BOUNDARY DAM CCS PROJECT IS NOW 6 MONTHS OLD!

- $1.467B
  - 600MM Power plant
  - 800MM Capture plant
  - (On budget!)

- 5,000,000 MWhr

- Heavy Loads

- Up to 120MW vs 110MW

- 300,000+ tonnes delivered for revenue

- 81 months instead of 72 months
BOUNDARY DAM CCS PROJECT IS NOW 6 MONTHS OLD!

- Some subsystems found to be conservative
- Some subsystems have deficiencies yet to solve: in reliability, capacity, automation or operability
- No “regulatory-reportable” spills
- On track for planned CO2 recovery rates
- Some equipment issues to be resolved
Viability requires minimizing . . .
- thermal energy requirements
- parasitic electrical load

- Power to Grid (120 MW)
- Existing parasitic load (11 MW)
- Compression (15 MW)
- Capture CO2, SO2 (9 MW)
- Amine & heat regeneration (14 MW)
EXCEEDING EXPECTATIONS
# Exceeding Expectations

<table>
<thead>
<tr>
<th>Performance Metric</th>
<th>Expected (pre-launch)</th>
<th>Actual (post-launch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MWs</td>
<td>110</td>
<td>120</td>
</tr>
<tr>
<td>CO$_2$ Purity</td>
<td>95.5%</td>
<td>99.9%</td>
</tr>
<tr>
<td>CO$_2$ Capture/Year</td>
<td>1 Million Tonnes</td>
<td>1 Million Tonnes</td>
</tr>
<tr>
<td>CO$_2$ Emission/Year</td>
<td>1 Million Tonnes</td>
<td>100,000 Tonnes</td>
</tr>
</tbody>
</table>
CHALLENGES ENCOUNTERED AND MANAGED

(Every Significant Project Has Challenges)

• Focused engineering vs. exploration of all avenues
  • Focus delivering to the business case

• Procurement Strategies
  • Value - transparency - timeliness

• Construction Productivity

• Management of IP
  • Maintaining proprietary process (commercial) information while objectively sharing critical knowledge with stakeholders
  • Trust

• HSE concerns
  • Many Initial unknowns – most resolved
  • Ongoing Refinements
  • No Insurmountable issues
ECONOMIC EFFECT OF “PERFECT INVENTIONS”

|$/MW$

- Carbon Compliant Coal
- Lower Steam Enthalpy
- Small absorber
- Shorter PP construction sched
- Shorter CC constr schedule
- < steam
- All of above
WHAT DO YOU NEED FOR CCS TO SUCCEED?

1. PEOPLE NEED TO SEE THAT IT WORKS

2. MUST HAVE SOCIAL ACCEPTANCE

3. MUST BE COST-COMPETITIVE WITH OTHER ACCEPTABLE ENERGY FORMS
PUBLIC ACCEPTANCE: BEING PROACTIVE
### MUST HAVE SOCIAL ACCEPTANCE

**GLOBAL ASSESSMENT**

<table>
<thead>
<tr>
<th>2008</th>
<th>2015</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 or 20 pilot plants globally</td>
<td>Number of pilot plants roughly unchanged (+/- in various regions)</td>
<td>Now have years of operating data</td>
</tr>
<tr>
<td>Large financial incentives for development:</td>
<td>Kemper County under construction</td>
<td>Areas of confidence?</td>
</tr>
<tr>
<td>– Canada</td>
<td>Petra Nova announced</td>
<td>Areas of weakness?</td>
</tr>
<tr>
<td>– USA</td>
<td>Capture from fertilizer and gas processing</td>
<td>Critical mass?</td>
</tr>
<tr>
<td>– EU</td>
<td>China/US accord</td>
<td></td>
</tr>
<tr>
<td>– Australia</td>
<td>Future Gen 2.0 and other flagship projects shut down</td>
<td></td>
</tr>
<tr>
<td>– UK</td>
<td>Loss of public confidence in some regions</td>
<td></td>
</tr>
<tr>
<td>– Germany</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Spain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Norway</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
UNDERSTANDING THE BARRIERS

What are the social barriers to CCS?

• Perception of cost
  – Capital cost
  – Social cost
  – Lifecycle cost
• Perception of health risk
• Perception of Environmental risk
• Preference for alternate solutions

Updated and robust socioeconomic assessments needed
MUST BE COST-COMPETITIVE WITH ACCEPTABLE ALTERNATIVES
CAN WE CLOSE THE GAP?

• Technical improvements
• Business case improvements
  – Economies of scale and replication
  – Better certainty in design and performance
  – Reduced financial, business and execution risk
  – Equivalent tax treatment

WILL THE GAP CLOSE ITSELF?

• Gas price increase
• Emissions regulations for gas
## The Future of CCS at SaskPower

<table>
<thead>
<tr>
<th>Unit</th>
<th>Initial Investment</th>
<th>Final Investment</th>
<th>In Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>BD 4/5</td>
<td>2016</td>
<td>2019*</td>
<td>2025*</td>
</tr>
<tr>
<td>BD 6</td>
<td>2022</td>
<td>2024</td>
<td>2028*</td>
</tr>
<tr>
<td>PR 1</td>
<td>2024</td>
<td>2026</td>
<td>2030*</td>
</tr>
<tr>
<td>PR 2</td>
<td>2026</td>
<td>2026</td>
<td>2030*</td>
</tr>
<tr>
<td>Shand 1</td>
<td>2037</td>
<td>2039</td>
<td>2043*</td>
</tr>
<tr>
<td>New Build</td>
<td>New costs more than rebuild today</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Fixed by regulation
POSSIBLE FUTURE OF CCS AT SASKPOWER BOUNDARY DAM UNITS #4 & 5
WHERE WE ARE GOING
LEARNING STARTS HERE. OUR NEXT PLANT WILL BE UP TO 30% CHEAPER.
CONSORTIUM
TAKE THE TOUR
www.SaskPowerCCS.com/tour
SASKPOWER CCS

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