

“CO₂ In Wyoming”
Jim Bridger Integrated Gasification
Combined Cycle Project

Joint Producers Meeting
Wyoming Enhanced Oil Recovery Institute
June 26, 2007
Ian Andrews, Manager, Resource Development

PacifiCorp

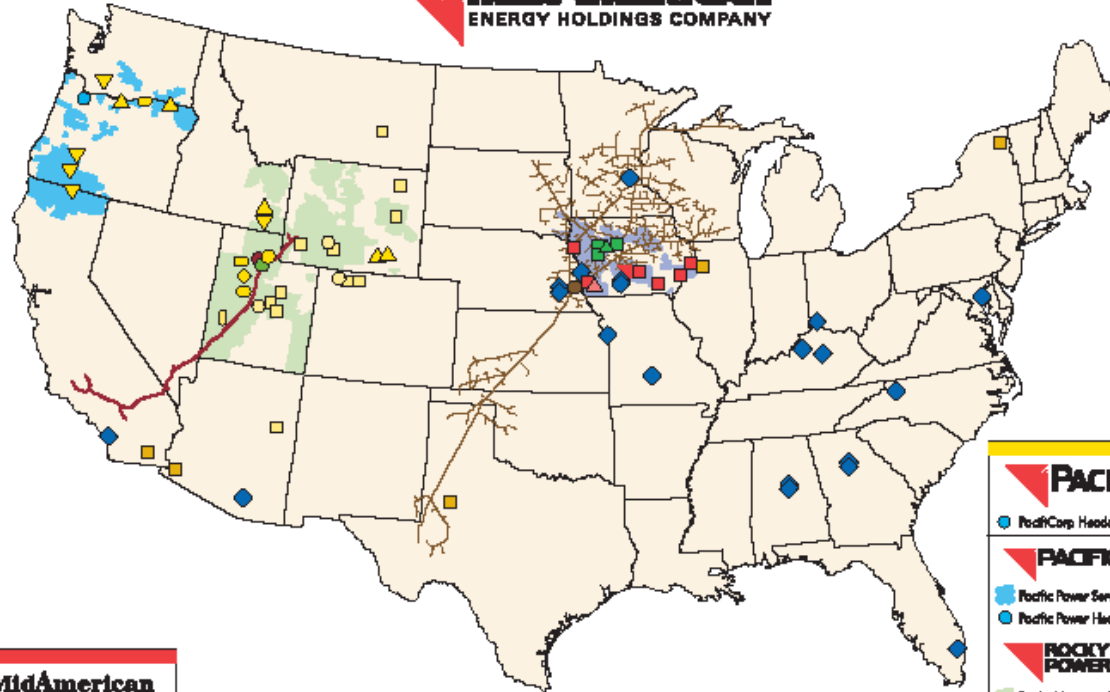
- Supply and distribute electric energy in six western states: California, Idaho, Oregon, Utah, Washington, and Wyoming
 - ▶ **PacifiCorp Energy:** Generation, Mining, and Commercial & Trading
 - ▶ **Rocky Mountain Power:** Provide transmission & distribution services in Idaho, Utah, and Wyoming
 - ▶ **Pacific Power:** Provide transmission & distribution services in California, Idaho, and Oregon
- 1.67 million customers
- Over 9,500 MW of generating resources (net capability)
 - ▶ Thermal ~8,000 (coal and gas)
 - ▶ Hydro ~1,200
 - ▶ Renewables ~300+ (wind and geothermal)
 - ▶ Contracts (Includes wind, coal, and gas)
- Over 6,500 employees

PacifiCorp – Service Territory



- Coal-Fired Thermal Plants
- Gas-Fired Thermal Plants
- ▲ Geothermal Plants
- Hydro Systems
- ◆ Wind Projects
- ▲ Coal Mines

MidAmerican Energy Holdings Company



MidAmerican ENERGY

- MidAmerican Energy Company Service Territory
- MidAmerican Energy Holdings Company and MidAmerican Energy Company Headquarters
- Generation Operations
- Generation Development
- Wind Project Operations
- Wind Project Development

CALENERGY

- Generation Operations

Electric Services of America, Inc.
a subsidiary of energy utilities

- Real Estate Operating Companies

Northern Natural Gas

- Northern Natural Gas Pipelines
- Northern Natural Gas Headquarters

Korn River
AN ENERGY SERVICE COMPANY

- Korn River Gas Transmission Pipelines
- Korn River Headquarters

PACIFICORP

- PacificCorp Headquarters

PACIFIC POWER

- Pacific Power Service Territory
- Pacific Power Headquarters

ROCKY MOUNTAIN POWER

- Rocky Mountain Power Service Territory
- Rocky Mountain Power Headquarters

PACIFICORP ENERGY

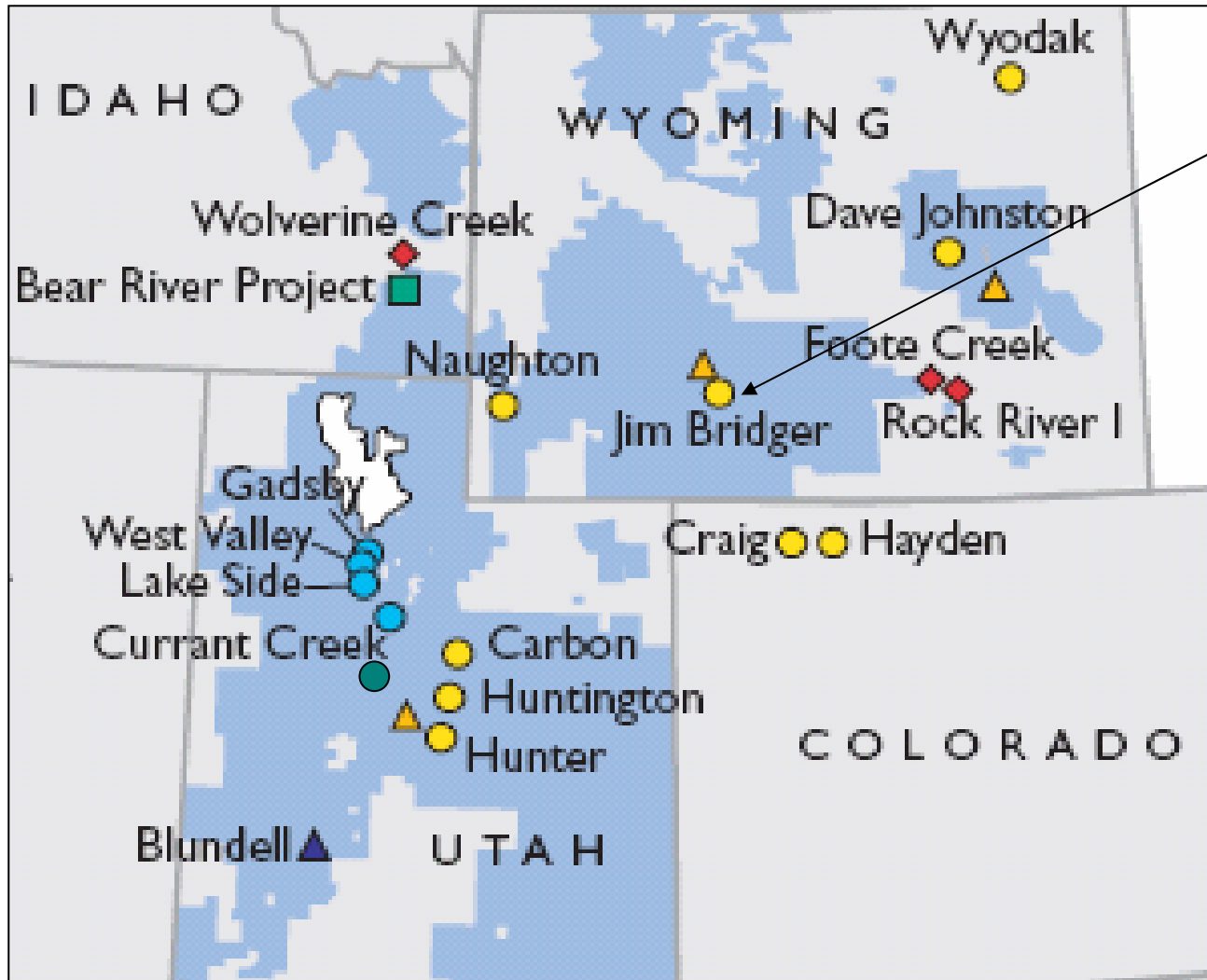
- PacificCorp Energy Headquarters
- Cool-Fueled Thermal Plants
- Gas-Fueled Thermal Plants
- Wind Projects
- Geothermal Plants
- Coal Mines
- Hydro Systems
- Generation Development



PacifiCorp - Future Resource Needs

- Load forecasts indicate a need for over 2,000 MW of new resources by 2012 and 2,500 MW by 2016 (12% reserve margin) on the east side of system
- Robust renewables commitment - 2000 MW by end of 2013
- Coal-based generation is a preferred baseload option – given abundant coal reserves (especially in Wyoming) and concerns about volatility of natural gas
- Utilities at a crossroads: the coal technology choices (and when) present unique challenges:
 - ▶ Uncertainty regarding future carbon constraints
 - ▶ Cost premium for Integrated Combined Cycle Gasification (IGCC)
 - ▶ Need for cost recovery
 - ▶ Uncertainty regarding the long term performance of IGCC
 - ▶ Pulverized coal CO₂ capture technologies – still in development

Major Resources & Development Areas



Jim Bridger
500 – 800 MW
2014+

Jim Bridger IGCC Project

- Previous IGCC studies indicate Wyoming-based IGCC resources will have lower costs of energy compared to alternative states
- July 2006 - Wyoming Infrastructure Authority (WIA) issued an RFP for a Wyoming-based gasification project in Wyoming. Purpose: pursue federal co-funding under Sect 413 of Energy Policy Act of 2005.
 - ▶ High altitude (>4,000' elevation)
 - ▶ Low rank coal (<9,000 Btus/lb)
 - ▶ Carbon capture “capable”
 - ▶ Currently funding is not authorized
- PacifiCorp submitted its proposal in October 2006 based on joint efforts of Siemens-Kiewitt and PacifiCorp for a project located at Jim Bridger.
- WIA selected PacifiCorp proposal in April 2007.
- Agreement in place between WIA & PacifiCorp to pursue Feasibility Study Phase with technology suppliers

Jim Bridger Plant, Point of Rocks, Wyoming

- Factors influencing location selection:
 - ▶ Brownfield site (4 x 530 MW), experienced O&M organization
 - ▶ Proximity to low cost Wyoming coal sources.
 - ▶ Bridger is 17 miles away from high pressure CO₂ pipeline.
 - ▶ Identified as an ideal location for permanent sequestration in Washakie/Bridger uplift area (underneath Jim Bridger plant)
 - ▶ Located near major natural gas transmission lines.
 - ▶ Key interconnection point for major transmission system development
- Background ambient air data collection completed in May, 2007
- Additional water rights appropriation for new resources approved in August, 2006

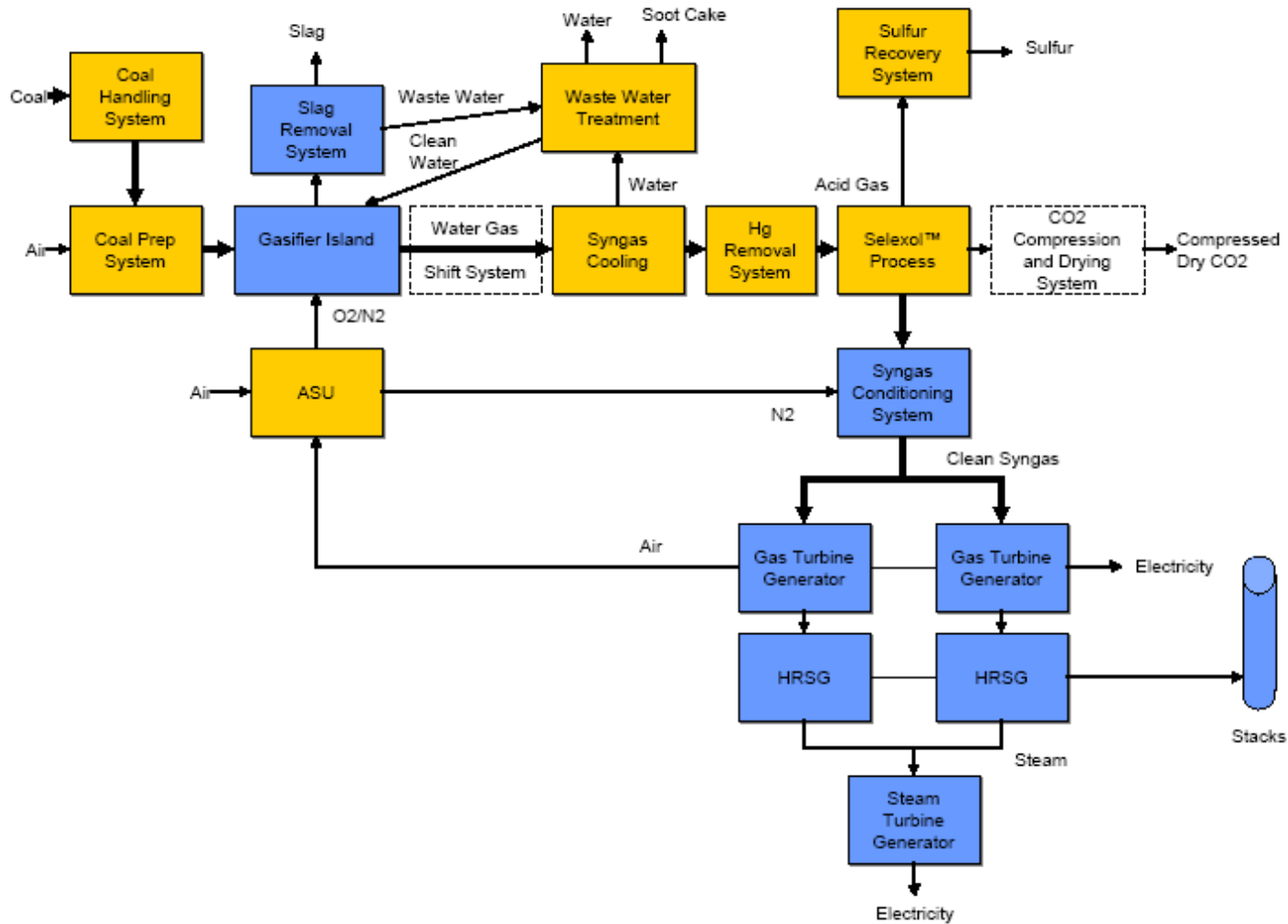
Feasibility Study Design Basis

- Standard Reference Power Block Design:
 - ▶ 2 x 1 combined cycle using two state-of-the-art “F” class gas turbine-generators (General Electric, Mitsubishi, or Siemens), two 3-pressure heat recovery steam generators, and one steam turbine-generator.
- Water-cooled
- Nominal capacity: 470 - 500 MW on syngas at site conditions (42°F)
 - ▶ Option for additional duct firing capacity using natural gas
 - ▶ Startup and secondary fuel: natural gas.
- EPRI Level II controls (selective catalytic reduction-SCR) for reduced NO_x emissions; SCR requires higher levels of SO₂ removal, high levels Hg (>90%) capture.

Feasibility Study Design Basis

- Designed for sub-bituminous Powder River Basin Coal (8,800 Btus/lb). Primary source after demonstration would be southwestern Wyoming (Bridger coal, 9,400 - 9,500 Btus/lb)
- CO₂ “capture capable”
- Target CO₂ capture level – California standard (1,100 lbs of CO₂ per net MWh)
 - ▶ Include site compression
 - ▶ Includes performance impact for change in syngas characteristics
 - ▶ Includes increased auxiliary loads
 - ▶ 50 - 60% CO₂ capture level depending on gasifier technology, operating margin, etc.

Simplified Block Diagram



Jim Bridger Plant – IGCC Site



Proposed Schedule

- Feasibility Study/Assessment: 2007
- Front End Engineering Design 2008 – 2009
- Funding 2008
- Permitting 2008 – 2009
- Full Notice to Proceed 2010
- Combined Cycle On-line 2013
- IGCC On-line 2014

Project Activity

- Preliminary engineering studies performed.
- Wyoming Infrastructure Authority initiating efforts to obtain preliminary federal funding
- Owner's Engineer selected for next phase. RFI to be issued in next week
- Property acquisition process initiated
- One year of ambient air quality monitoring/collection completed in May 2007

Carbon Dioxide Production - Estimates

- A nominal 475-500 MW IGCC plant, without capture, would produce 11,500-12,000 tons CO₂ per day.
- With capture to meet California standard, the plant would capture (produce) ~ 6,300-7,200 tons CO₂ per day (103–118 MMCF/day)
- Design annual capacity factors: 85%+; (planned maintenance outages in spring & fall).
- Quality to match existing CO₂ pipeline specifications
- Delivery pressures ~2,200 - 2,500 psig

Seeking offtakers or aggregators to enter into long term MOUs/LOIs for CO₂ from facility.

Will be sending out inquiries to determine level of interest in next 6-8 weeks.

Thank you

Questions? Comments?

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