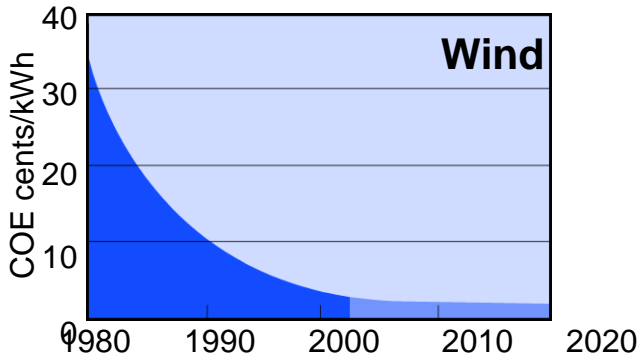


- Not including federal PTC, transmission costs, wind integration costs
- Risk of future carbon regulations could add 0.8-2.5 c/kWh to the cost of new coal and 0.3-0.8 c/kWh to new gas

Sources: EIA, Annual Energy Outlook, 2004; UCS, Renewing Our Economy, 2004



# Declining Renewable Energy Costs

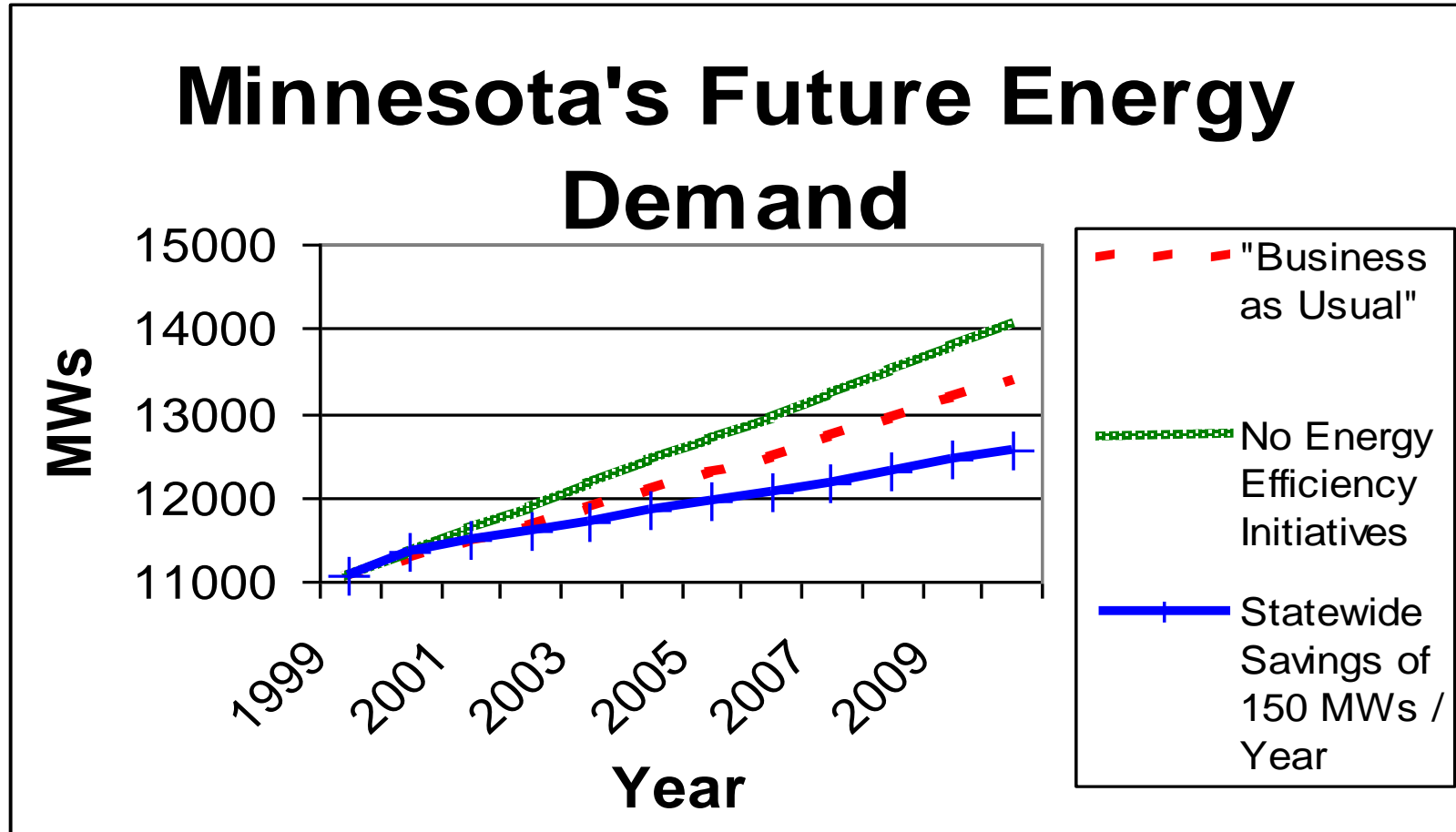


Source: NREL Energy Analysis Office  
Updated: June 2002

**30-year levelized cents/kWh in constant \$2000**



# Future Outlook



Source: Center for Energy and Environment





# Policies Moving Forward

- Upper Midwest needs to follow California, New England with regional cap and trade for CO2.
- Accelerate development of IGCC with carbon capture and storage; pair IGCC with wind to overcome barriers to new transmission; retire existing coal as soon as possible.
- Plan and build transmission to move 5,000 to 10,000 megawatts of new wind by 2025.
- Establish aggressive efficiency goals; reform utility ratemaking to remove disincentives to conserve.



# Thank You

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