navius research brief

How resilient are the Canadian oil sands to carbon constraints?

Review of MIT's oil sands study

Author and Contact:

Jotham Peters
Jotham@NaviusResearch.com

Navius Research Inc.
Vancouver / Toronto
520-580 Hornby Street
Vancouver, BC V6C 3B6
778-868-3744
www.NaviusResearch.com

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Massachusetts Institute of Technology (MIT) released a paper in July 2012 suggesting that achieving Canada's targets for greenhouse gas emissions (GHG) would significantly reduce the rate of growth of Canada's oil sands.[i] In this brief, Navius evaluates MIT's analysis and concludes that oil sands activity is likely to be more resilient to climate constraints. Using Navius' GEEM model we provide an alternative estimate of this resiliency, and show how it is also highly dependent on the design of climate policy.

How sensitive is oil sands production to oil prices and carbon policy?

An important assumption in the MIT study relates to the sensitivity of oil sands production to oil prices. High oil prices incent greater investment in bitumen extraction, while lower prices yield less investment. A carbon policy implemented by developed countries would reduce the price for oil due to lower global demand and also impose carbon costs on bitumen extraction. These carbon costs can be equated to a further decline in the market price for bitumen. With the demand and carbon cost dynamics combined, MIT's study indicates that achieving Canada's 2020 target would have the same effect as a $15 per barrel decline in the price for oil.[ii] In MIT's study, this leads to between a 30% and 75% decline in bitumen production by 2020 (depending on the availability of carbon capture and storage, which would have a mitigating effect). However, if the analysis was conducted using parameters inferred from the National Energy Board's *Canada's Energy Futures* study, the same reduction in oil price would lead to less than a 10% decline in bitumen production.[iii]

Conclusion: Findings about the resilience of oil sands production to carbon constraints are highly sensitive to modeling assumptions. When nationally accepted modeling assumptions are employed, oil sands production is likely to be more resilient to carbon constraints than MIT's study would suggest.

Does carbon policy always have the same effect as a change in oil price?

The answer here is a definite "no". However, MIT simulated a carbon constraint in such a way that the answer would be "yes". In analyses using computable generation equilibrium (CGE) models, such as MIT's EPPA model, the revenue earned from a carbon price must be re-allocated throughout the economy. The method by which these revenues are recycled dictates the winners and losers under the policy. For example, revenues can be used to:

1. *Provide transfers to households*. In this case, households are the beneficiary of the policy, but GHG-intensive industries such as the oil sands bear the full brunt of the carbon price.
2. *Support activity in GHG-intensive and trade exposed industries.* In this case, GHG-intensive industries still have an incentive to reduce emissions intensity by adopting technologies such as carbon capture and storage, but impacts on the sector's level of activity are mitigated.

MIT simulated the first option, which imposes a significant cost on the sector.[iv] While this method of recycling the revenue from a carbon price is a legitimate option available to policy makers, no policy maker in Canada has actually proposed this approach. The carbon price established by Alberta's Specified Gas Emitters Regulation is more in line with the second option.[v] While the federal government has not released its oil and gas sector regulation, all hints point to the second approach rather than the first.

Conclusion: Activity in the oil sands sector is sensitive to the design of climate policy. The policy approach envisioned and modeled in MIT's study leads to an extreme decline in activity from the oil sands, while the approaches currently in place or being discussed in Canada would substantially mitigate impacts on production levels.

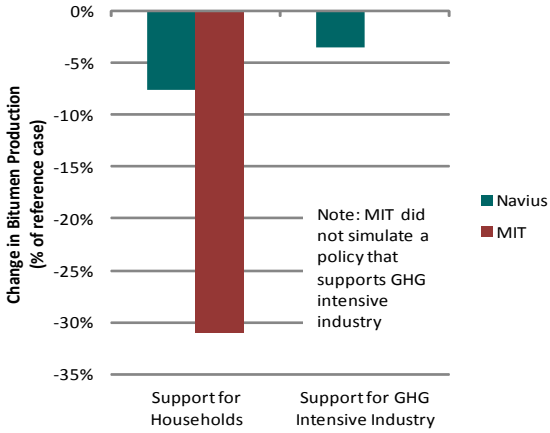
How is oil sands activity affected by achieving Canada's 2020 emissions target?

To evaluate the effect of modeling and policy assumptions, we conducted original modeling using our General Equilibrium and Emissions Model, GEEM. Navius' GEEM and MIT's EPPA are both CGE models, so their structures are similar. However, GEEM has been calibrated with parameters inferred from Canadian analyses, its technological assumptions for the oil sands sector have been extensively reviewed by the Government of Canada and Alberta, and it is capable of modeling multiple policy design options.

We used GEEM to estimate the impact on oil sands production of two different policy design approaches to achieving Canada's 2020 GHG emissions target. The left side of Figure 1 shows that even when examining the same policy design (using carbon pricing revenue to support households), Navius forecasts that achieving Canada's GHG emissions target would have a much smaller impact on oil sands activity than estimated by MIT. The right side of Figure 1 shows how changing the climate policy design to better match the policies proposed in Canada (using carbon pricing revenue to support GHG intensive sectors) could substantially mitigate the impact of climate policy on output from the oil sands sector.

Conclusion: Canada's oil sands are likely to be more resilient to carbon constraints than estimated by MIT. Furthermore, the climate policies currently being considered in Canada would mitigate impacts on sector activity while retaining the incentive to reduce emissions intensity by adopting technologies such as carbon capture and storage.

Figure 1: Impact of Climate Policy on Canadian Oil Sands Sector Output (comparison of alternate policy design options)



Several uncertainties remain in the analysis, and warrant a deeper examination. Since this Research Brief was aimed at examining MIT's findings, Navius modeled the same GHG reduction and oil price scenario as MIT, so that the results could be directly compared. However, if the global community pursues deeper reductions in emissions (e.g., to limit the increase in temperatures to 2°C), prices for oil may decline further. The resiliency of oil sands production to a greater dampening in global oil demand requires further analysis.

Lastly, Navius modeled two climate policy options to illustrate the sensitivity of the results to policy design. However, further options are available to policy makers, such as using the revenues from a carbon price to invest in low- and zero-emissions technologies (i.e., a technology fund). Alternative policy designs would have different impacts on the oil sands sector.

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[i] Chan G, Reilly J, Paltsev S, Chen Y, 2012, "The Canadian oil sands industry under carbon constraints", Energy Policy, 50: 540-550.

[ii] According to the MIT study, if Annex I countries achieve their stated targets for emissions in 2020, the price for light oil would be about $10 per barrel lower than in the absence of the policy. MIT estimates that Canada will require a carbon price of about $50 per tonne CO_2e to achieve its 2020 target, which can be translated into a maximum cost of $4.5 per barrel of in-situ bitumen (in-situ bitumen extraction produces 0.091 tonnes of CO_2e per barrel of bitumen). The cost imposed on mined bitumen would be lower due to its lower emissions intensity (Personal communication with Chen Y, 2012).

[iii] The elasticity of supply for bitumen production in 2020 can be inferred to be 0.55 from the National Energy Board, 2011 Canada's Energy Futures, available from http://www.neb-one.gc.ca. If MIT used this elasticity, the decline in oils sands activity would be closer to 8-10%.

[iv] Personal communication with Chen Y, 2012; Paltsev S, Reilly J, Jacoby H, Eckaus R, McFarland J, Sarofim M, Asadoorian M, and Babiker M, 2005, The MIT Emissions Prediction and Policy Analysis (EPPA) Model: Version 4, Joint Program Report Series.

[v] Alberta Environment, 2007, Technical guidance document for baseline emissions intensity applications, available from www.environment.gov.ab.ca.

For questions about this research or to inquire about custom analyses, please contact Jotham Peters at Jotham@NaviusResearch.