



Canada's Oil Sands - Part 2

Posted by [Gail the Actuary](#) on September 1, 2009 - 10:06am

Topic: [Supply/Production](#)

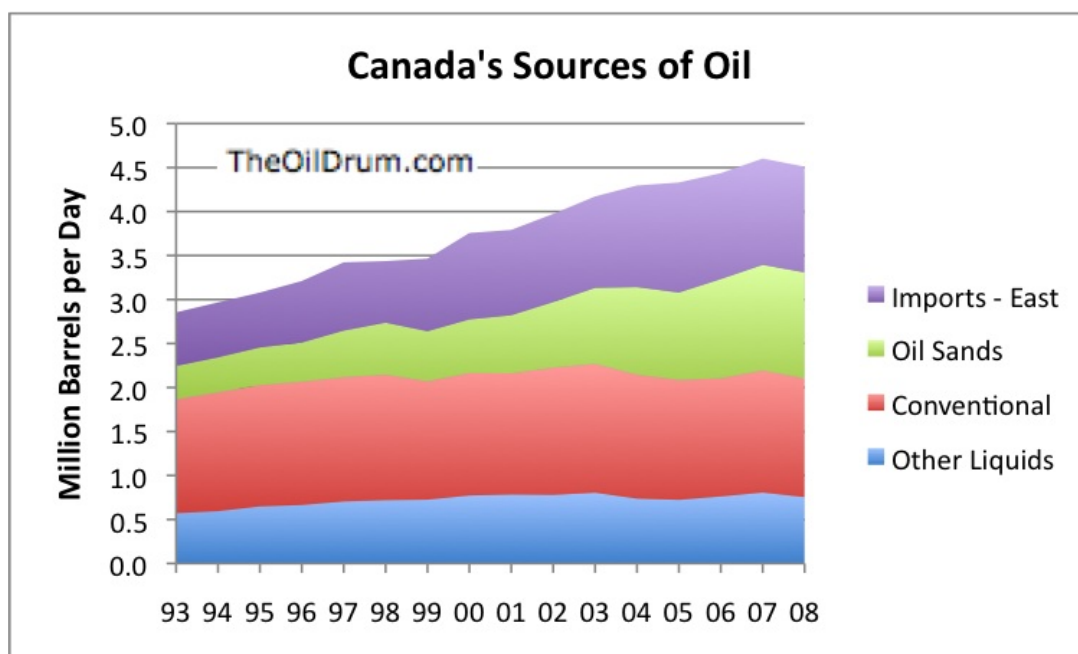
Tags: [alberta](#), [american petroleum institute](#), [bitumen](#), [oil sands](#), [tar sands](#) [[list all tags](#)]

This is a follow-up to [Part 1](#), which tells about my recent trip to Canada's oil sands, on a trip sponsored by the American Petroleum Institute (API).

In Part 2 of this post, I provide some additional thoughts to help the reader come to his / her own conclusions about the future of the oil sands. I talk a little about how Canada's oil sands production fits in with its other sources of supply, and how this in turn relates to Canada's exports. I also look a little at some political issues and how these fit in with environmental issues. A closely related post is this [recent post](#).

How much will oil sands production expand in the future?

There is no doubt that there is a huge amount of resource in place - between 1.7 and 2.5 trillion barrels, according to the Oil Sands Discovery Centre's [Oil Sands Story](#). Of this, 173 billion barrels (about 10%) is considered producible with current technology at 2006 prices (\$66 barrel for WTI). Production to date has been relatively low, though--only 1.2 million barrels a day in 2008, according to Canadian Association of Petroleum Producers ([CAPP](#)).



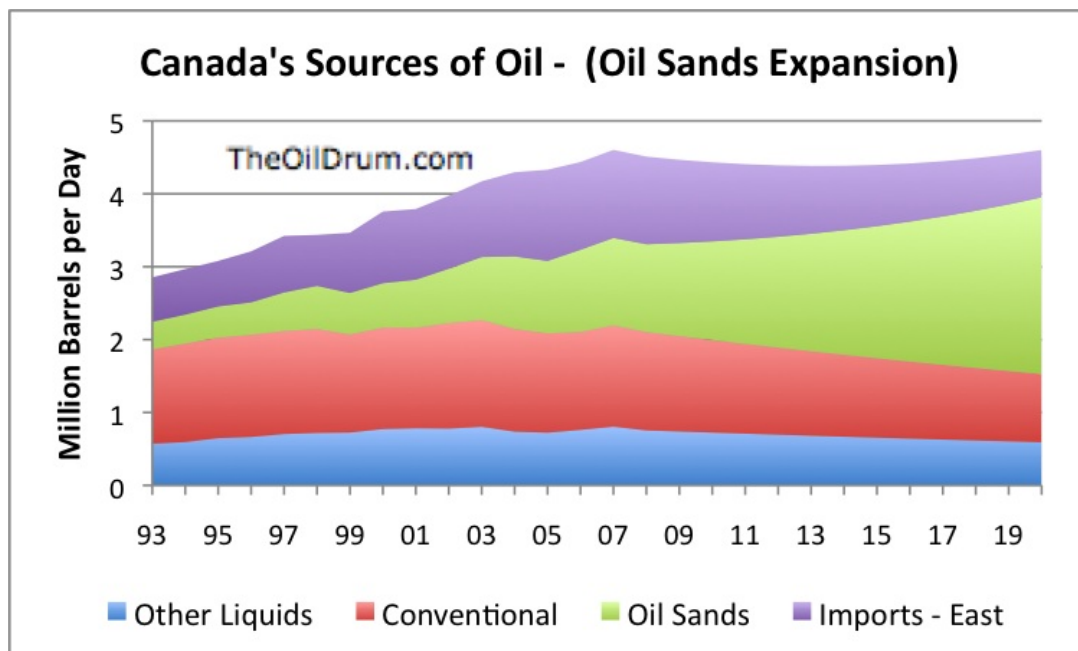
*Sources of Canadian oil, including imports from the East Coast - Based on EIA and CAPP data.
See this [post](#).*

A big part of the reason that Canada can export oil to the United States is the fact that it is importing oil on its East Coast for its own use. When one looks at oil sands in relationship to its other oil sources (including imports), oil sands oil is only about one quarter of the total. The non-oil sands portion is expected to decrease in the future, so a significant increase in oil sands production is needed simply to offset expected decreases elsewhere. See my [earlier post](#) about this.

Unless oil prices rise above today's level, and stay higher, it seems unlikely that there will be a major increase in oil sands production. Don Thompson from the Oil Developers Group told us that in order to justify new development, the cost of West Texas Intermediate (WTI) crude must be at least \$80 a barrel. CERA indicates in a new report ([free with registration](#)) that more than 70% of proposed Oil Sands expansion projects were postponed, after the drop in oil prices in 2008. CERA quotes a needed WTI price of \$65 to \$85 barrel to justify Oil Sands expansion--but based on a rate of return of 10%--which is probably not high enough.

Even beyond high oil prices, a major ramp up would also require a huge amount of investment funds. For example, if one wanted to add 1 million barrels a day of upgraded oil by adding new mines and upgraders, it would require an investment of roughly \$126 billion dollars, [based on a CERA estimate of \\$126,000 per flowing barrel](#). It would also require a huge amount of credit availability and a veritable army of workers.

In the absence of a major improvement in technology (or perhaps even with one, since a big change in technology often takes a long time to implement), my estimate of the ramp up in oil sands production to 2020 is given below:

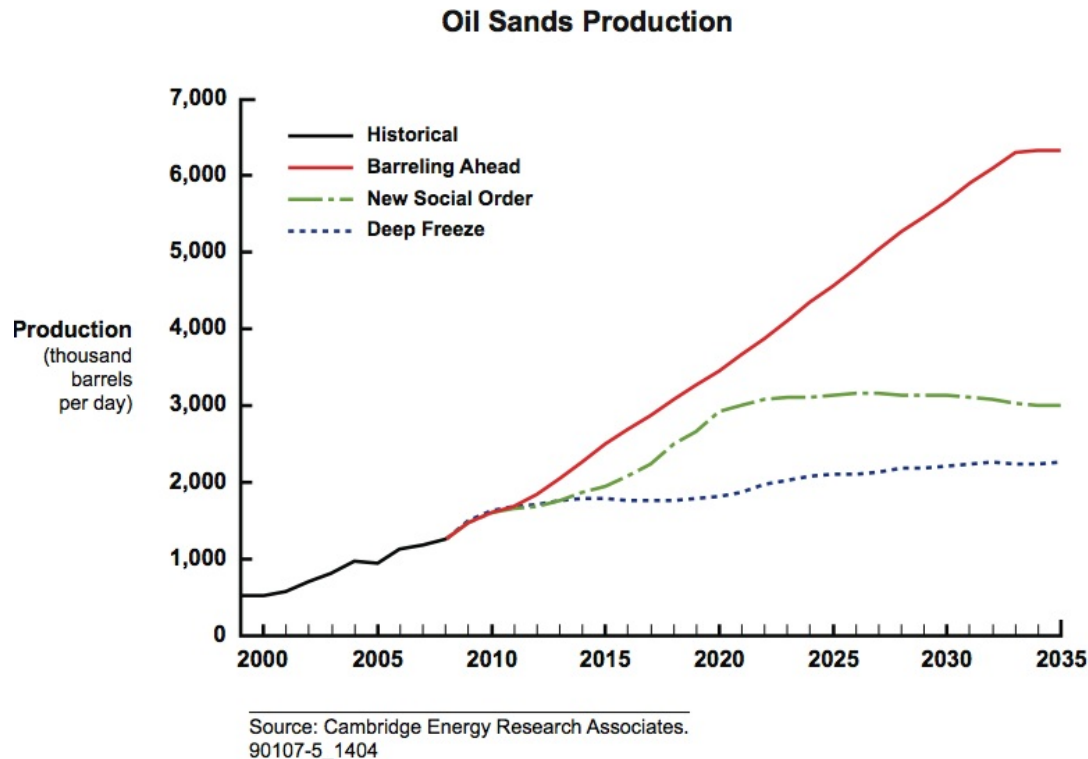


My rough estimate of Canada's future oil sands production, other oil production, and overseas imports to their East Coast as shown in this [post](#).

I am forecasting that oil sands production will approximately double by 2020 (from 1.2 million barrels per day in 2008, to 2.4 million barrels a day in 2020). This forecast, in part, reflects Tony Eriksen's ("ace's") calculation that projects already approved and in construction are expected to bring production up to 1.94 million bpd. Growth beyond that is expected to be constrained for a

number of reasons, including difficulty in obtaining sufficient investment funds, need for a high price of oil to justify new construction, difficulty in obtaining enough diluent, and the possibility that royalties will be higher as governments discover that oil companies are among the few companies from whom higher taxes might be extracted.

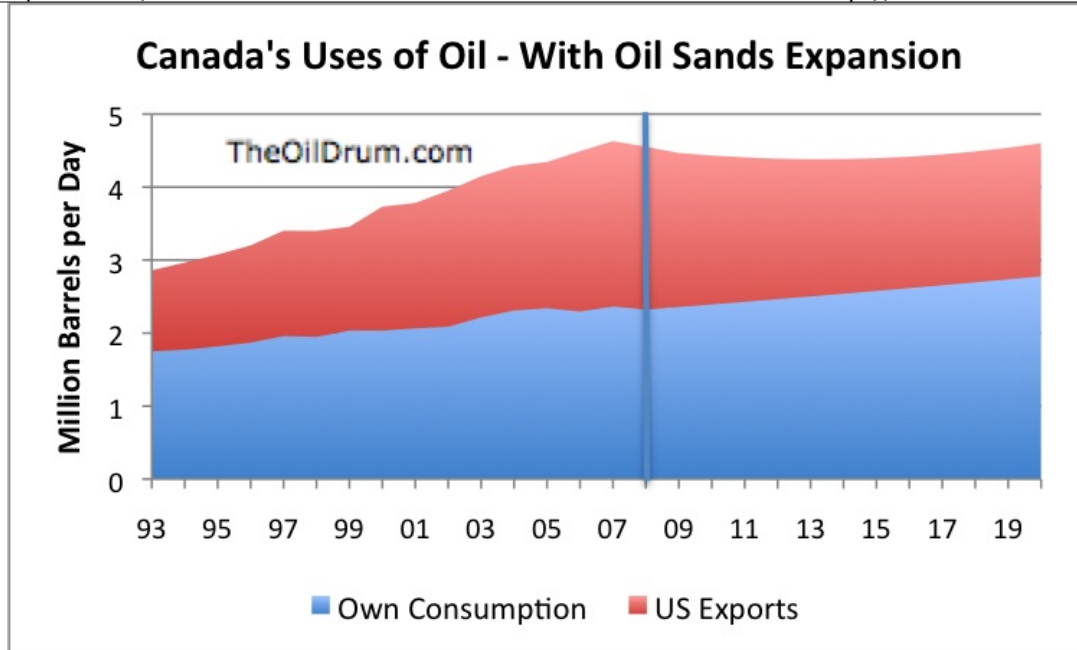
Note that even with this increase in oil sands production, the total supply of oil available to Canada (including imports) dips somewhat, and exports are likely to decline. My forecast for oil sands production to 2020 is similar to the average of CERA's two lower production forecasts, taken from the [new CERA report](#).



CERA forecast of Oil Sands production, from report cited above.

Even in CERA's "Barreling Ahead" forecast, the ramped up production will barely make a dent in the four or six Saudi Arabias of new oil production that Fatih Birol of the IEA [has said](#) will be needed if new production is to offset declines.

How much Canadian oil will the United States import?



*Canada's exports to the United States, **if** it exports everything that is left over to the United States*

Based on the forecast I made for oil sands production, the amount of imports to the United States are likely to drop somewhat, even if the United States continues to receive virtually all of Canada's oil exports.

Will oil actually be exported to the US?

But how likely is this scenario? When one reads Canadian material, it becomes clear that many Canadians would very much like to diversify the countries it exports to, even if currently nearly all pipelines lead from Canada to the United States. With the US as its only export partner, Canada has little leverage in bargaining over price. Also, there are details such as the US charging less for gasoline than Canada--why should Canadians be taxed to keep their consumption down, and the same time Americans can buy Canadian oil and sell it for less? [NAFTA](#) limits changes right now, but over the long term, that can be changed.

Canada is already working on an approach that will allow it to export oil in directions other than the US, to help diversify its exports. The approach is a rail link that acts like a pipeline, and can be implemented quite quickly. China and others with few environmental concerns are particularly favored as export partners. Canadian National (CN) also [has tracks going East](#), so this approach could also be used to bring oil from western Canada to eastern Canada.

[CN's revolutionary pipeline on rails](#)

The Canadian National Railway has developed a transformative strategy it calls the "Pipeline on Rail" which can move oil sands production quickly and cheaply to markets in North America or Asia. . .

CN could gear up its capacity to ship by rail up to four million barrels a day of oil at less cost and more quickly, bypassing the need to finance huge pipelines. By the end of this

year, the company will be shipping 10,000 barrels daily from producers whose reserves are now stranded.

[Oils sands: Canada to China, Japan, India not US](#)

This project, in its early stages, will eliminate three barriers to the development of Canada's vast oil sands: the cost, delays and financial risks involved in building multi-billion dollar pipelines; the politics of obstruction south of the border from environmentalists and the danger of selling oil to monopoly buyers in the U.S. which has, in the past, resulted in contracts being ripped up when times were tough.

It also allows Canada to decouple from the American economy when it comes to its most important commodity which is oil products. This is because all the oil sands production can be routed to the west coast for shipment to Asia or anywhere, thus avoiding monopoly pricing and bullying by the Americans. Besides that advantage, oil sands are the national trump card in the future and the American economy, now sputtering, will never be as robust as before.

China is interested in investing in the oil sands. Just today we read that [China is paying C\\$1.9 billion](#) for an oil sands investment.

Alberta will ramp up oil sands, to the best of its ability

Alberta is very dependent on the oil sands industry, both for jobs and revenue. A report by Canadian Energy Research Institute (CERI) [indicates](#)

. . .every dollar spent on big oil projects stokes nearly \$2.50 in further spending in Alberta, plus another roughly \$2.50 in the rest of Canada. In other words, a \$10-billion decrease in energy spending translates into about \$60-billion in lost economic activity across the country.

These revenues translate to tax revenues as well, so I find it difficult to believe that Alberta will cut back oil sands production voluntarily, or even limit new production. If the US wants to cut back on imports because it is unhappy about CO2 or other environmental issues, I don't see that as a huge problem to Canada. Canada will sell its oil elsewhere.

Potential Impact of Loss of Oil Sands Production on US

From the US point of view, the potential loss of oil sands oil could be problematic. Pipelines that feed the oil sands oil feed directly to the Midwest. If oil sands oil is cut off, the ones likely to be hit the hardest hit are Midwestern American farmers. We know from experience that when there is a shortage of oil, it is the folks at the end of the pipeline that are hit. If the US decides it doesn't want Canadian oil, or if Canada cuts us off, it is likely the folks at the end of the pipelines, away from Chicago and the Midwest that would be hit most--places like North and South Dakota.

We could theoretically import more oil (perhaps from OPEC) to one of our coasts, and pipe it to the Midwest. This might or might not be successful. We don't have a rationing plan to work around shortages of diesel fuel in the Midwest at this point--maybe we should be thinking about such a plan.

How big an issue is environmental considerations?

Oil sands oil has a number of environmental issues. The one which is most obvious is the clearing of forests and taking up layers of overburden, storing them for many years, and then putting them back. This is an issue primarily with *mining*, rather than in place (*in situ*) production. Mining also tends to produce tailings ponds that are polluted with bitumen which is missed in the extraction process and with [naphthenic acid](#). There is concern that water from this tailings water will escape, or will harm birds that happen to land in it. Companies use scarecrows and noise makers to attempt to keep birds away, but sometimes these precautions [fail](#). There is also concern about the amount of water use, especially if production of bitumen from the oil sands should scale up.

There are other concerns with the extracted sulphur, and whether it gets into the air, as sulphur dioxide gas. As far as I know, the biggest issue with this is with upgrading operations, where the sulphur is separated out from the bitumen, such as that of Syncrude.

There are also metals that are found with the oil sands oil. This can be both good and bad. Bad because they could potentially be another source of pollution, and good, if they can be used as a source of rare earth minerals. We [read](#):

It has been found that the tailings are a unique and rich source of titanium (5-10 % on solids), zirconium (2-5 %) and iron and rare earth minerals (8-12 %). These valuable minerals are at present not being recovered.

The quote relates to a patent for a method of extraction of these minerals, by applying centrifuge methods to tailings ponds. I expect we will see more centrifuge methods used in the future, both because of the possibility of financial gain, and because of a desire to reduce the amount of water stored in tailing ponds.

In situ production has much less direct environmental issues than mining, because it disturbs the soil much less, and because it leaves some of the potential pollutants underground. In situ results in far less tailings ponds. Most of the problems from in situ mining result simply from the fact that it is a low EROEI process, and uses a lot of natural gas in its production. As a result, its carbon footprint is quite high.

While there are quite a few environmental issues, I think that what we hear may be exaggerated.

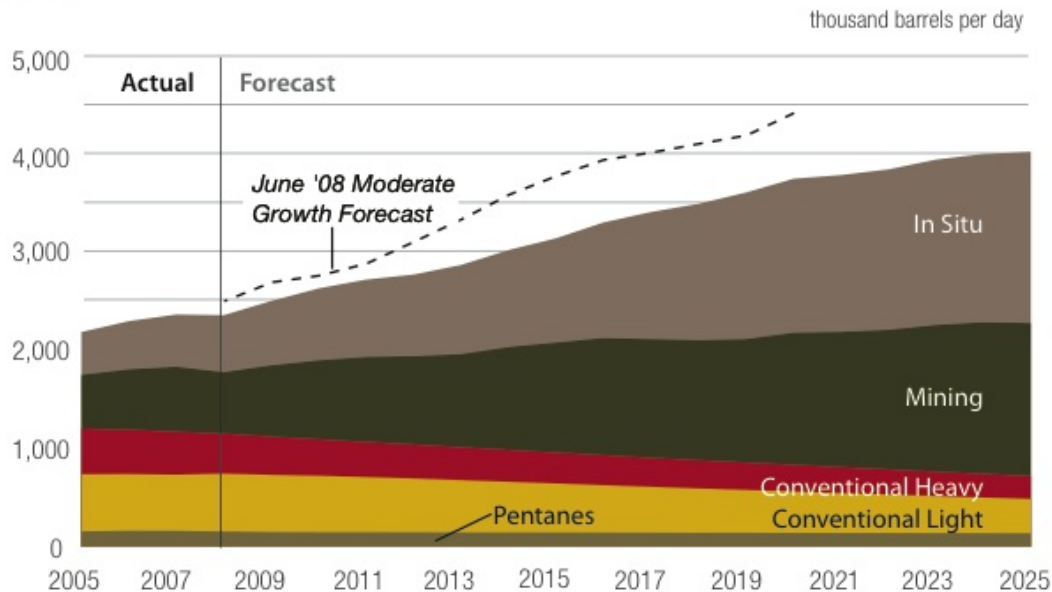
Scale-up Confusion

I think the issue of "scale up" is a matter of huge confusion to environmental groups. How much worse will the environmental impact be, 10 or 20 years from now, if oil sands production continues to grow as forecast? Will the scale up have 20 times the current environmental impact of the worst company, or will the impact be quite small, as production is shifted more and more to *in situ* (in place) facilities, that don't disturb the ground except to lay underground pipelines to

heat the bitumen, and as new environmental laws begin to have more impact?

Suppose that production actually grows to the extent forecast by the Canadian Association of Petroleum Producers (CAPP) in its "growth case". (This is more of an increase than I am showing in my forecast earlier in the post.)

Figure 2.3 Growth Case - Western Canada Oil Sands & Conventional Production



CAPP "Growth Case" forecast for Western Canada, including conventional as well as oil sands production, from [June 2009 Report](#).

With this forecast, mining will roughly double between 2008 and 2025, and in place production will triple. Mining is the problematic one, in terms of land disturbance, water use, and tailing ponds. At worst, it would seem to me that there will be double the amount of pollution issues in 2025 that we have now, based on the forecast increase in mining. But even this estimate is high--companies will be getting rid of legacy technology that holds them back environmentally, and recent law changes (such as one passed in 2009 [requiring much more rapid retirement of tailing ponds](#)) will further reduce the impact of increased production.

The amount of surface area that is currently covered by oil sands mines amounts to about 200 square miles (518 square kilometers), according to the [CERA report](#). This corresponds to a square 14 miles (23 kilometers) on its side, which is smaller than the footprint of many cities. What we are talking about, based on the CAPP mining forecasts, is, at worst, is doubling this footprint. The equivalent square would have an area of 400 square miles, so would measure 20 miles (32.2 kilometers) on a side.

Likely Area to be Disrupted by Mining

The confusion about scale up has led to very strange statements. For example, I recently got an e-mail from the Sierra Club that said (regarding the recent approval of the Alberta Clipper Pipeline):

This decision is deeply distressing because tar sands development in Alberta, Canada is

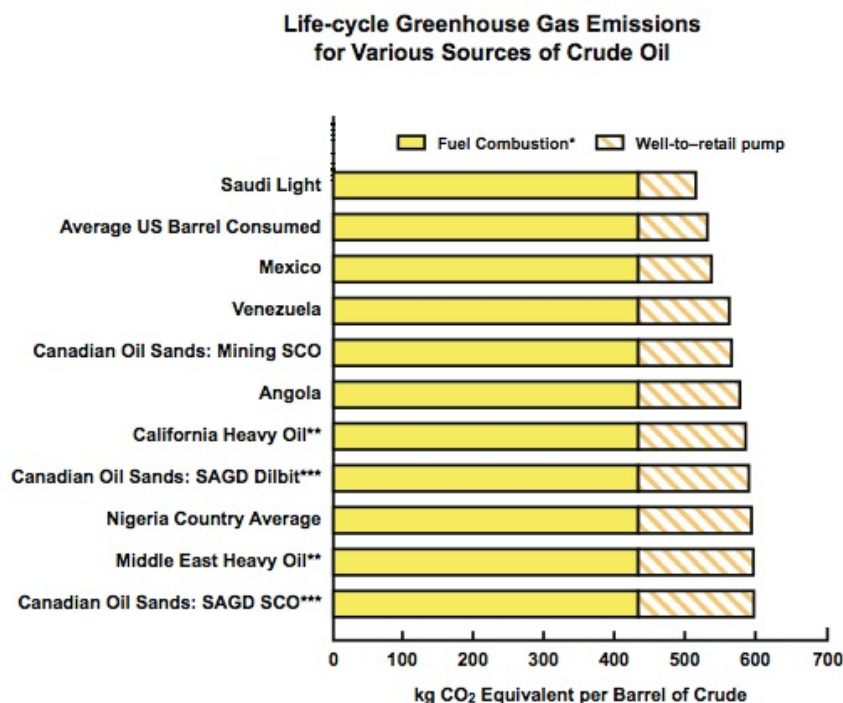
creating an environmental catastrophe, with toxic tailings ponds so large they can be seen from space and plans to strip away the forests and peat lands in an area the size of Florida.

The entire area where oil sands deposits are located is the size of Florida. But the mines themselves are tiny in comparison--the size of a not very large city. Perhaps we are talking about doubling this by 2025. The tailing ponds are contained within this area. The percentage of this area covered by tailing ponds is now about 10%. This percentage may very well decrease, as new technology and new stricter laws are implemented.

When trees are cut, we were told that the trees are sold to the logging companies in the area, and thus offset other trees that would have been logged elsewhere. The peat moss is stored for later reuse, according to the [Province of Alberta](#).

Carbon Dioxide Emissions

Another question is how to measure carbon emissions. Do you look at emissions during their whole life cycle, or only during extraction and refining? One would expect emissions to go up with the cost of producing oil (or decline in EROEI), and that is generally what a CERA study shows. The majority of the emissions relate to burning the oil that is produced, and these remain unchanged regardless of how low the EROEI of producing the oil is.



Source: Cambridge Energy Research Associates.

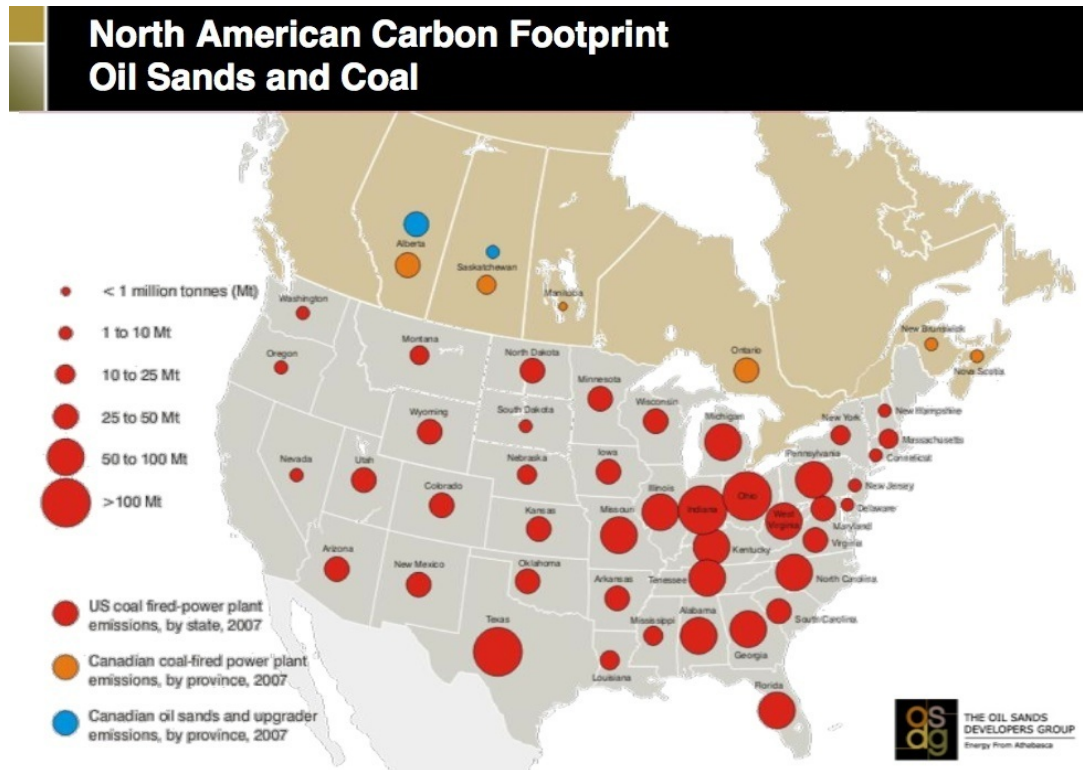
*The life-cycle GHG emissions estimate is based on a per barrel of crude basis, assuming an average carbon content. To convert this to a refined product basis, such as gasoline or diesel, additional assumptions would be needed to apportion well-to-retail pump emissions to individual refined products. This depends on the product slate associated with individual crude sources and refinery-specific configurations.

**Assumes steam-assisted gravity is used for production.

***Assumes a steam-oil ratio of 3.

CERA's comparison of Greenhouse Gas emissions, on a well to wheel basis.

Also, in terms of absolute level, if one compares CO₂ emissions from oil sands operations to those of coal fired power plants, the coal fired power plants seem to be a much bigger problem. If Alberta's oil sands emissions were doubled (as might possibly occur by 2025), they still would be less than the coal fired electricity emissions of many US states.



Comparison of Oil Sands Emissions with Coal Fired Power Plant Emissions, from [Setting the Record Straight](#) presentation by Don Thompson.

Athabasca River Pollution

Another source of confusion is pollution of the Athabasca River. The Athabasca River has been polluted for many years, and will continue to be polluted, because the river runs right through the oil sands area. In fact, the oil sands deposit was discovered because of water pollution.



Oil Sands Natural Leakage to Athabasca River.

The health of rivers in the area is being monitored by [Regional Aquatics Monitoring Program](#)

(RAMP), a multi-stakeholder committee which includes representatives from oil companies, [Ft. McMurray First Nation](#), [Ft. McKay First Nation](#), [Health Canada](#), [Alberta Pacific Forest Industries](#), [Fisheries and Oceans Canada](#), and [many others](#).

Each year, RAMP issues a [scientific report](#). The indications of these reports seem to show little problem with water pollution or overuse, except for a general mercury pollution problem, which I understand is quite widespread, extending throughout the US and Canada.

Air Pollution

With all of the pollution problems I had heard about, I assumed air pollution would be a real problem. Instead, the air was very clear. [Don Thomson](#) of the Oil Sands Developers Group told us the air in Ft. McMurray tests better than that in any other major city in Canada for air pollution, on almost any common pollutant. This may be in part because Ft. McMurray is several miles away from the mines.

I don't have many details on air pollution, except that this is one of the areas regulated by the province of Alberta. For example, Syncrude has undertaken a project called [Syncrude's Emissions Reduction Project](#) (SERP), designed to reduce stack emissions of sulphur compounds by 60% from current approved levels by 2011, under an agreement with the province.

Political Football Game

It seems to me that the Oil Sands are a huge political football game, and a good percentage of the environmental stories we hear are related to the posturing going on to win this football game.

Eastern Canada vs. Western Canada

First, Eastern Canada knows that it is likely to losing its imports from the East, due to peak oil. It needs the oil from Alberta, but as long as Alberta regulates the oil sands and exports the oil from the oil sands to the United States, (or to China), the East Coast is out of luck. So if Eastern Canada can show that Alberta is not doing a good enough job of regulating the oil sands, then it can perhaps get control through new Federal regulation of the oil sands. With that control, the Eastern part of Canada can be assured of getting oil. Also, if they want to raise taxes, it will be helpful to them. So we have reports like the one by [Ecojustice](#), advocating additional Federal regulation.

US vs. Canada / China / Far East

Second, the US is the current recipient of the oil from the oil sands. If the United States can be convinced that we don't want it, because of environmental problems, that makes it all the easier for Eastern Canada to get it, or for Western Canada to export to China. Western Canada really would prefer not to sell to the United States, since the price it gets from the US is perceived to be not the best, and the US is viewed as a bully.

Consultants /Think Tanks / Environmental Reports

Because of the political situation, there is a big "market" for reports by consultants and think tanks that show huge environmental problems. There are also all kinds of ways one can legitimately show that there might be a problem. For example:

[Undermining the Report Card: The Oil Sands Report Card](#) by WWF and the Pembina Institute. This report compares the various oil sands projects against one another on a number of different variables, and makes statements such as, "If all companies had as low emissions as [lowest company], there would be a savings of _____ in emissions." That is interesting, but doesn't tell you whether there is a problem in the first place.

Statements like "Toxic tailing ponds filled with liquid mine wastes already cover more than 50 square kilometers," also from [Oil Sands Report Card](#). Fifty square kilometers corresponds to a square a little over 7 kilometers (4.4 miles) on a side. Having so many tailings ponds is not great, but it is not as huge a problem as it is made out to be. In the future, the amount isn't likely to grow much, with more in-situ production, and with recent changes in [regulations regarding tailing ponds](#) that require much quicker ends to the ponds. Environmental Commissioner Renner told us that the oldest tailings pond (which is the one with by far the most leakage issues) is expected to be retired in 2010.

Photos with captions like, "Oil sands operations remove rivers, forests, and wetlands in order to access the oil sands beneath," also from [Oil Sands Report Card](#). The angle of the picture makes it look like a huge area is involved, and the way the caption is worded makes it sound like there are no steps being taken to put the pieces back in place according to current views of best environmental practices.

Statements by aboriginal groups that they have some cancer above normal levels. Any of us who have studied probability know what the issue is here. There are all kinds of little aboriginal groups with population of around 1,000. So if you look at enough of these groups, some of the groups will have a handful of people with one or another kind of cancer. There is pollution in the area--there always has been, because the river naturally runs through the oil sands. The background pollution level may raise the probabilities of cancer a bit higher. But there doesn't seem to be any study showing an overall problem.

Not for Profit Issues

Not for Profit organizations are almost certainly under funding pressures. If they want donations, it is to their advantage to make things sound as dire as possible. If the leaders of the organizations truly don't understand the size of scale up issues, these organizations can easily make statements that inadvertently overstate how bad the future will be, relative to today.

Also, needless to say, their analyses are not of the nature of a cost/benefit analysis. They just tell you that there might be environmental costs involved, not that the oil eventually produced might provide benefits.

These organizations also don't tell you about the likely environmental consequences, if the replacement oil were extracted in a much more heavily populated area, such as one of the OPEC countries. The environmental impacts on the population would likely be worse--but a lot less reported, and a lot less regulated.

People trust Not for Profits. After all, they are "do good" organizations. A person might think that someone is looking over the shoulder of Not for Profits to see that what they say is adequately supported by facts, but I can't see that that is happening at all. This is complicated "stuff" to understand. If these organizations miss the boat, or slant things in a way to get more donations, no one is likely the wiser.

How the Politics Will Work Out

No one really knows the answer to this--but we certainly have a lot of people who are willing to take reports at face value, without considering the possibility that political maneuvering may be distorting what we see. Since peak oil is not in the newspapers, even Oil Drum readers assume "higher-ups" don't know about peak oil. That is simply not true. They know that imports may be declining in the future, and find Trojan horses in which to hide their causes.

There is one thing I am pretty sure of. No politician in Canada really has any intention of stopping oil sands production based on environmental concerns, although a few may want to make certain it doesn't grow too rapidly. Mostly what politicians want is the oil, or the profits from the oil, for themselves. If it takes an exaggeration or two about environmental issues to reach this end, so be it.

Note: Oil sands vs Tar sands. The province of Alberta and CAPP prefer oil sands, so that is the terminology I have used. Oil sands is also far more commonly used, according to Google.

Previous Oil Sands / Tar Sands articles.

[Canada's Oil Sands - Part 1](#) - Gail the Actuary - Aug. 2009

[World Oil Exports; US Oil Imports; and a Few Thoughts on Canada](#) - Gail the Actuary - Aug. 2009

[EROI Update: Preliminary Results using Toe-to-Heel Air Injection](#) - Dave Murphy - March 2009

[Unconventional Oil: Tar Sands and Shale Oil - EROI on the Web, Part 3 of 6](#) - Charles Hall guest post - April 2008

[Tar Sands: The Oil Junkie's Last Fix, Part 2](#) - Guest post by Chris Nelder - September 2007

[Tar Sands: The Oil Junkie's Last Fix, Part 1](#) - Guest post by Chris Nelder - August 2007

[Extracting Heavy Oil: Using Toe to Heel Air Injection \(THAI\)](#) - Gail the Actuary - August 2007

[Canadian Oil Sands Production Update](#) - Sam Foucher - Oct. 2006



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