Monetizing U.S. Coal/Petcoke: The Gasification Opportunity

Rice University Energy Forum
April 17, 2009

James Childress
Executive Director
Gasification Technologies Council
Gasification Industry Overview
The Coal Moratorium & the Dash to Natural Gas for Power Generation
The Gasification Response
Public Policy Response?

http://www.gasification.org
## Industry Growth
### Operating Plant Statistics 2004 vs. 2007

<table>
<thead>
<tr>
<th></th>
<th>2004</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2004</strong></td>
<td><strong>117</strong> operating plants</td>
<td><strong>142</strong> Operating Plants</td>
</tr>
<tr>
<td></td>
<td><strong>385</strong> gasifiers</td>
<td><strong>420</strong> Gasifiers</td>
</tr>
<tr>
<td></td>
<td>Capacity~<strong>45,000</strong> MWth</td>
<td>Capacity~<strong>56,000</strong> MWth</td>
</tr>
<tr>
<td><strong>Feeds</strong></td>
<td>Coal <strong>49%</strong>, Pet. Resid. <strong>36%</strong></td>
<td>Coal <strong>55%</strong>, Pet. Resid. <strong>32%</strong></td>
</tr>
<tr>
<td><strong>Products</strong></td>
<td>Chemicals <strong>37%</strong>, F-T <strong>36%</strong>, Power <strong>19%</strong></td>
<td>Chemicals <strong>44%</strong>, F-T <strong>30%</strong>, Power <strong>18%</strong></td>
</tr>
</tbody>
</table>

[http://www.gasification.org](http://www.gasification.org)
Geographical Distribution of World Gasification Capacity

(MW$_{th}$ Equivalent)

http://www.gasification.org
Where’s the Growth?

http://www.gasification.org
Shares of Growth in World Gasification Capacity 2004-2010 (without Pearl GTL)

- Asia: 81%
- Europe: 14%
- Americas: 5%

Canada, Long Lake
# 2004-2010 Gasification Scoreboard

(Plant Startups)

<table>
<thead>
<tr>
<th></th>
<th>China</th>
<th>U.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flag</td>
<td><img src="image" alt="China Flag" /></td>
<td><img src="image" alt="U.S. Flag" /></td>
</tr>
<tr>
<td>Score</td>
<td>29</td>
<td>0</td>
</tr>
</tbody>
</table>

[http://www.gasification.org](http://www.gasification.org)
The Coal Moratorium
&
The Dash to Gas

http://www.gasification.org
Factors Affecting Gasification in U.S.

- Opposition to Coal Includes IGCC
- Carbon Regulation is the Catalyst
- Path of Least Resistance – Natural Gas
- Natural Demand & Gas Prices
- Natural Gas Dependent Industries & Consumers Impacted
- Gasification a Competitive Alternative

http://www.gasification.org
EIA Forecast Off the Mark?

U.S. Non-Nuclear Energy Demand
For Power Generation
(Quadrillion Btu’s)

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2020</th>
<th>Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>20.44</td>
<td>22.01</td>
<td>8%</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>6.79</td>
<td>6.73</td>
<td>-1%</td>
</tr>
<tr>
<td>Renewables</td>
<td>4.06</td>
<td>5.79</td>
<td>43%</td>
</tr>
<tr>
<td>Total</td>
<td>31.10</td>
<td>34.23</td>
<td>10%</td>
</tr>
</tbody>
</table>

http://www.gasification.org

2009 EIA Annual Energy Outlook
U.S. Gasification Direction

In a carbon constrained world, growing demand for gasification in face of rising NG & oil demand & prices and concerns over energy imports. Key product sectors:

- Chemicals, Fertilizers,
- Refinery Polygen (H₂/Electricity/Fuels),
- Fuels & SNG

http://www.gasification.org
Benefits of Gasification Products

- Use Domestic Resources
- Long Term Competitive Output
- Lower Cost CCS Option
- “No planned gasification based U.S. project is without a CCS element”
Carbon Capture & Compression Costs

- Pulverized Coal: $40 per metric ton
- IGCC: $30 per metric ton
- CTL: $10 per metric ton
- Industrial Gasification: $0 per metric ton

Sources: MIT, Eastman Chemical

http://www.gasification.org
Proposed U.S. Gasification Plants

Source: Gasification Technologies Council
Product Shares for Proposed U.S. Gasification Plants

Source: Gasification Technologies Council
Public Policy Arena:
What is Needed?

http://www.gasification.org
• Public sector financial and policy support a necessity

• Construction & operation of commercial scale gasification manufacturing plants (IGCC, CTL, SNG) with CCS using a variety of feedstocks;

• Incentives that recognize and reward the ability of “industrial gasification” to offer large scale, near term opportunities for CCS at lower costs;

• A uniform national policy framework addressing regulation of CO$_2$ emissions and CCS, incentives, liability limitations and insurance for early adopters; and

• Cease fire in the zero sum energy war

http://www.gasification.org
Key Unknowns

Length & Depth of Economic Downturn
Direction of National Carbon Policy
Timing of Carbon Regulation

http://www.gasification.org
Questions? Comments?

jchildress@gasification.org

http://www.gasification.org