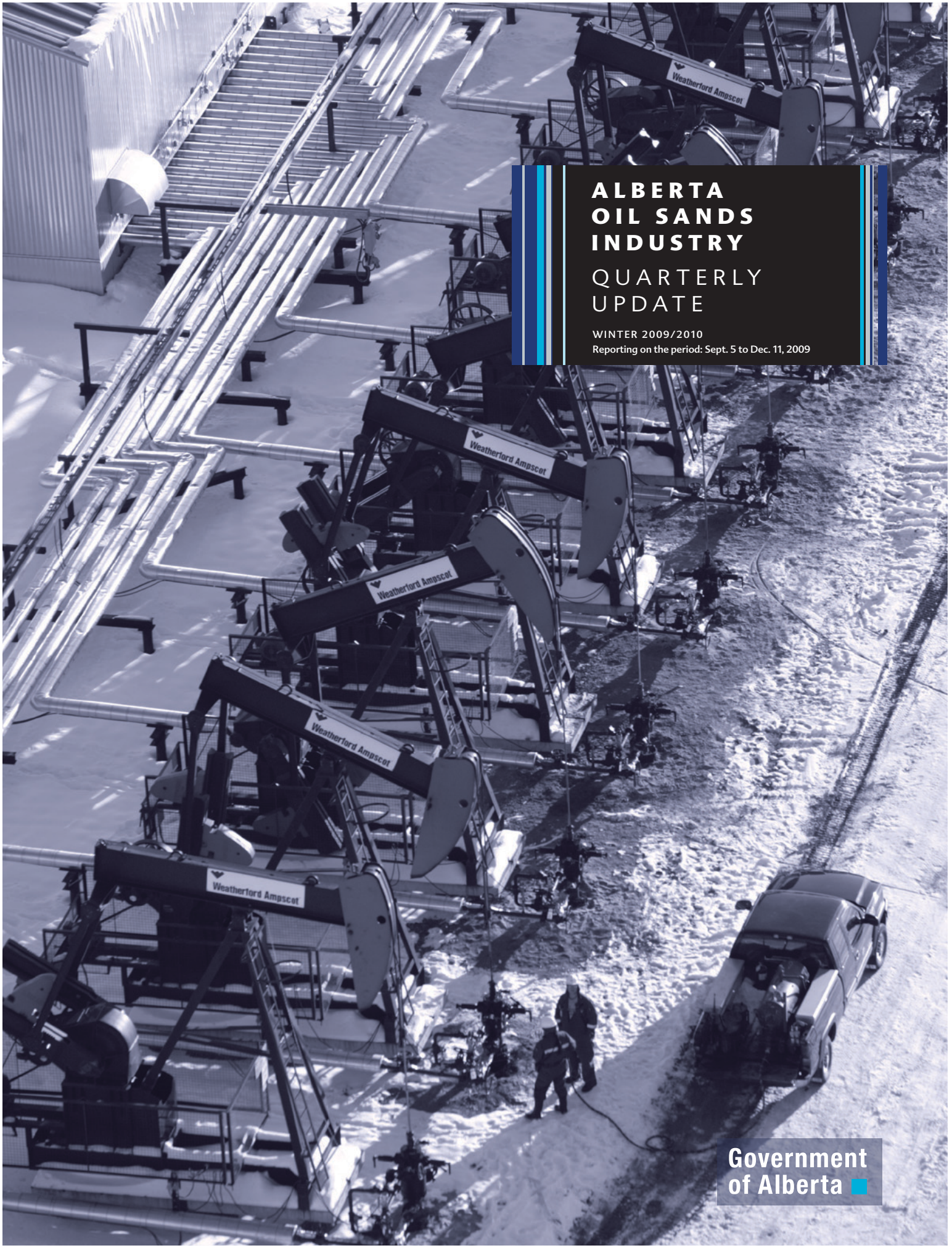

ALBERTA OIL SANDS INDUSTRY

QUARTERLY UPDATE

WINTER 2009/2010

Reporting on the period: Sept. 5 to Dec. 11, 2009

Government of Alberta

All about the oil sands

Background of an important global resource

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Alberta has the second-largest deposit of oil in the world—only Saudi Arabia can claim a larger stockpile of crude. But 170 billion of Alberta's 179 billion barrels of oil have the special quality of being bitumen, a resource that has been developed for decades but is only now coming into the forefront of the global energy industry, as conventional supplies—so-called "easy" oil—continue to be depleted. The figure of 170 billion barrels represents what is considered economically recoverable with today's technology, but with new technologies, this reserve estimate could be increased to as much as 315 billion barrels.

There are three major bitumen (or oil sands) deposits in Alberta. The largest is the Athabasca deposit, located in the province's northeast in the Regional Municipality of Wood Buffalo. The main population centre of the Athabasca deposit is the City of 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.

Today bitumen is produced as an energy source by two means—mining and in situ. The majority of oil sands production is done by surface mining, but this will likely change in the future, as 80 per cent of Alberta's bitumen deposits are too deep underground to economically employ this technology.

Right now 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 via gravity, the melted bitumen flows into the lower well and is pumped to the surface using artificial lift.

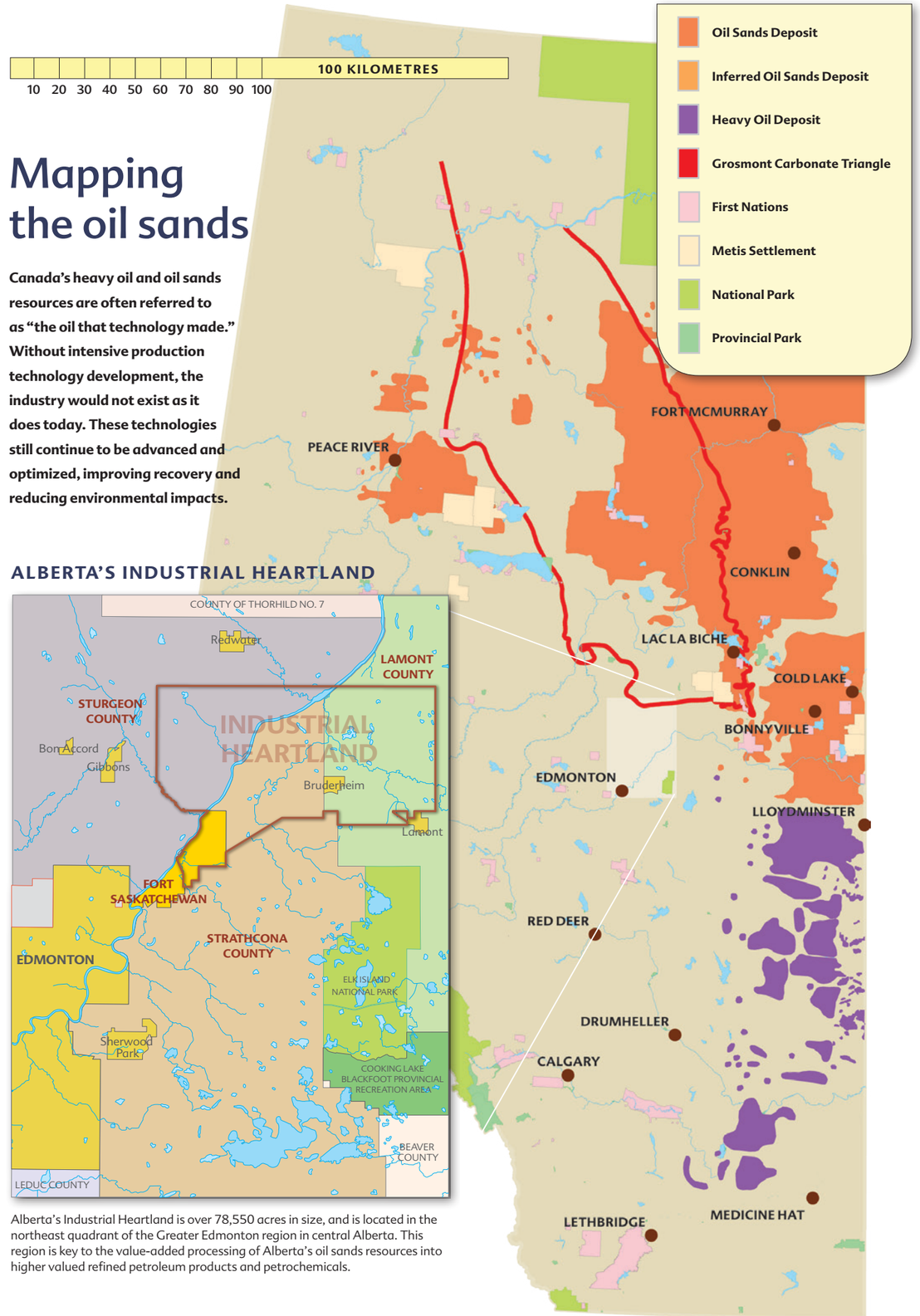
Both SAGD and CSS are used in the Cold Lake and Peace River deposits, while SAGD is the in situ technology of choice in the Athabasca deposit. The choice is based on a number of things including geology. The technologies combined currently produce just over one million barrels per day.

Research is underway on a number of other production technologies designed to optimize production and minimize water and energy use, including vapour extraction (VAPEX), and a form of in situ combustion known as toe to heel air injection (THAI).

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 (SCO), which is a refinery feedstock. At these refineries it can be transformed into transportation fuels and other products. ■

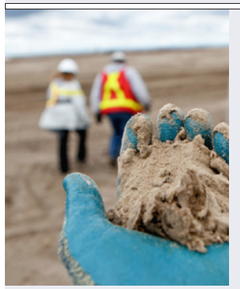
Mapping the oil sands

Canada's heavy oil and oil sands resources are often referred to as "the oil that technology made." Without intensive production technology development, the industry would not exist as it does today. These technologies still continue to be advanced and optimized, improving recovery and reducing environmental impacts.



Alberta's Industrial Heartland is over 78,550 acres in size, and is located in the northeast 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.

Government update



GOVERNMENT POLICY

Value-added strategy

On Oct. 20 and 22, 2009, the Alberta government hosted workshops in Edmonton and Calgary with invited industry representatives to review the findings of the recently completed Alberta Midstream Chemical Cluster Site Requirement Study. The study assessed the land use, infrastructure, and logistics requirement for the development of a purpose-built world-class midstream chemical cluster in Alberta's Industrial Heartland area using oil-based feedstocks.

The study is a critical piece in the development of the business case to see the creation of a cluster complex in the Greater Edmonton Area to enhance the value of the oil sands resource through the production of refined products and petrochemicals for local and export markets.

The feedback received from industry during these workshops provides government with direction on action items to move the strategy forward. A presentation of the study findings can be found at www.energy.alberta.ca/petrochemical/pdfs/alberta_midstream_chemical_cluster_site_requirements_study.pdf.

Bitumen royalty-in-kind

On Oct. 19, 2009, the province issued a Request for Proposals (RFP) to process up to 75,000 barrels per day of royalty bitumen within Alberta.

The final RFP has two notable changes from the initial RFP that was released in August. The two changes include the project commencement deadline being extended by two years to 2018 so that new projects just beginning the approval process today can still meet the required timeline. The second notable change allows for construction of a bitumen upgrader in two or more phases, provided all phases will be complete and operational by Dec. 31, 2018.

The deadline for receipt of proposals is Jan. 27, 2010. The RFP, detailed information on the process, and a list of frequently asked questions can be accessed through www.energy.alberta.ca/BRIK-REOI.asp.

Water for Life

The Government of Alberta has released its Water for Life action plan, the road map that the government and its partners will follow over the next 10 years. It can be accessed at http://environment.gov.ab.ca/info/library/8236.pdf. The action plan supports the goals and directions outlined in Alberta's renewed Water for Life strategy, found at http://environment.gov.ab.ca/info/library/8035.pdf. The renewed Water for Life action plan emphasizes three priorities: healthy aquatic ecosystems, conservation, and education.

The plan lays out the actions Alberta intends to deliver over the next decade. It includes activities Alberta committed to deliver as part of its original Water for Life strategy and incorporates new actions to address the province's emerging water challenges and current realities. The action plan also supports regional environmental objectives and Alberta's cumulative effects management approach.

For a copy of the renewed action plan and strategy, visit www.waterforlife.alberta.ca.

RESEARCH AND TECHNOLOGY

Carbon capture and storage

The Alberta government has moved onto the global stage with the signing of letters of intent for projects with Shell Canada, TransAlta Corporation, Enhance Energy, North West Upgrading, and Swan Hills Synfuels to implement large-scale carbon capture and storage (CCS) technology. Two of these projects, Shell and Enhance Energy, are specific to oil sands development.

The letter of intent with Shell Canada Energy, on behalf of the Athabasca Oil Sands Project, will provide $745 million in funding for its Quest project over the next 15 years. The province has also signed a letter of intent with TransAlta Corporation on Project Pioneer at the Keephills 3 plant west of Edmonton. The project will utilize leading-edge technology to capture CO_2 for use in enhanced oil recovery and storage. The province will provide $431 million over the next 15 years towards the development of this project. An additional $5 million will be provided to the project to support front-end engineering and design.

A letter of intent was also signed with Enhance Energy and North West Upgrading to construct a 240-kilometre CO_2 pipeline system that will significantly increase the province's capacity for future CCS projects. When completed, the Alberta Carbon Trunk Line (ACTL) pipeline will connect the Industrial Heartland near Fort Saskatchewan south to the producing oil fields near Clive, north of Red Deer. The ACTL will be designed to carry about 40,000 tonnes of CO_2 per day or approximately 14 million tonnes per year. With the province's investment of $495 million over a 15-year period, construction is expected to begin in 2011 with operations commencing in late 2012.

Finally, the province has also signed a letter of intent for $285 million with Swan Hills Synfuels. The company, which initially received $8.8 million in provincial funding in March through the Alberta Energy Research Institute toward its $30-million demonstration project to turn deep coal seams into synthetic natural gas, will replicate its successful large-scale project. The project will supply enough syngas to create 300 megawatts of power generation. The captured CO_2 will be used for enhanced oil recovery.

No funds will be distributed to these projects until grant agreements are signed.

Alberta's committed funding toward commercial-scale greenhouse gas emission reduction is approximately $1.96 billion, leading to emission cuts of approximately five million tonnes annually beginning in 2015. CCS projects support the provincial energy strategy to enhance clean energy production through energy technology leadership.

Climate change

Environment Minister Rob Renner met in November with key U.S. environmental, policy, and industry leaders in California to share Alberta's efforts to advance greener energy production and discuss general environmental issues.

The Nov. 18–20 mission showcased Alberta's efforts in pioneering game-echanging technologies for clean energy development, such as CCS. It also helped the province gain a better understanding of California's environmental policies. Minister Renner met with a variety of organizations, including the California Environment Protection Agency and the California Air Resources Board, whose objectives complement the work of Alberta's Clean Air Strategic Alliance.

Tailings ponds

The Energy Resources Conservation Board (ERCB) has received plans with dates for construction, use and closure of fluid tailings ponds from six Alberta oil sands operators as required by Directive 074: Tailings Performance Criteria and Requirements for Oil Sands Mining Schemes, accessible at www.ercb.ca/docs/documents/directives/directive074.pdf.

The directive requires operators to prepare tailings plans and report on tailings ponds annually, reduce fluid tailings through fines captured in dedicated disposal areas, and convert fines into trafficable deposits that are ready for reclamation five years after deposits have ceased.

Albian Sands Energy Inc., Canadian Natural Resources Limited, Imperial Oil Resources Ventures Limited, Shell Canada Inc., Suncor Energy Ltd., and Syncrude have submitted tailings plans under Directive 074. The ERCB will now conduct a detailed and comprehensive technical review of the plans. The plans will not be approved until the ERCB is satisfied that they comply with ERCB requirements. ■

Other information sources of interest

An Alberta project that uses CO_2 to enhance coalbed methane extraction received an international award from the Carbon Sequestration Leadership Forum (CSLF) on Oct. 13 in London, England.

The Alberta Enhanced Coalbed Methane Recovery Project, led by the Alberta Research Council, was completed in 2008. The project involved injecting CO_2 into deep, unminable coal beds, displacing the underground methane with CO_2. The process reduces greenhouse gas emissions while also enabling greater recovery of coalbed methane.

Alberta Energy Minister Knight accepted the award on behalf of the Alberta Research Council at the awards event, which also recognized three other projects. The awards were part of a three-day conference hosted by the CSLF.

A second Alberta project, co-led by ARC Resources Ltd. and the Alberta Research Council, was endorsed by the CSLF during its meetings. The Industrial Heartland area Redwater Project, which began in 2008 and is still in progress, aims to store CO_2 emissions from Alberta's Industrial Heartland region, a cluster of energy-related industries east of Edmonton near Fort Saskatchewan, in the underground Redwater Reef formation. The formation has the potential to handle all the emissions from the region's operations for more than 20 years, estimated at about one million tonnes of CO_2 per year by 2015.

Upcoming events

Cold Climate Construction Conference and Expo
March 2–3, 2010, Edmonton, Alberta

National Buyer Seller Forum
March 23–25, 2010, Edmonton, Alberta

Water Technologies Symposium 2010—WaterTech 2010
April 21–23, 2010, Banff, Alberta

Global Petroleum Show
June 8–10, 2010, Calgary, Alberta

What's new in the oil sands

Key updates from winter 09/10

EnCana shareholders have voted more than 99 per cent in favour of a corporate reorganization to separate the company into two—EnCana, which will focus on natural gas development; and **Cenovus Energy**, an integrated oil company. All of EnCana's oil sands assets—including the prolific Foster Creek steam assisted gravity drainage (SAGD) project, and growing SAGD installation Christina Lake—are now in the hands of Cenovus.

Sid Dykstra, who served as president and chief executive officer of Opti Canada from June 2001 to April 2009, has joined the board of emerging oil sands player **Southern Pacific Resource Corp**. Under Dykstra's leadership of Opti, the company initiated, financed, and developed the Long Lake project, an integrated SAGD/upgrading complex south of Fort McMurray, Alberta, that incorporates Opti's proprietary OrCrude upgrading technology. Long Lake is currently producing about 14,000 barrels per day, ramping up to capacity of 72,000 barrels per day. Dykstra was replaced at Opti by Christopher Slubicki earlier in 2009.

Southern Pacific continues to advance its 12,000-barrel-per-day STP-McKay SAGD project. It recently completed its detailed project execution plan, resulting in an overall net reduction in required capital costs. The application continues to be reviewed by Alberta regulatory agencies.

Statoil Canada will participate in a new field research and pilot project to test technology that could potentially reduce water usage and CO_2 emissions at its Leismer in situ oil sands project.

The company believes the piloting of its steam-solvent co-injection project (SOLVE) technology will demonstrate a minimum 10 per cent savings on the steam to oil ratio (SOR) required for extraction, potentially rising as high as 25 per cent.

"Reduction in the [SOR] has a direct effect on reducing water use and CO_2 emissions since the solvent increases the amount of bitumen produced per barrel of water and fuel consumed," said Åge Kristensen, vice-president of heavy oil research and development for Statoil Canada.

The company's partner is the Petroleum Technology Research Centre in Regina. Sustainable Technology Development Canada has awarded the SOLVE project $6 million to assist in the development and deployment of this technology to lessen the environmental impacts of in situ oil sands extraction.

Excelsior Energy has filed a patent application with the Canadian Intellectual Property Office for an in situ combustion overhead gravity drainage (COGD) process it has developed in consultation with **Hot-Tec Energy**.

Hot-Tec is a private company affiliated with members of the in situ combustion research group in the Department of Chemical and Petroleum Engineering in the Schulich School of Engineering at the University of Calgary.

The COGD process uses cyclic steam and steam flood techniques to predispose the viscous oil reservoir to form a combustion chamber similar in geometry to the steam chamber in steam assisted gravity drainage.

Excelsior recently submitted an application to regulatory authorities for an experimental pilot project to field demonstrate the COGD technology with a targeted start-up in early 2011.

A proposed in situ oil sands project will see the first commercial use of a solvent such as butane to recover up to 120,000 barrels per day of bitumen with a steam to oil ratio of two to one, says **EnCana Corporation** (now **Cenovus Energy**).

The Narrows Lake project, northwest of EnCana's existing Christina Lake project in northeastern Alberta, will use a combination of steam-assisted process (SAP) and SAGD, the company announced.

"We are very close to commercializing SAP, and that should be the first application commercially that you see for SAP," said Harbir Chhina, vice-president of upstream operations in the integrated oil division. A regulatory application is scheduled to be filed in the second quarter of 2010.

Capital costs, including new roads and camps, are expected to be similar to that of Christina Lake, which has been US$20,000 per flowing barrel, but could be as high as US$30,000 per flowing barrel.

Technologies to tackle sustainability challenges in oil sands production, such as managing carbon dioxide emissions and using geothermal energy instead of natural gas, will be the aim of a new collaboration between the **University of Alberta** (U of A) and one of Europe's largest scientific research organizations.

The U of A and the **Helmholtz Association of German Research Centres** have signed a five-year agreement called the Helmholtz Alberta Initiative.

The initiative also hopes to develop recycling technology for fresh water and improve reclamation of lands disturbed by oil sands mining and lands taken over by tailings ponds.

The initiative will expand the university's current number of nearly 50 oil sands–related research projects by sharing the workload with the Helmholtz association's staff of 28,000 at 16 centres across Germany.

Canadian Natural Resources says it will be unable to achieve the 2010–2012 phase-in schedule for fines capture in a dedicated disposal area (DDA) required by Alberta's regulator.

The schedule is not achievable, as its Horizon oil sands mine is still in the start-up phase of operations, says the company in its annual tailings plan submission filed with Alberta's Energy Resources Conservation Board (ERCB).

The process equipment and DDA(s) necessary to capture sufficient fines cannot be designed, approved, procured, constructed, and commissioned within this period, it says.

As an alternative, Canadian Natural plans to develop and implement fines capture technology that exceeds the annual target of 90 per cent of fines capture by 2015 with a 2025 target for ultimately exceeding the cumulative fines capture requirements of the ERCB's Directive 074.

All six mining operators have submitted their plans to manage Directive 074 to the ERCB.

Alberta Oilsands (AOS) has increased the designed production capacity and accelerated the project timeline of its Clearwater West pilot project.

The designed production capacity has increased to approximately 5,000 barrels per day from 2,000 barrels per day due to a new design configuration using stacked well pairs.

AOS expects to submit its pilot application to the Energy Resources Conservation Board (ERCB) in the near term. The company anticipates that the submission will be a significant step towards a reserve classification milestone.

First production from the project is scheduled for the first quarter of 2011. The project will use low-pressure SAGD with expanding-solvent SAGD.

KBR has been awarded a contract by **Suncor Energy** to provide turnaround services for Suncor's 2010 turnaround project at its oil sands plant in Fort McMurray, Alberta.

KBR Canada will provide turnaround planning, management, and execution for the shutdown and maintenance of the plant including direct-hire labour resources, management of subcontractors, and coordination of activities with the client workforce and other contractors on site during the turnaround.

Southern Pacific Resource Corp. has signed an agreement with **EnCana** (Cenovus) to acquire the Senlac SAGD project in Saskatchewan, a producing heavy oil interest currently averaging 5,000 barrels per day for a net purchase price of approximately $90 million.

The acquisition will dramatically alter Southern Pacific by adding facilities, operations, relevant experience and significant cash flow to pursue the corporation's STP-McKay project and other prospects in the Athabasca oil sands.

The company says the acquired operations and technical expertise will directly complement the corporation's STP-McKay project, which has been designed to recover 12,000 barrels per day using similar SAGD technology.

The Alberta government will invest more than $241 million over the next five years to develop raw Crown land in the Parsons Creek and Saline Creek Plateau areas adjacent to Fort McMurray, Alberta.

In addition to housing for an estimated 9,500 residents, the plans will include land for new industrial and commercial developments in Fort McMurray.

The province will lead the development, designing plans for the communities and preparing serviced land for sale to developers and builders in anticipation of continued growth in the oil sands. Revenue generated from the sale of the parcels will be reinvested in public infrastructure such as schools and affordable housing in the new communities.

"Now is the right time to prepare Alberta for its next phase of growth," Premier Ed Stelmach said in a news release. "With this investment, we are working with Fort McMurray to create new jobs for today and new homes for tomorrow. We will be ready to support future expansion in the oil sands."

The ERCB has set a date for a public hearing on **Total E&P Canada**'s proposed oil sands upgrader.

The hearing on the upgrader—which would have an ultimate capacity of 295,000 barrels per day—of bitumen will begin Feb. 24, 2010, in Fort Saskatchewan, Alberta.

The proposed project would be constructed in two phases with a first-phase capacity of 150,000 barrels per day and a second phase beginning operations four years later with a cumulative capacity of 245,000 barrels per day. Debottlenecking would increase capacity to 295,000 barrels per day.

Fuelled with a capital budget of $5.5 billion for 2010, **Suncor Energy** is going ahead with stages 3 and 4 of its stalled Firebag in situ project, but its proposed Voyageur upgrader and Fort Hills mining project will remain on the shelf. ➟

"This actually officially restarts the growth in oil sands," says Rick George, president and chief executive officer.

The Lockerbie & Hole division of Aecon Group will complete field construction of Firebag Stage 3 (expected to be complete by the third quarter of 2010), while Flint Energy Services will conduct module fabrication.

At peak, the work will employ close to 1,000 people at the two service companies combined.

Excelsior Energy has engaged **CIBC World Markets** as its strategic advisor to identify and secure a major joint venture partner for the development of its experimental combustion overhead gravity drainage COGD pilot project at the company's Hangingstone property near Fort McMurray, Alberta.

The company has already filed an application for the pilot with the Energy Resources Conservation Board (ERCB), and filed a patent application for the process. Pilot project operations are expected to commence mid-2010.

The cost is estimated to be approximately $35 million to $50 million, which contemplates a 1,000-barrel-per-day facility and up to three COGD well arrays.

Keyera Facilities Income Fund has entered into a long-term agreement with **Imperial Oil** to provide diluent transportation, storage, and rail offload services in the Edmonton/Fort Saskatchewan area for Imperial's Kearl oil sands project.

Keyera will transport diluent by pipeline from supply sources in the Edmonton area to a diluent delivery pipeline north of Fort Saskatchewan for delivery to the Kearl site near Fort McMurray, Alberta. Keyera will also provide diluent storage and rail offload services in the Edmonton region.

Upon start-up of the 110,000 barrel per day first phase of the Kearl project, currently expected in late 2012, Keyera anticipates that operating cash flow from the agreement will initially be in the range of $10 million to $11 million annually, growing to approximately $16 million as the second and third phases of Kearl come on stream.

Long Lake SAGD project minority interest holder **Opti Canada** says its board of directors has initiated a process to explore strategic alternatives for enhancing shareholder value. The company says the current trading price of its common shares does not reflect the value of its assets.

Scotia Waterous and **TD Securities** have been engaged as financial advisors to assist in this process, which could include capital markets opportunities, restructuring the current credit facility, asset divestitures, and/or a corporate sale, merger, or other business combination.

Imperial Oil and **ExxonMobil** will pay $250 million to acquire UTS Energy Corporation's 50 per cent working interest in three undeveloped oil sands leases in northeastern Alberta.

"We believe we have demonstrated the value of these leases," says William Roach, UTS president and chief executive officer. "We have been telling the market that for a while and the market didn't appear to value them so we thought we would demonstrate the value.... This transaction demonstrates the success of UTS's strategy of generating cash reserves organically by finding new oil sands resources."

More than four decades after **Imperial Oil** broke ground for the first thermal in situ field pilots at Cold Lake in northeastern Alberta and 25 years after the first commercial production, the project has surpassed one billion barrels of cumulative production.

Only three other fields in Canada have achieved that milestone (operations at Syncrude and Suncor being two of them). Cold Lake is the only in situ project to have done so.

Over the years of operation, technological advancements have tripled recovery rates while reducing fresh water use and surface land disturbance.

Sunshine Oil Sands has received regulatory approval for a single-well cyclic steam stimulation (CSS) pilot targeting bitumen locked in carbonates. The project, called Harper, will allow Sunshine to analyze the bitumen and determine the correct approach for carbonate development—such as simulations of CSS versus SAGD, and horizontal versus vertical wells. The company has a 100 per cent working interest in over 600 sections of land in the Harper area. It will occur during the winters of 2009 and 2010.

Although **North Peace Energy**'s thermal recovery project at Red Earth, Alberta, has been producing bitumen continuously for a number of months, the piloting efforts have not yet demonstrated the production rates and steam to oil ratios (SORs) required to advance full commercial development.

First-cycle production rates for the carbon storage and sequestration project have been lower than expected, resulting in higher SORs than anticipated, so it may need additional pilot strategies, the company reported in releasing its third-quarter results. In addition, because steam injection rates are lower than anticipated increased injection pressure limits may be required, or modified steaming strategies will need to be developed, said North Peace.

Initial results are encouraging but, as expected, several cycles will be required to demonstrate commerciality, said the company. North Peace is now optimizing steaming strategies and is investigating the use of alternate well types and configurations to maximize production rates and reduce SORs. ■

Project listings

Updated status of oil sands projects in Alberta

As of January 8, 2010.

TECHNOLOGY LEGEND

CSS	Cyclic steam stimulation
COGD	Combustion overhead garvity drainage
ET-DSP	Electro-thermal dynamic stripping process
N-SOLV	Heated solvent vapour extraction
SAGD	Steam assisted gravity drainage
THAI	Toe to heel air injection

COMPANY	CURRENT PROJECT	CAPACITY (bbl/d)	START-UP	REGULATORY STATUS	DEVELOPMENT PROGRESS	TECHNOLOGY
ATHABASCA REGION — IN SITU						
ALBERTA OILSANDS						
Clearwater	Pilot	5,000	2011	Announced	Alberta Oilsands will use stacked well pairs instead of a single layer, expected to more than double peak production capacity to 5,000 from 2,000 bbl/d.	SAGD
	Commercial Project	10,000	TBD	Announced		SAGD
ATHABASCA OIL SANDS						
Dover	Pilot	1,000-2,000	TBD	Applied	The Government of Canada has approved the 60 per cent stake in these two projects to PetroChina for $1.9 billion. Commercial development is in early stages.	SAGD
MacKay River	Pilot	2,200	TBD	Applied		SAGD
	Commerical Phase 1	35,000	2014	Announced		SAGD
BLACKPEARL RESOURCES						
Blackrod	Pilot	500	2009	Application	BlackPearl has commenced road construction and completed the steam generator. Target is to complete construction and start steaming in Q1 2011.	SAGD
CANADIAN NATURAL RESOURCES						
Birch Mountain East	Phase 1	60,000	2016	Announced		TBA
Gregoire Lake 1	Phase 1	60,000	2018	Announced		TBA
Grouse	Phase 1	60,000	2014	Announced		TBA
Kirby	Phase 1	45,000	2012	Applied	Canadian Natural plans to sanction Kirby in 2010.	SAGD
Leismer	Phase 1	30,000	2018	Announced		TBA
CENOVUS ENERGY						
Borealis	Phase 1	35,000	TBD	Applied	EnCana shareholders have voted over 99 per cent in favour of the split-off of Cenovus Energy as a stand-alone integrated oil company. All assets now transferred.	SAGD
Christina Lake	Phase 1A	10,000	2002	Operating		SAGD
	Phase 1B	8,800	2008	Operating		SAGD
	Phase 1C	40,000	2011	Construction		SAGD
	Phase 1D	40,000	TBD	Approved		SAGD
	Phase 1E	40,000	TBD	Announced		SAGD
	Phase 1F	40,000	TBD	Announced		SAGD
	Phase 1G	40,000	TBD	Announced		SAGD
Narrows Lake	Phase 1A	40,000	TBD	Announced	Narrows Lake would use a combination of solvents and SAGD.	SAGD
	Phase 1B	80,000	TBD	Announced		SAGD
Foster Creek	Phase 1A	24,000	2001	Operating		SAGD
	Debottlenecking	6,000	2003	Operating		SAGD
	Phase 1C — Stage 1	10,000	2005	Operating		SAGD
	Phase 1C — Stage 2	20,000	2007	Operating		SAGD
	Phase 1D	30,000	2009	Operating		SAGD
	Phase 1E	30,000	2009	Operating		SAGD
	Phase 1F	30,000	2016	Application		SAGD
	Phase 1G	30,000	2017	Application		SAGD
	Phase 1H	30,000	TBD	Application		SAGD
CHEVRON CANADA						
Ells River		100,000	TBD	Announced	Chevron has decided to place Ells River on hold. The company does not believe the project will provide the necessary returns in the foreseeable future to compete for capital investment relative to others in its global portfolio.	TBA
CONNACHER OIL AND GAS						
Great Divide	Pod 1	10,000	2007	Operating	Production averaged 8,540 barrels per day in the first 12 days of December. Connacher expects production to average 9,000 barrels per day in 2010.	SAGD
	Pod 2 (Algar)	10,000	2010	Under construction	Construction proceeding on schedule and under budget. Expected to be complete in April 2010 followed by 90 days of steaming. Ramp up to capacity anticipated in early 2011.	SAGD
	Expansion	24,000	2012	Disclosed		SAGD

COMPANY	CURRENT PROJECT	CAPACITY (bbl/d)	START-UP	REGULATORY STATUS	DEVELOPMENT PROGRESS	TECHNOLOGY
CONOCOPHILLIPS CANADA						
Surmont	Phase 1	27,000	2008	Operating	Plant continues to ramp up to full capacity.	SAGD
	Phase 2	83,000	2014 - 2016	Approved	Engineering underway.	SAGD
DEVON CANADA						
Jackfish	Phase 1	35,000	2007	Operating		SAGD
	Phase 2	35,000	2011	Under construction	Jackfish 3 regulatory application to be filed in 2010.	SAGD
ENERPLUS RESOURCES						
Kirby	Phase 1	10,000	TBD	Application	Enerplus has announced deferral of the Kirby project, but regulatory application continues to move through the process.	SAGD
	Phase 2	25,000	TBD	Announced		SAGD
E-T ENERGY						
Poplar Creek		10,000	2011	Application	Expanded field test of ET-DSP electric production technology continues.	ET-DSP
EXCELSIOR ENERGY						
Hangingstone	Phase 1	10,000	2011	Application	Excelsior Energy has engaged CIBC World Markets to identify and secure a major joint venture partner for the Hangingstone project.	COGD
GRIZZLY OIL SANDS						
Algar Lake		10,000	TBD	Announced	Application expected to be filed in January 2010.	SAGD
HUSKY ENERGY						
McMullen	Pilot	775	TBD	Application		SAGD
Sunrise	Phase 1	60,000	TBD	Approved	Project partners will review project sanction by the end of 2009 and move to final approvals in the first half of 2010. FEED continues. Husky says good progress has been made in optimizing the project to reduce costs. Sanction expected in 2010.	SAGD
	Phases 2-3	140,000	TBD	Approved	FEED continues. Good progress has been made in optimizing the project to reduce cost and the project is planned for sanction in 2010.	SAGD
IVANHOE ENERGY						
Tamarack	SAGD with HTL upgrading	20,000	2014	Announced	Tamarack advanced through a number of engineering and regulatory milestones in Q3. Delineation drilling to begin in January 2010.	SAGD
JAPAN CANADA OIL SANDS						
Hangingstone	Pilot	10,000	1999	Operating		SAGD
	Phase 1	35,000	TBD	Disclosed	Preparing Regulatory Application and Conducting EIA.	SAGD
KOREA NATIONAL OIL CORPORATION						
BlackGold	Phase 1	10,000	2012	Application	Korea National Oil Corporation is purchasing Harvest Energy Trust for $4.1 billion.	SAGD
	Phase 2	20,000	TBD	Announced		SAGD
LARICINA ENERGY						
Germain	SAGD pilot	1,800	TBD	Application	Laricina reports the pilot is "development ready."	SAGD
	Phase 1	10,000	TBD	Announced		SAGD
Saleski	Carbonate SAGD demonstration	1,800	2010	Approved	Two horizontal well pairs to be drilled this winter.	SAGD
	Phase 1	10,000	TBD	Announced		SAGD
MEG ENERGY						
Christina Lake	Phase 1	3,000	2008	Operating		SAGD
	Phase 2	22,000	2009	Operating	Commissioning underway.	SAGD
	Phase 2B	35,000	TBD	Application		SAGD
	Phase 3A	75,000	TBD	Application		SAGD
	Phase 3B	75,000	TBD	Announced		SAGD
NEXEN						
Long Lake	Phase 1	72,000	2007	Operating	Steam debottleneck project completed. Electric submersible pumps continue to be installed in a number of wells. Approximately 42 well pairs currently have ESPs, with 39 well pairs currently on production. Partner Opti expects the project will be at or near design rates later than previous guidance of late 2010.	SAGD
	Phase 2	72,000	TBD	Announced		SAGD
	Phase 3	72,000	TBD	Announced		SAGD
	Phase 4		TBD	Announced		SAGD
Long Lake South	Phase 1	70,000	TBD	Applied		SAGD
	Phase 2	70,000	TBD	Applied		SAGD
N-SOLV						
	Pilot plant	2,000	TBD	Announced		N-SOLV
PATCH INTERNATIONAL						
Ells River		10,000	TBD	Announced	Patch has successfully completed the transactions relating to the sale of all of its assets to its unnamed working interest partner and its working interest partner's joint venture partner for $6 million.	SAGD

COMPANY	CURRENT PROJECT	CAPACITY (bbl/d)	START-UP	REGULATORY STATUS	DEVELOPMENT PROGRESS	TECHNOLOGY
PETROBANK ENERGY AND RESOURCES						
Whitesands	Pilot	1,900	2006	Operating	P1B and P2B wells have been drilled and completed, with P1B on early production. Company completed 15 mandatory regulatory inspections of plant pressure vessels in Q3-09, finding no signs of corrosion and very little erosion in vessels and piping, saying further confirmation of integrity of THAI.	THAI
	Expansion	1,900	2008	Approved	Expansion on hold in favour of capitalizing on existing infrastructure.	THAI
May River	Phase 1	10,000	TBD	Application	Approval anticipated in early 2010.	THAI
	Subsequent Phases	90,000	TBD	Disclosed		THAI
SOUTHERN PACIFIC RESOURCE						
STP McKay		12,000	2012	Application	ERCB has issued its supplemental information request. Southern Pacific says no significant issues have been identified with the application, and the project remains on track for construction to begin in 2010.	SAGD
STATOIL CANADA						
Kai Kos Dehseh-Leismer	Demonstration	10,000	2011	Under construction	Construction approximately 72 per cent complete. First steam expected in Q3-10.	SAGD
Leismer	Commercial	10,000	TBD	Application		SAGD
	Expansion	20,000	TBD	Application		SAGD
Corner		40,000	TBD	Application		SAGD
Thornbury		40,000	TBD	Application		SAGD
Corner	Expansion	40,000	TBD	Application		SAGD
Hangingstone		20,000	TBD	Application		SAGD
Thornbury	Expansion	20,000	TBD	Application		SAGD
Northwest Leismer		20,000	TBD	Application		SAGD
South Leismer		20,000	TBD	Application		SAGD
SUNCOR ENERGY						
Chard	Phase 1	40,000	TBD	Announced		SAGD
Firebag	Phase 1	33,000	2004	Operating		SAGD
	Phase 2	35,000	2006	Operating		SAGD
	Cogeneration and Expansion	25,000	2007	Operating	Firebag sulphur plant completed on schedule in Q3-09.	SAGD
	Phase 3	52,500	2011	Under construction	Work on Firebag Stages 3 and 4 has been reactivated.	SAGD
	Phase 4	62,500	2012	Application		SAGD
	Phase 5	62,500	TBD	Application		SAGD
	Phase 6	62,500	TBD	Application		SAGD
	Stages 3-6 Debottlenecking	23,500	TBD	Application		SAGD
Lewis	Phase 1	40,000	TBD	Disclosed		SAGD
	Phase 2	40,000	TBD	Disclosed		SAGD
MacKay River	Phase 1	33,000	2002	Operating	Suncor will not be providing any further updates on next projects to move forward until late 2010.	SAGD
	Phase 2	40,000	2012	Approved		SAGD
Meadow Creek	Phase 1	40,000	TBD	Approved		SAGD
	Phase 2	40,000	TBD	Approved		SAGD
SUNSHINE OILSANDS						
Harper pilot	Production mobility test	<1,000	TBD	Approved	Sunshine Oilsands has received regulatory approval for a single-well cyclic steam stimulation project in carbonates.	SAGD
Legend Lake	Phase 1	10,000	TBD	Announced		SAGD
	Phase 2 (two stages)	40,000	TBD	Announced		SAGD
West Ells	Phase 1	10,000	TBD	Announced		SAGD
	Phase 2 (two stages)	40,000	TBD	Announced		SAGD
	Phase 3	30,000	TBD	Announced		SAGD
Thickwood	Phase 1	10,000	TBD	Announced		SAGD
	Phase 2 (two stages)	40,000	TBD	Announced		SAGD
	Phase 3	25,000	TBD	Announced		SAGD
TOTAL E&P CANADA						
Joslyn	Phase 1	2,000	2004	Suspended	Production suspended. Total to provide ERCB with report on its options and plans for the project by Jan. 31, 2010.	SAGD
	Phase 2	10,000	2006	Suspended		SAGD
	Phase 3A	15,000	TBD	Withdrawn		SAGD
	Phase 3B	15,000	TBD	Disclosure		SAGD

COMPANY	CURRENT PROJECT	CAPACITY (bbl/d)	START-UP	REGULATORY STATUS	DEVELOPMENT PROGRESS	TECHNOLOGY
VALUE CREATION GROUP						
Terre de Grace	Pilot	10,000	TBD	Application	Expecting approval soon, working on financing.	SAGD
	Phase 1	40,000	TBD	Applied		SAGD
	Phase 2	40,000	TBD	Announced		SAGD
ATHABASCA REGION — MINING						
ATHABASCA OIL SANDS PROJECT						
Jackpine	Phase 1A	100,000	2010/11	Under construction	Project partner Marathon Oil reports Expansion 1 is on track and anticipated to begin mining operations in the second half of 2010, and upgrader operations in late 2010 or early 2011.	Mining
	Phase 1B	100,000	TBD	Approved		Mining
	Phase 2	100,000	TBD	Application		Mining
Muskeg River	Existing Facilities	155,000	2002	Operating		Mining
	Expansion and Debottlenecking	115,000	TBD	Approved	Final investment decision delayed.	Mining
Pierre River	Phase 1	100,000	TBD	Applied		Mining
	Phase 2	100,000	TBD	Applied		Mining
CANADIAN NATURAL RESOURCES						
Horizon	Phase 1	110,000	2009	Operating	Production lower in Q3-09 than guidance due to challenges including premature equipment failures and ore processing challenges. Canadian Natural believes it has largely resolved reliability issues, but is cautious as it enters first full winter of operations.	Mining
	Tranche 2	6,000-15,000	TBD	Approved	Engineering and procurement continues for Tranche 2, focusing on reliability and uptime.	Mining
	Tranche 3	10,000-20,000	TBD	Approved	Tranches 3 and 4 continue to be re-profiled based on learnings from Phase 1.	Mining
	Tranch 4	approx. 105,000	TBD	Approved		Mining
IMPERIAL OIL						
Kearl	Phase 1	100,000	2012	Under construction	Project is proceeding with detailed design, procurement, and construction activities with a current workforce of about 3,000 employees and contractors.	Mining
	Phase 2	100,000	TBD	Approved		Mining
	Phase 3	100,000	TBD	Approved		Mining
SUNCOR ENERGY						
Fort Hills	Phase 1	165,000	TBD	Approved	Future of Fort Hills remains undecided. Suncor will not announce any new projects or expansions beyond Firebag 3 and 4 until late 2010.	Mining
	Debottlenecking	25,000	TBD	Approved		Mining
Suncor — original operations	Millennium	294,000	1967	Operating		Mining
	Steepbank Debottleneck Phase 3	4,000	2007	Operating		Mining
	Millennium Debottlenecking	23,000	2008	Operating		Mining
	North Steepbank Extension		2010	Operating	North Steepbank extraction plant completed within schedule and revised budget in September 09. It is expected to improve reliability and productivity.	Mining
Voyageur South	Phase 1	120,000	TBD	Application		Mining
SYNCRUDE (MILDRED LAKE AND AURORA)						
Syncrude — original operations	Stages 1 and 2	290,700	1978	Operating	Majority partner Canadian Oil Sands Trust reports that the heavy maintenance planned for 2009 is "essentially behind us," and production should gain strength.	Mining
	Stage 3 Expansion	116,300	2006	Operating		Mining
	Stage 3 Debottleneck	46,500	TBD	Announced		Mining
	Stage 4 Expansion	139,500	TBD	Announced		Mining
TOTAL E&P CANADA						
Joslyn	Phase 1 (North)	50,000	TBD	Applied	Total will delay sanction, citing the need for oil prices to rise past $80/bbl.	Mining
	Phase 2 (North)	50,000	TBD	Applied		Mining
	Phase 3 (South)	50,000	TBD	Announced		Mining
	Phase 4 (South)	50,000	TBD	Announced		Mining
Northern Lights	Phase 1	57,250	TBD	Withdrawn	Northern Lights asset is being integrated into Total portfolio. Will reinstate after new timing is determined.	Mining
	Phase 2	57,250	TBD	Withdrawn		Mining
UTS/TECK COMINCO						
Equinox		50,000	TBD	Announced	Draft design basis memorandum engineering study is under review by partners, but will not be finalized until potential to develop the project as a satellite bitumen froth production facility to Frontier has been evaluated.	Mining
Frontier	Phase 1	100,000	TBD	Announced	Preliminary mine planning and conceptual designs for mine and extraction facility complete. UTS intends to move forward with a design basis memorandum and associated field work early in 2010, preparing an application for early 2011.	Mining
	Phase 2	60,000	TBD	Announced		Mining

COMPANY	CURRENT PROJECT	CAPACITY (bbl/d)	START-UP	REGULATORY STATUS	DEVELOPMENT PROGRESS	TECHNOLOGY
COLD LAKE REGION — IN SITU						
BR OIL SANDS ($HELL)						
Orion	Phase 1	10,000	2008	Operating		SAGD
	Phase 2	10,000	TBD	Approved		SAGD
CANADIAN NATURAL RESOURCES						
Primrose/Wolf Lake	Wolf Lake	13,000	1985	Operating		CSS
	Wolf Lake SAGD	5,500	TBD	Application		SAGD
	Primrose South	45,000	1985	Operating		CSS
	Primrose North	30,000	2006	Operating		CSS
	Primrose East (Burnt Lake)	32,000	2009	Operating	After initial steaming at Primrose East the company discovered oil seepage at surface on one of the new multiwell pads. Investigative work has been completed and diagnostic steaming began in August. Canadian Natural continues to work with regulators to identify and resolve the issue.	CSS
	CSS Follow-up Process	25,000	2018	Application		CSS
HUSKY ENERGY						
Caribou	Demonstration Project	10,000	TBD	Approved		SAGD
Tucker	Phase 1	30,000	2006	Operating	Husky is optimizing Tucker to ramp up production, reporting some wells are now performing according to plan.	SAGD
IMPERIAL OIL						
Cold Lake	Phases 1-10: Leming, Maskwa, Mahihkan	110,000	1985	Operating	The Cold Lake project has surpassed one billion barrels of cumulative production. Only three other fields in Canada have achieved this milestone.	CSS
	Phases 11-13: Mahkeses	30,000	2003	Operating		CSS
	Phases 14-16: Nabiye, Mahihkan North	30,000	TBD	Approved	Imperial filed amendment applications for Nabiye in August. The project continues to be advanced.	CSS
KOCH EXPLORATION CANADA						
Gemini	SAGD Project	10,000	TBD	Application	Permit application filed on June 15, 2009. Koch is performing detailed engineering work and public consultation continues.	SAGD
OSUM OIL SANDS						
Taiga	SAGD Project	25,000-35,000	2014	Announced	Rick Walsh, former project director for Suncor Energy, has joined Osum as vice-president, projects. Osum is working towards filing its project application.	SAGD
PENGROWTH ENERGY TRUST						
Lindbergh	SAGD Pilot	2,500	TBD	Application	Currently completing response to supplemental information requests, anticipates approval in 2010.	SAGD
PEACE RIVER REGION — IN SITU						
ANDORA ENERGY (PAN ORIENT)						
Sawn Lake	SAGD Demonstration	700	TBD	Approved	All season access to the site is currently underway, expected to be complete in 2009. Timing for equipment procurement and project drilling and construction TBD.	SAGD
NORTH PEACE ENERGY						
Red Earth	CSS Pilot	1,001	2008	Operating	Early stage pilot project has not yet demonstrated the production rates and steam to oil ratios to warrant full commercial development. Company reports encouraging results but is currently optimizing steaming strategies and investigating different well types and patterns.	CSS
	Expansion	3,000	TBD	Announced		CSS
PENN WEST ENERGY TRUST						
Seal	CSS Pilot	75	TBD	Application	The Seal area is listed as one of the negotiable business opportunities with Penn West.	CSS
SHELL CANADA						
Carmon Creek	Cadotte Lake	12,501	1986	Operating		CSS
	Phase 1	80,000	TBD	Announced	Shell has re-initiated stakeholder consultation, by way of a public information document. It is preparing an environmental impact assessment for a new application targeted for later this year.	CSS
	Phase 2	80,000	TBD	Announced		CSS
ATHABASCA REGION — UPGRADING						
CANADIAN NATURAL RESOURCES						
Horizon	Phase 1	135,000	2008	Operating	Production lower in Q3-09 than guidance due to challenges including premature equipment failures and ore processing challenges. Canadian Natural believes it has largely resolved reliability issues, but is cautious as it enters first full winter of operations.	Upgrader
	Tranche 2	6,000-15,000	TBD	Approved	Engineering and procurement continues for Tranche 2.	Upgrader
	Tranche 3	10,000-20,000	TBD	Approved	Tranches 3 and 4 continue to be re-profiled based on learnings from Phase 1.	Upgrader
	Tranche 4	approx 140,000	TBD	Approved		Upgrader

COMPANY	CURRENT PROJECT	CAPACITY (bbl/d)	START-UP	REGULATORY STATUS	DEVELOPMENT PROGRESS	TECHNOLOGY
NEXEN						
Long Lake	Phase 1	72,000	2008	Operating	Project partner Opti Canada reports successful testing of solvent deasphalter and thermal cracking units in upgrader prior to recently completed turnaround, which will allow the operator to gasify the heaviest parts of the barrel rather than its lighter parts. Once the transition is complete, synthetic crude yields are expected to increase to about 80 per cent.	Upgrader
	Phase 2	72,000	TBD	Approved		Upgrader
	Phase 3	72,000	TBD	Announced		Upgrader
	Phase 4	72,000	TBD	Announced		Upgrader
	Phase 5	72,000	TBD	Announced		Upgrader
	Phase 6	72,000	TBD	Announced		Upgrader
SUNCOR ENERGY						
Suncor — original operations	Base U1 and U2	281,000	1967	Operating		Upgrader
	Millennium Vacuum Unit	43,000	2005	Operating		Upgrader
	Millennium Coker Unit	116,000	2008	Operating		Upgrader
Voyageur	Phase 1	156,000	TBD	Suspended	Suncor will not announce any new projects or expansions beyond Firebag 3 and 4 until late 2010.	Upgrader
	Phase 2	78,000	TBD	Approved		Upgrader
SYNCRUDE						
Mildred Lake	Stages 1 and 2	290,700	1978	Operating	Majority partner Canadian Oil Sands Trust reports that the heavy maintenance planned for 2009 is "essentially behind us," and production should gain strength.	Upgrader
	Stage 3 Expansion	116,300	2006	Operating		Upgrader
	Stage 3 Debottleneck	46,500	TBD	Announced		Upgrader
	Stage 4 Expansion	139,500	TBD	Announced		Upgrader
VALUE CREATION						
Terre de Grace Upgrader	Phase 1	2,000	TBD	Application	Approval anticipated soon. Working on financing.	Upgrader
	Phase 2	10,000	TBD	Application		Upgrader
INDUSTRIAL HEARTLAND REGION — UPGRADING AND REFINING						
ATHABASCA OIL SANDS PROJECT						
Scotford Upgrader 1		155,000	2003	Operating	Project partner Marathon Oil reports Expansion 1 is on track and anticipated to begin mining operations in the second half of 2010, and upgrader operations in late 2010 or early 2011.	Upgrader
	Expansion	90,000	2010	Under construction		Upgrader
Scotford Upgrader 2	Phase 1	100,000	TBD	Applied		Upgrader
	Phase 2	100,000	TBD	Application		Upgrader
	Phase 3	100,000	TBD	Application		Upgrader
	Phase 4	100,000	TBD	Application		Upgrader
BA ENERGY						
Heartland Upgrader	Phase 1	54,400	TBD	Approved	BA owner Value Creation expects the company to come out of creditor protection later this year. Encouraged by Alberta's bitumen royalty in kind program. Working to put project back into action. Equipment sold at recent court-imposed auction purchased by BA owner Value Creation Group.	Upgrader
	Phase 2	54,400	TBD	Approved		Upgrader
	Phase 3	54,400	TBD	Approved		Upgrader
NORTH WEST UPGRADING						
Upgrader	Phase 1	50,000	TBD	Approved	Site preparation complete. Focus is on commercial agreements.	Upgrader
	Phase 2	50,000	TBD	Approved	Northwest Upgrading is encouraged by changes to Alberta's changes to its bitumen royalty in kind RFP.	Upgrader
	Phase 3	50,000	TBD	Approved		Upgrader
SUNCOR ENERGY						
Fort Hills Upgrader	Phase 1	165,000	TBD	Approved	Future of Fort Hills remains undecided. Suncor will not announce any new projects or expansions beyond Firebag 3 and 4 until late 2010.	Upgrader
	Phases 2 and 3	175,000	TBD	Approved		Upgrader
STATOIL CANADA						
Upgrader	Phase 1	75,000	TBD	Withdrawn	Application on hold indefinitely.	Upgrader
	Phase 2	175,000	TBD	Withdrawn		Upgrader
TOTAL E&P CANADA						
Northern Lights Upgrader	Phase 1	56,600	TBD	Withdrawn		Upgrader
	Phase 2	56,600	TBD	Withdrawn		Upgrader
Total Upgrader	Phase 1	150,000	TBD	Application	Regulatory hearing scheduled to being in February in Fort Saskatchewan, AB.	Upgrader
	Phase 2	95,000	TBD	Application		Upgrader
	Debottlenecking	50,000	TBD	Application		Upgrader

Glossary of oil sands terms

API An American Petroleum Institute measure of liquid gravity. Water is 10 degrees API, and a typical light crude is from 35 to 40. Bitumen is 7.5 to 8.5.

Barrel The traditional measurement for crude oil volumes. One barrel equals 42 US 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 oilsand, but saturation varies.

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.

Cyclic steam stimulation For several weeks, high-pressure steam is injected into the formation to soften the oilsand before being pumped to the surface for separation. The pressure created in the underground environment causes formation cracks that help move the bitumen to producing wells. After a portion of the reservoir has been saturated, the steam is turned off and the reservoir is allowed to soak for several weeks. Then the production phase brings the bitumen to the surface.

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.

Diluent *see Condensate*

Established recoverable reserves Reserves recoverable under current technology and present and anticipated economic conditions, plus that portion of recoverable reserves that is interpreted to exist, based on geological, geophysical, or similar information, with reasonable certainty.

Established reserves Reserves recoverable with current technology and present and anticipated economic conditions specifically proved by drilling, testing, or production, plus the portion of contiguous recoverable reserves that are interpreted to exist from geological, geophysical, or similar information with reasonable certainty.

Extraction A process, unique to the oil sands industry, which separates the bitumen from the oilsand 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 byproducts.

Greenhouse gases Gases commonly believed to be connected to climate change and global warming. CO_2 is the most common, but greenhouse gases also include other light hydrocarbons (such as methane) and nitrous oxide.

Initial established reserves Established reserves prior to the deduction of any production.

Initial volume in place The volume calculated or interpreted to exist in a reservoir before any volume has been produced.

In situ Latin for "in place." In situ recovery refers to various methods used to recover deeply buried bitumen deposits.

In situ combustion A displacement enhanced oil recovery method. It works by generating combustion gases (primarily CO and CO_2) downhole, which then "pushes" 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 oilsand existing within the specified lease area. The land must be reclaimed and returned to the Crown at the end of operations.

Muskeg A water-soaked layer of decaying plant material, one to three metres thick, found on top of the overburden.

Oil Sands Bitumen-soaked sand, located in four geographic regions of Alberta: Athabasca, Wabasca, Cold Lake, and Peace River. The Athabasca deposit is the largest, encompassing more than 42,340 square kilometres. Total 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 oilsand. Must be removed before oil sands can be mined. Overburden underlies muskeg in many places.

Pilot plant Small model plant for testing processes under actual production conditions.

Proven recoverable reserves Reserves that have been proven through production or testing to be recoverable with existing technology and under present economic conditions.

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

Remaining established reserves Initial reserves less cumulative production.

Royalty The Crown's share of production or revenue. About three quarters of Canadian crude oil is produced from lands, including the oil sands, on which the Crown holds mineral rights. The lease or permit between the developer and the Crown sets out the arrangements for sharing the risks and rewards.

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.

Synthetic crude oil A manufactured crude oil comprised of naptha, 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 byproduct of removing the bitumen from the oilsand.

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 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 process by which heat energy is used to reduce the viscosity of bitumen in situ to facilitate recovery.

Toe-to-heel air injection (THAI) An in situ combustion method for producing heavy oil and oilsand. In this technique, combustion starts from a vertical well, while the oil is produced from a horizontal well having its toe in close proximity to the vertical air-injection well. This production method is a modification of conventional fire flooding techniques in which the flame front from a vertical well pushes the oil to be produced from another vertical well.

Truck-and-shovel mining Large electric or hydraulic shovels are used to remove the oilsand and load very large trucks. The trucks haul the oilsand to dump pockets where it is conveyed or pipelined to the extraction plant. Trucks and shovels are more economic to operate than the bucket-wheel reclaimers and draglines they have replaced at oil sands mines.

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).

Vapour extraction (VAPEX) VAPEX is a non-thermal recovery method that involves injecting a gaseous hydrocarbon solvent into the reservoir where it dissolves into the sludge-like oil, which becomes less viscous (or more fluid) before draining into a lower horizontal well and being extracted.

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

CONTACTS

Oil Sands Producers

Alberta Oilsands	www.aboilsands.ca
Albian Sands Energy	www.albiansands.ca
Andora Energy	www.andoraenergy.com
Athabasca Oil Sands	www.aosc.com
Baytex Energy	www.baytex.ab.ca
Canadian Natural Resources	www.cnrl.com
Chevron Canada	www.chevron.ca
Connacher Oil and Gas	www.connacheroil.com
ConocoPhillips Canada	www.conocophillips.ca
Devon Canada	www.dvn.com
EnCana	www.encana.com
Enerplus Resources Fund	www.enerplus.com
E-T Energy	www.e-tenergy.com
Excelsior Energy	www.excelsiorenergy.com
Husky Energy	www.huskyenergy.ca
Imperial Oil	www.imperialoil.ca
Ivanhoe Energy	www.ivanhoe-energy.com
Japan Canada Oil Sands	www.jacos.com
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 Peace Energy	www.northpec.com
North West Upgrading	www.northwestupgrading.com
N-Solv	www.n-solv.com
Occidental Petroleum Corporation	www.oxy.com
Oilsands Quest	www.oilsandsquest.com
Opti Canada	www.opticanada.com
OSUM Oil Sands	www.osumcorp.com
Pan Orient Energy	www.panorient.ca
Patch International	www.patchenergy.com
Pengrowth Energy Trust	www.pengrowth.com
Petro-Canada	www.petro-canada.com
Petrobank Energy and Resources	www.petrobank.com
Shell Canada	www.shell.ca
Southern Pacific Resource	www.shpacific.com
Statoil Canada	www.statoil.com
Suncor Energy	www.suncor.com
Sunshine Oilsands	www.sunshineoilsands.com
Syncrude	www.syncrude.ca
Talisman Energy	www.talisman-energy.com
Teck Cominco	www.teckcominco.com
Total E&P Canada	www.total-ep-canada.com
UTS Energy	www.uts.ca
Value Creation Group	www.vctek.com

Associations/Organizations

Alberta Building Trades Council	www.albertabuildingtrades.com
Alberta Chamber of Resources	www.acr-alberta.com
Alberta Chambers of Commerce	www.abchamber.ca
Alberta Energy	www.energy.gov.ab.ca
Alberta Energy Research Institute	www.aeri.ab.ca
Alberta Environment	www.environment.alberta.ca
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Alberta Research Council	www.arc.ab.ca
Alberta's Industrial Heartland Association	www.industrialheartland.com
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Canadian Heavy Oil Assocation	www.choa.ab.ca
Canadian Oil Sands Network for Research and Development	www.conrad.ab.ca
Energy Resources Conservation Board	www.ercb.ca
Lakeland Industry and Community Association	www.lica.ca
Natural Resources Conservation Board	www.nrcb.gov.ab.ca
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