EnerFAQs

Frequently Asked Questions on the Development of Alberta's Energy Resources
ENERGY RESOURCES CONSERVATION BOARD

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Oil Sands

The oil sands have played an important role in Alberta's economy for more than four decades, but the last 10 years have seen a dramatic increase in interest from both industry and the public. This EnerFAQs provides an overview of Alberta's oil sands, discusses both mining and in situ production methods, and explains how the Energy Resources Conservation Board (ERCB) regulates the resource.

What are the oil sands?

Oil sands are made up of naturally occurring bitumen, a viscous oil typically unable to flow to surface, along with water, sand, and clay. The sand grains are coated by a layer of water and bitumen.

The oil sands are believed to have been formed from the remains of tiny organisms buried in the seabed of an ocean that covered Alberta hundreds of millions of years ago. The gradual accumulation of silt and sand, combined with mountain building to the west, heated and compressed the remains, converting them over time into oil. This oil eventually migrated and saturated vast areas of sand near the surface, where bacteria consumed the lighter hydrocarbon chains, leaving behind only the molasses-like bitumen.

Aboriginal peoples were the first to use bitumen from the Athabasca sands hundreds of years ago to waterproof clothing and canoes. Efforts to commercialize oil sands deposits occurred in the late 19th century and first part of the 20th century, but had limited results. The first oil sands plant, built by what is known today as Suncor Energy, began commercial production in 1967, followed by Syncrude's Mildred Lake project, which commenced operation in 1978. Since then, technological innovations have helped to improve efficiency and lower production costs, which has made investing in the oil sands more economically attractive, generating dozens of projects. However, oil sands projects generally require much greater capital expenditures and longer lead times to reach commercial production than conventional oil projects.

The Government of Alberta states that since 1998 the cumulative investment in oil sands is well in excess of $70 billion.

Currently, there are two ways of producing bitumen: open pit mining and in situ operations, which entail producing the oil to surface through a wellbore.

Where are oil sands deposits located in Alberta?

Oil sands deposits occur around the world, but Alberta sits atop the largest known deposits. Alberta's oil sands are found in three main areas: Athabasca, Cold Lake, and Peace River, which combined cover more than 140 800 square kilometres (see map on next page). The deposits are buried at varying depths beneath the earth's surface and are covered by muskeg, sandstone, and shale, which together are known as overburden.

The Athabasca oil sands area is perhaps the best known of the three regions due to the large open pit mines and numerous in situ projects in the area.

How large are the reserves?

The total remaining established reserves for crude bitumen is 169.3 billion barrels (27 billion cubic metres). Only 4.3 per cent of the initial established crude bitumen reserves have been produced since commercial production started in 1967.

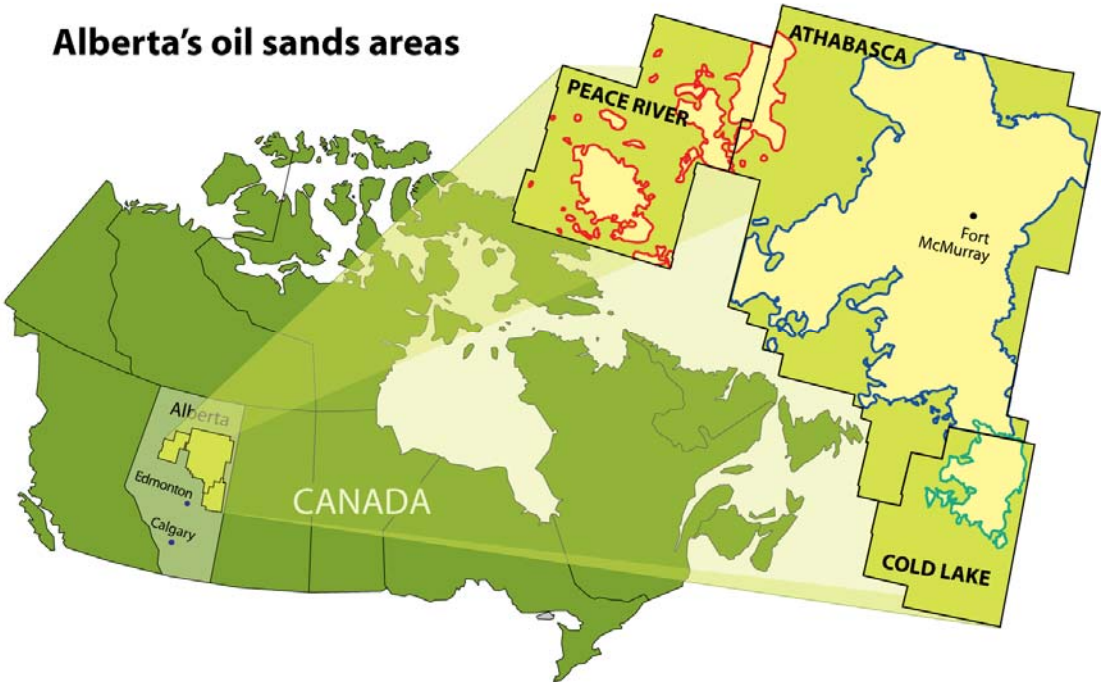
Of the total remaining established reserves, 34 billion barrels (5.4 billion cubic metres), or about 20 per cent, is considered recoverable by surface mining methods, while the remaining 80 per cent, or 135 billion barrels (21.5 billion cubic metres), is considered too deep to be mined and can only be recovered through in situ methods.

See *ST98-2011: Alberta's Energy Reserves 2010 and Supply/Demand Outlook 2011-2020* for more information on bitumen reserves and production.

How much bitumen is produced every year?

Alberta's bitumen production first outstripped conventional oil output in 2001. Production of bitumen continues to grow, accounting for more than 78 per cent of Alberta's total crude oil and raw bitumen output. Bitumen production in Alberta is about 1.6 million barrels (256 thousand cubic metres) per day, of which 55 per cent is from mining operations and the remainder is from in situ methods.

The ERCB expects Alberta's bitumen production to increase to 3.5 million barrels (549.6 thousand cubic metres) per day by 2020.



How many oil sands projects are there?

There are 7 oil sands mining projects and 26 commercial in situ projects approved, in addition to about 130 primary recovery projects and 12 experimental schemes.

For mining projects, almost two-thirds of the initial established reserves were under active development at the end of 2008. Currently, Suncor, Syncrude,

Albian Sands, and Canadian Natural Resources are the only operators producing from mines. Shell and Imperial Oil are the operators of mining projects considered to be under active development.

How is crude bitumen extracted from the oil sands?

Depending on the depth of the deposit, two different methods are used to recover bitumen. Around Fort McMurray, much of the crude bitumen occurs near the surface and is recovered by open pit mining, while reserves found at greater depths are produced in situ (meaning "in place").

In mining, the overburden is removed and oil sands ore is mined using large shovels and trucks. The bitumen is then processed to separate it from the sands, clays, and water before it is upgraded to synthetic crude oil.

In situ recovery takes place both by primary development—similar to conventional crude oil production—and by enhanced recovery, whereby steam or solvents are injected into the reservoir to reduce the viscosity of the bitumen, allowing it to flow to a wellbore, where it is then produced up to the surface. Currently, two technologies account for most in situ bitumen production: steam-assisted gravity drainage (SAGD), which sees steam injected into a horizontal wellbore to heat the bitumen and allow it to drain into a second wellbore below, where it is then produced to surface; and cyclic steam stimulation (CSS), where steam is injected into a wellbore to heat and thin the bitumen, allowing it to be produced to surface from the same wellbore.

Who regulates oil sands development?

The ERCB ensures that appropriate precautions are taken to develop oil sands resources in the interests of all Albertans through regulation, application review, conditions and approval management, surveillance, and enforcement. ERCB oil sands requirements, which industry must abide by, exist to maintain public safety during mining and extraction, in situ injection and production, and upgrading.

Operators at mining operations are required to submit annual mine plans and tailings management plans to the ERCB to allow for the evaluation of ongoing operations. The ERCB conducts this oversight to ensure that Alberta's resources are being developed in a safe and efficient manner for the benefit of all Albertans. In 2008, the ERCB issued *Directive 073: Requirements for Inspection and Compliance of Oil Sands Mining and Processing Plant Operations in the Oil Sands Mining Area*, marking a major update of its oil sands mining inspection process. This update doubled oil sands mining inspections from past years and introduced a more proactive approach, with clearer expectations for industry. ERCB inspections are detailed and thorough; each one can take up to one week to complete. As is the case with all ERCB inspections, enforcement action will occur if an oil sands operator is found to be in noncompliance with ERCB regulations.

The ERCB requires that operators for all commercial and experimental in situ oil sands schemes provide annual performance presentations, as specified in *Directive 054: Performance Presentations, Auditing, and Surveillance of In Situ Oil Sands Schemes*. These annual presentations, which complement ongoing site inspections of in situ operations, are available for viewing on the ERCB Web site www.ercb.ca.

In addition to the ERCB, other provincial and federal government bodies are involved in regulating various aspects of Alberta's oil sands.

The ERCB has a memorandum of understanding with Alberta Environment featuring a coordinated regulatory approval process for major oil sands development applications that require approvals under both the *Oil Sands Conservation Act* and the *Environmental Protection and Enhancement Act*. Although separate approvals are issued by the ERCB and Alberta Environment, application processing activities are integrated into a "one-window" approach to ensure efficiency of process, consistency of disposition, and enhanced protection of the public interest.

Alberta Sustainable Resource Development focuses on public land and provincial resources, such as fish and wildlife. Alberta Sustainable Resource Development is also engaged in cumulative effects and biodiversity planning projects for the oil sands areas and oil sands monitoring and compliance initiatives.

In addition, some applications for oil sands mining developments result in a joint federal and provincial review. Such reviews—covered under the Canada-Alberta Agreement on Environmental Assessment Cooperation—are triggered when an application to the ERCB also requires an environmental assessment by the Canadian Environmental Assessment Agency. As well, joint reviews can be triggered when Canadian government interests are in play, such as when projects are proposed on federal lands or are slated to receive federal funding.

How do companies apply for an oil sands project?

When a company is ready to proceed with an oil sands application, Alberta Environment requires that it draft a development proposal, known as a public disclosure document. The ERCB requires that the company consult stakeholders who could be directly and adversely affected by the proposed development early on to attempt to address any issues of concern.

A public notice of the application is issued, giving stakeholders the opportunity to file objections to the ERCB or statements of concern to Alberta Environment. For major projects, the applicant must then draft an environmental impact assessment, which is a joint process that can involve several provincial and federal government departments and is coordinated by Alberta Environment.

An ERCB hearing may be necessary if the application receives objections. For more information on the ERCB hearing process, see *EnerFAQs 2: Having Your Say at an ERCB Hearing*.

Who regulates bitumen upgraders?

The ERCB also regulates facilities that upgrade the bitumen into synthetic crude oil (SCO). Bitumen contains high levels of carbon in relation to hydrogen. Therefore, it requires upgrading to remove the carbon, add hydrogen, or change the molecular structure. The main product of upgrading is SCO, which can be refined later into a range of consumer products.

Currently, three facilities in the Fort McMurray area and one near Fort Saskatchewan upgrade crude bitumen. Additional upgrading capacity is scheduled to come on line at both these locations in the near and long term.

What are tailings?

Tailings is a term used to describe waste (composed of water, sands, silt, clay, and residual bitumen) from oil sands extraction processes. Fluid-fine tailings—fine solids that remain in a suspension for long periods of times before they settle—require long-term containment in what are known as tailings ponds. Alberta's inventory of tailings ponds is now 720 million cubic metres, which cover an area of about 130 square kilometres.

How are tailings ponds regulated?

As part of its responsibility to oversee oil sands mining and processing operations, the ERCB regulates the discard, including tailings.

The memorandum of understanding with Alberta Environment recognizes the ERCB as the lead regulator for approving the need, location, design, and performance of discard sites and also recognizes the role and need for ERCB input into the broader process for establishing reclamation criteria that are clear and meet the objectives of the Government of Alberta.

Directive 074: Tailings Performance Criteria and Requirements for Oil Sands Mining Schemes provides performance criteria for fine tailings consolidation operations and sets out requirements for consolidated tailings ponds and for reporting on performance against the criteria. The directive also requires that detailed tailings plans be filed as part of future annual mine plan submissions.

As with all other aspects of oil sands operations, the ERCB takes very seriously the management of tailings and is rigorous in its enforcement of tailings regulations. Tailings directive requirements are enforced in accordance with *Directive 019: ERCB Compliance Assurance—Enforcement.*

Additional Information

For further information on the ERCB or its processes or if you have general questions about oil and gas in Alberta, contact the ERCB's Customer Contact Centre, Monday to Friday (8:00 a.m. - 4:30 p.m.) at 1-855-297-8311 (toll free) or 403-297-8311

This EnerFAQs is one in a series:

No. 1: What Is the Energy Resources Conservation Board?
No. 2: Having Your Say at an ERCB Hearing
No. 3: Inspections and Enforcement of Energy Developments in Alberta
No. 4: All About Critical Sour Wells
No. 5: Explaining ERCB Setbacks
No. 6: Flaring and Incineration
No. 7: Proposed Oil and Gas Development: A Landowner's Guide
No. 8: Coalbed Methane
No. 9: The ERCB and You: Agreements, Commitments, and Conditions
No. 10: Public Health and Safety: Roles and Responsibilities of Agencies That Regulate Upstream Oil and Gas
No. 11: All About Appropriate Dispute Resolution (ADR)
No. 12: Oil Sands
No. 13: Emergency Response Preparedness in the Energy Industry
No. 14: Horizontal Multistage Hydraulic Fracturing
No. 15: Objecting to an Energy Resource Project

Every year the ERCB collects, compiles, and publishes a large amount of technical data and information about Alberta's energy development and resources for use by both industry and the general public. This includes raw data, statistics, information on regulations, policies, and decisions, and hearing materials.

Publications may either be viewed at the ERCB library or obtained from Information Services. Both are housed on the main floor of the ERCB head office in Calgary. Publications may also be downloaded free of charge from the ERCB Web site www.ercb.ca.

To obtain a print or CD copy of a specific publication, contact ERCB Information Services (telephone: 403-297-8190; fax: 403-297-7040; or e-mail: infoservices@ercb.ca).

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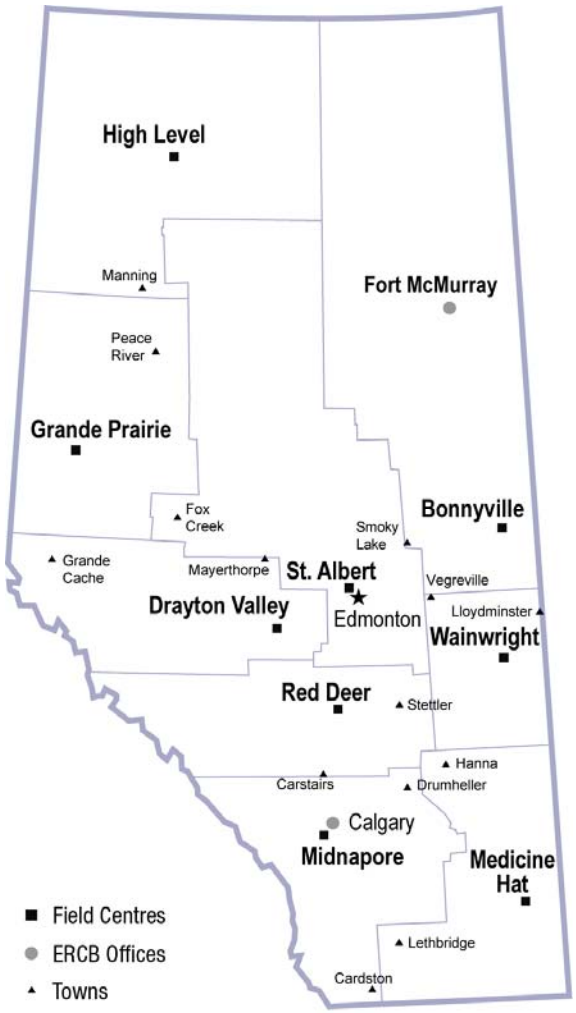

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