Alberta's Oil Sands 2006

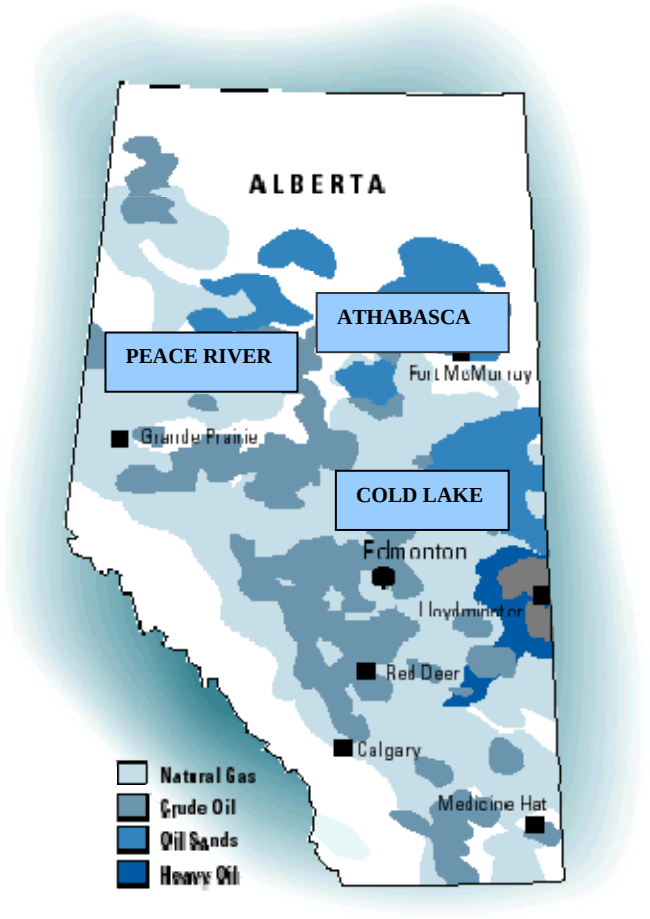
Alberta's oil sands are abundant, accessible, and affordable sources of crude oil. With the continuing decline of conventional North American crude oil reserves, the focus is turning towards oil sands exploration, development, and production. According to the Alberta Energy and Utilities Board (AEUB), production averaged 1.26 million barrels per day (bpd) of bitumen in 2006. Of this total, marketable production included approximately 660 thousand bpd sold as synthetic crude oil (SCO) and distillates, and approximately 466 thousand bpd sold as bitumen. Marketable oil sands production currently represents 42 per cent of Canada's total crude output. According to the AEUB, SCO and non-upgraded bitumen accounted for 62% of total Alberta crude oil and equivalent production. This is expected to increase to 86% by 2016.

What are Oil Sands?

- Oil sands are crude deposits that are substantially heavier (more viscous) than other crude oils. Oil sands consist of sand, bitumen, mineral rich clays and water. Bitumen is a product of the oil sands that requires upgrading to synthetic crude oil or dilution with lighter hydrocarbons to make it transportable by pipelines and usable by refineries.

Oil Sands Reserves

- Alberta has huge deposits of oil sands that underlie 140,200 square kilometres (54,132 square miles) of the province. These deposits are separated into three regions: Peace River, Athabasca (Fort McMurray area), and Cold Lake (north of Lloydminster).
- Of the remaining established reserves, about 82% is considered recoverable by in situ methods; the rest is recoverable by surface mining methods.



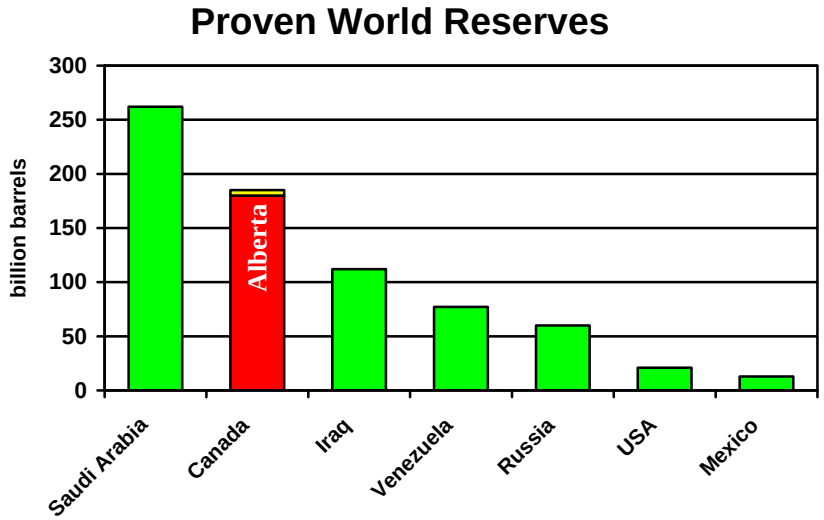
- These oil sands deposits contain approximately 1.7 trillion barrels of bitumen in-place, of which 173 billion barrels are proven reserves that can be recovered using current technology.

Alberta's Crude Oil Reserves – December 2006

Billion Barrels	Conventional Oil	Oil Sands
Initial Volume In-Place	65.4	1701
Remaining Established	1.6	173
Remaining Ultimate Potential	19.7	315

Source: Alberta Energy & Utilities Board

- As of December 2006, there are approximately 3360 oil sands (mineral rights) agreements with the Province totalling approximately 54,275 square kilometres (20,956 square miles). Close to 61 percent of possible oil sands areas are still available for exploration and leasing.
- According to the *Oil & Gas Journal* and the *US Energy Information Administration* Canada's 180 billion barrels of proven oil reserves (accounting for 15% of world reserves), ranks second largest after Saudi Arabia. The majority of these reserves, 174 billion barrels, are found in Alberta's oil sands.



Oil Sands Production -- Current & Projected

- In 2006, oil sands bitumen production averaged 1.26 million bpd. Of this total, more than 660 thousand bpd was sold as synthetic crude oil and distillates, while approximately 466 thousand bpd was sold as clean bitumen. The AEUB forecasts 86% of the production of 3.19 million bpd of total Alberta crude oil and equivalent supply by 2016 will be from non-upgraded bitumen and SCO.

Oil Sands Production Methods

- There are two types of oil sands production methods: mining and in-situ.
- Mining oil sands requires an open-pit mine operation. Oil sands are moved by trucks and shovels to a cleaning facility where the material is mixed with warm water to remove the bitumen from the sand. Today, all operating oil sands mines are linked with upgraders that convert the bitumen to synthetic crude oil.
- For oil sands reservoirs too deep to support economic surface mining operations, some form of an in-situ or “in place” recovery is required to produce bitumen. In-situ oil sands production is similar to that of conventional oil production where oil is recovered through wells. The AEUB estimates that 82 percent of the total bitumen ultimately recoverable will be with in-situ techniques. In general, the heavy, viscous nature of the bitumen means that it will not flow under normal conditions. Numerous in-situ technologies have been developed that apply thermal energy to heat the bitumen and allow it to flow to the well bore. These include thermal (steam) injection through vertical or horizontal wells such as cyclic steam stimulation (CSS), pressure cyclic steam drive (PCSD) and steam assisted gravity drainage (SAGD). Other technologies are emerging such as pulse technology, vapour recovery extraction (VAPEX) and toe-to-heel air injection (THAI).
- There are reservoirs in the oil sands where primary or "cold" production is possible. The bitumen in these areas will flow to the well bore when co-produced with sand through the use of progressive cavity pumps, the same technology that is used in conventional heavy oil production. This type of production technology is commonly called cold heavy oil production with sand (CHOPS). While this bitumen is lighter than the bitumen found in mineable and other in-situ reserves, it is heavier than conventional heavy oil. A significant difference between primary bitumen and conventional heavy oil production is the amount of sand that is co-produced. Sand production in primary bitumen wells may be two to three times greater than sand production in conventional heavy oil wells.
- In general, oil sands mines are found in central Athabasca deposits (around Fort McMurray). In-situ recovery methods are used in the Cold Lake, south Athabasca and Peace River deposits.

Government Framework

- The oil sands mineral rights in approximately 97 percent of Alberta’s 140 thousand square kilometers (54 thousand square miles) of oil sands area are owned by the provincial Crown and managed by the Alberta Department of Energy. The remaining three percent of the oil sands mineral rights in the province are held by the federal Crown within Indian reserves, by successors in title to the Hudson’s Bay Company, by the national railway companies and by the descendents of original homesteaders through rights granted by the federal Crown before 1887. These rights are referred to as “freehold rights”.
- The Departments of Environment and Sustainable Resource Development administer complementary environmental policies. The AEUB regulates oil and gas activities in the province.
- The Alberta Department of Energy is responsible for administering the legislation that governs the ownership, royalty and administration of Alberta’s oil, gas, oil sands, coal, metallic and other mineral resources. The Department’s main objective is to manage these non-renewable resources to ensure their efficient development for the greatest possible benefit to the province and its people.

Oil Sands Royalty[1]

- In 1996, Alberta announced a new generic royalty regime for oil sands based on recommendations from a joint industry/government national task force. This regime is defined in the Mines and Minerals Act and the Oil Sands Royalty Regulation 1997, as amended (OSRR 97). Royalty is calculated using a revenue-less-cost calculation.
- In early project years before capital investment and other costs are recovered, the royalty rate is lower than the rate that is applied after costs are recovered. This helps project cash flows in early years. Once costs are recovered, the Province shares in project profits. Details are provided below.
  - In the pre-payout period (before the project has recovered all of its costs), projects pay royalty tied to 1 percent of gross revenue; and
  - In the post-payout period (after the project has recovered all of its costs), projects pay royalty tied to the greater of 1 percent of gross revenue or 25 percent of net revenue.
- Since 1990, oil sands royalties have totalled over $6.3 billion.

Announced Investment

Since 1996, when the generic royalty regime was introduced, more than $60 billion ($C) has been invested the oil sands, with over $14 billion invested in 2006 alone. Future investments in excess of $100 billion in new projects and project expansions and upgraders have been announced by industry.

Oil Sands Projects & Employment

- As of December 31, 2006, there were 21 companies representing 74 projects approved under the OSRR 97.
- In an August 2005 study by the Canadian Energy Research Institute, bitumen produced could reach 3.6 million bpd by 2020. Based on this projection, 6.6 million person years of employment (direct, indirect and induced) would be created by the oil sands industry world wide from the years 2000 to 2020.
- Of the 6.6 million person years, 3.6 million person years (56%) of employment would be created in Alberta.
- According to the Athabasca Regional Issues Working Group (RIWG), in 2006 over 1,500 aboriginal people were directly employed by oil sands developers or as contractors, which is nearly a 60% increase since 1998. The value of contracts between the oil sands industry and aboriginal companies in 2006 was $412 million.

- Oil sands (OSRR 97 projects) production in 2006 by recovery method was as follows:

– Mining	760,839 bpd
– Thermal (CSS, PSCD, SAGD)	333,564 bpd
– Primary (Cold, CHOPS)	128,035 bpd
	1,222,438 bpd

- Oil sands (OSRR 97 projects) production in 2006 by region was as follows:

– Athabasca	926,008 bpd
– Cold Lake	276,377 bpd
– Peace River	20,053 bpd
	1,222,438 bpd

[1] In October 2007, the Government of Alberta announced changes to the oil sands royalty framework that will become effective January 1, 2009.

Oil Sands Projects Bitumen Production as at December 31, 2006*

Company Name	Project Name	Location	Recovery Method	Production (bpd)	Recent Company or Project Announcements
Baytex	Reita Lake, Mann Lake East	Cold Lake	Primary	3,503	
	Seal Bluesky	Peace River	Primary	549	
				4,052	
Bonavista Energ Trust Ltd.	5 projects	Cold Lake	Primary	**3,020**	
Canadian Natural Resources	19 projects (1)	Cold Lake	Primary	37,941	
	Wolf Lake, Alberta Lindbergh, Elk Point	Cold Lake	CSS	12,656	
	Primrose	Cold Lake	CSS	54,064	Primrose / Wolf Lake productions expected to reach 120,000 bdp by 2009
	Britnell; Pelican lake	Athabasca	Primary	13,141	
	Wabasca	Athabasca	Primary	16,356	
	Kirby Thermal Project	Athabasca	SAGD	-	
	Burnt Lake	Cold Lake	SAGD	492	
				134,650	
Canadian Oil Sands Trust	Syncrude (2)	Athabasca	Mining/Upgrader	**114,257**	Through staged growth, production to to increase to about 500,000 barrels of crude oil per day post 2015
Chevron Texaco	Athabasca Oil Sands Project (3)	Athabasca	Mining	**29,165**	Full production expected to be 155,000 bpd of bitumen
Conoco Phillips	Syncrude (2)	Athabasca	Mining/Upgrader	28,082	
	Surmont (4)	Athabasca	SAGD	268	Surmont bitumen production to be 110,000 bpd by 2010
				28,350	
Delphi Energy	John Lake	Cold Lake	Primary	**55**	
Devon	5 projects (9)	Cold Lake	Primary	11,987	
	Jackfish	Athabasca	SAGD	**-**	Steam injection to begin in 2007 with 35,000 bpd expected by late 2008
				11,987	
Encana	Foster Creek	Athabasca	SAGD	37,582	Production at Foster Creek expected to grow to approximately 210,000 barrels per day.
	Christina Lake	Athabasca	SAGD	5,995	18,000 bdp expected by 2008; growing to 190,000 bpd over next decade
	Pelican Lake	Athabasca	Primary	27,439	
				71,015	
Harvest Operations Corp.	Lindbergh South	Cold Lake	Primary	**699**	
Imperial Oil	Cold Lake	Cold Lake	CSS	151,916	Cold Lake bitumen production to be 180,000 bpd by 2008
	Syncrude (2)	Athabasca	Mining/Upgrader	77,747	Syncrude SCO production to be 500,000 bpd by 2016
				229,663	
Japan Canada Oilsands	Hangingstone	Athabasca	SAGD	**7,707**	
Koch Petroleum	North Wabasca	Athabasca	Primary	302	
	Reno Project	Peace River	Primary	302	
				604	
Mocal	Syncrude (2)	Athabasca	Mining/Upgrader	**15,549**	Syncrude SCO production to be 500,000 bpd by 2016
Murphy Oil Ltd.	Lindbergh	Cold Lake	Primary	44	
	Syncrude (2)	Athabasca	Mining/Upgrader	15,549	Syncrude SCO production to be 500,000 bpd by 2016
	Peace River	Peace River	Primary	188	
				15,781	
Nexen	Syncrude (2)	Athabasca	Mining/Upgrader	22,484	Syncrude SCO production to be 550,000 bpd by 2016
	Long Lake (6)	Athabasca	SAGD/Upgrader	242	Initial production of approximately 60,000 bpd (2009-09) to increase to 240,000 bpd over next decade
				22,726	
Opti	Long Lake (6)	Athabasca	SAGD/Upgrader	**242**	Initial production of approximately 60,000 bpd (2008-09) to increase to 240,000 bpd over next decade
Penn West Petroleum	Dawson Seal	Peace River	Primary	**1,148**	Production target of 20,000 bpd by year-end of 2011
Petro-Canada	MacKay River	Athabasca	SAGD	21,419	McKay River bitumen production to be 27,000 bpd by 2008+
	Dover	Athabasca	SAGD	147	Meadow Creek bitumen production to be 40,000 bpd
	Syncrude (2)	Athabasca	Mining/Upgrader	37,319	Syncrude SCO production to be 550,000 bpd by 2016
	Dover Vapex	Athabasca	SAGD/vapex	18	

Company Name	Project Name	Location	Recovery Method	Production (bpd)	Recent Company or Project Announcements
				58,903	
Shell Canada Limited	Peace River	Peace River	Pressure Pulse/SAGD	2,571	
	Shell SR2000	Peace River	Pressure Pulse/SAGD	3,959	
	Athabasca Oil Sands Project (3)	Athabasca	Mining/Upgrader	87,494	Full production expected to be 155,000 bpd of bitumen
	Seal 1, Seal 11, Seal-Northern Cadotte (8	Peace River	Primary	11,338	
	Woodenhouse (8)	Athabasca	Primary	25	
				105,386	
Suncor	Steepbank and Millennium Mines (7)	Athabasca	Mining/Upgrader	304,028	
	Firebag	Athabasca	SAGD	33,680	Suncor SCO production to be 550,000 bpd by 2010-2012
				337,708	
TOTAL S.A.	Surmont (4)	Athabasca	SAGD	**268**	Surmont bitumen production to be 110,000 bpd by 2010
	Jocelyn (5)	Athabasca	SAGD	**338**	
				606	
Western Oil Sands	Athabasca Oil Sands Project (3)	Athabasca	Mining/Upgrader	**29,165**	On October 18, 2007, Marathon Oil Corporation completed the acquisition of Western Oil Sands
OIL SANDS PRODUCTION (OIL SANDS ROYALTY PROJECTS)				**1,222,437**	
OIL SANDS PRODUCTION (CONVENTIONAL, EXPERIMENTAL, & FREEHOLD PROJECTS)				**32,705**	22,767 bpd in 2006; 11,081 bpd in 2005
TOTAL OIL SANDS PRODUCTION (AEUB)				**1,255,142**	

*** Sources: ADOE/AEUB**

(1) CNRL's 19 combined projects include: Seibert Lake, Fort Kent, Frog Lake, Elk Point, John Lake, Ashmont, Ranger Cold Lake, Lindbergh, Marwayne, Elk Point, Edward Lake, Beartrap, Elizabeth, West Marwayne, Reita Lake, North Murphy Lindbergh, Lindbergh North, Fishing Lake, Moose Hills, Elk Point

(2) Syncrude ownership on Dec 31, 2006: Canadian Oil Sands Trust (36.74%), Imperial Oil (25%), Petro Canada (12%), Conoco Philips (9.03%), Nexen (7.23%), Mocal (5%), Murphy Oil (5%); Syncrude average bitumen production in 2006 = 321,987.6 bpd (AEUB). Average 2006 SCO production = 259,886.7 bpd (AEUB)

(3) Athabasca Oil Sands Project ownership on Dec 31/06: Shell Canada (60%), Chevron Texaco (20%), Western Oil Sands (20%); AOSP average bitumen production in 2006 = 145,822.7 bpd (AEUB).

(4) On May 10/05, Devon sold its Surmont interest to TOTAL and ConocoPhillips-- resulting ownership: TOTAL (50%), ConocoPhillips (50%)

(5) As of Dec. 12/05 TOTAL increased its Deer Creek common shares from 82.4% to 100%.

(6) Opti-Nexen Long Lake project ownership as of June 2003: Opti (50%), Nexen (50%).

(7) Suncor average mining bitumen production in 2006 = 304,027.5 bpd (AEUB). Suncor average SCO production in 2006 = 257,792.7 bpd (AEUB)

(8) On July 10, 2006, Shell Canada completed the acquisition of Blackrock Ventures.

(9) Devon's 5 combined projects include Manatokan, John Lk, Iron R., Mann Lk, Mann N