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

Annual Energy Outlook 2008
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.

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, NOx, 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

Source: EIA -7A data for 2006 and COAL RESEARCH AND DEVELOPMENT TO SUPPORT NATIONAL ENERGY POLICY- National Academy of Sciences Prepublication copy
Fossil Fuel Production Prices 1950-2005

Source: COAL RESEARCH AND DEVELOPMENT TO SUPPORT NATIONAL ENERGY POLICY- National Academy of Sciences Prepublication copy
Natural Gas Prices (2003-2007)
Weekly Coal Prices (2005-2008)

28 cents/MMBtu
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.

56 cents/MMBtu
Railroads Have Access to Capital
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

<table>
<thead>
<tr>
<th>Cost Component</th>
<th>Units</th>
<th>Coal</th>
<th>Gas-CC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital</td>
<td>$/kw</td>
<td>$2,500-3,500</td>
<td>$700-1,000</td>
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<tr>
<td>Fixed O&amp;M</td>
<td>$/Kw-yr</td>
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<td>$25.0</td>
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<tr>
<td>Variable O&amp;M</td>
<td>$/Mwh</td>
<td>$3.1</td>
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<tr>
<td>Heat Rate</td>
<td>Btu/kwh</td>
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<td>7000</td>
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<tr>
<td>Fuel Cost</td>
<td>$/MMBtu</td>
<td>$1.50-3.50</td>
<td>$8.00-10.00</td>
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<tr>
<td>Capacity Factor</td>
<td>%</td>
<td>85%</td>
<td>85%</td>
</tr>
<tr>
<td>Capital Recovery Factor</td>
<td>%/yr</td>
<td>10- 12%</td>
<td>10- 12%</td>
</tr>
<tr>
<td>Unit size</td>
<td>MW</td>
<td>750</td>
<td>575</td>
</tr>
<tr>
<td>Carbon Cost</td>
<td>$/ton CO2</td>
<td>$10-35</td>
<td>$10-35</td>
</tr>
</tbody>
</table>
### Example 1: Economics Favor Coal

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<tr>
<td>Unit size</td>
<td>MW</td>
<td>750</td>
<td>575</td>
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<tr>
<td><strong>Total Cost/MWh</strong></td>
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<td>55</td>
<td>71</td>
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<tr>
<td>Carbon Cost</td>
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<tr>
<td><strong>Total Cost/MWh w/CO2</strong></td>
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<td>65</td>
<td>75</td>
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Example 2: Economics Favor Gas

<table>
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</tr>
<tr>
<td>Unit size</td>
<td>MW</td>
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<td>575</td>
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<td><strong>97</strong></td>
<td><strong>92</strong></td>
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<tr>
<td>Carbon Cost</td>
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<td>14</td>
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<tr>
<td><strong>Total Cost/MWh w/CO2</strong></td>
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<td><strong>132</strong></td>
<td><strong>106</strong></td>
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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?