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Examining risks of new oil and gas production in Canada

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Cover photo: Aerial view of oil sands operations © Bloomberg Creative / Getty

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Contents

Key Messages

- Canada's oil and gas industry is particularly vulnerable to drops in global oil demand and price, a trend that may persist well into the future. The country's oil and gas producers may face increasing challenges in competing with other, lower-cost producers.

- Further investments in oil and gas infrastructure – and particularly new oil sands projects, new shale and tight oil fields, and new LNG projects – are increasingly risky given market trends and fundamentals.

- Canada's long-term, "net zero" greenhouse gas emissions targets will require the country to untangle itself from dependence on oil and gas production. Policymakers should break this "carbon lock-in" and pursue other, more sustainable and resilient avenues for economic recovery and growth.

Introduction

Even in times of economic stability, the workings of oil and gas markets can seem opaque. It can be difficult to understand how a barrel of oil can sell for US$100 one year, and just US$50 the next, as happened in the middle of the last decade. Now, a global pandemic has added to that uncertainty, with oil prices hitting *all-time* lows of below US$20 per barrel.

But even in the throes of the current economic crisis, policymakers focused on the long-term health of people and the economy can look to the fundamentals of supply and demand in oil and gas markets to help guide recovery efforts. After all, those fundamentals will drive the role of oil and gas in our societies for decades to come.

In this paper, we examine the risks of future Canadian oil and gas development, using an analysis based on these fundamentals. We also consider how this development squares with Canada's climate commitments and a growing momentum towards a transition away from fossil fuels.

We write as the COVID-19 outbreak in Canada is hopefully beginning its long, slow retreat. Our aim is to inform energy planning and economic recovery, especially in Canada. Many of the same observations will also apply in the United States, and across Latin America, Africa, and Europe, where extraction costs are higher than those for the lowest-cost producers in the Middle East.

In recent weeks, both the Canadian national government and the provincial government in the oil patch of Alberta have announced economic support measures for oil and gas industry and workers. Indeed, people across the country, including workers in the oil and gas industry, need extraordinary support to make it through this COVID-induced economic crisis.

But as this paper shows, it could be a mistake to hitch Canada's recovery and future economic prospects too tightly to fossil fuel production, even in the western provinces where oil and gas remain top of mind. Oil and gas is a volatile industry, with a long history of boom and bust cycles. Furthermore, around the world, other, lower-cost producers may well be able to out-compete some Canadian sources of these fuels. This makes further investments in oil and gas infrastructure and expansion risky for Canadian communities that might otherwise count on those revenues and those jobs.

It could be a mistake to hitch Canada's recovery and future economic prospects too tightly to fossil fuel production, even in the western provinces.

Furthermore, right before the pandemic, Canada was in the middle of a discussion about its climate action plan. Government planners in climate and energy were preparing details on how to meet the goal of net zero emissions country-wide by 2050, which is the global emissions target consistent with meeting the 1.5°C temperature limit that Canada helped secure at COP 21 in Paris in 2015.

While those climate goals are not centre stage for many in mid-2020, they are no less pressing. When the debate about how to meet the net zero emissions goal returns in earnest, Canada will have to further reckon with how to move away from fossil fuels. As several observers have noted, meeting ambitious decarbonization targets could require Canada to untangle itself from oil and gas and reduce its production, especially from the oil sands (Harvey and Miao 2018; Hughes 2018; OECD 2017; Palen et al. 2014; Sherlock 2019).

This paper discusses the oil market, then the gas market, and closes with a discussion of what these market outlooks suggest for policymakers in Canada, especially those leaders in the administration of Prime Minister Justin Trudeau, who are concerned both with ensuring a resilient economic recovery and minimizing the risk of runaway climate change.

Global oil demand and supply

In April 2020, the oil market experienced a historic collapse. In some places, oil traders were actually paying to unload their oil, since there were few places left to store it.

This example, though extreme, is in line with economic theory. When demand for oil (or any commodity product) drops rapidly, suppliers aggressively compete to find buyers. They cut prices, and cut them again, until they can move their product. And, if oil traders find themselves with oil on their hands and nowhere to put it, they may even, in this rare circumstance, have to pay someone to take it.

The extremely low prices seen in recent weeks will resolve over time, as oil producers around the world will take the obvious and necessary step to shut down some oil wells, ceasing production in places where prices cannot cover costs. This process – along with the natural declining production from existing wells – will eventually help demand and supply reach equilibrium.

Where will this reshuffling leave Canada's oil industry? To explore this question, we look at how oil consumption and prices will settle when economies emerge from the effects of the COVID crisis and demand and supply reunite.

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That landing place for price and quantity will be determined not just by the pace of economic recovery, but also by trends in technology and behaviour, many of which were already underway pre-COVID. The future of oil will also be affected by policies governments put in place to follow through on their announced intentions to dramatically reduce greenhouse gas emissions (such as in the Paris Agreement).

Figure 1 shows alternative scenarios of future oil markets in the form of curves that relate oil supply and demand to price. In this figure, the lowest-cost producers (mainly already-producing fields in the Middle East) are shown first, followed by a succession of higher-cost producers as one moves to the right across the chart. As the supply curve rises, more oil is produced, but at increasing cost for that last, sometimes called "marginal", barrel.

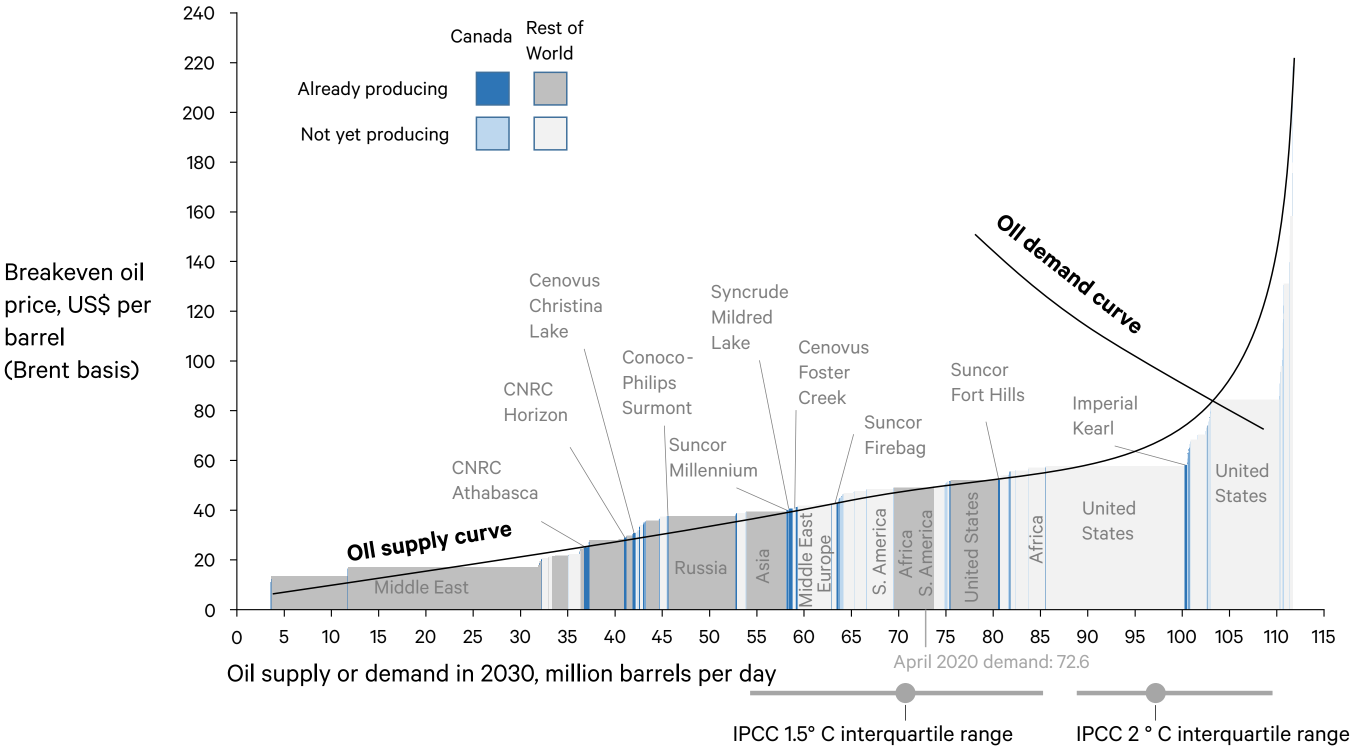
Oil demand can be described in a similar way, with the relationship to price reversed. For consumers, the lower the price of oil, the higher the demand, as people can afford to drive or fly more and have less incentive to purchase efficient or alternative (e.g. electric) vehicles. In Figure 1, this oil demand curve is shown as a grey line that slopes downward to the right, as the lowering price increases consumer demand.

We can use this supply-demand framework to evaluate the implication of changes to the oil market, by examining how such changes might shift the supply or demand curves in one direction or the other, and thus also shift where the two curves intersect. Figure 1 depicts a return to a pre-COVID demand outlook for 2030, with global oil consumption of about 105 million barrels of oil per day and with prices at around US$85–US$90 per barrel (IEA 2019).

In that "baseline" global oil scenario, one can use Figure 1 to see which regions, and which Canadian oil projects, would be "in the money". Any producer in the chart shown to the left of 105 million barrels of oil per day – including most already-producing projects in Canada – should be able to compete based on their cost of production being lower than about US$85 per barrel.

Indeed, according to fossil fuel companies and oil industry analysts, most existing Canadian oil resources have break-even costs below this price, meaning that they can cover their ongoing operations and maintenance costs, if not necessarily pay back investors for the prior, "sunk" capital costs.

Figure 1. Supply and demand for oil in 2030



Prices are listed in Brent crude terms. The oil demand curve is shown with an elasticity of demand of -0.3 (Erickson et al. 2018) and assumes a 2030 demand outlook pre-COVID. The calculation of break-even price for each field includes any discount for the actual price received by each producer; for example, Canadian oil sands projects are assumed to receive between US$5 to US$23 less per barrel compared to the Brent prices shown, to account for quality and transport differences relative to other crudes. For Canadian oil supply, each block represents a particular project at a specific stage of development. For oil supply outside Canada, each block represents an entire country's oil at a specific stage of development (i.e. already-producing, under development, discovered but not yet producing, not-yet-discovered). For example, the chart shows two large blocks of not-yet-producing US oil: one for discovered, and one for not-yet-discovered oil. This "lumping" of oil into discrete blocks is an approximation, done here to simplify the presentation, since not all oil within any given block has exactly the same break-even price.

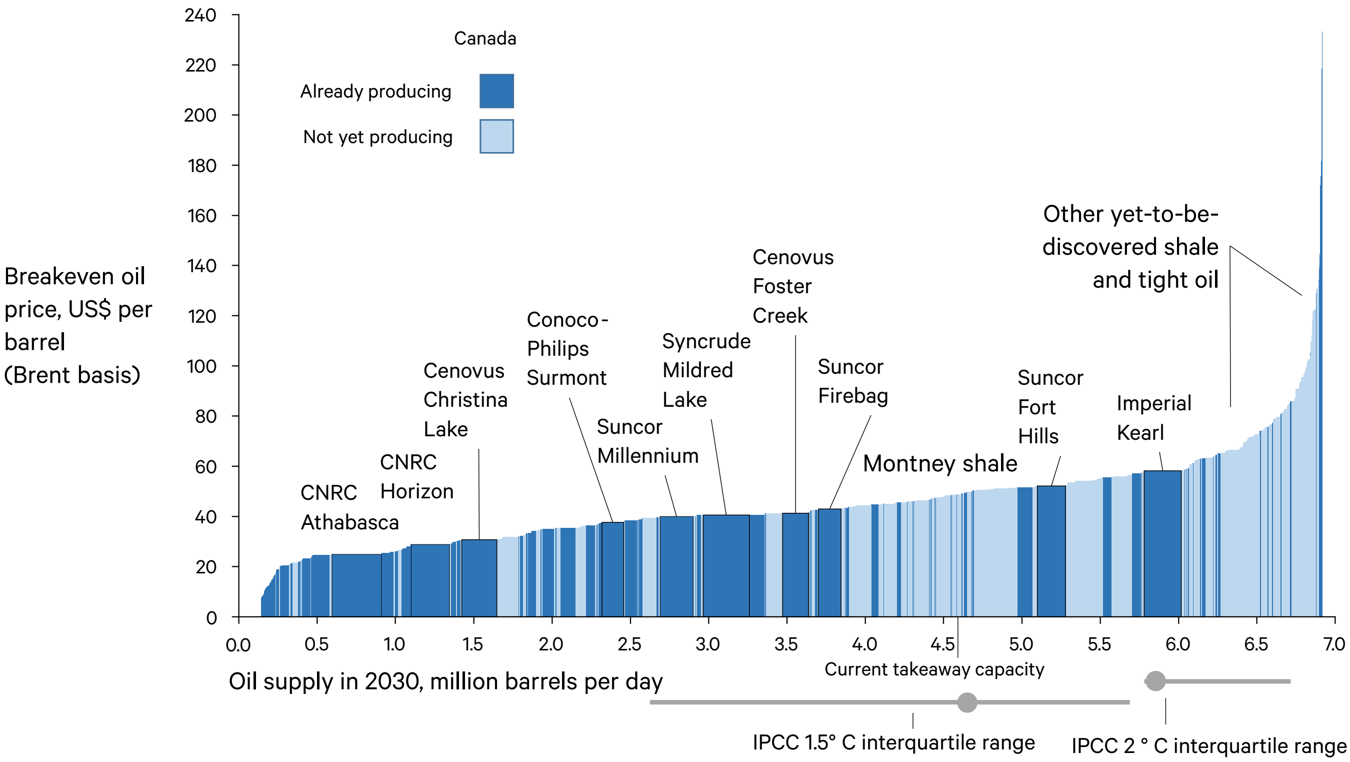
Source: Rystad Energy (2020) plus median and interquartile ranges of oil demand from IPCC 1.5° and 2° scenarios (IPCC, 2018) as summarized in the Production Gap Report (SEI et al. 2019). Here, following the Production Gap Report, the scenarios shown represent those with a 66% probability of meeting each temperature limit. It is important to note that this implies a one-in-three chance of not meeting the Paris Agreement's temperature target, and may therefore not be seen to be stringent enough, let alone to meet the aim of being "well below" 2° C.

Figure 2 below pulls out *only* the Canadian projects, to allow for a closer look. In contrast to the already-producing projects, several *new*, not-yet-producing oil fields in Canada would require high oil prices (well over US$80 per barrel) to be financially viable. This is especially true for yet-to-be-discovered shale and tight oil resources in Alberta, British Columbia, and Saskatchewan (among the light shaded blocks to the right). Though not labelled individually, these include tight oil fields in the Cardium, Duvernay and Viking formations, as planned, for example, by Obsidian Energy, Repsol and Crescent Point Energy, respectively. This also includes PetroChina's Dover oil sands project, for which the final investment decision has not yet been made. Similarly, oil sands expansions at Kearl, Cold Lake, and Jackfish require prices over US$60 per barrel and could also be financially risky.

Still, the world may not return to a pre-COVID baseline oil demand outlook, for two central reasons. The first reason is that consumers may already be substantially changing how they use energy (Lewis 2020).

For example, the market for electrified road transportation – cars and trucks – has been advancing so rapidly that the price of electric vehicles (EVs) could fall below that for oil-based internal combustion engine (ICE) vehicles before the mid-2020s (Bloomberg New Energy Finance 2019). As EV manufacturers increasingly benefit from economies of scale – and societies come to appreciate the many benefits of EVs compared to fossil-fuel-based technologies – EV sales could overtake ICE sales by the mid-2030s (Bloomberg New Energy Finance 2019).

Figure 2. Cost curve of Canadian oil production in 2030



Prices are listed in Brent crude terms. The calculation of break-even price for each field includes any discount for the actual price received by each producer; for example, Canadian oil sands projects are assumed to receive between US$5 to US$23 less per barrel compared to the Brent prices shown, to account for quality differences relative to other crudes. Current takeaway capacity (pipeline plus rail) based on Canada Energy Regulator (2019) and exclude Enbridge Line 3, Keystone XL, and Trans Mountain Expansion.

Source: Rystad Energy. IPCC oil consumption ranges are mapped to this chart based on where each Canadian project falls in the global cost curve (Figure 1, above) and are therefore based on cost alone, not factoring in other considerations, such as differing national capabilities and responsibilities for a just and equitable transition (Kartha et al. 2016).

Furthermore, standard outlooks for air travel – until recently, the fastest-growing segment of oil demand (IEA 2019) – could be overly bullish. It is, of course, too early to predict how consumer preferences will return in the wake of COVID, but one legacy of the virus is that some travellers – especially business travellers – may increasingly meet with colleagues virtually online, and use air travel less.

All told, some analysts see that, under these trends, global oil demand may *already* have peaked — at 2019 levels of 101 million barrels per day (bpd) – and will decline from here (Lee 2020; Lewis 2020).

Alternatively, it is possible that oil demand may instead stay flat at roughly the 2019 level or increase slightly over the next decade (Crooks et al. 2020), if, for example, people delay EV purchasing and eschew public transportation in the wake of the COVID crisis. Even with flat demand, however, any oil project with break-even prices higher than about US$58 per barrel – or to the right of Imperial's Kearl oil sands project in Figure 2 – would not appear to be financially viable. This includes numerous, not-yet-proven oil reserves in the Cardium, Duvernay, and Viking formations, as well as new oil sands projects.

The second reason to question baseline oil demand outlooks is the policy response to climate change. Governments, including Canada, have committed to pursue a 1.5°C or well below 2°C limit to global warming. Those temperature limits imply dramatically reduced fossil fuel use and production (SEI et al. 2019).

For oil, the 1.5°C limit implies that demand in 2030 is at levels observed during the COVID crisis, or about 73 million barrels per day (Rystad Energy 2019; SEI et al. 2019). But unlike the present, these levels would not arise because of economic contraction. Instead, the driver would be dramatic action by policymakers to bring about an economy that thrives on renewably sourced electricity and other non-fossil forms of energy, and that substitutes high-carbon services (such as long-distance business travel) with deeply low-carbon ones (such as videoconferencing). This trajectory would be consistent with the job-creation imperatives of ambitious post-COVID recovery; indeed, a low-carbon energy system can, on balance, lead to net increases in employment (Garrett-Peltier 2017; Guterres 2020; Hepburn et al. 2020).

The Canadian government committed to this low-carbon economy when it led the push for the 1.5°C limit to be included in the Paris Agreement. Following through on this commitment would mean, if the oil market fundamentals in Figures 1 and 2 hold true, that the long-term marginal cost of oil, and therefore long-term oil price, could average around US$50 per barrel, the price that corresponds with a long-term demand outlook of 70 million to 75 million bpd. This finding is similar to that by Canadian researchers looking at the price of oil under low-carbon scenarios (Harvey 2017; Jaccard et al. 2018).

Those prices could pose a risk to the Canadian oil industry (Heyes et al. 2018). As shown in Figure 3, most new production would no longer be economic, and Canada's total oil production in 2030 would stay in the range of recent levels (4.5 to 5 million bpd).

Most Canadian producers, even oil sands producers, are now able to produce oil from already-producing projects for less than US$50 per barrel (CNRC, Cenovus, Conoco-Philips, and Syncrude, for example, can all continue producing for US$41 per barrel or less from their largest oil sands projects). However, the oil market could yet evolve in ways that render even these projects too costly to continue producing. (See Box 1 for a discussion of the sensitivity of oil sands profitability to factors such as transport access and quality discounts.)

An added risk for Canada's oil producers showed itself recently, in the form of a price war. In late winter 2020, just as global oil demand was plummeting, Saudi Arabia and Russia both dramatically increased production. By increasing production during a time of falling demand, Saudi Arabia was hoping to offset revenue losses from the dropping price via increased sales, while Russia was hoping to increase its geopolitical standing within "OPEC+" (Yergin 2020).

This price war was temporary, but it showed how the prospect of falling oil demand could lead low-cost producers to purposefully flood the market with oil. If low-cost producers see the writing on the wall with respect to climate change and the inevitability of declining oil demand (or simply if they commit, in the long term, to driving higher-cost producers out of the market), they could speed up their plans to bring their oil resources to market, bringing forward in time oil they had planned to leave for much later (Sheppard 2020). This behaviour would expand (push rightward) the low-end of the supply curve in Figure 1 (e.g. the block for Middle East would grow wider), pushing all blocks to the right, leading to lower prices and uneconomic outcomes – asset "stranding" – for a number of higher-cost producers. In such an outcome, the long-term price of oil could be as low as US$20 to US$30 per barrel (the cost of extraction in the Middle East), similar to levels in spring 2020, leaving 80% or more of Canada's oil uneconomic to extract. (See Box 2 for a discussion of how expanding oil production increases global consumption and CO_2 emissions.)

The likelihood of such a dire outcome for higher-cost producers is difficult to gauge, and under normal circumstances would seem unlikely (Jaccard et al. 2018). But recent actions by Saudi Arabia, Russia, and others (e.g. UAE) show it is not impossible (El Gamal 2020), and the prospect of such terminally low oil prices should give Canada serious pause. Pushing forward with previous plans – as charted by the Canada Energy Regulator – to expand an oil-dependent economy in the country's oil patch (i.e., western provinces) could turn out to be a bad investment for companies, government, and the public, leaving communities no better off than they are already in this economic crisis.

BOX 1: MARKET ACCESS AND QUALITY DISCOUNTS CAN MAKE OR BREAK OIL SANDS VIABILITY

Recent industry cost assessments, as shown in Figure 1, suggest that most major existing oil sands projects (and half of all Canadian oil) would be resilient, in the long-term, to oil prices as low as around US$40 per barrel. This means that they can cover their ongoing operating and maintenance costs and keep producing oil, even as in many cases they are still unable to compensate investors or fully cover their debt service.

This finding is consistent with our previous assessment, in which we concluded that "most major existing oil sands projects are resilient to fluctuations, or even a decline, in oil price, and are therefore locked in" (Erickson 2018), as well as to findings from Canada-based researchers (Heyes et al. 2018).

However, embedded in these cost assessments – based on data from oil consultancy Rystad Energy – are assumptions about pipeline and rail infrastructure and the quality discounts that affect the long-term viability of much of Canada's oil sands.

In brief, oil traders and refiners pay less (a "discount") for heavy oils high in sulphur, like diluted bitumen from the oil sands, since it is more expensive to transport and refine, and can also yield a lower value set of products (Heyes et al. 2018). Relatedly, if oil pipeline and rail infrastructure is congested, competition for transportation of these products can result in additional discounts.

For the largest oil sands projects – CNRC's Athabasca and Horizon projects, Syncrude's Mildred Lake, and Suncor's Millennium – Rystad assumes that the discount is US$5 to US$8 as compared to Brent prices, in large part because these projects further process ("upgrade") their bitumen before marketing it, increasing its quality and reducing the discount. For most other producers, the discount is US$15 to US$23 relative to Brent prices.

These assumptions may be optimistic, however, as historical discounts have been higher than this, and may yet well be higher again in the future (Heyes et al. 2018; Scotiabank 2018), potentially putting many more oil sands projects at risk of not being able to cover their ongoing costs. This, in turn, would mean these projects would no longer be able to keep producing under the lower-demand scenarios in Figure 1.

For example, consider a hypothetical project that would break even at US$40/barrel under the assumption of a US$20 per barrel discount. Were that project instead to be subject to discount of US$30-US$40 per barrel – a possibility, according to some analysts (Scotiabank 2018) – its break-even price would increase to US$50 per barrel and its ability to keep producing could be jeopardized beyond what we consider in this paper.

Fossil gas demand and supply

Unlike oil production, fossil gas production (often called natural gas) in Canada has declined modestly (by a few percent) in recent years, from prior highs in 2006. However, the country has plans to expand production, chiefly from the shale formations, such as the Montney shale, of Alberta and British Columbia. New wells in these fields have been expected not only to offset recent declines but, by 2030, to eclipse 2006 levels (Canada Energy Regulator 2019).

BOX 2: EXPANDING OIL PRODUCTION INCREASES GLOBAL OIL CONSUMPTION

Regardless of the financial risks of oil, expanding supply is a loss when it comes to the global climate. As described in this paper, adding more supply decreases the long-term price of oil, thereby increasing consumption (and by inference, carbon dioxide emissions).

This can be seen in Figure 1, if one imagines the supply curve shifting rightward under the addition of new supplies of oil. More supply pushes down the price of oil, while increasing the level of consumption.

In fact, under "baseline" oil market outlooks, research suggests that oil consumption and price levels could be as sensitive to changes in supply as they are to changes in demand (Caldara et al. 2019). That means, as shown in Figure 1, the supply and the demand curves would be similarly "steep" (similar slopes, just in opposite directions.)

The similar "steepness" of oil supply and demand curves means that decreasing long-term oil supply can have, under certain circumstances, roughly as much impact on global oil consumption as reducing oil demand (Erickson et al. 2018). Another way to look at this is that, if supply decreased in Canada, other global producers would only be able to make up some of the lost production, at higher cost. Global consumption would thus decrease by up to half the amount of reduced production.

The climate benefits of reducing the production of oil sands could be even greater than for most other types of oil, since the oil sands are more greenhouse gas emissions-intensive to extract, refine, and combust than most other oils. This means that whatever oil would (partially) substitute for any reduced Canadian production would likely be less emissions-intensive (Erickson and Lazarus 2014; Israel et al. 2020; Oil Climate Index 2016).

Markets for gas are less global than they are for oil, and so it is more appropriate to look to fundamentals in regional (not global) gas markets for clues of potential risks to Canada's plans to increase gas production.

In particular, the economics of gas fields in Western Canada are likely driven by supply and demand outlooks in two specific regional markets: the North American market, and the Pacific (largely East Asian) liquefied natural gas (LNG) market.

Canadian gas currently is sold almost exclusively within North America: about two-thirds to Canada and the remaining one-third to the United States (Canada Energy Regulator 2019). However, demand in North America is expected to be mostly flat over the next decade (Canada Energy Regulator 2019; US EIA 2020), and so the growth potential for Canada's gas, if it exists, is in prospective LNG demand in the Pacific market, especially from countries in east Asia (Rystad Energy 2019).

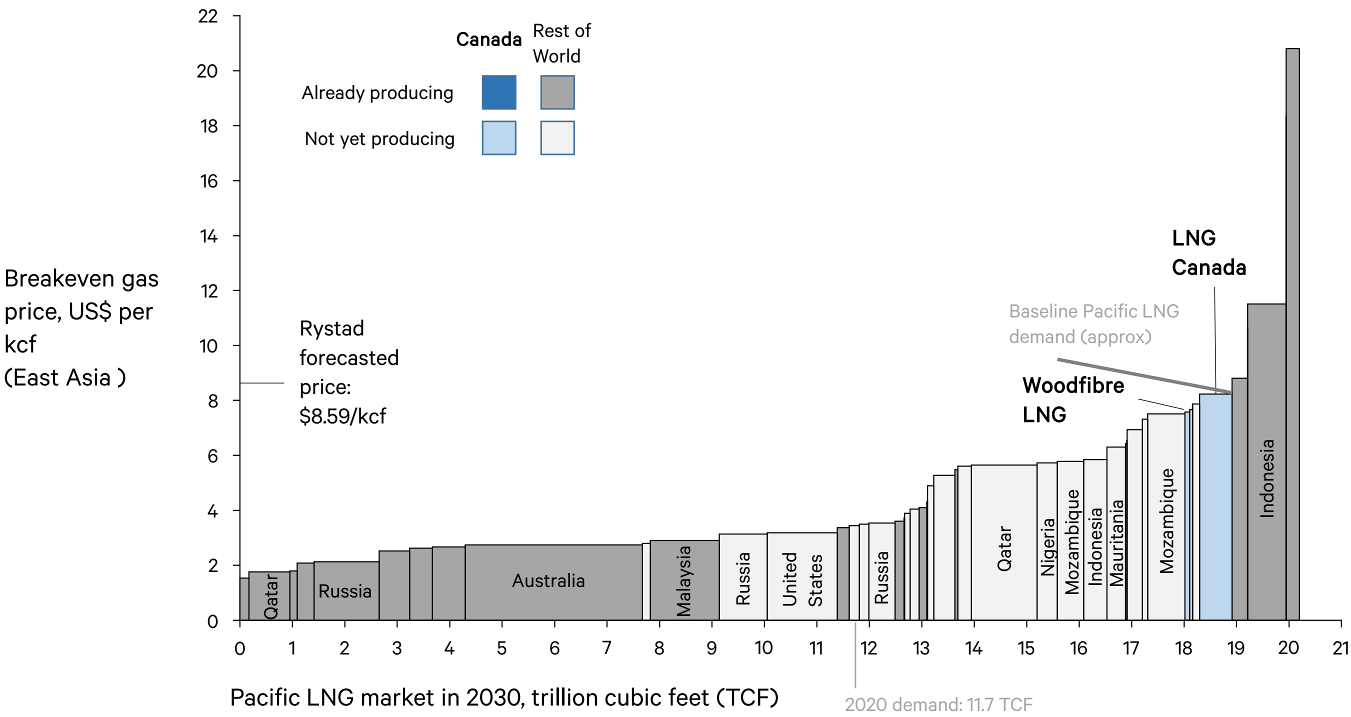
One Canadian project in particular – LNG Canada – is currently under construction, and could (if future expansions also proceed) export close to 1 trillion cubic feet (TCF) of gas annually by 2030. This project needs to see an LNG price of about US$8.20 per thousand cubic feet (kcf) (US$7.90 per MMBtu) to break even (Rystad Energy 2020).

LNG prices in the Pacific market were above that break-even point (at around US$10 per kcf) in late 2018, when the LNG Canada joint venture (led by Shell) announced its final investment decision (Thompson 2020; Uhl and Wetselaar 2018). But that price point was near the end of a price rally; the price of gas in this market has steadily declined since then (and not just because of COVID-19), to below US$3 per kcf in early 2020 (Thompson 2020).

To explore the long-term economics of LNG from the west coast of Canada, Figure 3 shows a future (2030) perspective on supply and demand fundamentals in the Pacific Gas LNG market, using a similar supply-curve approach as was shown for the global oil market in Figure 1.

As the chart shows, a number of already-existing, "brownfield" gas fields in Qatar, Russia, Australia, and Malaysia are supplying the Pacific LNG market at low (delivered) costs of around US$2 to US$3 per kcf. New (as-yet-incomplete) projects in Russia, the United States, Qatar, and a number of other countries are expected to be able to break even at around US$4 to US$6 per kcf.

Figure 3.Cost curve of Pacific market gas production in 2030, with Canadian projects identified



Prices are listed on a delivered basis to East Asian markets. The LNG demand curve is shown with an elasticity of demand of -1.4 (Huntington et al. 2019). Because this chart shows only the Pacific LNG segment of the global gas market, a market segment for which the precise role of gas under low-carbon pathways levels has not been studied in detail, 1.5- and 2-degree demand levels are not shown.

Source: Rystad Energy (Rystad Energy 2019).

These economics leave a very narrow path for LNG Canada to succeed and turn a profit for its investors. As shown here, the LNG Canada project appears to be the highest-cost of the new, not-yet-producing LNG projects – more than US$1.50 per kcf more expensive than new sources in Qatar, and as much as US$5 per kcf more expensive than new sources in Russia and the United States. Were these other sources able to produce more than foreseen in Figure 3, they could well "bump" LNG Canada out of contention for supplying LNG for new demand in Asia (IEA 2019; Tsafos 2020).

Similarly, if gas demand in the Pacific Market ends up even 5% lower (1 TCF) than recent forecast levels, LNG Canada could be out of the money. Demand could be lower than expected for any number of reasons, including intense price competition between gas and renewable electricity in east and southeast Asia (Gray et al. 2020; IEA 2019; Tsafos 2020), and policies to address climate change (Grant and Coffin 2019). As the International Energy Agency wrote late last year, "There is significant uncertainty as to the scale and durability of demand for imported LNG in developing markets around the world" (IEA 2019).

Likewise, higher-than-expected LNG supply from other countries (like Qatar) also puts at risk other LNG projects in Canada – such as the smaller approved project, Woodfibre LNG (shown in Figure 3), or the larger Chevron/Woodside Kitimat LNG project (not shown due to lack of cost information) – as it could drive down prices, perhaps below what the project needs to break even (IEA 2019; Tsafos 2020).

This window into LNG economics indicates that investors – and the Canadian policymakers supporting them – are placing a risky bet on the future of LNG.

Still, the North American market may offer reasonable future prospects, at least for gas delivered by pipeline to nearby markets instead of by sea. Even flat demand in North America (as forecast in a baseline case) would provide opportunities for continued drilling of new gas wells, since new wells could compensate for the rapid annual decline of production from existing wells and fields (Canada Energy Regulator 2019).

Indeed, there are some reasons to believe that gas demand in North America will stay flat, or even increase, suggesting some hope for the economics of Canada's gas production. For example, even as renewable power is becoming increasingly competitive with gas turbines in the North American power sector – putting downward pressure on gas demand (Dyson et al. 2019) – the economics for alternatives to gas in the continent's other major consuming sectors (e.g. industry and residential space heating) are not yet as favourable (Tsafos 2020).

But neither is continued gas demand in North America well-assured. A deeply low-carbon transition would instead see a steady move away from gas, with *global* demand falling nearly 30% by 2030 compared to recent levels under a median 1.5°C pathway (SEI et al. 2019), and *North American* demand falling more than 10% from recent levels by 2030 under even the less-stringent 2°C limit (IEA 2019). And, as in the Pacific LNG market, Canada's gas faces stiff competition – in this case, from US sources.

Lastly, the decision to expand gas production offers no serious long-term reductions in greenhouse gas emissions, and may even increase emissions. As many modelling analyses have shown, further expansion of North American gas supply crowds out low-carbon power (renewables) as much as it helps close down high-carbon power (coal) (Gillingham and Huang 2019; Shearer et al. 2014). This leads to little if any net CO_2 emissions benefit, and potentially an emissions *increase* once methane (CH_4) loss from gas systems is factored in. In other sectors of gas demand – such as industry and marine shipping – the GHG benefits of gas can also be murky (Erickson and Lazarus 2018; Pavlenko et al. 2020).

Collectively, these findings indicate that, from a purely financial perspective, new LNG investments are a risky bet for Canadian firms, governments, and the public. From a climate perspective, they are a risky bet as well; with few exceptions, further expansion of gas production pushes in the wrong direction, away from meeting climate limits.

Discussion and conclusions

The government of Canada, like most national governments, is currently wrestling with how to help its people through the health and economic crisis of COVID, while also putting in place major policies that could bring about economic recovery.

A challenge in putting the economy back together again is how to rebuild industries that are more resilient than the current one – and thus more able to withstand future shocks, whether those shocks are exogenous (e.g. from a pandemic) or rather self-inflicted (such as from climate change, or financial crises).

As this briefing paper has shown, there is uncertainty about whether fossil fuel projects in Canada – *new* oil and gas developments in particular, but perhaps even existing oil sands projects – can make financial sense even under recent long-term trends, let alone under the reduced demand for oil and gas that a serious response to climate change would bring.

In short, on financial metrics alone, new oil and gas production is a risky bet for Canadian investors and the governments that subsidize them (Corkal et al. 2020). When one factors in climate change, the case for any increase in total Canadian oil or gas production becomes tenuous, at best.

Of course, there is a tempting play to be made, to continue subsidizing the oil and gas industry now, in hopes that it can make it through the current shock. Some are trying that approach in Alberta (White 2020), even at the expense of supporting other pressing needs, such as education.

Still, there are other ways to put the oil patch to work, with more obvious and certain long-term benefits. The recent effort to fund well clean-up and methane reduction programs in Alberta is one such example, showing that the Trudeau administration is considering environmental improvements as part of recovery efforts (Harris 2020).

Subsidies are also not the only way to give industry more certainty (and price support). The recent mandated production cuts, which the industry agreed to, even if reluctantly, could be one template (Scotiabank 2018). If applied long-term (not just for short-term stability), a coordinated wind-down of production could limit production and greenhouse gas emissions while helping to provide a more stable price environment (Asheim et al. 2019).

A long-term plan for phasing down the country's oil and gas industry could even help provide the industry something they have sought: greater clarity about the administration's stance on oil development.

For example, in a February 2020 letter to Canada's Minister of Environment and Climate Change, Teck CEO Don Lindsay, while withdrawing the company's application for the Frontier oil sands project, stated: "investors and customers are increasingly looking for jurisdictions to have a framework in place that reconciles resource development and climate change" (Lindsay 2020). Indeed, the need for a national discussion on responsible development of Canada's natural resources was a theme of Lindsay's letter.

In pursuing such a conversation, fossil fuel executives may seek a resource development framework that is bullish on oil and gas. But climate-concerned government officials should be sceptical, and instead start moving away from "carbon lock-in", breaking the inertia of fossil fuel energy systems that holds back a low-carbon energy transition. As UN Secretary General António Guterres said in the days before last year's climate negotiations: "we simply have to stop digging and drilling" (Binnie 2019).

This paper provides a window into the long-term fundamentals of oil and gas supply and demand, to help inform the debate about further development of these resources in Canada. There are clearly many considerations and perspectives to consider in making decisions on investment, infrastructure, and industry support. The significant risks to economic development and the climate from further dependence on oil and gas, as described in this paper, should be among them.

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