



Oil sands 101

Canada has the fourth-largest oil reserves in the world, and 97% of them are located in the oil sands¹. Pathways Alliance is a collaboration between six of Canada's largest oil sands companies, working together for Canada's energy future.

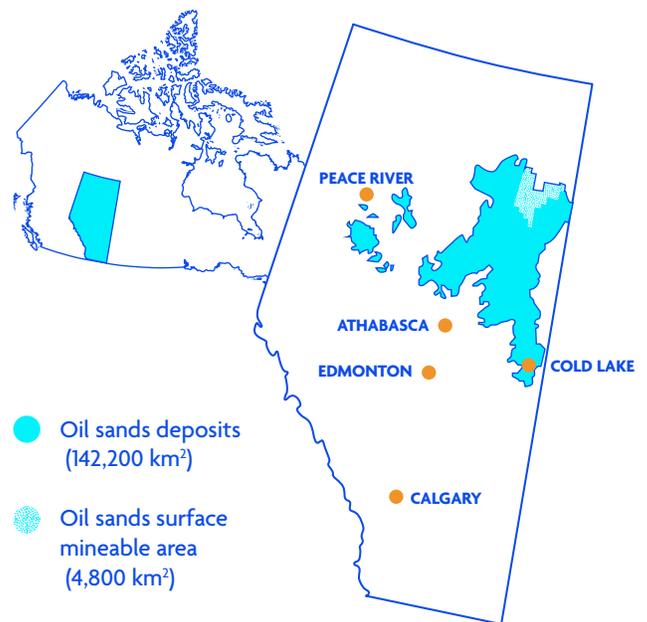


What are the oil sands?

Oil sands are a naturally occurring mixture of sand, water and bitumen (also called heavy oil). Oil sands can also refer to an area where oil sands exist, e.g., the Alberta oil sands.

Where are Canada's oil sands?

Canada's oil sands are found in three deposits in Alberta and Saskatchewan: the Athabasca, Peace River and Cold Lake deposits.



¹"Energy Fact Book 2024–2025." Natural Resources Canada, 2025, energy-information.canada.ca

How is oil recovered from the oil sands?

Traditional drilling techniques like pump jacks won't extract bitumen. One challenge is that bitumen is mixed in with sand and clay. Another challenge is that bitumen is almost solid at room temperature (about the same consistency as peanut butter) and doesn't flow.

There are two methods of recovering oil from oil sands.



In-situ

In-situ, otherwise known as in-place extraction, is where bitumen is extracted directly from the deposit itself.

Steam-assisted gravity drainage (SAGD) and cyclic steam stimulation (CSS) are two of the technologies used for in-situ (in-place) extraction. With both SAGD and CSS, steam is injected into the underground bitumen deposit, heating the bitumen so it becomes less thick and can be pumped to the surface for processing.



Mining

About 20% of oil sands reserves are close enough to the surface to be mined.² Mining operations use large shovels to scoop the oil sands into heavy haul trucks. Next, they're transported to a crusher to be broken down into smaller pieces. Hot water separates the bitumen from the sand and clay, and it's sent to a treatment plant for processing. The leftover materials (called tailings) are managed separately.



Did you know?

Once dismissed as too challenging to extract, the oil sands have become essential to Canadian energy production. Today, thanks to innovation and persistence, the oil sands are a secure source of energy for the world, making up 65.4% of Canada's total crude oil products.³

² "Oil Sands Discovery Centre: Facts About Alberta's Oil Sands and Its Industry." Government of Alberta, 2016. open.alberta.ca.

³ "Crude Oil Year in Review 2023." Statistics Canada, 7 March 2024. statcan.gc.ca.

Why do oil sands operations produce emissions?

In-situ emissions

During in-situ oil extraction, steam helps liquefy the bitumen so it can be pumped to the surface. This steam is created in large boilers powered by natural gas, which is the main source of greenhouse gas emissions from these operations.

Mining emissions

For mining operations, emissions come from equipment like diesel vehicles and shovels, and also from the mined surface itself as methane escapes when we dig into the formation. Boilers powered by natural gas are used to heat water for the extraction process—this is the main source of emissions from mining. Once mining has been completed, some emissions also come from tailings ponds. Tailings are materials that remain after bitumen is extracted, which include trace amounts of bitumen. As this bitumen breaks down over time in tailings ponds, methane and carbon dioxide evaporate.



Canada's Oil Sands Innovation Alliance

Canada's Oil Sands Innovation Alliance (COSIA) has worked together since 2012 and is the innovation arm of Pathways Alliance. Its members are focused on collaborative action and innovation in oil sands environmental technology. To do this, COSIA brings together thought leaders from industry, government and academia.

Did you know?

COSIA focuses on four key Environmental Priority Areas, or EPAs: tailings, water, land and greenhouse gases.





The role of innovation

Canada has been a trailblazer since the inception of the modern petroleum industry.

A history of innovation

Since the late 1800s, Canadian energy companies have adopted and developed new technologies and processes to extract oil and gas and adapt to rapidly changing global environments. The industry now routinely develops oil and gas from deposits that were previously considered impossible to produce. That includes the oil sands, which began commercial production in 1967.⁴

Research, development and collaboration

As a result of investments by Pathways member companies in new technologies, innovations and operational improvements, CO₂e per barrel of oil produced has dropped by about 22% in the Canadian oil sands since 2011, according to analysis by the Government of Alberta.

⁴ "Canada Oil and Gas Industry Overview." CAPP, 2024.



DID YOU KNOW?

An environmental impact assessment is a rigorous process that typically takes years to complete.

How is the oil sands industry regulated?

Before beginning a project, oil sands companies are required to conduct consultation with Indigenous communities, landowners, municipalities and other groups who may be affected by their operations. After consultation, companies must outline evidence of their efforts to address stakeholder concerns.

Next, an environmental impact assessment is conducted to help mitigate negative impacts and determine a plan for reclamation once operations have finished. After the environmental assessment, a project application is submitted to the regulator for approval.



How does the oil sands industry consult and engage with Indigenous groups?

We can't stress strongly enough how vital it is to have a strong and constructive relationship with Indigenous groups and communities where we operate. We recognize the need to continue meaningful engagement with Indigenous peoples on our environmental performance. Care for the communities where we operate is a core value for Pathways Alliance members and we will continue to seek input from Indigenous groups, who have a strong historical connection to the land, air and water.



Indigenous economic inclusion

Canada's oil sands industry has a long history of collaborating with Indigenous groups to enable them to acquire equity and share in the benefits of resource development. Indigenous-owned businesses have become an integral part of the oil sands industry over the past four decades.

Community relations

Pathways Alliance works to support communities in northeast Alberta near oil sands operations. Through open dialogue, collaboration and meaningful engagement, we support initiatives that enhance social well-being and workforce development. Our approach prioritizes mutual respect, shared values and long-term partnerships that contribute to resilient, thriving communities, whether through local investment, volunteer programs or strategic partnerships. Pathways Alliance focuses our social investment efforts in the following priority areas:

- Advancing Indigenous Reconciliation specific to cultural preservation
- Innovation
- Healthy communities
- Workforce development



Why do we need the oil sands?

Global energy demands are rising, and there's a vital need to ensure greater security and stability for the world's energy supply.



The world needs secure energy

With the fourth largest oil reserves in the world, Canada has an important role to play in the global energy future. Forecasts vary, but what's certain is that global energy demand hasn't peaked yet—and oil will continue to be a major part of the energy mix.

- The global middle class is currently growing at a pace of 100 million people per year.⁵
- Today, worldwide oil consumption is just over 100 million barrels per day.⁶

Canada's global role

Between 2001 and 2023, Canadian production rose by 2.8 million barrels per day.⁷ Nearly all this growth came from the oil sands. By 2022, Canada's oil sands yielded 3.1 million barrels per day.⁸ Today, the oil sands remain an immense economic driver for Canada and Alberta, and a secure source of energy for the world.

An economic driver

The oil sands industry is a key economic driver for Alberta and Canada, contributing billions to the economy annually while helping to provide a secure source of energy here and to the world. Our province and country have long benefited from a strong energy sector that generates thousands of jobs and helps fund essential services, including education and roads. With rising costs, incomes not keeping up and economic uncertainty, Canadian families are struggling. It's important to keep all sectors of our economy going strong—including our oil sands sector.

Did you know?

- 446,000+ Canadians are directly or indirectly employed by the oil and gas industry, including strong Indigenous representation (6%) in the oil and gas workforce.⁹
- From 2017–2023 the oil and gas sector contributed \$123 billion to federal and provincial governments.¹⁰

Learn more at

[PathwaysAlliance.ca](https://www.pathwaysalliance.ca) or reach us at contact@pathwaysalliance.ca.

5. [Agnolucci, Paolo & Makarenko, Nikita. "Growing oil supplies amid moderating demand and geopolitical uncertainty: What lies ahead for oil?" World Bank Blogs, Nov. 5, 2024.](#)

6. ["Oil Analysis and Forecast to 2030." International Energy Agency, 2024.](#)

7. ["The North American Advantage: Secure Oil and Gas Production." S&P Global, 2023.](#)

8. ["Absolute Greenhouse Gas Emissions from Canadian Oil Sands Did Not Increase in 2022 Even as Production Grew." S&P Global, Aug. 9, 2023.](#)

9. ["Energy Fact Book 2024–2025." Natural Resources Canada, 2024.](#)

10. ["Oil and gas extraction revenues, expenses and balance sheet." Statistics Canada, Sept. 25, 2024.](#)