Factors That Affect the Design of Clean Coal Technologies – Phase II: 2nd Interim Report

Synfuel Park Feasibility Study

by
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Purdue Energy Modeling Research Groups (PEMRG) December 6, 2006
Phase 2 Project Team

PURDUE:

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(with help from other IGS and SUFG staff)
Phase II Vision

• Investigate the feasibility of one or more Synfuel Parks in the state using gasified Indiana coal to produce
  – Any or all of Fischer-Tropsch (FT) Diesel, Jet Fuel, Electricity, Synthetic Natural Gas, and related chemicals

• Having conforming air & water emissions and expectation of sequestering CO2
Concepts & Options

- Indiana Mines
  - Coal
  - Syngas
- Gasifier & Purification
- CO2
- C Bed Methane
- Aquifer Sequester
- E Oil Recovery
  - FT Synthesis
  - Syngas
  - Electricity
- Comb Cyc Generation
- Liquids
  - FT Diesel
  - Naphtha
  - Wax
- Separation & Upgrading
  - Kerosene (Jet Fuel)
Data Collection

• Gasification (gasifiers, ASU, syngas cleaning)
  – Technologies (data of 7 gasifiers collected…)
  – Cost data (historical and forecast)

• FT process
  – Technologies (once through vs recycled)
  – Cost data (historical and forecast)

• Power islands, etc.

• CO2 sequestration options & potentials

Both historical cost and estimates vary by sources & scaling -- need careful analysis
Site Investigations

- Objective to better understand the issues, advantages & disadvantages of various sites in the state
- We do **not** intend to recommend specific sites
  - Rather indicate the kinds of sites that should be attractive
Site Selection Criteria

- Coal access
- Sequestration access
- Land acquisition
- Transportation (rail, highway, water way)
- Transmission lines
- Gas pipelines
- Cooling water
- Waste disposal, environment
- Labor force
- Economic development
IGS Site Map

Legend
- I-69
- Major Roads
- Rail System (INDOT)
- Pipelines (>12 inches diameter)
- Electric Power Lines
- I-69 - Five-Mile Buffer
- Roads_Pipelines_Transmission_Rail_Intersect
- Pipelines_Transmission_Rail_Intersect
- Pipelines_Transmission_Intersect
- Surface Mines
- Underground Mines
ECBM & EOR Potential

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Merom Visit

- Merom site 4500 acres in Sullivan County
- 2 miles from Wabash
- Greenfield example
- Site of major Hoosier Energy power plant
- Close to proposed Future-Gen site in Illinois
Merom
Merom: Analysis

- There is plenty of water both from underground and from the lake. The Turtle Creek Reservoir has a surface area of 1,550 acres.
- Current power transmission line is not enough for extra power output of large amount. A substation is ~ 10 miles to the north of Merom, which has connections to many other locations.
- There is no natural gas pipeline to the plant. However, HE has purchased the right of way to constructed a pipeline from Merom to a point to the east (about 8 miles).
- Power is readily available for big projects such as a synfuel park
- There are about 1900 acres land left for landfilling
- There is a state highway about 2.5 miles to the east of the plant.
Merom: Analysis (cont)

- Coal fields are nearby
- There is a rail track leading to the power plant. HE owns about 1.6 miles of the track. In addition, HE owns the rail cars for coal transportation
- HE also uses trucks for coal transportation. On average, rail track delivers about 65% of its coal
- There is significant CO2 sequestration potential
- The area is relatively flat, and site preparation is easier
- It is not far from Terre Haute, labor force is available
- HE is very helpful in the study
Crane Visit

- Crane Naval Weapons site in Martin county
- Major ordinance storage, testing & maintenance
- Special potential example
- Need for development in region
  - Crane may close
Crane Resources

- 63,000 acres
- Opportunity mostly on periphery
- In kind lease deals
Crane: Analysis

- Very hilly, and the largest flat area is about 80 acres
- Limited water, a small lake is about 800 acres, fed by a very small creek
- Connected to the East-West rail system, with many rail routs within the complex
- No major highway connection, and the situation can be improved if I69 is built along its front gate
- There is a gas citygate, with about 30% capacity loading
- There are two power substations, one from Hoosier Energy, the other, from Duke
Crane: Analysis (cont)

- More than 5,000 people are working for the base, some with technology background
- Most of the land is not contaminated
- ESOP Advisors Inc has been hired for planning economic development in 6 counties around Crane. They asked H2 production and biomass fuel as part of the synfuel park
- The site is not far from major coal sources
- People from there are eager to talk development
- There is a technology park at the Northwest side of the base (State certified). Purdue has a small training facility there
Mt. Vernon Visit

• Mt. Vernon in Posey County site of Country Mark Coop refinery
  – Major off-road diesel producer with Illinois basin crude
• FT-products-linked site
• Great deal of nearby power production
• Adjacent to Ohio River
Mt. Vernon

PURDUE ENERGY MODELING RESEARCH GROUPS
Mt Vernon: Analysis

• Very limited land area for expansion
• Could be extra capacity for down stream FT refining, such as naphtha processing
• They cannot say whether they could accept naphtha from a potential Wabash CTL plant
  – Depends on the composition of the naphtha
  – Current refinery size is difficult to expand for extra production
• Expansion of power production may meet objection from public due to numerous existing plants
Mt Vernon: Analysis (cont)

- Power transmission is tight, and expansion may be difficult.
- Gas pipelines are nearby
- Rail system is good
- Highway system is good, but truck and agriculture traffic is heavy, and can be heavier after two proposed ethanol plants are only
- Labor force is good since the region has considerable with heavy industry.
- About 25 miles west of Evansville
Future Visits Planned

• Mine mouth site
  – Probably Black Beauty (Minnehaha and/or Francisco)

• Possibly a brown-field site
Synfuel Park Design Opt

- Maximize the economic returns over
  - Sites
  - Coal supplies
  - Numbers, sizes & types of different facilities
  - Markets for different products (including competitive risks from crude oil & tar sands)
  - Transportation & infrastructure at all stages
  - Management of CO2 & other environmental concerns
  - Government incentives & regulation
Planned Time Line

~ Mar 2007: Complete site/data analysis + Preliminary Synfuel Park optimization model

~ May 2007: Final Synfuel Park optimization model & calibration + Risks and Incentives + Scenario specification

~ June 2007: Results, analyses, and final report