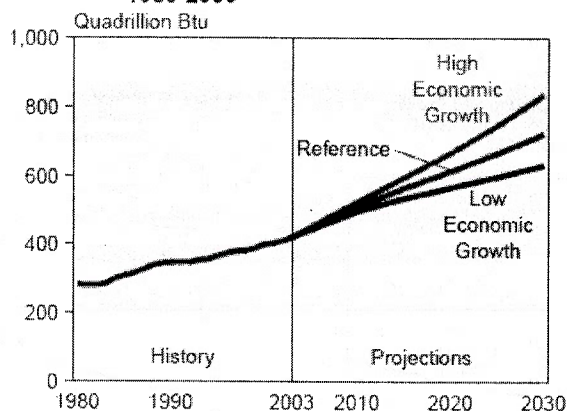


<http://www.dmr.nd.gov>

600 East Boulevard Ave. - Dept 405
Bismarck, ND 58505-0840
(701) 328-8020 (701) 328-8000

World energy consumption is expected to grow 50-100% in 25 years.

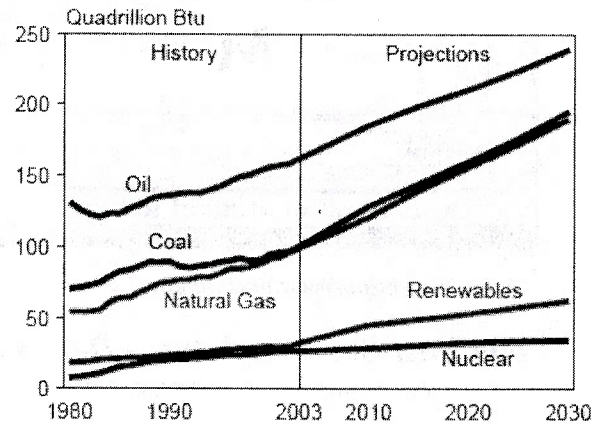
Figure 14. World Marketed Energy Consumption in Three Economic Growth Cases, 1980-2030



Sources: History: Energy Information Administration (EIA), *International Energy Annual 2003* (May-July 2005), web site www.eia.doe.gov/iea/. Projections: EIA, System for the Analysis of Global Energy Markets (2006).

Renewable fuels have big % growth, but “Ancient Energy” sources grow the most. Fossil, Nuclear, and Geothermal are “Ancient Energy”.

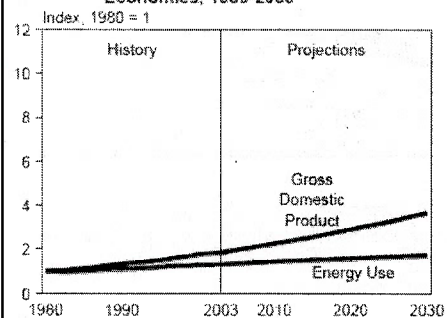
Figure 10. World Marketed Energy Use by Fuel Type, 1980-2030



Sources: History: Energy Information Administration (EIA), *International Energy Annual 2003* (May-July 2005), web site www.eia.doe.gov/iea/. Projections: EIA, System for the Analysis of Global Energy Markets (2006).

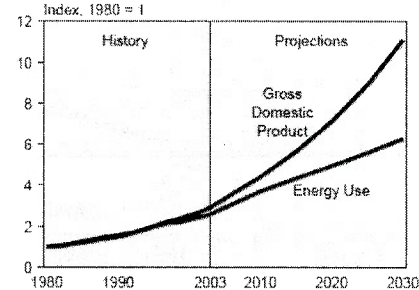
High energy use ain't all bad.

Figure 15. Growth in Energy Use and Gross Domestic Product for the OECD Economies, 1980-2030



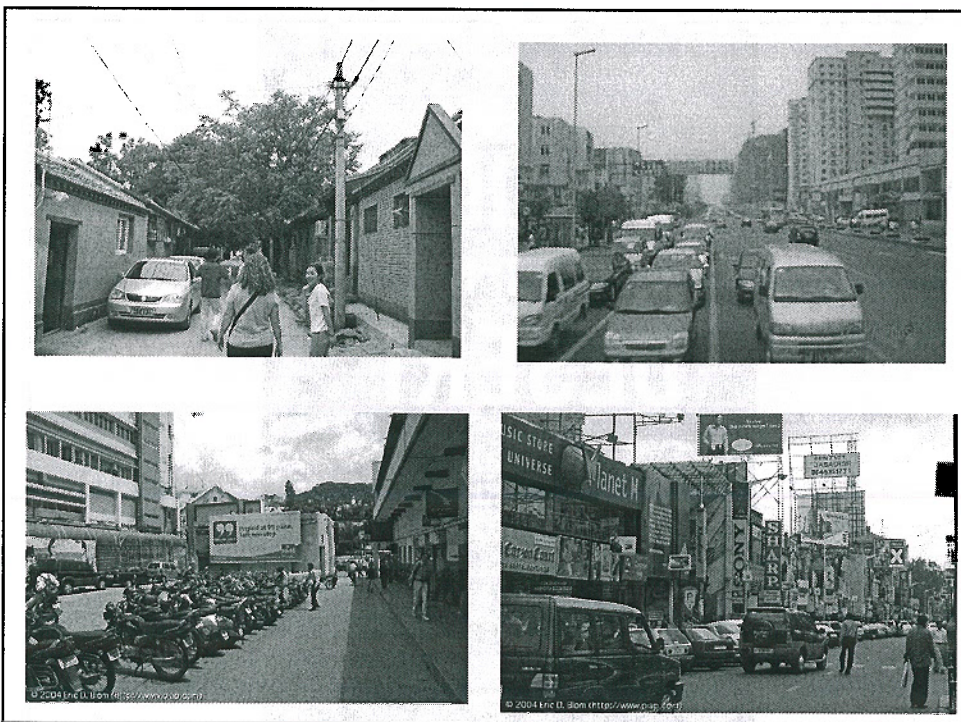
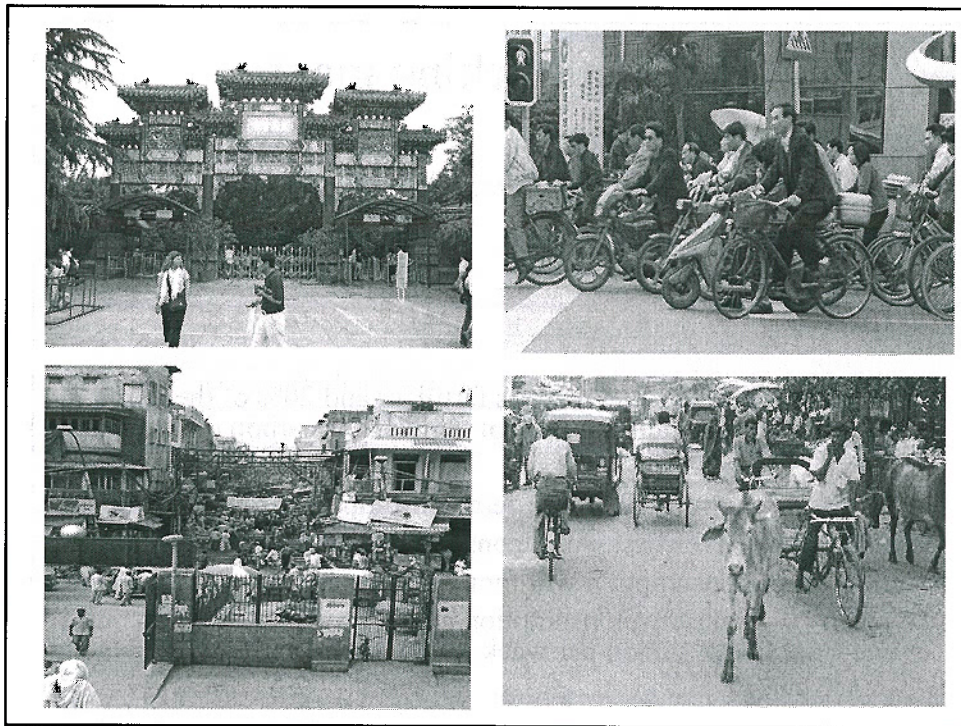
Sources: History: Energy Information Administration (EIA), *International Energy Annual 2003* (May-July 2005), web site www.eia.doe.gov/iea/. Projections: EIA, System for the Analysis of Global Energy Markets (2006).

Figure 16. Growth in Energy Use and Gross Domestic Product for the Non-OECD Economies, 1980-2030



Note: Non-OECD economies in this figure exclude non-OECD Europe and Eurasia.

Sources: History: Derived from Energy Information Administration (EIA), *International Energy Annual 2003* (May-July 2005), web site www.eia.doe.gov/iea/. Projections: EIA, System for the Analysis of Global Energy Markets (2006).



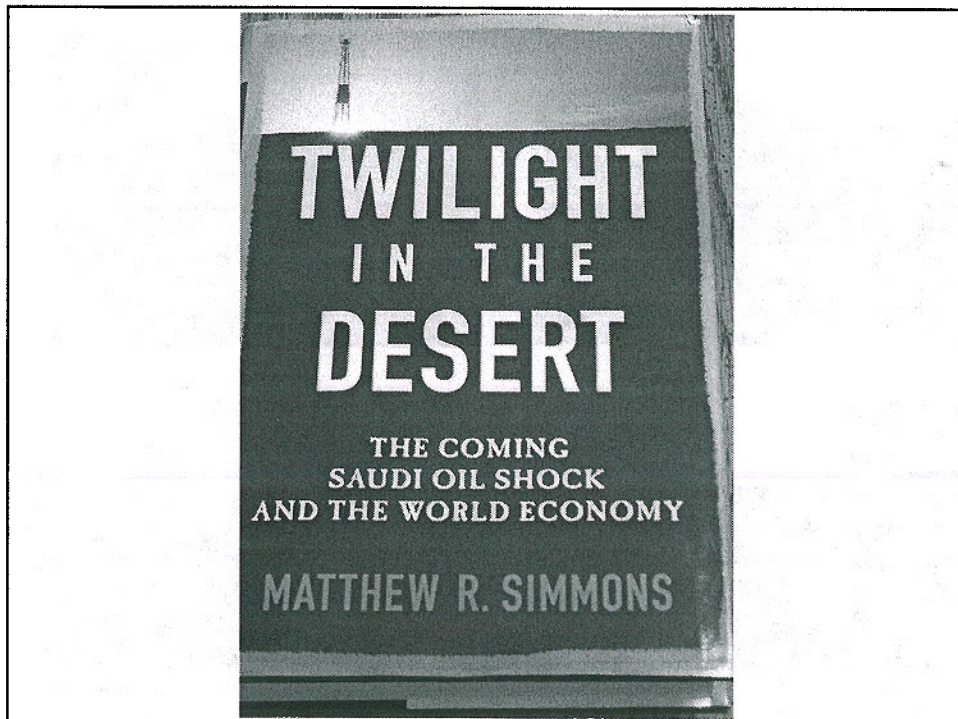
Asia the lurching giant

Year	Population (billion)	People/ Household	% Urban	Vehicles (million)
1980	2.3	4.7	23	1
2000	3.0	3.5	38	15
2015	3.7	3.0	50	500

Asia now uses 90% of the world's fertilizer and 20% of the world's pesticides while emitting 30% of the world's carbon dioxide.

If the rest of the world achieves zero consumption growth,
but Asia achieves first world consumption levels,
total world consumption will more than double.

To reach US electricity consumption levels China will have to build
one Coal Creek station per week for 31 years.



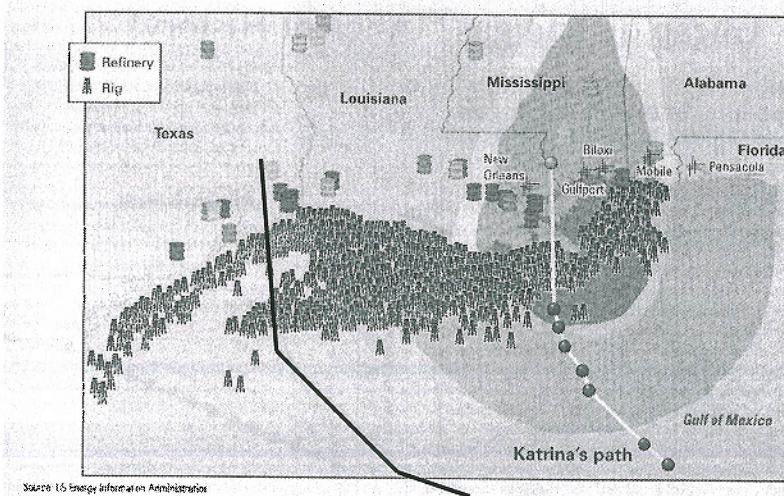
Saudi Arabia

Year	Pop(million)	MBOPD	Reserves(BB)	Fields	Wells
1960		1,219		18	
1970	6	4,117	110/50/15	37	100
1980	9	9,839	160/?/?	64	800
1990	14	8,300	260/?/?	76	2,000
2000	22	6,830	260/?/?	101	5,000
2010*	30	20,000??			

43% under 14, birthrate 6.3, national debt \$170 billion,
GDP \$9,000/person versus Spain \$15,000

2/3 of world petroleum production growth 2000-2006 came from Russia, not OPEC

HURRICANE KATRINA'S PATH

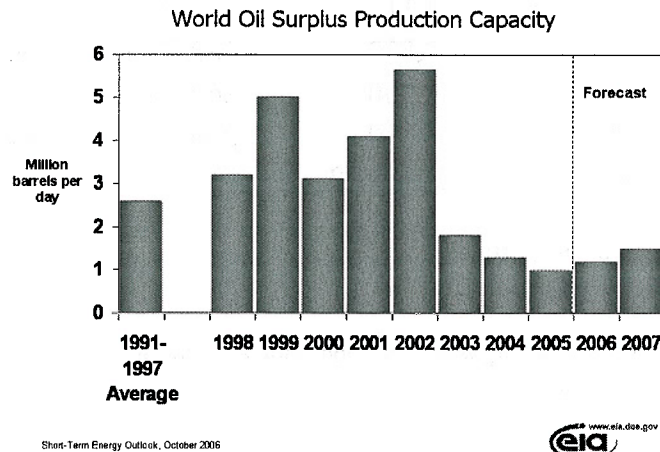


Source: US Energy Information Administration

Rita

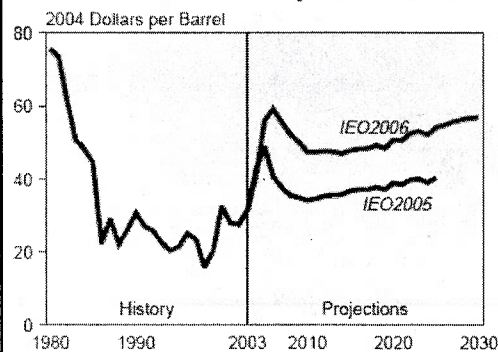
1/3 of US oil and gas production (4,000 platforms); 1/2 of US refining capacity
7 of 10 VLCC ports; Henry Hub; 33,000 mi of natural gas and gasoline pipelines; SPR
\$25 billion in damage and \$16 billion lost revenue

A world that consumes 86 million barrels of oil every day with only 1-2 million barrels per day surplus capacity is like the average North Dakotan (\$32,500 annual income) relying on a \$2 balance in their checking account.

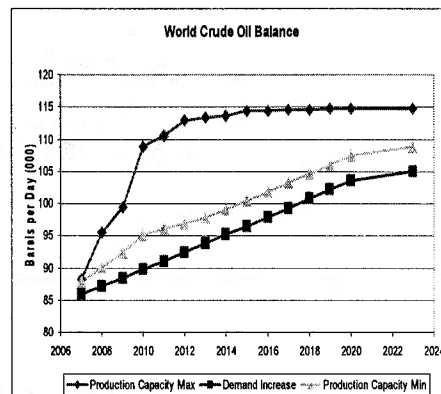


Cheap oil and gas? Ancient History!

Figure 11. Comparison of *IEO2005* and *IEO2006*
World Oil Price Projections, 1980-2030



Sources: History: Energy Information Administration (EIA). *Annual Energy Review 2004*, DOE/EIA-0384(2004) (Washington, DC, August 2005), web site www.eia.doe.gov/emeu/aer/contents.html. *IEO2005*: EIA, *International Energy Outlook 2005*, DOE/EIA-0484(2005) (Washington, DC, July 2005), web site www.eia.doe.gov/oiat/ieo/index.html. *IEO2006*: EIA, *System for the Analysis of Global Energy Markets* (2006).



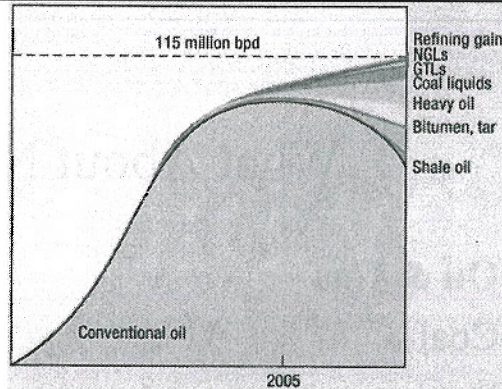
Professor Ken Deffeyes has stated, conventional oil production does peak within three weeks of Thanksgiving Day, November 2005, it is possible that unconventional oil could fill the gap well into the future.

Also, I had to cut off the graph's right side so as not to give the impression that a peak will never come—it will. I just don't know when. When it comes to prediction, I prefer to foresee what happened yesterday. Cutting off the right side also prevents having to show that, when a permanent supply shortfall finally happens, it will likely decline at least 1-2% per year, while world demand will increase by a similar amount. The growing 2-4% wedge will eventually get too large for anyone to believe.

However, it is worth noting that the range of estimates to peak has narrowed over the last decade or so, with the perennial pessimists forecasting a range between next week and five years hence, and the optimists at the EIA and IEA saying that it will be in the 2016 to 2037 range, depending on assumptions of demand growth and the ultimate resource size. Thus, an agreement, or what passes for an agreement, is forming, that a permanent shortfall will occur in the next 11 to 32 years.

IEA forecasts that oil demand will grow 50% by 2030. IEA also forecasts that unconventional oil (oil sands, extra-heavy oil) will contribute 8 million bpd to world supply within 25 years. And

So what if conventional oil peaks? As long as unconventional liquid hydrocarbons prolong it.



So what if conventional oil peaks? As long as unconventional liquid hydrocarbons prolong it.

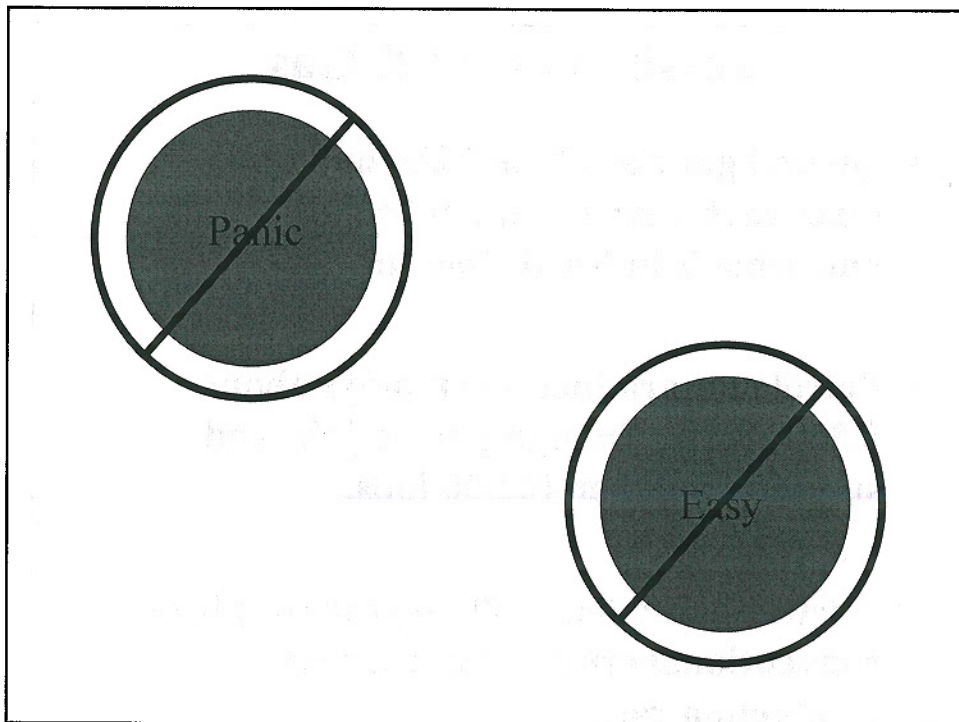
Conventional - 3.3 billion barrels = 137 years down, 105 to go

Heavy - 4.4 billion barrels = 25 years down, 150 to go

Bitumen and Tar - 3.3 billion barrels = 10 years down, 175 to go

Coal to liquids - 1 billion barrels = 80 to 100 years worth

Renewable - the only way to sustain our lifestyle indefinitely

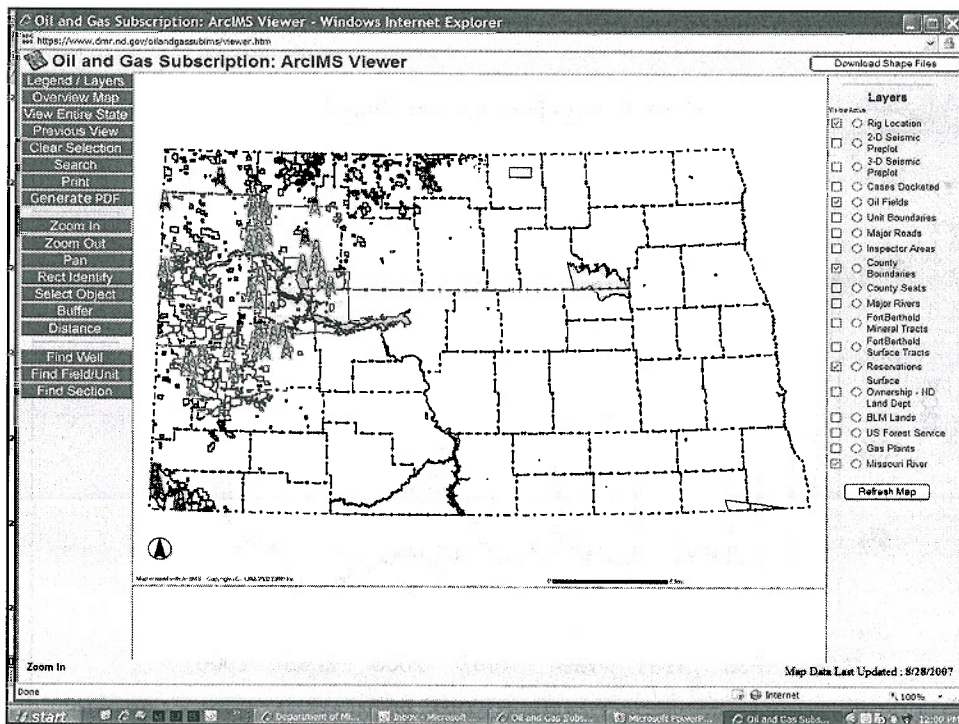
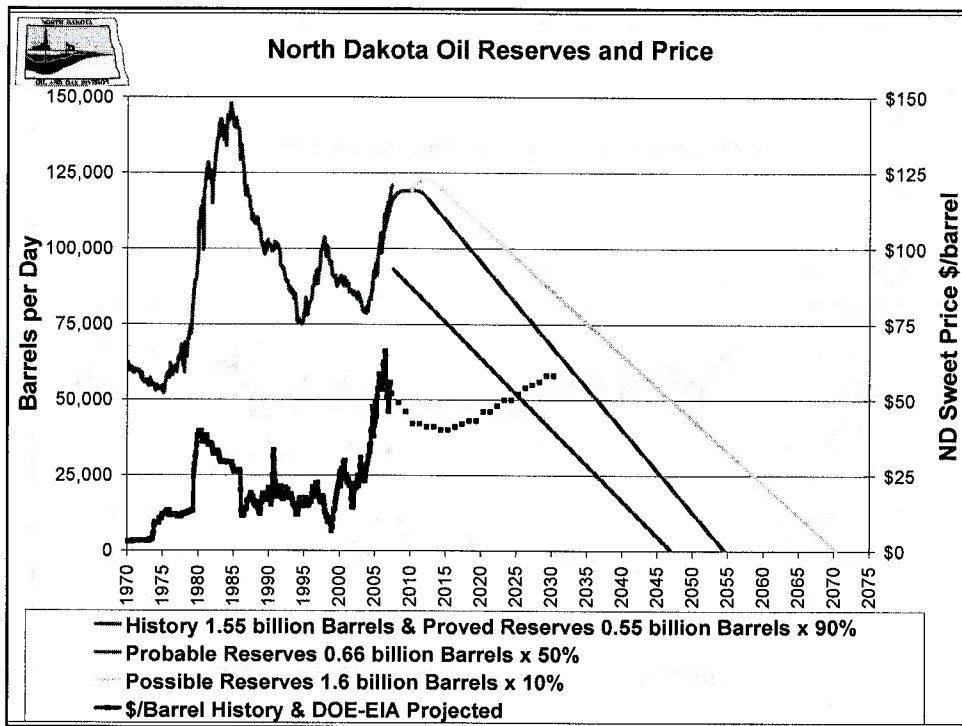


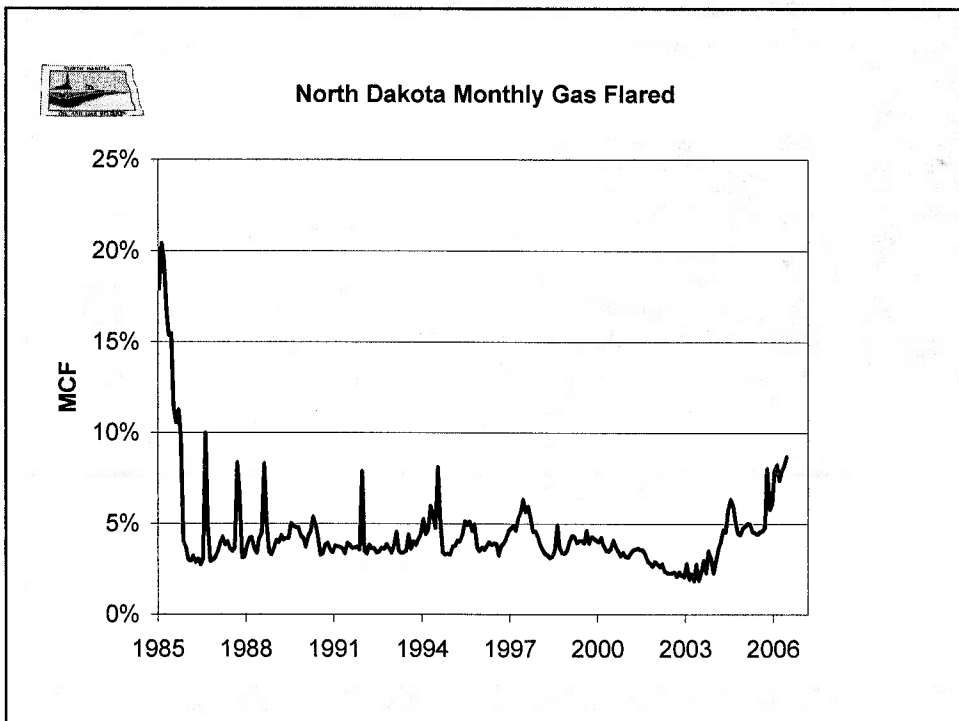
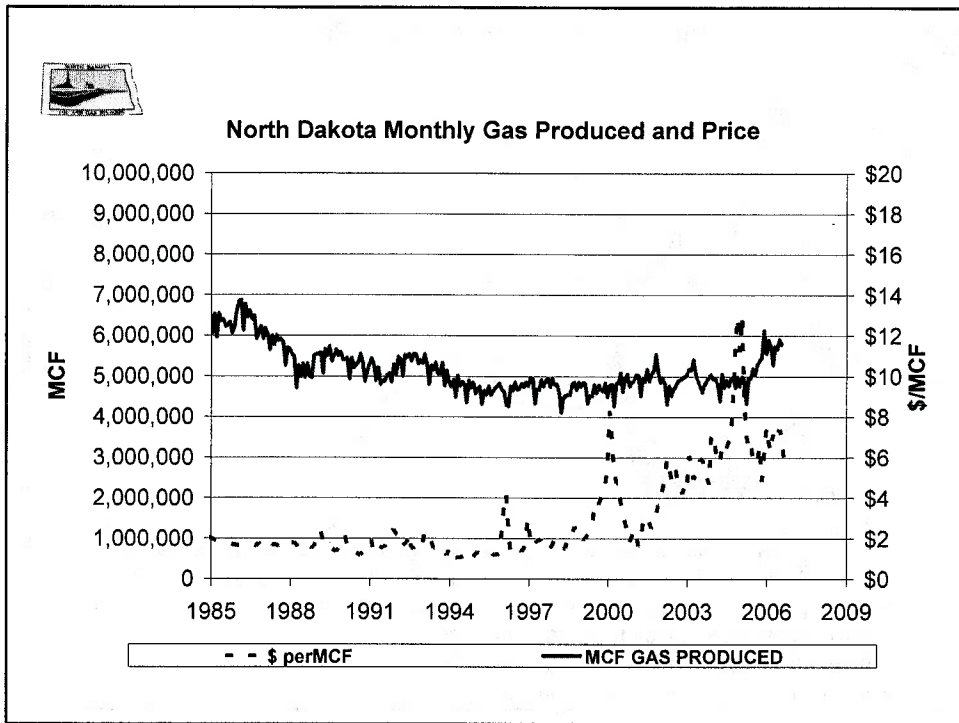
What About ND?

- **Oil & Gas**
- Coal
- Nuclear
- Geothermal
- Ethanol
- Wind
- Hydro

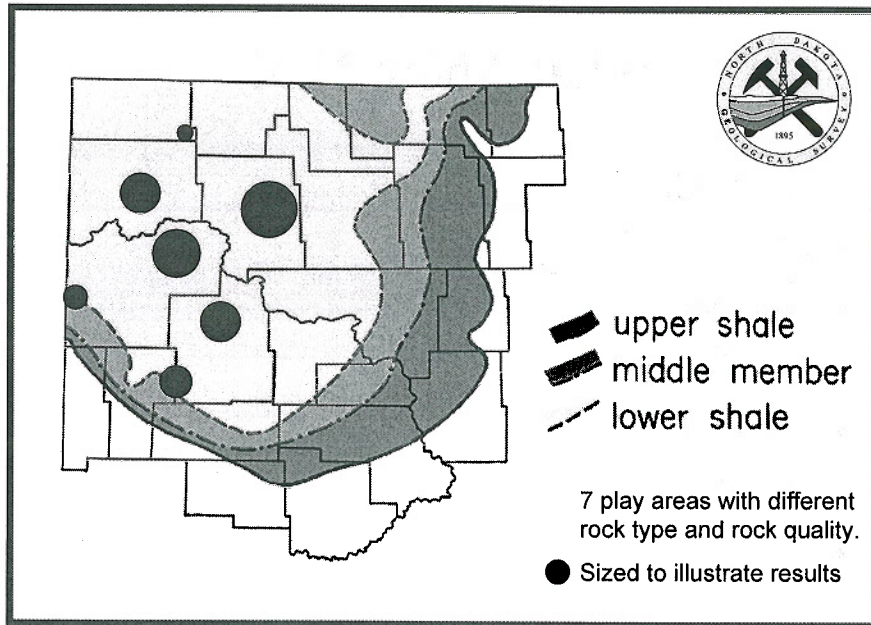
Fossil Fuel Oil & Gas

- **Oil and gas pay about \$280 million in taxes each year to support counties, cities, and schools in North Dakota.**
- **Petroleum production employs about 5,300 citizens in high paying jobs and supports another 10,000 jobs.**
- **North Dakota has a 50-70 year supply of conventional crude oil at current production rates.**





Lynn Helms, Department of Mineral Resources



Fossil Fuel Oil & Gas

- In 2004 North Dakota produced 31 million barrels of oil and 60 billion cubic feet of natural gas.
 - North Dakota's one refinery processed 21 million barrels of crude oil and our 9 natural gas plants processed 58 billion cubic feet of natural gas.
 - North Dakota consumed 20.4 million barrels of refined petroleum products and 60 billion cubic feet of natural gas.
 - Processing and consumption are unchanged, but production is up 45% for crude oil and 25% for natural gas.

What About ND?

- Oil & Gas
- **Coal**
- Nuclear
- Geothermal
- Ethanol
- Wind
- Hydro

Fossil Fuel Coal

- **Coal conversion pays about \$80 million in taxes each year to support counties, cities, and schools in North Dakota.**
- **Coal mining and conversion directly employs about 4,000 citizens and supports another 20,000 jobs.**
- **North Dakota has > 800 year coal supply at current usage rates.**

THE LIGNITE RESOURCES OF NORTH DAKOTA

by

Edward C. Murphy, Ned W. Kruger, Gerard E. Goven,
Quentin L. Vandal, Kimberly C. Jacobs, and Michele L. Gutenkunst

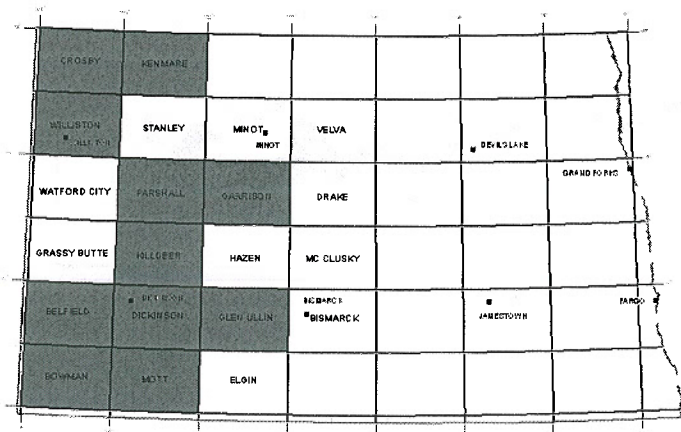


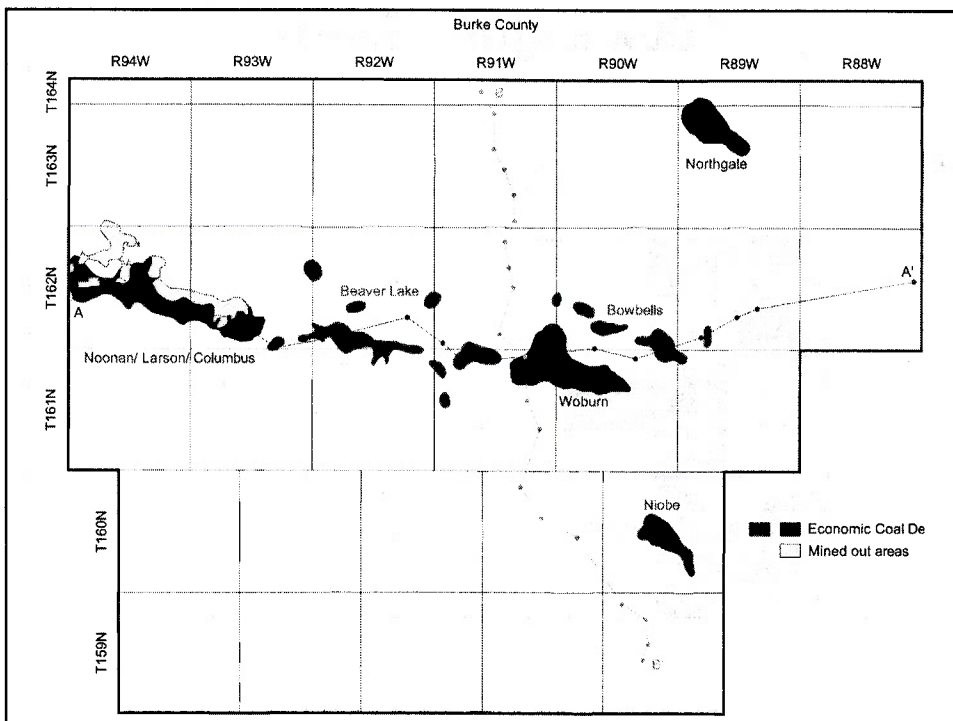
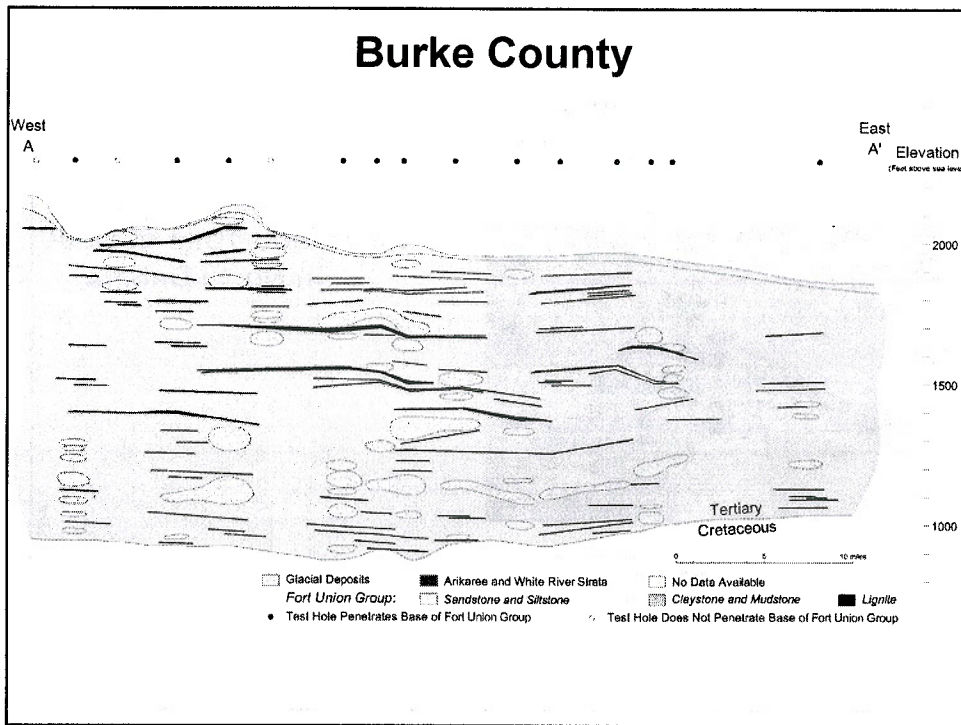
1.3 Trillion Tons of Coal in North Dakota

REPORT OF INVESTIGATION NO. 105
North Dakota Geological Survey
Edward C. Murphy, State Geologist
Lynn D. Helms, Director Dept. of Mineral Resources
2006

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THE LIGNITE RESERVES OF NORTH DAKOTA

by
Edward C. Murphy

**25 Billion Tons of
Mineable Lignite**



REPORT OF INVESTIGATION NO. 104
North Dakota Geological Survey
Edward C. Murphy, State Geologist
Lynn D. Helms, Director Dept. of Mineral Resources
2006

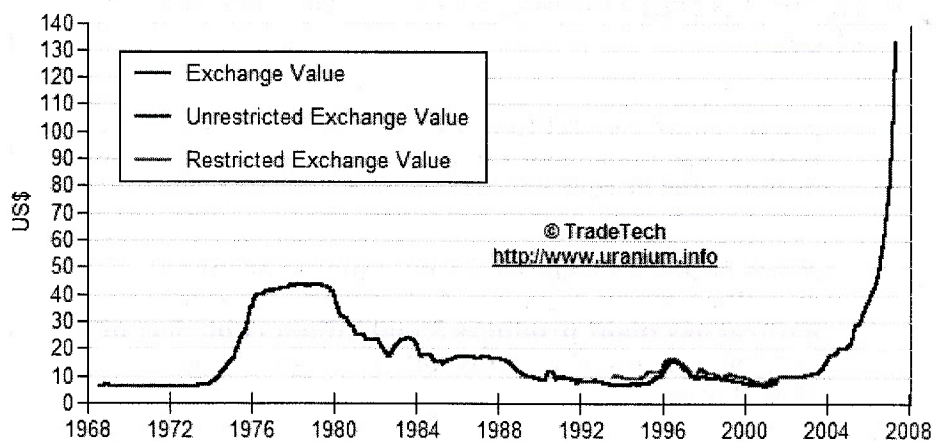
Fossil Fuel Coal

- **In 2004 North Dakota produced 30 million tons of coal.**
 - **North Dakota's coal fired power plants, synthetic natural gas plant, and Leonardite plant consumed 30 million tons of coal.**
 - **North Dakota's coal fired power plants produce 28 million MWh per year of electricity, the synthetic natural gas plant produces 55-60 billion cubic feet of natural gas, and the Leonardite plant produces 10,000 tons.**
 - **North Dakota consumes 11 million MWh of electricity, no synthetic natural gas, and no Leonardite each year.**

What About ND?

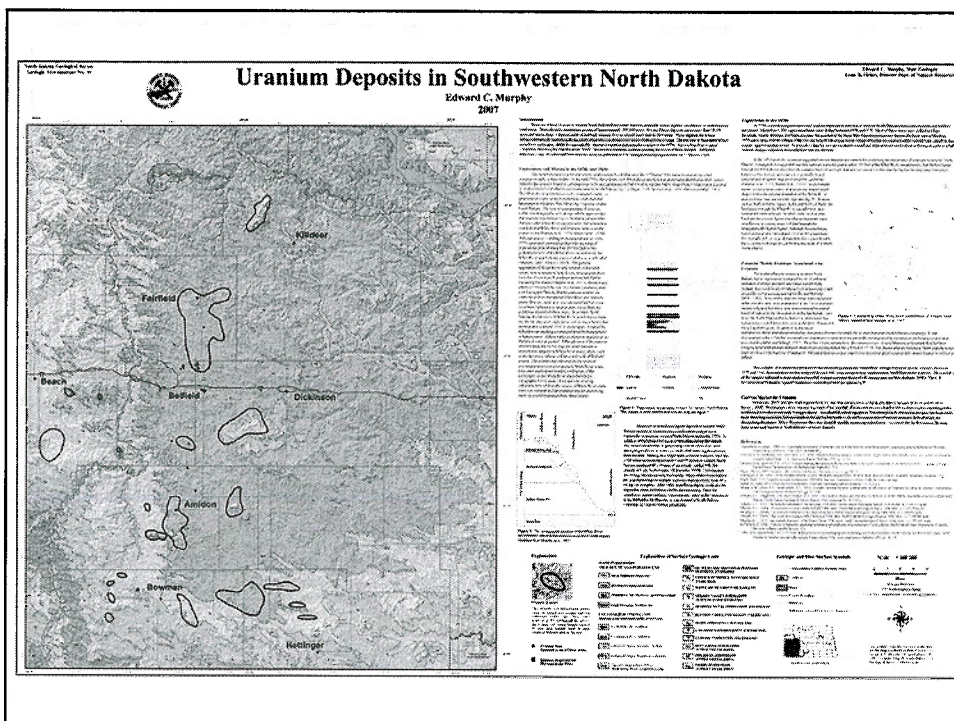
- Oil & Gas
- Coal
- **Nuclear**
- Geothermal
- Ethanol
- Wind
- Hydro

Nuclear



Nuclear

- 6 Uranium maps have been published by NDGS.



Nuclear

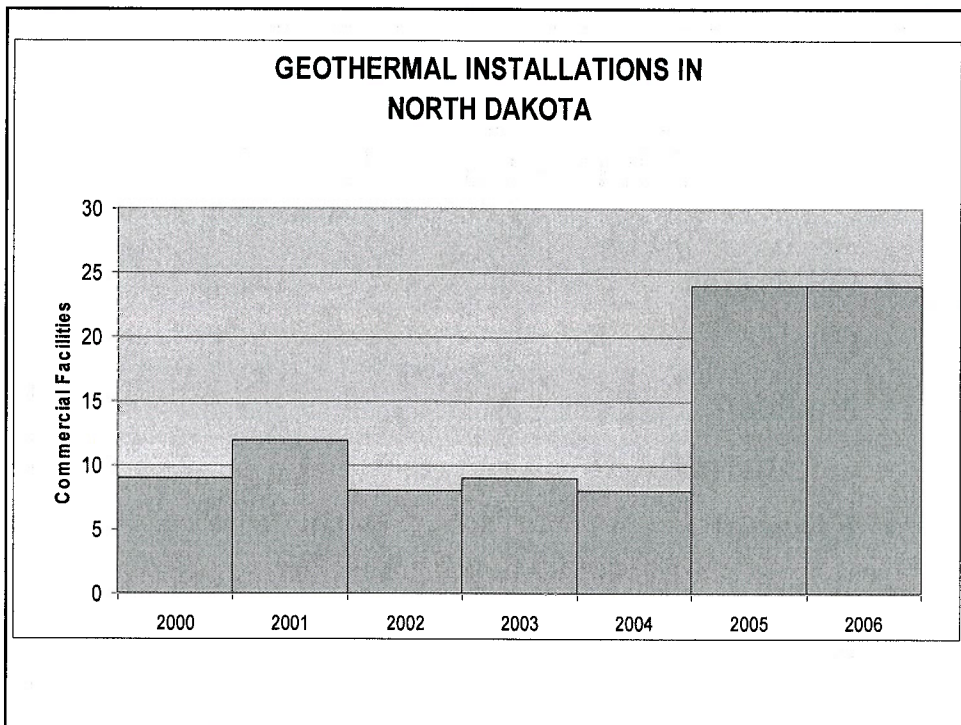
- **North Dakota produces and consumes no Uranium or nuclear power.**

- **North Dakota's last known Uranium production was in 1967 – 1968.**

- **US EIA records show total historical production of North Dakota Uranium of 85,000 tons. This represents <10% of reserves.**

What About ND?

- Oil & Gas
- Coal
- Nuclear
- **Geothermal**
- Ethanol
- Wind
- Hydro



Geothermal

- **Reduces fossil fuel demand and power plant emissions.**
- **Ground loops are regulated to prevent ground water contamination.**
- **Geothermal installation creates high paying jobs.**
- **75% of the energy is free.**
- **Residential systems payout in 5-7 years and Commercial systems in 3-5 years.**
- **North Dakota has almost unlimited potential for ground loop source geothermal.**
 - **In 2004 North Dakota produced 200 billion BTU of geothermal energy. Permit applications have tripled since then.**

What About ND?

- Oil & Gas
- Coal
- Nuclear
- Geothermal
- **Ethanol**
- Wind
- Hydro

Ethanol

- **North Dakota produced 39 million gallons in 2005 with plans to add up to 350 million gallons / year production by 2009.**
- **North Dakota consumes about 8 million gallons of ethanol each year.**
- **Reduces oil demand and imports and automobile emissions.**
- **Increases demand for a domestic farm product – corn**
 - 10% of ND corn was used for ethanol in 2005
- **Ethanol plant construction and production create high paying jobs.**
- **Good transportation fuel because it is portable.**

Ethanol

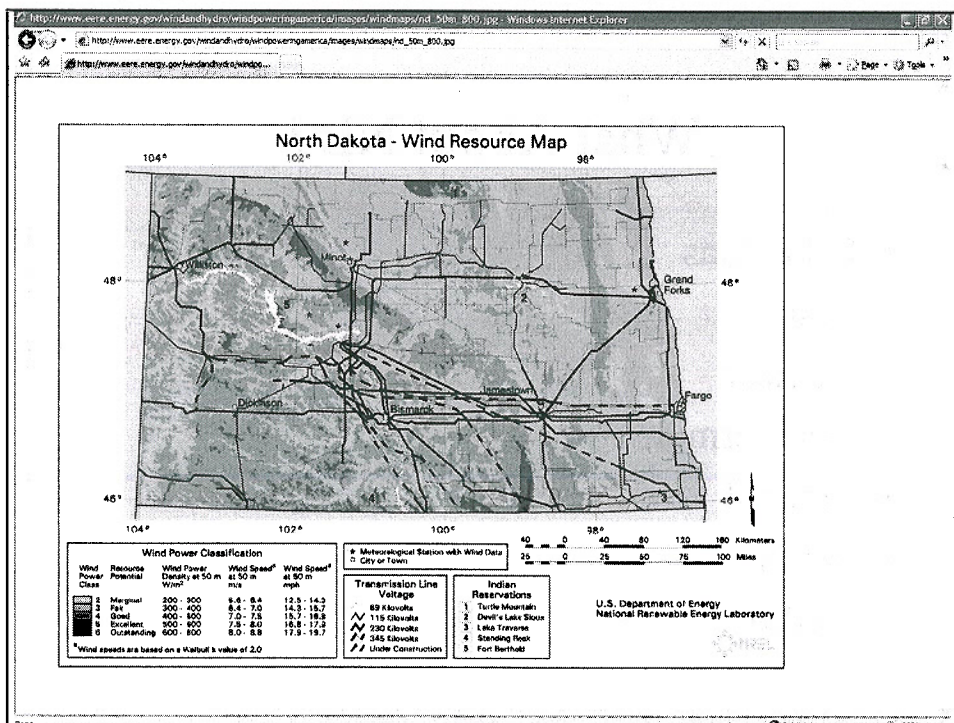
- **Current technology can produce 21% of U.S. gasoline consumption using 100% of the U.S. corn crop.**
 - **Not an acceptable replacement for truck, train, and jet fuels.**
 - **Less efficient and energy density than petroleum**
 - **1.23 times inputs versus 16.7 times for petroleum**
 - **Ethanol moved by truck or train - picks up water and contaminants in pipelines**
 - **Ethanol production uses a lot of water.**
 - **3 gallons of water to produce each gallon of ethanol**
 - **To replace 21% of US gasoline will consume 4 Souris Rivers for ethanol plants and 10 Red Rivers for irrigation**
 - **Ethanol production generates a lot of carbon dioxide.**
 - **58 cubic feet per gallon**
 - **Requires taxpayer subsidies when oil is less than \$60/barrel.**

What About ND?

- Oil & Gas
- Coal
- Nuclear
- Geothermal
- Ethanol
- **Wind**
- Hydro

Wind

- Reduces fossil fuel demand and power plant emissions.
- Wind power production creates high paying jobs.
- North Dakota has 124 towers capable of about 180 MWh at optimum wind speed.
- North Dakota has potential to generate 1.2 million MWh at optimum wind speed (>827,000 towers = 18% of state).



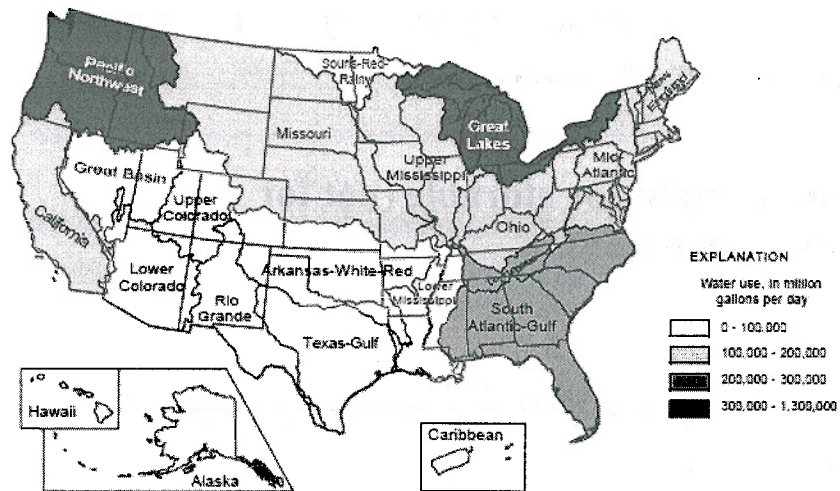
Wind

- **Current technology yields 40% of rated wind generator capacity.**
- **Not portable or storable (not for transportation).**
 - **H₂?**
- **1.5 cent per KWH tax credit needed to be economic.**

WHAT'S HAPPENING IN ND?

- **Oil**
- **Coal**
- **Nuclear**
- **Geothermal**
- **Ethanol**
- **Wind**
- **Hydro**

Hydro



Hydro

- **Reduces fossil fuel demand and power plant emissions.**
- **North Dakota produces about 2.5 billion KWh.**
- **North Dakota consumes about 1.5 – 1.7 billion KWh.**

Hydro

- **Not portable (unusable for transportation).**
- **No growth potential for North Dakota.**
- **Dams and reservoirs impact the environment.**

