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Canada's role in global energy security: practical considerations for a low carbon transition*

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ABSTRACT
As the holder of the some of the world's largest reserves of oil and gas, along with world class deposits of many critical minerals needed for the energy transition, Canada is well-positioned to meet the energy needs of our allies and partners. Canada must act fast to remove impediments to energy investment, production and export capacity at a time when geopolitics is upending global energy markets and demand and supply are becoming unbalanced. Stable, secure and affordable energy supplies are vital to human well-being and economic development. Canada has the capacity to play a role in ensuring the energy transition occurs in a way that does not create unnecessary economic hardship, foment inequality and civil unrest, or threaten global energy security.

RÉSUMÉ
En tant que détenteur de certaines des plus grandes réserves de pétrole de gaz au monde, ainsi que de gisements de classe mondiale de nombreux minéraux essentiels à la transition énergétique, le Canada est bien placé pour répondre aux besoins énergétiques de ses alliés et partenaires. Le Canada doit agir rapidement pour éliminer les obstacles à l'investissement dans l'énergie, à la production et à la capacité d'exportation, à un moment où la géopolitique bouleverse les marchés mondiaux de l'énergie et où l'offre et la demande se déséquilibrent. Des approvisionnements énergétiques stables, sûrs et abordables sont essentiels au bien-être humain et au développement économique. Le Canada a la capacité de jouer un rôle en veillant à ce que la transition énergétique se fasse d'une manière qui ne crée pas de difficultés économiques inutiles, n'alimente pas les inégalités et les troubles civils, et ne menace pas la sécurité énergétique mondiale.

Introduction

What makes a transition "responsible"? Though this question is debated passionately across civil society, industry, and government, fundamentally a responsible energy

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transition should strive to ensure access to stable, affordable, and environmentally sustainable energy for all people on earth.

There has often been a lack of balance and perspective in the public discourse regarding the role of hydrocarbon resources in the energy transition. The majority of the public narrative, shaped in large part by environmental groups and magnified by the mainstream media, is that hydrocarbon production needs to be shut down as soon as possible and resources left in the ground in order to address an impending climate disaster.

The assumption by activists and even some politicians is that limiting access to fossil fuels will somehow speed up the energy transition because we can replace fossil fuels with clean renewables sooner: a supply rather than demand side approach. But this is a fallacy because renewables are far from being sufficiently available or reliable to replace fossil fuels at this point in the transition. In addition, if the drive to eliminate fossil fuels continues too aggressively, the predictable result will be energy shocks that are even more serious than the ones we are experiencing now, resulting in rapidly rising prices, lack of supply, reduced living standards, and even political unrest. And without affordable energy from our current, fossil fuel-based sources of energy, that transition will be more expensive and thus take longer.

This paper proceeds in three main sections. First, it evaluates global energy demand scenarios and concludes that oil and gas demand is not likely to meaningfully decline for several decades. Second, due to the competitiveness of the oil sands and growing demand for liquefied natural gas (LNG), it ascertains that there is indeed space, need, and rationale for Canadian oil and gas in global markets during this long transition. Third, it examines the security risks inherent in declining Canadian and other Western oil and gas production as a proportion of global production.

A responsible transition

Even as awareness of climate change and its causes have grown, there is a lack of public understanding about what is involved in an energy transition. The nature of complex systems is such that they are inherently difficult to influence and almost impossible to predict. An energy transition is about moving from one mode of producing and using energy to another; this is change on a massive scale. However, to what degree the energy transition can actually be influenced or "managed" by governments or any other actor is debatable within the scientific literature (see Meadowcroft, 2009; Smith et al., 2005). Certainly, the pathway the transition follows will not be predictable with any degree of certainty. Transitions are tremendously complex, costly, full of uncertainties, and take decades to complete.

The International Energy Agency (IEA) states that the energy transition will "bring about a major shift in the primary energy mix away from carbon-intensive fuels towards low-carbon energy sources" (IEA, 2021a). It is important to note that "low-carbon energy sources" does not mean "zero-carbon sources" and does not limit those sources to renewables such as wind and solar. Any fuel that has either low emissions or whose emissions can be abated by way of technology can be understood as a "low-carbon energy source." In addition to renewables, this includes natural gas and coal with carbon capture, utilization, and storage technology (CCUS), hydroelectricity, and nuclear power. In a responsible transition where the goal is to mitigate emissions as fast as possible while maintaining economic sustainability and affordable energy prices, all low-carbon sources should be considered.

Even though the cost of renewable technologies has fallen rapidly (solar down by 89 percent, and wind down by 70 percent) (Lazard Ltd., 2019), and installed capacity has increased dramatically, solar and wind still only account for 9 percent of world electricity generation (IEA, 2021a). Natural gas will continue to play an important part in the energy transition because gas-fired generation is needed for managing peak system demand in electricity grids as well as filling in for renewables when the sun is not shining and the wind is not blowing. Grid-scale battery storage is still years away from being broadly economically feasible (see, for example, US Department of Energy, 2020). As clean electrification increases and wind and solar make up an increasingly larger share of power generation, the need to manage variability will become critical and natural gas will continue to play a key role in the grid. In addition, heavy industry, long-distance transport, and aviation are not suited to electrification for a number of technical reasons and fossil fuel use here is likely to remain high until new technological innovations appear to solve these problems. Replacing existing infrastructure before its useable lifetime ends, even as lower carbon solutions become available, will entail financial losses that most companies, consumers, and governments will choose not to absorb.

None of these challenges is impossible to overcome. Distributed energy systems and micro-grids may alleviate risks in certain locations. Replacing natural gas with low-carbon gases such as bio-gas, bio-methane, ammonia, hydrogen, or mixtures of methane and hydrogen may inject new life into existing pipeline infrastructure.

A responsible transition recognizes that many clean energy solutions are promising and must be encouraged, but it also recognizes that these technologies will take significant time and money to become commercially viable, cost competitive, and scaled up to the point where they can eventually displace most fossil fuels. A responsible transition does not prioritize one goal above all others – it recognizes that multiple goals must be pursued simultaneously, and this necessarily implies making trade-offs. A responsible transition is therefore one where all energy sources – with the appropriate abatement technologies where necessary – are regarded as potential contributors to simultaneously balancing multiple societal goals, including climate change, economic sustainability, consumer affordability, and energy security.

Overview of global energy demand

Fossil fuels made up 84 percent (with oil and gas accounting for 57 percent) of global primary energy consumption in 2019. Any significant reduction in supply will be met with shortages and higher prices because there simply isn't enough renewable energy capacity available to meet demand as global energy use continues to recover from the historic collapse caused by the COVID-19 pandemic in 2020.

The economic recovery in 2021 tightened commodity markets and contributed to global inflationary pressures. The huge crude oil inventory surplus that built up in 2020 is being gradually used up and oil prices reached multi-year highs in 2022 as a shortage of natural gas, LNG, and coal drive demand for oil. According to the IEA (2021b) this could keep the oil market in deficit for at least the short-term. The Russian invasion of Ukraine exacerbated, but did not beget, this.

Currently, as the economic recovery gains steam, strong demand combined with a lack of production is driving prices steadily higher. West Texas Intermediate (WTI) crude oil prices have ranged from US$20/barrel at the beginning of the pandemic in mid-2020 to over US$100/barrel in March 2022.

According to the IEA, global competition for LNG supplies amid coal shortages and the Ukraine War have driven spot natural gas prices steadily upward; they reached the highest levels ever recorded in Europe in August 2022. Coal prices have also risen, and coal use is expected to reach record levels in 2022 as well (IEA, 2022).

Higher energy prices are also adding to inflationary pressures. High natural gas and coal prices have led to higher electricity prices in many global markets. This situation led to the irony of US President Biden threatening retaliation against Russia and Saudi Arabia if they didn't increase oil output, despite promoting an activist climate change agenda at COP26 only months earlier.

In addition to the cutback in investment capital that energy producers themselves made in response to the drop in demand brought on by the pandemic, there is no question that moves by advocacy groups and activist investors to discourage further investment in the fossil fuel sector has had a significant impact. These factors have led to a situation where demand cannot be satisfied by supply, resulting in higher prices. As Daniel Yergin, vice-president of the consultancy IHS Markit asserted, the spike in fuel prices "puts energy security and reliability back on the same agenda as energy transition" and may provoke a rethink of the timing and extent of putting curbs on investment in fossil fuels (Brower, 2021).

Many argue that high prices are what the world needs to wean itself off fossil fuels, spurring investment in clean energy substitutes as they become more price competitive. But this ignores the time lags in scaling up clean energy supply infrastructure, not to mention the considerable costs of doing so. In the meantime, will consumers (and voters) put up with the increasing prices and price volatility that a sudden shift off fossil fuels would imply? As the response of the Biden administration to high gasoline prices shows, not any time soon. Gasoline prices – the most conspicuous indicator of the cost of energy to Western voters – rose by an average of US$1.00 per gallon (from $2.40 to $3.40) from the time Biden took office in January 2021 to November 2021. This triggered a vociferous response from the Biden administration, ranging from diplomatic pressure on the Organization of Petroleum Exporting Countries (OPEC) to increase production to a coordinated release of strategic oil reserves from the United States, the United Kingdom, India, and Japan. These actions belie the lack of appetite by even wealthy nations to pass the costs of an energy transition on to their voters.

In its 2021 report *Oil 2021: Analysis and Forecast to 2026,* the IEA affirms that the COVID-19 pandemic has forced rapid changes in behaviour that are affecting oil markets. More people (at least in Western countries) have been working from home, driving less, and cutting down on leisure and business travel. It is not yet clear whether these behaviour changes will be permanent trends or just temporary anomalies. But the IEA is raising the prospect of oil demand peaking sooner than previously expected as long as governments enact stronger policies to speed up the transition to low-carbon energy.

In spite of the above, the IEA states that "current government policies and industry plans show that energy transition initiatives will have only a marginal impact on oil demand over the next six years" (IEA, 2021b, p. 18). The same report forecasts a steady increase in oil demand over the short to medium term, forecasting that by 2025 it will be 3.5 mb/d (million barrels a day) above the 2019 level of 100.7 mb/d (IEA, 2021b, p. 18).

The question is, how sustainable are the high prices for gas and coal, and to a lesser extent oil, in the face of stronger commitments at COP26 to wean the world off fossil fuels? The International Energy Agency, the US Energy Information Administration, and OPEC all say that global oil demand will continue to recover through to at least the end of next year at which time they expect that oil consumption will exceed comparable 2019 levels and hit new highs (Lee, 2021). All of this growth in demand is expected to be generated by emerging and developing economies which are experiencing rising incomes and populations. But where will the supply come from?

Canada's energy situation and context

Climate policy narratives calling for an immediate reduction in fossil fuel use in Canada have been successful in both directing investors towards ESG (environmental, social, and governance) funds, as well as increasing regulatory and legal burdens on domestic fossil fuel production and transportation.

This, alongside the anemic returns that the oil and gas industry suffered after 2014 and the dramatic fall in global demand due to the pandemic, resulted in a sharp decline in upstream oil and gas investment and capital expenditures in 2020. Despite large build-ups of reserves in the aftermath of the pandemic, now that economies are recovering inventories are being used up and demand for energy is returning to pre-pandemic levels. This is the main reason why parts of the world are currently experiencing an energy price shock – economies recovering from a pandemic-induced recession are bouncing back at a rate faster than supply can follow.

If we assume that oil demand will eventually peak and decline as a result of climate policies and technological advances in non-fossil fuel energy sources, what will become of Canada's oil industry?

Critics often contend that Canadian energy will be amongst the first to become uncompetitive in a smaller oil market due to our higher emissions, the grade of our oil, and the higher cost of extraction in our oil sands. As such, investment in expanding production is pointless: new pipelines and oil sands mines will become "stranded assets," i.e. suffer from unanticipated or premature write-downs, devaluations, or conversion to liabilities. The following section addresses these concerns.

Heavy oil

Crude oil has widely varying qualities and chemical compositions and is generally categorized by grade. The American Petroleum Institute (API) gravity number expresses the density of oil, and gives rise to the idea of "light" or "heavy" oil. The level of sulphur is also a differentiator, with "sweet" crudes having less sulphur, and "sour" crudes having a higher sulphur content. Canada has sources of both heavy oil (in the oil sands and around Lloydminster) and light oil (in southern Alberta and Saskatchewan and offshore Newfoundland and Labrador).

There is sometimes an assumption that heavy oil, of which Canada has massive reserves, is an inferior product. However, that is not necessarily true. Heavy oil can be more expensive to refine and transport, which affects its price. But there is also demand for the refined products that heavy oil yields. Light crudes are more commonly used for transportation fuels. Heavy crudes can be refined for that purpose, but their constituents are also used as feedstock for plastics, petrochemicals, and road surfacing materials. Different refineries are often optimized for different crudes. Many Asian refineries are being built or upgraded to allow for more heavy oil imports, with positive impacts on demand. Drops in exports of heavy oil from Venezuela and Mexico are also favourable for Canadian producers.

There is an expectation that even as the demand for transportation fuels declines, that for petrochemicals will grow. Efforts are currently underway, for example, to develop cost-competitive carbon fibre from the constituents of the oil sands' heavy oil, a huge potential market and competitor to energy-intensive steel. Meanwhile, plastics is the fastest-growing group of bulk materials in the world, and synthetic nitrogen fertilizers underpin nearly half the world's food production. Demand for these is expected to grow by up to a quarter by 2040 as more citizens in Asia and Africa move into the middle class and consume more goods (IEA, 2018).

Emissions

The oil and gas sector is Canada's largest greenhouse gas emitter. In 2019, it accounted for 26 percent of total national emissions (Environment and Climate Change Canada, 2021). This is concomitant with the nature of the industry, and its size relative to other Canadian sectors. However, with regards to mitigating climate change and meeting Canada's Paris Agreement commitments, more work needs to be done to reduce the oil and gas sector's footprint.

The notoriety of the oil sands, which has led to dedicated campaigns to stop production, export products, or invest in operations from there, is due in large part to the energy intensity, and thus emissions, inherent in extracting bitumen from sand. Heavy crude is more greenhouse-gas-intense than light crude globally, and the early processes for extracting the bitumen were particularly energy intensive.

On an absolute basis, emissions of GHGs from the oil and gas sector have increased 87 percent from 102 megatonnes of carbon dioxide equivalent (Mt CO_2eq) in 1990 to 191 megatonnes in 2019. However, this is attributable to the fact that there has been increased production. There are significant efforts underway to reduce the intensity of greenhouse gas emission in the oil sands, not least in order to attract potential investors.

There are many different production sites in the oil sands; not all are created equal and there is significant variation in emissions. In 2018, Canadian oil sands emissions intensity varied from 0.04 to 0.201 tonnes of CO_2e per barrel (IHS Markit, 2020).

New technologies are having a significant impact in cutting emissions. According to 2019 data from the government of Alberta, emissions intensity in the oil sands fell by 21 percent between 2011 and 2018: from 0.086 tonnes of CO_2e per barrel to 0.067 tonnes (Alberta, 2021). This puts Alberta's oil sands emissions intensity in line with that of its competitors: IHS Markit estimates that average Alberta oil sands emissions per barrel range from 1.6 percent below to 8.6 percent above the US average, depending on the production process (IHS Markit, 2020).[1] The government of Alberta expects emissions intensity to continue to fall by 16–23 percent over the coming decade (Jaremko, 2021).

The six largest oil sands producers (Canadian Natural, Cenovus, Suncor, Conoco Phillips, MEG Energy, and Imperial), representing 95 percent of production in Alberta's oil sands, established an alliance in June 2021 to achieve net-zero by 2050 through strategies such as carbon capture utilization and storage, process improvements, electrification and fuel substitution energy efficiency, and other emerging technologies (Oilsands Pathways to Net Zero Undated). In total, the plan would see a reduction in emissions of 68 megatonnes (MT) by 2050 from the 70 MT produced by the sector in 2020. Interim targets include cuts of 22 MT by 2030 and an additional 25 MT in cuts by 2040.

In fact, here the oil sands have an advantage: because the bulk of production is divided between only a dozen or so facilities, it is relatively easy, at least compared to conventional production, to capture CO_2 emissions through CCUS technologies.

Cost

One more criticism of oil sands production is that it is amongst the most costly to develop and therefore most vulnerable to prolonged oil price drops, and is a waste of resources sure to lead to stranded assets. This was the subject of many analyses in the early days of the COVID-19 pandemic when a sharp drop in mobility depressed demand for oil, especially for transportation fuels, and led to oil prices becoming negative for a short while as producers scrambled to store their excess product.

Few producers can withstand oil prices of $30 per barrel. Saudi Arabia and other gulf producers do have lower production costs – as low as $2.80/bbl. However, OPEC states often need a far higher price than that to break even fiscally – i.e. for governments to have enough oil revenues to balance their budgets – so they impose output controls to keep prices acceptable for producers. In Canada, a 2019 government of Alberta report pegged the break-even WTI price for a new stand-alone mine to within the US $75-85/bbl range, with in-situ production at around US$55 or US$60 per barrel (Alberta, 2019).

That said, the oil sands have cut costs dramatically in the past seven years. The 2008–2014 cycle saw oil hold steady at around $100/bbl, and as such there was less imperative for cost cutting. However, the lean years since then have made most Canadian oil and gas companies intensely focused on cost-saving measures, and they are more competitive as a result. For example, in late 2021, Canadian Natural (formerly CNRL) stated that its oil sands mining and upgrading operating costs had fallen by more than 50 percent between 2013 and 2020 – a $23/bbl reduction in just seven years, equating to a reduction of $3.5 billion in annual operating costs.

In addition, the oil sands are unique in that they have a very low decline rate (the pace at which production is expected to drop as the oil is extracted) when compared to conventional oil. While conventional oil basins in North America typically decline at a rate of about 10–20 percent per year, the decline rate in Alberta's oil sands is about 4 percent annually. This means that if and when oil demand declines, and as less investment goes into exploration and development, the oil sands will be amongst the last sources of oil left standing.

The fear of peak demand is creating the reality of peak supply, and investment into new oil and gas production is starved. Return on capital has become the preeminent concern for investors. With their low decline rates and increasing takeaway capacity out of Canada from the Line 3 and soon Transmountain Expansion (TMX) pipelines, Canadian oil sands producers are lined up for maximum free cash flow. In fact, oil sands producers have the lowest sustaining capital expenditures (the replacement capital expenditures necessary to maintain existing capacity), amongst their peers (BMO, 2021). This may be discouraging for Alberta politicians who would rather see new investment, construction, and labour force growth. But it does reflect the Canadian oil sands' long-term profitability.

The great pipeline debate

Few issues have been as polarizing in contemporary Canadian politics as efforts to build new pipelines. On the one side, environmentalists assert that in order to avoid a climate catastrophe, no new production can come online. That means that no new pipelines are necessary; in fact, they are counterproductive to efforts to reduce emissions. Pipelines have thus gained symbolic importance in the fight to mitigate climate change for activists, voters, and politicians. The rejection of Energy East, the cancellation of Northern Gateway and Keystone XL, and high-profile protests against the Coastal GasLink and TMX in British Columbia are the most prominent examples.

From an industry perspective, there is no doubt that a lack of pipeline transportation capacity has diminished profits. From a public interest perspective, this has meant less corporate tax revenue and lower royalties for both provincial governments and for First Nations that produce oil on reserve.

The loss comes in a number of ways. First, if there is no pipeline capacity to get the product to market, there is no incentive to meaningfully increase production, and Canada simply exports fewer barrels than it would otherwise.

Second, a shortage of pipeline capacity makes transportation costs more expensive. When the United States was a net importer of oil and gas for decades, pipeline routes and refinery capacity was optimized for Canadian imports. But the shale revolution – the combination of hydraulic fracturing and horizontal drilling that enabled the US to significantly increase its production of oil and natural gas beginning in the mid-2000s – upended those business models. The United States became the world's largest producer of oil and gas, and by 2018 was a net exporter of those fuels for the first time in decades.

Because almost all of our existing pipeline capacity goes through the United States, there is minimal opportunity to sell it to different markets at higher prices. That is why the Northern Gateway and TMX pipelines (that would give Canadian oil access to Asian and other global markets), and Keystone XL (that would give access to gulf coast refineries better suited to heavy oil), were seen as so important to Canadian oil producers: the marketability of Western Canadian Select (WCS) crude would be higher.

Shipping crude by rail has become more common in response to constrained pipeline capacity. While it offers flexibility to producers and provides a means to move crude to and from areas where there are no pipeline connections, it is more expensive for transportation and not as safe.

The combination of further distance to market, heavier grade, and competition with American producers for refinery capacity has led to what is called a "differential" between the benchmark price for Canadian crude, Western Canada Select (WCS), and the benchmark price for American crudes, Brent and West Texas Intermediate.

The price differential between WTI and WCS over the past decade has varied from about $4/bbl in 2014 to as high as $55/bbl in October 2018. TD Bank found that the price differential cost Canada $117 billion between 2010 and 2017 (Varcoe, 2018).

Industry advocates would note that reduced Canadian pipeline capacity has not restricted global demand or consumption, but simply landlocked Canadian product and resulted in lower prices for the oil and gas we are able to export, to the economic detriment of the country.

Canada's oil and gas ESG performance

Currently one of the more common ways to judge the non-financial performance of a company, sector, or country, is to assess its "ESG" performance, or its environmental, social, and governance indicators. In particular, ESG has become important in investment circles as investors pressure funds and banks to invest their money in areas that are deemed good for society.

There are no universal standards for measuring ESG performance and it can vary significantly from bank to bank or index to index. In many ways, greenhouse gas emissions have become the default measure of ESG performance and investing for publicly traded oil companies, as it is quantifiable and directly related to climate change. Yet this can vary too, depending on whether direct or indirect, and upstream and downstream emissions are counted, sometimes referred to as scope 1 (direct emissions from owned or controlled sources), scope 2 (indirect emissions from the generation of purchased energy) and scope 3 (all indirect emissions not included in scope 2).

Amongst the higher profile ESG rankings, Canada is at or near the top amongst their oil exporting peers.

For the 2020 Yale Environmental Performance Index (EPI), Canada comes in 20th globally (Yale Center for Environmental Law and Policy, 2020). However, relative to the other Top 20 major oil exporters, Canada comes only behind Norway with an EPI score of 71 compared to their 77.7, versus the other top exporters of oil: UAE (55.6), Russia (50.5), Saudi Arabia (44.0), and Iraq (38.5).

When combining environmental, social, and governance performance, Canada does even better, again coming behind only Norway. Amongst those with the largest proven reserves – i.e. those that will be supplying oil after peak demand, in the decades to come – Canada ranks first.

Critics may point out that Canada's performance as a country is not relevant; it is the actual oil industry that should be judged. But by that metric, the Canadian majors including Suncor, Canadian Natural, and Cenovus, all fare well against their peers.

If GHG emissions are your only metric, then as intense emitters, the oil sands still stand out, although they are making good progress. But based on any number of other social, environmental, and governance metrics, they are high performers.

Natural gas

Natural gas has slightly different dynamics and makes an even better case for Canadian product based on ESG and climate factors. Natural gas is exported in both its gaseous form, via pipeline, and in a cooled and liquefied state which dramatically reduces its volume, as LNG. Canada is the world's fifth largest producer of natural gas and sixth largest exporter. Its main competitors are Norway, Australia, United States, Russia, and Qatar.

Canada has not been able to benefit from the record prices for natural gas in 2022. Unlike almost every other major natural gas exporter in the world, Canada's production has remained flat for over a decade even as global demand has risen. In fact, exports actually declined, from 3.844 trillion cubic feet in 2007 to 2.876 in 2016 (Canada Gas Association Undated). This is due to the shale revolution in the United States, which has led to strong growth in their own natural gas production, from just over 50 billion cubic feet per day in 2006 to just over 90 billion cubic feet in 2019 (Natural Resources Canada, 2020).

Canada has no LNG export capacity and so has relied on the United States as its only natural gas customer through gas pipelines. But that customer needs less and less of our product. That means that the US has benefited from the global LNG boom while Canada has stood idle.

Since 2011, 24 projects in Canada have been issued long-term export licenses, but none are operational (Natural Resources Canada, 2020). Only two are under construction: LNG Canada in Kitimat and Woodfibre LNG in Squamish. US LNG export capacity, by contrast, increased from less than 1 billion cubic feet per day in 2015 to 10.8 billion cubic feet per day at the end of 2020. In 2015, the US exported a total of about 28 billion cubic feet of LNG to seven countries. In 2020, US LNG exports reached a record high of about 2,390 billion cubic feet to 40 countries, and LNG exports accounted for 45 percent of total US natural gas exports (US EIA, 2021).

Today, with record high natural gas prices in Europe and unprecedented differentials between North American and Asian gas prices, the United States is in the enviable position of importing Canadian oil at Henry Hub gas prices and selling it at Asian spot prices. Canada is leaving billions of dollars on the table in its inability to export LNG.

That is doubly a shame because BC LNG promises to be amongst the cleanest on the planet, i.e. with the lowest emissions intensity. That is due to a combination of the lower-CO_2 composition of natural gas from British Columbia's Montney Formation, widespread electrification of upstream operations like drilling and processing, and the use of green power from BC's hydro-driven electrical grid. While the global emissions average is 0.26 to 0.35 tonnes of CO_2 equivalent per tonne of LNG produced, LNG Canada in Kitimat is being designed for 0.15 tonnes of CO_2 equivalent per tonne; and Woodfibre LNG and Kitimat LNG (currently on hold) are designed for an intensity of approximately 0.06 to 0.08 tonnes of CO_2 equivalent per tonne of LNG (JWN, 2019).

Simply put, Canadian oil and gas companies are amongst the most committed to credible climate strategies and have significantly better social and governance performance than their oil and gas exporting peers. As such, there is a solid argument to be made that if ESG truly is a priority, then the Canadian oil and gas sector should be amongst the last to reduce production.

Table 1. Share of global oil and gas reserves and production by ownership type.

	Share of Reserves		Share of Production	
	Oil	Gas	Oil	Gas
State-owned/controlled oil companies (NOCs)	65.7%	60.1%	57.8%	51.3%
Independents	22.0%	26.4%	28.4%	33.4%
Majors	12.3%	13.5%	13.9%	15.3%

Source: IEA, 2020.

Big oil vs NOCs

Contrary to the popular narrative, the "big oil" companies (i.e. the supermajors, including BP, Shell, ExxonMobil, Chevron, Total, and Conoco Phillips) control a relatively small share of global oil and gas reserves and production. The reality is that state-owned and/or controlled oil and gas companies control the majority of global oil and gas production. In 2018, national oil companies (NOCs) controlled over 65 percent of global oil reserves and 60 percent of global oil production (IEA, 2020). The supermajors controlled only between 12 and 15 percent of oil and gas reserves and production with independent producers making up the rest.

Many of these NOCs are under the influence of authoritarian regimes with weak environmental, social, and governance practices including countries such as Russia, Saudi Arabia, China, Iran, and Venezuela. Some of these countries have weaponized their production capabilities by threatening to slow or stop crucial supplies, manipulate prices, or exert geopolitical leverage over import-dependent countries. Russia is a current case in point (Table 1).

A recent study calculated the effect of efforts to curtail or reduce fossil fuel supplies on the market share of supplier countries, including those with state-owned and/or state-controlled national oil companies and members of OPEC and non-OPEC supplier countries. The study shows the outcome for two scenarios: a phase-out scenario where upstream investment by the private sector is assumed to drop by half by 2030 and stop by 2040, and a "Dead Stop" scenario where upstream investment by the private sector is assumed to completely halt, as suggested by the IEA in its Net-Zero 2050 scenario. Where oil production is stopped immediately, OPEC achieves a 75 percent market share by 2028, and 83 percent by 2040. Even under a gradual phase-out scenario, non-OPEC production drops by just over 50 percent, with OPEC's market share rising to 75 percent from 55 percent today.

In short, the faster that oil supplies are curtailed, the more concentrated oil supplies become amongst the members of OPEC and other regimes with national oil companies (e.g. Russia) (Lynch, 2021). This has significant implications for global energy security.

Energy security implications

Discussions of energy supply and demand in the past decade have primarily been viewed through an environmental and climate policy lens, and have focused on reducing fossil fuel use. It's easy to forget that for the latter half of the twentieth century, energy was viewed almost exclusively through an economic and security perspective. As supply became more reliable, at least in the Western world, energy security – defined by the IEA as "the uninterrupted availability of energy sources at an affordable price" was largely taken for granted. As the green energy transition hits its first road bumps, the issue of energy security is making a comeback.

Energy and human development historically

While taken for granted today, the ability to secure adequate sources of energy has largely determined human progress. As Lambert et al. describe, the history of human cultural advancement tracks the development of energy resources and the evolution of energy conversion technologies (Lambert et al., 2014). More recently, the energy provided by burning fossil fuels, from coal to oil and natural gas, has been largely responsible for both the incredible economic progress made since the start of the industrial era, and the rapid rise in global population and urbanization. There is an almost perfect correlation (indeed causation) between the availability of high quality energy and human development (Lambert et al., 2014).

The reason why the green energy transition is proving so challenging is that oil has incredible energy density that is proving difficult to match. In addition, it is possible to transport oil to almost any location on the planet and as such provide energy to regions that don't have access to high quality local energy sources. Electricity, by contrast, loses power over distance and requires transmission lines to transport.

The past century has seen the build-up of energy systems that revolve around the extraction, refining, and transportation of fossil fuels; in addition, during that time the global population has increased from 2 billion people to just shy of 8 billion. There is, as of yet, no way to support 8 billion people (and growing) without the energy derived from fossil fuels.

The 1970s energy crisis

The 1970s energy crisis was triggered by an OPEC oil embargo in 1973, made in retaliation for the Arab-Israeli War. The result was a near quadrupling of the price of oil leading to inflation, a global recession, and gas shortages. A second shock in 1979 arising from the Iranian revolution triggered another deep recession and more social disruption.

From a geopolitical perspective, these events were highly significant. First, the unprecedented economic expansion in the post-World War II era can largely be attributed to the fall in real energy prices in that period as oil and gas production expanded and efficiencies were found in refining and transporting. The energy crisis of the 1970s ended this run. It also led to protracted American engagement in the Middle East, as securing reliable oil imports from the region became vital to US interests. This became arguably the most consequential foreign policy issue of the late twentieth and early twenty-first centuries until the shale revolution led the US to become energy independent, becoming a net exporter of oil for the first time in decades in 2018.

The energy crisis of the 1970s also resulted in outsized foreign policy influence from Saudi Arabia, Iraq, Iran, Russia, Venezuela and others, providing authoritarian regimes with more power than certainly is in Canadian interests.

The current energy crisis is not a result of an embargo by a hostile foreign power. It is a result of underinvestment in fossil fuels when there are still inadequate low carbon alternatives, and it has been exacerbated by the Russian invasion of Ukraine. We have pursued supply constraining rather than demand constraining strategies to address the climate crisis and the result is an energy shock.

Simply curtailing investment in oil and gas creates supply shortages with limited impact on demand. Much of the world continues to rely on fossil fuels to sustain their economies and improve living standards. Energy shocks are destabilizing to global energy security, inhibit people in the developing world from accessing affordable energy, and can lead to geopolitical concerns if major suppliers use their market power to gain political leverage over other countries.

Energy security is not solely a fossil fuel issue either. With the growth in renewables and increasing electrification, the concept of energy security is changing. Renewable electricity offers the advantage of being a domestically produced resource – no one owns the wind and the sun, whereas oil, gas, and coal must be imported if a country has few domestic sources of these fuels. In this sense, the power of major fossil fuel providers will eventually be diluted.

However, the risks to energy security do not disappear; instead they shift toward the resources and resource providers whose inputs are essential to producing the wind turbines, solar cells, batteries, fuel cells, low-carbon fuels, and other green technologies that we will increasingly rely on for reliable and affordable electricity. It will therefore be important to continue to deal with traditional energy security risks for oil and gas while at the same time broadening our concept of energy security to consider new potential risks associated with the transition to clean energy.

Currently China has a near monopoly in producing and processing rare earth elements (REE), critical components in many high-tech devices, and it is the dominant global processor of lithium, cobalt, nickel, and copper (IEA, 2021). It is obviously detrimental to Canadian and Western energy security for China to have so much control over the minerals that are essential to build electric vehicles, batteries, windmills, solar panels, and transmission lines. As part of maintaining energy security and economic independence, it is important that we develop domestic and North American capabilities and supplies of these essential components. Canada and the United States established the Joint Action Plan on Critical Minerals Collaboration in January 2020 as a response to the threat, with regular working groups meeting to move the plan forward, but that is only a first step. The $3.8 billion announced in Budget 2022 to support critical minerals is another. In the near future, not only will Canada need to work with its allies to bolster its critical mineral supply chain and processing capability, but strategic reserves of some essential products should also be considered.

Conclusion

No responsible transition can be achieved unless climate change goals are balanced with economic and energy security considerations. But under the current public discourse it is difficult to have a balanced and reasoned discussion. The realities imposed by the war in Ukraine and the energy crisis in Europe are imparting greater pragmatism, however.

Energy policy in the transition must be flexible, acknowledge the economic and social costs of various policy choices, and consider the stability and resilience of the energy system in order to avoid disruptions and shocks. Energy policies focused solely on increasing renewables in the energy system entail a much higher risk to the stability of the energy system than polices that employ multiple energy sources. Policies that focus more on "clean energy sources" – including fossil fuels with carbon capture and sequestration – should be preferred over those that favour renewable sources only. Energy system resiliency requires diverse energy sources so that economic and supply shocks affecting one or more sources does not destabilize the system during the transition.

This implies a strong and continuing role for Canada in providing fossil fuels to global markets. A responsible transition for Canada means that we should continue to promote strong measures to mitigate the effects of climate change, but do so while ensuring that there are stable and affordable supplies of energy for the world's consumers. It then follows that Canada should export oil and gas to countries that will continue to depend on these supplies for their energy needs for some decades to come, while at the same time working with those same countries to promote clean energy technology development and investing in green infrastructure. Better that Canadian energy producers with high levels of environmental, social, and governance practices supply our allies and partners with the energy and mineral resources they need than countries and companies that lack those credentials.

Note

1. It should be noted that emissions intensity evaluation is an imperfect and contested science, with different methodologies producing different results.

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