



Oh, Canada! -- Natural Gas and the Future of Tar Sands Production

Posted by [Dave Cohen](#) on June 20, 2006 - 3:19pm

Topic: [Supply/Production](#)

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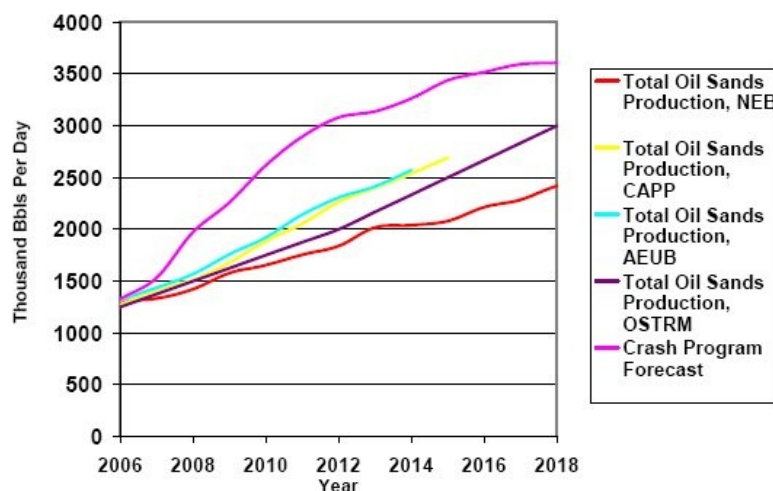
Update [2006-6-20 15:19:22 by Dave]: Perhaps this should be considered a follow-up to HO's excellent post [Mining Canadian Oil Sands into the future](#). It's not meant to be a rebuttal of any kind since I am really looking at different issues pertaining to tar sands production. I apologize for its length but it seemed necessary to make my points.

The "missing link" to the *Uppsala* paper (pdf) has been corrected.

I was investigating [sour gas](#) and it turned out that about 30% of the gas produced in the Western Canada Sedimentary Basin (WCSB) is sour. As things do, one thing led to another and I found that this gas can be "sweetened" and used although it contains H₂S (hydrogen sulfide), which is toxic at levels as low 10 ppm (parts per million). However, the real path and story became natural gas usage to carry out production of the tar sands.

There turns out to be a worrisome supply issue. Here are some claims made about tar sand production going forward.

Figure 4. Different Oil Sands Production Forecasts



Predictions for Tar Sands Oil Production
Figure 1 -- [Click to Enlarge](#)

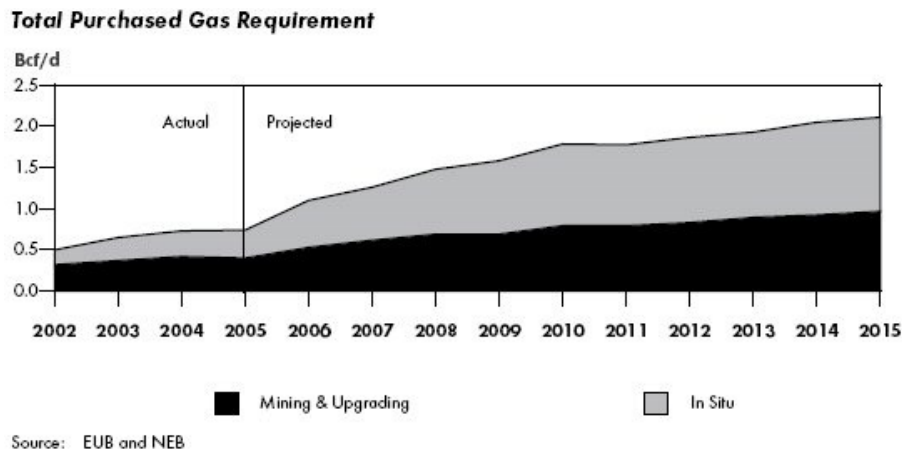
However, tar sands production of approximately 1.0/mbd in 2005 also used 0.72/bcf (billion cubic feet) of natural gas as I read in this brief [press release](#).

According to the [NEB's](#) [National Energy Board of Canada] 2006 oil sands [Energy Market Assessment](#), the amount of gas used in oil sands production will rise to 2.1 billion cubic feet a day in 2015 from about 700 million cubic feet last year....

"We don't see any issues on gas availability," said Bill Wall, oil technical specialist for the NEB.

This story is about why I don't believe Bill.

As you can see in *Figure 2* from the NEB, the PlanetArk press release is accurate. Note that natural gas is required to support both the *in situ* SAGD and mining & upgrading.



The NEB's Assessment of Natural Gas Usage
Figure 2 -- Click to Enlarge

So, the main questions arising from this are

- What is the state of Canada's natural gas production?
- Do future projections support such a large increase in natural gas usage to support tar sands production?
- Are there are alternatives to using natural gas?

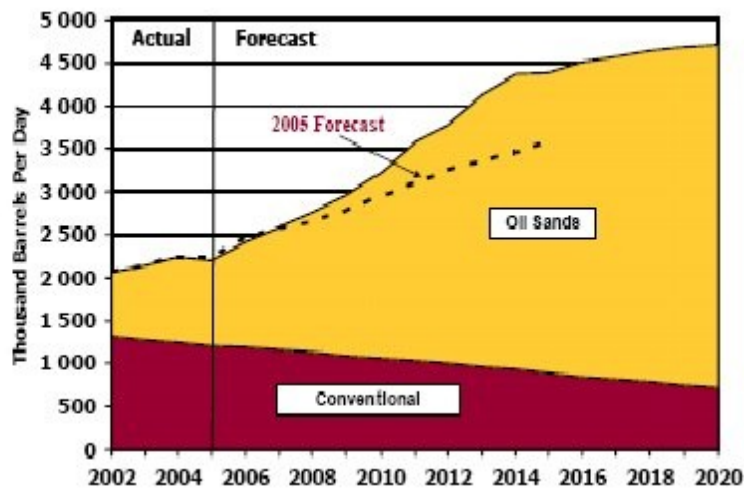
But first, we must discuss how and why natural gas is necessary for producing the tar sands. The newest most efficient *in situ* method for tar sands recovery uses [Steam Assisted Gravity Drainage](#) [SAGD]. As this important paper [A Crash Program Scenario for the Canadian Oil Sands Industry](#) by Bengt Söderbergh, Fredrik Robelius and Kjell Aleklett (Uppsala Hydrocarbon Depletion Study Group) tells us:

Natural gas-fired facilities generate steam [for SAGD] and provide process heat for bitumen recovery, extraction and upgrading. Further, natural gas also provides a source of hydrogen used in hydroprocessing and hydrocracking as part of the upgrading process.... Although there is considerable variation between individual projects, an industry rule of thumb is that it takes 1000 cubic feet of natural gas to produce one barrel of bitumen. The demand for mining recovery is a more modest 250 cubic feet per barrel. Current natural gas demand for upgrader hydrogen amounts to approximately 400 standard cubic feet per barrel. Future hydrogen additions for upgrading into higher quality SCO [synthetic crude oil], may reach another 250 cubic feet per barrel. In

addition to this, if no coke burning is taking place, yet another 80 standard cubic feet of barrel for upgrader fuel is to be added. Therefore, a future barrel of in situ produced high quality SCO may require more than 1700 standard cubic feet of natural gas....

This paper (henceforth, referred to as *Uppsala*) is the source of *Figure 1* and subsequent graphs and information below. It is important to note that in *Figure 1*, the *Uppsala* "crash program" estimate is higher than the others, including that of the NEB and CAPP (Canadian Association of Petroleum Producers). However, it turns out that CAPP has just released a new report [Canadian Crude Oil Production and Supply Forecast 2006 - 2020](#) (May 2006) that reflects or even exceeds the *Uppsala* scenario for tar sands production. Therein we find the following graph.

Chart 2: Comparison of Oil Sands versus Conventional Oil Production



CAPP Canadian Oil Production
Figure 3 -- Click to Enlarge

In the fine print, we find that 2005 tar sands production was 0.99/mbd with an expected rise to 1.26/mbd in 2006. Tar sands production is expected to rise to 3.5/mbd by 2015 and 4.0/mbd by 2020. Since these numbers are in line with the *Uppsala* "crash program", their projections gain some credibility. You can find a [summary](#) of the CAPP report if you don't want to wade through the whole thing.

Has Canadian Natural Gas Production Peaked?

The answer is "yes" according to diverse sources. Here in [Canadian natural gas reserves continue to fall despite record drilling activity](#), we find that the Canadian Association of Petroleum Producers records falling proven reserves. Canada's NEB, in agreement with *Uppsala*, put the peak figure at 16.8/bcfd in their latest report.

The profile for Canadian natural gas production appears to have flattened and is expected to remain around 476.0 million m³/d (16.80 Bcf/d) through 2006. As Canadian conventional gas production declines, this may be offset by increases in natural gas from coal (NGC) production. Natural gas from coal, which is also known as coal bed methane, may become a significant contributor to Canadian gas supply in the longer term.

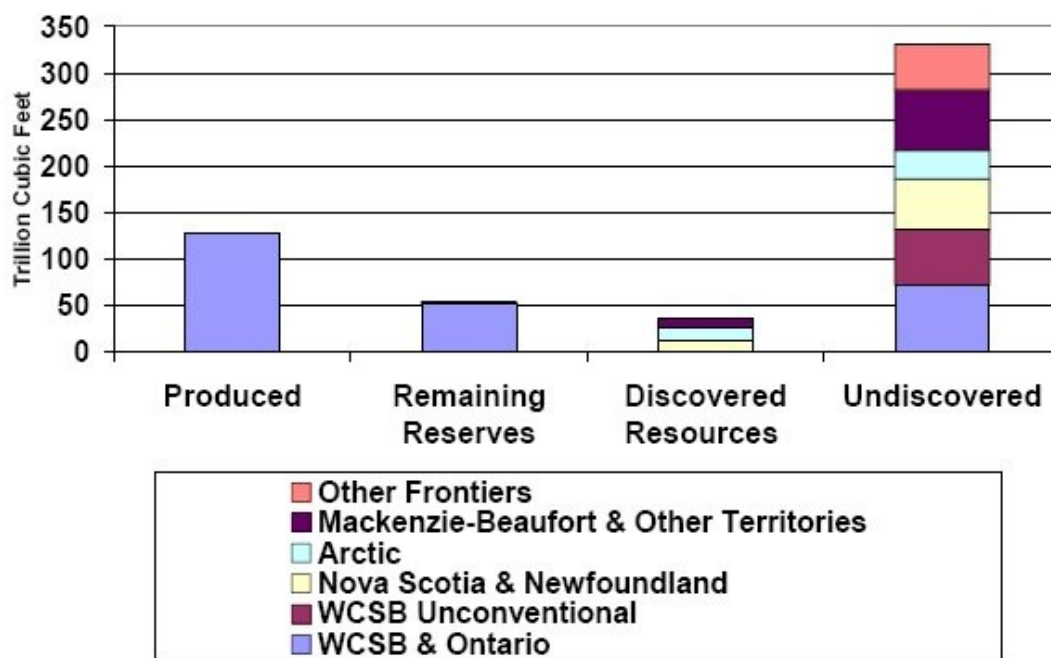
By 2006, natural gas demand is expected to grow in Canada and the U.S. to

approximately 1 980.7 million m³/d (69.92 Bcf/d) from approximately 1 950.7 million m³/d (68.86 Bcf/d) in 2004, an increase of 1.5 percent.

In Canada **the most significant growth in demand for natural gas is from oil sands operations**, which could reach 28.6 million m³/d (1.01 Bcf/d) by the fourth quarter of 2006, an increase of 8.3 million m³/d (0.29 Bcf/d) over 2004.

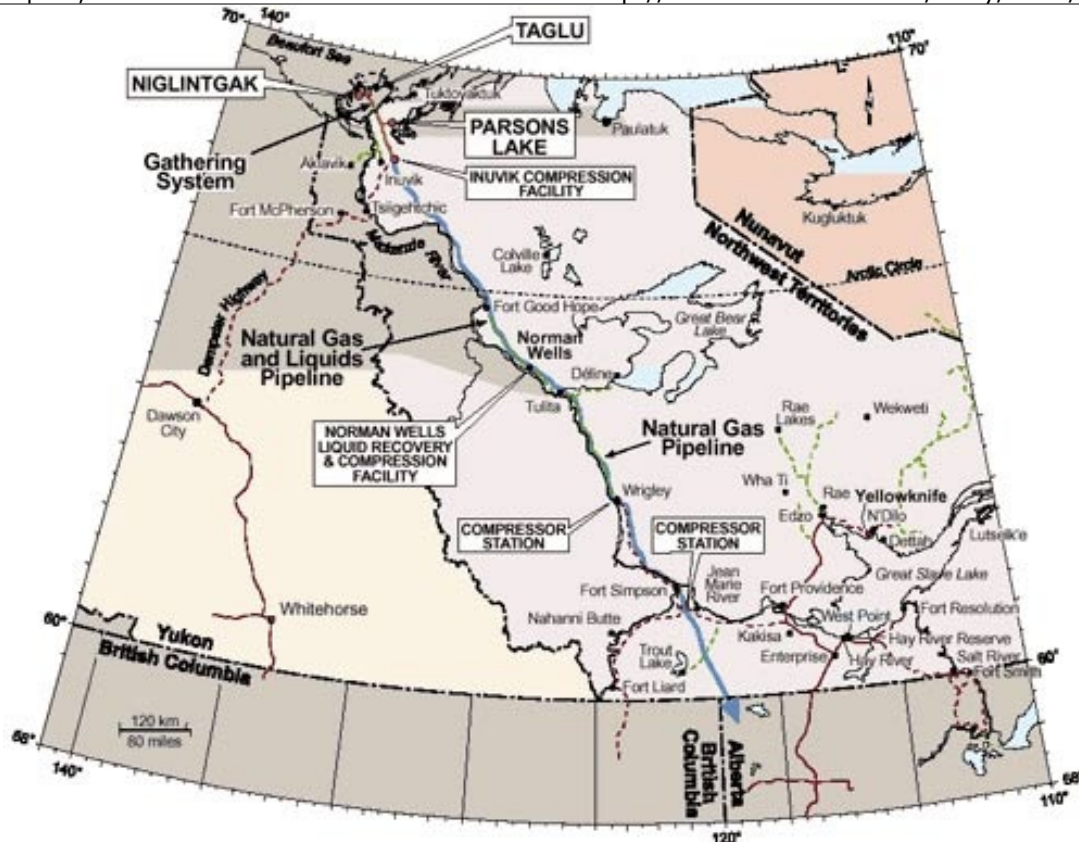
For further confirmation, look at the [Canadian natural gas](#) country brief from the EIA. Regarding reserves, here's the big picture from *Uppsala*.

Figure 6. Natural Gas Resources in Canada, Supply Push Scenario



Canadian Gas Reserves 2005
Figure 4 -- Click to Enlarge

This brings us to North America's Arctic natural gas and especially the Mackenzie Delta, which is supposed to be an important new source of natural gas to the Alberta region supplying as much as 1.2/bcf. The three main fields in this region facing the Beaufort Sea, Taglu, Parson's Lake and Niglintgak, contain about 5.8/tcf (trillion cubic feet) of proven reserves and "undiscovered" reserves may be as high as 62/tcf.

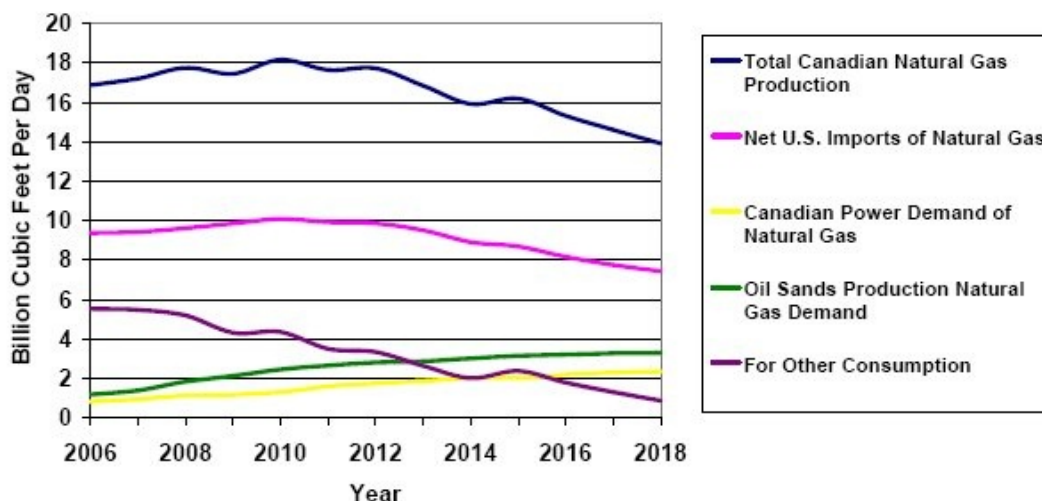


*The Mackenzie Valley Pipeline
Figure 5 -- Click to Enlarge*

As you can see, the end point of this pipeline is Alberta and the reserves numbers are reflected in *Figure 4*. However, there are now the usual [problems](#) with the construction of the pipeline. No doubt the project will be completed but we can expect the usual delays, cost overruns and other logistical difficulties.

Future Availability of Natural Gas for the Tar Sands

As the expression goes, a good picture is worth a 1000 words. Here it is, from *Uppsala*.



Available Canadian Natural Gas for Other Consumption

Figure 6 -- Click to Enlarge

Eyeballing the graph, we find that by 2018, Canadian natural gas production will be about 14/bcfd and consumption is projected to go something like this--numbers approximate, of course!

1. Exports to the US -- 7.5/bcfd
2. Canadian power demand -- 2.2/bcfd
3. Tar Sands production -- 3.1/bcfd
4. Other Consumption -- 1.2/bcfd

That covers it all, the whole shooting match, which is 14/bcfd. Incredibly, tar sands production is higher than internal Canadian electrical power demand and this leaves a paltry 1.2/bcfd for *all other Canadian usage*, which would include any industry, agriculture or manufacturing there that uses natural gas. Clearly, this is not going to work. Even if the MacKenzie pipeline comes online successfully in the 2010/2011 timeframe as projected and *all the gas transported* from the Arctic is used for tar sands production and finally, we assume the WCSB 2005 contribution of 1.1/bcfd (which is almost certainly *very generous*), there would still be a 0.8/bcfd *shortfall* of natural gas supply for tar sands production in the year 2018. Something's got to give.

Recall that *Uppsala* bases its projections on its "crash program forecast" which in terms of tar sands production is equivalent to the latest CAPP longterm forecast of May 2006.

[editor's note, by Dave] Tar sands natural gas usage will reach 1.01/bcfd by the 4th quarter of 2006 from 0.72/bcfd in 2005. According to the CAPP production data, there will be an increase of 0.225/mbd of oil production from 2005 to 2006 *accompanied by* an increase of 0.29/bcfd of natural gas required for that new production, an astonishing 29% increase in just one year. This is related to increased use of SAGD for *in situ* bitumen extraction.

Unfortunately, the NEB report only covers the short-term out to the end of this year, so at present I do not know their longer term projections. But we know this much...

Canadian gas produced from the WCSB contributes almost 98 percent of the total gas produced in Canada and will remain the mainstay for the outlook period. Alberta, British Columbia and Saskatchewan contribute roughly 80, 16 and 4 percent, respectively, to the production from the WCSB, while natural gas from offshore Nova Scotia provides most of the remaining production.

Issue 1: Canadians are facing high and volatile natural gas prices over the outlook period. Although high gas prices have benefited Canadian economic growth, higher energy costs present a challenge for consumers and the industrial sector.

Issue 2: For oil sands producers, high and volatile natural gas prices have added uncertainty to the cost of their operations. Consequently, suitable alternatives for natural gas are being investigated by oil sands producers and they will make investment decisions based on the overall economics of their operations.

Regarding Issue #2, I would say "no kidding!" Where's the extra gas going to come from in the longer term? LNG (liquified natural gas) imports? How are you going to get them to Alberta, which is geographically in the middle of nowhere? Natural gas from coal (NGC) [as described by

Development of the resource is at an early stage with the production in 2004 at 4.3 million m³/d (0.15 Bcf/d) or less than 1 percent of Canadian gas output.

But, most importantly, why would Canadians put up with this politically unacceptable situation in which their scarce natural gas resources are either 1) exported to America or 2) used to produce synthetic crude oil which is then mostly exported to other countries to their detriment and for the profit of corporations like Suncor Energy? To me, the future scenario is completely untenable, both logistically and politically. It is a fantasy world for those who espouse it.

Alternatives to Using Natural Gas?

Uppsala summarizes the alternatives to using natural gas.

There are alternatives to natural gas as hydrogen source as well as energy source. However, alternative hydrogen sources, predominantly partial oxidation gasification of coal or oil sands residues have low efficiency, negative environmental impacts and a more complicated process for purification of hydrogen. (Alberta Chamber of Resources, 2003)

Coal combustion in advanced boilers or gasification of residue bitumen, is an option to replace natural gas for energy although greenhouse gas emissions would increase significantly. However, nuclear energy is another possible source of electricity and steam.

The first alternative, which uses coal or involves a kind of "bootstrapping" of the operation is obviously costly and has low efficiency. The viable alternative is to build a nuclear power plant there. Jerome a Paris at Daily Kos reported on this back in the fall of 2005 in [Big oil getting desperate: Making oil with nuclear energy](#).

French oil giant Total SA, amid rising oil and natural-gas prices, is considering building a nuclear power plant to extract ultraheavy oil from the vast oil-sand fields of western Canada....

At the same time, prices of natural gas -- which oil-sands producers have relied on to produce the steam and electricity needed to push the viscous oil out of the ground -- have risen 45% in the past year. That is prompting Total, which holds permits on large fields in Alberta that contain oil sands, to consider building its own nuclear plant and using the energy produced to get the job done....

Unfortunately, my brief searches have not turned up much information about Total's plan--it seems to be moribund for now. Quoting from this Rigzone [article](#), "The extraction process is so labor intensive and requires so much heat, in order to extract the oil from the tar sand that 'Total briefly floated the idea of building a nuclear-power plant' in Fort Mc Murray". So, for right now, the idea seems dead. Also, I suppose it would be possible in theory to provide the required energy

In conclusion, I do not see where the extra natural gas is going to come from to scale up tar sands production to levels foreseen by agencies like CAPP. From the supply side, the logistics (pipelines) and the political side, there are major obstacles at every turn. This will be especially true as more natural gas is required to produce a barrel of oil using the *in situ* SAGD method. I recommend great skepticism toward claims that this miracle resource will replace a large part declining conventional oil from existing fields. And I haven't even mentioned the water problems. Oh, wait, that's the Canadian Chamber of Commerce knocking at my door.... Gotta run.



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