Clean Coal and Co-Production Potential

Clean Coal For Transportation Fuels Workshop

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Outline

1. ConocoPhillips
2. E-Gas Technical Heritage
3. Gasification Process
4. LGTI experience at Dow
5. Wabash Experience
6. Environmental Benefits of Gasification
7. FT Liquids Experience
ConocoPhillips Introduction

- NYSE: COP
- Eighth largest publicly owned energy company worldwide—based on oil & gas reserves
- Third largest integrated energy company in the United States
- Second largest refiner in US, 5th in world
- World’s leading producer of petroleum coke
- Headquartered in Houston
E-Gas Gasification Commercial Feedstock Offerings and Gasifier Scale-up

- **1975 Pilot**: 36 TPD
- **1979 Proto 1**: 400 TPD
- **1983 Proto 2**: 1600 TPD
- **LGTI 1987–1995**: 2,400 TPD
- **Wabash 1995 - 2005**: 2,600 TPD

For 2010 Start-up E-Gas Technology Commercial Offerings
- Bituminous
- Sub-Bituminous
- Petcoke

Bituminous IL #6 coal
Petcoke – Multiple refineries.
LGTI Summary

- Operated 1987 – 1995 at Dow Chemical’s Louisiana Division under Synfuels Corporation Contract
- Over one third of the coal-to-power gasification in U.S.
- Supplied Syngas to two Siemens Westinghouse W501D5 turbines
- 2400 TPD sub-bituminous coal feed (1.5 X scale-up)
- Over 3.7 million tons of sub-bituminous coal processed
- Included significant testing of dry particulate removal system and petroleum coke and bituminous coal (second stage only)
Wabash River

One of the Cleanest Coal Fired Power Plants in the World

1.7 million tons of bituminous
1.3 million tons of pet coke

• 2500 TPD bituminous coal feed
• 262 MW Net output
• Operational since 1995 at Cinergy’s Wabash River Plant
• SG Solutions LLC now owns Syngas Plant, ConocoPhillips provides professional services on site

Source: SG Solutions, LLC
## Wabash Emissions Comparison

### Emissions, lb/MWh

<table>
<thead>
<tr>
<th></th>
<th>SO2</th>
<th>NOx</th>
<th>CO</th>
<th>PM-10</th>
<th>VOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 1 before Repowering</td>
<td>38.2</td>
<td>9.3</td>
<td>0.64</td>
<td>0.85</td>
<td>0.03</td>
</tr>
<tr>
<td>IGCC (1999 annual average)</td>
<td>1.075</td>
<td>0.75</td>
<td>0.555</td>
<td>0.09</td>
<td>0.09</td>
</tr>
<tr>
<td><strong>Emissions Reduction TPY</strong></td>
<td>5,505</td>
<td>1,179</td>
<td>(83)</td>
<td>101</td>
<td>(25)</td>
</tr>
</tbody>
</table>

Comparing 100 MW PC unit running 35% availability and 262 MW IGCC running 75% availability

(5.6 X more megawatt hours produced)
Repowering Emissions Comparison

Source: Wabash River Repowering Project, 1999 average reported to IDNR
Comparative Emissions of Coal Based Power Plants

1) Wisconsin Electric Power SCPC information from April 2003 Draft Environmental Impact Statement, Elm Road Generating Station, Volume 1, Public Service Commission of Wisconsin & Department of Natural Resources, Table 7-11, p. 155 (Pittsburgh No. 8 coal)


3) Supplemental Information for PSD Permit Application, March 25, 2003, Prepared by Earth Tech, Inc. for Indeck - Elwood, LLC.

4) Wabash River Repowering Project, 1999 average reported to IDNR
Total Air Emissions From Coal Power Plants

From references cited in previous slide.
All plants scaled to 550 MW at 90% annual capacity factor.
Pollutant Removal Advantages

**Mercury Removal**
- 90-95% removal utilizing carbon beds

**Carbon Dioxide**
- Gasification is the most cost effective method for CO2 removal
Solid Byproducts – not Wastes

- **Sulfur - 99.99% pure**
  - 100,000+ tons sold at Wabash
  - 400,000,000 equivalent lbs of SO$_2$

- **Slag - Black, glassy sand like material**
  - Inert, passes TCLP & UTS
  - Asphalt
  - Construction backfill
  - Landfill cover
ConocoPhillips GTL History

- 1997 – Started R&D with DuPont
- 1999 – Conoco Spin-off from DuPont
  - World class R&D Organization/Facility in Ponca City
- 2001 – Commit 400 BPD Demonstration Plant
- 2002 – Conoco & Phillips Petroleum Merge
- 2003 – Start up GTL Demonstration Plant
- 2003 – COP Acquisition of E-Gas Technology
ConocoPhillips Gas-to-Liquids Technology

Gas Processing

Air Separation

Offsites: Buildings, Controls, Flares, Fire Water

COPox™ Syngas

Fischer Tropsch

Product Refining

Product Storage & Export

Integrated Utilities: Water, Steam, Power, Air, Nitrogen

ConocoPhillips Gas Technology
Demonstration Plant
Ponca City, Oklahoma
Gasification
Common Sense
For Energy And
The Environment