

New Baseload Coal Generation: Warts and All

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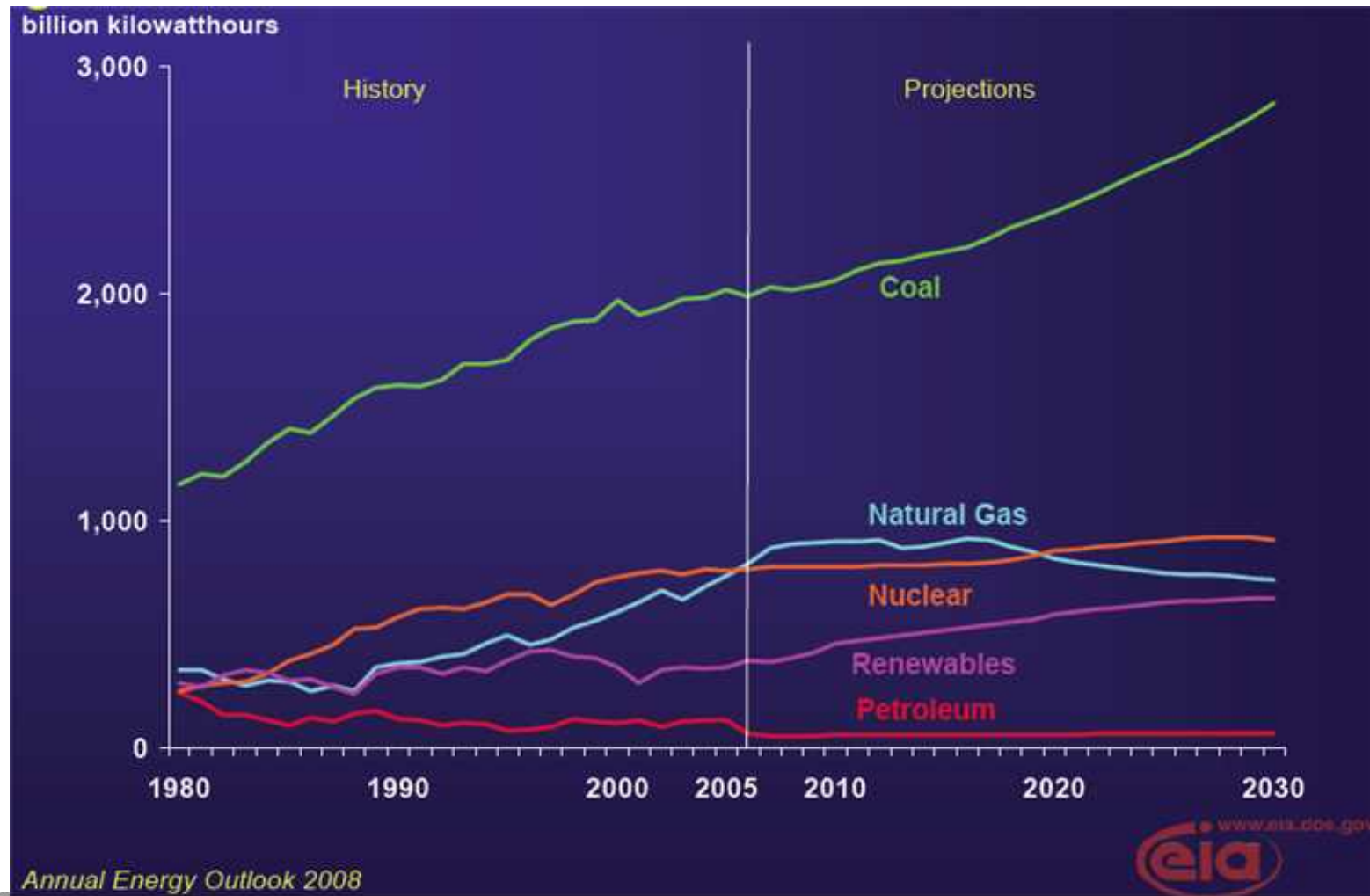
Agenda

- The US needs to add new baseload coal-fired generating capacity in order to meet load growth
- Most proposed new coal-fired generating units are being delayed and many have been cancelled
- What are the impediments to construction of new coal-fired generating units and how can they be addressed?

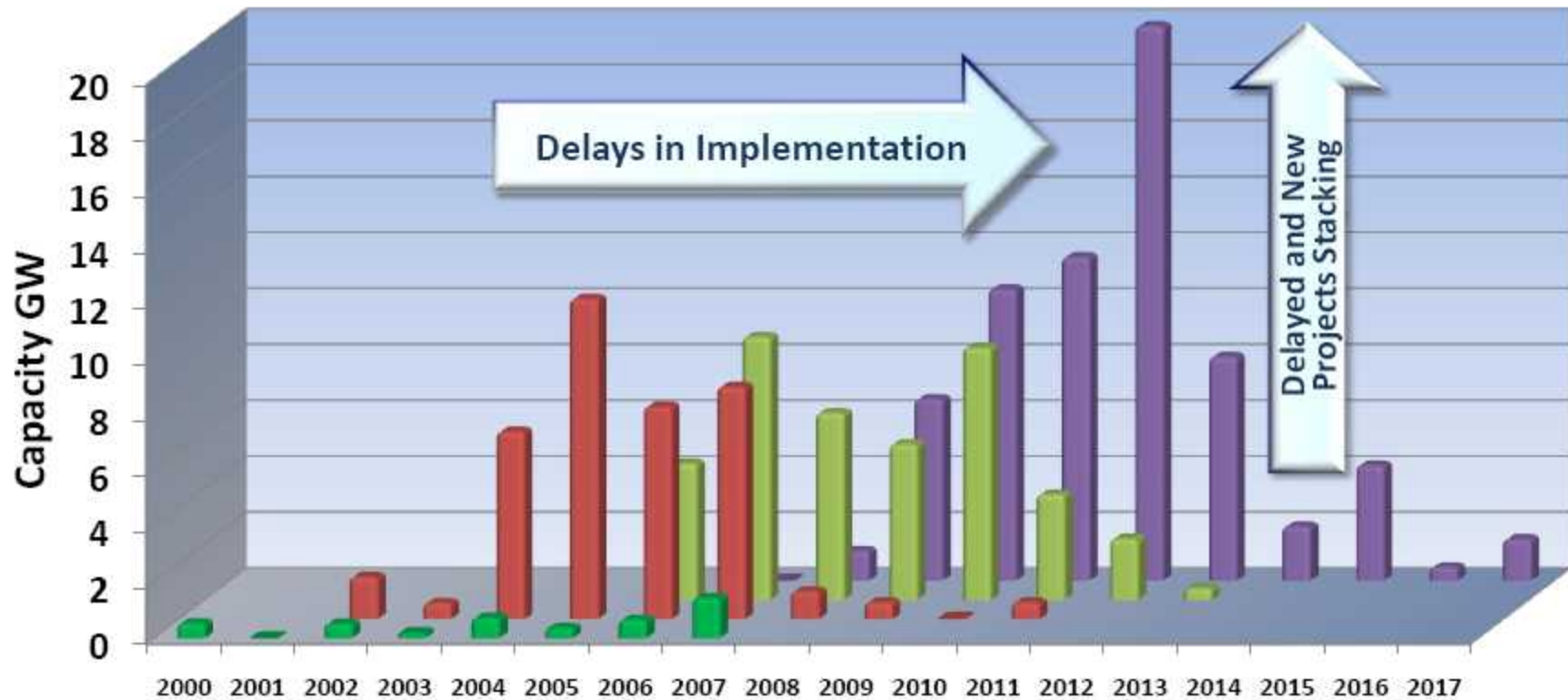
There are two major impediments to construction of new coal-fired units and they will be tough but not impossible to address



Coal is Largest Future Generation Source



Coal-Fired Plants Delayed/Cancelled



Historically, actual capacity has been seen to be significantly less than proposed capacity. For example, the 2002 report listed 36,161 MW of proposed capacity by the year 2007 when actually only 4,478 MW (12%) were constructed.

■ Actual
 ■ 2002 Report
 ■ 2005 Report
 ■ December 2007



Source: 2007 data Global Energy Decisions – Velocity Suite (12/31/2007)
 2002 – 2005 data – Previous NETL Tracking New Coal-Fired Power Plants Reports

2/7/2008



Coal-Fired Plants Cancelled in 2007

- 17,000 MW (26 units) cancelled in 2007 according to JT Boyd analysis
- Sierra Club "Stopping the Coal Rush" data base reports:
 - 65 Victories
 - 62 Active cases
 - 17 Progressing
 - 14 Upcoming
 - 15 Uncertain
- Personal Experience working on seven cancelled plants (four in Florida)



Manageable Risks

- Coal availability
- Coal Prices
- Transportation costs
- Transportation reliability
- Emission Allowance costs (SO₂, NO_x, Hg)

U.S. Coal Reserves

Current Production = 1.2 Billion tons
(92% US electricity)

Recoverable Reserves

- Existing mines = 19 billion tons
- Total Recoverable = 264 billion tons

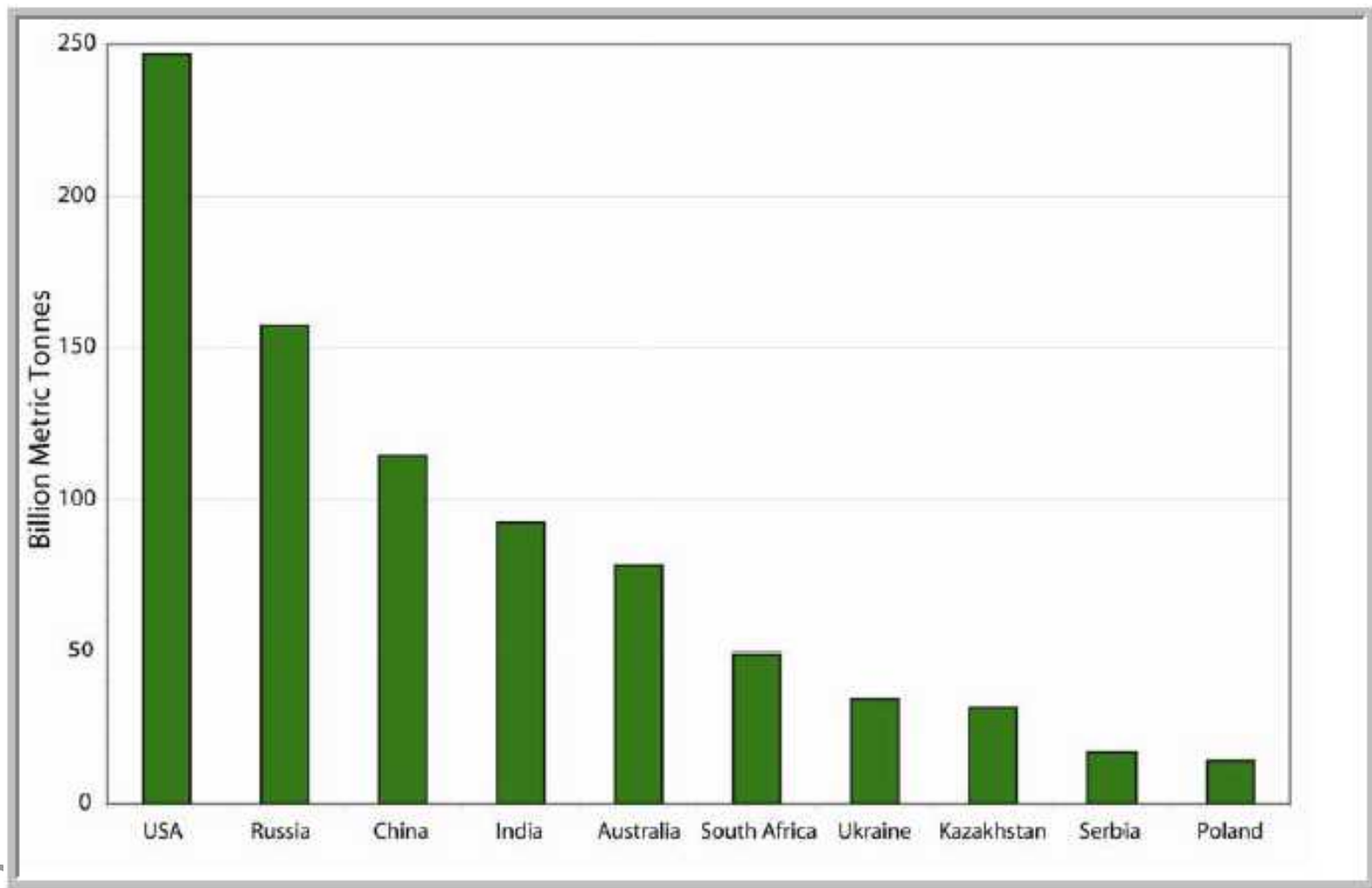
Reserve Base

- Demonstrated = 490 billion tons
- Identified = 1,700 billion tons
- Including undiscovered = 4,000 billion tons



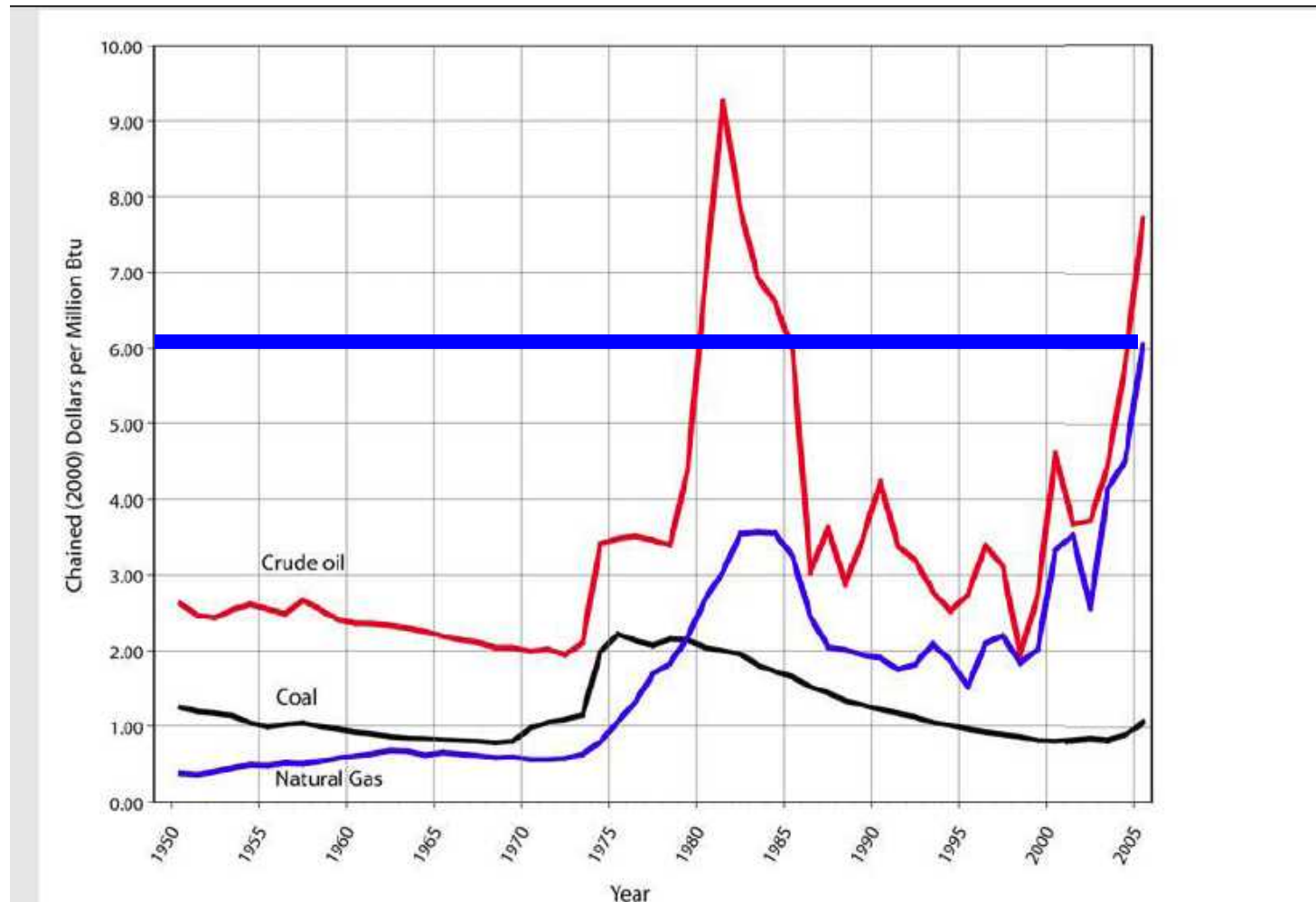
Source: EIA -7A data for 2006 and COAL RESEARCH AND DEVELOPMENT TO SUPPORT NATIONAL ENERGY POLICY- National Academy of Sciences Prepublication copy

Coal Reserves Are A US Strength



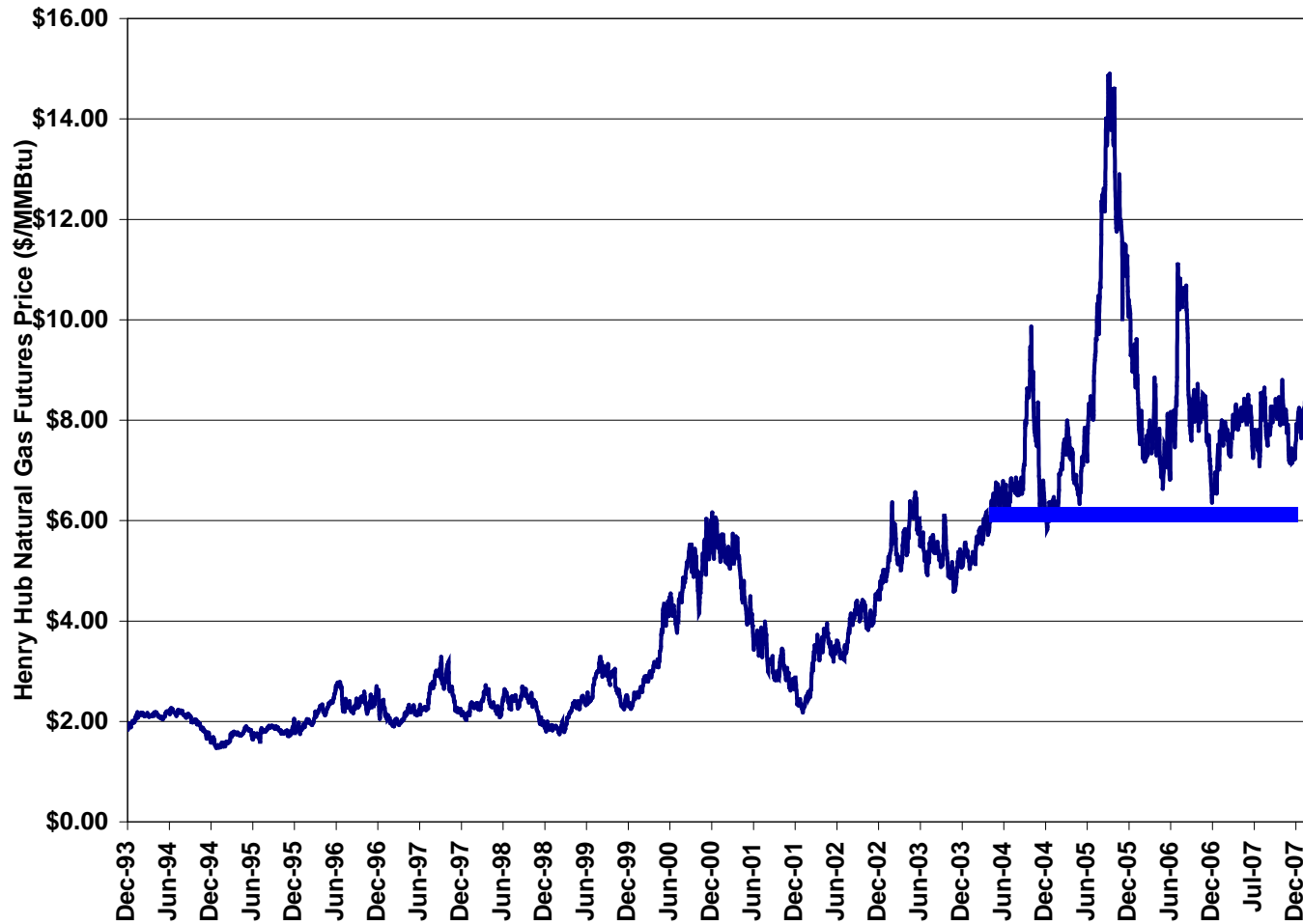
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Fossil Fuel Production Prices 1950-2005

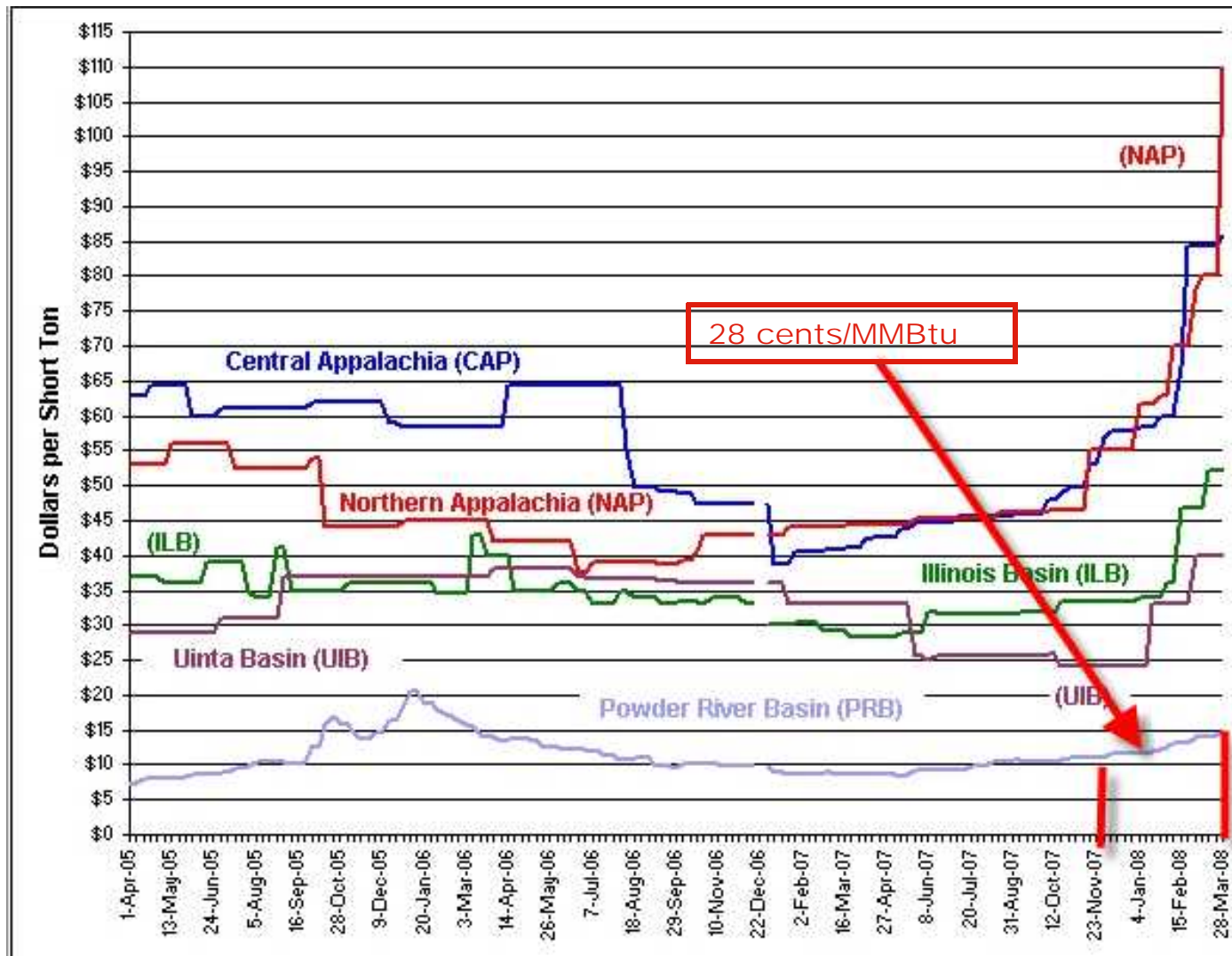


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Natural Gas Prices (2003-2007)

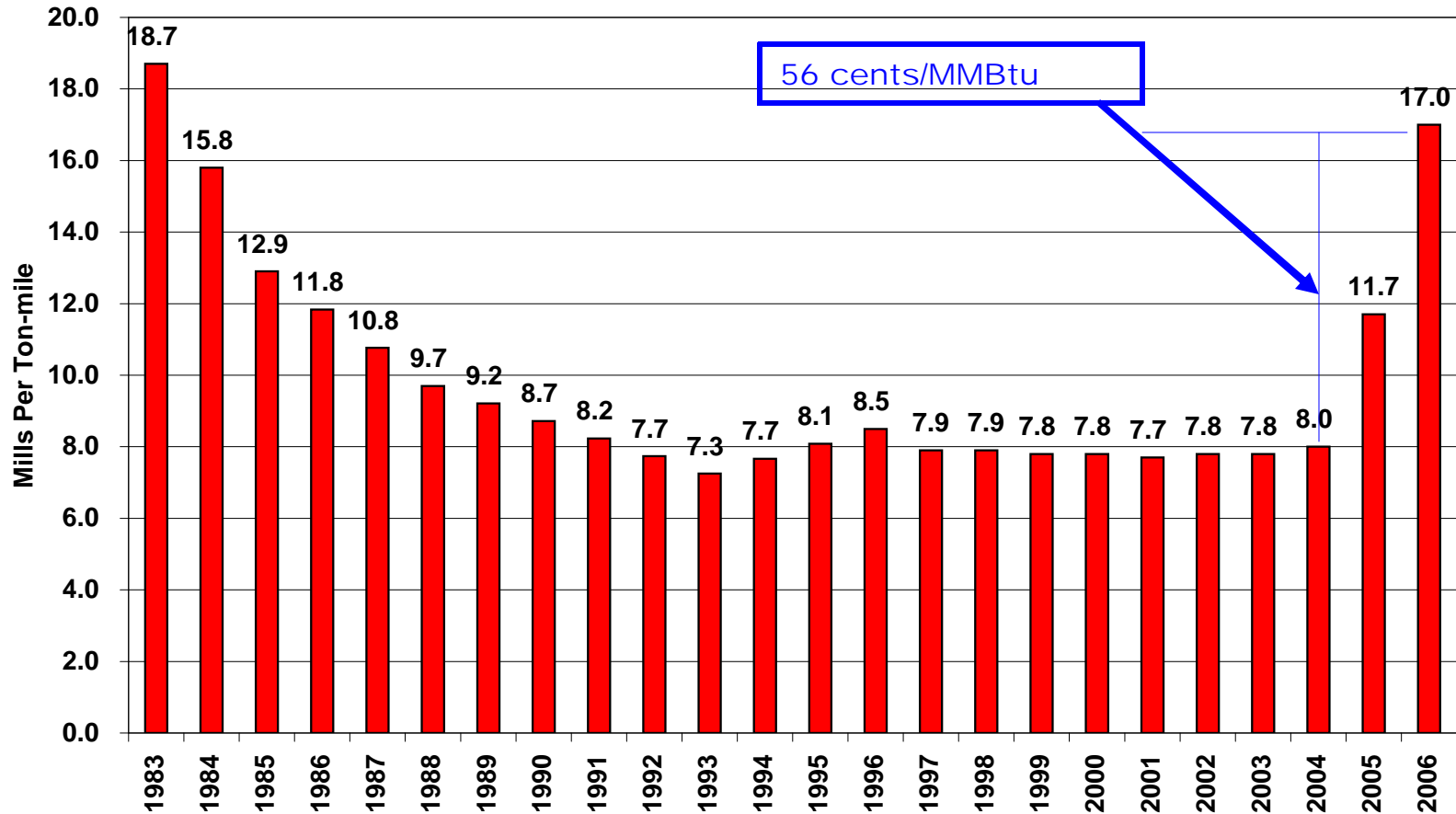


Weekly Coal Prices (2005-2008)



Western Rail Rates

Rail Rates for Shipments of PRB Coal to Competitively-Served Destinations
(starting rates for new multi-year contracts, including fuel surcharges, and assuming railcars are provided by the shipper)



Sources: Estimates by Fieldston Co., Inc., PA Consulting Group, Pace Global Energy Services, and Hellerworx.



Railroads Have Access to Capital



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Two Major Impediments

- The costs of installing new coal-fired generating units have increased rapidly in the past few years, so are they still more economical than Gas-CC or nuclear units?
- If we are serious about reducing carbon emissions, does it make sense to build new coal-fired generating units?

Coal vs. Natural Gas Economics



Cost of New Coal Units

- Costs have increased rapidly in the past five years
- New plant costs for pulverized coal boilers including financing costs: estimated range is \$2,500-\$3,500/Kw
- Many new proposed coal units are being built by Co-ops and Municipal Authorities
- Form and costs of carbon controls are unknown

New Coal vs. Gas-CC Input Ranges

Cost Component	Units	Coal	Gas-CC
Capital	\$/kw	\$2,500-3,500	\$700-1,000
Fixed O&M	\$/Kw-yr	\$35.0	\$25.0
Variable O&M	\$/Mwh	\$3.1	\$2.5
Heat Rate	Btu/kwh	9300	7000
Fuel Cost	\$/MMBtu	\$1.50-3.50	\$8.00-10.00
Capacity Factor	%	85%	85%
Capital Recovery Factor	%/yr	10- 12%	10- 12%
Unit size	MW	750	575
Carbon Cost	\$/ton CO2	\$10-35	\$10-35

Example 1: Economics Favor Coal

Cost	Units	Coal	Gas-CC	
Capital	\$/kw	\$2,500	\$700	
Fixed O&M	\$/Kw-yr	35	25	
Variable O&M	\$/Mwh	3.1	2.5	
Heat Rate	Btu/kwh	9300	7000	
Fuel Cost	\$/MMBtu	\$1.50	\$8.00	
Capacity Factor	%	85%	85%	
Capital Recovery Factor	%/yr	10%	10%	
Unit size	MW	750	575	
Total Cost/MWh		55	71	-16
Carbon Cost	\$/MWh	10	4	
Total Cost/MWh w/CO2		65	75	-10

Example 2: Economics Favor Gas

Cost	Units	Coal	Gas-CC	
Capital	\$/kw	\$3,500	\$1,000	
Fixed O&M	\$/Kw-yr	35	25	
Variable O&M	\$/Mwh	3.1	2.5	
Heat Rate	Btu/kwh	9300	7000	
Fuel Cost	\$/MMBtu	\$3.50	\$10.00	
Capacity Factor	%	85%	85%	
Capital Recovery Factor	%/yr	12%	12%	
Unit size	MW	750	575	
Total Cost/MWh		97	92	5
Carbon Cost	\$/MWh	35	14	
Total Cost/MWh w/CO2		132	106	26

7 Arrested as North Carolina Residents Shut Down Construction at Cliffside Coal Plant



"Shortly after activists locked themselves to construction equipment, police arrived on the scene and used pain compliance holds and tazers to force them to unlock themselves. The act of civil disobedience is one of over 100 protests taking place around the world on what climate activists are calling Fossil Fools Day, a confrontational day of protest targeting companies the groups say are responsible for runaway carbon dioxide emissions." Salem-News.com Apr-01-2008 10:39

AMP Ohio (March 31, 2008 Protest)



Carbon Capture and Sequestration (CCS)

- What does it cost to make units CCS ready?
 - New units
 - Existing units
- When will the technology be ready?
- In what aquifers can we store the CO₂?
- How will storage impact other reservoirs?
- Who handles the liability for CO₂ leakage?
- How do we accommodate the parasitic load?

Should we keep building coal plants in the interim?

Issues Related to Cost of New Coal Plants

- Increase in costs for conventional coal units
- IGCC construction costs uncertain
- Cost of CCS uncertain
- Possible CCS benefits (e.g. EOR)
- Possible new and better technologies
- Availability of skilled workers
- Banks assigning new coal plants greater risk

Implications of Not Building New Coal Plants

- Assuming load growth continues.....
- More gas plant construction
- Increase LNG imports
- Retain and operate inefficient older coal units
- Increase power prices
- More difficult to replace petroleum in transportation

Challenge

Is there potential for a “grand compromise” that allows continuing construction of new coal-fired generating units and upgrading the efficiency of older units while taking steps to reduce overall carbon emissions and eliminate petroleum dependency?

