“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
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+

Bear River Project
Wolverine Creek
Naughton
Jim Bridger
Wyodak
Dave Johnston
Foote Creek
Rock River I

Gadsby
West Valley
Lake Side
Currant Creek
Carbon
Hunter
Blundell
**Jim Bridger IGCC Project**

- Previous IGCC studies indicate Wyoming-based IGCC resources will have lower costs of energy compared to alternative states.

  - 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 CO$_2$ 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 NOx 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.
Jim Bridger Plant – IGCC Site
<table>
<thead>
<tr>
<th>Proposed Schedule</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Feasibility Study/Assessment:</td>
<td>2007</td>
</tr>
<tr>
<td>Front End Engineering Design</td>
<td>2008 – 2009</td>
</tr>
<tr>
<td>Funding</td>
<td>2008</td>
</tr>
<tr>
<td>Permitting</td>
<td>2008 – 2009</td>
</tr>
<tr>
<td>Full Notice to Proceed</td>
<td>2010</td>
</tr>
<tr>
<td>Combined Cycle On-line</td>
<td>2013</td>
</tr>
<tr>
<td>IGCC On-line</td>
<td>2014</td>
</tr>
</tbody>
</table>
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 CO$_2$ per day.

- With capture to meet California standard, the plant would capture (produce) ~ 6,300-7,200 tons CO$_2$ per day (103–118 MMCF/day)

- Design annual capacity factors: 85%+; (planned maintenance outages in spring & fall).

- Quality to match existing CO$_2$ pipeline specifications

- Delivery pressures ~2,200 - 2,500 psig

Seeking offtakers or aggregators to enter into long term MOUs/LOIs for CO$_2$ from facility. Will be sending out inquiries to determine level of interest in next 6-8 weeks.
Thank you
Questions?  Comments?

Contacts:
  Nick Rahn, VP Resource Development & Construction,
  nick.rahn@pacificorp.com, 801-220-4715

  Ian Andrews, Manager, Resource Development
  Ian.Andrews@pacificorp.com, 801-220-4286