Oil Sands Basics

Dayna Linley
Oil & Gas Sustainability Analyst
Jantzi-Sustainalytics
Sustainalytics is an international and independent sustainability research and services provider with coverage of North America, Europe and Asia.

- More than 50 analysts assess corporate environment, social and governance (ESG) performances
- Our database contains sustainability profiles for more than 2,000 companies
- Evaluation methodologies for more than 40 different industries
- A consistent and thorough methodology that allows for robust comparative analysis
Agenda

• Shift to Unconventionals
• Key Players
• Language and Definitions
• Extraction Processes
• Impacts
• Future Outlook
• Current Engagements
Shift to Unconventional
Oil in a Age of Uncertainty
## Oil in a Age of Uncertainty

<table>
<thead>
<tr>
<th>From:</th>
<th>To:</th>
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<tbody>
<tr>
<td>Light oil</td>
<td>Heavier oils, contaminants</td>
</tr>
<tr>
<td>Conventional drilling</td>
<td>Non-conventional extraction</td>
</tr>
<tr>
<td>Easy to access</td>
<td>Isolated locations, extreme conditions</td>
</tr>
</tbody>
</table>
Canada’s Unconventionals

- Coalbed Methane
- Shale Gas
- Oil Sands
Alberta’s Oil Sands

- 1.7 Trillion barrels
- Politically Stable
- Developed
- Low Security
- Technology
Why Alberta’s Unconventional Oil

Source: Dayna Linley
Key Players
Current Mining Sites

Albian Sands
Athabasca Oil Sands Project

- Shell Canada (RDS)-60%
- Marathon Canada (MRO)-20%
- Chevron Canada (CVX)-20%

Syncrude

- Canadian Oil Sands Trust (TSE:COS)-36.74%
- Suncor Energy (SU)-12%
- Imperial Oil (TSE:IMO)-25%
- Nexen (NXY)-7.23%
- Murphy Oil (MUR)-5%
- Mocal-5%
- ConocoPhillips (COP)-9.03% (Sinopec)*

Canadian Natural Resources Inc. (CNQ)

- Suncor Energy Inc. (SU)

*Sinopec recently purchased ConocoPhillips although the deal has not been finalized.
# A Few of the Players

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<tr>
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<tbody>
<tr>
<td>BP plc (BP)</td>
<td>ConocoPhillips (COP)</td>
<td>MEG</td>
<td>PetroChina</td>
</tr>
<tr>
<td>Canadian Natural Resources Limited (CNQ)</td>
<td>Devon Energy (DVN)</td>
<td>Nexen Inc. (NXY)</td>
<td>Royal Dutch Shell (RDS)</td>
</tr>
<tr>
<td>Canadian Oil Sands Trust (TSE:COS)</td>
<td>Husky Energy (TSE: HSE)</td>
<td>Occidental Petroleum Corp (OXY)</td>
<td>Sinopec</td>
</tr>
<tr>
<td>Cenovus Energy (formally EnCana) (TSE:CVE)</td>
<td>Imperial Oil (TSE:IMO)</td>
<td>Penn West Energy Trust (TSE:PWT)</td>
<td>Suncor Energy (SU)</td>
</tr>
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Language and Definitions
What’s in a Name...

<table>
<thead>
<tr>
<th>Have you heard:</th>
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<tbody>
<tr>
<td>Oil Sands</td>
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<tr>
<td>In Situ</td>
</tr>
<tr>
<td>Bitumen</td>
</tr>
<tr>
<td>Upgrading</td>
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</tbody>
</table>
Grain by Grain

- Tar Sands
- Oil Sands
- Bituminous Sands
Oil Sands to Synthetic Crude Oil

**Oil Sands**
- Sand
- Clay
- Water
  - salts & chemicals

**Bitumen**
- Sulphur
- Coke
- (Hydrogen in)

**Synthetic Crude Oil**
- Extraction
- Upgrading
- Refining
Talk the Talk

• Efficiency Benchmarks
  – SOR – Steam to Oil Ratio
  – Tonnes of Material moved per barrel

• CSS – Cyclic Steam Stimulation
• CCS – Carbon Capture and Storage
• EOR – Enhanced Oil Recovery
Extraction Processes
Oil Sands to Bitumen

• Mining – Shallow
• 55% of production
• 18% of total reserves

Source: Suncor Energy
Further Mining Information

• [http://energytomorrow.org/mediaroom/?id=136&type=v](http://energytomorrow.org/mediaroom/?id=136&type=v) (first minute good)

• [http://video.mining.com/videos/1686c0/athabasca_oil_sands_project_%3a_oil_sands_technology_(3_of_7).asp](http://video.mining.com/videos/1686c0/athabasca_oil_sands_project_%3a_oil_sands_technology_(3_of_7).asp)

Oil Sands to Bitumen - SAGD

- Steam Assisted Gravity Drainage
- In Situ (in place) – Deep
- 45% of production
- 82% of total reserves

Source: Canadian Centre for Energy Information
Further SAGD Information

- [http://www.cenovus.com/operations/technology/sagd.html](http://www.cenovus.com/operations/technology/sagd.html) (SAGD video on right side of page)

Oil Sands to Bitumen - CSS

- Cyclic Steam Stimulation
- In Situ (in place) – Deep
- 45% of production
- 82% of total reserves

Source: Oil Sands Developers Group
Bitumen to Synthetic Crude Oil

- Shorten carbon chains
  - Coking
  - Hydrocracking
- 5 upgraders in Alberta
- US refinery retrofits

Source: David Dodge, The Pembina Institute, [www.pembina.org](http://www.pembina.org)
Impacts
Mining Environmental Impacts

**Air**
- SO2
- NOX
- VOCs
- GHG

**Land**
- Peatland Drainage
- Habitat Destruction
- Slow ELC Reclamation

**Water**
- Athabasca River
- Tailings Ponds
- Groundwater Drawdown
In Situ Environmental Impacts

Air
- SO2
- NOX
- GHG

Land
- Habitat Fragmentation
- ELC Reclamation

Water
- Less Surface Water
- More Groundwater
Contrasting Cumulative Impacts: Land

**Mining**

**In Situ**

Source: Louis Helbig

Source: David Dodge, The Pembina Institute, [www.pembina.org](http://www.pembina.org)
Environmental Impacts

Secondary Impacts
- Land and Biodiversity
- Air and GHGs
- Water

Impacts from Inputs to the Oil Sands

Site Specific Impacts
- Land and Biodiversity
- Air and GHGs
- Water

Cumulative Impacts

Secondary Impacts
- Land and Biodiversity
- Air and GHGs
- Water

Impacts from Inputs to the Oil Sands
Environmental Risk

The environmental risks to individual operators include:

**Reputational Risk** – social license to operate (local, provincial, national, international)

**Legal Risk** – allegation of health issues and increased cancer rates, trans-boundary pollution

**Regulatory Risk** – Water for life, tailings directive, land use planning (all in Alberta), potential GHG regs, low carbon fuel standards (California, Europe)

**Operational Risk** – water availability, temperature design ranges already severe, technological dependence
Sustainalytics Methodology

Consumers are demanding oil

Why Develop the Oil Sands?
- Huge Oil Resource
- Stable Political Regime
- Infrastructure
- Low Security Costs
- Technologically Feasible

Environmental Issues
- GHG and Air Emissions
- Water Impacts
- Land & Biodiversity Impacts
- Cumulative Impacts
- Secondary Impacts

Social Issues
- Health Effects
- Shortage of Skilled Labour
- Aboriginal Rights
- Stressed Infrastructure
- Growing Populations

Corporate Responsibility

Mitigation Measures to Address Oil Sands ES Impacts

Sustainalytics Risk Assessment

Gap Analysis: Has the company successfully mitigated its risks? Is the company meeting stakeholder expectations?
Best Practices

R&D

* Petrobank Energy (TSE:PBG) *

- New Extraction Technology
  - Toe-to-Heel Air Injection (THAI™)
  - no steam, less energy, decrease GHG

Water

* Suncor Energy (SU) *

- Tailings Management
  - Tailings Reduction Operations
  - Compliance with Directive 074

Biodiversity

* Nexen Inc. (NXY) *

- Conservation Efforts
  - Signatory to the Boreal Forest Conservation Framework
  - Sponsor of the Alberta Biodiversity Monitoring Institute
Looking Ahead
Coming down the pipeline...

- Increasing Production
  - New projects
  - Increasing project efficiencies
  - New parts (replacing pumps etc.)

- New Players
  - All the super majors are in
  - National Petroleum companies
    - Particularly strong action from China

- New Technology
  - In situ solvents
  - Carbon Capture and Storage
Unconventional is becoming the new normal
Thank You

For more information please contact:

Dayna Linley
Oil & Gas Sustainability Analyst
Jantzi-Sustainalytics
dlinley@jantzisustainalytics.com