Key Economic Challenges Facing the Canadian Oil Sands Industry

Presentation Outline

- Industry Challenges
  - Overview
  - Project Costs and Economics
  - Energy and Hydrogen Supply Options
- Oil Sands Production Outlook
  - Unadjusted Case
  - Adjusted Case
- Conclusions
The "Triple Bottom Line"

- Healthy Environment
- Strong Economy
- Social Well-Being

Oil Sands Industry Challenges and Industry Sustainability

- Air Emissions
  - Greenhouse Gases
  - Criteria Air Contaminants (SOx, NOx, PM, VOCs, CO, NH3)
- Water Use
  - Consumption
  - Recycle
- Liquid Waste Disposal
- Solid Waste Disposal
  - Tailings
  - Other Solid Wastes
- Reclamation and Abandonment
- Cumulative Effects
Oil Sands Industry
Societal Challenges

- Public Services
  - Health
  - Education
  - Other
- Public Infrastructure
  - Road
  - Water & Sewer
  - Rail
  - Other
- Regulatory Agencies
  - Staffing & Expertise
  - Workload
  - Funding
- Pace of Development
- First Nations
- Project Legacies

Oil Sands Industry
Economic Challenges

- Capital Costs
  - Labour Availability and Productivity
  - Services and Materials
  - Project Execution
- Operating Costs
  - Purchased External Energy
  - Non-Energy Operating Costs
- Energy and Hydrogen Supply Options
- Fiscal and Regulatory Uncertainties
  - Provincial Royalties
  - Corporate Income Taxes
  - Greenhouse Gas Emissions
- Markets
  - Integration/Final Product (Bitumen, SCO, RPPs, or Petrochemicals)?
  - Market Access
- Product Prices
  - Light Sweet Crude (WTI/MSW)
  - Heavy-Light Differentials
**Integrated Project Capital Costs**

- AOSP Phase 1
- Suncor Millennium
- Syncrude Stage 3/UE1
- CNRL Horizon Phase 1
- AOSP Expansion
- Fort Hills Phase 1
- Nexen/OPTI Long Lake
- Syncrude N Lights

Sources: Company Announcements; Strategy West Inc.

**Non-Integrated Project Capital Costs**

- N Lights Low
- N Lights High
- MacKay River 1
- Firebag 1
- Firebag 2
- Tucker 1
- Great Divide 1
- MacKay River 2 Low
- MacKay River 2 High
- Mining & Extraction Project

Sources: Company Announcements; Strategy West Inc.
### Hypothetical Oil Sands Projects - Cost Assumptions

<table>
<thead>
<tr>
<th>Product</th>
<th>SAGD</th>
<th>Mining &amp; Extraction</th>
<th>Upgrading (Coker)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial CAPEX (Real 2007 C$ per b/d)</td>
<td>$30,000</td>
<td>$40,000</td>
<td>$50,000 (SCO)</td>
</tr>
<tr>
<td>Non-energy OPEX (Real 2007 C$/b)</td>
<td>$7.00</td>
<td>$9.00</td>
<td>$7.00</td>
</tr>
<tr>
<td>Purchased Natural Gas (GJ/b)</td>
<td>1.20</td>
<td>0.30</td>
<td>0.50</td>
</tr>
<tr>
<td>SCO Yield</td>
<td>-</td>
<td>-</td>
<td>85%</td>
</tr>
<tr>
<td>GHG Emission Penalty ($/t)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: Strategy West Inc.

### Hypothetical Oil Sands Projects - Illustrative Investment Returns

#### Oil Sands Royalty Regulation, 1997

- SAGD
- M&E
- Upgrader
- ME&U

#### New Royalty Framework, 2007

- SAGD
- M&E
- Upgrader
- ME&U

Reduced Federal Tax Rate

Source: Strategy West Inc.
Value Chain Strategic Considerations

- Technical Complexity and Cost
- Retail RPPs (ex-Tax Pump Price)
- Wholesale RPPs (Rack Price)
- Synthetic Crude Oil
- Blend

Bitumen Production
Bitumen Upgrading
Refining
Distribution & Marketing

Upgrading Technology Options

- Technical Complexity and Cost
- Product Price
- Sweet Premium SCO
- Sweet SCO
- Sour SCO
- Primary Upgrading
- Primary Upgrading + Hydrotreating
- Primary Upgrading + Fixed-bed Hydrocracking

Not to Scale
Alberta Price Realizations (Jan 2005 to Dec 2007)

<table>
<thead>
<tr>
<th></th>
<th>Average Price (C$/b)</th>
<th>Average Price Relative to MSW (C$/b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Bitumen Value</td>
<td>$31.34</td>
<td>43%</td>
</tr>
<tr>
<td>Dilbit @ Hardisty</td>
<td>$47.58</td>
<td>66%</td>
</tr>
<tr>
<td>MSW @ Edmonton</td>
<td>$72.10</td>
<td>100%</td>
</tr>
<tr>
<td>Rack Price (Regular Unleaded @ Edmonton)</td>
<td>$94.31</td>
<td>131%</td>
</tr>
<tr>
<td>Ex-tax Pump Price (Regular Unleaded @ Edmonton)</td>
<td>$112.83</td>
<td>157%</td>
</tr>
</tbody>
</table>

Sources: Canadian Association of Petroleum Producers; EnCana; Petro-Canada; Strategy West Inc.
Current Sources of Thermal Energy, Hydrogen and Electricity

Thermal Energy
- Purchased natural gas
- Produced gases (in situ projects)
- Process gases (upgraders)
- Liquid hydrocarbon fuels
- Crude bitumen
- Coke and other bitumen residues (upgraders)

Hydrogen
- Steam Methane Reforming (natural gas)

Electricity
- On-site generation
- Purchased electricity

Conventional Marketable Gas and CBM Production in Alberta

Source: Alberta EUB; Report ST98-2007; June 2007
Industry Options to Reduce Purchased Gas Requirements

- Conservation/Energy Efficiency Improvements
- New Bitumen Recovery Technologies
  - In Situ
  - Mining and Extraction
- Alternative Sources of Thermal Energy, Electricity and Hydrogen
  - Gasification of Bitumen Residues
  - Combustion of Bitumen/Bitumen Residues
  - Nuclear

Oil Sands Gasification Projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Gasification Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPTI/Nexen Long Lake Phases 1-4</td>
<td>Construction (Phase 1)</td>
</tr>
<tr>
<td>North West Upgrading Phases 1-3</td>
<td>Approved</td>
</tr>
<tr>
<td>Northern Lights Phases 1 &amp; 2</td>
<td>Application</td>
</tr>
<tr>
<td>Shell Scotford Upgrader 2 Phases 1-4</td>
<td>Application</td>
</tr>
<tr>
<td>Suncor Voyageur Phase 2</td>
<td>Being Evaluated</td>
</tr>
<tr>
<td>Fort Hills Sturgeon Phases 2 &amp; 3</td>
<td>Being Evaluated</td>
</tr>
<tr>
<td>CNRL Horizon Phases 4 &amp; 5</td>
<td>Being Evaluated</td>
</tr>
<tr>
<td>CNRL Primrose Phases 1 &amp; 2</td>
<td>Being Evaluated</td>
</tr>
<tr>
<td>NAOSC Upgrader Phase 2</td>
<td>Being Evaluated</td>
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</tbody>
</table>

Source: Project Applications and Company Announcements
Combustion of Bitumen/Bitumen Residues

- Coke Burning
  - Suncor power plant
  - Syncrude Fluid Cokers
- Multiphase Superfine Atomized Residue (MSAR)
- Asphaltenes
  - Mining project cogeneration facilities

Issues
- SO₂ and particulate emissions require flue-gas scrubbing
- CO₂ emissions exceed those from combustion of natural gas

Opportunities
- O₂ firing
- CO₂ capture

The Nuclear Option

Potential Benefits
- Reduced Greenhouse Gas Emissions
- Competitive Thermal Energy and Electricity Cost
- Long-Term Price Stability

Issues
- Public Concerns
  - Safety
  - Terrorist threats
  - Nuclear waste disposal
- Capital Cost
- Reactor Size/Technology
- Reliability/Refurbishment
- Timing
  - Alberta nuclear by 2017?
  - All technologies must be certified by the CNSC
Projected Oil Sands Industry Purchased Natural Gas Consumption

Does not include gas used for production of electricity at oil sands cogeneration facilities

Sources: Canadian Association of Petroleum Producers; Strategy West Inc.

Projected Oil Sands Industry Purchased Natural Gas Intensities

Does not include gas used for production of electricity at oil sands cogeneration facilities

Sources: Canadian Association of Petroleum Producers; Strategy West Inc.
Oil Sands Industry Outlooks

- Comprehensive Project Database
  - Used to develop aggregated industry outlooks
- Unadjusted Outlook
  - Assumes all existing and proposed projects are developed and meet their announced startup dates
- Adjusted Outlook
  - Project-by-project timing adjustments
  - Project-by-project probability assessment

Bitumen Production Outlook - Unadjusted Case

Source: Strategy West Inc.
SCO and Non-Upgraded Bitumen Supply Outlook - Unadjusted Case

![Graph showing SCO and Non-Upgraded Bitumen supply outlook.](image)

Source: Strategy West Inc.

CAPEX - Unadjusted Case

<table>
<thead>
<tr>
<th>Production Increase</th>
<th>Initial CAPEX</th>
<th>Average Annual Initial CAPEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining &amp; Extraction</td>
<td>2.2</td>
<td>$40,000 (Bitumen)</td>
</tr>
<tr>
<td>In Situ</td>
<td>2.5</td>
<td>$10,000-$35,000 (Bitumen)</td>
</tr>
<tr>
<td>Incremental Production</td>
<td>4.7</td>
<td></td>
</tr>
<tr>
<td>Upgrading</td>
<td>2.8</td>
<td>$50,000 (SCO)</td>
</tr>
<tr>
<td>Total CAPEX</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: does not include sustaining capital

Source: Strategy West Inc.
Oil Sands Historical CAPEX

Includes Sustaining Capital

Capital Spending ($ billions)

Source: Canadian Association of Petroleum Producers

Adjusted Industry Outlook - Project-by-Project Assessment

Project Timing
- Lease evaluation
- Disclosure
- Application preparation and EIA
- Application review and approval
- Detailed engineering
- Internal approval
- Construction
- Phasing

Project Probabilities
- Project status
- Owners
  - Operating experience
  - Financial capacity
  - Technical capability
  - Other factors
- Technology
- Existing operations
- Integration
- Timing

Source: Strategy West Inc.
**Bitumen Production Outlook - Adjusted Case**

- Primary & Experimental
- Peace River In Situ
- Cold Lake In Situ
- South Athabasca In Situ
- North Athabasca In Situ
- Athabasca Mining

Source: Strategy West Inc.

**SCO and Non-Upgraded Bitumen Supply Outlook - Adjusted Case**

- Non-Upgraded Bitumen
- Synthetic Crude Oil

Source: Strategy West Inc.
## CAPEX - Adjusted Case

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining &amp; Extraction</td>
<td>1.3</td>
<td>$40,000 (Bitumen)</td>
</tr>
<tr>
<td>In Situ</td>
<td>1.4</td>
<td>$10,000-$35,000 (Bitumen)</td>
</tr>
<tr>
<td>Incremental Production</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>Upgrading</td>
<td>1.6</td>
<td>$50,000 (SCO)</td>
</tr>
<tr>
<td>Total CAPEX</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: does not include sustaining capital

Source: Strategy West Inc.

## Comparative Industry Outlooks

![Comparative Industry Outlooks](image)

### Sources:
- Canadian Association of Petroleum Producers
- Energy and Utilities Board
- National Energy Board
- Strategy West Inc.
Conclusions

- Oil sands projects are experiencing cost pressures but provide economically attractive investment opportunities at oil prices of US$60-70/b (WTI @ Cushing, OK).
- The oil sands industry is aggressively taking action to reduce its consumption of purchased natural gas.
- The many challenges facing the industry will cause some project delays and cancellations.
- These challenges are being addressed and the industry will continue to grow.

Thank You

Questions?

Please visit www.strategywest.com for oil sands project lists and other detailed oil sands industry information