Factors that Affect the Design & Implementation of Clean Coal Technologies in Indiana: Phase 2 – Feasibility Studies

Presentation to the CCTR Advisory Group
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Phase 1 – Scoping Study

(completed December 2005)
Phase 1 Project Team

PURDUE:
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ADVISORS:
• Dick Foltz (& Gayle Mayo), IMPA
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• Francois Botha, ICCI
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(with guidance from Cinergy)
Clean Coal Technology (CCT)

- CCT \( \approx \) methods for using coal with substantially reduced environmental emissions
- Includes Integrated Gasification Combined Cycle (IGCC) with near zero emissions
- What coal-fired & combinations to include?
  - Supercritical PC (high temp & pressure)
  - Circulating Fluidized Bed (input with limestone)
Phase 1 Effort

- Study began by developing a compendium of information about topics along two dimensions
  - First is the technologies of CCT
  - Second is the Indiana environment for CCT
- Then investigated a series of scenarios about alternative technologies, and CO₂ capture (or not) in new construction and/or some retrofit, in order to address CO₂ possible regulation
Phase 2 – Feasibility Studies of Some Indiana Project Concepts
Phase 2 - Vision

• Develop and refine concepts for two related categories of Indiana CCT projects
  – Coal by Wire (clean coal merchant plants)
  – More ambitious Synfuel Park producing power, liquid fuels, fertilizers, steel coke, etc

• Investigate for each the likely technologies, financing, markets, location, fuel sources, costs, and management of CO$_2$ & other environmental concerns
Phase 2 - Purpose

• Assess the feasibility of CCT projects that could
  – Promote the environmentally responsible use of Indiana coals
  – Stimulate economic development within the state

• Continue building research/analysis capacity to deal with future CCT and regulatory issues
Coal by Wire - Location

• Siting
  – Mine-mouth or other
  – Water requirements
  – Access/transport for coal supplies
  – Access/location for CO$_2$ management

• Transmission network
  – Current system loading
  – Need and cost of expansion or new construction
Coal by Wire - Technologies

• Power Production Technologies
  – Integrated Gasification Combined Cycle (IGCC)
  – Atmospheric Fluidized Bed Combustion (AFBC)
  – Super/Ultra Critical Pulverized Coal (SCPC)

• Opportunities for biomass co-firing

• Emission Prevention/Regulation
  – SOx, NOx, Mercury
Coal by Wire - CO$_2$

- Capture technologies
- Disposal/sequestration technologies
- Economic issues
  - Sequestration/transport costs
  - Stimulation of valuable products (e.g. coal bed methane)
Coal by Wire - Financing

• Capital & operating costs
• Potential markets for electricity produced
  – Where to sell
  – Likely prices (baseload vs. cycling)
  – Reliability credits (e.g. MISO)
• Potential investors
• Impacts of federal, State and/or local incentives
  – Loan guarantee (e.g. DOE) impact on capital cost
  – Tax incentives
  – Future inclusion in the State rate base
Coal by Wire – Econ Impact

- Assessment of macro-economic impacts of the proposed Coal by Wire project
  - Use of Indiana coal
  - Jobs & economic activity from construction & operation
Synfuel Park - Location

• All the same location issues as the Coal by Wire
• Added considerations of access to markets for non-power products (synfuels, chemicals, etc.)
• Added land requirements, transportation & connectivity interactions among operations
Synfuel Park - Technologies

- Direct Coal Liquification (DCL)
  - Status/costs of technologies
  - Fuel produced (gasoline, diesel, methanol, etc.)
- Indirect/Gasifier Coal Liquification (ICL)
  - Status/cost of technologies
  - Fuel produced (gasoline, diesel, methanol, etc.)
  - Conflicts & synergies with power production (polygeneration, peak vs. offpeak)
- Direct sales of syngas
- Steel coke manufacture (sister project)
Synfuel Park – CO$_2$

- Same removal and sequestration/management issues as with the Coal by Wire, including potential for economic value
- Additional options/technologies in various liquid fuel technologies
  - Different CO$_2$ concentrations, different stages
- Potential link to an Indiana role in FutureGen
Synfuel Park - Financing

• Same electricity considerations as Coal by Wire
• Many additional technologies for which to estimate capital & operating costs
• New concerns for markets of other products
• New opportunities to spread capital costs & incentives across related industries & draw wider range of investors (e.g. venture capitalists)
• New options for federal/State/local site incentives (such as Ports of Indiana)
Synfuel Park – Econ Impact

- Use of Indiana coals still central
- Now potentially wide array of industries contributing jobs & economic development
  - More complicated assessment
Task A – Data Collection

- Refine existing knowledge of CCT costs, technologies & markets
- Investigate potential sites, including potential for CO$_2$ management
- Investigate liquid fuel, chemical & coke technologies, costs & markets
- Collect information on investment markets & economic impacts of projects
Task B – Min Cost Designs

• Conduct modeling to determine least cost designs for Coal by Wire alone
• Elaborate to encompass Synfuel Park
  – preferred mix of technologies
  – costs, markets & financing for each
  – technology synergies & interfaces
• Assess risks due to technology, financing & markets
Task C – Financing & Econ Impact

• Investigate potential sources of financing
• Delineate and analyze options for federal, State and/or local incentives
  – Impacts on financial viability of projects
  – Costs to Indiana rate/tax payers
  – Conduct modeling to develop preferred alternatives
• Develop estimates of job & development impacts
  – Use of Indiana coals
  – Construction
  – Long term (coal & other)
Deliverables

• Progress reports at Advisory Group meetings
• Final report
  – Reviewing data and analysis
  – Assessing the feasibility of the Coal by Wire and Synfuel Park projects
  – Suggesting preferred alternatives
  – Outlining needs for further research
Phase 2 – Time & Budget

• Twelve months from approval and notice to proceed for this phase
• Total budget of $150K from CCTR
• Quarterly updates at Advisory Group meetings
• Final report at end of project period

(Hope to have cooperation and advice from partners at IGS, Cinergy and elsewhere)