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Oil Sands Update

Energy From Athabasca

December 2008

In this issue...

Oil sands development is all about technology - always has been; always will be. We've seen that improvements in economic and environmental performance in the oil sands are strongly linked. The less that is consumed or emitted in developing the oil sands, the more efficient and sustainable the process becomes. And technology has been at the core of those improvements.



Jacob Irving,
Executive Director

After all, it wasn't that long ago when the burning question of the day was, "Can the oil sands be economically developed?" Through ingenuity, the application of technology and a lot of hard work, this question was answered positively, within the span of a single generation.

The burning question today is, "Can the oil sands be developed in an increasingly environmentally responsible way?" Development and application of new technology will play a key role in proving that indeed they can be.

In this, our Technology, issue we'll look back at technology in the oil sands so far, and look ahead to promising new technologies which have the potential to shape the future of oil sands development.

Jacob Irving
Executive Director, OSDG

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Quick Facts

Did you know that in 2001, about 14,500 vehicles used Highway 63 south of Confederation Way in Fort McMurray? Fast forward to 2007 and that number had grown to about 31,600 vehicles per day.

Pass it on

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A brief history of the oil sands

It took decades to determine initially how to extract bitumen from the stubborn, sticky sand holding it. And ever since commercial production of oil sands began, researchers, government and industry have been trying to find a better way to do it -- in a relentless quest for knowledge, efficiency, profitability and environmental responsibility.



"Cyrus" a bucketwheel now on display at the Oil Sands Discovery Centre, was purchased by GCOS in 1971. The massive machine weighs more than 500 mid-sized cars. It was retired in 1983.

Photo courtesy - Oil Sands Discovery Centre

"Figuring out how to best get things done up here has always been challenging, but I think the companies that have done well are the companies that have persevered and haven't been afraid to push ahead, try new things and learn from failures as well as successes," says Bill Rennie, director of stakeholder relations with Japan Canada Oil Sands Ltd. (JACOS), which is celebrating its 30th year in the oil sands this year.

Investigation into the potential development of the oil sands began in the late 1800s, with a number of scientists trying to find the best way to unlock the oil from the sands. The first commercial sale of bitumen took place in 1930, but the first oil sands operation as we now know it began in 1967 with the creation of the Great Canadian Oil Sands (GCOS), now Suncor Energy Inc.

GCOS put the oil sands on a commercial footing by introducing bucketwheel mining, while Syncrude Canada Limited, which is also celebrating its 30th year as a producing entity this year, was the first to bring even larger draglines to the oil sands. Both of these mining extraction technologies were connected to the processing plant by a system of conveyor belts.

In the 1980s the industry began to move away from draglines and bucketwheels to truck and shovel mining. The shift in technology enabled miners to better select the richest oil sand and reject material interspersed in the ore body, while providing for greater mobility. And the improvements didn't stop there.

"There has been so much progress made, but I really think one of the key benchmarks in the history of development of the oil sands involved the move to hydrotransport," says Gord Winkel,

manager of technology for Imperial Oil's Kearl Oil Sands Project.

"Early (bucketwheel) extraction involved moving huge amounts of material to the plants via conveyor belts at which time the material was transformed into a slurry and made ready for extraction. This was very energy intensive as one can imagine. After industry started using trucks and shovels, we developed crushers so it could be turned into a slurry closer to the site for transport by pipeline to the plant."

Winkel says one of the key benefits of hydrotransport was that a lot of the mixing was done along the way, so lower-temperature extraction was made possible. In early days, the extraction process required all of the ore and water to be heated up to around 80 degrees Celsius. Now, extraction takes place at between 35 and 40 degrees Celsius, reducing the amount of energy required at that stage of the process.

Winkel says what industry is aiming for now is the separation taking place at the mine, so the sand doesn't have to be transported all the way to the plants.

"The closer we can do this to the site, the less energy we'll use."

While great technological strides have been made since the 1970s, technological improvements continue, in both mining and in situ oil sands operations. The vision is oil sands operations that use less water, consume less energy, generate lower greenhouse gas emissions and yield high-quality products.

Links:

- Canadian Centre for Energy Information:
www.centreforenergy.com
- Government of Alberta (Oil Sands):
www.oilsands.alberta.ca
- Jacos: www.jacos.com/History.htm
- Oil Sands Discovery Centre:
www.oilsandsdiscovery.com
- Suncor Energy: <http://www.suncor.com/Default.aspx?cid=73&lang=1>
- Syncrude Canada: <http://www.syncrude.ca/users/folder.asp?FolderID=5657>
- University of Alberta:
www.engineering.ualberta.ca/COSI.cfm

Technology Profiles

Low-impact Seismic

While the shortest path between two points may be a straight line, sometimes the crooked corridor is kinder.

With only 2.5 per cent of the oil sands-bearing ground in Alberta available to be surface-mined, 80 per cent of Alberta's oil sands will need to be produced using in-situ technology (see Summer 2008 issue of Oil Sands Update). The siting of any in-situ injection and production wells is based on an understanding of the geology below the surface, and seismic testing is used to get a picture of what things look like underground.

Adding some zigs and zags to the cutlines required for the seismic testing is one of the ways industry is working to address surface disturbance, wildlife impacts and other concerns being raised about the practice.

"When there isn't a perfectly straight seismic line, there are no obvious or unnatural sightlines for predators to use to hunt," says Chris Fordham, manager of strategy and regional integration for Suncor Energy Inc. "Cutlines also detour around trees and other habitat," he adds.

Overall, industry has made a number of changes to oil sands seismic testing that have led to a significant reduction in the footprint the practice creates:

- The average width of oil sands seismic lines is now about three metres, compared to earlier lines which were up to eight metres wide. Many of the newest seismic cuts are only 1.75 metres wide
- More compact equipment, such as mulchers and narrow-track dozers, are being used, which reduces damage to the ground, speeding up the re-vegetation process
- The use of GPS allows for more precise movement of the equipment
- The lines are often barricaded to keep them from being used by people for recreational purposes
- Where possible, overland movement of people and equipment is reduced by flying them in via helicopter.

The end result? The Alberta government estimates switching to low-impact seismic processes has reduced

the footprint from seismic work by 60 per cent.

Tailings management

Industry and government are tackling tailings with vigour in an effort to eventually make tailings ponds obsolete.

The Energy Resources Conservation Board released a tailings management policy in draft form at the end of June, which included a directive, Tailings Performance Criteria and Requirements for Oil Sands Mining Schemes.

“Tailings ponds are an important environmental issue in Alberta – and more and more, they are becoming the focus of national and international attention,” said ERCB Chairman Dan McFadyen, who says the directive will set firm requirements for oil sands operators to manage tailings.

Tailings ponds are settling basins. Water used in oil sands production carries material left over from the extraction processes. The left over material, generally composed of sand, silt, clay and residual bitumen settles out of the water in the ponds. Using the ponds allows oil sands mining operations to clarify and recycle more than 80 per cent of the water they use.

The location of the tailings ponds, and their construction, are carefully planned, based on knowledge of the underlying geology. The ponds, and the area around them, are closely monitored, and the ponds are equipped with technology designed to intercept and return any seepage back into the pond.

The water in the ponds is constantly recycled back into the separation process to produce bitumen. The other material settles out to the bottom of the pond to eventually be used in reclamation of the pond site. But while the coarse sand in the tailings settles quickly, the fine tailings do not and this is a key focus of research.

There’s about 1.5 barrels of mature fine tailings produced as a result of one barrel of bitumen production, according to Natural Resources Canada’s CANMET Energy Technology Centre.

Tailings ponds in the oil sands region cover about 130

square kilometres, an area industry is as keen to see reduced as everyone else.

“Aside from the purely environmental benefits of reducing the size of the tailings ponds and further cutting the amount of water we use, reduction of tailings ponds will help companies reduce their production costs – something companies are always striving to do,” says Don Thompson, President of the Oil Sands Developers Group.

“It must be recognized, however, that tailings ponds are an integral part of the operation and are fundamental to achieving high recycling rates for water,” he adds.

A recently announced \$3-million Energy Innovation Fund grant to the University of Alberta’s School of Energy and the Environment will be used to help find new technology to help reclaim tailing ponds more quickly, while oil sands operators are already developing and applying a number of technologies to better manage tailings.

Among the processes being applied:

- Suncor and Syncrude use consolidated (or composite) tailings (CT) technology to mix tailings with gypsum and sand causing the tailings to settle faster.
- Canadian Natural Resource Limited’s Horizon project will capture CO2 emissions and transport them via pipeline to its extraction plant where the emissions will react with silts in tailings to become a solid.
- Syncrude is testing the use of fresh water layered over a deposit of fine tails to form a lake, called water capping.

Links:

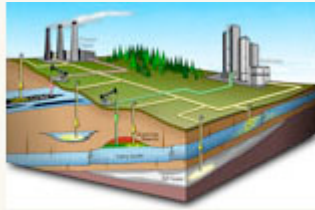
- CANMET: www.nrcan.gc.ca/es/etb/cwrc/English/home_e.html
- Canadian Oil Sands Network for Research and Development: www.conrad.ab.ca
- Energy Resources Conservation Board: www.ercb.ca/portal/server.pt/gateway/PTARGS_0_0_303_263_0_43/http%3B/ercbContent/publishedcontent/publish/ercb_home/news/current_projects/tailings.aspx
- Government of Alberta tailings brochure (PDF download): www.oilsands.alberta.ca/documents/

[Tailings_management.pdf](#)

- University of Alberta: www.see.ualberta.ca

Carbon capture and storage

With concerns being raised about the carbon intensity of synthetic oil produced from oil sands, a report released late last year by a consortium



Graphic courtesy - Alberta Geological Survey (AGS)

including a number of oil sands companies, suggests underground storage of carbon dioxide (CO₂) is one important way to potentially deal with CO₂ emissions in this country.

The report, *Carbon Capture and Storage: A Canadian Environmental Superpower Opportunity*, was prepared by the Integrated CO₂ Network (ICO₂N), which represents leading Canadian industrial companies including many of those operating in the oil sands.

The report details what the Network sees as the measures necessary to implement a large-scale carbon capture and storage (CCS) system in Canada. The group's research found that such a system could reduce carbon dioxide (CO₂) emissions by 20 million tonnes annually, which is the equivalent of removing four million cars from the road.

While the industry must take a close look at all the options to reduce environmental impacts, the report said the proposed system is Canada's single largest potential greenhouse gas reduction opportunity.

"The growing public awareness of the climate change challenge is translating into a strong desire for more information on solutions and technologies like CCS," says Stephen Kaufman, chair of the ICO₂N steering committee. "This report is designed to create greater public awareness of CCS and the significant role we believe it should play as part of Canada's climate

change response.”

The proposed system would move captured CO2 via pipeline both to buyers who would inject it into mature oil fields for enhanced oil recovery and also to operators who could be incented to permanently store it in depleted oil and gas reservoirs.

While many believe the capture and storage of CO2 is too costly for widespread adoption just yet, the idea had been gaining increasingly widespread interest, and research into the technology is much better funded than it has ever been before.

The government of Alberta has created a \$2-billion fund to advance carbon capture and storage (CCS) projects in the province with a goal of reducing greenhouse gas emissions by up to five million tonnes annually. In addition, three test wells will soon be drilled for a large-volume CO2 sequestration test project in Alberta, using \$6.6 million in funding from the provincial government, through the Alberta Energy Research Institute (AERI), as part of a three-year \$20-million project.

Links:

- Alberta Environment:
www.environment.alberta.ca
<http://www.environment.alberta.ca/1319.html>
- Alberta’s Oil Sands (Government of Alberta site):
www.oilsands.alberta.ca
- Integrated CO2 network: www.ico2n.com

Keeping things moving on the road

Both the technology being applied in the oil sands and the people applying the technology need to get to the oil sands facilities, and that has increasingly strained transportation infrastructure in the Regional Municipality of Wood Buffalo. But while the road may be a bit rough now, more convenient



commuting is just around the corner.



For example, the graders hit the streets of downtown Fort McMurray last summer to complete the work necessary for the initial phases of construction for the Thickwood Boulevard and Confederation Way interchanges, which accommodate 50,000 vehicles daily and are a notorious bottleneck for people trying to move around the city. Work is also underway on the new five-lane Athabasca River Bridge in the city. It's all part of the more than \$600 million being spent to address transportation issues in the region.

One of the challenges has been to make sure the traffic impacts from all that construction are kept to a minimum, but the interchange work will cause some additional delays in the short-term because of the need for temporary lights, flag people and other traffic control devices.

"This has taken a considerable amount of planning and preparation, because we know these are congested areas, and so we're designing high-quality detours that keep the traffic flowing," says Rizwan Hussain, a construction engineer for Alberta Transportation working on the interchanges.

"But we are on track, and we are building this in stages to minimize disruptions. All of the interchanges will be built by mid-2011 to coordinate with the opening of the Athabasca River Bridge."

Building these infrastructure projects in Fort McMurray means looking beyond a cookie-cutter approach to design and engineering, says Ken Tanner, a project manager with Flatiron Constructors Canada Ltd.

"The deck on the (Athabasca River) bridge, for instance, is designed for 1,100 tonnes which is more than 10 times the average weight that bridges are usually built to accommodate," he says. "You can fabricate a coker in Edmonton, and drive it up here right over this bridge. That's unusual. The structural steel is also corrosion-resistant and is built to withstand the temperatures."

When completed, the projects will improve traffic flow, making the roads safer and reducing drive times and congestion for heavy haul truckers and Fort McMurray residents heading out to work, or to do some Christmas shopping.

"We know that the commuting experience has a significant impact on people's quality of life, and that's why we have come together to make sure we all stay focused on making these improvements," says Gary Dahl, of Canadian Natural

Resources Ltd., and Chair of the Oil Sands Developers Group's Transportation committee.

"Our job on the committee is to make sure that the government understands the needs of the people, and we want to help get them the information they need to plan, make decisions and implement solutions."

Dahl says patience is critical while the work continues, and the Oil Sands Developers Group is working to keep safety top of mind for everyone throughout the process.

"We need people to drive responsibly – respecting traffic flow, road conditions and the rules of the road," says Dahl.

What area drivers can do to keep traffic moving safely:

- Ride the bus
- Carpool
- Avoid driving during peak times, such as during shift changes, if possible
- Prevent collisions by observing speed limits, adapting driving habits to road conditions, staying aware and driving defensively
- Be courteous and allow traffic to merge When merging, signal and maintain speed of traffic flow when it's safe to do so

The Road Ahead – regional transportation projects just completed, ongoing and planned

- Twinning of 16 kilometres of Highway 63 south of Fort McMurray, including northbound truck staging area five kilometers north of Highway 881 - Just completed
- Highway 63 and Fort McKay intersection improvement project, including dedicated turning bays to Highway 63 and the Fort McKay access road - Just completed
- Thickwood Boulevard and Confederation Way interchange construction
- Athabasca River Bridge in Fort McMurray
- New passing lanes and repaving of 70 kilometres of Highway 63 north of Highway 55
- Twinning of additional 224 kilometres of Highway 63 south of Highway 881 to the junction of Highway 55 near Grassland
- Repaving of five kilometres of Highway 63 within Fort McMurray

Links:

- Alberta Ministry of Transportation:
www.infratrans.gov.ab.ca/projects
 - Alberta Ministry of Transportation (depiction of
Thickwood and Confederation Way interchanges):
[alberta.ca/acn/200807/239880F0E3D02-BD9C-ABF5-
CD1E78D58312E962.html](http://alberta.ca/acn/200807/239880F0E3D02-BD9C-ABF5-CD1E78D58312E962.html)
 - RMWB Transit information:
[www.woodbuffalo.ab.ca/residents/getting_around
/maps.asp
?subnav=4](http://www.woodbuffalo.ab.ca/residents/getting_around/maps.asp?subnav=4)
 - Fort McMurray Today (photo and story):
[www.fortmcmurraytoday.com/ArticleDisplay.aspx
?e=1208943](http://www.fortmcmurraytoday.com/ArticleDisplay.aspx?e=1208943)
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Visit our website: www.oilsandsdevelopers.ca

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