BIOGRAPHY

Gerald Bruce

MEG Energy Corp.

Gerald Bruce has spent over twenty-eight years working in the downstream sector of the Canadian oil industry, graduating with a Bachelor of Applied Science Degree in Chemical Engineering from the University Waterloo in 1981.

Gerald has extended his 23 years of refining experience with a large Canadian integrated oil company into the world of heavy oil production, upgrading and refining. Gerald worked for Jacobs Consultancy in Calgary helping a variety of international clients understand the challenges and opportunities in transforming bitumen into value added products, through production, marketing, upgrading and refining of heavy oil.

In 2007, Gerald joined MEG Energy Corp. as Manager, Upgrading. MEG Energy Corp is a privately held junior oil sands company with plans for in excess of 200 kbd SAGD production.

Gerald is on the board of directors for the Canadian Heavy Oil Association and the VP of the Canadian Crude Quality Technical Association (CCQTA).

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ABSTRACT

Bitumen and Heavy Oil Production – Behind the Scenes

Gerald Bruce
MEG Energy Corp.

Development of the vast Alberta oil sands reserves has forecast production levels in excess of 3 million BPD by 2020. This production is poised to make a significant contribution to the security and stability of energy supply for benefit of both North America and global customers as conventional oil supplies decline.

The challenges associated with the successful implementation of development plans include overcoming perception challenges that are now associated with oil sands. The quest for responsible, sustainable and economic development includes the identification; refinement and application of technologies which can help us understand the carbon footprint from “well to wheels”.

Conventional heavy oil, mined bitumen and thermal bitumen production all contribute to the mix of quality feedstocks on their way to finished products. CHOPS, Mining, SAGD CSS and beyond are all part of the landscape.

This presentation provides insight, appreciation and understanding of how oil sands and heavy oil production is evolving to meet the future industry/environmental challenges.
Bitumen and Heavy Oil Production
Behind the Scenes

Presented to:
National Centre for Upgrading Technology (NCUT)
Upgrading and Refining Conference:
September 14-16, 2009 - Edmonton, Alberta, Canada
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.

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Calgary, Alberta T2P 3L5
Phone: 403-269-1755
Overview

- **History and perspective**
  - Heavy oil and bitumen
  - Production methods
  - Mining vs in-situ production

- **Growth and Development**
  - Production Forecasts
  - Investment Plans

- **Moving Forward**
  - Sustainability
    - What does this mean to Alberta heavy oil?
    - The role of technology?

- **A new reality.....**
HEAVY OIL IN ALBERTA
Canada, with 175 billion barrels in oil sands reserves, ranks 2nd only to Saudi Arabia in global oil reserves.
173 billion barrels of proved oil sands reserves remain

- Fort McMurray
- Edmonton
- Calgary
Where Heavy Oil and Oil Sands Are

- **Conventional heavy oil**
  - Lloydminster

- **Mining bitumen near Fort McMurray**
  - Deposits close to the surface
    - < 75 m of overburden

- **Thermal production of bitumen**
  - Deeper deposits
    - > 75 m of overburden
  - In-situ production methods
    - *Steam assisted gravity drainage (SAGD)*
    - *Cyclical Steam Stimulation (CSS)*

- **Carbonate formations as well**
  - Shale oil production techniques
Deposits of sand, heavy oil (bitumen)

12% bitumen in oil sands

Surface mining and in-situ production

80% of bitumen reserves are too deep to mine
Bitumen is separated from the sand

Heavy, sour, viscous hydrocarbon, difficult to process

Near solid at room temperature

Challenging chemistry

Upgrade to Synthetic Crude Oil (SCO) or “dilute and ship”
● Commercial interest dates back to 1906

● Mining “near surface” bitumen
  ⇦ Great Canadian Oil Sands (1967)
    ♦ Now Suncor
  ⇦ Syncrude (1978)
    ♦ Consortium with 7 partners
      - Imperial, Conoco-Phillips, Petro-Canada, Nexen, Murphy, Mocal Energy, Canadian Oil Sands
    ♦ Albian Sands (2002)
      - Shell(60%), Chevron (20%), Marathon (20%)
    ♦ CNRL (2009)

● Mined bitumen gets upgraded to Synthetic Crude Oil
  ⇦ Various types
Mined Bitumen and SCO Production

Alberta mined bitumen production and synthetic crude oil production and price, 1967-2008

- Mined bitumen
- SCO production
- SCO price

Great Canadian Oil Sands (Suncor) start-up
Syncrude start-up
Alberta Oil Sands Project start-up

Source: EUB ST98-2008

SCO = Synthetic Crude Oil
• 80% of bitumen is too deep to mine
  ⇒ Need “in place” production methods

• Thermal production methods
  ⇒ Cyclical Steam Stimulation (CSS)
    ✤ Cold Lake Blend (1970’s)
  ⇒ Steam Assisted Gravity Drainage (SAGD)
    ✤ Diluted bitumen
      - Dilbit (naphtha)
      - Synbit (sweet synthetic crude)

• First to market:
  ⇒ Cold Lake Blend

• Opti/Nexen Long Lake
  ⇒ Integrate SAGD and Field upgrading
Cyclical Steam Stimulation
– Esso Cold Lake

Steam Assisted Gravity Drainage
• Horizontal Well Pairs – Injectors and Producers
• AOSTRA and Roger Butler
Split Between CSS and SAGD

Source: ERCB ST98-2008

2/3 CSS 1/3 SAGD
Thermal Production

Cyclical Steam and SAGD

Source: EUB ST98-2008
SAGD Production to Market

Blended Bitumen ➔ Partially Upgraded Bitumen ➔ Full Synthetic Crude ➔ Finished Products

Source: Statoil Hydro

Illustration of Thermal Production to Synthetic Crude Oil
Bitumen Blend vs Synthetic

Growth Case - Western Canada Oil Sands & Conventional Supply

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
<th>Forecast</th>
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<td>2025</td>
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*Bitumen Blend includes some volumes of upgraded heavy sour crude oil and bitumen blended with diluent or upgraded crude oil.

4,000 + kBPD total

Source: CAPP

June 2009 Forecast
Now extends to 2025
In Situ vs Mining

Note: Split between in situ and mining

Source: CAPP June 2009 – Growth Case
# Planned Alberta Investment

## Inventory of Major Alberta Projects

<table>
<thead>
<tr>
<th>Project Sector</th>
<th># of Projects</th>
<th>Value of All Projects</th>
<th># on Hold</th>
<th>Value of On-Hold Projects</th>
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<tr>
<td>Agriculture &amp; Related</td>
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<td>$72.9</td>
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<td>Biofuels</td>
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<td>Chemicals &amp; Petrochemicals</td>
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<td>Commercial/Retail</td>
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<td>Commercial/Retail and Residential</td>
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<td>Infrastructure</td>
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<td>Institutional</td>
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<td>Manufacturing</td>
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<td>Mining</td>
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<td>Oil &amp; Gas</td>
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<td><strong>Oilsands</strong></td>
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<td><strong>$76,930.0</strong></td>
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<td><strong>Total</strong></td>
<td><strong>1,040</strong></td>
<td><strong>$239,626.2</strong></td>
<td><strong>58</strong></td>
<td><strong>$83,719.7</strong></td>
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**Source:** Alberta Economic Development

- Oil Sands > $C136 billion total, > $C77 “on hold”
- TOTAL >$C239 billion >$C84 “on hold”
MOVING FORWARD

What a difference a year makes!
Have We Been Here Before?

WTI Price History - 1986 to present

Crude Oil Prices (WTI NYMEX) $US per barrel

Volatility
Price Forecast?

Uncertainty

Source: ERCB ST98 - 2008

Forecast: Variable.... Subject to change
Oil Sands Industry Challenges

• Realities of the current state
  ➜ Oil price decline
  ➜ Financial market turmoil – debt & equity
  ➜ Project Costs remain “misaligned” with current price
    ♦ Project deferral and cancellation

• Ongoing
  ➜ Environmental performance
    ♦ Air, water, and land
    ♦ Public perception of industry

• Balance – energy, environment, economy
  ➜ Demonstrating real improvements

• Positioning for sustainability
- Slow down of the rate of growth
  ➞ More of a sustainability focus

- The “gold rush” is over
  ➞ High cost projects are not viable
  ➞ Adjustment to $40 oil means not all projects will proceed
  ➞ What oil price do you need?

- The industry is doing a lot of “rethinking”
  ➞ Reducing cost, environmental positioning
  ➞ Value adding strategy

- Environmental drivers
  ➞ Greenhouse gases, CO2, water, land
  ➞ Carbon footprint
  ➞ Well to wheels
Industry Attention

- **Sustainability**
  - Land, Water and Air

- **Land**
  - Minimize land use

- **Water Use & Quality**
  - 85-90%+ recycle… zero liquid discharge

- **Air**
  - Manage emissions
  - Anticipate future regulations

- **Advanced technology application**
  - Reservoir, oil/water treatment, steam raising, upgrading, integration
  - Dry tailings, extraction developments
Technology Development

● Improve Production effectiveness through:
  ➞ Enhancements to SAGD
    ♦ Thermal-solvent processes
  ➞ Combustion
    ♦ Toe-to-heal-air injection (THAI)
  ➞ Electrical Heating
  ➞ In-situ upgrading
  ➞ Field upgrading…. Integration with SAGD
    ♦ Reduce/eliminate diluent and make your own fuel
  ➞ Alternate fuels use… Integration

● Goal:
  ➞ Lower cost production
  ➞ Environmental performance
  ➞ Sustainability
• Long term strategy
  ⇒ 40 years+ supply of heavy oil in the ground

• Alberta Oil Sands production volumes will continue to increase
  ⇒ Slower pace than initially envisioned

• Dealing with volatility and uncertainty
  ⇒ Value added strategy

• The role “technology” will play to improve industry effectiveness
  ⇒ Next generation technologies

• Overcoming current oil sands industry perception
  ⇒ Demonstrated results
Conclusions

- Fundamentals remain sound for medium to longer term
  - Resource base
  - Canadian industry track record and capability
  - Secure, reliable supplier with good market access

- Serious challenges remain
  - Technical –hard to extract and sensitive to market and input costs
  - Environmental –land, water, emissions (including CO₂)
  - Social –community growth, native population
  - Human resource –maintaining a skilled labor force

- Technology is a key lever

- Security of supply is a strong foundation for major development
Visit the CHOA website for more information

WWW.CH OA.AB.CA