Indiana Energy Project
CCTR
Status Update

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SAIC
From Science to Solutions

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Objective

Interim discussion of our approach and design concept to include supporting an Indiana Energy R&D Center

The Time is Now – The Place is Indiana

- **Energy Independence and environment increasingly critical national priorities**
- **Strong government, industry, academic partnership in Indiana**
- **Series of CCTR analyses show SW-Ind a strong contender for coal gasification and sequestration potential**
- **Strong State support for adoption of clean coal technology and energy production**
- **Strong local demand for potential coal gasification products**
- **Technology available to achieve major energy and environmental goals**
- **DOE restructuring of FutureGen**
- **Strong DoD priority for energy independence**
  - Crane support/congressional support
  - Defense Science Board recommendation that energy independence be an important criteria in future BRACs (Report of the Defense Science Board Task Force on DoD Energy Strategy, *More Fight – Less Fuel,* February 2008.
  - Strong DoD interest in synthetic liquid fuels (esp JP-8)

State Program Goals

- Create a focused approach to solve the "clean coal" problem
- Design and build a functional coal fired plant (test bed) suitable for R&D and the hub of an Indiana Energy R&D center
- Achieve energy independence for NSWC Crane and enhance Crane's value to DoD
- Enable growth in Indiana Energy Industry by developing commercially viable technologies
- Encouraging DoD / DOE to become the first adopter due to National Security considerations

Primary Team Objectives

- **Create a focused approach to enhance economically viable "clean coal" opportunities for Indiana**
  - Commercial viability
  - Enable growth in Indiana energy industry
  - Increase the use of Indiana coal
  - Design-in a capacity to blend biomass into coal gasification
  - Product mix tailored to regional demand requirements
  - Modular design that could be scaled and modified to other locations and conditions
  - Design as close to zero emissions as possible
  - Design to CO2 sequestration ready specifications and maximize commercial CO2 use
- **Achieve "Crane energy independence" and enhance Crane's value to DoD**
  - Ability to provide adequate net electric power to support Crane in an emergency
  - And/or the potential ability to supply Crane's natural gas requirements with Synthetic Natural Gas
  - Located on or near the Crane Division, Naval Surface Warfare Center in Southwestern Indiana to enhance "physical security"
  - Concept is designed to encourage DoD/DOE to support this project as a pilot for replication in other locations to provide small scale distributed electric power/F-T liquids/SNG to meet DoD energy independence goals.
- **Design a viable coal-fired plant that incorporates space, facilities, and fixtures that can support use as an R&D test bed and a hub for an Indiana Energy R&D center.**

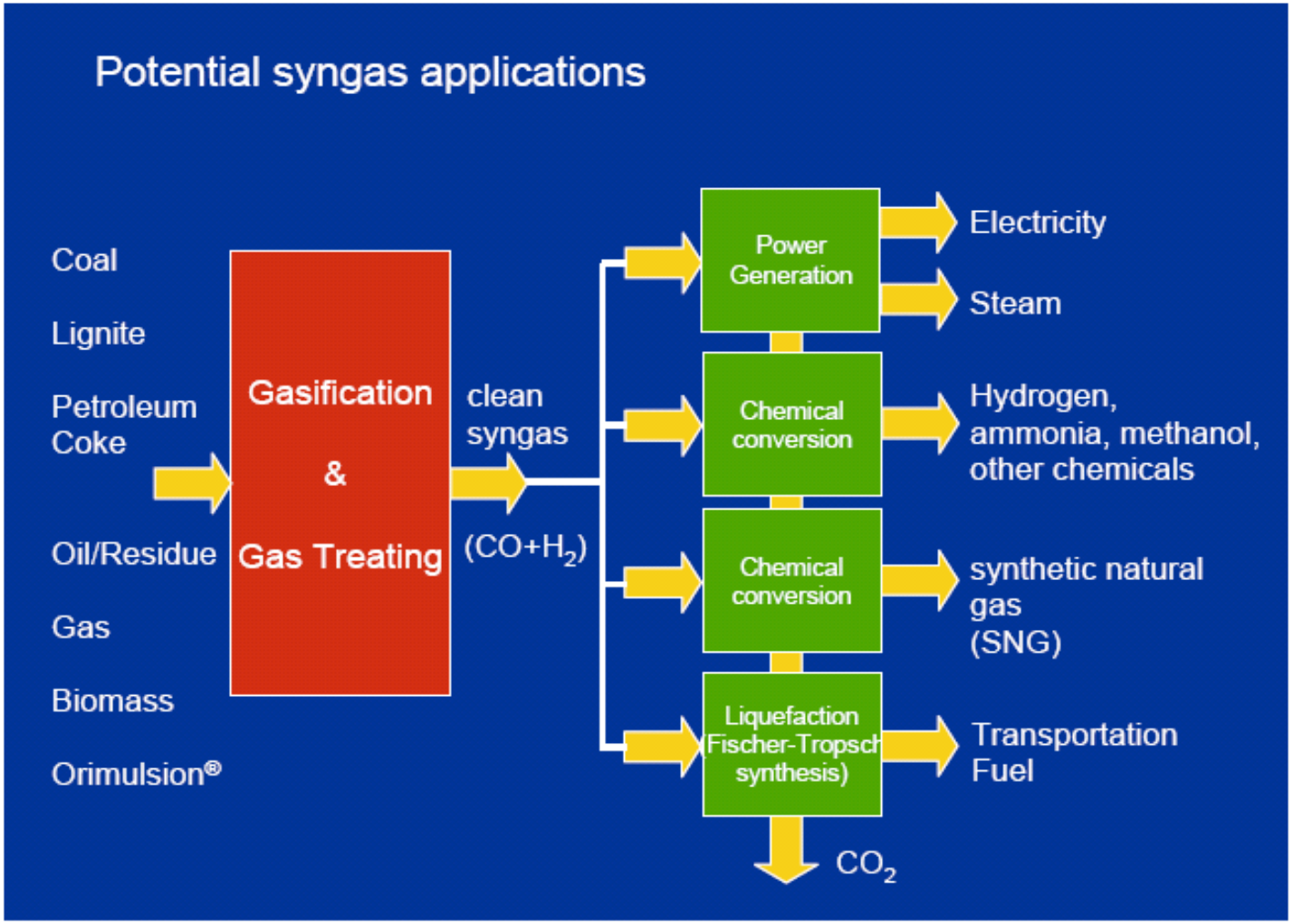
Accomplishments and Milestones: I

- Indiana funding $150,000 through the Center for Coal Technology Research (CCTR) – Authority to proceed Jan. 2008
- SAIC funding $300,000 to date – project launch September 2007
- Tiger Team kick-off meeting at Hoosier Energy – October 24, 2007
- Tiger Team design review meeting in Pittsburg – January 7-10, 2008
- Facility design meetings in Tulsa OK, with SAIC Utility/Refinery design subsidiary (December 2007 and February 2008)
- Regular communications with Marty Irwin, Director CCTR

Accomplishments and Milestones: II

- **Site visits**
  - Wabash IGCC
  - Hoosier pulverized coal and peaking plants
  - Air Liquide/GPC carbon capture facility (Daviess County)
- **Potential Customer/Partner Communications**
  - Wabash
  - Hoosier Energy
  - National Rural Electric Cooperative Association
  - CountryMark
  - Air Liquide
  - Conoco Phillips
  - DOE
  - Crane/NAVFAC
  - Air Force
  - Delphi
  - Cummins
- **Key teaming and external support communications**
  - Purdue University/Indiana University
  - Members of Indiana Congressional delegation (Lugar, Bayh, Ellsworth, Hill)

Alternative Syngas Product Streams



Source: Ross Rava, Shell Global Solutions (US) Inc., Coal-Gen, Milwaukee, Wisconsin, August 1-3, 2007.

Preliminary Design Considerations

- **Product options drive capital cost**
  - Product mix choice significantly affects plant design
  - Three primary product options best fit Indiana market conditions
    - IGCC to pipeline quality SNG
    - IGCC to anhydrous ammonia for fertilizer production
    - IGCC to Fischer-Tropsch for ultra low sulfur diesel and related distillates
  - IGCC + F-T is highest capital cost option but best fits full range of State planning goals
- **Scale economies are significant for all options**
  - Reference design was selected based on minimum commercially viable sized plant that best met the full range of State planning goals
  - Using the best available engineering design and cost information on IGCC and F-T facilities, SAIC developed a decision model to generate preliminary design, scale and cost estimates
- **Engineering cost estimates for the detailed Reference Design are being generated**
  - A economic analysis of costs and revenues will follow

Technology and Plant Design

- **Selected design concept: a 2000 to 3000 ton/day Coal to Liquids facility (IGCC to Fischer-Tropsch)**
  - 25MW continuous electric power (Crane grid independence)
  - 4500-6000 b/day FT liquids
  - CO_2 capture and sale or sequestration ready
  - By product capture/sale
  - Facility design maximized to support clean coal R&D and commercialization
  - Optimize the ability to meet or exceed all current and expected environmental regulations
- **If implemented could be the first commercially viable Coal to Liquids facility in the US**
- **Design concept is innovative in the integration of commercially available technologies, combined with the ability to perform R&D on products, processes and sequestration**

Research, Development & Training Platform and Facility

- Modular plant with each island sized and plumbed to permit R&D interfaces
  - Alternative materials storage, processing, and handling technologies (coal and biomass)
  - Space and "port" for an additional gasifier
  - Syngas slipstream (raw and clean) for industry and university product & process testing
  - Potential hydrogen slipstream
  - F-T liquid distillate slipstreams (raw distillate and/or refined distillate)
  - Grid and grid interface access for grid management and stability testing
  - CO2 slipstream for testing alternative sequestration technologies & systems

- Extensive sensor and data capture systems for research, simulation, and training (on-site and remote)

- Labs and meeting/class rooms for training and short/long term university and industry R&D teams

Location Options

- **On or off Crane**
  - On-Crane: Unable to pay more for power without high-level policy decision: strict use restrictions on commercial activity
  - Off-Crane superior due to internal Navy approval and environmental processes, facility scaling, and operational flexibility
    - Contiguous w/ Crane border provides superior physical security
    - Non-contiguous site w/in 20 miles of Crane improves access to water and reduces transportation costs for coal input and liquid fuel export, while still providing Crane energy independence but at lower levels of physical security
- **All options near adequate water, coal, and good infrastructure (refined petroleum pipeline, rail, road, power lines)**
  - Non-contiguous option superior on all logistics criteria

Risks and Risk Mitigation

- **Collapse in market price of oil**
- **Political/policy changes**
  - Esp. environmental opposition to CTL
- **Design/build cost risk**
  - Very rapid construction cost escalation
- **Operation risk**
  - Primarily skilled labor availability
- **Competitive technology risk (alternate processes for synthetic liquid fuels, electric vehicles, hydrogen)**
- **Identification of lead investor/source of funds**
  - No US based team with track record in commercial CTL
  - Major financial institutions see oil price risk and CO2 policy risk as major barriers to investing
- **Demand for R&D center**

Next Steps

- **Submit comments to DOE RFI on FutureGen for sequestration funding consideration (March 3)**
- **Interim brief to CCTR (March 6)**
- **Feasibility brief to Lt. Governor (Mid-April)**
- **If approved, launch Phase 2**
  - Refine cost and revenue estimates for business plan
  - Formally engage potential partners and funding sources in a strategic discussion of launch strategy
  - Identify funding and launch detailed engineering design