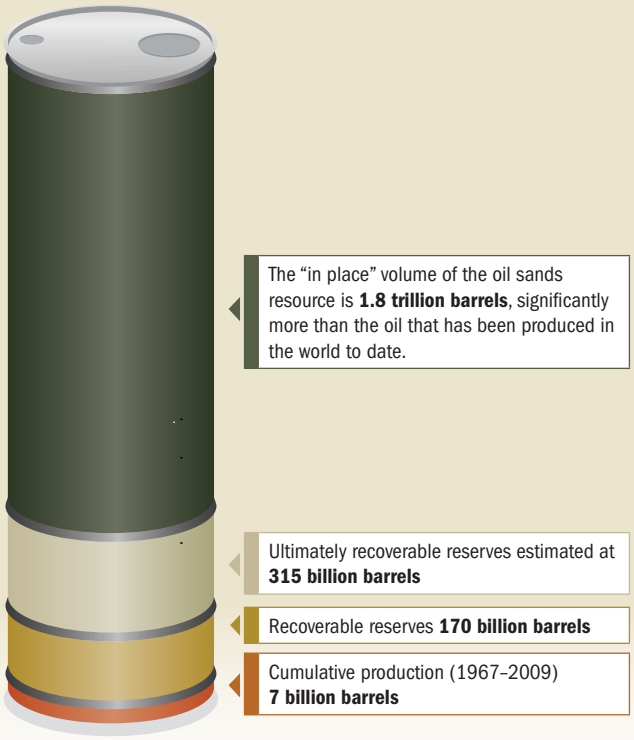
Oil Sands

A strategic resource for Canada, North America and the world

The oil sands are a strategic resource that is important for the energy security of Canada, North America and the world. The oil sands comprise more than 97 percent of Canada's 175 billion barrels of proven oil reserves. In 2009, production from the oil sands was 1.5 million barrels per day. While more than 7 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 this situation is expected to continue for decades. Even with the investments that world governments, including Canada, are making in renewable energy, in efficiency and in other measures to support a low-carbon energy future, the International Energy Agency's *World Energy Outlook* for 2009 still expects world oil demand to grow by 1 percent per year to 2030.

As the more easily accessible and lighter crude oils are depleted around the world, countries are turning increasingly to heavier and less accessible oil resources, which are more energy intensive to extract and process. Through strict regulatory regimes and new technological developments, Canada is committed to developing our heavy oil resources, including the oil sands, in a sustainable and responsible way.



Sources: *Oil & Gas Journal*, Alberta Energy Resources Conservation Board, Organisation for Economic Co-operation and Development.

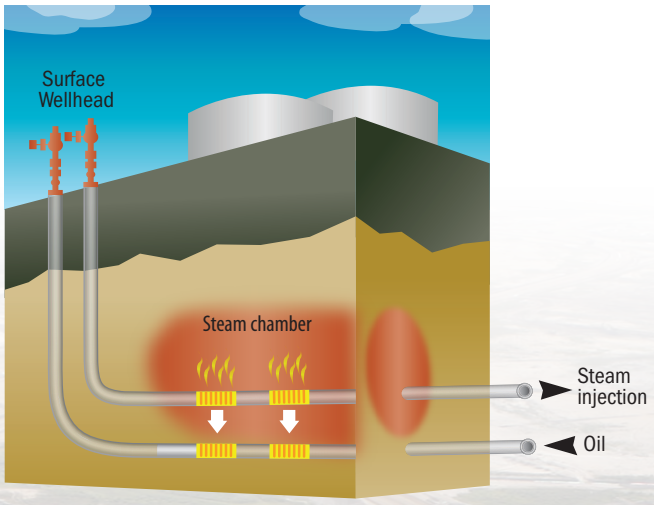
Canada

What are the oil sands?

The oil sands are the second largest proven or established deposit of crude oil in the world, underlying a land mass of 142 200 square kilometres (km²). The oil sands are found in Western Canada, beneath sections of boreal forest, prairies and wetlands. The crude oil is suspended in an ore that is a mixture of sand, clay and water, known as the oil sands. In the oil sands region, there are some deposits where the oil is mobile enough 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 deposit is below the surface. About 20 percent of the oil sands resource is within 75 metres of the surface and can be accessed only 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.

Steam Assisted Gravity Drainage (SAGD), the predominant technology for in-situ extraction

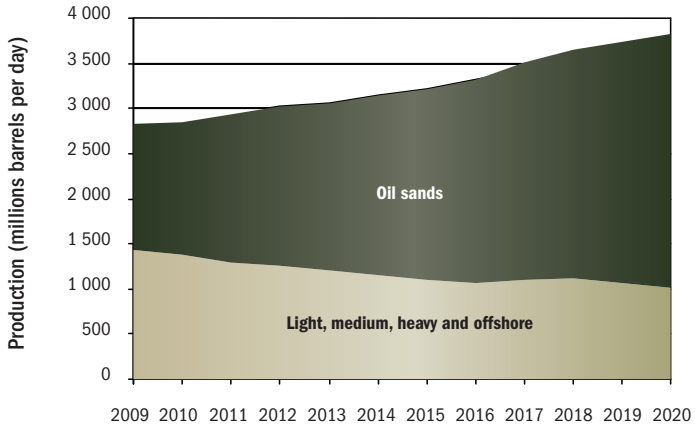


Source: Devon Energy, adapted by Natural Resources Canada.

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 Statistics Canada, in 2008 capital expenditures in the oil sands sector were C$20.7 billion. Since 1967, when commercial oil sands development began, production has grown as the technology to extract and process the resource has become more cost-effective. Canada's National Energy Board forecasts oil sands crude production to rise to 2.8 million barrels per day by 2020. This production would contribute to Canada's overall crude oil production, which is forecasted to rise to 3.8 million barrels per day by 2020. This growth is expected despite declining production from more easily accessible and lighter crude oil sources.

Canada's forecast oil production to 2020



Source: National Energy Board, 2009.

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 have jurisdiction over development of natural resources, including the oil sands. The Government of Canada has or shares specific regulatory responsibilities for issues of national interest, including environmental protection. The federal and provincial governments in

Canada recognize that the economic and energy security benefits of our energy resources, including the oil sands, must be balanced by sound environmental stewardship.

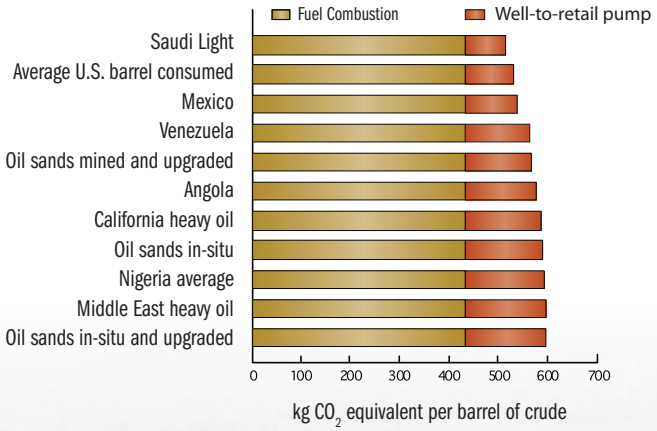
Oil sands development is subject to environmental standards that are among the most comprehensive in the world. Major oil sands projects require substantive environmental assessments before they are approved. Governments also require extensive environmental monitoring and reporting throughout the life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

Addressing the environmental impacts

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

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 5 percent of Canada's GHG emissions. The oil sands industry has made significant progress in reducing its emissions per barrel of oil produced. Between 1990 and 2008, GHG emissions per barrel were reduced by 39 percent. Oil sands facilities must continue to reduce their GHG emissions, as part of Canada's commitment to emissions reductions.

Life-cycle GHG emissions from various sources of crude oil



Source: IHS Cambridge Energy Research Associates (CERA), *Growth in the Canadian Oil Sands: Finding the New Balance*, 2009.

GHG emissions can be put in perspective by comparing oil sands crude on a life-cycle basis with other crude oils. 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.

Recent independent science-based studies have determined that life-cycle GHG emissions from oil sands crude are from about 5 to 15 percent higher than those from other crudes consumed in the United States. In some cases, oil sands crude has lower life-cycle emissions compared with other conventionally accessible crude oils.

Water use and tailings ponds: Oil sands production is water intensive and varies 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 withdrawal limits from the river. Three 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: Canada's boreal forest stretches across the country and covers 3.1 million km². After more than 40 years of oil sands development, oil sands mining has disturbed approximately 602 km² of land. While oil sands operations are projected to

continue to expand, the vast majority of this growth is anticipated to arise from in-situ operations. While in-situ operations have their own impacts, such as forest fragmentation and wildlife disturbances, less land is disturbed than with mining operations. Companies are required by law to remediate and reclaim land after the oil sands have been extracted so the area can sustain vegetation and wildlife such as that which existed before the disturbance. Currently, 67 km² are under active reclamation.

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 making combined investments of more than C$3 billion to advance carbon capture and storage technologies in Canada for both oil sands and power generation applications.

New technologies are 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 more efficiently separate the bitumen from the sand and to 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.

The oil sands are a strategic resource for Canada, North America and the world. 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 :
Les sables bitumineux : une ressource stratégique pour le Canada, l'Amérique du Nord et le monde entier

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