

## All about the oil sands

Background of an important global resource



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Glossary of oil sands terms

**Alberta** has the second-largest deposit of oil in the world — only Saudi Arabia But 170 billion of Alberta's 179 billion been developed for decades but is only now coming into the forefront of the considered economically recoverable technologies, this reserve estimate could be increased to as much as 315

There are three major bitumen (or oil sands) deposits in Alberta. The largest is the Athabasca deposit, the Regional Municipality of Wood oil sands deposit is referred to as Cold main population centre the City of Cold deposit called Wabasca links to the

The existence of bitumen in Alberta has in 1719, when a Cree named Wapasu in what is now the Wood Buffalo area had traditionally used the bitumen,

Today bitumen is produced as an energy source by two means — mining and in situ. The majority of oil sands

as 80 per cent of Alberta's bitumen

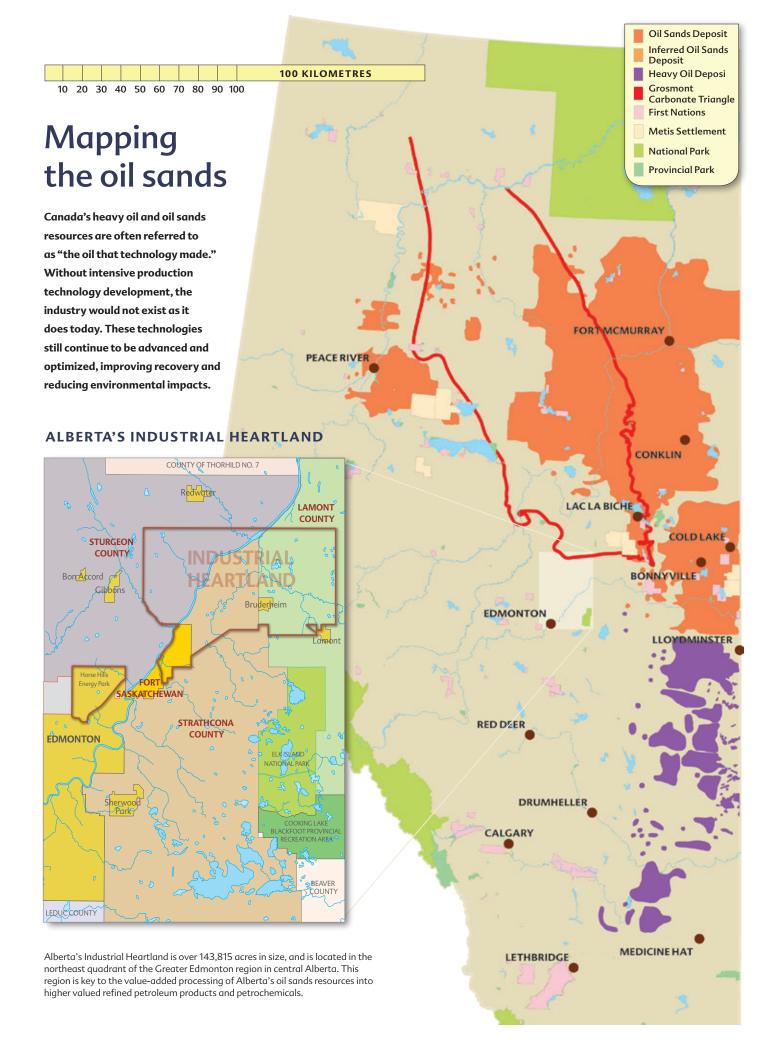
Right now there are essentially two used rather than trucks and shovels). In cyclic steam stimulation (CSS), high-pressure steam is injected into bringing the bitumen to the surface.

In steam assisted gravity drainage 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

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

other production technologies designed water and energy use, including vapour extraction (VAPEX), and a form of in

or "upgraded," can be used directly as pipeline. Adding value, some producers upgrade their product into synthetic and other products. ■



# Government update



#### ALBERTA COMPETITIVENESS INITIATIVE

The Alberta Competitiveness Council, comprised of senior government and industry stakeholders, continues its work to make Alberta one of the most competitive and attractive locations for investment. In addition to a broad review of the province's overall economic competitiveness, task teams are currently reviewing four specific sectors: agriculture (grains and oil seeds), financial services, manufacturing and petrochemicals/chemicals.

As part of its sector review, the petrochemicals/ chemicals task team is assessing a source of alternative feedstock for the sector, based on the offgases generated from bitumen upgrading.

An interim report summarizing this work to date is expected to be released by the end of 2010. The report will also outline competitiveness-enhancing initiatives currently underway and present a benchmarking framework to assess Alberta's competitiveness across these sectors.

A more detailed report will be released in 2011, including specific benchmarks and focused recommendations for implementation by both government and industry.

### **ERCB PROJECT REVIEWS**

The Energy Resources Conservation Board (ERCB) has approved with conditions a tailings management plan for the Imperial Kearl project. In its decision, the ERCB has directed Imperial to submit an updated plan by January 2012 that evaluates alternatives and proposes measures to further accelerate fines tailings treatment. The Imperial Kearl project, slated to begin operating in 2012, involves one tailings pond, which will be decommissioned by 2038.

The ERCB is continuing its reviews of the three remaining tailings plans, submitted by Canadian Natural Resources for its Horizon project and by Shell for the Jackpine and Muskeg River projects.

Thus far, oil sands operators have committed more than \$1.5 billion in upgrades to comply with the ERCB directives.

## REGULATORY EFFICIENCIES IMPROVE ALBERTA'S OIL AND GAS COMPETITIVENESS

Substantive actions to improve Alberta's competitiveness are highlighted in the 90-day progress report of Alberta's Regulatory Enhancement Task Force that was released in June. The task force reported that ongoing savings in time and cost for both industry and government are being achieved, while protecting public safety, conserving resources and ensuring industry complies with Alberta's environmental standards.

Progress to date includes:

- Pilot work towards a system of coordinated compliance inspections;
- Successful streamlining of assessment submissions required prior to oil sands developments;
- Simplification of subsurface well spacing requirements;
- Improved access to information and regulations;
- Clarification and simplification of regulatory publications;
- Elimination of obsolete and expired regulatory publications; and
- Harmonization of regulations with other provinces.

Recommendations for a renewed regulatory and policy assurance system will be delivered by the end of 2010.

The task force report, Enhancing Assurance: The First 90 Days, identifies how the Alberta government is pursuing a comprehensive review of the regulatory system for oil and gas development, and successes that have been achieved on specific enhancements. The report is available at:

www.energy.alberta.ca.

## AWARDS RECOGNIZE ENVIRONMENTAL LEADERSHIP IN ALBERTA

Three projects were recognized in two new award categories sponsored by the Alberta government at the 19th Annual Emerald Awards ceremony on June 10 in Calgary.

The Emerald Challenge Award — Oil Sands recognized Chris Fordham from Suncor for excellence related to environmental activities in Alberta's oil sands. Alberta Pacific Industries and Innovative Pipelining Strategies each received the Emerald Certified Shared Footprints Award for excellence in demonstrating a reduced environmental footprint using integrated land management.

Fordham was recognized for his leadership on a project with industry and multiple stakeholder groups to establish thresholds, objectives and frameworks

to protect the environment. Alberta Pacific Industries and Innovative Pipelining Strategies received their award for reducing human-caused disturbance on the land by coordinating their land-based activities with those of other land users in a program of integrated land management.

The Emerald Awards are hosted by the Alberta Emerald Foundation. The June 10 ceremony recognized 31 finalists in nine categories and celebrated the outstanding achievements by Albertans committed to protecting, preserving, enhancing and sustaining the province's natural environment.

### ALBERTA STIMULATES NEW ENERGY **INVESTMENT, NEW TECHNOLOGIES**

In order to further energize investment, the Alberta government introduced initiatives to accelerate new technologies that encourage development of Alberta's vast unconventional and deep resource pools and finalized royalty curves for conventional oil and gas.

Building on the work of government and industry that resulted in the March release of the document Energizing Investment, the Emerging Resources and Technologies Initiative modifies the royalty rate for wells that require use of high-cost technologies.

Stimulating application of new technologies in resources that have not been tapped is expected to increase overall production, resulting in increased economic activity.

The Emerging Resource and Technologies Initiative will be reviewed in 2014 and the Alberta government has committed to providing three years notice to industry at that time if it decides to discontinue the initiative.

## PACIFIC NORTHWEST ECONOMIC REGION **MEMBERS GATHER IN CALGARY**

Pacific NorthWest Economic Region (PNWER) is a public-private partnership dedicated to encouraging global economic competitiveness and preserving the world-class natural environment in the Pacific Northwest.

The PNWER 20th Annual Summer Summit, which was held July 16—20 in Calgary, brought together 500 legislators, business leaders and policy experts from Alaska, British Columbia, Idaho, Oregon, Montana, the Northwest Territories, Saskatchewan, Washington and Yukon. Topics of discussion included renewable energy, economic development, environment, border security, disaster resilience, sustainable development, mental health and addictions, water policy and livestock health.

Summit highlights included speeches from Alberta Premier Ed Stelmach, Alaska State Senator Lesil McGuire, and U.S. Ambassador to Canada David Jacobson. During the summit, Alberta's Minister of Sustainable Resource Development Mel Knight was sworn in as the next president of PNWER.

As part of their briefings during the summit, which were followed by a guided tour of the oil sands, U.S. legislators were provided with an overview of the province's plan for responsible energy development.

### CANADIAN ENERGY EFFICIENCY ALLIANCE — **REPORT CARDS**

In August, the Canadian Energy Efficiency Alliance released a report card that evaluated energy efficiency practices across Canada. Alberta earned a B+ rating for its efforts, sharing the title of most improved province in Canada with Prince Edward Island and Nunavut

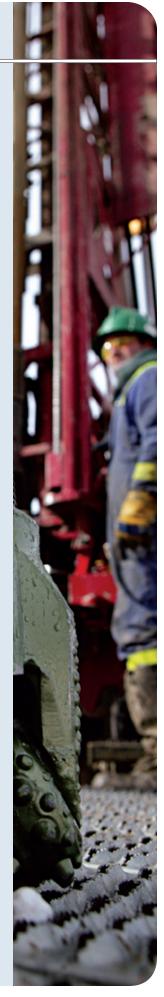
Actions taken to reduce carbon emissions, improve day-to-day environmental practices and transition to a clean-energy future are showing positive results. In 2008, the province introduced its Climate Change Strategy. This strategy has led to a series of key initiatives, including the creation of the Climate Change and Emissions Management Corporation, which sets out to develop the province's resources in a more environmentally friendly way.

Alberta has also invested \$2 million to establish a one-stop action centre to help Alberta municipalities save energy and money and channelled \$78.5 million into clean-energy research and waste-to-energy projects. This includes the Helmholtz-Alberta Initiative, the Carbon Management Canada research network, Enbridge's CO<sub>2</sub> Slurry Pipeline Project, Otoka Energy's wood waste project, and the City of Edmonton and Strathcona County's waste-to-energy initiative.

### STELMACH PROMOTES CANADA-U.S. ENERGY **COOPERATION**

Premier Ed Stelmach reinforced the strategic and national importance of Alberta's oil sands, as well as the critical role they play in North American energy security at the Council of the Federation Summer Meeting held in Winnipeg from Aug. 4 to 6.

The Council of the Federation is made up of Canada's 10 provinces and 3 territories. It promotes interprovincial territorial cooperation and meaningful relations between governments based on respect for the Constitution, and also shows leadership on issues important to all Canadians.



## What's new in the oil sands

## Key updates from fall 2010



III Cenovus Energy, which has an estimated resource in place of 137 billion barrels of bitumen, plans to increase production fivefold to 300,000 barrels per day (net) in 10 years, averaging \$8-per-barrel finding and development costs.

That growth is expected to come from expansions at its Foster Creek and Christina Lake steam assisted gravity drainage (SAGD) operations as well as new projects at Narrows Lake and Grand Rapids.

Narrows Lake, located near Christina Lake, is the next project expected to be developed. The project design includes the possibility to apply solvent-aided process along with SAGD. Grand Rapids is a new project in the Greater Pelican region. The company plans to test a SAGD well pair at Grand Rapids in the fall of 2010 and possibly submit a regulatory application by the end of 2011.

III Now that Petrobank Energy and Resources' oil sands recovery process has been verified by a third party, the company is ready to take the patented toe to heel air injection (THAI) in situ combustion technology to the outside world, says its leadership.

"We are very, very, very, very far down the track on some pretty large licensing agreements internationally," says Chris Bloomer, senior vice-president; chief operating officer, heavy oil; and director.

Bloomer says that interest in THAI has been received from North America, Venezuela, central Asia, Russia, the Middle East and African countries. Several companies have signed confidentiality agreements, allowing them to assess the technology, to be followed by a licensing agreement upon approval.

III Southern Pacific Resource Corp. has closed its acquisition of Bounty Developments' 20 per cent working interest in 59 sections of land in McKay, Alberta.

The acquisition gives Southern Pacific an undivided 100 per cent working interest in all of its McKay lands, including the 10.5-section STP-McKay SAGD project 45 kilometres northwest of Fort McMurray, Alberta. As part of the agreement, first announced on March 19, Southern Pacific has also purchased a 20 per cent working interest in 32 sections of land at Ells River adjacent to Southern Pacific's MacKenzie block.

Southern Pacific also announced that the Toronto Stock Exchange (TSX) has approved its application to graduate from the TSX Venture Exchange to the TSX. The company's shares have ceased trading on the TSX Venture Exchange and began trading on the TSX on June 3. The shares will continue to trade under the symbol STP.

independent reserve-and-resource evaluation,
Athabasca Oil Sands (AOS) has increased its company
gross resource volumes by approximately 20 per cent
to 8.71 billion barrels, compared to the estimates
(pro forma the completion of AOS's transaction with
PetroChina International Investment Company) set out
in the company's 2009 year-end reserves report.

AOS's resources are comprised of 8.59 billion barrels of contingent resource (best estimate) and 114 million barrels of probable reserves.

Five people — four contractors and one employee — were injured in a fire at Syncrude's Mildred Lake 7-3 diluent recovery unit on June 10.

According to a company press release, Syncrude emergency personnel extinguished the fire, which began at about 2 p.m., and operations isolated the 7-3 unit. Damages are believed to be minor, but the full extent is not known at this time. The press release also said Syncrude has informed Alberta Environment, Workplace Health and Safety, and the ERCB.

On June 25, the provincial court judge presiding over Syncrude's trial relating to the deaths of 1,606 migratory waterfowl on one of its tailings ponds two years ago ruled in favour of the Crown.

Syncrude was charged under both federal and provincial environmental laws.

The joint venture is reviewing the judge's response to the charges in order to decide whether it will appeal.

- "This is a significant decision, and it is important that we take the time to decide our path forward," says Tom Katinas, Syncrude's president and chief executive officer. "Our decision to go through a lengthy and difficult trial wasn't about the fine. As we said in court, we are deeply concerned that the judge's decision on these charges sets a precedent that could have serious ramifications for Canada's mining industry."
- The July 10 release of steam and bitumen from a producer well at Devon Canada's Jackfish steam assisted gravity drainage (SAGD) project near Conklin, Alberta, resulted from a small hole in the wellhead, likely caused by sand erosion, says a company official. Devon's technical team has completed ultrasonic testing of all the Jackfish wellheads and determined the issue is limited to three wellheads on one pad, says Dave Hager, executive vice-president of exploration and production. Devon will be making the necessary modifications to the wellheads and, subject to



regulatory approval, expects to bring the affected pad back on production. Hager says that cleanup is about 90 per cent complete, and that the production impact is minimal — about 5,000 barrels per day — while the affected pad is shut in.

Privately held Value Creation Incorporated (VCI), part of the Value Creation Group, and its wholly owned subsidiary BA Energy have filed an application with the ERCB for TriStar, an integrated in situ / upgrading pilot project just south of Fort McMurray, Alberta.

VCI says the project will establish the high reservoir qualities of the leases and affirm the significant advantages of the integration of SAGD with VCI proprietary upgrading technologies, which can directly upgrade SAGD wellhead slurry of bitumen emulsion. The combination is expected to significantly simplify process complexity, achieving very significant competitive advantages in capital and operating costs, as well as reducing environmental footprint and emissions.

- III A joint review panel (JRP) will begin reviewing into Total E&P Canada's application for the proposed Joslyn oil sands mine at a public hearing in Fort McMurray, Alberta, started on Sept. 21 and will be running through Oct. 8. The JRP is expected to hear opposition to the proposal.
- Leading oil sands figure Eric Newell is among four industry leaders inducted into the Canadian Petroleum Hall of Fame this September. On Sept. 23, the Hall of Fame Society officially inducted the four at the 14th annual gala dinner in Edmonton.

Each year, the society inducts up to six men and women whose contributions to Canada's petroleum industry allow them to stand tall among their peers.

- Aux Sable Canada has executed a long-term off-gas processing agreement with Shell Canada Products. The agreement secures a new feedstock source for Aux Sable Canada's Heartland Offgas Plant located in the City of Fort Saskatchewan, approximately 20 kilometres northeast of Edmonton. The plant was originally designed to process off-gas from the nearby BA Energy upgrader, which ceased construction in 2008.
- III Laricina Energy has completed a private placement to a wholly owned subsidiary of Korea Investment Corporation for gross proceeds of approximately \$50 million. This comes in addition to a July 28 private placement for gross proceeds of approximately \$26.2 million, increasing the total gross proceeds raised to \$76.2 million.

Laricina expects to use these proceeds to further develop its assets, in particular the construction and development of the 5,000-barrel-per-day Germain commercial demonstration project, regulatory work for future expansion phases at Germain and Saleski (which is under construction), and for general corporate purposes.

The regulatory amendment to enlarge the Germain project to 5,000 barrels of bitumen per day and incorporate solvents is well underway, with approval expected in the third quarter of 2010.

With financing in place, Laricina will begin ordering equipment and prepare for construction in the first quarter of 2011, with first steam to occur in the second half of 2012.

III Alberta's Industrial Heartland Association, along with supporters from the petrochemical industry, local municipalities and employee groups, has launched a public campaign to build support for more oil sands value-added products within the province of Alberta.

"The time to act is now," says Don Rigney, mayor of Sturgeon County and chair of the association. "All this is about skilled, full-time, long-term jobs, pensions and benefits; that's what will build us to the future, and we are losing that."

The new website refineitwherewemineit.ca provides information on how value added is important to Albertans, and gives visitors an opportunity to share their thoughts.

■ Total E&P Canada will pay a cash amount of \$3.08 per share to acquire UTS Energy Corporation with its main asset, a 20 per cent interest in the proposed, Suncor-led Fort Hills oil sands mine. With its remaining assets UTS is forming a new company, SilverBirch Energy Corporation.

Total attempted a hostile takeover of UTS last spring, which the company's board successfully rejected, based on its consideration that the stock was being significantly undervalued. The board has unanimously approved the new transaction.

Silverbirch is left with significant oil sands assets of its own, including 50/50 interest in two proposed mining projects with Teck Resources.

■ Statoil Canada is applying for approval to increase output at its nearly completed Leismer in situ oil sands project — to 40,000 barrels per day from 10,000 barrels per day — and to construct and operate the Corner project, for total additional production of 70,000 barrels of bitumen per day.



The ERCB has scheduled a hearing on these applications for Oct. 12 at its head office in Calgary. The regulator has received numerous letters about Kai Kos Dehseh. Perpetual Energy (formerly Paramount Energy) has indicated concerns that its gas production would be negatively affected by the SAGD process. The Oil Sands Environmental Coalition has also submitted concerns related to project mitigation; greenhouse gas emissions; and terrestrial, water and socio-economic impacts.

Statoil spokesman Peter Symons says, "Every stakeholder, if they have standing before the board, they have the opportunity to present their opposition or questions."

- Inter Pipeline Fund has entered into a long-term agreement to construct additional bitumen blend capacity on the Cold Lake pipeline system. New facilities will add approximately 180,000 barrels per day of oil-gathering capacity to meet strong forecast production growth at the Foster Creek SAGD project operated by Cenovus Energy. Inter Pipeline will construct a new 27-kilometre pipeline south of the Foster Creek installation, connecting with an existing oil storage terminal on the Cold Lake system located at La Corey, Alberta. Capital costs are estimated at \$40 million and the new pipeline is expected to be in service in early 2011. Transporting approximately 450,000 barrels per day, the Cold Lake system is the largest oil-gathering pipeline in the region.
- III Harvest Operations has closed its acquisition of the proposed BlackGold SAGD project from Korea National Oil Corporation (KNOC) for \$374 million. The acquisition was financed by Harvest with the issuance of additional shares to KNOC. The project, near Conklin, Alberta, has existing Energy Resources Conservation Board approval for a Phase 1 project of 10,000 barrels per day, and has made an application for a Phase 2 project that would increase production to 30,000 barrels per day. Harvest's upstream capital budget for 2010 will increase to \$415 million to allow for the 2010 development costs of the project. KNOC has agreed to inject additional capital into Harvest in order to fund the 2010 BlackGold project costs.
- III TransCanada Corporation is tentatively planning a large pipeline to bring natural gas to the in situ oil sands area of northeastern Alberta. The company's wholly owned subsidiary, NOVA Gas Transmission, is evaluating the potential Leismer-Kettle River Crossover pipeline project, which would be located 120 kilometres southeast of Fort McMurray and 140 kilometres north of Lac La Biche. Expected to be up to 24 inches in diameter, the proposed pipeline would tap into an existing NOVA pipeline near Highway 63 at the Leismer compressor station. It would extend roughly 80 to 100 kilometres east of Highway 63 into an area where several SAGD projects now operate and others are planned. An application is to be filed to the National Energy Board by the end of the first quarter of next year.

III Grizzly Oil Sands has awarded SNC-Lavalin an engineering and procurement contract for its new Algar Lake SAGD facility in northeastern Alberta.

The project consists of an initial 5,000-barrel-per-day central processing facility with associated well pads, flow lines, tank farm and an eight-megawatt cogeneration facility. Work has begun out of SNC-Lavalin's Calgary office, and the detailed design of the project is expected to be completed in April 2011.

SNC-Lavalin says this is a unique project in the fact that the execution plan is based on engineering and constructing a completely modularized processing facility capable of being trucked to site. Field construction requirements will be limited to placing and interconnecting the modules followed by commissioning of the facility.

III Flint Energy Services reports that Flint Transfield Services (FT Services), its 50 per cent owned maintenance company, is the successful bidder for maintenance contracts with Nexen worth an estimated \$95 million over three years.

FT Services will provide electrical and instrumentation services and a portion of mechanical maintenance services at Nexen's Long Lake SAGD facility, southeast of Fort McMurray, Alberta. Work will commence later this year and continue through 2013.

III Enbridge has entered into an agreement with Suncor Energy to construct a new, 95-kilometre 30-inch diameter crude oil pipeline (the Wood Buffalo Pipeline), connecting the Enbridge Athabasca terminal, which is adjacent to Suncor's oil sands plant, to the Cheecham terminal, which is the origin point of Enbridge's Waupisoo Pipeline.

The Waupisoo Pipeline delivers crude oil from several oil sands projects to the Edmonton mainline hub.

The new pipeline will parallel Enbridge's existing Athabasca Pipeline between the Athabasca and Cheecham terminals. Suncor's existing commitments on the Athabasca Pipeline will remain in place.

An application has been filed with the ERCB and, pending regulatory approval, the new line is expected to be in service by mid-2013.

III Junior Osum Oil Sands has made two significant modifications to the plans for its proposed Taiga SAGD facility in the Cold Lake region of Alberta based on its initial community consultations. It has moved the central processing facility across a highway to the site of an old oil sands pilot operation, so the area is already impacted and some infrastructure is already available. The company has also changed its planned construction schedule from three phases to two, shortening the overall construction period.



# **Project listings**

# Updated status of oil sands projects in Alberta

As of September 4, 2010.

#### TECHNOLOGY LEGEND

COGD Combustion overhead gravity drainage

CSS Cyclic steam stimulation

ET-DSP Electro-thermal dynamic stripping process N-SOLV Heated solvent vapour extraction

SAGD Steam assisted gravity drainage

THAI Toe to heel air injection

COMPANY	CURRENT PROJECT	CAPACITY (bbl/d)	START- UP	REGULATORY STATUS	DEVELOPMENT PROGRESS	TECHNOLOGY
ATHABASCA	REGION — IN S	SITU				
ALBERTA OILSANDS						
	Pilot	4,500	2011	Application	AOS has conducted "mini-fracs" in a cased vertical well to measure the stress state of the bitumen reservoir and the cap rock. It is also measuring	SAGD
Clearwater West	Commercial Project	15,000	2012	Announced	temperature in a vertical observation well in order to measure conditions prior to bitumen production.	SAGD
ATHABASCA OIL SAN	DS				profito blanch production.	
	Phase 1	35,000	2014	Application		SAGD
NA IZ	Phase 2	40,000	2017	Application	In addition to MacKay and Dover, AOSC has submitted to regulatory applications for experimental testing in the Dover West region steam injection,	SAGD
MacKay	Phase 3	40,000	2019	Application		SAGD
	Phase 4	35,000	2012	Application	and a process featuring conduction heating.	SAGD
Dover	Phase 1	35,000 - 50,000	2015	Announced		SAGD
BLACKPEARL RESOUR	CES					
Blackrod	Pilot	500	2011	Application	BlackPearl says it anticipates regulatory approval in 2010, along with drilling its SAGD well pair. Engineering and design work on the steam and water handling facilities ongoing. Total capital costs including all-weather road pegged at \$25 million. First steam for Q1/2011.	SAGD
CANADIAN NATURAL	RESOURCES					
Birch Mountain East	Phase 1	60,000	2018	Announced		ТВА
Birch Mountain	Phase 2	60,000	2021	Announced		ТВА
Gregoire Lake 1	Phase 1	60,000	2023	Announced		ТВА
Grouse	Phase 1	60,000	2016	Announced		SAGD
Kirby	Phase 1	45,000	2013	Application	Canadian Natural is proceeding with detailed engineering and design, and plans to sanction and scope in late 2010.	ТВА
CENOVUS ENERGY						
Telephone Lake	Phase A	35,000	TBD	Application	$\label{prop:prop:continuous} Additional information is being collected to support regulatory application.$	SAGD
reiepiione zane	Phase B	15,000	TBD	Announced		SAGD
	Phase A & B	10,000	2002	Operating	Approvals for E, F, and G are expected in 2011, and a wedge-well pilot has been launched at Christina Lake. Application for Phase H to be filed in 2015.	SAGD
	Phase C	40,000	2011	Construction		SAGD
	Phase D	40,000	2013	Approved		SAGD
Christina Lake	Phase E	40,000	2014	Application		SAGD
	Phase F	40,000	2016	Application		SAGD
	Phase G	40,000	2017	Application		SAGD
	Phase H	40,000	2019	Announced		SAGD
Narrows Lake	Phase A-C	130,000	2016	Announced	Application to be submitted in Q3.	SAGD
	Phase A-E	120,000	2001	Operating		SAGD
	Phase F	30,000	2014	Application		SAGD
Foster Creek	Phase G	30,000	2016	Application	Application for Phase I to be filed in 2013. Cenovus says the next phases	SAGD
	Phase H	30,000	2017	Application	of production at Foster Creek (Phase F) and Christina Lake (Phase E) are expected a year earlier than originally planned.	SAGD
	Phase I	25,000	2019	Announced		SAGD
	Phase A	60,000	2017	Announced		
Grand Rapids	Phase B	60,000	TBD	Announced	SAGD test to begin by the end of 2010, with commercial regulatory application to follow by the end of 2011.	
	Phase C	60,000	TBD	Announced	, , , , , , , , , , , , , , , , ,	
CONNACHER OIL AND	GAS					
	Pod 1	10,000	2007	Operating	Al de	SAGD
Great Divide	Pod 2 (Algar)	10,000	2010	Operating	Algar commissioning underway. 15 out of 17 well pairs at Algar receiving steam. Pod One production lower than expected in Q2 because of periodic power out-	SAGD
	Expansion	24,000	2013	Disclosed	ages and pump failures.	SAGD

COMPANY	CURRENT PROJECT	CAPACITY (bbl/d)	START- UP	REGULATORY STATUS	DEVELOPMENT PROGRESS	TECHNOLOGY
CONOCOPHILLIPS CA	NADA					
	Phase 1	27,000	2007	Operating		SAGD
Surmont	Phase 2	83,000	2014 - 2016	Under construction		SAGD
	Pilot	1,200	1997	Operating		SAGD
DEVON CANADA		,				
	Phase 1	35,000	2007	Operating	Sand erosion is being cited as the cause of a July steam/bitumen release.	SAGD
Jackfish	Phase 2	35,000	2011	Under	Devon reports Jackfish 2 construction is now over 75 per cent complete.	SAGD
Jucinisi.	Phase 3	35,000	TBD	Construction Announced	Jackfish 3 regulatory application to be filed in Q3-2010.	SAGD
Kirby-Pike	Phase 1	75,000 TBD	2015	Announced	Delineation drilling expected to begin in the second half of 2010.	JAGD
ENERPLUS RESOURCES		100	2015	Amounced	Defined to Francisco and Franc	
ENERI EGG REGGORCE	Phase 1	10,000	TBD	Application		SAGD
Kirby	Phase 2	25,000	TBD	Announced	Enerplus says it is considering various alternatives relating to Kirby, given its desire to focus on plays that offer scope and scale with near-term cash flow.	SAGD
E-T ENERGY	T Huse 2	23,000	100	Amounced	, , , , , , , , , , , , , , , , , , , ,	JAGD
E-I ENERGI	Pilot	1,000	2007	Operating	E.T. Energy has respired from ding from Alberta's Climate Change and Emis	
Poplar Creek		10,000	2011	Application	E-T Energy has received funding from Alberta's Climate Change and Emissions Management Corporation to further testing.	ET-DSP
EXCELSIOR ENERGY		10,000	2011	7 трричистоп		21,22
Hangingstone	Pilot	1,000	2011	Application	A June 2010 financing of \$26 million is allowing Excelsior to move ahead with the project. It will continue to delineate, engineer and design to support 10,000 bbl/d SAGD application in 2011.	COGD
GRIZZLY OIL SANDS						
Algar Lake	Phase 1	5,000	2013	Application	Grizzly has awarded SNC-Lavalin engineering and procurement for the first	SAGD
Algui Luke	Phase 2	5,000	2013	Application	phase of the project.	
HUSKY ENERGY						
McMullen	Pilot	755	TBD	Application	64 cold production wells are planned in 2010. Husky is planning tests of air injection, SAGD and CSS.	SAGD
Sunrise	Phase 1	60,000	2014	Approved	Husky says FEED for the first phase of Sunrise is complete and tenders for major engineering and construction contracts have been issued. Work has progressed for negotiations of the transport of diluent to Sunrise and diluted	SAGD
	Phases 2-3	140,000	TBD	Approved	bitumen back to BP's Toledo refinery. Sanction expected this year.	SAGD
IVANHOE ENERGY						
Tamarack	SAGD with HTL upgrading	20,000	2014	Announced	EIA has been completed and supporting engineering and design near completion. Application to be submitted in fall 2010.	SAGD
JAPAN CANADA OIL S	ANDS					
Hangingstone	Pilot	10,000	1999	Operating	IACOS anticipatos avagasian approved in O2/2011	SAGD
Hangingstone	Phase 1	35,000	TBD	Application	JACOS anticipates expansion approval in Q3/2011	SAGD
KOREA NATIONAL OII (HARVEST ENERGY TR						
חייויכיון	Phase 1	10,000	2012	Approved	Project sanction anticipated in 2010. KNOC has awarded build to GS E&C	SAGD
BlackGold	Phase 2	20,000	TBD	Application	Corporation of Korea.	SAGD
LARICINA ENERGY						
Germain	SAGD pilot	5,000	2012	Application		SAGD
Germani	Phase 1	10,000	TBD	Announced	Laricina has closed two equity financings, securing an additional \$76.2 mil-	SAGD
C. I. I.	Carbonate SAGD demonstration	1,800	2010	Under construction	lion, which it says will allow it to move forward with confidence on Germain. First steam at Saleski remains on track for the fourth quarter.	SAGD
Saleski	Phase 1	10,000	TBD	Announced		SAGD
MEG ENERGY						
	Phase 1	3,000	2008	Operating		SAGD
	Phase 2	22,000	2009	Operating		SAGD
Christina Lake	Phase 2B	35,000	2013	Approved	MEG is now a public company trading on the TSX under the symbol MEG.	SAGD
	Phase 3A	75,000	TBD	Application	Phase 2B to begin operations in 2013.	SAGD
	Phase 3B	75,000	TBD	Application		SAGD
NEXEN						
	Phase 1	72,000	2007	Operating		SAGD
	Phase 2	72,000	TBD	Announced	Nexen says Long Lake is on track to exit 2010 at 40,000 to 60,000 bbl/d.	SAGD
Long Lake	Phase 3	72,000	TBD	Announced		SAGD
	Phase 4	72,000	TBD	Announced		SAGD
			TDD			SACD
Long Lake South	Phase 1	70,000	TBD	Approved		SAGD

COMPANY	CURRENT PROJECT	CAPACITY (bbl/d)	START- UP	REGULATORY STATUS	DEVELOPMENT PROGRESS	TECHNOLOGY
N-SOLV						
	Pilot plant	2,000	TBD	Announced		N-SOLV
PARAMOUNT RESOURC	ES					
Hoole	Commercial project	TBD	TBD	Announced	Paramount is conducting reservoir analysis and surface work including collecting baseline environmental data. Application to be filed in 2011.	SAGD
PETROBANK ENERGY AI	ND RESOURCES				recting buseline environmental data. Application to be filed in 2011.	
	Pilot	1,800	2006	Operating	Q2 production average 100 bbl/d, reaching as high as 535 bbl/d, but	THAI
Whitesands	FIIOC	1,800	2000	Operating	encountering operational issues.	
	Expansion	1,800	TBD	Approved	Expansion on hold in favour of capitalizing on existing infrastructure.	THAI
May River	Phase 1	10,000	2012	Application	Alberta Environment contingent approval issued April 2010.	THAI
	Subsequent Phases	90,000	TBD	Disclosed		THAI
SOUTHERN PACIFIC RES	OURCE					
STP-McKay		12,000	2012	Application	ERCB has completed review and found no technical issues outstanding. Final approvals expected in time for construction start in fall 2010.	SAGD
STATOIL CANADA						
Kai Kos Dehseh-Leismer	Demonstration	10,000	2010	Under		SAGD
Rui Rus Deliseii-Leisiiler				construction		
Leismer	Commercial	10,000	TBD	Application		SAGD
	Expansion	20,000	TBD	Application		SAGD
Corner		40,000	TBD	Application	Statoil says construction is about 95 per cent complete, conducting	SAGD
Thornbury	Evnansion	40,000 40,000	TBD	Application	instrumentation and loop checks. Site officially "hot" as of July 1. Steam injection to commence later this year.	SAGD
Hangingstone	Expansion	20,000	TBD	Application  Application	···	SAGD
Thornbury	Expansion	20,000	TBD	Application		SAGD
Northwest Leismer	Expunsion	20,000	TBD	Application		SAGD
South Leismer		20,000	TBD	Application		SAGD
SUNCOR ENERGY						
Chard	Phase 1	40,000	TBD	Announced		SAGD
	Phase 1	33,000	2004	Operating		SAGD
	Phase 2	35,000	2006	Operating		SAGD
	Cogeneration and Expansion	25,000	2007	Operating		SAGD
Firebag	Phase 3	68,000	2011	Under	Firebag Phase 3 expected to be complete in the second quarter of 2011, fol-	SAGD
riiebug				construction	lowed by an an 18- to 24-month ramp-up.	
	Phase 4	68,000	2012	Approved	Construction of Phase 4 remains subject to Suncor board approval.  Suncor has received regulatory approval for stages 4 through 6 of its Firebag	SAGD
	Phase 5	68,000	TBD	Approved	project.	SAGD
	Phase 6	68,000	TBD	Approved		SAGD
Lewis	Phase 1	40,000	TBD	Application		SAGD
	Phase 2	40,000	TBD	Application		SAGD
MacKay River	Phase 1	33,000	2002	Operating		SAGD
.videray Niver	Phase 2	40,000	TBD	Approved	Suncor will not be providing any further updates on next projects to move forward until late 2010.	SAGD
Mandauce	Phase 1	40,000	TBD	Approved		SAGD
Meadow Creek	Phase 2	40,000	TBD	Approved		SAGD
SUNSHINE OILSANDS						
Harper pilot	Production mobility test	<1,000	TBD	Approved	Project is expected to commence construction in 2010.	SAGD
Legend Lake	Phase 1	10,000	TBD	Announced		SAGD
-3 24	Phase 2 (two stages)	40,000	TBD	Announced		SAGD
	Phase 1	10,000	2012	Application	Construction to begin in 2011.	SAGD
West Ells	Phase 2 (two stages)	40,000	2013	Announced		SAGD
	Phase 3	30,000	TBD	Announced		SAGD
Thickward	Phase 1	10,000	TBD	Announced		SAGD
Thickwood	Phase 2 (two stages) Phase 3	40,000 25,000	TBD TBD	Announced Announced		SAGD
	Phase 1	2,000	2004	Suspended		SAGD
			2004		The ERCB has released its long-awaited report into the steam release that	
Joslyn	Phase 2	10,000		Suspended	occured at Joslyn in May 2006. Total plans to abandon the in situ portion of	SAGD
	Phase 3A	15,000	TBD	Withdrawn	the Joslyn project.	SAGD
	Phase 3B	15,000	TBD	Withdrawn		SAGD

COMPANY	CURRENT PROJECT	CAPACITY (bbl/d)	START- UP	REGULATORY STATUS	DEVELOPMENT PROGRESS	TECHNOLOGY
TOTAL E&P CANADA						
	Phase 1	2,000	2004	Suspended		SAGD
loch/n	Phase 2	10,000	2006	Suspended	Total E&P Canada is in the process of determining the best way forward for	SAGD
Joslyn	Phase 3A	15,000	TBD	Withdrawn	the assets on its Joslyn in situ lease.	SAGD
	Phase 3B	15,000	TBD	Withdrawn		SAGD
VALUE CREATION GRO	UP					
	Pilot	10,000	TBD	Approved	BP will become majority owner and operator of Terre de Grace project for \$900 million.	SAGD
Terre de Grace	Phase 1	40,000	TBD	Announced		SAGD
	Phase 2	40,000	TBD	Announced		SAGD
TriStar	Pilot	1,000	TBD	Application	Value Creation says the project will deonstrate high-reservoir qualities and advantages of integrating SAGD with its upgrading technology.	
ATHABASCA	REGION – MIN	ING				
ATHABASCA OIL SAND	OS PROJECT					
	Phase 1A	100,000	2010/ 2011	Under construction	Project partner Marathon Oil reports Expansion 1 is on track and anticipated to begin mining operations in the second half of 2010, and upgrader operations in late 2010 or early 2011.	Mining
Jackpine	Phase 1B	100,000	TBD	Approved		Mining
	Phase 2	100,000	TBD	Application		Mining
	Existing Facilities	155,000	2002	Operating	Marathon says a turnaround in April and May has been completed at a net	Mining
Muskeg River	Expansion and	115,000	TBD	Approved	cost to the partner of \$99 million. Shell has announced a field demonstration of its new tailings technology.	Mining
	Debottlenecking Phase 1	100,000	TBD	Application	or its new tallings technology.	Mining
Pierre River	Phase 2	100,000	TBD	Application		Mining
CANADIAN NATURAL F		,		търрпешион		
	Phase 1	110,000	2009	Operating	Approaching stable rates near capacity. Maintenance underway.	Mining
	Tranche 2	6,000- 15,000	TBD	Approved	Canadian Natural hopes to sanction Tranche 2 by the end of 2010.	Mining
Horizon	Tranche 3	10,000- 20,000	TBD	Approved	Tranches 3 and 4 continue to be re-profiled based on learnings from Phase 1.	Mining
	Tranche 4	approx. 105,000	TBD	Approved		Mining
IMPERIAL OIL		,				
	Phase 1	110,000	2012	Under construction	Current construction includes work on piling, foundations, and starter dike, as well as vessel and pipe fabrication. About 2,000 workers are currently	Mining
Kearl	Phase 2	100,000	TBD	Approved	on the project. Imperial Oil CEO Randy Broiles is taking a position with ExxonMobil, and will be replaced by Glenn Scott, currently president of	Mining
	Phase 3	100,000	TBD	Approved	ExxonMobil Canada.	Mining
SUNCOR ENERGY						
Fort Hills	Phase 1	165,000	TBD	Approved	Capital plans and sequencing for Suncor's next growth stages are under evaluation with a further update expected in Q4-2010.	Mining
	Debottlenecking	25,000	TBD	Approved	Total E&P Canada has acquired UTS' 20 per cent stake in Fort Hills.	Mining
	Millennium	294,000	1967	Operating		Mining
Suncor — original	Steepbank Debottleneck Phase 3	4,000	2007	Operating	Suncor says its remaining 2010 capital growth spending will be directed towards completion of a naptha unit at Upgrader 2, which is expected to	Mining
operations	Millennium Debottlenecking	23,000	2008	Operating	increase the value of its product mix. The project is expected to be complete by the end of the fourth quarter of 2011.	Mining
	North Steepbank Extension		2010	Operating		Mining
Voyageur South	Phase 1	120,000	TBD	Application		Mining
SYNCRUDE (MILDRED I	LAKE AND AURORA)					
	Stages 1 and 2	290,700	1978	Operating		Mining
Syncrude — original	Stage 3 Expansion	116,300	2006	Operating	Canadian Oil Sands Trust is reporting strong production rates in Q2/2010, however its	Mining
operations	Stage 3 Debottleneck	46,500	TBD	Announced	full-year volumes are now expected to be impacted by unplanned maintenance.	Mining
	Stage 4 Expansion	139,500	TBD	Announced		Mining
TOTAL E&P CANADA						
	Phase 1 (North)	50,000	TBD	Application		Mining
Joslyn	Phase 2 (North)	50,000	TBD	Application	The hearing for Total's Joslyn project will take place in September and October. Facing	Mining
	Phase 3 (South)	50,000	TBD	Announced	opposition from groups including the Regional Municipality of Wood Buffalo.	Mining
	Phase 4 (South)	50,000	TBD	Announced		Mining
Northern Lights	Phase 1	57,250	TBD	Withdrawn	Northern Lights asset is being integrated into Total portfolio. Will reinstate	Mining
	Phase 2	57,250	TBD	Withdrawn	after new timing is determined.	Mining

COMPANY	CURRENT PROJECT	CAPACITY (bbl/d)	START- UP	REGULATORY STATUS	DEVELOPMENT PROGRESS	TECHNOLOGY
COLD LAKE R	EGION – IN SI	ΤU				
BR OIL SANDS (SHELL)						
	Phase 1	10,000	2008	Operating		SAGD
Orion	Phase 2	10,000	TBD	Approved	Shell is reportedly slowing its oilsands investments in favour of less costly conventional resources.	SAGD
CANADIAN NATURAL R	ESOURCES					
	Wolf Lake	13,000	1985	Operating		CSS
	Wolf Lake SAGD	5,500	TBD	Application		SAGD
	Primrose South	45,000	1985	Operating		CSS
Primrose/Wolf Lake	Primrose North	30,000	2006	Operating		CSS
	Primrose East (Burnt Lake)	32,000	2009	Operating	In Q1/2009, operational issues on one pad caused steaming to cease on all Primrose East pads. Canadian Natural is working with the regulator to commence normal steaming.	CSS
	CSS Follow-up Process	25,000	2018	Application	Canadian Natural says its CSS follow-up process requires technology development.	css
HUSKY ENERGY						
Caribou	Demonstration Project	10,000	TBD	Approved		SAGD
Tucker	Phase 1	30,000	2006	Operating	During Q2, Husky drilled four new well pairs, as well as tying-in and commencing steam injection on three other pairs. Applications are proceeding for additional drilling and development work in 2010.	SAGD
IMPERIAL OIL						
	Phases 1-10: Leming, Maskwa, Mahihkan	110,000	1985	Operating	Imperial reports that production has returned to normal levels. Imperial Oil	CSS
Cold Lake	Phases 11-13: Mahkeses	30,000	2003	Operating	CEO Randy Broiles is taking a position with ExxonMobil, and will be replaced	CSS
	Phases 14-16: Nabiye, Mahihkan North	30,000	TBD	Approved	by Glenn Scott, currently president of ExxonMobil Canada.	CSS
KOCH EXPLORATION CA	ANADA					
Gemini	Pilot	1,200	TBD	Application	Application filed in June 2009.	SAGD
	SAGD Project	10,000	TBD	Application		SAGD
OSUM OIL SANDS						
Taiga	SAGD/CSS Project	25,000- 35,000	2014	Application	Based on the results of community consultations, Osum has changed the planned location of Taiga as well as its phases. It will now be built in two phases instead of three.	SAGD
PENGROWTH ENERGY 1	rust					
Lindbergh	SAGD Pilot	2,500	2012	Application	Approval anticipated in 2010. Pengrowth will spend \$15 million on project in 2010.	SAGD
PEACE RIVER	REGION - IN	SITU				
ANDORA ENERGY (PAN	ORIENT)					
Sawn Lake	SAGD Demonstration	700	TBD	Approved	Working on procurement of long-lead items.	SAGD
NORTH PEACE ENERGY						
	CSS Pilot	1,000	2008	Operating	North Peace Energy has received regulatory approval for a new process at	css
Red Earth	Expansion	3,000	TBD	Announced	the project called Top Down Steam Drive. This will be undertaken when	css
	Commercial Project	10,000	TBD	Announced	funds are secured. In the interim, the company has suspended operations.	css
SHELL CANADA						
	Cadotte Lake	12,501	1986	Operating		CSS
Carmon Creek	Phases 1 and 2	80,000	TBD	Application	New application filed January 2010. Shell expects construction of first 40,000-barrel-per-day plant to commence in 2011, with a second 40,000-barrel facility three years following.	css
NORTHWEST	SASKATCHEWA	N – IN	SITU			
OILSANDS QUEST						
	Reservoir Test	600	2008	Operating		
Axe Lake	SAGD Test	TBD	TBD	Application	Oilsands Quest has announced it is pursuing strategic alternatives in order to secure	
	Commercial SAGD	30,000	TBD	Application	funds to progress its operations.	

COMPANY	CURRENT PROJECT	CAPACITY - BITUMEN (bbl/d)	CAPACITY - PRODUCTS (bbl/d)	START-UP	REGULATORY STATUS	DEVELOPMENT PROGRESS	TECHNOLOG
ATHABASCA R	EGION – UPG	RADING					
CANADIAN NATURAL R	ESOURCES						
	Phase 1	135,000	114,000	2008	Operating	Approaching stable rates near capacity. Maintenance underway.	Upgrader
Horizon	Tranches 2 & 3	135,000	118,000	TBD	Approved	Canadian Natural hopes to sanction Tranche 2 by the end of 2010. Tranches 3 and 4 continue to be re-profiled based on learnings from Phase 1.	Upgrader
	Tranche 4	145,000	125,000	TBD	Announced	<u> </u>	Upgrader
NEXEN							
	Phase 1	72,000	58,500	2008	Operating		Upgrader
	Phase 2	72,000	58,500	TBD	Approved		Upgradei
	Phase 3	72,000	58,500	TBD	Announced	Nexen says Long Lake is on target to exit 2010 at	Upgradei
Long Lake	Phase 4	72,000	58,500	TBD	Announced	40,000 to 60,000 barrels per day.	Upgradei
	Phase 5	72,000	58,500	TBD	Announced		Upgradei
	Phase 6	72,000	58,500	TBD	Announced		Upgradei
SUNCOR ENERGY		·					- 13
	Pass III and III	291 000	335,000	1067	Operating	Suncor says its remaining 2010 capital growth spending	Unavados
Supror original	Base U1 and U2	281,000	225,000	1967	Operating	will be directed towards completion of a naptha unit at	Upgradei
Suncor — original operations	Millennium Vacuum Unit	43,000	35,000	2005	Operating	Upgrader 2, which is expected to increase the value of	Upgradei
speracions	Millennium Coker Unit	116,000	97,000	2008	Operating	its product mix. The project is expected to be complete by the end of the fourth quarter of 2011.	Upgrade
Voyageur	Phase 1	156,000	127,000	TBD	Suspended	Capital plans and sequencing for the next stages of Suncor's growth to be announced in Q4-2010.	Upgrader
	Phase 2	78,000	63,000	TBD	Approved		Upgradei
SYNCRUDE							
	Stages 1 and 2	290,700	250,000	1978	Operating		Upgradei
Mildred Lake	Stage 3 Expansion	116,300	100,000	2006	Operating	Canadian Oil Sands Trust is reporting strong production rates in Q2/2010, however its full-year volumes are now	Upgradei
villarea Lake	Stage 3 Debottleneck	46,500	40,000	TBD	Announced	expected to be impacted by unplanned maintenance.	Upgradei
	Stage 4 Expansion	139,500	120,000	TBD	Announced		Upgradei
VALUE CREATION							
Terre de Grace Upgrader	Phase 1	2,000	N/Q	TBD	Application	BP will become majority partner in Terre de Grace	Upgradei
ierre de Grace Opgrader	Phase 2	10,000	N/Q	TBD	Application	project for \$900 million.  Value Creation says the project will deonstrate high-	Upgradei
TriStar	Pilot	1,000	N/Q	TBD	Application	reservoir qualities and advantages of integrating SAGD with its upgrading technology.	
INDUSTRIAL	HEARTLAND R	EGION –	UPGRAD	ING			
ATHABASCA OIL SAND	S PROJECT						
		155,000	158,000	2003	Operating	Project partner Marathon Oil reports Expansion 1 is on track and anticipated to begin mining operations in the	Upgrader
Scotford Upgrader 1	Expansion	90,000	91,000	2010	Under construction	second half of 2010, and upgrader operations in late 2010 or early 2011.	Upgrader
	Phase 1	100,000	97,750	TBD	Application		Upgrader
Scotford Upgrader 2	Phase 2	100,000	97,750	TBD	Application	Alberta's Industrial Heartland Association says hearing	Upgradei
ocociora opgradei z	Phase 3	100,000	97,750	TBD	Application	for all phases to occur sometime in 2010.	Upgradei
	Phase 4	100,000	97,750	TBD	Application		Upgrade
BA ENERGY		.00,000	71,130	,50	ripplication		- opgruder
SATERICA CONTRACTOR OF THE CON	Phase 1	54.400	46 300	TDD	Априсусь		Harman
	Phase 1	54,400	46,300	TBD	Approved		Upgradei
Heartland Upgrader	Phase 2	54,400	46,300	TBD	Approved	Construction suspended.	Upgradei
	Phase 3	54,400	46,300	TBD	Approved		Upgradei
NORTH WEST UPGRAD	NG						
		F0.000	46,400	2013	Approved	The Alberta government reports that negotiations are	Upgradei
	Phase 1	50,000	40,400				
Upgrader	Phase 1 Phase 2	50,000	46,400	TBD	Approved	underway with NWU to build the upgrader as part of its	Upgradei
Jpgrader					Approved Approved	underway with NWU to build the upgrader as part of its bitumen royalty in-kind initiative.	
	Phase 2	50,000	46,400	TBD		,	
SUNCOR ENERGY	Phase 2	50,000	46,400	TBD		bitumen royalty in-kind initiative.	Upgradei
SUNCOR ENERGY	Phase 2 Phase 3	50,000 50,000	46,400 46,400	TBD TBD	Approved Approved	,	Upgradei Upgradei
SUNCOR ENERGY Fort Hills Upgrader	Phase 2 Phase 3 Phase 1	50,000 50,000 165,000	46,400 46,400 145,000	TBD TBD	Approved	bitumen royalty in-kind initiative.  Capital plans and sequencing for the next stages of	Upgradei Upgradei
SUNCOR ENERGY Fort Hills Upgrader	Phase 2 Phase 3 Phase 1 Phases 2 and 3	50,000 50,000 165,000 175,000	46,400 46,400 145,000 145,000	TBD TBD TBD TBD	Approved Approved Approved	bitumen royalty in-kind initiative.  Capital plans and sequencing for the next stages of	Upgradei Upgradei Upgradei
SUNCOR ENERGY Fort Hills Upgrader STATOIL CANADA	Phase 2 Phase 3  Phase 1 Phases 2 and 3  Phase 1	50,000 50,000 165,000 175,000	46,400 46,400 145,000 145,000	TBD TBD TBD TBD TBD	Approved Approved Approved Withdrawn	bitumen royalty in-kind initiative.  Capital plans and sequencing for the next stages of	Upgrade Upgrade Upgrade Upgrade
SUNCOR ENERGY Fort Hills Upgrader STATOIL CANADA Upgrader	Phase 2 Phase 3 Phase 1 Phases 2 and 3	50,000 50,000 165,000 175,000	46,400 46,400 145,000 145,000	TBD TBD TBD TBD	Approved Approved Approved	bitumen royalty in-kind initiative.  Capital plans and sequencing for the next stages of Suncor's growth to be announced in Q4-2010.	Upgradei Upgradei Upgradei Upgradei
SUNCOR ENERGY Fort Hills Upgrader STATOIL CANADA Upgrader TOTAL E&P CANADA	Phase 2 Phase 3  Phase 1 Phases 2 and 3  Phase 1 Phase 2	50,000 50,000 165,000 175,000 75,000	46,400 46,400 145,000 145,000 65,000 152,000	TBD TBD TBD TBD TBD TBD TBD	Approved  Approved  Withdrawn  Withdrawn	bitumen royalty in-kind initiative.  Capital plans and sequencing for the next stages of Suncor's growth to be announced in Q4-2010.	Upgrader Upgrader Upgrader Upgrader Upgrader
SUNCOR ENERGY Fort Hills Upgrader STATOIL CANADA Upgrader TOTAL E&P CANADA Northern Lights	Phase 2 Phase 3  Phase 1 Phases 2 and 3  Phase 1 Phase 2  Phase 1	50,000 50,000 165,000 175,000 75,000 175,000	46,400 46,400 145,000 145,000 65,000 152,000	TBD TBD TBD TBD TBD TBD TBD TBD	Approved  Approved  Withdrawn  Withdrawn	bitumen royalty in-kind initiative.  Capital plans and sequencing for the next stages of Suncor's growth to be announced in Q4-2010.	Upgradei Upgradei Upgradei Upgradei Upgradei
SUNCOR ENERGY Fort Hills Upgrader STATOIL CANADA Upgrader TOTAL E&P CANADA Northern Lights	Phase 2 Phase 3  Phase 1 Phases 2 and 3  Phase 1 Phase 2  Phase 2	50,000 50,000 165,000 175,000 75,000 175,000 56,600 56,600	46,400 46,400 145,000 145,000 65,000 152,000 50,600	TBD	Approved  Approved  Approved  Withdrawn  Withdrawn  Withdrawn	bitumen royalty in-kind initiative.  Capital plans and sequencing for the next stages of Suncor's growth to be announced in Q4-2010.	Upgrader Upgrader Upgrader Upgrader Upgrader Upgrader Upgrader
SUNCOR ENERGY Fort Hills Upgrader  STATOIL CANADA  Upgrader  TOTAL E&P CANADA  Northern Lights Upgrader	Phase 2 Phase 3  Phase 1 Phases 2 and 3  Phase 1 Phase 2  Phase 2  Phase 1 Phase 2 Phase 1	50,000 50,000 165,000 175,000 75,000 175,000 56,600 150,000	46,400 46,400 145,000 145,000 50,600 50,600 138,000	TBD	Approved  Approved  Approved  Withdrawn  Withdrawn  Withdrawn  Application	bitumen royalty in-kind initiative.  Capital plans and sequencing for the next stages of Suncor's growth to be announced in Q4-2010.  Application on hold indefinitely.  ERCB hearing completed in June. Alberta's Industrial	Upgrader Upgrader Upgrader Upgrader Upgrader Upgrader Upgrader Upgrader
Upgrader  SUNCOR ENERGY  Fort Hills Upgrader  STATOIL CANADA  Upgrader  TOTAL E&P CANADA  Northern Lights Upgrader  Total Upgrader	Phase 2 Phase 3  Phase 1 Phases 2 and 3  Phase 1 Phase 2  Phase 2	50,000 50,000 165,000 175,000 75,000 175,000 56,600 56,600	46,400 46,400 145,000 145,000 65,000 152,000 50,600	TBD	Approved  Approved  Approved  Withdrawn  Withdrawn  Withdrawn	bitumen royalty in-kind initiative.  Capital plans and sequencing for the next stages of Suncor's growth to be announced in Q4-2010.  Application on hold indefinitely.	Upgrader



# 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 US gallons (159 litres). There are 6.29 barrels in one cubic metre of oil.

#### **Bitumen**

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

#### Condensate

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

#### Cyclic steam stimulation

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

#### Density

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

#### Diluent

see Condensate

### Established recoverable reserves

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

#### **Established reserves**

Reserves recoverable with current technology and present and anticipated economic conditions specifically proved by drilling, testing, or production, plus the portion of contiguous recoverable reserves that are interpreted to

exist from geological, geophysical, or similar information with reasonable certainty.

A process, unique to the oil sands industry, which separates the bitumen from the oils and 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).

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

#### **Greenhouse** gases

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

#### Initial established reserves

Established reserves prior to the deduction of any production.

#### Initial volume in place

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

#### In situ

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

#### In situ combustion

A displacement enhanced oil recovery method. It works by generating combustion gases (primarily CO and CO<sub>2</sub>) 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 oilsand 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.

#### Oil Sands

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

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

#### Pilot plant

Small model plant for testing processes under actual production conditions

#### Proven recoverable reserves

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

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

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

#### **Tailings**

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

#### 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 oilsand. 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 oils and and load very large trucks. The trucks haul the oilsand 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.

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

# CONTACTS

## Oil Sands Producers

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- Albian Sands Energy
- Andora Energy
- Athabasca Oil Sands
- Bavtex Energy
- Canadian Natural Resources
- Cenovus Energy
- Chevron Canada
- Connacher Oil and Gas
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- Devon Canada
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- Imperial Oil
- Ivanhoe Energy
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- Laricina Energy
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## **Associations/Organizations**

- Alberta Building Trades Council
- Alberta Chamber of Resources
- Alberta Chambers of Commerce
- Alberta Energy
- Alberta Energy Research Institute
- Alberta Environment
- Alberta Finance and Enterprise
- Alberta Research Council
- Alberta Research Co
   Alberta's Industrial
- Heartland Association
- Canadian Association of
- Geophysical Contractors
   Canadian Association of
- Canadian Association of Petroleum Producers
- Canadian Heavy Oil Association
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