

Background of an important global resource



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Glossary of oil sands terms

Canada has the third-largest oil reserves in the world, next to Saudi Arabia and Venezuela. Of Canada's 179 billion barrels of oil reserves, 170 billion barrels are located in Alberta, and have the special quality of being bitumen. This is 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

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 ir 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.

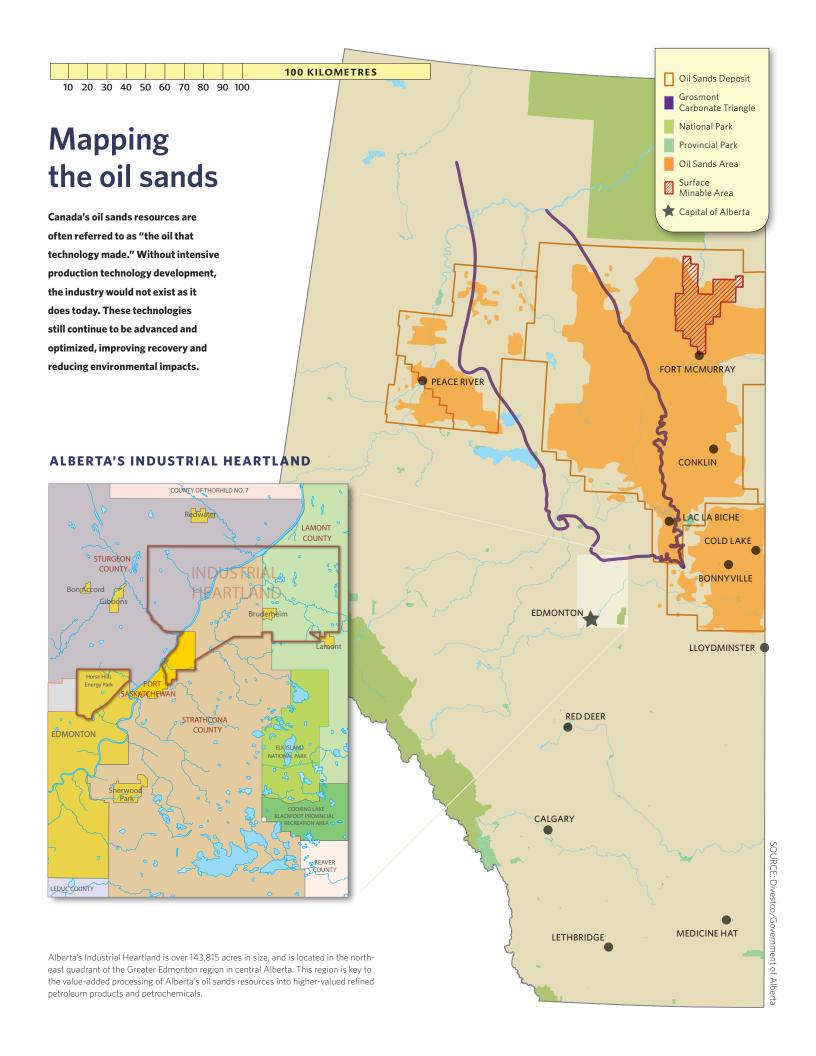
Right now there are essentially two commercial methods of in situ (Latin for "in place," essentially meaning wells are used rather than trucks and shovels). In cyclic steam stimulation (CSS), high-pressure steam is injected into directional wells drilled from pads for a period of time, then the steam 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 numbe 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 (SCO), which is a refinery feedstock. At these refineries it can be transformed into transportation fuels and other products.



Government update



NEW ADVISORY BODY TO COORDINATE TRANSPORTATION PLANNING IN OIL SANDS REGION

A new advisory committee will review and will make recommendations to the Alberta government on the current and future transportation needs of the Athabasca oil sands region. The committee of municipal, industry and provincial representatives will take into account the region's unique economic and infrastructure needs and the importance of the oil sands to the province's economy.

The Athabasca Oil Sands Area Transportation
Coordinating Committee will include representatives from
the Regional Municipality of Wood Buffalo; the Oil Sands
Developers Group; the Alberta Economic Development
Authority; the Fort McMurray Airport Authority; the
Northern Alberta Development Council; Cindy Ady, MLA
Calgary-Shaw; and the Alberta government.

The committee will meet a minimum of four times per year and will provide strategic advice and recommendations on transportation planning, design, funding, construction, operations and maintenance, including all classes of roads, transit, rail and air traffic within the Athabasca oil sands area.

This committee is part of 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. For more information about Responsible Actions, visit www.oilsands.alberta.ca.

CANADA AND ALBERTA TAKE ACTION TO IMPLEMENT WORLD-CLASS MONITORING SYSTEM FOR THE OIL SANDS

Increased air, water, land and biodiversity monitoring in the oil sands will begin this year as the Government of Canada and Government of Alberta take a major step forward in their partnership to improve environmental monitoring in the oil sands region.

The Joint Canada-Alberta Implementation Plan for Oil Sands Monitoring 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 more sites will be sampled for more substances more frequently. The program is designed to provide an improved understanding of the long-term cumulative effects of oil sands development.

The three-year implementation plan begins this spring with increased sampling frequency, parameters and

locations. It will also integrate relevant parts of existing monitoring efforts and will give government and industry the scientific foundation necessary to continue to promote the environmentally sustainable development of the oil sands. The implementation plan reflects the *Integrated Oil Sands Environment Monitoring Plan* released by Environment Canada in July and will be consistent with the Government of Alberta's plans for a province-wide environmental monitoring system.

As the process continues to move forward, implementation of the monitoring program will be jointly managed by the Government of Canada and the Government of Alberta. Annual progress reports on implementation will be prepared for the first three years, with an external scientific peer review of the program at the end of the third year. Following that, a full external, scientific review of the new program will be conducted every five years.

USE OF NEW TECHNOLOGIES SPURS PROVINCE TO RECORD LAND REVENUES

Capping a record year that saw renewed confidence in Alberta's oilpatch, for the first time in provincial history Alberta has exceeded \$3 billion in land sales for a calendar year. Revenues for the final calendar-year sale of provincial petroleum and natural gas mineral leases and licences, also known as land sales, were \$145,621,531.32. This brings the total revenue collected to \$3.54 billion for the 2011 calendar year.

Several records were set in 2011. In the August 24 sale, a record was set for the highest-ever price paid for a petroleum and natural gas parcel, more than \$123.5 million, for a licence southeast of Fox Creek, Alta. The June 1 sale netted the highest-ever single-sale record, collecting more than \$841 million for the province.

Total calendar sales in 2010 were \$2.39 billion. This was the first time the province collected more than \$2 billion in revenues from petroleum and natural gas land sales.

PREMIER REDFORD WELCOMES KEYSTONE XL REAPPLICATION

Premier Alison Redford issued the following statement in response to TransCanada Corporation's February announcement that it will soon reapply for a presidential permit for the Keystone XL pipeline, and in the meantime begin work on the pipeline's southern leg, known as the Gulf Coast Project. Premier Redford was visiting Chicago at the time.

"Today's announcement from TransCanada is welcome news for Albertans. I believe very strongly in the merits



and benefits of this critical pipeline and the Government of Alberta will continue to advocate for our energy interests in the United States.

"The Keystone XL pipeline is a game-changing piece of infrastructure that will create thousands of job opportunities on both sides of the border. It will reduce America's need for oil imports from jurisdictions with much weaker environmental policies and who do not share the same values as Canadians and Americans.

"For Alberta, Keystone means our oil has greater access to our largest and most important trading partner. Being in Chicago...is clearly demonstrating that there are strong supporters of our energy in the U.S. It also demonstrates that more work needs to be done to ensure our American friends fully understand the rigorous processes we have in place to develop our oil sands responsibly. I am very proud to tell our story and I will use my time [in Chicago] and when I am in Washington and New York to champion our responsible energy production.

"Our government recognizes that the approval of the Keystone XL pipeline is a U.S. decision. I remain optimistic that this project will be evaluated on its merits and that the discussions surrounding it will be guided by science and fact.

"I also applaud TransCanada's decision to proceed as soon as possible with construction of the Gulf Coast Project, which will carry crude from Cushing, Oklahoma, to refineries on the Gulf Coast. This, together with Enbridge's Seaway pipeline, will help close the gap between North American and international oil prices, benefitting Canadian producers and increasing royalties and tax revenues to help pay for health care, education and other public services."

PREMIER REDFORD PLEASED WITH EUROPE'S FUEL **QUALITY DIRECTIVE VOTE**

Alberta Premier Alison Redford issued the following statement in response to the February European Union (EU) voting against including crude from the oil sands under the fuel quality directive (FQD).

"Alberta has always advocated that the fuel quality directive should treat all crudes equally and be based on scientific, verifiable data. It is very encouraging to see [this] vote from EU technical experts. Our hope is that [the] decision from the technical experts is not circumvented for political reasons.

"This government has worked diligently to ensure Europe has access to the most current and up-to-date information on Alberta's responsible oil sands development. Albertans can feel confident that this government will continue to be a strong voice in support of this important industry.

"[This] vote is a small victory for Alberta, but the process in Europe means that a discriminatory FOD could resurface. Alberta remains committed to working with the EU on the FQD to ensure it is transparent, accountable and scientifically supported."

PUBLIC HEARING PROCESS STARTS FOR THE **ENBRIDGE NORTHERN GATEWAY PROJECT**

On May 27, 2010, Northern Gateway Pipelines Limited Partnership submitted its application to the National Energy Board (NEB) with respect to the Enbridge Northern Gateway Project. A joint review panel was established by the Minister of the Environment and the NEB to assess the environmental effects of the proposed project and review the application under both the Canadian Environmental Assessment Act and the National Energy Board Act. The panel recently issued the hearing order and held the first public hearings on Jan. 10, 2012. Based on the projected schedule, the panel anticipates releasing the Environmental Assessment Report in the fall of 2013 and its final decision on the project around the end of 2013.

The proposed Northern Gateway project involves the construction of two 1,170-kilometre-long pipelines running from Bruderheim, Alta., to Kitimat, B.C., and the construction and operation of the Kitimat Marine Terminal. For more information on the joint review process, please

visit the panel's website at

www.gatewaypanel.review.gc.ca.



What's new in the oil sands

Key updates from spring 2012



Morth West Upgrading Inc. (NWU) aims to make a final investment decision early in 2012 for the \$5-billion, 50,000-barrel-per-day first phase of its proposed 150,000-barrel-per-day bitumen refinery near Edmonton.

"We are now in the process of taking a financial proposal to our board of directors for approval," says Jerry Crail, NWU's vice-president of engineering and construction. "A detailed financial plan is already in place, and private investors and financial institutions have pledged funding."

The refinery will be owned equally by NWU and Canadian Natural Resources Limited, with NWU acting as operator. Canadian Natural, which plans to supply the facility with 12,500 barrels of bitumen per day, also expects board sanction for the project in 2012. The facility would also receive volumes from the Government of Alberta's Bitumen Royalty in-Kind program.

"In March 2012, detailed engineering work is due to start," Crail says, adding that long-lead items, including reactors and heavy wall columns, have already been fabricated and are lying in lowa, waiting to be trucked to the construction site.

Six companies have been pre-qualified for the main construction contracts. They are Lurgi AG of Germany, Japan's Toyo Engineering Corporation, WorleyParsons Ltd. of Australia, Calgary-based IMV Projects, and Jacobs Engineering Group Inc. and Fluor Corporation, both of the United States. Crail did not comment on the pre-qualification process, but says at this point no selection has been made.

III Southern Pacific Resource Corp. is seeking to triple production at its STP-McKay project to 36,000 barrels per day. The company has submitted an application to the Alberta Energy Resources Conservation Board (ERCB) and Alberta Environment and Water for approval to expand its 12,000-barrel-per-day STP-McKay Phase 1 project area, allowing it to construct a second steam assisted gravity drainage (SAGD) facility within the project area capable of producing an additional 24,000 barrels per day of bitumen.

The company says that STP-McKay Phase 2 will have the benefit of all the information obtained from the construction and preliminary operations

at STP-McKay Phase 1, which is currently under construction and scheduled for first steam in the second quarter of 2012. The company is budgeting 18 months for regulatory approval of Phase 2, based on the 15 months required for approval of Phase 1.

The Alberta government has launched a new web portal (www.osip.alberta.ca) designed to make it easy to find detailed information on the environmental performance of Alberta's oil sands facilities.

Searchable data includes such things as facility-specific water use, greenhouse gas emissions, tailings pond size, and land disturbance and reclamation.

While oil sands data and information has always been publicly available, it has often been difficult to find and time-consuming to access. The portal is the culmination of three years of work to compile data and information from a variety of sources.

Canada's oil sands producers have formed a new alliance, Canada's Oil Sands Innovation Alliance (COSIA), focused on accelerating the pace of improving environmental performance.

Chief executive officers of 12 companies have signed the alliance's founding charter, committing to COSIA's vision to "enable responsible and sustainable growth of Canada's oil sands while delivering accelerated improvement in environmental performance through collaborative action and innovation."

Members of the alliance include: BP Canada Energy Company, Canadian Natural Resources, Cenovus Energy Inc., ConocoPhillips Canada, Devon Canada Corporation, Imperial Oil Limited, Nexen Inc., Shell Canada Limited, Statoil Canada Ltd., Suncor Energy Inc., Teck Resources Limited and Total E&P Canada Ltd.

The creation of COSIA as an independent alliance builds on work done over the past several years by both oil sands industry members and research and development organizations, the alliance says. COSIA will take these efforts to a much larger scale and will help the industry address environmental challenges by breaking down barriers in the areas of funding, intellectual property enforcement and human resources that may otherwise impede progress on environmental performance.



III SNC-Lavalin Group Inc. has been awarded a major contract by an oil sands mining producer to provide engineering, procurement and construction services for a froth treatment plant in the Fort McMurray, Alta., region, valued in excess of \$650 million.

The froth treatment plant will process 155,000 barrels of feedstock per day from the bitumen extraction plant in the form of bitumen froth. The engineering phase is now underway and construction is scheduled to begin in February 2012. Mechanical completion for the construction is expected in September 2014.

While the customer was not publicly disclosed, there is speculation that the work is for an expansion of Canadian Natural's Horizon project.

The final regulatory approvals are now in place and construction is underway for Grizzly Oil Sands ULC's Algar Lake SAGD project. The approval, granted in December, is for a 11,300-barrel-per-day project that will be built in two 5,560-barrel-per-day phases.

Grizzly says it is on budget and on track for an early 2013 start-up for the first phase, which has an estimated cost of about \$220 million.

Paramount Resources Ltd. is transferring its Alberta oil sands and carbonate bitumen interests to a new wholly owned subsidiary, Cavalier Energy Inc. On completion of the reorganization, all of Paramount's oil sands and bitumen carbonate leases will be owned by Cavalier (originally intended to be called Pixar Petroleum Corp.), including Hoole and Saleski.

Paramount says the creation of Cavalier will allow accelerated development of these high-impact, capital-intensive properties on a self-funding basis. Cavalier's near-term focus is expected to be the development of its 100 per cent-owned leases at Hoole and the further delineation of its carbonate bitumen leases at Saleski.

Paramount says the majority of the work necessary for the regulatory application for a commercial development at Hoole has been completed, together with preliminary front-end engineering and design, and reservoir modelling and simulation, which has been verified by core flood experiments. Preparatory work for project development is continuing, including field activities focused on optimizing water-source and disposal options.

III Statoil Canada has applied for regulatory approval to test the injection of solvent at its Leismer SAGD project and says if the pilot proves successful, the process could see commercial use at Leismer as early as 2017 if it can find a long-term condensate-type diluent supply. If it is successful, solvent co-injection could also be used at the planned Corner project, Statoil's next phase of oil sands development.

The company says co-injection will have the overall effect of improving economics while reducing greenhouse gas emissions. Statoil is hoping for regulatory approval before June 2012. Construction of the solvent injection facilities will begin following approval and is tentatively scheduled to start in the second quarter of 2012.

Following a six-year regulatory process, Total E&P Canada has received federal cabinet approval for its \$9-billion Joslyn North oil sands mine about 70 kilometres north of Fort McMurray.

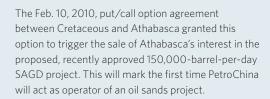
The production potential of the Joslyn North mine is currently estimated at 100,000 barrels per day with further expansion potential up to 200,000 barrels per day. First production is planned for 2018 at the site, which is west of the Athabasca River and directly south of Canadian Natural's Horizon installation.

Teck Resources' January purchase of SilverBirch Energy Corporation strengthens its proposed Frontier oil sands mine with a net cash outlay of \$435 million, says Teck president and chief executive officer Don Lindsay.

"Teck now has the opportunity to explore new potential partnerships and other alternatives to move Frontier towards development," he said in a news release. Under the agreement, Teck gains ownership of the proposed Frontier project, previously owned in a 50/50 venture with SilverBirch. A new company will be formed with the remaining SilverBirch assets—including prospective in situ lands at Audet.

■ Athabasca Oil Sands Corp. has exercised an option to sell its 40 per cent interest in the MacKay River oil sands project to Cretaceous Oilsands Holdings Limited, a wholly owned subsidiary of PetroChina International Investment Limited, for \$680 million in cash. ➤





Imperial Oil has approved a \$2-billion expansion of its Cold Lake, Alta., cyclic steam stimulation operation in northeastern Alberta. The Nabiye project, expected to start up by year-end 2014, will increase production by more than 40,000 barrels per day to about 200,000 barrels per day.

Imperial received original regulatory approvals for Nabiye in 2004, but in 2010 obtained approval for an amended application to improve the environmental performance of the expansion. The project amendments included a 170-megawatt cogeneration facility to enhance the plant's energy efficiency, a reduction in the number of well pads, reducing the environmental footprint and the addition of sulphur-recovery facilities.

Imperial's Cold Lake facility is the largest and longestrunning in situ oil sands operation in Canada and includes four steam-generation and bitumen-production plants.

MEG Energy Corp. now has regulatory authorization to proceed with its Christina Lake Phase 3 project. Engineering work on the 150,000-barrel-per-day facility is currently underway, including a planned \$60-million investment this year to assess optimum sizing and timing for the initial phase of the multistage project.

Pengrowth Energy Corporation has commenced the injection of steam at its Lindbergh pilot SAGD project, located in the Cold Lake area. The company says the project is a key component of its growth strategy, with the potential to increase oil and liquids production by up to 80 per cent and 2010 year-end reserves by 61 per cent over the next four years.

"Successfully injecting first steam at our pilot project at Lindbergh is a significant and exciting milestone for Pengrowth," says Steve De Maio, vice-president of in situ oil development and operations. "Production from the pilot is expected to increase throughout 2012 to approximately 1,000 barrels of oil per day by year-end and peaking at 1,200 barrels of oil per day later in 2013. A successful proof-of-concept pilot will provide Pengrowth with the certainty needed to develop an initial 12,500-barrel-of-oil-per-day commercial project."

III Sunshine Oil Sands Ltd. is going public on the Hong Kong Stock Exchange after receiving ERCB approval for the first phase of the West Ells oil sands project.

West Ells, a 10,000-barrel-per-day oil sands project, is to proceed in two phases of 5,000 barrels per day each, expected to begin construction this year and produce first steam in 2013. The SAGD project is expected to be capable of ultimately producing up to 100,000 barrels per day of bitumen from the Wabiskaw zone over a period of 18 years, with a productive life of more than 50 years.



Project listings

Updated status of oil sands projects in Alberta

As of March 9, 2012

COGD Combustion overhead gravity drainage

Cyclic steam stimulation

ET-DSP Electro-thermal dynamic stripping process

N-SOLV Heated solvent vapour extraction SAGD Steam assisted gravity drainage

TAGD Thermal assisted gravity drainage THAI Toe to heel air injection

URRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
NORTH ATHABAS	CA REGION	и — мін	IING	
CANADIAN NATURAL RESC	URCES LIMITED			
Horizon				
Canadian Natural says that rel oreparation plant is being com for a coker expansion, in part o Phase 2B, and engineering is o	missioned, there ha lue to coker fire reb	as been a six-ı uild, lump sur	month schedule slip ir	its Phase 2A plans
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
IMPERIAL OIL LIMITED				
Kearl				
Imperial Oil says that Kearl Ph tioned Kearl Phase 2.	ase 1 is approximate	ely 80 per cer	nt complete. The com	pany has sanc-
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				
The Canadian Environmental agreement to establish a joint the existing joint panel agreen	panel for review of nent for the review	the Pierre Riv of the Jackpin	er Mine project, as we e Mine expansion pro	ell as revisions to ject.
Expansion	100,000	2017	Approved	Mining
Phase 1A	100,000	2010	Operating	Mining
Phase 1B	100,000	TBD	Approved	
Muskeg River				Mining
Commercial	155,000	2002	Operating	
Expansion &	155,000	2002 TBD	Operating Approved	Mining Mining Mining
				Mining
Expansion & Debottlenecking				Mining
Expansion & Debottlenecking Pierre River	115,000	TBD	Approved	Mining
Expansion & Debottlenecking Pierre River Phase 1 Phase 2	115,000	TBD 2018	Approved Application	Mining Mining Mining
Expansion & Debottlenecking Pierre River Phase 1 Phase 2	115,000	TBD 2018	Approved Application	Mining Mining Mining
Expansion & Debottlenecking Pierre River Phase 1 Phase 2 SILVERBIRCH ENERGY CORI Frontier Teck Resources Limited will (SilverWillow Energy Corpo	115,000 100,000 100,000 PORATION acquire SilverBirch ration) with the fo	TBD 2018 TBD	Approved Application Application a new company wil	Mining Mining Mining Mining
Expansion & Debottlenecking Pierre River Phase 1 Phase 2 SILVERBIRCH ENERGY CORI Frontier Teck Resources Limited will (SilverWillow Energy Corpo	115,000 100,000 100,000 PORATION acquire SilverBirch ration) with the fo	TBD 2018 TBD	Approved Application Application a new company wil	Mining Mining Mining Mining
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Expansion & Debottlenecking Pierre River Phase 1 Phase 2 SILVERBIRCH ENERGY CORE Frontier Teck Resources Limited will (SilverWillow Energy Corpo SilverBirch's 50 per cent into Phase 1	115,000 100,000 100,000 PORATION acquire SilverBirch ration) with the forerest in Frontier.	TBD 2018 TBD h Energy and rmer compa	Approved Application Application a new company will ny's in situ assets. To Application	Mining Mining Mining Mining Mining be spun out eck gains

40,000

Phase 4 Equinox

2030

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY			
SUNCOR ENERGY INC.							
Base Operations							
In Q4 of 2011, Suncor began to mine ore from the North Steepbank extension. Additionally, at the upgrader, the Millennium Naphtha Unit is now producing hydrogen and is expected to reach full design rates in early 2012.							
Millennium Debottlenecking 23,000 2008 Operating Mining							
Millennium Mine	294,000	1967	Operating	Mining			
North Steepbank Extension	180,000	2012	Construction	Mining			
Steepbank Debottleneck Phase 3	4,000	2007	Operating	Mining			
Fort Hills							
Current capital expenditures for	r Fort Hills are arou	und design ba	se memorandum engi	ineering.			
Debottleneck	25,000	TBD	Approved	Mining			
Phase 1	165,000	2016	Approved	Mining			
Voyageur South							
Phase 1	120,000	TBD	Application	Mining			
SYNCRUDE CANADA LTD.							
\$4.6-billion Mildred Lake mine Syncrude Emissions Reduction				\$1.6-billion			
Aurora South Train 1	100,000	2016	Approved	Mining			
Aurora South Train 2	100,000	2018	Approved	Mining			
Base Mine Stage 1 & 2 Expansion	290,700	1978	Operating	Mining			
Stage 3 Expansion	116,300	2006	Operating	Mining			
TOTAL E&P CANADA LTD.							
Joslyn North Mine							
Project partner Suncor Energy engineering, regulatory and en			ditures are around ge	ological,			
Phase 1	100,000	2018	Approved	Mining			
Joslyn South Mine							
Phase 1	100,000	TBD	Announced	Mining			
Northern Lights Mine							
Phase 1	57,250	TBD	On Hold	Mining			
Phase 2	57,250	TBD	On Hold	Mining			
NORTH ATHABAS	CA REGION	1 — IN :	SITU				
ATHABASCA OIL SANDS CO	RP.						
Birch							

12,000

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOG
Dover West Clastics				
Application for the 12,000-bar	rel-per-day Phas	e 1 was filed in	December 2011.	
Phase 1	12,000	2015	Announced	SAGD
Phase 2	35,000	TBD	Announced	SAGD
Phase 3	35,000	TBD	Announced	SAGD
Dover West Leduc Carbonates	5			
AOSC says that TAGD piloting application for a two-phase details.				2012. Regulat
Phase 1 Demonstration	6,000	2014	Application	TAGE
Phase 2 Demonstration	6,000	TBD	Application	TAGE
CANADIAN NATURAL RESOL	URCES LIMITED			
Birch Mountain				
Phase 1	60,000	2022	Announced	SAGD
Phase 2	60,000	2026	Announced	SAGD
CENOVUS ENERGY INC.				
Telephone Lake Borealis				
Cenovus has filed the environm mercial project at Telephone La		sessment for a	90,000-barrel-per-o	day phase con
Phase A	45,000	TBD	Application	SAGD
Phase B	45,000	TBD	Announced	SAGD
DOVER OPERATING CORP.				
Dover				
Phase 1	50,000	2015	Application	
Phase 1 Subsequent Phases Mackay River PetroChina Company Limited H MacKay River project from forr	200,000 nas exercised its	TBD right to purcha	Application se the remaining 40 ds, marking the first	time PetroChir
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Phase 1 Subsequent Phases Mackay River PetroChina Company Limited h MacKay River project from forr act as project operator in the o Phase 1 Phase 2 Phase 3	200,000 has exercised its mer partner Athail sands. ERCB pr 35,000 40,000	right to purcha basca Oil San oject approval 2014 2017 2019	Application se the remaining 40 ds, marking the first in granted January 20 Application Application Application	per cent of the time PetroChi (2.
Phase 1 Subsequent Phases Mackay River PetroChina Company Limited H MacKay River project from forr act as project operator in the o Phase 1 Phase 2	200,000 nas exercised its: mer partner Atha il sands. ERCB pr 35,000 40,000	right to purcha basca Oil Sano oject approval 2014 2017	Application se the remaining 40 ds, marking the first to granted January 201 Application Application	per cent of the time PetroChi (2.
Phase 1 Subsequent Phases Mackay River PetroChina Company Limited h MacKay River project from forr act as project operator in the o Phase 1 Phase 2 Phase 3 Phase 4	200,000 has exercised its mer partner Atha il sands. ERCB pr 35,000 40,000 40,000 35,000	right to purcha basca Oil Sano oject approval 2014 2017 2019 TBD	Application se the remaining 40 ds, marking the first i granted January 20 Application Application Application Application	per cent of the time PetroChi
Phase 1 Subsequent Phases Mackay River PetroChina Company Limited h MacKay River project from forr act as project operator in the o Phase 1 Phase 2 Phase 3 Phase 4 E-T ENERGY LTD. Poplar Creek E-T is now working on what it of fine tuning of its well patterns.	200,000 has exercised its mer partner Atha il sands. ERCB pr 35,000 40,000 40,000 35,000	right to purcha basca Oil Sano oject approval 2014 2017 2019 TBD	Application se the remaining 40 ds, marking the first i granted January 20 Application Application Application Application	per cent of the time PetroChi 2. SAGD SAGD SAGD SAGD SAGD SAGD SAGD SAG
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Phase 1 Subsequent Phases Mackay River PetroChina Company Limited H MacKay River project from forr act as project operator in the o Phase 1 Phase 2 Phase 3 Phase 4 E-T ENERGY LTD. Poplar Creek E-T is now working on what it of fine tuning of its well patterns. plans to access the IPO market Phase 1 Phase 2	200,000 has exercised its mer partner Atha il sands. ERCB pr 35,000 40,000 35,000 calls Step 3 of its The next step with in 2012. 10,000 40,000	right to purcha basca Oil Sano oject approval 2014 2017 2019 TBD pilot, intended II be a commercial	Application se the remaining 40 ds, marking the first of granted January 20 Application Announced	per cent of the time PetroChi 2. SAGD SAGD SAGD SAGD SAGD SAGD SAGD SAG
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Phase 1 Subsequent Phases Mackay River PetroChina Company Limited It MacKay River project from form act as project operator in the oracle as p	200,000 has exercised its mer partner Atha il sands. ERCB pr 35,000 40,000 40,000 35,000 talls Step 3 of its The next step with in 2012. 10,000 40,000 1,000 on remains on scimplete and Husk no plant and delive	right to purcha basca Oil Sanoject approval 2014 2017 2019 TBD pilot, intended II be a commental be a comm	Application se the remaining 40 ds, marking the first it granted January 201 Application Application Application Application Application Application Application Operating Announced Operating	per cent of the time PetroChi 2. SAGD SAGD SAGD SAGD SAGD SAGD SAGD SAG
Phase 1 Subsequent Phases Mackay River PetroChina Company Limited Hackay River project from forract as project operator in the office of the phase 1 Phase 2 Phase 3 Phase 4 E-T ENERGY LTD. Poplar Creek E-T is now working on what it offine tuning of its well patterns. plans to access the IPO market Phase 1 Phase 2 Pilot HUSKY ENERGY INC. Sunrise Husky says Phase 1 construction the 49 SAGD well pairs are contion of foundations for the main	200,000 has exercised its mer partner Atha il sands. ERCB pr 35,000 40,000 40,000 35,000 2alls Step 3 of its The next step within 2012. 10,000 40,000 1,000 on remains on scimplete and Husk in plant and delive 60,000	TBD right to purcha basca Oil Sano oject approval 2014 2017 2019 TBD pilot, intended II be a commercial to a commercial	Application se the remaining 40 ds, marking the first of granted January 201 Application Application Application Application Application Application Application Application Operating production in 2014, costs are trending on or equipment began Construction	per cent of the time PetroChi 2. SAGD SAGD SAGD SAGD SAGD SAGD SAGD SAG
Phase 1 Subsequent Phases Mackay River PetroChina Company Limited It MacKay River project from form act as project operator in the oracle as p	200,000 has exercised its mer partner Atha il sands. ERCB pr 35,000 40,000 35,000 40,000 35,000 40,000 1,000 40,000 1,000 40,000 1,000 50,000 50,000	right to purcha basca Oil Sancoject approval 2014 2017 2019 TBD pilot, intended li be a commer 2014 2016 2007	Application se the remaining 40 ds, marking the first in granted January 201 Application Announced Operating production in 2014. costs are trending on or equipment began Construction Approved	per cent of the time PetroChin (2). SAGD SAGD SAGD SAGD SAGD SAGD SAGD SAG

20,000

20,000

Phase 1

Phase 2

2013

TBD

SAGD

Phase 3

Phase 3 Expansion

	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOG
MARATHON OIL CORPORAT	ION			
Birchwood				
Pilot	12,000	2016	Announced	SAGD
OAK POINT ENERGY LTD.				
Lewis				
Oak Point Energy reports that o	engineering and p	rocurement is	s ongoing.	
Pilot	1,720	2013	Application	SAGD
ROYAL DUTCH SHELL PLC				
Grosmont				
The project, which would incorpurchase of additional leases in Canada's Grosmont acreage.				
Pilot	TBD	TBD	On Hold	SAGD
SOUTHERN PACIFIC RESOUR	CE CORP.			
STP McKay				
Southern Pacific says construct				
the end of Q2 of 2012, with pro				
Phase 1	12,000	2012	Construction	SAGD
Phase 2A	12,000	2015	Application	SAGD
Phase 2B	12,000	TBD	Application	SAGD
SUNCOR ENERGY INC. Firebag				
wells at the Firebag project. Cogeneration and Expansion	25,000	2007	Operating	SAGD
Stage 1	35,000	2004	Operating	
Stage 2	05.000		Operating	SAGD
	35,000	2006	Operating	SAGD SAGD
Stage 3	62,500	2006		
Stage 3 Stage 3-6 Debottleneck			Operating	SAGD
	62,500	2011	Operating Operating	SAGD SAGD
Stage 3-6 Debottleneck Stage 4	62,500 23,000 62,500	2011 TBD 2013	Operating Operating Application Construction	SAGD SAGD SAGD SAGD
Stage 3-6 Debottleneck Stage 4 Stage 5	62,500 23,000 62,500 62,500	2011 TBD	Operating Operating Application Construction Approved	SAGD SAGD SAGD SAGD
Stage 3-6 Debottleneck Stage 4 Stage 5 Stage 6	62,500 23,000 62,500	2011 TBD 2013 2018	Operating Operating Application Construction	SAGD SAGD SAGD SAGD
Stage 3-6 Debottleneck Stage 4 Stage 5 Stage 6	62,500 23,000 62,500 62,500	2011 TBD 2013 2018	Operating Operating Application Construction Approved	SAGD SAGD SAGD SAGD
Stage 3-6 Debottleneck Stage 4 Stage 5 Stage 6 Lewis	62,500 23,000 62,500 62,500 62,500	2011 TBD 2013 2018 2019	Operating Operating Application Construction Approved Approved	SAGD SAGD SAGD SAGD SAGD SAGD
Stage 3-6 Debottleneck Stage 4 Stage 5 Stage 6 Lewis Phase 1 Phase 2	62,500 23,000 62,500 62,500 62,500	2011 TBD 2013 2018 2019	Operating Operating Application Construction Approved Approved	SAGD SAGD SAGD SAGD SAGD
Stage 3-6 Debottleneck Stage 4 Stage 5 Stage 6 Lewis Phase 1 Phase 2 MacKay River Suncor has confirmed that the	62,500 23,000 62,500 62,500 40,000 40,000	2011 TBD 2013 2018 2019 TBD TBD TBD	Operating Operating Application Construction Approved Approved Application Application	SAGD SAGD SAGD SAGD SAGD SAGD SAGD
Stage 3-6 Debottleneck Stage 4 Stage 5 Stage 6 Lewis Phase 1 Phase 2 MacKay River Suncor has confirmed that the	62,500 23,000 62,500 62,500 40,000 40,000	2011 TBD 2013 2018 2019 TBD TBD TBD	Operating Operating Application Construction Approved Approved Application Application	SAGD SAGD SAGD SAGD SAGD SAGD SAGD
Stage 3-6 Debottleneck Stage 4 Stage 5 Stage 6 Lewis Phase 1 Phase 2 MacKay River Suncor has confirmed that the pany will spend \$70 million on	62,500 23,000 62,500 62,500 40,000 40,000 MacKay River ex the project in 20	2011 TBD 2013 2018 2019 TBD TBD TBD Dansion is a ke	Operating Operating Application Construction Approved Approved Application Application	SAGD SAGD SAGD SAGD SAGD SAGD
Stage 3-6 Debottleneck Stage 4 Stage 5 Stage 6 Lewis Phase 1 Phase 2 MacKay River Suncor has confirmed that the pany will spend \$70 million on MR2 Phase 1	62,500 23,000 62,500 62,500 40,000 MacKay River ex the project in 20 40,000	2011 TBD 2013 2018 2019 TBD TBD TBD Dansion is a ke	Operating Operating Application Construction Approved Approved Application Application Application Application	SAGD SAGD SAGD SAGD SAGD SAGD SAGD SAGD
Stage 3-6 Debottleneck Stage 4 Stage 5 Stage 6 Lewis Phase 1 Phase 2 MacKay River Suncor has confirmed that the pany will spend \$70 million on MR2 Phase 1 SUNSHINE OILSANDS LTD.	62,500 23,000 62,500 62,500 40,000 MacKay River ex the project in 20 40,000	2011 TBD 2013 2018 2019 TBD TBD TBD Dansion is a ke	Operating Operating Application Construction Approved Approved Application Application Application Application	SAGD SAGD SAGD SAGD SAGD SAGD SAGD SAGD
Stage 3-6 Debottleneck Stage 4 Stage 5 Stage 6 Lewis Phase 1 Phase 2 MacKay River Suncor has confirmed that the pany will spend \$70 million on MR2 Phase 1 SUNSHINE OILSANDS LTD. Harper Sunshine Oilsands is mobilizing	62,500 23,000 62,500 62,500 40,000 40,000 MacKay River ex the project in 20 40,000 33,000	2011 TBD 2013 2018 2019 TBD TBD TBD 2016 2002	Operating Operating Application Construction Approved Approved Application Application Application Operating	SAGD SAGD SAGD SAGD SAGD SAGD SAGD SAGD
Stage 3-6 Debottleneck Stage 4 Stage 5 Stage 6 Lewis Phase 1 Phase 2 MacKay River Suncor has confirmed that the pany will spend \$70 million on MR2 Phase 1 SUNSHINE OILSANDS LTD. Harper Sunshine Oilsands is mobilizing	62,500 23,000 62,500 62,500 40,000 40,000 MacKay River ex the project in 20 40,000 33,000	2011 TBD 2013 2018 2019 TBD TBD TBD 2016 2002	Operating Operating Application Construction Approved Approved Application Application Application Operating	SAGD SAGD SAGD SAGD SAGD SAGD SAGD SAGD
Stage 3-6 Debottleneck Stage 4 Stage 5 Stage 6 Lewis Phase 1 Phase 2 MacKay River Suncor has confirmed that the pany will spend \$70 million on MR2 Phase 1 SUNSHINE OILSANDS LTD. Harper Sunshine Oilsands is mobilizing edly with a number of producti	62,500 23,000 62,500 62,500 40,000 40,000 40,000 33,000 g for a second cycon improvements	2011 TBD 2013 2018 2019 TBD TBD TBD 2016 2002	Operating Operating Application Construction Approved Approved Application Application Application Operating Operating	SAGD SAGD SAGD SAGD SAGD SAGD SAGD SAGD
Stage 3-6 Debottleneck Stage 4 Stage 5 Stage 6 Lewis Phase 1 Phase 2 MacKay River Suncor has confirmed that the pany will spend \$70 million on MR2 Phase 1 SUNSHINE OILSANDS LTD. Harper Sunshine Oilsands is mobilizing edly with a number of production	62,500 23,000 62,500 62,500 40,000 40,000 MacKay River ex the project in 20 40,000 33,000	2011 TBD 2013 2018 2019 TBD TBD TBD 2016 2002	Operating Operating Application Construction Approved Approved Application Application Application Operating Operating Operating Operating	SAGD SAGD SAGD SAGD SAGD SAGD SAGD SAGD
Stage 3-6 Debottleneck Stage 4 Stage 5 Stage 6 Lewis Phase 1 Phase 2 MacKay River Suncor has confirmed that the pany will spend \$70 million on MR2 Phase 1 SUNSHINE OILSANDS LTD. Harper Sunshine Oilsands is mobilizing edly with a number of productic Carbonate Pilot Legend Lake	62,500 23,000 62,500 62,500 40,000 40,000 MacKay River ex the project in 20 40,000 33,000	2011 TBD 2013 2018 2019 TBD TBD TBD 2016 2002	Operating Operating Application Construction Approved Approved Application Application Application Operating Operating Operating Operating	SAGD SAGD SAGD SAGD SAGD SAGD SAGD SAGD

TBD

TBD

20,000

10,000

SAGD

SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Thickwood				

Sunshine Oilsands has submitted the regulatory application for its Thickwood SAGD project, anticipating project start-up in 2015.

Phase 1	10,000	2015	Application	SAGD
Phase 2	20,000	2017	Announced	SAGD
Phase 2 Expansion	20,000	2020	Announced	SAGD

West Ells

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Sunshine has received regulatory approval to proceed with a 10,000-barrel-per-day SAGD project at West Ells. Former Harvest Operations Corp. John Zahary has been appointed president and CEO.

Phase 1	5,000	2012	Approved	SAGD
Phase 2	5,000	2013	Approved	SAGD
Phase 3	40,000	2018	Announced	SAGD
Phase 4	40,000	2024	Announced	SAGD

VALUE CREATION INC.

Terre de Grace

Pilot 10,000	TBD	Approved	SAGD
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SOUTH ATHABASCA REGION — IN SITU

ALBERTA OILSANDS INC.

Clearwater West

Alberta Oilsands anticipates approval for the Clearwater West pilot in 2012, with construction to follow. Shabir Premij has retired as chairman and CEO, replaced by interim CEO Michael Lee and chairman Jack Crawford.

Phase 2	25,000	2016	Announced	SAGD
Pilot	4,350	2012	Application	SAGD

ATHABASCA OIL SANDS CORP.

Hangingstone

AOSC says the engineering design basis memorandum is complete, and certain long-lead items have been procured, such as evaporators and boilers. Construction is targeted to start in late 2012.

Phase 1	12,000	2014	Application	SAGD
Phase 2	35,000	2017	Announced	SAGD
Phase 3	35,000	2019	Announced	SAGD

BLACKPEARL RESOURCES INC.

Blackrod

Alberta Environment and Water is preparing the final terms of reference for the commercial project phases. BlackPearl says production at the pilot is now over 300 barrels per day with an instantaneous SOR of less than 3:1, exceeding model expectations. The application for the 80,000-barrel-per-day commercial project is nearing completion, and will be submitted to the regulator in Q2 of 2012.

Phase 1	20,000	2016	Announced	SAGD
Phase 2	30,000	TBD	Announced	SAGD
Phase 3	30,000	TBD	Announced	SAGD
Pilot	TBD	2011	Operating	SAGD

CANADIAN NATURAL RESOURCES LIMITED

Gregoire Lake

Phase 1	60,000	2024	Announced	ТВА
111836 1	00,000	2024	Ailliounceu	IDA

Grouse

Regulatory application is targeted for early 2012. Alberta Environment has issued its final terms of reference for the Grouse environmental impact assessment.

Commercial	40.000	2017	Announced	CACD	
Commercial	40,000	2017	Announced	SAGD	1

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Kirby (North)				

CNRL has submitted the environmental impact assessment for all phases at Kirby North and South.

Phase 1	50,000	2016	Application	SAGD
Phase 2	30,000	2019	Application	SAGD

Kirby (South)

 $Canadian\ Natural\ says\ construction\ remains\ on\ track\ and\ on\ budget.\ The\ company\ has\ submitted\ the\ environmental\ impact\ assessment\ for\ all\ phases\ of\ expansion\ at\ Kirby\ North\ and\ South.$

Phase 1	45,000	2013	Construction	SAGD
Phase 2	15,000	2020	Application	SAGD

CENOVUS ENERGY INC.

Christina Lake

Construction of Phase D is more than 70 per cent complete and production is expected in Q4. Construction of Phase E is more than 30 per cent complete, with initial production expected in Q4 of 2013. Ground preparation continues for Phase F. Production capacity for both Phases F and G has been increased by 10,000 barrels per day to 50,000 barrels per day each.

Phase 1A	10,000	2002	Operating	SAGD
Phase 1B	8,800	2008	Operating	SAGD
Phase C	40,000	2011	Operating	SAGD
Phase D	40,000	2012	Construction	SAGD
Phase E	40,000	2013	Approved	SAGD
Phase F	50,000	2016	Approved	SAGD
Phase G	50,000	2017	Approved	SAGD
Phase H	40,000	2019	Announced	SAGD

Foster Creek

Ground preparation is now complete for Phases F-H. At Phase F, site preparation and the installation of pipe racks continues to progress on schedule.

Phase A	24,000	2001	Operating	SAGD
Phase B Debottleneck	6,000	2003	Operating	SAGD
Phase C Stage 1	10,000	2005	Operating	SAGD
Phase C Stage 2	20,000	2007	Operating	SAGD
Phase D	30,000	2009	Operating	SAGD
Phase E	30,000	2009	Operating	SAGD
Phase F	45,000	2014	Construction	SAGD
Phase G	40,000	2015	Approved	SAGD
Phase H	40,000	2016	Approved	SAGD
Phase I	45,000	2017	Announced	SAGD

Narrows Lake

Phase 1	43,333	2017	Application	SAGD
Phase 2	43,333	TBD	Application	SAGD
Phase 3	43,334	TBD	Application	SAGD

Pelican Lake Grand Rapids

Cenovus has filed the environmental impact assessment for a commercial project at Pelican Grand Rapids.

Phase A	60,000	2017	Application	SAGD
Phase B	60,000	TBD	Application	SAGD
Phase C	60,000	TBD	Application	SAGD
Pilot	600	2011	Operating	SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
CONNECTED OF AND CACLINITED				

ONNACHER OIL AND GAS LIMITED

Great Divide

Connacher chairman and CEO Dick Gusella has relinquished his post. The company's board has announced the initiation of a process to examine all potential strategies for the company going forward.

Algar Pod 2	10,000	2010	Operating	SAGD
Expansion	24,000	2014	Application	SAGD
Pod 1	10,000	2007	Operating	SAGD

CONOCOPHILLIPS CANADA LIMITED

Surmont

ConocoPhillips says it has received regulatory approval to increase production capacity of Phase 2 to 109,000 barrels per day, up from the previously approved 83,000 barrels per day.

Phase 1	27,000	2007	Operating	SAGD
Phase 2	109,000	2015	Construction	SAGD
Pilot	1,200	1997	Operating	SAGD

DEVON CANADA CORPORATION

Jackfish

Devon reports that Jackfish 3 construction is now underway, and that Jackfish 2 volumes are ramping up ahead of plan and on target to reach capacity of 35,000 barrels per day by late 2012.

Phase 1	35,000	2007	Operating	SAGD
Phase 2	35,000	2011	Operating	SAGD
Phase 3	35,000	2015	Construction	SAGD

Pike

Devon is currently drilling appraisal wells and acquiring seismic on its Pike oil sands leases in order to determine the optimal development plan. Alberta Environment has issued its final terms of reference for the project.

1A	35,000	2016	Announced	SAGD
1B	35,000	2017	Announced	SAGD
1C	35,000	2017	Announced	SAGD

GRIZZLY OIL SANDS ULC

Algar Lake

Partial owner Gulfport Energy says Grizzly's construction is on track for commissioning in Q4 with first production in mid-2013. Grizzly will also likely soon file a regulatory application for a SAGD project at Thickwood.

Phase 1	5,650	2013	Construction	SAGD
Phase 2	5,650	2014	Approved	SAGD

HARVEST OPERATIONS CORP

BlackGold

Harvest president and CEO John Zahary has stepped down and will be replaced by Myunghuhn Yi as part of the transition of ownership to Korea National Oil Corporation.

Phase 1	10,000	2014	Construction	SAGD
Phase 2	20,000	2015	Application	SAGD

HUSKY ENERGY INC.

McMullen

Husky says that steam injection commenced in September 2011, followed by first air injection successfully initiated in December 2011.

Air Injection Pilot- Experimental	755	2012	Construction	SAGD
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JAPAN CANADA OIL SANDS LIMITED

Hangingstone

JACOS owner Japan Petroleum Exploration is delaying a decision on an expansion at Hangingstone until mid-2012 due to a delay in regulatory approval.

Expansion	35,000	2015	Application	SAGD	
Hangingstone Pilot					
Pilot	11,000	1999	Operating	SAGD	

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
LADICINA ENERGY LTD				

Germain

Civil site construction is complete. Well pair drilling has commenced. Procurement, engineering and module fabrication continues. Laricina has commenced an expansion of its camp to support project construction. Laricina has submitted the environmental impact assessment for its 150,000-barrel-per-day expansion at Germain.

Phase 1 Commercial Demonstration	5,000	2013	Construction	SAGD
Phase 2	30,000	2015	Application	SAGD
Phase 3	60,000	2018	Application	SAGD
Phase 4	60,000	2021	Application	SAGD

Laricina says the Saleski pilot sold 26,300 barrels of bitumen as of the end of Q3 of 2011. Pilot testing continues with an additional steam cycle added to each operating pair. The company has received regulator approval for the addition of a second steam generator. The Phase 1 application continues to move through the regulatory process, and now first steam is targeted for early 2014 rather than late 2013.

Phase 1	10,700	2014	Application	SAGD
Pilot	1,800	2011	Operating	SAGD

MEG ENERGY CORPORATION

Christina Lake

MEG says that detailed engineering on Phase 2B is 93 per cent complete. All materials and project modules have been ordered, with delivery and on-site construction scheduled to continue through 2012 with completion scheduled for 2013. The company has received regulatory approval for the multistage Phase 3.

Phase 1 Pilot	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

Regulatory application to be filed for 100,000-barrel-per-day project in Q2 of 2011.

Phase 1	50,000	2018	Announced	SAGD
Phase 2	50,000	TBD	Announced	SAGD

N-SOLV CORPORATION

Dover

N-Solv and partner Suncor Energy have been granted funding from the Government of Canada under Sustainable Development Technology Canada to develop the N-Solv pilot.

Demonstration Plant	500	2012	Announced	N-SOLV
NEXEN INC.				

Long Lake

Nexen says its focus at Long Lake continues to be to fill unused capacity at the upgrader. The company is currently advancing 60 additional wells to achieve this task.

Long Lake South (Kinosis) Phase 1	40,000	TBD	Approved	SAGD
Long Lake South (Kinosis) Phase 2	40,000	TBD	Approved	SAGD
Phase 1	72,000	2008	Operating	SAGD
Phase 2	72,000	TBD	Approved	SAGD
Phase 3	72,000	TBD	Application	SAGD
Phase 4	72,000	TBD	Announced	SAGD

PARAMOUNT RESOURCES LTD.

Hoole

Paramount is spinning off its oil sands assets including Hoole and carbonate leases into a new firm called Cavalier Energy Inc. The company says the majority of work necessary for the Hoole regulatory application has been completed, together with preliminary front-end engineering and design, reservoir modelling and simulation.

Commercial	35,000	2015	Announced	SAGD

Phase 11-13

Phase 14-16

30,000

40,000

2014

CSS

1.5

Pilot Expansion

3.000

TBD

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CURRENT PROJECT	CAPA	CITY	START-UP	REGULATORY STATUS	TECHNOLOGY
KOCH EXPLORATION	CANADA CORP	ORATIO	N		
Gemini					
ERCB approval for a pha	ased 10,000-bar	rel-per-d	lay commerci	al project in March 2	012.
Phase 1	5,0	00	TBD	Approved	SAGD
Phase 2	5,0	00	TBD	Approved	SAGD
OSUM OIL SANDS CO	RP.				
Taiga					
Osum has completed a \$1 billion in private equi			cement. The	company has raised i	n excess of
Phase 1	17,5	00	2014	Application	SAGD
Phase 2	17,5	00	2016	Application	SAGD
PENGROWTH CORPO	RATION				
Lindbergh					
Pengrowth achieved firs	st steam at the Li	indbergh	pilot in Febru	uary.	
Phase 1 Commercial	12,5	500	2014	Application	SAGD
Phase 2 Commercial	17,5	00	2016	Announced	SAGD
Pilot	1,2	00	2012	Operating	SAGD
ROYAL DUTCH SHELL	PLC				
Orion					
Phase 1	10,0	000	2007	Operating	SAGD
Phase 2	10,0	000	TBD	Approved	SAGD
PEACE RIVER	REGION -	- IN	SITU		
Andora Energy majority review continues, but n asset. The process cont	o bids have been tinues.	received	d either to pu	rchase the company o	or farm into the
review continues, but n asset. The process cont SAGD Demonstration	o bids have been tinues. 1,4	received			
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review continues, but n asset. The process cont SAGD Demonstration NORTHERN ALBERTA Sawn Lake Company owner Deep ' pleted its reservoir moc concluding the project v	o bids have been tinues. 1,4 OIL LTD. Well Oil & Gas Ir delling for a propuwould yield communication.	oc. says Eosed hor	TBD DeGolyer & Nizontal cyclic	Approved AcNaughton Canada steam stimulation pi	SAGD Limited has conlot at Sawn Lake,
review continues, but n asset. The process cont SAGD Demonstration NORTHERN ALBERTA	o bids have been tinues. 1,4 OIL LTD. Well Oil & Gas Ir delling for a propuwould yield communication.	000 oc. says [osed hor mercially	TBD DeGolyer & Nizontal cyclic	Approved AcNaughton Canada steam stimulation pi	SAGD Limited has con lot at Sawn Lake,
review continues, but nasset. The process cont SAGD Demonstration NORTHERN ALBERTA Sawn Lake Company owner Deep pleted its reservoir moc concluding the project pilot plan and options for CSS Pilot	o bids have been inues. 1,4 OIL LTD. Well Oil & Gas Ir delling for a propure would yield comport capitalization.	nc. says Eosed hormercially	TBD DeGolyer & Mizontal cyclic viable extract	Approved Approved MacNaughton Canada steam stimulation pi	SAGD Limited has con lot at Sawn Lake, rrently preparing
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SAGD Demonstration NORTHERN ALBERTA Sawn Lake Company owner Deep beleted its reservoir moconcluding the project opilot plan and options for CSS Pilot PETROBANK ENERGY Dawson Petrobank says the Day	o bids have been inues. 1,4 OIL LTD. Well Oil & Gas Ir delling for a propi would yield compor capitalization. 70 AND RESOURC	oc. says [osed hormercially]	TBD DeGolyer & N izontal cyclic viable extrac	Approved AcNaughton Canada steam stimulation pition. Deep Well is cu Approved	SAGD Limited has con lot at Sawn Lake rrently preparing
SAGD Demonstration NORTHERN ALBERTA Sawn Lake Company owner Deep pleted its reservoir moc concluding the project pilot plan and options for CSS Pilot PETROBANK ENERGY Dawson Petrobank says the Day development is being control of the project plan and options for CSS Pilot	o bids have been inues. 1,4 OIL LTD. Well Oil & Gas Ir lelling for a propound yield comor capitalization. 70 AND RESOURC	nc. says [osed hornercially]	TBD DeGolyer & M izontal cyclic viable extrac TBD cent complet	Approved AcNaughton Canada steam stimulation pition. Deep Well is cu Approved e and will be completed Q3.	SAGD Limited has con lot at Sawn Lake, rrently preparing CSS
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review continues, but nasset. The process cont asset. The process cont SAGD Demonstration NORTHERN ALBERTA Sawn Lake Company owner Deep pleted its reservoir moc concluding the project pilot plan and options for CSS Pilot PETROBANK ENERGY Dawson Petrobank says the Dav development is being continued by the project plan and options for CSS Pilot PETROBANK ENERGY Dawson Petrobank says the Dav development is being continued by the project plan and options for CSS Pilot Phase 2 THAI Demonstration ROYAL DUTCH SHELL Peace River Alberta's environmental mental impact assessm Cadotte Lake Carmon Creek - Phase	o bids have been inues. 1,4 OIL LTD. Well Oil & Gas Ir delling for a propio would yield common capitalization. 70 AND RESOURC vson THAI pilot it onsidered, target 10,0 TE PLC 1 40,0 1 40,0 2 40,0	received one of the control of the	TBD CeGolyer & Moizontal cyclic viable extract TBD Cent complete the complete the complete that cyclic viable extract complete that cyclic viable extract viable	Approved Approved AccNaughton Canada steam stimulation pi tion. Deep Well is cu Approved e and will be complet Q3. Announced Construction mplete Shell Canada I nsion. Operating	cram into the SAGD Limited has conlot at Sawn Lake rrently preparing CSS THAI THAI THAI CSS CSS CSS
review continues, but nasset. The process cont SAGD Demonstration NORTHERN ALBERTA Sawn Lake Company owner Deep pleted its reservoir moc concluding the project pilot plan and options for CSS Pilot PETROBANK ENERGY Dawson Petrobank says the Dav development is being continued by the project plan and options for CSS Pilot PETROBANK ENERGY Dawson Petrobank says the Dav development is being continued by the project plans and provided by the project plans and project plans and provided by the project plans and project	o bids have been inues. 1,4 OIL LTD. Well Oil & Gas Ir delling for a propio would yield common capitalization. 70 AND RESOURC vson THAI pilot it onsidered, target 10,0 TE PLC 1 40,0 1 40,0 2 40,0	received one of the control of the	TBD CeGolyer & Moizontal cyclic viable extract TBD Cent complete the complete the complete that cyclic viable extract complete that cyclic viable extract viable	Approved Approved AccNaughton Canada steam stimulation pition. Deep Well is cu Approved e and will be completed a Q3. Announced Construction Toperating Application	cram into the SAGD Limited has conlot at Sawn Lake rrently preparing CSS THAI THAI THAI CSS CSS CSS
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review continues, but nasset. The process cont saset. The process cont SAGD Demonstration NORTHERN ALBERTA Sawn Lake Company owner Deep pleted its reservoir moc concluding the project pilot plan and options for CSS Pilot PETROBANK ENERGY Dawson Petrobank says the Daw development is being or Phase 2 THAI Demonstration ROYAL DUTCH SHELL Peace River Alberta's environmentamental impact assessm Cadotte Lake Carmon Creek - Phase SOUTHERN PACIFIC Red Earth Southern Pacific is anal	o bids have been inues. 1,4 OIL LTD. Well Oil & Gas Ir delling for a propious of the propius of	received 00 00 00 00 ES LTD. 00 ES LTD. 00 ES CTO 00 00 00 00 00 00 00 00 00 00 00 00 00	TBD Cedolyer & M izontal cyclic viable extract TBD Cent complete latory filing in TBD TBD S deemed con n Creek expa 1986 2015 TBD	Approved Approved AccNaughton Canada steam stimulation pi tion. Deep Well is cu Approved Approved c and will be completed and accompleted Construction Application Application Application	SAGD Limited has con lot at Sawn Lake, rrently preparing CSS te in Q2. Full field THAI THAI CSS CSS CSS CSS

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
SASKATCHEWAN	REGION —	IN SITU	J	
OILSANDS QUEST INC.				
Axe Lake				
Oilsands Quest has entered in restructure the company.	nto a solicitation pr	ocess looking	for offers to acquire	or
Commercial	30,000	TBD	On Hold	SAGD
Reservoir Test	600	2008	On Hold	SAGD
SAGD Pilot	TBD	TBD	On Hold	SAGD
NORTH ATHABAS	CA REGIOI	N — UPG	RADER	
CANADIAN NATURAL RESC	OURCES LIMITED			
Horizon				
Canadian Natural says that re ore-preparation plant is being 2A plans for a coker expansio awarded for its Phase 2B, and	commissioned, th n, in part due to co	ere has been ker fire rebuil	a six-month schedul d, lump sum contrac	e slip in its Phase
Phase 1	114,000	2009	Operating	Mining
Phase 2A	10,000	2014	Approved	Mining
Phase 2B	45,000	TBD	Approved	Mining
Phase 3	80,000	TBD	Approved	Mining
IVANHOE ENERGY INC.				
Tamarack				
lvanhoe says it delivered the r requests relating to its applica			nd of supplemental i	nformation
Phase 1	34,784	2014	Application	Upgrader
SUNCOR ENERGY INC.				
SUNCOR ENERGY INC. Base Operations				
Base Operations In Q4 of 2011, Suncor began tupgrader, the Millennium Nap				ditionally, at the
Base Operations In Q4 of 2011, Suncor began tupgrader, the Millennium Nap				ditionally, at the
Base Operations In Q4 of 2011, Suncor began t upgrader, the Millennium Nap design rates in early 2012.	ohtha Unit is now p	roducing hyd	rogen and is expecte	ditionally, at the d to reach full
Base Operations In Q4 of 2011, Suncor began tupgrader, the Millennium Nardesign rates in early 2012. Millennium Coker Unit	97,000	roducing hydi	ogen and is expecte	ditionally, at the d to reach full
Base Operations In Q4 of 2011, Suncor began t upgrader, the Millennium Nap design rates in early 2012. Millennium Coker Unit Millennium Vacuum Unit	97,000 35,000	2008 2005	Operating Operating	ditionally, at the d to reach full Upgrader Upgrader
Base Operations In Q4 of 2011, Suncor began tupgrader, the Millennium Nardesign rates in early 2012. Millennium Coker Unit Millennium Vacuum Unit U1 and U2 Fort Hills	97,000 35,000 225,000	2008 2005 1967	ogen and is expecte Operating Operating Operating	ditionally, at the d to reach full Upgrader Upgrader Upgrader
Base Operations In Q4 of 2011, Suncor began tupgrader, the Millennium Nardesign rates in early 2012. Millennium Coker Unit Millennium Vacuum Unit U1 and U2 Fort Hills	97,000 35,000 225,000	2008 2005 1967	ogen and is expecte Operating Operating Operating	ditionally, at the d to reach full Upgrader Upgrader Upgrader
Base Operations In Q4 of 2011, Suncor began tupgrader, the Millennium Napdesign rates in early 2012. Millennium Coker Unit Millennium Vacuum Unit U1 and U2 Fort Hills Current capital expenditures to	97,000 35,000 225,000	2008 2005 1967 Dund design b	Operating Operating Operating Operating ase memorandum e	ditionally, at the d to reach full Upgrader Upgrader Upgrader
Base Operations In Q4 of 2011, Suncor began tupgrader, the Millennium Napdesign rates in early 2012. Millennium Coker Unit Millennium Vacuum Unit U1 and U2 Fort Hills Current capital expenditures to Phase 1	97,000 35,000 225,000 for Fort Hills are ar	2008 2005 1967 Dund design b	Operating Operating Operating Operating operating Onerating Operating	Upgrader Upgrader Upgrader Upgrader Upgrader Upgrader
Base Operations In Q4 of 2011, Suncor began tupgrader, the Millennium Nardesign rates in early 2012. Millennium Coker Unit Millennium Vacuum Unit U1 and U2 Fort Hills Current capital expenditures to Phase 1 Phase 2 & 3 Voyageur Upgrader 3 Current capital expenditures a	97,000 35,000 225,000 for Fort Hills are an 145,000 are around remobil	2008 2005 1967 Dund design b TBD TBD	Operating Operating Operating Operating ase memorandum e On Hold On Hold	ditionally, at the d to reach full Upgrader Upgrader Upgrader Upgrader Upgrader Upgrader Upgrader
Base Operations In Q4 of 2011, Suncor began tupgrader, the Millennium Nardesign rates in early 2012. Millennium Coker Unit Millennium Vacuum Unit U1 and U2 Fort Hills Current capital expenditures to Phase 1 Phase 2 & 3 Voyageur Upgrader 3 Current capital expenditures a	97,000 35,000 225,000 for Fort Hills are an 145,000 are around remobil	2008 2005 1967 Dund design b TBD TBD	Operating Operating Operating Operating ase memorandum e On Hold On Hold	ditionally, at the d to reach full Upgrader Upgrader Upgrader Upgrader Upgrader Upgrader Upgrader
Base Operations In Q4 of 2011, Suncor began tupgrader, the Millennium Napdesign rates in early 2012. Millennium Coker Unit Millennium Vacuum Unit U1 and U2 Fort Hills Current capital expenditures the Phase 1 Phase 2 & 3 Voyageur Upgrader 3 Current capital expenditures and modification of project examples.	97,000 35,000 225,000 for Fort Hills are ar 145,000 145,000 are around remobil	2008 2005 1967 Dund design b TBD TBD	Operating Operating Operating Operating ase memorandum e On Hold On Hold	ditionally, at the d to reach full Upgrader Upgrader Upgrader Upgrader Upgrader Upgrader Upgrader Upgrader
Base Operations In Q4 of 2011, Suncor began tupgrader, the Millennium Napidesign rates in early 2012. Millennium Coker Unit Millennium Vacuum Unit U1 and U2 Fort Hills Current capital expenditures to Phase 1 Phase 2 & 3 Voyageur Upgrader 3 Current capital expenditures and modification of project expended to the project expended to the project expended to the project expenses and modification of project expenses 1	97,000 35,000 225,000 for Fort Hills are are 145,000 145,000 are around remobil eccution plans.	2008 2005 1967 Dund design b TBD TBD TBD izing the work	Operating Operating Operating Operating Operating On Hold On Hold Approved	Upgrader
Base Operations In Q4 of 2011, Suncor began tupgrader, the Millennium Napdesign rates in early 2012. Millennium Coker Unit Millennium Vacuum Unit U1 and U2 Fort Hills Current capital expenditures to Phase 1 Phase 2 & 3 Voyageur Upgrader 3 Current capital expenditures and modification of project expenses 1 Phase 1 Phase 2	97,000 35,000 225,000 for Fort Hills are an 145,000 145,000 are around remobil recution plans.	2008 2005 1967 Dund design b TBD TBD TBD izing the work	Operating Operating Operating Operating Operating On Hold On Hold Approved	Upgrader
Base Operations In Q4 of 2011, Suncor began tupgrader, the Millennium Nardesign rates in early 2012. Millennium Coker Unit Millennium Vacuum Unit U1 and U2 Fort Hills Current capital expenditures to Phase 1 Phase 2 & 3 Voyageur Upgrader 3 Current capital expenditures and modification of project expenditures and mo	97,000 35,000 225,000 for Fort Hills are an 145,000 145,000 are around remobil recution plans. 127,000 63,000 & South	2008 2005 1967 Dund design b TBD TBD izing the work 2017 TBD	Operating Operating Operating Operating Operating Operating Approved Approved Approved Sign is now complet ate for the \$1.6-billic	ditionally, at the d to reach full Upgrader ef or its \$4.6-billio
Base Operations In Q4 of 2011, Suncor began tupgrader, the Millennium Nardesign rates in early 2012. Millennium Coker Unit Millennium Vacuum Unit U1 and U2 Fort Hills Current capital expenditures to Phase 1 Phase 2 & 3 Voyageur Upgrader 3 Current capital expenditures and modification of project expenditures and mo	97,000 35,000 225,000 for Fort Hills are an 145,000 145,000 are around remobil recution plans. 127,000 63,000 & South	2008 2005 1967 Dund design b TBD TBD izing the work 2017 TBD	Operating Operating Operating Operating Operating Operating Approved Approved Approved Sign is now complet ate for the \$1.6-billic	ditionally, at the d to reach full Upgrader ef or its \$4.6-billio
Base Operations In Q4 of 2011, Suncor began tupgrader, the Millennium Nardesign rates in early 2012. Millennium Coker Unit Millennium Vacuum Unit U1 and U2 Fort Hills Current capital expenditures of the project expenditure of the project expensive of the project	97,000 35,000 225,000 for Fort Hills are an 145,000 145,000 are around remobil recution plans. 127,000 63,000 & South mat front-end engine cements. The targens now been extended.	2008 2005 1967 und design b TBD TBD izing the work 2017 TBD	Operating Operating Operating Operating Operating Operating On Hold On Hold Approved Approved Approved Approved	ditionally, at the d to reach full Upgrader of current design Upgrader Upgrader
Base Operations In Q4 of 2011, Suncor began tupgrader, the Millennium Nap design rates in early 2012. Millennium Coker Unit Millennium Vacuum Unit U1 and U2 Fort Hills Current capital expenditures to the project expenditures of the project expenditure of the project expensive of t	97,000 35,000 225,000 for Fort Hills are an 145,000 145,000 are around remobil recution plans. 127,000 63,000 & South hat front-end enging cements. The targenas now been extended.	2008 2005 1967 Dund design b TBD TBD izing the work 2017 TBD eering and dest in-service deded into Q1 of 1978	Operating Operating Operating Operating Operating Operating On Hold On Hold Approved Approved Approved Sign is now complete ate for the \$1.6-billious of 2012. Operating	ditionally, at the d to reach full Upgrader Upgrader
Base Operations In Q4 of 2011, Suncor began tupgrader, the Millennium Nardesign rates in early 2012. Millennium Coker Unit Millennium Vacuum Unit U1 and U2 Fort Hills Current capital expenditures of the properties of the p	97,000 35,000 225,000 for Fort Hills are are 145,000 145,000 are around remobil recution plans. 127,000 63,000 & South that front-end enging the period of the period o	2008 2005 1967 und design b TBD TBD izing the work 2017 TBD eering and de tin-service dided into Q1 of	Operating Operating Operating Operating Operating Operating On Hold On Hold Approved	Upgrader
Base Operations In Q4 of 2011, Suncor began tupgrader, the Millennium Nardesign rates in early 2012. Millennium Coker Unit Millennium Vacuum Unit U1 and U2 Fort Hills Current capital expenditures of the properties of the p	97,000 35,000 225,000 for Fort Hills are are 145,000 145,000 are around remobil recution plans. 127,000 63,000 & South that front-end enging the period of the period o	2008 2005 1967 und design b TBD TBD izing the work 2017 TBD eering and de tin-service dided into Q1 of	Operating Operating Operating Operating Operating Operating On Hold On Hold Approved	Upgrader
Base Operations In Q4 of 2011, Suncor began tupgrader, the Millennium Nardesign rates in early 2012. Millennium Coker Unit Millennium Vacuum Unit U1 and U2 Fort Hills Current capital expenditures of the project expenditure of the project expensive of the project e	97,000 35,000 225,000 for Fort Hills are are 145,000 145,000 are around remobil recution plans. 127,000 63,000 & South that front-end enging the period of the period o	2008 2005 1967 und design b TBD TBD izing the work 2017 TBD eering and de tin-service dided into Q1 of	Operating Operating Operating Operating Operating Operating On Hold On Hold Approved	Upgrader

8,400

TBD

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Pilot

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
SOUTH ATHABAS	A REGION	I — UPG	RADER	
NEXEN INC.				
Long Lake				
Nexen says its focus at Long La pany is currently advancing 60				rader. The com-
Phase 1	58,500	2008	Operating	Upgrader
Phase 2	58,500	TBD	Approved	Upgrader
Phase 3	58,500	TBD	Announced	Upgrader
Phase 4	58,500	TBD	Announced	Upgrader
ALUE CREATION INC.				
TriStar				
Value Creation is providing the	ERCB with addition	onal informat	ion supporting its app	olication.
Pilot	840	TBD	Application	Upgrader
NDUSTRIAL HEAI	RTLAND R	EGION -	– UPGRADEI	R
NORTH WEST UPGRADING I	NC.			
Redwater Upgrader				
inal sanction is anticipated in	2012			
Phase 1	77,000	TBD	Approved	Ungrador
Phase 2	77,000	TBD	Approved	Upgrader
Phase 3	77,000	TBD		Upgrader
	77,000	100	Approved	Upgrader
Scotford Upgrader 1 Shell says the focus at Scotford chrough debottlenecking. Alber	rta's environment	al impact asse	essment director has	deemed complet
Scotford Upgrader 1 Shell says the focus at Scotford through debottlenecking. Alber the environmental impact asse project from the Scotford upgra	rta's environmenta ssment report for ader.	al impact asse Shell Canada	essment director has i's Quest carbon capt	deemed complet ure and storage
Scotford Upgrader 1 Shell says the focus at Scotford through debottlenecking. Alber the environmental impact asse project from the Scotford upgra	rta's environment: ssment report for ader. 158,000	al impact asse Shell Canada 2003	essment director has i's Quest carbon capt Operating	deemed completure and storage Upgrader
Scotford Upgrader 1 Shell says the focus at Scotford through debottlenecking. Alber the environmental impact asse project from the Scotford upgrading the second second second second second second second second second se	rta's environmenta ssment report for ader.	al impact asse Shell Canada	essment director has i's Quest carbon capt	deemed complet ure and storage
Scotford Upgrader 1 Shell says the focus at Scotford through debottlenecking. Alber the environmental impact asse project from the Scotford upgratement of the scotford upgratement of the Scotford Upgrader 2 Scotford Upgrader 2	rta's environment ssment report for ader. 158,000 91,000	al impact asso Shell Canada 2003 2011	essment director has 's Quest carbon capt Operating Operating	deemed completure and storage Upgrader
Scotford Upgrader 1 Shell says the focus at Scotford hrough debottlenecking. Alber he environmental impact asse project from the Scotford upgra Commercial Expansion Scotford Upgrader 2 Shell withdrew its application for	ta's environment ssment report for ader. 158,000 91,000 or all phases of Sc	al impact assi Shell Canada 2003 2011 cotford Upgra	essment director has is Quest carbon capt Operating Operating der 2 in fall 2010.	deemed completure and storage Upgrader Upgrader
Scotford Upgrader 1 Shell says the focus at Scotford hrough debottlenecking. Alber he environmental impact assessoroject from the Scotford upgrace. Commercial Expansion Scotford Upgrader 2 Shell withdrew its application for the second of	ta's environment ssment report for ader. 158,000 91,000 or all phases of So 97,750	2003 2011 cotford Upgra	essment director has is Quest carbon capt Operating Operating der 2 in fall 2010. Cancelled	deemed completure and storage Upgrader Upgrader Upgrader
Scotford Upgrader 1 Shell says the focus at Scotford through debottlenecking. Alber the environmental impact asse project from the Scotford upgrader 2 Commercial Expansion Scotford Upgrader 2 Shell withdrew its application for Phase 1 Phase 2	ta's environment: ssment report for ader. 158,000 91,000 or all phases of Sc 97,750 97,750	2003 2011 cotford Upgra TBD	essment director has is Quest carbon capt Operating Operating der 2 in fall 2010. Cancelled Cancelled	deemed completure and storage Upgrader Upgrader Upgrader Upgrader
Scotford Upgrader 1 Shell says the focus at Scotford through debottlenecking. Alber the environmental impact asse project from the Scotford upgrates and the second	ta's environment: ssment report for ader. 158,000 91,000 or all phases of Sc 97,750 97,750 97,750	2003 2011 cotford Upgra TBD TBD	essment director has 's Quest carbon capt Operating Operating der 2 in fall 2010. Cancelled Cancelled Cancelled	deemed complei ure and storage Upgrader Upgrader Upgrader Upgrader Upgrader Upgrader
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Phase 1

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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.

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.

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 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 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 hotwater extraction (in mining-based recovery).

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

Initial volume in place

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

Latin for "in place." In situ recovery refers to various methods used to recover deeply buried bitumen denosits

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.

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.

A water-soaked layer of decaying plant material, one to three metres thick, found on top of the overburden.

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.

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

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.

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.

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 (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.

A combination of water, sand, silt and fine clay particles that are a byproduct 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

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 (hvdroconversion).

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 sludgelike oil, which becomes less viscous (or more fluid) before draining into a lower horizontal well and being

Viscosity

The ability of a liquid to flow. The lower the viscosity, the more easily the liquid will flow.

CONTACTS

Oil Sands Producers

- Alberta Oilsands
- **Andora Energy**
- Athabasca Oil Sands
- **Baytex Energy**
- BlackPearl Resources
- **Canadian Natural Resources**
- **Cenovus Energy**
- **Chevron Canada**
- · China National Offshore Oil Corporation
- · Connacher Oil and Gas
- · ConocoPhillips Canada
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- N-Solv
- Oak Point Energy
- **Occidental Petroleum Corporation**
- **Oilsands Ouest**
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- **Pan Orient Energy**
- Paramount Resources Ltd.
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- **Talisman Energy**
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Associations/Organizations

- **Alberta Building Trades Council**
- Alberta Chamber of Resources
- **Alberta Chambers of Commerce**
- **Alberta Energy**
- **Alberta Environment and Water**
- Alberta Innovates
- **Alberta Treasury Board and** Enterprise
- Alberta's Industrial
- **Heartland Association**
- Canada's Oil Sands Innovation Alliance
- **Canadian Association of**
- **Geophysical Contractors Canadian Association of**
- Petroleum Producers
- **Canadian Heavy Oil Association**
- Canadian Oil Sands Network for **Research and Development**
- **Energy Resources Conservation** Board
- In Situ Oil Sands Alliance
- **Lakeland Industry and Community** Association
- Natural Resources Conservation
- Oil Sands Developers Group
- **Oil Sands Secretariat**
- **Petroleum Technology Alliance**

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