Canada has the third-largest oil reserves in the world, after Saudi Arabia and Venezuela. Of Canada’s 174 billion barrels of oil reserves, 170 billion barrels are located in Alberta, and about 169 billion barrels are recoverable from bitumen. This is a resource that has been developed for decades but is now gaining increased global attention as conventional supplies—so-called “easy” oil—continue to be depleted. The figure of 169 billion barrels of bitumen represents what is considered economically recoverable with today’s technology, but with new technologies, this reserve estimate could be significantly increased. In fact, total oil sands reserves in place are estimated at 1.8 trillion barrels.

There are three major bitumen (or oil sands) deposits in Alberta. The largest is the Athabasca deposit, which is located in the province’s northeast in the Regional Municipality of Wood Buffalo. The main population centre of the Athabasca deposit is 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. In 2011, 51 per cent of oil sands production came from mines, but by 2015, in situ bitumen production is expected to surpass mined bitumen production. Alberta will need to rely to a greater extent on in situ production in the future, as 80 per cent of the province’s proven bitumen reserves are too deep underground to recover using mining methods.

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 the melted bitumen flows into the lower well via gravity 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 selection is based on a number of factors, 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, including variations on solvent-assisted SAGD and CSS, recovery using electricity, and in situ combustion. 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, which is a refinery feedstock. That can be transformed into transportation fuels and other products.
Mapping the oil sands

Canada’s 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.

Alberta’s Industrial Heartland is over 143,815 acres in size, and is located in the north-eastern 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.
ERCB REPORTS SHOW SEVEN PER CENT GROWTH IN CONVENTIONAL CRUDE OIL PRODUCTION AND REVISED IN-PLACE ESTIMATES OF FOUR BITUMEN DEPOSITS

The Energy Resources Conservation Board (ERCB) has released Alberta’s Energy Reserves 2011 and Supply/Demand Outlook 2012-2021, which outlines the state of reserves and the supply-and-demand outlook for Alberta’s diverse energy resources: crude bitumen, crude oil, natural gas, natural gas liquids, coal and sulphur.

In 2011, Alberta’s conventional crude oil production totalled 77.9 thousand cubic metres (m³) (490 thousand barrels) of oil per day with a yearly total of 28.4 million m³ (179 million barrels). This is a seven per cent increase from 2010, the first rise in production since 1995, due to the higher production rates from horizontal wells.

The Athabasca Upper, Middle and Lower Grand Rapids deposits and the Athabasca Nisku oil sands deposit were reassessed for year-end 2011. The review of the three Grand Rapids deposits resulted in a seven per cent increase of the total in-place crude bitumen resource to 9.3 billion m³ (58.4 billion barrels), which is attributed to an increased number of wells drilled in the area. The reassessment of the Nisku deposit resulted in a 57 per cent increase of the in-place resource to 16.2 billion m³ (102 billion barrels), which is attributed to an increase in average thickness and an expansion of the delineated resource area.

In 2011, Alberta produced 277 thousand m³ (1.7 million barrels) per day of raw crude bitumen from the oil sands for a yearly total of 101 million m³ (637 million barrels) or an eight per cent increase over Alberta’s 2010 oil sands production.

The ERCB forecasts Alberta’s annual raw crude bitumen production will total 587.3 thousand m³ (3.7 million barrels) per day for a total of 214 million m³ (1.35 billion barrels) per year by 2021.

The report notes that, since 1967, Alberta has produced about 1.3 billion m³ (8.1 billion barrels) of raw crude bitumen from the oil sands and has produced about 2.6 billion m³ (16.5 billion barrels) of crude oil since 1914.

Other report highlights include:
- Alberta’s total remaining established crude bitumen and crude oil reserves totalled 27.0 billion m³ (170.2 billion barrels), consisting of 26.8 billion m³ (168.6 billion barrels) of crude bitumen and 245.9 million m³ (1.5 billion barrels) of crude oil.
- Remaining established crude oil reserves increased by a net four per cent, similar to the increase last year, as the cumulative result of reserves additions from 2011 drilling, reserve revisions and production.
- Remaining established marketable conventional gas reserves stood at 945 billion m³ (33.5 trillion cubic feet), a decrease of eight per cent from 2010.
- Remaining established reserves of natural gas liquids stood at 254.5 million m³ (1.6 billion barrels), down three per cent from 2010.
- Alberta’s remaining established coal reserves are down very slightly and stand at 33 billion tonnes (37 billion tons).

NEW WEST PARTNERSHIP STREAMLINES BUSINESS REGISTRATION ACROSS THE WEST

The New West Partnership Trade Agreement is a far-reaching economic partnership between the provinces of Alberta, British Columbia and Saskatchewan, designed to foster prosperity for the region and for our people through meaningful interprovincial collaboration. Under the agreement, businesses registering as a corporation will no longer need to register separately in each of the three jurisdictions as extra-provincial registration will be facilitated by the home province.

Businesses across western Canada will find it easier to operate throughout the region under New West Partnership rules that took effect July 1.

Corporations will be asked to provide additional information to their home province to have their extra-provincial registration take effect in the remaining jurisdictions. No additional fees will be required for extra-provincial registration in the two other provinces. The partnership removes the need for corporations to file their annual filing requirement in all three provinces. Instead, corporations will now be able to file once in their home province.

Reducing red tape and creating a more open and competitive marketplace with British Columbia and Saskatchewan will help Alberta businesses expand their markets and attract new clients. These actions help secure Alberta’s economic prosperity.

For more information, visit the New West Partnership at www.newwestpartnership.ca.
The Alberta government has agreed to the conditional sale of 202 acres of Crown land in the Saline Creek area to the Rotary Club of Fort McMurray to develop a new residential community with housing options ranging from town houses to single-family units. The lands adjoin property where the Rotary Club is proposing to develop a public golf course.

The conditional sale is part of the Alberta government’s comprehensive strategy for releasing additional Crown land for the timely development of more residential, industrial and commercial lands in Fort McMurray. Over the next couple of months, both parties will work towards finalizing the agreement so that initial activity can begin on-site as soon as possible.

This land sale is an important component of the province’s land release strategy and Responsible Actions, Alberta’s 20-year strategic plan for the oil sands, which includes efforts to support further planning and development of vibrant communities in the oil sands regions.

**ALBERTA GOVERNMENT FREES UP LAND TO GIVE FORT MCMURRAY MORE ROOM TO GROW**

“Alberta’s strong network of researchers, engineers and scientists are continually breaking through with new technologies to improve environmental performance in the oil sands, just as their expertise unlocked the resource in the first place. The establishment of COSIA represents an understanding of shared responsibility. We look forward to working with the alliance to pool our expertise and knowledge with that of other stakeholders as we continue to deliver environmental excellence.”

**EARLY IMPROVEMENTS IN PLACE FOR OIL SANDS MONITORING PROGRAM**

In July, Canada’s Environment Minister Peter Kent, and Alberta’s Environment and Sustainable Resource Development Minister Diana McQueen toured several of the new oil sands monitoring stations now in place in the early stages of implementation of the Joint Canada-Alberta Implementation Plan for Oil Sands Monitoring.

The Joint Canada-Alberta Implementation Plan for Oil Sands Monitoring, announced by Minister Kent and Minister McQueen in February, commits to a scientifically rigorous, comprehensive, integrated and transparent environmental monitoring program for the region. It outlines the path forward to enhance the monitoring of water, air, land and biodiversity in the oil sands by demonstrating how we will sample more sites for more substances more frequently. The program is designed to provide an improved understanding of the long-term cumulative effects of oil sands development. Both ministers were pleased with the progress they saw, noting that the monitoring enhancements for the first year of the joint plan are well underway, that the joint approach is working well and that initial results from the new enhanced monitoring are expected this year. Implementation will continue to be phased in over three years to ensure installation of necessary infrastructure, incremental enhancement of activities and appropriate integration with existing monitoring activities in the region.

The joint plan strengthens environmental monitoring programs for air, water, land and biodiversity in the oil sands region. It will result in improved knowledge of the state of the environment in the oil sands area and an enhanced understanding of cumulative effects and environmental change, including future impacts arising from multiple stressors, which will become more important to understand as development continues.
By the time the three-year plan is fully implemented in 2015, there will be more sampling sites over a larger area, the number and types of parameters being measured will increase, the frequency of sampling will increase and an integrated, open-data-management plan will be created. Under the plan, the governments of Alberta and Canada will work together over the next three years as partners to implement a world-class monitoring program for the oil sands that integrates all environmental components—air quality, water quality, water quantity, aquatic ecosystems, terrestrial biodiversity and wildlife habitats.

**SHELL QUEST CCS PROJECT APPROVED WITH CONDITIONS**

The Energy Resources Conservation Board (ERCB) has issued Decision 2012 ABERCB 008, which includes conditions, for Shell Canada Limited’s application for a carbon capture and storage project north of Edmonton.

The hearing panel determined it is in the public interest to proceed with the project, noting the proposed reservoir is a suitable location for the long-term storage of CO₂, and the combination of geological conditions, engineering design, operational practices and extensive monitoring program mitigate any potential risks the project might pose.

The ERCB held a hearing in Redwater, Alta., from March 6–9, 2012, to consider the applications and any concerns from interveners. ERCB hearings are formal, quasi-judicial proceedings during which evidence is given, and cross-examination and argument take place.

Prior to issuing its final approval, the ERCB is required to refer the application to Alberta Environment and Sustainable Resource Development for review. Alberta Environment and Sustainable Resource Development may impose additional conditions with respect to the environment, which will be added to the ERCB’s approval.

**PREMIER REDFORD ADDRESSES GOVERNMENT OF BRITISH COLUMBIA’S REQUIREMENTS FOR NORTHERN GATEWAY PIPELINE**

Premier Alison Redford issued the following statement following the Government of British Columbia’s announcement regarding the proposed Northern Gateway Pipeline:

“Alberta is committed to building our country and cementing Canada’s position as a global energy superpower. Leadership is about working together, and that’s when our country benefits from our energy economy.

“[Recently], the Government of British Columbia released a list of requirements to be met to satisfy their concerns about the perceived environmental risks associated with the Northern Gateway Pipeline. Every Canadian, no matter what province they call home, expects that energy development is done with a high degree of environmental safeguards. This is why a rigorous environmental review is underway by the National Energy Board. It is why the company involved has committed an additional $500 million for increased monitoring and safety measures. These efforts, combined with the fact that pipelines are still by far the safest means by which to transport oil, significantly mitigate the environmental risk and weaken the B.C. government’s argument for compensation based on potential risk.

“As Alberta has said repeatedly, and as we saw in the recent report from the senate’s Energy, Environment and Natural Resources Committee, accessing new energy markets is a national imperative. It is essential for the economic benefit of Canada.

“Our confederation works as well as it does because of the free flow of goods and products through provinces and territories—including forest products, oil, liquefied natural gas, potash, uranium, grain and manufactured goods.

“We’ve worked very hard through our New West Partnership to ensure free trade across the B.C./Alberta/ Saskatchewan borders and the shared economic rewards have been great for our citizens.

“Leadership is not about dividing Canadians and pitting one province against another—leadership is about working together. That’s when our country benefits; that’s when Canada leads. Through a Canadian energy strategy, the provinces and territories together will reach their full energy potential and contribute to increased prosperity and a higher standard of living for all Canadians.”

**ENERGY MINISTER COMMENTS ON NEW INVESTMENT ANNOUNCEMENT FROM CNOOC**

Alberta’s Energy Minister Ken Hughes issued the following statement in response to the offer by China National Offshore Oil Corporation (CNOOC) to purchase Nexen Inc., Canada’s 12th largest energy company. Nexen has agreed to a US$15.1-billion takeover by CNOOC, marking the most important acquisition to date by an Asian firm in Canada.

Nexen produces approximately 213,000 barrels of oil equivalent per day.

“[This] potential transaction is further evidence of the vital importance of Alberta’s oil sands to meet global energy demand.

“Foreign investment benefits Albertans and Canadians, putting Canadian firms in a better position to compete globally. Nexen itself is a Canadian company that maintains operations around the world—including in the Gulf of Mexico, Africa and the North Sea. The investment required to develop oil sands resources is significant. The oil sands have already drawn investment from China, the United States, Norway, Japan, South Korea, France, Thailand and the United Kingdom. The result is jobs for Canadians here and abroad, and competitive products on an international market.

“The offer is subject to approval by the federal government under terms of the Investment Canada Act. Operations in the Alberta oil sands must operate under existing regulatory frameworks, employment standards, safety codes and environmental laws.”
In what would be by far the biggest Chinese acquisition in the Canadian oilpatch, state-owned China National Offshore Oil Corporation (CNOOC) Limited has agreed to buy Nexen Inc. for US$15.1 billion.

CNOOC has invested $2.8 billion in Canada since 2005 when it bought a 16.7 per cent stake in then-private MEG Energy Corp. for US$122 million. CNOOC is already partnered with Nexen through its 35 per cent stake in the Long Lake steam assisted gravity drainage (SAGD) and upgrader project acquired through last year’s $2.1-billion purchase of OPTI Canada Inc.

The Nexen deal—which has been approved by both companies’ boards of directors—is also subject to shareholder and regulatory approval. If successful, the deal would be China’s biggest foreign takeover.

Canadian Natural Resources Limited has submitted regulatory applications for its proposed 50,000-barrel-per-day, $1.53-billion Grouse in situ oil sands project. Receipt of regulatory approvals in the second quarter of 2014 would allow the company to begin construction in the first quarter of 2015. Drilling and completion of the first well pairs would commence in third quarter of 2014 and Canadian Natural anticipates first steam in the fourth quarter of 2017. Initial production would occur in the first quarter of 2018.

BlackPearl Resources Inc. has filed a commercial development application with regulators for an 80,000-barrel-per-day steam assisted gravity drainage (SAGD) project, Blackrod, expected to cost $2.8 billion to build. BlackPearl currently operates a SAGD pilot at Blackrod, which it says has been generating commercial production rates.

The first phase of the proposed 20,000-barrel-per-day commercial project is expected to begin construction in the fourth quarter of 2013, pending regulatory approval. Blackrod targets a relatively new production formation, the Grand Rapids.

Southern Pacific Resource Corp. has announced that steam began circulating through the second pad of six steam assisted gravity drainage (SAGD) well pairs at the STP-McKay thermal project on July 13. This brings to 12 the total SAGD well pair count currently being steamed at the newly operational project.

Steam will now be circulated through all 12 SAGD wellbores for a period of three to four months, after which bitumen production is scheduled to begin.

About 1,000 people are working on North West Upgrading Inc.’s Alberta upgrader/refinery project, the company reports. About $600 million has been spent so far, components with long delivery times have been ordered, and engineering and design activities are underway in preparation for sanction in the third quarter.

Construction of the 50,000-barrel-per-day first phase is expected to take about 36 months. North West and partner Canadian Natural Resources Limited hope to have the plant, in the Industrial Heartland near Edmonton, on stream by mid-2015.

Newspaper publisher David Black is hoping to construct a $13-billion refinery near Kitimat, B.C., which would have the capacity to process all of the output of the planned Enbridge Inc. Northern Gateway pipeline.

The refinery would be designed specifically for processing oil sands heavy crude oil, processing up to 550,000 barrels per day of diluted feedstock. The diluent would be separated and returned to Edmonton via the proposed Enbridge secondary pipeline. It’s hoped that construction will begin in 2014 and be finished by 2020.

Técnicas Reunidas Canada reports that it has been awarded a major contract by an oil sands synthetic crude oil producer to provide engineering, procurement and construction services for its upgrader in the Fort McMurray region, valued above $800 million. The upgrader will process above 300,000 barrels per day of diluted bitumen, and will include a new vacuum unit. Técnicas Reunidas says the project started its engineering phase in the second quarter of 2012. This is the first project for the company in the oil sands sector.

Cenovus Energy Inc. says it has decided to conclude its formal process of looking for a partner for its proposed Telephone Lake oil sands project as it develops what could potentially be another cornerstone asset.

Cenovus says that the process was never financially driven, but rather about looking for something that would bring strategic value, perhaps helping to manage light-heavy differentials. Telephone Lake is expected to start construction in 2014.

Horizon North Logistics Inc. has entered into a contract for the sale of a new 1,900-person dormitory complex to a major operator in the Fort McMurray oil sands region. Total value of the project, which includes design, manufacture, transportation and site installation, is approximately $140 million.

Horizon will begin manufacturing the project in the fourth quarter, with installation scheduled to be complete in early 2014. The majority of the project manufacturing work will take place in Horizon’s plant in Kamloops, B.C.
What’s new in the oil sands

TECHNOLOGY

Tervita Corporation has entered into an exclusive lease agreement with TTS Energy Canada Ltd. for the first rack-and-pinion service rig on the continent.

Tervita says the technology is safer and more environmentally friendly than traditional rigs, requiring fewer workers to operate while keeping those employees at a safer distance from the operation. The new rig has the flexibility of being powered by diesel or electricity, and is designed to provide greater automation.

Much work remains and the process is not “a slam dunk,” but MEG Energy Corp. says that after achieving a steam-oil ratio of 1.8:1 at the first phase of a pilot at its Christina Lake steam assisted gravity drainage (SAGD) project, the company is now undertaking the engineering design to assess the technology’s incorporation in the Phase 2 project area. MEG is piloting injecting non-condensable gas into three SAGD well pairs in the Phase 1 area.

“The techniques we use here are designed to replace steam with recyclable gas in order to maintain pressure in the reservoir,” says president and chief executive officer Bill McCaffrey. “To date, the use of non-condensable gas has freed up our steam requirements by about 25 per cent with no drop in production. That steam is now free to be redeployed into pre-drilled wells that provide a very efficient way of adding low-cost barrels.”

Syncrude Canada Ltd. owners report that work is progressing on technologies designed to make mining operations compliant with rules surrounding tailings ponds. Two projects, the Aurora North tailings management plant and a centrifuge tailings management project at Mildred Lake, will start this year and take until the end of 2014 to complete. The Aurora North tailings plant will add sand and a small amount of gypsum to tailings so that it coagulates and turns into solid, trafficable material that can be trucked away and used to reclaim land. Syncrude majority partner Canadian Oil Sands Limited plans to spend $300,000 on the project this year. The targeted in-service date is fourth-quarter 2013.

Syncrude is also pioneering centrifuge technology that puts bitumen into a tumbler at high speed with a flocculent to separate the solids from water. The pilot is expected to be turned into a commercial project ready for operations in fourth-quarter 2014.

Value Creation Inc. is proposing a phased 75,000-barrel-per-day steam assisted gravity drainage project with output to be converted using the company’s patented accelerated decontaminated bitumen processing and primary upgrading technology. The project would be developed in three phases, with construction anticipated to start in May 2014. The first phase will be designed to produce 15,000 barrels per day of bitumen, which will be converted to 12,750 barrels per day of decontaminated crude oil.

Groundwork is expected to begin this fall for the 45,000-barrel-per-day first phase of Cenovus Energy Inc.’s Narrows Lake solvent assisted process (SAP) in situ project in the South Athabasca region. It will be the industry’s first use of SAP with butane on a commercial scale, a process designed to thin the oil and allow it to flow more freely to the producing well. Sanction by Cenovus and partner ConocoPhillips Canada is expected by the end of this year. First production at Narrows Lake is anticipated in 2017.

Niagara, Ont.–based Accipiter Radar Technologies Inc. reports that Syncrude Canada Ltd. recently installed its radar-based bird protection system at its oil sands tailings ponds. Accipiter says the technology is the same system that helps keep birds and planes apart at airports, and is the largest and most sophisticated radar-based bird protection system ever deployed. The system includes several types of deterrent devices, both on land and floating on the ponds, including high-power acoustic hailing devices, propane cannons, strobe lights and animated predator effigies.

Tervita Corporation has announced a new agreement to license and market a new technology designed to treat evaporator blowdown in a more responsible, sustainable and cost-effective way for steam assisted gravity drainage (SAGD) operators. The technology was developed by Veolia Water Solutions & Technologies.

Evaporator blowdown is the remaining waste solution after produced water has been treated. Previously, evaporator blowdown was injected into caverns as waste. The new technology will create two waste streams where there was previously one, providing producers with more environmentally appropriate disposal.

Tervita is currently engineering a pilot plant and expects construction to be complete by April 2013, with plans to move to a SAGD operation later in the year.
OIL SANDS PROJECT TECHNOLOGY GUIDE

CSS—CYCLIC STEAM STIMULATION
CSS involves injecting high-pressure steam into the reservoir for several weeks, followed by several weeks where the reservoir is left to “soak.” The heat softens the bitumen and the water dilutes and separates the bitumen from the sand. The pressure creates cracks and openings through which the bitumen can flow back into the steam injector wells, which are converted to production mode.

ET-DSP—ELECTRO-THERMAL DYNAMIC STRIPPING
ET-DSP combines the majority of the dominant heat transfer mechanisms to heat and mobilize bitumen in situ. Electrodes are placed in a grid configuration and a production well is located within the center of each series of electrode wells. The technology has been commercially applied for soil remediation and is expected to reduce greenhouse gas emissions and water use.

N-SOLV
N-Solv involves the injection of pure, heated solvent vapour into an oil sands reservoir where it condenses, delivering heat to the reservoir and subsequently dissolving the bitumen, with the resulting miscible liquids flowing by gravity to a production well. It is designed to accelerate extraction rates and reduce greenhouse gas emissions.

SAGD—STEAM ASSISTED GRAVITY DRAINAGE
SAGD employs two parallel horizontal wells: one injection well near the top of the reservoir, through which high-pressure steam is continuously flowing by gravity to a production well. The process is intended to generate the heat required to melt the remainder of the bitumen and allow it to flow into the production well. The process is intended to reduce greenhouse gas emissions and water use.

THAI—TOE-TO-HEEL AIR INJECTION
THAI uses a vertical air injection well with a horizontal production well. Air is injected at the toe of the reservoir, and the air-oil mixture flows up through the reservoir to the heel, where it is extracted. The process is intended to reduce greenhouse gas emissions and water use.

SURFACE MINING
Integrated oil sands mining operations accomplish three main functions: mining the oil sands, separating the bitumen from the sand and upgrading the bitumen so refiners can work with it.

TAGD—THERMAL ASSISTED GRAVITY DRAINAGE
TAGD uses an array of downhole heaters installed in horizontal wells to heat the reservoir via thermal conduction.

NORTH ATHABASCA REGION — MINING

CANADIAN NATURAL RESOURCES LIMITED

Horizon
Canadian Natural says the addition of a third ore preparation plant, commissioned in Q1/2012, is making a significant difference in improving uptime. Its Phase 2A coker expansion is tracking to its revised schedule, lump sum contracts have been awarded for key pieces of the Phase 2B expansion, and engineering is on track for Phase 3.

| Phase 1 | 135,000 | 2008 | Operating | Mining |
| Phase 2A | 10,000 | 2014 | Approved | Mining |
| Phase 2B | 45,000 | TBD | Approved | Mining |
| Phase 3 | 80,000 | TBD | Approved | Mining |
| Tranche 2 | 5,000 | 2012 | Operating | Mining |

IMPERIAL OIL LIMITED

Kearl
Imperial Oil says that, as of the end of Q2/2012, Kearl Phase 1 is 94 per cent complete, with construction 88 per cent complete. All modules fabricated in Korea and transported through North America have now arrived at site and are being reassembled and integrated into the plant.

| Phase 1 | 110,000 | 2012 | Construction | Mining |
| Phase 2 | 110,000 | 2015 | Construction | Mining |
| Phase 3 Debottleneck | 70,000 | 2020 | Approved | Mining |

SHELL ALBIAN SANDS

Project listings
Updated status of oil sands projects in Alberta As of Aug. 21, 2012

<table>
<thead>
<tr>
<th>CURRENT PROJECT</th>
<th>CAPACITY</th>
<th>START-UP</th>
<th>REGULATORY STATUS</th>
<th>TECHNOLOGY</th>
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<td>Summer 2012</td>
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<td></td>
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<tr>
<td>Pierre River</td>
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| A joint-review panel of the Canadian Environmental Assessment Agency and Energy Resources Conservation Board has been established to review the proposed Pierre River mine project.

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<tr>
<th>CURRENT PROJECT</th>
<th>CAPACITY</th>
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<tr>
<td>Suncor Energy Inc.</td>
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<td>Base Operations</td>
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| Suncor says it has its tailings reduction operations (TRO) infrastructure project and commenced operations. It is also in the process of starting up the hydrotreating unit and hydrogen plant of the new Millennium Naphtha Unit, which is expected to stabilize secondary upgrading capacity and provide flexibility during maintenance activities for secondary upgrading units in the future.

| Phase 1          | 100,000  | 2018     | Application        | Mining     |
| Phase 2          | 100,000  | TBD      | Approved           | Mining     |
| Millennium Debottleneck | 23,000 | 2008 | Operating | Mining |
| Millennium Mine | 294,000  | 1967     | Operating          | Mining     |
| North Steepbank Extension | 180,000 | 2012 | Operating | Mining |
| Steepbank Debottleneck Phase 2 | 4,000 | 2007 | Operating | Mining |
**QUARTERLY UPDATE**

**Canadian Natural Resources Limited**

Suncor expects to present development plans to the board of directors for a sanctioning decision in 2013.

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<tr>
<th>Current Project</th>
<th>Capacity</th>
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<tr>
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**BP P.L.C.**

BP says that ongoing appraisal activities include delineation drilling, seismic acquisition and appraisal of water sources.

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<tr>
<th>Current Project</th>
<th>Capacity</th>
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**Voyageur South**

Suncor considers Voyageur South to be a longer-term project and has not confirmed a start-up date.

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<th>Current Project</th>
<th>Capacity</th>
<th>Start-Up</th>
<th>Regulatory Status</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>120,000</td>
<td>TBD</td>
<td>Application</td>
<td>Mining</td>
</tr>
</tbody>
</table>

**Syncrude Canada Ltd.**

Mildred Lake/Aurora North & South

Lead partner Canadian Oil Sands says that with turnarounds now complete and no major maintenance planned for the rest of the year, Syncrude is expecting robust production over the remainder of 2012.

<table>
<thead>
<tr>
<th>Current Project</th>
<th>Capacity</th>
<th>Start-Up</th>
<th>Regulatory Status</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aurora South Train 1</td>
<td>100,000</td>
<td>2016</td>
<td>Approved</td>
<td>Mining</td>
</tr>
<tr>
<td>Aurora South Train 2</td>
<td>100,000</td>
<td>2018</td>
<td>Approved</td>
<td>Mining</td>
</tr>
<tr>
<td>Birch</td>
<td>290,700</td>
<td>1978</td>
<td>Operating</td>
<td>Mining</td>
</tr>
<tr>
<td>Stage 3 Expansion</td>
<td>116,300</td>
<td>2006</td>
<td>Operating</td>
<td>Mining</td>
</tr>
</tbody>
</table>

**Teck Resources Limited**

**Frontier**

Teck says it anticipates receiving the final supplemental information requests relating to the Frontier regulatory application in Q3/2012, and responding in Q4.

<table>
<thead>
<tr>
<th>Current Project</th>
<th>Capacity</th>
<th>Start-Up</th>
<th>Regulatory Status</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>75,000</td>
<td>2021</td>
<td>Application</td>
<td>Mining</td>
</tr>
<tr>
<td>Phase 2</td>
<td>80,000</td>
<td>2024</td>
<td>Application</td>
<td>Mining</td>
</tr>
<tr>
<td>Phase 3</td>
<td>80,000</td>
<td>2027</td>
<td>Application</td>
<td>Mining</td>
</tr>
<tr>
<td>Phase 4 Equinox</td>
<td>40,000</td>
<td>2030</td>
<td>Application</td>
<td>Mining</td>
</tr>
</tbody>
</table>

**Total E&P Canada Ltd.**

Joslyn North Mine

Project partner Suncor Energy says development plans will be submitted to the companies’ respective boards of directors for a sanctioning decision in 2013.

<table>
<thead>
<tr>
<th>Current Project</th>
<th>Capacity</th>
<th>Start-Up</th>
<th>Regulatory Status</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>100,000</td>
<td>2018</td>
<td>Approved</td>
<td>Mining</td>
</tr>
</tbody>
</table>

**Athabasca Oil Sands Corporation**

**Birch**

AOS says that $26.3 million was spent on Birch in the first half of the year on its winter drilling and 3-D seismic programs. These both support the filing of its regulatory application, which is anticipated to go it alone on the project.

<table>
<thead>
<tr>
<th>Current Project</th>
<th>Capacity</th>
<th>Start-Up</th>
<th>Regulatory Status</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>12,000</td>
<td>TBD</td>
<td>Announced</td>
<td>SAGD</td>
</tr>
<tr>
<td>Phase 2</td>
<td>6,000</td>
<td>2015</td>
<td>Application</td>
<td>TAGD</td>
</tr>
</tbody>
</table>

**Dover West Carbonates (Leduc)**

AOS says testing of its TAGD technology has demonstrated proof of concept. Design basis memorandum for the demonstration project is wrapping up, and engineering design specifications work has begun. Construction has started on a heater assembly facility outside of Strathmore, Alta.

<table>
<thead>
<tr>
<th>Current Project</th>
<th>Capacity</th>
<th>Start-Up</th>
<th>Regulatory Status</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>12,000</td>
<td>2015</td>
<td>Application</td>
<td>TAGD</td>
</tr>
<tr>
<td>Phase 2</td>
<td>6,000</td>
<td>2015</td>
<td>Application</td>
<td>TAGD</td>
</tr>
</tbody>
</table>

**BP P.L.C.**

**Terre de Grâce**

BP says that ongoing appraisal activities include delineation drilling, seismic acquisition and appraisal of water sources.

<table>
<thead>
<tr>
<th>Current Project</th>
<th>Capacity</th>
<th>Start-Up</th>
<th>Regulatory Status</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot</td>
<td>10,000</td>
<td>TBD</td>
<td>Approved</td>
<td>SAGD</td>
</tr>
</tbody>
</table>

**Canadian Natural Resources Limited**

**Birch Mountain**

Canadian Natural says geological scoping is underway.

<table>
<thead>
<tr>
<th>Current Project</th>
<th>Capacity</th>
<th>Start-Up</th>
<th>Regulatory Status</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>60,000</td>
<td>2019</td>
<td>Announced</td>
<td>SAGD</td>
</tr>
<tr>
<td>Phase 2</td>
<td>60,000</td>
<td>2023</td>
<td>Announced</td>
<td>SAGD</td>
</tr>
</tbody>
</table>

**Cenovus Energy Inc.**

Telephone Lake Borealis

Cenovus has concluded its process to identify a strategic partner for Telephone Lake and has decided to go it alone on the project.

<table>
<thead>
<tr>
<th>Current Project</th>
<th>Capacity</th>
<th>Start-Up</th>
<th>Regulatory Status</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase A</td>
<td>45,000</td>
<td>TBD</td>
<td>Application</td>
<td>SAGD</td>
</tr>
<tr>
<td>Phase B</td>
<td>45,000</td>
<td>TBD</td>
<td>Application</td>
<td>SAGD</td>
</tr>
</tbody>
</table>

**Dover Operating Corp.**

**Dover**

The director of environmental assessment has notified the ERCB that the environmental impact assessment report for the project is complete.

<table>
<thead>
<tr>
<th>Current Project</th>
<th>Capacity</th>
<th>Start-Up</th>
<th>Regulatory Status</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dover North Phase 1</td>
<td>50,000</td>
<td>2016</td>
<td>Application</td>
<td>SAGD</td>
</tr>
<tr>
<td>Dover North Phase 2</td>
<td>50,000</td>
<td>2018</td>
<td>Application</td>
<td>SAGD</td>
</tr>
<tr>
<td>Dover South Phase 2</td>
<td>50,000</td>
<td>2022</td>
<td>Application</td>
<td>SAGD</td>
</tr>
<tr>
<td>Dover South Phase 3</td>
<td>50,000</td>
<td>2020</td>
<td>Application</td>
<td>SAGD</td>
</tr>
<tr>
<td>Dover South Phase 4</td>
<td>50,000</td>
<td>2022</td>
<td>Application</td>
<td>SAGD</td>
</tr>
<tr>
<td>Dover South Phase 5</td>
<td>50,000</td>
<td>2024</td>
<td>Application</td>
<td>SAGD</td>
</tr>
</tbody>
</table>

**E-T Energy Ltd.**

**Poplar Creek**

The ERCB has released its decision on the 10,000-barrel-per-day project application. It says E-T has not demonstrated the technology is capable of obtaining or sustaining commercial production rates and the application is not approved. The ERCB says E-T can reapply based on more performance data, which the company says it has (the application did not include data from the current test).

<table>
<thead>
<tr>
<th>Current Project</th>
<th>Capacity</th>
<th>Start-Up</th>
<th>Regulatory Status</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental Pilot</td>
<td>1,000</td>
<td>2007</td>
<td>Operating</td>
<td>ET-DSP</td>
</tr>
<tr>
<td>Phase 1</td>
<td>10,000</td>
<td>TBD</td>
<td>Announced</td>
<td>ET-DSP</td>
</tr>
<tr>
<td>Phase 2</td>
<td>40,000</td>
<td>TBD</td>
<td>Announced</td>
<td>ET-DSP</td>
</tr>
</tbody>
</table>

**Husky Energy Inc.**

**Saleski**

Husky says evaluation work continues, as does design basis memorandum work for the pilot plant and initial field environmental monitoring. These activities will support a regulatory application.

<table>
<thead>
<tr>
<th>Current Project</th>
<th>Capacity</th>
<th>Start-Up</th>
<th>Regulatory Status</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbonate Pilot</td>
<td>TBD</td>
<td>2016</td>
<td>Announced</td>
<td>TBD</td>
</tr>
</tbody>
</table>

**Sunrise**

Husky says drilling of its planned 49 SAGD well pairs is now complete. Detailed engineering is also complete, and construction of field facilities has reached 50 per cent completion.

<table>
<thead>
<tr>
<th>Current Project</th>
<th>Capacity</th>
<th>Start-Up</th>
<th>Regulatory Status</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>60,000</td>
<td>2014</td>
<td>Construction</td>
<td>SAGD</td>
</tr>
<tr>
<td>Phase 2</td>
<td>50,000</td>
<td>2016</td>
<td>Approved</td>
<td>SAGD</td>
</tr>
<tr>
<td>Phase 3</td>
<td>50,000</td>
<td>TBD</td>
<td>Approved</td>
<td>SAGD</td>
</tr>
<tr>
<td>Phase 4</td>
<td>50,000</td>
<td>TBD</td>
<td>Approved</td>
<td>SAGD</td>
</tr>
</tbody>
</table>

**Ivanhoe Energy Inc.**

**Tamarack**

Ivanhoe says it has received and responded to the second round of supplemental information requests regarding its project application from the ERCB. It continues to expect approval in 2012.

<table>
<thead>
<tr>
<th>Current Project</th>
<th>Capacity</th>
<th>Start-Up</th>
<th>Regulatory Status</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>20,000</td>
<td>2013</td>
<td>Application</td>
<td>SAGD</td>
</tr>
<tr>
<td>Phase 2</td>
<td>20,000</td>
<td>TBD</td>
<td>Application</td>
<td>SAGD</td>
</tr>
</tbody>
</table>

**Marathon Oil Corporation**

**Birchwood**

Marathon says that based on results of completed appraisal drilling, a regulatory application will be filed in 2012.

<table>
<thead>
<tr>
<th>Current Project</th>
<th>Capacity</th>
<th>Start-Up</th>
<th>Regulatory Status</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstration</td>
<td>12,000</td>
<td>2016</td>
<td>Application</td>
<td>SAGD</td>
</tr>
</tbody>
</table>

**Oak Point Energy Ltd.**

**Lewis**

<table>
<thead>
<tr>
<th>Current Project</th>
<th>Capacity</th>
<th>Start-Up</th>
<th>Regulatory Status</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot</td>
<td>1,720</td>
<td>2013</td>
<td>Application</td>
<td>SAGD</td>
</tr>
</tbody>
</table>

**Silverwillow Energy Corporation**

**Audet**

Silverwillow says for the remainder of 2012 it will focus on analyzing samples and data from this year’s drilling program. It will also be conducting an environmental baseline assessment and preparing preliminary engineering design for a pilot SAGD project to enable preparation of a regulatory application, which is expected to be filed in Q2/2013.

<table>
<thead>
<tr>
<th>Current Project</th>
<th>Capacity</th>
<th>Start-Up</th>
<th>Regulatory Status</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot</td>
<td>12,000</td>
<td>2016</td>
<td>Announced</td>
<td>SAGD</td>
</tr>
</tbody>
</table>
that development will proceed.
 Petroleum Consultants, considers the project to have a high degree of certainty of implementation and
West Ells participating project start-up in 2015.
Thickwood Sunshine says that steam cycle injection operations at Harper have proved thermally induced oil
mobility.
SUNSHINE OILSANDS LTD.
Harper Sunshine says that steam cycle injection operations at Harper have proved thermally induced oil
mobility.
Legend Lake Carbonate Pilot 1,000 2011 Operating SAGD
Thickwood Sunshine Oilsands has submitted the regulatory application for its Thickwood SAGD project, antici-
pating project start-up in 2015.
West Ells Sunshine says that following regulatory approval, its external reservoir engineering firm, GLJ Pet-
roleum Consultants, considers the project to have a high degree of certainty of implementation and
that development will proceed.
A Phase 1 5,000 2013 Construction SAGD
A Phase 2 5,000 2014 Approved SAGD
A Phase 3 20,000 2018 Approved SAGD
B Phase 1 20,000 2020 Approved SAGD
B Phase 2 20,000 TBD Approved SAGD
C Phase 1 30,000 TBD Approved SAGD
SOUTH ABAHASCA REGION — IN SITU
ALBERTA OILSANDS INC.
Clearwater West Alberta Oilsands says it has responded to a third round of supplemental information requests from
the ERCB regarding the project application. The company expects the regulator will hold a public
hearing into the project, due in part to its proximity to the Fort McMurray airport.
Phase 1 Pilot 4,350 TBD Application SAGD
Phase 2 25,000 2016 Approved SAGD
-quart- update

Alberta oil sands industry

Devon says construction of the Jackfish 3 project is now approximately 40 per cent complete.

Pike

Grizzly Oil Sands ULC

Muskwa

Laricina says testing on its latest well pair at Saleski has resulted in greatest bitumen production anticipated reservoir behaviour.

Laricina says detailed engineering is 80 per cent complete. Procurement of long-lead items is complete, piling commenced in January, and modules began being transported to the site in March. The company has applied to add a fourth once-through steam generator and associated equipment due to improved reservoir performance.

Black Gold

Husky says that during Q2 eight slant wells that were drilled in late 2011 were put on cold production. Drilling operations for 32 further slant wells began in June. At the air injection pilot, the reservoir process is proceeding with production start-up anticipated in Q3.

Cenovus says fabrication and facility construction for Phase F is more than 50 per cent complete. Earthworks and site preparation are also underway for Phase G and design engineering for Phase H. Alberta regulators have issued the final terms of reference for Phase J.

Algar Lake

Laricina says testing on its latest well pair at Saleski has resulted in greatest bitumen production anticipated reservoir behaviour.

Hangingstone Pilot

The director of environmental assessments has notified the ERCB that the environmental impact assessment for the expansion project is complete.

Grizzly plans to submit a new regulatory application using its SAGD development model at May River in mid-2013.

Expansions

The company has applied to add a fourth once-through steam generator and associated equipment due to improved reservoir performance.

Expansions

The company has applied to add a fourth once-through steam generator and associated equipment due to anticipated reservoir behaviour.

Laricina says testing on its latest well pair at Saleski has resulted in greatest bitumen production achieved to-date at 1,200 barrels per day. The company says it is now in the final stages of proving commerciality of SAGD in bitumen carbonates.
**MEG ENERGY CORPORATION**

**Christina Lake**
As of June 2012, MEG says detailed engineering on the Phase 28 expansion is 99 per cent complete, and over 100 of 140 modules have been installed, with the remainder expected to be complete in 2012. All materials have been ordered, with delivery and on-site construction expected to be complete in 2013. Approximately 60 per cent of the horizontal wells for the 42 SAGD well pairs have been drilled.

- **Phase 1 Plot**: 3,000, 2008, Operating, SAGD
- **Phase 2A**: 22,000, 2009, Operating, SAGD
- **Phase 2B**: 35,000, 2013, Construction, SAGD
- **Phase 3A**: 50,000, 2016, Approved, SAGD
- **Phase 3B**: 50,000, 2018, Approved, SAGD
- **Phase 3C**: 50,000, 2020, Approved, SAGD

**Surmont**
The final terms of reference for the environmental impact assessment report for the Surmont project have been issued by Alberta Environment.

- **Phase 1**: 60,000, 2018, Announced, N-Solv
- **Phase 2**: 60,000, TBD, Announced, N-Solv

**N-SOLV CORPORATION**

**Dover**
Reports are that first results from a $60-million N-Solv field test are expected in spring 2013.
- **Demonstration Plant**: 500, 2012, Announced, N-Solv

**NEXEN INC.**

**Long Lake**
Nexen says it has achieved first production from Pad 12 at Long Lake and began steering Pad 13 ahead of expectations. The company says a major turnaround commencing in mid-August will result in lower Q3 production.

- **Long Lake South (Kinosiis)**, Phase 1: 40,000, TBD, Approved, SAGD
- **Long Lake South (Kinosiis)**, Phase 2: 40,000, TBD, Approved, SAGD
- **Phase 1**: 72,000, 2008, Operating, SAGD
- **Phase 2**: 72,000, 2008, Operating, SAGD
- **Phase 3**: 72,000, TBD, Approved, SAGD
- **Phase 4**: 72,000, TBD, Approved, SAGD

**STATOIL**

**Kai Kos Dehased**
Statoil says its next projects will be an expansion to Lemmer and the Corner project. Cormer will be sanctioned late in 2013 or early in 2014.

- **Corner**: 40,000, 2015, Approved, SAGD
- **Corner Expansion**: 40,000, TBD, Application, SAGD
- **Hangingstone**: 20,000, TBD, Application, SAGD
- **Lemmer Commercial**: 10,000, TBD, Approved, SAGD
- **Lemmer Demonstration**: 10,000, 2010, Operating, SAGD
- **Lemmer Expansion**: 20,000, TBD, Approved, SAGD
- **Lemmer Northwest**: 20,000, TBD, Application, SAGD
- **Lemmer South**: 20,000, TBD, Application, SAGD
- **Thornbury**: 40,000, TBD, Application, SAGD
- **Thornbury Expansion**: 20,000, TBD, Application, SAGD

**SUNCOR ENERGY INC.**

**Chard**
- **Phase 1**: 40,000, TBD, Announced, SAGD

**Meadow Creek**
- **Phase 1**: 40,000, TBD, Approved, SAGD
- **Phase 2**: 40,000, TBD, Approved, SAGD

**VALUE CREATION INC.**

**Advanced TriStar**
Value Creation says it is preparing the regulatory application for the Advanced TriStar project.

- **ATS-1**: 15,000, 2016, Announced, SAGD
- **ATS-2**: 30,000, 2019, Announced, SAGD
- **ATS-3**: 30,000, 2022, Announced, SAGD

**TriStar**
Value Creation is providing the ERCB with additional information supporting its application.
- **Pilot**: 1,000, 2014, Application, SAGD

**COLD LAKE REGION — IN SITU**

**BIRCHWOOD RESOURCES INC.**

**Sage**
Birchwood has released its public disclosure document and has held an open house with area residents, some of whom were concerned by the development.
- **Pilot**: 5,000, 2015, Announced, SAGD

**CANADIAN NATURAL RESOURCES LIMITED**

**Primrose/Wolf Lake**
Canadian Natural says its near-term priorities at Primrose include maximizing steam plant utilization by adding pads, a future facility debottleneck, expansion, assessment of a potential Grand Rapids formation expansion, and optimization of steaming techniques to improve on the 15 per cent recovery factor. Two pilots will be conducted in 2012.

- **Primrose East**: 32,000, 2008, Operating, CSS
- **Primrose North**: 30,000, 2006, Operating, CSS
- **Primrose South**: 45,000, 1985, Operating, CSS
- **Wolf Lake**: 13,000, 1985, Operating, CSS

**HUSKY ENERGY INC.**

**Caribou**
- **Demonstration**: 10,000, TBD, Approved, SAGD

**Tucker**
- **Phase 1**: 30,000, 2006, Operating, SAGD

**IMPERIAL OIL LIMITED**

**Cold Lake**
Imperial says that the Nabiye expansion was 22 per cent complete at the end of Q2.

- **Phase 1-10**: 110,000, 1985, Operating, CSS
- **Phase 11-13**: 30,000, 2002, Operating, CSS
- **Phase 14-16**: 40,000, 2014, Construction, CSS

**KOCH EXPLORATION CANADA CORPORATION**

**Gemini**
Koch’s Canadian subsidiaries are seeking a strategic investor to advance development and monetize certain oil sands interests including the Cold Lake (Gemini) asset.

- **Phase 1**: 12,000, TBD, Approved, SAGD
- **Phase 2**: 10,000, TBD, Approved, SAGD

**OSUM OIL SANDS CORP.**

**Taiga**
OSUM says that Cold Lake First Nations has withdrawn its objection to the Taiga project. It was the only official intervener in the project’s regulatory hearing. Pending regulatory approval, OSUM says it will go ahead with development.

- **Phase 1**: 23,000, 2016, Application, SAGD
- **Phase 2**: 22,000, 2017, Application, SAGD

**PENGROWTH CORPORATION**

**Lindbergh**
Pengrowth achieved first steam at the Lindbergh pilot in February. The company says the reservoir is responding to steam injection, and production performance so far indicates good oil mobility, straightforward treating and minimal solids production, all of which are encouraging at this early stage. Full SAGD operations are expected in Q2.

- **Phase 1 Commercial**: 12,500, 2014, Application, SAGD
- **Phase 2 Commercial**: 17,500, 2016, Announced, SAGD
- **Pilot**: 1,200, 2012, Operating, SAGD

**ROYAL DUTCH SHELL PLC**

**Orion**
- **Phase 1**: 10,000, 2007, Operating, SAGD
- **Phase 2**: 10,000, TBD, Approved, SAGD

**PEACE RIVER REGION — IN SITU**

**ANDORA ENERGY CORPORATION**

**Sawn Lake**
Andora Energy majority owner PanOrient Energy Corp. anticipates activities related to the Sawn Lake asset to come into focus over the remainder of 2012 with a clear course of action to be communicated shortly after the sale of assets in Thailand, which occurred in mid-June.

- **SAGD Demonstration**: 1,400, TBD, Approved, SAGD
NORTHERN ALBERTA OIL LTD.

Sawm Lake

Company owner Deep Well Oil & Gas says DeGolyer & MacNaughton Canada has completed its reservoir modelling for a proposed horizontal cyclic steam stimulation pilot at Sawm Lake, concluding the project would yield commercial viable extraction. Deep Well is currently preparing a pilot plan and options for capitalization.

CSS Pilot

700 TBO

Approved

CSS

PETROBANK ENERGY AND RESOURCES LTD.

Dawson

Petrobank says it is awaiting regulatory approval to initiate cold production on its two well demonstration project to condition the reservoir prior to THAI operations.

Experimental THAI Demonstration

TBO 2013

Construction

THAI

SABA

Pilta River

Alberta’s environmental assessment director has deemed complete Shell Canada’s environmental impact assessment report for the Carmon Creek expansion.

Cadotte Lake

12,500 1986

Operating

CSS

Carmon Creek - Phase 1

40,000 2015

Application

CSS

Carmon Creek - Phase 2

40,000 2018

Application

CSS

SOUTHERN PACIFIC RESOURCE CORP.

Red Earth

Southern Pacific is analyzing results from its latest CSS test at Red Earth. The company says it will finalize future development plans by the end of Q2.

Commercial

10,000 TBO

Announced

CSS

Pilot

1,000 2009

Operating

CSS

Pilot Expansion

3,000 TBO

Announced

CSS

SASKATCHEWAN REGION — IN SITU

OILSANDS QUEST INC.

Axe Lake

Oilsands Quest says that some of the bids received to acquire, restructure or recapitalize its business could, if subject to further negotiation, be capable of being brought before the court for approval. The company and its court-appointed monitor, Ernst & Young Inc., have agreed that the best interests of Oilsands Quest and its stakeholders will be best served if Ernst & Young takes over operational responsibilities including completion of a transaction.

Commercial

30,000 TBO

On Hold

SAGD

Reservoir Test

600 2008

On Hold

SAGD

SAGD Pilot

TBO

On Hold

SAGD

NORTH ATHABASCAN REGION — UPGRADER

BPCL

Terre de Grace

BP says that ongoing appraisal activities include delineation drilling, seismic acquisition and appraisal of water sources.

Pilot

8,400 TBO

Approved

Upgrader

CANADIAN NATURAL RESOURCES LIMITED

Horizon

Canadian Natural says the addition of a third ore preparation plant, commissioned in Q1/2012, is making a significant difference in improving uptime. Its Phase 2A coker expansion is tracking to its revised schedule, lump sum contracts have been awarded for key pieces of the Phase 2B expansion, and engineering is on track for Phase 3.

Phase 1

114,000 2009

Operating

Upgrader

Phase 2A

10,000 2014

Approved

Upgrader

Phase 2B

45,000 TBO

Approved

Upgrader

Phase 3

80,000 TBO

Approved

Upgrader

Tranche 2

5,000 2012

Operating

Upgrader

IVANHOE ENERGY INC.

Tamarack

Ivanhoe says it has received and responded to the second round of supplemental information requests regarding its project application from the ERCB. It continues to expect approval in 2012.

Phase 1

34,764 2014

Application

Upgrader

SUNCOR ENERGY INC.

Base Operations

Suncor says it has its tailings reduction operations (TRO) infrastructure project and commenced operations. It is also in the process of starting up the hydrotreating unit and hydrogen plant of the new Millennium Naphttha Unit, which is expected to stabilize secondary upgrading capacity and provide flexibility during maintenance activities for secondary upgrading units in the future.

Millennium Coker Unit

97,000 2008

Operating

Upgrader

Millennium Vacuum Unit

35,000 2005

Operating

Upgrader

U1 and U2

225,000 1967

Operating

Upgrader

CURRENT PROJECT | CAPACITY | START-UP | REGULATORY STATUS | TECHNOLOGY

--- | --- | --- | --- | ---

**NORTHERN ALBERTA OIL LTD.**

| Sawn Lake |  |  |  |  |

**PETROBANK ENERGY AND RESOURCES LTD.**

| Dawson |  |  |  |  |

**SABA**

| Pilta River |  |  |  |  |

**SOUTHERN PACIFIC RESOURCE CORP.**

| Red Earth |  |  |  |  |

**SASKATCHEWAN REGION — IN SITU**

| OILSANDS QUEST INC. |  |  |  |  |

**NORTH ATHABASCAN REGION — UPGRADER**

| BPCL |  |  |  |  |

**CANADIAN NATURAL RESOURCES LIMITED**

| Horizon |  |  |  |  |

**IVANHOE ENERGY INC.**

| Tamarack |  |  |  |  |

**SUNCOR ENERGY INC.**

| Base Operations |  |  |  |  |

| Millennial Oilsands Expansion |  |  |  |  |

| Millennial Vacuum Unit |  |  |  |  |

| U1 and U2 |  |  |  |  |

**CURRENT PROJECT | CAPACITY | START-UP | REGULATORY STATUS | TECHNOLOGY

--- | --- | --- | --- | ---

**Fort Hills**

|  |  |  |  |  |

**Voyageur Upgrader 3**

|  |  |  |  |  |

**SYNCRUDE CANADA LTD.**

|  |  |  |  |  |

**SOUTH ATHABASCAN REGION — UPGRADER**

|  |  |  |  |  |

**NEXEN INC.**

| Long Lake |  |  |  |  |

**VALUE CREATION INC.**

| Advanced TriStar |  |  |  |  |

**TRISTAR**

|  |  |  |  |  |

**INDUSTRIAL HEARTLAND REGION — UPGRADER**

|  |  |  |  |  |

**SHELL ALBIAN SANDS**

|  |  |  |  |  |

**SCOTLAND Upgrader 1**

|  |  |  |  |  |

**VALUE CREATION INC.**

|  |  |  |  |  |

**Heartland**

|  |  |  |  |  |
Glossary of oil sands terms

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 U.S. 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 oil sand, 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 (CSS)
For several weeks, high-pressure steam is injected into the formation to soften the oil sand 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 cool 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 oil sand 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 by-products.

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 oil sand existing within the specified lease area. The land must be reclaimed and returned to the Crown at the end of operations.

Muskog
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–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 sand 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 process production using two closely spaced horizontal wells: one for steam injection and the other for production of the bitumen/water emulsion.

Synthetic crude oil (SCO)
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 are a by-product of removing the bitumen from the oil sand.

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.
C O N T A C T S

Oil Sands Producers

- Alberta Oilsands
  www.aboilisands.ca
- Andora Energy
  www.andoraenergy.com
- Athabasca Oil Sands
  www.baytex.ca
- BlackPearl Resources
  www.blackpearlresources.ca
- Canadian Natural Resources
  www.cnri.com
- Cenovus Energy
  www.cenovus.com
- Chevron Canada
  www.chevron.ca
- China National Offshore Oil Corporation
  www.cnoc.ca
- ConocoPhillips Canada
  www.conocophillips.ca
- Devon Canada
  www.devon.com
- Dover Operating Corp.
  www.doveropco.com
- Enerplus Resources Fund
  www.enerplus.com
- E-T Energy
  www.e-tenergy.com
- Grizzly Oil Sands
  www.grizzlyoilsands.com
- Harvest Operations Corp.
  www.harvestenergy.ca
- Imperial Oil
  www.imperialoil.ca
- Ivanhoe Energy
  www.ivanhoeenergy.com
- Japan Canada Oil Sands
  www.jacos.com
- Koch Exploration Canada
  www.kochind.com
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  www.knoc.co.kr
- Laricina Energy
  www.laricinaenergy.com
- Marathon Oil
  www.marathon.com
- MEG Energy
  www.megenergy.ca
- Nexen
  www.nexeninc.com
- North West Upgrading
  www.n-w upgrading.com
- N-Solv
  www.nsolv.com
- Oak Point Energy
  www.oakpointenergy.ca
- Occidental Petroleum Corporation
  www.oxy.com
- Oilsands Quest
  www.oilsandsquest.com
- OSUM Oil Sands
  www.osumcorp.com
- Pan Orient Energy
  www.panorient.ca
- Paramount Resources Ltd.
  www.paramountres.com
- Pengrowth Energy Trust
  www.pengrowth.com
- Petrobank Energy and Resources
  www.petrobank.com
- PetroChina
  www.petrochina.com.cn/Ptr
- Shell Canada
  www.shell.ca
- Sinopec
  www.english.sinopec.com
- Southern Pacific Resource Corp.
  www.shpacific.com
- Statoil Canada
  www.statoil.com
- Suncor Energy
  www.suncor.com
- Sunshine Oilsands
  www.sunshineoilands.com
- Syncrude
  www.syncrude.ca
- Talisman Energy
  www.talisman-energy.com
- Teck Resources
  www.teck.com
- Total E&P Canada
  www.total-ep-canada.com
- Value Creation Group
  www.vctek.com

Associations/Organizations

- Alberta Building Trades Council
  www.buildingtradesalberta.ca
- Alberta Chamber of Resources
  www.acr-alberta.com
- Alberta Chambers of Commerce
  www.abchamber.ca
- Alberta Energy
  www.energy.gov.ab.ca
- Alberta Enterprise and Advanced Education
  www.eae.alberta.ca
- Alberta Innovates
  www.albertainnovates.ca
- Alberta Environment and Sustainable Resource Development
  www.srd.alberta.ca
- Alberta’s Industrial Heartland Association
  www.industrialheartland.com
- Canada’s Oil Sands Innovation Alliance
  www.cosia.ca
- 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.canadianoilsandsnetwork.ca
- Energy Resources Conservation Board
  www.ercb.ca
- In Situ Oil Sands Alliance
  www.isoc.ca
- Lakeland Industry and Community Association
  www.lica.ca
- Natural Resources Conservation Board
  www.nrcb.gov.ab.ca
- Oil Sands Developers Group
  www.oidsanddevelopers.ca
- Oil Sands Secretariat
  www.finance.alberta.ca
- Petroleum Technology Alliance Canada
  www.ptac.org}

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