

*Oil Sands:  
What does the future hold?*



# Introduction

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*Oil sands are deposits of clay, sand, water and bitumen – i.e. oil in a solid or semi-solid state. Bitumen requires unconventional extraction methods to get it to the surface, and ‘upgrading’ to convert it into synthetic crude oil. Most of the world’s oil sand resources (about 80%) are located in Alberta, Canada<sup>1</sup>.*

*The oil sands industry receives much international criticism because of its heavy social and environmental impact, which can in turn generate complex legal, regulatory and social risks to shareholder value.*

*The future of the oil sands industry remains uncertain. While the low price of oil has pushed some energy companies out of Canadian oil sands, and controversies surrounding the resource have also affected banks, fossil fuels and oil sands in particular remain an important source of revenue and energy for Canada.*

*This paper examines the social and environmental impact of oil sands production, providing insights from Vigeo Eiris’ research and analysing different perspectives on future industry developments.*

*23 out of 161 oil & gas companies included in Vigeo Eiris’ research universe were identified as having involvement in oil sands operations. An observation that might seem paradoxical is that companies in Alberta demonstrate particularly well formalised commitments backed by a wide range of KPIs. This behaviour is explained by a close public scrutiny and Alberta’s strong regulatory system and compliance requirements.*

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<sup>1</sup> “Oil Sands” - Geology.com website - accessed 14/06/2017

“BP and Shell: Rising Risks in Tar Sands Investments, Platform and Greenpeace” - 2008

## How oil sands are used to produce petroleum products

### Extraction

The bitumen found in oil sands can rarely be pumped straight from the ground in its natural state to use as conventional oil. There are two main ways of extracting bitumen:

1. Surface mining is done to extract bitumen that lies close to the surface. The area is stripped of layers of vegetation and earth, and large open-pit mines are created from which the bitumen is removed with large shovels and trucks. At the processing plant, the oil sand is crushed and treated with hot water and chemicals to release the bitumen.
2. More than 80% of oil sand reserves are located beneath the surface and require an in-situ method of extraction. Steam-assisted gravity drainage (SAGD) is the most common method of in-situ extraction: steam is injected into a horizontal well, sending heat to reduce the bitumen's viscosity. The bitumen is then forced to the surface to be cleaned<sup>1</sup>.

### Upgrading

Too heavy to be sent directly to a conventional refinery, the bitumen extracted from oil sands is upgraded by fractionation and chemical treatment into synthetic crude oil. It can then be refined into petroleum products.

### Refining

Refineries convert raw crude oil into final products such as fuels (e.g. gasoline, kerosene and diesel) and other consumer products such as oil lubricants and asphalt. Refineries have to be modified to handle heavier crude streams and become 'high-conversion refineries'.

1 "What are Oil Sands", "Oil Sands Development" - Canadian Association of Petroleum Producers' website - accessed 14/06/2017

## Environmental, social and economic concerns raised by oil sands production

Oil sands have been a recent source of public debate and even political conflict. Whilst oil sands production has driven rapid economic growth in certain regions including Alberta, there is increasing concern that this growth is also causing unprecedented ecological harm. The United Nations Environment Programme identified Alberta's oil sand mines as one of 100 key global 'hotspots' of environmental degradation. In Canada, major environmental NGOs and local First Nations representatives have started to call for a moratorium on new oil sands projects until the associated environmental destruction can be mitigated. At the same time, prominent political observers have publicly argued that oil sands development is proceeding at a rate that is not economically and socially beneficial for Alberta.

Here is an overview of the major environmental, social and economic problems that are part of the debate over the future of the oil sands industry.

### Greenhouse gas (GHG) emissions

The nature of oil sands make them very energy-intensive to produce – energy is needed to transport the earth, break it down into smaller pieces and heat the water used in the separation process. Deeper sources of oil that are extracted in-situ require even more energy: to produce steam and inject it underground, so that the oil can be heated to the point it can be pumped to the surface<sup>2</sup>. Upgrading is also an extremely energy-intensive process: it takes about 500 cubic feet of natural gas to upgrade a barrel of oil sands bitumen to the stage where it can be refined<sup>3</sup>.

Consequently, oil sands take far more energy to extract and refine than conventional oil: numerous studies have shown that its production is 3-5 times more greenhouse gas intensive. Oil sands represent Canada's fastest growing source of

2 "Why Water Is a Problem for the Oil Sands" - "Alberta Venture" Magazine - accessed 14/06/2017

"Analysis shows increased carbon intensity from Canadian oil sands" - the U.S. Department of Energy - 26/06/2015

3 "BP and Shell: Rising Risks in Tar Sands Investments, Platform and Greenpeace" – 2008

greenhouse gases, with production accounting for 14% of Canada's total GHG emissions in 2014, up from 8% in 2011<sup>1</sup>. Moreover, 80% of oil sands' climate impact comes from the release of carbon whenever the fuel is burned. As the released emissions contribute to global climate change incrementally, further expansion of oil sands will jeopardise emission reduction targets set by the 2016 Paris Climate Agreement to limit global warming to below 2 degrees Celsius<sup>2</sup>.

### Land disturbance and mine tailings

The most visually recognisable environmental impact of oil sands production is the substantial land disturbance associated with surface mining, which is difficult to reclaim. The recovery process takes decades, and less than 1% of land disturbed by mining is 'certified reclaimed'<sup>3</sup> to date.

Oil sands mining operations also produce large volumes of waste in the form of mine tailings. Leakage from oil sand tailings ponds, which covered 176 square kilometres in 2014, have been one of the biggest public relations problems for the sector since they are viewed as a potential threat to groundwater. The water in these ponds is acutely toxic to any aquatic or wildlife that come into contact with it. Federal research published in 2014 revealed that toxic chemicals from Alberta's oil sand tailing ponds were leaching into groundwater and seeping into the Athabasca River. Previous studies have estimated seepage at 6.5 million litres a day from a single pond. Tailing ponds take decades to solidify and are especially difficult to reclaim. The first tailing pond in the oil sands industry which started in 1967 has only recently been reclaimed to a solid state. The public is increasingly sceptical of producers' ability to manage mine tailings over the long term<sup>4</sup>.

### Water use

A large amount of water is required to process oil sands. A study found that 2.8 litres of water was required to obtain a litre of bitumen using in-situ drilling, while surface mining required 28.5 litres

of water per litre of bitumen. For comparison, 0.2 to 5.8 litres of water is required to produce a litre of conventional oil. The threat to water resources seems even more likely as production shifts towards in-situ methods that use brackish and saline groundwater that is treated before being turned into steam. Groundwater levels could easily become stretched as pumping levels increase, and adjacent freshwater aquifers could also face important ecological and social impacts. Developing oil sands extraction projects in countries with drier climates or in regions of water scarcity will exert increasing pressure on local water resources and could potentially result in competition with other users, such as those involved in crop production or the maintenance of aquatic ecosystems<sup>5</sup>.

### Air pollution

Upgrading bitumen contributes significantly to air pollution, with SO<sub>x</sub> (Sulphur Oxide) emissions making up 8.7 % of Canada's total. Also of concern is the issue of soil and lake acidification from the presence of NO<sub>x</sub> (Nitrogen Oxide) and SO<sub>2</sub> (Sulphur Dioxide). The soils of northern Alberta and the nearby lakes of the contiguous province of Saskatchewan are highly sensitive to acid deposits and have little buffering capability<sup>6</sup>.

According to a study published in the Nature Journal in 2016, Canada's oil sands operations are one of the biggest producers of secondary organic aerosols<sup>7</sup> in North America. The researchers found that oil sands production emitted between 55 and 101 metric tonnes of secondary organic aerosols per day. Aerosols from urban and industrial pollution are of concern to scientists because they can affect regional climate patterns, and have also contributed to Arctic warming. Scientists are still trying to understand the health effects these particles can trigger when inhaled; previous studies have linked them to lung cancer, cardiovascular disease and diabetes<sup>8</sup>.

1 "Environmental consequences of oil production from oil sands" - Research article – 02/02/2017  
 2 "Climate on the Line: Why new tar sands pipelines are incompatible with the Paris goals" - Oil Change International - January 2017  
 3 "The Future of the Canadian Oil Sands" -The Oxford Institute for Energy studies - February 2016  
 4 "Profiling Oil Sands Mixtures from Industrial Developments and Natural Groundwaters for Source Identification" - Environmental Science and Technology Journal - 21/01/2014

5 "Environmental consequences of oil production from oil sands" - Research article - 02/02/2017  
 6 "The Future of the Canadian Oil Sands" - The Oxford Institute for Energy studies - February 2016  
 7 Secondary organic aerosols - a component of atmospheric particulate matter formed by oxidation of low-volatility organic vapours (from mined oil sands material in this case)  
 8 "Oil sands operations as a large source of secondary organic aerosols" - Research article published on Nature - 25/05/2016

### *Impact on indigenous peoples*

Indigenous communities living around oil sands development sites have been warning for years that industrial production has been polluting their land and ecosystems, threatening their health and way of life. Indigenous residents living and fishing downstream from the mines are concerned about water quality and the level of toxins present in both the water and the fish. Fishermen allegedly catch an increasing number of fish with deformities such as blisters, crooked tails, abnormal faces and eyes. It is also alleged that cancer rates are up. For example, five incidents of bile-duct cancer have been recorded among the 1,000 residents of Fort Chipewyan community; the illness is so rare it usually affects no more than 1 in 100,000 people<sup>1</sup>. According to the Natural Resources Defence Council, biliary cancers have been linked to petroleum and to polycyclic aromatic hydrocarbons (PAHs) (chemicals in tar and soot)<sup>2</sup>.

Another alarming trend has been the decline of caribou<sup>3</sup> populations in the oil sands region of Alberta, as a result of deteriorations to their habitat from mining and in-situ infrastructure and exploration. This decline is significant for many aboriginal groups for whom caribou is an important part of the traditional diet. A lawsuit was filed in March 2017 by the Canadian Parks and Wilderness Society (CPAWS) against the federal environment minister, asserting that the Government of Canada is not following its own rules about protecting caribou<sup>4</sup>. Furthermore, fearing that further oil sands development would damage the environment, Canadian First Nations and U.S. tribal communities signed a treaty at the end of 2016 to fight the development and distribution of oil sands products from Alberta<sup>4</sup>.

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1 "Alberta tar sands pollution suspected in rare cancer cases" - PRI - 19/02/2015

2 "Canadian Aboriginal Concerns with Oil Sands" - The Pembina Institute - September 2010

3 The federal government's Committee on the Status of Endangered Wildlife in Canada lists Alberta's mountain caribou as endangered, or at imminent risk of extinction, and its boreal caribou as threatened. The east side of the Athabasca River herd of caribou, for example, has declined 71% since 1996 - "Canadian Aboriginal Concerns with Oil Sands" - The Pembina Institute - September 2010

4 "CPAWS files lawsuit against Government of Canada for allegedly not following caribou protection rules" - JWN News - 20/04/2017

## Dim prospects for growth

Oil sands investments have generally resulted in substantial losses over the past ten years. Disappointed with the performance of the oil and gas industry in Canada, investors have been fleeing oil sands stocks since 2011. BlackRock Asset Management decided to close the oil sands exchange-traded fund (ETF) in August 2015. Royal Dutch Shell, ConocoPhillips, Marathon Oil and Statoil have sold off oil sands properties to Canadian buyers<sup>1,2</sup>.

As one of the most expensive and least efficient oil production methods, oil sands face other obstacles to capital growth such as the low-cost oil market. Lower crude oil prices in recent years have undermined the economic viability of oil sands production, with the average price of oil being well below the break-even point for producers. Based on the Canadian Energy Research Institute annual estimates, break-even costs for oil sands producers stood at USD 60.5/barrel for SAGD crude including processing and transportation. The equivalent for mined crude was USD 75.73/barrel. These do not compare favourably with 2017's average WTI price of USD 49.61/barrel<sup>3,4</sup>. Also, according to the Canadian Association of Petroleum Producers, the long-term forecast for oil sands output in 2030 has fallen to 3.7 million barrels per day (bpd) down from 5.2 million bpd<sup>5</sup>.

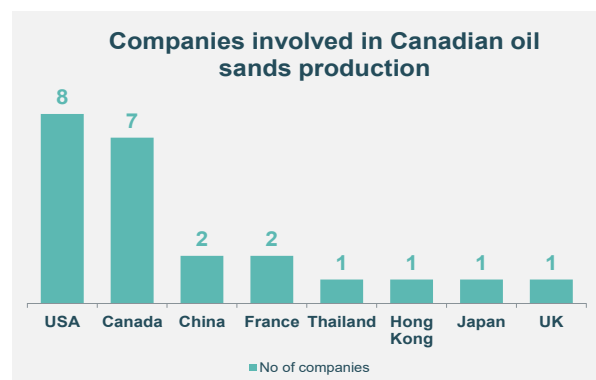
It is also worth noting the concept of 'stranded assets', describing assets that have become obsolete or non-performing ahead of their useful life, and must be recorded on a company's balance sheet as a loss of profit. Canada's oil sand reserves are alleged to be in the process of becoming stranded assets. The independent financial think

tank Carbon Tracker estimate that up to USD 220 bn worth of Canada's oil sands reserves are at risk of becoming unrecoverable.

Furthermore, the increasing availability of competing energy sources such as oil shale, gas and renewable energy are deterring investors' interest in oil sands. In fact, Grafton Asset Management Inc., a firm that originally brought foreign investment into Canada's oil and gas industry, is looking to add alternative energy to its portfolio for the first time as it readies itself for the decline of fossil fuels. Bidding on new renewable energy projects in Alberta, Shell has started working on a project to turn vegetable products into diesel fuel in Alberta. It is also working with auto-manufacturers on plans for a hydrogen fuel-cell network<sup>6</sup>. According to a 2014 report by Clean Energy Canada, renewable energy growth in Canada produced more jobs than the oil sands industry<sup>7</sup>.

Proportion of turnover from oil sands extraction (thresholds)	Companies	Country	Number
0-10%	Chevron Corporation	USA	15
	ConocoPhillips	USA	
	Exxon Mobil	USA	
	Gulfport Energy	USA	
	Occidental Petroleum	USA	
	Murphy Oil	USA	
	Total	France	
	Maurel et Prom	France	
	PetroChina	China	
	China Petroleum & Chemical	China	
	CK Hutchison Holdings	Hong Kong	
	Japan Petroleum Exploration	Japan	
	Baytex Energy	Canada	
	PTT	Thailand	
BP	UK		
10-20%	Canadian Natural Resources	Canada	2
	Devon Energy	USA	
20-33%	Cenovus Energy	Canada	2
	Marathon Oil	USA	
33-50%	Husky Energy	Canada	3
	Imperial Oil	Canada	
	Suncor Energy	Canada	
>= 50%	MEG Energy	Canada	1

- 1 "The Future of the Canadian Oil Sands" - The Oxford Institute for Energy studies - February 2016  
"Canadian operators buy oil sands assets as foreign groups retreat" - Financial Times - 02/04/2017  
"Exxon Relents, Wipes Oil Sands Reserves From Its Books" - InsideClimateNews - 23/02/2017
- 2 "Exodus From Canada's Oil Sands Continues as Energy Giants Shed Assets" - InsideClimateNews - April 2017
- 3 "Lower-for-Longer Crude Prices Threaten Oil Sands Investment" - Morningstar Commodities Research - 15/03/2017
- 4 <https://www.statista.com/statistics/266659/west-texas-intermediate-oil-prices/>
- 5 "Once Unstoppable, Tar Sands Now Battered from All Sides" - Yale School of Forestry and Environmental studies - 1/02/2016



- 6 "As Sun Sets on Canada Energy, Grafton Eyes Renewables" - Bloomberg - 5/01/2017
- 7 "Tracking the energy revolution" - report published by Clean Energy Canada - December 2014

## How does Vigeo Eiris assess the impact of oil sands companies?

The environmental impact of oil sands companies are assessed by Vigeo Eiris in the sustainability criteria 'Pollution prevention and Control', 'Protection of biodiversity', 'Protection of water resources', 'Energy use and GHG emissions', 'Management of non-greenhouse gas emissions', and 'Waste management'.

Vigeo Eiris' *Controversial Activities Screening* also collects data on oil and gas companies' involvement in oil sands extraction and production, and the level of their involvement depending on the proportion of revenue they derive from this activity. As of 07/09/2017, 23 companies were identified as having involvement in oil sands, the majority of which are Northern American.

Vigeo Eiris analysed how companies with over 10% involvement in oil sands address the environmental issues they face. These include American *Marathon Oil* and *Devon Energy* and Canadian *Cenovus Energy*, *Husky Energy*, *Imperial Oil*, *Suncor Energy*, *MEG Energy*, and *Canadian Natural Resources*.

*MEG Energy*, the company with greatest involvement in oil sands production, displays the worst performance of all companies under review with the lowest score of 18 in the Environment domain. The company did not report on measures to reduce waste, NOx and SO2 emissions, energy consumption and related GHG emissions. There was also no reporting on the prevention and control of industrial accidents and pollution.

All other companies display weak to limited performance in the Environment domain, with the majority (6 out of 8) demonstrating increased GHG emissions. It is worth noting that 5 of the 8 companies with oil sands involvement display higher scores in the Environment domain compared to all other North American oil and gas companies under review. This can be linked to stricter regulatory requirements and greater pressure for improved environmental performance. Three notable examples include *Suncor Energy*, *Cenovus Energy* and *Canadian Natural Resources*.

*Suncor Energy* is the top performer in the area of environmental strategy (with a score of 67/100), protection of water resources (51/100) and management of non-GHG emissions (66/100). The company set quantitative targets with clear timeframes and baselines to improve energy efficiency, to reduce fresh water consumption, and to increase the reclamation of disturbed land. The company achieved reductions in water consumption, wastewater Chemical Oxygen Demand and emissions of NOx, SO2 and VOCs.

*Cenovus Energy* is the top performing company in the area of biodiversity protection, displaying robust performance (54/100). It has implemented protection strategies for endangered species and land rehabilitation programmes. The company has also used innovative measures to manage its water consumption compared to its peers. Over 84% of water used in steam production at the Foster Creek and Christina Lake oil sands projects came from recycled water. The company's Wedge Well™ technology helps increase the total recovery of oil, whilst lowering net environmental impact. It allows more bitumen to be accessed using less steam, and therefore requires less water and gas to create the steam.

*Canadian Natural Resources* achieved positive results in the majority of key environmental areas. It managed to decrease spill volumes and oil content in discharged water. The company's water consumption, SO2 emissions, GHG emissions (including from flaring and venting) and production of hazardous and non-hazardous waste decreased as well.

It is interesting to observe that the four companies with highest biodiversity protection scores are all Canadian companies with involvement in oil sands. As suggested above, this can be linked to Alberta's rigorous regulatory system and strong compliance requirements. Comparing the regulatory levels in Alberta with those in the US Gulf Coast, Mexico, Russia and Africa, as well as the National Oil Companies of Southeast Asia, South America, China and the Middle East, reveals that Alberta is a global leader in driving environmental responsibility and compliance<sup>1</sup>.

<sup>1</sup> "An International Comparison of Leading Oil and Gas Producing Regions" – WorleyParsons & Canadian Association of Petroleum Producers – 2014

Banks are increasingly becoming the focus of protests and campaigns for their role in financing fossil fuel projects. Based on *Vigeo Eiris' Controversy Database*, 28 banks were identified as financing oil sands between 2014 and 2016 (4 Chinese, 15 European and 9 American banks). Whilst the majority of financial institutions under review are not responsive on this issue, some banks have already taken important steps towards tackling climate change by announcing their commitment to stop funding oil sands projects at the One Planet Summit held in Paris in December 2017.

*Credit Agricole* committed to excluding all oil sands projects as these are incompatible with the goal of combatting climate change, and represent an economic risk for investors.

*Société Générale* announced that it would no longer finance the production of oil from oil sands anywhere in the world.

*Groupe BPCE/Natixis* pledged to no longer finance anywhere in the world:

- ▶ exploration and production projects concerning oil extracted from oil sands;
- ▶ infrastructure projects (pipelines, terminals etc) primarily devoted to transporting or exporting oil extracted from oil sands;
- ▶ companies whose revenues primarily rely on the exploration, production, transport, storage or export of oil extracted from oil sands.

*AXA* announced the divestment of over EUR 700 m from the main oil sands producers and associated pipelines, and the discontinuation of further investments in these businesses.



## Conclusion

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*As observed, the risks for oil sand investors are numerous. Under the Paris Climate Agreement, there is even greater pressure on Canada to limit its carbon emissions. Though producers have spent billions to reduce both local pollution and greenhouse gas emissions, oil sands production still creates more land disturbance, uses more water, and emits more greenhouse gases per barrel than conventional oil production.*

*The lack of experience on land reclamation and the debate on oil sands impact shows that companies have not yet established effective mitigation methods. Major oil sands projects must tackle significant labour market fluctuations, volatile energy (natural gas) costs, project delays, uncertain regulatory and legal burdens due to increasing allegations of health issues, as well as allegations of violations to indigenous people's constitutional rights. These factors coupled with increasing costs from the mitigation of environmental and social risks, and low oil prices are unlikely to attract many investors. This does not bode well for oil sands growth in a relatively oversupplied world where competing energy sources are lowering their costs and opening market access (e.g. US tight oil). Furthermore, an increasing number of energy and environment experts take the view that a year of cancelled projects in 2016, steady expansion of renewable energy and more concerted international action to slow global warming could indicate the end of oil sands megaprojects<sup>2</sup>. Bank announcements after the One Climate Summit in December 2017 only serve to confirm this view.*

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1 Tight oil (also known as shale oil) is conventional oil that is found within reservoirs with very low permeability, often shale or tight sandstone. Production of this oil requires hydraulic fracturing to create sufficient permeability to allow oil to flow at economic rates.

2 "Once Unstoppable, Tar Sands Now Battered from All Sides" – Yale School of Forestry and Environmental studies – 1/02/2016

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