



Wind vs Coal: An Environmental Scorecard

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Objective: To compare wind vs coal generation across environmental attributes

- Regulated Emissions
- Water Use
- Waste Materials
- Mining Impact and Net Energy Balance
- Global Warming Impacts



Why is Coal the Right Benchmark?

- Majority of Midwest power is coal-fired
- Almost all proposed new generation is coal or wind
- Nuclear power industry is stagnant
- Only 3% of Midwest power is gas-fired
 - Large construction boom in 1990s but too expensive to operate



A typical 500 MW pulverized coal plant every year produces

- 10,000 tons of sulfur dioxide, the main cause of acid rain
- 10,000 tons of nitrogen oxide, a major cause of smog
- 500 tons of particulates
- 125,000 tons of ash and 193,000 tons of sludge



- Mercury, arsenic, lead and cadmium

Coal-fired generation has an estimated national annual public health cost > \$150 Billion (\$240 Million per 500 MW plant or \$57/MWh)

Health Effect	Cases per Year	Costs (\$MM)
Premature Mortality	23,600	\$149,274
Hospital Admissions	21,850	\$187
Emergency Room Visits for Asthma	26,000	\$7
Heart Attacks	38,200	\$3,284
Chronic Bronchitis	16,200	\$5,523
Asthma Attacks	554,000	\$15
Lost Work Days	3,186,000	\$367



1,500 MW of wind produces

- NO sulfur dioxide
- NO nitrogen oxide
- NO particulates
- NO ash or sludge
- NO heavy metals



A typical 500 MW coal plant every year uses

- 100 billion gallons of cooling water
 - Discharge water is 16 degrees warmer
 - Impacts aquatic life through both intake screens and elevated temperatures
- 1.4 million tons of coal, enough to fill 15,000 railcars



The Source of Coal-fired Generation

Powder River Basin, WY

Before
Mining



During
Mining

Mountaintop Removal, WV



1,500 MW of wind energy uses

- NO cooling water
- NO coal, therefore no mining, no mountaintop removal, no railcars



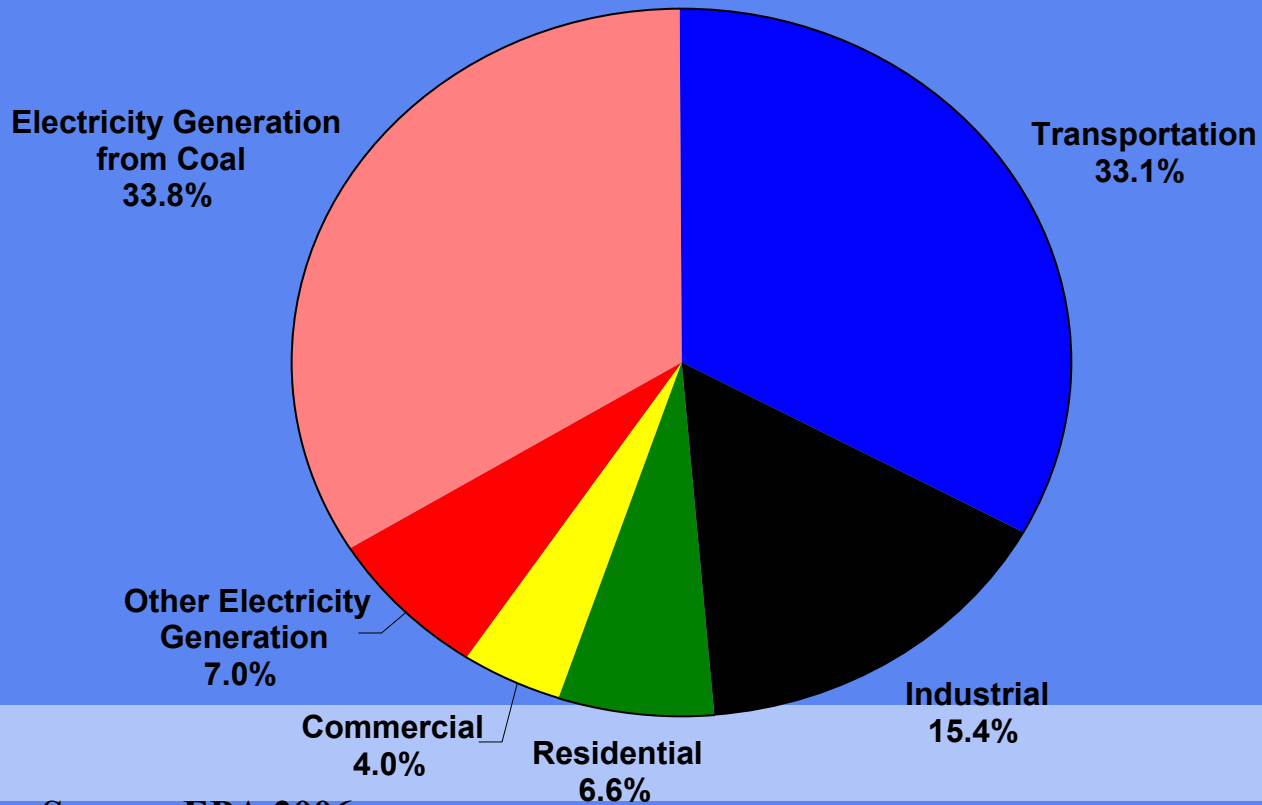
Coal and Global Warming

- Debate over global warming and its causes is over
- 6 Midwest states produce 5% of world's CO2 emissions
- 39% of U.S. CO2 emissions from power generation
- 97% of electric sector CO2 emissions in Midwest come from coal-fired generation



Coal and Global Warming

Sources of U.S. Energy Related CO₂ Emissions, 2004



Source: EPA 2006



A typical 500 MW coal plant every year produces

- 3.7 million tons of CO₂ emissions, equivalent to cutting down 161 million trees or 610,000 cars operating for a full year

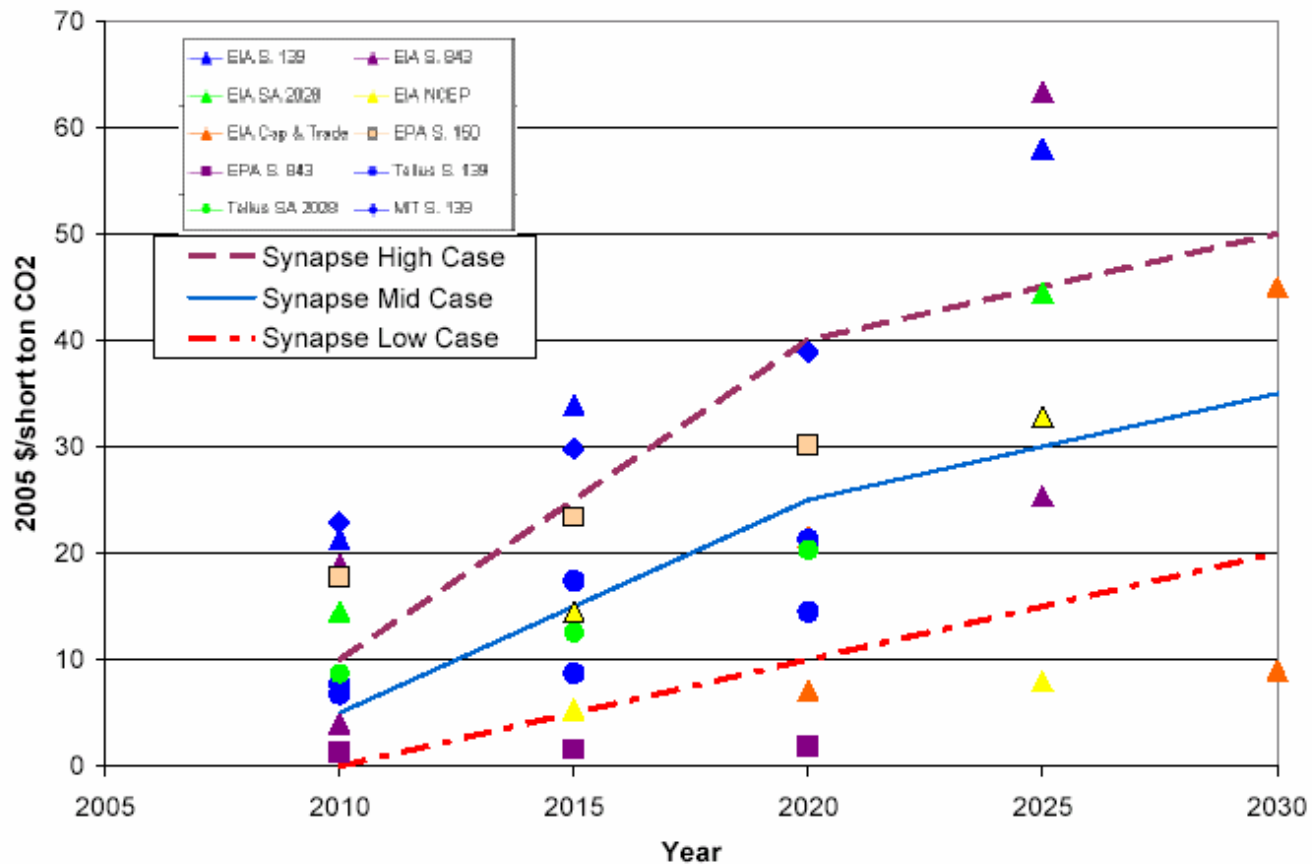


1,500 MW of wind energy produces

- NO CO₂ emissions, equivalent to adding 161 million trees or removing 610,000 cars from the road



The Anticipated Cost of CO2 Emissions



The Anticipated Cost of CO2 Emissions

Many utilities believe they can get in “under the wire” or pass costs on to ratepayers

Regulatory history suggests otherwise (nuclear plant overruns)

Regulators beginning to require utilities to factor in cost of CO2 in permitting process.

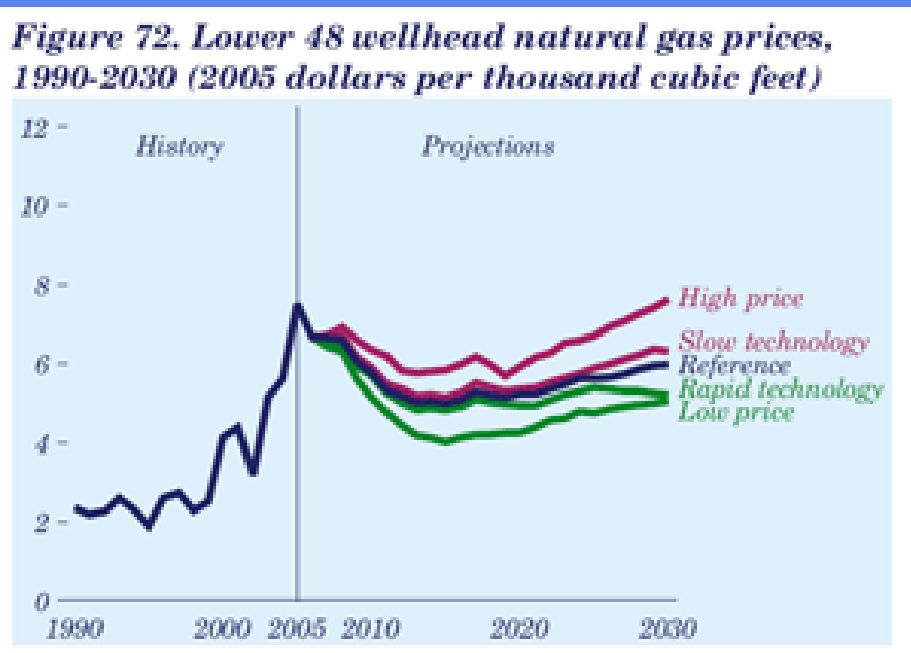
Merchant plants will be “out of the money”



What About Natural Gas?

Natural gas has less than 1/2 the CO₂ emissions of coal but...

Natural gas is not CO₂-neutral and definitely not cheap



Does Wind Energy Displace Coal Generation?

- Energy efficiency plus renewables defer the need to build new coal-fired generation and allow the shut-down of dirtiest plants.
- Wind energy is not dispatchable but is predictable
- Wind energy is the lowest marginal-cost energy source
- Wind displaces fossil-fired generation on the margin
 - first gas, then high-cost coal



Two Paths-You Choose

Coal: A bridge to the 19th Century



Wind: A bridge to the 22nd Century

