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REIMAGINING CANADA'S ROLE IN GLOBAL ENERGY SECURITY

Practical Considerations for a Low Carbon Transition

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Executive Summary

The world is currently facing simultaneous energy and climate crises. There is considerable scientific consensus that the impacts of a changing climate are having significant human costs as well as adverse impacts on biodiversity. And broad agreement exists that we must put in place strong measures to mitigate and adapt to the effects of climate change. At the same time, some climate policy responses have had significant negative effects on energy security, threatening the global economic recovery from the COVID-19 pandemic and putting our future economic security at risk.

Sadly, the pace, logistics, and costs of the transition from fossil fuels to low or zero carbon sources of energy are still hotly debated. This is because reliable and affordable energy is fundamental to our modern economic, political, and social systems, as well as to human well-being, and fossil fuels are still the most reliable and affordable sources of that energy. Energy transitions take decades and there are no quick and easy replacements for fossil fuels, meaning that even the most optimistic scenarios for an energy transition still see coal, oil, and natural gas providing a majority of the world's energy supply for at least the next decade.

Canada's energy and climate policy debate has become removed from practical considerations. Ottawa has often assumed a moralizing stance in this debate and shown itself to be willing to ignore practical energy realities for the sake of appealing to certain political constituencies. Thus the debate has become polarized and energy security has suffered as a result. Simply put, the current tension between energy security and climate is not sustainable.

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. If Canada does not act to export its resources to hungry markets abroad, it will be ceding those opportunities to countries like Russia, Venezuela, and those in the Middle East, which will use their greater market share and leverage over global energy supplies to gain economic and political leverage.

Canadians live comfortable lives and have almost unprecedented access to affordable clean energy. It is easy to believe that if we can speed up the energy transition and quickly get to net-zero emissions, so can everyone else. This is mistaken. Many other countries that do not have sufficient domestic energy supplies or suitable conditions for renewable energy are concluding that the uncertain impacts of aggressive climate change policies are less threatening than the known consequences of a chaotic energy transition. Canada's response should acknowledge this reality. We ignore an energy crisis in favour of the climate crisis at our peril.

Canada should leverage its position as a stable, reliable, and environmentally responsible supplier of energy resources to the world throughout the transition. Indeed, we will soon be well positioned to contribute meaningfully to global energy security and the energy security of key partners and allies in the Indo-Pacific and elsewhere. Once completed, the TMX pipeline expansion and LNG export terminals will allow Canada to ship oil and gas to buyers in Asia who are increasingly concerned about their energy security in a more uncertain and turbulent geopolitical environment. Importantly, Canada's west coast terminals are closer to the Indo-Pacific than other major shipping ports in North America and our sea lanes to Northeast Asia uncontested and safe.

None of this is to deny the urgent need to pursue strong climate policies and a sustainable energy transition, but we need to do so in a responsible way. Yes, there are health, environmental, and social risks associated with climate change. But equally, there are risks from a chaotic energy transition.

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.

Sommaire

À l'heure actuelle, le monde doit simultanément faire face à des crises énergétiques et climatiques. Les scientifiques s'accordent largement pour reconnaître les lourdes conséquences des changements climatiques en matière de coûts humains et de perte de biodiversité et la nécessité d'adopter des mesures fortes pour les atténuer et s'y adapter. Parallèlement, certaines de ces mesures de lutte ont, sur le plan de la sûreté de l'approvisionnement énergétique, des effets négatifs importants qui menacent la reprise économique mondiale postpandémique et mettent en danger la sécurité économique future.

Malheureusement, le rythme, la logistique et les coûts de remplacement des combustibles fossiles par des sources d'énergie à émissions de carbone faibles ou nulles font encore l'objet de vifs débats. C'est qu'une énergie fiable et abordable est essentielle à nos systèmes économiques, politiques et sociaux modernes, ainsi qu'au bien-être humain, et que les combustibles fossiles sont encore les sources d'énergie les plus fiables et abordables. Comme le remplacement des combustibles fossiles n'est ni rapide ni facile, les transitions énergétiques prennent des décennies, ce qui signifie que même dans les scénarios les plus optimistes, le charbon, le pétrole et le gaz naturel fourniront la majorité de l'approvisionnement énergétique mondial pendant la prochaine décennie, au moins.

Le débat sur la politique énergétique et climatique du Canada s'est détaché des considérations d'ordre pratique. Ottawa a souvent pris un ton moralisateur dans ce débat et a paru disposé à faire abstraction des réalités concrètes en matière d'énergie afin de plaire à certains corps électoraux. Le débat s'est ainsi polarisé, et la sécurité énergétique en a souffert. En termes simples, la tension actuelle entre la sécurité énergétique et le climat n'est pas viable.

Le Canada est bien placé pour répondre aux besoins énergétiques de tous ses alliés et partenaires puisqu'il est doté de réserves de pétrole et de gaz parmi les plus importantes au monde et de nombreux gisements de minéraux de qualité essentiels à la transition énergétique. Si le Canada ne fait rien pour exporter ses ressources sur un marché international avide, il se privera de possibilités que saisiront des pays comme la Russie, le Venezuela et d'autres

du Moyen-Orient, et ces pays utiliseront leur plus grande part du marché et leur influence accrue sur les approvisionnements énergétiques mondiaux pour renforcer leur poids économique et politique.

Les Canadiens vivent bien et disposent d'un accès presque sans précédent à une énergie propre et abordable. Il est naturel de croire que s'il est aisé pour le Canada d'accélérer la transition énergétique et d'atteindre rapidement des émissions nettes nulles, il en va de même aussi pour le reste du monde. Il s'agit là d'une erreur. De nombreux autres pays dépourvus d'un approvisionnement énergétique national suffisant ou des conditions propices à l'utilisation d'énergies renouvelables en arrivent à conclure que les effets incertains de politiques climatiques fortes sont moins menaçants que les conséquences connues d'une transition énergétique chaotique. Le Canada devrait reconnaître cette réalité par les mesures qu'il met en place. C'est à ses risques et périls qu'il néglige la crise énergétique au profit de la crise climatique.

Tout au long de la transition, le Canada devrait tirer parti de sa position mondiale de fournisseur énergétique stable, fiable et respectueux de l'environnement. En effet, le Canada sera bientôt bien placé pour contribuer notablement à la sécurité énergétique mondiale et à celle de ses partenaires et alliés clés dans la région indopacifique et ailleurs. Le projet d'expansion du pipeline TMX et les terminaux d'exportation de GNL permettront au Canada, une fois terminés, de livrer du pétrole et du gaz aux acheteurs asiatiques inquiets de la sécurité énergétique en raison de l'environnement géopolitique plus incertain et instable. Soulignons que les terminaux de la côte ouest du Canada sont plus proches de l'Indopacifique que les autres grands ports de navigation nord-américains et que les voies maritimes vers l'Asie du Nord-Est sont sécurisées et sûres.

Il ne s'agit pas ici de nier l'urgence d'adopter des politiques climatiques fortes et d'opérer une transition énergétique durable. Il faut toutefois procéder de manière responsable. Si les changements climatiques amènent leur lot de risques sanitaires, environnementaux et sociaux, une transition énergétique chaotique comporte autant de risques.

Le Canada doit agir rapidement pour éliminer les obstacles à l'investissement, à la production et à la capacité d'exportation dans le secteur de l'énergie à un moment où la géopolitique bouleverse les marchés mondiaux et où un déséquilibre apparaît entre l'offre et la demande. 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

The purpose of this paper is to highlight the importance of Canada's oil and gas in contributing to global energy security while supporting a responsible energy transition.

What makes a transition "responsible"? Though this question is debated passionately across civil society, industry, and government, it seems to us that a responsible energy transition must ensure access to stable, affordable, and environmentally sustainable energy for all people on earth.

There has 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 future energy shocks that are even more serious than the ones we are experiencing now – rapidly rising prices, lack of supply, reduced living standards, and even political unrest.

The record is clear: energy transitions, such as from wood to coal, or from coal to oil, are protracted affairs (Smil 2016). For us, a responsible transition must effectively balance competing societal goals; it will require careful planning, enlightened policies, and clear market signals that provide adequate energy while significantly curtailing emissions.

The low carbon transition itself will require unprecedented amounts of industrial activity, including huge investments in mining, transmission, man-

ufacturing, and construction. Without affordable energy from our current, fossil fuel-based sources of energy, that transition will be more expensive and thus take longer.

This paper proposes to bring the public discussion back to a more realistic perspective and inject balance into the debate by providing data and analysis that shows that:

- Hydrocarbons will continue to play an essential role in global energy security to 2050 and beyond, even as clean energy sources steadily increase their share of global primary energy demand.

- Asia and Africa will lead energy demand and growth to 2050.

- Recent agreements at the COP26 climate talks made significant progress on a number of areas but the reality is that the world is not on track to meet the 2016 Paris Agreement goal of limiting global warming to an increase of 1.5°C; even reaching the goal of limiting warming to 2.0°C will be extremely difficult.

- As energy demand outstrips supply, global energy security considerations will become more pressing.

- Canada remains one of the largest sources of global energy resources not controlled by state-owned enterprises or autocratic regimes. Its oil and gas production will become increasingly important to global energy security, as will its critical mineral reserves.

- Canada should leverage its position as a stable, reliable and environmentally responsible supplier of energy resources to the world.

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 first step is to help everyone understand what an energy system is, since technologies, institutional arrangements (e.g., laws, regulations, norms), social

practices, and human relationships (including producer-consumer relations, intermediary organizations, and public authorities) are mutually dependent and exist within the broader context of cultural paradigms, norms, values, and socio-economic trends (global energy markets, international institutional frameworks, etc.). This means that any changes to one part of the system have repercussions for other parts.

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, Stirling, and Berkhout 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.

> *"An energy transition is about moving from one mode of producing and using energy to another.*

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."[1] 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 will likely remain high until new technological innovations solve these problems. Replacing existing infrastructure before its usable 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 are 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

The short-term outlook

Fossil fuels made up 84 percent (oil and gas make up 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 the global economy continues to recover from the historic collapse in demand 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 have reached multi-year highs 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.

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$90/barrel in February 2022.

According to the IEA, global competition for LNG supplies amid coal shortages have driven spot natural gas prices steadily upward; they reached the highest levels ever recorded in Europe during the second-half of 2021 (IEA 2021c). Prices for LNG delivered to Northeast Asia reached US$34.47 per million British thermal units (mmbtu) in September, the highest on record since 2009 (Stapczynski, Shiryaevskaya, and Koh 2021). Coal prices have also risen in Asia in 2021, driven by growing demand and a lack of supply, particularly in China.

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.

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 is 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 US$2.40 to US$3.40) from the time Biden took office in January 2021 to No-

vember 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, 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, 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 2022 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.

Outlook for global long-term demand to 2050

Projections of global energy demand over the next several decades are highly dependent on the underlying scenario and the set of assumptions used. Unanticipated changes in policies, demand shocks, and technology developments are just some of the uncertainties that can have an impact on the validity of scenarios. Therefore, it is best to remember that scenarios are not meant to be absolutely reliable forecasts, but rather indicative of general trends based on the underlying assumptions made, including those related to economic growth, climate policy, technology choices, etc. As the energy environment changes, the scenarios themselves may need to be adjusted or reinterpreted in light of developments.

The IEA's most recent *World Energy Outlook* report (IEA 2021a) includes three main scenarios. The well-publicized Net-Zero Emissions by 2050 Scenario (NZE) is a "backcasting" scenario that starts with the assumption that the world can achieve net-zero emissions by 2050 and outlines various actions that need to take place between now and 2050 to achieve this goal. The Stated Policies Scenario (STEPS) reflects the situation with the current set of climate policies that have already been put in place, without any major additional ones, including from COP26. The Announced Pledges Scenario (APS) takes into account all of the climate commitments made by governments globally up to October 2021. This includes all Nationally Determined Contributions (NDCs) and longer-term net-zero targets, and the scenario assumes that all these commitments will be met in full and on time.

> *Most emissions reductions are likely to come from abatement and efficiency technologies.*

At COP26, several countries announced new net-zero commitments alongside pledges to phase out the use of coal, reduce methane emissions and eliminate deforestation. As a result, the IEA updated its APS scenario in early November 2021. While emissions are set to see additional reductions – mostly as a result of India's pledge to reach net-zero by 2070 – it is still unclear whether the update to the APS will affect the oil and gas demand outlook in any significant way. Most emissions reductions are likely to come from abatement and efficiency technologies and not from outright reductions in the consumption of fossil fuels.

Long-term demand for oil and gas varies widely depending on the scenario. The *World Energy Outlook* report states that if the world implements the current and announced policies that had already been agreed to leading up to COP26 (i.e., the STEPS scenario), oil demand in 2050 will remain above 100 mb/d. On the other hand, "if the world single-mindedly pursues a 1.5 °C stabilization objective, then oil demand falls to 24 mb/d in the same year." For natural gas, the range is 5100 billion cubic metres (bcm) under the STEPS scenario and 1750 bcm under a "Net-zero by 2050" scenario (IEA 2021a).

The long-term supply of oil and gas will be largely dependent on the level of investment in the global oil and gas sector, which in turn will determine the capability of supplier countries to meet global demand. In 2020 oil and gas capital expenditures were US$335 billion, considerably down from the US$461 billion spent in 2019 before the pandemic. In 2021, the figure is forecasted to be around US$348 billion as companies continued to restrain

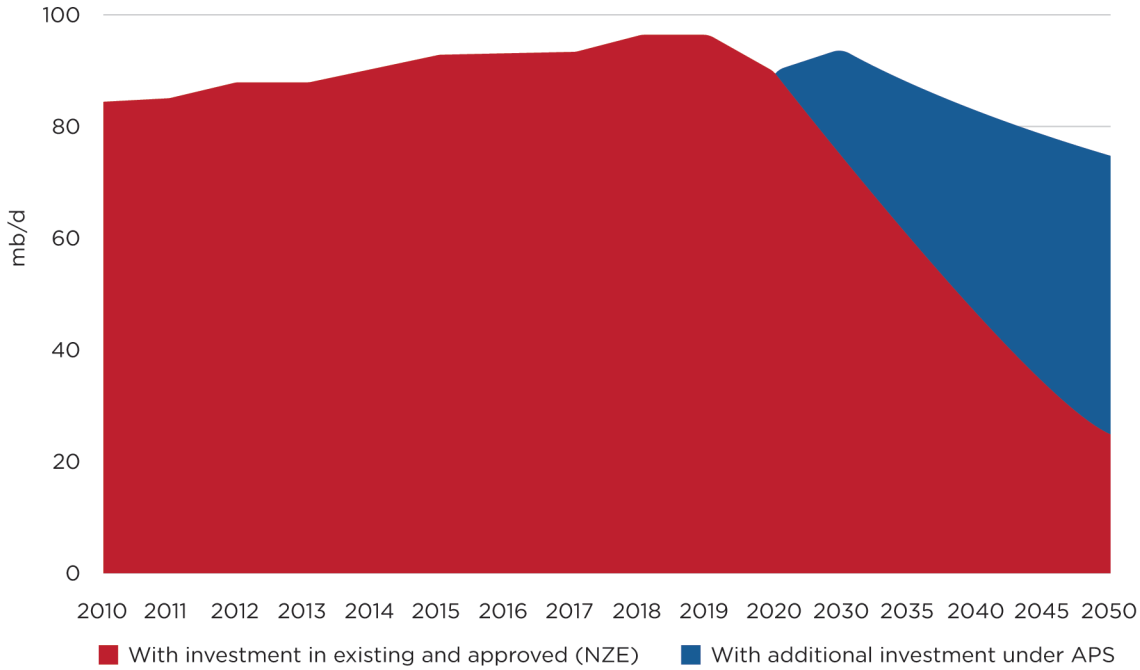
spending and activity (Taboada 2021). As economies recover through the rest of 2021 and beyond, oil and gas investment is expected to make a slow recovery (McKinsey 2021).

According to the IEA, annual upstream oil and gas spending between 2021 and 2050 is expected to average US$495 billion in the APS scenario, and spending on new fields is forecast to drop by one-third compared with the STEPS scenario. This may be optimistic given the slow recovery in post-pandemic spending. The NZE scenario assumes no new investment in oil fields beyond those already approved, although it assumes that investment in exploiting existing fields will continue (IEA 2021a).

The IEA stated at COP26 that global warming could be limited to 1.8°C above pre-industrial levels by 2100 if all the commitments made in Glasgow were completely fulfilled and on time. However, the likelihood that all commitments will be delivered "completely" and "on time" is very low given the past record. Nonetheless, a pathway that leads to a 1.8°C increase implies a level of annual average oil and gas spending falling somewhere between US$295 billion (the APS scenario) and US$495 billion (the NZE scenario).

Given the above, it would be prudent and realistic to assume oil demand in 2050 will most likely fall somewhere between the levels implied in the NZE and APS scenarios, i.e., 24 and 75 million barrels per day by 2050 (see Figure 1).

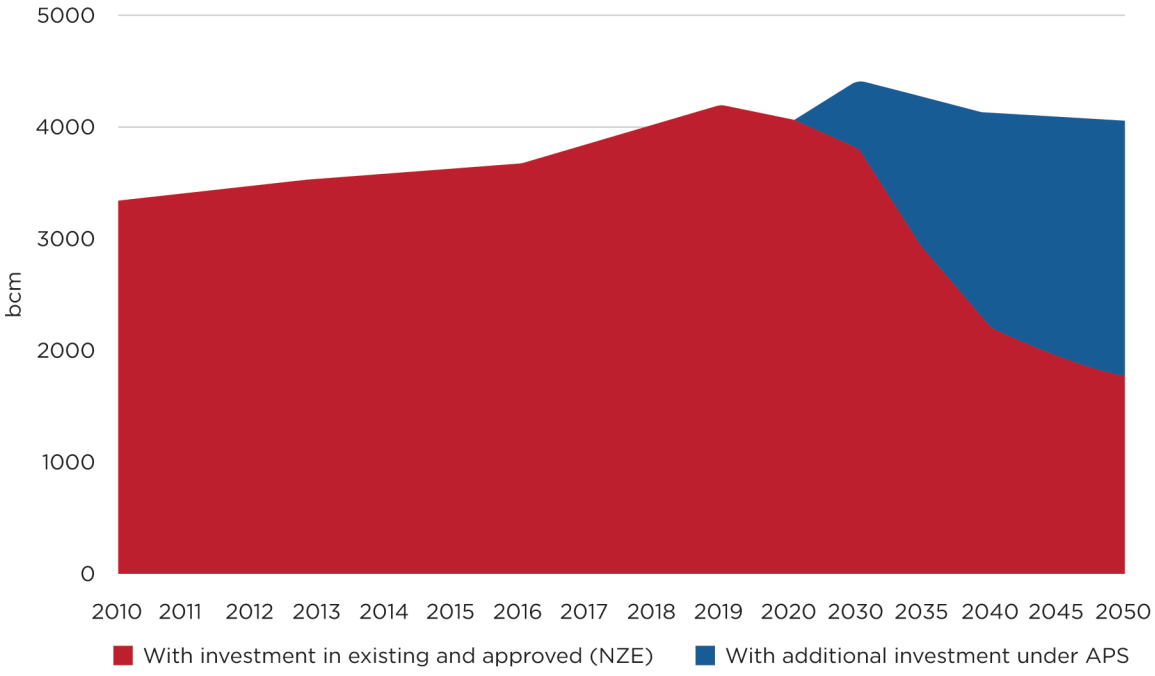
FIGURE 1: GLOBAL DEMAND FOR OIL UNDER TWO SCENARIOS



Source: Created with data from the IEA (2021a).

Demand for natural gas is likely to fall less than that for oil due to its importance as a transition fuel for phasing out coal and as back-up for renewable generation. Similar to oil, it would be prudent and realistic to assume natural gas demand in 2050 will most likely fall somewhere between the levels implied in the NZE and APS scenarios, i.e., between 1747 and 4004 billion cubic meters by 2050 (see Figure 2).

FIGURE 2: GLOBAL DEMAND FOR NATURAL GAS UNDER TWO SCENARIOS



Source: Created with data from the IEA (2021a).

The share of oil and gas in total primary energy supply in 2050 will range from 19 percent in the Net Zero by 2050 Scenario (NZE) to 42 percent in the Announced Pledges Scenario (APS) (IEA 2021a). Although there is a great deal of uncertainty about the future course of events, a reasonable approximation of actual demand in 2050 would be around the midpoint between the upper end of these two scenario ranges: for oil, at around 50 mb/d and for gas at around 2875 bcm. This estimation is also roughly consistent with the IEA's COP26 update of the APS scenario (IEA 2021e). These figures may actually be quite conservative because, given the past record, it is likely that not all climate pledges made by governments will be implemented in full or on time.

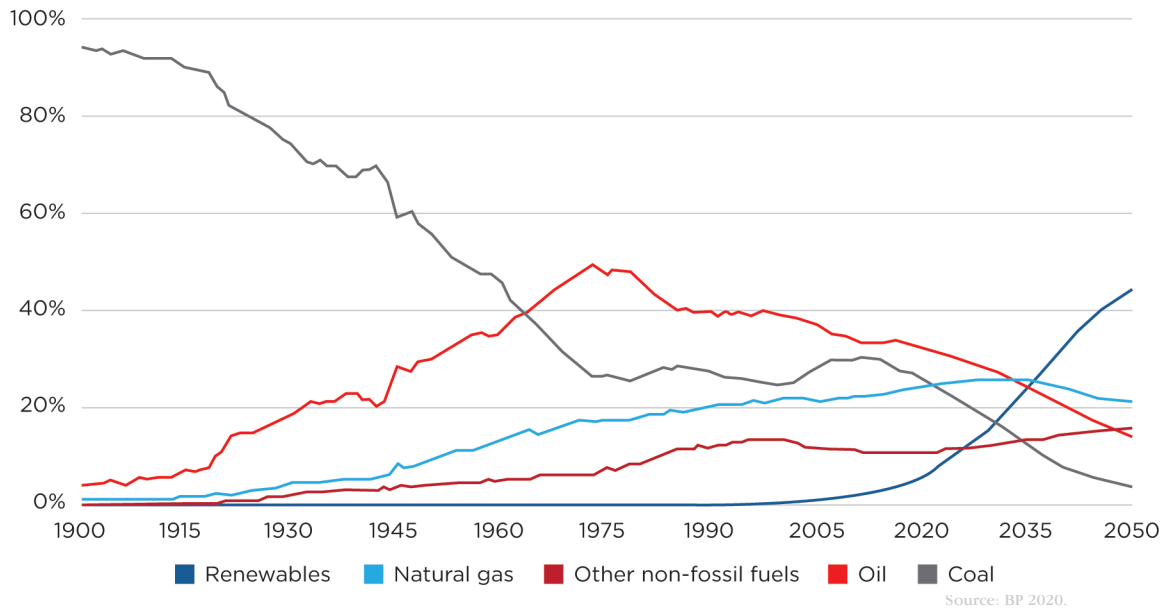
Other Long-Term Projections

In addition to the IEA scenarios, we examined recently published scenario research that two other organizations have developed in order to compare the results with those of the IEA. The scenarios these organizations developed generally align with the three IEA scenarios: a business-as-usual case, a scenario that assumes countries follow through on all climate commitments

made to date (i.e., mostly the Paris climate agreement, in this case), and a "green" scenario similar to the IEA's net-zero scenario.

Similar to the IEA, BP's projections of primary energy demand (see Figure 3) employs three scenarios: Rapid, Business As Usual (BAU), and Net-Zero. BP's "Rapid" scenario assumes a significant increase in carbon prices (reaching US$250/tonne) in developed countries by 2050, weaker oil demand as a result of the COVID-19 pandemic, and other policy interventions to stimulate renewables and mitigate emissions. BP compared its Rapid scenario to the scenarios that other organizations produced and noted that the average growth of primary energy over the next 30 years assuming the Rapid scenario is towards the bottom end of the range of other published scenarios, including the Intergovernmental Panel on Climate Change (IPCC) 2°C scenario and is also near the low end of other scenarios in terms of carbon emissions (BP 2020, 143).[2]

FIGURE 3: BP'S PROJECTIONS OF PRIMARY ENERGY DEMAND TO 2050



Source: BP 2020.

As Table 1 shows, the share of fossil fuels that are anticipated to compose primary energy demand in 2050 ranges from 67 percent under the BAU case, to 38.9 percent under the Rapid scenario, and 21.7 percent under the Net-Zero scenario.

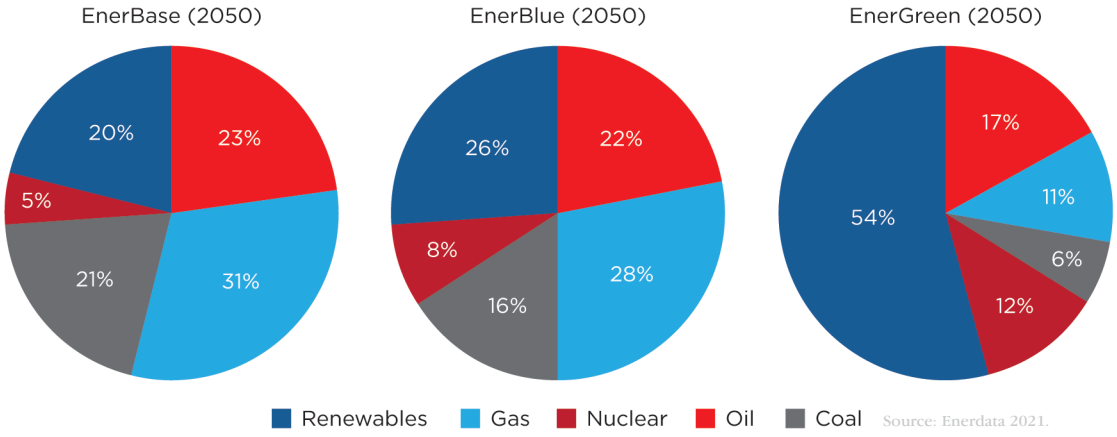
Enerdata has developed three scenarios that incorporate increasingly stringent emissions policy targets (Enerdata 2021) (see Figure 4). Under its "Enerblue" scenario, which assumes that all participating countries fully adhere to their Paris climate commitments, fossil fuels account for 66 percent of total primary energy consumption in 2050. Even under its most stringent "Evergreen" scenario, in which countries meet increasingly stringent commitments consistent with limiting a global temperature increase to 2°C, fossil fuels still account for 34 percent of total primary[3] energy consumption in 2050.

TABLE 1: BP'S PROJECTIONS OF SHARES OF PRIMARY ENERGY CONSUMPTION IN 2018 AND 2050

Primary energy source	2018	Rapid	Net Zero	BAU
Coal	27.0%	3.9%	1.9%	17.0%
Oil	33.0%	14.0%	6.8%	24.0%
Gas	24.0%	21.0%	13.0%	26.0%
Nuclear	4.2%	7.0%	9.1%	4.2%
Hydro	6.5%	9.1%	9.9%	7.1%
Renewables (incl. biofuels)	4.7%	44.0%	59.0%	22.0%
Total	**100%**	**100%**	**100%**	**100%**

Source: BP 2020.

FIGURE 4: ENERDATA'S EMISSIONS POLICY TARGETS UNDER THREE SCENARIOS



Source: Enerdata 2021.

The results for the share of fossil fuels in the energy mix in 2050 derived from the scenarios among the three organizations are summarized in Table 2. All three organizations have scenarios that are roughly comparable with the three IEA scenarios named in the table header. As can been seen, the IEA and BP scenario results are very similar across all scenarios.

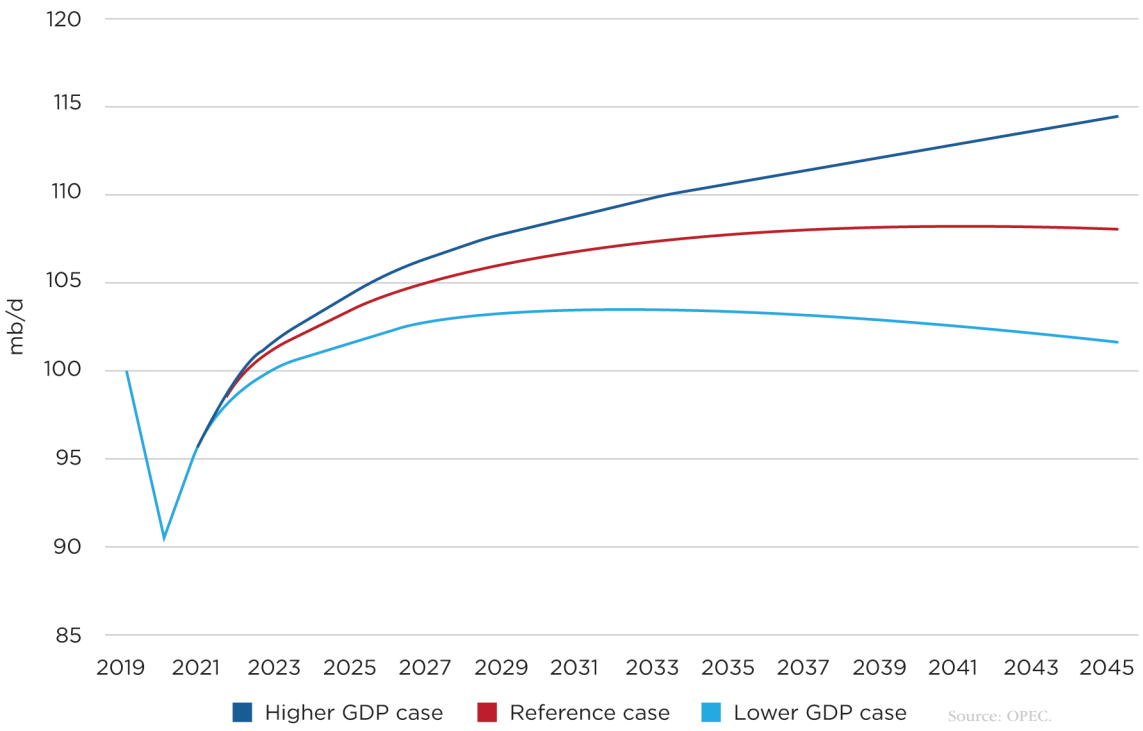
Several observers have deemed the BP and IEA forecasts too optimistic. OPEC's *World Oil Outlook*, produced to guide OPEC production targets in order to provide stability to oil markets, forecasts oil demand to rise by 17.6 mb/d between 2020 and 2045, growing from 90.6 mb/d in 2020 to 108.2 mb/d in 2045. It expects most of that growth to come in the next 15 years before plateauing, rather than declining (OPEC 2021).

TABLE 2: SHARE OF FOSSIL FUELS IN THE ENERGY MIX IN 2050 ACCORDING TO DIFFERENT SCENARIOS FROM THREE ORGANIZATIONS

	STEPS (Stated Policies Scenario)	APS (Announced Pledges Scenario)	NZE (Net Zero Emissions by 2050)
IEA	66.0%	42.0%	19.0%
BP	67.0%	39.0%	22.0%
Enerdata	75.0%	66.0%	34.0%

Sources: IEA 2021a; BP 2021; Enerdata 2021.

FIGURE 5: GLOBAL OIL DEMAND IN ALTERNATIVE CASES, 2019-2045, OPEC FORECASTS (OPEC 2021)



In summary, while forecasts vary significantly, it is likely that significant demand for oil and gas will remain until 2050, even under the most stringent climate scenarios (see Figure 5).[4] Although fossil fuel demand will begin to decline in the next five to 15 years, we expect that these fuels will remain important energy sources, providing energy security and backstopping renewables out to 2050 and beyond.

The regional structure of demand

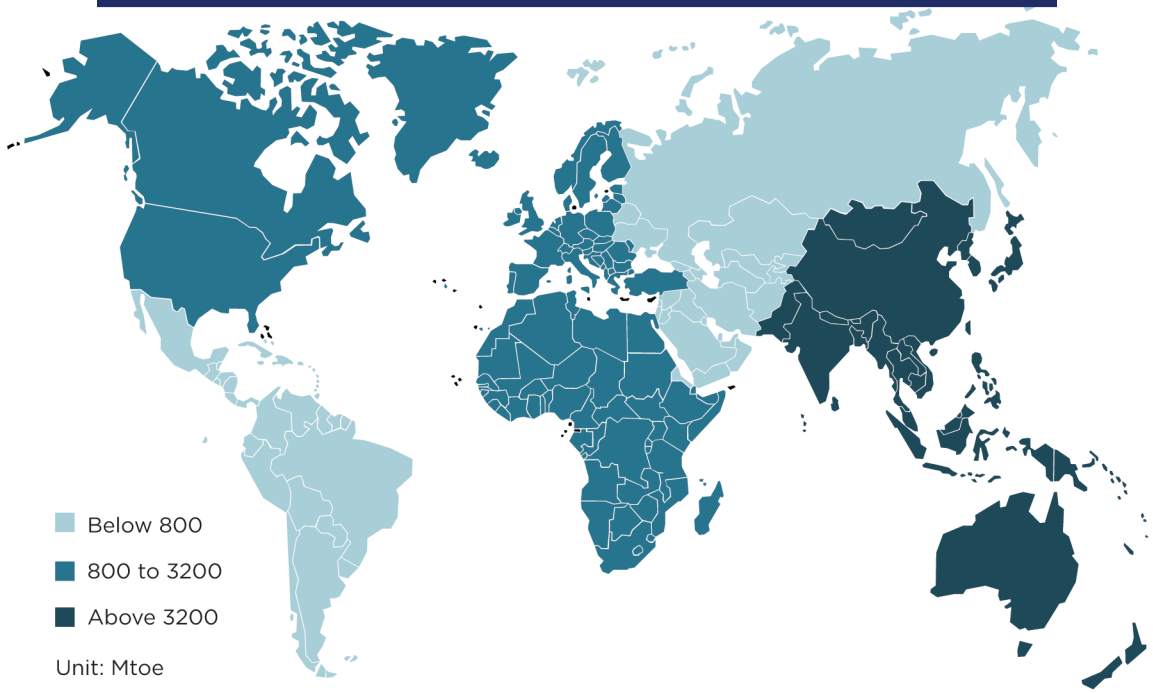
The regional breakdown of energy demand shows that the Asia-Pacific[5] region is by far the largest energy consumer and its share of global demand is set

to steadily increase. In 2020, the Asia-Pacific region accounted for about 43 percent of global total final energy consumption, followed by North America with 18 percent, and Europe with 14 percent (IEA 2021a).

Longer-term, the outlook for energy demand varies somewhat among various scenarios and forecasts. All of the scenario forecasts that this paper examines[6] estimate that by 2050, the Asia-Pacific region will account for anywhere from 45 to 52 percent of primary energy demand (see Figure 6).

Table 3 lists the total energy supply for all regions under all IEA scenarios and compares this with historical data.

FIGURE 6: TOTAL PRIMARY ENERGY CONSUMPTION IN 2050 [MEGA TONNES OF OIL EQUIVALENT (MTOE)]



Asia-Pacific 52.2% | North America 13.2% | Europe 10.0% | Africa 6.8% | Latin America 6.5% | CIS 5.9% | Middle-East 5.2%

Source: Enerdata 2021.[7]

Oil

Regionally, while oil demand is anticipated to peak around 2024 in Europe and North America, oil demand in Asia-Pacific is expected to be the strongest at that time, although growing at a slightly slower pace than before the pandemic (IEA 2021b). Globally, the demand for oil is forecasted to increase by about 4.4 mb/d until 2026. At 4.1 mb/d, the Asia-Pacific region will account for more than 90 percent of this increase (see Table 4).

Oil demand in the Indo-Pacific region under the three scenarios ranges from 17.2 to 38.8 mb/d and accounts for about 37 to 39 percent of global oil demand by 2050 (see Table 5).

TABLE 3: TOTAL ENERGY SUPPLY BY REGION AND SCENARIO [EXAJOULES (EJ)]

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	**544.7**	**613.0**	**589.1**	**671.0**	**743.9**	**651.1**	**674.4**	**599.2**	**577.9**
North America	**112.6**	**115.8**	**107.7**	**112.1**	**106.2**	**101.9**	**82.7**	**101.3**	**80.3**
United States	94.1	94.8	88.3	90.9	83.6	82.3	64.4	82.6	64.5
Central and South America	**26.6**	**28.5**	**26.9**	**31.4**	**41.0**	**29.8**	**35.9**	**28.7**	**33.3**
Brazil	12.1	13.5	13.1	15.3	19.8	13.9	15.4	14.2	15.8
Europe	**89.2**	**82.4**	**77.5**	**75.5**	**69.9**	**71.8**	**61.6**	**70.2**	**56.5**
European Union	64.5	59.5	55.5	52.4	45.1	48.9	37.8	48.8	37.6
Africa	**28.0**	**34.6**	**34.0**	**42.4**	**61.8**	**41.7**	**59.5**	**29.6**	**43.1**
Middle East	**26.2**	**32.9**	**32.2**	**39.3**	**53.6**	**39.5**	**55.2**	**34.9**	**45.0**
Eurasia	**35.2**	**39.8**	**38.3**	**42.4**	**47.2**	**42.6**	**47.2**	**40.0**	**37.1**
Russia	28.5	32.2	31.0	34.1	35.6	34.2	35.6	32.5	29.9
Asia-Pacific	**211.8**	**261.4**	**259.4**	**306.7**	**335.6**	**303.8**	**309.1**	**276.2**	**265.1**
China	107.3	143.4	146.1	163.4	157.3	162.5	133.4	149.9	125.1
India	29.3	39.1	37.2	52.1	70.5	52.0	70.4	43.6	52.7
Japan	20.9	17.4	16.2	15.8	13.3	15.0	12.1	15.0	12.1
Southeast Asia	22.7	29.9	29.1	39.5	51.9	39.6	51.8	36.1	40.2

Source: IEA 2021a..

TABLE 4: GLOBAL ENERGY DEMAND BY REGION

	2019	2020	2021	2022	2023	2024	2025	2026	2019-26 Growth	2019-26 Growth
North America	25.3	22.2	23.8	24.5	24.7	24.7	24.6	24.6	-0.4%	-0.7
Central and South America	6.6	5.9	6.3	6.6	6.7	6.7	6.8	6.9	0.7%	0.3
Europe	15.7	13.8	14.6	14.8	15.0	15.0	14.9	14.9	-0.8%	-0.8
Africa	4.2	3.8	4.0	4.2	4.4	4.5	4.7	4.8	1.7%	0.5
Middle East	8.3	7.6	7.9	8.2	8.4	8.5	8.7	8.9	0.9%	0.6
Eurasia	4.4	4.2	4.3	4.4	4.5	4.6	4.6	4.7	1.1%	0.4
Asia-Pacific	35.2	33.4	35.6	36.9	37.7	38.2	38.9	39.3	1.6%	4.1
World	**99.7**	**91.0**	**96.5**	**99.4**	**101.2**	**102.3**	**103.2**	**104.1**	**0.6%**	**4.4**

Source: IEA 2021b.

Increased demand in China and India are expected to account for the majority of the increases in oil demand in the Asia-Pacific region. With continued economic growth and increasing numbers of people enter middle-class status, these countries are expected to steadily increase their energy consumption.

Natural gas

Natural gas demand is expected to increase under all scenarios over the next five years, with China, the Middle East, and Southeast Asia leading the demand growth to 2030 at least. Much of the growth in natural gas demand in the developing economies is in the industrial/manufacturing and power sectors (with coal switching to gas) whereas in the US, Europe, and Japan, de-

mand is expected to decline in the building and power sectors with increased electrification.

TABLE 5: OIL DEMAND BY REGION AND SCENARIO (IN MILLIONS OF BARRELS PER DAY)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	**86.7**	**96.6**	**87.9**	**103.0**	**103.0**	**96.1**	**76.7**	**87.6**	**47.0**
North America	**22.2**	**22.7**	**20.1**	**21.3**	**16.7**	**18.0**	**7.7**	**17.7**	**6.8**
United States	17.8	18.4	16.4	17.4	13.4	14.7	5.4	14.6	5.4
Central and South America	**5.5**	**5.5**	**5.0**	**5.4**	**6.0**	**4.8**	**4.0**	**4.5**	**2.4**
Brazil	2.3	2.4	2.3	2.4	2.5	1.9	1.1	1.9	1.0
Europe	**13.9**	**13.0**	**11.9**	**10.4**	**6.4**	**9.0**	**3.6**	**8.7**	**2.2**
European Union	10.6	9.7	8.9	7.4	4.1	6.2	1.4	6.2	1.3
Africa	**3.3**	**4.0**	**3.6**	**5.1**	**8.4**	**5.0**	**7.9**	**4.6**	**4.3**
Middle East	**6.6**	**7.4**	**6.7**	**8.2**	**10.2**	**8.2**	**10.2**	**7.2**	**6.1**
Eurasia	**3.2**	**3.8**	**3.7**	**4.4**	**4.5**	**4.4**	**4.5**	**4.0**	**2.6**
Russia	2.6	3.1	3.0	3.5	3.1	3.5	3.1	3.2	2.0
Asia-Pacific	**25.0**	**32.0**	**30.8**	**38.5**	**38.8**	**37.8**	**30.1**	**33.0**	**17.2**
China	8.8	13.1	13.3	15.7	13.4	15.7	6.4	13.6	5.9
India	3.3	4.8	4.4	7.2	9.2	7.2	9.2	6.0	4.1
Japan	4.2	3.4	3.1	2.8	1.8	2.4	0.8	2.4	0.8
Southeast Asia	4.0	5.1	4.7	6.6	7.7	6.6	7.6	5.6	3.2
International bunkers	**7.0**	**8.3**	**6.1**	**9.6**	**11.9**	**8.9**	**8.8**	**7.9**	**5.4**

Source: IEA 2021a.

Over the long-term, global demand for LNG is expected to nearly double to 700 million tonnes annually by 2040, up from 360 million tonnes in 2020. Regionally, Asia is expected to represent nearly 75 percent of this growth as domestic natural gas production declines and LNG increasingly becomes a transition fuel to replace coal (Shell 2021).

Natural gas demand in the Asia-Pacific region under the three scenarios will range from 880 to 1442 bcm and account for about 28-36 percent of global oil demand by 2050. In the STEPS scenario, nearly all of the global increase in natural gas demand between 2020 and 2030 is expected to come from emerging markets and developing countries. Demand for natural gas in China increases by 40 percent between 2020 and 2030 (see Table 6).

Looking toward 2050

In this report, we have examined and compared recent scenarios published by several reputable energy organizations with long track records of modelling and scenario development. We have relied mainly on the IEA scenarios because these are the ones that most often have been used by governments and in climate discussions to aid in policy development.

TABLE 6: NATURAL GAS DEMAND BY REGION AND SCENARIO (IN BILLIONS OF CUBIC METRES)

	Historical			Stated Policies		Announced Pledges		Sustainable Development	
	2010	2019	2020	2030	2050	2030	2050	2030	2050
World	3336	4076	3999	4554	5113	4249	3852	4038	2452
North America	835	1122	1096	1154	1073	933	418	900	328
United States	678	895	876	905	813	720	248	711	233
Central & South America	148	164	148	154	191	152	154	134	98
Brazil	29	37	35	32	41	28	22	27	21
Europe	696	611	596	587	497	504	234	483	118
European Union	446	413	401	392	297	315	60	314	57
Africa	106	164	164	208	319	210	308	193	170
Middle East	391	554	559	658	839	665	841	541	435
Eurasia	574	624	597	663	711	668	712	634	419
Russia	467	507	481	536	531	541	533	516	348
Asia-Pacific	588	837	839	1114	1442	1105	1164	1146	880
China	111	305	322	454	521	443	314	438	359
India	64	64	63	133	207	133	206	173	142
Japan	107	104	99	74	59	64	34	63	34
Southeast Asia	150	172	164	226	333	230	333	231	141
International bunkers	-	0	1	16	40	12	21	8	5

Source: IEA 2021a.

In our analysis of future oil and gas demand, we have taken a conservative approach, assuming that all nationally determined contributions, net-zero pledges, and other climate commitments will be fulfilled for each of the scenarios examined. In reality, this is improbable. In the history of the UN climate process, few countries have fully implemented their climate commitments on time or in full and there is little reason to expect that things will be different with the COP26 agreement.

Yet some scenarios, particularly the IEA's net-zero backcasting scenario, rely on heroic assumptions, including that all countries fully and completely execute the required policies at an unprecedented level and speed. Unfortunately, there is no precedent in the history of global governance and global institutional cooperation that would indicate that such rapid and radical changes to the way the world produces and uses energy are technically or fiscally realistic and achievable. The issue of whether the disruptions and economic impacts resulting from such sweeping changes would be accepted by consumers and voters is another question altogether. Given the historical record, one should maintain some healthy skepticism about that.

We therefore conclude that while the world must continue to make considerable progress toward reducing both GHG emissions and hydrocarbon use over the next 30 years, the most realistic scenario is one that acknowledges that oil and gas (with abatement technologies) will retain a significant share of primary energy demand even up to 2050 and perhaps beyond.

COP26 and its implications

With the completion of the UN-sponsored COP26 climate talks in Glasgow, it is important to review some of the outcomes and implications that resulted from this process and assess the impact on Canada's energy resources sector.

Putting the rhetoric in context

One can take seriously the undeniable threat posed by climate change while also asking whether some of the theatrics and hyperbole surrounding climate summits doesn't serve to trivialize the process. It is important to note that the climate scientists that write the IPCC reports, on which the talks rely, do not use hyperbolic rhetoric. According to the IPCC, its reports are supposed to focus on a "solution-based approach," helping to identify how high-level climate policy goals might be met without advocating any specific mitigation options.

In fact, climate scientists have outlined scenarios modelling not only the potential environmental impacts of climate change, but also the Shared Socioeconomic Pathways (SSPs) representing different combinations of challenges to climate change mitigation and to adaptation (O'Neill, Kriegler, Ebi, et al. 2017). In one highly cited report written for the IPCC, all five pathway scenarios, even the hottest ones, showed improvement in human well-being on average, with expectations that life expectancy and incomes will continue to improve and poverty and hunger rates will continue to decline. As the lead author expressed, climate change may drag down rates of improvement in human well-being, but "we're generally in the climate-change field not talking about futures that are worse than today" (as quoted in Marris 2021).

Naturally, at climate summits ambitions are set artificially high on purpose, presumably so that even when results fall short, the world is hopefully left better off than before. In November 2019 the UN set a very high bar stating that the world needed to cut greenhouse gas (GHG) emissions "by 7.6% every year for the next decade" in order to hold the global temperature increase to 1.5°C by 2100. The IPCC has said that at current levels of CO2 emissions the globe's 1.5°C "carbon budget" will be used up within 12 years. The IPCC has said that global temperature increases can remain below 2°C during this century only under scenarios where CO2 emissions reach net-zero around 2050.

What was accomplished at COP26?

The two-week COP26 conference in Glasgow in 2021 ended with some significant accomplishments, including a pledge by countries to strengthen emissions-reduction targets for 2030 and formal recognition that the world needs to reduce global greenhouse-gas emissions by 45 percent by 2030. Also agreed to were rules to create a framework for a global carbon market, a new

agreement on cutting methane emissions, a "phase-down" of coal, a pledge to provide more funding for adaptation in vulnerable nations, a promise to end and reverse deforestation by 2030, and completion of rules on carbon trading. In a surprise move, the US and China agreed to work toward achieving the 1.5°C temperature goal set out in the 2015 Paris Agreement. Yet China did not join an international agreement made at COP26 to limit methane and it remains reluctant to address its domestic coal emissions, at least in the short-term.

It has been estimated that the additional measures agreed to at COP26 will result in about a 7.5 percent reduction in carbon emissions by 2030. However, despite the 5.4 percent dip in emissions brought on by the COVID-19 pandemic in 2020, global emissions were set to rise by 4.9 percent in 2021.[8] Given that the world has already warmed by 1.1°C, and with economies growing again after the pandemic, many scientists and informed observers acknowledge that we have already passed the point of being able to meet the 1.5°C goal this century.

In Glasgow, the International Energy Agency (IEA) made the surprising announcement that global warming could be limited to 1.8°C above pre-industrial levels by 2100 if all the commitments made in Glasgow were completely fulfilled and on time. Given that no COP climate commitments have ever been completely fulfilled on time in the history of the COP process, that would appear wildly optimistic. In any case, if the IEA's analysis is correct, then fossil fuel production does not need to be shut down immediately and resources don't have to be left in the ground after all because no such commitments were made at COP26.

At the Glasgow conference, 20 countries also agreed to end financing for fossil fuel projects abroad. While several countries had already agreed to end international financing for coal, this agreement applies to oil and gas projects. The UK, Canada, the US, and several other countries signed on to the agreement, which promises to "end new direct public support for the international unabated fossil fuel energy sector by the end of 2022, except in limited and clearly defined circumstances that are consistent with a 1.5°C warming limit and the goals of the Paris Agreement."[9] Judging by the careful wording, it would appear that this agreement would not necessarily rule out providing government funding for projects like natural gas power plants using carbon capture and storage or financing LNG-receiving terminals, all of which continue to be in high demand in Asia and will be required to help phase out coal and provide backup for an expansion of renewable electricity generation.

In Glasgow, 23 new countries signed on to a pledge to phase out coal power with major economies phasing out by the 2030s and the rest of the world by the 2040s. The countries also agreed to end all financing in new coal power generation domestically and internationally.

Climate promises again fall short of climate solutions

However, China, India, and the US – which together account for over 70 percent of global (thermal) coal consumption – refused to sign on to the agreement. Both China and India rely heavily on coal power and the average age of their plants is only around 12 years, with 20 to 30 years of lifespan left in them. And since coal-fired power remains integral to energy affordability and economic sustainability in India and China, the prospects of coal-fired power plants being consigned to history anytime soon are low.

It seems unfair for rich Western countries to expect energy-poor developing countries like India to remove coal from their energy mix while millions of their people still live without access to electricity or fuel for their stoves. In India, the pandemic diminished the ability of many people to pay for fuels and made it very difficult to travel to liquid fuel refilling stations during the lockdown. Yet India was criticized.

Rather than criticize India for not signing on to net-zero emissions by 2050, rich countries should applaud India for making a commitment to do so by 2070, given how far India needs to go to catch up with the developed West.

If other countries are serious about wanting India or other developing countries to align with the 2050 target, it's unlikely that New Delhi would turn down the billions or even trillions of dollars in transfers needed to achieve that goal. In the meantime, India will likely continue to expand renewables, but will also expand its reliance on coal power. The reality is that coal is a cheap and reliable fuel source, both of which are critical to India's continued economic development.

Canada's COP26 commitments

In his national statement at COP26, Prime Minister Trudeau announced that Canada will "cap oil and gas sector emissions today and ensure they decrease tomorrow at a pace and scale needed to reach net-zero by 2050" (Tasker 2021). This appears to build on earlier commitments he made at the Leader's Summit on Climate in April 2021[10] and on the campaign trail.

Canada's oil and gas sector, which accounts for about 26 percent of this country's total GHG emissions, has already agreed to cut emissions. Several major producers have signed on to an initiative to achieve net-zero emissions by 2050. And the Alberta government has already agreed to a 100 megatonne cap on emissions from the oil sands (Alberta Undated). The prime minister's announcement raises questions about how much further the federal government will go in reducing caps on emissions, how the five-year emissions targets would be issued and enforced, and whether the cap would apply to the whole oil and gas sector or whether it would target specific companies or extraction practices.

At the same time, Environment Minister Steven Guilbeault says that the "market will decide" which energy sources will be used in the transition. If that is true, then it is fair to ask why emissions caps are needed at all when Canada already has a price on carbon that will be ratcheted up over time.[11] While it may be that the announcement will not have a significant negative economic impact beyond what has already been announced and agreed to, the question remains whether expanding oil sands production – or even LNG production – while staying under the cap is still a possibility.

Canada also announced a commitment to achieve net-zero emissions in its electricity grid by 2035. Given that 60 percent of Canada's power generation is hydro (Canadian Hydropower Association Undated), and all coal-fired power plants are slated to be either decommissioned or retrofitted with CCUS (Canada Energy Regulator 2020), this should be achievable. Strict emissions requirements already in place will only affect gas-fired power plants with lower efficiencies. The prime minister also announced as much as $1 billion in aid will be directed to developing countries to help them transition from coal-based to low-emissions electricity. This is a positive move that should be applauded as long as there are strong accountability measures in place to ensure that the money leads to real emissions decline and is not just a token gesture.

In terms of Canada's exports of energy resources, it would appear the country's prospects for exporting its energy resources will not be significantly impeded by the commitments made in Glasgow so far. Given that the Canadian government is still proceeding to complete the TransMountain Expansion (TMX) pipeline (which it owns), Canada remains on track to increase oil exports offshore. The prime minister also announced that Canada is "working toward" ending exports of thermal coal by no later than 2030. This statement is somewhat ambiguous but in any case the ban will have minimal impact on Canada's balance of trade because the vast majority of Canada's coal exports are metallurgical coal, used in steel-making, which is not directly affected by the ban.

Climate puritanism versus climate realism

In October 2021 leaked documents indicated that Saudi Arabia, Australia, and Japan were among a group of countries attempting to make changes to the IPCC Working Group III draft report that is to be published next March (Battersby 2021). Apparently these countries objected to a statement in the draft report that said "the focus of decarbonization efforts in the energy systems sector needs to be on rapidly shifting to zero-carbon sources and actively phasing out fossil fuels."

Of course, these countries are being criticized for daring to suggest changes to a report that is supposed to reflect policy options for governments to

consider. In fact, what many countries legitimately argue is that their energy systems will still require fossil fuels for some period of years while they shift to alternative sources. It seems that some in the IPCC may be promoting a kind of ideological purity test that blesses only certain "zero-carbon" sources for use in the transition. Fossil fuels with CCUS and nuclear power are "dirty" under this rubric, even though they are low-carbon. This flies in the face of the reality that a wide range of low-carbon sources will need to be employed in order to meet the aggressive targets that have been agreed to in the COP process.

Despite the lofty ambitions and rhetoric broadcast at climate summits, the hard work begins where climate commitments meet the reality of economics and local politics back in home countries. As such, trade-offs will have to be made in order to manage the impact on economies, prices, and jobs, while also being fiscally responsible. The consequences of not doing so risk social and political pushback and ultimately public support for the transition itself. The consequences are also seen in energy markets today, reflected in fuel shortages and rising prices in many countries, and consumer subsidies and tax credits in response. The world is learning the hard way that the global economy still relies on fossil fuels. While the emissions those fuels produce must eventually be reduced to net-zero, this process will take decades to accomplish.

Canada's energy situation and context

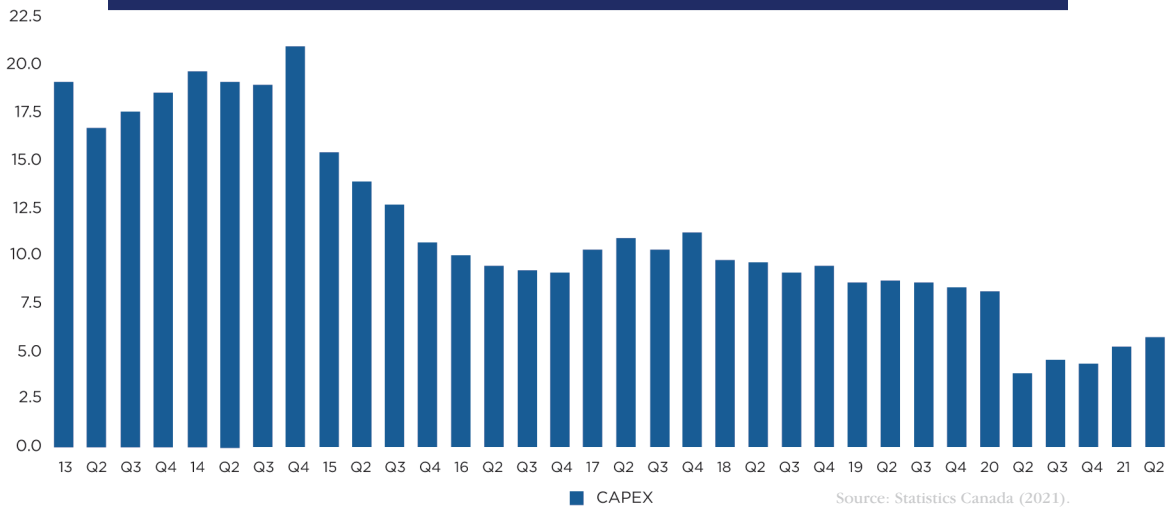
Climate policy narratives calling for an immediate reduction in fossil fuel use in Canada have been successful in both directing investors towards ESG (environmental, social, and governance) funds, as well as increasing regulatory and legal burdens on domestic fossil fuel production and transportation.

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 (see Figure 7). 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.

Instead of trying to shut down the oil and gas industry and strand Canada's hydrocarbon endowments, transition advocates should be turning their at-

tention to working with the incumbent energy companies in order to leverage their oil and gas expertise, infrastructure, and business savvy to develop hybrid energy sources. This will help move Canada through the transition while creating new jobs, improving competitiveness, and enhancing energy security at home.

FIGURE 7: CAPITAL EXPENDITURES BY OIL AND GAS INDUSTRIES IN CANADA, 2013-2021



Source: Statistics Canada (2021).

What is the rationale for working with, rather than against, the oil and gas industry through the transition?

First of all, oil and gas companies have both the capital and the know-how to move into new energy businesses – and we will need this expertise.

Second, even though low carbon energy sources should become dominant by 2050, the world will still need low-emissions hydrocarbon resources to satisfy certain industrial requirements and to meet various specialized needs, even in 2050 and beyond.

Third, renewable and alternative fuels will be required in the transition and the existing oil and gas firms are best placed to develop a second growth engine based on these technologies.

Fourth, there is much potential for hydrogen to become an important fuel and storage medium and oil, gas, and pipeline firms have the expertise and infrastructure to help create a hydrogen economy.

Starving these firms of capital will only make the transition more difficult, longer, and costlier for Canada.

Canadian competitiveness

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 2018a).

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 CO2eq) 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 and appease 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 CO2e 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 CO2e 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). The government of Alberta expects emissions intensity to continue to fall by 16 to 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 mega-

tonnes (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.

The Canadian Association of Petroleum Producers (CAPP) has asked the federal government to pay for 75 percent of the several billion dollar cost of CCUS facilities through a tax credit. Negotiations will need to balance the federal government's commitment to the Paris Agreement and other domestic emissions targets, which the net zero pathway would support significantly, while avoiding criticism that efforts that help the oil and gas sector to reduce emissions is still a fossil fuel subsidy. The result may reveal whether popular sentiment is more committed to reducing GHG emissions or punishing high emitters.

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 US$30 per barrel. Saudi Arabia and other gulf producers do have lower production costs – as low as US$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).

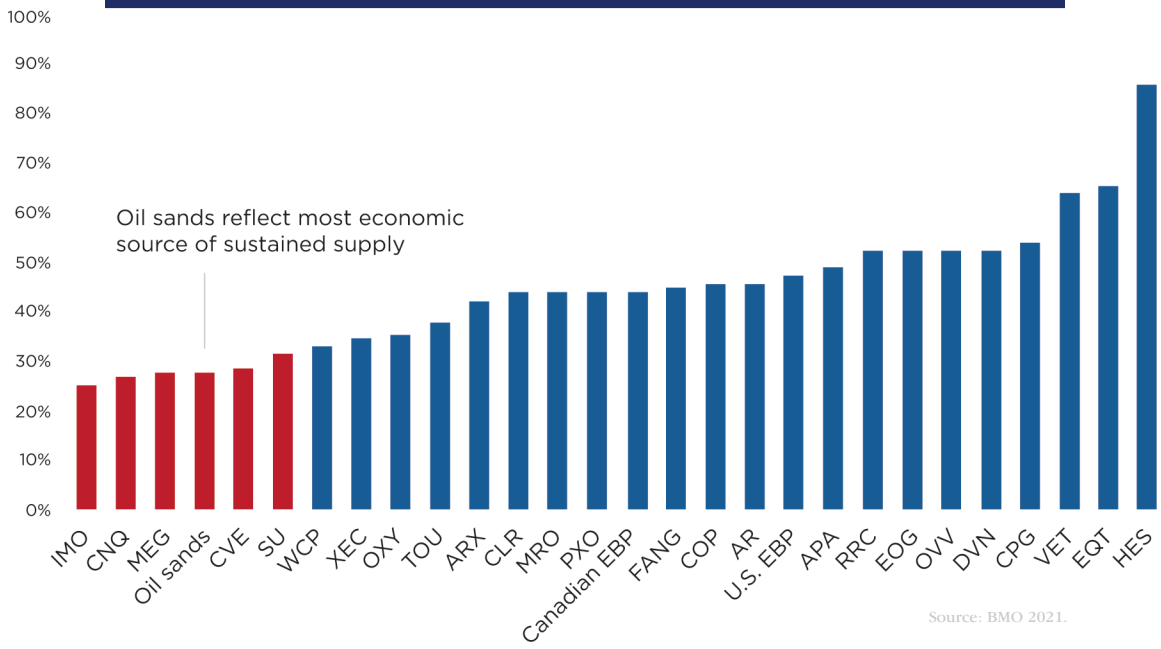
That said, the oil sands have cut costs dramatically in the past seven years. The 2008-2014 cycle saw oil hold steady at around US$100/bbl, and as such there was less imperative for cost cutting. However, the lean years since then have made most Canadian oil and gas companies intensely focused on cost-saving 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 to 20 percent per year, the de-

cline 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 (the pace at which production is expected to decline over the lifetime of the asset) and increasing takeaway capacity out of Canada from the Line 3 and soon TMX pipelines, Canadian oil sands producers are lined up for maximum free cash flow. As Figure 8 demonstrates, oil sands producers have the lowest sustaining capital expenditures (the replacement capital expenditures necessary to maintain existing capacity), amongst their peers. 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.

FIGURE 8: SUSTAINING CAPITAL RATIO OF NORTH AMERICAN OIL COMPANIES



Source: BMO 2021.

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 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 (WCS) and the benchmark price for crudes (Brent and West Texas Intermediate).

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

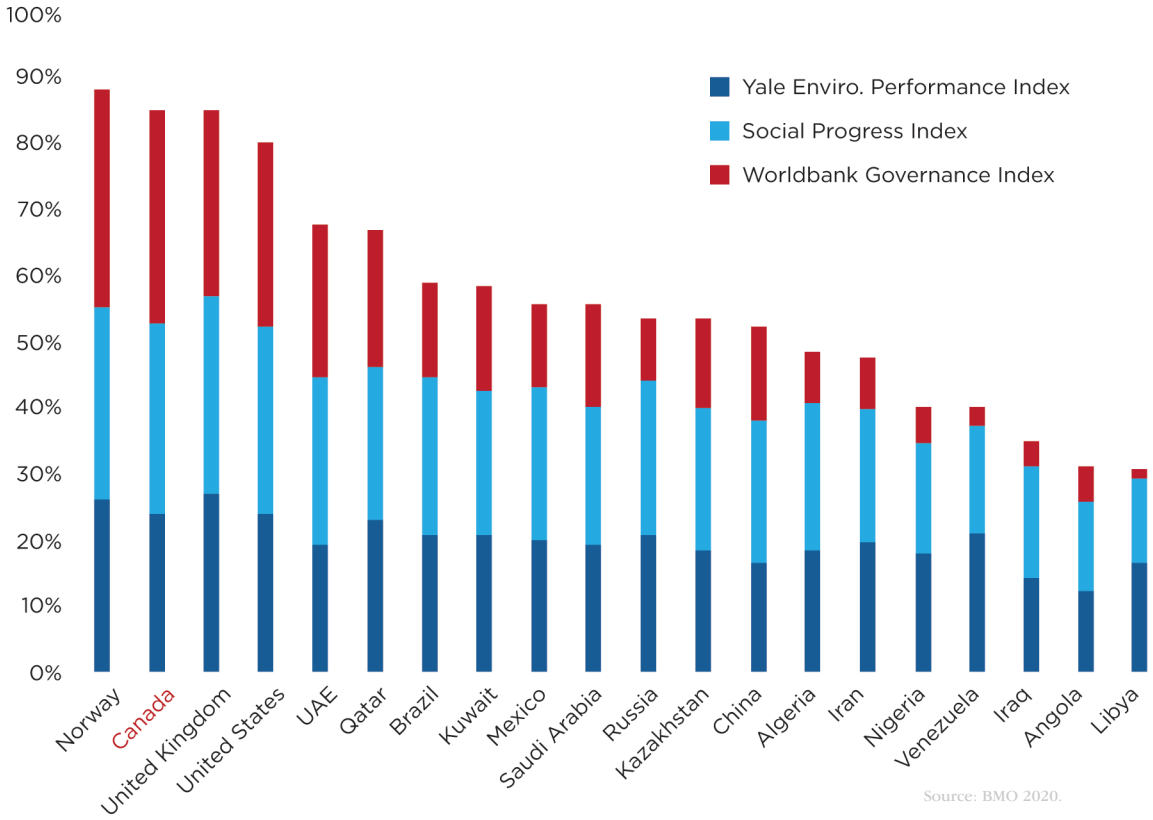
When combining environmental, social, and governance performance, Canada does even better, again coming behind only Norway. Amongst those with the largest proven reserves – i.e., those that will be supplying oil after peak demand, in the decades to come – Canada ranks first (see Figure 9).

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. Two questions arise. First, why would activists and investors dismiss other ESG metrics in their characterization of oil sands as uniquely problematic? And second, why wouldn't the current federal government support the oil sands to reduce their emissions as quickly as possible, for example through CCUS tax credits on enhanced oil recovery, and use a carrot rather than a stick approach to reducing GHGs from Canada's oil sector?

FIGURE 9: CANADA'S GLOBAL RANKING IN 2020 ON ENVIRONMENTAL, SOCIAL, AND GOVERNANCE (ESG) PERFORMANCE



Source: BMO 2020.

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 2021. 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 have 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 one, LNG Canada in Kitimat, is under construction, with another, Woodfibre LNG in Squamish, expected to begin construction in the first quarter of 2022. 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 2390 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 LNG from BC 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-CO2 composition of natural gas from BC's Montney Formation, widespread electrification of upstream operations like drilling and processing, and the use of green power from the province's hydro-driven electrical grid. While the global emissions average is 0.26 to 0.35 tonnes of CO2 equivalent per tonne of LNG produced, LNG Canada in Kitimat is being designed for 0.15 tonnes of CO2 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 CO2 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.

International production comparison

Contrary to the popular narrative, the "big oil" companies (i.e., the majors) 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 so-called "majors"[13] controlled only between 12 and 15 percent of oil and gas reserves and production with independent producers making up the rest (see Table 7.).

Many of these NOCs are under the influence of authoritarian regimes with weak environmental, social, and governance practices including countries such as Russia, China, Iran, and Venezuela. Most OPEC countries lie in the Middle East. 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 7: 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.

Tables 8 and 9 show proven reserves, production, and ESG performance for the top 10 oil and gas supplier countries in the world. Countries are ranked in terms of the size of proven reserves and also on the basis of their performance on an index of environmental, social, and governance indicators.

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 com-

pletely 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.

TABLE 8: OIL RESERVES, PRODUCTION, AND ESG INDEX (2020)

		Reserves		Production		ESG Performance	
Rank (reserves)	Country	Proven Reserves (billion barrels)	Share of total (%)	Production ('000 bpd)	Share of total (%)	ESG index	Rank
1	Venezuela	303.8	17.5	540	0.6	48.2	8
2	Saudi Arabia	297.5	17.2	11039	12.5	59.5	6
3	**Canada**	**168.1**	**9.7**	**5135**	**5.8**	**75.8**	**1**
4	Iran	157.8	9.1	3084	3.5	57.3	7
5	Iraq	145.0	8.4	4114	4.7	46.0	9
6	Russia	107.8	6.2	10667	12.1	65.9	4
7	Kuwait	101.5	5.9	2686	3.0	60.7	5
8	UAE	97.8	5.6	3657	4.1	68.6	3
9	United States	68.8	4.0	16476	18.6	75.4	2
10	Libya	48.4	2.8	390	0.4	N/A	N/A
	World	**1732.4**	**-**	**88391**	**-**	**-**	**-**

Sources: Reserves and production figures: BP (2021). ESG Index: Heath and Foyer (2020) with data from Yale (Environmental Performance Index), Bertelsmann Stiftung (Sustainable Development Goals Index) and World Bank (World Development Indicators)

TABLE 9: GAS RESERVES, PRODUCTION, AND ESG INDEX (2020)

		Reserves		Production		ESG Performance	
Rank (reserves)	Country	Proven Reserves (Tcf)	Share of total (%)	Production (Bcf)	Share of total (%)	ESG index	Rank
1	Russia	1320.5	19.9	61.61	16.6	65.9	5
2	Iran	1133.6	17.1	24.2	6.5	57.3	8
3	Qatar	871.1	13.1	16.53	4.4	55.5	9
4	United States	445.6	6.7	88.25	23.7	75.4	4
5	China	296.6	4.5	18.72	5.0	61.8	6
6	Saudi Arabia	212.6	3.2	10.82	2.9	59.5	7
7	Australia	84.4	1.3	13.75	3.7	76.3	2
8	**Canada**	**83.1**	**1.3**	**15.94**	**4.3**	**75.8**	**3**
9	Algeria	80.5	1.2	7.86	2.1	53.8	10
10	Norway	50.5	0.8	10.75	2.9	80.5	1
	World	**6641.8**	**-**	**371.83**	**-**	**-**	**-**

Sources: Reserves and production figures: BP (2021). ESG Index: Heath and Foyer (2020) with data from Yale (Environmental Performance Index), Bertelsmann Stiftung (Sustainable Development Goals Index) and World Bank (World Development Indicators)

In short, the results show that over the transition period to 2050, 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 20th 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, Hall, Balogh, 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, Hall, Balogh, 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

Few Canadians recall the 1970s energy crisis. It 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 20th and early 21st 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 looming energy security crisis

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. We have pursued supply constraining rather than demand constraining strategies to address the climate crisis and the result is an energy shock.

The head of the IEA, Fatih Birol, stated in May 2021 that "The pathway to net zero is narrow but still achievable. If we want to reach net zero by 2050 we do not need any more investments in new oil, gas, and coal projects" (Chestney 2021). Notwithstanding these comments, demand for these fuels has been increasing along with sharp price increases, particularly as economies recover from the lockdowns. As we have seen, simply curtailing investment in oil and gas creates supply shortages with limited impact on demand. These facts demonstrate that 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.

Today, we are seeing and experiencing threats to global energy security. Rising natural gas prices have European governments warning their citizens of blackouts and factories are being forced to shut down. Germany has shut down its nuclear power plants and ramped up wind and solar, and is now are forced to keep coal power plants open and buy nuclear power from France. In China, a stronger than expected post-COVID economic recovery has resulted in a sharp increase in demand, including for fossil fuels. Coal-fired power plants that had been shut down had to be started up again, even as China had cut off coal imports from Australia. Russia continues to threaten Ukraine over gas supplies. Ironically, even as President Biden attended the COP26 climate summit in Glasgow, he was asking OPEC to increase oil production and recently announced the planned release of millions of barrels from the US strategic reserves in coordination with several other countries in order to bring prices down.

There is an important relationship between energy, security, and climate. The reality is that the energy transition will proceed in different ways and at different speeds in various countries, depending on their unique circumstances. Developing countries such as India and even China have said they will continue to rely on fossil fuels to preserve energy affordability and bring more of their people out of poverty, even as they continue to expand renewable power.

In terms of security, energy is subject to politicization and manipulation. Most OPEC countries diverge from Canada on human rights, democracy, and support for religious extremists. Under the IEA scenarios, future oil and gas supplies will become increasingly concentrated among a small number of OPEC members and Russia. This increasing concentration could have serious negative consequences for energy security, including increased risk from political unrest in producing countries, less cooperation from NOCs on sharing emergency reserves, and a smaller spot market that could dilute market liquidity during shortages or supply shocks (Lynch 2021).

With the growth in renewables and increasing electrification, the concept of energy security is changing as the energy system evolves through the transition. 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 and perhaps even disappear.

However, what many people forget is that 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. Energy security is

shifting to focus on these areas, as well as the supply chains for critical minerals that are vital inputs to these technologies. In short, the energy transition will have many geopolitical implications and will reshape international energy relations. In the years ahead, 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.

This all means that we can expect the different approaches and policies undertaken in different countries to cause trade tensions with some countries or blocs implementing border restrictions on goods based on their emissions, provoking retaliation in some cases.

In the short- to medium-term, however, oil and gas will remain in demand and therefore supply and affordability will remain of key concern to energy security, even as the energy transition proceeds. Hydrocarbon production will likely become increasingly concentrated in only a few countries – many of which are authoritarian regimes. This is of great concern to countries such as China, Japan, South Korea, Germany, and others that are still heavily dependent on imports of fossil fuels and feel the effects of shortages and price shocks acutely.

Given that key allies and partners in the Asia-Pacific will require oil, gas, and other fuels to maintain their energy security over the next 30 years or so, it is incumbent on Canada to provide them with a safe, reliable, and stable alternative to the increasing concentration of hydrocarbon that is being supplied by authoritarian petro-states and regimes in unstable parts of the world. If we do not, the market power of those authoritarian petro-states could potentially allow them to use their oil and gas supplies as tools of geopolitical leverage. This is not a theoretical argument – it is occurring today. To preserve and maintain global energy security, the only responsible course is to use our resource endowments to dilute the influence of these regimes and provide assurances to our partners and allies.

This is why it is so important for Canada, as one of the largest free market sources of global energy resources not controlled by state-owned enterprises and with high environmental, social, and governance standards, to contribute to global energy security by supplying our allies and partners with the energy resources they will need over the course of the transition. While we continue to reduce emissions in the oil and gas sector and improve our own environmental performance, Canada should also leverage its emerging position as a stable, reliable, and environmentally responsible supplier as we move through the energy transition.

Are there free market alternatives if Canada abdicates its role in supplying oil? With LNG, Canada's absence has become an opportunity for Australia and the

US to become significant suppliers. And American shale has provided an effective counterweight to OPEC in the past decade. But there are good reasons to think that key oil sources may change heading to 2030, and that Canada's role could become more critical. That's because US shale is characterized by steep decline rates and variable reservoir quality. At best, US production will follow a stable decline. But it can no longer pick up the slack in global markets (Eaton 2022). Canada's enormous reserves could.

And that is why the IEA's Fatih Birol, on the occasion of the launch of its country report on Canada in January 2022, asserted that "We will still need oil and gas for years to come… I prefer that oil is produced by countries… like Canada who want to reduce the emissions of oil and gas" (Rabson 2022).

Europe's impending energy conflicts

It is well worth pointing out the security implications of relinquishing a larger and larger share of global oil and gas production; the primary one is that it gives those who control the market incredible leverage. We are already seeing that today with the European energy crisis. Europe gets up to 40 percent of its natural gas from Russia, with many individual countries relying even more heavily on it. A combination of post-pandemic global LNG demand, low storage after last year's harsh winter, and a shift to renewables that has left it exposed to gaps in energy supply have driven natural gas prices to record highs.

Russia's dependence on Ukraine as a transit hub for its gas exports had seemingly acted as a deterrent to Russian aggression. But, at the time of writing, a massive movement of Russian troops, equipment, and artillery to the Ukraine border had exploded into an open invasion.

The United States had previously expressed security concerns with Germany and Europe becoming too reliant on Russian gas imports, though it also had a competing interest as a major LNG exporter to European markets. The geopolitical situation has evolved very quickly and there are now significant efforts to reduce both Western investments in Russian oil and gas and European dependence on it.

It is imperative that countries worldwide treat energy supply security issues with the appropriate seriousness that they deserve. While accepting that the climate crisis is real and urgent, there are nearer-term risks to human life and well-being if we don't have reliable and affordable energy systems in place. Leaving global energy security in the hands of Russia and OPEC is a huge and unacceptable risk.

As we make the transition to become more dependent on electricity and battery storage in lieu of fossil fuels, new energy security considerations arise. Currently China has a monopoly in producing and processing rare earth el-

ements (REE), critical components in many high-tech devices, and it is the dominant global processor of lithium, cobalt, nickel, and copper (IEA 2021d). 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.

A responsible transition: Balancing competing goals

No serious commentators argue that the world does not need to address climate change. The real debate is over how to do it, the timeframe, and the trade-offs that will be necessary.

The reality is that, even in the unlikely event that all countries immediately implement all the plans and policies they agreed to at COP26 and previous climate summits, the chances of effecting the scale of changes required in the global energy system to meet the 1.5°C target over the next 30 years is vanishingly close to zero, as many pragmatic scientists and analysts have admitted. It will be incredibly daunting to meet the 2.0°C target. The science says that greenhouse gasses already accumulated in the atmosphere mean that climate change is now locked in, likely for decades. While this is a depressing thought, we think it is a much more honest and realistic appraisal of the pathway we are on than sustaining the delusion that if all oil and gas production were to be immediately stopped, the world would be able to meet its climate objectives and avoid catastrophe. You only have to look at the current energy crisis to realize that such drastic measures would lead to economic disaster, followed by social upheaval. And the result would set back climate change efforts for years, making the consequences even worse.

While the world wrestles with multiple challenges including poverty, refugees, inflation, rising housing costs, health care and other social needs, climate change policies must contend for scarce public funds and political attention from policy-makers. Climate solutions might appear obvious and efficient from the point of view of an activist or a scientist but be politically and/or economically unfeasible or ethically unacceptable. Despite the rhetoric surrounding the climate change issue, climate is not the only policy priority facing societies and political leaders. Societies must balance the costs and reg-

ulatory burdens of climate policies with economic growth, tax policy, social policy, and other urgent issues. To expect that societies will deal with climate change at any cost and at the expense of other urgent needs and issues is both naive and even irresponsible.

Canadians often forget that the situation that people in developing countries face is much different than what we face in Canada. Many emerging market and developing economies continue to encounter public health challenges resulting from COVID-19. The pandemic has slowed efforts to improve access to electricity and clean cooking fuels. There is a lack of financial and other resources to aid in the recovery and capital remains as much as seven times more expensive than in advanced economies. Yet these regions are just entering a phase of rapid economic development that will drive energy demand as countries seek to bring millions of people out of poverty. Energy demand is expected to increase by almost 2 percent annually through to 2030[14] as billions of people in countries like India will want access to affordable power for lighting, heating, and cooking, and to purchase refrigerators, air conditioners, and other consumer goods that we in the West currently take for granted. While every effort should be made by wealthy countries to provide assistance to developing countries to build clean energy infrastructure, coal and natural gas infrastructure is already in place or being built and energy affordability will remain a paramount concern. Thus, these countries will continue to rely on fossil fuels for many years to come.

A responsible transition to low- or zero-emission energy recognizes that every country has unique circumstances and challenges and that the transition will not proceed in the same way or at the same pace in every region. Different countries will have different priorities, timelines, and compromises to make. We must do all we reasonably can to mitigate and adapt to climate change while at the same time balance the economic and social need for reliable and affordable energy. A responsible transition therefore requires making trade-offs among competing issues so society as a whole can move forward.

Conclusion

No responsible transition can be achieved unless climate change goals are balanced with economic and energy security considerations.

The current public discourse is dominated by shrill calls to meet ever-increasing climate goals, egged on by disingenuous politicians and a media culture focused on attracting attention by highlighting the most headline-grabbing issues. Under these circumstances, it is increasingly difficult to have a balanced and reasoned discussion.

In addition to climate change, governments and publics are faced with competing needs to provide adequate housing, improve mental health services, eliminate energy poverty, meet increasing health care needs, assist those living under the poverty line, and tackle homelessness, all while maintaining public infrastructure, schools, military, and other social needs. The point is that climate change action cannot be so onerous that it crowds out efforts aimed at addressing other worthy needs. Climate must be balanced with economic, social, and energy security requirements so as to maintain public support and economic sustainability. This necessarily means that the world may not be able to meet the ever-increasing climate action demands of some advocacy groups on the timelines they expect.

Of course, this does not mean we should give up on dealing with climate change. Strong efforts to mitigate GHG emissions must continue. However, the reality is that in the face of the infeasibility of taking such drastic measures that economies would be devastated and governments starved from funding other pressing social needs, the world must put more emphasis on adaptation to the long-term inevitability of a changing climate.

In short, we need to cut emissions and increase clean energy sources, as well as draw from existing hydrocarbon sources for as long as necessary to maintain a stable, affordable energy supply over the transition period.

We believe that the most successful approach will be where markets decide on the most appropriate energy sources and technologies based on their price and availability, where trade agreements continue to allow for the global movement of energy products, and where voters and consumers are the primary deciders in choosing the appropriate pathways to reaching our energy and climate goals.

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.

The case for Canadian oil and gas exports is strong and can be summarized as follows:

The global demand for oil is expected to plateau and then begin slowly falling sometime in the next decade (although such predictions are notoriously

difficult to get right). However, due to shareholder and environmental activist pressures, investment in upstream oil exploration and development by the energy majors is falling, and the high decline and depletion rates in shale oil production in the US means that the global oil supply is likely to fall faster than demand. Meanwhile, stranding energy resources in North America, Europe, and elsewhere means that fossil fuel market power will become increasingly concentrated in OPEC and authoritarian regimes and their NOCs. This creates a real risk of energy being used a political tool of coercion and that supply and price shocks could increase in the coming years.

There is enormous existing investment in pipelines, power plants, and petrochemical facilities that many countries want to use until their useful operating life is complete. It is clear from COP26 that efforts to phase out coal in the developing world is not currently acceptable because these countries are prioritizing economic development and therefore will continue to rely on existing infrastructure to sustain economies and maintain affordability.

Asia is still fast-growing, and alongside Africa comprises most of the forecasted global population growth. Energy demand is thus growing at a similar pace, and countries there will rely on oil and gas to sustain economic growth over the coming decades, even as they invest in clean energy technologies. Asian refiners have made large investments in upgrading their facilities to process heavy grades of crude, which includes Canadian heavy crude from the oil sands.

The need for oil for transportation and particularly for petrochemical feedstocks will remain significant over the transition period because it will take decades to fully transition to non-emitting transportation methods and there are few substitutes for oil when it comes to certain industrial and chemical processes. Likewise, natural gas is seen as an important bridging fuel during the transition and essential to balancing electricity grids in a world with increasing electricity generation from intermittent renewables such as wind and solar.

Turning to the supply side, Canada will soon be well positioned to contribute meaningfully to global energy security and the energy security of key partners and allies in Asia-Pacific and elsewhere. Once complete, the TMX pipeline expansion will allow Canada to ship heavy oil from oil sands facilities that have very low depletion rates and low break-even points to buyers in Asia who increasingly have the capability to refine heavy crudes.

Canada has significant geopolitical advantages in shipping to Asia. Canada's west coast terminals are closer to Asia than other major shipping ports in North America, lowering shipping costs. Second, in a world that is increasingly contentious, the sea lanes between Canada's west cost and Northeast Asia are uncontested and safe, unlike the contested sea lanes of the South China

Sea where Middle Eastern crude shipments must pass. All these advantages add up to enhanced energy security for countries like Japan, South Korea, Taiwan, and others that would be customers for Canadian crude oil and natural gas.

As ESG standards continue to gain traction and countries pay more attention to these factors in global trade, the ESG case for Canadian hydrocarbons is strong. As we have shown, among the top 10 countries ranked by oil reserves and production, Canada and the US are the only countries where oil is not owned and controlled by state-owned enterprises or dominated by autocratic regimes. In fact, Canada is ranked number one in terms of ESG performance amongst the major oil producing countries. For natural gas, Canada is ranked eighth in the world for reserves and ranks third on ESG performance, far higher than competitors such as Russia and Iran.

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.

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Endnotes

1 There is no universally accepted definition of "low carbon energy" or "low carbon electricity."

2 BP reports that their Rapid scenario is "in line with the median IPCC scenario. Within that, the use of CCUS [carbon capture, utilization, and storage technology] in Rapid is broadly in the middle of the spread of external outlooks, although below the bottom of the range of IPCC scenarios which embody a stronger view of the potential role of CCUS" (BP 2020, 143).

3 Primary energy consumption measures total domestic energy demand, while final energy consumption refers to what end users actually consume. The difference relates mainly to what the energy sector needs itself and to transformation and distribution losses.

4 We would expect that in a net-zero emissions scenario, virtually all of this production would incorporate emissions abatement technologies such as carbon capture and storage.

5 This report uses the term "Indo-Pacific" to include the countries of the Asia-Pacific as well as India, Pakistan, and Bangladesh.

6 This includes scenario forecasts from the IEA, EIA, BP, and Enerdata.

7 Based on the "Enerblue" scenario, which assumes the successful implementation of all nationally determined contributions submitted by countries at the 2015 Paris Climate Change Conference (Enerdata Undated).

8 Figures from the Global Carbon Project and Rincon (2021).

9 The objective of the Paris Agreement is "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels."

10 During the Leaders Summit on Climate, Prime Minister Justin Trudeau announced that Canada will enhance its "emissions reduction target under the Paris Agreement – known as a Nationally Determined Contribution (NDC) – to 40-45% below 2005 levels, by 2030" (Canada, Office of the Prime Minister 2021).

11 Canada's current price on carbon is $40 per tonne and will gradually rise to $170 per tonne by 2030.

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

13 The majors are seven large integrated oil and gas companies that have an outsized influence on industry practices and direction.

14 Under the IEA's STEPS and APS scenarios.

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>
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