



**Asia-Pacific
Economic Cooperation**

The impact of COVID-19 on oil and gas security

APEC Oil and Gas Security Studies

Series 18

APEC Energy Working Group

April 2022

EWG 01 2020S

Produced by

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APEC#222-RE-01.3.

ISBN 978-981-18-4295-5.

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FOREWORD

COVID-19 brought unique challenges to all aspects of our lives over the past 18 months. The pandemic changed how we live, work, and socialise, resulting in unprecedented impacts to member economies. Because oil and gas play an essential role in our current social and economic activities, the pandemic is also affecting oil and gas markets.

This report is based on analysis begun in early 2021 to research the impacts of the pandemic on oil and gas security in the APEC region. Some of the largest impacts to global energy supply and demand occurred in the APEC region, and the persistence of the pandemic means that the long-term effects remain uncertain. Prior to the pandemic, oil and gas markets were experiencing changing dynamics and challenges, and COVID-19 brought new challenges to oil and gas security and the resiliency of the APEC energy system. As the largest oil and gas consuming region in the world, APEC economies need to understand these dynamics to better prepare for their energy futures. This study examines the changes to oil and gas markets brought on by the COVID-19 pandemic and provides insights and implications for APEC economies as they adapt their energy policies to a post-pandemic world.

I very much hope our Oil and Gas Security Studies (OGSS) series will continue to provide useful information to help APEC economies better address oil and gas security issues. We will continue to work closely with governments and other stakeholders to support your efforts in ensure an affordable and secure energy future.



Kazutomo IRIE

President

Asia Pacific Energy Research Centre

April 2022

ACKNOWLEDGEMENTS

This report was made possible by the collaboration of the Asia Pacific Energy Research Centre (APERC) through the discussion and collaboration of the people named below.

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EXECUTIVE SUMMARY

COVID-19 caused an unprecedented drop in oil consumption and a substantial drop in natural gas consumption. During the onset of the pandemic, mobility restrictions and a general fear of the virus brought global oil demand down a quarter in April 2020. The price shock caused by this decline was exacerbated by a coinciding Saudi-Russia price war that caused oil prices to fall briefly below zero on financial markets. While the initial impacts were significant, recent data suggests that the COVID-19 impact on oil and gas demand will be temporary. Oil demand is reverting close to pre-pandemic levels, and could surpass it in 2022, while APEC gas demand is already surpassing 2019 levels. Meanwhile, the supply impacts of COVID-19 appear against a backdrop of falling oil and gas investment trends that predate the pandemic. As the largest oil and gas importing region in the world, it is important to understand the changing dynamics in oil and gas markets following the COVID-19 pandemic and the implications for oil and gas supply security.

In gas markets, rising LNG prices reflect the potential that supply or logistical challenges may threaten the reliability of the northeast Asian energy system this winter. The primary energy security issues facing oil markets are high and volatile prices as North American loses market share relative to Middle East oil exporters. Higher prices for both oil and gas will hinder the effectiveness of pandemic recovery packages through higher energy costs for energy importers. This report examines the implications of these developments for oil and gas security in the APEC region.

The report has six sections. The first section describes the scope of the study and provides a definition of oil and gas supply security. The second section details how the pandemic affected oil and gas demand through reduced economic activity and government-imposed mobility restrictions. The third section discusses the impact of COVID-19 on oil and gas supplies along with other factors that reduced supplies, including an investment climate that favors investor remuneration over supply growth, and the impact of COVID-19 on the development of LNG infrastructure. The fourth section analyses how COVID-19 recovery spending can improve APEC oil and gas security by illustrating the fiscal capacity of APEC members, tracing energy-related fiscal spending by sector, and drawing lessons from the energy sector impacts of government spending following the Great Financial Crisis. The fifth section builds on the conclusions of the preceding three sections to highlight the potential for future oil and gas disruptions in the APEC region and concludes with a call to resist energy subsidies as a solution to potential crises. The final section details 12 recommendations to minimise the vulnerabilities of oil and gas supply in APEC. The key findings and implications of the report are summarised below.

COVID-19 caused an unprecedented, but temporary drop in oil consumption. APEC oil demand is reverting close to 2019 levels and should surpass them in the short-term.

The COVID-19 pandemic was significantly disruptive for oil demand, causing a 20% APEC-wide demand drop during its onset. However, despite rolling lockdowns throughout the globe, consumption is rebounding, currently sitting at 10% below 2019 levels. Oil demand is already growing past pre-virus levels in some economies, and by 2022, aggregate APEC oil demand should surpass 2019 volumes. Over the next five years, oil demand will grow around 5%. However, the state of the pandemic introduces uncertainty into this demand recovery and growth trajectory. The evolution of the virus, the ability of governments to contain the spread of the virus in a timely manner and the pace of inoculations could all

affect mobility restrictions, both around the globe and within individual economies, and in turn, reduce oil demand. While there is potential for the COVID-19 pandemic to alter the economy and the amount of oil APEC economies use, the aggregate impact on the role oil plays in APEC economies appears to be temporary.

The fall in natural gas demand in early 2020 is temporary and partly due to warmer weather. APEC gas demand is already setting records and will continue to grow.

APEC-wide gas consumption fell 4% during the onset of the pandemic, but it is difficult to tease out how much of this impact is attributable to COVID-19. Most demand impacts in early 2020 were due to warmer weather. Demand surpassed 2019 levels in June 2020, and is currently surging, sitting 14% above the pre-pandemic benchmark. APERC expects demand to grow 14% over the next five years, which will require over 40% more LNG imports into the region. There are uncertainties to this demand trajectory, including the weather, any potential policy changes and the emergence of a significantly tight and globally competitive natural gas market in 2021. However, any impact of COVID-19 on gas use appears transitory, and the fundamentals that drove APEC demand growth prior to the pandemic will continue into the medium term.

COVID-19 is exacerbating the supply dampening effects of previously existing oil and gas investment trends.

APEC supply is largely determined by the actions of OPEC+ and investors in the North American market. The low profitability of publicly traded oil and gas producers over the past decade led to stricter debt provisions and shifting expectations of equity owners, which is increasing the industry's cost of capital and limiting its ability to fund supply growth. Even in the face of higher oil and gas prices, investors are prioritising the improvement of balance sheets and the diversion of cashflows to remuneration. Oil and gas equities are now income-generating assets. The low prices emanating from the demand shock of COVID-19 and the Saudi-Russia price war accelerated this trend. These constraints are binding oil production below pre-pandemic levels in some economies and could limit both oil and gas supply growth over the medium term. While COVID-19 is accelerating decline rates of oil producers in some economies due to labour restrictions, APEC supply is more so determined by the actions of OPEC+ and investors in the North American market. However, this could change if the pandemic persists.

With demand surging and supply constraints binding, energy security events are becoming increasingly likely, and are already occurring.

The unexpected and dramatic reductions in oil and gas consumption caused by COVID-19 drove oil and gas prices to very low levels. Lower prices and uncertainty about when demand would return dampened investment in the oil and gas sector. As a result of these circumstances, the oil and gas sectors are not able to respond adequately to the return of oil and gas demand. This temporary imbalance between demand and supply has made oil and gas prices more volatile and has increased the likelihood of oil and gas supply disruptions. We are already seeing examples of this. Although the price volatility and temporary disruptions were not caused solely by the pandemic, the uncertainty about future oil and gas demand created by the pandemic has been one of the causal factors.

The affordability of supply is already being challenged, as illustrated by exorbitant price increases in LNG

this summer and the rise of oil prices over 75 USD per barrel. The likelihood of disruptions is also increasing. Several gas security crises this year illustrate this. For oil markets, the supply constraints binding North American producers are shifting the nexus of the marginal producer out of APEC and into less stable regions, increasing the risk of availability disruptions. Furthermore, supply and logistical disruptions are being exacerbated by the rising frequency of extreme weather events. Hurricanes in the Gulf of Mexico this summer are exacerbating the erosion of global oil inventories and extremely cold winters are challenging the delivery of gas to end-users when it is needed the most, as illustrated by the northeast Asian LNG shortage and the Texas Big Freeze.

Reducing the impact of a potential supply shock to the pandemic recovery is paramount. One way to do this is reducing import dependence. One action APEC economies could take is targeting their COVID-19 recovery packages towards reducing oil and gas demand. Government support for emerging technologies following the 2007 – 2009 recession encouraged their adoption over the past decade. Targeting emerging low-carbon technologies and energy efficiency gains could help reduce import dependence in the mid- to long-term.

While APEC government support is helping oil and gas suppliers endure the pandemic, it is not increasing oil and gas supply nor is it improving energy security.

Government support has been instrumental in enabling business across APEC to endure the significant economic consequences of the pandemic, as mobility restrictions and virus fears reduced revenues across all sectors. This includes oil and gas suppliers. While many bankruptcies did destroy some oil and gas supply, much of this occurred in the US shale sector, where financial trends were already starting to bind supply prior to the pandemic.

However, this fiscal response will do little to grow APEC oil and gas supply or enhance energy security as currently constructed. Much of the fiscal funding is supporting energy consumers, such as the aviation sector. A little over 5% is funding oil and gas supply, and most of that is financing the remuneration of debtors, equity holders and executives of companies and not the capital expenditures necessary to grow oil and gas supply.

Furthermore, little pandemic spending is going towards the tried-and-true measures that can mitigate the impacts of oil and gas disruptions. A survey of the debt-to-GDP ratios of APEC member economies suggests that there is fiscal capacity to take on debt to finance initiatives that can mitigate the impacts of oil and gas disruptions in the APEC region. Rapidly growing APEC economies, that are or could become significant oil, gas, and petroleum product importers, are generally in a better position to do this than developed economies and large oil and gas suppliers. Utilising this fiscal firepower to invest in energy security, such as investing in the storage and distribution facilities required to establish a Strategic Petroleum Reserves (SPR), would help mitigate the impacts of future supply disruptions.

The tried-and-true methods are key to improving APEC oil supply security.

With oil inventories dwindling as unplanned outages constrain offshore oil supply and refinery production in the US Gulf of Mexico, the potential for an oil security event is rising. The usual measures of increasing oil stockpiles and building SPRs remain the surest way to reduce the impact of an oil supply disruptions in the future. China did both in 2020, increasing stockpiles by 30% and structurally expanding its SPR capacity, together bringing its inventories to cover over 100 days of net imports.

However, due to the large upfront capital costs and significant maintenance and operating requirements, SPRs remain an elusive solution for many economies.

Leasing space or ticketing from existing SPRs remain viable alternatives to building SPRs. Australia did this at the start of the pandemic, taking advantage of extremely low prices to secure a leasing agreement with the US SPR for a volume of oil representing two to five days of Australian oil consumption. Leasing out space is a good way to reduce the large financing costs of SPRs. Mandating commercial coverage for significant oil-using facilities is another solution.

The COVID-19 pandemic provided a unique opportunity to increase oil stockpiles and storage capacity. While inventories certainly increased across APEC during the pandemic, much of the commercial inventories are back to pre-pandemic levels. Further investment and purchasing will be necessary to mitigate the impacts of a potential oil security shock in the future.

LNG reloading is an emerging tool to reduce the impacts of LNG disruptions.

While LNG re-exports are not new to the APEC region, APEC Asian LNG importers are increasingly implementing LNG re-loading capabilities to capitalise on arbitrage opportunities and alleviate the impact of LNG shortages for other importers during peak periods. Thailand's first LNG re-export during the northeast Asian LNG shortage was instrumental in avoiding an LNG crisis last winter. The low LNG utilisation rate of regasification terminals by APEC LNG importers suggests room for further LNG re-loading in APEC's future.

APEC LNG importers should examine the LNG re-loading potential at their existing regasification facilities and consider implementing re-loading capacity to its utmost potential and push to ensure that all future LNG regasification terminals are engineered to re-load LNG. The buildout of LNG re-loading can be encouraged by removing restrictive price restrictions in their economies and looking for collaborative financing opportunities across APEC members. Stockpiling LNG during low-demand periods will also benefit LNG exporters through higher utilisation of their export terminals.

Shortcomings in APEC's gas supply chain are undermining its ability to deliver supply to consumers during peak periods, which is paramount for gas security.

While APEC gas supply is growing in aggregate to meet rising demand, the gas supply chain is sometimes unable to effect timely delivery of gas to consumers when it is needed most. Extreme weather events exacerbate the infrastructure challenge. The Texas Deep Freeze in February 2021 demonstrates that the winterisation of the US gas supply chain would increase the reliability of APEC's gas supply going forward. While the summer months are typically reserved for routine maintenance in the Pacific basin LNG market, unplanned outages stemming from tropical storms and other issues are limiting gas supply during this most competitive storage injection season in LNG's history. To minimize markets impacts of future storage build seasons, APEC LNG exporters should evaluate the feasibility of APEC LNG exporters coordinating their outage and summer maintenance schedules.

SECTION 1. INTRODUCTION

1-1 Objective and scope of this study

The coronavirus 2019 (COVID-19) pandemic severely disrupted oil and gas markets globally and in the APEC region. In response, APERC prepared this study of the impact of COVID-19 on oil and gas supply security in the APEC economies as one of the Oil and Gas Security Studies (OGSS). This report analyses the likely effects of the pandemic and associated government responses on oil and gas demand and supply and the security of those supplies. The report also identifies both individual and collective actions that can reduce the likelihood and severity of potential future oil and gas supply disruptions.

While energy security more broadly includes other forms of energy and the critical minerals for producing renewable technologies, this study is focused only on oil and gas supply security because the mandate of the OGSS is limited to oil and gas. This study includes consideration of oil and gas supplies used to produce electricity, such as LNG or diesel consumed in the power sector but does not address electricity security and power grid reliability. For the remainder of this report the terms “energy security” and “oil and gas supply security” will be used interchangeably.

While the COVID-19 pandemic is, by definition, a global event, this report will focus primarily on the energy security impacts on the APEC region. Because oil and gas markets are global in nature, and discussions of oil and gas security involve energy sources from economies outside the APEC region, this analysis could cover non-APEC economies. Nevertheless, the oil and gas developments in other regions will be discussed only to the extent they affect APEC energy security.

Finally, this paper will not evaluate government policies and actions taken to contain the COVID-19 pandemic or discuss trade-offs between the health of the population and the health of the economy. It will instead focus on the impacts of those policies and actions on oil and gas markets and supply security using positive analysis.

1-2 Definition of energy security

Oil and gas supply disruptions can impose large economic and social costs on an economy. For this reason, governments adopt policies that reduce the likelihood of energy disruptions and/or mitigate their impacts if, and when, they occur. The APEC Energy Working Group (EWG) endorsement of the APEC Oil and Gas Security Initiative (OGSI) in 2014 to aid APEC economies in addressing energy supply security and dealing with potential supply shortages and emergencies is consistent with this goal. The Oil and Gas Security Studies (OGSS) program is one of the three pillars of the Oil and Gas Security Initiative (OGSI). Its primary purpose is to encourage APEC economies to review their respective policies, plans, programmes and measures on oil and gas security, which could help them in adopting appropriate approaches to handling possible supply shortage or supply emergencies in the future.

For the purposes of this series of the OGSS, APERC defines energy security as *providing reliable energy at reasonable cost*. This definition is consistent with many current definitions of energy security¹, although there are also many other definitions of energy security².

1-3 Effects of the COVID-19 pandemic on APEC economies

The COVID-19 pandemic is both a public health crisis and a global economic crisis. The prospect of the pandemic overwhelming and causing the collapse of the medical system prompted individuals to limit their mobility and governments to implement strict mobility measures to contain the spread of the virus. This is sending ripples throughout the APEC and global economies, prompting governments to implement unprecedented fiscal and monetary measures to mitigate the impacts and prepare for an indeterminate post-pandemic economic recovery.

Confirmations of global COVID-19 cases and deaths suggest that the pandemic is generally affecting APEC at a level consistent with the general global experience³. As of writing, 35% of global infections and deaths are in APEC, and while these numbers are slightly below APEC's 38% share of the global population (Johns Hopkins University, 2021). GDP projections see APEC emerging ahead of the world, contracting 2.5% in 2020 versus the 6.8% for rest of the world (APEC PSU, 2020). However, the health, travel restrictions and economic impacts vary, with APEC economies containing some of highest and lowest statistics. While the arrival of vaccination programs brings hope to the horizon, the emergence of variant virus strains and the difficult task of establishing effective and expedient inoculation supply chains across APEC are obstacles that could draw out the pandemic globally and in the APEC region. These factors are important to consider when discussing the mid-term impact of COVID-19 on the oil and gas sector.

1-4 Report Outline

Following this Introduction, Section 2 describes how behavioral changes and government restrictions during the pandemic caused a reduction in demand for oil and gas in APEC and how the pandemic could continue to shape demand in the coming years. Section 3 highlights the effects of the pandemic on the oil and gas industry and how those effects intersect with the headwinds facing oil and gas financing prior to the pandemic, including the repercussions of declining investment in the oil and gas sector in APEC economies. Section 4 discusses the adverse impacts of the pandemic on government balance sheets and how those impacts could reduce the ability of APEC economies to prepare for potential oil and gas supply disruptions in the future.

The last two sections shift the focus to the energy security implications of the pandemic. Section 5 highlights how the dramatic drop in oil and gas consumption in 2020 rippled through the oil and gas sector making supply less secure and increased the likelihood of future oil and gas supply disruptions. Section 6 concludes with an evaluation of the suite of initiatives and policies available to governments to

¹ For example, the IEA currently defines energy security as “the uninterrupted availability of energy sources at an affordable price” (IEA, 2020).

² Please see APERC's Series 8 OGSS for an exploration on several definitions of energy security (2016).

enhance their oil and gas supply security, including actions that capitalize on lower oil and gas prices on offer during the pandemic to enhance oil and gas security.

SECTION 2. IMPACT OF COVID-19 ON OIL AND GAS DEMAND IN APEC ECONOMIES

Although the coronavirus pandemic caused an unprecedented drop in oil consumption and a substantial, if not unprecedented, decline in gas consumption, it now appears increasingly likely that these reductions were not long-lasting. Eighteen months after the start of the pandemic oil consumption is returning to its pre-pandemic growth rate and gas consumption already exceeds pre-pandemic levels in the APEC region. Notwithstanding the tremendous economic, social, health and personal costs of the virus, the basic structures of the APEC economies remain intact as do the energy requirements associated with those structures. Industrial activity remains robust as does its high dependence on fossil fuels. Recent data suggest that energy demand in buildings did decline during the pandemic, but this is mainly due to warmer weather, not an evolution of consumer behaviour. The permanence of teleworking, or its long-term impact on building demand throughout the APEC region, is still uncertain as is the long-term effect on energy consumption in the building sector. Electricity demand from all sectors of the economy continues to grow, and along with it the demand for gas-fired generation, a trend that is being amplified by the impetus to reduce the CO₂ emissions of from the power sector in accordance with various environmental goals, such as NDCs and net-zero commitments. Lastly, while transport continues to experience significant short-term activity declines due to mobility restrictions and low confidence in the social safety of air travel during the pandemic, we expect the trough to be temporary. Assistance from governments throughout APEC ensured the survival of the aviation sector. Road transport demand is receiving a boost due to lower confidence in public transportation. Despite continued government restrictions due to new strains of the coronavirus, oil consumption in the APEC region is well on its way to reaching pre-pandemic levels and natural gas consumption already exceeds previous levels.

Economic activity as measured by gross domestic product (GDP) is a primary driver of oil and natural gas demand. The impacts of COVID-19 on APEC GDP growth rates were substantial, but not as large as originally expected. Real GDP in APEC fell 1.8% in 2020, while falling 5.1% in the rest of the world. Secondly, the economic impact of the pandemic is now expected to be temporary. The International Monetary Fund (IMF) sees APEC GDP rebounding above 2019 levels in 2021 and growing 20% above 2019 levels by 2025. This is moderately better than the economies of the non-APEC world, which are expected to grow 16% above 2019 levels by 2025.

The pace of economic recovery will vary across APEC economies. By 2021, seven economies will still have GDP below 2019 levels, and one will still be below 2019 levels in 2022. However, the most significant oil and gas importing economies are those that are driving the largest increases over this period. Economic activity over the next five years is projected to grow 43% in Viet Nam, 37% in China, 26% in Indonesia, 25% in Malaysia and 24% in the Philippines. This return to growth by China and Southeast Asia will likely produce significant growth in oil and gas demand for APEC economies over the next five years.

2-1 Impact of COVID-19 on oil demand

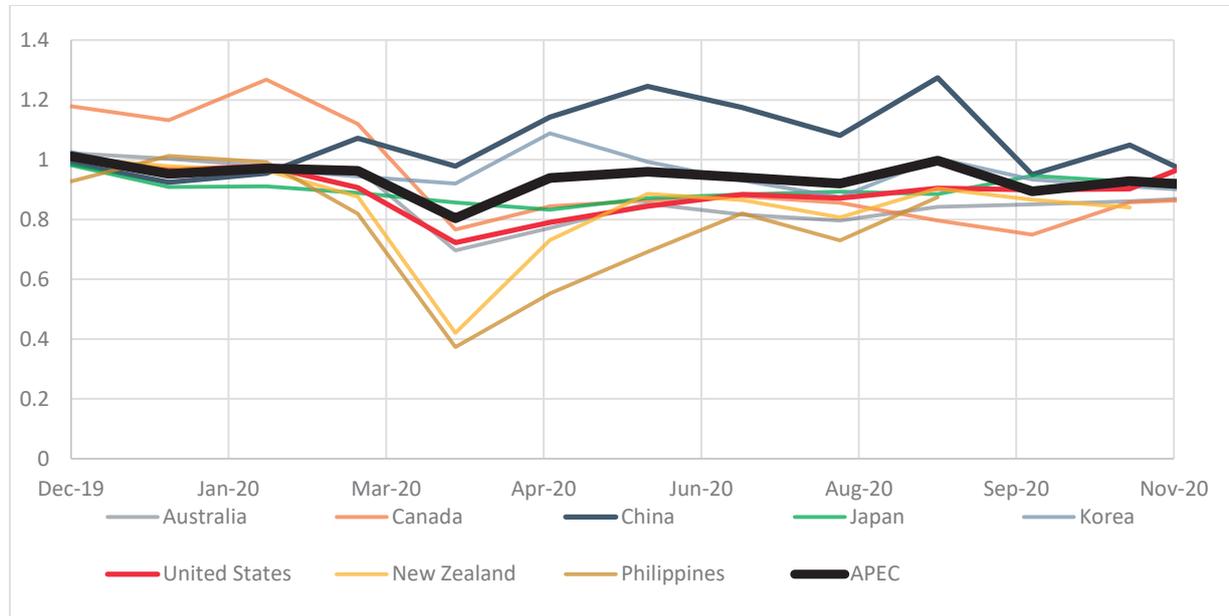
APEC accounts for over half of global oil demand. Oil demand is dominated by the transport sector, which within APEC consists of around 89% of total end-use demand (EGEDA, 2021). Changes in transport

activity had a massive impact on oil within the APEC region due to the role that travel and commuting play in driving its demand. Varying levels of travel restrictions swept through APEC economies starting in February 2020, with measures in China; Hong Kong, China; Chinese Taipei; South Korea and Viet Nam. By March all APEC economies had some form of travel restrictions in place, a situation that was also mirrored globally. While all levels of each economy were affected, travel restrictions had a devastating impact on the aviation sector. The effects on other transport sectors were more varied, depending on the extent and severity of government measures combating COVID-19 coupled with the impact from a reduction in overall economic activity.

The onset of the global pandemic response led to a halving of road transport activity and a two-thirds decline in aviation activity, but a modest recovery led to an approximately 7% fall in overall oil demand in 2020 (JODI, 2021). Globally this drop was approximately 8.8% (IEA, 2020; IEA, 2021a; Flight Aware, 2020). Much of the global demand recovery is attributable to APEC, specifically China, where swift responses to the virus allowed a relaxation of mobility restrictions. As China is responsible for one-third of APEC oil demand this is helping push liquid fuel demand in road transport close to 2019 levels. However, economies still enduring the virus will continue to see demand slacken due to mobility restrictions. Meanwhile, the recovery in aviation fuels is less broad, as the widespread lifting of international travel restrictions depends on lower coronavirus infections due to widespread inoculation and/or the natural immunity of those who have recovered from the disease.

The largest demand reductions occurred in April 2020 with APEC demand 20% less than its 2019 level. While the overall APEC demand is dominated by the demand changes in the largest APEC economies, China and the US, the decline in April was seen broadly across all economies. The most significant declines occurred in economies that imposed tight travel restrictions. New Zealand and the Philippines saw some of the largest demand reductions with oil demand shrinking 60% in April 2020. As these restrictions were eased, demand gradually recovered but did not return to 2019 levels in 2020.

Figure 2-1: Normalised monthly oil demand in 2020 compared to same month in 2019

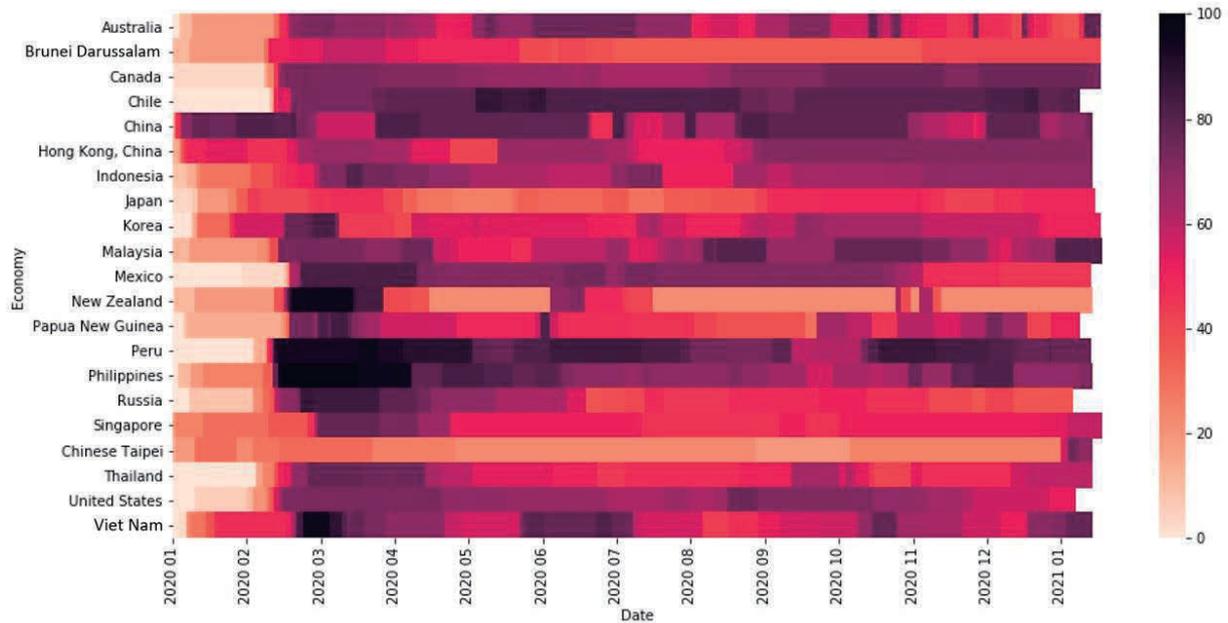


Source: EGEDA (2021)

China was one of the few economies that saw demand rise above 2019 levels, with demand growth in May and June corresponding to an easing of overall mobility restrictions. In the US, demand fell 27% in April and gradually recovered throughout 2020.

The impact on oil demand was largely reflective of the level of pandemic response imposed by each APEC economy and the types of policies used to combat COVID-19, such as teleworking, travel restrictions, non-essential business closures, closure of public spaces, and restricting food purchases to takeout. However, the level and severity of these policy tools varies widely across APEC, and the level of stringency of these policies strongly correlates with the impacts on oil demand.

Figure 2-2: Stringency of COVID-19 response within APEC economies



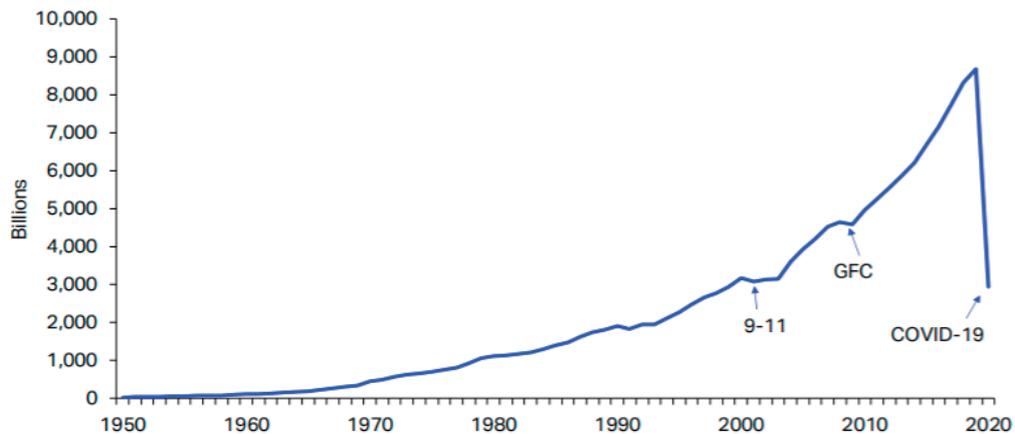
Source: Oxford University (2021)

The stringency of COVID-19 response is a function of the share of population under restrictions and the severity of those restrictions. The darker the colour, the more severe the response and the higher the share of the population affected by this restriction. As these measures primarily affect movement, they have a strong correlation with oil demand. A complete recovery in road transport demand will require a sufficient decline in COVID-19 cases to instil confidence in governments to relax the stringency of their pandemic response, and signal to individuals that it is safe to engage in pre-pandemic activities.

Aviation

Aviation demand was the hardest hit sector globally and has been the slowest to recover. International aviation remains significantly lower than its 2019 level. The shock to airlines was completely unprecedented, with the fall in travel surpassing the falls that followed 9/11 and the Great Financial Crisis (Figure 2-4).

Figure 2-3: Worldwide passenger kilometres flown annually



Source: IATA (2021)

Demand for kerosene, which is primarily used in aviation as jet fuel, fell 30% in 2020 and at its lowest point in April 2020 demand was down 63% from a year earlier.

International aviation hubs, such as Singapore and Hong Kong, China, saw significant decreases in activity during the onset of the virus. In 2020, scheduled flights in these economies fell to less than 10% of the previous year by April and remained at extremely depressed levels throughout 2020. China and Hong Kong, China, at the epicentre of the COVID-19 outbreak, were the first to see a reduction in flights. However, because of its dependence on international travel, Hong Kong, China has been much slower to recover. In China, a resurgence in domestic travel drove flights to near-normal levels by September 2020 before tighter restrictions, due to new viral strains, led to a decline during January 2021.

Economies with a smaller share of international travel compared to domestic aviation, such as China, Japan, and the USA, were less affected than those with higher shares of international travel.

Table 2-1: Monthly scheduled flights (domestic and international) in 2020 compared with the same month the previous year

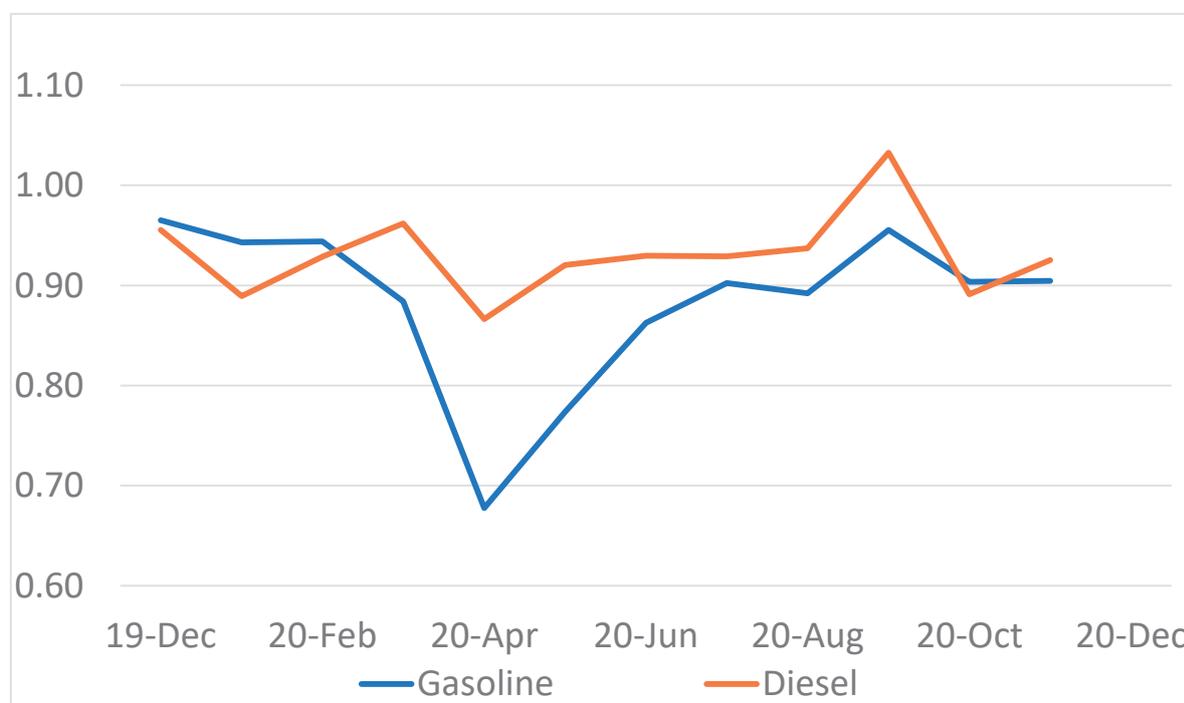
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hong Kong, China	-10%	-47%	-77%	-93%	-90%	-90%	-91%	-90%	-89%	-87%	-88%	-89%
Singapore	0%	-16%	-43%	-94%	-97%	-95%	-94%	-92%	-94%	-93%	-92%	-89%
Australia	-2%	-3%	-6%	-85%	-86%	-83%	-77%	-76%	-74%	-71%	-67%	-46%
Korea	2%	-11%	-49%	-56%	-49%	-49%	-48%	-41%	-46%	-39%	-41%	-48%
China	5%	-54%	-38%	-42%	-28%	-20%	-17%	-10%	-5%	0%	-3%	-3%
US	3%	-2%	0%	-58%	-73%	-67%	-51%	-48%	-47%	-47%	-42%	-42%
Japan	3%	-3%	-16%	-39%	-46%	-44%	-37%	-29%	-37%	-38%	-36%	-36%

Source: OAG (2021)

Road transport

Gasoline fuels the majority of light passenger vehicles and is therefore the most responsive to government travel restrictions. Gasoline makes up approximately 35% of overall petroleum products demand in APEC and generally drives the trends for total oil demand. In April 2020, year-on-year gasoline demand fell 33% in APEC as governments imposed increasingly stringent measures to combat COVID-19. Gasoline demand gradually returned, reaching 90% of 2019 levels by July 2020 as restrictions were eased and economies adapted (Figure 2-5).

Figure 2-4: 2020 monthly diesel and gasoline demand in APEC compared to the same month in 2019



Source: EGEDA (2021)

Diesel fuel supplies the majority of freight activity, and the dynamics of freight movement are generally closely tied to economic activity. However, despite GDP dropping a projected 2.5% in APEC in 2020, freight demand persisted, buoying diesel requirements throughout the region. Diesel demand was less affected than gasoline by the pandemic, at its lowest point in April showing only a 13% year-on-year decline. While the fall in diesel demand was smaller than gasoline, its recovery has been much slower. By October 2020, diesel and gasoline were at similar levels compared to the same month in 2019, primarily due to strong gasoline demand growth from China. Overall, APEC demand for diesel in 2020 was 7% lower than in 2019.

Industry (including non-energy) is the second-largest oil consumer in APEC, making up around 32% of total APEC oil demand. The effect of coronavirus on the industrial sector was much less pronounced than transport. Data limitations make it difficult to show the specific impacts on oil demand from the industrial sector in APEC. Petrochemicals are responsible for the majority of industry oil demand. Other important sectors are construction, non-metallic minerals, and mining.

Globally, impact on the petrochemical demand was mixed. Supply chains relating to manufactured goods saw a significant downturn. However, plastics and other petrochemicals, for example packaging materials for goods such as food sanitary products and medical applications, remained robust throughout the pandemic (McKinsey, 2021).

The main factor impacting future oil demand will be the duration and severity of the COVID-19 pandemic within APEC and across the world. This depends on a decline in coronavirus cases, due to inoculation or natural immunity, that permit governments to relax mobility restrictions and the instillation of confidence in people to increase their mobility closer to pre-pandemic levels. This is particularly necessary for oil demand, which, as Section 2-1 highlights, is primary a function of the movement of people within and between economies. Figure 2-2 provides an indication of how the degree of restriction measures remaining across various APEC economies as of early 2021.

2-2 Impact of COVID-19 on gas demand and trade

Gas demand

While the COVID-19 pandemic delivered an unprecedented shock to global energy demand, affecting all fuels, natural gas demand proved to be more resilient. According to the International Energy Agency (IEA), global gas demand decreased in 2020 by 2.5% compared to an 8% and 7% decline in coal and oil demand, respectively (CEDIGAZ, 2021).

The impact in APEC gas demand was, overall, milder compared to the rest of the world, with an estimated decrease of 1.0% (EGEDA, 2021; IEA, 2021c). However, this was the result of dramatic differences among APEC economies, in which impacts on gas demand varied drastically, from double-digit decreases in some economies to record high demand in others.

To contextualise this halt on demand growth in APEC, overall gas demand represented about 57% of total global gas demand and 67% of the demand growth in 2019. Moreover, after a decade of fast growth, APEC demand growth had already slowed in 2019, increasing only 1.5% compared to 9.2% the previous year. The slowdown was driven by a variety of dynamics across the largest gas-consuming economies in the region, including less rapid economic growth in China, less demand growth from the US power sector, a net decrease in Russia and relatively high temperatures in the northern hemisphere's

winter. At the same time, global gas production outpaced demand growth, creating an oversupplied global gas market before the pandemic hit. In APEC, gas production increased by 6% in 2019, with other major producers outside the region like Qatar or Norway showing similar growth rates.

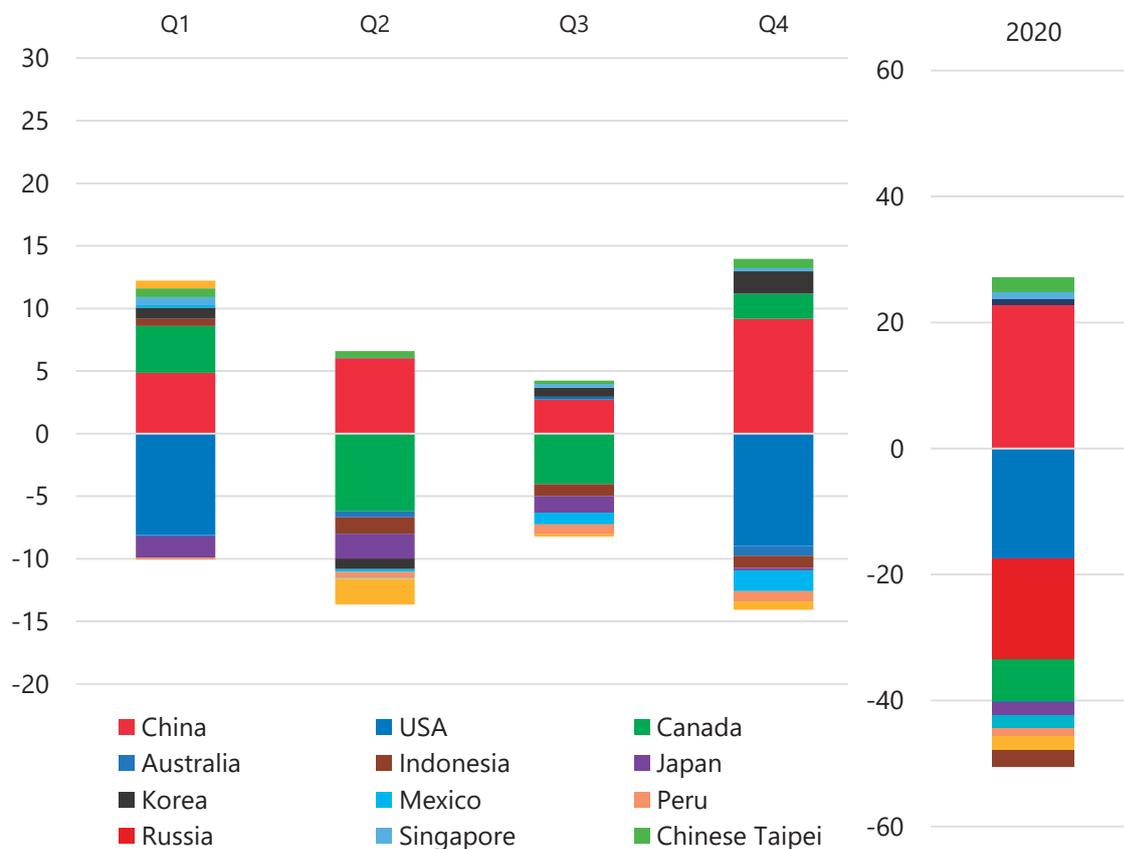
In 2020, as the pandemic expanded globally, governments' restrictive measures aimed at containing COVID-19 varied substantially across the APEC region, both in strictness and timing. As a result, the effects on gas demand in the 21 APEC economies were dramatically different (Figure 2-5). According to monthly data from APEC EGEDA and the IEA, overall gas demand in APEC showed a net decrease of around 22 billion cubic metres (bcm), or -1.0%, when compared to 2019.⁴ While this reduction was lower than the global average, after five years of continuous growth, 2020 was the first year that APEC gas demand did not grow since 2014. The marginal decrease resulted from opposing trends within APEC. Gas demand decreased in most economies, but it did so remarkably in the US and Russia. Meanwhile, it showed minimal variations versus the previous year in Australia and Chile, and it actually grew in a handful of economies, with China and Chinese Taipei even breaking historical record highs.

China was the first economy where lockdown measures were implemented, which meant a reduction in transportation, industry, and power demand. However, in contrast to what happened in many other economies, China's gas demand increased by an annual 6% rate when compared to 2019, with demand falling by only 1.1% in January on a year-on-year (y-o-y) basis and increasing every month thereafter. While China's gas demand increased by 23 bcm, or 6%, in 2020, this was considerably lower than the 8.6% seen in 2019 and the double-digit growth rates from previous years. Large potential for gas demand growth remains in China as gas currently has a low share (8%) of China's primary energy mix compared to coal and oil. Future gas demand growth is expected in the industry and buildings sectors as China's gas pipeline network further expands.

While China led APEC demand growth in absolute terms, gas demand also grew in Brunei Darussalam (4%); Chile (0.1%), Korea (2%), Hong Kong, China (54%); Singapore (8%) and Chinese Taipei (10%). The largest volume gain in this group was in Chinese Taipei, with a 2.3 bcm increase in 2020, with imports reaching 24 bcm, an unprecedented high level. These economies share some commonalities in their demand response to the pandemic. They imposed strict lockdowns, border controls, and contact tracing measures, particularly in the second quarter of 2020. Later, they showed some signs of economic recovery in the third and fourth quarters. Economic growth contributed to increased demand for power generation, as well as some gains from the industrial sector in Korea, Japan and Chinese Taipei.

⁴ Malaysia (demand only); Papua New Guinea and Viet Nam were excluded from this analysis as no monthly gas data was available.

Figure 2-5: Changes in quarterly natural gas demand in APEC by economy in 2020 vs 2019 (bcm)



Source: APEC EGEDA Monthly data (2020), IEA Monthly Natural gas Statistics (2021c), Secretaría de Energía (2021), Ministerio de Energía y Minas del Perú (2021)

Demand growth in these economies was overshadowed by declines in most other APEC members. Consumption decreases in the majority of APEC economies were accentuated in the second quarter of 2020. Cumulatively, the US saw the largest fall, by as much as 18 bcm, or 2%, a sharp contrast to the 23 bcm annual growth seen in 2019. This decline was driven by steep drops in the buildings (over 20 bcm) and industry (5 bcm) sectors and was only partially offset by a 2.7% (9 bcm) rise in gas-fired power generation as the coal-to-gas fuel switching trend observed in the last five years continued (EIA, 2021).

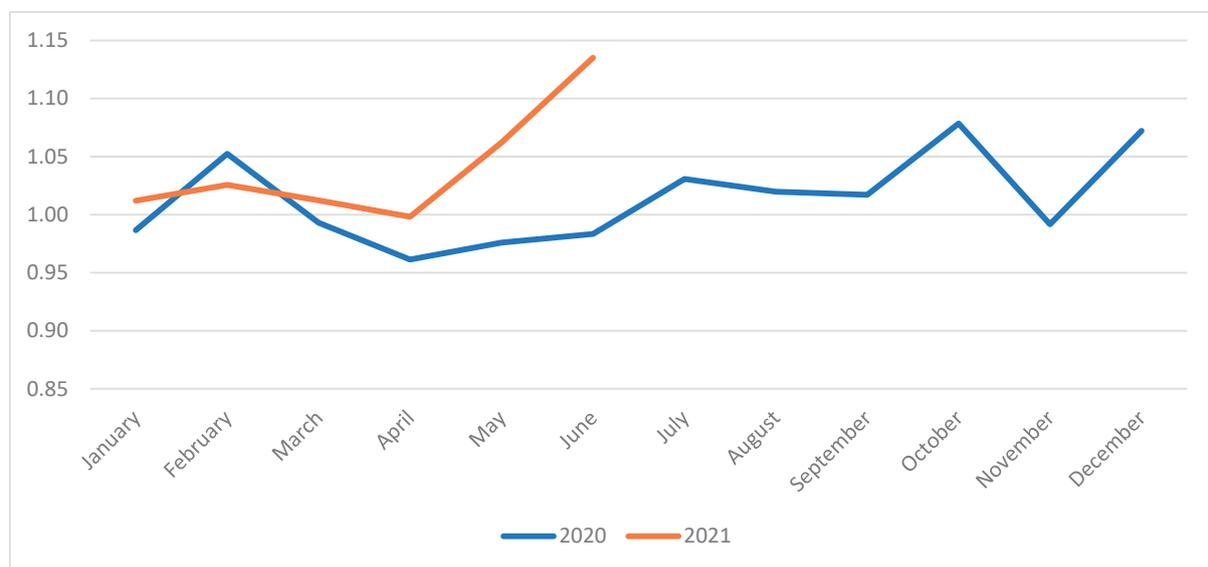
The two other North American economies, Canada and Mexico, followed a similar trend, with gas consumption decreasing by 5% and 3%, respectively, for a combined drop of approximately 10 bcm (SENER, 2021). In Canada, this decline was driven by less heating demand in the buildings sector and own-energy consumption as oil and gas demand activity fell in response to lower demand. In Mexico, gas consumption in the power and industry sectors slowed, while in the US, piped imports grew by 6% at the expense of declines in LNG imports (-67%) and domestic gas production (-5%).

Gas demand also fell in Japan by a cumulative 2%, or 2 bcm, driven mostly by less power generation. Indonesia and Thailand also showed a downward trend in their gas demand, accounting for 8% and 6% declines, respectively. Power generation is the main engine of both demand and additional growth in

these two Southeast Asian economies. Other APEC economies with smaller volumes of gas consumption also saw their demand decline, representing a combined decrease of 2 bcm, including Australia (-1%), New Zealand (-2%), Peru (-17%) and the Philippines (-9%). Finally, according to the Ministry of Energy, Russia’s gas demand fell by 3%, or 16 bcm, in 2020, a large drop and second only to that seen in the US. Most of this decrease is explained by an 11% decline on thermal power generation in the first three quarters of 2020, with gas-fired capacity accounting for 70% of the total (SO-UPS, 2020).

Lastly, preliminary data suggest that APEC gas demand is already returning to its pre-pandemic levels. Led by soaring demand in China, APEC gas demand rose 14% above 2019 levels in June 2021 (Figure 2-6). This suggests that APEC natural gas demand may be returning to its pre-pandemic growth trends.

Figure 2-6: APEC Monthly Gas Demand Normalised to 2019 levels, 2020 and 2021

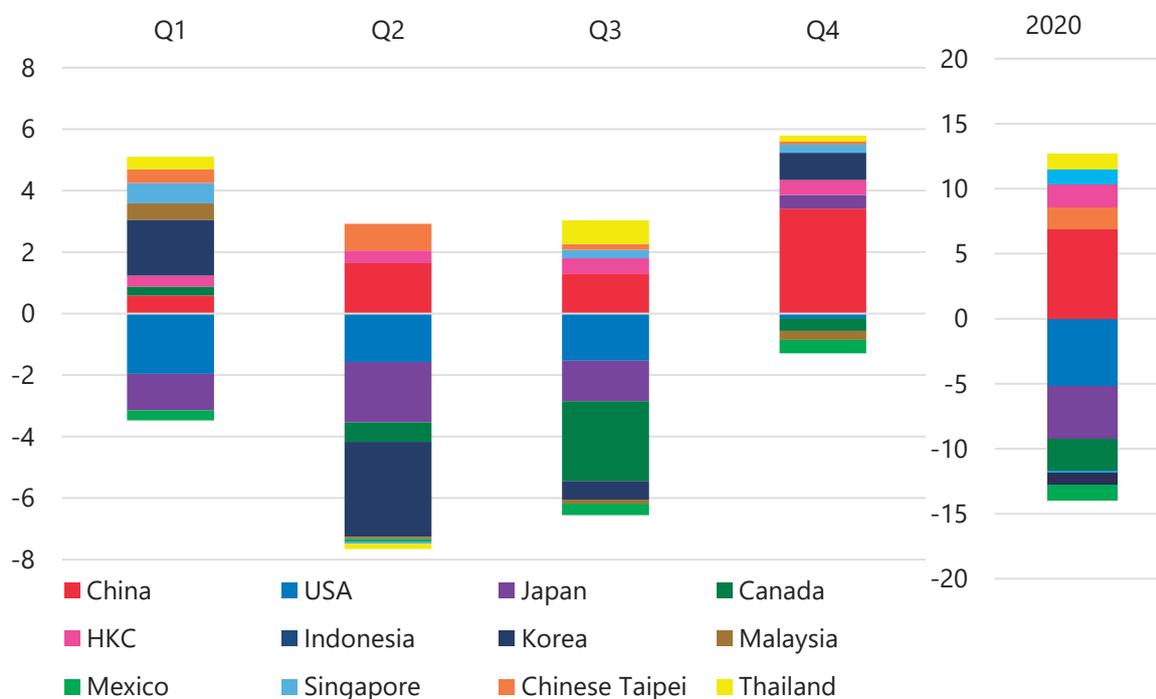


Source: EGEDA (2021), APERC Analysis

LNG and gas trade

Overall APEC natural gas imports fell by 0.9% following several years of growth, increasing by 1.5% per annum in 2019 and by 5.1% in 2018. Interestingly, APEC LNG imports rose by 2% or 5 bcm, which was more than offset by a decline in pipeline gas imports. This overall decrease in gas imports resulted from a combination of trends in major APEC importers and was intrinsically and tightly related to the impacts on gas demand described before. Out of the 15 importing economies in APEC, gas imports decreased in seven of them, with the largest decreases taking place in the US and Japan.

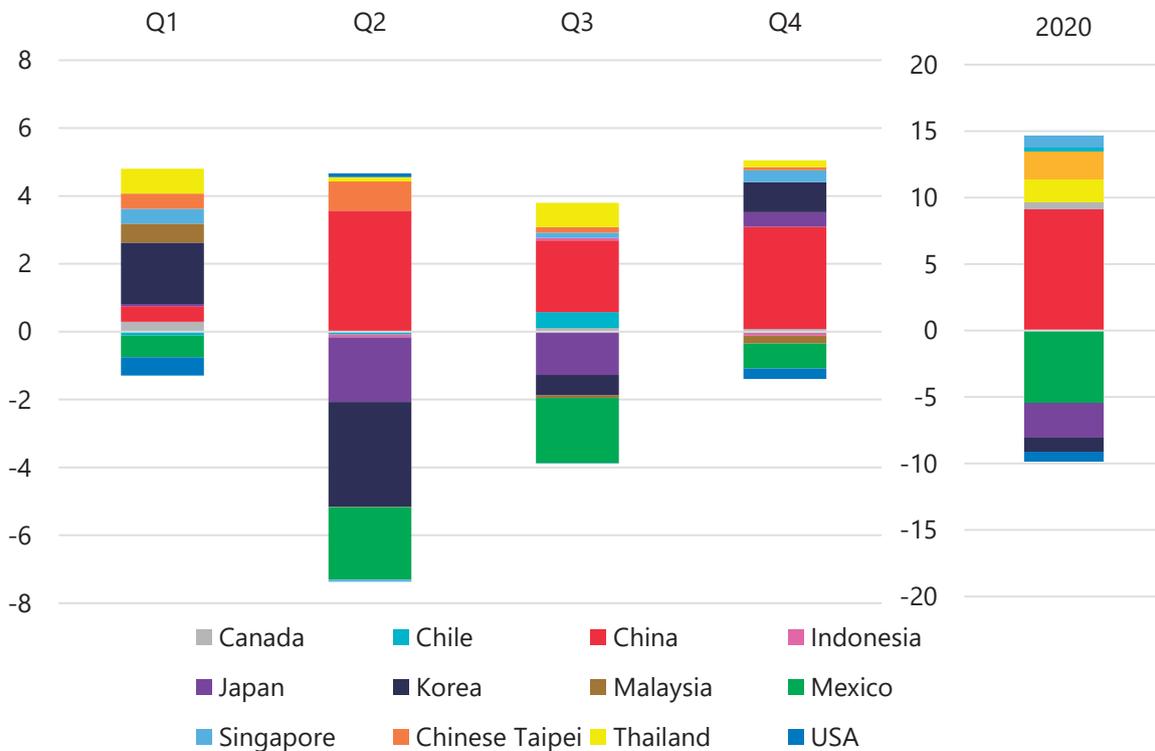
Figure 2-7: Changes in quarterly natural gas imports in APEC by economy in 2020 vs 2019 (bcm)



Source: APEC EGEDA Monthly data (2020), IEA Monthly Natural Gas Statistics (2021c), Secretaría de Energía (2020), Ministerio de Energía y Minas del Perú (2020)

LNG plays a fundamental role in APEC gas trade dynamics, accounting for 54% of total gas imports in 2019. Moreover, LNG imports have been growing in APEC at a 6.2% average annual rate. In 2020, out of the 12 LNG importing economies in the region, LNG imports grew in seven economies, with most growth taking place in China, followed by Thailand and Chinese Taipei. In contrast, LNG imports fell in Mexico and the US in favour of US piped volumes. LNG imports also fell in Japan and Korea, where declines were mostly the result of the COVID-19 pandemic. This highlights the increasing importance of LNG in the overall natural gas trade, as well as its relative importance and inelasticity, particularly in Asia.

Figure 2-8: Changes in quarterly LNG imports in APEC by economy in 2020 vs 2019 (bcm)



Source: APEC EGEDA Monthly data (2021), IEA Monthly Natural Gas Statistics (2021c), CEDIGAZ (2021)

2-3 Short-term and medium outlook for demand

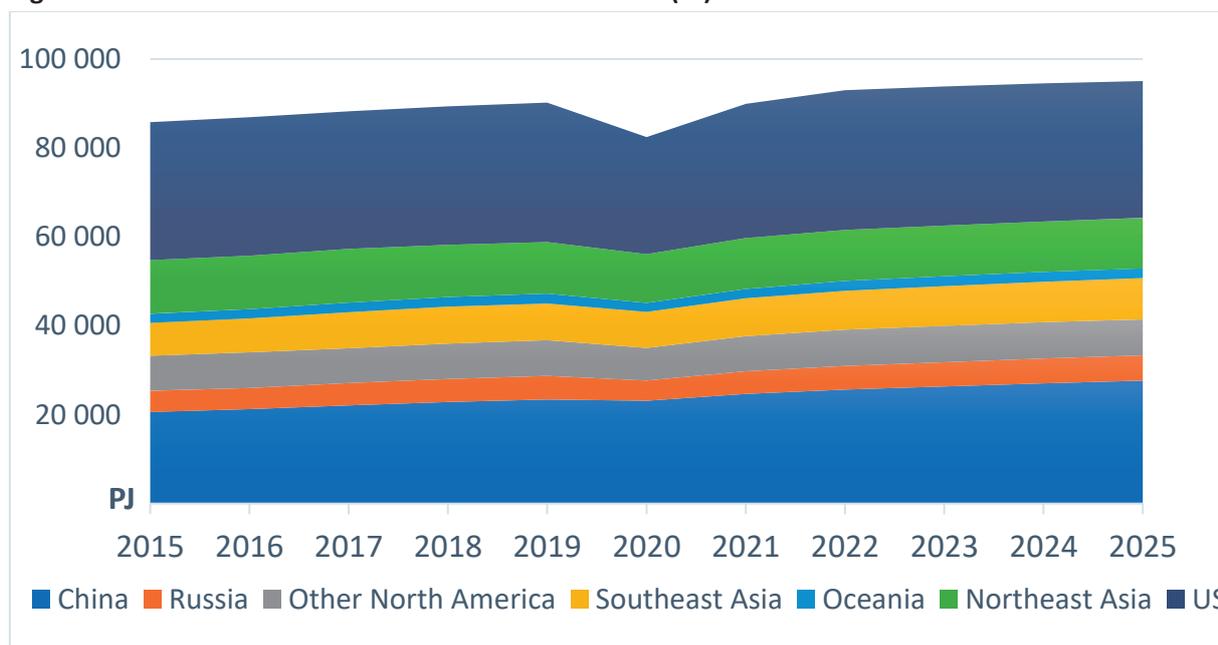
APEC oil demand outlook

Significant uncertainty remains around recovery from the COVID-19 pandemic. However, at least domestically, some return to normality is likely as vaccination programs progress in APEC economies. Regarding international travel, border closures remain in place in many APEC economies and a return to normality in most economies is significantly less likely in 2021. However, while there is uncertainty around the timing, it is very likely that borders will reopen and travel without quarantine restrictions will be permitted. The timing of this depends greatly on vaccine rollouts and their effectiveness against emerging new variants of coronavirus. According to internal APERC projections, oil demand in APEC is expected to recover quickly, driven by China reaching and exceeding 2019 levels by 2022. After that sharp recovery growth period, growth from 2022 onwards will be slower than in the previous decade. The average annual growth from 2015 to 2019 was 1.6% whereas in the period 2022 to 2025 growth of only 0.7% per year is predicted.

A similar recovery path is by expected by other agencies, including the IEA, which sees a slightly slower recovery globally, with oil demand reaching pre-pandemic levels in 2023, one year after APERC's projected recovery (IEA, 2021a).

Regionally, Southeast Asia, China and Russia were responsible for driving oil demand growth between 2018 and 2025. Growth in China is 2.6% per annum. Growth is also expected to be strong in Southeast Asia, particularly Malaysia and Viet Nam, increasing 2.0% by 2025. Other North America, in contrast, trends down from 2022 at a rate of 0.5% per year, as slow demand growth will be offset by improvements in energy efficiency and electrification. In northeast Asia, the gradual decline in oil demand within Japan will be offset by the growth in Korea leaving the overall trend declining only slightly by 0.5% per year.

Figure 2-9: Oil demand in APEC economies 2014 – 2025 (PJ)

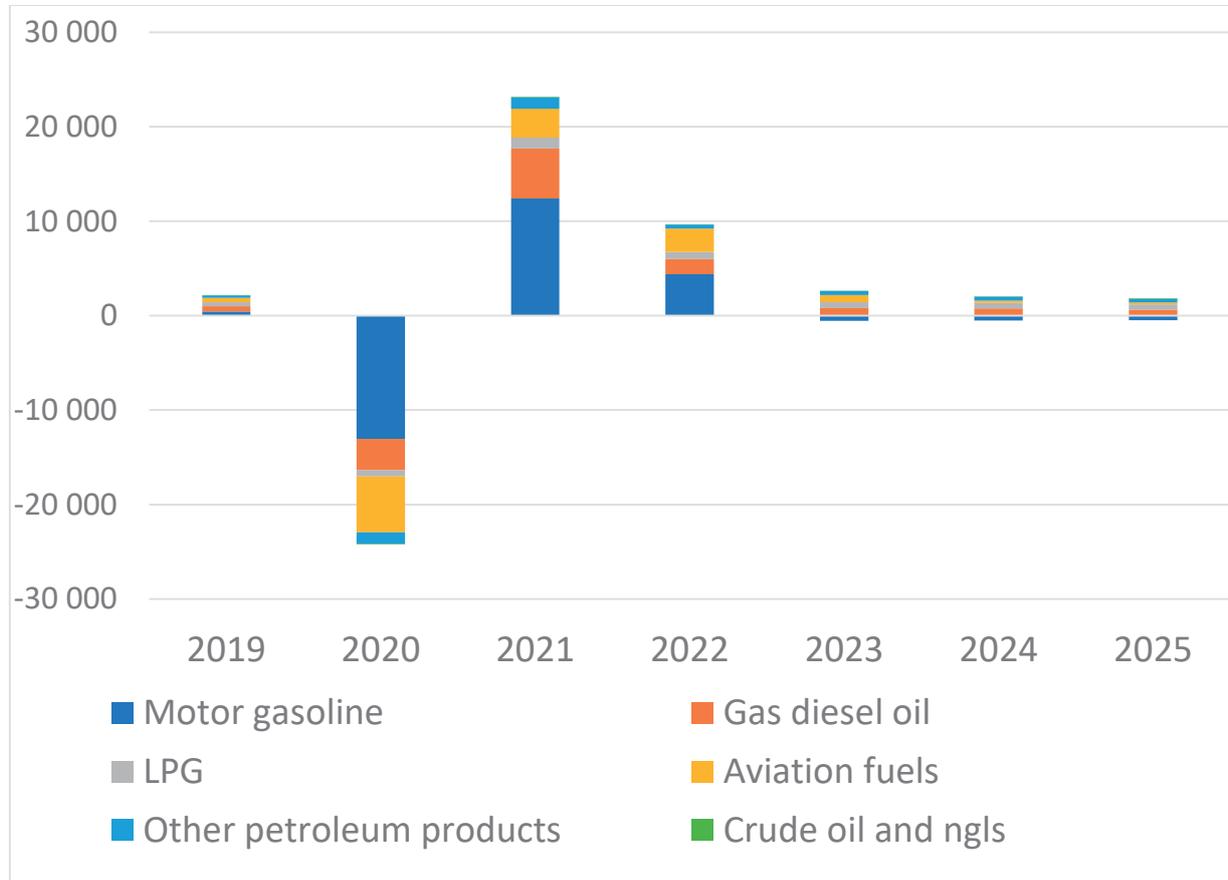


Source: EGEDA (2021) and APERC analysis

In oil products, gasoline will briefly peak above pre-pandemic levels in 2022 but will then begin a marginal decline. This is due to improving energy efficiency and growing sales of electric vehicles offsetting the growth in demand from Southeast Asian economies. The outlook for APEC differs slightly to the global outlook presented by the IEA, which sees gasoline demand peaking in 2019 and never recovering to its pre-pandemic levels (IEA, 2021a).

Diesel, after rapid recovery in 2021 and 2022, will begin a slow 0.8% growth trend from 2023 to 2025 driven by a recovery in freight demand in China, which will grow 25% from 2018 to 2025.

Figure 2-10: Change in demand for oil products by year (PJ)



Source: EGEDA (2021) and APERC analysis

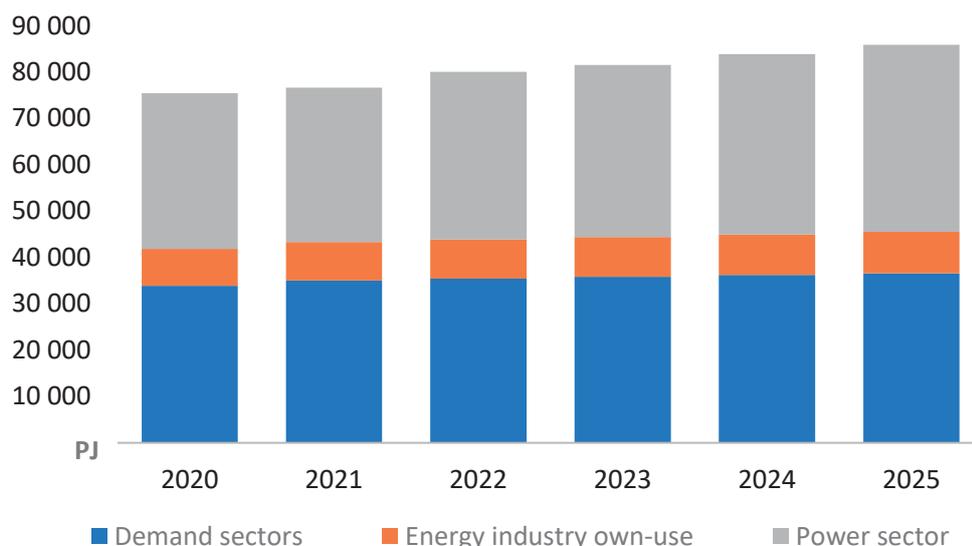
Domestic aviation demand will recover from its 2020 lows, seeing a strong growth in aviation jet fuel of 22% and 15% in 2021 and 2022, respectively. However, after recovering to pre-pandemic levels in 2023, jet fuel will grow modestly, at a rate of 1.3% per year. International aviation demand will be much slower to recover. The International Airline Association does not expect international travel to reach 2019 levels until 2024. Furthermore, travel is projected to be more regionally focused, keeping average trip length low through 2025. This will keep international bunkers depressed during this period.

APEC gas demand outlook

While the uncertainty surrounding the pace and scope of the recovery from the COVID-19 pandemic creates a significant risk for short-term oil demand, it poses a smaller downside risk to short-term natural gas demand. APEC gas demand only fell 0.9% during 2020, but most of this was probably due to warmer weather. A reversion to seasonal weather trends may alone be enough to continue gas growth. Furthermore, the significant drivers of gas demand, namely industrial activity and electricity demand, have been resilient in the face of the virus due to their isolation from the impacts of mobility restrictions necessary to contain the virus. For these reasons, it is APERC’s view that APEC natural gas demand will continue to be resilient as APEC traverses an uncertain pandemic recovery over the next five years.

Figure 2-11 shows a projection of natural gas demand for the APEC region out to 2025, whereby demand grows nearly 14% to almost 86 000 PJ. While growth is expected in all sectors, the main driver will be increases in the power sector, which will grow 20% during this short-term projection period. Much of this growth will occur in the Southeast Asia region and in China, where power demand will triple over the next three years.

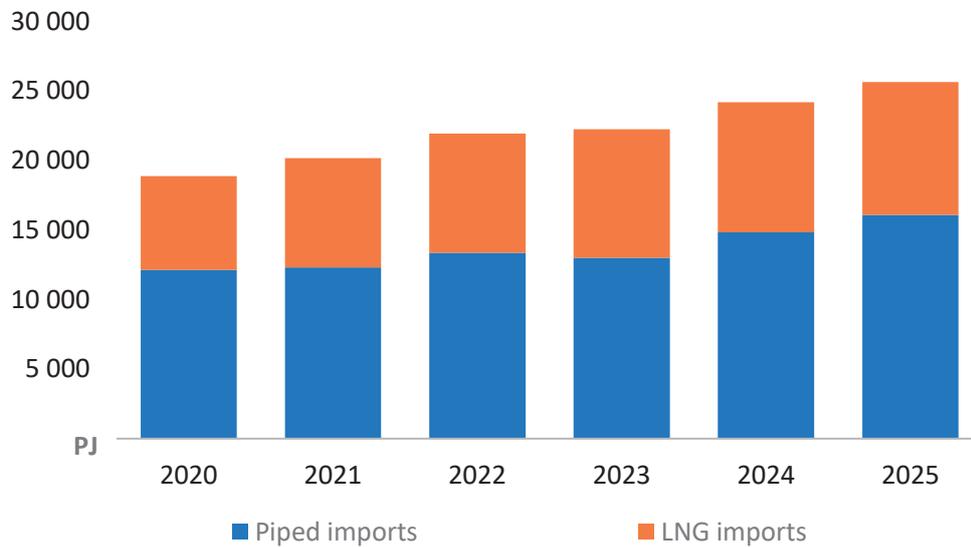
Figure 2-11: APEC natural gas demand by sector, 2020 to 2025 (PJ)



Source: EGEDA (2021), APERC Analysis (2021)

This growth in natural gas demand will likely cause an increase in gas imports. Figure 2-12 highlights the impact that rising gas demand will have on the APEC region. While supplies are expected to grow, significant growth in end-use and power sectors will prompt a 36% increase in gas imports into APEC by 2025. Pipeline exports will grow by a third, mostly on the back of intra-APEC trade, as Mexico imports higher volumes from the US and the expansions to the Power of Siberia pipelines bring higher flows of Russian gas into China. Traditionally, flows from such stable suppliers would rarely be of concern for energy security. Recent events are challenging this assumption. The freeze-offs of US gas production during the unseasonably cold 2021 winter due to a lack of winter-proofing of critical infrastructure illustrate the vulnerability of the gas supply to both the US and Mexico. This will be a concern that both economies will need to address as enduring outages during the seasonal temperature peaks of winter and summer is not a tenable solution for consumers in the future, particularly as both integrate more gas supply into their energy mix. However, the impact of severe weather events on oil and gas security is outside the scope of this report, which deals strictly with the impact of COVID-19 on oil and gas security.

Figure 2-12: APEC natural gas imports by mode, 2020 to 2025 (PJ)



Source: EGEDA (2021), APERC Analysis (2021)

LNG imports will outpace pipeline imports, growing 42% above 2020 levels by 2025 on the back of higher industrial activity and power demand in the Asian import economies. China, again, will do a lot of this lifting, starting with a 20% growth in 2021, and a 50% growth over the five-year period. This significant call on LNG will increase the likelihood of LNG security events such as the LNG crisis endured by Northeast Asia during this winter. It is true that a conflation of extraordinary factors led to this crisis, but a significant growth in imports over the next five years will increase both the likelihood and potential severity of LNG disruptions to APEC LNG importers. While importers are procuring higher volumes of LNG ahead of schedule to prevent a similar event next winter, the lack of gas storage in APEC’s Asian LNG importers will remain a key vulnerability of APEC gas security during the next decade. Section 6 and 7 will discuss what some APEC members are doing to creatively deal with this storage vulnerability and how others can mimic them to mitigate the impact of future LNG security events going forward.

SECTION 3. IMPACT OF COVID-19 ON OIL AND GAS SUPPLIES

COVID-19 caused an unprecedented drop in global oil demand and a substantial reduction in global natural gas demand. As a result, oil and natural gas prices fell precipitously in all major markets in March and April 2020. The price shock reduced investment in oil and gas production, development, and transportation facilities as companies attempted to cope with the drop in demand. As long as demand stays below supply, the impacts on oil and gas security are minimal. But as oil and natural gas consumption increased from its pandemic lows (as detailed in Section 2), energy security issues have emerged in both oil and natural gas markets. This section quantifies the impact of lower prices on APEC oil and gas supplies. This section also highlights issues that have and could continue to cause oil and gas

supplies to lag demand growth and increase the likelihood of future oil and gas disruptions in the APEC economies.

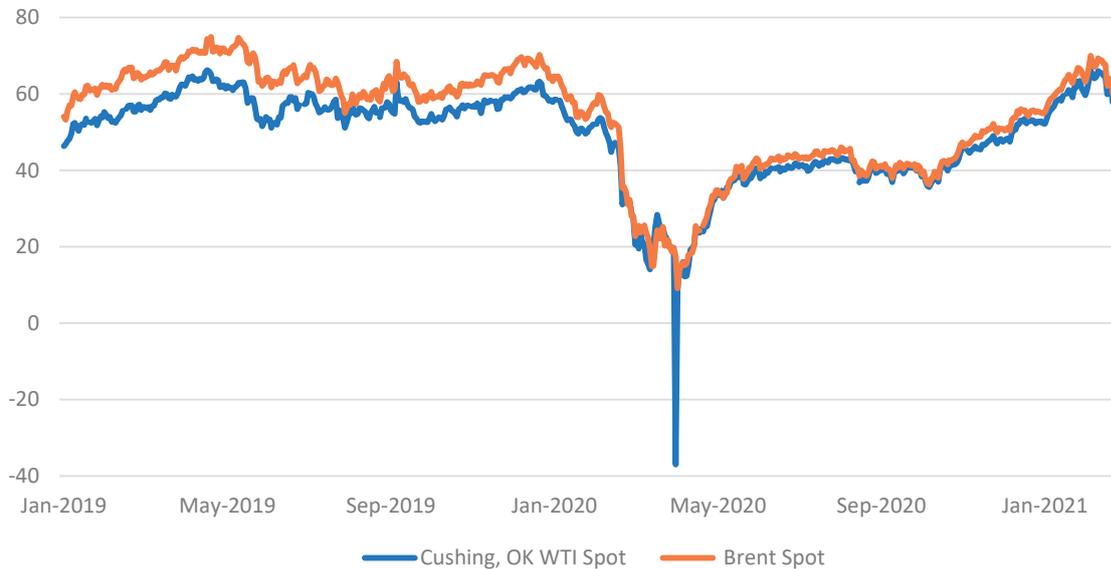
Despite the significant impacts that the pandemic had on oil and gas markets at the beginning of the pandemic, it is not correct to attribute all the changes in oil and gas supplies solely to the pandemic. While oil supplies are lower and gas supply is growing past 2019 levels, the levels of production are also affected by several market and geopolitical factors in addition to the pandemic. The decisions of OPEC OPEC+, together with shifts in financing costs and investor expectations for publicly traded oil and gas producers, all affect oil and gas supplies and are largely independent of pandemic.

3-1 Immediate impact of the pandemic

Oil supplies

As COVID-19 spread globally in early 2020, so did mobility restrictions, which drove significant declines in oil demand and prices. As prices began to slide in early March 2020 (Figure 3-1), OPEC+ began discussing output curtailments to align with the demand drop and support the market. A Russian objection to these proposals prompted Saudi Arabia to declare an abrupt end to OPEC+ coordination on 8 March 2020, effectively starting a price war with Russia. Prices fell precipitously as the World Health Organization (WHO) declared the COVID-19 pandemic a global health emergency. In the face of the unprecedented fall in demand, the world's largest producers increased production, creating a global supply imbalance that peaked with a supply excess of 20 to 30 Mb/d in April 2020. This stark imbalance briefly broke oil markets and the calamitous nature of the instability brought a rapid end to the price war a month after it started. Following discussions between OPEC+ and other major producing economies, a combination of voluntary and market-driven curtailment stabilised oil markets in the immediate term and set the stage for a smooth trajectory out of the coronavirus pandemic. This meant capping supply below demand to erode the inventory accumulated during the first quarter of 2020, and coordinating production increases as mobility restrictions eased and demand recovered.

Figure 3-1: Daily Brent, WTI Spot Prices from January 2019 to March 2021 (USD per barrel)



Source: EIA (2021a)

Oil markets remain governed by this relationship, with some manoeuvring within OPEC+ to make up for compliance shortfalls. Demand is persisting above initial expectations, around 96 Mb/d, and coordination among OPEC+ actors is putting a lower ceiling on global supply of 94 Mb/d (IEA, 2021a). This imbalance is sufficiently eroding the accumulation of oil inventories during the onset of the pandemic. As inventories approach pre-pandemic levels, the strengthening of oil prices to their pre-pandemic levels, together with the shift of the futures market into backwardation, indicates that oil markets are rebalancing. Significant uncertainties remain, but if current trends continue throughout 2021, the oil markets could become more balanced in 2022.

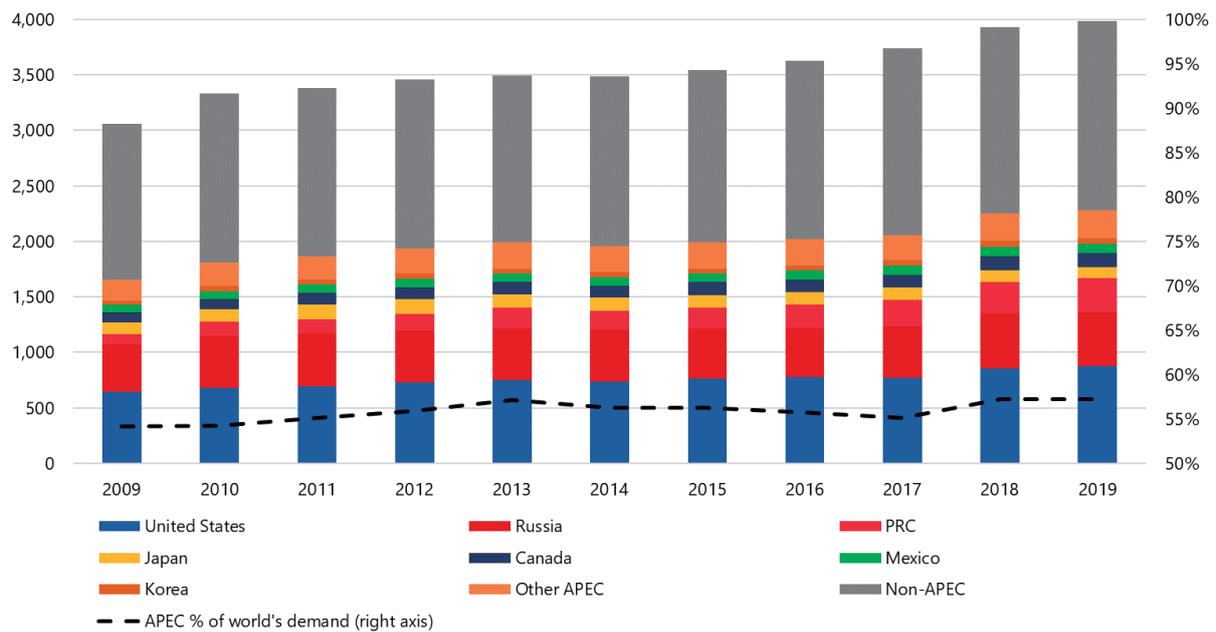
The largest determinant of oil supplies will be the willingness and determination of OPEC to alter its current course of tightening oil markets. OPEC appears steadfast in achieving a tighter market, continuing its policy of withholding seven Mb/d of supply into April 2021, and will relax production constraints in response to rebounding demand, not in anticipation of it (OPEC, 2021). This prudence speaks to the uncertain nature of the demand recovery and risks increasing the likelihood of a supply shortage and accelerating the speed of its occurrence. Although OPEC decisions may be the single most important determinant of future oil supply levels, the factors affecting oil production volumes in Russia, the US, Canada, and China will also play important roles and will affect oil security in the APEC region in the coming years.

Gas supplies

APEC plays a significant role in natural gas markets, consuming more than half of the world's gas supply, accounting for two-thirds of the annual growth in global consumption, and 60% of global natural gas production in 2019 (IEA, 2020). The APEC region includes some of the most active gas trading economies in the world, including three of the top-five global exporters (Russia, the United States and Canada) and

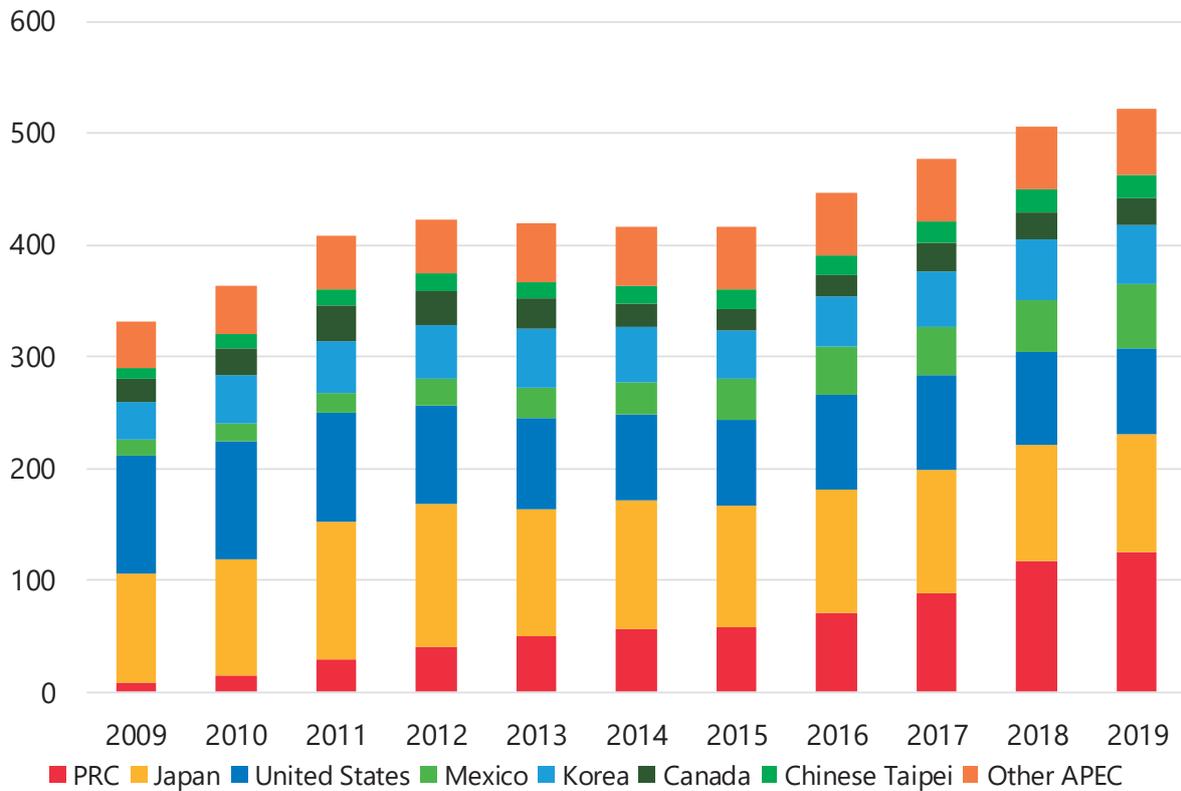
three of the top-five world importers (China, Japan and the US). APEC is an overall net exporter of natural gas, driven by pipeline exports from Russia, Canada, and the US, which together account for 60% of APEC gas exports. Gas imports into APEC are split nearly evenly, with 46% moving by pipeline and 54% by LNG. APEC is key to global LNG trade, with 12 members importing LNG in 2019, including four of the top-five global importers. APEC accounts for 61% of total LNG trade and 54% of incremental growth in demand in the past decade. APEC represents 55% of global LNG exports in 2019, driven by the impressive rise of Australia, the US and Russia as major global LNG exporters (GIIGNL, 2021).

Figure 3-2: Natural gas demand in APEC and the world, 2009-2019 (bcm)



Sources: IEA, Natural Gas Information (2020); APEC EGEDA, Energy Balance Table (2020)

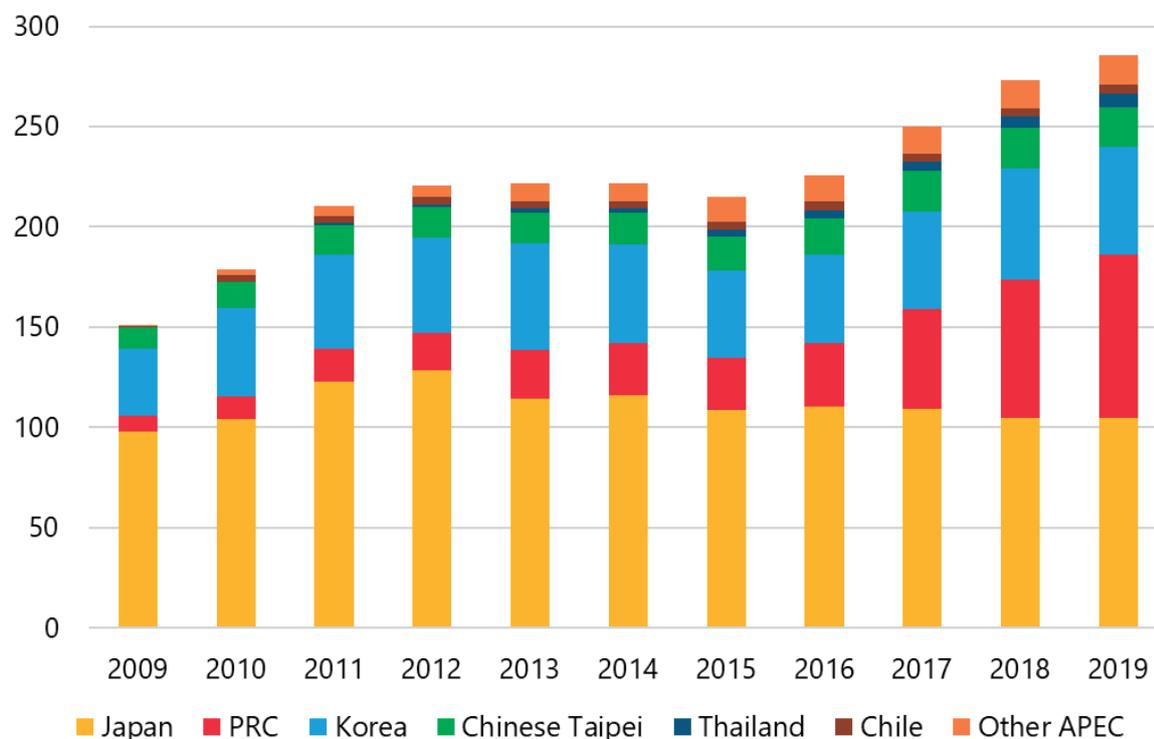
Figure 3-3: APEC natural gas imports by economy, 2009-2019 (bcm)



Sources: IEA, Natural Gas Information (2020); CEDIGAZ (2020)

2020 began in an environment of historical record-highs in global gas demand, production, and trade (IEA, 2020). 2019 just saw a record 96 bcm of new LNG liquefaction capacity reach final investment decisions (FIDs) (IEA, 2021b). However, despite historically high demand, the annual growth of global demand slowed, from 5.1% in 2018 to 1.5% in 2019 (IEA, 2020). LNG production, on the back of growing liquefaction capacity, outpaced demand, creating an overhang of supply from 2019 into 2020. Seasonal heating in northeast Asia and Europe was expected to absorb this surplus but above average temperatures and a mild winter diminished the demand for natural gas, particularly LNG (IGU, 2020). Thus, when the first lockdowns and restrictive measures to contain COVID-19 started in China in January 2020, the global LNG market was already in state of oversupply.

Figure 3-4: LNG imports in APEC by economy, 2009-2019 (bcm)



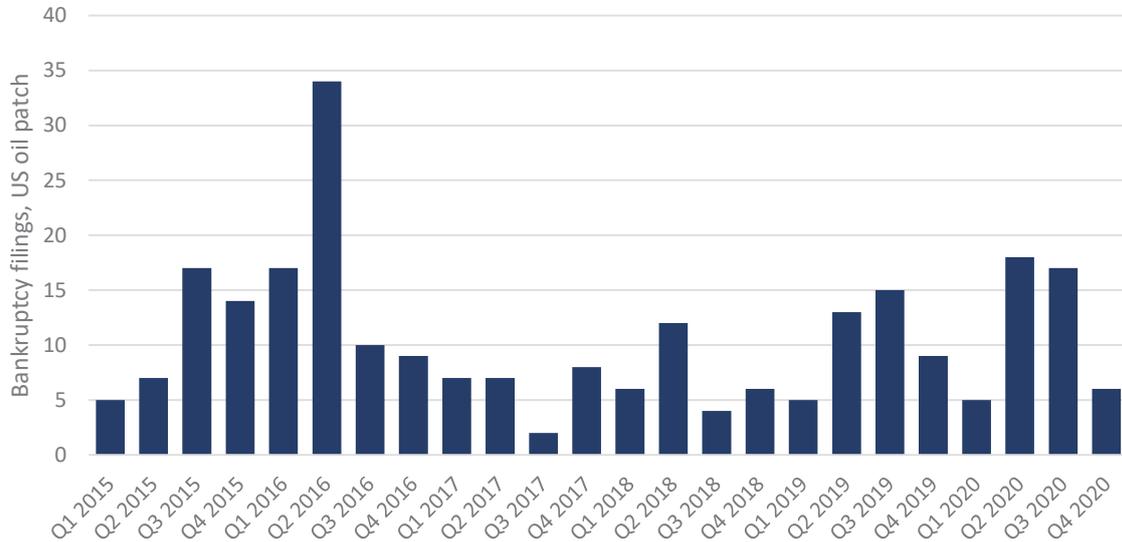
Sources: IEA, Natural Gas Information (2020); CEDIGAZ (2020)

3-2 How COVID-19 impacts investment trends

COVID-19 accelerated existing investment trends

While collapsing revenues and price volatility during 2020 brought renewed focus on the viability of the oil and gas sector as an investment class, one should not identify the pandemic as a cause for trends that existed before COVID-19. Energy was not only the worst-performing equity of 2020, but the worst-performing sector of the S&P500 on 23% of all trading days since 2015 (Bespoke, 2020). Going back to the start of the commodity super-cycle in 2005, the annualised rate of return on oil and gas companies is 2%, the S&P500's 9% (McKinsey, 2020). Collapsing prices in 2014 and the higher volatility thereafter began a transition away from large-scale projects with high upfront capital costs, such as offshore and oil sand mining, and towards shorter-cycle projects with shorter payout periods. It also squeezed out many unprofitable companies, with bankruptcies peaking at higher levels than during the pandemic (Figure 3-5).

Figure 3-5: US oil and gas producer bankruptcy filings



Source: H&B (2020a)

Many survivors, particularly shale producers, did little to alter their business models. Low interest rates, unsustainable accounting practices, and productivity enhancements enabled them to maintain operations. Resource-based loans (RBLs)⁵ allowed companies to monetise their petroleum reserves as part of a revolving credit line to provide the capital required to continuously drill enough wells to prevent the steep decline in rates from reducing production and revenue levels. But the inclusion of proven, undeveloped reserves created a perverse incentive to become successful exploration companies instead of returning cash to investors. RBLs allow drilling to generate short-term cash flow but incur significant capital outlays, and reserve discovery unlocks more RBL credit to fund drilling to pay off these outlays, starting the cycle again. Shale companies are net cash negative on aggregate, resulting in many bankruptcies (Deloitte, 2020). Despite negative cash flow, companies continued to pursue growth, leading to underperformance of the asset class compared to other equities.

Prior to the pandemic, constraints arose to reduce these unsustainable practices, omitting undeveloped reserves from borrowing base calculations, and including clauses to prioritise cash flows towards investors instead of E&P (H&B, 2020b). The pandemic accelerated this reset, as lower prices have led to lower RBL redeterminations, reserve and equity impairments, and higher leverage ratios, triggering bankruptcies, shut-ins and laying the groundwork for significant consolidation in the sector. Many producers in North America in a tenuous financial position and the subsequent demand and supply shocks greatly exacerbated their position (S&P Global, 2020). Even with government support, which has allowed many US oil and gas producers to remain operating through the worst impacts of 2020, there

⁵ RBLs are a financing tool that secures loans against oil and gas reserves by monetising them into a borrowing base that a company can use to fund its operations.

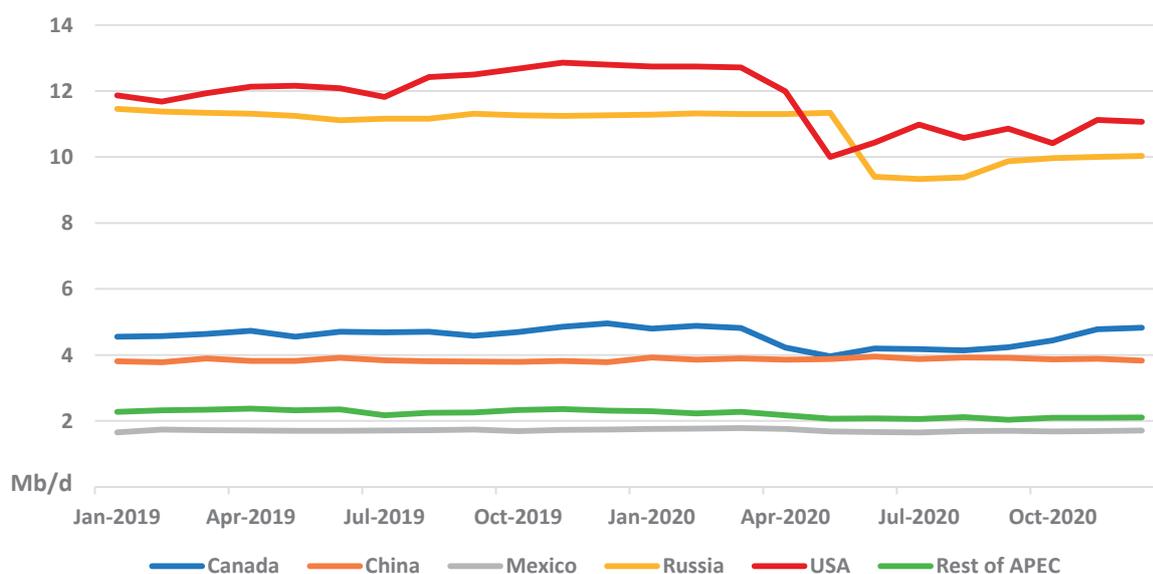
has been a spike in the number of bankruptcies of oil and gas producers in the US and a rise in consolidation. In return for capital, investors are eliminating cheap credit mechanisms and stressing income-generation. After years of being growth assets, fuelling the supply boon of the past decade, oil and gas equities are becoming income assets (Columbia SIPA, 2020). Until producers can illustrate an ability to grow production while sufficiently remunerating investors, finance will act as an upper bound on oil and gas supply growth from North America.

3-3 Short to mid-term impact on oil and gas supplies

The ability of APEC to increase oil supplies

If OPEC is unwilling to reverse its current strategy, the mitigation of potential supply shortages depends largely on the ability of several APEC members to rebuild the production capacity that was lost in 2020. Select actors within APEC possess the capability to build productive capacity to alleviate any market shortage over the coming years and are generally the same economies that significantly reduced capacity in response to the crisis: Russia, the US and Canada. This trio was responsible for 32% of the decline in global oil supplies in 2020; together with OPEC, that share becomes 94% (EIA, 2021b). This section will discuss the ability of APEC economies to rebuild capacity and grow oil production again.

Figure 3-6: Monthly Crude Oil Production in APEC, 2019 to 2020 (Mb/d)



Source: Economy statistics, JODI (2021), EIA (2021b), APERC estimations

Russia's production capacity through 2025 will be a function of balancing the benefits of its OPEC+ relationship with its desire to grow oil revenues, increase the efficiency of existing oilfields and research the exploitation of new oil resources. While Russia has been balancing these conflicting desires since 2016, it will probably remain within the production constraints of OPEC+ at least until the oil market tightens enough to warrant a diverging strategy. Russia has set a long-term 2030 oil production target of 11 Mb/d, which is 0.50 Mb/d above current levels. In the absence of the current OPEC+ agreement, Russia could probably increase its production to pre-pandemic highs of 11.50 Mb/d and manage natural

declines to maintain levels above 11 Mb/d by 2025. However, it is difficult to know the extent to which brownfield declines will impede increases until Russia ends its participation in the OPEC+ alliance (OIES, 2019). A 12% decline in Russian drilling productivity from 2008 to 2018 suggests that this could be a limiting factor.

Increases beyond that will require investment and the exploitation of new resources. Russia is eager to explore new production methods to increase efficiency and unlock new resources. First, it believes that EOR in select fields will slow production declines and add 2 Mb/d of production by 2030. While a higher cost resource at 55-60 USD per barrel, it is currently economic to produce and will continue to be in the event of a supply shortage. Secondly, production from offshore, Arctic offshore, and “difficult-to-recover” tight and shale resources could boost production levels by 2030. However, American and EU sanctions are restricting the capital flows and technological imports required to exploit these resources, which will dampen production increases over the next decade. Russia could mitigate the impact of sanctions by creating domestic supply chains to fulfil technological and equipment gaps. In the absence of sanctions, OIES believes that production could flow above 12 Mb/d in the 2020s.

While the impacts of dual-demand and supply shock were immediate in Canada, they will not be long-lasting. Oil sand producers have been restructuring their business since the oil price crash of 2014, trimming capital expenditures by opting for smaller, leaner projects. The pandemic is not destroying supply as previous downturns already took many high-cost projects off the table. Several extraordinary events, including forest fires and pipeline capacity constraints, have prompted in-situ oil sand producers to develop procedures to halt and restart production without damaging their resources (ConocoPhillips, 2020). Because of these lessons, Canada’s pre-pandemic production capacity remains intact and is being fully utilised. However, further growth will be limited by infrastructure constraints, the ability to pay out cash to investors, and the longer lead times to grow production. Consolidation in the sector could help improve balance sheets faster and lead to incremental gains before 2025. Oil supply growth to at least 5.6 Mb/d by 2025 on the back of planned expansions and commissioned phases is expected (CER, 2020).

The US is a wild card for satisfying global supply needs over the next five years. From 2016 to 2020, while playing the role of swing producer, the flexibility and short-cycle period of US tight and shale oil production allowed it to rapidly respond to price signals and keep prices in the range of 40 – 80 USD per barrel. Much of this growth came on the back of cheap credit and unsustainable accounting practices outlined earlier. Short-term priorities for US producers will be centred around healing balance sheets and illustrating financial discipline by returning cash to investors. This will limit production capacity. The EIA does not expect the production levels to return to pre-pandemic levels by 2022.

Several significant oil producers in APEC will likely be unable to help alleviate the oil supply shortage due to the structural decline of their existing resource bases and the financial challenges that the pandemic created. This includes Malaysia, Indonesia, Mexico, Brunei Darussalam and Thailand. Most production from these economies comes from national oil companies (NOCs) and conventional resources. While both factors ease the impact of the pandemic on production (Figure 3-6), the lack of competition from capital sources outside NOC channels could impede growth going forward. Except for Thailand, all have released public documents detailing production targets while having little success in achieving those targets. Brunei Darussalam, Malaysia and Indonesia are banking on investments in enhanced oil recovery (EOR) to offset these trends by 2030 or 2035. Despite having ambitious goals of increasing

production to 50% above 2018 levels by 2025, Mexico's oil production continues to decline and fails to meet annual growth targets. For all these economies, the resulting revenue declines during the pandemic could further hurt the ability of their NOCs to grow production. Several other small oil producers exist in APEC, but their scale of production is too small to affect the global oil balance over the next five years. Out of these, Australia is the lone economy growing oil production in recent years, albeit at a small scale.

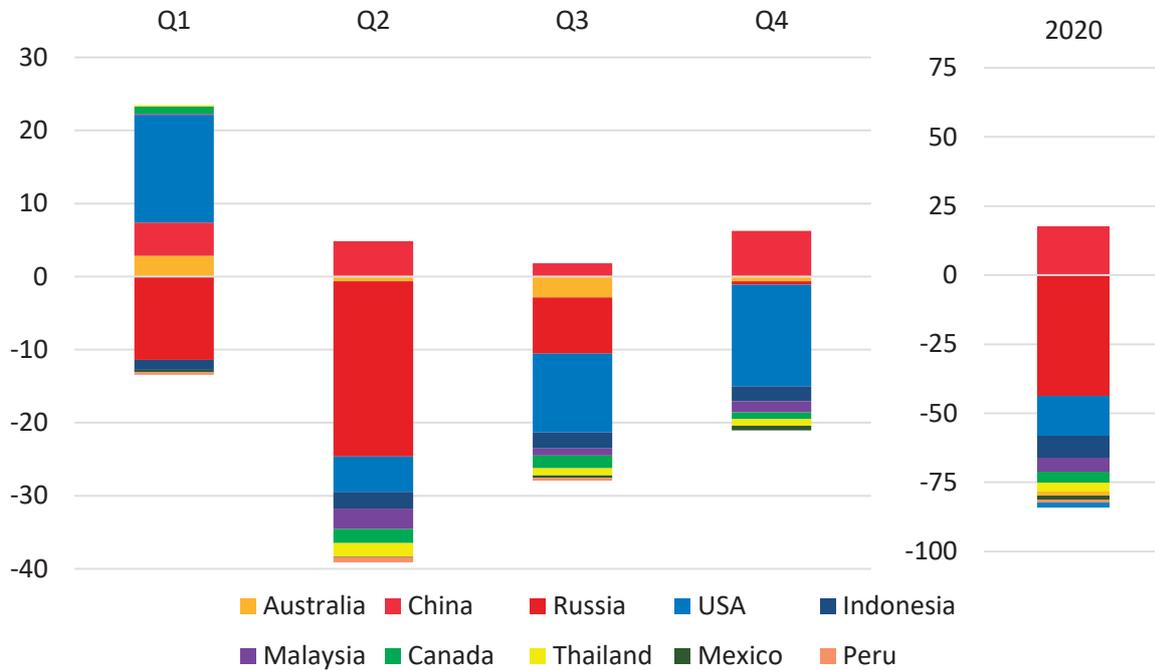
China deserves special attention because of its role as both a significant net-importer and oil producer. The significance of NOCs in China's oil industry explains the persistence of its production during the pandemic, but also presents limitations to growing production over the next five years. Moreover, deteriorating relations between the US and China, as well as the significant role that the US plays in supplying the energy-producing equipment necessary to increase oil supplies, is increasing China's focus on energy security (Downs, 2020). The rising tensions between the economies during the pandemic is heightening this focus, which may prompt China to pursue more ambitious production targets in its upcoming 14th Five Year Plan (FYP). China is considering further liberalisation to the upstream oil and gas industry, adding competition in the exploration and production of its resources in an effort to increase domestic production and reduce import dependence. It is possible that COVID-19 could increase China's oil supplies through 2025 due to this indirect channel.

Several uncertainties could alter the oil supply dynamic over the next few years. The persistence or rapid alleviation of the pandemic could alter the course of APEC oil supply requirements. The evolution of OPEC+ coordination will alleviate or exacerbate concerns surrounding oil disruptions. The emergence of Iranian exports would improve oil supply. While market-driven producers are transitioning into income-generating companies, recent M&A activity in North America could help accelerate the repair of balance sheets, enabling growth sooner rather than later. The emergence of private companies, insulated from investor influence, could drive production gains (Bloomberg, 2021). Lastly, further pressure on public companies to reduce emissions and building emissions and production reduction targets into their long-term business plans could limit supply and reduce energy security over the coming decade.

The ability of APEC to increase gas supplies

While global gas production was affected by the ongoing pandemic, falling by 3% in 2020, the impacts to global gas supply are milder compared to oil (CEDIGAZ, 2021). APEC continued to play a significant role, retaining 61% of global gas production in 2020 and declining at a similar rate to global gas production (2.7%) (IEA, 2021b).

Figure 3-7: Changes in quarterly natural gas production in select APEC economies, 2020 vs 2019 (bcm)

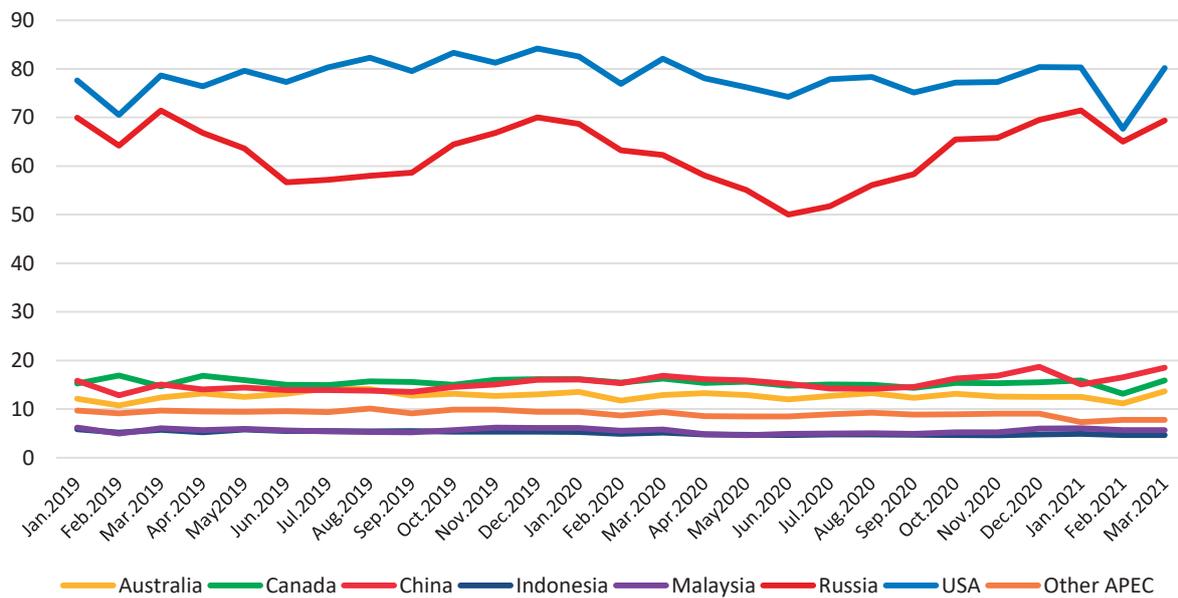


Sources: APEC EGEDA Monthly data (2021), IEA Monthly Natural gas statistics (2021c), Secretaría de Energía (2021), Ministerio de Energía y Minas del Perú (2021), economy statistics, JODI (2021), EIA (2021b), APERC estimations

Nowhere did gas production fall more than in Russia, with a 6% decline of 44 bcm. This was driven by a simultaneous steep decline in European demand and domestic consumption. Production in the US fell for the first time in a decade by 15 bcm, or 2%, with associated gas driving the declines following the steep decline of crude production. Production fell in all APEC gas producers, except for China, where production grew 10% to a record high of 190 bcm, and Papua New Guinea, where LNG exports drove production up 1%.

While Figure 3-7 illustrates the concentration of production losses in Q2 2020, Figure 3-8 shows how the top-two producers evolved throughout 2020. Despite the differences, by January 2021, gas output levels in most APEC producers returned to pre-pandemic levels. In fact, in that month, APEC gas production was marginally higher (0.4%) than in January 2019. This recovery proves that, while the pandemic is not yet over, APEC gas production is already above the output levels seen in 2019. Further production growth in the future, however, remains uncertain.

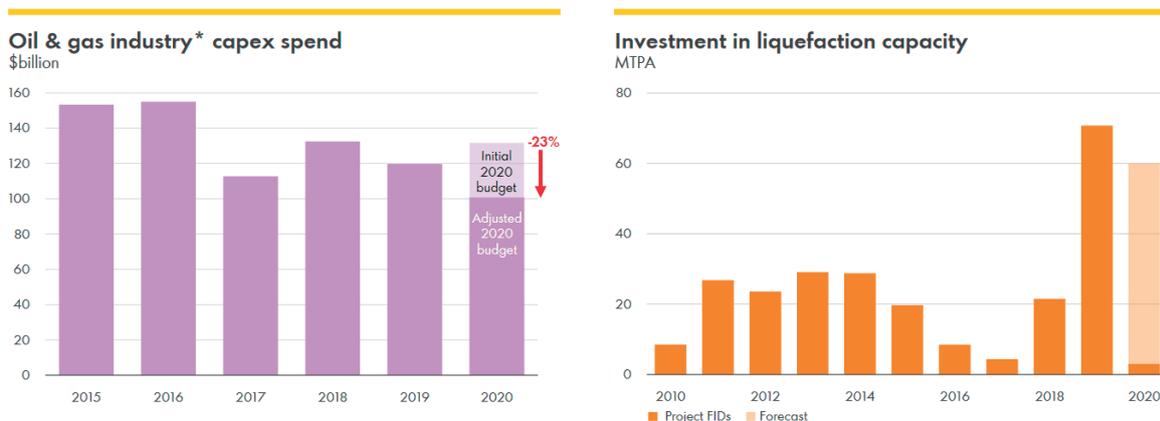
Figure 3-8: Monthly natural gas production in selected APEC economies (2019-2021) (bcm)



Sources: APEC EGEDA Monthly data (2021), IEA Monthly Natural gas Statistics (2021c), Secretaría de Energía (2021), Ministerio de Energía y Minas del Perú (2021)

One major concern affecting the availability of natural gas supply is the steep decrease in oil and gas investment detailed in Section 3-2. Indeed, as noted in Figure 3-9, the oil and gas industry CAPEX fell for a third consecutive year and was 23% lower than initially budgeted in 2020, falling almost in half to its lowest in at least two decades (Shell, 2021b; IEA, 2021b). While short term supplies appear to be growing, this casts uncertainty on the path that gas supply growth may take in the second half of the 2020s. Additionally, as detailed in Section 3-4, only one liquefaction project was sanctioned in 2020, providing about 5% of the expected capacity growth.

Figure 3-9: Oil and industry CAPEX and investment in liquefaction capacity



Source: Shell (2021)

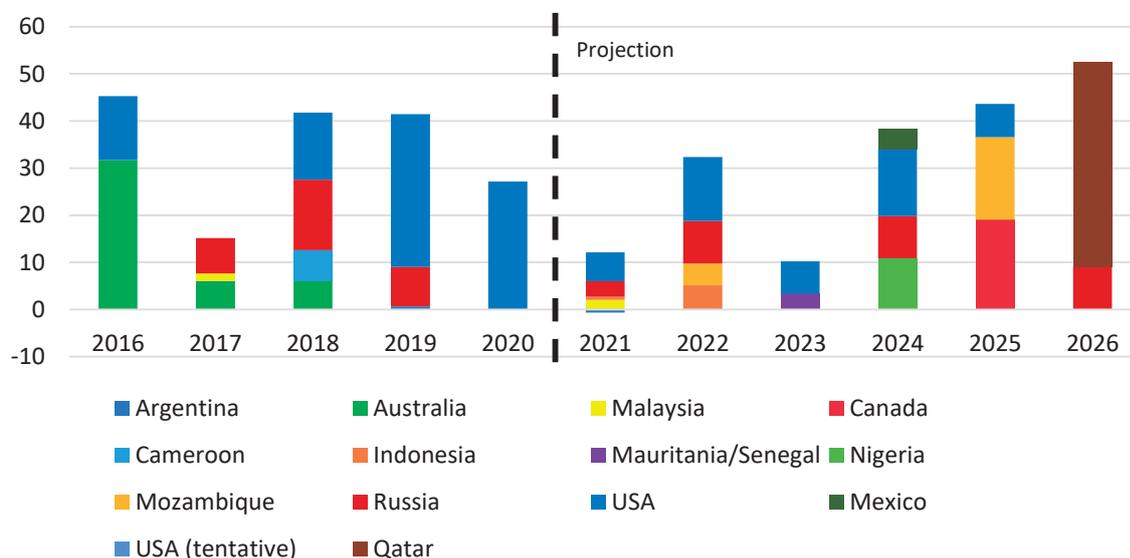
Having said that, global production is back at pre-pandemic levels and the IEA projects that 2021 will surpass 2019 levels, albeit in an uneven manner (IEA, 2021b). The US is a good example of this, with domestic production increasing marginally in 2021 and only recovering to 2019 levels by 2022 (EIA, 2021b). This results from a differentiated trend within the US, with production growth in the dry gas Appalachian basin and a slow recovery in associated gas from oil-drive basins like the Permian due to investor constraints and oil price volatility (IEA, 2021b). In contrast, Russia expects gas production in 2021 to grow by 7%, surpassing 2019 levels. In China production is projected set another historical high, surpassing 200 bcm in 2021. Elsewhere, LNG exports are already pushing Australian gas production to pre-pandemic levels. Finally, Qatar's LNG exports, the most relevant source of gas supply to APEC outside the region, were barely affected by the pandemic: its deliveries to APEC economies rose by 2% in 2020 (CEDIGAZ, 2021).

With APEC gas supply already recovered to pre-pandemic levels, gas supplies should not be an issue for APEC gas security prior to 2025. However, gas security was tested twice in APEC this year, with a northeast Asia LNG supply crisis in January 2021 and a freeze-off of almost 16% of American gas supply causing acute shortages in both Mexico and the US. Furthermore, this summer, perhaps in a response to these shortages, has seen LNG import demand raise LNG spot prices significantly, as importers rush to secure supplies to avoid being caught short. Thus, while APEC possess the *ability* to increase gas supplies to meet recent demand levels on an annual basis, several security crises highlight vulnerabilities throughout the gas supply chain. The ability to increase gas supply on annual aggregates matters little if consumer needs cannot be met due to the inability to sustain production during weather anomalies or logistical challenges preventing timely delivery of LNG cargoes.

3-4 LNG infrastructure delays in APEC economies

As previously noted, for the LNG industry the COVID-19 pandemic meant an exacerbation of uncertainty, price volatility and geographically dispersed shocks to both demand and supply. Not surprisingly, this meant two main challenges in terms of infrastructure: delays to current projects underway and postponements on decisions to build new infrastructure. Projects under construction faced delays, as supply chains and labour availability were affected by the pandemic restrictions. These effects were uneven across regions due to the variations in governmental responses. Moreover, companies and investors decided to postpone FIDs of several new liquefaction and regasification projects in 2020. Despite this, liquefaction capacity increased by 27 bcm per year (bcm/y), while 26 bcm/y of regasification capacity came online in 2020 (IGU, 2021). As of May 2021, the industry remains cautious in the face of this uncertainty, with only one major infrastructure announcement in 2021, QatarGas' North Friel East FID. Despite this, we do not expect a sustained tightening of the global LNG market until the 2030s, as around 190 bcm/y of liquefaction capacity currently under construction is expected to come online by 2026, as seen in Figure 3-10.

Figure 3-10: Liquefaction capacity additions by year and economy, 2016-26 (bcm)

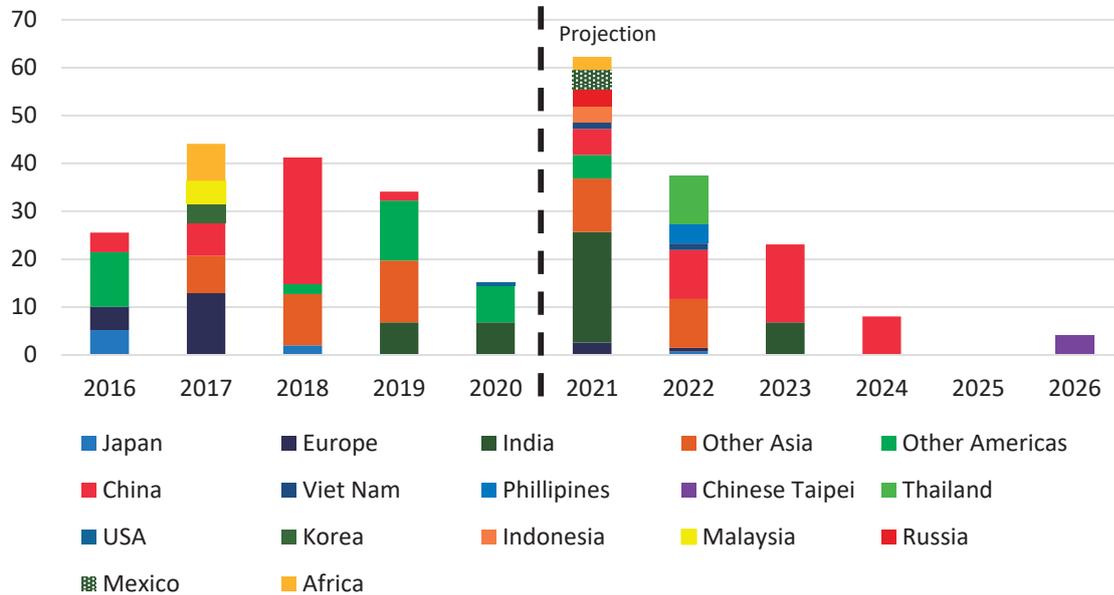


Source: APERC analysis, IGU (2021)

At the start of 2020, around 150 bcm/y of liquefaction capacity was under construction, of which 24 bcm/y was expected to become available during that year (IGU, 2020). However, the effects of the pandemic, particularly the disruption to supply chains and lockdown restrictions, affected the construction of these projects. Despite the adverse situation, 27 bcm/y of liquefaction capacity went online in 2020, all in the US, including Freeport LNG T2 and T3, Cameron LNG T2 and T3, and six trains at Elba Island LNG (IGU, 2021). Four APEC projects faced delays, however, and are now expected to start operating in 2021. These delayed projects are the Portovaya LNG and Yamal LNG T4 in Russia, PFLNG Dua in Malaysia and Indonesia’s Sengkang LNG T1. Other projects avoided delays and should start operations as planned, including Corpus Christi LNG T3 in 2021, as well as Calcasieu Pass LNG and Golden Pass LNG, in 2022 and 2024, respectively.

Regasification terminals were similarly affected by COVID-19 restrictions. In January 2020, 26 receiving terminals, representing 98 bcm/y of capacity, were under construction and around 30 bcm/y of regasification capacity was commissioned in 2020 (IGU, 2021). Supply chain disruptions, mobility restrictions and demand reductions took their toll, delaying 17 bcm/y of capacity to 2021. On the other hand, projects totalling 13 bcm/y of regasification capacity managed to start operations in 2020. Over 60 bcm/y of regasification capacity should commission in 2021, resulting from a combination of deferrals and projects that remain on schedule. Most of this infrastructure is in non-APEC economies, particularly India. However, the 1.4 bcm/y Hai Linh LNG terminal in Viet Nam is expected to start operations in 2021, as is the Cilamaya Jawa-1 FSRU in Java, Indonesia.

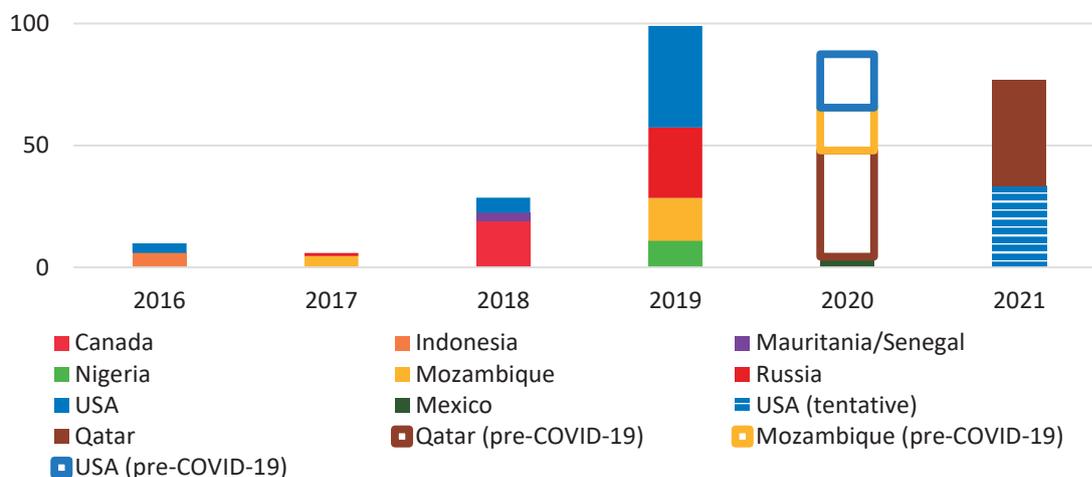
Figure 3-11: Regasification capacity additions by year and economy, 2016-26 (bcm)



Source: APERC analysis, IGU (2021)

In terms of sanctioned liquefaction capacity, 2019 had seen an unprecedented high of 100 bcm/y of capacity reaching FID (IEA, 2020). At the start of 2020, analysts and key stakeholders expected the sanctioning of around 90 bcm/y of liquefaction capacity (IGU, 2021). However, as a consequence of the pandemic, only one project reached FID in 2020, the 4.4 bcm/y Energía Costa Azul (ECA) LNG in Mexico. Highly expected FIDs, including Qatar’s North Field Expansion, Mozambique’s Rovuma LNG and different projects in the US, were deferred. As of June 2021, however, QatarGas had already sanctioned its huge 43 bcm/y capacity expansion on its North Field East project. Meanwhile, some projects, including Port Arthur LNG, Freeport LNG T4 and Driftwood LNG in the US, delayed their sanctioning and are expecting to achieve it sometime in 2021. Uncertainty remains but APERC expects sanctioned liquefaction capacity to be around 75 bcm/y at the end of 2021.

Figure 3-12: Sanctioned liquefaction capacity by year and economy, 2016-21 (bcm)



Source: APERC analysis, IGU (2021)

With current online liquefaction capacity standing at 616 bcm/y and LNG trade reaching an all-time high of 484 bcm in 2020, annual average LNG supply is projected to keep surpassing demand well into the mid-2020s. Moreover, with 189 bcm/y of liquefaction capacity currently under construction to begin operations by 2026, global LNG supply should be well positioned to meet robust LNG demand growth in the mid-term. Moreover, according to the International Gas Union (IGU), about 1 213 bcm/y of liquefaction capacity is at a pre-FID or aspirational stage. Nevertheless, the growing rate of LNG demand, with current regasification capacity at 1 156 bcm/y and over 135 bcm/y of additional capacity under construction, will create pressure to secure a continuous supply, particularly in growing demand centres like China, Indian and Indonesia. Moreover, new importers, notably Viet Nam and the Philippines, with rapid energy demand growth and declining domestic gas supplies, are expected to ramp up their LNG imports after the commissioning of their first regasification terminals in 2021 and 2023, respectively. Therefore, despite the delays in the construction and sanctioning of liquefaction and regasification terminals, global LNG supply should be in position to meet growing LNG demand in the APEC region, but there will likely be seasonal issues due to infrastructure constraints.

The security of gas supply in APEC, particularly the Asian importing regions of China and southeast Asia, is not a question of supply or the global existence of liquefaction infrastructure, but a question of logistics and gas storage. Section 5 will detail how this absence of gas storage creates significant logistical constraints for procuring just-in-time delivery of LNG for gas when it is most needed, which can result in significant disruptions like those witnessed in north-east Asia during the latest winter.

SECTION 4. FISCAL IMPLICATIONS OF COVID-19 IN THE APEC REGION

A key goal of government support and stimulus is to ensure that businesses survive the worst of the downturn in demand brought on by COVID-19. While this will not save all businesses, it should be able to prevent a collapse in any given sector. For example, while there have been several bankruptcies amongst the underperforming US shale producers, support has helped producers endure the hardest part of the pandemic. Going forward, the allocation of capital to increase oil and gas supply will be determined largely by the equities market. In Canada and the US, this will likely limit the uplift that government assistance will have on oil and gas supplies, as cashflow preference is for investor remuneration, not production growth. It will be difficult for governments to encourage publicly traded producers to increase supply in this environment.

An examination of the government balance sheets in this section (Figure 4-1) highlights that several significant APEC oil and gas importers, including China and many southeast Asian economies, have debt-to-GDP ratios below 60%. There is room for many APEC members to ramp-up fiscal spending to reduce the vulnerabilities and risks to oil and gas supply disruptions.

A notable difference between the COVID-19 recession and the Global Financial Crisis (GFC) from 2007 to 2009 is that monetary policy will be relatively ineffective at growing oil and gas supplies in the current recession. While interest rates came down significantly in 2009, fuelling cheap credit for supply growth in Australia, Canada and the US, they have been relatively low ever since, leaving little room for rates to fall presently.

4-1 Government and central bank response to COVID-19 in the APEC region

The economic impacts of COVID-19 have been immense and are still unfolding. Consumers and businesses throughout APEC are adapting to a new demand and new supply reality. To meet the challenge of this economic disruption, APEC governments, central banks, and other state-based institutions are providing support. The support is alleviating the worst of the short- to medium-term economic hardship, and will facilitate a smoother recovery once the health situation improves.

Most APEC economies have imposed periods of shutdown for non-essential economic activity and have limited the extent of trade within and between different jurisdictions. Social distancing measures have also been imposed to limit the transmissibility of the virus. The combined actions of shutdowns and social distancing have led to a significant reduction in labour demand, resulting in reduced working hours and reduced business operations. The resultant loss in income has filtered through to almost all sectors of economies, though some have been affected more than others. While the health impacts of the pandemic persist, it is difficult for economies to return to their full economic potential. The challenge for APEC economies is to provide a level of support to households and businesses that will allow them to endure the worst impacts of the virus, enabling them to return to their full economic potential once the pandemic subsides.

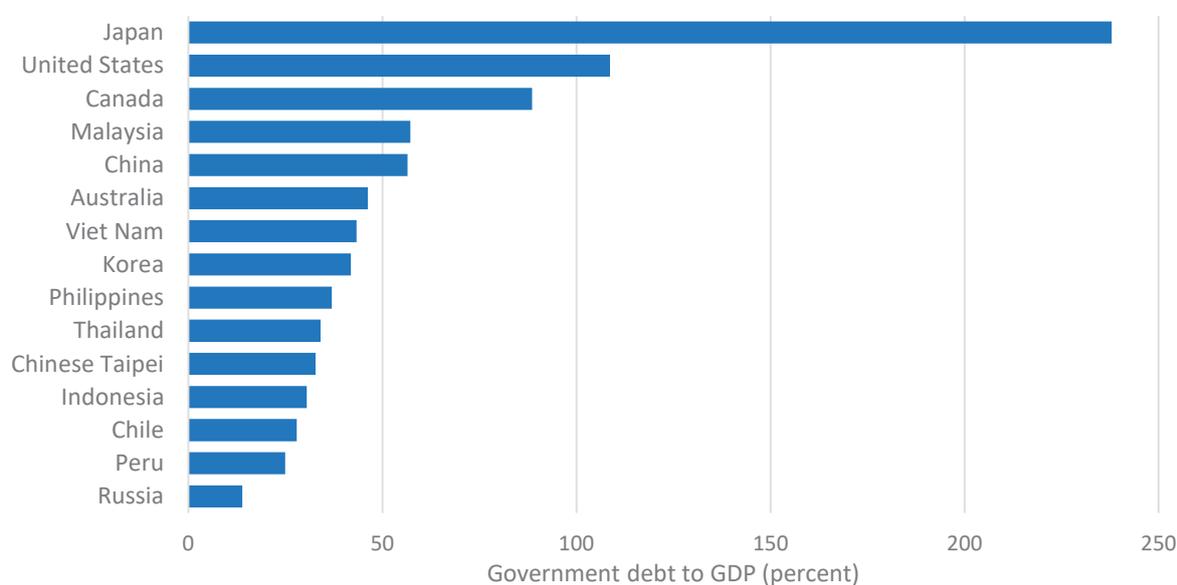
Determining appropriate levels of support is complex. Support interventions typically reduce economic efficiency by adversely impacting economic incentives. Moreover, both fiscal (government balance sheets) and monetary (central banks) support imposes a cost that will eventually need to be met. It is

important to provide support that is well targeted and adequate in size. However, this is again complicated by the uncertainty, magnitude, and path of the pandemic.

Government balance sheet response in APEC economies

Governments tax their populace to fund government spending on things such as infrastructure, education, and health. When taxes are insufficient to meet government spending, governments can fund the shortfall by issuing government bonds, which is synonymous with taking on debt. Government debt is a viable way to meet spending commitments in lieu of taxation. Over the course of recent decades, there has been a general trend of increasing levels of government debt. This has culminated in very large increases of sovereign debt-to-GDP levels by many economies in response to the 2009 GFC. APEC debt levels just before the pandemic hit, in 2019, are shown in Figure 4-1.

Figure 4-1: Government debt-to-GDP ratio for select APEC economies, 2019



Source: IMF (2021)

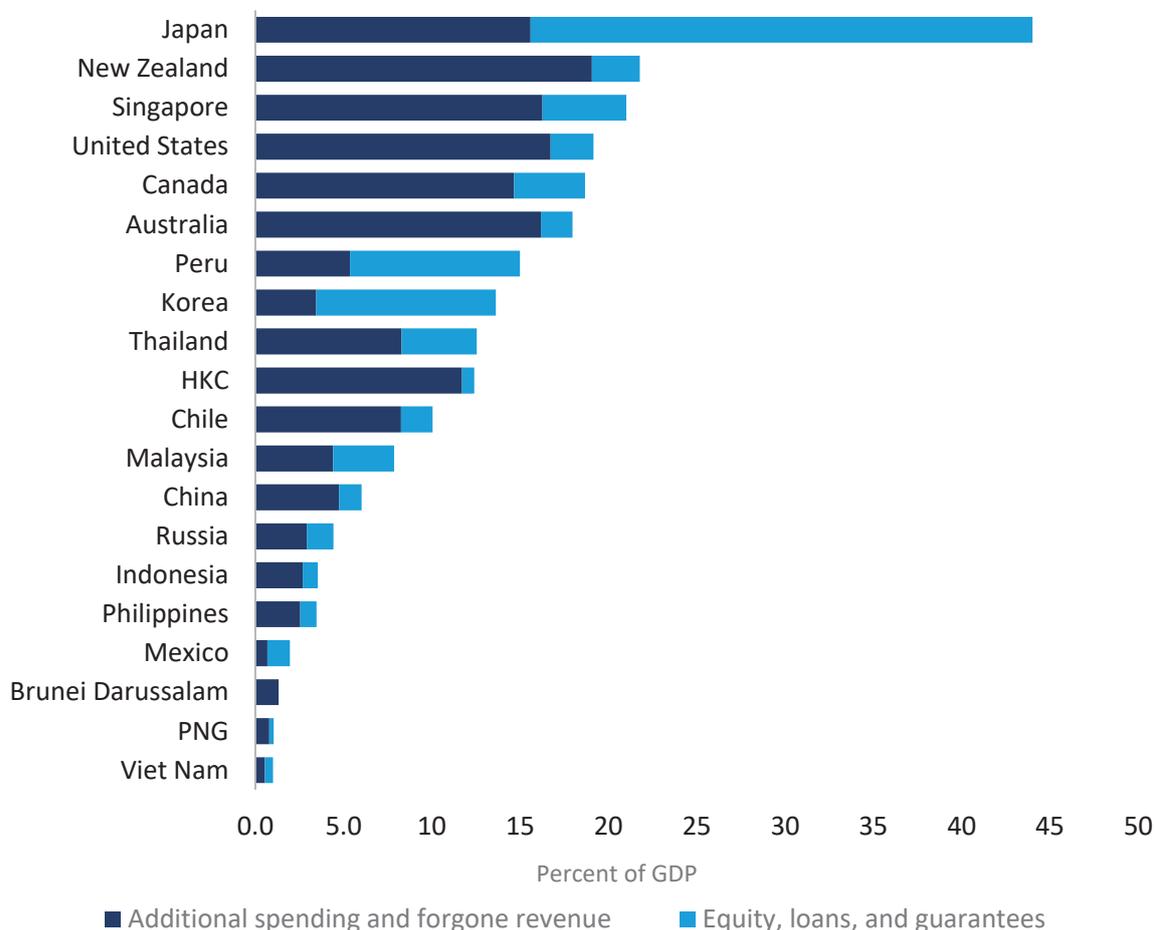
Japan is a clear outlier, with a government debt level almost two-and-a-half times its GDP. Japan's debt levels have been rising since its finance and real estate bubble burst in the 1990s. For many economies, a government debt level as high as Japan's would lead to default. However, this has yet to happen in Japan due to large-scale purchasing of government bonds by the Bank of Japan, and a large proportion of debt being held by domestic investors. This has helped to alleviate the pressure of rising yields, given that these domestic investors are less likely to sell their holdings.

Even though government debt-to-GDP levels were much lower in other APEC economies, sovereign default risk is still significant. In the US, government debt stood at 109% of GDP, followed by Canada at 89%. Malaysia, China, Australia, Viet Nam and Korea all had high, but more manageable ratios that were closer to 50% of GDP. In the case of Australia, a more manageable government debt-to-GDP level may seem prudent. However, households in Australia are some of the most indebted in the world, meaning that the economy is still susceptible to default risk, albeit via a different route.

Inflated debt-to-GDP levels are not necessarily unsustainable, so long as interest rates remain low. This is because the burden is not the absolute level of debt, but the cost to service the debt. Interest rates are now near zero, or very near zero, for many APEC economies, with the trend of lower and lower interest rates directly related to the trend of higher and higher levels of government debt, especially since the Great Financial Crisis. Low interest rates help economies take on more debt, especially in response to events such as those that took place in 2020. However, financial prudence remains important. Ever expanding levels of debt will eventually lead to a reckoning.

In response to the rapidly worsening pandemic situation in early 2020, many APEC governments moved quickly to enact government spending support programs. As of December 31, 2020, the IMF estimates that the level of fiscal support to APEC economies amounted to USD 8 342 billion. This comprised USD 5 825 billion of additional spending and foregone revenue and USD 2 518 billion of liquidity support in the form of equity, loans and guarantees. The total fiscal support provided by APEC governments is shown as a proportion of each member economy's GDP in Figure 4-2.

Figure 4-2: Discretionary fiscal response to the COVID-19 crisis in APEC economies, at the end of 2020



Source: IMF (2021)

The APEC economies of New Zealand, the US, Singapore, Australia, Japan and Canada each initiated large additional spending responses equal to 15 to 20% of GDP, which includes accounting for revenue losses. The magnitude of liquidity support provided by APEC economies was typically smaller. However, for Japan, this support was larger than the additional spending and foregone revenue, equal to USD 1 428 billion. Most of this support involved concessional loans and guarantees to Japanese firms. Taken together, Japan’s response will have significantly increased the government debt burden, as shown in Figure 4-2. Peru and Korea also provided extensive liquidity support via guarantees on loans to small to medium-sized enterprises (IMF, 2021).

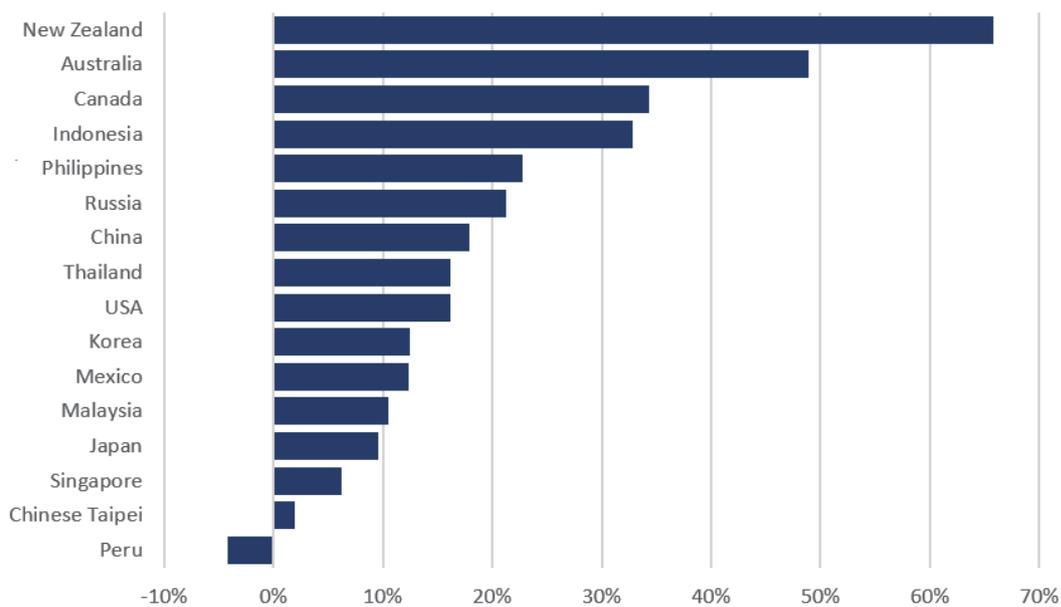
These APEC support programs were funded through a spate of government bond issuances throughout APEC and the world. Issuing bonds is preferable to raising taxes in times of economic turmoil, because while taxation is typically an immediate obligation, debt shifts the obligation to a future point in time.

Ordinarily, there are many buyers of government-issued bonds, accounting for the risk-adjusted nature of the sovereign issuing government. However, the market fallout in March 2020 meant that sellers of government bonds far outweighed buyers. Banks, insurance companies, asset managers, mutual funds, hedge funds, and other financial institutions became net sellers of bonds due to their demand for cash to meet obligations caused by the turmoil.

In response to this turmoil, many central banks shouldered a larger role in the market for government bonds, effectively acting as buyers of last resort. As mentioned, this is a role that has been assumed by the Bank of Japan for many years now. In some economies, such as the US, central banks also purchased non-government bonds, such as mortgage-backed security bonds, due to a mismatch between demand and supply that was threatening the financial stability of these markets.

The various support programs devised by APEC economies have caused the level of outstanding government debt to increase considerably. The level of outstanding government-issued debt at the beginning of the third quarter 2020 grew in all surveyed APEC economies except for Peru (Figure 4-3).

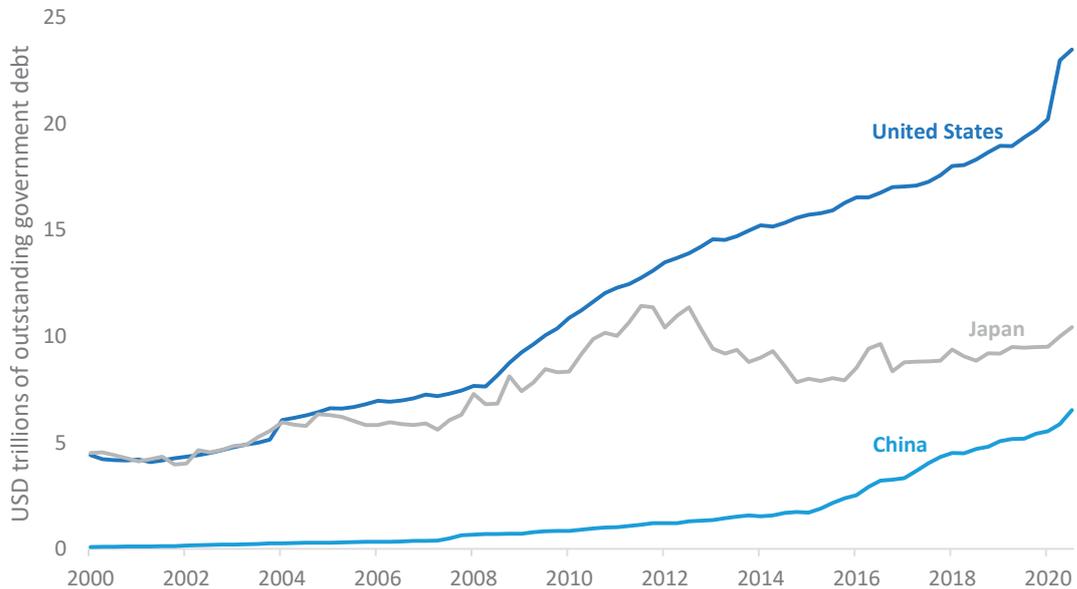
Figure 4-3: Change in outstanding government-issued debt between beginning of first quarter, 2020 and beginning of third quarter, 2020



Source: FRED (2021)

For economies like New Zealand and Australia, the percentage change has been very large, though this is mainly due to these APEC economies having a lower initial level of sovereign debt, as shown in Figure 4-1. For economies like China, Japan, and the US, the change is smaller, but this is because these economies already had a very high level of sovereign debt (Figure 4-4).

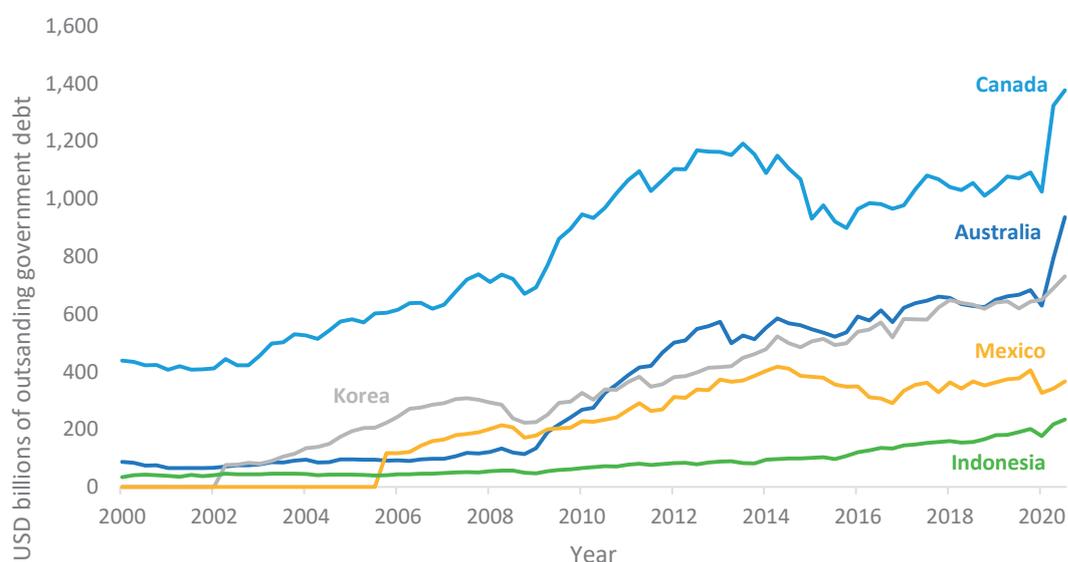
Figure 4-4: China, Japan, and the US outstanding government-issued debt, January 2000 to July 2020



Source: FRED (2021)

For Australia, Canada, and Indonesia, the change in the size of outstanding government-issued debt is stark for the first two quarters of 2020 (Figure 4-5), increasing by 49%, 34%, and 33%, respectively. In contrast, Korea and Mexico government debt has continued to follow a historical trend, though the increase for the first half of 2020 still amounts to a 13% and 12% increase, respectively.

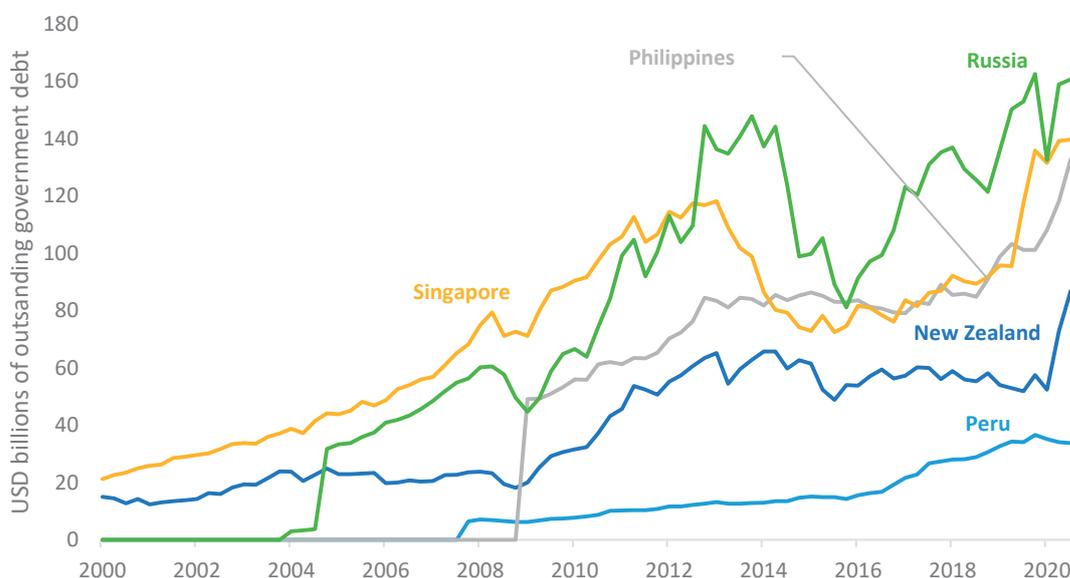
Figure 4-5: Australia, Canada, Korea, Indonesia, and Mexico outstanding government-issued debt, January 2000 to July 2020 (USD Billions)



Source: FRED (2021)

For the last cluster of APEC economies shown in Figure 4-6, New Zealand (66%), and the Philippines (23%) show a clear increase in government bond issuances. Singapore also increased its government-issued debt, but this occurred prior to the pandemic. Russia reissued sovereign debt in the second and third quarters of 2020 that almost made up for the decline that it posted in the first quarter, 2020. Peru's level of government debt issuance has remained at a similar level for the first half of 2020, falling by 4%. Thailand (16%), Malaysia (11%) and Chinese Taipei (2%) posted modest increases that were in line with historical trends.

Figure 4-6: New Zealand, Peru, the Philippines, Singapore, and Russia outstanding government-issued debt, January 2000 to July 2020 (USD billions)



Source: FRED (2021)

The extent to which APEC economy governments have taken on debt varies in APEC. However, it is clear that APEC governments are now shouldering larger sovereign debt levels than would have otherwise been the case.

Monetary policy response in APEC economies

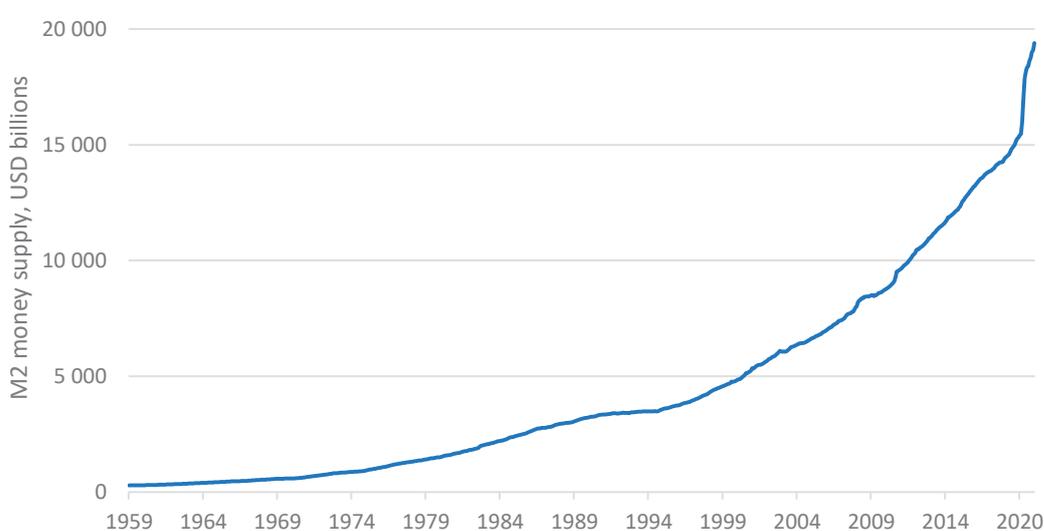
Central banks are chiefly tasked with ensuring financial stability. They may also have mandates that target employment, inflation, interest rates or exchange rates. Since the GFC, interest rates have been at historic lows for many economies. This is implicitly tied to high government and private debt levels that have been consistently growing for many economies, as shown in the section above.

Reducing interest rates is one of the main ways that central banks stimulate economic activity. But in a close-to-zero interest rate environment, this policy response is less effective. Moreover, to attempt to stimulate economic activity while limiting human interactions to avoid the worst impacts of the pandemic is not feasible.

With already low interest rates and no immediate need to stimulate economic activity while the health crisis persists, there has only been a limited role for central banks in reducing interest rates in response to COVID-19. Instead, central banks have been important in providing liquidity to ensure financial stability. This has involved central banks in both developing and advanced APEC economies intervening in the money market, foreign exchange markets, government bond markets, and non-government securities markets, taking measures to ensure markets continued to operate in the face of increased uncertainty caused by COVID-19.

For instance, with the large increase in US government-issued debt (Figure 4-4), the US Federal Reserve purchased a significant portion of these bonds, thereby injecting liquidity into markets. Figure 4-7 shows that the US Federal Reserve was the dominant buyer of US Treasury bonds that were issued to fund COVID-19 support programs. The spike in the money supply in 2020 onwards correlates closely with the increase in government debt issuances shown in Figure 4-7. Many other APEC central banks have been large buyers of government debt that was issued to fund support programs to see economies better weather the impacts of COVID-19.

Figure 4-7: US M2 money supply, 1959 to 2021 (USD Billions)



Source: FRED (2021)

The turmoil in financial markets has also led to innovative ways for central banks to ensure financial stability. For instance, in Australia, the Term Funding Facility was provided to large domestic banks by the Reserve Bank of Australia to ensure funding costs remain accommodative. The Term Funding Facility has kept financing costs artificially lower than would otherwise be the case without central bank intervention. This intervention is at the expense of the central bank shouldering a larger burden of counterparty risk, which can be justifiable in the context of an economic shock such as COVID-19.

4-2 Where is COVID-19 relief money going?

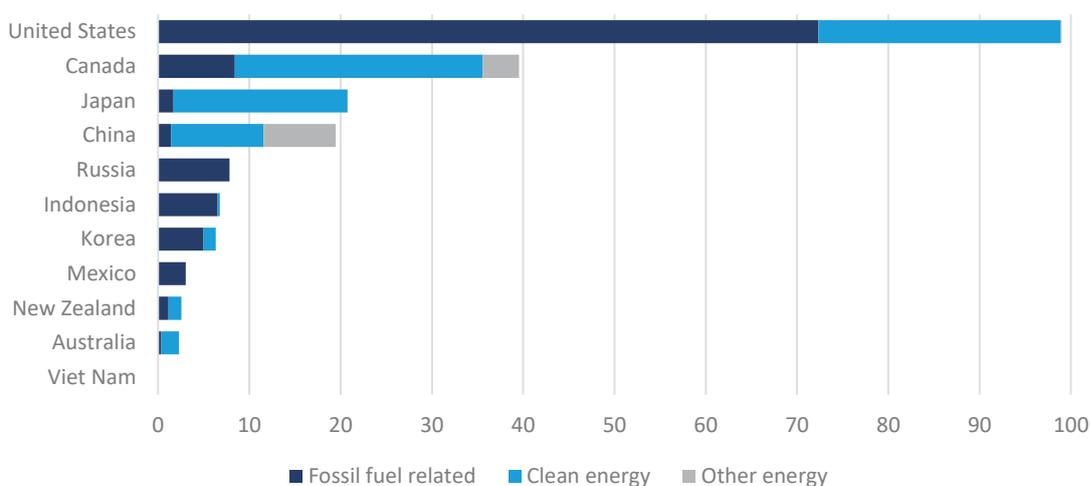
New government debt issuance, existing taxation, and available reserves are funding a raft of support measures for consumers and businesses in APEC member economies. A large proportion of government spending has been in the form of direct cash handouts to households and businesses. This spending has offset the loss of income and reduced economic activity that has come with lockdowns and social distancing policies designed to slow the transmission of the virus.

This short-term support to meet the health challenge of COVID-19 has been vital for the welfare of APEC member economy citizens. Without such support, many businesses would have failed due to being unable to endure liquidity and solvency issues resulting from reduced economic activity. This support is

allowing businesses to remain in a period of stasis, ready to begin operating again once the worst of the pandemic impacts begin to subside. Without such support, the recovery would be less rapid.

In addition to meeting the challenge of forced economic slowdown, APEC governments have devised productive stimulus programs to promote economic recovery during the continued health crisis, and for when the health impacts begin to abate. Part of this economic stimulus is directed towards the energy sector for many economies. Figure 4-8 shows the level of committed energy sector funds for a select group of surveyed APEC economies.

Figure 4-8: Announced fiscal spending on energy sector programs, in 2020 and 2021 (USD billions)



Note: Other energy includes nuclear, “first generation” biofuels, biomass and biogas, waste-to-energy, hydrogen of unspecified origin, and multiple energy types, that is: instances where both fossil and non-fossil energy are tied together (Energy Policy Tracker, 2021).

Source: Energy Policy Tracker (2021)

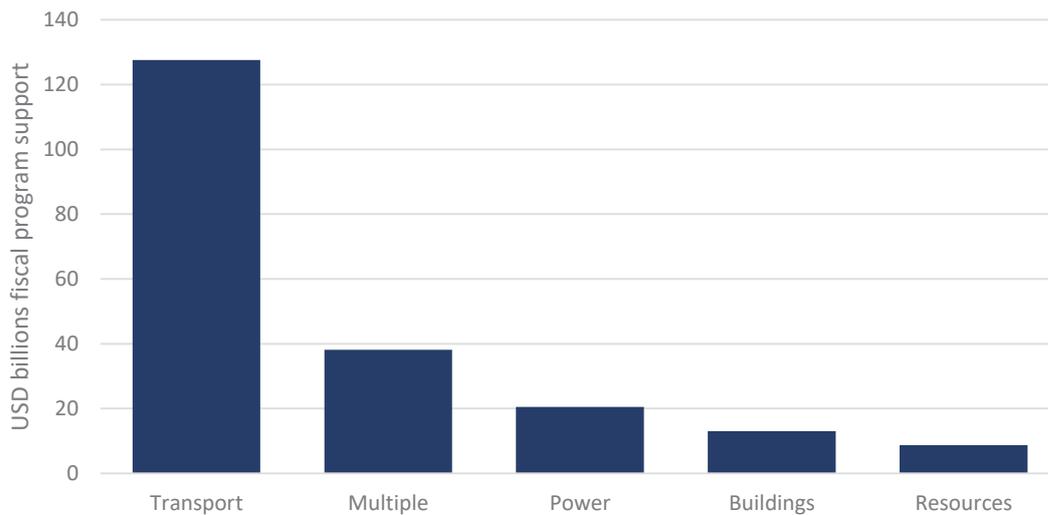
The fiscal spending is implemented by multiple levels of government. Support for fossil fuels is both direct and indirect. For example, in Canada, aviation industry relief is a form of indirect fossil fuel support. Similarly, in Australia, there is support for regional hydrogen clusters which will be dependent on fossil fuel to produce the hydrogen.

The most fiscal support to the energy sector is being provided by the US government and amounts to USD 99 billion. The combined fiscal support being provided by these 11 APEC member economies in 2020 and 2021 is over USD 208 billion.

For Russia, tax code amendments on oil and gas production and changes in certain relief measures on the mineral extraction tax and export tax mean that the fossil fuel sector is effectively supporting the rest of the economy, to the tune of over USD 3.1 billion. This negative support is not included in Figure 4-8.

The sectors that are receiving the most fiscal support align with those sectors that have been hardest hit by the pandemic. Figure 4-9 shows that USD 128 billion had flowed to the transport sector, with much of that support directed towards aviation. In the US, the Department of Treasury will use USD 58 billion of funds raised through the Coronavirus Aid, Relief, and Economic Security (CARES) Act to provide support to airlines. Similarly, China is providing Cathay Pacific with a USD 3.6 billion bailout package.

Figure 4-9: APEC fiscal spending on energy sector programs in 2020 and 2021, by sector (USD billions)



Note: Fiscal support captured in this chart is only for Australia, Canada, China, Indonesia, Korea, Japan, Mexico, New Zealand, Russia, the United States, and Viet Nam.

Source: Energy Policy Tracker (2021)

The US CARES Act is also providing fiscal support of USD 25 billion for public transit. Similarly, the Chinese government is providing USD 14.5 billion of railway development capital as part of a wider industry support package, and Canada is providing USD 11.1 billion of public transit infrastructure funding.

In the US, CARES is also providing USD 10 billion for airports, distinct from airlines, and USD 1.0 billion support for Amtrak rail services. There are multiple other aviation relief packages being offered by APEC member economies, including bailouts to airlines in Indonesia and Korea and airline support packages in Japan, Australia, and Russia.

For more overarching support to the energy sector, Japan is allocating USD 18.7 billion to a fund to develop innovative technologies for carbon neutrality. In Russia, Gazprom is allocating USD 7.3 billion for the gasification of Russian regions. In China, there is USD 1.34 billion to launch a Green Development Fund, which aims to spur a clean post-COVID transition. For these 11 APEC economies, there is USD 20.5 billion of fiscal funding commitments for the power generation sector. China is also allocating USD 8.7 billion of this power commitment for ultra-high-voltage transmission line investments.

Direct support for the oil and gas sectors

There is also support being provided to APEC oil and gas sectors directly. For instance, in Australia, the federal government is providing subsidies to oil refineries and providing grants to assist with building additional diesel storage and announced measures to promote a gas-led recovery. Measures include support for increased production (including the potential development of new basins), as well as investments in infrastructure to improve access and delivery. This support will promote domestic use of natural gas, though may not be sufficient to reverse the current trend of declining natural gas use in Australia (IEEFA, 2020).

Canada is providing tax relief for petroleum producers, allocating additional budget finance to the oil and gas sector, including the extension of natural gas networks, deferment of liability levies on producers, and providing USD 239 million to keep Newfoundland and Labrador's offshore oil production a going concern. To complement this support, the Canadian government has also announced funds to improve energy efficiency, reduce emissions, and foster other cleantech initiatives in the oil and gas sectors. This meets the dual mandate of supporting the oil and gas sectors while making progress to meeting emissions reductions goals. Canada has tabled multiple targeted support measures for the oil and gas sectors.

Mexico, Indonesia and China are also allocating targeted fiscal support for domestic oil and gas companies (EPT, 2021). Indonesia is providing USD 2.6 billion compensation payment for PT Pertamina, the state-owned oil and gas enterprise and Mexico is reducing Pemex's tax obligation by USD 3.0 billion to foster exploration and extraction activities.

Meanwhile, Russia is intervening in the oil and gas sectors by raising taxes to support the rest of the economy. However, this is unlikely to lead to reduced production, due to the large export markets that Russia services; gas production is relatively inelastic. Gazprom is simultaneously allocating USD 7.3 billion for the gasification of Russian regions, which will provide an additional domestic stimulus for Russian oil and gas (EPT, 2021). Russia is also providing a tax deduction linked to the volume of investments in natural gas liquids. This support policy occurred due to the oil price plunge and demand shock caused by COVID-19 in early 2020. In the US, much of the support to the oil and gas sector is indirect and flows via broad-based support provided to businesses in all sectors. The oil and gas sectors have benefited from this support, even though it is not necessarily targeted at them. There has been direct support in the form of waivers and reductions in royalties for oil and gas extraction (EPT, 2021). Federal reserve purchases of corporate bonds have also provided direct benefits to the US oil and gas sectors.

Most of the initial fiscal stimulus for COVID-19 was economy-wide support for consumers and businesses, and was not targeted at specific sectors. Direct oil and gas support fiscal spending is occurring, though at relatively low levels of USD 8.8 billion throughout APEC (5.4% of energy sector assistance). It is currently unclear how much of this funding will result in a tangible increase in oil and gas supplies to meet demand once it returns to pre-pandemic levels. Without support being conditional on supply growth, it may instead flow through to investors (through dividends and share buybacks) or be used to reduce financial leverage. This outcome is likely due to investor focus on income generation spurred by several years of unsustainable supply growth and presents a primary risk to the surety of the short-term oil and gas supply.

4-3 What could be learned from the Great Recession relief packages?

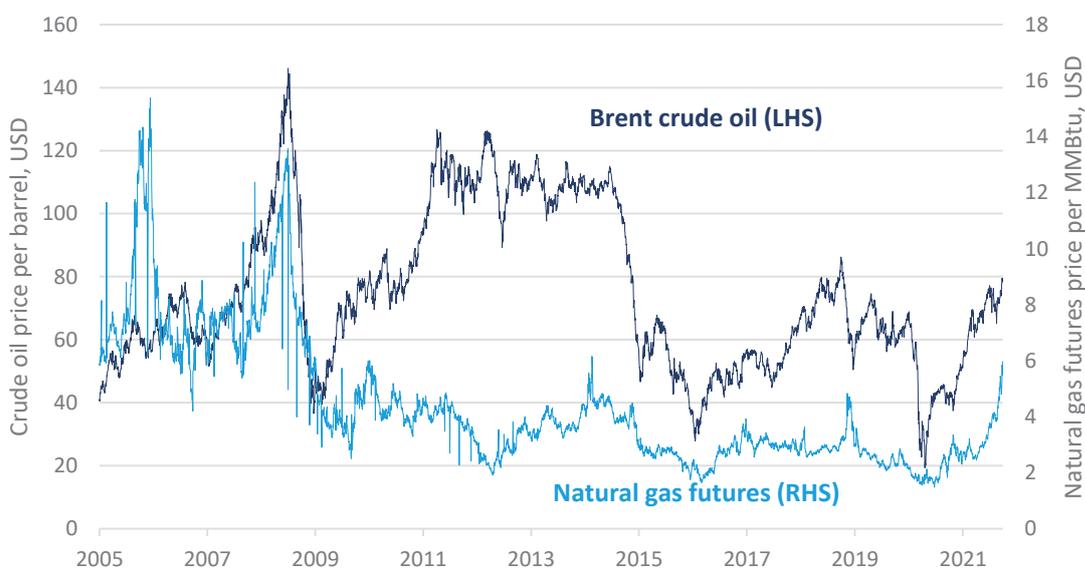
Assessment of relief packages requires an analysis of the observed impacts with reference to a counterfactual scenario; a state of the world where no interventions were made. This is difficult given that the world can only ever tread one path. There is no way for governments or central banks to simultaneously intervene and not intervene at the same time.

When the market ruptures began in 2007, the global interest rate environment was very different to what it is now. Central banks had sufficient room to lower interest rates to stimulate demand. But by the time Lehman Brothers collapsed in September 2008, financial institutions were unwilling to lend at any price, given the high risk of counterparty default and bankruptcy.

A massive supply of liquidity by central banks, expansion of deposit insurance, guarantees for bank debts, capital injections using public funds, separation of toxic assets from balance sheets and governmental control of troubled financial institutions took place to ensure financial markets continued to operate (Nakao, 2010). Similar interventions were repeated by governments and central banks in early 2020 in response to the COVID-19 influenced market turmoil.

Once financial stability was restored in 2008, the deterioration of the real economy became the next challenge. APEC and the world face similar challenges now, in 2021. Following the GFC, governments shifted to enacting expansionary fiscal policy and central banks moved to set accommodative monetary policy. The oil and gas sectors were particularly hard hit by the economic fallout, with an initial steep decline in oil and gas prices, as shown in Figure 4-10. Crude oil prices moved from above USD 140 to below USD 40 in the space of months. The financial crisis also led to a drop in valuation of oil and gas assets as credit contracted and earnings projections fell.

Figure 4-10: Oil and natural gas benchmark prices, 2005 to 2021



Source: Investing.com (2021)

After the initial deflationary impacts of the great recession, the extent of government and central bank stimulus facilitated a global recovery. Oil prices moved higher once again, though gas prices remained comparatively low. The sustained lower prices for gas were due to the shale revolution that facilitated large increases in production, particularly in North America.

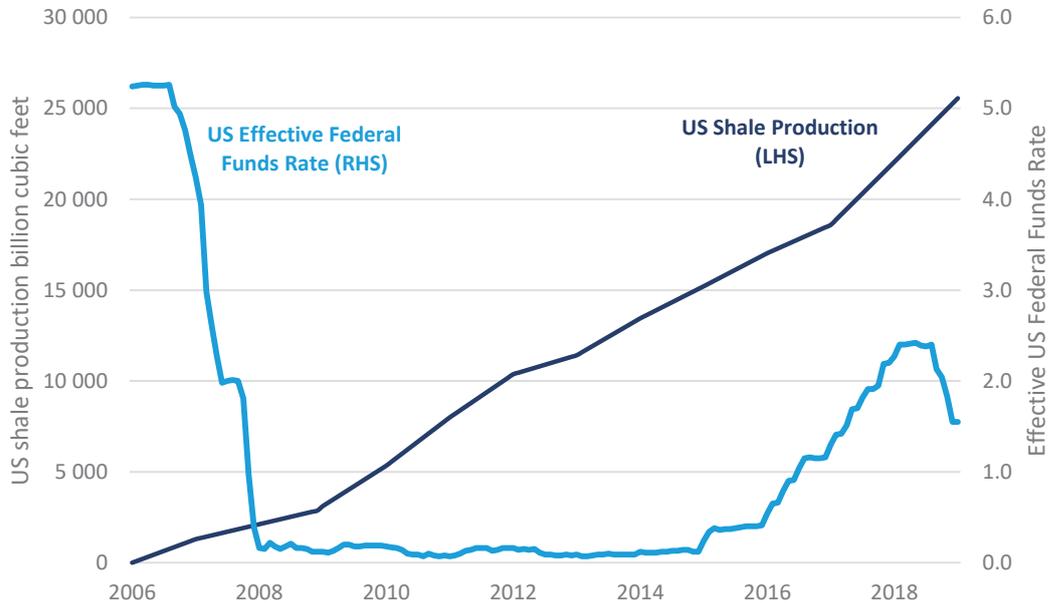
The impact of government and central bank stimulus on APEC's oil and gas sector

In the US, the American Recovery and Reinvestment Act injected almost USD 900 billion dollars into the US economy in response to the GFC. Ninety billion was committed to clean energy projects with the intention of facilitating a transition away from a high dependence on fossil fuels. The clean stimulus experience of the United States also occurred in other APEC economies like Korea and China. Green investments helped economies recover, created jobs, and built up new industries (Jaeger, Westphal and Park, 2020).

While fiscal spending was successful in the clean energy domain, the monetary policy impacts have been more influential. The low interest rate environment was instrumental in encouraging financing for the young shale gas industry in the US. For the rest of APEC, similarly low borrowing costs and a large supply of surplus capital led to significant unconventional gas developments. This meteoric increase in natural gas production and LNG export capacity was largely enabled by the lower global interest rate environment that has been in place since the GFC (Mclean, 2018).

For APEC economies, the technological innovation that has facilitated the production of shale gas has been one of the most influential factors for oil and gas security. But the magnitude of influence of this innovation would not have been as large without the accommodative investment environment that was in place following the GFC. For the US, the increase in shale gas production accelerated after the financial crisis, as shown in Figure 4-11. Interest rates began to rise in the US in 2015, though they were still at relatively low levels in the years leading to the COVID-19 pandemic.

Figure 4.11: US shale production and effective US Federal Reserve Funds rate, 2006 to 2020



Source: FRED (2021); EIA (2021)

For Australia, a similar large ramp-up in unconventional gas production occurred, increasing from 289 PJ in the 2013-14 financial year, to over 1 408 PJ in 2018-19 (DISER, 2020). This increase in production occurred long after the GFC. But the low global interest rate environment was a factor in promoting the development of these resources for burgeoning demand markets in Asia. In the global market for oil and gas, collective government and central bank support facilitated a recovery for consumers and businesses. This recovery flowed through to oil and gas producers, via indirect transmission.

Ultimately, both government balance sheet spending and monetary stimulus provided by central banks is transitory. There is no ‘free lunch’, with the costs of any increased activity borne later. But the transitory nature of stimulus can still have long lasting impacts for resource allocation. A portion of the stellar growth in the oil and gas sector in the US is due to the distortion caused by low interest rates. Of course, cheap credit is only part of the story, and the shale gas revolution probably would have occurred eventually, driven by the high prices of the commodity super cycle.

The main difference between 2021 and 2009 is that monetary policy is less able to provide a short-term stimulus effect. Interest rates are already at-or-near zero in many economies, which means that fiscal spending is likely to be more influential in promoting economic recovery. The additional oil and gas supplies brought on by lower interest rate policies in 2009 will not be replicated in the COVID recovery.

Fiscal policy could play a much larger role in delivering oil and gas security. With government debt-to-GDP already large in many APEC economies (Figure 4-1), any additional spending needs to be well targeted. Otherwise, the eventual burden of providing support may become too large for APEC economies to withstand, either through increased taxation or a large public debt burden, which would dampen long-term economic activity in the region. However, the impact of rising energy prices and

supply disruptions will also be costly and limit economic activity throughout APEC during the pandemic recovery. A consideration of the costs and benefits of financing energy security improvements with government spending in periods of economic crisis is a useful avenue for further research.

SECTION 5. THE IMPACT OF COVID-19 ON OIL AND GAS SUPPLY SECURITY

COVID-19 caused an unprecedented drop in oil consumption and a substantial drop in natural gas consumption. These unexpected and dramatic reductions in consumption caused both oil and gas prices to fall to low levels, and thereby slowed and reduced investment in the upstream, midstream and downstream segments of the oil and gas industries.

The emergence of new variants of COVID-19 further increased the uncertainty about the duration of the pandemic and its near-term effects on global economies and oil and gas demand. Lower prices and uncertainty about when demand would return dampened investment in the oil and gas sector.

As a result of these circumstances, the oil and gas sectors have not been in a position to respond adequately to the return of oil and gas demand, as described in Section 2. This temporary imbalance between oil and gas demand and supply has made oil and gas prices more volatile and has increased the likelihood of oil and gas supply disruptions.

We are already seeing examples of how COVID-19 combined with shifting investor preferences to create increased price volatility and temporary supply disruptions. Although the price volatility and temporary disruptions were not caused solely by the pandemic, the uncertainty about future oil and gas demand created by the pandemic has been one of the causal factors.

This evidence put forward in this report suggests that COVID-19 is reducing oil and gas security in the APEC region. Section 2 speaks of resilient, growing natural gas demand and diminished but pent-up oil demand. Both fuels are ready to grow past pre-pandemic levels, but the path of oil demand will depend on the successful navigation out of the pandemic. Section 3 highlights that a focus on income generation is constraining supply. The delivery of precarious market conditions by COVID-19 is accelerating the former trend, and financing constraints are keeping oil production at levels lower than before the pandemic, when shale and tight resources allowed the US to play the role of marginal producer. If these constraints persist during the oil demand resurgence, oil supply disruptions could appear in the form of a sustained period of higher prices. While these constraints have yet to bind gas supply, the market's inability to deliver LNG cargoes in the face of surging demand suggests a potential for significant gas security events. Section 4 highlights that although monetary and fiscal policies are aiding producers, they are unlikely to jumpstart supply growth due to the unwillingness of investors to deviate from their demands for income generation following years of underperformance from growth strategies. While COVID-19 is not the only cause of deteriorating energy security, the likelihood of oil and gas disruptions is higher than it was before the pandemic.

5-1 Implications for oil supply security

Looking ahead throughout 2021 and after the COVID-19 pandemic, there is concern that an oil supply disruption may stem from the inability of producers to increase supplies enough to maintain pace with

growing oil demand. While the pandemic initially built up a buffer of significant oil and oil product inventories, coordination among OPEC+ and other actors to produce below demand for much of the pandemic is gradually reducing inventories, which are now near pre-pandemic levels. In these market conditions, a surge in pent-up oil demand following the pandemic risks putting significant upward pressure on oil prices. If oil producers are unable, or unwilling, to provide a lower cost supply to alleviate this pressure, the locus of swing producers will shift away from the US shale producers and onto less stable, higher-cost producers, increasing the cost of oil production. This scenario is likely to challenge the affordability of oil supply for APEC members, and therefore to qualify as an oil security event.

However, this is unlikely to lead to instances where key infrastructure projects are short of crude or oil products needed to fuel the APEC economy. In the absence of an emergency, such as a blockage of supplies from the Middle East, refineries will receive crude oil, and end-users oil products, albeit at higher prices.

While higher oil prices are a boon to producer-exporters, on a net basis, a significant rise in prices would both impede the effectiveness of the pandemic recovery and challenge the affordability of energy in the APEC region. Because commodity price changes tend to trickle down to end-user prices paid by consumers, and because APEC is a net-importer of both oil and oil products, this increase would effectively funnel consumer expenditure out of APEC. Furthermore, due to the oil-indexation of long-term LNG contract prices, the cost of importing LNG for end-use and power demand would rise, too. Throughout APEC, almost all aspects of the economy would see lower potential due to a structural rise in the cost of doing business.

APERC estimates that an annual increase of oil prices from USD 65 to USD 100 per barrel would shave 0.25% off real GDP growth in the APEC region, and an increase to 150 USD per barrel would shave off 0.71%⁶. Hidden behind these numbers are the benefits to producers: Brunei Darussalam, Canada, Mexico and Russia would collectively gain 0.93% and 2.0% on their real growth rates in these respective scenarios.

However, affordability is not the only concern facing APEC economies. The shifting of the marginal production nexus out of North America and into OPEC+ increases the risk of challenging the availability of crude oil and oil products to APEC importers. Many OPEC+ members reside in the Persian Gulf, where a potential disruption of oil shipments through chokepoints, like the Strait of Hormuz, could lead to an acute oil shortage. For example, Japan depends on the Strait of Hormuz for 80% of its oil supplies and China imports over half of its oil from the Middle East. A potential security event in the area, like an attack on VLCCs similar to what happened to Japanese vessels in the Hormuz Strait in 2019, or a blockade, could cause substantial price increases and severely impair the ability of APEC members to fuel their economies with oil and petroleum products.

With OPEC+ voluntarily restricting oil output below oil demand and oil inventories sinking below their five-year range, the current oil market environment may be entering a precarious situation, where APEC

⁶ Calculations are a synthesis of several studies that estimate the impact of oil price changes on GDP growth from the perspectives of both net importers (Naoyuki & Taghizadeh-Hesary, 2014) and producer exporters (Kitous et al., 2016).

members may be unable to mitigate the impacts of a typical seasonal supply shock. Hurricane Ida is one such example, as is recent activity at APEC Strategic Petroleum Reserves (SPRs).

Hurricane Ida

Hurricane Ida was one of the strongest storms to make landfall in the US Gulf of Mexico (GoM) and is turning out to be perhaps the most devastating for oil markets. The GoM contains a significant amount of American energy infrastructure, including offshore producing fields that deliver 15% of US oil production and 5% of its natural gas production, almost half of US refining capacity, over half of its natural gas processing capacity and the bulk of American LNG export terminals. Fortunately, Ida did not seem to exacerbate the gas shortage facing global natural gas markets. It did significantly impact offshore production, putting 90% of production offline at its peak, and still impairing 20% of production in early September. However, LNG exports increased following Ida because it did not traverse into the path of most LNG export facilities and production is mostly fed by onshore shale resources.

Unfortunately, the impact on oil markets has been more significant. Like gas, Ida put 90% of GoM offshore oil production offline at its peak, and production is currently a fifth lower than its pre-storm level. However, unlike gas, offshore oil represents a higher share of US production. Ida also took out several GoM refineries during one of the tightest product markets of the last decade, sending August gasoline prices to their highest monthly level since 2014. The outages from Ida could result in 30 Mb of crude oil losses at a time when oil inventories are already falling below their five-year averages. The IEA expects that Ida will cause almost all of the global oil production outages of 900 kb/d and refinery outages of 700 kb/d in September, resulting in significant drawdowns in inventories. While the relaxation of OPEC+ supply restrictions and higher prices are boosting supply, more help is needed to reduce the upward price pressure and reduce the risks of an availability crisis. On the downside, the occurrence of another hurricane, Nicholas, and any other in this late hurricane season, could drag the oil market down into further precarity.

Recent APEC strategic petroleum reserve activity

Two APEC members, the US and China, are taking part in SPR transactions that should help mitigate the market impact. The US SPR is taking part in two activities. The first is not in response to a looming oil supply crisis. Typically, the US SPR is used in emergency situations, to mitigate the impacts of oil disruptions, and in times of conflict. However, the government can order transactions to finance spending for its programs. During the first sale, on August 23, the US SPR was directed to sell 20 Mb of its stocks to do just that: finance government spending (IEA, 2021b). While the direction took place before Hurricane Ida, the oil will be delivered between early October and mid-December, which will certainly help alleviate part of the deficit stemming from the aftermath of Ida. The second activity is the loaning of oil products to refineries impacted by Ida. While temporary, this will alleviate the potential for an availability crisis for oil product issuers in the US region and alleviate some of the significant pressure on product prices.

Despite the buildout of its SPR in recent years (see the next Section), China has yet to sell out from it. That will change in late September when China initiates the first auction to sell 7.4 Mb of oil from its SPR (NFSRA, 2021). This sale should also reduce pressure on prices and reduce the likelihood of supply disruptions. Furthermore, because this is the first transaction, it suggests a differentiation of the Chinese

SPR from the US SPR approach, which is typically only used during emergency disruptions. China may use its SPR to actively influence the market, not only as a provider of fuel of last resort.

While any release of supply will help, it is unclear how much either the Chinese or American SPR activity will be useful in stemming a potential oil supply crisis throughout the APEC region. The US SPR is unlikely to be used again unless a significant emergency occurs, which will probably only prevent significant oil and product disruptions in the US. Asian importers that rely on significant volumes from the Hormuz Strait will still face the potential of acute delivery shortages. China's first oil auction, while large, only covers about one day of its consumption. While ample firepower exists to fuel larger auctions, this is an unproven policy, still in its infancy, and it could take many months or years to understand its effectiveness.

5-2 Implications for natural gas supply security

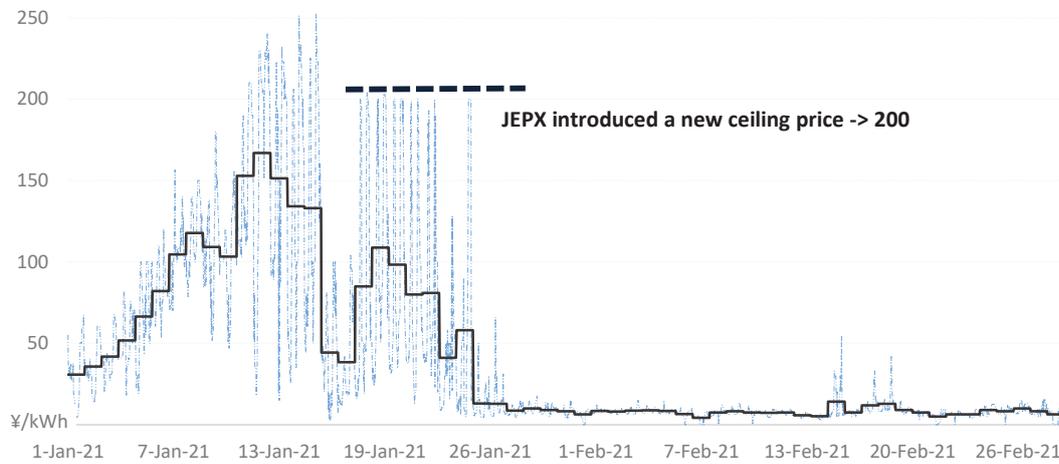
In a manner very similar to recent developments in the oil sector, uncertainty about the duration of the pandemic and shifting preferences in financial markets have combined to dampen and slow investment in all segments of the gas industry. As a result, global gas prices have increased and become more volatile, and the likelihood of supply disruptions has increased. Two recent examples outlined in this subsection illustrate the effects of these three factors on natural gas supply security

The northeast-Asian LNG Crisis

During the 2020/2021 winter in Japan, the news of an LNG inventory shortage during a cold snap caught power and LNG market participants by surprise, and logistical challenges caused by global liquefaction curtailment, a Panama Canal closure and a shortage of LNG carriers limited the ability of the spot market to fulfil an unexpected demand surge. Not only did this increase the cost of LNG imports and power prices, but it also reduced electricity demand, through curtailment requests, and almost led to blackouts throughout Japan, and even led some retailers to exit the retail business.

Figure 5-1 illustrates the impact that such LNG supply disruptions can have on electricity markets in APEC using the daily Japan Electric Power Exchange (JEPX) wholesale power price during the last winter. On 13 January 2021, the daily average of JEPX set a daily high of ¥154 per kWh, 23 times its 2020 average. On the same day, JKM also set a record, hitting USD 32 per MMBTU, eight times its 2020 average. While economies typically have storage worth several days of crude oil and oil products, the lack of gas storage in Asian APEC economies often requires the procurement of LNG for just-in-time delivery. Thus, supply disruptions of a single LNG cargo can create responsive price spikes, and with downstream sectors, like power, also reliant on the just-in-time delivery model, this vulnerability increases.

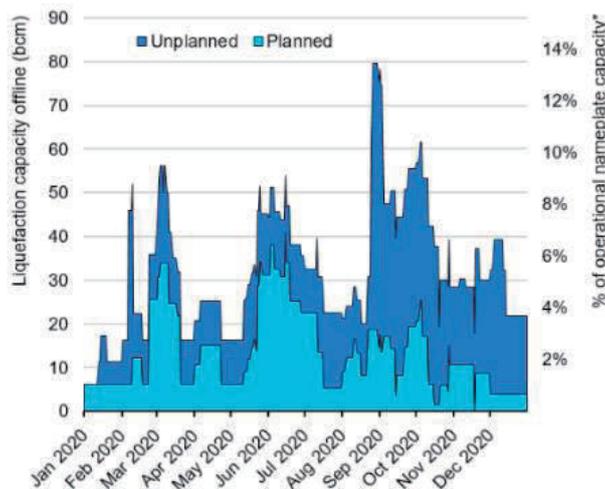
Figure 5-1: Spot market electricity prices in Japan. Peak winter season 2020-2021 (¥ per kWh)



Source: (JEPX, 2021), APERC Calculations

While the supply crisis occurred in the winter of 2020/2021, its causes began earlier, when storage building efforts were limited by unexpected outages of liquefaction plants in Q3 2020. Notable outages include Norway’s Hammerfest LNG and Australia’s Prelude LNG. In September, about 14% of global liquefaction capacity was offline due to a combination of these outages and scheduled maintenance, as seen in Figure 5-2 (IEA, 2021b). While hard to measure, these outages certainly limited the LNG storage builds during the summer season, increasing the vulnerability of LNG importers to a supply risk in the coming winter.

Figure 5-2: Planned and unplanned liquefaction capacity outages in 2020 (bcm)

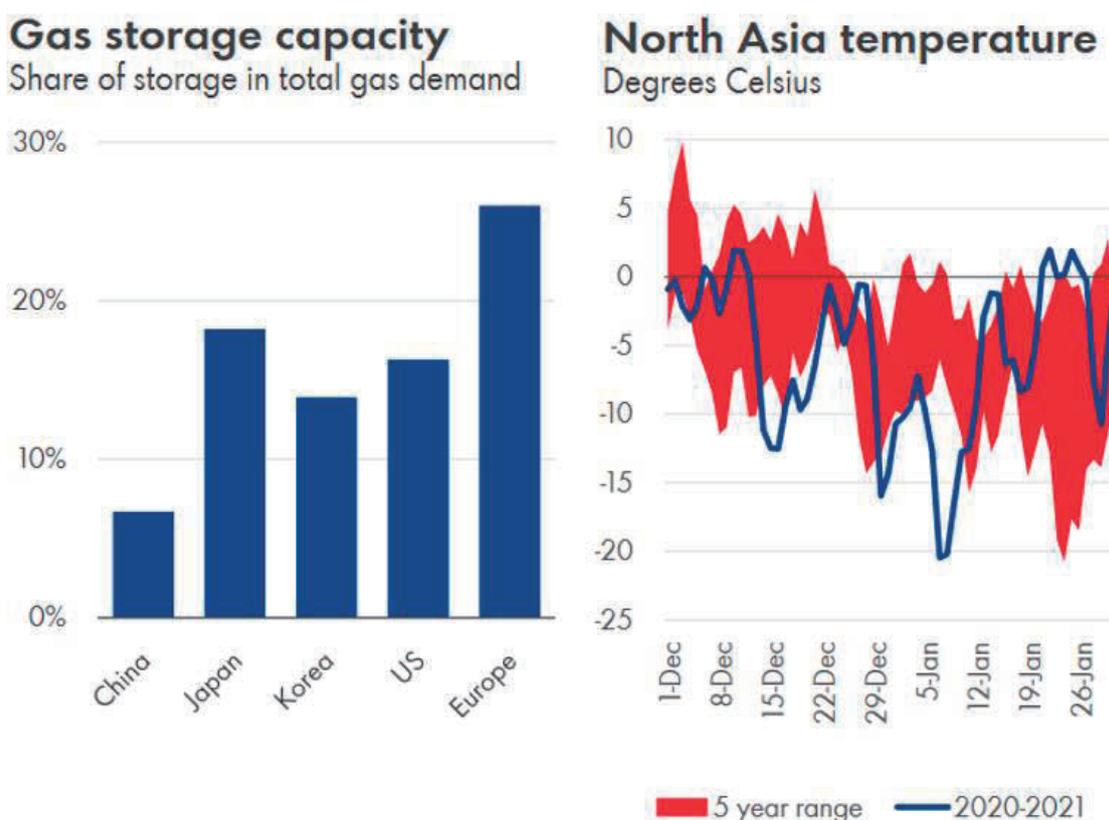


Source: IEA analysis based on Rystad Energy (2021), Gas Market Analytics; ICIS (2021), ICIS LNG Edge (IEA, 2021a)

Moreover, gas storage capacity totalled less than 10% of total annual gas consumption in China and less than 15% in South Korea, well below the European average, as shown in Figure 5-3. As cargoes from all

over the world headed to north-east Asia, the Panama Canal became congested and some LNG vessels coming from the USA opted for alternative and longer routes. All this contributed to a sudden rise in charter rates to almost USD 200 000/day, more than tripling the rates seen only four months before, in August. While prices returned to levels like those of early December by late January, this temporary “perfect storm” highlighted the lack of gas storage in north-east Asia, and other infrastructure limitations in the Pacific basin gas market.

Figure 5-3: Gas storage capacity versus domestic demand and North Asia temperatures



Source: Shell interpretation of IHS Markit, Wood Mackenzie and S&P Global Platts data (Shell, 2021), with analyst edit to economy names to comply with APEC Publication Guidelines

While there were many interacting factors that also contributed to this crisis⁷, this temporary price shock reflects the volatility of natural gas demand to extreme cold, and highlights infrastructure constraints, especially in the Pacific basin. The absence of LNG export facilities on the western coast of North America and limited gas storage capacity in Asia causes a strong disconnect between Asian and North American

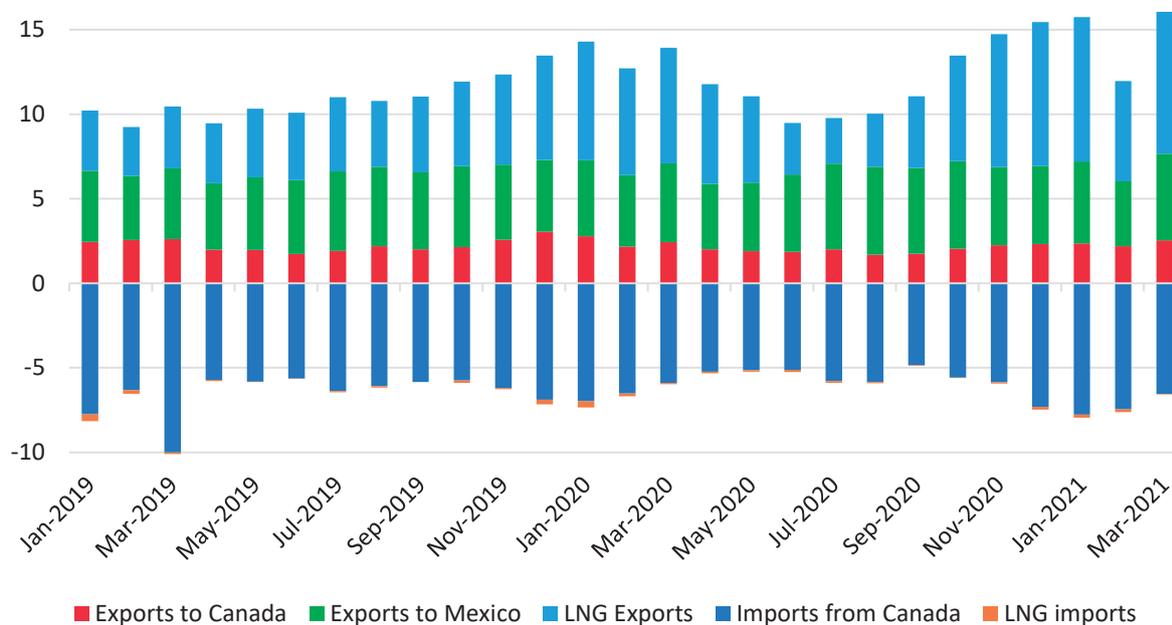
⁷ The so-called “Asia’s Big Freeze” is the result of a complex interaction of factors not discussed here, including the unavailability of most nuclear reactors for power generation in Japan due to safety concerns, record high gas-fuelled heating demand in China and limitations on coal-fired generation in Korea.

LNG supply. This crisis signals the need to enhance energy security by expanding infrastructure in the region, particularly in storage capacity.

The resilience of APEC gas supplies

In the period February 15 - 19, 2021, many regions in North America faced temperatures well below their five-year averages. Most notably, the temperature in Texas dropped from -2 °C on February 13th to -12 °C two days later; the temperature was 7°C a year earlier (NOAA, 2021). These extreme weather conditions created a series of cascading effects that led to blackouts for over 10 million people, economic damage of over 100 billion dollars and the loss of at least 100 lives (Busby et al., 2021). This lack of resilience in the face of extreme weather caused a net natural gas production loss of 16 bcm, 16% lower than the previous month, at a time when demand was critical for sustaining human life.

Figure 5-4: US gas monthly trade by source or destination 2019-21 (bcm)



Source: EIA (2021)

While Canada’s natural gas production also fell year-on-year by 7% in February 2021, no region was more affected than Texas, where a quarter of US production occurs. Texas gas production fell by 24% in February 2021 compared to 2020 (EIA, 2021). Apart from the direct impacts on electricity generation in the US, the lack of production also reduced exports. US gas pipeline exports to Mexico were curtailed, creating gas scarcity in the import-dependent Mexican power system, and spreading the blackouts to over 4 million households in six Mexican states (CFE, 2021). Monthly US piped gas exports to Mexico fell over 20% in February 2021. To combat natural gas scarcity, monthly Mexican LNG imports rose 0.2 bcm to levels not seen since August 2020 (CEDIGAZ, 2021). Additionally, the unavailability of gas also impacted US LNG exports, which fell by 6% compared to February 2020 and by 31% versus January 2021.

Much of the gas infrastructure, including gas pipelines and storage capacity, is not built to withstand low temperatures (Busby et al., 2021). While some of the solutions to enhance energy security in North

America, particularly in Texas, go well beyond the natural gas industry, it is likely that similar scenarios will be seen again. Reinforcing energy resilience in the region depends on adapting or “weatherising” gas infrastructure to these extreme weather conditions all along the value chain, from the producing wells to the end-user meters.

Are the gas disruptions of 2021 a harbinger of things to come?

Natural gas is expected to play an increasing role in the APEC’s electricity mix following the COVID-19 pandemic, potentially exacerbating the seasonal peaks of gas demand and increasing the likelihood of gas shortages like those seen in Northeast Asia last winter. But even if natural gas demand remains stable, the weather extremes could lead to similar electricity and gas shortages. While brief in nature, these events are very disruptive. In emerging markets, high prices can lead to direct cancellation of LNG cargoes, which effectively renders gas infrastructure inoperable during peak demand periods⁸. Developed markets are more likely to pay these higher prices, but the opaque and complex nature of the LNG supply chain can create instances where market signals are slow to alleviate market shortages. The gas price spikes in January 2021 illustrate how the resilience of the electricity supply will be increasingly vulnerable to gas shortages from LNG suppliers during peak periods over the next five years. The uncertainty that such potential volatility brings to prospective LNG adopters in the APEC region could undermine financial commitments to the construction of LNG infrastructure, thereby increasing the uncertainty faced by incumbent and prospective APEC LNG suppliers (IEEFA, 2021)⁹. Lastly, rising LNG imports, the resulting surge in global LNG benchmarks and dwindling European gas inventories suggest that demand could potentially already be outstripping supply growth in 2021. While this trend could be driven by attempts to avoid supply disruptions in the winter months, the persistence of higher prices would certainly challenge the affordability of LNG in APEC in the immediate term.

5-3 Energy subsidies in an era of reduced oil and gas security

Because of the high dependence of APEC economies on oil and gas consumption, higher and more volatile energy prices typically raise affordability concerns and often correlate with higher government subsidies. Just as April 2020 may have been an opportunity for governments to phase out fossil fuel subsidies, a bull run in commodity prices will put significant pressure on governments to maintain or increase fossil fuel subsidies. Under such pressure, governments will be tempted to allocate part of their COVID relief programs to reducing the burden of high energy prices. This could be in the form of lower taxes, lower regulated rates or government transfers. Such subsidies will alleviate the impact of higher energy prices, and perhaps limit the immediate impact of a price spike on economic activity.

However, subsidies are short-term solutions that fail to reduce import dependence. According to the IEA, APEC fossil fuel subsidies were almost USD 80 billion in 2019. APERC estimates that an annual price rise to USD 100 per barrel could raise subsidies to almost USD 150 billion. A higher spike to USD 150 per barrel would cost almost USD 220 billion. Between these price spikes, the increase in APEC subsidies would be equal to between 28% and 59% of the pandemic recovery stimulus for the energy sector. A

⁸ Both Pakistan and Bangladesh passed on LNG tenders during the LNG price spike (IEEFA, 2021).

⁹ Due to regulation, the high cost of disruption may not be paid by end-users but by wholesalers, distributors or retailers. While consumers may pay eventually through higher rates, the cost can be spread across users and time by regulatory authorities.

preference for such subsidies could crowd out support for initiatives that improve the long-term oil and gas security of APEC members, such as reducing dependence on oil and gas imports or building storage to reduce vulnerability to oil and gas disruptions.

SECTION 6. POTENTIAL ACTIONS GOVERNMENTS CAN TAKE TO ENHANCE ENERGY SECURITY

In the early stages of the pandemic, many voices called for policymakers to utilise COVID-19 as a potential accelerant to a low-carbon energy transition. And in fact, a number of governments have recently committed to more aggressive decarbonisation efforts in the run-up to COP 26. However, oil and gas today remain essential inputs to APEC economies. Global gas demand is already surpassing pre-pandemic levels, while global oil demand is growing close to it, and expectations are for both to continue growing in the near term.

While the energy transition remains an important long-term priority, circumstances over the past year have brought energy security concerns to the fore. Section 5 described several events in oil and gas markets that highlight recent price increases and supply disruptions, but this recent summer saw many examples of price volatility and supply disruptions: LNG prices set summer records; European natural gas inventories, which act as de facto gas storage for Asian LNG importers, have hit five-year lows; US oil demand is reaching record highs; to reduce oil prices, China is releasing oil from its growing SPR and the US is urging OPEC+ to increase its oil supply targets; and upstream issues are prompting Malaysia's Petronas into deferring summer LNG cargoes into the autumn, raising concerns that deferrals could also occur in the winter. Together, all of these events suggest a world where energy is more expensive, and disruptions more likely. The potential for significant energy price inflation poses a serious risk to the economic recoveries for APEC economies.

At the early stages of drafting this report, energy prices and construction costs were low, which presented an opportunity for APEC members to mitigate their vulnerabilities to future oil and gas disruptions events at relatively low cost. A few economies took advantage of this opportunity as detailed below. But the opportunity for low-cost acquisition of oil stocks and investment in natural gas debottlenecking facilities is now past, at least for the near term. While the dynamic nature of oil and gas markets may exacerbate the current security challenges or assuage the current urgency to tackle energy security before publication, we believe the following policy recommendations remain relevant.

6-1 Potential actions to address oil supply security risks and vulnerabilities

Replenishing and expanding petroleum stockpiles

Action 1: Dedicate crude oil and petroleum product stocks to a SPR for energy security purposes

SPRs are an important tool protecting economies from the economic impacts of oil supply disruptions and mitigating the impact of higher pricing that occurs during the structural booms of oil markets. Abstaining from increasing crude oil stockpiles is putting several APEC members at risk of bearing the brunt of an oil affordability crisis, and maybe even suffering an acute availability crisis, both of which are more likely than they were prior to the pandemic. While there are concerns about incurring too much debt during the COVID-19 recovery, Figure 4-1 illustrates that the debt-to-GDP levels of several key importing economies are low enough to handle a higher debt level. Investing in SPRs, or their

alternatives, would mitigate the risk that commodity inflation poses to derailing the pandemic recovery for APEC oil importers.

Action 2: Utilise low oil prices to replenish crude oil and oil product inventories

The low oil prices resulting from the pandemic and oil price war created a unique opportunity to replenish oil inventories and build strategic oil stockpiles. While oil prices appreciated enough to eliminate these potential benefits, several APEC economies already possess SPRs and several took advantage of this unique opportunity to grow reserves during the pandemic.

Recent actions of APEC member economies

As articulated in Section 3-4, rising Sino-US tensions are prompting China to pursue policies that improve its energy security, and a liberalisation of its upstream oil and gas markets is being considered (Downs, 2021). Evidence suggests that this is already helping China increase its storage capacity. Kayrros believes that China took advantage of low prices to replenish oil stockpiles and increase oil inventory capacity (Kayrros, 2021)¹⁰. Public numbers are hard to acquire, but media reports suggest that China's total crude oil reserves rose 30% over 2019 levels to 1 160 Mb in 2020, with 290 Mb to 370 Mb of this being part of its SPR (Reuters, 2020). This is enough to cover over 100 days of Chinese net imports, with around 26 to 34 days of SPR coverage. According to Bloomberg, China may continue to build strategic and commercial stockpiles, with total coverage reaching between 120 to 180 days over the coming years (Bloomberg, 2021).

Despite signing the AIEP in 1979, Australia has yet to build or maintain emergency stockpiles sufficient to fulfil 90 days of oil consumption without the aid of net imports (Allens, 2020). In 2020, Australia held between 75 and 81 days of reserves, with a third of those being held outside the domestic economy. The day prior to the WHO declaring the COVID-19 outbreak a pandemic, Australia and the US signed a 94 AUD million SPR lease agreement for Australia to purchase oil and lease space in the US SPR (Allens, 2020). The belief is that this agreement represents around two to five days of domestic consumption. Because the US SPR does not possess any stockpiles in Australia, there is a desire to locate strategic reserves on Australian soil. Australia is currently seeking proposals to boost domestic reserves by 7 to 15 Mb by 2026, the latter of which would achieve compliance with the 90-day AIEP threshold. According to the IEA, Australian stockpiles rose from 55 Mb to 60 Mb throughout 2020.

The US holds the largest SPR in the world at 714 Mb. While it did not make any plans to increase strategic stockpiling during the pandemic, it did broker the lease with Australia, and US industry accounted for the largest stockpile increase in the world. A precipitous drop in prices, demand declines and a significant contango in the futures incentivised massive storage injections, raising stockpiles from 697 days of coverage to 3 452 on the back of both commercial and government increases (IEA, 2021). Total global stocks did increase throughout 2020, rising from 172 to 187 days of cover. In New Zealand, stockpiles were flat, with coverage declining from 88 to 87, just shy of the IEA 90-day target. Total Japanese crude oil stocks also increased in 2020, from 172 to 191 days of cover (IEA, 2021). The Philippines publicly announced its intention to replenish oil stocks during the pandemic, and by June

¹⁰ Kayrros is a consultant that utilises satellite imagery to generate insights into multiple industries. In this example, it utilises satellite imagery to estimate crude oil and oil product storage levels in China, as well as the change in storage capacity over the course of the pandemic.

2020, inventories hit 22 days of coverage, about 0.8 days higher than they were at the end of 2019 (DOE, 2020; PNA, 2020).

In late 2020, Japan's Agency for Natural Resources and Energy (ANRE)¹¹ and Kuwait Petroleum Corporation (KPC) signed an agreement to start a joint oil storage project of 3.1 million barrels. Representing about one and a half days of Japanese crude oil demand, the project will serve to alleviate distress in both Japan and Asian economies in future oil supply disruptions (METI, 2020).

While the Korean National Oil Company (KNOC) announced its intention to take advantage of lower prices with more oil stockpiles in 2020, its year-end stockpiles were only about 0.5 Mb higher than 2019 (KNOC, 2020). Korea has a target of building its strategic stockpiles to 101 Mb, up from 97 Mb at the end of 2020.

Thailand went in another direction, reducing oil reserve ratios during the onset of the pandemic to reduce the operational costs of refineries and oil traders to align with lower demand for oil products (Bangkok Post, 2020). Thailand specifies its oil reserves requirements relative to average annual consumption. Thai law typically mandates that it hold 6% of annual consumption, good for 22 days of crude demand, but cabinet reduced this to 4%, or 15 days, during 2020.

Viet Nam is aiming to increase its crude oil stockpiles to cover 90 days in the 2020 to 2025 period, up from its current levels of around 45 days. It is not clear if the economy is closer to achieving this target than it was prior to COVID-19. While crude oil imports rose 54% in 2020, it is unclear if the imports led to higher stockpiling or to feed processing activity at commercial facilities. Binding constraints on imports during the onset of the pandemic in April shed doubt on the likelihood of a sudden rise in stockpiling capability (VN Express, 2020). However, the year did see construction start on a long-delayed facility at the Dung Quat terminal that will add around 30 to 45 days of coverage once both phases are completed (Pields, 2020). These projects are integral to improving energy security over the next five years. Viet Nam became a net importer of crude oil in 2018, and APERC analysis shows that falling production and rising demand for crude oil and oil products will increase its import dependence by 2025 (GSO, 2021). Higher storage levels may be necessary to cover rising net imports in the future.

Several APEC economies did not appear to respond to the low energy prices by building up stockpiles or storage capacity during the last year. From an energy security perspective, achieving the status of net-exporter somewhat obviates the need to maintain a threshold of crude oil stockpiles for emergency situations. Thus, Canada, Brunei Darussalam, Mexico and Russia are not reviewed in this discussion, nor is Hong Kong, China, due to its lack of crude oil imports. Data was not available for Chinese Taipei's 2020 crude oil inventories at the time of analysis, but the economy does have energy security requirements mandating at least 60 days of commercial coverage and 30 days of government back-stop coverage (MOEA, 2019). However, it appears that several net importers, including Malaysia, the Philippines, Indonesia, Singapore, Papua New Guinea, Chile and Peru, continue to have stockpiles well below the recommended coverage of 90 days, and did not utilise the pandemic to remedy this shortcoming.

¹¹ Part of Japan's Ministry of Economy, Trade, and Industry. (METI), ANRE is an agency responsible for the policies related to energy and natural resources.

Evidence suggests that overall, APEC seized the opportunity presented by the COVID-19 pandemic to replenish and expand its SPRs. While actions are not universal across APEC, the massive action by China alone could significantly improve energy security in the region due to the region’s large and growing appetite for crude oil. Furthermore, ambitions by Australia, Viet Nam and Japan to build further upon stockpiles and storage capacity will mitigate the impacts of future crude oil supply disruptions. However, as illustrated by Table 6-1, several net importing APEC economies are still short of achieving the IEA recommendation of 90-day crude oil stocks over the next five years¹².

Table 6-1: Days of Net Imports, Crude Oil and Oil Products in Net-Importing APEC Economies, Dec 2020

Economy	Crude Oil Inventories	Deficit to IEA Threshold
Australia	68	22
Chile	25	65
China	106	0
Indonesia	19	71
Japan	191	0
Korea	187	0
Malaysia	0	90
New Zealand	87	3
Papua New Guinea	21	69
Peru	30	60
Philippines	61	29
Singapore	25	65
Chinese Taipei	90	0
Thailand	34	56
United States	3 454	0
Viet Nam	20	70

Source: IEA (2021), Government Policy, Government Reports, Media Reports, APERC Analysis

SPR Alternatives: Leasing, ticketing and mandating net import coverage at commercial operations

Ticketing, leasing and instituting commercial stockpile obligations are all methods that can reduce the cost of accessing and operating SPRs. Energy security throughout the APEC region can be improved by pursuing cooperative storage solutions that spread out excess coverage across more vulnerable economies. Japan and Korea can play a key role in reducing the impact of oil supply disruptions due to their proximity to Asian APEC members.

¹² As part of the Agreement on an International Energy Program, the IEA obligates members to hold emergency oil stocks equivalent to at least 90 days of net oil imports. In the event of severe disruptions, members may collectively decide to release these stocks to mitigate the impact of the event.

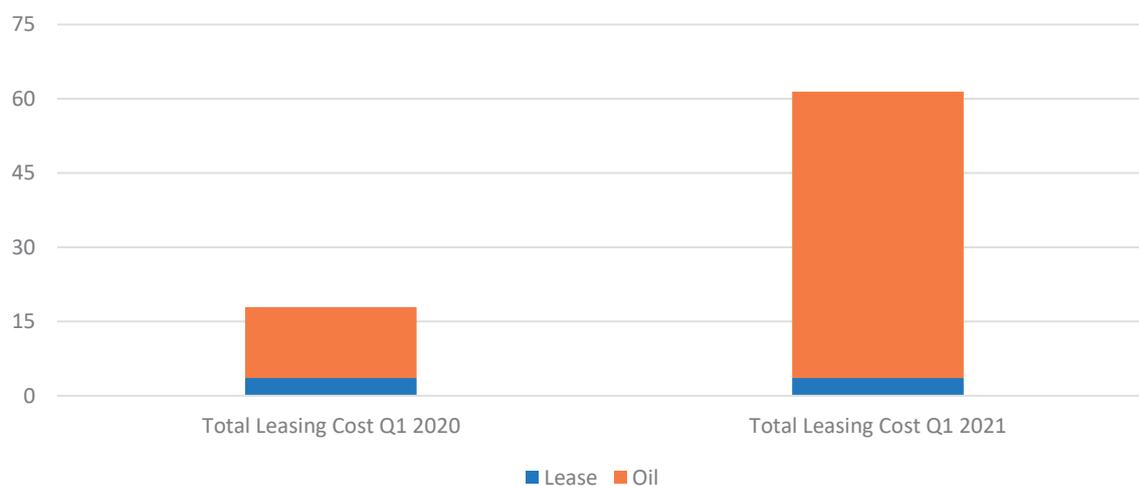
Action 3: Encourage the use of leases or tickets from existing SPRs in the APEC region to provide net import coverage in the absence of a domestic SPR.

SPRs are expensive assets, requiring high upfront capital costs and significant operational and maintenance costs, with uncertain benefits that may flow out of the economy that bears the risk of the asset and towards the global collective of net oil importers. This creates a free-rider effect, wherein market participants benefit from the existence of an SPR without having to cover the costs associated with it. According to analysis from the IEA in 2013, the costs of building, maintaining and operating an oil storage facility range from six to 11 USD a barrel per year (ERIA, 2017). For many economies, this is a significant insurance premium to pay for the benefit of a collective good and is a significant deterrent to SPR investment. This is especially true after a global recession, as many APEC members will be hard-pressed allocating billions of dollars to build-up strategic crude oil stockpiles when their coffers are recovering from supporting citizens and businesses during the pandemic and spurring the recovery after it. However, fiscal prudence will not buffer APEC from the impact of a significant oil price spike in coming years, while building oil stockpiles will.

One way to reduce the cost hurdle is for SPR owners to open up holdings to spare capacity using leases. Table 6-1 illustrates that the US, Japan and Korea have significant extra capacity above the threshold of the 90-day cover recommendation for IEA member economies. This provides a way to spread the costs to free-riders and cover the capital, operating and maintenance costs associated with using an SPR. A specific example of this is the agreement between Australia and the US, wherein the US SPR will lease reserve space to Australia over a ten-year period. APERC calculations reveal that this arrangement implies a leasing cost that could be as cheap as 3.6 USD per barrel, with the crude costs dragging that up to almost 18 USD¹³. Assuming constant leasing prices, this is 29% lower than a similar leasing arrangement would be in Q1 2021 (Figure 6-1). Such cooperation can encourage further expansion and utilisation of SPRs in APEC, improving its resilience to crude oil supply disruptions. Japan has been searching for similar partnerships over the past two years to take up space in its SPR and reduce operating and maintenance costs.

¹³ This assumes a 639 kb/d net imports coverage for five days and that the 94 AUD million agreement covered oil prices at then-current levels of 14 USD per barrel. If Australia did not procure the oil barrels on that day, the cost would be higher (Allens, 2021).

Figure 6-1: Estimated Cost of US SPR Leasing Agreement (USD per barrel)



Source: Allens (2021), APERC Calculations

Action 4: Mandate stockpiling at commercial operations.

An alternative to leasing is mandating net import coverage at commercial operators, such as refineries, importing terminals, traders and petrochemical facilities. Several APEC economies, including Singapore, Thailand, Indonesia and Malaysia, have spare capacity at commercial facilities that could move economies closer to compliance with a 90-day threshold (ERIA, 2017). A theoretical advantage of this strategy is that it shifts energy security compliance costs onto industry. However, maintaining higher stockpiles comes with higher operating costs, and if existing storage is inadequate, the significant capital outlay to achieve compliance may be prohibitive. After enduring the COVID-19 recession, refiners and transport hubs may require government assistance to comply with stockpiling targets, and governments may not have the fiscal ability to provide such support.

6-2 Potential actions to address gas supply security risks and vulnerabilities

Expanding LNG reloading capacity to increase storage in the APEC region

Gas storage, including at LNG terminals, is indispensable to maintain the security of the gas supply. However, these facilities are capital-intensive and cannot be easily developed without meeting certain conditions, which are difficult for many economies to satisfy. Because of this, gas storage development in the APEC region does not follow the rapid increase in demand, and much of the APEC region relies on the flexibility of European gas markets, and thus European storage, to meet its needs via cargo diversions in the winter months (OIES, 2021). The lack of on-site storage is a significant vulnerability to APEC LNG importers. However, APEC members are repurposing LNG import facilities into LNG reloading centres, effectively turning their demand nodes into small storage sites that can mitigate the impact of LNG disruptions in the region. This section recommends policy action that can further facilitate this development.

Action 5: Assess the technical potential for LNG reloading at existing regasification terminals and implement reloading capacity to the technical limits of each facility. Furthermore, all newbuild LNG import terminals, both greenfield and expansions, could consider the implementation of LNG reloading capability.

An APEC-wide assessment of reloading potential at existing facilities would be useful to ascertain the technical potential of LNG reloading in the region. An expansion of reloading capability to increase the utilisation of APEC's LNG storage potential could mitigate the impact of future LNG disruptions.

While not as flexible as European gas markets, APEC members are a lot closer to each other. For example, it took seven days to ship Thailand's first spot cargo to Japan's Ogishima Power Station. This suggests that shipments between China, Southeast Asian and northeast Asian economies will incur similar voyage times to LNG cargoes from Australia. Those emanating from the US or Europe would take at best 20 days to reach the same markets. Because reducing average LNG carrier voyage duration increases effective LNG carrying capacity, shorter shipments in Asia could also benefit LNG importers by lowering the call on chartering services, and thus reducing carrier rates. Suppliers, too, would benefit, as LNG re-exporters could generate extra revenues to help pay off their costly gas infrastructure. Overall, embracing LNG reloading in APEC will add flexibility to the LNG market, which would reduce the likelihood of LNG disruptions and their severity when they occur.

Experience over the past year illustrates how the emergence of seasonal supply shortages during winter peak periods in northeast Asia will open arbitrage opportunities, allowing various APEC economies to become seasonal gas suppliers via LNG re-exports. For example, during the LNG and JEPX price spike in the winter of 2020/2021, both Thailand and Indonesia leveraged their LNG reloading capabilities to send their first re-export cargoes to alleviate the LNG shortages in northeast Asia (LinkedIn, 2021).

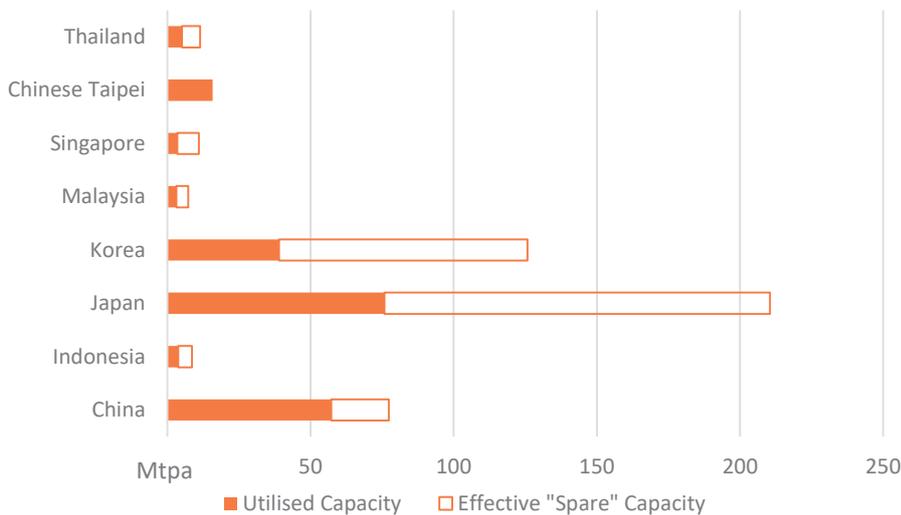
Thailand and Indonesia are effectively mimicking Europe's role as a conditional storage hub for Asia over the last decade by leveraging both the flexibility in their gas supplies and surplus LNG storage to capitalise on any arbitrage opportunities that materialise during the winter months. The rise of the portfolio player in the LNG industry over the last decade is necessitating flexibility throughout the LNG value chain, and the emergence of additional LNG services to valorise regasification capital is further evidence of this (APERC, 2020). Through a combination of cargo diversions, LNG re-exports and piped imports, Europe is leveraging its flexibility to provide storage services for Asian LNG demand. While Thailand and Indonesia do not have significant gas storage, they have surplus LNG storage (Figure 6-2), a mix of domestic production and pipeline trade that can be leveraged to flexibly react to arbitrage opportunities, and a proximity to Asian LNG markets.

LNG re-exports are not new to APEC – Singapore is the second largest re-exporter in the world behind France (GIINGL, 2020). What is new is the direct use of LNG re-exports for mitigating the impact of LNG security events like those seen this winter. Interest appears to be piquing. This summer, Japan's Saibu Gas co. imported LNG from Russia's Arctic Yamal terminal, with the intention of parking it temporarily at the Hibiki LNG terminal in Kitakyushu for eventual re-export to Asian economies (Nikkei, 2021). Furthermore, the company intends to conduct similar imports for re-export in the future.

Such arbitrage opportunities will not be limited to the winter months. Demand for space cooling runs year-round in many Southeast Asian economies and rises in northeast Asian during the summer months

of the northern hemisphere. The run-up on LNG benchmark prices during this summer illustrates that supply disruptions could also be an issue in future summers.

Figure 6-2 Capacity Utilisation of APEC Asian LNG Importers (Mtpa)



Source: IGU (2020)

While the low utilisation rates of APEC’s Asian LNG importers (Figure 6-2) suggest vast LNG reloading potential, there are technical hurdles that limit widespread application. In a 2018 report, GIIGNL details the challenges and technical risks of enabling reloading on existing LNG regasification terminals (GIIGNL, 2019). The specifics of these are too technical for this report but suffice it to say that prospective LNG re-exporters cannot simply begin reloading overnight. A full-scale assessment of the associated risks of reloading must be conducted throughout the affected operations of a terminal. Because most incumbent LNG regasification facilities were built prior to the rise of the LNG portfolio player, many facilities were engineered solely for regasification and thus are not optimised for LNG reloading. While augmentations to enable reloading are technically feasible, the economic implications of any technical limitations or risks may be unsuitable for some regasification facilities or their operators¹⁴. Actual statistics are hard to verify, but the current LNG reloading capability of the seven Asian LNG importers is somewhere between five and 17 terminals, or 2.5 Mm³ to 12 Mm³ of LNG storage capacity. This represents 5.5% to 27% of total LNG storage in the region¹⁵. However, the technical limitations probably skew the effective reloading capacity to the lower end of this range. Recent reloading activity mostly occurs at newer facilities, built during the rise of the LNG portfolio player in the 2010s, such as Singapore’s Jurong, Thailand’s Map ta Phut, or the repurposed Arun facility in Indonesia. APEC could collectively reduce the threat of gas supply disruptions in APEC in the coming years by finding

¹⁴ For example, reloading speeds at older terminals are between a sixth and third of the unloading speed. This increases docking times, limiting the upside of flexibility and could add unnecessary wear to the docking structure.

¹⁵ These ranges are based on estimates by both the IGU (lower end) and the GIIGNL (higher end). APERC calculations include the additional reloading capability of Thailand’s Map Ta Phut and Indonesia’s Arun terminals.

collaborative projects to increase the capacity of LNG reloading closer to the Northeast and Southeast Asia region. Collaboration could include sharing technical expertise for repurposing existing LNG import terminals for reloading or finding collaborative partnerships to invest in LNG reloading terminals in the region.

Action 6: Identify collaborative financing opportunities within and outside APEC economies

The decision to amend a financing law by JOGMEC last year, enabling Japan to finance LNG reloading and import terminals outside of Japan, is a welcome step (JOGMEC, 2020; S&P Global, 2020). Another example of such collaboration is the discussion between Russia's Novatek and Japan's Saibu Gas co. to form a joint venture to park LNG in Japan and re-export it into Asia when supply disruptions create arbitrage opportunities (Nikkei, 2021).

LNG exporters can also play a role in improving APEC gas security by embracing the LNG reloading business model. Russia's Novatek is building a business case for an LNG reloading terminal on the Kamchatka Peninsula. The project would be sourced from northern Yamal LNG cargoes, and reload LNG carrier for export into Asian markets. Projects on the Kamchatka Peninsula terminal would be strategically placed to respond to market signals and mitigate future security events. Japan is considering investing in the project (S&P Global, 2020). A suite of newbuild LNG terminals throughout APEC, including a second terminal in Thailand, several new expansions in Japan and new facilities in China, Chinese Taipei, and Korea, and the first terminals in both Viet Nam and the Philippines, offer collaborative financing opportunities to build up APEC's LNG reloading capacity.

Embracing the expansion of LNG reloading on existing LNG regasification terminals could also help economies reduce the risk of stranding their LNG infrastructure in the event of a low-carbon energy transition. For example, as Japan targets a reduction of LNG usage in its power mix to 20% by 2030, it will no doubt see the utilisation rate of its import terminals fall further. Repurposing these LNG import terminals for LNG re-export into Asia during lucrative arbitrage opportunities could help offset the declining revenues associated with lower LNG imports, and reduce the impact of LNG disruptions throughout the Asian region.

Expanding LNG storage capability and utilisation during peak periods could also benefit the producer-exporters in the APEC region and mitigate the impact of curtailments during the seasonally lower demand periods during the summer months of the northern hemisphere.

Action 7: Remove restrictive regulations that prevent LNG from trading at spot market prices.

The business case for LNG reloading outlined here is dependent on arbitrage and thus requires that economies allow prospective reloaders to respond to timely market signals. Thus, regulations and contracts that restrict the destination of an LNG cargo or the price point of sales could hinder the effectiveness of LNG reloading as a policy tool for reducing LNG supply disruptions.

For example, Japanese price mechanisms emanating from LNG SPA agreements in LNG buyer contracts often restrict contract prices between the "Long Term" and "Delivered-in Japan" LNG prices (Nishimura & Asahi, 2021). Normally, LNG spot prices fall between these two extremes, but in periods of significant market distress, like during LNG shortages, the spot price exceeds this limit. Limiting the reselling price of LNG by Japanese buyers to prices lower than the market signal of the spot price eliminates the arbitrage opportunities between utilities within the economy. Current pricing restrictions act as a limit

to both reloading LNG and investing in LNG reloading capability, effectively limiting the degree to which Japan can use LNG reloading to mitigate LNG disruptions in its own region. Eliminating these contract restrictions to allow LNG resellers to sell cargoes at the global spot price will reduce the likelihood and severity of future LNG and electricity disruptions by encouraging trade among Japanese buyers and adding flexibility to its LNG industry. Another example is the destination clauses of LNG contracts.

Action 8: Evaluate the feasibility of LNG reloaders to top up LNG storage during periods of low prices

Stockpiling excess LNG in storage will not only mitigate the impact of future supply disruptions, but will also reduce the cost of gas supply and provide prospective LNG reloaders with the option of selling excess LNG to potential parties that are experiencing short supply during peak periods. For example, Thailand imported a surplus of LNG during all-time spot price lows in 2020, and then sold a surplus cargo to Japan during the northeast supply crunch in the winter of 2021.

Sustaining gas supply and minimising outages

Action 9: Evaluate the benefits and costs of APEC producer-exporters winterising their entire gas supply chain.

Texas's Big Freeze during this past winter illustrates a key vulnerability to the global natural gas supply chain. While the US is now one of the largest producer-exporters of LNG in the world, its supply is not useful if it is susceptible to such a significant disruption when it is needed the most. As APEC's demand continues to increase, the share of US supply fuelling this demand is also rising. Winterisation is paramount for the interests of not only American and Mexican energy security, but the energy security of all APEC LNG importers. Governments should encourage financial support to overcome any hurdles in investing in winterisation.

Action 10: Evaluate the feasibility of APEC LNG exporters coordinating their outage schedules and summer maintenance outages to reduce the impact on the global LNG market.

The past two summers illustrate how outages at LNG export terminals can significantly impact the LNG market. Outages and deferrals from key LNG suppliers, including some APEC members, are limiting the storage builds in both Europe and APEC members. For the second winter season, many importers may be relying on just-in-time spot deliveries to fuel peak demand. Of course, unplanned outages are unpredictable, and many are occurring this winter. APEC LNG exporters could cooperatively cover lost LNG export capacity by implementing planned outage deferrals at working facilities in the event of disruptive unplanned outages. While summer is historically a timely period for planned maintenance, rising demand and a greater adoption of air conditioning could be a sign of a sizeable summer peak in the global LNG market. As demand for LNG and air conditioning increases, exporters may also want to spread out maintenance outages throughout the year, instead of concentrating them in the summer months.

6-3 Potential actions that could improve both oil and gas supply security

Recommendation 11: Utilise COVID-19 recovery packages to reduce import dependence

One method for reducing the likelihood and severity of energy security events over the next several years is by reducing the import dependence of APEC economies. As articulated in Section 4, the recessionary impact of COVID-19 is resulting in an unprecedented amount of fiscal and monetary stimulus to buoy the economy throughout the crisis and stimulate it after the crisis ends.

Government support for emerging technologies following the 2007 – 2009 recession encouraged their adoption over the past decade (BCG, 2020). Offshore wind in Europe, solar cost reductions through the establishment of a PV manufacturing sector in China, the large-scale adoption of solar in the US, and cost reductions in battery technologies in South Korea, were all aided by a recovery stimulus. In the case of batteries and solar PV, much of the investment broke emerging barriers, like R&D and the establishment of supply chains. There is an opportunity for the current stimulus to break similar barriers. For example, throughout APEC, about 5.7% of the stimulus for mobility is earmarking the development or adoption of ZEVs, including EVs and hydrogen (EPT, 2021). The DOE is also targeting another 60% drop in solar costs by 2030 (CleanTechnica, 2021). While only 35% of APEC stimulus is targeting clean developments, these measures could mimic the post-2009 stimulus, prompting the adoption of low-carbon technology, reducing the demand for oil and gas in the coming decade, and improving energy security. Decoupling oil and gas demand from the global economy will not be an easy endeavour, and it will probably take decades, not five to ten years, for meaningful action to materialise. However, if the energy transition accelerates and market-driven oil and gas suppliers begin to adhere to binding carbon budgets, one impact could be a reduction in energy security in the APEC region.

6-4 Enhancing oil and gas supply security

As described in Section 5, we are already seeing examples of how the uncertain demand recovery from the COVID-19 pandemic along with shifting investor preferences is causing temporary imbalances between oil and gas demand and supply. These imbalances have caused increased price volatility and temporary supply disruptions. Although the price volatility and temporary disruptions were not caused solely by the pandemic, the uncertainty about future oil and gas demand created by the pandemic has been one of the causal factors.

Price volatility and temporary disruptions in oil and gas supplies can cause enormous economic costs to an economy, and it is prudent for APEC members to carefully evaluate potential actions they could take to minimise and/or mitigate the costs of those potential future disruptions.

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