

# ALBERTA OIL SANDS INDUSTRY

## QUARTERLY UPDATE



### SUMMER 2018

Reporting period:  
MAR. 16, 2018  
TO JUN. 21, 2018

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# MARKET UPDATE

## ALBERTA BACKSTOPS FEDERAL PURCHASE OF TRANS MOUNTAIN PIPELINE EXPANSION

Construction of the Trans Mountain Pipeline expansion is set to resume this summer after the Government of Canada completes its \$4.5-billion purchase of the asset, and the existing pipeline. Ottawa will also cover the costs of the \$7.4 billion expansion project.

The transaction, announced on May 29, is supported by a \$2 billion backstop from the Government of Alberta.

It's the only way to ensure the halted project gets built, according to Canadian finance minister Bill Morneau.

"When we are faced with an exceptional situation that puts jobs at risk, that puts our international reputation on the line, our government is prepared to take action," Morneau told reporters.

Kinder Morgan halted the 590,000-bbl/d project to connect Alberta crude to tidewater markets in April due to permitting delays and political opposition in British Columbia. The company set a May 31 deadline to decide if it would proceed with the expanded line.

### **ALBERTA'S BACKSTOP**

Instrumental to the continued construction and completion of the project is backstop funding from the Government of Alberta.

Under the agreement, Alberta commits to provide a backstop to the Government of Canada to help cover costs arising from unforeseen circumstances. If Alberta's backstop is ultimately required, it would share eligible costs with Canada, up to a maximum contribution of \$2 billion. Alberta's contribution would be payable to Canada only upon successful completion of the project. In exchange for its contribution, Alberta would receive equity in the completed project commensurate with its contribution.

Alberta Treasury Board and Finance estimates that a lack of market access for oil products costs Alberta \$6.5 million per day in government revenue.

### **DEALING WITH PIPELINE OPPOSITION**

As a private company, Kinder Morgan does not have the authority to overrule a hostile provincial government – but Ottawa does. B.C. Premier John Horgan has even conceded it will be easier for him to deal with Ottawa, rather than with Kinder Morgan, when addressing provincial concerns over the pipeline.

"I do believe that the federal government now is totally accountable, not just for regulation and approval of a pipeline, but they now are responsible from well-head to tidewater and beyond, and I think that allows me to have more candid discussions with the owners of the pipeline than I would have been able to when they were shareholders in a Texas-based oil company," Horgan said. "The federal government now is completely accountable, and I think that is probably at the end of the day a good thing."

As for protesters, some of whom have shown up at Kinder Morgan shareholder meetings, their adversary is no longer a big Texas pipeline company, but their own federal government.

### **OTTAWA DOES NOT PLAN LONG-TERM OWNERSHIP**

The federal government has made it clear that it does not intend to be the long-term owner of the Trans Mountain Pipeline system.

"Our goal, of course, is to be involved only in as much as we de-risk this project. We don't think that long term the federal government should be involved in

commercial activity," Morneau said.

As part of the sale agreement, Kinder Morgan has agreed to work with the federal government to seek a third party buyer through July 22, 2018.

It could end up with another midstream company, or a joint venture that might include pension funds, First Nations, and oil producers that would use the new pipeline. Kinder Morgan itself could even end up being one of the shareholders.

"I would not be surprised if it's the same group, reconstituted with some sort of ownership structure change," Jihad Traya, an analyst for Solomon Associates, told Business in Vancouver. "Theoretically you can still have Kinder Morgan having portions of it."

The Cheam First Nation is one Indigenous group that is interested in taking a stake. Chief Ernie Crey said one way of gaining equity is through the federal government's reconciliation efforts.

"Definitely I see an open door to the possibility of taking out an equity position in the pipeline as part of what I would describe as economic reconciliation with Canada," Crey said. "But for sure we would have to go to large lenders and borrow funds to take out a stake in the pipeline."

If Ottawa can't find a buyer, Canadian taxpayers will be stuck with a highly profitable pipeline.

The existing Trans Mountain pipeline made \$300 million in revenue last year, with a 9.5% return on equity, according to University of Calgary economics Prof. Trevor Tombe.

But Morneau has made it clear his government has no desire to be a long-term pipeline owner.

Tombe doesn't think Canada will find a buyer until after the twinning project is complete, however.



SOURCE: KINDER MORGAN CANADA

"The tricky part is getting it completed," he said. "But once it's complete, it's a very valuable asset."

As Tombe points out, pipelines receive stable revenues from petroleum producers, regardless of where oil prices go, so they are reliable money-makers.

"Once it's built, they'll easily be able to offload the asset to a private buyer," he said.

Traya agrees: "Bluntly, this is a great asset. It's a very profitable, very strategic asset."

Existing profit sharing or other agreements established by Kinder Morgan and Indigenous groups will be maintained under this new arrangement.

## DEAL VALUE

The federal political opposition has raised concerns about the \$4.5-billion payment, stating that it is approximately \$2 billion more than the company itself estimated the existing Trans Mountain Pipeline to be worth.

Reading of financial documents for both Kinder Morgan and Kinder Morgan Canada suggests the figure to be right on the money in terms of its actual value.

According to its most recent interim financial statements, Kinder Morgan Canada puts its assets at \$4.6 billion.

Canoe Financial puts Kinder Morgan Canada's market value at \$6 billion. That would include both the value of hard

assets, plus the value the market places on the company, which is reflected in things like share value, market capitalization and optionality.

Kinder Morgan Canada's assets include the existing Kinder Morgan pipeline, Westridge Marine Terminal, jet fuel pipeline, Puget Sound pipeline, a bulk commodities terminal in North Vancouver, the Canadian portion of the Cochin pipeline, and rail and storage facilities in Edmonton.

But Ottawa is not buying the non-pipeline assets, so they must be subtracted from the value calculation.

Kinder Morgan doesn't break down the value of individual assets, so it's hard to say just how much those non-pipeline assets are worth. But even if you subtracted \$1 billion, you have to add the \$1.1 billion that is included in the sale price for the money already spent on the expansion project, which gets you back in the \$4.5 billion range.

## OUTSTANDING COURT CASES

What cases are still before the courts that could jeopardize the project?

None, according to Robin Junger, a lawyer specializing in Aboriginal and environmental law with McMillan LLP.

More than a dozen court challenges against the Trans Mountain pipeline project have failed. Cases still in play include the B.C. government's referral to the BC Court of Appeal to clarify whether it has

the authority to restrict the flow of diluted bitumen from Alberta through B.C.

The best the province can hope for is acknowledgment that it has the legal authority to impose some conditions on the pipeline under provincial environmental laws, Junger said.

"There is no scenario in which the BC Court of Appeal says you can stop this pipeline," Junger said. "The only question is this: 'If you have the ability to regulate bitumen at all ... how far can you go without stopping it?'"

Another important case is still before the Federal Court of Appeal, with a ruling expected any day. In that case, five First Nations argued Canada failed to properly consult Aboriginal stakeholders.

It is essentially the same argument made against the Northern Gateway project. In that case, the same court ruled Canada had failed to properly consult, essentially ordering the government to redo its consultations. That never happened, however, because the new Trudeau government put an end to the Northern Gateway project.

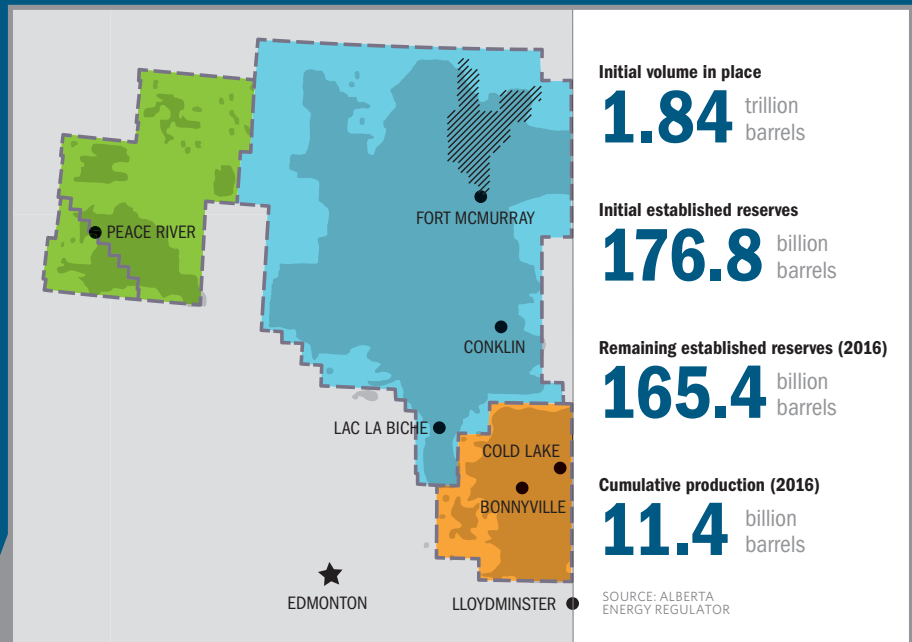
The worst that could happen is additional delays to the project – delays the federal government is now prepared to indemnify.

"If you lose a duty-to-consult case, it's not the end of the world for a project," Junger said. "You go and consult some more and then you redo the decision." ■



# 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.





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# RESOURCE + TECHNOLOGY SPOTLIGHT

## BITUMEN PARTIAL UPGRADING

Alberta commits up to \$1 billion  
to accelerate commercialization

### BACKGROUND

The Province of Alberta has committed up to \$1 billion to accelerate commercialization of technology that is expected to increase potential markets for Alberta crude, free up pipeline capacity, improve pricing and reduce greenhouse gas emissions.

That package of potential is attributed to a suite of technologies known as bitumen partial upgrading. There are currently at least 10 of these systems at various stages of development in Alberta, but none have reached commercial scale. It is estimated that it would take approximately \$300 million to move one of these technologies through to commercialization.

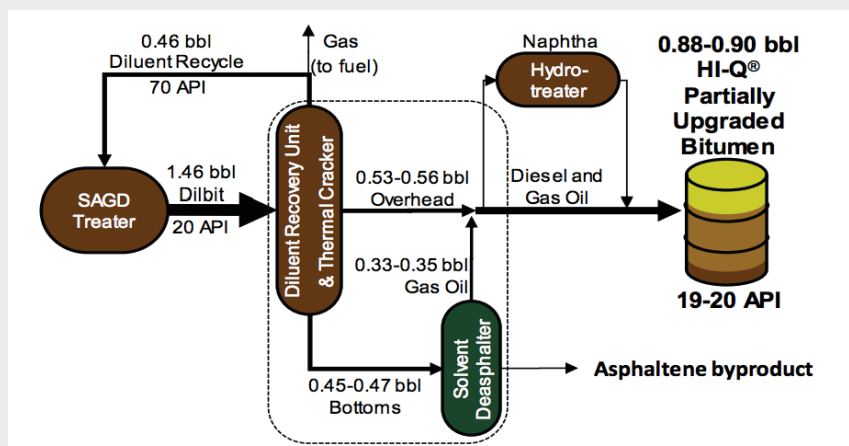
Alberta expects that its funding will leverage construction of two to five partial upgrading facilities representing up to \$5 billion in private investment.

Applications to participate in the program are due on September 4, with a decision on successful applicants expected by year-end.

This funding follows passing of the The Energy Diversification Act, which also commits \$500 million in funding for a second round of the Petrochemicals Diversification Program and \$500 million for the Petrochemicals Infrastructure Program. For more information please see Alberta's Oil and Gas Industry Quarterly Update.

Here's a look at a selection of partial upgrading technologies under development.

**BLOCK-FLOW DIAGRAM OF THE MEG HI-Q PROCESS**



SOURCE: MEG ENERGY

### FIELD UPGRADING: DESULPHURIZATION AND UPGRADING

Field Upgrading currently operates a 2,500-bbl/d field pilot near Edmonton of its Desulphurization and Upgrading (DSU) process for sour heavy sulphur removal and upgrading.

The process is designed to convert "bottom-of-the-barrel" material from refineries to lower-sulphur fuel for ships. Field Upgrading hopes to capitalize on the expected rise in demand for low-sulphur bunker fuel after the new International Maritime Organization standard for reduced sulphur content in marine fuel takes effect on Jan. 1, 2020.

According to the company, DSU occurs in three general steps:

1. Sodium, along with small quantities of hydrogen, is mixed with sour bitumen feeds to break down the molecule by precipitating metals and preferentially seeking out and removing sulphur and nitrogen as salts.
2. Hydrogen attaches to the open ends of molecules that were exposed after removing the sulphur and metals to prevent formation of cyclic hydrocarbons and olefins.
3. Sodium is recovered using a patented

ceramic transport membrane reactor developed by Ceramatec.

In April 2018 Field Upgrading received \$10 million in funding from the Province of Alberta to advance its technology testing.

### MEG ENERGY: HI-Q

Since 2003, in situ oil sands producer MEG Energy has been developing Hi-Q, which it calls a "low-intensity, low-cost field-deployable heavy crude quality improvement process." It is described as "mild thermal cracking with advanced solvent deasphalting," which extracts asphaltenes and resins. Hi-Q is a three-step process:

1. Diluent that was added to bitumen for field treating and initial pipeline shipping is removed and recycled back to the SAGD production facilities for re-use.
  2. Some of the lighter portion of the bitumen is separated from the heavier portion of the bitumen.
  3. Asphaltenes are removed.
- After the successful operation of a small-scale research project, MEG has proposed a 3,000-bbl/d commercial demonstration plant north of Edmonton.

BASE TECHNOLOGY	PARTIAL UPGRADING TECHNOLOGY	COMPANY	VOLUME YIELD (%)	NELSON COMPLEXITY	API GRAVITY	DILUENT ADDITION
Delayed coking (benchmark)			70-82%	7-8	19	no
Carbon reduction	Hi-Q	MEG Energy	88-90%	4-5	19	no
Carbon reduction	HTL	Ivanhoe Energy (now FluidOil)	89%	6.5-7.5	19	no
Carbon reduction	WRITE process	Wyoming University	97%	3.5-4.5	19	yes
Carbon reduction	VCI ADC	Value Creation Inc.	78%	4-5	19	no
Hydrogen addition- carbon rejection	SCW	JGC Corporation	75%	4-5	19	no
Hydrogen addition- carbon rejection	DSU	Field Upgrading	95%	6-7	19	yes
Hydrogen addition- carbon rejection	ETX IYQ	ETX Systems	84-90%	7-8	23	no
Hydrogen addition	FT-crude	Expander Energy	121-123%	13-15	22-24	no
Hydrogen addition	HCAAT	Headwaters Inc.	95-103%	9-10	22	no
Hydrogen addition	ENI EST	Eni	100%	9.5-10.5	25-27	no

SOURCE: PARTIAL UPGRADING: BACKGROUND REVIEW IN SUPPORT OF NATIONAL PARTIAL UPGRADING PROGRAM, OCTOBER 2015

### **FLUIDOIL: VISCOSITOR HEAVY TO LIGHT**

FluidOil acquired Ivanhoe Energy in 2016 and combined its Heavy to Light (HTL) partial upgrading technology with its own Viscositor system.

Viscositor Heavy-To-Light (VHTL) involves rapid thermal conversion of heavy oil into higher value partially upgraded synthetic crude. The company says the technology positions the heavy oil producer to capture the majority of the market value differential between heavy and light oil and eliminates the need for adding diluent to enable transportation.

"In addition, by-products from VHTL are used to produce significant amounts of energy that is captured and utilized on-site," FluidOil says.

FluidOil says it successfully tested the combined technology on its V25 Pilot plant in Coryton, London. In April 2018 the company formed a new joint venture to advance the commercialization of the technology in Mexico.

### **FRACTAL SYSTEMS: JET-SHEAR**

Fractal Systems says the objective of its Jet-Shear technology is to change or modify the structure of bitumen and heavy oil to reduce viscosity and improve its value with almost 100 percent volumetric yield.

Jet-Shear uses low severity, hydrodynamic cavitation and mild thermal cracking to structurally modify asphaltene molecules by separating resin groups attached to the asphaltene core, the company says.

"The rapid change in pressure allows microbubbles to form around nucleation sites. Kinetic energy from cavitation converts to chemical energy and modifies heavy oil microstructures and the state of aggregation. The resulting de-structuring lowers viscosity and bulk density with essentially no change in the volumetric yield."

Fractal Systems sold a 1,000-bbl/d pilot project near Provost, Alta. to Cenovus Energy in August 2017. Cenovus then applied to the Alberta Energy Regulator to have the facility license extended to March 2020.

### **SHERITT INTERNATIONAL: HYDROMETALLURGICAL PROCESS**

Nickel producer Sherritt International announced in May that its Alberta-based Technologies division had successfully completed a pilot-scale demonstration of a proprietary process to upgrade bitumen and eliminate the need for addition of diluent.

The process is based on experience developing hydrometallurgical processes, the use of autoclaves, and stems from research previously conducted in the area of coal liquefaction. Sherritt says its process is based on the use of reactor technology that involves combining hydrogen with bitumen under pressure at high temperature in the presence of a proprietary catalyst suspended through mechanical agitation.

Sherritt's process was first tested in 2015 to upgrade Cuban heavy oil. More recently, the company says it successfully completed test work on several bitumen products from Alberta at its technology facility in Alberta's Industrial Heartland. ■



## REGULATORY UPDATE

### Industry praises Alberta Energy Regulator's new Integrated Decision Approach

Suncor Energy Inc.'s latest application for oil sands growth is being reviewed under a new regulatory approach that has previously delivered reduced costs and improved return on investment.

The company filed its proposed 160,000 bbl/d Lewis SAGD project in February under the Alberta Energy Regulator's (AER) new Integrated Decision Approach (IDA). It's Suncor's third oil sands project to be reviewed under IDA, a process which spokeswoman Erin Rees said will enable the company to obtain "significant lifecycle regulatory efficiencies and flexibility."

"This process has the benefits of up-front approval for all project components, reduced regulatory burden for stakeholders and the company and reduced risk of regulatory delays," Rees said.

"Suncor was fortunate to have Meadow Creek East successfully chosen to pilot this new process in 2016 as an industry leader. We also submitted Meadow Creek West under the IDA in 2017 and Lewis in early 2018."

An IDA includes "all elements that will be needed to complete an energy development—from start to finish, including all construction plans and details about how the development will operate and how the operator plans to eventually close down the development and reclaim the land; and be for a broad range of activities, from a single well to a pipeline, a facility, or a larger, more complex project," according to the AER.

This steps away from the previous approach of reviewing project components as separate items. The system has been in development since 2014 and is in the early stages of implementation. While the IDA is not mandatory, as of March 2018 companies are encouraged to submit applications for all activities of a major project as a single, integrated application.



The Canadian Association of Petroleum Producers (CAPP) has praised the approach, citing it as having delivered positive results in a recent report on competitiveness of Canadian projects.

CAPP estimated in July 2017 that the Meadow Creek East IDA review resulted in project capital cost savings of about three per cent, or about \$50 million for a 50,000-bbl/d project. Of key importance, CAPP noted that the approach had potential to improve return on investment for an in situ oil sands project by approximately 0.5 per cent.

"It is through efforts such as the IDA process that government can work with industry and key stakeholders to substantially streamline the regulatory approval process — eliminating redundancies and

providing greater certainty while continuing to achieve social and environmental outcomes," CAPP said.

The Meadow Creek East IDA pilot combined approximately 2,500 applications into one, according to AER spokeswoman Tracie Kenyon. She said that the regulator has tested IDA with two pilots in addition to Meadow Creek East and West: an integrated oil effluent pipeline application submitted by Canadian Natural Resources Limited that combined four applications and decisions into one, and an integrated cold heavy oil production application also submitted by Canadian Natural Resources that combined 59 applications and decisions into one.

Kenyon said the IDA process is designed to be clear and consistent about rules and processes, as well as be more open and transparent to industry and its stakeholders.

"This will build public and stakeholder confidence in the AER," she said. "We are working very hard to move our systems into new technology and update our processes from the ground floor. We believe that IDA will be fully realized by the end of 2019."

[Click here for more information on the IDA.](#)

**The new process**  
**saved Suncor**  
**about \$50 million**  
**on a 50,000**  
**bbl/d project.**

## WHAT'S NEW PROJECTS

■ Nexen says it will proceed with the Long Lake Southwest in situ oil sands expansion project in northern Alberta. The approximately C\$400 million project will add 26,000 bbls/d of production from three well pads that will be tied-in to the company's existing Long Lake facility.

Construction is set to begin shortly, with first oil anticipated in late 2020.

The company said: "This decision further affirms CNOOC Limited's long-term confidence in the Alberta energy sector and helps achieve the Alberta government's climate objectives. We remain committed to growing our Canadian production profile, and our oil sands assets are an important component of this strategy."

■ Suncor Energy says that the new Fort Hills oil sands mine has already reached its nameplate production capacity, months ahead of schedule and despite slower than expected start up.

The company says that following the May 11 commissioning of the third and final secondary extraction train, the plant was tested at full rates of 194,000 bbls/d. In addition, Suncor says it has completed a seven-day reliability test of the plant running in excess of 90 percent of capacity "with no significant issues."

Completion of ramp-up was initially expected by the end of 2018, and Suncor maintained that schedule following a delay in start-up of secondary extraction. First oil, which was targeted before the end of 2017, was achieved at the end of January.

■ The federal-provincial joint review panel assessing the proposed Frontier oil sands mine says it is ready to commence its public hearing.

The proposed \$20 billion project, owned by Teck Resources, commenced

the environmental assessment process in January 2012. The joint review panel was appointed in May 2016 and given 13 months to assess the project and its environmental impacts. It won approval last November for an eight-month delay to complete its review.

Frontier is designed in three phases totaling 260,000 bbls/d. It is located about 110 kilometres south of Fort Chipewyan, making it the most northerly of oil sands mining developments.

Hearing dates and locations have not been determined. The panel intends to start the hearing as early as September.

■ All hands are on commissioning at the Sturgeon Refinery with construction officially complete, according to the North West Redwater Partnership (NWR).

All of the refinery's 10 large specialized units are now constructed, with commissioning at various stages across the facility. In a staggered approach similar to its construction strategy, some units are finished commissioning while others have just begun, the company says.



SOURCE: CENOVUS ENERGY

The refinery has been operating since December 2017, processing synthetic crude into diesel. This is possible without construction being complete, NWR says, because only two thirds of the refinery's units are needed to produce diesel using synthetic crude oil as a feedstock. "Because synthetic crude is a partially upgraded feedstock, it has already undergone some processing. The Sturgeon Refinery has used this partially upgraded feedstock as part of the commissioning and start up process for the majority of the units, resulting in a steady production of diesel for our customers for the past several months," the company says.

The project is designed to produce ultra low sulphur diesel using bitumen as feedstock.

"Now that construction is complete, and commissioning is well underway, the refinery will be switched over from synthetic crude to bitumen feedstock in the coming months," NWR says. "This will be the next major milestone – refining Alberta's low value bitumen into much higher value diesel." ■

## WHAT'S NEW BUSINESS

■ A new report from the Canadian Energy Research Institute (CERI) says that in situ oil sands growth projects have competitive economics at today's oil prices.

CERI's latest study pegs the per-bbl supply cost of a 30,000 bbl/d SAGD expansion with a steam/oil ratio of 2.8:1 and a capital cost of \$600 million at US\$51.59/bbl, including transportation and blending.

"At current WTI prices of just above US\$66/bbl, these projects are decidedly economic," CERI said. "The relative position of oil sands projects against other crude oils is comparatively competitive, and as oil prices are expected to increase, so will the profitability of oil sands projects."

There are risk factors that might affect project economics, researchers added, including market access. The study, which also updates CERI's oil sands production forecast, "is not limited by transportation capacity," assuming that pipelines and rail will provide the needed service to move additional volumes of bitumen.

■ The International Energy Agency (IEA) says that Canadian oil production continues growing strongly despite constrained pipeline takeaway capacity.

Surging production in both the Canada and the U.S. accounted for a rise in non-OPEC volumes of approximately 2.1 million bbls/d in April compared to a year earlier, the IEA said.

Thanks to a handful of key major projects that recently came online, Canada's production was about 200,000 bbls/d higher in Q1/2018 over Q1/2017. This includes Suncor Energy's Fort Hills oil sands mine and Canadian Natural Resources' Horizon Phase 3 integrated oil sands mining and upgrading facility, as well as the Hebron offshore field.

"Canadian oil production held steady in March, near a record 5.2 million bbls/d, despite reports that oil sands



producers scaled back output due to steep discounts for Canadian grades compared to WTI at Cushing," the IEA said in its May Oil Market Report.

"Supply of non-upgraded oil sands rose by 42,000 bbls/d month-over-month to 1.8 million bbls/d — a new record — more than offsetting slightly lower output of upgraded production. Suncor's Fort Hills likely contributed with the company announcing that the second of three extraction trains at the project became operational at the end of the quarter.

"Output likely fell sharply in April and May however, as maintenance at oil sands facilities intensified."

The maintenance has contributed to alleviating some of the pressure on pipeline export capacity, the IEA said.

■ North American Construction Group announced two new oil sands term contracts in June, the first that the mining contractor has negotiated in several years, according to CEO Martin Ferron. First North American was awarded a two-year extension to a key Master Services

Agreement with an unnamed major oil sands customer, taking the expiry to August 2022. Then, in a related contract, the company was awarded new work scope involving mine reclamation services.

The second contract has a duration of three years, commencing with this winter season, providing incremental work backlog valued at around \$160 million.

"It appears to becoming a trend that customers are willing to consider term contracts to lock in heavy equipment availability in a tightening marketplace," Ferron said in a statement.

■ Junior oil sands producer Connacher Oil & Gas was granted an extension of creditor protection in June. Hit hard by the oil price downturn, the company was first granted creditor protection on May 17, 2016. It was last granted an extension in January, to June 29, 2018. The stay has now been extended to September 30, 2018.

Acting as Connacher's monitor, Ernst & Young reports that a group of qualified bidders for Connacher's approximately 14,000 bbls/d of in situ oil sands assets is moving into the next phase towards a transaction. ■

## WHAT'S NEW ENVIRONMENT + TECHNOLOGY

■ A research facility to convert CO<sub>2</sub> emissions into valuable products is now open at Alberta's largest natural gas-fired power plant.

Owned and operated by InnoTech Alberta, an applied research subsidiary of Alberta Innovates, the Alberta Carbon Conversion Technology Centre will use flue gas emissions from the Shepard Energy Centre in Calgary to "test and refine" new technologies.

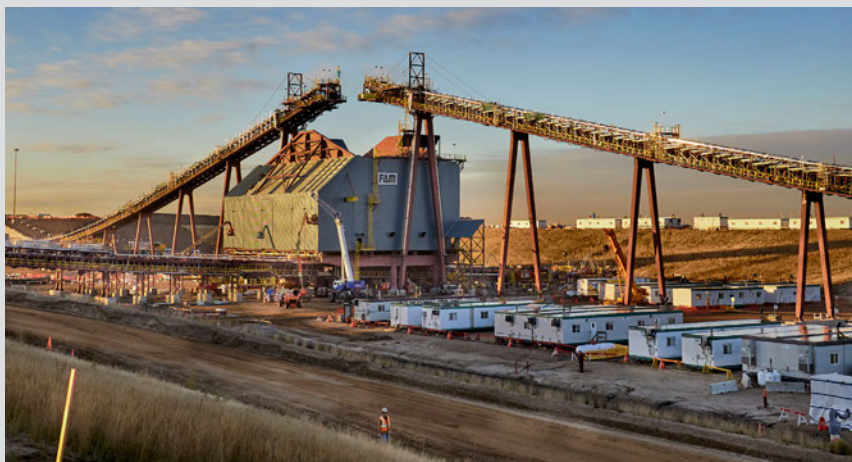
The first tenants of the facility will be five finalist teams from the US\$20 million NRG COSIA Carbon XPRIZE competition.

Following completion of the competition in early 2020, the facility will continue as a test centre for new technology development in this area. With its unique capabilities, it is expected to become a global hub for innovators, InnoTech Alberta says.

■ With support from Syncrude, the Tallcree First Nation, the Nature Conservancy of Canada (NCC) and the federal government, Alberta is establishing the world's largest contiguous area of protected boreal forest.

The province is formally creating five new and expanded wildland provincial parks that were identified in the Lower Athabasca Regional Plan (LARP) in 2012. The lands connect with Wood Buffalo National Park and other existing wildland parks to create a total of 67,000 square kilometres of protected area – more than twice the size of Vancouver Island. It is the largest addition to the Alberta parks system in the province's history.

Syncrude contributed \$2.3 million to help purchase a timber quota from the Tallcree First Nation, enabling creation of the new protected area. While Syncrude will receive a conservation offset for future mining development from the province in return, the land in question is not directly tied to the project's operations.



SOURCE: SUNCOR ENERGY

■ Through its Emissions Reduction Alberta (ERA) initiative, the province has announced up to \$70.6 million in funding toward oil sands projects estimated to result in potential greenhouse gas emissions reductions of up to four megatonnes of annual CO<sub>2</sub> equivalent reductions in Alberta by 2030:

1. \$10 million: CLEANSEAS Demonstration Project
2. \$10 million: Imperial Oil Enhanced Bitumen Recovery Technology Pilot
3. \$10 million: Cenovus Energy/Heavy Oil Solutions Partial Upgrader with Integrated Water Treatment
4. \$10 million: Cenovus Energy/FSG Technologies Flash Steam Generation Field Prototype
5. \$10 million: MEG Energy eMVAPEX Pilot
6. \$10 million: Cenovus Energy Multi-Pad Pilot of Solvent-Aided Process
7. \$5.6 million: Canadian Natural Resources In-Pit Extraction Process
8. \$2.5 million: Suncor Energy/Devon Energy/Suez High-Temperature Membranes for SAGD Water Treatment
9. \$2.5 million: ConocoPhillips Canada Non-Condensable Gas Co-Injection for Thief Zones.

■ Suncor Energy reports that production from its new Fort Hills oil sands mine has a carbon footprint that is on par with the average refined barrel in the United States.

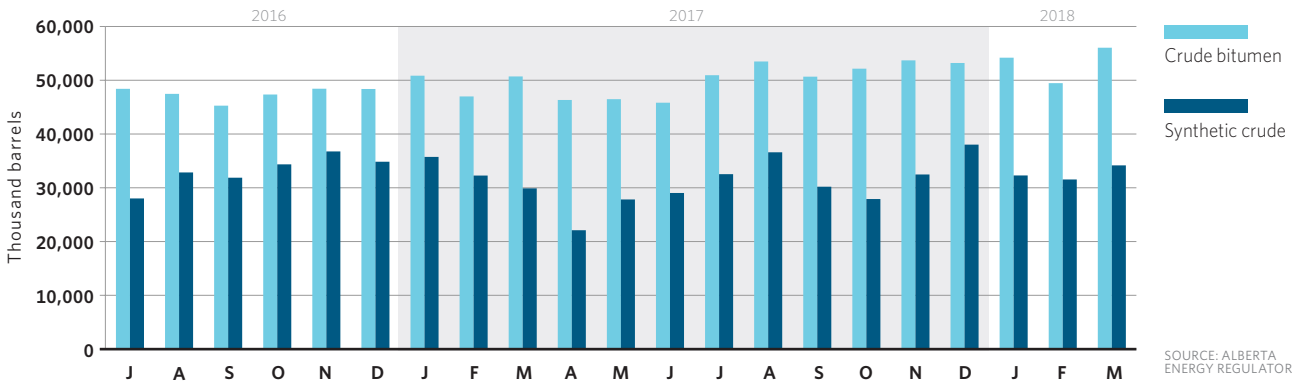
"Basically what we do at Fort Hills that we don't do at any of our other mines is we literally cut off about 10 percent of the barrel. The 10 percent that we cut off has the most carbon in it, so we put that carbon back in the ground," said chief operating officer Mark Little.

"It's kind of like accelerated carbon sequestration. We cut it off, put it back in the ground, and then the barrel that we ship to market is a much better quality barrel."

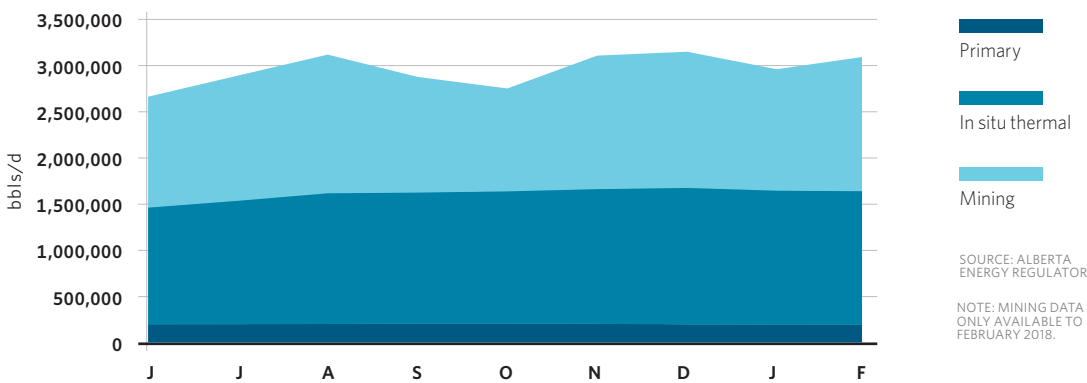
The technology is called paraffinic froth treatment (PFT), and it has been in commercial use since Shell started up the Athabasca Oil Sands Project in 2002, and was put to work again at the AOSP Jackpine expansion in 2010 as well as at both operating phases of Imperial Oil's Kearl mine, which started in 2013 and 2015, respectively. The new owner of the AOSP, Canadian Natural Resources, has announced it is now developing a 35,000 bbl/d PFT expansion at its Horizon mine. ■

# OIL SANDS DATA

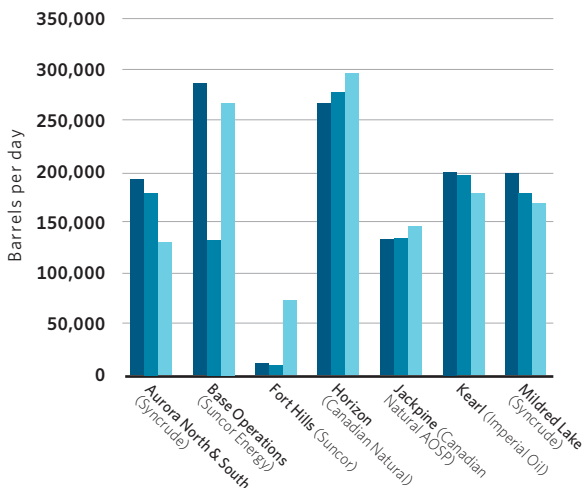
## ALBERTA CRUDE BITUMEN AND SYNTHETIC CRUDE PRODUCTION



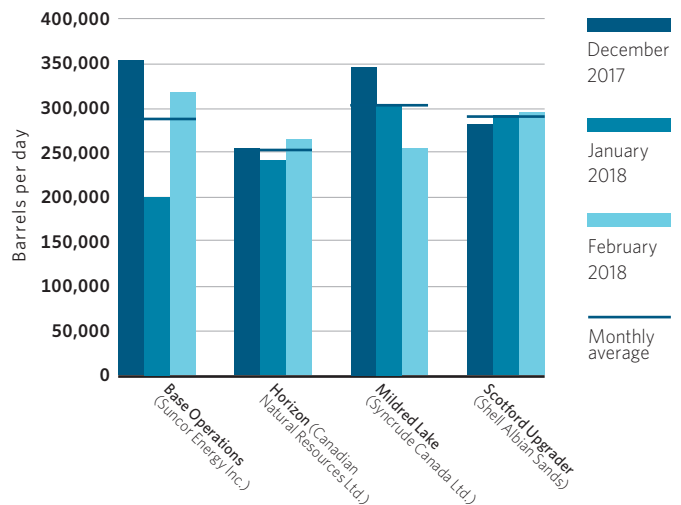
## ALBERTA BITUMEN PRODUCTION BY EXTRACTION TYPE



## OIL SANDS MINING PRODUCTION BY PROJECT



## OIL SANDS UPGRADER PRODUCTION BY PROJECT





## THERMAL OIL SANDS PRODUCTION BY PROJECT FEBRUARY 2018 - APRIL 2018

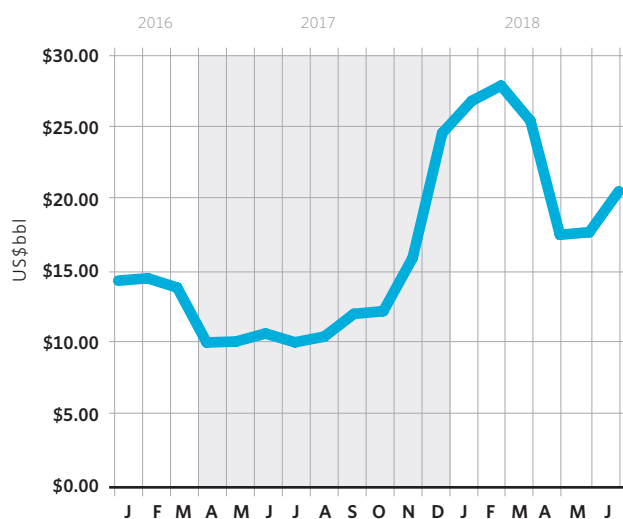
(Barrels per day)

COMMERCIAL SCHEMES					
COMPANY	PROJECT	FEB	MAR	APR	MONTHLY AVERAGE
Cenovus Energy Inc.	Christina Lake	199,451	198,378	210,685	202,838
Suncor Energy Inc.	Firebag	208,170	208,635	196,712	204,506
Cenovus Energy Inc.	Foster Creek	158,250	143,735	167,373	156,452
Imperial Oil Limited	Cold Lake	155,481	144,472	144,802	148,252
ConocoPhillips Canada Limited	Surmont	138,848	133,462	127,253	133,188
Devon Canada Corporation	Jackfish	115,081	115,545	109,659	113,428
MEG Energy Corp.	Christina Lake	89,687	88,974	87,425	88,695
Canadian Natural Resources Limited	Primrose & Wolf Lake	74,122	59,554	59,402	64,359
Husky Energy Inc.	Sunrise	47,408	47,377	50,925	48,570
CNOOC Limited	Long Lake	42,666	44,811	46,583	44,687
Canadian Natural Resources Limited	Kirby South	37,686	37,511	31,701	35,633
Suncor Energy Inc.	Mackay River	36,436	36,552	37,665	36,884
Husky Energy Inc.	Tucker	22,669	22,606	22,557	22,610
Athabasca Oil Corporation	Leismer Demonstration	21,812	21,967	18,781	20,854
Pengrowth Energy Corporation	Lindbergh	15,571	15,714	15,928	15,738
Japan Canada Oil Sands Limited	Hangingstone	15,620	16,504	12,636	14,920
Connacher Oil and Gas Limited	Great Divide	12,715	12,680	12,497	12,631
Athabasca Oil Corporation	Hangingstone	9,729	8,338	9,198	9,088
Osum Oil Sands Corp.	Orion	8,555	8,901	7,731	8,396
Brion Energy Corporation	Mackay River	8,549	8,451	7,784	8,261
Canadian Natural Resources Limited	Peace River/Carmon Creek	3,671	2,133	1,094	2,299
Sunshine Oilsands Ltd.	West Ells	2,055	2,054	1,582	1,897
BlackPearl Resources Inc.	Blackrod	438	443	406	429
Canadian Natural Resources Limited	Peace River	40	11	---	25
<b>Total Commercial</b>		<b>1,424,708</b>	<b>1,378,806</b>	<b>1,380,376</b>	<b>1,394,630</b>

SOURCE: AER (ALBERTA ENERGY REGULATOR)

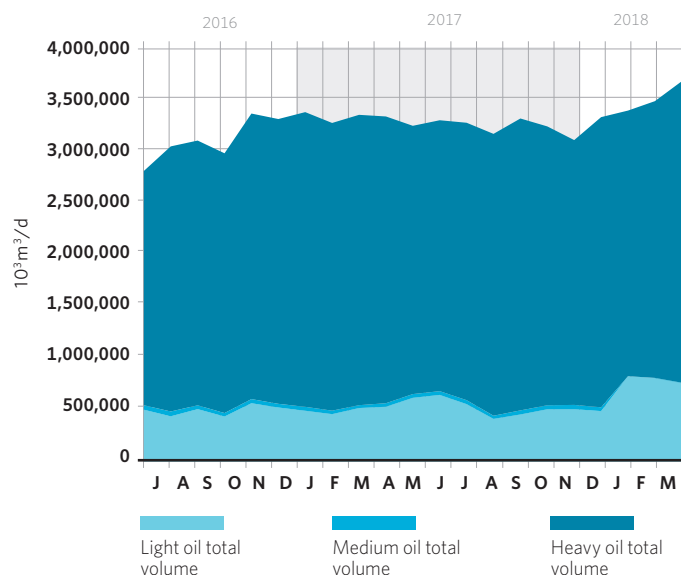
## CRUDE OIL PRICE DIFFERENTIAL (\$US/BBL)

Recorded until Dec. 4, 2017



SOURCE: DAILY OIL BULLETIN

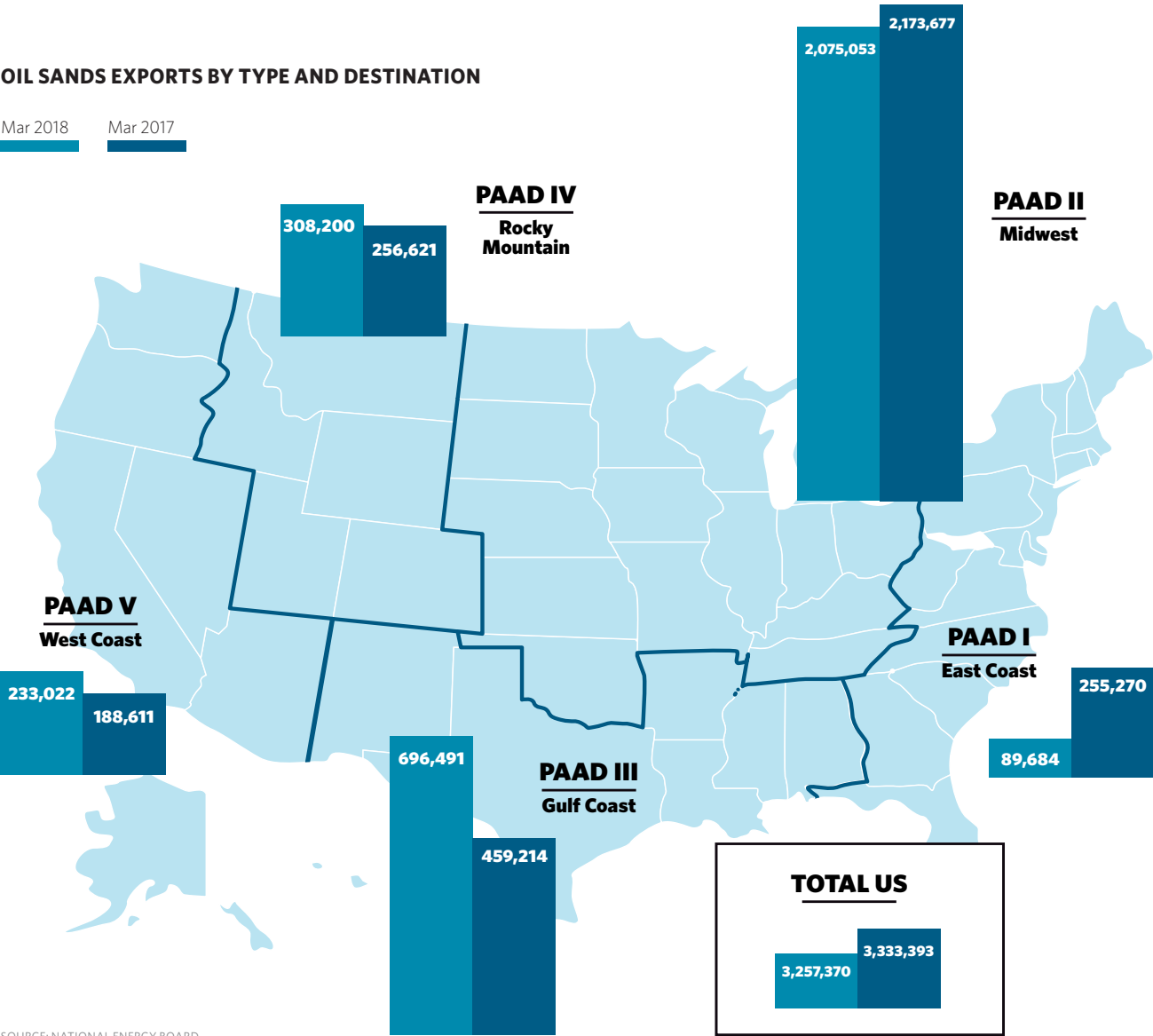
## CANADIAN CRUDE OIL EXPORTS



SOURCE: NATIONAL ENERGY BOARD

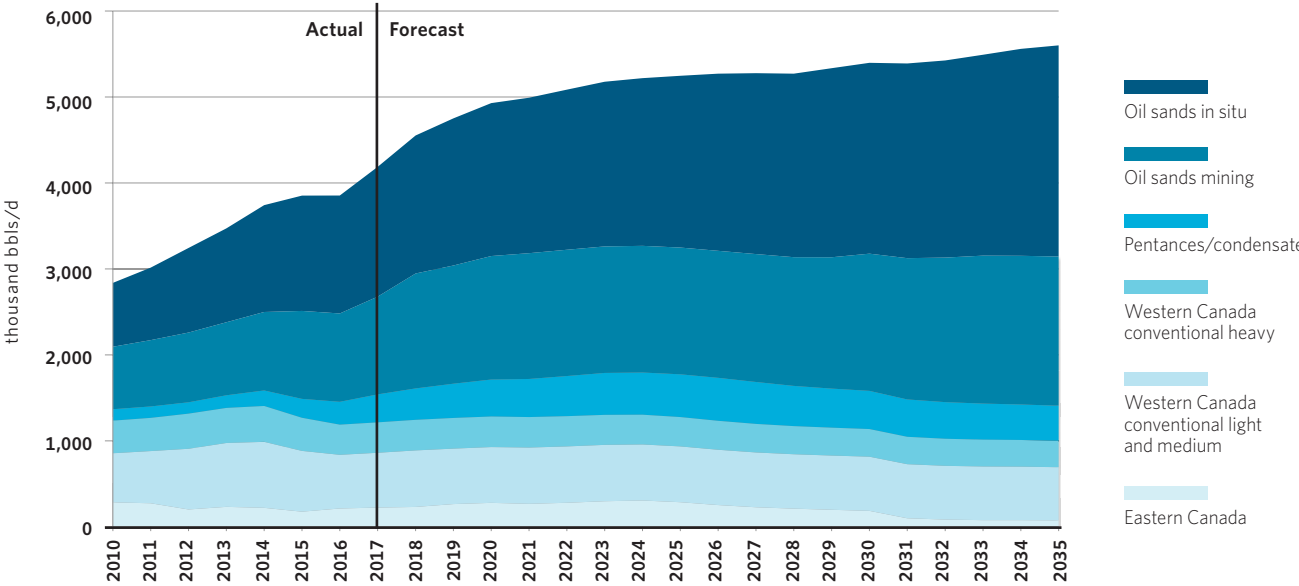
OIL SANDS EXPORTS BY TYPE AND DESTINATION

Mar 2018    Mar 2017



SOURCE: NATIONAL ENERGY BOARD

CANADIAN OIL SANDS & CONVENTIONAL PRODUCTION FORECAST 2018



SOURCE: CAPP

# 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 (kg/m<sup>3</sup>) or degrees on the American Petroleum Institute (API) gravity scale. In western Canada, oil up to 900 kg/m<sup>3</sup> 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.

# 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.cnooc ltd.com](http://www.cnooc ltd.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.nsolve.ca](http://www.nsolve.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)**