Alberta has the second-largest deposit of oil in the world—only Saudi Arabia can claim a larger stockpile of crude. But 170 billion of Alberta’s 179 billion barrels of oil have the special quality of being bitumen, a resource that has been developed for decades but is only now coming into the forefront of the global energy industry, as conventional supplies—so-called “easy” oil—continue to be depleted. The figure of 170 billion barrels represents what is considered economically recoverable with today’s technology, but with new technologies, this reserve estimate could be increased to as much as 315 billion barrels.

There are three major bitumen (or oil sands) deposits in Alberta. The largest is the Athabasca deposit, located in the province’s northeast in the Regional Municipality of Wood Buffalo. The main population centre of the Athabasca deposit is the City of Fort McMurray. The second-largest oil sands deposit is referred to as Cold Lake, just south of Athabasca, with the main population centre the City of Cold Lake. The smallest oil sands deposit is known as Peace River, which is located in northwest central Alberta. A fourth deposit called Wabasca links to the Athabasca and is generally lumped in with that area.

The existence of bitumen in Alberta has been known for a long time. The first mention of it in Canadian history was in 1719, when a Cree named Wapasu brought a sample of the “gum” to a Hudson’s Bay trading post. First Nations in what is now the Wood Buffalo area had traditionally used the bitumen, which seeps from outcrops along the Athabasca River, to waterproof their canoes.

Today bitumen is produced as an energy source by two means—mining and in situ. The majority of oil sands production is done by surface mining, but this will likely change in the future, as 80 per cent of Alberta’s bitumen deposits are too deep underground to economically employ this technology.

Right now there are essentially two commercial methods of in situ (Latin for “in place,” essentially meaning wells are used rather than trucks and shovels). In cyclic steam stimulation (CSS), high-pressure steam is injected into directional wells drilled from pads for a period of time, then the steam is left to soak in the reservoir for a period, melting the bitumen, and then the same wells are switched into production mode, bringing the bitumen to the surface.

In steam assisted gravity drainage (SAGD), parallel horizontal well pairs are drilled from well pads at the surface. One is drilled near the top of the target reservoir, while the other is drilled near its bottom. Steam is injected into the top well, a steam chamber forms, and via gravity, the melted bitumen flows into the lower well and is pumped to the surface using artificial lift.

Both SAGD and CSS are used in the Cold Lake and Peace River deposits, while SAGD is the in situ technology of choice in the Athabasca deposit. The choice is based on a number of things including geology. The technologies combined currently produce just over one million barrels per day.

Research is underway on a number of other production technologies designed to optimize production and minimize water and energy use, including vapour extraction (VAPEX), and a form of in situ combustion known as toe to heel air injection (THAI).

Bitumen that has not been processed, or “upgraded,” can be used directly as asphalt. It must be diluted to travel by pipeline. Adding value, some producers upgrade their product into synthetic crude oil (SCO), which is a refinery feedstock. At these refineries it can be transformed into transportation fuels and other products.
Canada’s heavy oil and oil sands resources are often referred to as “the oil that technology made.” Without intensive production technology development, the industry would not exist as it does today. These technologies still continue to be advanced and optimized, improving recovery and reducing environmental impacts.

**Mapping the oil sands**

Alberta’s Industrial Heartland is over 78,550 acres in size, and is located in the northeast quadrant of the Greater Edmonton region in central Alberta. This region is key to the value added processing of Alberta’s oil sands resources into higher valued refined petroleum products and petrochemicals.
Government update

GOVERNMENT POLICY

Bitumen Royalty-in-Kind
To enhance Alberta’s value-add activities such as upgrading, refining, and petrochemical development, as well as to strengthen the provincial economy, the Government of Alberta is developing a Bitumen Royalty-in-Kind (BRIK) policy that will help encourage strategic value-add activity in the province based on the oil sands resource. As a demonstration of its commitment, the Government of Alberta released a Request for Proposals (RFP) on July 21, 2009, to procure a long-term contract to process or purchase a share of royalty volumes of bitumen.

As the resource owner, the Alberta government is entitled to take its royalty share of bitumen production-in-kind, as it does currently for conventional oil. The province intends to use a portion of its bitumen royalty volumes to supply a company on a commercial basis with an agreed-upon amount between 50,000 and 75,000 barrels per day of bitumen.

On Aug. 6, 2009, the government held a technical information session on the BRIK RFP process to provide clarification to interested parties. Parties were asked to submit their comments and suggestions for changes to the BRIK RFP by Aug. 31. On Sept. 30, 2009, the government will reissue the BRIK RFP based on the comments received and interested parties will then have until Dec. 2, 2009, to submit their proposals. The government is expected to announce the status of its RFP evaluation by March 31, 2010, and could potentially enter into an agreement in 2010. A BRIK program is expected to come into effect in 2012.

The RFP, detailed information on the BRIK process, and a list of questions and answers is available at www.energy.alberta.ca/BRIK.asp.

Clean Air Strategy
The Clean Air Strategic Alliance has submitted Recommendations for a Clean Air Strategy for Alberta to the Government of Alberta. The comprehensive report will help inform the development of an updated provincial clean air strategy to guide Alberta’s long-term approach to air quality management.

In drafting the 14 recommendations, stakeholders established several objectives to improve Alberta’s air quality. These include enhancements to regional management of air quality, better prevention and control of air pollution, and providing air-related information to all Albertans.

For more information on the recommendations of the Clean Air Strategic Alliance, visit www.casahome.org.

To learn more about air management in Alberta, visit www.environment.alberta.ca.

RESEARCH AND TECHNOLOGY

Carbon capture and storage
The Alberta government has completed its evaluation of projects applying for $2 billion in funding for the development of carbon capture and storage (CCS). As a result, government has identified a list of potential projects and is currently finalizing agreements with the most suitable proposed developments.

The first round of commercial-scale projects is expected to achieve annual CO₂ reductions by 2015 equivalent to taking approximately one million vehicles, or about one-third of all registered vehicles in the province, off the road.
A full list of projects that applied for funding is available at www.energy.alberta.ca.

The Alberta government has also released the final report of the Carbon Capture and Storage Development Council. Its recommendations are designed to be a blueprint for how the province can best implement CCS. The report can be found at www.energy.alberta.ca/Initiatives/1690.asp.

Chaired by former Syncrude president Jim Carter, the council reviewed the economic, infrastructure, and regulatory needs of CCS and how government and industry can work together now and in the future. The council included experts from industry, the research sector, and the provincial and federal governments.

The council, appointed by Premier Ed Stelmach in April of 2008, is part of the pledge made in Alberta’s 2008 Climate Change Strategy, which committed to reducing projected emissions by 200 megatonnes by 2050.

For more information on the CCS program, visit www.energy.alberta.ca.

Oil sands reclamation research

The Government of Alberta has awarded $1.5 million to the School of Energy and the Environment at the University of Alberta to support oil sands reclamation research.

The recently established Oil Sands Research and Information Network (OSRIN) will use the grant to conduct comprehensive reclamation-related research. OSRIN will help provide industry with the scientific foundation for the best environmental management practices in the oil sands.

This funding builds on a previous commitment made by the Government of Alberta to establish and operate OSRIN. The School for Energy and the Environment received a $3-million grant last year through the Energy Innovation Fund to launch the network to provide a structure for allocating related Government of Alberta research funds. Research will be targeted at improving reclamation and tailings management in the oil sands industry through better information, technology, or other systems.

Other information sources of interest

Two independent studies have found direct emissions from producing, transporting, and refining oil sands crude are in the same range as those of the other crudes refined in the United States. The Life-Cycle Analysis of North American and Imported Crude Oils is based on two independent studies that comprise the first robust comparison of domestic, imported, and oil sands crude processes in U.S. refineries. The research, conducted over the past year by U.S.-based consulting companies Jacobs Consultancy and TIAX LLC, was funded by the Alberta Energy Research Institute (AERI).

The studies found that direct greenhouse gas (GHG) emissions from the oil sands are generally about 10 per cent higher than direct emissions from other crudes in the United States. If cogeneration is taken into consideration, oil sands crudes would be similar to conventional crudes in terms of GHG emissions.

Previous studies used a simplified model representation for calculating direct emissions from different crude oil sources. This new research shows a wide range of emissions resulting from the production, transportation, and refining of oil. The range of emissions is based on several factors including location, reservoir depth, oil characteristics, and production technology.

To review the entire studies or for more information, visit www.aeri.ab.ca.

Upcoming events


World Heavy Oil Congress
Nov. 3—5, 2009, Puerto La Cruz, Venezuela

Cold Climate Construction Conference and Expo

National Buyer Seller Forum

Water Technologies Symposium 2010—WaterTech 2010
April 21—23, 2010, Banff, Alta.
What’s new in the oil sands
Key updates from fall 2009

The merger of Suncor Energy and Petro-Canada has closed, resulting in the creation of an energy giant. The "new" Suncor is now determining its next steps.

After raising new funds, Connacher Oil and Gas has re-activated its suspended Algar steam assisted gravity drainage (SAGD) project. Connacher said it anticipates that construction at Algar and the drilling of the 15 SAGD well pairs will take approximately 275 days from commencement of field activities, thus being completed in April 2010.

Imperial Oil, which recently announced its plans to go ahead with its $8-billion Kearl mine, is also dusting off plans for an expansion of its Cold Lake cyclic steam stimulation project and plans to apply for regulatory approval this year.

“We have just initiated public consultations in the Cold Lake area and we are advancing design of the project," said Imperial spokesman Pius Rolheiser.

Imperial first announced plans to apply for regulatory approval of the three-phase, 30,000 barrel per day expansion in 2004.

However, it delayed the plans, partially because the overheated Alberta economy was driving up construction costs. Now that construction and materials costs are down, it plans to proceed with the expansion.

Rolheiser said it will resubmit its earlier application because it has made three important design modifications to the expansion, which it calls its Nabiye project. (Nabiye is the Dene word for otter.)

“All three changes are designed to improve the environmental performance of the project,” he said.

FirstEnergy Capital has released a research document outlining its thoughts on what price of oil will loosen the purse strings of oil sands producers, announcing project commitments once again. Well, it looks like that is US$60 per barrel WTI.

FirstEnergy looked at the implied after-tax internal rates of return for non-upgraded bitumen projects, both mining and in situ, using what it calls “a conservative representation on a number of fronts.”

Times may be looking up for investment in the sector, at least on the production side.

“Based on the current price of oil layered together with a very weak natural gas price environment, we believe that bitumen projects are going to start coming back on the table, with the Kearl oil sands project the first to be announced,” wrote analysts William Lacey and Michael Dunn. “The next project of significance that we believe will come back onto the table will be Firebag 3 [68,000 barrels per day, about $1.2 billion left to be spent] in Q4 2009, and in all likelihood will be followed by Firebag 4 [68,000 barrels per day in 2010].”

Investment in upgrading capacity within Alberta is likely to remain stalled, however.

“At present, we believe it is more efficient to export bitumen to more complex refineries in the U.S. Upper Midwest and in the Gulf of Mexico,” the analysts explained. “This is not to say that future upgrading investments will not occur in Alberta; however, we believe any decision to construct new upgrading capacity will more likely be driven by political decisions and/or incentives than economic ones.”

A forecast slowdown in the pace of oil sands development coupled with the additional pipeline capacity expected to be on stream by the end of 2010 will result in spare crude oil pipeline capacity out of western Canada until 2019, says a new industry study.

Enbridge's Alberta Clipper and TransCanada’s Keystone and Keystone extension projects will provide additional capacity of 1.04 million barrels per day for a total of more than 2.8 million barrels per day of oil sands production. That will meet or exceed forecast supply for nearly a decade, according to the Canadian Association of Petroleum Producers’ (CAPP) annual crude oil and market forecast outlook.

Depending on the production schedule when the pipelines come on, the tolls will have to adjust to reflect that spare capacity, which will mean higher tolls for shippers in the early years, Greg Stringham, vice-president of markets and oil sands for the association, said in an interview. “It could be a significant cost to them as it goes forward.”

Research that benchmarks well-to-wheels life cycle greenhouse gas (GHG) emissions has found that direct emissions from producing, transporting, and refining oil sands crude are in the same range as those of other volumes refined in the United States.

Carbon-dioxide emissions generated from oil sands activities are on average about 10 per cent higher than competing U.S. crude imports, and were approximately the same as heavy oil produced in California, says the Alberta Energy Research Institute.

The findings contradict some previous studies that concluded GHG emissions from oil sands were as much as 40 per cent higher than those from other sources.

Husky Energy has no intention of shutting down its Tucker steam assisted gravity drainage project, said John Lau, Husky president and chief executive officer.
Asked by analysts recently if closing Tucker was in the cards, Lau delivered a swift “no,” followed by a brief pitch for the project, situated about 30 kilometres west of the town of Cold Lake, Alta.

“Tucker is one of the best projects, producing in the range of 3,000 to 5,000 barrels per day. We have no intention to push [production] up yet, because of volatility in the [oil] price, but we’ll definitely keep our options open.”

By year end, Husky hopes to see the project reach exit volumes of 5,000 to 6,000 barrels per day.

Officially launched in October 2006, Tucker was supposed to reach capacity of about 30,000 barrels per day within 18 to 24 months.

Further opening up Asian markets for growing oil sands production is a top strategic goal for producers, although pipelines that could support the expansion, such as proposals to Kitimat, B.C., are still a ways off, according to major pipeline operators.

Ian Anderson, president of Kinder Morgan Canada, told a TD Newcrest unconventional oil conference in July that the Kitimat option is on the company’s radar screen.

“It’s a great northern port option,” he said. “We stand with [Enbridge] in recognition of the viability of Kitimat and the attractiveness of Kitimat.”

He said, though, that incremental expansion south to the Port of Vancouver and increasing ship sizes over time is more in line with where the supply/demand economics will be, at least for the next decade.

Southern Pacific Resource Corp. has appointed BMO Capital Markets as its financial advisor to help evaluate the options to finance construction of the corporation’s first SAGD oil sands project,pegged at approximately $400 million.

Southern Pacific recently submitted the project application for its 80 per cent owned 12,000 barrel per day STP-McKay project north of Fort McMurray, close to Petro-Canada’s MacKay River project, running since 2002.

Almost exactly one year after Enbridge started construction on the Canadian leg of its Alberta Clipper pipeline, it has been the final go-ahead to continue the project into the United States. Alberta Clipper will have initial capacity of 450,000 barrels per day, connecting oil sands crude supplies with the U.S. Midwest by mid-2010.

In its approval, the U.S. Department of State said the pipeline will “[increase] trade with a stable and reliable ally,” and is “a positive economic signal during a difficult economic period.”

There has been an uproar from environmental groups, including this statement from Sierra Club executive director Carl Pope: “Importing dirty tar sands oil is not in our national interest.... At a time when concern is growing about the national security threat posed by global warming, it doesn’t make sense to open our gates to one of the dirtiest fuels on Earth.”

Inter Pipeline Fund says its $1.8-billion Corridor pipeline expansion project is now mechanically complete and all facilities have been successfully dry commissioned. Over 3.9 million person-hours have been invested in the project to date.

Remaining work includes minor remediation activities along the pipeline rights-of-way and wet commissioning of new facilities when oil is initially delivered into the system. This work will continue into 2010. The project connects Shell’s mining operations north of Fort McMurray with its upgrader in the Edmonton region. The expansion fits into current expansions underway at both sites.

As the Canadian business unit of Petrobank Energy and Resources merges with TriStar Oil and Gas to become PetroBakken Energy, a dominating force in Saskatchewan’s Bakken resource play, it’s business as usual for the company’s heavy oil business unit in Alberta and its demonstration of toe to heel air injection (THAI).

“It’s steady as she goes,” says Chris Bloomer, Petrobank’s senior vice-president and chief operating officer, heavy oil. The company believes that with the THAI process, it is on the verge of creating a new global solution for the extraction of heavy oil.

Petrobank’s three-well THAI pilot in the Athabasca oil sands has been operating since 2006, and although it has experienced its challenges, Bloomer says the company has confirmed that the process works.

Alberta Environment has issued Osum Oil Sands the final terms of reference for an environmental impact assessment (EIA) report on the company’s proposed 35,000 barrel per day Taiga steam assisted gravity drainage project near Cold Lake, Alta.

Pending regulatory approval, it is Osum’s intention to begin construction in the third quarter of 2011 with subsequent start-up expected in the second quarter of 2013 and first bitumen production in early 2014.

The final terms of reference is the regulators’ list of information it requires for Taiga’s EIA, which is to be followed by a formal application with Alberta’s Energy Resources Conservation Board.

Another one of the world’s largest oil companies is buying into the oil sands. For $1.9 billion, state-owned PetroChina, a subsidiary of China National Petroleum Corporation, will purchase 60 per cent ownership of Athabasca Oil Sands Corp.’s two proposed in situ projects.

The transaction is subject to federal review under foreign ownership rules.
# Project listings

Updated status of oil sands projects in Alberta

As of Sept. 4, 2009.

<table>
<thead>
<tr>
<th>COMPANY</th>
<th>CURRENT PROJECT</th>
<th>CAPACITY (bbl/d)</th>
<th>START-UP</th>
<th>REGULATORY STATUS</th>
<th>DEVELOPMENT PROGRESS</th>
<th>TECHNOLOGY</th>
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## Alberta Oilsands
### Athabasca Region — In Situ

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<tr>
<th>COMPANY</th>
<th>CURRENT PROJECT</th>
<th>CAPACITY (bbl/d)</th>
<th>START-UP</th>
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<th>TECHNOLOGY</th>
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<tbody>
<tr>
<td>Clearwater</td>
<td>Pilot</td>
<td>2,000</td>
<td>TBD</td>
<td>Announced</td>
<td>Application to be submitted before year-end. Reports new contingent resource estimate of 182.5 million barrels from Ryder Scott.</td>
<td>SAGD</td>
</tr>
<tr>
<td></td>
<td>Commercial Project</td>
<td>10,000</td>
<td>TBD</td>
<td>Announced</td>
<td>Company has reached an agreement with the Fort McMurray Regional Airport Commission that outlines royalties and warrants that AOS will grant the airport in exchange for confirmed access to certain lands.</td>
<td>SAGD</td>
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### Athabasca Oilsands

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<tr>
<th>COMPANY</th>
<th>CURRENT PROJECT</th>
<th>CAPACITY (bbl/d)</th>
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<th>DEVELOPMENT PROGRESS</th>
<th>TECHNOLOGY</th>
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<tbody>
<tr>
<td>Dover</td>
<td>Pilot</td>
<td>1,000-2,000</td>
<td>TBD</td>
<td>Applied</td>
<td>AOSC has entered into an agreement where PetroChina will acquire 60 per cent working interest in both projects for $1.9 billion.</td>
<td>SAGD</td>
</tr>
<tr>
<td>MacKay River</td>
<td>Pilot</td>
<td>2,200</td>
<td>TBD</td>
<td>Applied</td>
<td>Canadian Natural will decide in late 2009 or early 2010 when to proceed.</td>
<td>SAGD</td>
</tr>
<tr>
<td></td>
<td>Commercial Phase 1</td>
<td>35,000</td>
<td>2014</td>
<td>Announced</td>
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<td>SAGD</td>
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### BlackPearl Resources

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<tr>
<th>COMPANY</th>
<th>CURRENT PROJECT</th>
<th>CAPACITY (bbl/d)</th>
<th>START-UP</th>
<th>REGULATORY STATUS</th>
<th>DEVELOPMENT PROGRESS</th>
<th>TECHNOLOGY</th>
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</thead>
<tbody>
<tr>
<td>Blackrod</td>
<td>Pilot</td>
<td>500</td>
<td>2009</td>
<td>Application</td>
<td>2009 budget has been increased, assisting in further project development.</td>
<td>SAGD</td>
</tr>
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</table>

### Canadian Natural Resources

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<thead>
<tr>
<th>COMPANY</th>
<th>CURRENT PROJECT</th>
<th>CAPACITY (bbl/d)</th>
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<th>REGULATORY STATUS</th>
<th>DEVELOPMENT PROGRESS</th>
<th>TECHNOLOGY</th>
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</thead>
<tbody>
<tr>
<td>Birch Mountain</td>
<td>Phase 1</td>
<td>60,000</td>
<td>TBD</td>
<td>Announced</td>
<td></td>
<td>TBA</td>
</tr>
<tr>
<td></td>
<td>Phase 2</td>
<td>60,000</td>
<td>TBD</td>
<td>Announced</td>
<td></td>
<td>TBA</td>
</tr>
<tr>
<td>Grease</td>
<td>Phase 1</td>
<td>60,000</td>
<td>TBD</td>
<td>Announced</td>
<td></td>
<td>TBA</td>
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<tr>
<td>Kirby</td>
<td>Phase 1</td>
<td>45,000</td>
<td>TBD</td>
<td>Applied</td>
<td></td>
<td>SAGD</td>
</tr>
<tr>
<td></td>
<td>Phase 1</td>
<td>30,000</td>
<td>TBD</td>
<td>Announced</td>
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<td>SAGD</td>
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### Chevron Canada

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<tr>
<th>COMPANY</th>
<th>CURRENT PROJECT</th>
<th>CAPACITY (bbl/d)</th>
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<th>TECHNOLOGY</th>
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<tbody>
<tr>
<td>Els River</td>
<td></td>
<td>100,000</td>
<td>2015</td>
<td>Announced</td>
<td>Chevron has decided to place Els River on hold. The company does not believe the project will provide the necessary returns in the foreseeable future to compete for capital investment relative to others in its global portfolio. Project staff will remain in place until shutdown work concludes by year-end.</td>
<td>TBA</td>
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### ConocoPhillips Canada

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<tr>
<th>COMPANY</th>
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<tbody>
<tr>
<td>Surmont</td>
<td>Phase 1</td>
<td>27,000</td>
<td>2008</td>
<td>Operating</td>
<td>Engineering underway.</td>
<td>SAGD</td>
</tr>
<tr>
<td></td>
<td>Phase 2</td>
<td>83,000</td>
<td>2014 - 2016</td>
<td>Approved</td>
<td></td>
<td>SAGD</td>
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### Devon Canada

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<tr>
<th>COMPANY</th>
<th>CURRENT PROJECT</th>
<th>CAPACITY (bbl/d)</th>
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<th>TECHNOLOGY</th>
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</thead>
<tbody>
<tr>
<td>Jackfish</td>
<td>Phase 1</td>
<td>35,000</td>
<td>2008</td>
<td>Operating</td>
<td>Devon reports construction is about 40 per cent complete.</td>
<td>SAGD</td>
</tr>
<tr>
<td></td>
<td>Phase 2</td>
<td>35,000</td>
<td>2011</td>
<td>Approved</td>
<td></td>
<td>SAGD</td>
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### Encana

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<th>COMPANY</th>
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<tr>
<td>Borealis</td>
<td>Phase 1</td>
<td>35,000</td>
<td>TBD</td>
<td>Applied</td>
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<td>SAGD</td>
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<tr>
<td></td>
<td>Phase 2</td>
<td>32,500</td>
<td>TBD</td>
<td>Announced</td>
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<tr>
<td></td>
<td>Phase 3</td>
<td>32,500</td>
<td>TBD</td>
<td>Announced</td>
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<td>SAGD</td>
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<tr>
<td>Christina Lake</td>
<td>Phase 1A</td>
<td>10,000</td>
<td>2002</td>
<td>Operating</td>
<td></td>
<td>SAGD</td>
</tr>
<tr>
<td></td>
<td>Phase 1B</td>
<td>8,800</td>
<td>2008</td>
<td>Operating</td>
<td></td>
<td>SAGD</td>
</tr>
<tr>
<td></td>
<td>Phase 1C</td>
<td>40,000</td>
<td>2011</td>
<td>Under construction</td>
<td>EnCana reports Phase 1C remains on schedule and on budget. Phase 1D to be sanctioned in Q4-09.</td>
<td>SAGD</td>
</tr>
<tr>
<td></td>
<td>Phase 1D</td>
<td>40,000</td>
<td>TBD</td>
<td>Approved</td>
<td></td>
<td>SAGD</td>
</tr>
<tr>
<td></td>
<td>Phase 1E</td>
<td>40,000</td>
<td>TBD</td>
<td>Announced</td>
<td>Regulatory applications for 1E-1G expected in Q3-09.</td>
<td>SAGD</td>
</tr>
<tr>
<td></td>
<td>Phase 1F</td>
<td>40,000</td>
<td>TBD</td>
<td>Announced</td>
<td></td>
<td>SAGD</td>
</tr>
<tr>
<td></td>
<td>Phase 1G</td>
<td>40,000</td>
<td>TBD</td>
<td>Announced</td>
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<td>SAGD</td>
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<td>COMPANY Name</td>
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<td>Foster Creek</td>
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<td></td>
<td>Debuttlingecking</td>
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<td>Phase 1C – Stage 1</td>
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<td>Commission nearing completion. Production ramping up.</td>
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<td>Phase 1E</td>
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<td>Regulatory applications for 1E-1G expected in Q3-09.</td>
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<td>Kirby</td>
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<td>E-T ENERGY</td>
<td>Poplar Creek</td>
<td>10,000</td>
<td>2011</td>
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<td>Expanded field test of ET-DSP complete.</td>
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<td>Hangingstone</td>
<td>Phase 1</td>
<td>10,000</td>
<td>2011</td>
<td>Application</td>
<td>Application for in situ combustion technology submitted in June 2009.</td>
<td>COGD</td>
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<td>GRIZZLY OIL SANDS</td>
<td>Algar Lake</td>
<td>10,000</td>
<td>TBD</td>
<td>Announced</td>
<td>Grizzly is completing engineering and updating reservoir characterization to include the resource identified during the past winter’s drilling program. Plan is to file a regulatory application by year-end.</td>
<td>SAGD</td>
</tr>
<tr>
<td>HUSKY ENERGY</td>
<td>McMullen</td>
<td>775</td>
<td>TBD</td>
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<tr>
<td></td>
<td>Sunrise</td>
<td>50,000</td>
<td>TBD</td>
<td>Approved</td>
<td>Project partners will review project sanction by the end of 2009 and move to final approvals in the first half of 2010. Work continues on the optimization of Sunrise in order to simplify the scope and take advantage of declining construction price levels.</td>
<td>SAGD</td>
</tr>
<tr>
<td></td>
<td>Phase 3</td>
<td>50,000</td>
<td>TBD</td>
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<tr>
<td></td>
<td>Phase 4</td>
<td>50,000</td>
<td>TBD</td>
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<td></td>
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<tr>
<td>IVANHOE ENERGY</td>
<td>Tamarack</td>
<td>SAGD with HTL upgrading</td>
<td>20,000</td>
<td>2013 Announced</td>
<td>Engineering work continues. Front-end engineering and design targeted for completion in Q4.</td>
<td>SAGD</td>
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<tr>
<td>JAPAN CANADA OIL SANDS</td>
<td>Hangingstone</td>
<td>Pilot</td>
<td>10,000</td>
<td>2002 Operating</td>
<td></td>
<td>SAGD</td>
</tr>
<tr>
<td></td>
<td>Phase 1</td>
<td>35,000</td>
<td>TBD</td>
<td>Disclosed</td>
<td>Preparing regulatory application and conducting environmental impact assessment.</td>
<td>SAGD</td>
</tr>
<tr>
<td>KOREA NATIONAL OIL CORPORATION</td>
<td>BlackGold</td>
<td>Phase 1</td>
<td>10,000</td>
<td>TBD Announced</td>
<td>Approval anticipated this year. Once that is in place, will start engineering, procurement and construction.</td>
<td>SAGD</td>
</tr>
<tr>
<td></td>
<td>Phase 2</td>
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<tr>
<td>LARICINA ENERGY</td>
<td>Germain</td>
<td>SAGD pilot</td>
<td>1,800</td>
<td>2012 Application</td>
<td>Laricina reports the pilot is “development ready.”</td>
<td>SAGD</td>
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<tr>
<td></td>
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<td>TBD</td>
<td>Announced</td>
<td></td>
<td>SAGD</td>
</tr>
<tr>
<td></td>
<td>Saleski</td>
<td>Carbonate SAGD demonstration</td>
<td>1,800</td>
<td>2011 Approved</td>
<td>ERCB approval in hand. Alberta Environment approval expected shortly.</td>
<td>SAGD</td>
</tr>
<tr>
<td></td>
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<td>TBD</td>
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<tr>
<td>MEG ENERGY</td>
<td>Christine Lake</td>
<td>Phase 1</td>
<td>3,000</td>
<td>2008 Operating</td>
<td>Construction nearing completion.</td>
<td>SAGD</td>
</tr>
<tr>
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<td>Phase 2</td>
<td>22,000</td>
<td>2009</td>
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<td>Phase 2B</td>
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<td>TBD</td>
<td>Application</td>
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<tr>
<td></td>
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<tr>
<td>NEXEN</td>
<td>Long Lake</td>
<td>Phase 1</td>
<td>72,000</td>
<td>2007 Operating</td>
<td>Nexen says ramp-up is progressing and the reservoir continues to perform as expected given the amount of steam that has been injected. Steam volumes have been limited by ability to treat water. Scheduled downtime in Q3 for maintenance.</td>
<td>SAGD</td>
</tr>
</tbody>
</table>
### Alberta Oil Sands Industry Quarterly Update

#### Long Lake (cont’d)
- **Phase 2**: 72,000 TBD
  - Sanctioning deferred until late 2009.
- **Phase 3**: 72,000 TBD
- **Phase 4**: TBD

#### Long Lake South
- **Phase 1**: 70,000 TBD
  - Approved
- **Phase 2**: 70,000 TBD
  - Approved

#### N-SOLV
- **Pilot plant**: 2,000 2010
  - Announced
  - Patch is in early stages of insolvency. Project is on hold until it changes hands.

#### Patch International
- **Ells River**: 10,000 TBD
  - Announced
  - Patch is in early stages of insolvency. Project is on hold until it changes hands.

#### PetroBank Energy and Resources
- **Whitesands**
  - **Pilot**: 1,900
    - 2006
    - Operating
  - **Expansion**: 1,900
    - 2008
    - Approved
    - Expansion on hold in favour of capitalizing on existing infrastructure.

#### Petro-Canada (Suncor)
- **Chard**
  - **Phase 1**: 40,000 TBD
    - Announced
    - Merger with Suncor has closed.
- **Lewis**
  - **Phase 1**: 40,000 TBD
    - Disclosed
  - **Phase 2**: 40,000 TBD
    - Disclosed

#### Southern Pacific Resource
- **STP McKay**: 10,000 TBD
  - Announced
  - New resource evaluation by McDaniel and Associates says project has 188.4 million barrels of proved-plus-probable reserves, a 50 per cent increase over the previous year. Alberta Environment has stated application is administratively complete.

#### StatoilHydro Canada
- **Kai Kos Dehseh-Leismer**
  - **Demonstration**: 10,000
    - 2009
    - Under construction
    - Construction approximately 63 per cent complete, reports on track for first steam in the latter part of 2010.
  - **Commercial**
    - 20,000 TBD
    - Applied
      - SAGD
  - **Corner**
    - 40,000 TBD
    - Applied
      - SAGD
  - **Hangingstone**
    - 20,000 TBD
    - Applied
      - SAGD
  - **South Leismer**
    - 20,000 TBD
    - Applied
      - SAGD

#### Suncor Energy
- **Firebag**
  - **Phase 1**: 33,000
    - 2004
    - Operating
    - Merger with Petro-Canada has closed.
  - **Phase 2**: 35,000
    - 2006
    - Operating
  - **Cogeneration and Expansion**: 25,000
    - 2007
    - Operating
  - **Phase 3**: 52,500
    - TBD
    - Suspended
    - Project is now in “safe mode,” awaiting resumption of expansion work.
  - **Phase 4**: 62,500
    - TBD
    - Application
      - Construction of the Firebag sulphur plant, originally targeted for completion in Q2-09 is now scheduled to be finished in Q3-09. Delay is due to delivery schedule of modules from vendors.
  - **Phase 5**: 62,500
    - TBD
    - Application
  - **Phase 6**: 62,500
    - TBD
    - Application
  - **Stages 3-6 Debuttletucking**: 23,500
    - TBD
    - Application

#### Sunshine Oil Sands
- **Harper pilot**
  - Production mobility test
    - N/Q
    - TBD
    - Announced
  - **Legend Lake**
    - **Phase 1**: 10,000 TBD
      - Announced
    - **Phase 2 (two stages)**: 40,000 TBD
      - Announced
  - **West Ellis**
    - **Phase 1**: 10,000 TBD
      - Announced
    - **Phase 2 (two stages)**: 40,000 TBD
      - Announced
    - **Phase 3**: 30,000 TBD
      - Announced
### COMPANY

<table>
<thead>
<tr>
<th>COMPANY</th>
<th>CURRENT PROJECT</th>
<th>CAPACITY (bbl/d)</th>
<th>START-UP</th>
<th>REGULATORY STATUS</th>
<th>DEVELOPMENT PROGRESS</th>
<th>TECHNOLOGY</th>
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<tr>
<td><strong>THICKWOOD</strong></td>
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<td><strong>TOTAL E&amp;P CANADA</strong></td>
<td>Phase 1</td>
<td>2,000</td>
<td>2004</td>
<td>Suspended</td>
<td>Production suspended reportedly due to failure to reach target levels. Reserves debooked. Total to complete study into future options in the third quarter.</td>
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<td><strong>VALUE CREATION GROUP</strong></td>
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### ATMABASCA REGION – MINING

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<th>COMPANY</th>
<th>Phase 1A</th>
<th>100,000</th>
<th>2010/11</th>
<th>Under construction</th>
<th>Shell says the project is at peak construction, with about 10,000 workers on the combined mine and upgrader sites.</th>
<th>Mining</th>
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<tr>
<td>Jackpine</td>
<td>Phase 1B</td>
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<td>Expansion and Debottleneck</td>
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<td>2002</td>
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<td>Muskeg River</td>
<td>Phase 1</td>
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<td>Final investment decision delayed.</td>
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<td>Phase 2</td>
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<td>TBD</td>
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<td><strong>CANADIAN NATURAL RESOURCES</strong></td>
<td>Phase 1</td>
<td>135,000</td>
<td>2008</td>
<td>Operating</td>
<td>Rates continue to fluctuate as ramp-up continues but has at times exceeded 110,000 barrel per day capacity.</td>
<td>Mining</td>
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<td>Phase 2</td>
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<td><strong>IMPERIAL OIL</strong></td>
<td>Phase 1</td>
<td>100,000</td>
<td>TBD</td>
<td>Approved</td>
<td>Imperial’s board has sanctioned Kearl. Site access clearing and muskeg drainage underway.</td>
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<td>100,000</td>
<td>TBD</td>
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<td>Mining</td>
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<tr>
<td><strong>PETRO-CANADA (SUNCOR)</strong></td>
<td>Phase 1</td>
<td>165,000</td>
<td>TBD</td>
<td>Approved</td>
<td>Merger with Suncor complete. Sanction on hold until commodity prices and financial markets stabilize.</td>
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<tr>
<td></td>
<td>Debottlenecking</td>
<td>25,000</td>
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<td><strong>SUNCOR ENERGY</strong></td>
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<td>Millennium</td>
<td>294,000</td>
<td>1967</td>
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<td>Steepbank Debottleneck Phase 3</td>
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<td>Millennium Debottleneck</td>
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<td>2008</td>
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<td>North Steepbank Extension</td>
<td></td>
<td>2010</td>
<td>Under construction</td>
<td>Cost now expected to be about $980 million as a result of labour shortages and premiums incurred to maintain project schedule.</td>
<td>Mining</td>
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<td>Voyageur South</td>
<td>120,000</td>
<td>TBD</td>
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<td><strong>SYNCRUDE</strong></td>
<td>Stages 1 and 2</td>
<td>290,700</td>
<td>1978</td>
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<td>Stage 3 Expansion</td>
<td>116,300</td>
<td>2006</td>
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<td><strong>TOTAL E&amp;P CANADA</strong></td>
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<td>50,000</td>
<td>TBD</td>
<td>Applied</td>
<td>Investment decision targeted for 2010, depending on results of regulatory process.</td>
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<tr>
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<td>TBD</td>
<td>Applied</td>
<td>Mining</td>
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<tr>
<td></td>
<td>Phase 3 (South)</td>
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<tr>
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<td>Phase 4 (South)</td>
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<td>Announced</td>
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<tr>
<td></td>
<td>Northern Lights</td>
<td></td>
<td></td>
<td></td>
<td>Northern Lights asset is being integrated into Total portfolio. Will reinstate after new timing is determined.</td>
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</tr>
</tbody>
</table>
### UTS/TECK COMINCO

<table>
<thead>
<tr>
<th>COMPANY</th>
<th>CURRENT PROJECT</th>
<th>CAPACITY (bbl/d)</th>
<th>START-UP</th>
<th>REGULATORY STATUS</th>
<th>DEVELOPMENT PROGRESS</th>
<th>TECHNOLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equinox</td>
<td>Phase 1</td>
<td>50,000</td>
<td>TBD</td>
<td>Public disclosure</td>
<td>Baseline environment and historical resource studies complete. Project evaluation will follow completion of Frontier scoping studies later in 2009.</td>
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<tr>
<td>Frontier</td>
<td>Phase 1</td>
<td>100,000</td>
<td>TBD</td>
<td>Public disclosure</td>
<td>UTS and Teck intend to initiate a design basis memorandum for Frontier later in 2009 with an application planned for late 2010 or early 2011. Finalization of 2010 budget expenditures planned for Q4.</td>
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<td></td>
<td>Phase 2</td>
<td>60,000</td>
<td>TBD</td>
<td>Public disclosure</td>
<td></td>
<td>Mining</td>
</tr>
</tbody>
</table>

### COLD LAKE REGION – IN SITU

<table>
<thead>
<tr>
<th>BR OIL SANDS (SHELL)</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Orion</td>
<td></td>
<td>10,000</td>
<td>2008</td>
<td>Operating</td>
<td></td>
<td>SAGD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10,000</td>
<td>TBD</td>
<td>Approved</td>
<td></td>
<td>SAGD</td>
</tr>
</tbody>
</table>

### CANADIAN NATURAL RESOURCES

| Primrose/Wolf Lake         | Wolf Lake                | 13,000           | 1985     | Operating         |                      | CSS      |
|                            | Wolf Lake SAGD           | 5,500            | TBD      | Application       |                      | SAGD     |
|                            | Primrose South           | 45,000           | 1985     | Operating         |                      | CSS      |
|                            | Primrose North           | 30,000           | 2006     | Operating         |                      | CSS      |
|                            | Primrose East (Burnt Lake)| 32,000           | 2009     | Operating         |                      | CSS      |
|                            | CSS Follow-up Process    | 25,000           | TBD      | Application       |                      | CSS      |

### HUSKY ENERGY

| Canbou                    | Demonstration Project    | 10,000           | TBD      | Approved          | Husky has implemented a decrease in bitumen production in order to focus on steam chamber development. | SAGD     |
|                          |                          |                  |          |                   |                      |          |
| Tucker                    | Phase 1                  | 30,000           | 2006     | Operating         |                      | SAGD     |

### IMPERIAL OIL

| Cold Lake                 | Phases 1-10: Leming, Maskwa, Mahihkan | 110,000         | 1985     | Operating         |                      | CSS      |
|                          | Phases 11-13: Mahikeses       | 30,000           | 2003     | Operating         |                      | CSS      |
|                          | Phases 14-16: Nabiye, Mahihkan North | 30,000           | TBD      | Approved          | Imperial will re-submit its Nabiye project after design modifications to improve environmental performance. | CSS      |

### KOCH EXPLORATION CANADA

| Gemini                    | SAGD Project              | 10,000           | TBD      | Application       | Permit application filed on June 15, 2009. Koch is performing detailed engineering design work and public consultation is ongoing. | SAGD     |

### OSUM OIL SANDS

| Taiga                     | SAGD Project              | 25,000 - 35,000  | 2014     | Disclosed         | Alberta Environment has issued its final terms of reference for Osuri’s environmental impact assessment, its list of information required. EIA to be followed by an application. | SAGD     |

### PENGROWTH ENERGY TRUST

| Lindbergh                | SAGD Pilot                | 2,500            | TBD      | Application       | Pengrowth says development of the pilot remains important, as commercial development is ready to move forward once prices improve. | SAGD     |

### PEACE RIVER REGION – IN SITU

<table>
<thead>
<tr>
<th>ANDORA ENERGY (PAN ORIENT)</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawn Lake</td>
<td>SAGD Demonstration</td>
<td>1,400</td>
<td>TBD</td>
<td>Application</td>
<td>All season access to the site is currently underway, expected to be complete in 2009. Timing for equipment procurement, project drilling, and construction TBD.</td>
<td>SAGD</td>
</tr>
</tbody>
</table>

### NORTH PEACE ENERGY

| Red Earth                 | CSS Pilot                | 1,001            | 2008     | Operating         | Project has been operating since the start of 2009. North Peace is not ready to make any definitive conclusions on anticipated commercial steam injectivity or production rates. | CSS      |
|                          | Expansion                | 3,000            | TBD      | Announced         | North Peace is re-assessing its capital budget for the second half of 2009 and exploring various alternatives for obtaining funds to progress future capital requirements. | CSS      |

### PENN WEST ENERGY TRUST

| Seal                      | CSS Pilot                | 75               | TBD      | Application       |                      | CSS      |

### SHELL CANADA

| Carmon Creek              | Cadotte Lake             | 12,501           | 1986     | Operating         | Shell has re-initiated stakeholder consultation, by way of a public information document. It is preparing an environmental impact assessment for a new application targeted for later this year. | CSS      |
|                          | Phase 1                  | 37,500           | TBD      | Announced         |                      | CSS      |
|                          | Phase 2                  | 50,000           | TBD      | Announced         |                      | CSS      |

### ATHABASCA REGION – UPGRADING

<table>
<thead>
<tr>
<th>CANADIAN NATURAL RESOURCES</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizon</td>
<td>Phase 1</td>
<td>135,000</td>
<td>2008</td>
<td>Operating</td>
<td>Rates continue to fluctuate as ramp-up continues but has at times exceeded 110,000 barrel per day capacity.</td>
<td>Upgrader</td>
</tr>
<tr>
<td></td>
<td>Phases 2 and 3</td>
<td>135,000</td>
<td>TBD</td>
<td>Approved</td>
<td></td>
<td>Upgrader</td>
</tr>
</tbody>
</table>
## Alberta Oil Sands Industry Quarterly Update

### Horizon (cont’d)
- **Phase 4**: 145,000 TBD - Announced
- **Phase 5**: 162,000 TBD - Announced

### Nexen
- **Long Lake**
  - **Phase 1**: 72,000 2008 - Operating
  - **Phase 2**: 72,000 TBD - Approved
  - **Phase 3 (TBD - Announced)
  - **Phase 4**: 72,000 TBD - Announced
  - **Phase 5**: 72,000 TBD - Announced
  - **Phase 6**: 72,000 TBD - Announced

### Suncor Energy
- **Base U1 and U2**: 281,000 1967 - Operating
- **Millennium Vacuum Unit**: 43,000 2005 - Operating
- **Millennium Coker Unit**: 116,000 2008 - Operating
- **Voyageur**
  - **Phase 1**: 156,000 TBD - Approved
  - **Phase 2**: 78,000 TBD - Approved

### Syncrude
- **Mildred Lake**
  - **Stages 1 and 2**: 290,700 1978 - Operating
  - **Stage 3 Expansion**: 116,300 2006 - Operating
  - **Stage 3 Debottleneck**: 46,500 TBD - Announced
  - **Stage 4 Expansion**: 139,500 TBD - Announced

### Value Creation
- **Terre de Grace Upgrader**
  - **Pilot**: 10,000 TBD - Application
  - **Phase 1**: 2,000 TBD - Announced
  - **Phase 2**: 10,000 TBD - Announced

### Industrial Heartland Region – Upgrading and Refining

#### Athabasca Oil Sands Project
- **Scotford Upgrader 1**
  - **Phase 1**: 155,000 2003 - Operating
  - **Expansion**: 90,000 2010 - Under construction
- **Scotford Upgrader 2**
  - **Phase 1**: 100,000 TBD - Applied
  - **Phase 2**: 100,000 TBD - Application
  - **Phase 3**: 100,000 TBD - Application
  - **Phase 4**: 100,000 TBD - Application

#### BA Energy
- **Heartland Upgrader**
  - **Phase 1**: 54,400 TBD - Approved
  - **Phase 2**: 54,400 TBD - Approved
  - **Phase 3**: 54,400 TBD - Approved

#### North West Upgrading
- **Upgrader**
  - **Phase 1**: 50,000 TBD - Approved
  - **Phase 2**: 50,000 TBD - Approved
  - **Phase 3**: 50,000 TBD - Approved

#### Petro-Canada (Suncor)
- **Fort Hills Upgrader**
  - **Phase 1**: 165,000 TBD - Approved
- **Strathcona Refinery Conversion**
  - **Phases 2 and 3**: 175,000 TBD - Approved
  - **Conversion**: 135,000 2008 - Operating

#### StatoilHydro Canada
- **StatoilHydro Upgrader**
  - **Phase 1**: 75,000 TBD - Withdrawn
  - **Phase 2**: 175,000 TBD - Withdrawn

#### Total E&P Canada
- **Northern Lights Upgrader**
  - **Phase 1**: 56,600 TBD - Withdrawn
  - **Phase 2**: 56,600 TBD - Withdrawn
- **Total Upgrader**
  - **Phase 1**: 150,000 TBD - Application
  - **Phase 2**: 95,000 TBD - Application
  - **Debottlenecking**: 50,000 TBD - Application

### Development Progress
- **Upgrader**
- **Merger with Petro-Canada closed.**
- **Voyageur has been wound down into “safe mode,” awaiting resumption of expansion work.**
- **Major maintenance on new coker completed, mining operations reportedly on improving trend from previously constrained bitumen supply.**
- **Approval anticipated in the short term. Working on financing.**
- **Site preparation complete. Focus is on commercial agreements.**
- **Construction decision on Fort Hills upgrader has been deferred.**
- **Merger with Suncor has closed.**
- **Site is in the process of answering supplemental information requests related to its application.**
API
An American Petroleum Institute measure of liquid gravity. Water is 10 degrees API, and a typical light crude is from 35 to 40. Bitumen is 7.5 to 8.5.

Barrel
The traditional measurement for crude oil volumes. One barrel equals 42 US gallons (159 litres). There are 6.29 barrels in one cubic metre of oil.

Bitumen
Naturally occurring, viscous mixture of hydrocarbons that contains high levels of sulphur and nitrogen compounds. In its natural state, it is not recoverable at a commercial rate through a well because it is too thick to flow. Bitumen typically makes up about 10 per cent by weight of oilsand, but saturation varies.

Condensate
Mixture of extremely light hydrocarbons recoverable from gas reservoirs. Condensate is also referred to as a natural gas liquid, and is used as a diluent to reduce bitumen viscosity for pipeline transportation.

Cyclic steam stimulation
For several weeks, high-pressure steam is injected into the formation to soften the oilsand before being pumped to the surface for separation. The pressure created in the underground environment causes formation cracks that help move the bitumen to producing wells. After a portion of the reservoir has been saturated, the steam is turned off and the reservoir is allowed to soak for several weeks. Then the production phase brings the bitumen to the surface.

Density
The heaviness of crude oil, indicating the proportion of large, carbon-rich molecules, generally measured in kilograms per cubic metre (kg/m³) or degrees on the American Petroleum Institute (API) gravity scale; in western Canada, oil up to 900 kg/m³ is considered light to medium crude—oil above this density is deemed as heavy oil or bitumen.

Diluent
see Condensate

Established recoverable reserves
Reserves recoverable under current technology and present and anticipated economic conditions, plus that portion of recoverable reserves that is interpreted to exist, based on geological, geophysical, or similar information, with reasonable certainty.

Established reserves
Reserves recoverable with current technology and present and anticipated economic conditions specifically proved by drilling, testing, or production, plus the portion of contiguous recoverable reserves that are interpreted to exist from geological, geophysical, or similar information with reasonable certainty.

Extraction
A process, unique to the oil sands industry, which separates the bitumen from the oilsand using hot water, steam, and caustic soda.

Froth treatment
The means to recover bitumen from the mixture of water, bitumen, and solids “froth” produced in hot water extraction (in mining-based recovery).

Gasification
A process to partially oxidize any hydrocarbon, typically heavy residues, to a mixture of hydrogen and carbon monoxide. Can be used to produce hydrogen and various energy byproducts.

Greenhouse gases
Gases commonly believed to be connected to climate change and global warming. CO₂ is the most common, but greenhouse gases also include other light hydrocarbons (such as methane) and nitrous oxide.

Initial established reserves
Established reserves prior to the deduction of any production.

Initial volume in place
The volume calculated or interpreted to exist in a reservoir before any volume has been produced.

In situ
Latin for “in place.” In situ recovery refers to various methods used to recover deeply buried bitumen deposits.

In situ combustion
A displacement enhanced oil recovery method. It works by generating combustion gases (primarily CO and CO₂) downhole, which then “pushes” the oil towards the recovery well.

Lease
A legal document from the province of Alberta giving an operator the right to extract bitumen from the oilsand existing within the specified lease area. The land must be reclaimed and returned to the Crown at the end of operations.
Muskeg
A water-soaked layer of decaying plant material, one to three metres thick, found on top of the overburden.

Oil Sands
Bitumen-soaked sand, located in four geographic regions of Alberta: Athabasca, Wabasca, Cold Lake, and Peace River. The Athabasca deposit is the largest, encompassing more than 42,340 square kilometres. Total deposits of bitumen in Alberta are estimated at 1.7 trillion to 2.5 trillion barrels.

Overburden
A layer of sand, gravel, and shale between the surface and the underlying oil sand. Must be removed before oil sands can be mined. Overburden underlies muskeg in many places.

Pilot plant
Small model plant for testing processes under actual production conditions.

Proven recoverable reserves
Reserves that have been proven through production or testing to be recoverable with existing technology and under present economic conditions.

Reclamation
Returning disturbed land to a stable, biologically productive state. Reclaimed property is returned to the province of Alberta at the end of operations.

Remaining established reserves
Initial reserves less cumulative production.

Royalty
The Crown’s share of production or revenue. About three quarters of Canadian crude oil is produced from lands, including the oil sands, on which the Crown holds mineral rights. The lease or permit between the developer and the Crown sets out the arrangements for sharing the risks and rewards.

Steam assisted gravity drainage (SAGD)
An in situ production process using two closely spaced horizontal wells: one for steam injection and the other for production of the bitumen/water emulsion.

Synthetic crude oil
A manufactured crude oil comprised of naphtha, distillate, and gas oil-boiling range material. Can range from high-quality, light sweet bottomless crude to heavy, sour blends.

Tailings
A combination of water, sand, silt, and fine clay particles that is a byproduct of removing the bitumen from the oil sands.

Tailings settling basin
The primary purpose of the tailings settling basin is to serve as a process vessel allowing time for tailings water to clarify and silt and clay particles to settle, so the water can be reused in extraction. The settling basin also acts as a thickener, preparing mature fine tails for final reclamation.

Thermal recovery
Any process by which heat energy is used to reduce the viscosity of bitumen in situ to facilitate recovery.

Toe-to-heel air injection (THAI)
An in situ combustion method for producing heavy oil and oil sand. In this technique, combustion starts from a vertical well, while the oil is produced from a horizontal well having its toe in close proximity to the vertical air-injection well. This production method is a modification of conventional fire flooding techniques in which the flame front from a vertical well pushes the oil to be produced from another vertical well.

Truck-and-shovel mining
Large electric or hydraulic shovels are used to remove the oil sand and load very large trucks. The trucks haul the oil sand to dump pockets where it is conveyed or pipelined to the extraction plant. Trucks and shovels are more economic to operate than the bucket-wheel reclaimers and draglines they have replaced at oil sands mines.

Upgrading
The process of converting heavy oil or bitumen into synthetic crude either through the removal of carbon (coking) or the addition of hydrogen (hydroconversion).

Vapour extraction (VAPEX)
VAPEX is a non-thermal recovery method that involves injecting a gaseous hydrocarbon solvent into the reservoir where it dissolves into the sludge-like oil, which becomes less viscous (or more fluid) before draining into a lower horizontal well and being extracted.

Viscosity
The ability of a liquid to flow. The lower the viscosity, the more easily the liquid will flow.
Oil Sands Producers

- Alberta Oilsands
  www.aboilsands.ca
- Albion Sands Energy
  www.albion sands.ca
- Andora Energy
  www.andoraenergy.com
- Athabasca Oil Sands
  www.aosc.ca
- Baytex Energy
  www.baytex.ab.ca
- Canadian Natural Resources
  www.cnrl.com
- Chevron Canada
  www.chevron.ca
- Connacher Oil and Gas
  www.connacheroil.com
- ConocoPhillips Canada
  www.conocophillips.ca
- Devon Canada
  www.dvn.com
- Encana
  www.encana.com
- Enerplus Resources Fund
  www.enerplus.com
- E-T Energy
  www.e-energy.com
- Excelsior Energy
  www.excelsiorenergy.com
- Husky Energy
  www.huskyenergy.ca
- Imperial Oil
  www.imperialoil.ca
- Ivanhoe Energy
  www.ivanhoe-energy.com
- Japan Canada Oil Sands
  www.jacos.com
- Laricina Energy
  www.laricinaenergy.com
- Marathon Oil
  www.marathon.com
- MEG Energy
  www.megenergy.com
- Nexen
  www.nexeninc.com
- North Peace Energy
  www.northpce.com
- North West Upgrading
  www.northwestupgrading.com
- N-Solv
  www.n-solv.com
- Occidental Petroleum Corporation
  www.oxy.com
- Oilsands Quest
  www.oilsandsquest.com
- Opti Canada
  www.opticanada.com
- OSUM Oil Sands
  www.osumcorp.com
- Patch International
  www.patchenergy.com
- Pan Orient Energy
  www.panorient.ca
- Pengrowth Energy Trust
  www.pengrowth.com
- Petro-Canada
  www.petro-canada.com
- Petrobank Energy and Resources
  www.petrobank.com
- Shell Canada
  www.shell.ca
- Southern Pacific Resource
  www.sphpacific.com
- StatoilHydro Canada
  www.statoilhydro.com
- Suncor Energy
  www.suncor.com
- Sunshine Oilsands
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- Syncrude
  www.syncrude.ca
- Talisman Energy
  www.talisman-energy.com
- Teck Cominco
  www.teckcominco.com
- Total E&P Canada
  www.total-ep-canada.com
- UTS Energy
- Value Creation Group
- Alberta Building Trades Council
  www.albertabuildingtrades.com
- Alberta Chamber of Resources
  www.acr-alberta.com
- Alberta Chambers of Commerce
  www.abchamber.ca
- Alberta Energy
  www.energy.gov.ab.ca
- Alberta Energy Research Institute
  www.aeri.ab.ca
- Alberta Environment
  www.environment.alberta.ca
- Alberta Finance and Enterprise
  www.finance.gov.ab.ca
- Alberta Research Council
  www.arc.ab.ca
- Alberta's Industrial Heartland Association
  www.industrialheartland.com
- Canadian Association of Geophysical Contractors
  www.cagc.ca
- Canadian Association of Petroleum Producers
  www.capp.ca
- Canadian Heavy Oil Association
  www.choa.ab.ca
- Canadian Oil Sands Network for Research and Development
  www.conrad.ab.ca
- Energy Resources Conservation Board
  www.ercb.ca
- Lakeland Industry and Community Association
  www.lica.ca
- Natural Resources Conservation Board
  www.nrcb.gov.ab.ca
- Oil Sands Developers Group
  www.oilandsdevelopers.ca
- Petroleum Technology Alliance Canada
  www.ptac.org

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