



The Bottom Line

Why Canada Is Unlikely to Sell the Last Barrel of Oil

Aaron Cosby¹

December 2022

Summary

- Canadian producers are vulnerable to two foreseeable threats: declining global demand for oil and falling oil prices.
- Almost all Canadian exports go to U.S. refineries. This reliance on captive buyers will initially shield Canada from the worst of the decline in demand, but this buffer will not last.
- Nothing will shield Canada from global oil price drops and volatility. Pressure on Organization of Petroleum Exporting Countries-plus discipline as members rush to increase oil production in the face of declining demand will result in prices that are low and even more volatile than normal.
- Canadian oil producers' environmental, social, and governance performance will not help preserve Canada's market share, since it does not matter to the refineries buying the product.
- Marginal producers will not survive in the post-peak market, and efficient producers will see low profits, remitting low royalties and taxes. In line with history, large numbers of workers will lose their jobs in the sector.
- Canada cannot afford to delay support for diversifying into sectors that can replace oil as an engine of economic prosperity.

¹ Acknowledgements: Richard Masson and Nichole Dusyk generously reviewed this briefing. Any errors or omissions remain the responsibility of the author.



Oil demand and oil prices are currently booming, spurred by under-investment in exploration and an unexpected demand surge as COVID-19 restrictions were lifted, and greatly exacerbated by the Russian invasion of Ukraine. Nonetheless, almost all analysts see global demand for oil peaking around 2030 (BP, 2022; DNV, 2022; International Energy Agency [IEA], 2022; McKinsey, 2022; Rystad Energy, 2022). Recent International Institute for Sustainable Development [IISD] analysis predicts falling demand by 2030 and significant declines thereafter as new technologies and ambitious climate policies eat into all of oil's major end uses (Cosbey, 2022).

It is not obvious, though, what that means for Canadian oil producers. Will they thrive even as the global market shrinks? Will Canadian environmental, social, and governance (ESG) credentials help grow or maintain the country's market share? Will they, as suggested by former Premier of Alberta Jason Kenney, help Canada buck global circumstances and sell the proverbial last barrel of oil (Braid, 2022)?

This policy brief explores four factors that define the answers to those questions:

- The destination of Canada's crude oil exports
- Whether Canada can win markets with its ESG credentials
- Whether Canada can win markets on price
- What to expect from Canada's global competitors

Almost All of Canada's Oil Exports Go to U.S. Refiners

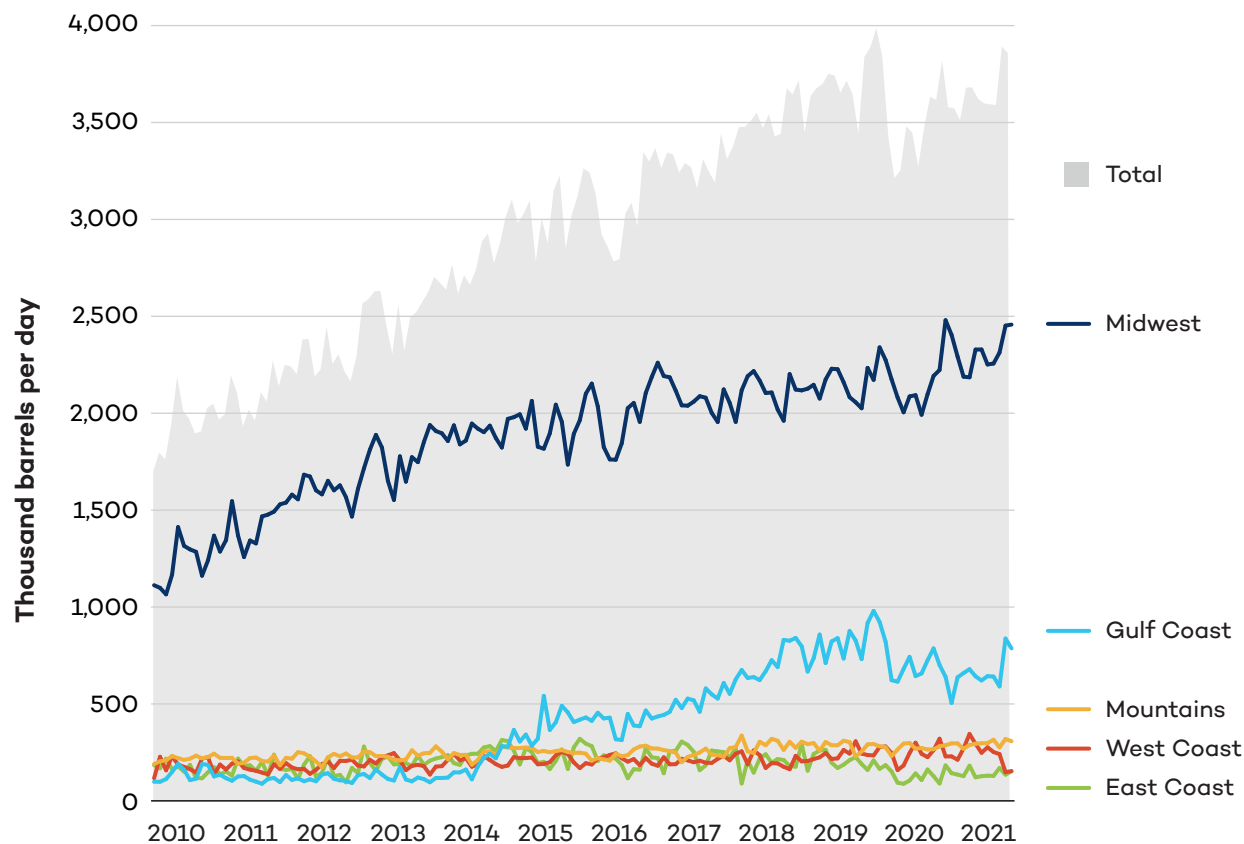
In 2021, Canada exported 3.3 million barrels a day (bpd) of crude oil, or 80% of domestic production (Canada Energy Regulator, 2022; UN Comtrade, 2021). Over 94% of those exports went to the United States, and 80% were in the form of heavy crude of the type produced in Western Canada's oil sands (Canada Energy Regulator, 2022).

Figure 1 shows where those exports went: overwhelmingly to Midwest refiners in Illinois and Minnesota (primarily through the Enbridge and Keystone pipeline systems), but increasingly also to Gulf Coast refiners as U.S. pipeline reversals and transport by rail have increased Canadian producers' ability to reach them.

Several major Midwest refineries and some Gulf Coast refineries are deliberately set up to refine oil sands-type heavy crude. Many in the Midwest have made recent multibillion-dollar investments in capacity specifically designed to do so. For the Midwest refineries, Canada is the only viable source of crude feedstock; they do not have tidewater access to import crude from other suppliers (or to export their final product). Gulf Coast refiners can import crude by tanker, but other global sources of heavy crude—primarily in Mexico and Venezuela—have dropped to almost negligible levels of production, so Canada is a critically important source.



Figure 1. U.S. refining district destinations for Canadian crude exports



Source: Canada Energy Regulator, 2022.

What will those export patterns mean for Canada when global demand drops? Canadian oil exporters are potentially vulnerable to two forces: lower demand and lower price. On demand, Canada is partially insulated from global trends because it mostly sells to Midwest U.S. refiners whose output is consumed in the United States. But Canada is not completely insulated from drops in global demand for three reasons:

- U.S. demand itself will be dropping. The U.S. Inflation Reduction Act is projected to shave 2.1 million bpd off U.S. demand for petroleum products by 2030 and 4.1 million bpd by 2035, relative to 2021 U.S. consumption of 18.6 million bpd of crude (Jenkins et al., 2022).² Those numbers are likely underestimates since they do not factor in the ban on the sale of conventional light cars and trucks in California by 2035 or the follow-on announcements that will come from 15 other states with linked regulatory regimes (Gearino, 2022).

² A 42 U.S.-gallon barrel of crude is refined into 45 gallons of petroleum products.



- Though U.S. demand decreases won't necessarily translate directly into reduced Canadian imports (the complex modern refineries to which Canada sells would not likely be the first to cut production), the pressure for such cuts will be significant. U.S. refiners exported 46% of their production in 2021 (U.S. Energy Information Administration, n.d.), and they will be selling into a declining global market.
- A small but increasing amount of Canadian crude finds its way to markets beyond the United States through the Gulf Coast in flows that reached almost 300,000 bpd in 2021 (Kelly & Williams, 2022). The expansion of the Transmountain pipeline to the Canadian West Coast would, if completed, add another 600,000 bpd of non-U.S. export capacity. Combined, that would amount to 27% of total 2021 exports.

The conclusion is that Canada's U.S. export patterns provide a buffer but do not shield it much from lower demand for its exported crude oil as global demand drops.

Canada is also directly vulnerable to the price impacts of a global decrease in demand, and its U.S. export markets do little to shield it from those impacts. Prices are, to a large extent, set in a global market. Those prices are set both by demand and supply, however, so it matters what Canada's global competitors will do as demand falls—a topic that is explored below.

ESG Credentials Will Not Preserve Canadian Oil's Market Share

If Canada were vying to sell the proverbial last barrel of oil, would it matter how its oil was produced? Would greenhouse gas (GHG) intensity matter, for example, or would it matter whether it was considered “ethical” or produced to high ESG standards? The short answer is: probably not.

For some products, production methods impact marketability. At comparable price and quality, final consumers will favour “green” and ethically produced products. For goods like food, clothing, and electronics, a variety of labelling schemes allow consumers to choose, even to pay a premium for labelled products (Voora et al., 2022). But for commodities like oil, the situation is different. When refined Canadian oil is finally sold at the pumps, it is indistinguishable from other gasoline, and tracking the source at the retail level would be daunting. The original customers are mostly U.S. refiners dependent on the supply of heavy Canadian crude, as detailed above, who focus on quantity, quality, and price—not ESG. ESG considerations clearly matter a great deal to oil sector *investors* (Flavelle, 2020; Graney, 2021), but they do not preoccupy most *customers*. While investors influence companies' ability to finance expansion, new projects, and infrastructure, they don't buy the final product, and therefore their opinions don't directly affect a company's market share. This will be especially true in the context of a shrinking market in which Canadian producers will not need to expand operations to compete for the few remaining buyers. Canadian crude oil's emissions intensity would matter if the United States implemented a clean fuel standard governing the life-cycle carbon content of transportation fuels such as gasoline. By design, such a standard would reduce the market share of crude oil produced at high



emissions intensity, including most of Canada's U.S. exports (see Box 1). California, Oregon, and Washington have clean fuel standards in place. But, while such a policy has been suggested by legislators (House Select Committee on the Climate Crisis, 2020; Senate Democrats Special Committee on the Climate Crisis, 2020), it would face strong opposition from the domestic refining sector and raise the price of gasoline for American drivers, making it unlikely to pass in the foreseeable future.

Box 1. How does Canadian crude oil measure up on GHG emissions intensity?

It is complicated to judge how the GHG intensity of Canadian oil production as a whole stacks up against international competitors because Canada's different producers use different production methods, with very different emissions-intensity profiles (Birn & Crawford, 2020). In terms of emissions intensity, for oil sands, in-situ mining is much worse than surface mining, and both are much worse than conventionally produced crude oil.

That said, one of the most prominent international benchmarking exercises for the GHG intensity of oil production suggested that Canadian crude oil production is, on average, among the most polluting. Canada's mean score was ranked fourth worst in the world for 2015—besting only Algeria, Venezuela, and Cameroon (Masnadi et al., 2018). That high score is heavily influenced by emissions-intensive oil sands operations, which produce over 65% of Canada's crude oil.

Beyond the question of whether ESG matters for Canadian oil's market share is the more basic matter of whether Canada's producers are, in fact, world leaders on ESG criteria, as claimed by some industry groups and pundits (Canadian Association of Petroleum Producers, n.d.; Dziuba et al., 2020).

On environmental performance, Box 1 makes it clear that Canada's overall GHG intensity of production is not world class. Beyond emissions, Canada's oil sands operations have been dogged for years by a record of serious water and air pollution impacts (Alberta Environmental Monitoring Panel, 2011; Leahy, 2019; Liggio et al., 2016). Those impacts were singled out as disproportionately affecting Indigenous peoples by the United Nations Special Rapporteur on the implications for human rights of the environmentally sound management and disposal of hazardous substances and wastes (Tuncak, 2020).

Oil sands development has been responsible for extensive impacts on the traditional territories of many First Nations in Alberta, in violation of treaty rights and without proper consultation or respect for basic principles such as cumulative effects management (Lower Athabasca Regional Plan Review Panel, 2015). In many instances, the industry's consultations and impact assessments with respect to Cree, Dene, and Métis rights have been designed in a manner to expedite oil sands development (Baker & Westman, 2018). Members of many Nations in the region, such as Athabasca Chipewyan First Nation and Fort McKay First Nation, have denounced these impacts for decades. Additionally, the Beaver Lake Cree Nation has an ongoing



lawsuit against the governments of Alberta and Canada on the basis that the cumulative impacts of this industrial development violate their Treaty 6 rights (Beaver Lake Cree Nation, n.d.).

Canadian producers' mismanagement of the end of the oil and gas project life cycle should also be considered. In Alberta, as of September 2022, 3,309 oil and gas sites are considered orphaned, meaning the original owners failed to fulfill their responsibility for costly end-of-life decommissioning and restoration (Orphan Well Association, 2022a). Many of those sites were strategically sold to insolvent operators (Lewis et al., 2018). Responsibility for them now falls to the industry-funded Orphan Well Association, but current industry contributions are grossly inadequate. The Association has CAD 169 million in assets against orphaned sites that it estimates will cost almost CAD 700 million to clean up (Orphan Well Association, 2022b). Liability estimates for all existing sites are much higher, reaching up to CAD 260 billion (De Souza et al., 2018). The difference has partly been borne by taxpayers through government loans and bailouts to treat inactive and orphaned wells (Government of Canada, 2020), violating the polluter-pays principle. But most orphan wells remain unremediated, and a large proportion of "active" wells are, in fact, inactive but not declared as such, meaning the farmers and ranchers on whose land they sit suffer the environmental and economic consequences (Boychuk et al., 2021).

Similarly, it is arguably an ESG issue that some Alberta oil and gas companies owe hundreds of millions of dollars in unpaid municipal taxes (French, 2022) and tens of millions of dollars in unpaid lease payments to landowners (Riley, 2022).

Some insist the last barrel of oil should be sold by a country like Canada that respects democracy and human rights (Braid, 2022). However, this is largely beside the point: while Canada as a country may have better ESG institutions than many of the world's top oil-producing countries, ESG criteria traditionally centre on the behaviour of the firm in question, not the government policies where they happen to operate. Some Canadian oil producers score well on ESG criteria, and others score poorly (CSRHub, n.d.).

Ultimately, however, whether Canada's producers' ESG rating *should* preserve its market share is irrelevant. As argued above, it won't; buyers of Canadian oil don't discriminate on ESG grounds.

Canada Is Far From the Lowest-Cost Producer

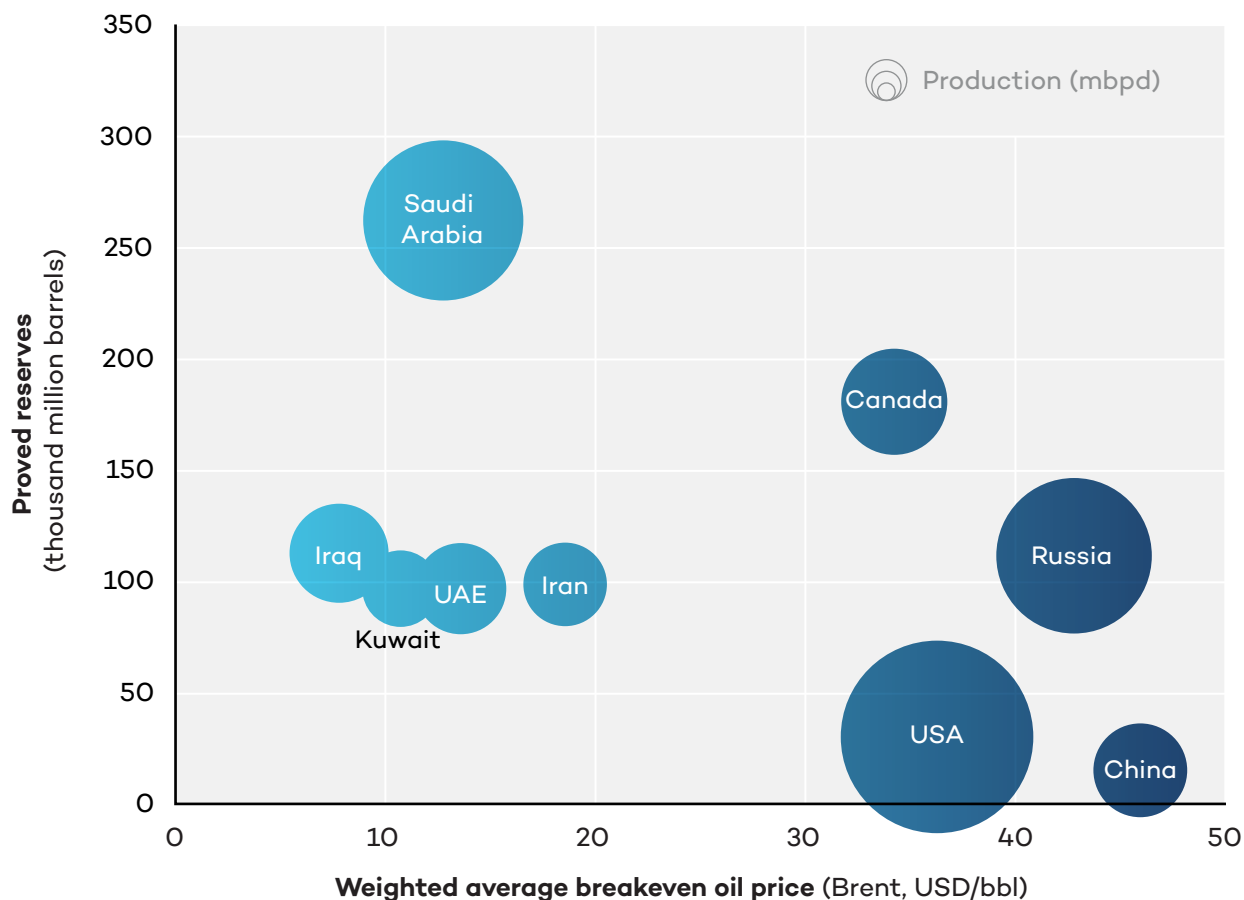
If ESG status won't save Canadian oil's market share, could Canada compete on price? Most of Canada's crude oil exports do not compete directly on global markets, though there are increasing exports from the U.S. Gulf Coast that do, and there will be substantially more with the completion of the TMX pipeline. And Canadian crude does not compete directly with the lighter, sweeter crude produced in most other countries. But Canada's costs of production relative to its major competitors still matter in the long run, especially in a shrinking post-peak global market.

Figure 2 shows how those costs measure up among the top 10 oil-producing nations, expressed here as the weighted average Brent crude U.S. dollar per barrel breakeven price in each country.



While costs of production have come down dramatically in Canada over the last 20 years, Canada is still not a low-cost oil producer, especially compared to its Middle Eastern competitors.

Figure 2. Global costs and reserves



Note: Horizontal axis is the weighted average breakeven oil price for all existing producers. Bubble size indicates 2020 production levels.

Sources: Rystad UCube data; BP (2021).

As of November 2022, the price of Brent crude is in the mid-eighties (USD), so prices could fall significantly before most Canadian producers, with a weighted average breakeven oil price of USD 35.21, became unprofitable. But in a future global market with falling demand and prices, there would be significant reserves and production in countries that would continue to be profitable long after Canadian production is not.



The Post-Peak Market for Oil Will Be Savage

Despite Canada not currently participating directly in global markets, global supply and demand trends—and the prices that result from them—directly affect the price Canadian oil producers receive. It is, therefore, important to forecast the strategic behaviour of non-Canadian producers in response to what we know is coming: a peak of global demand by around 2030, followed by a marked decline (Cosbey, 2022).

In the face of lower returns driven by climate policy, some have predicted a dynamic known as the green paradox, where producers predict their reserves will be worth less in the future, and rush to extract and sell more of them in the present (Sinn, 2012). This would mean lower prices for all (and more consumption of cheap oil, hence the paradox). Others have criticized this theory, noting that significantly ramping up production is not a simple matter for most producers, particularly in the short term (Cairns, 2014).

In today's circumstances, however, the green paradox would not necessitate a difficult ramp-up—it could simply amount to deliberately following existing plans in the face of declining demand. A survey of production plans for 12 major oil-producing countries shows projected increases by 2030 amounting to more than 10% of 2020 global production (Stockholm Environment Institute et al., 2021). By contrast, under plausible assumptions, global demand for oil could decline 22% by 2030 and more steeply thereafter (Cosbey, 2022).

International (private) oil companies might change expansion plans in response to obvious decline trends; some shareholders would likely demand it. In the same vein, Cairns (2014) also criticizes the green paradox model on the grounds that it would be economically irrational for major producers to increase production and tank prices. But more than half of global oil supply comes from national oil companies (Natural Resource Governance Institute, 2019). These companies are not strictly profit motivated, and are usually mandated by national governments to contribute to broader policy objectives, such as creating employment (Losman, 2010). Some national governments will very likely demand a ramping-up of production in the face of declining demand and prices.

For decades, global oil markets have been protected from oversupply by the discipline of the Organization of the Petroleum Exporting Countries (OPEC) and, more recently, OPEC-plus. But the organization has always been subject to tensions, with heavily oil-dependent members seeking to increase production to address their urgent development needs (Blas et al., 2020; Lee, 2020; Smith et al., 2020). Declining oil prices with no long-term prospect for price recovery would ratchet those tensions up to new levels, risking a loss of collective discipline and resulting oversupply and volatility.



Conclusions

How will the coming peak and drop in global demand affect Canadian producers?

They will face low and volatile prices for oil. There is a mismatch between planned increases in production and potential decreases in consumption, which indicates prices will also go down. The weakening of OPEC discipline in a post-peak-oil world may also create increased price volatility, which has outsized impacts on investment, royalties, and other elements of the Alberta economy in particular (Cosbey et al., 2021).

And they will face declining demand for their products. Canada's focus on the United States as a destination market means it will be partly sheltered from global demand effects—U.S. refiners will buy Canadian crude even as global demand falls. But they will face increasing pressure as export markets are curtailed *and* domestic consumption falls. The refineries that buy Canada's oil are large, complex, and low cost and are likely to maintain markets for some time even as demand shrinks, but at some point, even they will curtail production.

Meanwhile, Canada cannot count on its producers' (often questionable) ESG credentials to preserve market share. While ESG matters to investors and to builders of pipelines seeking social licence, it does not matter to the refineries that buy Canada's oil; they are largely locked into Canadian heavy crude by massive investments in the capacity to use it as a feedstock.

Neither can Canada rely on a low cost of production to help its position. While Canadian producers have reduced costs significantly since 2014, their oil is, on average, still much more costly than that of all the major Middle Eastern producers, which have huge reserves and capacity. In a battle to sell the last barrel, we face a cost disadvantage.

All things considered, it is straightforward to predict whether Canada will sell the last barrel of oil; it will not. But the more immediate and fundamental question is this: how will Canada fare in the savage post-2030 market of declining demand—a market characterized by low prices and even more volatility than the historical norm? Canada's marginal producers will not survive; its more efficient producers will reap low profits, remitting low royalties and taxes. New investments will be almost unthinkable, other than incremental extensions of existing operations. Based on past experience, between cost-cutting and lack of new investment, the sector will shed large numbers of workers.

The coming peak and drop in global demand matters for Canadian producers—in the long run, it presents an existential threat. In the near-to-medium term it promises to take the vitality out of a sector that has historically contributed enormously to the Canadian and provincial economies.

These realities are acutely important for Canadian government policy. Canada cannot afford to delay support for diversifying into sectors that can replace oil as an engine of economic prosperity while simultaneously building a cleaner, healthier world.



References

- Alberta Environmental Monitoring Panel. (2011). *A world class environmental monitoring, evaluation and reporting system for Alberta: The report of the Alberta Environmental Monitoring Panel*. https://wbea.org/wp-content/uploads/2018/06/a_world_class_environmental_monitoring_evaluation_and_reporting_system_for_alberta_the_report_of_the_alberta_environmental_monitoring_panel.pdf
- Baker, J. M., & Westman, C. N. (2018). Extracting knowledge: Social science, environmental impact assessment, and Indigenous consultation in the oil sands of Alberta, Canada. *The Extractive Industries and Society*, 5(1), 144–153. <https://harvest.usask.ca/handle/10388/12503>
- Beaver Lake Cree Nation. (n.d.). *Defend the treaties. Draw the line*. <https://beaverlakecreenation.ca/defend-the-treaties/>
- Birn, K., & Crawford, C. (2020). *The GHG intensity of Canadian oil: A new analysis*. IHS Markit.
- Blas, J., Smith, G., & El Wardany, S. (2020, April 9). *Global oil deal at risk after Mexico refuses Saudi-Russia plan*. Bloomberg Markets. <https://www.bloomberg.com/news/articles/2020-04-09/opec-agrees-on-deep-oil-output-cuts-to-fight-market-slump>
- Boychuk, R., Anielski, M., Snow, J., Jr., & Stelfox, B. (2021). *The big cleanup: How enforcing the polluter pay principle can unlock Alberta's next great jobs boom*. Alberta Liabilities Disclosure Project. https://www.aldpcoalition.com/files/ugd/6ca287_2ffe90ca7c354d3eac43b5f141b6ec8a.pdf
- BP. (2022). *Energy outlook 2022*. <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2022.pdf>
- Braid, D. (2022, February 10). Braid: In public shift, Kenney says Alberta has to go green over time. *Calgary Herald*. <https://calgaryherald.com/news/politics/braid-in-public-shift-kenney-says-alberta-has-to-go-green-over-time>
- Cairns, R. D. (2014). The green paradox of the economics of exhaustible resources. *Energy Policy*, 65, 78–85.
- Canada Energy Regulator. (2021). *Canada's energy future 2021*. <https://www.cer-rec.gc.ca/en/data-analysis/canada-energy-future/2021/index.html>
- Canada Energy Regulator. (2022). *Commodity statistics*. <https://apps.cer-rec.gc.ca/CommodityStatistics/Statistics.aspx?language=english><https://apps.neb-one.gc.ca/CommodityStatistics/Statistics.aspx?language=english>
- Canadian Association of Petroleum Producers. (n.d.). *Climate change & the Canadian oil and gas industry*. <https://www.capp.ca/environment/climate-change/>
- Cosbey, A. (2022). *Why Canada needs to plan for a steep decline in global oil demand*. International Institute for Sustainable Development. <https://www.iisd.org/articles/deep-dive/canada-can-expect-declining-oil-demand>



- Cosbey, A., Sawyer, D., & Stiebert, S. (2021). *In search of prosperity: The role of oil in the future of Alberta and Canada*. International Institute for Sustainable Development. <https://www.iisd.org/publications/search-prosperity-oil-alberta-canada>
- CSRHub. (n.d.). *Oil & gas sustainability ratings*. CSRHub Consensus ESG Ratings. <https://www.csrhub.com/search/industry/Oil-and-Gas-Extraction>
- De Souza, M., Jarvis, C., McIntosh, E., & Bruser, D. (2018, November 1). *Alberta regulator privately estimates oilpatch's financial liabilities are hundreds of billions more than what it told the public*. Canada's National Observer. <https://www.nationalobserver.com/2018/11/01/news/alberta-regulator-privately-estimates-oilpatches-financial-liabilities-are-hundreds>
- DNV. (2022). *Energy transition outlook 2022: A global and regional forecast to 2050*. <https://www.dnv.com/energy-transition-outlook/index.html>
- Dziuba, J., Ollenberger, R., Kwan, R., & Wittkopf, C. (2020). *The 400 billion barrel opportunity for friendly oil, and Canada's evolving role*. BMO Capital Markets. <https://research-ca.bmocapitalmarkets.com/documents/140A6529-CE63-4B90-A627-06768A001783.PDF>
- Flavelle, C. (2020, February 12). *Global financial giants swear off funding an especially dirty fuel*. *The New York Times*. <https://www.nytimes.com/2020/02/12/climate/blackrock-oil-sands-alberta-financing.html>
- French, J. (2022, March 8). *Oil and gas companies now owe Alberta rural communities \$253M in unpaid taxes*. CBC. <https://www.cbc.ca/news/canada/edmonton/oil-and-gas-companies-now-owe-alberta-rural-communities-253m-in-unpaid-taxes-1.6377641>
- Gearino, D. (2022, September 1). *California just banned gas-powered cars. Here's everything you need to know*. Inside Climate News. <https://insideclimatenews.org/news/01092022/california-just-banned-gas-powered-cars-heres-everything-you-need-to-know/>
- Government of Canada. (2020, April 17). *Prime Minister announces new support to protect Canadian jobs*. Prime Minister of Canada. <https://pm.gc.ca/en/news/news-releases/2020/04/17/prime-minister-announces-new-support-protect-canadian-jobs>
- Graney, E. (2021, March 1). *ESG focus will help attract investors to oil sands, Kenney says*. *The Globe and Mail*. <https://www.theglobeandmail.com/business/article-how-alberta-will-implement-esg-measures/>
- Healing, D. (2020, July 30). *Total "virtue signalling" by writing off oil sands assets: CAPP CEO*. BNN Bloomberg. <https://www.bnnbloomberg.ca/total-takes-8-billion-writedown-on-carbon-heavy-oil-assets-1.1472601>
- House Select Committee on the Climate Crisis. (2020). *Solving the climate crisis: The congressional action plan for a clean energy economy and a healthy, resilient, and just America*. House Select Committee on the Climate Crisis. <https://climatecrisis.house.gov/sites/climatecrisis.house.gov/files/Climate%20Crisis%20Action%20Plan.pdf>



- International Energy Agency. (2022). *World energy outlook 2022*. <https://www.iea.org/reports/world-energy-outlook-2022>
- Jenkins, J. D., Mayfield, E., Farbes, J., Jones, R., Patankar, N., Xu, Q., & Schivley, G. (2022). *Preliminary report: The climate and energy impacts of the Inflation Reduction Act of 2022*. Zero-carbon Energy Systems Research and Optimization Laboratory. https://repeatproject.org/docs/REPEAT_IRA_Preliminary_Report_2022-08-12.pdf
- Kelly, S., & Williams, N. (2022, February 11). *Canadian oil barrels head out of the U.S. Gulf in record numbers*. Reuters. <https://www.reuters.com/business/energy/canadian-oil-barrels-head-out-us-gulf-record-numbers-2022-02-11/>
- Leahy, S. (2019). *This is the world's most destructive oil operation—And it's growing*. *National Geographic*. <https://www.nationalgeographic.com/environment/article/alberta-canadas-tar-sands-is-growing-but-indigenous-people-fight-back>
- Lee, J. (2020, September 12). *There's no easy fix to OPEC's whack-a-mole problem*. Bloomberg.com. <https://www.bloomberg.com/opinion/articles/2020-09-13/opec-s-60th-birthday-the-oil-cartel-s-got-a-whack-a-mole-problem>
- Lewis, J., Jones, J., D'Aliesio, R., Wang, C. (2018, November 23). *Hustle in the oil patch: Inside a looming financial and environmental crisis*. *The Globe and Mail*. <https://www.theglobeandmail.com/canada/article-hustle-in-the-oil-patch-inside-a-looming-financial-and-environmental/>
- Liggio, J., Li, S.-M., Hayden, K., Taha, Y. M., Stroud, C., Darlington, A., Drollette, B. D., Gordon, M., Lee, P., Liu, P., Leithead, A., Moussa, S. G., Wang, D., O'Brien, J., Mittermeier, R. L., Brook, J. R., Lu, G., Staebler, R. M., Han, Y., ... Gentner, D. R. (2016). Oil sands operations as a large source of secondary organic aerosols. *Nature*, 534, Article 7605. <https://doi.org/10.1038/nature17646>
- Losman, D. L. (2010). The rentier state and national oil companies: An economic and political perspective. *Middle East Journal*, 64(3), 427–445. <https://doi.org/10.3751/64.3.15>
- Lower Athabasca Regional Plan Review Panel. (2015). *Review panel report 2015: Lower Athabasca Regional Plan*. <https://open.alberta.ca/dataset/5c910acf-9e8c-46b5-b52d-60fc8bd2bbbd/resource/d9a6bff5-f9b5-45fe-81ed-a8de3492e271/download/2016-review-panel-report-2015-lower-athabasca-regional-plan-2016-06-22.pdf>
- Masnadi, M. S., El-Houjeiri, H. M., Schunack, D., Li, Y., Englander, J. G., Badahdah, A., Monfort, J.-C., Anderson, J. E., Wallington, T. J., Bergerson, J. A., Gordon, D., Koomey, J., Przesmitzki, S., Azevedo, I. L., Bi, X. T., Duffy, J. E., Heath, G. A., Keoleian, G. A., McGlade, C., ... Brandt, A. R. (2018). Global carbon intensity of crude oil production. *Science*, 361(6405), 851–853. <https://doi.org/10.1126/science.aar6859>
- McKinsey. (2022). *Global energy perspective 2022*. <https://www.mckinsey.com/~media/McKinsey/Industries/Oil%20and%20Gas/Our%20Insights/Global%20Energy%20Perspective%202022/Global-Energy-Perspective-2022-Executive-Summary.pdf>



- Natural Resource Governance Institute. (2019, April 18). *The national oil company database*. <https://resourcegovernance.org/analysis-tools/publications/national-oil-company-database>
- Orphan Well Association. (2022a). *Orphan inventory*. <https://www.orphanwell.ca/about/orphan-inventory/>
- Orphan Well Association. (2022b). *Orphan Well Association annual report 2021/2022*. https://www.orphanwell.ca/wp-content/uploads/2022/07/OWA-Annual_2021_web.pdf
- Riley, S. J. (2022, April 5). The Alberta government spent another \$22 million on unpaid land rent for oil and gas operators in 2021. *The Narwhal*. <https://thenarwhal.ca/alberta-oil-gas-land-rent-2021/>
- Rystad Energy. (2022). *Upstream trends report June 2022*.
- Senate Democrats Special Committee on the Climate Crisis. (2020). *The case for climate action: Building a clean economy for the American people*. https://www.schatz.senate.gov/imo/media/doc/SCCC_Climate_Crisis_Report.pdf
- Sinn, H.-W. (2012). *The green paradox*. MIT Press.
- Sleep, S., Dadashi, Z., Chen, Y., Brandt, A. R., MacLean, H., & Bergerson, J. A. (2021). Improving robustness of LCA results through stakeholder engagement: A case study of emerging oil sands technologies. *Journal of Cleaner Production*, 281. <https://doi.org/10.1016/j.jclepro.2020.125277>
- Smith, G., Blas, J., & El Wardany, S. (2020, December 1). *OPEC+ works silently to repair crack at oil coalition's core*. Bloomberg. <https://www.bloomberg.com/news/articles/2020-12-01/opec-splits-at-its-core-risking-deal-that-underpins-oil-price>
- Stockholm Environment Institute, International Institute for Sustainable Development, ODI, E3G, & United Nations Environment Programme. (2021). *The production gap report 2021*. https://productiongap.org/wp-content/uploads/2021/11/PGR2021_web_rev.pdf
- Tuncak, B. (2020). *Visit to Canada: Report of the Special Rapporteur on the implications for human rights of the environmentally sound management and disposal of hazardous substances and wastes (A/HRC/45/12/Add.1)*. UN Human Rights Council. http://www.srtoxics.org/wp-content/uploads/2020/09/Canada-HRC-45_AUV.pdf
- UN Comtrade. (2021). *International trade statistics database*. <https://comtrade.un.org/>
- United States Energy Information Agency. (n.d.). *Oil imports and exports*. <https://www.eia.gov/energyexplained/oil-and-petroleum-products/imports-and-exports.php>
- Voora, V., Larrea, C., Huppé, G., & Nugnes, F. (2022). *Standards and investments in sustainable agriculture*. IISD's State of Sustainability Initiatives Review Series. International Institute for Sustainable Development. <https://www.iisd.org/system/files/2022-04/ssi-initiatives-review-standards-investments-agriculture.pdf>

© 2022 The International Institute for Sustainable Development
Published by the International Institute for Sustainable Development.

This publication is licensed under a [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-nc-sa/4.0/).

RE-ENERGIZING CANADA

Re-Energizing Canada is a multi-year IISD research project envisioning Canada's future beyond oil and gas. This publication is part one of *The Bottom Line* policy brief series, which digs into the complex questions that will shape Canada's place in future energy markets.

INTERNATIONAL INSTITUTE FOR SUSTAINABLE DEVELOPMENT

The International Institute for Sustainable Development (IISD) is an award-winning independent think tank working to accelerate solutions for a stable climate, sustainable resource management, and fair economies. Our work inspires better decisions and sparks meaningful action to help people and the planet thrive. We shine a light on what can be achieved when governments, businesses, non-profits, and communities come together. IISD's staff of more than 120 people, plus over 150 associates and consultants, come from across the globe and from many disciplines. With offices in Winnipeg, Geneva, Ottawa, and Toronto, our work affects lives in nearly 100 countries.

IISD is a registered charitable organization in Canada and has 501(c)(3) status in the United States. IISD receives core operating support from the Province of Manitoba and project funding from governments inside and outside Canada, United Nations agencies, foundations, the private sector, and individuals.

Head Office

111 Lombard Avenue, Suite 325
Winnipeg, Manitoba
Canada R3B 0T4

Tel: +1 (204) 958-7700

Website: www.iisd.org

Twitter: @IISD_news



iisd.org