



# IGCC Working Group

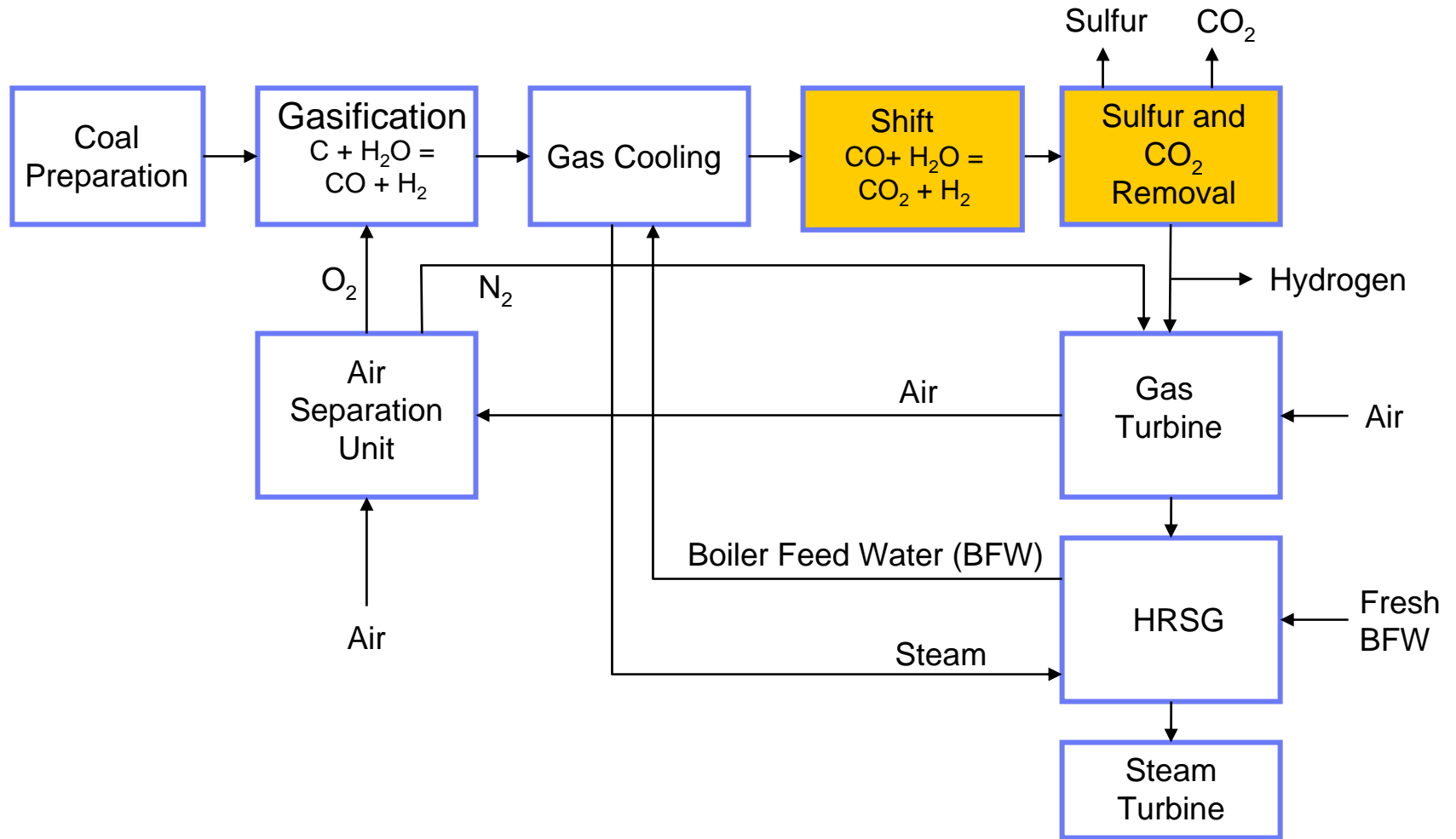
July 6, 2006



# Agenda

- Introductions
- Estimated Costs of Carbon Capture
  - Jim Lacey
- Southwestern Regional Sequestration Partnership
  - B. J. McPherson – New Mexico Inst. of Mining & Tech.
  - David Curtiss – University of Utah
- Wyoming Enhanced Oil Recovery
  - Jim Steidtmann – Enhanced Oil Recovery Institute
- Weyburn Sequestration
  - Ray Knudsen – Petroleum Technology Research Center

# IGCC with CO<sub>2</sub> Capture



# Carbon Capture Provisions

- What is meant by Carbon Capture Provisions?
  - **No Provisions**
  - **Minimum Provisions** – Includes space for additional equipment and balance of plant at later date – results in performance penalty upon conversion
  - **Moderate Provisions** – Includes space and correct configuration/sizing of major components to allow minimal performance penalties
  - **Extensive Provisions** – Includes total design for conversion with no changes to operating components
- Costs developed with and without provisions for future carbon capture

# IGCC with CO<sub>2</sub> Capture

From: PacifiCorp IGCC Feasibility Evaluation (June 2006 - Exhibit 3-27, Page 39)

Plant Configuration: 2x1 with E-Gas, Black Butte Coal, GE 7FB GT at Bridger Site

Item	Description	Base Case Performance w/o CO <sub>2</sub> Capture	Alt.1- Performance with CO <sub>2</sub> Capture with Minimum Provisions	Alt.2-Performance with CO <sub>2</sub> Capture with Moderate Provisions
1	Gross Plant output (MW)	604	580	613
2	Aux. Load (MW)	<u>107</u>	<u>145</u>	<u>153</u>
3	Net Plant Output (MW)	497	435	460
4	Net Plant Heat Rate (Btu/kWh)	8,655	9,890	9,827
5	Fuel Consumption (MMBtu/hr)	4,301	4,301	4,520
6	CO <sub>2</sub> Emissions to Atm. (MTPY)	3,267	327	343
7	CO <sub>2</sub> Delivered to Pipeline (MTPY)	0	2,940	3,090
8	Grass Root Cost Details:			
	Total Plant Cost (000's \$)	\$918,126	\$1,138,797	\$1,169,241
	Unit Cost (per net output)	\$1,848	\$2,619	\$2,542
	Delta CO <sub>2</sub> Capture Costs	Base	\$220,671	\$251,115
9	Retrofit Cost Details:			
	Total Plant Cost (000's \$)	\$918,126	\$1,149,677	\$1,180,505
	Unit Cost (per net output)	\$1,848	\$2,644	\$2,567
	Delta CO <sub>2</sub> Capture Costs	Base	\$231,551	\$262,379

# Costs for CO<sub>2</sub> Capture – Rules of Thumb

- SCPC
  - Use of amine based CO<sub>2</sub> removal processes results in an increase in electricity cost of about 70-75%.
  - Refrigerated ammonia systems have been postulated to reduce the capture cost in half.
  - Plant capacity is reduced about 20-25%.
- IGCC
  - Carbon Capture will increase electricity production cost approximately 25-30%.
  - Previous example increases electricity cost about 27%.
  - Plant capacity is reduced 7-12%.

# IGCC – SCPC Breakeven Analysis

