SASKPOWER CCS
GHGT-12
MIKE MONEA, PRESIDENT, CCS INITIATIVES
SA SKPOWER’S ENERGY MIX.

• 490,000 customers
• 151,000KM of transmission line
• 3,513 MW generating capacity
DIVERSIFIED POWER GENERATION.

- COAL 50%
- GAS 25%
- HYDRO 20%
- WIND 3%
- OTHER 2%
In 2013, invested $2B in our electrical system including a record $1.3B internally and $700M through a partnership with Northland Power.

Forecasting to invest $1B annually for the foreseeable future.

3 key elements to SaskPower's ongoing capital spending program:
1. Forecasted system growth;
2. Sustainment investments; and

<table>
<thead>
<tr>
<th>Gas</th>
<th>Value</th>
<th>Gas</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₂</td>
<td>0.0000</td>
<td>CO₂</td>
<td>99.9974</td>
</tr>
<tr>
<td>O₂</td>
<td>0.0000</td>
<td>C₂</td>
<td>0.0000</td>
</tr>
<tr>
<td>N₂</td>
<td>0.0026</td>
<td>H₂S</td>
<td>0.0000</td>
</tr>
<tr>
<td>C₂O</td>
<td>0.0000</td>
<td>C₃⁺</td>
<td>0.0000</td>
</tr>
<tr>
<td>C₁</td>
<td>0.0000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abbott
PGC10000
CCS TIMELINE.

Pre 2000
Canadian Clean Power Coalition Studies

2001
Coal-fired Generation Option Study

2006
Shand 1 Study

2007
“Clean Coal Project”

2007
Shand 2

2008
Retrofit Options

2009
Pre-Commitment Engineering Unit 3

2010
Go Decision: Refurbishment of Power Plant

Today
Commercial Operation

2011
Detailed Engineering
COMPARING COSTS.

Baseload Natural Gas Cost of Electricity

- Capital Investment
- Fuel Expense
- O & M

BD3 Carbon Capture Cost of Electricity

- Capital Investment
- Fuel Expense
- O & M

Figures from 2009 - 2010
COMPARING REGULATIONS.

- **USA** – 1,100 lb/MWh gross
  *Approx 0.712 tonnes/MWh net factoring in 30% parasitic load for CCS equipment

- **Canada** – 0.420 tonnes/MWh

- **USA** – 1,000 lb/MWh gross
  *Approx 0.504 tonnes/MWh net

- **Canada** – 0.420 tonnes/MWh
Carbon Capture and Storage Initiatives
EXECUTIVE STRATEGIC PLANNING SESSION
BOUNDARY DAM CCS PROJECT

BOUNDARY DAM
CCS PROJECT
## BOUNDARY DAM UNIT 3

<table>
<thead>
<tr>
<th>Emission Change</th>
<th>Pre-CCS</th>
<th>Post-CCS</th>
<th>Reduction</th>
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</thead>
<tbody>
<tr>
<td>CO₂</td>
<td>1094</td>
<td>120</td>
<td>90%</td>
</tr>
<tr>
<td>SO₂</td>
<td>11</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>NO</td>
<td>1.5</td>
<td>1.1</td>
<td>27%</td>
</tr>
<tr>
<td>PM10</td>
<td>.2</td>
<td>.02</td>
<td>90%</td>
</tr>
<tr>
<td>PM2.5</td>
<td>.1</td>
<td>.03</td>
<td>70%</td>
</tr>
</tbody>
</table>
• Regina Saskatchewan- 210,000 people
• One million tonnes of captured CO2 from coal:
  • Removes CO2 emissions from all Regina cars
  • Also captures all the CO2 from home heating
  • Plus..keeps 50% of the lights on in Regina

• Or 250,000 cars off the road each year....
GENERATION COSTS.

Figures from 2009 - 2010

Data Source: 2010 Electrical Power Research Institute, Program on Technology Innovation: Integrated Generation Technology Options
CCS FACILITY.
BOUNDARY DAM
CCS PROJECT
CO₂ STRIPPER
CO₂ PIPELINE.
UNIT 3 TURBINE.
SECURING OFF-TAKERS.

- Sale of flyash for concrete production 100%.

- Sale of sulphuric acid, used primarily for industrial purposes including fertilizer.

- Sale of CO$_2$ to oil company for EOR.
ENHANCED OIL RECOVERY.

- Around 30,000 bl/day: a 35-year high
- 20,000 bl/day are due to the CO₂ flood

Current production at 35 year high

CO₂ EOR

Waterflood Improvement

Primary & Waterflood

Vertical Infills

Pre CO₂ Hz Infills

Primary & Waterflood
Pure CO$_2$ storage with SaskPower’s Carbon Storage and Research Centre’s host project, Aquistore.

Independent monitoring project that identifies feasibility of injecting CO$_2$ into a deep saline reservoir in an effort to reduce GHG emissions.

Aquistore will receive approximately 350,000 tonnes of CO$_2$ over its life. Storage is regulated by the Ministry of Environment.

Will be measured, monitored, verified and audited.

Saskatchewan has experience with storage due to the Weyburn Midale project. Approximately 20 million tonnes of CO$_2$ stored and monitored.
MAKING THE NEW REALITY.

Complex Commissioning

Unprecedented Simulator Training

Detailed SOP

Vendor Contract Negotiations
WHERE WE ARE GOING
WHERE ARE WE GOING.

CCTF

Amine Chemistry Lab

University Collaboration

Boundary Dam 4+5
BOUNDARY DAM
CCS PROJECT
TOURS
SA SKPOWER CCS
GHGT-12
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