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Getting the Balance Right
The Oil Sands, Exporting and Sustainability

At a Glance

- The Alberta oil sands contain reserves second only to Saudi Arabia's.
- U.S. and Canadian oil demand will be satisfied from somewhere—and the oil sands offer some key advantages.
- The perceived Achilles heel of the oil sands is the related production of greenhouse gases. However, the existing GHG gap between the oil sands and conventional oil is not as wide as is often asserted.
- Sustainable exports from the oil sands will require ongoing investment in improved technologies.

Recently, members of the Conference Board's International Trade and Investment Centre visited the oil sands in northern Alberta. The members saw a resource that should, through significant and growing exports to the U.S. market, be a critical driver of Canada's future wealth. But the visit also raised many questions about the sustainability of oil sands production and what that means for exporting.

This briefing discusses whether—and how—expanded production and exports from the Canadian oil sands can be reconciled with a sustainability agenda. A sustainability agenda must address environmental impacts (e.g., greenhouse gas [GHG] emissions, other airborne emissions, land and water usage), economic impacts, and social impacts. Greenhouse gas emissions from oil sands production have received much attention. Despite a 33 per cent reduction in GHG emissions per barrel of production since 1990, oil sands production growth has resulted in a rising trend in total emissions.

A FEW BASIC FACTS

The oil sands in northeastern Alberta contain proven reserves of about 173 billion barrels of oil (second only to Saudi Arabia's reserves), of which 20 per cent could be produced by mining technologies and the remainder by drillable (in situ, or underground) technologies. Produced bitumen can then be refined or upgraded to synthetic crude oil.[1] Production has been made commercially viable by the combination of higher global oil prices, and by innovation and the constant pursuit of greater operating efficiency in production.

Current oil sands production stands at 1.21 million barrels a day, or about 440 million barrels annually,[2] more than half of which is exported to the United States. The value of producers' sales of oil sands production in 2008 was $37.8 billion. That compares with $45.6 billion from all other crude oil and condensate sales in Canada.[3] Revenues in 2009 were lower due to lower oil prices. This puts oil sands revenues in the same general range as those of the distressed motor vehicle manufacturing sector, where revenues are estimated to have fallen to about $32 billion in 2009.[4]

Bitumen extraction is done by numerous private sector firms that lease plots of land from the Alberta government. (In-ground resources are a provincial responsibility in Canada.) The producers use either open-pit mining—the method used by such firms as Suncor and Syncrude—or drillable underground processes to extract the oil or bitumen from the sands. Drillable production essentially involves injecting steam into the bitumen deposits through wells. The steam then heats the bitumen to the point where it becomes liquid enough to flow to the production well. Once on the surface, the bitumen is separated from any produced water, which is then returned to the steam production process. The technique chosen depends primarily on the depth of the oil sands deposits. In 2008, Alberta produced 264 million barrels of synthetic crude[5] from mining and 213 million barrels of bitumen from in situ operations,[6] so bitumen accounted for 72 per cent of Alberta's and 47 per cent of Canada's total oil production.

The fiscal regime has undergone some controversial changes in recent years, although it is still a payout-based system. Companies invest huge capital sums prior to production and pay a small percentage of gross revenues in royalties until their capital expenditures are fully recovered, after which they pay a much larger share of annual net revenues. The royalty share is also sensitive to oil prices.

DEMAND FOR OIL SANDS PRODUCTION

The actual and potential demand for oil sands production is huge, both in North America and elsewhere. The U.S. imports over 60 per cent of its oil requirements, making it a prime international energy market for Canada and other oil-producing nations. A core truth in assessing the future of the oil sands is that U.S. and Canadian oil demand will be satisfied from somewhere—and the oil sands have some key advantages as a preferred supplier. Although extraction costs are higher than are those for most conventional sources, the oil sands require very little exploration expenditures, very little exploration risk (i.e., no dry holes), their location is known, and they are a more stable and accessible source of U.S. and

1 Government of Alberta, "Alberta's Oil Sands: Facts and Stats" [online]. Website content. Edmonton: Author [cited December 21, 2009]. www.oilsands.alberta.ca/519.cfm.

2 Canadian Association of Petroleum Producers, *Statistical Handbook* (Calgary: Author, 2009), Table 3.2a. (Note: Data used were for 2008, converted at 6.29 barrels/cubic metre.)

3 Ibid. Table 4.25b.

4 The Canadian Energy Research Institute has published studies detailing the economic and employment impacts of oil sands production.

5 Almost all the bitumen produced by mining operations is upgraded to synthetic crude before shipping to market. Synthetic crude is a high-quality product that contains little sulphur and, when refined, yields high proportions of transportation fuels.

6 Energy Resources Conservation Board, *ST98-2009: Alberta's Energy Reserves 2008 and Supply/Demand Outlook 2009–2018* (Calgary: Author, 2009), p. 3.

Canadian oil supply than many other global sources (such as Venezuela, Nigeria, or parts of the Middle East). Not surprisingly, Canada is already the largest supplier to the United States at 19 per cent of the oil import market.[7]

The majority of current markets for Canada's oil sands production are within North America, making it a strategic resource for the region. While Canada and Alberta will capture a significant share of the direct benefits of oil sands development (such as employment, investment earnings, and government revenues), the broader economic benefits of its development are shared across the border. The United States benefits at many levels. Oil from the oil sands flows to the U.S. market not by tanker, but by pipe within a regulated and integrated North American market. U.S. suppliers of materials and equipment win a portion of the contracts for new investment in production and pipelines. U.S. financiers provide some of the risk capital. U.S. refineries generate various end products. U.S. distributors deliver gasoline and other oil products to final users, and Americans in general consume the products.

Moreover, the oil sands are being ramped up at a time when global output of conventional light oil is in decline (which is one factor behind the upward structural shift in oil prices).

Just as Canada is already the largest supplier of oil to the U.S. market, which represents approximately one-quarter of world oil consumption, there is talk of developing a second pipeline to the West Coast to supply the Chinese and Asian markets.[8] This second portal would create a more competitive international market for Canadian oil sands output, and the mere threat of diverting oil sands production to Asia may help to temper extremes in U.S. policy.

7 U.S. Energy Information Administration, "U.S. Imports by Country of Origin" [online]. Website content. Washington, DC: Author [cited December 21, 2009]. http://tonto.eia.doe.gov/dnav/pet/pet_move_impcus_a2_nus_ep00_im0_mbbl_a.htm.

8 The Trans Mountain pipeline currently carries Alberta crude oil, including synthetic crude, through British Columbia. Some of this crude already reaches Asian markets.

ENVIRONMENTAL IMPACTS

The oil sands have generated numerous environmental concerns related to land use, water use, air quality, and the emission of greenhouse gases. Open-pit mining of any sort is not pretty, and the oil sands were recently featured in *National Geographic* magazine accompanied by a series of accusatory photos. As well, one producer was recently fined for the death of 500 waterfowl that landed in a tailings pond. As required by provincial regulators, the miners have recently announced that they are working toward introducing new dry tailings techniques that will eventually eliminate the need for tailings ponds.[9] This step is long overdue, and critics of oil sands development point—legitimately—to a need to accelerate the progress. The current and approved future mining projects collectively extract a volume of water from the Athabasca River that is monitored and has been deemed by the Alberta government to be surplus to in-stream flow needs, and hence unlikely to have a detrimental impact on the ecosystem.[10] While the river flow is high in the spring and summer, withdrawals may become subject to restriction during times of low flow. As a result, oil sands mine operators are examining off-stream storage and other options to ensure water is not a constraint to their winter production.

Oil sands operations also have significant impacts on the land. In the broader context, Alberta is developing integrated land-use frameworks that will cover the impacts on land and water of the full range of economic activities in each region. To date, oil sands mining operations have affected 530 square kilometres of land, of which 65 square kilometres have been reclaimed.[11]

9 Suncor applied to its Alberta regulators in October 2009 to introduce a new dry tailings technique. (See: Suncor Energy, "Tailings Management" [online]. Website content. Calgary: Author [cited December 21, 2009]. www.suncor.com/en/responsible/3229.aspx.)

10 Environmental groups argue that the in-stream flow needs have been understated, and that oil sands water withdrawals represent a serious threat to the ecosystem. For the Athabasca River, total water removals by all users cannot exceed 10 per cent of the flowing volume.

11 Government of Alberta, "Environment: Reclaiming Alberta's Oil Sands" [online]. Website content. Edmonton: Author [cited November 24, 2009]. http://environment.alberta.ca/2596.html.

To date, Syncrude has reclaimed 25 per cent of its Mildred Lake site, is working on the Aurora site, and has received a reclamation certificate from Alberta Environment for 104 hectares at Gateway Hill. Although it is drillable production rather than mining, Imperial has reclaimed 65 per cent of impacted lands at Cold Lake, with 19 per cent permanently reclaimed.[12] Reclamation is not a simple process, and there are numerous initiatives currently under way to better understand what is required. This is an important element of the environmental stewardship that must accompany oil sands development.

The perceived Achilles heel of the oil sands is the related production of greenhouse gases.

Drillable production is much less invasive in terms of land use because it uses wells rather than mines. Most of the action occurs in wells underground, with surface facilities for steam production, piping to and from the extraction sites, and oil separation and storage. Injection wells and production wells are drilled horizontally from central locations, further decreasing the impact on surface lands. Drillable oil sands extraction operations require water and energy for steam production, which is used to extract the oil from the sand. Because of this, drillable projects generally require more water per barrel of bitumen produced than do mines. However, the water is taken from below the water table and would not be considered fit for human consumption without expensive processing. The water is purified to an extent that will not cause operating problems in the steam plant and is recycled to the greatest extent possible. (In many cases, 95 per cent of the water used is recycled.)

One of the research priorities for drillable methods is to reduce the steam required per barrel of bitumen produced. This effort also greatly reduces energy consumption since producing steam is the largest energy requirement of drillable projects. Those firms that are successful in developing techniques that minimize the water and energy used to produce steam for extraction will have a huge potential competitive advantage. Success in these efforts will also result in a higher level of energy produced per unit of energy consumed and will reduce greenhouse gas emissions per unit of bitumen produced.

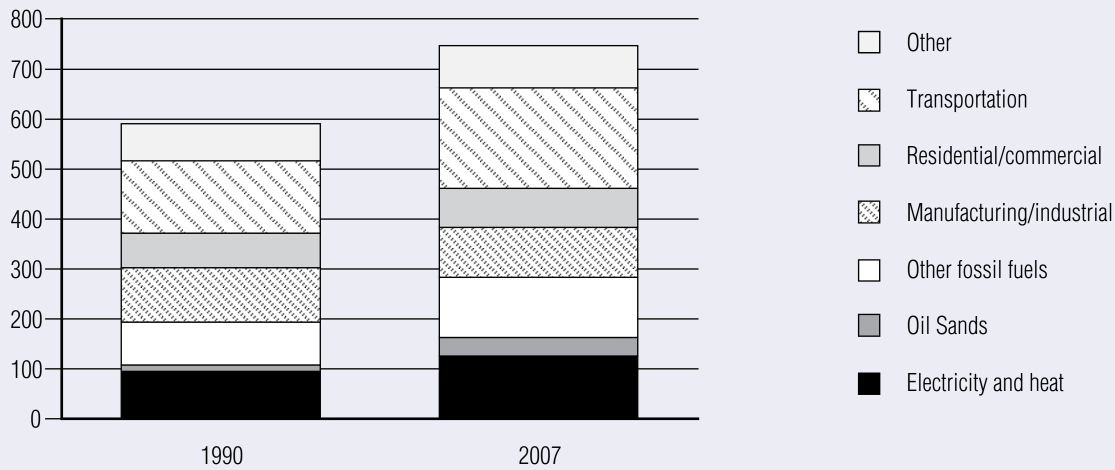
The perceived Achilles heel of the oil sands is the related production of greenhouse gases. Commitments to reduce the greenhouse gas intensity of oil sands production have already been made, and Alberta has introduced limits (or "caps") on greenhouse gas emissions intensity for large emitters. Failure to meet the intensity limit requires the emitter to purchase offsets within Alberta, or to contribute $15 per tonne of CO2 produced to a fund that is used for investment in improved technologies. Nonetheless, production is increasing faster than emissions intensity is being reduced, with the result that overall CO2 production is expected to continue to rise as oil sands output increases. This is a key reason why the oil sands have attracted so much attention—and also a reason why carbon capture and storage technologies are a major focus of current technology funding.

Not surprisingly, the prospect of rising output of oil and emissions from the oil sands has become a magnet for environmentalists. The oil sands already produce about 5 per cent of Canada's greenhouse gas emissions[13] (see Chart 1), and that share will inevitably grow as production is ramped up, notwithstanding efforts to reduce the emissions associated with each barrel produced. The prospect of rising overall greenhouse gas emissions from the oil sands has made this a central issue in North American discussions on climate change.

12 Canadian Association of Petroleum Producers, *Environmental Challenges and Progress in Canada's Oil Sands* (Calgary: Author, 2008). See also company websites for more details.

13 Calculated from Environment Canada's National Inventory Report for 2007 and the emissions reported to Environment Canada for 2007 by 17 oil sands facilities whose emissions are large enough to require reporting.

Chart 1
Canada's Greenhouse Gas Emissions
(million tonnes)



Sources: The Conference Board of Canada; Environment Canada.

TWO BIG QUESTIONS

At this stage, we see two fundamental questions that deserve further discussion. First, are the oil sands "dirtier" than other sources of oil in terms of GHG emissions? As conventional oil production from many sources begins to decline, global reliance on heavier oil is growing—and there is a perception that more GHGs come from heavy oil than from conventional oil.

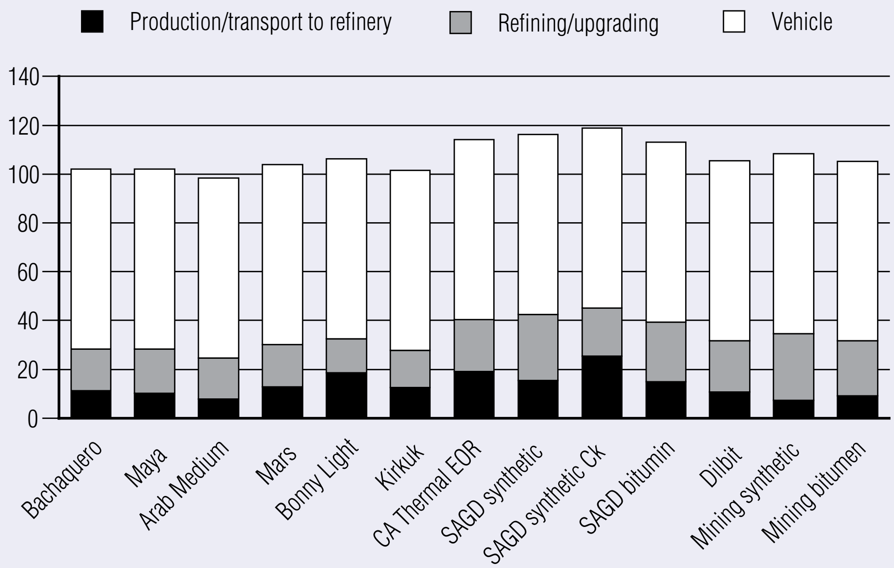
However, the existing GHG gap between the oil sands and conventional oil is not as wide as is often asserted. Recent analysis suggests that on a "wells-to-wheels" basis (i.e., through the full chain of production, shipping, refining, and consumption), GHGs per barrel from oil sands crude are between 7 per cent and 21 per cent higher than the lowest-emitting crude oil currently refined in the United States.[14] (See Chart 2.) Indeed, mined oil sands production performs better than drillable because it uses less energy for processing (in particular, for creating steam).

14 Jacobs Consultancy, *Life Cycle Assessment Comparison of North American and Imported Crudes* (Calgary: Alberta Energy Research Institute, 2009), p. 8-12. Similar results have been attained by other analysts.

The big challenge for oil sands producers, in terms of environmental impact and reputation, will be to keep developing new and enhanced extraction techniques that reduce input energy requirements for drillable projects in particular, hence reducing the emission of GHGs. Some see potential for carbon capture and storage (CCS) from in situ plants and from upgraders, although this technology will require significant cost reductions to be commercially successful. Nevertheless, private oil sands producers will need to constantly seek new ways to improve their operating efficiency and to minimize their production of GHGs as they continue to pursue their economic goals while producing oil efficiently and in an environmentally and socially responsible manner. A positive example of technological change is the use of gas-fired cogeneration to generate steam for the oil sands project while at the same time supplying surplus electricity to the Alberta grid, which is primarily served by coal-fired generation. To the extent that this cogenerated power reduces the need for coal-fired electricity, the overall GHG impact is reduced.

The second question to be discussed is: What is fundamentally driving oil sands production? The answer, of course, is the demand for energy in Canada and, in

Chart 2
Wells-to-Wheels Emissions for Selected Crudes Refined to Reformulated Gasoline
(g/MJ)*



*g/MJ measures the grams of CO2 equivalent GHGs emitted per megajoule of reformulated gasoline consumed, after accounting for all emissions from producing and refining the crude or bitumen into reformulated gasoline blending stock, plus all emissions from transporting the gasoline to the service station, and burning the gasoline in vehicles.
Sources: The Conference Board of Canada; Alberta Energy Research Institute.

particular, the United States. U.S. demand for oil products averaged about 19.5 million barrels a day in 2008[15] and has waned since the recession struck. However, it is expected to start growing again unless there are significant changes to the underlying drivers of that demand—factors such as the price of energy for consumers, auto fuel efficiency, the technology used in new and existing buildings, and even urban design.

Canadian oil sands producers and shippers, of course, are not focused on reducing overall U.S. energy demand. Their focus is on capturing a growing share of the U.S. energy market by producing oil as efficiently as possible while safeguarding their corporate reputations. As we noted earlier, if the U.S. (or Canadian) oil market is not supplied from Canada, then oil will continue to be purchased from somewhere else—with relatively comparable levels of related GHGs on a wells-to-wheels basis.

So why have the oil sands attracted so much attention from environmental critics? Part of the answer is tactical. It is much easier to pursue and criticize a few private oil sands producers operating in a neighbouring democratic nation, than to criticize state oil companies operating in weak democratic or authoritarian nations that are far away. More fundamentally, frustrating production by a few firms is easier than convincing millions of consumers to change their lifestyles and driving habits and thereby reduce end demand for oil products. But if GHG emissions are to be stabilized and reduced, action must be taken both by energy producers and by energy consumers.[16] This will be as true in China as it is in the United States and Canada.

15 U.S. Energy Information Administration, "Product Supplied" [online]. Website content. Washington, DC: Author [cited December 21, 2009]. http://tonto.eia.doe.gov/dnav/pet/pet_cons_psup_dc_nus_mbblpd_a.htm.

16 The wells-to-wheels analyses indicate that between 62 per cent and 75 per cent of total emissions come from cars and trucks. Improving vehicle efficiency is therefore three to four times more effective at reducing GHG emissions than improving oil sands production efficiency.

FUTURE PROSPECTS

Some analysts have suggested that Canada should take active steps to slow the pace of development in the oil sands.[17] They argue that strong oil prices and rising oil exports are key factors behind the strengthening of the Canadian dollar, making it harder for other sectors of the Canadian economy to compete internationally. They say slower oil sands development would take some of the steam out of the rising dollar and ease cost pressures on development projects. The production of GHGs provides another reason for some to propose that we slow or curtail the expansion of oil sands production.

We see problems with this line of thinking. As discussed here, oil sands expansion is being driven by end demand for oil products in the United States, Canada, and elsewhere. That demand will be met from someplace. Given accelerated efforts to reduce environmental impacts (including GHG emissions), why not the oil sands?

In 2007, road transportation in Canada accounted for 137 million tonnes (Mt) of GHG emissions (18 per cent of the total). Oil sands production, by comparison, accounted for 40 Mt of GHG emissions in 2007.

At the same time, these efforts should be supplemented with measures to reduce demand for oil products. Vehicle emissions are an important part of that demand. Environment Canada's National Inventory report[18] indicates that in 2007, road transportation in Canada accounted for 137 million tonnes (Mt) of GHG emissions (18 per cent of the total), up from 98.4 Mt in 1990. Oil sands production, by comparison, accounted for 40 Mt of GHG emissions in 2007. A portion of the growth is attributed to the transition from cars to trucks (including sport utilities and crossovers). Similar results exist for the United States. Fairness across sectors, and long-term competitiveness for both Canada and the U.S., are arguments in support of the need for improvements in every link of the energy value chain, and emissions from vehicles merit priority treatment.

The sustainable pace of oil sands development is a different question. Some leaders in the oil production sector are now acknowledging the need to proceed with new oil sands investment at a more measured pace, with greater discussion and coordination among developers and with governments. This would help to mitigate the strong cost pressures for labour and materials that emerged in recent years. As well, more could be done by governments to manage the fiscal and other impacts of frenzied oil sands development.

Sustainable exports from oil sands can be achieved, but it will require ongoing investment—by the producers and by governments—in improved technologies and a re-balancing of the climate change agenda.

As for the impact of oil sands development on the exchange rate, a floating exchange rate policy has served Canada well for decades. The renewed strength of the Canadian dollar is a consequence of rising global commodity prices and downward pressure on the U.S. dollar, which itself reflects both global recovery and the deep economic problems facing the U.S. economy. We acknowledge that the pace of increase in the Canadian dollar has created challenges for some sectors, notably manufacturers. That said, fundamentally changing Canada's exchange rate policy, such as fixing the exchange rate to the U.S. dollar or intervening to slow the loonie's pace of increase, would create a whole new set of policy problems.[19] This puts the onus on manufacturers and other firms to manage

17 Oil sands critics range from CAW economist Jim Stanford to Al Gore, who was even quoted as saying "extracting oil from Alberta's tar sands jeopardizes the survival of our species" (Toronto Star on line, November 2009).

18 Environment Canada, "Canada's 2007 Greenhouse Gas Inventory" [online]. Website content. Ottawa: Author [cited December 21, 2009]. http://www.ec.gc.ca/pdb/GHG/inventory_report/2007/som-sum_eng.cfm#s1.

19 For example, China is trying to slow the pace of appreciation of the yuan, but this is leading to a massive buildup in domestic liquidity that will have inflationary consequences down the road.

their exposure to changes in the value of the loonie, through practices like operational hedging (as discussed in a soon-to-be-released Conference Board report tentatively titled *Dollar Volatility: Who Takes the Hit?*).

CONCLUSION

Sustainable exports from the oil sands can be achieved, but it will require ongoing investment—by the producers and by governments—in improved technologies and a re-balancing of the climate change agenda. The most logical medium-term scenario is for oil sands producers to continue to pursue market opportunities in the United States and other markets while developing new and enhanced extraction techniques that reduce their emissions of GHGs. The climate change agenda will need to place more emphasis on reducing the global consumption of energy and related GHG emissions, even as we continue to search for new, cleaner production technologies. A full range of policy tools will need to be examined and utilized to reduce global energy consumption, including carbon taxes, cap-and-trade systems, higher vehicle fuel standards, stronger energy standards for buildings, urban re-design, investment in public transit, and other forms of intervention.

Whether the logical scenario, as just described, can become the most likely scenario will depend on a range of factors. The eventual shape of U.S. climate change legislation and the progress (or lack of progress) that resulted from the recent Copenhagen climate change talks are key factors. Canada's strategy will have to remain a balancing act between our interests in growing oil sands and other fossil fuels production and our desire to reduce global and national production of GHGs, with increased emphasis on measures that would stem end demand for energy.

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1 These organizations do not necessarily endorse the research conclusions of this briefing.

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by *Len Coad* and *Glen Hodgson*

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