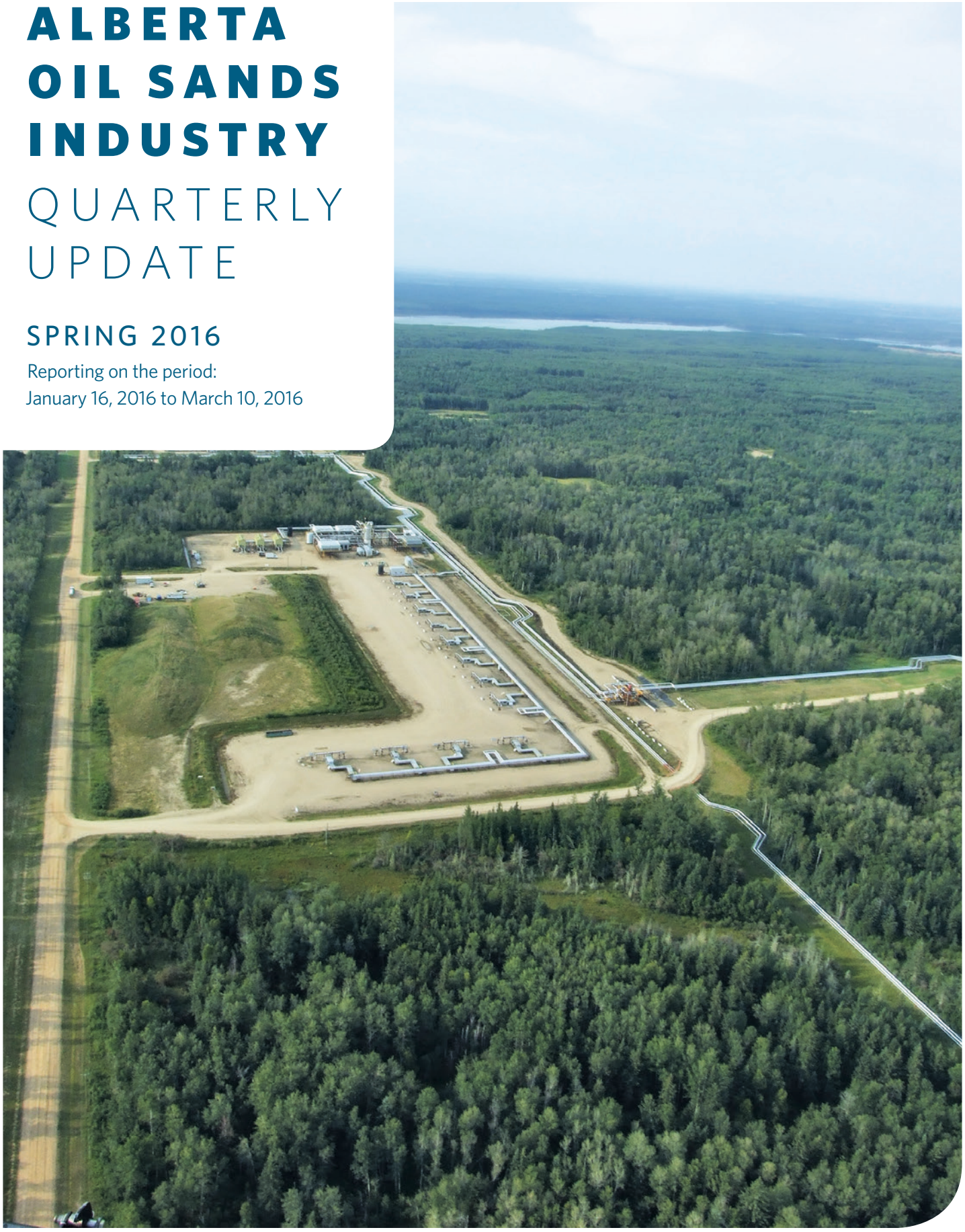
ALBERTA OIL SANDS INDUSTRY QUARTERLY UPDATE

SPRING 2016

Reporting on the period:
January 16, 2016 to March 10, 2016



All about the oil sands

Background of an important global resource

Canada has the third-largest oil reserves in the world, after Saudi Arabia and Venezuela. Of Canada's 173 billion barrels of oil reserves, 170 billion barrels are located in Alberta, and about 168 billion barrels are recoverable from bitumen. This is a resource that has been developed for decades but is now gaining increased global attention as conventional supplies—so-called "easy" oil—continue to be depleted. The figure of 168 billion barrels of bitumen represents what is considered economically recoverable with today's technology, but with new technologies, this reserve estimate could be significantly increased. In fact, total oil sands reserves in place are estimated at 1.8 trillion barrels.

There are three major bitumen (or oil sands) deposits in Alberta. The largest is the Athabasca deposit, which is located in the province's northeast in the Regional Municipality of Wood Buffalo. The main population centre of the Athabasca deposit is Fort McMurray. The second-largest oil sands deposit is referred to as Cold Lake, just south of Athabasca, with the main population centre the City of Cold Lake. The smallest oil sands deposit is known as Peace River, which is located in northwest-central Alberta. A fourth deposit called Wabasca links to the Athabasca and is generally lumped in with that area.

The existence of bitumen in Alberta has been known for a long time. The first mention of it in Canadian history was in 1719, when a Cree named Wapasu brought a sample of the "gum" to a Hudson's Bay trading post. First Nations in what is now the Wood Buffalo area had traditionally used the bitumen, which seeps from outcrops along the Athabasca River, to waterproof their canoes.

For the first time in 2012, in situ oil sands production exceeded mined oil sands production in Alberta. In 2014, 58 per cent of the province's oil sands volumes were produced using in situ methods. Alberta will continue to rely to a greater extent on in situ production in the future, as 80 per cent of the province's proven bitumen reserves are too deep under-ground to recover using mining methods.

There are essentially two commercial methods of in situ (Latin for "in place," essentially meaning wells are used rather than trucks and shovels). In cyclic steam stimulation (CSS), high-pressure steam is injected into directional wells drilled from pads for a period of time, then the steam is left to soak in the reservoir for a period, melting the bitumen, and then the same wells are switched into production mode, bringing the bitumen to the surface.

In steam assisted gravity drainage (SAGD), parallel horizontal well pairs are drilled from well pads at the surface. One is drilled near the top of the target reservoir, while the other is drilled near its bottom. Steam is injected into the top well, a steam chamber forms, and the melted bitumen flows into the lower well via gravity and is pumped to the surface using artificial lift.

Both SAGD and CSS are used in the Cold Lake and Peace River deposits, while SAGD is the in situ technology of choice in the Athabasca deposit. The selection is based on a number of factors, including geology. The technologies combined currently produce just over one million barrels per day.

Research is underway on a number of other production technologies designed to optimize production, including variations on solvent-assisted SAGD and CSS, recovery using electricity and in situ combustion.

Bitumen that has not been processed, or "upgraded," can be used directly as asphalt. It must be diluted to travel by pipeline. Adding value, some producers upgrade their product into synthetic crude oil, which is a refinery feedstock. That can be transformed into transportation fuels and other products. ■

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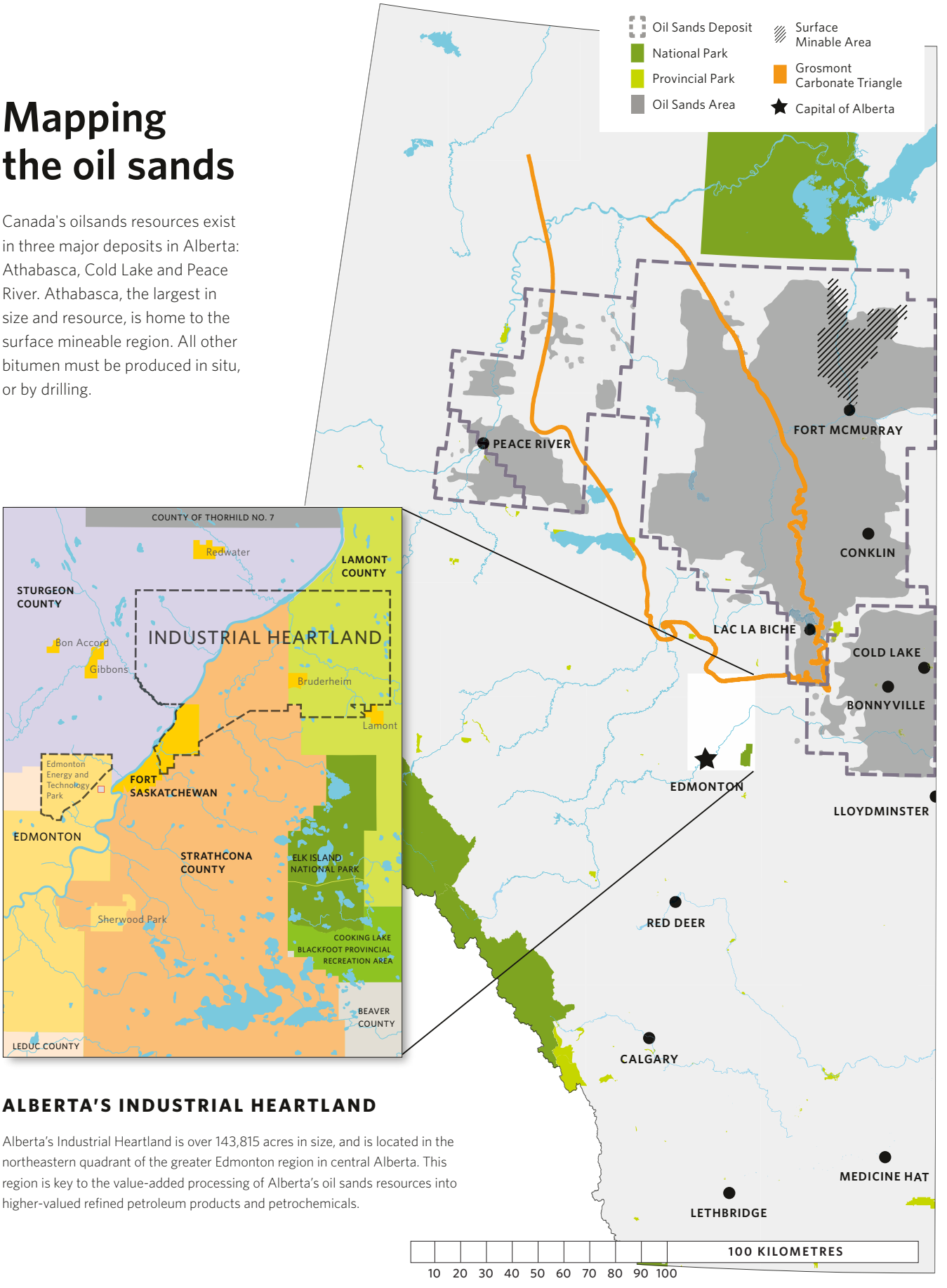
On the cover: An aerial shot of ConocoPhillips Canada's 118,0000-bbl/d Surmont 2 SAGD project, which started producing bitumen in September. ConocoPhillips Canada

Mapping the oil sands

Canada's oilsands 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.



ALBERTA'S INDUSTRIAL HEARTLAND

Alberta's Industrial Heartland is over 143,815 acres in size, and is located in the northeastern quadrant of the greater Edmonton region in central Alberta. This region is key to the value-added processing of Alberta's oil sands resources into higher-valued refined petroleum products and petrochemicals.

SOURCE: DIVESTCO INC./GOVERNMENT OF ALBERTA

GOVERNMENT UPDATE

Alberta Government

PREMIER NOTLEY'S STATEMENT ON ALBERTA NEB SUBMISSION SUPPORTING TRANS MOUNTAIN PIPELINE

In mid-January, Premier Rachel Notley wrote to the National Energy Board in support of Kinder Morgan's proposal to expand capacity of its Trans Mountain Pipeline transporting Alberta crude to the B.C. coast for export.

"Our government believes this project is good for Albertans and good for all Canadians. It will create jobs, spur economic growth, and help fund our province's transition to a greener, less carbon-intensive economy on many levels," Notley said.

"There is significant interest in this project. Our colleagues in British Columbia have restated their position that they want their five conditions met before they will lend their support to this pipeline expansion.

"We encourage Kinder Morgan to continue working with the federal government and the government of British Columbia on these issues. I believe there is a path forward for this pipeline to get approved, but this path forward is not the same failed path Conservative governments have chosen and continue to choose.

"We will not get pipelines built by picking fights with other provinces through the media. And we will not get pipelines built by refusing to take action against global warming. We will get pipelines built by working collaboratively with other jurisdictions and having drama-free discussions about pipelines based on their merits."

Notley said that Alberta's recently announced climate leadership plan will help the province realize new market access projects for the oil industry.

"Our climate leadership plan gives Alberta the opportunity to show the world that we can combat climate change while also protecting the good, mortgage-paying jobs of our oil and gas industry."

HISTORICALLY LOW OIL PRICES AND DECLINING REVENUE IMPACTING THIRD-QUARTER RESULTS

Alberta faces a significant budget shortfall as oil prices continue to collapse to the lowest levels in more than a decade, causing a substantial hit to government revenue.

The oil price collapse has significantly impacted Alberta's resource and personal income tax revenue streams. Prudent financial management, including the re-profiling of some projects and bringing expenses in line with the province's new economic reality, has helped the province mitigate some of the effects of the oil price shock this fiscal year.

Total revenue for 2015-16 is forecast to be $43.1 billion. This is $660 million lower than estimated in the 2015 budget, due primarily to a reduction of $762 million in personal income tax revenue and a $294-million net decrease to resource revenue. Total expense is forecast to be $49.4 billion to $463 million lower than anticipated at budget.

CLIMATE LEADERSHIP PLAN WILL PROTECT ALBERTANS' HEALTH, ENVIRONMENT AND ECONOMY

Alberta's Climate Leadership Plan accelerates the transition from coal-fired power plants to more renewable energy and natural gas power, puts a price on carbon pollution for everyone and sets emissions limits for the oil sands.

Other measures include broad programs to improve energy efficiency, support green technological innovations, reduce methane, and provide support to protect families and small businesses.

The plan is based on the advice of the Climate Change Advisory Panel, led by Andrew Leach, which heard from thousands of individual Albertans and stakeholder groups this fall.

On the advice of leaders from our energy industry and from civil society, the government will legislate an overall oil sands emissions limit of 100 megatonnes, reducing carbon output per barrel, with provisions for new upgrading and co-generation. The government will also phase out pollution created by coal-fired electricity generation by 2030 and will implement a new methane reduction strategy.

One hundred per cent of proceeds from carbon pricing will be reinvested in Alberta, either invested directly into pollution-reducing measures such as clean-energy research, or invested in an adjustment

PHOTO: SUPREME MODULAR FABRICATION

fund that will help individual families and small businesses.

JOINT STATEMENT BY THE PRIME MINISTER OF CANADA AND THE PREMIER OF ALBERTA

In early February, Prime Minister Justin Trudeau and Premier Rachel Notley issued the following joint statement after their meeting in Edmonton:

"Canada works best when we all work together. Albertans are proud Canadians who have contributed enormously to the economic and social fabric of our country, and Canadians want to be there for Albertans in challenging times."

The three main areas of federal-provincial cooperation cited are jobs and the economy, clean growth and climate change, and energy infrastructure and market access.

The federal government is committed to fast-tracking infrastructure to support Alberta's long-term needs and create short-term jobs. "In addition," said the statement, "in response to a request from Alberta, the Government of Canada stands prepared to provide up to $250 million to the province in the form of an advance fiscal stabilization payment as a result of losses in natural resource revenue."

Both governments recognized that growing Canada's economy to attract investment and create jobs goes hand in hand with combatting climate change. The upcoming First Ministers' meeting looks to establish a pan-Canadian framework for reducing emissions.

The prime minister and premier pointed to Alberta's work in introducing its Climate Leadership Plan, which means "conversations about pipelines are now easier to have."

"We agreed that we must get these resources to market in responsible, sustainable ways that Canadians trust, based on robust environmental assessments and that contribute to greater investment and long-term economic growth and job creation."

THRONE SPEECH HIGHLIGHTS SUPPORTS FOR CHILDREN, JOB CREATION AND ECONOMIC DIVERSIFICATION

The Alberta government's spring agenda focuses on investment in children in low-income families, job creation and economic diversification.

A new child benefit plan will help 380,000 children living in low-income households, while government works to create new jobs and opportunities, build on traditional economic strengths, diversify markets and products, and increase accountability and responsible public fiscal management.

Highlights of the Speech from the Throne (full speech found here) include the government's agenda to:

- diversify energy markets;
- pursue a coherent and effective economic strategy;
- invest in a greener, more sustainable economy;
- take a responsible approach to public finances; and
- make democratic reforms to ensure accountability.

Says Premier Rachel Notley, "We are addressing the energy price shock with continued, focused efforts to diversify markets for our energy products with a new pipeline, major investments in infrastructure priorities and economic diversification, and help for families facing immediate hardship. We will do so in partnership with industry, other Canadian governments, Indigenous peoples, municipalities and all Albertans." ■

PHOTO: SUPREME MODULAR FABRICATION

LABOUR UPDATE

OIL SANDS SECTOR WORKFORCE REQUIREMENTS TO SHIFT FROM GROWTH AND EXPANSION

A shift in Alberta's oil sands sector from growth and expansion to improving the reliability and performance of existing operations will have long-term impacts on the sector's workforce requirements, says a new labour demand outlook.

By 2020, the growth of 5,170 operations workers (up 17 per cent from 2014) and 4,700 ongoing maintenance workers (a 38 per cent increase) will largely offset the decrease of 10,305 (an 84 per cent drop) in on-site construction jobs, according to the PetroLMI study.

The **report**, *Oil Sands Construction, Maintenance and Operations Labour Demand Outlook to 2020*, estimates that by 2020 a total of 54,145 direct construction, ongoing maintenance and operations workers will be employed in the oil sands sector, a decrease of approximately one per cent over 2015.

The study provides insight into the impact of 2015 spending and production forecasts on longer-term hiring requirements in the oil sands sector.

The oil sands sector delayed, deferred or cancelled a number of projects in 2015, with a 30 per cent reduction from record capital spending of $35.7 billion in 2014, and is not expected to recover before 2020, the report noted. As a result, demand for future on-site construction labour has been significantly reduced with spending focused on completing projects that currently are under construction.

At the same time, however, production from the oil sands sector will continue to grow across mining, in situ and upgrading operations from projects that are either in the late stage of construction or have recently transitioned into operations. "There are always going to be jobs just to keep the plants running," Emma Monaghan, project manager, said in an interview.

Although overall workforce requirements for the oil and gas industry have been severely affected by a reduction in investment, hiring is expected to continue to 2020 as substantial capital has already been invested in large-scale oil sands projects, according to Carol Howes, vice-president of communications and PetroLMI, with Enform.

"What remains to be seen, as on-site construction of major projects winds down towards the latter half of the forecast period, is the impact of lower oil sands capital investment on production and jobs after 2020."

JOB CREATION AND ECONOMIC DIVERSIFICATION A PRIORITY LEADING INTO BUDGET 2016

Economic diversification, job creation and strong family supports dominated the conversation at a recent Budget 2016 town hall hosted by Alberta's premier and finance minister.

Premier Rachel Notley and President of Treasury Board and Finance Minister Joe Ceci spoke with Albertans during the town hall in Fort McMurray and discussed challenges facing the northern Alberta community as the province continues to face the steepest and most prolonged slide in oil prices in recent history. Albertans from across the province also joined the conversation online, where they had the opportunity to ask questions throughout the event.

"Today we heard about the personal impact of sustained low oil prices on Alberta's families. The enormity of this once-in-a-generation challenge is most apparent in communities like Fort McMurray, where economic success is tied so closely with oil development. This underscores the urgency of our efforts to diversify Alberta's economy as part of our economic action plan," Notley said.

Fort McMurray residents were invited to discuss their concerns in person with the premier and the finance minister. They were joined by Albertans who tuned in to the live-streamed broadcast. Discussion from today's event will help inform Alberta's 2016 budget.

"Difficult times continue to lie ahead for the province as we head into Budget 2016. Our government has a plan to help Albertans weather the storm by deploying all the tools at our disposal, including aggressive infrastructure investment, making capital available to small- and medium-sized businesses through ATB Financial and using the Heritage Fund to invest in Albertans and their jobs," Ceci said. ■

WHAT'S NEW IN THE OIL SANDS

BUSINESS

Alberta is moving in a positive direction on market access thanks to a suite of new climate policies from the provincial government, according to a manager with the Canadian Association of Petroleum Producers (CAPP). The province's improving environmental image on the global stage does not necessarily resolve local opposition to pipelines, however.

"From our perspective, particularly at a national or global perspective, folks are viewing Alberta differently. This initiative does position Alberta in a different lens," said Ben Brunnen, CAPP's manager of fiscal and economic policy. "Folks definitely appreciate Alberta's perspective, but there still needs to be some level of engagement or shift in how we're approaching these issues locally."

Two workers were killed following an explosion in December in the hydrocracker unit of the bitumen upgrader at the Long Lake SAGD project. Long Lake owner Nexen says the upgrader has been shut down and bitumen production has been reduced to minimum rates. An investigation is underway.

CAPP is forecasting total Canadian capex spending in 2016 at $40 billion: $20 billion in the oil sands and $20 billion for the rest of the oil and gas industry. This total spend is half of what it was in 2014 at $81 billion.

Historically, $20 billion in oil sands capex is more than was spent in 2010, more than in 2008, 2007 and almost double what was spent in the downturn of 2009, according to CAPP data. Why this downturn feels so bad—beyond the human toll in more than 60,000 layoffs and the hobbled long-term oil sands industry growth projection—is the growing consensus that more pain is yet to come.

Suncor Energy is promising to improve reliability at the Syncrude joint venture by investing more resources and working more closely with its operator, ExxonMobil Corporation, following its successful bid to acquire part owner Canadian Oil Sands Limited (COS).

The $4.2-billion acquisition increases Suncor's Syncrude ownership from 12 to 49 per cent.

"You put a certain amount of resource in when you're a 12 per cent owner; you put a very different amount of resource in when you're a 49 per cent shareholder," said Steve Williams, Suncor president and chief executive officer.

Williams said Suncor has a great deal of respect for Exxon's capability and has no plans to replace Exxon as operator.

"I think we will be able to offer them some real assistance, and we've started to talk to them about that possibility."

In light of low commodity prices, Connacher Oil and Gas is reducing production at its Great Divide SAGD project. Average production for the month of January is expected to be 7,000–8,000 bbls/d. February and March production is expected to be 3,000–4,000 bbls/d. Both plants at Great Divide will remain operating the majority of this time, and equipment maintenance is ongoing.

Based on field estimates, Connacher's Great Divide production for Q4 2015 averaged roughly 13,900 bbls/d.

Commercial well pairs at the Lindbergh SAGD project are tracking similar to its pilot wells while type curves for the pilot well pairs' actual production continue to exceed expectations, Pengrowth Energy reports.

Steaming at the 12,500-bbl/d project began in December 2014.

Pengrowth says it expects the recovery factor from the commercial well pairs to be virtually identical to the pilot well pairs.

Lindbergh exited 2015 at 15,100 bbls/d, just short of the 16,000 bbls/d the company expected to reach by year-end. ■

WHAT'S NEW IN THE OIL SANDS

TECHNOLOGY

Cenovus Energy says it is testing surface and downhole technologies that could reduce SAGD costs by 30 per cent.

Downhole improvements alone are expected to bring finding and development costs to single digits from about $12–$13/bbl over the next three to five years.

The company says it has been able to reduce about 40–50 per cent of the metal on drilling pads on "zero-based modules" that will start operating this year.

Additionally, the company says that new reservoir management techniques it has been working on over the past couple of years to improve wellbore conformance and well productivity at the Foster Creek SAGD project have yielded excellent results.

These enhancements, which include downhole instrumentation and optimization work, as well as steam circulation start-up on new pads, have reportedly increased wellbore conformance at Foster Creek to approximately 90 per cent from between 70 and 75 per cent previously.

New technologies to make the oil sands sector carbon competitive need to be commercialized much more quickly, says a retired Suncor executive.

Gord Lambert, Suncor's former executive adviser, sustainability and innovation, says that it takes about 13 years from the time a new technology is conceived until commercial availability.

"We can't afford that type of cycle time in this business world nowadays. We have to make that much, much shorter—which means bolder effort," Lambert says.

"It's a technology development problem, not a technology deployment problem.

"In other words, we don't have the successor to SAGD.... There's some really exciting pilots being developed currently to try and develop that next generation of 'SAGD technology' that would be dramatically less energy intensive. But we don't have that just yet."

Lambert believes Alberta's new carbon policy will help the oil sands industry. While Alberta has some clean oil sands technology funding now, Lambert believes the carbon levy that will be collected by the province offers "even greater capacity to fund [a] collective technology development effort [which] is going to be mission critical for the province."

Nsolv has been awarded $13 million in grant funding from Sustainable Development Technology Canada to commercialize its warm solvent in situ bitumen extraction technology.

The technology is designed to reduce greenhouse gas (GHG) emissions by lowering the amount of energy needed to remove heavy oil from the ground. Nsolv says its process uses zero water and very little natural gas to heat the solvent, resulting in an 80 per cent reduction in GHG emissions compared to existing extraction methods.

The company says it is in discussions with a major oil producer to jointly develop a commercial project.

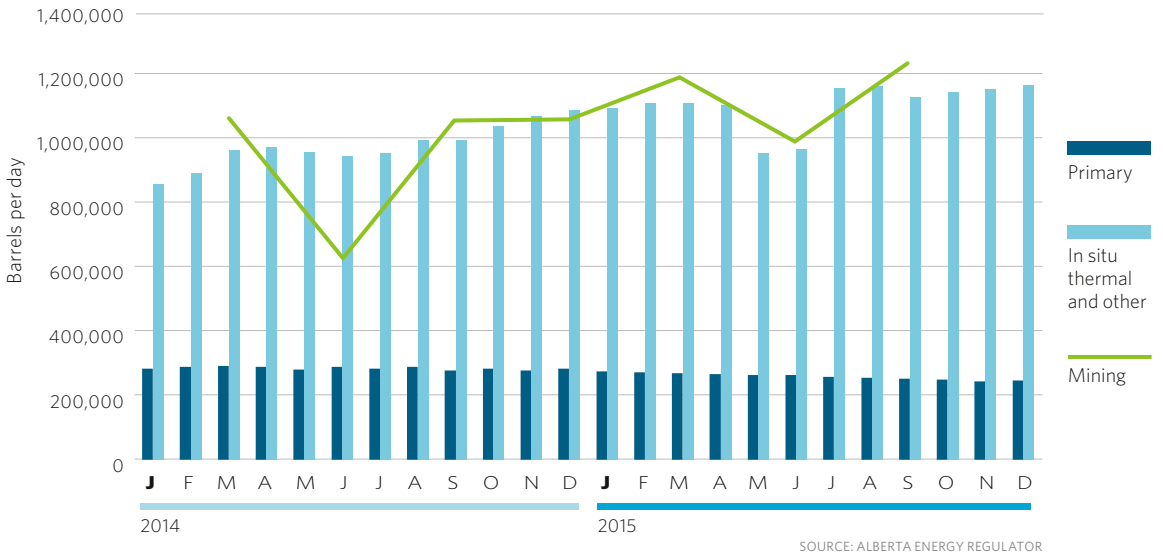
Three oil sands producers are exploring whether fuel cells could simultaneously separate CO_2 from a flue gas stream and generate electricity.

Cenovus Energy is the lead partner of a joint industry project with Devon Energy, Royal Dutch Shell, the University of Calgary and Alberta Innovates, the Alberta government's research agency.

The project is intended to quantify the benefits of using fuel cells to separate CO_2 from the flue gas of SAGD steam generators. The first pilot would be at the 14-megawatt, natural gas–fired heat-and-power plant on the university's main campus. Cenovus says the partners expect to make a decision by fall about whether to proceed. ■

OIL SANDS PRODUCTION DATA

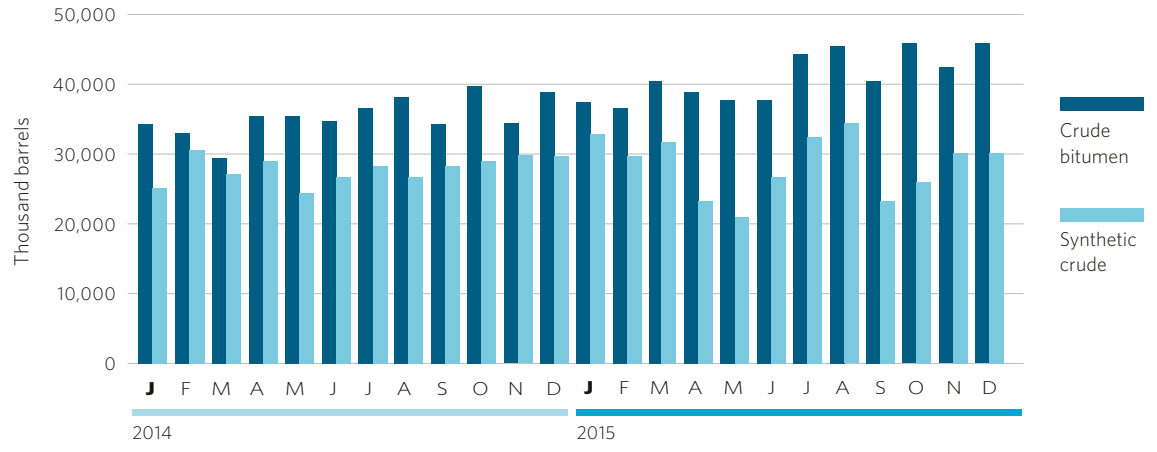
Alberta oil sands production by extraction method



SOURCE: ALBERTA ENERGY REGULATOR

*Mining production data for the fourth quarter of 2015 not available at time of publishing.

Alberta crude bitumen and synthetic crude production



SOURCE: ALBERTA ENERGY REGULATOR

OIL SANDS TECHNOLOGY LEGEND *See oil sands project status listing on page 10.*

ADC (Upgrading) Accelerated decontamination

AIRINJ Air injection

C & SC Cyclic and solvent cyclic

CCC (Upgrading) Cold catalytic cracking

C-SAGD Cyclic steam assisted gravity drainage

CSS Cyclic steam stimulation

ESEIEH Enhanced solvent extraction incorporating elecromagnetic heating

ET-DSP Electro-thermal dynamic stripping

HCSS Horizontal cyclic steam stimulation

HTL Heavy-to-light upgrading process

In situ Production technology undisclosed; will use drilling and enhanced recovery

LP-SAGD Low-pressure steam assisted gravity drainage

Mining Truck and shovel mining

Nsolv purified condensing solvent extraction technology

Orcrude Primary upgrading process

SAGD Steam assisted gravity drainage

SAP Solvent aided process

SC-SAGD Solvent cyclic steam assisted gravity drainage

TAGD Thermal assisted gravity drainage

THAI Toe to heel air injection

UPG Bitumen upgrading

USP (Upgrading) Ultra-selective pyrolysis

VSD Vertical steam drive

PROJECT LISTINGS *See oil sands project technology legend on page 9.*

Updated status of oil sands projects in Alberta | As of March 2016

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
NORTH ATHABASCA REGION — MINING				
Canadian Natural Resources Limited				
Horizon				
The start-up of Horizon Phase 2B is targeted for Oct. 2016 and will add 45,000 bbls/d of production capacity. Phase 3 is currently on schedule and budget with start-up in Q4 2017.				
Phase 1	135,000	2008	Operating	**Mining**
Reliability - Tranche 2	5,000	2014	Operating	**Mining**
Phase 2A	12,000	2014	Operating	**Mining**
Phase 2B	45,000	2016	Construction	**Mining**
Phase 3	80,000	2017	Construction	**Mining**
Imperial Oil Limited				
Kearl				
Imperial says that Kearl bitumen production averaged 203,000 bbl/d in Q4. The increase was largely due to continued strong performance from the expansion project and optimization efforts at the combined Kearl operation.				
Phase 1	110,000	2013	Operating	**Mining**
Phase 2	110,000	2015	Operating	**Mining**
Phase 3	80,000	TBD	On Hold	**Mining**
Phase 4 Debottleneck	45,000	TBD	On Hold	**Mining**
Shell Albian Sands				
Jackpine				
Phase 1A	100,000	2010	Operating	**Mining**
Phase 1B	100,000	TBD	Approved	**Mining**
Expansion	100,000	TBD	Approved	**Mining**
Muskeg River				
Project partner Marathon Oil says that record production of approximately 285,000 bbls/d during Q3 was largely due to improved operational reliability and no planned maintenance.				
Commercial	155,000	2002	Operating	**Mining**
Expansion & Debottlenecking	115,000	TBD	Approved	**Mining**
Pierre River				
Shell has withdrawn its application for the Pierre River project, saying it wants to focus on its existing oil sands operations. The company says it will continue to hold the Pierre River leases and may re-apply in the future.				
Phase 1	100,000	TBD	Cancelled	**Mining**
Phase 2	100,000	TBD	Cancelled	**Mining**
Suncor Energy Inc.				
Base Operations				
Suncor says that planned upgrader maintenance was completed in the fourth quarter of 2015. Additionally, upgrader reliability exceeded 90 per cent, more than a year ahead of the company's plan.				
Millennium Mine	294,000	1967	Operating	**Mining**
Steepbank Debottleneck Phase 3	4,000	2007	Operating	**Mining**
Millennium Debottlenecking	23,000	2008	Operating	**Mining**
North Steepbank Extension	180,000	2012	Operating	**Mining**
Fort Hills				
Suncor says that at the end of Q4/15, construction is more than 50 per cent complete. Spending during the quarter included engineering, procurement, module fabrication and site construction.				
Phase 1	160,000	2017	Construction	**Mining**
Debottleneck	20,000	TBD	Approved	**Mining**
Voyageur South				
Suncor considers Voyageur South to be a "longer-term" project and has not confirmed a start-up date.				
Phase 1	250,000	2024	Announced	**Mining**
Syncrude Canada Ltd.				
Mildred Lake/Aurora				
In December, Syncrude performed coker maintenance originally scheduled for mid-2016. Suncor Energy announced that it will acquire Canadian Oil Sands in early 2016. Upon completion Suncor will have a 48.74 per cent interest in Syncrude.				
Base Mine Stage 1 & 2 Expansion	290,700	1978	Operating	**Mining**
Stage 3 Expansion	116,300	2006	Operating	**Mining**
Centrifuge Tailings Management	TBD	TBD	Operating	**Mining**
Aurora SouthTrain 1	100,000	TBD	Approved	**Mining**
Aurora SouthTrain 2	100,000	TBD	Approved	**Mining**
Mildred Lake Mine Extension (MLX)	184,000	2023	Application	**Mining**
Teck Resources Limited				
Frontier				
Teck has filed a project update for the Frontier mining development. The capital cost has been increased to $20.6 billion and the total capacity is now 260,000 bbls/d. Alberta Environment and Parks says that supplemental information responses regarding the Frontier application/EIA are now under review.				
Phase 1a	85,000	2026	Application	**Mining**
Phase 1b	85,000	2027	Application	**Mining**
Phase 2	90,000	2037	Application	**Mining**
Total E&P Canada Ltd.				
Joslyn North Mine				
Total has withdrawn the regulatory applications for the Joslyn North Mine.				
Phase 1	100,000	TBD	On Hold	**Mining**
NORTH ATHABASCA REGION — IN SITU				
Athabasca Oil Corporation				
Birch				
Athabasca lists Birch as one of its long-term assets.				
Phase 1	12,000	TBD	Announced	**SAGD**
Dover West Carbonates (Leduc)				
Athabasca lists Dover West as one of its long-term assets.				
Phase 1 Demonstration	6,000	TBD	Approved	**TAGD**
Phase 2 Demonstration	6,000	TBD	Application	**TAGD**
Dover West Sands & Clastics				
Athabasca lists Dover West as one of its long-term assets.				
Phase 1	12,000	TBD	Application	**SAGD**
Phase 2	35,000	2019	Announced	**SAGD**
Phase 3	35,000	2020	Announced	**SAGD**
Phase 4	35,000	2022	Announced	**SAGD**
Phase 5	35,000	2024	Announced	**SAGD**
BP p.l.c.				
Terre de Grace				
BP stated in late 2014 that it is unlikely that Terre de Grace would come online before 2020.				
Pilot	10,000	TBD	Approved	**SAGD**

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Brion Energy Corporation				
Dover				
Dover Experimental Pilot	2,000	2017	Approved	**SAGD**
Dover North Phase 1	50,000	TBD	Approved	**SAGD**
Dover North Phase 2	50,000	TBD	Approved	**SAGD**
Dover South Phase 3	50,000	2021	Approved	**SAGD**
Dover South Phase 4	50,000	2023	Approved	**SAGD**
Dover South Phase 5	50,000	2025	Approved	**SAGD**
MacKay River				
Phase 1	35,000	2015	Construction	**SAGD**
Phase 2	40,000	TBD	Approved	**SAGD**
Phase 3	40,000	2020	Approved	**SAGD**
Phase 4	35,000	2022	Approved	**SAGD**
Canadian Natural Resources Limited				
Birch Mountain				
Phase 1	60,000	TBD	Announced	**SAGD**
Phase 2	60,000	TBD	Announced	**SAGD**
Cenovus Energy Inc.				
East McMurray				
Phase 1	30,000	TBD	Announced	**SAGD**
Steepbank				
Phase 1	30,000	TBD	Announced	**SAGD**
Telephone Lake				
Cenovus says it continues to review development options for Telephone Lake after receiving regulatory approval in late 2014.				
Phase A	45,000	TBD	On Hold	**SAGD**
Phase B	45,000	TBD	Approved	**SAGD**
E-T Energy Ltd.				
Poplar Creek				
E-T and Bayshore Petroleum will merge and continue operating as Bayshore. The company plans to restart production at the Poplar Creek site using a combination of E-T and Bayshore's proprietary technologies.				
Experimental Pilot	1,000	2012	Suspended	**ET-DSP**
Grizzly Oil Sands ULC				
Thickwood				
The Alberta Energy Regulator says it will defer decisions on applications for in situ oilsands projects in the new "shallow thermal area" of the Athabasca region until it has developed formal regulatory requirements. Grizzly Thickwood is one of five impacted projects.				
Phase 1	6,000	TBD	Cancelled	**CSS & SAGD**
Phase 2	6,000	TBD	Cancelled	**CSS & SAGD**
Husky Energy Inc.				
Saleski				
Husky filed the regulatory application for its Saleski pilot in early May 2013.				
Carbonate Pilot	3,000	TBD	Application	**CSS**
Sunrise				
Husky says that Sunrise is steadily ramping up toward expected capacity of about 60,000 bbls/day around the end of 2016.				
Phase 1A	30,000	2015	Operating	**SAGD**
Phase 1B	30,000	2015	Operating	**SAGD**
Phase 2A	35,000	TBD	On Hold	**SAGD**
Phase 2B	35,000	TBD	Approved	**SAGD**
Future Phases	70,000	TBD	Approved	**SAGD**
Imperial Oil Limited				
Aspen				
Imperial has amended its regulatory application for Aspen to use solvent-assisted SAGD versus conventional SAGD. Aspen is now proposed to be executed in two phases of 75,000 bbls/d, with development timing subject to regulatory approvals and market conditions. A final investment decision could me made as early as 2017.				
Phase 1	75,000	2020	Application	**SA-SAGD**
Phase 2	75,000	TBD	Application	**SA-SAGD**
Ivanhoe Energy Inc.				
Tamarack				
Ivanhoe has announced that despite considerable efforts by the company, its trustee and major creditors, the parties have been unable to reach a viable restructuring proposal under the Bankruptcy and Insolvency Act. The company was deemed bankrupt as of 11:59 PM MDT on June 1.				
Phase 1	20,000	TBD	Cancelled	**SAGD**
Phase 2	20,000	TBD	Cancelled	**SAGD**
Koch Exploration Canada Corporation				
Dunkirk				
Koch has withdrawn the Dunkirk project from the regulatory review process.				
Commercial Demonstration	2,000	2017	Cancelled	**SAGD**
Phase 1	30,000	TBD	Cancelled	**SAGD**
Phase 2	30,000	TBD	Cancelled	**SAGD**
Marathon Oil Corporation				
Birchwood				
Marathon had anticipated receiving regulatory approval for the Birchwood project by the end of 2014. Upon receiving this approval, the company will further evaluate its development plans.				
Demonstration	12,000	TBD	Cancelled	**SAGD**
Oak Point Energy Ltd.				
Lewis				
Oak Point Energy says the Lewis project is well positioned (no additional work required) for exploitation when oil prices recover.				
Pilot	1,720	TBD	Approved	**SAGD**
Prosper Petroleum Ltd.				
Rigel				
Prosper Petroleum filed its regulatory application for the Rigel SAGD project in November 2013. Regulatory approval is expected in the second half of 2015.				
Phase 1	10,000	2017	Application	**SAGD**
Southern Pacific Resource Corp.				
STP-McKay				
Southern Pacific and certain of its subsidiaries have obtained creditor protection under the Companies' Creditors Arrangement Act. The STP-McKay is being suspended to preserve capital until oil prices recover.				
Phase 1	12,000	2012	Suspended	**SAGD**
Suncor Energy Inc.				
Dover				
N-Solv Corporation says that since start-up in Q2/2015, the pilot plant has produced over 60,000 barrels of oil.				
Nsolv BEST Pilot	300	2014	Operating	**Nsolv**
ESEIEH Pilot	N/A	2015	Operating	**ESEIEH**
Firebag				
Suncor says that work at Firebag continues to focus on well pad construction to sustain existing production, and has deferred planned maintenance from 2016 to 2017. Effective Jan. 1, 2016, Suncor says nameplate capacity at Firebag increased from 180,000 to 203,000 bbls/d as a result of completion of debottlenecking activities.				
Stage 1	35,000	2004	Operating	**SAGD**
Stage 2	35,000	2006	Operating	**SAGD**
Cogeneration and Expansion	25,000	2007	Operating	**SAGD**
Stage 3	42,500	2011	Operating	**SAGD**
Stage 4	42,500	2012	Operating	**SAGD**
Stage 5	62,500	TBD	Approved	**SAGD**
Stage 6	62,500	TBD	Approved	**SAGD**
Stage 3-6 Debottle-neck	23,000	TBD	Operating	**SAGD**
Lewis				
Phase 1	40,000	TBD	Announced	**In situ**
Phase 2	40,000	TBD	Announced	**In situ**

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
MacKay River				
Suncor says that spending is currently focused on ongoing well pad construction to maintain existing production levels.				
Phase 1	33,000	2002	Operating	**SAGD**
Debottleneck	5,000	2014	Operating	**SAGD**
MR2	20,000	TBD	On Hold	**SAGD**
Sunshine Oilsands Ltd.				
Legend Lake				
Phase A1	10,000	TBD	Application	**SAGD**
Phase A2	30,000	TBD	Announced	**SAGD**
Phase B1	30,000	TBD	Announced	**SAGD**
Phase B2	30,000	TBD	Announced	**SAGD**
Thickwood				
Phase A1	10,000	TBD	Approved	**SAGD**
Phase A2	30,000	TBD	Announced	**SAGD**
Phase B	30,000	2021	Announced	**SAGD**
West Ells				
Sunshine says that first oil was achieved at West Ells in December 2015.				
Phase A1	5,000	2015	Operating	**SAGD**
Phase A2	5,000	TBD	Approved	**SAGD**
Phase A3	30,000	TBD	Announced	**SAGD**
Phase B	20,000	TBD	Announced	**SAGD**
Phase C1	30,000	TBD	Announced	**SAGD**
Phase C2	30,000	TBD	Announced	**SAGD**
Value Creation Inc.				
Audet				
Value Creation has acquired SilverWillow Energy and its Audet project.				
Pilot	12,000	TBD	Application	**SAGD**
SOUTH ATHABASCA REGION — IN SITU				
Athabasca Oil Corporation				
Hangingstone				
The company says that initial production ramp-up continues to progress, and has updated its thermal oil exit guidance to between 5,000 and 7,000 bbls/d (up from 3,000–6,000 bbls/d). The Environmental Impact Assessment director has deemed the EIA report complete for the Hangingstone expansion project.				
HS-1	12,000	2015	Operating	**SAGD**
HS-2A Debottleneck (1 and 2)	8,000	TBD	Application	**SAGD**
HS-2B Expansion	32,000	2019	Application	**SAGD**
HS-3	30,000	2021	Application	**SAGD**
BlackPearl Resources Inc.				
Blackrod				
BlackPearl says that results from the second pilot SAGD well pair continue to be positive, producing in excess of 550 bbls/d with an SOR of 2.6. There have been no new updates regarding the status of its 80,000-bbl/d commercial application, which is under review by the AER.				
Pilot	800	2011	Operating	**SAGD**
Phase 1	20,000	TBD	Application	**SAGD**
Phase 2	30,000	TBD	Application	**SAGD**
Phase 3	30,000	TBD	Application	**SAGD**
Canadian Natural Resources Limited				
Gregoire Lake				
Phase 1	60,000	TBD	Announced	**SAGD**
Phase 2	60,000	TBD	Announced	**SAGD**
Grouse				
Canadian Natural lists the first phase of Gregoire in its growth plan following construction of Kirby North Phase 1, which was suspended early in 2015 due to market conditions.				
Commercial	40,000	2020	Application	**SAGD**
Kirby				
Canadian Natural says that Kirby South production continues its ramp up to design capacity. Q4/2016 volumes averaged 33,000 bbls/d, and in November production exceeded 41,000 bbls/d.				
KS1 - Kirby South	40,000	2013	Operating	**SAGD**
KN1 - Kirby North	40,000	TBD	On Hold	**SAGD**
KN2 - Kirby North	60,000	TBD	Approved	**SAGD**
Cavalier Energy Inc.				
Hoole				
Regulatory approval for the first phase of the Hoole project was granted in June 2014. Development of this phase is dependent upon Cavalier Energy securing financing and sanctioning by its board of directors.				
Phase 1	10,000	TBD	Approved	**SAGD**
Phase 2A	35,000	TBD	Announced	**SAGD**
Phase 2B	35,000	TBD	Announced	**SAGD**
Cenovus Energy Inc.				
Christina Lake				
The Phase F expansion is nearing completion, with first oil expected in the third quarter of 2016. Phase H received regulatory approval in December 2015.				
Phase 1A	10,000	2002	Operating	**SAGD**
Phase 1B	8,800	2008	Operating	**SAGD**
Phase C	40,000	2011	Operating	**SAGD**
Phase D	40,000	2012	Operating	**SAGD**
Phase E	40,000	2013	Operating	**SAGD**
Optimization (Phases C,D,E)	22,000	2015	Operating	**SAGD**
Phase F	50,000	2016	Construction	**SAGD**
Phase G	50,000	TBD	On Hold	**SAGD**
Phase H	50,000	TBD	Approved	**SAGD**
Foster Creek				
Cenovus says that the Phase G expansion remains on track for expected production late in the third quarter of 2016. A scheduled turnaround has been deferred into 2017.				
Phase A	24,000	2001	Operating	**SAGD**
Phase B Debottleneck	6,000	2003	Operating	**SAGD**
Phase C Stage 1	10,000	2005	Operating	**SAGD**
Phase C Stage 2	20,000	2007	Operating	**SAGD**
Phase D	30,000	2009	Operating	**SAGD**
Phase E	30,000	2009	Operating	**SAGD**
Phase F	30,000	2014	Operating	**SAGD**
Phase G	30,000	2016	Construction	**SAGD**
Phase H	30,000	2017	On Hold	**SAGD**
Future Optimization (Phases F,G,H)	35,000	TBD	Announced	**SAGD**
Phase J	50,000	TBD	Approved	**SAGD**
Future Optimization	15,000	TBD	Announced	**SAGD**
Grand Rapids				
Cenovus has suspended operations at the Grand Rapids pilot due to low market conditions.				
Pelican Lake Pilot	600	2011	Suspended	**SAGD**
Pelican Upper Grand Rapids Phase A	10,000	TBD	On Hold	**SAP-SAGD**
Pelican Upper Grand Rapids Phase B	32,000	TBD	Approved	**SAP-SAGD**
Pelican Upper Grand Rapids Phase C	29,000	TBD	Approved	**SAP-SAGD**
Pelican Upper Grand Rapids Phase D	29,000	TBD	Approved	**SAP-SAGD**
Pelican Upper Grand Rapids Phase E	32,000	TBD	Approved	**SAP-SAGD**
Pelican Upper Grand Rapids Phase F	29,000	TBD	Approved	**SAP-SAGD**
Pelican Upper Grand Rapids Phase G	19,000	TBD	Approved	**SAP-SAGD**
Narrows Lake				
Phase A	45,000	TBD	On Hold	**SAP-SAGD**
Phase B	45,000	TBD	Approved	**SAP-SAGD**
Phase C	40,000	TBD	Approved	**SAP-SAGD**

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
West Kirby				
Phase 1	30,000	TBD	Announced	**SAGD**
Winefred Lake				
Phase 1	30,000	TBD	Announced	**SAGD**
CNOOC Limited				
Long Lake				
An hydrocracker explosion at Long Lake on Friday, January 15 resulted in two fatalities. Nexen says its upgrader has been shut down and SAGD volumes have been reduced to minimum rates. No timeline for a full facility restart has been announced, and an AER investigation is underway.				
Phase 1	72,000	2008	Operating	**SAGD**
Kinosis (K1A)	20,000	2014	Operating	**SAGD**
Kinosis (K1B)	37,500	TBD	Approved	**SAGD**
Connacher Oil and Gas Limited				
Great Divide				
Connacher is reducing production at the Great Divide project to between 3,000–4,000 bbls/d in light of "exceptionally low commodity prices."				
Pod One	10,000	2007	Operating	**SAGD**
Algar	10,000	2010	Operating	**SAGD**
Expansion 1A	12,000	TBD	Approved	**SAGD**
Expansion 1B	12,000	TBD	Approved	**SAGD**
ConocoPhillips Canada Limited				
Surmont				
ConocoPhillips says that production at Surmont 2 is expected to ramp up through 2017. The Surmont 3 project application/EIA were submitted in 2015. In November, Alberta Environment & Parks says it sent the company a request for supplemental information and is awaiting response.				
Pilot	1,200	1997	Operating	**SAGD**
Phase 1	30,000	2007	Operating	**SAGD**
Phase 2	118,000	2015	Operating	**SAGD**
Phase 2 Debottleneck	57,000	TBD	Approved	**SAGD**
Phase 3 - Tranche 1	45,000	2020	Application	**SAGD**
Phase 3 - Tranche 2	45,000	2021	Application	**SAGD**
Phase 3 - Tranche 3	45,000	2023	Application	**SAGD**
Devon Canada Corporation				
Jackfish				
Gross production at Jackfish 3 exceeded nameplate capacity, averaging 38,100 bbls/d in the fourth quarter.				
Phase 1	35,000	2007	Operating	**SAGD**
Phase 2	35,000	2011	Operating	**SAGD**
Phase 3	35,000	2014	Operating	**SAGD**
Jackfish East				
Expansion	20,000	2018	Announced	**SAGD**
Pike				
Devon has applied to amend total capacity of the Pike project to 70,000 bbls/d from 105,000 bbls/d, using 52 well pads and 12 once-through steam generators. FEED is expected to be completed in 2015 as well as a cost structure.				
1A	35,000	2019	Approved	**SAGD**
1B	35,000	2020	Approved	**SAGD**
1C	35,000	TBD	Cancelled	**SAGD**
Grizzly Oil Sands ULC				
Algar Lake				
Grizzly has suspended operations at Algar due to low commodity prices.				
Phase 1	6,000	2014	Suspended	**SAGD**
Phase 2	6,000	TBD	Approved	**SAGD**
May River				
Grizzly responded to a third round of supplemental information requests regarding its May River application in early March. Regulatory approval is expected in 2015.				
Phase 1	6,000	TBD	Application	**SAGD**
Phase 2	6,000	TBD	Application	**SAGD**

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Harvest Operations Corp.				
BlackGold				
Harvest says that the CPF was mechanically complete in early 2015 and minor pre-commissioning activities will continue at a measured pace through the year, but first steam is on hold until the heavy oil price becomes favourable.				
Phase 1	10,000	TBD	On Hold	**SAGD**
Phase 2	20,000	TBD	Approved	**SAGD**
Japan Canada Oil Sands Limited				
Hangingstone				
JACOS says that start-up of the Hangingstone Expansion project remains on track for the third quarter of 2016.				
Expansion	20,000	2016	Construction	**SAGD**
Hangingstone Pilot				
Pilot	11,000	1999	Operating	**SAGD**
Koch Exploration Canada Corporation				
Muskwa				
Regulatory approval granted in June 2014.				
Pilot	10,000	TBD	Approved	**SAGD**
Laricina Energy Ltd.				
Germain				
Phase 1 CDP	5,000	2013	Suspended	**SC-SAGD**
Phase 2	30,000	TBD	On Hold	**SC-SAGD**
Phase 3	60,000	TBD	On Hold	**SC-SAGD**
Phase 4	60,000	TBD	On Hold	**SC-SAGD**
Saleski				
According to a report by its court-appointed monitor, PricewaterhouseCoopers, Laricina Energy plans to shut in the Saleski pilot by September 2015 in order to reduce costs. The company has been under creditor protection since March.				
Experimental Pilot	1,800	2011	Suspended	**C & SC-SAGD**
Phase 1	10,700	TBD	On Hold	**C-SAGD**
Phase 2	30,000	TBD	On Hold	**In situ**
Phase 3	60,000	TBD	Announced	**In situ**
Phase 4	60,000	2023	Announced	**In situ**
Phase 5	60,000	2026	Announced	**In situ**
Phase 6	60,000	TBD	Announced	**In situ**
MEG Energy Corporation				
Christina Lake				
MEG temporarily suspended operations between March 3–4 due to a small fire in the plant's sulphur treatment facility. The company says the fire did not impact the integrity of the main processing facilities and resulted in no injuries. MEG has reduced its 2016 budget by 50 per cent to $170 million.				
Phase 1 Pilot	3,000	2008	Operating	**SAGD**
Phase 2A	22,000	2009	Operating	**SAGD**
Phase 2B	35,000	2013	Operating	**SAGD**
Phase 3A	50,000	TBD	Approved	**SAGD**
Phase 3B	50,000	TBD	Approved	**SAGD**
Phase 3C	50,000	TBD	Approved	**SAGD**
Surmont				
The Environmental Assessment Director has deemed the Environmental Impact Assessment report complete for MEG Energy Corp.'s Surmont Project.				
Phase 1	40,000	TBD	Application	**SAGD**
Phase 2	40,000	TBD	Application	**SAGD**
Phase 3	40,000	TBD	Application	**SAGD**
OSUM Oil Sands Corp.				
Sepiko Kesik				
OSUM says it anticipates regulatory approval for Sepiko Kesik in 2015. EIA report has been deemed complete; the review took 91 weeks.				
Phase 1	30,000	2018	Application	**CSS-SAGD**
Phase 2	30,000	2020	Application	**CSS-SAGD**
PTT Exploration and Production				

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Mariana - Thornbury				
PTTEP says that the project is preparing for FEED activities.				
Phase 1	20,000	2021	Application	**SAGD**
Renergy Petroleum (Canada) Co., Ltd.				
Muskwa				
Renergy Petroleum received regulatory approval in January.				
Muskwa Experimental Pilot	TBD	2015	Approved	**Steam & CO_2**
Statoil				
Leismer				
Demonstration	10,000	2010	Operating	**SAGD**
Commercial	10,000	2011	Operating	**SAGD**
Expansion	20,000	TBD	Approved	**SAGD**
Northwest	20,000	TBD	Disclosed	**SAGD**
Suncor Energy Inc.				
Chard				
Phase 1	40,000	TBD	Announced	**In situ**
Meadow Creek East				
Jacobs Engineering has been awarded the design basis memorandum contract for the Meadow Creek project, using a replication strategy.				
Phase 1	40,000	2020	Approved	**SAGD**
Phase 2	40,000	2022	Approved	**SAGD**
Surmont Energy Ltd.				
Wildwood				
Phase 1	12,000	TBD	Application	**SAGD**
Value Creation Inc.				
Advanced TriStar				
ATS-1	15,000	TBD	Application	**SAGD**
ATS-2	30,000	TBD	Application	**SAGD**
ATS-3	30,000	TBD	Application	**SAGD**
DOEx (Demonstration of Excellence)				
Value Creation has filed an amendment to its regulatory approval to increase production capacity from 1,000 to 6,000 bbls/d.				
Pilot	6,000	2018	Application	**SAGD**
COLD LAKE REGION — IN SITU				
Baytex Energy Corp.				
Gemini				
Baytex has made the decision to decommission the Gemini SAGD pilot due to low oil pricing. The company says that since operations started last year the pilot has successfully captured the key data associated with its objectives. The company's primary objective was to confirm reservoir production capacity to support a commercial scale project. Following regulatory approval for the commercial project, any subsequent sanctioning decision will be considered in the context of the project economics in a higher commodity price environment.				
Pilot	1,200	2014	Suspended	**SAGD**
Commercial	5,000	TBD	Approved	**SAGD**
Birchwood Resources Inc.				
Sage				
Birchwood has until September 30, 2015 to submit a response to supplemental information requests related to the Sage regulatory application.				
Pilot	5,000	TBD	Cancelled	**LP-SAGD**
Canadian Natural Resources Limited				
Primrose & Wolf Lake				
Canadian Natural says that it continues to progress low pressure steamflood operations at Primrose Ease Area 1 as well as low pressure CSS operations at Primrose East Area 2, and that operations at Primrose East are meeting expectations.				
Wolf Lake	13,000	1985	Operating	**CSS**
Primrose South	45,000	1985	Operating	**CSS**
Primrose North	30,000	2006	Operating	**CSS**
Primrose East	32,000	2008	Operating	**CSS**
Devon Canada Corporation				
Walleye				
Devon says the Walleye project is currently on hold.				
Phase 1	9,000	TBD	Approved	**SAGD**
Husky Energy Inc.				
Caribou				
Demonstration	10,000	TBD	Approved	**SAGD**
Tucker				
Husky says that work is continuing to increase production and improve returns, with a new well pad that will add 5,000 bbls/d to bring production up to 20,000 bbls/d in 2017. Overall production at Tucker has averaged about 15,000 bbl/d since the beginning of September 2015.				
Phase 1	30,000	2006	Operating	**SAGD**
Imperial Oil Limited				
Cold Lake				
Looking ahead, Cold Lake, including Nabiye, will manage steaming strategies across all assets to enhance resource recovery. Late in 2015 Alberta Environment and Parks issued the final terms of reference for the Midzaghe project, and now awaits the submission of an environmental impact assessment and regulatory application.				
Phase 1-10	110,000	1985	Operating	**CSS**
Phase 11-13	30,000	2002	Operating	**CSS**
Experimental SA-SAGD	TBD	2013	Operating	**SA-SAGD**
Phase 14-16	40,000	2015	Operating	**CSS**
Cold Lake Expansion	55,000	TBD	Announced	**SA-SAGD**
OSUM Oil Sands Corp.				
Orion				
OSUM plans to revise the approved well pad development sequence at Orion, deferring two originally planned pads and developing on new sustaining pad as well as three new pads to increase production to the approved 20,000 bbls/d.				
Phase 1	10,000	2007	Operating	**SAGD**
Phase 2	10,000	TBD	Approved	**SAGD**
Taiga				
OSUM says that Taiga Phase 1 will be advanced in 2015-16 subject to financing.				
Phase 1	12,500	TBD	Approved	**CSS-SAGD**
Phase 2	12,500	TBD	Approved	**CSS-SAGD**
Phase 3	20,000	TBD	Approved	**CSS-SAGD**
Pengrowth Energy Corporation				
Lindbergh				
The 2016 allocation of $14 million of capital to Lindbergh will be directed to maintenance activities as well as further pre-engineering and design for the phase two expansion. Pengrowth expects to receive regulatory approval for the expansion phase of Lindbergh in the first half of the year.				
Pilot	1,260	2012	Operating	**SAGD**
Phase 1	11,240	2015	Operating	**SAGD**
Phase 1 Optimization	3,500	TBD	Operating	**SAGD**
Phase 2 Expansion	34,000	TBD	On Hold	**SAGD**
PEACE RIVER REGION — IN SITU				
Andora Energy Corporation				
Sawn Lake				
Project partner Pan Orient Energy says that the demostration project will be suspended at the end of February 2016 due to the expectation that extremely low bitumen prices may continue for some time, as well as the estimated time required for regulatory approval of the 3,200 bbl/d expansion application, which Pan Orient says will be submitted in March 2016. It is expected that a reactivation of the demonstration project would be considered as part of the expansion.				
Demonstration	1,400	2014	Suspended	**SAGD**
Expansion	3,200	TBD	Announced	**SAGD**
Baytex Energy Corp.				
Cliffdale				
Baytex says that operations at the Cliffdale CSS pilot were suspended in late September 2015.				
Pilot	2,000	2011	Suspended	**CSS**
Dawson				
Touchstone Exploration Inc. has disposed of its interest in the Dawson area of Alberta for cash consideration of $2.15 million.				
Experimental Demonstration	TBD	2014	Suspended	**CSS**

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Harmon Valley				
Pilot	TBD	2011	Operating	**CSS**
Murphy Oil Company Ltd.				
Seal/Cadotte				
Murphy Oil says that during Q3, volumes from the Seal area were reduced due to the shut-in of uneconomic wells and environmental monitoring together with natural decline.				
Pilot	TBD	TBD	Operating	**HCSS**
Demonstration	12,450	2019	Application	**HCSS**
Northern Alberta Oil Ltd.				
Sawn Lake				
Parent company Deep Well Oil & Gas says it is waiting on the preliminary results of the Sawn Lake SAGD pilot operated by Andora Energy to fine-tune the horizontal cyclic steam project design. Deep Well is a partner in the Sawn Lake project.				
Pilot	700	TBD	Approved	**HCSS**
Penn West Petroleum Ltd.				
Harmon Valley South				
In collaboration with its partner, Penn West has finalized the budget for the second half 2015 and first half 2016 development program in the area. Penn West's management is pleased to have the full support of its partner allowing for development to be accelerated in the play through the addition of a second rig to the program. The second rig is planned to start in September and carry through to the end of the year. Approximately 90 per cent of Penn West's expenditures continue to be paid for by our partner in the PROP joint venture.				
Pilot	TBD	2014	Operating	**HCSS**
Seal Main				
In collaboration with its partner, Penn West has finalized the budget for the second half 2015 and first half 2016 development program in the area. Penn West's management is pleased to have the full support of its partner allowing for development to be accelerated in the play through the addition of a second rig to the program. The second rig is planned to start in September and carry through to the end of the year. Approximately 90 per cent of Penn West's expenditures continue to be paid for by our partner in the PROP joint venture.				
Pilot	75	2011	Operating	**HCSS**
Commercial	10,000	TBD	Application	**HCSS**
Royal Dutch Shell plc				
Peace River				
Shell has stopped construction of the Carmon Creek project. Shell is retaining the project leases and some equipment as evaluations are ongoing.				
Cadotte Lake	12,500	1986	Operating	**CSS**
Carmon Creek - Phase 1	40,000	TBD	On Hold	**VSD**
Carmon Creek - Phase 2	40,000	TBD	On Hold	**VSD**
NORTH ATHABASCA REGION — UPGRADER				
BP p.l.c.				
Terre de Grace				
BP stated in late 2014 that it is unlikely that Terre de Grace would come online before 2020.				
Pilot	8,400	TBD	Approved	**ADC USP**
Canadian Natural Resources Limited				
Horizon				
The start-up of Horizon Phase 2B is targeted for Oct 2016 and will add 45,000 bbls/d of production capacity. Phase 3 is currently on schedule & budget with start-up in Q4 2017.				
Phase 1	110,000	2009	Operating	**UPG**
Reliability - Tranche 2	5,000	2014	Operating	**UPG**
Phase 2A	12,000	2014	Operating	**UPG**
Phase 2B	45,000	2016	Construction	**UPG**
Phase 3	80,000	2017	Construction	**UPG**
E-T Energy Ltd.				
Poplar Creek				
E-T and Bayshore Petroleum will merge and continue operating as Bayshore. The company plans to restart production at the Poplar Creek site using a combination of E-T and Bayshore's proprietary technologies.				
Experimental Pilot	TBD	TBD	Announced	**CCC**
Ivanhoe Energy Inc.				
Tamarack				
Ivanhoe has announced that despite considerable efforts by the company, its trustee and major creditors, the parties have been unable to reach a viable restructuring proposal under the Bankruptcy and Insolvency Act. The company was deemed bankrupt as of 11:59 PM MDT on June 1.				
Phase 1	34,784	TBD	Cancelled	**HTL**
Suncor Energy Inc.				
Base Operations				
Suncor says that planned upgrader maintenance was completed in the fourth quarter of 2015. Additionally, upgrader reliability exceeded 90 per cent, more than a year ahead of the company's plan.				
U1 and U2	225,000	1967	Operating	**UPG**
Millennium Vacuum Unit	35,000	2005	Operating	**UPG**
Millennium Coker Unit	97,000	2008	Operating	**UPG**
Syncrude Canada Ltd.				
Mildred Lake/Aurora				
In December, Syncrude performed coker maintenance originally scheduled for mid-2016. Suncor Energy announced that it will acquire Canadian Oil Sands in early 2016, upon completion Suncor will have a 48.74 per cent interest in Syncrude.				
Base Plant Stage 1 & 2 Debottleneck	250,000	1978	Operating	**UPG**
Stage 3 Expansion (UE-1)	100,000	2006	Operating	**UPG**
Stage 3 Debottleneck	75,000	TBD	Announced	**UPG**
SOUTH ATHABASCA REGION — UPGRADER				
CNOOC Limited				
Long Lake				
A hydrocracker explosion at Long Lake on January 15 resulted in two fatalities. Nexen says its upgrader has been shut down and SAGD volumes have been reduced to minimum rates. No timeline for a full facility restart has been announced, and an AER investigation is underway.				
Phase 1	58,500	2009	Suspended	**OrCrude**
Value Creation Inc.				
Advanced TriStar				
ATS-1	12,750	TBD	Application	**ADC USP**
ATS-2	25,500	TBD	Application	**ADC USP**
ATS-3	25,500	TBD	Application	**ADC USP**
DOEx (Demonstration of Excellence)				
Value Creation has filed an amendment to its regulatory approval to increase production capacity from 1,000 to 6,000 bbls/d.				
Pilot	12,000	2018	Application	**ADC USP**
INDUSTRIAL HEARTLAND REGION — UPGRADER				
North West Upgrading Inc.				
Redwater Upgrader				
As the result of an on-site pedestrian-vehicle incident Dec. 9, 2015, one of NWR's employees was fatally injured. The on-site workforce has reached 3,800 people. To date approximately 400 modules have been installed with more than 600 additional modules standing in various stages of assembly at module fabrication shops. Module delivery and assembly into the refinery will continue throughout 2016.				
Phase 1	50,000	2017	Construction	**UPG**
Phase 2	50,000	TBD	Approved	**UPG**
Phase 3	50,000	TBD	Approved	**UPG**
Shell Albian Sands				
Scotford Upgrader				
Shell has made a final investment decision on the HCU debottleneck project, which is expected to increase hydrocracking capacity by about 20 per cent. Project partner Marathon Oil says that planned turnarounds at the base upgrader and Muskeg River mine were completed on time and on budget in Q2, as well as unplanned downtime at the expansion upgrader.				
Commercial	155,000	2003	Operating	**UPG**
Expansion	100,000	2011	Operating	**UPG**
Scotford HCU Debottleneck	14,000	TBD	Announced	**UPG**

GLOSSARY of oil sands terms

ASPHALTENES
The heaviest and most concentrated aromatic hydrocarbon fractions of bitumen.

BARREL
The traditional measurement for crude oil volumes. One barrel equals 42 U.S. gallons (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.

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.

DENSITY
The heaviness of crude oil, indicating the proportion of large, carbon-rich molecules, generally measured in kilograms per cubic metre (kg/m^3) or degrees on the American Petroleum Institute (API) gravity scale; in western Canada, oil up to 900 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 addition of a diluent such as condensate or naphtha.

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

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

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).

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.

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.

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_2) downhole, which then "push" the oil towards the recovery well.

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).

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

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.

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.

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

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.

TAILINGS
A combination of water, sand, silt and fine clay particles that is a by-product 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.

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).

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

ASSOCIATIONS/ORGANIZATIONS

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