

# ALBERTA OIL SANDS INDUSTRY

## QUARTERLY UPDATE



### WINTER 2017

Reporting period:  
SEP. 12, 2017  
TO DEC. 7, 2017

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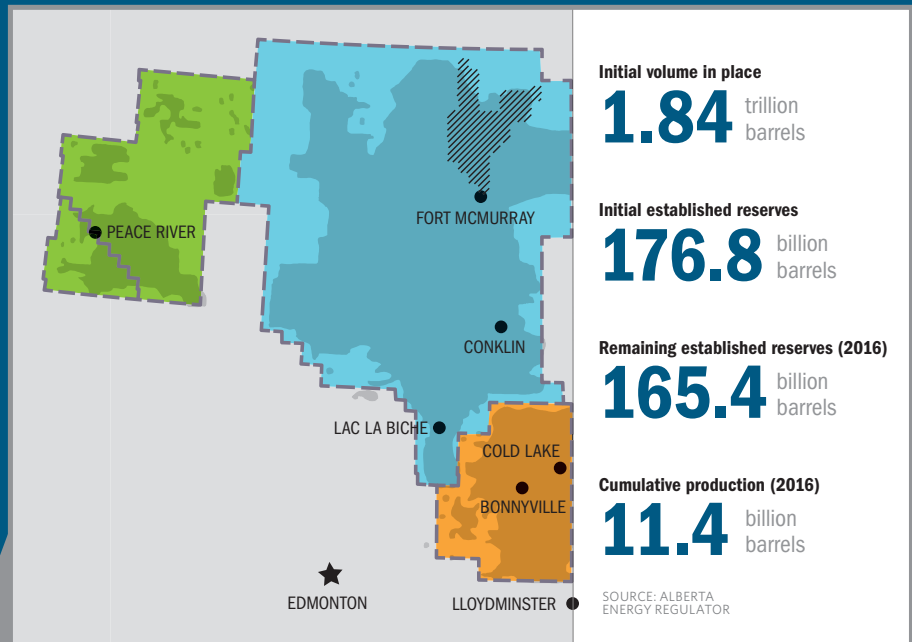
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# ALBERTA'S OIL SANDS

Canada's oil sands resources exist in three major deposits in Alberta: Athabasca, Cold Lake and Peace River. Athabasca, the largest in size and resource, is home to the surface mineable region. All other bitumen must be produced in situ or by drilling. Currently, the vast majority of oil sands production is exported to U.S. markets.





# MARKET UPDATE

## OIL SANDS GROWTH CONTINUES AS ALBERTA PREMIER PUSHES FOR PIPELINES

The largest maintenance turnaround in the history of Canadian Natural Resources led a dip in overall Canadian oil production in September, according to data from the International Energy Agency (IEA).

The turnaround at the integrated Horizon oil sands mining and upgrading project, which Canadian Natural noted was a 1.3-million man-hour event, resulted in the reduction of about 175,000 bbls/d.

This turnaround facilitated the tie-in of the new 80,000 bbl/d Horizon Phase 3 expansion, increasing Horizon SCO capacity to over 277,000 bbls/d.

Overall Canadian oil production averaged 4.7 million bbls/d in September, which includes a reduction in bitumen production of 37,000 bbls/d to 1.69 million bbls/d, according to the IEA.

"For the first nine months of 2017, Canadian oil output posted average annual growth of 380,000 bbls/d, albeit from a low base case in 2016 when wild-fires shut in a significant proportion of Albertan oil output," the IEA reported.

"For 2017 as a whole, Canadian production is expected to expand by 275,000 bbls/d, followed by a gain of around 235,000 bbls/d in 2018."

In all, the IEA expects non-OPEC production to grow by 680,000 bbls/d on average in 2017 and accelerate to 1.44 million bbls/d next year, of which US crude oil production represents 55 per cent. Canada, the UK and Brazil are "other notable sources of growth."

### 2018 OIL SANDS GROWTH

With production expected to ramp up to about 90 per cent of capacity at the 190,000 bbl/d Fort Hills project by fall, combined with ramp up at the newly commissioned 80,000 bbl/d Horizon

expansion and incremental increases at a number of in situ projects, total bitumen volumes may for the first time exceed three million bbls/d before the end of 2018.

It's very nearly there today: according to the most recent complete data from the Alberta Energy Regulator (AER), combined mined and in situ bitumen production averaged 2.926 million bbls/d in July 2017.

Oil sands production reached one million bbls/d in 2006 and two million bbls/d in 2013.

### NOTLEY DELIVERS PRO-PIPELINE MESSAGE ACROSS CANADA

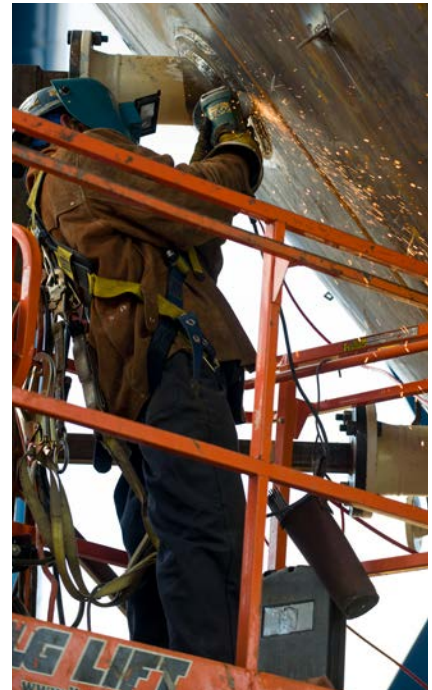
Alberta premier Rachel Notley was on a speaking tour Ontario, British Columbia and Alberta in late November and early December spreading the message about the importance of the Trans Mountain Pipeline expansion, and the critical role that Alberta's Climate Leadership Plan will play in Canada achieving its climate targets.

"Alberta's energy industry is a dominant part of what makes Canada tick," Notley said in Vancouver.

"There is not a school, there is not a hospital, there is not bus, a road, a bike lane or a port that doesn't owe something to the strong energy industry in the province of Alberta."

In terms of transfers, Alberta annually contributes \$22 billion more than it gets back from Ottawa, Notley said. In 2014, before the oil price crash, 44,000 British Columbians worked in Alberta, she added.

But she acknowledged that, for too long, Alberta has failed to act on mitigating the impacts on the climate both from its oil sands and its reliance on coal for power generation—something her government is trying to correct with an ambitious



climate change plan that includes carbon taxes, a cap on oil sands emissions, a plan to phase out coal power by 2030 and investments in renewable energy.

"When we are done, we will have made good on one of the most dramatic clean energy conversions anywhere in the world," she said, adding that Alberta's is now "one of North America's hottest renewable energy markets."

"Albertans took this step because, as Canada's largest energy producer, we know that we have a unique responsibility to tackle climate change," Notley said. "And we know that any climate action plan that doesn't include Alberta, frankly, is not a plan. It won't work."

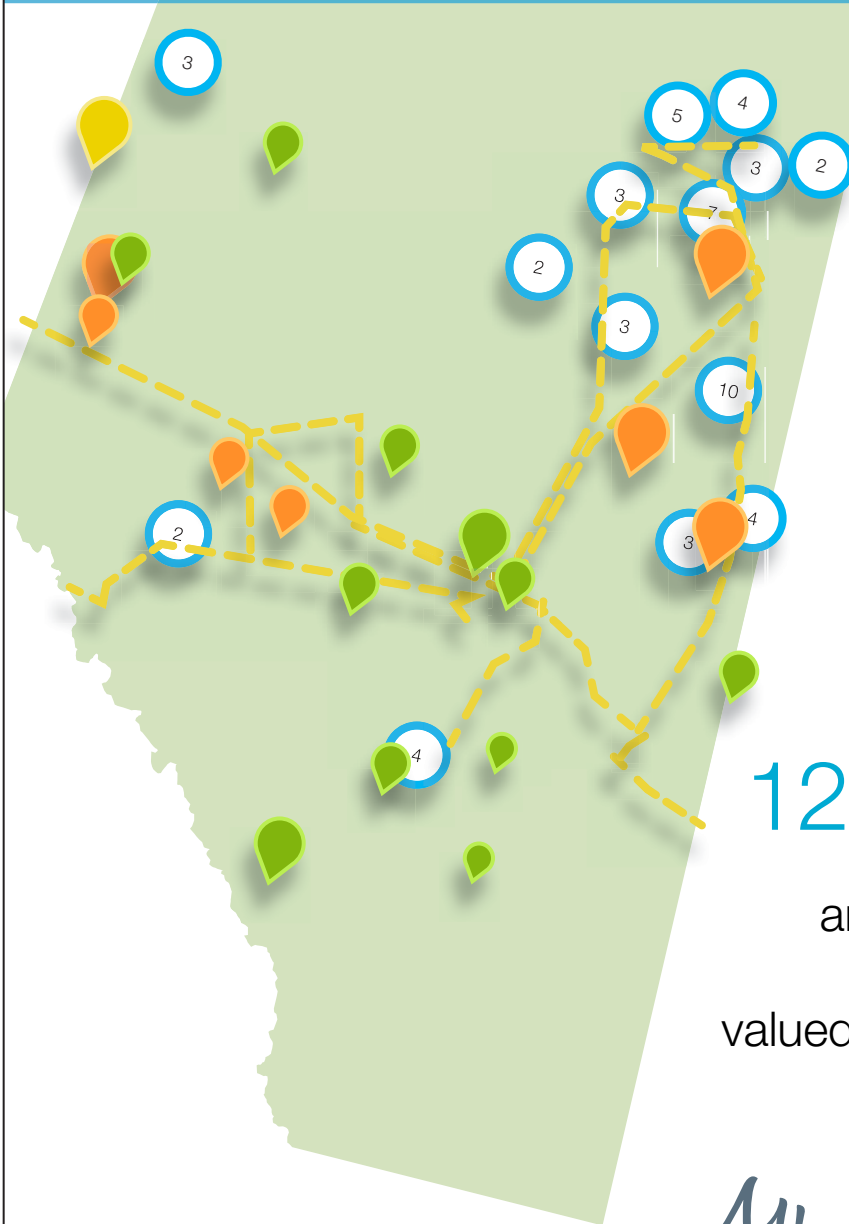
But she also warned that Alberta cannot finance such a massive transition without a strong economy.

"Alberta cannot fund the transition to a greener, lower carbon future if our economy is held hostage by geography," she said, referring to the need to get Alberta oil to foreign markets via B.C. ■

[majorprojects.alberta.ca](http://majorprojects.alberta.ca)

# ALBERTA MAJOR PROJECTS

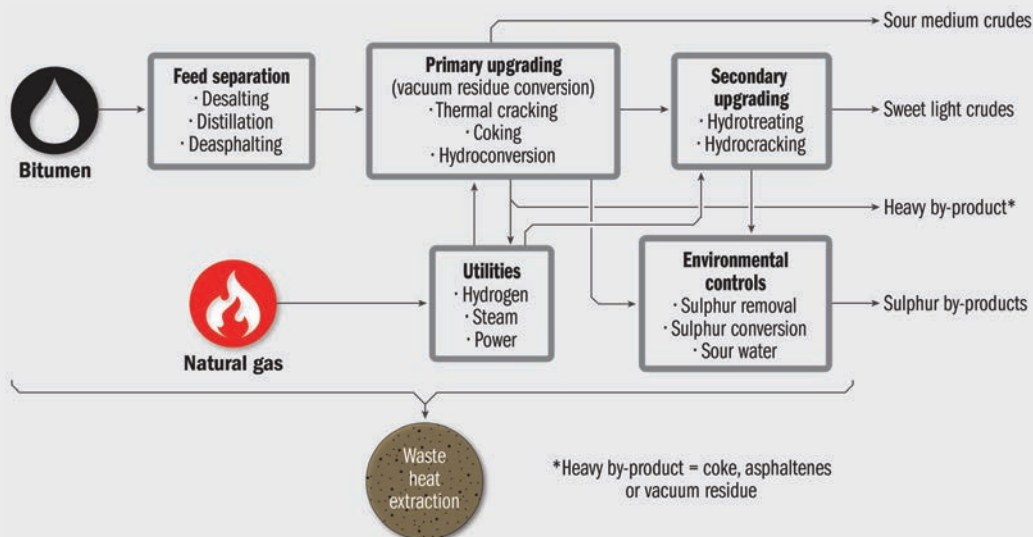
An inventory of private and public sector projects in Alberta valued at \$5 million or greater



127 oil & gas, pipeline  
and industrial projects  
valued at \$176.9B

Alberta  Government

# RESOURCE + TECHNOLOGY SPOTLIGHT



SOURCE: NATURAL RESOURCES CANADA

## BITUMEN UPGRADING

### BACKGROUND

As extra-heavy oil with consistency that ranges from a hockey puck to peanut butter, bitumen must be treated in order to flow through a pipeline and often to meet refinery specifications. For about 35 per cent of the bitumen currently produced in Alberta, this is done through chemical treatments called upgrading.

### HOW IT WORKS

Bitumen recovered from the oil sands is a complex mixture of hydrocarbons, and contains “impurities” such as sulphur, nitrogen, and trace metals such as vanadium. Upgrading is the process of separating and modifying the components of bitumen into various petroleum products or raw materials for further processing. Synthetic crude oil, which can be refined into numerous consumer products, is the main product of upgrading.

Upgrading relies on heating (thermal conversion, or coking), catalytic conversion, distillation, and hydrotreating to modify existing molecular structures and isolate, stabilize, and purify various molecular components.

### WHERE IT WORKS/ CURRENT STATUS

There are currently four operating bitumen upgraders in Alberta: three north of Fort McMurray and one in Alberta’s Industrial Heartland near Edmonton. Together these facilities produced 929,500 bbls/d of upgraded bitumen products in 2016, about 35 per cent of total bitumen production of 2.54 bbls/d, according to the Alberta Energy Regulator (AER).

### COMPANIES THAT USE UPGRADING IN ALBERTA

Alberta’s four bitumen upgraders are at Suncor Energy’s oil sands base plant, at Syncrude’s Mildred Lake facility, at Canadian Natural Resources’ Horizon plant, and at the Scotford Upgrader, which is majority owned by Canadian Natural Resources and operated by Shell.

Canadian Natural recently completed a major expansion to upgrading at Horizon, adding 80,000 bbls/d of processing capacity.

A fifth bitumen upgrader near Edmonton is currently under

construction and nearing completion. The Sturgeon Refinery, which is owned by Canadian Natural and North West Refining, will process feedstock including volumes from Alberta’s bitumen royalty in kind program, primarily directly to diesel.

### THE FUTURE

Investment in large upgrading facilities in Alberta is costly and not widely viewed as a competitive with other asset opportunities for many oil sands producers. As several refineries in the United States have invested in technology to process heavy oil, the majority of oil sands produced in Alberta is now exported as diluted bitumen. The AER forecasts that by 2025 the volume of bitumen upgraded in Alberta will decrease to 32 per cent of total production.

Operators are developing technologies known as “partial upgrading” that could add value to Alberta bitumen without requiring the significant investment of a full upgrading system. ■

WITH FILES FROM THE OIL SANDS DISCOVERY CENTRE AND DR. MURRAY GRAY

## WHAT'S NEW PROJECTS

To download our annual Excel listing of active Alberta oil sands projects visit: <http://www.jwnenergy.com/magazine/osid/>

■ Canadian Natural Resources is developing plans for a 30,000-40,000 bbl/d diluted bitumen expansion at its Horizon mining project, incorporating technology it acquired through its \$12.74-billion buy of the majority stake in the Athabasca Oil Sands Project (AOSP).

Using the AOSP's paraffinic froth treatment technology, Canadian Natural says it can take advantage of extra capacity on the front end of its mining process. The project plan is targeted for management approval in the fourth quarter of 2018.

■ Husky Energy has filed regulatory applications for a new 10,000-bbl/d steam-based oil sands project south of Fort McMurray.

Called McMullen Willow Creek, the project would use low-pressure cyclic steam stimulation technology, where single horizontal wells act as both steam injectors and bitumen producers.

The proposed McMullen Willow Creek site is located near the hamlet of Wabasca-Desmarais, nearby the suspended bitumen carbonates extraction pilot owned by Laricina Energy and Osum Oil Sands.

Husky's project has a projected initial capital cost of \$400 million, according to documents filed with the Alberta Energy Regulator.

Construction is expected to start in 2019, followed by first steam in 2022.

■ Official first oil isn't expected until December, but Suncor says it has already processed "several hundred thousand barrels" of bitumen froth at the new Fort Hills oil sands mine as test runs are conducted.

"Eighty per cent of the plant has now been turned over to operations.



SOURCE: CENOVUS ENERGY

Effectively that is 95 per cent started up—95 per cent of those bits of equipment have been started up: the boilers, the cogens, the primary extraction facilities," president and chief executive officer Steve Williams told analysts.

Suncor initiated construction on the 194,000-bbl/d project in October 2013. Two of six test runs have now been completed, and Williams said the results have been encouraging.

"These test runs are allowing us to prove out the mining, ore preparation, major site infrastructure, utilities and primary extraction. To date, no significant issues have been identified and our confidence in the high quality of construction continues to be confirmed," he said.

"The test runs also help us to de-risk first oil in December and the ramp up of production through 2018. We have a high degree of confidence in a relatively smooth production ramp up. We plan to be sustainably operating the plant at 90 per cent of capacity by this time next year."

■ Suncor continues to advance its plan for multiple new in situ oil sands projects through the 2020s. The company has filed the regulatory application for Meadow Creek West, a single-phase 40,000-bbl/d SAGD project located south of Fort McMurray.

In March 2017, Suncor received approval for two 40,000-bbl/d phases at

the adjacent property it calls Meadow Creek East.

The Meadow Creeks will see Suncor deploy its in situ replication strategy, designed to significantly reduce costs.

"As the first energy company to receive the approval for multiple in situ developments, we're looking at ways we can most profitably grow production, leveraging those learnings from previous projects," president and chief executive officer Steve Williams said in September.

"Replication will be a central focus of the next phase of oil sands growth, with 10 locations identified, which is expected to add approximately 360,000 bbls/d in production. 2022 has been targeted, market conditions supporting, for potential first oil from that initial phase."

Before the downturn, Suncor's next in situ growth project appeared to be a 20,000-bbl/d expansion at MacKay River, which currently produces about 23,000 bbls/d. This project was deferred in early 2015.

In terms of the timelines that have been made public by Suncor, the 40,000-bbl/d Meadow Creek East Phase 1 would be its first new green-field project. The company has said it expects first oil at Meadow Creek East in 2023.

Next would be 40,000 bbls/d at Meadow Creek West, which Suncor says it expects to achieve first oil in 2026. ■



## WHAT'S NEW BUSINESS

■ The Fort McKay and Mikisew Cree bands in northern Alberta have closed what is being described as the largest business investment to date by a First Nations entity in Canada, securing 49 per cent interest in Suncor's East Tank Farm, part of the new Fort Hills oil sands mining project.

The deal was originally announced in October 2016.

"It's incredible to get to today...we've dreamed of this for a long, long time," Suncor chief operating officer Mark Little said in a Facebook Live video with Fort McKay Chief Jim Boucher and Mikisew Cree Chief Archie Waquan.

The 190,000-bbl/d Fort Hills project is expected to imminently officially achieve first oil and ramp up to 90 per cent of capacity by fall 2018. Both chiefs said they were looking forward to the positive impacts the related revenues from the East Tank Farm operations would have on their communities.

"I'm ecstatic," said Waquan. "[It] will give my First Nation and also the future generations something that they can look forward to, and be able to develop our government, our infrastructure and our education, which is really, really important for my council."

Suncor said in a statement that it would use the proceeds from the sale to pay down debt.

■ Houston-based Civeo, one of the largest global providers of workforce accommodations, logistics and facility management services to the natural resource industry, has entered into an agreement to buy Edmonton's Noralta Lodge, which provides remote accommodations to the oil sands region. The deal is valued at approximately C\$367 million.

■ Despite lower oil prices and stricter restrictions on carbon emissions, in situ



SOURCE: SUNCOR ENERGY

oil sands production is expected to grow by at least one million barrels per day between now and 2040, according to the National Energy Board (NEB).

In October, Canada's energy regulator released its annual outlook report on Canada's energy future, which examines three different paths the market could follow. Under the reference case, which is based on a current economic outlook, a moderate view of energy prices and climate and energy policies that have been announced at the time of analysis, the NEB expects:

- Brent oil pricing to reach US\$75/bbl in 2022 and then average US\$80/bbl between 2026 and 2040.
- The Canadian price for carbon to be held at \$50/tonne between 2022 and 2040.
- No new oil sands mining projects to be built, and mining production to stay flat at about 1.5 million bbls/d between 2020 and 2040.
- In situ operators to not broadly implement steam/solvent processes.
- In situ oil sands production will increase from 1.4 million bbls/d in

2016 to three million bbls/d in 2040.

- The average in situ steam to oil ratio, a key measure of efficiency, will drop from 3:1 currently to about 2.25:1.
- Oil sands production to increase from 2.5 million bbls/d in 2016 to 4.5 million bbls/d in 2040.

■ With the impending completion of the Fort Hills oil sands mine and the Hebron project offshore Newfoundland and Labrador, Suncor is dropping its 2018 capital program outlook by approximately \$750 million.

Suncor's 2018 capital program is largely focused on sustaining capital, the company says, with major maintenance programs planned in both its oil sands upgrading operations and downstream refineries including a total plant turnaround at the Edmonton refinery.

Including expectations for Fort Hills to reach 90 per cent of capacity in fall 2018, Suncor expects production to increase to between 740,000 and 780,000 bbls/d next year, up from 680,000 to 720,000 bbls/d in 2017. ■

## WHAT'S NEW ENVIRONMENT + TECHNOLOGY

■ The Government of Alberta has announced a new \$1.4-billion investment to reduce emissions from oil and gas and electricity.

The program will provide \$440 million for oil sands innovation, \$225 million for research and development across sectors, \$240 million for industrial energy efficiency projects, \$63 million in grants for bioenergy and \$400 million in loan guarantees to reduce risk for financial institutions.

The investment includes \$80 million to Emissions Reduction Alberta in a continuation of funding for innovation grants and spending \$145 million to create the new Climate Change Innovation and Technology Framework to manage government investments in these projects.

The bulk of the funding comes from levies paid by large Alberta emitters.

■ Suncor has submitted its plan to the Canadian Environmental Assessment Agency to replace coke-fired boilers at its oil sands base plant with two cogeneration units. The units will provide steam for facility operations as well as export capacity of 700 MW to the Alberta grid, or about seven per cent of total capacity.

Suncor said its new project “is expected to offer base-load reliability to Alberta’s electricity grid as the province transitions to more intermittent renewable energy sources, while contributing lower carbon power supply to Alberta.”

Suncor says that a final sanction decision on the new cogen project is expected by the fourth quarter of 2018.

■ MEG Energy is increasing its spending on testing of its eMVAPEX technology in 2018 to \$100 million, up from \$70 million in 2017.

eMVAPEX is a two-step process that initiates with a steam injection mode to raise reservoir temperature to the point



where bitumen is mobilized, followed by solvent injection alone. The goal is to dramatically reduce water use and increase efficiency, lowering costs and greenhouse gas emissions.

To date, MEG says it has implemented the technology on three well pairs and their associated infill wells with encouraging results.

The 2018 capital allows for the conversion to eMVAPEX of up to seven additional well pairs and associated infills, and the construction of a solvent recycling facility to test the commerciality and scalability of the technology.

■ Canadian Natural Resources was in a league of its own among energy sector research and development investors in Canada as the country’s fourth biggest corporate research spender in 2016.

Canadian Natural’s \$558-million spend was close to triple the next largest spender in the energy sector, Suncor, which invested \$200 million, according to Research Infosource.

Imperial Oil was a close third at \$195 million, followed by Cenovus at \$69 million and Syncrude Canada at \$62 million.

■ A technology that uses radio waves to mobilize bitumen has received \$10 million in combined funding from Ottawa and the province of Alberta.

Acceleware, which reported successful completion a 1/20 scale field test of its RF XL technology earlier this year, says it will now proceed with field testing on a commercial scale.

“RF XL efficiently mobilizes heavy oil and bitumen by using radio waves to heat the water already present in the reservoir,” the company says.

“[It] requires no chemicals or solvents, no external water, utilizes a smaller surface footprint, and can reduce GHG [greenhouse gas] emissions by 50–100 per cent compared to SAGD.”

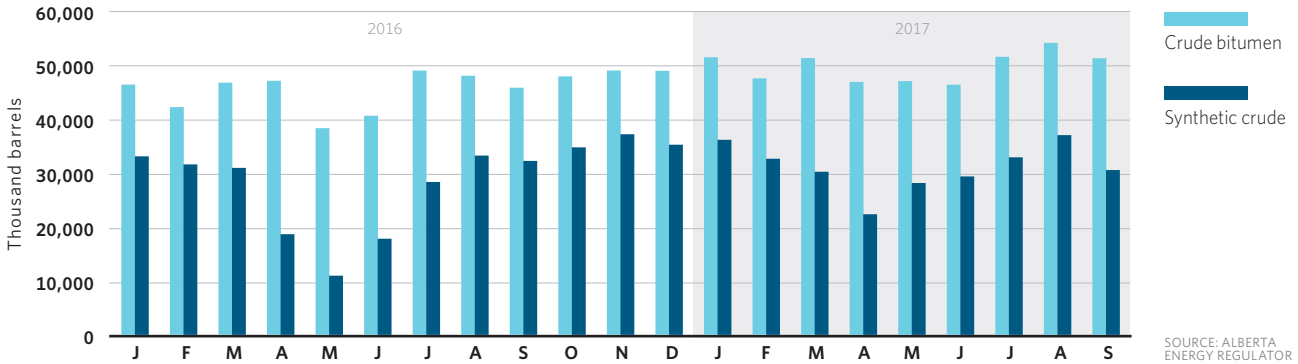
■ Canadian Natural Resources has committed up to \$3.7 million to conduct engineering and design of a commercial installation of Titanium’s technology to reduce methane emissions from oil sands tailings ponds while at the same time recovering bitumen, solvent and high-value heavy minerals.

The proposed project would be located at the Horizon mining and upgrading site, Titanium says. The project, estimated to cost \$10.2 million, has also received support from Emissions Reduction Alberta. ■

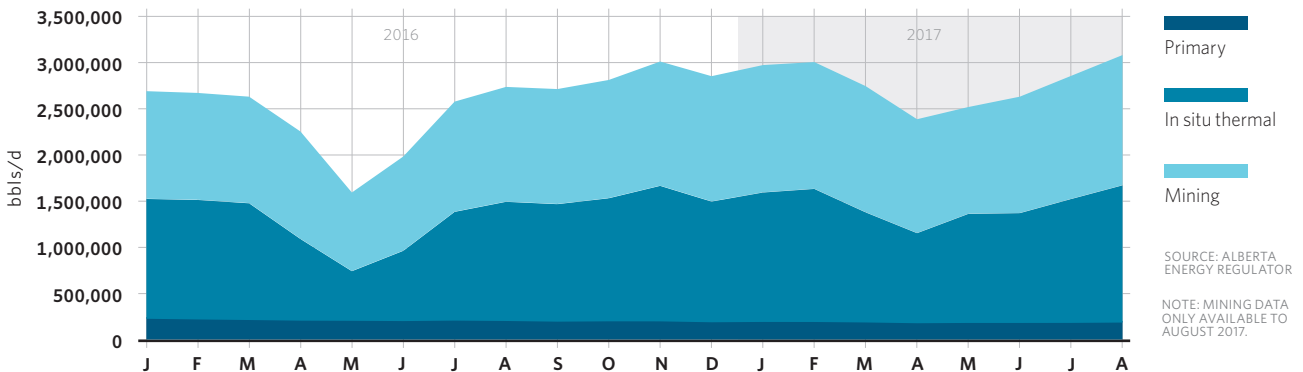


# OIL SANDS DATA

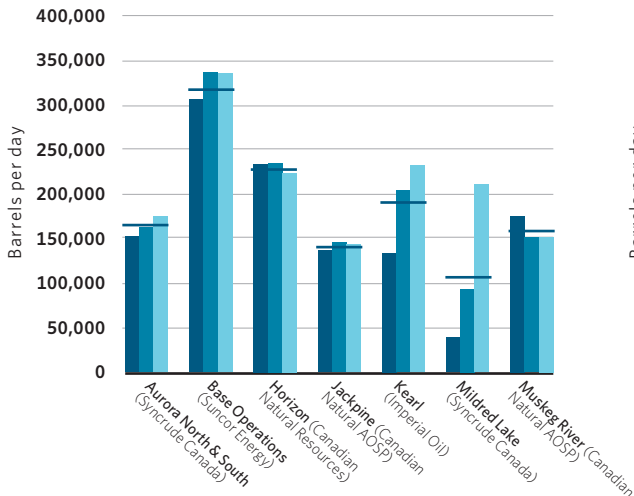
## ALBERTA CRUDE BITUMEN AND SYNTHETIC CRUDE PRODUCTION



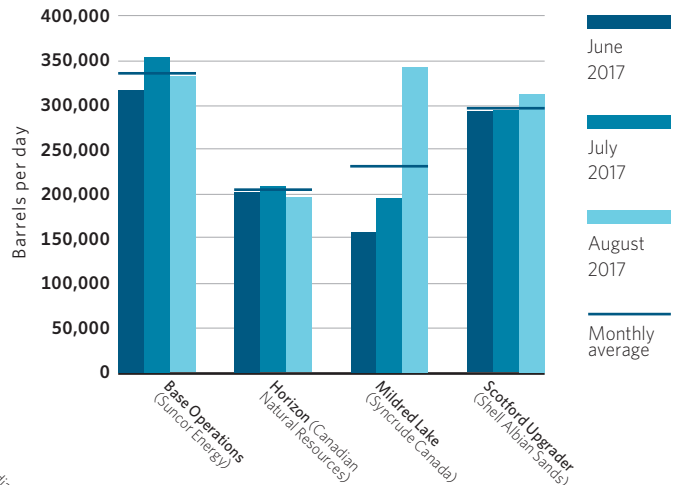
## ALBERTA BITUMEN PRODUCTION BY EXTRACTION TYPE



## OIL SANDS MINING PRODUCTION BY PROJECT



## OIL SANDS UPGRADER PRODUCTION BY PROJECT



## THERMAL OIL SANDS PRODUCTION BY PROJECT JULY 2017 – SEPTEMBER 2017

(Barrels per day)

COMMERCIAL SCHEMES					
COMPANY	PROJECT	JUL	AUG	SEP	MONTHLY AVERAGE
Cenovus Energy Inc.	Christina Lake	205,037.10	206,436.00	212,265.40	207,912.83
Suncor Energy Inc.	Firebag	191,929.80	207,104.60	213,011.40	204,015.27
Imperial Oil Limited	Cold Lake	164,193.60	160,890.80	164,949.70	163,344.70
Cenovus Energy Inc.	Foster Creek	167,644.80	142,010.70	153,385.20	154,346.90
Devon Canada Corporation	Jackfish	75,121.10	126,554.10	127,002.00	109,559.07
ConocoPhillips Canada Limited	Surmont	115,894.20	135,089.40	134,683.10	128,555.57
Canadian Natural Resources Limited	Primrose & Wolf Lake	77,162.80	80,264.30	76,569.60	77,998.90
MEG Energy Corp.	Christina Lake	78,150.90	79,784.40	79,854.20	79,263.17
CNOOC Limited	Long Lake	43,082.70	42,618.50	41,930.40	42,543.87
Husky Energy Inc.	Sunrise	40,734.70	39,674.20	40,812.70	40,407.20
Canadian Natural Resources Limited	Kirby South	36,684.70	37,984.80	36,404.80	37,024.77
Suncor Energy Inc.	Mackay River	36,201.00	36,591.60	16,662.30	29,818.30
Husky Energy Inc.	Tucker	16,500.70	23,276.70	23,772.30	21,183.23
Athabasca Oil Corporation	Leismer Demonstration	19,775.20	18,698.30	20,050.70	19,508.07
Pengrowth Energy Corporation	Lindbergh	13,569.00	14,048.30	8,618.30	12,078.53
Connacher Oil and Gas Limited	Great Divide	12,611.70	12,952.00	12,867.10	12,810.27
Athabasca Oil Corporation	Hangingstone	8,223.30	8,672.40	9,396.30	8,764.00
OSUM Oil Sands Corp.	Orion	7,543.40	8,106.30	8,194.40	7,948.03
Canadian Natural Resources Limited	Peace River/Carmon Creek	5,191.00	4,363.20	4,331.20	4,628.47
Brion Energy Corporation	Mackay River	5,068.30	6,893.00	7,822.00	6,594.43
Japan Canada Oil Sands Limited	Hangingstone	891.9	1,940.40	4,627.40	2,486.57
Sunshine Oilsands Ltd.	West Ells	1,302.00	1,712.70	2,284.50	1,766.40
BlackPearl Resources Inc.	Blackrod	464.2	505.7	501.9	490.60
Canadian Natural Resources Limited	Peace River	51.6	31.4	40.9	41.30
<b>Total Commercial</b>		<b>1,323,029.7</b>	<b>1,396,203.8</b>	<b>1,400,037.8</b>	<b>1,373,090.433</b>

SOURCE: AER (ALBERTA ENERGY REGULATOR)

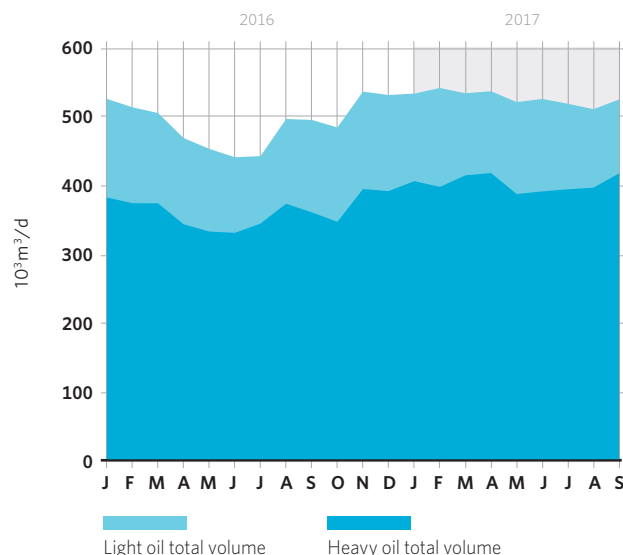
## CRUDE OIL PRICE DIFFERENTIAL (WTI-WCS)

Recorded until Dec. 4, 2017



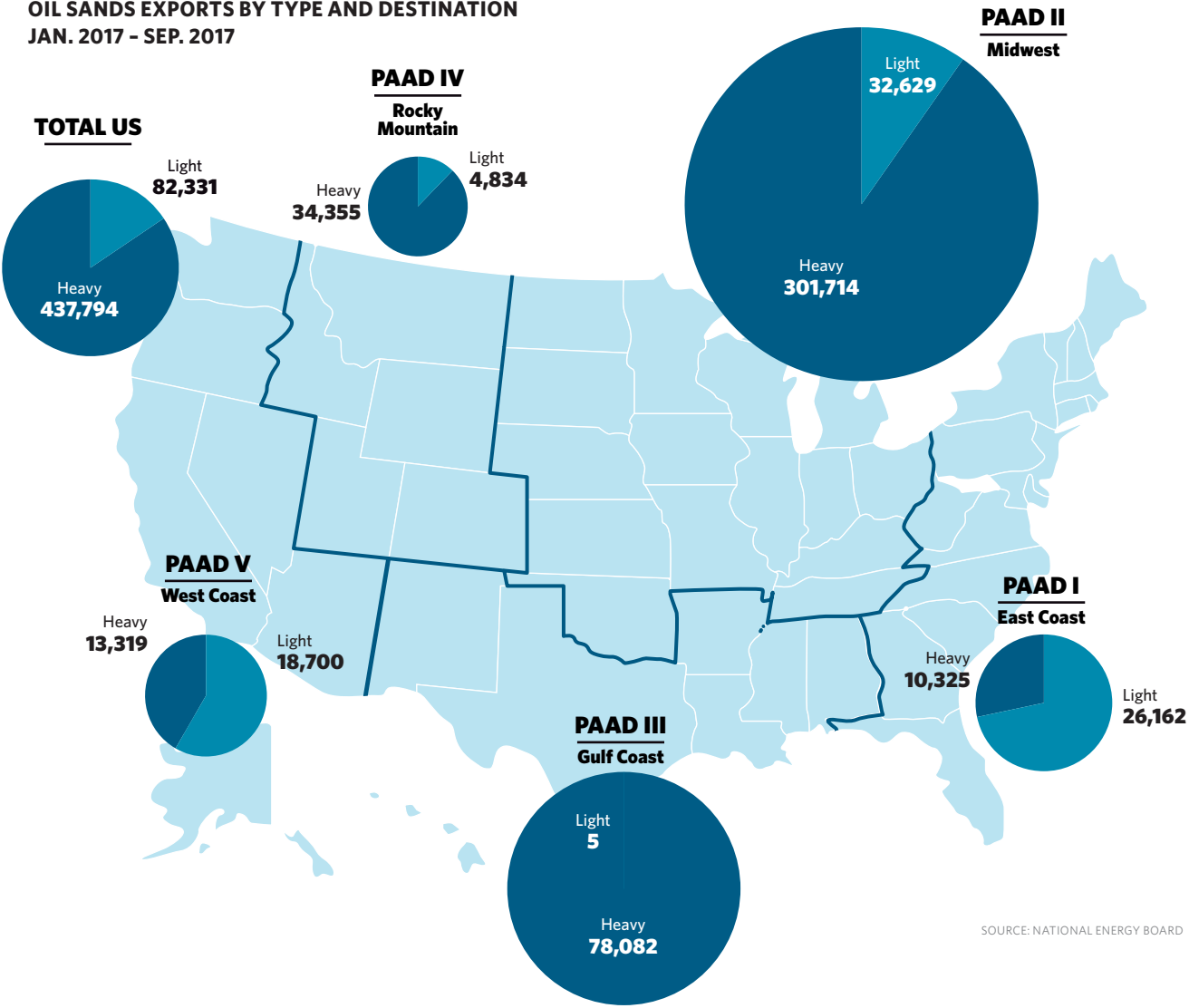
SOURCE: DAILY OIL BULLETIN

## CANADIAN CRUDE OIL EXPORTS

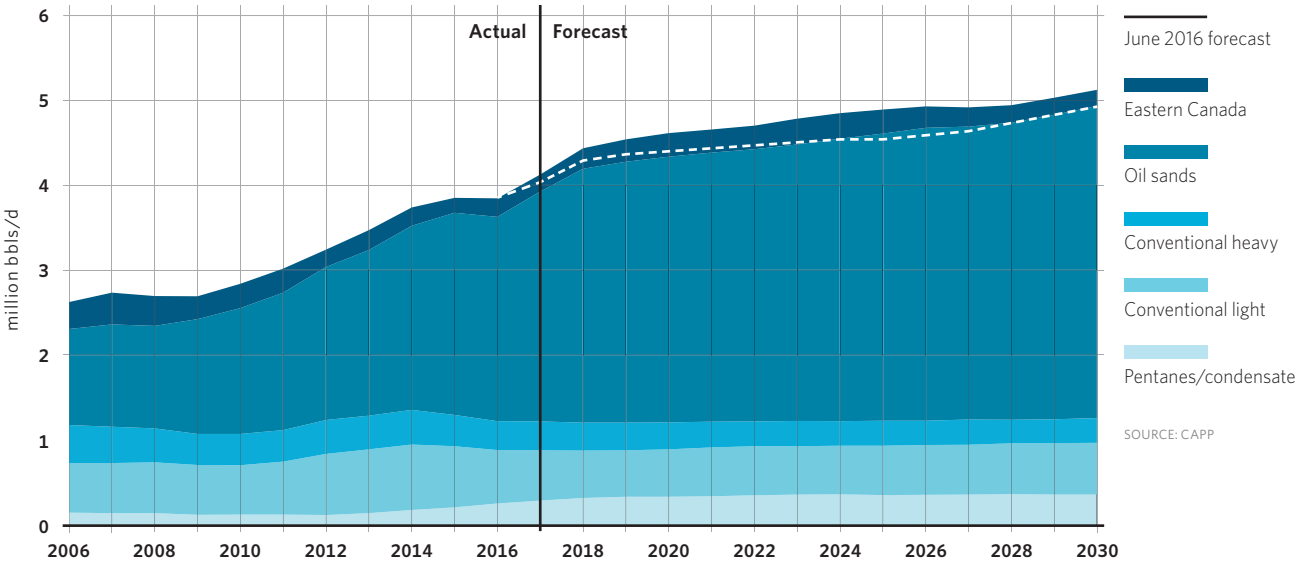


SOURCE: NATIONAL ENERGY BOARD

**OIL SANDS EXPORTS BY TYPE AND DESTINATION**  
**JAN. 2017 – SEP. 2017**



**CANADIAN OIL SANDS & CONVENTIONAL PRODUCTION**





# GLOSSARY OF OIL SANDS TERMS

## A

### **ASPHALTENES**

The heaviest and most concentrated aromatic hydrocarbon fractions of bitumen.

## B

### **BARREL**

The traditional measurement for crude oil volumes. One barrel equals 42 U.S. gallons or 159 litres. There are 6.29 barrels in one cubic metre of oil.

### **BITUMEN**

Naturally occurring, viscous mixture of hydrocarbons that contains high levels of sulphur and nitrogen compounds. In its natural state, it is not recoverable at a commercial rate through a well because it is too thick to flow. Bitumen typically makes up about 10 per cent by weight of oil sand, but saturation varies.

## C

### **COGENERATION**

The simultaneous production of electricity and steam, which is part of the operations of many oil sands projects.

### **COKING**

An upgrading/refining process used to convert the heaviest fraction of bitumen into lighter hydrocarbons by rejecting carbon as coke. Coking can be either delayed coking (semi-batch) or fluid coking (continuous).

### **CONDENSATE**

Mixture of extremely light hydrocarbons recoverable from gas reservoirs. Condensate is also referred to as a natural gas liquid and is used as a diluent to reduce bitumen viscosity for pipeline transportation.

### **CONVENTIONAL CRUDE OIL**

Mixture of mainly pentane and heavier hydrocarbons recoverable at a well from an underground reservoir and liquid at atmospheric pressure and temperature. Unlike bitumen, it flows through a well without stimulation and through a pipeline without processing or dilution.

### **CRACKING**

An upgrading/refining process for converting large, heavy molecules into smaller ones. Cracking processes include fluid cracking and hydrocracking.

### **CYCLIC STEAM STIMULATION (CSS)**

An in situ production method incorporating cycles of steam injection, steam soaking and oil production. The steam reduces the viscosity of the bitumen and allows it to flow to the production well.

## D

### **DENSITY**

The heaviness of crude oil, indicating the proportion of large, carbon-rich molecules, generally measured in kilograms per cubic metre ( $\text{kg/m}^3$ ) or degrees on the American Petroleum Institute (API) gravity scale. In western Canada, oil up to  $900 \text{ kg/m}^3$  is considered light-to-medium crude; oil above this density is deemed as heavy oil or bitumen.

### **DILBIT**

Bitumen that has been reduced in viscosity through the addition of a diluent such as condensate or naphtha.

### **DILUENT**

A light hydrocarbon blended with bitumen to enable pipeline transport. See Condensate.

## E

### **EXTRACTION**

A process unique to the oil sands industry that separates the bitumen from the oil sand using hot water, steam and caustic soda.

## F

### **FROTH TREATMENT**

The means to recover bitumen from the mixture of water, bitumen and solids “froth” produced in hot-water extraction (in mining-based recovery).

## G

### **GASIFICATION**

A process to partially oxidize any hydrocarbon, typically heavy residues, to a mixture of hydrogen and carbon monoxide. Can be used to produce hydrogen and various energy by-products.

### **GROUNDWATER**

Water accumulations below the Earth's surface that supply fresh water to wells and springs.

## H

### **HEAVY CRUDE OIL**

Oil with a gravity below 22 degrees API. Heavy crudes must be blended or mixed with condensate to be shipped by pipeline.

### **HYDROCRACKING**

Refining process for reducing heavy hydrocarbons into lighter fractions using hydrogen and a catalyst; can also be used in upgrading bitumen.

### **HYDROTRANSPORT**

A slurry process that transports water and oil sand through a pipeline to primary separation vessels located in an extraction plant.

### **HYDROTREATER**

An upgrading/refining process unit that reduces sulphur and nitrogen levels in crude oil fractions by catalytic addition of hydrogen.

## I

### **IN SITU**

A Latin phrase meaning “in its original place.” In situ recovery refers to various drilling-based methods used to recover deeply buried bitumen deposits.

## **IN SITU COMBUSTION**

An enhanced oil recovery method that works by generating combustion gases (primarily CO and CO<sub>2</sub>) downhole, which then push the oil toward the recovery well.

## **L**

### **LEASE**

A legal document from the province of Alberta giving an operator the right to extract bitumen from the oil sand existing within the specified lease area. The land must be reclaimed and returned to the Crown at the end of operations.

### **LIGHT CRUDE OIL**

Liquid petroleum with a gravity of 28 degrees API or higher. A high-quality light crude oil might have a gravity of about 40 degrees API. Upgraded crude oils from the oil sands run around 30–33 degrees API (compared to 32–34 for Light Arab and 37–40 for West Texas Intermediate).

## **M**

### **MATURE FINE TAILINGS**

A gel-like material resulting from the processing of clay fines contained within the oil sands.

## **O**

### **OIL SANDS**

Bitumen-soaked sand deposits located in three geographic regions of Alberta: Athabasca, Cold Lake and Peace River. The Athabasca deposit is the largest, encompassing more than 42,340 square kilometres. Total in-place deposits of bitumen in Alberta are estimated at 1.7 trillion to 2.5 trillion barrels.

### **OVERBURDEN**

A layer of sand, gravel and shale between the surface and the underlying oil sand in the mineable oil sands region that must be removed before oil sands can be mined.

## **P**

### **PERMEABILITY**

The capacity of a substance, such as rock, to transmit a fluid, such as crude oil, natural gas or water. The degree of permeability depends on the number, size and shape of the pores and/or fractures in the rock and their interconnections. It is measured by the time it takes a fluid of standard viscosity to move a given distance. The unit of permeability is the Darcy.

### **PETROLEUM COKE**

Solid, black hydrocarbon that is left as a residue after the more valuable hydrocarbons have been removed from the bitumen by heating the bitumen to high temperatures.

### **PRIMARY PRODUCTION**

An in situ recovery method that uses natural reservoir energy (such as gas drive, water drive and gravity drainage) to displace hydrocarbons from the reservoir into the wellbore and up to the surface. Primary production uses an artificial lift system in order to reduce the bottomhole pressure or increase the differential pressure to sustain hydrocarbon recovery, since reservoir pressure decreases with production.

## **R**

### **RECLAMATION**

Returning disturbed land to a stable, biologically productive state. Reclaimed property is returned to the province of Alberta at the end of operations.

## **S**

### **STEAM ASSISTED GRAVITY DRAINAGE (SAGD)**

An in situ production process using two closely spaced horizontal wells: one for steam injection and the other for production of the bitumen/water emulsion.

## **SURFACE MINING**

Operations to recover oil sands by open-pit mining using trucks and shovels. Less than 20 per cent of Alberta's oil sands resources are located close enough to the surface (within 75 metres) for mining to be economic.

### **SYNTHETIC CRUDE OIL**

A manufactured crude oil comprised of naphtha, distillate and gas oil-boiling range material. Can range from high-quality, light, sweet bottomless crude to heavy, sour blends.

## **T**

### **TAILINGS**

A combination of water, sand, silt and fine clay particles that is a byproduct of removing the bitumen from the oil sand through the extraction process.

### **TAILINGS SETTLING BASIN**

The primary purpose of the tailings settling basin is to serve as a process vessel, allowing time for tailings water to clarify and silt and clay particles to settle so that the water can be reused in extraction. The settling basin also acts as a thickener, preparing mature fine tails for final reclamation.

### **THERMAL RECOVERY**

Any in situ process where heat energy (generally steam) is used to reduce the viscosity of bitumen to facilitate recovery.

## **U**

### **UPGRADING**

The process of converting heavy oil or bitumen into synthetic crude either through the removal of carbon (coking) or the addition of hydrogen (hydroconversion).

## **V**

### **VISCOSITY**

The ability of a liquid to flow. The lower the viscosity, the more easily the liquid will flow.



## Capital Investment Tax Credit (CITC)

Are you an Alberta-based business conducting manufacturing, processing or tourism infrastructure activities? Are you looking to make an investment of at least \$1 million in value?

If so, you can apply for a 10 per cent tax credit on eligible capital expenditures, up to a maximum of \$5 million.

For more information on how and when to apply for the CITC, visit: [jobsplan.alberta.ca](http://jobsplan.alberta.ca) or email [citc.program@gov.ab.ca](mailto:citc.program@gov.ab.ca)

We listened to business leaders' ideas to create the Alberta Jobs Plan. This included implementing new tax credits, providing training for aspiring entrepreneurs, adding supports for established ones, increasing access to capital and cutting the small business tax.

Together, we are creating new jobs, diversifying Alberta's economy and making the lives of Albertans better.



# OIL SANDS CONTACTS

## OIL SANDS PRODUCERS

Athabasca Oil [www.atha.com](http://www.atha.com)  
Baytex Energy [www.baytex.ab.ca](http://www.baytex.ab.ca)  
BlackPearl Resources [www.blackpearlresources.ca](http://www.blackpearlresources.ca)  
Brion Energy [www.brionenergy.com](http://www.brionenergy.com)  
Canadian Natural Resources [www.cnrl.com](http://www.cnrl.com)  
Cenovus Energy [www.cenovus.com](http://www.cenovus.com)  
Chevron Canada [www.chevron.ca](http://www.chevron.ca)  
CNOOC [www.cnoocld.com](http://www.cnoocld.com)  
Connacher Oil and Gas [www.connacheroil.com](http://www.connacheroil.com)  
ConocoPhillips Canada [www.conocophillips.ca](http://www.conocophillips.ca)  
Devon Canada [www.dvn.com](http://www.dvn.com)  
Enerplus Resources Fund [www.enerplus.com](http://www.enerplus.com)  
E-T Energy [www.e-tenergy.com](http://www.e-tenergy.com)  
Grizzly Oil Sands [www.grizzlyoilsands.com](http://www.grizzlyoilsands.com)  
Harvest Operations [www.harvestenergy.ca](http://www.harvestenergy.ca)  
Husky Energy [www.huskyenergy.ca](http://www.huskyenergy.ca)  
Imperial Oil [www.imperialoil.ca](http://www.imperialoil.ca)  
Japan Canada Oil Sands [www.jacos.com](http://www.jacos.com)  
Koch Exploration Canada [www.kochexploration.ca](http://www.kochexploration.ca)  
Korea National Oil [www.knoc.co.kr](http://www.knoc.co.kr)  
Laricina Energy [www.laricinaenergy.com](http://www.laricinaenergy.com)  
Marathon Oil [www.marathon.com](http://www.marathon.com)  
MEG Energy [www.megenergy.com](http://www.megenergy.com)  
Nexen [www.nexeninc.com](http://www.nexeninc.com)  
North West Upgrading [www.northwestupgrading.com](http://www.northwestupgrading.com)  
Nsolv [www.nsolv.ca](http://www.nsolv.ca)  
Oak Point Energy [www.oakpointenergy.ca](http://www.oakpointenergy.ca)  
Occidental Petroleum [www.oxy.com](http://www.oxy.com)  
Osum Oil Sands [www.osumcorp.com](http://www.osumcorp.com)  
Pan Orient Energy [www.panorient.ca](http://www.panorient.ca)  
Paramount Resources [www.paramountres.com](http://www.paramountres.com)  
Pengrowth Energy [www.pengrowth.com](http://www.pengrowth.com)  
PetroChina [www.petrochina.com.cn/ptr](http://www.petrochina.com.cn/ptr)  
PTT Exploration and Production [www.pttep.com](http://www.pttep.com)  
Sinopec [www.sinopecgroup.com/group/en](http://www.sinopecgroup.com/group/en)  
Statoil Canada [www.statoil.com](http://www.statoil.com)  
Suncor Energy [www.suncor.com](http://www.suncor.com)  
Sunshine Oilsands [www.sunshineoilsands.com](http://www.sunshineoilsands.com)  
Syncrude [www.syncrude.ca](http://www.syncrude.ca)  
Teck Resources [www.teck.com](http://www.teck.com)  
Total E&P Canada [www.total-ep-canada.com](http://www.total-ep-canada.com)  
Touchstone Exploration [www.touchstoneexploration.com](http://www.touchstoneexploration.com)  
Value Creation Group [www.vctek.com](http://www.vctek.com)



## ASSOCIATIONS/ORGANIZATIONS

Alberta Chamber of Resources [www.acr-alberta.com](http://www.acr-alberta.com)  
Alberta Chambers of Commerce [www.abchamber.ca](http://www.abchamber.ca)  
Alberta Energy [www.energy.gov.ab.ca](http://www.energy.gov.ab.ca)  
Alberta Energy Regulator [www.aer.ca](http://www.aer.ca)  
Alberta Environment and Parks [www.aep.alberta.ca](http://www.aep.alberta.ca)  
Alberta Innovates [www.albertainnovates.ca](http://www.albertainnovates.ca)  
Alberta Innovation and Advanced Education [www.eae.alberta.ca](http://www.eae.alberta.ca)  
Alberta's Industrial Heartland Association [www.industrialheartland.com](http://www.industrialheartland.com)  
Building Trades of Alberta [www.bta.ca](http://www.bta.ca)  
Canada's Oil Sands Innovation Alliance [www.cosia.ca](http://www.cosia.ca)  
Canadian Association of Geophysical Contractors [www.cagc.ca](http://www.cagc.ca)  
Canadian Association of Petroleum Producers [www.capp.ca](http://www.capp.ca)  
Canadian Heavy Oil Association [www.choa.ab.ca](http://www.choa.ab.ca)  
In Situ Oil Sands Alliance [www.iosa.ca](http://www.iosa.ca)  
Lakeland Industry & Community Association [www.lica.ca](http://www.lica.ca)  
Natural Resources Conservation Board [www.nrcb.ca](http://www.nrcb.ca)  
Oil Sands Community Alliance [www.oscaalberta.ca](http://www.oscaalberta.ca)  
Oil Sands Secretariat [www.energy.alberta.ca](http://www.energy.alberta.ca)  
Petroleum Technology Alliance Canada [www.ptac.org](http://www.ptac.org)

**FOR MORE INFORMATION, PLEASE VISIT US AT**  
**[www.albertacanada.com](http://www.albertacanada.com)**



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[www.albertacanada.com/business/statistics/oil-sands-quarterly.aspx](http://www.albertacanada.com/business/statistics/oil-sands-quarterly.aspx)