



Photo courtesy of Cenovus

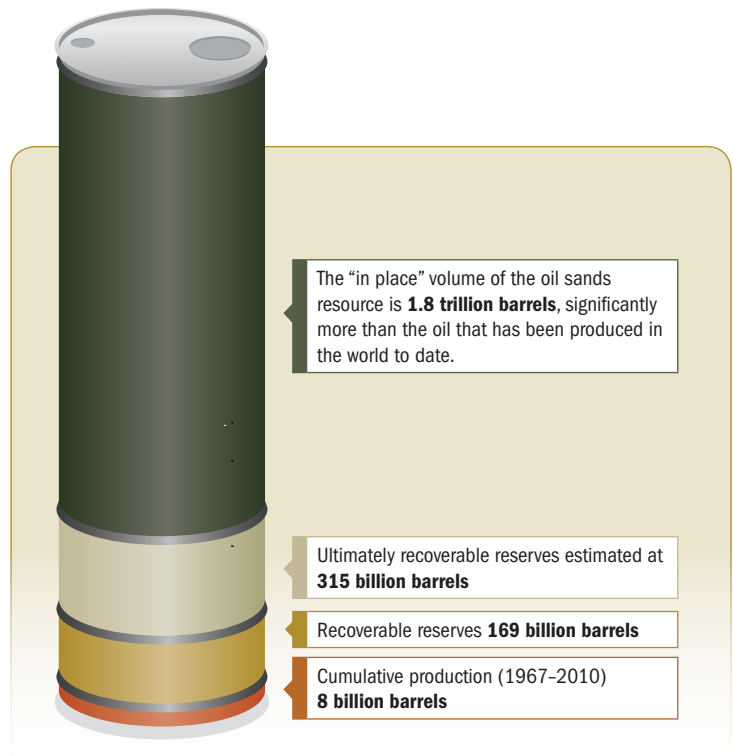
Oil Sands

A strategic resource for Canada, North America and the global market

The oil sands are a strategic resource that contributes to economic opportunity and energy security for Canada, North America and the global market. The oil sands comprise more than 98 percent of Canada’s 173 billion barrels of proven oil reserves. In 2011, production from the oil sands was 1.6 million barrels per day. While eight billion barrels of oil sands crude oil have been produced to date, this represents only a small portion of the overall resource. Continued demand for oil is expected to contribute to ongoing growth in oil sands production for years to come.

Oil plays a dominant role in meeting the world’s energy needs, and will for decades to come. Even with the investments that Canada and other countries are making in renewable energy, energy efficiency and other measures to support a low-carbon economy, the International Energy Agency’s World Energy Outlook for 2012 still expects world oil demand to grow by more than 0.5 percent per year until 2035, and the global economy to continue to rely more on oil than any other fuel.

As more easily accessible and lighter crude oils are depleted around the world, countries are turning increasingly to heavier and less accessible oil resources, which require more processing. As this shift in global production toward heavier crude continues, the carbon intensity of global oil supply will increase. Through strict regulatory regimes and new technological developments, Canada is committed to the responsible development of our resources, including reducing the carbon intensity of oil sands production and processing.



Sources: Alberta Energy Resources Conservation Board.

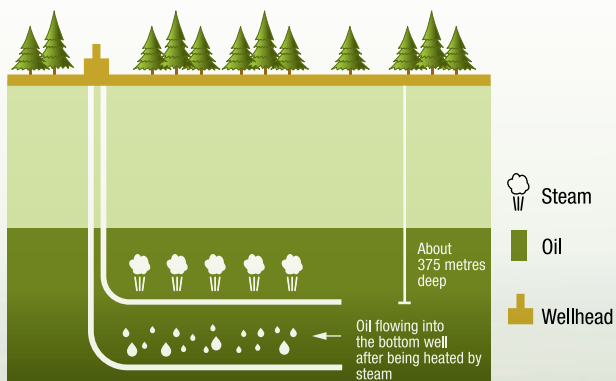
What are the oil sands?

The oil sands are the third largest proven or established deposit of crude oil in the world, underlying a land mass of 142 200 square kilometres (km²) (54 900 square miles [sq. mi.]). The oil sands are found in Western Canada, beneath sections of boreal forest, prairies and muskeg. The oil sands consist of crude oil suspended in an ore that is a mixture of sand, clay and water. In the oil sands region, there are some deposits where the oil's viscosity levels allow it to flow without the need for heating or dilution. However, most of the reserves consist of an extra-heavy crude oil known as bitumen. Bitumen can be extracted using two methods, depending on how deep the deposits are below the surface. About 20 percent of the oil sands resource is within 75 metres (250 ft.) of the surface and can be accessed through mining. The ore is dug up and mixed with warm water to separate and recover the bitumen from the sand. The remaining 80 percent of the oil sands resource is too deep to mine, and some form of drilling technology is required to extract the bitumen.

Generally, drilled, or "in-situ", oil sands production involves pumping steam underground to separate the bitumen from the sand and then recovering the bitumen through wells.

Raw bitumen, like other heavy oils, cannot be shipped because it is too thick for pipeline transportation. Bitumen is either diluted with lighter hydrocarbons to allow it to flow through pipelines or upgraded. Upgraders are similar to refineries and specialize in transforming bitumen into lighter crude oil.

In-situ production



Source: Cenovus, adapted by Natural Resources Canada, 2010.

Production and investment

Canada's oil sands are developed by the private sector, with major investments from companies based in Canada, the United States, Europe and Asia. As a result, the economic benefits of oil sands development reach across Canada and around the globe. According to the Government of Alberta, C\$116 billion were invested in the oil sands industry between 2000 and 2010. Since 1967, when commercial oil sands development began, production has grown as the technology to extract and process the resource has advanced and allowed commercial operations to become more cost-effective. Today, the oil sands generate economic benefits across the country and as of 2011, support 273 000 Canadian jobs.¹ Various projections forecast oil sands crude production will rise to between 3.2 to 3.7 million barrels per day by 2020. This growth is expected to occur despite declining production from more easily accessible and lighter crude oil sources.

Governance

The Government of Canada's policy toward the development of the oil sands and other natural resources has its basis in an open market where companies make business decisions within a regulatory framework designed to protect current and future Canadian interests. In Canada, the provinces of Alberta and Saskatchewan have jurisdiction over the development of oil sands within their provincial boundaries. The Government of Canada shares responsibility with the provinces for environmental protection. The Government of Canada is committed to ensuring that the economic and energy security benefits of the oil sands are balanced by sound environmental stewardship.

Oil sands development is subject to environmental standards that are among the most stringent in the world. Major oil sands projects require substantive environmental assessments before they are approved. Governments also require extensive environmental monitoring and reporting throughout the life of each project.

Addressing the environmental impacts

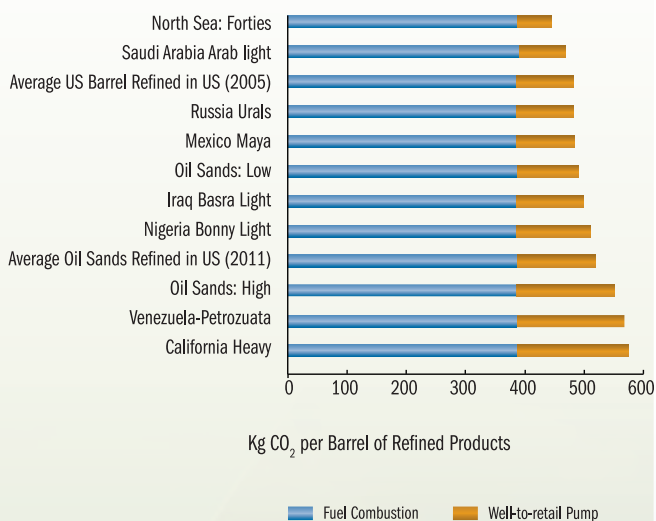
Similar to other existing and emerging energy sources, the development of the oil sands has impacts on the air, water and land.

¹ Source: Canadian Energy Research Institute (2012): *Pacific Access: Part 1 – Linking Oil Sands Supply to New and Existing Markets*.

Greenhouse gas (GHG) emissions: The Government of Canada has made a commitment to reduce Canada's GHG emissions by 17 percent from 2005 levels by 2020. Oil sands facilities currently account for about 6.9 percent of Canada's GHG emissions, approximately 0.1 percent of global emissions. The oil sands industry has made significant progress in reducing its emissions per barrel of oil produced. Between 1990 and 2010, GHG emissions per barrel were reduced by 26 percent. Oil sands facilities must continue to reduce their GHG emissions as part of Canada's commitment to emissions reductions.

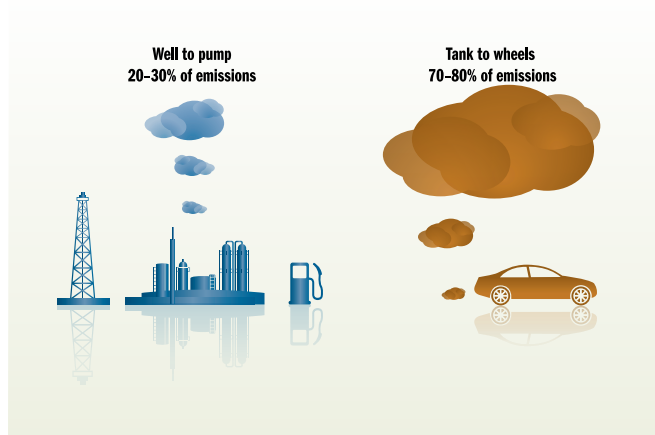
GHG emissions from oil production should be considered in their full effect, taking into account the emissions that are produced when the oil is consumed. Life-cycle assessment tracks GHG emissions from the extraction of crude through to production and use of the end product. All sources of oil have similar life-cycle GHG intensities due mainly to the fact that transportation fuel derived from any crude oil source has the same emissions at the end-use or combustion stage, which accounts for the vast majority of total life-cycle emissions.

Life-cycle GHG emissions for various sources of crude oil



Source: IHS CERA (2012) *Oil Sands, Greenhouse Gases, and US Oil Supply: Getting the*

Life-cycle emissions



Recent independent studies have shown that oil sands emissions are similar to a number of crudes, both heavy and light.

Water use and tailings ponds: Water use requirements in oil sands production vary depending on the technology used for extraction. For instance, oil sands mining operations use three to four barrels of water per barrel of bitumen, while oil sands in-situ operations require one barrel of water per barrel of bitumen. In-situ projects rely largely on groundwater for their water needs, with an ever increasing amount being saline or brackish water.

Mining operations take much of their water from the Athabasca River in Alberta. The federal and provincial governments manage this water use by setting a limit on the water that can be withdrawn from the river. A maximum of 3 percent of the Athabasca River's annual flow is allocated for use. Of this, only 2 percent is allocated to oil sands operations, and less than 1 percent is actually used. The Lower Athabasca River Water Management Framework ensures that during low flow conditions, withdrawals never exceed 10 percent of the natural river flow. To protect the quality of the river water, no production water is returned to the river. Instead, it is transferred to tailings ponds and then recycled into the production process. The Government of Alberta has established performance standards to reduce the accumulation of tailings that result from the oil sands mining process.

Boreal forest: Companies are required by law to remediate and reclaim 100 percent of the land after the oil sands have been extracted so the land is returned to a self-sustaining boreal forest ecosystem with local vegetation and wildlife. Canada's boreal forest stretches across the country and covers nearly 3.1 million km²

(1.2 million sq. mi.).² After more than 40 years of oil sands development, oil sands mining has impacted approximately 761 km² (294 sq. mi.) of land. While oil sands operations are projected to expand, the vast majority of this growth is anticipated to arise from in-situ operations. In-situ projects affect only one-seventh the area of a similar mining operation³ and no tailings ponds are produced.

Using technology to achieve sustainability

Innovation has been, and will continue to be, critical to reducing the environmental footprint of oil sands development. Industry and governments are making substantial investments to support a range of new technologies. For example, the federal and provincial governments are committed to exploring carbon capture and storage (CCS) to reduce GHG emissions in key sectors of the Canadian economy, including thermal electricity generation and oil sands. Canada is supporting CCS with substantial investments in large-scale demonstration projects. Working collaboratively, the Government of Canada, Alberta, Saskatchewan and British Columbia have committed more than C\$2 billion in funding to CCS. With leveraged private investments, the total Canadian investment for CCS has the potential to rise to around C\$6 billion and lead to six large-scale CCS demonstration projects in Canada.

New technologies are also being developed by government, industry and universities to reduce land impacts, water use and GHG emissions from oil sands development. Technologies that reduce steam requirements for in-situ oil sands are being developed and piloted to reduce water use and improve energy efficiency. These technologies either use alternatives to steam, such as solvents, to move the bitumen toward the wells or employ radically new techniques, such as heating the bitumen through electricity or in-place upgrading.

Oil sands mining research includes processes to separate the bitumen from the sand more efficiently, reduce energy and water requirements, as well as processes that will reduce the need for, and speed the reclamation of, large tailings ponds.

Advances in upgrader technologies include innovative combustion techniques, such as gasification, that could reduce the industry's reliance on natural gas while enabling the use of other transformative technologies, such as carbon capture and storage.

² The boreal forest, as described here, includes forest and other wooded land in Canada's boreal zone.

³ Source: The Pembina Institute (2010): *Mining vs. In-situ*.

The oil sands are a strategic resource for Canada, North America and the global market. The challenges associated with their development are being addressed through regulations, technological innovation and the political commitment to develop this resource in a responsible way.

Aussi disponible en français sous le titre :

Sables bitumineux : Une ressource stratégique pour le Canada, l'Amérique du Nord et le marché mondial

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