Canadian Heavy Oil Association

Canadian Heavy Oil Opportunities and Challenges

Presented to:

COQG

Calgary, June 24, 2008

Presented by: Gerry Belyk, 2006-2007 President
More information

Our Mission:
To provide an appropriate technical, educational and social forum for those employed in, or associated with, the heavy oil and oil sands industries.

The CHOA Annual Fall
Conference held on October 30.
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Canadian Heavy Oil Industry
Growth and Development Plans
Alberta

- Fort McMurray
- Edmonton
- Calgary
‘Historical’ Perspective

• 1719 - Athabasca River “seeps” noted by European explorers. Used by natives on canoes

• 1925 - Dr. Karl Clark demonstrated the first separation using hot water and caustic soda
Alberta Crude Oil Reserves

Canada, with 175 billion barrels in oil sands reserves, ranks 2nd only to Saudi Arabia in global oil reserves.
Heavy Oil

- Gravity < 20 API
- High viscosity

Gravity (API) 25 20 15 10 5
Viscosity (cP) Conventional Crude Oil Medium Oil Heavy Crude Oil Extra Heavy Oil (Tar Sand Oil & Bitumen)

Heat or Diluent Required to Flow

Viscosity Temperature Relationship for bitumen

- **Corn Syrup**
- **10W30 Motor Oil**
- **Water**

Temperature (°C)

Viscosity (cp)

- **raw bitumen**
- **diluted bitumen**

10°C

90°C
What are Oil Sands

• 10 - 12 wt. % bitumen

• *Unconsolidated, crumbles easily in hands*
Where Heavy Oil Lives

- Conventional heavy oil in the LLoydminster area
  - Cold production (CHOP)
    - With/without sand
- Mining near Fort McMurray
  - Athabasca river area
- Thermal production
  - Steam assisted gravity drainage (SAGD)
  - Cyclical Steam Stimulation (CSS)
Only 20% Mineable

More than 80% of reserves too deep to mine

Currently 65% of production is mined

Other recovery methods used for reserves too deep to mine

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Open Pit Mining
Truck & Shovel Mining

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Oil Sands Truck & Operator

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Cold Production with Sand (CHOPS)

Continued sand production with cuts ≥ 0.5%

Depth ~400-600 m

Thickness 2-7 m

– High Permeability Channels Developed – “wormholes” ⇒ much greater reservoir contact

– Substantial Increase in Oil rates (10X)
Cyclic Steam Stimulation (CSS)

Stages:
1. Steam injection into the reservoir
2. Steam and condensed water heat the viscous oil
3. Heated oil and water are pumped to the surface
SAGD In-situ Bitumen Recovery

New Technology:
- 2002 First commercial operation
- SAGD is a relatively new tool
Low Temperature Solvent (Vapex, NSolv)

Solvent Vapor Chamber

Injector

Draining diluted, deasphalted Oil (DAO)

Producer

Edge of diluted DAO
Toe-to-Heel Air Injection (THAI)
Alberta Production Growth

Source: CAPP – June 2007 (moderate case)
# Planned Alberta Investment

## Inventory of Major Alberta Projects

**Summary, December 2007**

<table>
<thead>
<tr>
<th>Sector</th>
<th># Total Projects</th>
<th>Value of Projects ($ millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture &amp; Related</td>
<td>8</td>
<td>$89.0</td>
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<tr>
<td>Biofuels</td>
<td>17</td>
<td>$2,342.5</td>
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<tr>
<td>Chemicals &amp; Petrochemicals</td>
<td>4</td>
<td>$372.0</td>
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<tr>
<td>Commercial/Retail</td>
<td>113</td>
<td>$8,597.9</td>
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<tr>
<td>Commercial/Retail and Residential</td>
<td>14</td>
<td>$3,663.5</td>
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<tr>
<td>Forestry &amp; Related</td>
<td>5</td>
<td>$420.0</td>
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<tr>
<td>Infrastructure</td>
<td>312</td>
<td>$17,309.5</td>
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<tr>
<td>Institutional</td>
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<tr>
<td>Manufacturing</td>
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<td>Oil &amp; Gas</td>
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<td>Oil Sands</td>
<td>52</td>
<td>$155,596.0</td>
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<td>Other Industrial</td>
<td>13</td>
<td>$168.8</td>
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<td>Pipelines</td>
<td>35</td>
<td>$11,713.1</td>
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<td>Power</td>
<td>40</td>
<td>$10,245.0</td>
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<tr>
<td>Residential</td>
<td>141</td>
<td>$6,179.4</td>
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<tr>
<td>Tourism/Recreation</td>
<td>110</td>
<td>$9,337.7</td>
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<tr>
<td><strong>Total</strong></td>
<td>1,079</td>
<td><strong>$244,775.4</strong></td>
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</table>

### Source: Alberta Economic Development

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Investment

• Bitumen production
  – Mining and extraction
  – Thermal bitumen production
    • Steam assisted gravity drainage (SAGD)
    • Cyclical steam stimulation (CSS)

• Upgrading/refining
  – Either linked with production or “stand alone”
  – Fort McMurray vs Edmonton

• Pipelines
  – Including condensate import/return
Planned Alberta Investment

<table>
<thead>
<tr>
<th>Year</th>
<th>Investment</th>
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<tbody>
<tr>
<td>1960</td>
<td></td>
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<tr>
<td>1970</td>
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<td>1980</td>
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<tr>
<td>2018</td>
<td></td>
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<tr>
<td>2020</td>
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</tbody>
</table>

*Completed: $48
Proposed: $100

Source: Alberta Industrial Heartland
Projects

Industrial Construction Projects
>100 MM Cdn (2004Q3 - 2011Q3)
Generated 2007-05-31 12:32

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Source: COAA
Upgrading

- Petro-Canada Sturgeon
- NorthWest Upgrading
- Total land position
- Suncor land position
- others

40 kms NE of Edmonton

Source: Alberta Industrial Heartland Association

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Good News

- With
  - Proven reserves
  - High oil prices
  - Technology improvements
  - Security of supply issues
  - Access to large markets
Good News

• We have
  – Unprecedented growth and development plans
  – A range of oil sands derived products destined for new and emerging markets
    • *Bitumen blends*
    • *Synthetic Crude Oil (variety of qualities)*
    • *Finished products*
Bad News

• There are many projects “clustered” in the same schedule

• Realities of workforce, construction, equipment, and infrastructure will likely
  – stretch out the schedules
  – change future plans some
Opportunities

• Think global
  – using the best people resources
  – wherever they may be
  • *engineering, labour, trades*

• Capitalizing on the unique qualities of bitumen
  – More than just a refinery feed

• New markets for heavy oil production are expanding
  – Opportunity to “tailor” production to meet the refining needs
Opportunities

• Apply innovative technology
  – Production, upgrading and refining
    • Anticipating environmental compliance
Challenges

• Following through with investment plans
  – Labour, engineering, equipment constraints

• Deciding where the value gets added
  – Identifying the right project
  – Upgrading investment vs. refinery investment

• Environmental responsibility
  – Natural gas, CO2, byproduct management