• **Energy Security**
  - Shifting Supply and Demand
    - The world is counting on Canada’s oil, gas is abundant
  - Access to existing and new markets

• **Environment**
  - Energy mix and conservation
  - Local/regional – water use/quality, land use, air quality, etc.
  - Global – greenhouse gas emissions policy

• **Jobs and Economic Growth**
  - Creating jobs across Canada and North America
Global Primary Energy Demand

- **Significant energy demand growth:**
  - Population, standards of living

- **Need all forms of energy:**
  - Increasing role for renewables
  - Continuing reliance on hydrocarbons
  - Increasing role for non-conventional crude oil & natural gas

- **Environmental challenges**
- **Technology is a key lever for sustainable growth**

---

**Current Policies Scenario**

**Global Crude Oil Reserves by Country**

<table>
<thead>
<tr>
<th>Country</th>
<th>Reserve (billion barrels)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saudi Arabia</td>
<td>260</td>
</tr>
<tr>
<td>Venezuela</td>
<td>211</td>
</tr>
<tr>
<td>Canada</td>
<td>175</td>
</tr>
<tr>
<td>Iran</td>
<td>137</td>
</tr>
<tr>
<td>Iraq</td>
<td>115</td>
</tr>
<tr>
<td>Kuwait</td>
<td>102</td>
</tr>
<tr>
<td>Abu Dhabi</td>
<td>92</td>
</tr>
<tr>
<td>Russia</td>
<td>60</td>
</tr>
<tr>
<td>Libya</td>
<td>46</td>
</tr>
<tr>
<td>Nigeria</td>
<td>37</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>30</td>
</tr>
<tr>
<td>Oman</td>
<td>25</td>
</tr>
<tr>
<td>United States</td>
<td>20</td>
</tr>
<tr>
<td>United States</td>
<td>19</td>
</tr>
</tbody>
</table>

Includes 170 billion barrels of oil sands reserves

**World Oil Reserves**

<table>
<thead>
<tr>
<th>State controlled</th>
<th>Accessible Oil Reserves</th>
<th>Other Accessible Reserves</th>
</tr>
</thead>
<tbody>
<tr>
<td>74%</td>
<td>52%</td>
<td>48%</td>
</tr>
</tbody>
</table>

Source: IEA World Energy Outlook 2010

Source: Oil & Gas Journal Dec. 2010
Growth Case - Western Canadian Oil Production

Industry Capital Spending

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2010E</th>
<th>2011F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Canada</td>
<td>$0.2</td>
<td>$0.5</td>
<td>$0.3</td>
</tr>
<tr>
<td>Oil Sands</td>
<td>$11</td>
<td>$13</td>
<td>$15</td>
</tr>
<tr>
<td>Western Canada</td>
<td>$20</td>
<td>$26</td>
<td>$26</td>
</tr>
<tr>
<td>East Coast Offshore</td>
<td>$1.7</td>
<td>$2.5</td>
<td>$3.0</td>
</tr>
</tbody>
</table>

Oil & Gas Investment Spending:

2009: $34 billion
2010: $42 billion (estimate)
2011: $44 billion (forecast)

Note:
Excludes spending mergers & acquisitions
Two Methods of Oil Sands Reserves: 80% Drilling and 20% Mining Land: 97% Drilling and 3% Mining

Canadian & U.S. Crude Oil Pipeline Proposals
Potential Tanker Markets for Canadian Oil Sands Production

Competitive travel distances for Canadian supply to both markets

Source: Enbridge Pipelines

• A mixture of water, clay, sands and residual bitumen
  - Used to settle solids and recycle water - 80% + recycle ratio

• Research to increase recycle, reduce pond size
  - Consolidated tailings
  - CO2 treatment (CNRL)
  - Thickener, Paste/Dry tailings
  - Tailings Reduction (Suncor)
  - Atmospheric Fines Drying (Shell)
  - Centrifuge (Syncrude)

• First tailings pond (Suncor) surface reclamation in 2010

• Industry Tailings Collaborative
  - Accelerate new technology implementation
Oil Sands Water Use

- **Mining**
  - 2-4 barrels of water per barrel of oil with 80-90% recycle
  - Currently use 0.5 per cent of the annual flow of the Athabasca river
    - 1/3 of City of Toronto water use
  - To protect during low flow periods government restrictions are in place
  - On-site water storage

- **Drillable (Insitu)**
  - 0.25-0.5 barrels of water per barrel of oil with 90-95% recycle
  - No water from Athabasca River
  - Shift to using non-potable (saline) sub-surface aquifers
  - New projects are using 100% saline for steam

**Federal Oil Sands Advisory Panel on Water Monitoring (Dec 2010)**
- Current monitoring system not “first-class state-of-the-art”
- A universal interest to achieve responsible development
- Significant amount of research, monitoring and environmental assessment
- Workable and successful frameworks demonstrated

**Alberta Water Monitoring Data Review Committee (Feb 2011)**
- Examine monitoring data and methodology of both government and academic research findings

**Provincial Environmental Monitoring System (June 2011)**
- Panel of independent experts
- World-class environmental monitoring, evaluation, and reporting for Alberta’s oil sands and entire province
Land Use and Reclamation

- Canada’s boreal forest (3,200,000 km²)
- Land covering the oil sands (142,200 km²)
- Land that could be impacted by mining (4,802 km²)
- Land mined over the last 40 years (662 km²)
  - 11% of land mined has been reclaimed

**How big is 662 km²?**

<table>
<thead>
<tr>
<th>Area (km²)</th>
<th>City proper</th>
<th>Greater metropolitan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edmonton, Alberta</td>
<td>684</td>
<td>9,419</td>
</tr>
<tr>
<td>Toronto, Ontario</td>
<td>630</td>
<td>7,125</td>
</tr>
<tr>
<td>Chicago, Illinois</td>
<td>606</td>
<td>28,164</td>
</tr>
<tr>
<td>Oslo, Norway</td>
<td>454</td>
<td>8,900</td>
</tr>
</tbody>
</table>

**Oil Sands Mining Footprint and Reclamation Process**

- Tailings Ponds
- Surface Mining
- Reclaimed Land

Source: Cambridge Energy Research Associates.
**Global Energy Related Emissions**

**Global Emissions**

- **United States**: 20%
- **China**: 21%
- **OECD Europe**: 15%
- **Canada**: 2%
- **Non-OECD Europe & Eurasia**: 10%
- **Japan**: 4%
- **India**: 5%
- **Australia/New Zealand**: 2%
- **Other**: 21%

**Other Fossil Fuel**

- **Electricity**: 16%
- **Manufacturing & Heavy Industry**: 15%
- **Transportation**: 22%
- **Agriculture**: 10%
- **Residential**: 7%
- **Service Industries**: 8%
- **Conventional Oil & Gas Production**: 12%
- **Oil Sands**: 5%

**GHG emissions from oil sands:**

- less than 1/1000th of global GHG emissions
- 5% of Canada’s GHG emissions

**Legend**

- 0-400 teragram
- 401-800 teragram
- 801-1200 teragram
- 1201+ teragram

**Source:** UNFCC & EC

http://maps.unfccc.int/di/map/
Full Cycle GHG Emissions

Source: Jacobs Consultancy, Life Cycle Assessment Comparison for North America and Imported Crudes, June 2009

HISTORICAL FRONT-DEC ICE EEX EUA & CER FUTURES & DAILY FUTURES PRICE

Source: ICE Futures Report Monthly Utilities Report & CAPP
**Reducing Greenhouse Gas Emissions**

- **Reducing GHG Emissions**
  - Using less energy input
  - Reducing energy waste/losses
  - Capturing waste heat
  - Cogeneration power/steam
  - Use energy more efficiently
  - CO2 capture technologies
    - Upgraders, hydrogen plants

**Oil Sands GHG Emissions/bbl**

- 1990: 25 g CO2 eq./mj
- 2008: 15 g CO2 eq./mj

- **Science based, independent analysis of the environmental aspects of Canada’s oil sands**

- **Addresses many of the issues and perceptions of oil sands development**
  - Reclamation is not keeping pace but sustainable reclamation is achievable
  - Water use does not threaten viability of the Athabasca River
  - No impact on Athabasca water quality
  - Tailings technologies are emerging but tailings inventory is growing
  - GHG emissions per barrel are reducing but growing production creates a challenge in meeting international commitments
  - Minimal impacts on regional air quality

December 2010
Oil Sands Information

• **Information/Education**
  - English, French, Norwegian, and German
  - Information on environment, economics and energy
  - Real examples of technology

• **Come See For Yourself videos**
  - CAPP website
  - YouTube

**Oil Sands Report 2010**
- Principles & Performance
- Measurement & Reporting
  - Safety and well-being
  - Water Management
  - Air Quality
  - Greenhouse Gas Emissions
  - Land use/reclamation
- Transparency
2010 Advertising Campaign

Background Slides
Energy Efficiency

- **Low energy extraction**
  - 35°C instead of 80°C = 1/3 less energy

- **Underground combustion rather than steam**
  - Petrobank Whitesands – THAI process

- **Additives to reduce the need for both water and energy (steam)**
  - LASER (Imperial), SAP (Cenovus), N-Solv
  - SC-SAGD (Laricina), SOLVE (Statoil/PTRC)

- **Electricity instead of steam to warm the heavy oil underground**
  - ET-Energy, Shell

Carbon Capture and Storage

- **Most effective at upgraders/hydrogen plants**
  - Shell Quest in development phase