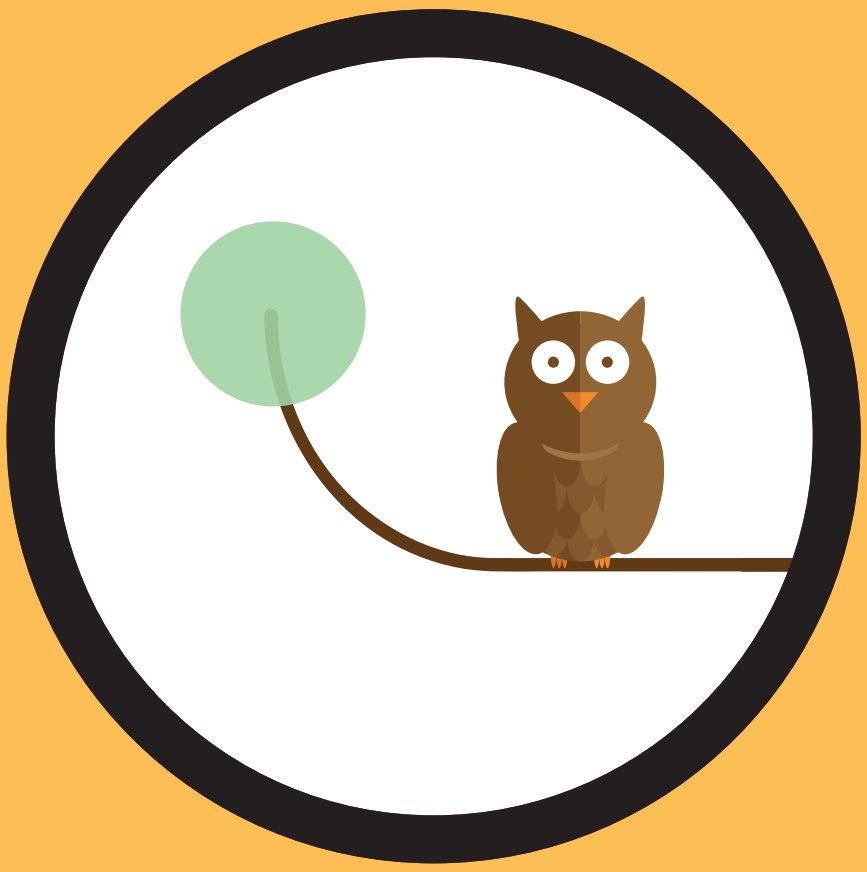
Perch



Black gold:

Alberta's oil resources

April 2017

ATB Financial®

WHY LOOK AT ALBERTA'S OIL RESOURCES?

Economics and Research, ATB Financial

From a highly-educated workforce and extensive infrastructure to stunning geography and dynamic cities, Alberta has a lot going for it.

We also have oil— lots and lots of oil.

Alberta is home to agricultural land, trees, minerals and natural gas—all of which are vitally important to our economic prosperity. But oil stands out as the most controversial asset in our repertoire of natural resources and as the one sector that can single-handedly propel our economy into a boom or drag it into a bust.

The controversies arise out of the environmental effects of oil sands production and the longstanding debate about how to make the Alberta economy less reliant on the volatile fortunes of oil production. The massive amount of revenue and investment generated by the oil sector account for its ability to tilt the economy toward a boom (when oil prices are high) and toward a bust (when oil prices are low).

And while many Albertans could probably cite the daily price of a barrel of West Texas Intermediate crude, there is room to improve our understanding of just how much oil we have, how much we produce and who buys it. This edition of **Perch** presents a handy set of answers to these questions.

What about natural gas? We tend to refer to Alberta's oil and gas sector as a single entity but it makes sense to address oil separately for two reasons. First, while both are significant assets, the economic impact of our oil has come to dwarf that of our natural gas. For example, the value of our international crude oil exports was almost six times that of our natural gas exports in 2015. Second, while there is a great deal of overlap between the oil and gas sectors, they face different challenges and opportunities. ATB's Economics and Research team will examine the key facts and trends relevant to natural gas in a future report.

About Perch

Thanks for taking a moment to read ATB Financial's Perch. Published quarterly, each edition focuses on a topic of importance to Albertans and their prosperity.

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Who are we?

We are ATB Financial's Economics & Research team. We work to share our province's economic story and to connect Albertans to the economic news and ideas they need to know about. Head on over to atb.com/economics to get a better look at who we are and what we do.

HOW MUCH OIL DOES ALBERTA HAVE?

Alberta is home to the third largest oil reserves in the world

At 167 billion barrels, Alberta's established reserves of crude oil represent 10 per cent of the global total and put it in the company of the oil reserve powerhouses of Venezuela, Saudi Arabia, Iran and Iraq (see Figure 1). If we exclude Alberta's reserves, Canada's 2.3 billion barrels would put it 34th on the global list just behind Argentina and tied with Columbia. As Figure 2 shows, almost all (99 per cent) of Canada's established oil reserves are located in Alberta.

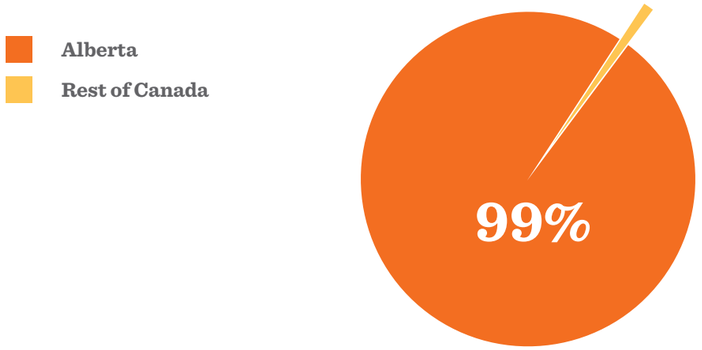
Figure 1: Global crude oil reserves, 2016

	Billions of barrels	Per cent of global total
Venezuela	300	18%
Saudi Arabia	267	16%
Alberta	167	10%
Iran	158	10%
Iraq	143	9%
Kuwait	102	6%
United Arab Emirates	98	6%
Russia	80	5%
Libya	48	3%
Nigeria	37	2%
United States	35	2%
Global total	1,650	100%

Source: US Energy Information Administration. The Alberta estimate is from the Canadian Association of Petroleum Producers.

Note: The figures in this chart refer to "proved" reserves (sometimes called "established" reserves). Proved reserves are estimated quantities of energy sources that analysis of geologic and engineering data demonstrates with reasonable certainty are recoverable under existing economic and operating conditions. Reserve figures change over time due to production, new discoveries and changing economic and operating conditions. The veracity of data provided by some jurisdictions has been questioned.

Figure 2: Established oil reserves in Canada, 2015
(per cent of total Canadian reserves)



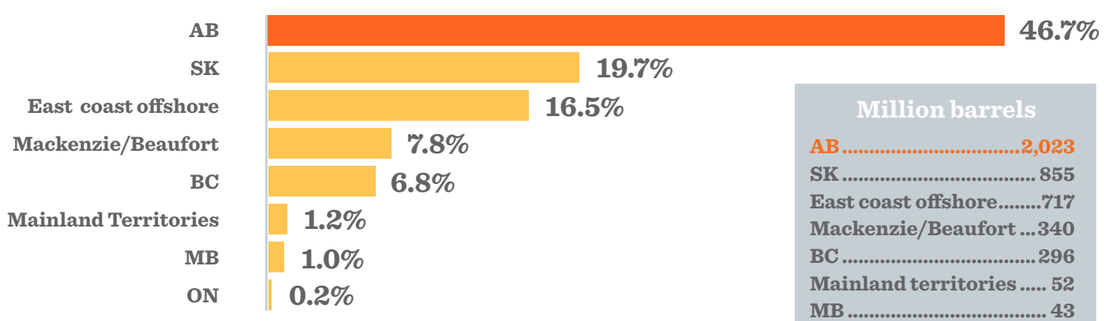
Source: Canadian Association of Petroleum Producers

Almost all of Alberta's oil reserves are found in the oil sands.

Alberta has about two billion barrels of conventional oil reserves (see Figure 3) while the other 165 billion barrels (99 per cent) is bitumen found in the oil sand deposits of northern Alberta. Conventional oil is a liquid that naturally flows to a well. Depending on its density, it ranges from heavy to light. Bitumen has a thick and sticky consistency (a.k.a. high viscosity) and will not flow to a well in its natural state. Synthetic crude oil is a liquid derived (a.k.a. upgraded) from bitumen.

Alberta's conventional oil accounts for almost half of the country's conventional reserves. The next largest conventional reserves are found in Saskatchewan.

Figure 3: Established conventional oil reserves in Canada, 2015
(per cent of total conventional reserves)

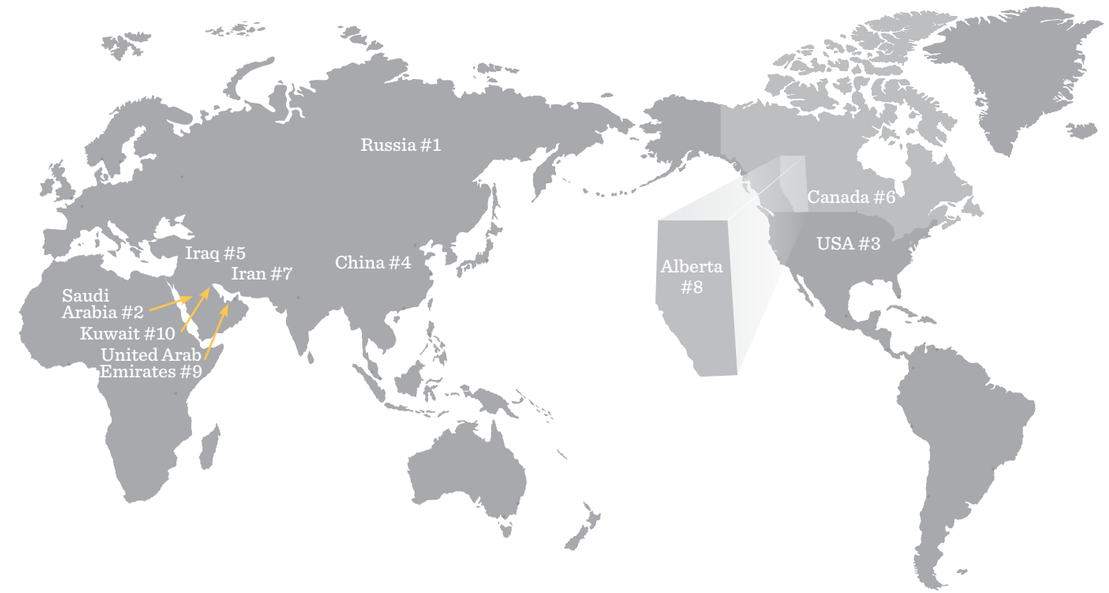


Million barrels	
AB	2,023
SK	855
East coast offshore	717
Mackenzie/Beaufort	340
BC	296
Mainland territories	52
MB	43
ON	9
TOTAL	4,333

Source: Canadian Association of Petroleum Producers

Note: Conventional oil in this chart includes pentanes plus. Pentanes plus is a mixture of liquid hydrocarbons extracted from natural gas in a gas processing plant. Pentanes plus is equivalent to natural gasoline. Numbers may not add due to rounding.

Crude oil production, 2015
(Million barrels per day)



Russia	10.3
Saudi Arabia	10.2
United States	9.4
China	4.3
Iraq	4.1
Canada	3.7
Iran	3.3
Alberta	3.1
United Arab Emirates	3.0
Kuwait	2.8
Venezuela	2.5
Brazil	2.4
Mexico	2.3
Nigeria	2.3
Angola	1.8
Kazakhstan	1.7
Norway	1.6
Qatar	1.5
Algeria	1.4
Colombia	1.0
Oman	1.0
Total	80.6

An ATB Financial infographic

Source: US Energy Information Administration and Statistics Canada, CANSIM table 126-0001

Note: Oil production statistics sometimes include "other liquids" such as natural gas liquids (ethane, propane, butane, isobutane, natural gasoline) and biofuels. To maximize comparability with the other data in this report, this chart includes only crude oil and lease condensate. Lease condensate is recovered from lease separators or field facilities at associated and non-associated natural gas wells and normally enters the crude oil stream after production. Total global production in 2015 including other liquids was 96.8 million barrels per day.

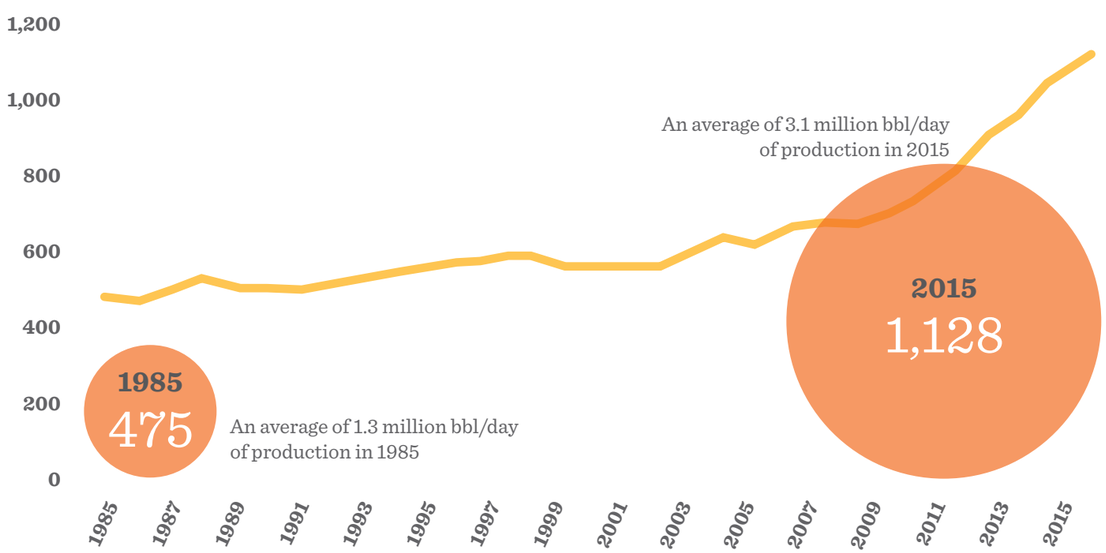
HOW MUCH OIL DOES ALBERTA PRODUCE?

Crude oil production in Alberta now exceeds one billion barrels per year.

The existence of oil reserves does not mean that they will be produced. Massive amounts of investment, expertise, creativity and technology are needed to locate, extract, transport and sell oil. This is a risky business subject to complex market forces and public policy choices. In addition to these challenges, Alberta is landlocked and the oil trapped in the oil sands is not as easy to extract as conventional crude—factors which put us at a disadvantage when it comes to transforming our oil resources into viable business ventures.

Despite these challenges, Alberta produced 137 per cent more oil in 2015 than it did in 1985. In 2014, Alberta's total annual production rose above one billion barrels for the first time and reached 1.1 billion barrels (3.1 million barrels per day) in 2015.

Figure 4: Alberta's total annual oil production, 1985-2015 (million barrels)



Source: Statistics Canada, CANSIM table 126-0001 and author's calculations

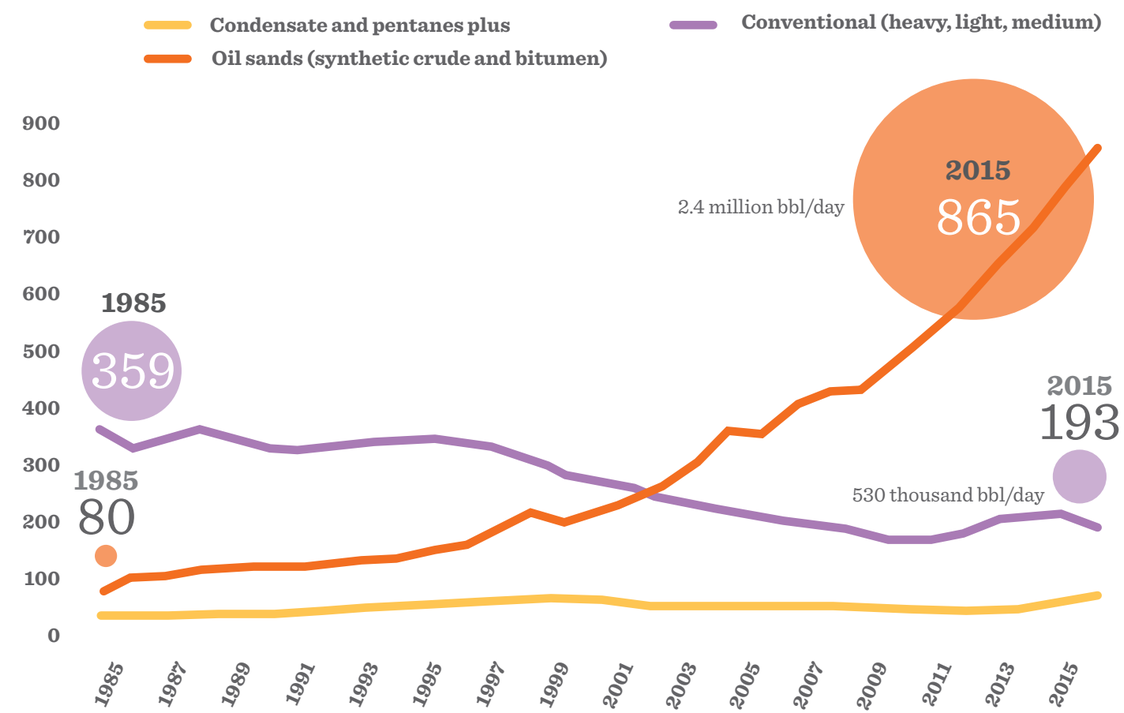
Note: bbl = barrels. Total includes the production of conventional oil, oil sands bitumen and synthetic crude and equivalents (pentanes plus and condensate). Data for 2016 have not been included for two reasons: 1) Statistics Canada changed its methodology for the Monthly Supply and Disposition of Crude Oil and Equivalent data series and created a new table (126-0003) that begins in March 2016. The numbers for January and February 2016 and for previous years that are reported in table 126-0001 are not directly comparable to those in the new table. 2) The disruption of oil production caused by the Fort McMurray forest fires makes the total production figures for 2016 an anomaly in the historical trend. Alberta's production dropped by 17 per cent (194 million barrels) in 2016 compared to 2015 due to the forest fires.

ALBERTA'S OIL PRODUCTION BY TYPE

Oil sands production accounts for the increase in Alberta's oil output.

Without the development of the oil sands (commercial production began in 1967 but didn't reach a million barrels a day until the mid-2000s), Alberta's oil production would be in decline. Conventional production has fallen from 359 million barrels in 1985 to 193 million in 2015 (see Figure 5). Over the same period, annual oil sands production increased over tenfold from 80 million barrels to 865 million.

Figure 5: Alberta's annual oil production by type, 1985-2015 (million barrels)



Source: Statistics Canada, CANSIM table 126-0001 and author's calculations

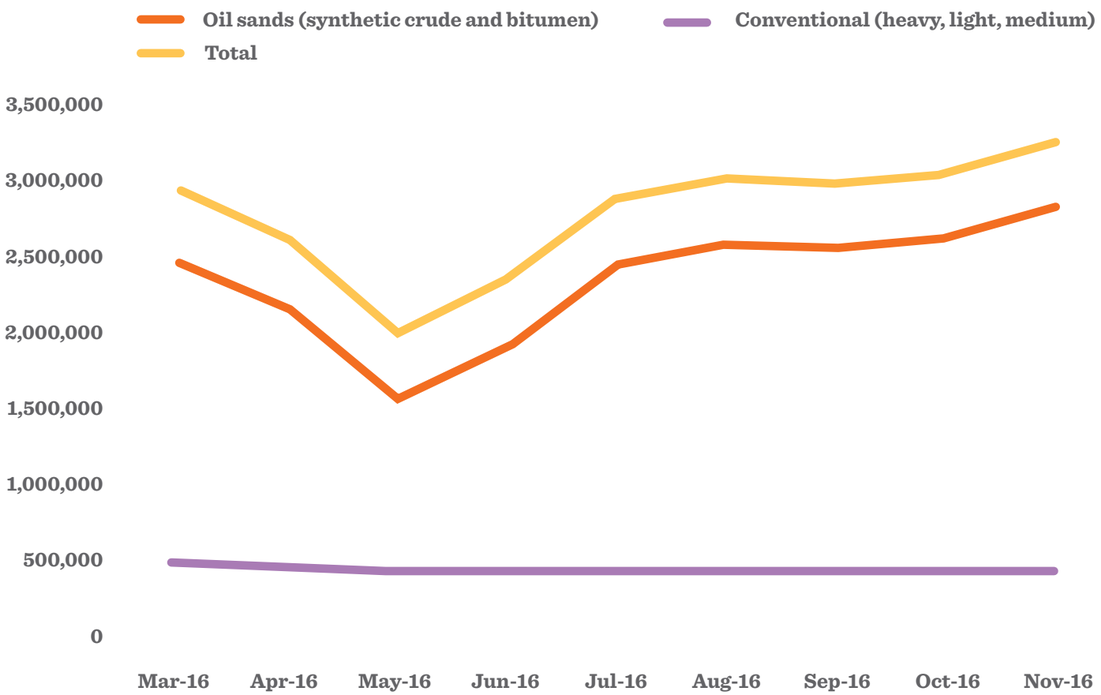
Note: bbl = barrels

IMPACT OF THE FOREST FIRES

Forest fires in northern Alberta disrupted oil sands output in 2016.

Alberta's oil sands are located in forested areas. As a result, forest fires that burned near oil sands operations in 2016 forced a shutdown of production. The dip in output can be clearly seen in Figure 6. Oil sands production fell by an average of almost 600 thousand barrels per day in May compared to April but had fully recovered by July.

Figure 6: Alberta's oil production March 2016 - November 2016 (barrels per day)



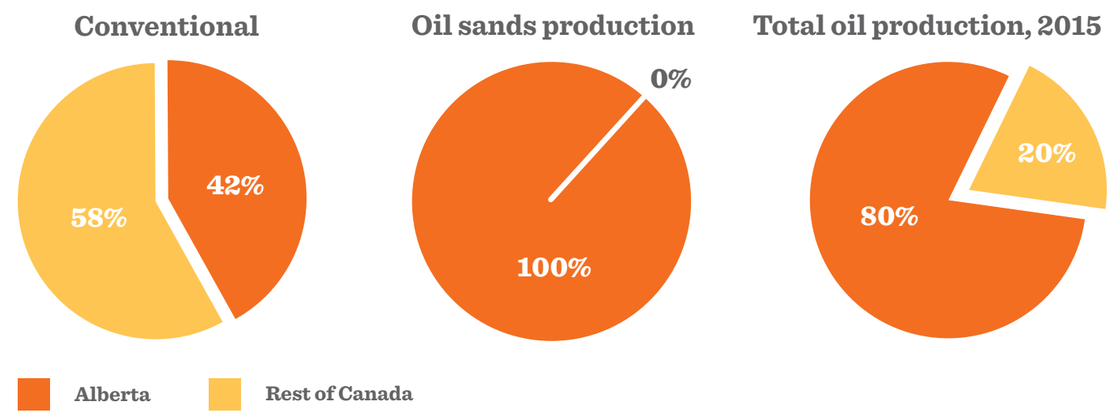
Source: Statistics Canada, CANSIM table 126-0003

Note: This chart does not include equivalents.

ALBERTA'S OIL PRODUCTION IN CONTEXT

Oil sands output in Alberta has not reached its full potential.

Figure 7: Oil production in Canada, 2015 (per cent of total)



Source: Statistics Canada, CANSIM table 126-0001 and author's calculations

When it comes to conventional oil production, Alberta produces less than the rest of Canada. When oil sands production is included – all of which takes place in Alberta – Alberta's share of Canada's oil production jumps from 42 per cent to 80 per cent (see Figure 7).

Despite being home to 99 per cent of Canada's oil reserves, Alberta does not currently produce 99 per cent of Canada's oil. The reason for this is that oil sands output has not reached its full potential. A National Energy Board projection has oil sands output reaching 4.8 million barrels per day by 2040.

Figure 8: Oil production, 2015
Barrels per day (millions)

	Canada	Alberta
Equivalent	0.2	0.2
Conventional	1.3	0.5
Oil sands	2.4	2.4
Total	3.9	3.1

Source: Statistics Canada, CANSIM table 126-0001 and author's calculations

Note: Equivalent includes condensate and pentanes plus.

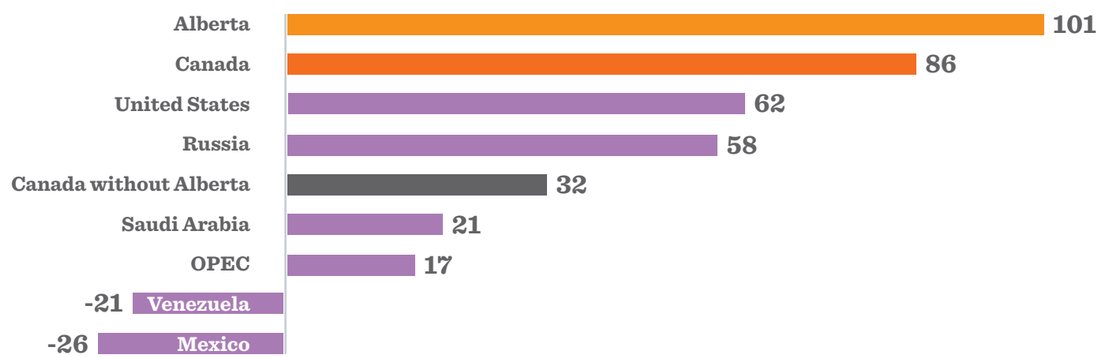
Oil sands production can be split into two categories: crude bitumen and upgraded synthetic crude oil. Bitumen accounted for 59 per cent of oil sands output in 2015 compared to 41 per cent for synthetic crude.

Alberta is a major global producer of oil but produces much less than the US and OPEC.

When comparing Alberta's crude oil production to other countries, we see that we were the eighth largest producer in the world in 2015, or about four per cent of total global output (see the infographic on page 5). With the rest of the country's production included, Canada sits in sixth spot. The combined production of OPEC in 2015 was 33.8 million barrels per day (42.0 per cent of total production).

Global production of crude oil increased by 18 per cent between 2000 and 2015. Over this same period, Alberta's production of crude oil jumped by 101 per cent while US production rose by 62 per cent and OPEC's by 17 per cent. Mexico's production, meanwhile, decreased by 26 per cent. Despite growing by a lower percentage, OPEC's increase in production between 2000 and 2015 was greater than Alberta's total output in 2015 (4.9 million barrels per day compared to 3.1 million barrels per day).

Figure 9: Growth in oil production, 2000-2015 (per cent change)



Source: Statistics Canada, CANSIM table 126-0001 and US Energy Information Administration

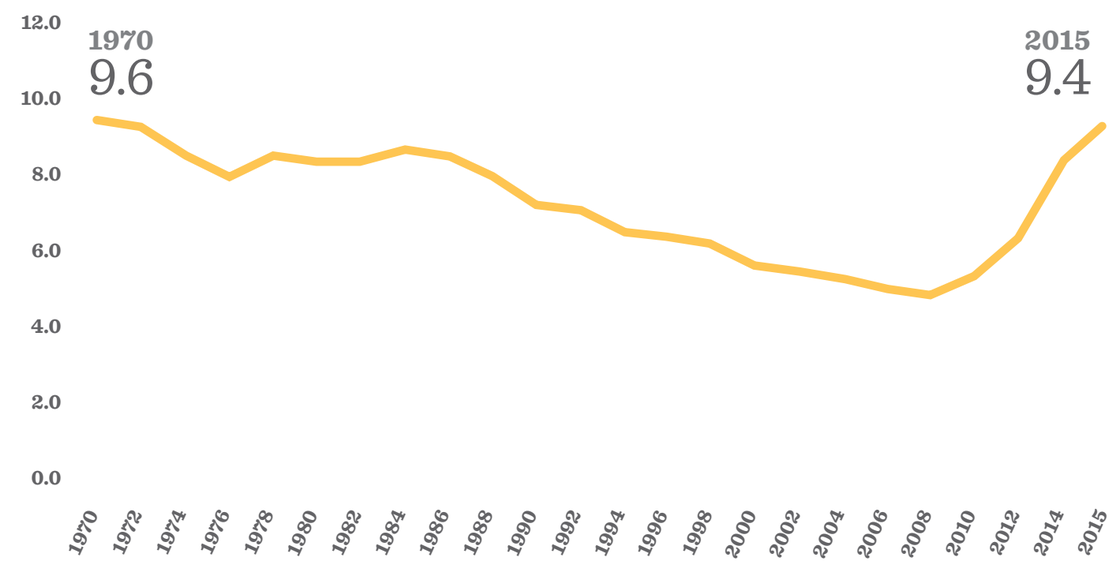
Our biggest customer—the US—is producing a lot more oil but is importing more from Alberta than ever before.

One of the most significant changes in the global oil sector has been the steep rise in US production over the last few years. US output had been slowly but steadily falling since the mid-1980s but started going up in 2009 (see Figure 10). In less than a decade, the US added 4.1 million barrels per day to its output by using hydraulic fracturing technology to unlock its shale deposits. US crude production fell to 8.9 million barrels per day in 2016 as low prices curtailed shale drilling but is expected to reach 9.5 million barrels per day in 2018.

Fortunately for Alberta, the sudden surge in US output has not displaced imports of crude from Alberta. As of 2015, the US was importing 1.2 million barrels of crude oil per day more from Alberta than it was in 2009—an increase of 88 per cent. Over the same period, imports from OPEC fell by 1.7 million barrels per day for a drop of 39 per cent. Imports of crude from Mexico were also down by 37 per cent (404 thousand barrels per day). US imports from all countries were down 18 per cent (1.7 million barrels per day).

Two reasons why imports from Alberta have increased are: 1) Alberta crude is relatively cheap; and 2) a large number of US refineries are set-up to process oil sands bitumen and other heavy crudes. Hence, while it makes sense to swap out light foreign crude for light US shale output, the same does not apply to Alberta's crude. Nonetheless, further increases in US production could start to chip away at imports from Canada, especially with regard to lighter varieties such as Alberta's synthetic crude. With only one foreign customer, we are at the mercy of forces within the US.

Figure 10: US crude oil production, 1970 - 2015 (million barrels per day)



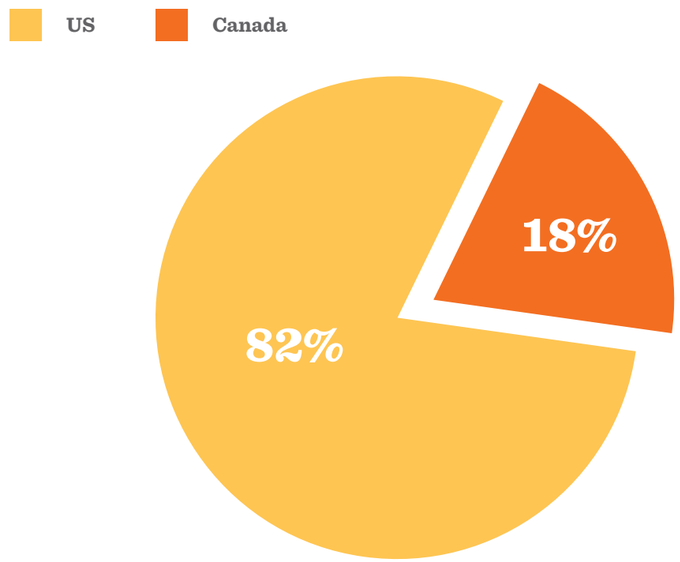
Source: US Energy Information Administration
Note: Includes crude oil and lease condensate.

WHO BUYS ALBERTA'S OIL?

Over 80 per cent of Alberta's oil heads south of the border.

There are three main customers for Alberta's oil: 1) Alberta refineries; 2) refineries in other parts of Canada; and 3) refineries in the US. While a significant amount of Alberta's oil output stays within Canada (18 per cent in 2015), most of our production is exported to the US (see Figure 11). Only a small amount (2,426 barrels per day in 2015) makes it to foreign customers other than the US.

Figure 11: Destination of Alberta's oil output, 2015 (per cent of total)



Source: Statistics Canada, CANSIM table 126-0001 and author's calculations

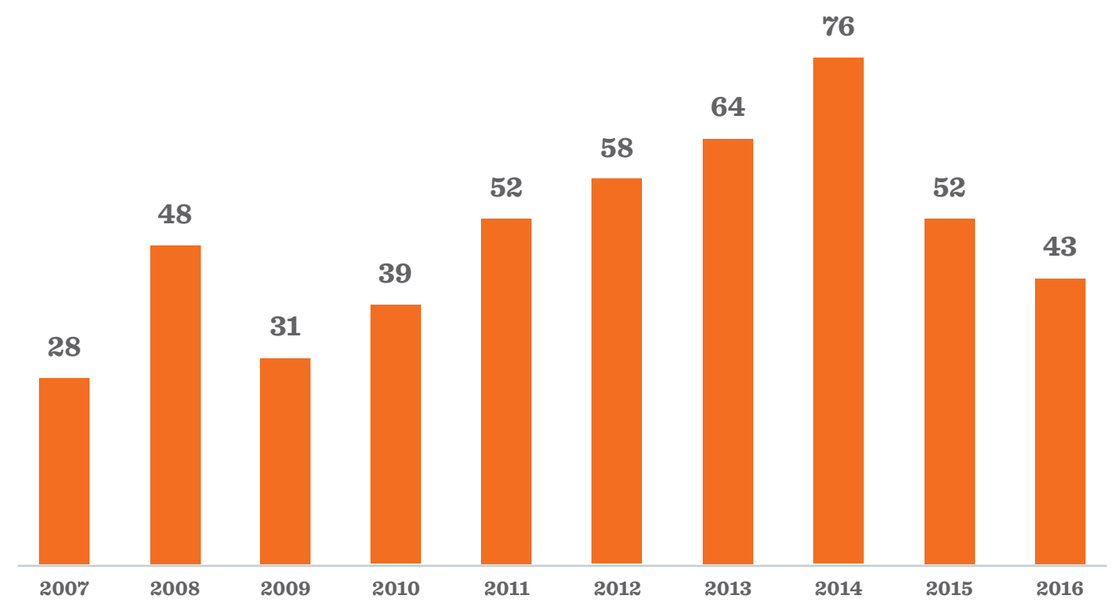
Despite producing more oil than it can use, Canada still imports a significant amount of oil from abroad—about 570 thousand barrels per day in 2015. Most of this oil is destined for eastern Canada. As the National Energy Board explains, "this is largely because there has been little infrastructure connecting western Canadian oil supplies to eastern Canadian markets."

HOW MUCH DOES ALBERTA GET FOR ITS OIL EXPORTS?

The value of Alberta's crude oil exports can change dramatically as the price of oil goes up and down.

The value of Alberta's international exports of crude oil (virtually all of which goes to the US) reached a record high in 2014 of $76 billion (see Figure 12). Lower prices cut this amount by $23 billion in 2015 (31 per cent). Soft prices and the lost production caused by the Fort McMurray forest fires saw the value of crude exports drop another $9 billion (18 per cent) in 2016. These drops follow several years of strong growth as production increased and prices stayed robust.

Figure 12: Value of Alberta's international exports of crude oil (billions of CDN $)



Source: Trade Data Online, HS Code 270900 - Crude Petroleum Oils and Oils Obtained from Bituminous Minerals

WHERE IS THE DEMAND FOR OIL HEADED?

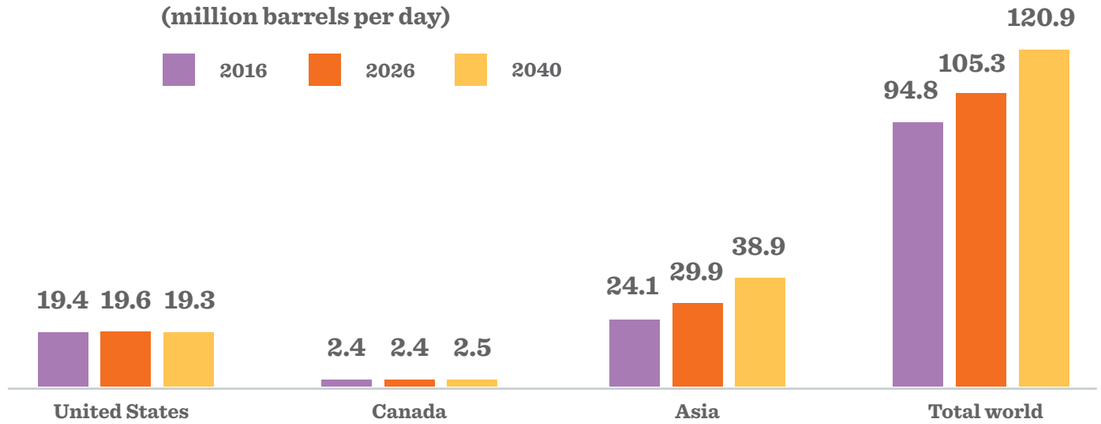
Long-term growth in oil demand will be strongest in Asia.

The future is uncertain, but the US Energy Information Administration's (EIA) reference case projection for US crude oil reported in the 2017 edition of its Annual Energy Outlook has production plateauing at about 10.5 million barrels per day in 2026. In this scenario, the US will continue to import large amounts of crude to meet its domestic demand. This is good news for Alberta because, even though US consumption of oil and other liquids is expected to be almost flat, demand for our oil should remain relatively strong. Keep in mind, however, that the EIA's projection is highly sensitive to price and technological change. Higher prices and advancements in tight oil extraction techniques could see US oil production increase by several million barrels per day more than in the reference case. If this happens, US demand for Alberta's oil could fall.

A more predictable problem is that there is limited room for growth in sales to the US, even if heavy oil supplies from California and Mexico continue to fall. As Figure 13 shows, the largest growth in oil consumption is projected to take place in Asia – the exact market to which we have almost no physical access at present. Between 2016 and 2040, China's consumption of crude oil and other liquids is projected to grow by 42 per cent (4.8 million barrels per day) while the growth in India's consumption will be 98 per cent (4.1 million barrels per day).

The rise in global oil consumption projected by the EIA is, of course, far from a certainty and there is a wide range of oil consumption scenarios that could happen. If, for example, the adoption of electric cars happens faster than expected or if government efforts to reduce oil consumption become much more aggressive, we may see the upward rise in demand turn downward. Old habits, population growth and rising living standards are, however, difficult trends to resist and all three favour increased oil consumption over the next twenty years.

Figure 13: Crude oil and other liquids consumption (million barrels per day)



Source: US Energy Information Administration, International Energy Outlook 2016

Note: Asia does not include Japan, S. Korea, Australia or New Zealand.

TODD TALKS

Todd Hirsch, ATB Chief Economist

And we thought figuring out how to extract oil from sand would be the hardest part

In the opening sequence of the classic comedy show The Beverly Hillbillies, Jed Clampett is out "shootin' at some food" when "up through the ground come a bubblin' crude."

A little more effort and ingenuity was required, but Albertans also hit the crude oil jackpot.

We still produce a fair amount of "bubblin' crude" in the form of conventional oil but it's the bitumen from our oil sands deposits that now accounts for both the majority of our oil reserves and annual production.

On the one hand, this is fantastic news because our ability to extract crude from the oil sands means we have the third largest oil reserves in the world. With the global demand for oil going up rather than down in the decades ahead, the potential economic benefits to Albertans of the oil sands are enormous.

On the other hand, the oil sands present us with a number of challenges.

First, squeezing oil from the oil sands is not as straightforward as, for example, drilling a well in the Ghawar Field in Saudi Arabia where old Jed Clampett's method of shooting at the ground and watching oil squirt out is not too far off. It's expensive oil to produce—and as a result, the profitability of oil sands operations are more sensitive to the price of oil than many others around the world.

There is still work to be done, but the application of new technology and techniques on the extraction side are paying off. This is bringing costs down and will help our producers stay viable even when prices are somewhat soft.

Second, we are acutely aware that our options are limited when it comes to the customers for our oil. Without major new pipelines to the west coast, we're unable to take advantage of Asia's growing demand for oil. At the same time, the US has been enjoying a shale oil boom that has the potential to crowd out imports from Alberta. Although predictions about the US becoming self-sufficient in oil may have been premature, our American friends certainly have a lot more of it than they did just a few years ago.

Fortunately, some US refineries actually require Alberta's heavy oil and bitumen because they invested heavily in creating facilities designed to refine heavy crude. They did this because they didn't know that there would be a shale oil boom and were expecting to rely on heavy oil from Alberta and Venezuela.

At the same time, light crude (including synthetic crude derived from bitumen) from Alberta sells at a discount. That has helped shield it from the effects of the shale oil boom—the US has been importing less crude from overseas while taking even more from Alberta. The problem is that if enough US crude keeps flowing, and the economics of the refineries change, our only customer might eventually need a lot less of what we have to sell.

Third, the oil sands has been singled out by many as "dirty" oil that, some argue, should be left in the ground. Hence, even though the US has built lots of new pipelines and has massively expanded the use of hydraulic fracturing to extract oil, President Obama cited our "extraordinarily dirty oil" as the reason for not approving the Keystone XL pipeline that would move about 800,000 barrels of Alberta oil per day to the US market. President Trump has since approved the

pipeline–which is good news for Alberta's oil sector—but opposition remains and there is no guarantee that it will be built.

Here at home, environmental antagonism and other roadblocks to pipelines highlight the ongoing resistance to the expansion of oil sands activity and Alberta's ability to reach Asian markets. Federal approval of two pipeline projects (the Trans Mountain Expansion and the Line 3 Replacement Program) has boosted spirits in the oil patch but they still face opposition as does the proposed Energy East Pipeline Project that would ship crude from Alberta and Saskatchewan to refineries in eastern Canada and an export terminal in Saint John.

These three challenges are significant so we are going to have to live up to our can do reputation in Alberta if we are going to successfully address them.

We've made improvements on the environmental side, and Alberta has some of the world's strictest environmental standards. Still, we have to do even better. We've made solid strides in terms of improving cost structures and efficiency, but we have to do even more. We've built strong relationships with our American cousins, but we have to work even harder to ensure we are the go to supplier south of the border. And we have to crack the nut and find a way to tap into the growing Asian market.

Easy, right?

Well, no.

But not impossible, either.

Having plenty of oil used to set us apart and it still does, but now this has to be combined with even greater amounts of creative thinking, expert diplomacy and environmental acumen. Anything less and we will not be able to keep enjoying the enormous benefits our black gold brings.

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