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And with the contribution from Research Analysts Narmadha Navaneethan and Cindy Feng.
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Excerpt

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III. North America

Canada, the United States and Mexico are highly integrated in the oil sector. In 2010, the United States imported about 2.0 million b/d of crude oil from Canada, 1.1 million of which was from oil sands. Mexico exported about 1 million b/d to the United States, about the same as in 2009. Canada and Mexico supply 22% and 10% of U.S. crude imports, respectively. Mexico imported 333,000 b/d of products from the U.S. and more than 100,000 b/d from Canada. The U.S. also imports products from Canada and exports small volumes of crude and products to both countries, including condensate for use as diluents for oil sands production in Canada.

The United States, Canada and Mexico all produce significant quantities of conventional heavy crude oil, and Canada’s oil sands are by far the world’s largest producer of bitumen. In the United States, heavy oil has been produced in California for more than 100 years. Almost 60% of Mexico’s oil production is heavy oil below 22° API, though this percentage will decrease as heavy oil declines while new sources of light crude oil are developed. The super-giant Cantarell heavy oil field in the Bay of Campeche is one of the largest fields ever discovered and still supplies over half of Mexico’s oil output. North America has the largest combined heavy oil and bitumen resources in the world at 2.2 trillion barrels.

Figure III.1: Heavy Oil Basins in North America and Resources in Billion Barrels

Data Sources: USGS and DOE updated by Hart Energy
Table III.1: New Mining Projects in the Athabasca Region of Alberta

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<th>Company</th>
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<th>Start Year</th>
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<td>Athabasca Oil Sands Project</td>
<td>Pierre River Mine Phase 1</td>
<td>2018</td>
<td>100,000</td>
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<tr>
<td>Athabasca Oil Sands Project</td>
<td>Pierre River Mine Phase 2</td>
<td>2022</td>
<td>100,000</td>
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<td>Imperial Oil</td>
<td>Kearl Phase 1</td>
<td>2012</td>
<td>110,000</td>
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<tr>
<td>Imperial Oil</td>
<td>Kearl Phase 2</td>
<td>2015</td>
<td>100,000</td>
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<tr>
<td>Imperial Oil</td>
<td>Kearl Phase 3</td>
<td>2021</td>
<td>100,000</td>
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<td>Suncor Energy Inc.</td>
<td>Voyageur South Mine</td>
<td>TBD</td>
<td>120,000</td>
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<tr>
<td>Total E&amp;P</td>
<td>Joslyn North Mine</td>
<td>2018</td>
<td>100,000</td>
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<td>Joslyn South Mine</td>
<td>TBD</td>
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<tr>
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<td>Northern Lights Mine Phase 3</td>
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<td>80,000</td>
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Sources: Oil Sands Review, Company reports and press releases

In-situ Operators

There is vastly more area available for in-situ production in the oil sands than for mining – 137,398 km² in Alberta. Though relatively small quantities of oil have been produced from the region using primary production techniques for a number of years, in-situ production didn’t take off until SAGD began being used in the early 2000s. An early SAGD project was the Japan Canada Oil Sands Limited (JACOS) Hangingstone SAGD pilot; it was started in 1999 and is ongoing. The earliest commercial scale SAGD projects were the Foster Creek and Christina Lake projects operated by Cenovas Energy (formerly Encana), and Suncor’s MacKay River project. These projects have all been expanded in phases and more expansions are planned. Producing projects in the Athabasca Oil Sands region and the operators are shown in Table III.2.

Table III.2: Producing In-Situ Projects in the Athabasca Region

<table>
<thead>
<tr>
<th>Company</th>
<th>Project</th>
<th>Start Year</th>
<th>Capacity b/d</th>
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<td>Hangingstone Pilot</td>
<td>1999</td>
<td>10,000</td>
</tr>
<tr>
<td>Cenovus Energy Inc.</td>
<td>Foster Creek</td>
<td>2001</td>
<td>120,000</td>
</tr>
<tr>
<td>Cenovus Energy Inc.</td>
<td>Christina Lake</td>
<td>2002</td>
<td>18,800</td>
</tr>
<tr>
<td>Suncor Energy Inc.</td>
<td>Mackay River</td>
<td>2002</td>
<td>33,000</td>
</tr>
<tr>
<td>Suncor Energy Inc.</td>
<td>Firebag</td>
<td>2004</td>
<td>93,000</td>
</tr>
<tr>
<td>ConocoPhillips Canada</td>
<td>Surmont</td>
<td>2007</td>
<td>27,000</td>
</tr>
<tr>
<td>Devon Canada Limited</td>
<td>Jackfish</td>
<td>2007</td>
<td>35,000</td>
</tr>
<tr>
<td>Connacher Oil and Gas</td>
<td>Great Divide</td>
<td>2007</td>
<td>10,000</td>
</tr>
<tr>
<td>MEG Energy Corp.</td>
<td>Christina Lake</td>
<td>2008</td>
<td>3,000</td>
</tr>
<tr>
<td>Nexen Inc. and Opti Canada</td>
<td>Long Lake</td>
<td>2008</td>
<td>72,000</td>
</tr>
<tr>
<td>MEG Energy Corp.</td>
<td>Christina Lake</td>
<td>2009</td>
<td>22,000</td>
</tr>
<tr>
<td>Laricina Energy</td>
<td>Saleski pilot</td>
<td>2010</td>
<td>600</td>
</tr>
<tr>
<td>Petrobank Energy</td>
<td>Whitesands - Pilot THAI</td>
<td>2010</td>
<td>1,800</td>
</tr>
<tr>
<td>Laricina Energy</td>
<td>Saleski Carbonate SAGD Demo</td>
<td>2010</td>
<td>1,800</td>
</tr>
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</table>

Sources: Oil Sands Review, Operating Company Reports
Figure III.6: Capital Cost Intensity Range in Barrels per Day of Capacity for Oil Sands Projects

Sources: Company Reports, Oil Sands Review

In 2010, oil sands capital expenditures were about $Cdn14 billion (US$13.6 billion), higher than in 2009 but still below the Cdn$18.5 billion (US$17.45 billion) that was spent in 2008. Organizations such as the Fort McMurray-based Oil Sands Developers Group (OSDG) are predicting a return to robust capital spending in 2011, with an estimate that Cdn$16 billion to be spent this year.

Development costs are often expressed as cost per barrel of oil or barrel oil equivalent (boe). This requires estimating the project reserves. This was done for the low and high cost projects in featured in Figure III.5, as shown in Table III.9. Reserves were estimated assuming a 40-year life for mining projects and upgraders, and a 25-year life for SAGD projects.

Table III.9: Oil Sands Costs in US$ per Barrels of Oil Reserves

<table>
<thead>
<tr>
<th>Type</th>
<th>$/Bbl Low</th>
<th>$/Bbl High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upgrader</td>
<td>0.89</td>
<td>2.18</td>
</tr>
<tr>
<td>Mining and Upgrader</td>
<td>0.49</td>
<td>2.18</td>
</tr>
<tr>
<td>Mining</td>
<td>0.49</td>
<td>0.99</td>
</tr>
<tr>
<td>SAGD and Upgrader</td>
<td>0.49</td>
<td>0.99</td>
</tr>
<tr>
<td>SAGD 2007 - 2010</td>
<td>0.49</td>
<td>1.19</td>
</tr>
<tr>
<td>SAGD 2011 - 2014</td>
<td>0.49</td>
<td>0.99</td>
</tr>
<tr>
<td>CSS</td>
<td>0.49</td>
<td>0.99</td>
</tr>
</tbody>
</table>

Source: Hart Energy
The TransCanada Keystone XL pipeline is the first of the proposed lines and is being held up by environmental concerns, in particular the higher level of GHG emissions from the Canadian oil sands. The ultimate approval lies with the U.S. Department of State; the public disclosure period has ended in which various individuals and groups were allowed to state their positions with respect to the pipeline. There are indications that the State Department is inclined to approve the pipeline because Canada is a secure source of oil supplies. In addition, because there would likely be no net reductions in global GHG emissions if the pipeline is not approved, it is easy to envision a scenario in which the emissions would be higher; for example, larger volumes of Canadian oil sands production will be exported outside of North America, while heavy oil from other countries is imported into the Gulf Coast. As this outlook projects, there are ample supplies of heavy crude oil on the export market to supply Gulf Coast refineries if the pipeline is not built.

Figure III.15: Crude Oil Pipelines in North America
The increasing production from the oil sands in the absence of new upgrading capacity will make it critical to secure additional supplies of condensate in Alberta. The Southern Lights condensate pipeline has been in service since July 2010. A second pipeline from Kitimat, British Columbia, to

Though heavy oil production began a steep decline in 2005, heavy oil exports to the United States have remained more or less constant. Heavy oil exports from Mexico will decline unless more oil can be found through exploration and delineation. By 2030, Mexico heavy oil exports to the U.S. will decline to 100,000 b/d unless additional Mexican crude oil resources are found (see Table III.25). By 2035, Mexico’s internal consumption will grow to the point that it will no longer export heavy crude oil even with new long-term heavy oil production.

Table III.25 provides the North American crude oil distribution, including the long-term production potential from all countries. The long-term outlook has the potential to add million b/d of heavy oil production by 2025 and nearly million b/d by 2035. With the higher heavy oil production volume, heavy crude oil imports from other regions will be displaced and a portion of the North American heavy oil production will be exported. The higher heavy oil volumes would result in exports of more than million b/d by 2035.

### Table III.25: North American Heavy Crude Oil Disposition Including Long-Term Potential Production (Thousand barrels per day)

<table>
<thead>
<tr>
<th>Production</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
</tr>
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<tbody>
<tr>
<td>Canada</td>
<td>1,547</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Mexico</td>
<td>1,394</td>
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<tr>
<td>U.S.</td>
<td>481</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Total</td>
<td>3,422</td>
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<table>
<thead>
<tr>
<th>Internal Use</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>417</td>
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<tr>
<td>Canadian Crude</td>
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<tr>
<td>Mexico Crude</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Mexico</td>
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<tr>
<td>US</td>
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<td>Total</td>
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</table>

<table>
<thead>
<tr>
<th>Export Market</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexico</td>
<td>164</td>
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</tr>
<tr>
<td>U.S.</td>
<td>0</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Total</td>
<td>164</td>
<td></td>
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</tr>
</tbody>
</table>

Source: Hart Energy