Co-Production

The Taylorville Energy Center (TEC)

A Case Study

Jim Jurczak, P.E.

Director, IGCC / Gasification Projects

Burns & McDonnell Engineering Co., Inc.

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IGCC Co-Production

Evaluation performed to determine feasibility of chemicals co-production at the TEC as a means to improve project economics.

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Project Overview

Owner: Christian County Generation, LLC (CCG)

- 50% Tenaska / 50% The ERORA Group

Excellent Location: Taylorville, Illinois

- Proximity to Coal Supplies
- Access to rail, transmission, water, gas

IGCC Selected (versus PC)

- Low emissions profile.
- 95% mercury removal.
- Potential future capability for CO_2 capture / sequestration.
- Saleable Byproducts
- Incentives

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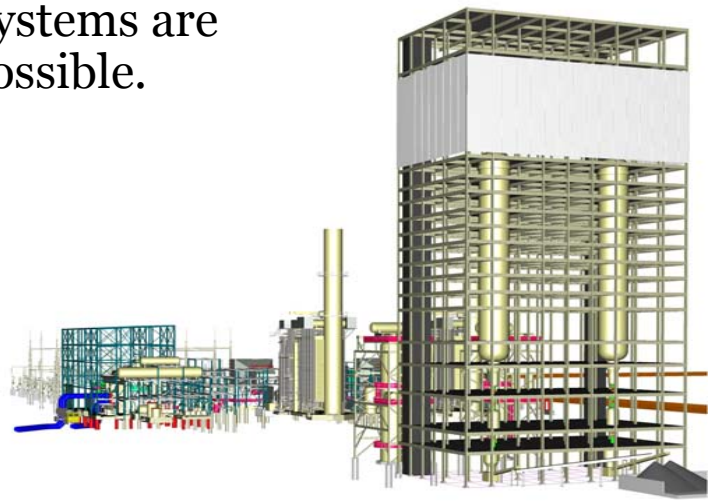
CCG's Design

IGCC Facility Configuration:

- GE radiant gasifiers.
- GE 2x1 combined cycle power block.
- Selexol acid gas removal system.
- Activated carbon beds for mercury removal.

Co-Production Considerations:

- Evaluated methanol and synthetic natural gas (SNG), SNG is transportation advantaged.
- Option to swing one gasifier's worth of syngas between power and chemicals
- Co-Production equipment and systems are "Add-On" to maximum extent possible.



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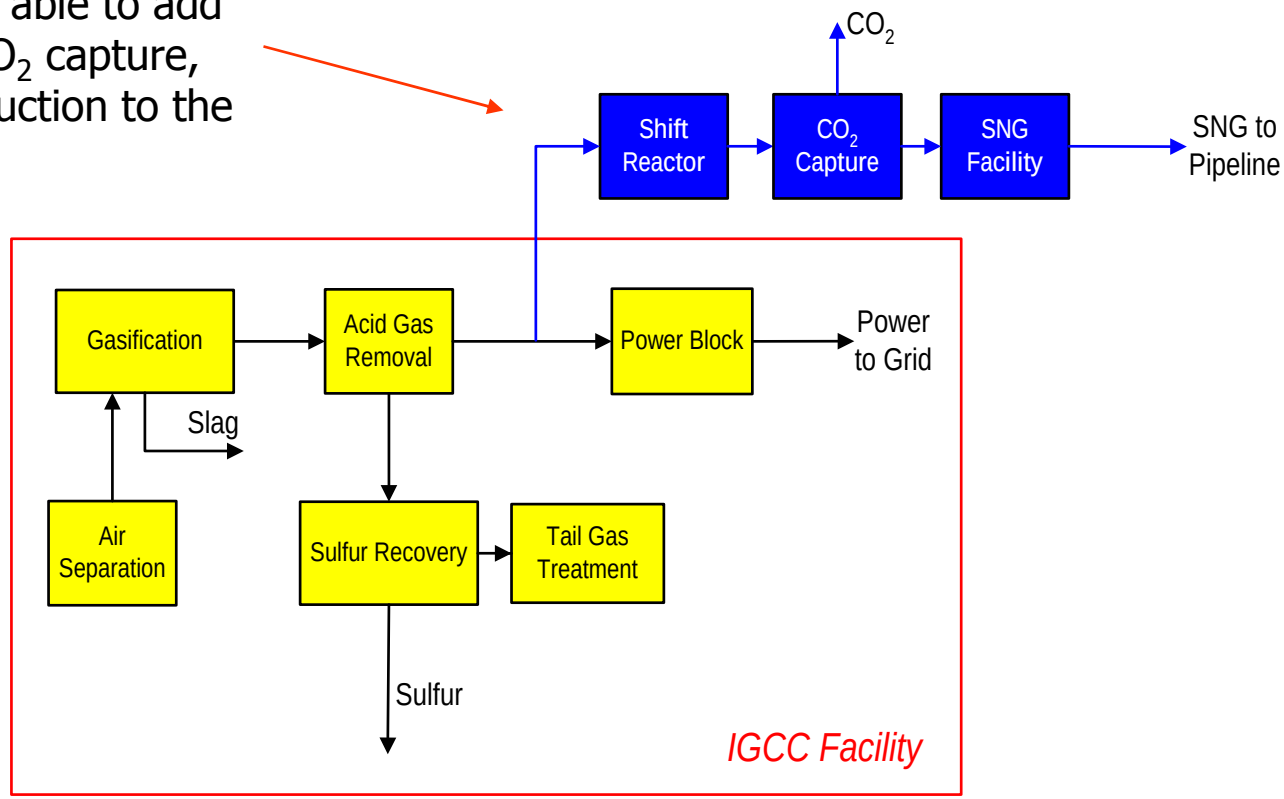
Basic Block Flow Diagram

- Intent is to be able to add sweet shift, CO_2 capture, and SNG production to the IGCC facility.



Certain pre-investment to the IGCC facility is required.

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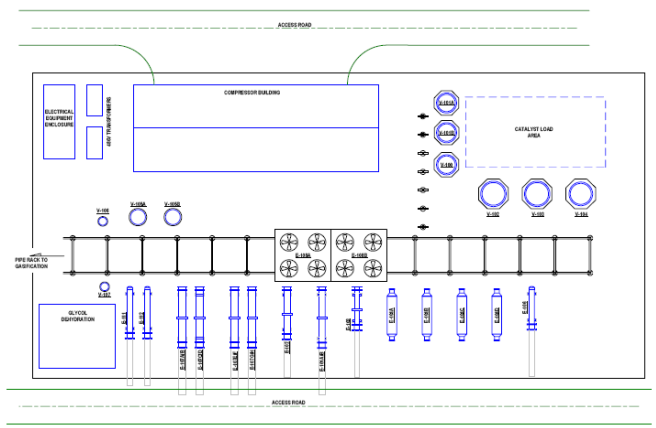
Engineering Scope of Work

Design Engineering

- Detailed Process Modeling
- Heat and Material Balances
- Process Flow Diagrams
- Facility General Arrangement
- Equipment Sizing
- Utility Summary

Economic Analysis

- Detailed lifecycle cost evaluation was performed.
  - Involved catalyst vendors.
  - Equipment quotes.



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Technical Considerations

Must meet pipeline quality gas requirements.

- Heating Value:
  - Minimize inerts in the syngas feed to the SNG facility.
  - Optimize H_2/CO ratio.
  - Optimize reactor temperatures.
- Moisture: Drying is needed.
- Contaminants:
  - Some specifications have a hydrogen limit.

Sulfur

- Sulfur deactivates the methanation catalyst.
- Protection required in front of catalyst beds.

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Technical Considerations (cont.)

Design for maximum SNG facility turndown.

Water / Steam Side Integration:

- Some steam and water is required (attempted to minimize).
- Utilize steam produced by SNG process in the shift reactor.

Certain Pre-Investment in IGCC Facility Required

- Higher purity O2 from ASU.
- Additional site space.
- Electrical auxiliary power capacity.
- Additional water required.

Performance (Confidential)

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Economics

Advantages:

- Maintain gasifiers at full capacity.
- Better ability for load following capability of power block.
- Reduced conversion cost.
  - Gasification and gas cleanup costs attributed the IGCC facility?
  - Common utilities

Disadvantages

- Pre-Investment requirements

Economic Evaluation (Confidential)

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Economic Comparison

Evaluation of PC versus IGCC with Co-Production

- **PC**
  - Lower capital cost.
  - Advantaged respecting aux power and fixed O&M.
- **IGCC**
  - Higher capital and O&M cost.
  - Cost advantaged at load factors equal to or less than 87%.
  - Significant option value to swing production of megawatts and SNG.

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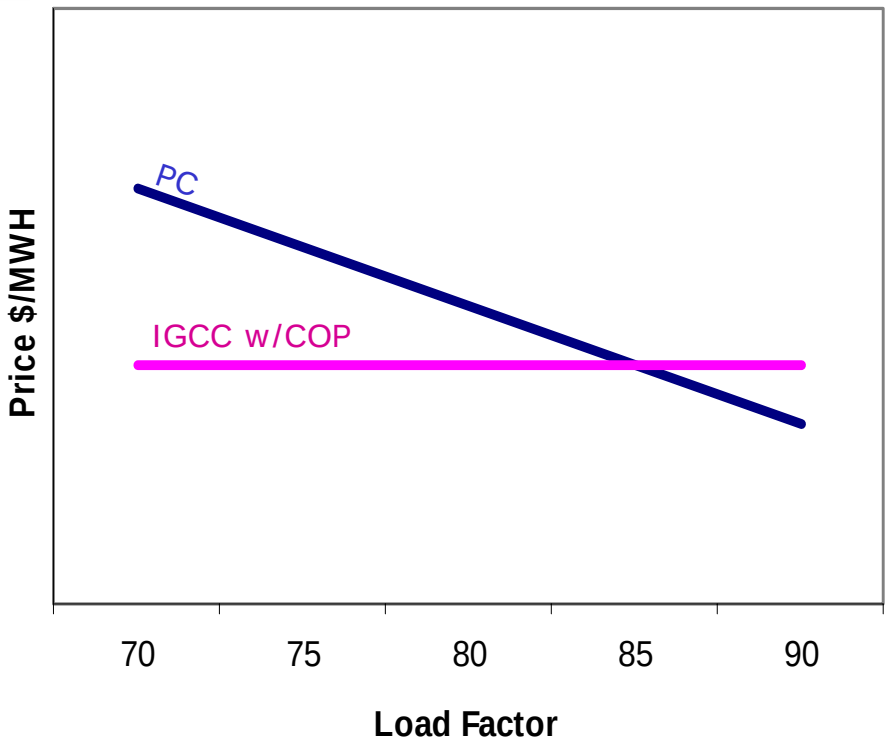
Economic Comparison – Load Factor

Load Factor Effect on Sales Price



- With co-production, IGCC can produce chemicals during those times when electrical prices/demand is low and coal-fired generation is less economical.
- The ability to generate a second revenue stream allows an IGCC to keep its energy price fixed over a range of dispatch levels.
- This provides a cost advantage over a PC facility.

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Thank You!

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