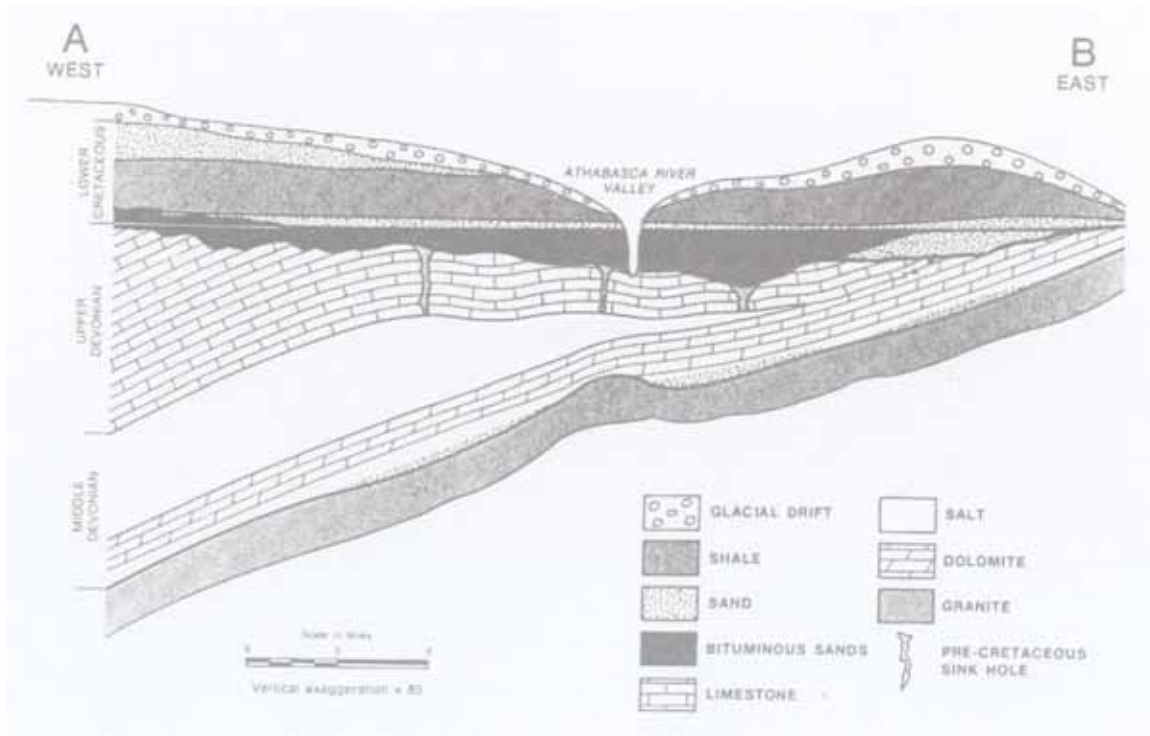


IN SITU TECHNOLOGY

Canada's long-term energy future depends to a large extent on the development of economical in-situ recovery processes to tap Alberta's vast oil sands reserves. A variety of in situ methods are used to recover bitumen, especially from deposits that are too deep to surface mine.



Graphic: pp. 183, Athabasca Oil Sands: Northern Resource Exploration 1875-1951

All in situ approaches face two major challenges. How can the viscosity of the bitumen be reduced so it will flow? And how can the bitumen be recovered? Different deposits may favour different production methods. Today, two major in situ techniques, Cyclic Steam Stimulation (CSS) and Steam Assisted Gravity Drainage (SAGD), are used commercially in Alberta's oil sands.

Production figures show the growing importance of in situ methods. Today total in situ production rivals production from mining oil sands, and in the near future most believe that in situ operations will produce more bitumen than mining.

IN SITU, Continued:

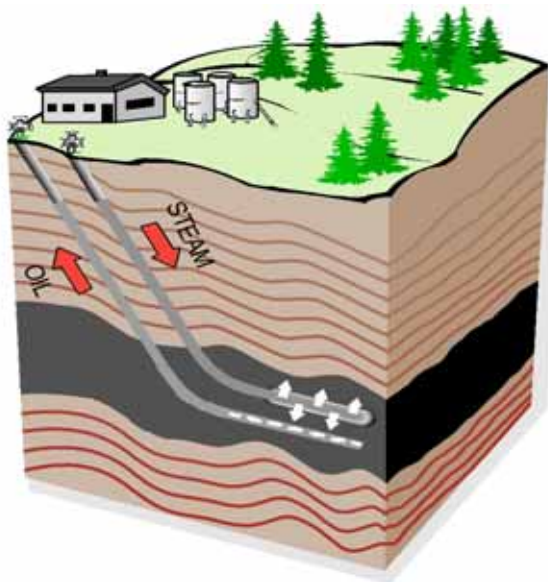
Cyclic Steam Stimulation (CSS)

CSS injects high-pressure, high temperature (about 350°C) steam into oil sand deposits. The pressure of the steam fractures the oil sand, while the heat of the steam melts the bitumen. As the steam soaks into the deposit, the heated bitumen flows to a producing well and is pumped to the surface. This process can be repeated several times in a formation, and it can take between 120 days and two years to complete a steam stimulation cycle.

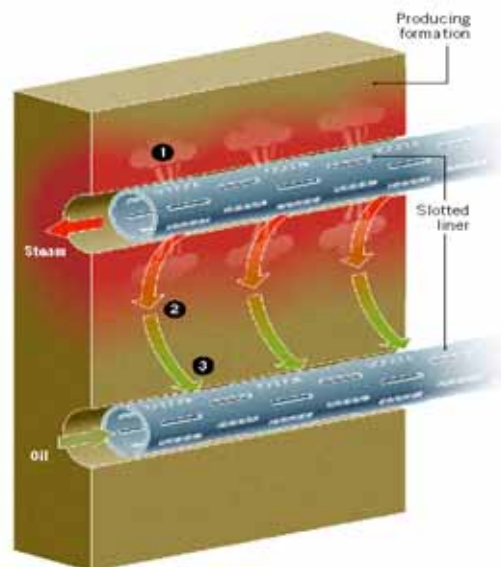
Steam Assisted Gravity Drainage (SAGD)

SAGD is the most popular enhanced oil recovery technology currently being adopted by Canadian heavy oil producers. An estimated one trillion barrels of oil in the Athabasca deposit are potentially recoverable with the present technology. Surface mining is only feasible for recovering up to 20% of the oil sands deposits, making SAGD the best known alternative for recovering the potential 80% of the remaining oil sands deposits.

SAGD technology requires the drilling of two parallel horizontal wells through the oil-bearing formation. Into the upper well, steam is injected creating a high-temperature steam chamber. The increased heat loosens the thick crude oil causing it to flow downward in the reservoir to the second horizontal well. This second well is located parallel to and below the steam injection well. This heated, thinner oil is then pumped to the surface via the second horizontal, or production well. Water is injected into the bitumen-drained area to maintain the stability of the deposit.



Courtesy of Petro-Canada



- ❶ Steam is injected into oil-producing reservoir.
- ❷ As the steam permeates the sand, the oil is heated and becomes less viscous.
- ❸ The oil flows more freely through the wellbore's slotted liner and is pumped to the surface.

Courtesy of the Petroleum Communication Foundation

IN SITU, Continued:

Toe to Heal Air Injection (THAI)

THAI technology offers many potential advantages over SAGD, including higher resource recovery of the original oil in place, lower production and capital costs, minimal usage of natural gas and fresh water, a partially upgraded crude oil product, reduced diluent requirements for transportation and significantly lower greenhouse gas emissions. The THAI process also has potential to operate in reservoirs that are lower in pressure, containing more shale, lower in quality, thinner and deeper than SAGD. This type of technology could be utilized in deep heavy oil resources both onshore and offshore.

Vapor Extraction Process (VAPEX)

The VAPEX process is a technology similar to SAGD but instead of steam, solvent is injected into the oil sands resulting in significant viscosity reduction. The injection of vaporized solvents such as ethane or propane help create a vapor-chamber through which the oil flows due to gravity drainage. The process can be applied in paired horizontal wells, single horizontal wells or a combination of vertical and horizontal wells. The key benefits are significantly lower energy costs, potential for *in situ* upgrading and application to thin reservoirs. The outstanding technical challenges are that it has yet to be field-tested and field injection and production strategies have yet to be developed.

Related Websites:

Suncor Firebag Project: www.suncor.com

Japan Canada Oil Sands Inc.: www.jacos.com

Petro-Canada Inc.: www.petro-canada.ca/oilsands

Encana Corporation: www.encana.com

Opti/Nexen Long Lake Project: www.longlake.ca

Source:

Ferguson, Barry Glen. Athabasca Oil Sands: Northern Resource Exploration 1875 – 1951. Canada: Gray's Publishing Ltd., 1978.
University of Alberta. An Introduction to Development in Alberta's Oilsand. Canada: Rob Engelhardt, Marius Todirescu, Feb. 2005
World energy Council. Cost Analysis of Advanced Technology for the Production of Heavy Oil and Bitumen in Western Canada, 2005. www.worldenergy.org