



Request for Proposal Technical Conference: Utah Docket 05-035-47

April 3, 2006



Agenda

- WorleyParsons Expanded IGCC Study
- Factors Driving IGCC Development
- Baseline Assumptions, Emissions, & “CO₂ Capture Ready”
- Preliminary Site Specific IGCC Cost of Energy estimates
- Strawman IGCC Development Schedule
- Summary
- Scheduling

WorleyParsons (WP) Expanded (2006) Study

- WorleyParsons Expanded IGCC Study – started Oct 2005
- Objective: Update and perform additional cost & performance (capacity, efficiency, availability, emissions) estimates. Revised scope of work has some similar and some changed components to previous WP IGCC Study:
 - Update some components of earlier Hunter IGCC Study to reflect current construction & other costs (elev: 5,644') [Utah, SW Wyoming, & PRB coals]
 - Added analysis of IGCC at Jim Bridger (elev: 6,670') with SW WY & PRB coal
 - Expanded scope to include review of Shell gasification technology
 - As in 2005 study:
 - Conoco-Philips “E-Gas”
 - Selective Catalytic Reduction (SCR) & wet cooling assumed
 - Impact of carbon capture provisions on plant design and cost
 - As in 2005 study, GE 7FB gas turbines utilized in reference plant, performance on syngas updated as determined by GE
 - Study results being adjusted to include Owner's costs & contracting assumptions not included in the consultant analysis.

Factors driving IGCC development

- There are slightly lower emissions of criteria pollutants (SO₂, NO_x, PM₁₀, Hg) compared to conventional (i.e. sub- & super-critical pulverized) coal-fired technologies. The level of reductions will depend on the level of environmental controls installed.
- The removal cost per ton of CO₂ is lower with IGCC than with other fossil-fuel (gas & coal) generation resources with similar levels of removal. However, subsequent to CO₂ capture, there are still multiple issues and uncertainties regarding CO₂ sequestration. These issues include the limited operational and commercial experience with sequestration as well as the uncertainties and potential risks associated with permanent geologic CO₂ storage.
- Up to 90+% of the carbon in syngas can be captured at IGCC plants with commercially available technology. The level of removal impacts cost.
- GE, Conoco-Phillips, and Shell have partnered with major Engineer Procurement and Construction (EPC) firms. These technology suppliers/consortia are establishing warranties and performance guarantees as well as O&M services to mitigate some development and performance risk.

Factors driving IGCC development

- Reduced Solid Wastes - IGCC plants produce about 25-60% less solid waste than conventional coal-fired plants of similar size depending on coal type and type of emissions control system.
- Reduced Water Consumption – Water-cooled IGCC plants use ~40% less water than similarly sized water-cooled conventional coal-fired plants.
- IGCC plants are slightly more efficient (5-7%) than supercritical coal-fired plants. Efficiency improvement results in lower CO₂.
- Potential for Incentive Tax Credit (ITC) benefits for early IGCC projects through 2005 Energy Policy Act and other potential benefits which may reduce costs of energy for early market projects.
- Perceived to have fewer obstructions in permitting process.

Challenges to IGCC Development (Recap)

- Cost
- Technology & Performance Risk
- Carbon Capture Capability & Sequestration
- Development & Procurement Process

Baseline IGCC Assumptions

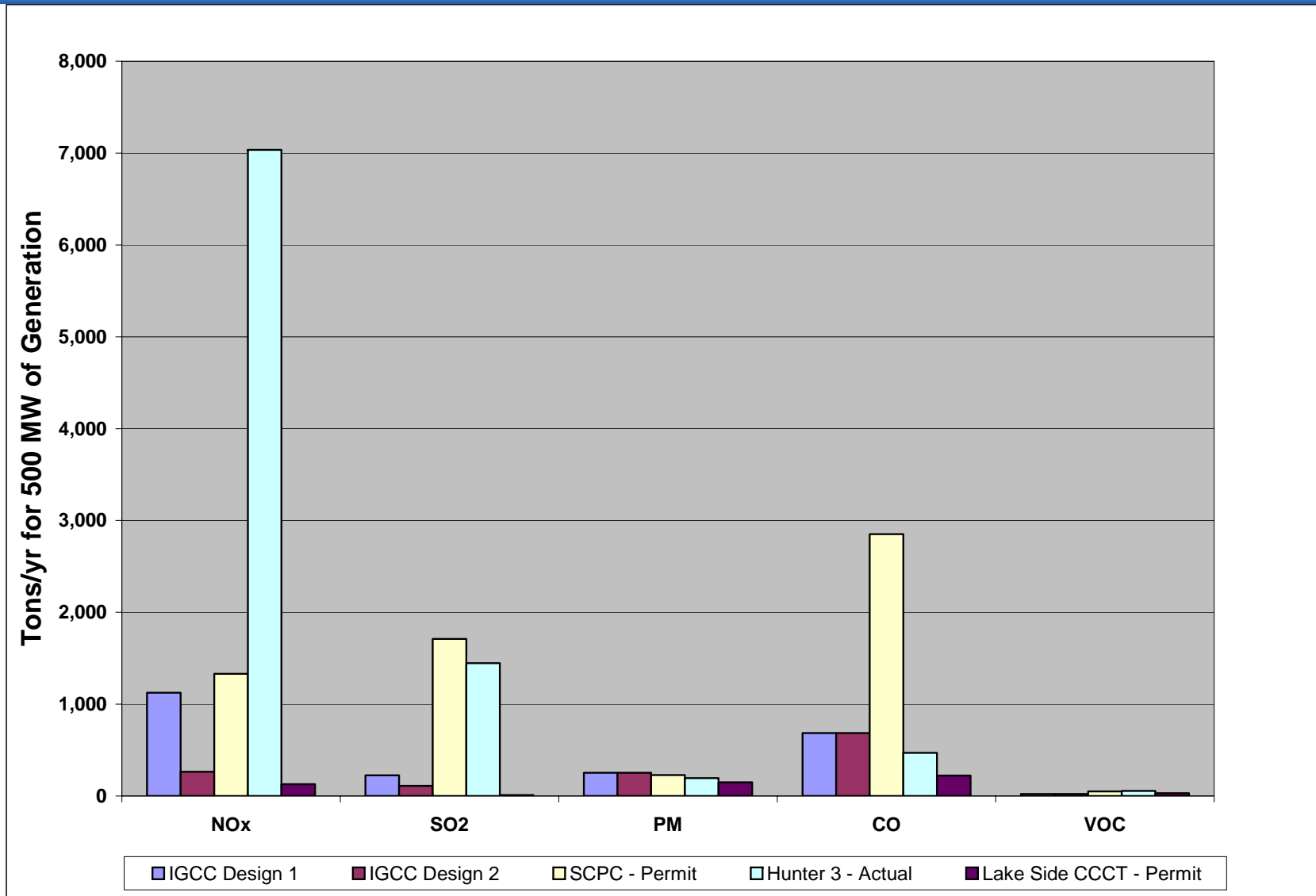
- EPRI “Coal Fleet” User Design Basis Specification (UDBS) used as Reference Case:
 - Spare gasifier assumed to achieve 90% capacity factor (except for Shell)
 - UDBS Design 2 Standard:
 - Selective Catalytic Reduction (reduced NO_x emissions)
 - Deeper sulfur removal
- Standard Provisions for “Carbon Capture Ready” (additional carbon capture capability evaluated as changes)
- Financial Assumptions
 - 10 Yr Modified Accelerated Cost Recovery System (MACRS) depreciation for Gasification Equipment, and 20 Yr MACRS for Power Island
 - Company Weighted Average Cost of Capital
 - Typical Financial Assumptions (economic life, ad-valorem taxes, etc)
- Impact of ITC evaluated as a potential outcome

Emission Comparison (lb/MMBtu)

	IGCC CoalFleet UDBS Design 1	IGCC CoalFleet UDBS Design 2	IGCC Steelhead Energy Center (IL)	IGCC Excelsior Mesaba Energy Project (MN)	IGCC Energy NW Pacific Mountain Energy Center (WA)	Pulv Coal IPP3 Permit	Gas-Fired CCCT Lake Side - Permit
NO_x	0.064	0.015	0.059	0.059	0.012	0.070	0.009
SO₂	0.0128	0.0064	0.0330	0.0220	0.0060	0.0900	0.0006
PM	0.0145	0.0145	0.0092	0.0100	0.0100	0.0120	0.0100
CO	0.039	0.039	0.039	0.030	0.050	0.150	0.015
VOC	0.0013	0.0013	0.0031	0.0020	0.0030	0.0027	0.0021

- Recently proposed IGCC projects currently going through permitting process more closely match UDBS Design Standard 1 (i.e. no SCR)
- NO_x emissions from IGCC UDBS Design 1 are essentially the same as the recently permitted NO_x emissions levels for pulverized coal plants.
- Future IGCC plants may require SCR.

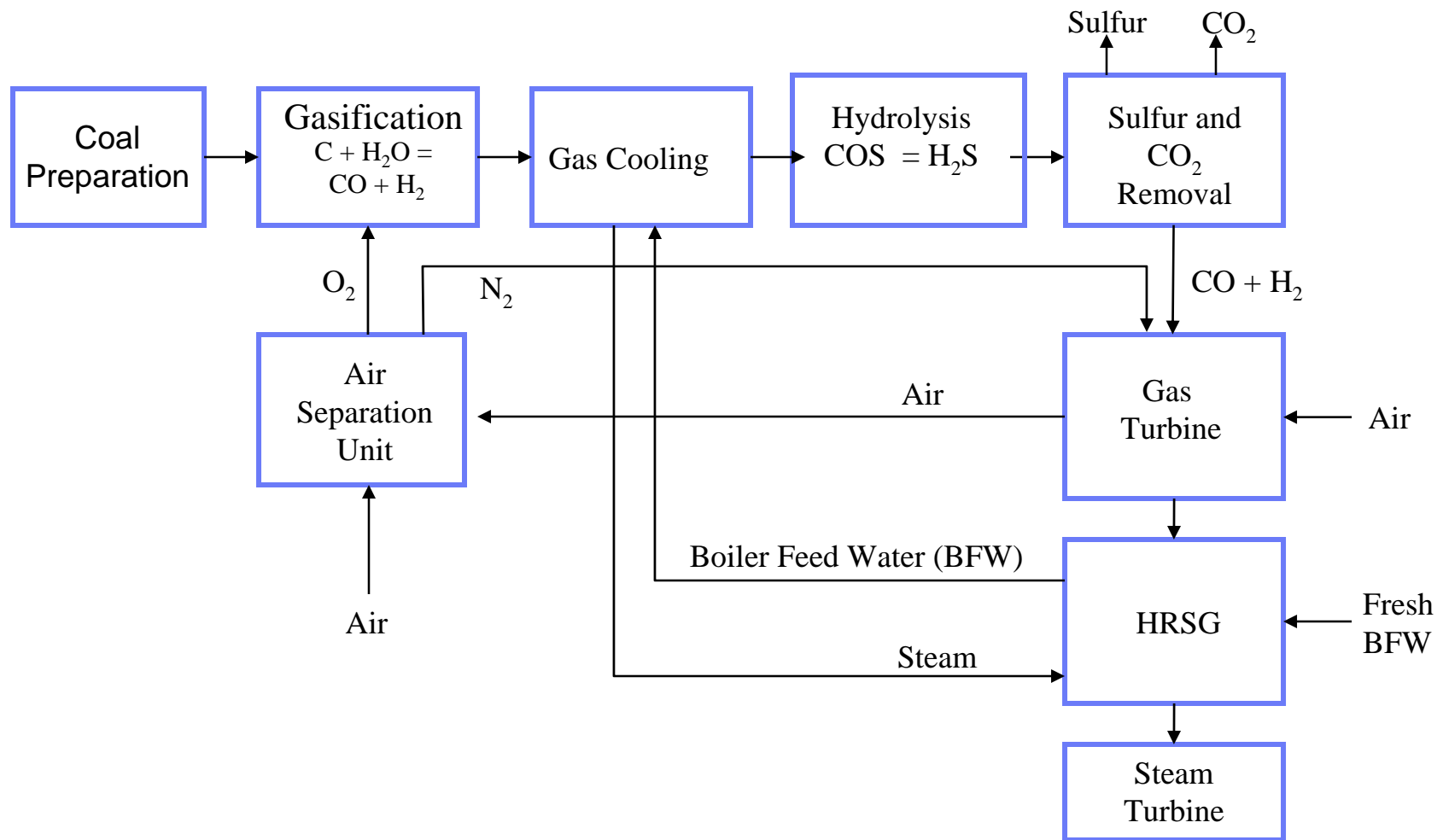
Comparative Emissions Chart (Tons/Year)



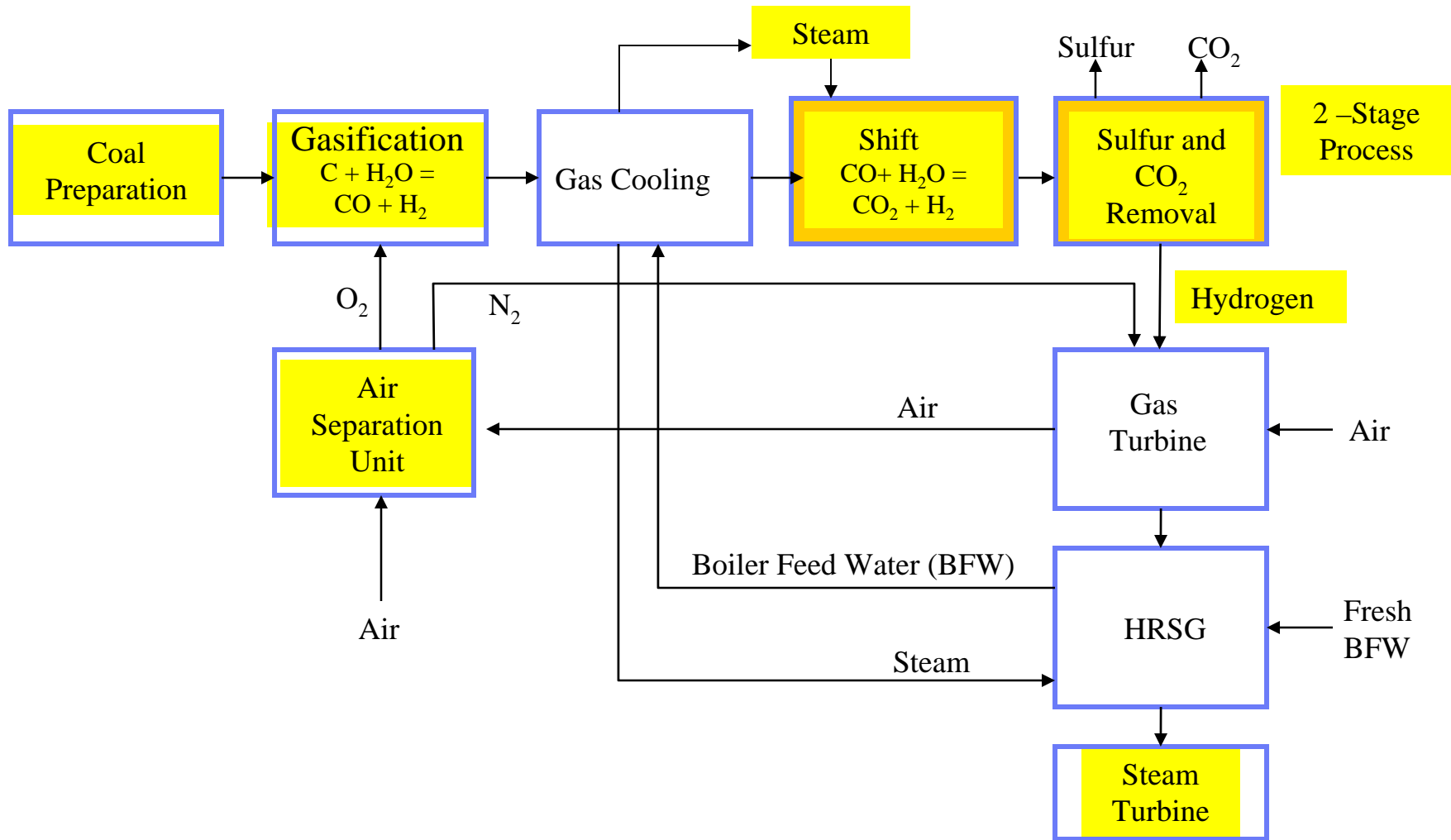
What is “Carbon Capture Ready”?

- Standard Design Provisions -
 - Design includes **space** for additional equipment, Balance of Plant, and site access to install carbon capture equipment at a later date.
 - When conversion occurs significant cost and efficiency penalties result.
 - **No significant added cost in initial design.**
- Moderate Design Provisions –
 - Design includes **oversizing** major operating components such as coal and solids handling, gasification process, & Air Separation Unit to mitigate cost and efficiency penalty by being able to fully fire turbines after CO₂ capture.
 - **Depending on gasifier technology, costs for Moderate Design Provisions will be from 5-10% of initial capital.**
- Extensive Design Provisions –
 - Includes **total design for conversion** including water-gas shift reactors and oversized components but excluding the CO₂ compressors.

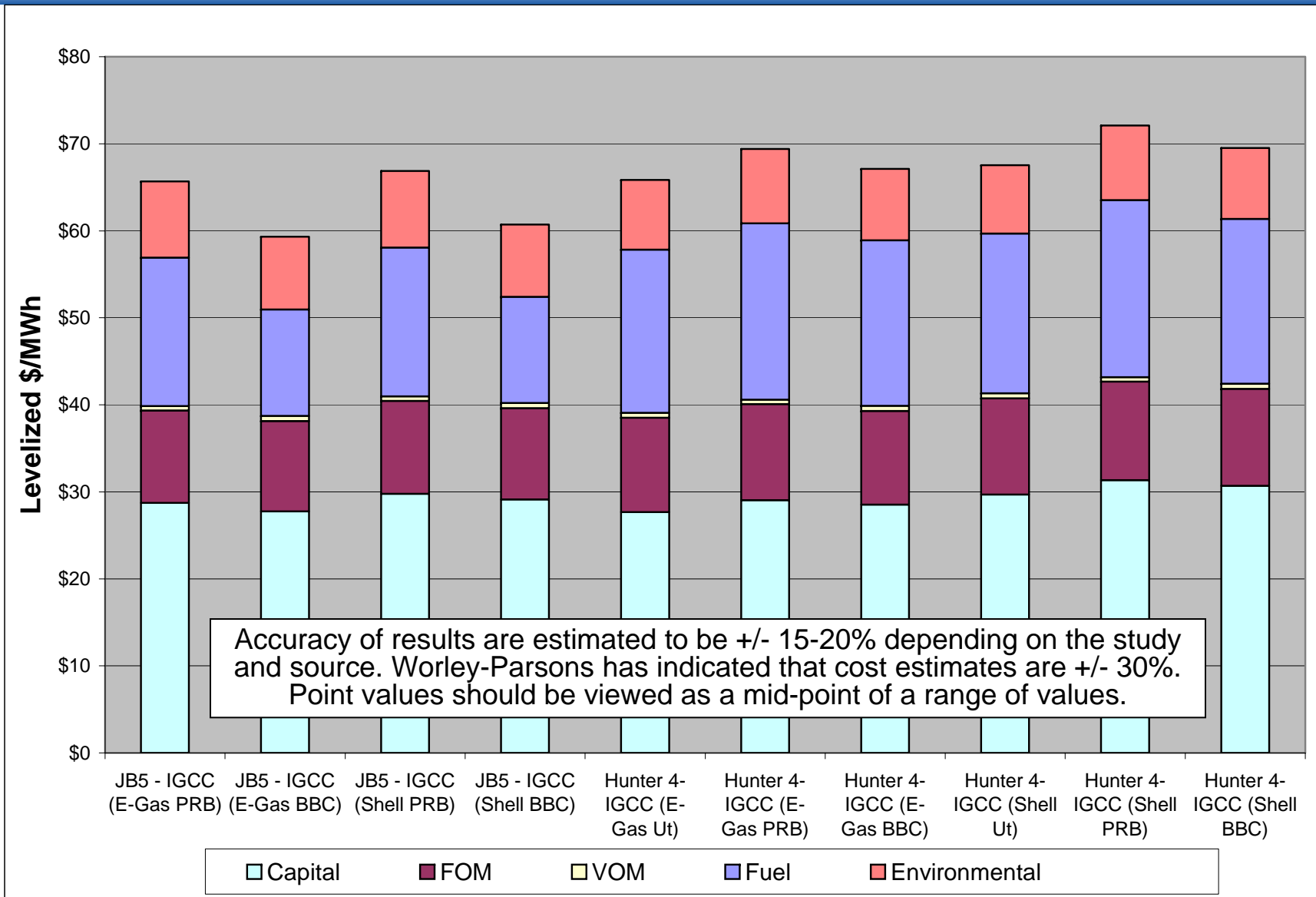
IGCC without CO₂ Capture



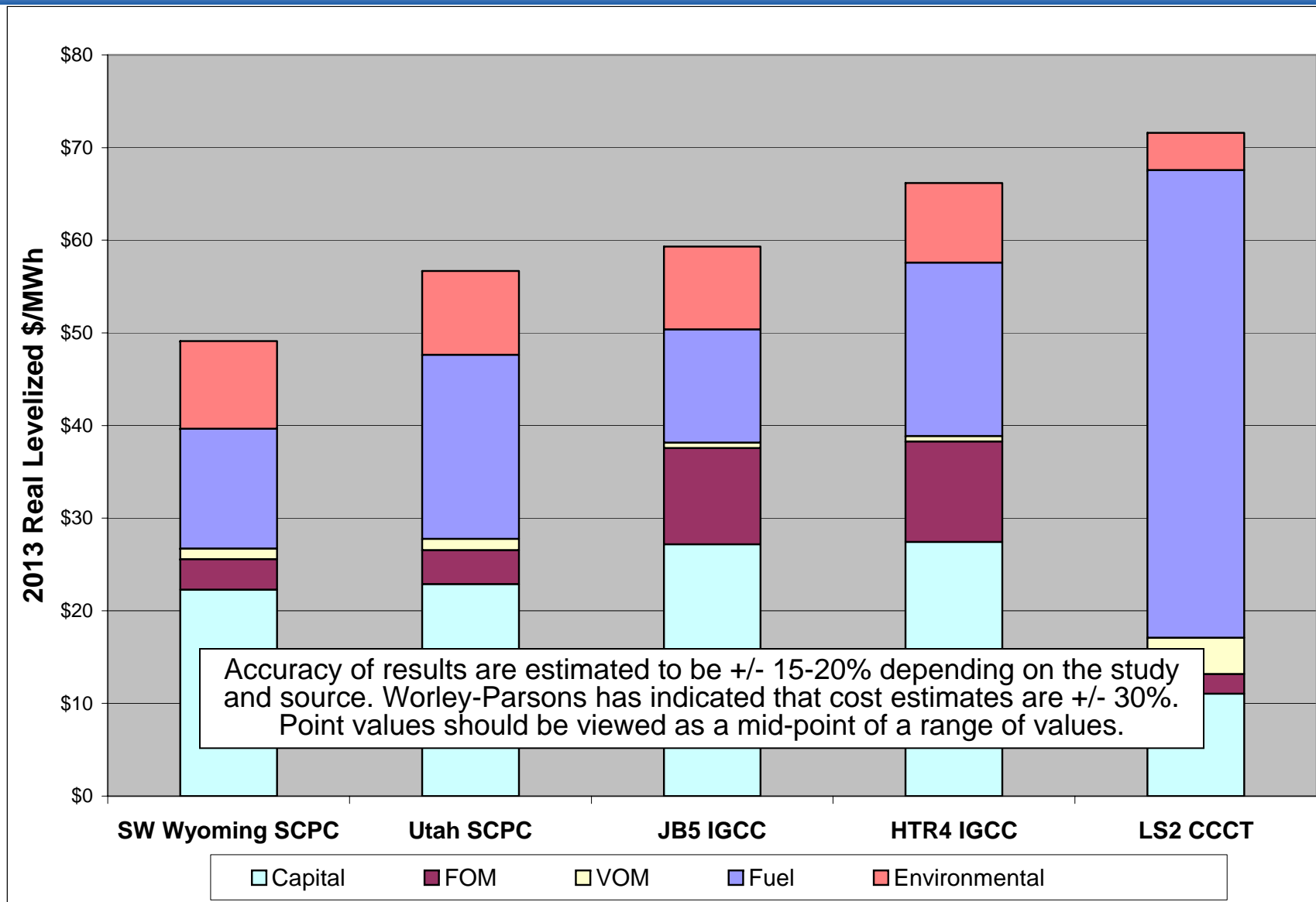
IGCC with CO2 Capture



Estimated Site Specific IGCC Costs of Energy based on Worley Parsons Expanded Study (Excludes Transmission) - Preliminary



Estimated Coal-based Resource Costs of Energy (Excludes Transmission) - Preliminary

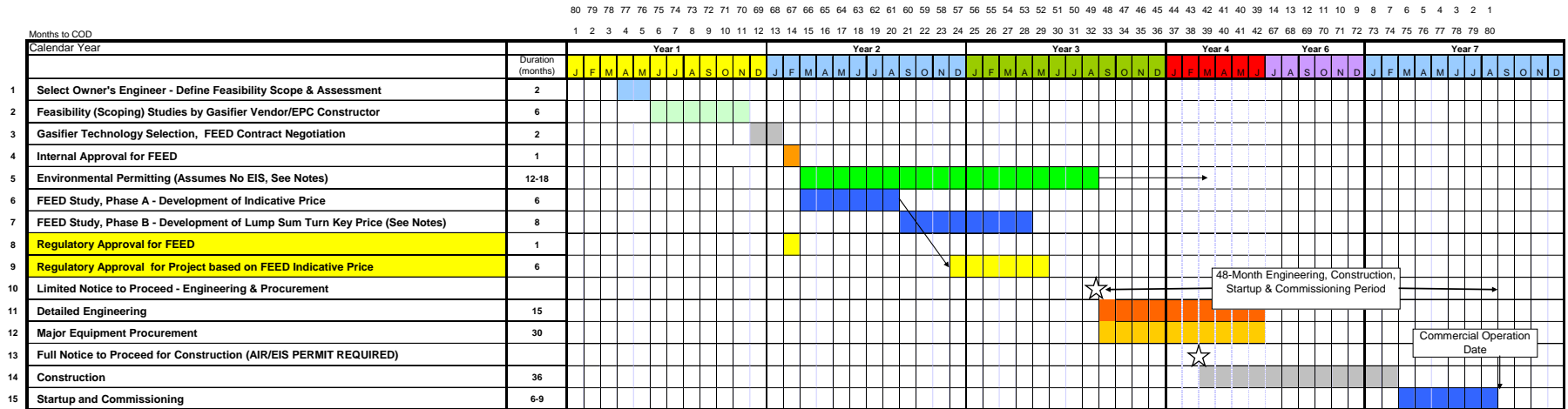


WP Expanded Study Summary Conclusions to date

- Based on preliminary evaluation, the results indicate that there is a substantial spread (15-25%) between supercritical, coal-fired options and IGCC depending on location, gasifier technology, coal type, assuming target availability levels are achieved.
- Accuracy of current results are estimated to be +/- 15-20% depending on the study and source. Worley-Parsons has indicated that cost estimates are +/- 30%. Point values should be viewed as a mid-point of a range of values.
- Estimated COE premium of IGCC over SCPC (when considering the overall accuracy of the estimates) is:
 - 15% to 20+% for a Utah-based resource depending on location & coal
 - 20% to 25+% for a SW Wyoming-based resources
- IGCC resources located in SW Wyoming are expected to be lower cost than Utah-based resources
- Gasifier technology has an impact on COE
- Under current gas price assumptions, IGCC appears to be a lower cost resource than gas-fired combined cycle assuming target availability factors are achieved.

Strawman IGCC Development Schedule

IGCC PROJECT SCHEDULE, Self - Build



Notes & Assumptions:

Waiver with Pre-Approval

If FEED study is NOT split, total FEED duration can be reduced by 2 months

FEED A Indicative Price would be used to start Regulatory Pre-Approval Process; Final confirmation upon completion of FEED B with development of firm Lump Sum Turn Key Price

EIS Requirement could increase start of construction by additional 6 - 12 months

This schedule is based on timelines provided by gasifier/technology suppliers and CoalFleet UDBS Specification

Summary

- Overview of IGCC Emissions
- Overview of estimated range of costs based on information received to date
- Presentation of a strawman IGCC Development Schedule
- Additional effort will focus on evaluating ITC/financing benefits, spare gasifier tradeoff, CO₂ capture & sequestration, availability impacts, EPC cost & “wraps,” turbine type, etc. Results will be provided to the IGCC Working Group.