

# APERC Gas Report 2023



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## Foreword

Global natural gas demand was expected to grow strongly in 2022 as the world's economies continued to recover from the COVID-19 pandemic, and decarbonization strategies encouraged fuel-switching from coal to gas. However, gas supply disruptions in 2022 caused sharp increases in gas prices, which dampened demand growth. As a result, global gas demand grew less than 1% in 2022.

The APEC region, which includes the three largest gas consumers in the world, accounted for 58% of the world's gas consumption in 2022 and was also affected by the supply disruptions. However, the gas consumption picture was mixed in the APEC region. Gas consumption in the United States and Canada rose by 3.6% and 5.7%, respectively. But gas demand declines in Russia, China, Japan, and Thailand offset much of that growth. In total, APEC gas demand grew only 0.7% in 2022.

The market dynamics of 2022 highlighted the energy security challenges of the gas-importing economies in the APEC region as the high LNG prices imposed increased costs on those economies. With the growing interest in LNG regasification projects observed in 2022 and 2023 in Southeast Asia and China, the region's exposure to future fluctuations in gas prices is likely to increase.

Natural gas production growth in the APEC region in 2022 continued to be largely concentrated in its largest producers: the United States, China, Canada and Australia. The observed decline in gas production in other APEC economies, mainly in Southeast Asia, highlight the need for additional upstream and midstream investment to enhance energy security and provide sufficient gas supplies to support economic growth.

The 2023 edition of the APERC Gas Report reflects the ongoing developments and challenges in the global gas market with a focus on the APEC region. I hope this report will be one of the references to be considered by policymakers across the APEC region when developing energy security and energy transition plans and programs. I would also like to express my sincere gratitude to the authors and contributors for their time and effort in writing and publishing this report. I am also grateful to APEC member economies for providing updated data through the APEC Expert Group on Energy Data and Analysis (EGEDA).



**Kazutomo IRIE**

President  
Asia Pacific Energy Research Centre  
May 2024

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We would like to take this opportunity to thank the APEC Expert Group on Energy Data and Analysis for supplying economy data, and researchers at APERC for providing the latest update on the gas development of each APEC economy. We also thank the administrative staff at APERC for their support.

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## Abbreviation and acronyms

### Abbreviation

bbl	barrel
bcf/d	billion cubic feet per day
bcm	billion cubic meter
GHG	greenhouse gas
GJ	giga joule
kWh	kilowatt hour
m <sup>3</sup>	cubic meter
Mtpa	million tonnes per annum
MMBtu	million British thermal units
SPAs	sale and purchase agreements
y-o-y	year-on-year

### Acronyms

APEC	Asia-Pacific Economic Cooperation
APERC	Asia Pacific Energy Research Centre
EIA	Energy Information Administration
FSRU	Floating Storage Regasification Unit
IEA	International Energy Agency
JKM	Japan-Korea Marker
LNG	Liquefied Natural Gas
NEA	Northeast Asia
NBP	National Balancing Point
SEA	Southeast Asia
TTF	Title Transfer Facility

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## Key Highlights

**Asia-Pacific Economic Cooperation (APEC) economies accounted for 58% of the world's natural gas consumption in 2022.** Three APEC economies were the largest gas consumers in the world in 2022: The United States, Russia and China. The United States remained the largest gas consumer in the world at 909 bcm, 22% of the world's natural consumption in 2022. In the same year, Russia consumed 472 bcm, while China consumed 359 bcm, accounting for 12% and 9% of the world's consumption, respectively.

**APEC's natural gas consumption stagnated in 2022 with a 0.7% annual growth rate.** The United States and Canada drove consumption growth in the region with a 3.6% and 5.7% growth rate, respectively. However, consumption contractions in Russia, China, Japan, and Thailand offset significant growth in the region. Demand contraction in the region was driven by slower economic growth in China, the impact of international sanctions on the Russian economy, lower gas consumption by the power sector in Japan, and lower domestic production coupled with high import prices in Thailand.

**Of all the downstream sectors, the power and heat sector consumed the most natural gas in the APEC region, accounting for 40% of total gas consumption.** The power and heat sector accounted for 944 bcm of regional consumption in 2021 and presented a year-over-year growth of 5.3%. The next two major natural gas users were the building and industry sectors---together accounting for 38% of natural gas consumption in the region in 2021.

**Medium-term outlooks for gas demand indicate that China will continue to drive gas demand growth in the region.** Projections suggest that China will continue increasing its gas consumption as the global energy system transitions toward cleaner sources, largely due to the economy's ongoing shift from coal to gas.

**The APEC region continued to be a dominant natural gas producer in 2022.** The region accounted for 58% of worldwide gas production. The region produced 2,422 bcm, a 0.7% contraction compared to the volume produced in the previous year. The contraction was primarily due to the fall in Russian production, a 11.8% decrease, as OECD Europe sought other gas sources amid the Russia-Ukraine war. The missing Russian gas volume was mostly offset by production growth in the United States, China, Canada, Australia, and Malaysia.

**Natural gas production in 2022 continued to be dominated by shale gas in the United States and conventional gas in Russia.** Marketed gas production in the United States reached 1013 bcm (3.7% y-o-y) while Russia reached 634 bcm (-11.8% y-o-y). The next largest producers in the APEC region, Canada, China, and Australia showed gas production growth rates above 4%, with Canada reporting the largest percentual growth supported by tight gas production.

**Natural gas production in Southeast Asia continued to decline in 2022.** The majority of gas producers in APEC Southeast Asia showed production declines throughout the last decade, a trend that was not reverted in 2022. Indonesia and Thailand experienced the steepest declines in gas production over the last decade, largely due to their reliance on maturing gas fields. In 2022, Indonesia and Thailand reported a 2.6% and 17.2% decrease in production, respectively. Malaysia is the only producer in the sub-region that added significant production volumes this decade. In 2022, Malaysia's production increased by 6.4%.

**Medium-term outlooks for gas production indicate that the United States and China will continue to drive gas production growth in the region.** Forecasts based on current trends in the global energy system, with a focus on energy transition, suggest that gas production in the United States and China will continue to grow throughout this decade. In contrast, projections indicate that production in Southeast Asia and Russia are unlikely to rebound before 2030.

**Total natural gas imports in the APEC region presented a 3.1% y-o-y decline.** The Russia-Ukraine war significantly disrupted the global gas market, leading to an unprecedented supply crunch and record-high prices in 2022. The reconfiguration of Europe's gas supply affected importers worldwide, but its impact on China's imports was particularly notable. China's total gas imports declined by 9.9% as high prices and slower economic growth limited gas demand.

**LNG imports in the APEC region showed a 5.9% y-o-y decline in 2022.** The decline was driven by a major contraction in China's LNG imports, offsetting the modest growth observed in other economies. A slower economic growth and record high prices for LNG resulted in China limiting LNG imports, leading to a contraction of 19.6% in 2022.

**Gas pipeline imports in the APEC region showed a 0.3% y-o-y growth in 2022.** These flat growth rates for pipeline imports were the result of pipeline gas imports contractions in Russia and Mexico, offsetting the growth observed in the United States and China.

**Total gas exports in the APEC region showed a 7.6% y-o-y decrease in 2022.** The main driver for the contraction in gas exports were the significantly lower pipeline exports flowing from Russia into Europe. Russia's annual exports dropped by a dramatic 30% as the economy lost partial access to the European market due to sanctions resulting from the Ukraine invasion and the interruption of gas flows through the Nord Stream pipeline.

**LNG exports in the APEC region experienced a 6.7% y-o-y increase in 2022.** The growth in LNG exports was driven by the United States and Malaysia increasing their annual exports by 14% and 13%, respectively. U.S. LNG's share in the European market increased as Europe scrambled to lessen its reliance on Russian gas imports. Malaysian LNG export growth in 2022 was driven by Asian buyers as U.S. and Qatari LNG was partially redirected to Europe.

**Gas pipeline exports in the APEC region showed a 19% contraction in 2022.** The reduction in pipeline exports was driven by the sharp decline in Russian gas flowing into Europe. Russian pipeline exports saw a 37% y-o-y decrease in 2022, mainly attributed to the interruption of the Nord Stream operations.

**Gas prices were extremely volatile in 2022.** Supply disruptions caused LNG prices to reach unprecedented levels in March 2022 that were then exceeded in August. Increased gas supplies and other market adjustments caused LNG prices to moderate in 2023 and return to historic levels in late 2023 and 2024.

**Medium-term outlooks for gas trade expect that China, Chinese Taipei, Thailand, and Viet Nam will drive import growth in the region.** Projections that focus on the ongoing transition in the global energy system suggest that China's imports are set to nearly double by 2030. In Southeast Asia, the decline in domestic production and efforts to reduce emissions indicate that the sub-region may grow more dependent on LNG imports.

**Medium-term outlooks for gas trade project that the United States will drive export growth in the region.** U.S. gas exports are expected to more than double by 2030. The bulk of the increase in exports will come in the form of LNG exports supported by sizeable gas production capabilities, as well as extensive liquefaction infrastructure. Although Russia exports are not expected to fully recover, the economy is planning to increase its exports to the Asian market via LNG exports and new pipeline projects.

**The pause on future LNG exports permits by the United States will impact investors who had made decisions based on selling to China and Japan.** The United States, in late January 2024, announced that it is temporarily pausing determinations on pending applications of LNG exports to non-FTA (Free Trade Agreement) countries until it can determine whether additional LNG exports are in the public interest. Neither Japan nor China have FTAs with the United States, so while their current LNG supply from the United States will not be impacted by this new policy, future U.S. LNG projects that were investing based on Japanese and Chinese consumption habits will now be under additional review.

## Section 1: Gas updates in APEC economies

Economy	Update
Australia	<ul style="list-style-type: none"> <li>• Australia's natural gas consumption increased by 4.2% in 2022.</li> <li>• Australia was the world's leading LNG exporter in 2022. LNG exports increased by 0.9%, from 104.1 bcm in 2021 to 105.1 bcm in 2022.</li> <li>• Prelude LNG export facility restarted production in April 2022 after a fire incident in December 2021. Extensive maintenance halted exports again in 2023.</li> <li>• A second gas processing train is under construction at the Pluto LNG plant. This expansion will increase liquefaction capacity by 5 Mtpa and it is expected to come online by 2026.</li> </ul>
Brunei Darussalam	<ul style="list-style-type: none"> <li>• Brunei's natural gas consumption increased by 14.5% in 2022.</li> <li>• LNG exports declined by 15.5% following a decrease in gas production in 2022. The reduction in gas production was due to unscheduled maintenance and rejuvenation activities in existing wells.</li> </ul>
Canada	<ul style="list-style-type: none"> <li>• Canada's natural gas consumption increased by 5.7% in 2022.</li> <li>• Natural gas production rose by 7.4% to 177.6 bcm in 2022, driven by increased domestic demand and exports to the United States.</li> <li>• The first LNG export facility, LNG Canada, with a 14 Mtpa capacity, is under construction and expected to start operations in 2025.</li> <li>• Woodfibre LNG, the second LNG export facility in Canada, with a 2.1 Mtpa capacity, is under construction and expected to start operations in 2027.</li> </ul>
Chile	<ul style="list-style-type: none"> <li>• Chile's natural gas consumption increased by 4.1% to 6.1 bcm in 2022, matching the pre-pandemic volumes of 2019.</li> <li>• Natural gas imports via pipeline from Argentina increased by 300% in 2022. The additional natural gas imports were used to produce electricity. Chile's power sector has increased gas generation capacity to balance variability in renewable power output.</li> </ul>
China	<ul style="list-style-type: none"> <li>• China's natural gas consumption contracted by 1.1% in 2022, driven by slower economic growth, price sensitivities, and the implementation of the zero-COVID policy.</li> <li>• Natural gas production grew by 6.3% in 2022, driven by conventional and tight gas developments.</li> <li>• China's LNG exports decreased by 19.6% in 2022, resulting from lower gas demand and increased domestic gas production.</li> <li>• Total LNG import terminal capacity reached 145 bcm in 2022, with 171 bcm under construction expected to come online by 2026.</li> </ul>
Hong Kong, China	<ul style="list-style-type: none"> <li>• Gas consumption decreased by 6.4% in 2022. Total energy consumption in Hong Kong, China contracted as the COVID-19 pandemic affected trade, tourism, and retail.</li> </ul>

Economy	Update
	<ul style="list-style-type: none"> <li>• The Hong Kong Offshore LNG terminal, the first LNG terminal in Hong Kong, China, with a capacity of 1.2 Mtpa, started operations in summer 2023.</li> </ul>
Indonesia	<ul style="list-style-type: none"> <li>• Indonesia's gas consumption increased by 2.9% in 2022. Gas consumption remained below 2019's level.</li> <li>• Natural gas production continued its downward trend in 2022, decreasing by 2.6% due to depleting mature gas fields.</li> <li>• LNG exports increased by 4.7% in 2022; however, total gas exports decreased as pipeline exports contracted by 21% in the same year. Temporal issues with upstream production resulted in the curtailment of pipeline exports to Singapore.</li> </ul>
Japan	<ul style="list-style-type: none"> <li>• Japan's gas consumption contracted by 2.8% in 2022, driven by less use in the power sector. Nuclear generation and renewables partially displaced gas consumption for electricity generation.</li> <li>• LNG imports decreased by 3.1% in 2022. Even amid the contraction, Japan was the largest LNG importer in the world due to China's significant decrease in LNG imports in the same year.</li> </ul>
Korea	<ul style="list-style-type: none"> <li>• Korea's gas consumption increased marginally by 0.9% in 2022.</li> <li>• Korea remained the third largest LNG importer in the APEC region behind China and Japan. LNG imports grew marginally by 1% in 2022.</li> <li>• Korea's 10<sup>th</sup> Basic Plan for Power Supply prioritizes growth in nuclear generation and renewable electricity over the expansion of gas generation.</li> </ul>
Malaysia	<ul style="list-style-type: none"> <li>• Malaysia's gas consumption increased by 2.4% in 2022.</li> <li>• Malaysia's gas production increased by 6.4% in 2022, driven by growth in consumption and exports.</li> <li>• Malaysia's total gas exports increased by 14.3% in 2022. LNG exports grew by 13.1% in the same year, driven by gas exports to Japan and South Korea.</li> </ul>
Mexico	<ul style="list-style-type: none"> <li>• Mexico's natural gas consumption decreased by 1.6% in 2022.</li> <li>• Natural gas production increased by 5.4% in 2022. Gas production continued to be below the levels observed before COVID-19.</li> <li>• Natural gas pipeline imports decreased by 3.9% in 2022. The drivers behind this contraction were high prices and prioritization of U.S. consumers during winter.</li> <li>• LNG imports continued to be less than 1 bcm in 2022. Gas pipelines connecting West Texas to Central and Southwest Mexico, which began operation between 2019 to 2021, decreased reliance on LNG imports.</li> <li>• The LNG liquefaction plant, Energia Costa Azul, with a capacity of 3.25 Mtpa is under construction and expected to be in operation in 2025.</li> </ul>
New Zealand	<ul style="list-style-type: none"> <li>• Gas consumption contracted by 9.2% in 2022, driven by a production decline of the same magnitude. The power and industry sectors reflected most of the contraction in gas use.</li> <li>• The decline in gas production can be attributed to the output contraction observed in Pohokura, New Zealand's largest gas field. The unexpected rapid</li> </ul>

Economy	Update
	decline in gas production started in 2020 and production levels did not recover in 2022.
Papua New Guinea	<ul style="list-style-type: none"> <li>• Gas consumption increased by 13.5% in 2022 to 1.1 bcm, crossing the 1 bcm threshold for the first time.</li> <li>• Gas production increased by 1.3% in 2022. Over 90% of the gas produced was exported as LNG.</li> </ul>
Peru	<ul style="list-style-type: none"> <li>• Natural gas consumption increased by 15.2% in 2022, surpassing pre-pandemic levels as natural gas comprised of a larger share in the Peruvian energy mix.</li> <li>• Natural gas production grew by 17.8% in 2022, reaching the levels observed in 2019.</li> </ul>
The Philippines	<ul style="list-style-type: none"> <li>• Gas production declined by 5.6% in 2022, continuing the downward trend in gas production from the Malampaya field. The Malampaya field is the only source of gas for the Philippines, and it is expected to be depleted by 2027.</li> <li>• Gas consumption contracted by 5.6% in 2022. The decrease in consumption responded to the decline in domestic gas production.</li> <li>• The Philippines is preparing to start receiving LNG imports. The AG&amp;P LNG import terminal, the first one in The Philippines, started operations in April 2023. Three additional regasification terminals are under construction with a combined capacity of 11.46 Mtpa. The regasification terminals are expected to come online by the end of 2024.</li> </ul>
Russia	<ul style="list-style-type: none"> <li>• Gas production contracted by 11.8% in 2022 as OECD Europe looked for other sources of gas amid the Russia-Ukraine war.</li> <li>• Gas consumption contracted by 3.1% in 2022 as Russia faced economic sanctions derived from the Russia-Ukraine war.</li> <li>• Gas exports through pipelines contracted by 37% in 2022 due to the abrupt decline in European imports mainly driven by the Nord Stream halt.</li> <li>• LNG exports increased by 4% in 2022 because of higher LNG exports to China and Europe.</li> <li>• Russia is currently building 44.7 bcm of yearly liquefaction capacity to diversify its importers.</li> </ul>
Singapore	<ul style="list-style-type: none"> <li>• Gas consumption contracted by 4.5% in 2022.</li> <li>• Pipeline gas imports from Indonesia decreased by 20.1% in 2022. Issues with upstream production in Indonesia led to the curtailment of gas exports. Depletion of gas production in Indonesia may force the prioritization of domestic consumption over exports in the coming years.</li> <li>• LNG imports increased by 4% to partially offset lower pipeline imports.</li> </ul>
Chinese Taipei	<ul style="list-style-type: none"> <li>• Gas consumption increased by 4% in 2022.</li> <li>• LNG imports grew by 4.1% and reached an all-time high of 26.6 bcm in 2022.</li> </ul>

Economy	Update
	<ul style="list-style-type: none"> <li>• A new regasification terminal, Taoyuan LNG, with a capacity of 3 Mtpa is under construction and is expected to be operational by 2025. Expansion at the Yung-An terminal is also under construction and is expected to be operational by 2027.</li> </ul>
Thailand	<ul style="list-style-type: none"> <li>• Gas consumption contracted by 7.7% in 2022. The decrease in domestic gas production and high import prices put pressure on price sensitive users, such as the power sector.</li> <li>• Gas production contracted by 17.2% in 2022. The decrease in domestic production is attributed to a reduction in output from the Erawan gas field.</li> <li>• Total imports increased by 11.3% in 2022 to offset the loss in domestic production. LNG imports increased by 21% in 2022, while pipeline imports of Burmese gas decreased by 0.7% in the same year.</li> <li>• Two new regasification terminals, Map Ta Phut 2 and Nong Fab LNG, started operations in 2022, increasing Thailand’s regasification capacity by 15 Mtpa.</li> </ul>
United States	<ul style="list-style-type: none"> <li>• Gas consumption increased by 3.6% in 2022, reaching 2019’s levels.</li> <li>• Gas production increased by 3.76% in 2022, reaching the all-time high level of 1013 bcm.</li> <li>• Total gas exports increased by 6.3% in 2022, driven by an increase in LNG exports.</li> <li>• LNG exports increased by 14.3% in 2022. U.S. LNG exports reached 103 bcm in 2022, positioning the United States as the second largest LNG exporter in the world after Australia.</li> <li>• The expansion in LNG exports was driven by increased exports to Europe, mainly to France, Spain, The Netherlands, and The United Kingdom.</li> <li>• The United States has three liquefaction projects expected to start operations by 2025: Golden Pass LNG (18.1 Mtpa), Corpus Christi LNG III (11.5 Mtpa), and Plaquemines LNG (24.0 Mtpa). Additionally, two projects under construction, Port Arthur LNG (13.5 Mtpa) and Rio Grande LNG (17.6 Mtpa), will further increase liquefaction capacity by 2027-28.</li> <li>• The United States, in late January 2024, announced that it is temporarily pausing determinations on pending applications of LNG exports to non-FTA (Free Trade Agreement) countries until it can update the economic and environmental analyses used to determine whether additional LNG export authorization requests to non-FTA countries are in the public interest. Existing authorizations for LNG exports and projects that are already under construction will remain unaffected.</li> </ul>
Viet Nam	<ul style="list-style-type: none"> <li>• Gas consumption increased by 8.9% in 2022. Gas consumption was dictated by domestic gas production which showed the same growth rate in 2022.</li> <li>• The first regasification terminal, Thi Vai LNG I, with a capacity of 1 Mtpa began commercial operations in 2023.</li> <li>• 8.1 Mtpa of additional regasification capacity is currently under construction.</li> </ul>

## Section 2: Gas Demand

### 2-1 World and APEC natural gas demand

Global and APEC natural gas consumption has been on the rise since 2012, with the exception of 2020 due to the COVID-19 pandemic. APEC's gas consumption grew 27% in the last decade, from 1,846 bcm in 2012 to 2,350 bcm in 2022. The growth in the APEC region during the last 10 years was higher than global natural gas consumption growth at 21%, leading to APEC's share of global gas demand increasing from 55% to 58% during the same period.

Global natural gas consumption experienced marginal growth in 2022 at less than 1%. This low growth can be attributed to the Russia-Ukraine war exacerbating already high gas prices in 2022, as well as the already tight supply conditions that started during the latter half of 2021 as demand increased due to the global economy rebounding from the COVID-19 crisis. APEC's natural gas consumption growth also stagnated, 0.7% in 2022 relative to 2021 levels, driven by differing consumption trends in the region. The United States and Canada drove consumption growth in the region with a 3.6% and 5.7% growth rate, respectively. However, consumption contractions in Russia, China, Japan, and Southeast Asia offset significant growth in the region. The United States remained the dominant natural gas user at 22% of worldwide gas consumption, followed by Russia at 12%, and China at 9%.

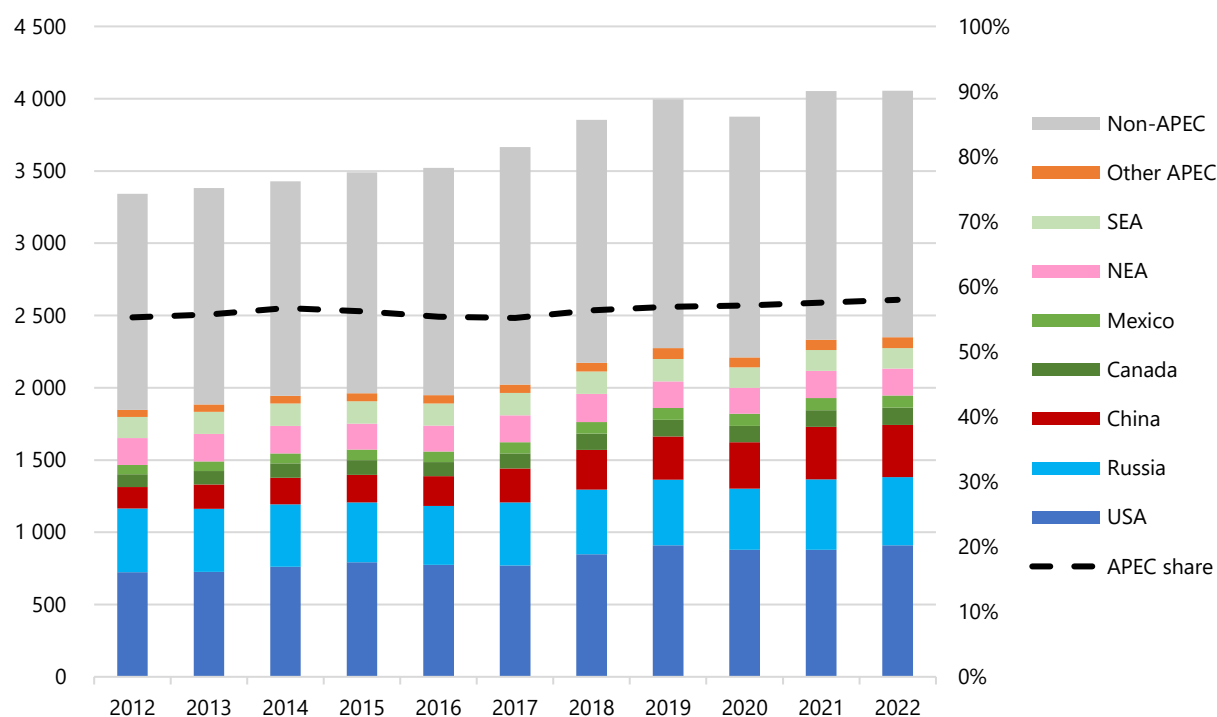
Russia represented the largest consumption contraction in absolute numbers in the region in 2022. The impact of international sanctions on the Russian economy, resulting from the Russia-Ukraine war, caused a shrinkage in economic activities and domestic gas consumption. Russian natural gas domestic demand fell 15.2 bcm in 2022. For the APEC region, Russia's decrease in gas consumption offset almost 50% of the growth observed in the United States (31 bcm) for the same year.

China and Japan also experienced a demand contraction in 2022, at 1.1% and 2.8% respectively. China's decrease in demand resulted from slower economic growth, price sensitivities, and the implementation of the zero-COVID policy that hindered economic recovery (IEA, 2023a). The decrease in Japan's gas demand was caused by a contraction in gas consumption in the power sector as the economy accelerated efforts to restart its nuclear fleet to reach their projected goal of having nuclear represent 20-22% of their power generation mix (IEEFA, 2023), which offset gas consumption growth in the industrial and commercial sectors.

Natural gas consumption in Southeast Asia also showed an overall decrease in 2022. Thailand drove the contraction in natural consumption in the sub-region with a 7.7% decrease in demand (3.8 bcm). The significant drop in demand mainly resulted from a decrease in domestic gas production and high gas import prices affecting power producers. This triggered the economy's reduced gas consumption and increased coal, diesel, and fuel oil consumption for electricity generation as part of its short-term energy security measures.



Figure 2.1: Natural gas demand in APEC and the world, 2012-2022 (bcm)



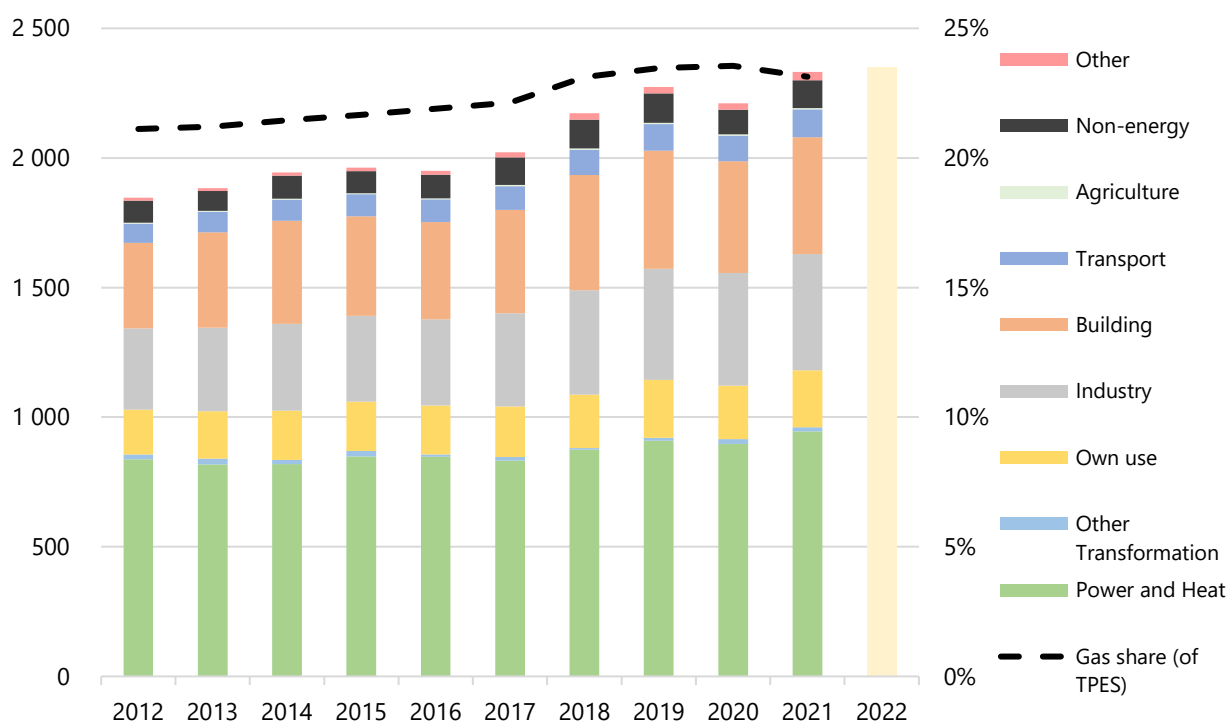
Source: CEDIGAZ

The APEC region used approximately 40% of its natural gas supply for power and heat generation in 2021. The power and heat sector accounted for a consumption of 944 bcm in the region in 2021 and presented a year-over-year growth of 5.3%. Although these sectors enjoyed relatively low gas prices at the beginning of 2021, prices increased sharply due to market tightening resulting from the initial COVID-19 recovery. High prices hampered a further demand increase during the second half of 2021 as users were forced to look for cheaper fuel alternatives.

The next two major natural gas users comprised of the building and industry sectors--together accounting for 38% of natural gas consumption in the region. The industry sector proved more resilient as it continued to grow over the last decade, even amid the COVID-19 pandemic. In 2021, the industry sector presented a y-o-y growth of 3.1%. Building natural gas consumption increased by 4.6% in that same year; however, the sector did not return to pre-pandemic levels as commercial activities were still recovering.

The transport and non-energy sectors together accounted for 9.1% of regional gas consumption in 2021. Both sectors presented clear signs of demand recovery in 2021, with the transport sector surpassing levels observed in 2019. Although the non-energy sector presented a y-o-y growth of 12% in consumption levels, it did not reach pre-pandemic levels. Most of the demand contraction in the sector resulted from slow growth in fertilizer production in the United States (EIA, 2022).

Figure 2-2: Natural gas demand in APEC by sector, 2012-2022 (bcm)



Note: Sectorial data for the year 2022 was not available at the time of writing.

Gas demand in the “power and heat” sector considers gas consumption for electricity generation, heat production in combined heat and power cycles, as well as district cooling. Gas consumption for heating and cooling in residential and commercial buildings is included in the “building” sector.

Source: CEDIGAZ, EGEDA

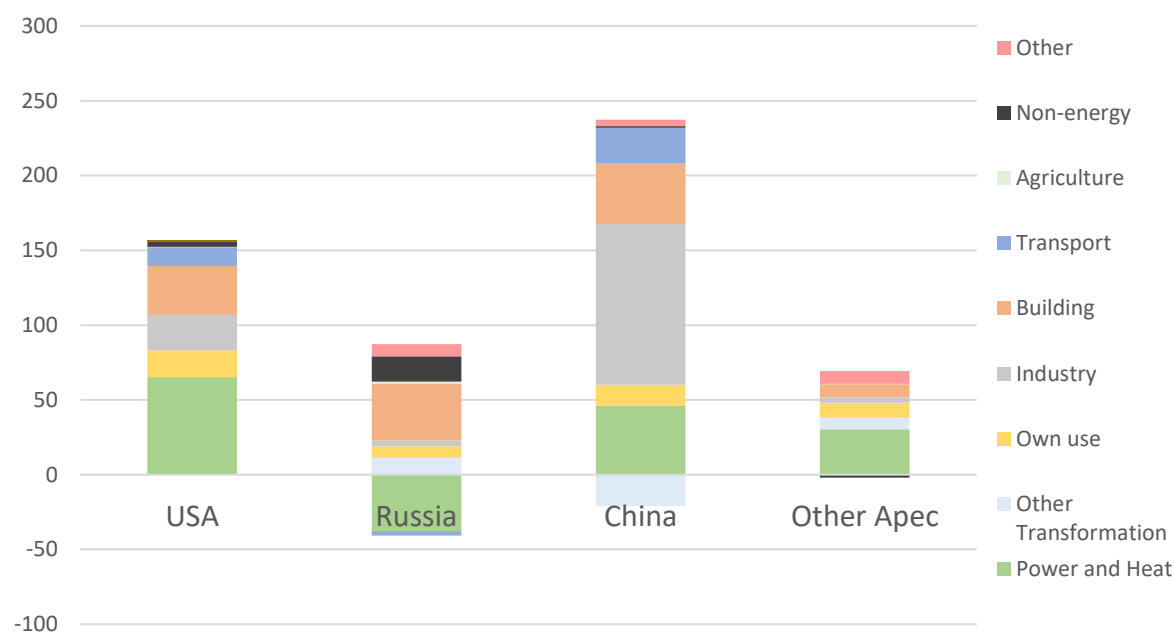
The positive changes (increments) in natural gas consumption in the region between 2012 and 2021 were driven predominantly by the industry, building, and power and heat sectors. Most of the consumption increase occurred in China and the United States, as they accounted for 76% of the demand increase in the region for the time period analyzed.

Demand expansion in China, the largest one in the region at 216 bcm, came mostly from its industry sector (107 bcm). The expansion in demand was mainly driven by the shift from coal to less polluting energy sources, especially coal to gas in industry and electricity generation.

The United States also experienced substantial growth in natural gas demand, with 155 bcm added in the last decade, mainly driven by power and heat generation. These sectors added 65 bcm of natural gas consumption, as increased electricity and heat demand coupled with coal-to-gas transition propelled demand in the economy.

Russia presented a more subtle growth in gas demand during the previous decade, adding 46 bcm of natural gas in 2021 compared to 2012. Unlike the rest of the economies, the power and heat sectors in Russia presented contractions in demand resulting from higher power generation from coal, hydropower, and nuclear sources. However, this decline was offset by more robust demand from other sectors, including heating in residential and commercial buildings, which required an additional 66 bcm of gas over the same period.

Figure 2-3: Changes in natural gas demand in APEC by sector, 2012-2021 (bcm)



Note: Sectorial data for the year 2022 was not available at the time of writing.

Gas demand in the “power and heat” sector considers gas consumption for electricity generation, heat production in combined heat and power cycles, as well as district cooling. Gas consumption for heating and cooling in residential and commercial buildings is included in the “building” sector.

Source: CEDIGAZ, EGEDA

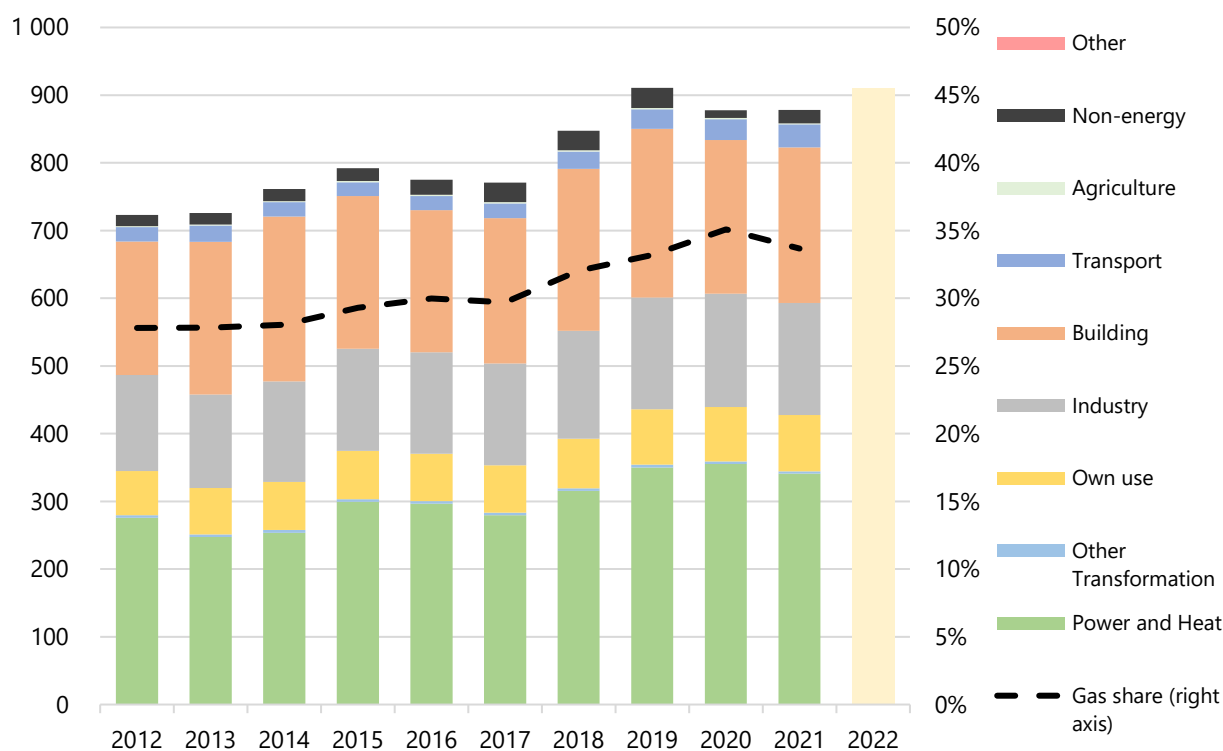
### 2-1-1 Gas demand in the United States

Over the past decade, the United States has remained the world's largest natural gas consumer, with its demand increasing by 25%. Although demand in the economy was rapidly growing from 2017 to 2019, the COVID-19 pandemic caused demand contraction in 2020 and it flattened demand in 2021. It was not until 2022 that demand rebounded closer to pre-pandemic levels.

The power and heat sector accounted for the largest share of natural gas consumption in the United States in 2021 at 39%. However, the sector presented a 4% y-o-y decline in consumed volume due to increasing natural gas prices throughout the year from the low 2020 levels. The upward trend in prices hindered the competitiveness of natural gas even as electricity demand increased. The competitive cost of coal and the rise in renewable generation were the primary substitutes for high-priced natural gas. (IEA, 2021). Similarly, the industry sector responded to high natural gas prices by reducing its demand. In 2021, the sector presented a 1.1% y-o-y decline in gas demand despite the rebound in economic activities.

However, the resurgence of economic activities in the United States had a positive impact on natural gas consumption in some sectors, particularly in those that have limited flexibility in fuels or feedstocks. In 2021, natural gas consumption in the non-energy, transport, and building sectors increased by 67%, 11%, and 1.3%, respectively. The absolute demand increase in these three sectors was almost enough to offset the demand contraction in the power and heat sector.

Figure 2.4: Natural gas demand in the United States by sector, 2012-2022 (bcm)



Note: Sectorial data for the year 2022 was not available at the time of writing.

Gas demand in the “power and heat” sector considers gas consumption for electricity generation, heat production in combined heat and power cycles, as well as district cooling. Gas consumption for heating and cooling in residential and commercial buildings is included in the “building” sector.

Source: CEDIGAZ, EGEDA

### 2-1-2 Gas demand in Russia

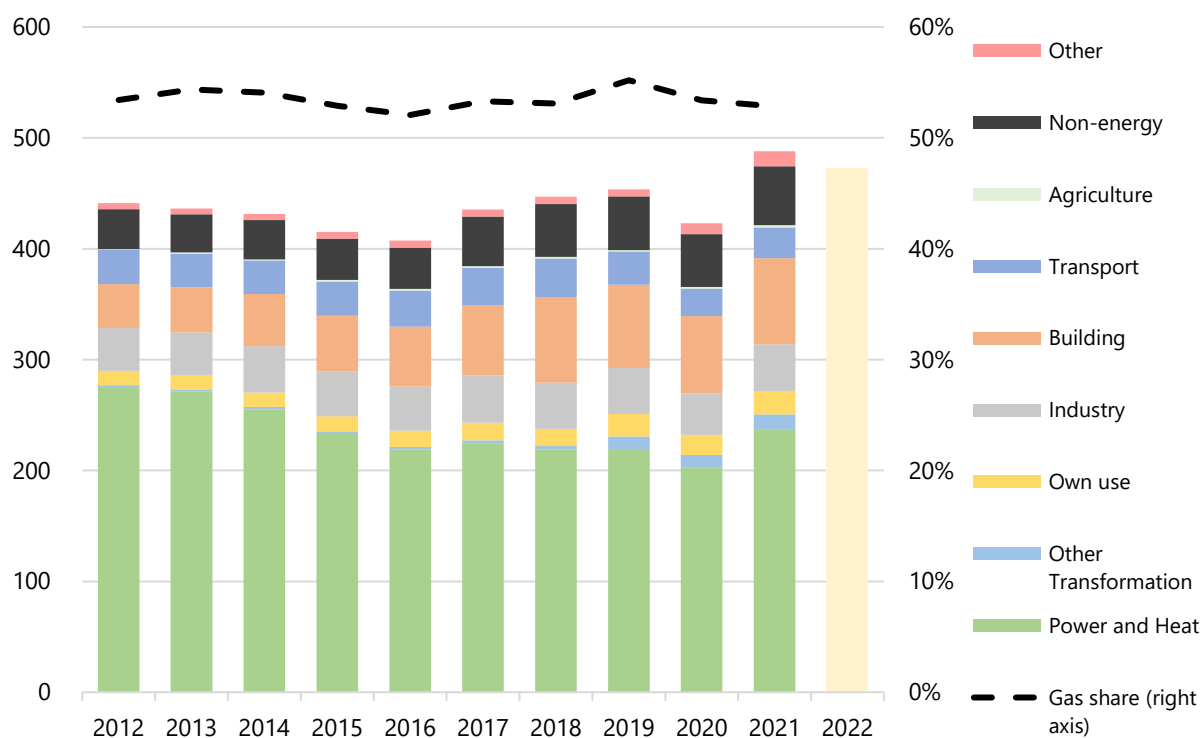
Russia has remained the world’s second-largest natural gas user for the past decade, accounting for 12% of worldwide consumption. The economy has access to the largest proven gas reserves in the world, which results in natural gas consistently providing over 50% of its primary energy supply. The varied consumption trends during the past decade reflect the impacts of economic downturns and rebounds.

In 2021, natural gas consumption showed a 15% y-o-y increase due to a long heating season and the gradual economic rebound after the initial shock of the COVID-19 pandemic (IEA, 2021). The power and heat sector dominated Russia’s natural gas consumption at 49%. With a 17% y-o-y growth, it represented more than half of the absolute increase in natural gas consumption.

The buildings and industry sectors represent the next largest consumers in Russia. In 2021, each sector accounted for 16% and 9% of total natural gas demand, respectively. These two sectors also greatly benefited from the economic rebound in 2021, with 14% and 11% y-o-y growth, respectively.

Total gas consumption in 2022 declined from the 2021 level as sanctions resulting from the Russia-Ukraine war negatively affected the economic activities in Russia.

Figure 2.5: Natural gas demand in Russia by sector, 2012-2022 (bcm)



Note: Sectorial data for the year 2022 was not available at the time of writing.

Gas demand in the “power and heat” sector considers gas consumption for electricity generation, heat production in combined heat and power cycles, as well as district cooling. Gas consumption for heating and cooling in residential and commercial buildings is included in the “building” sector.

Source: CEDIGAZ, EGEDA

### 2-1-3 Gas demand in China

China is the third largest natural gas consumer in the world, currently accounting for 9% of global gas consumption. The economy has presented a clear upward trend in its gas demand for the past decade, including during the COVID-19 pandemic. It was not until 2022 that the economy showed a decrease in its demand levels due to high gas prices and slower GDP growth (S&P Global, 2022).

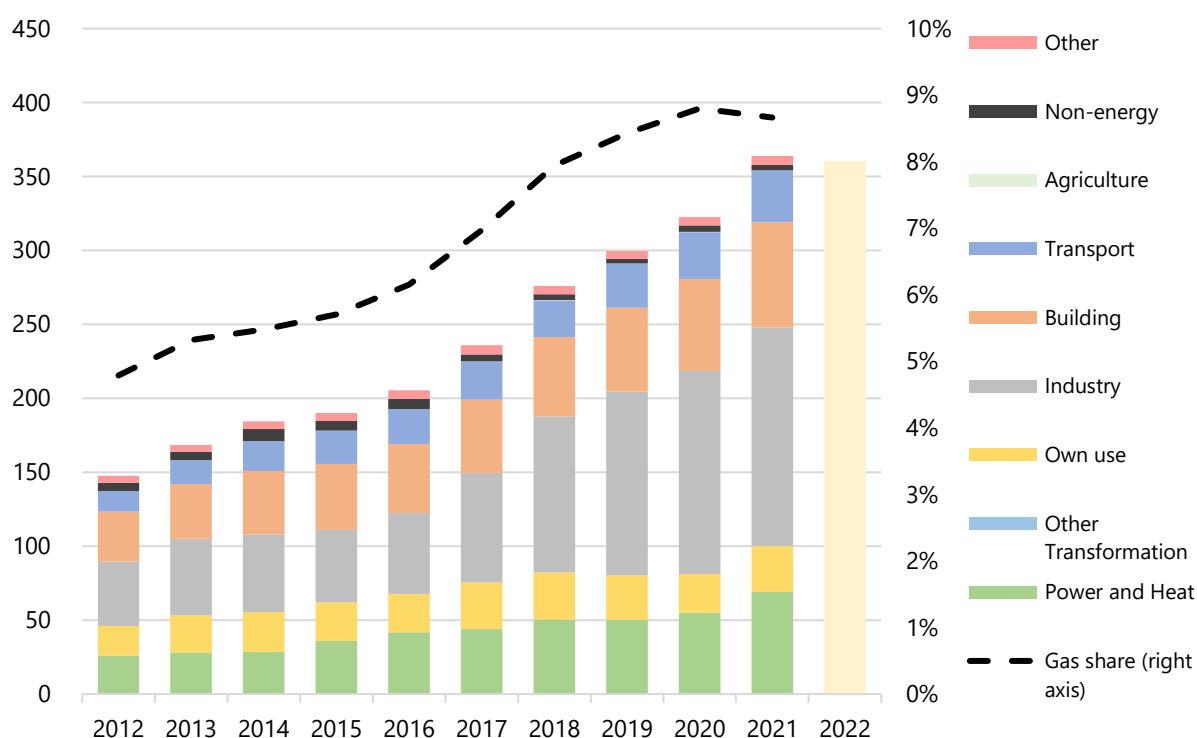
The industry sector accounts for 40% of natural gas consumption in China and has been the demand driver in the economy for the past decade. In 2021, the sector showed a 7.8 % y-o-y increase in the natural gas volume consumed. A strong rebound in economic activities at the beginning of the year and ongoing coal-to-gas conversions supported the demand in this sector; however, higher LNG prices in the second half of the year hampered demand growth in price-sensitive sections of the industry (IEA,2021).

The buildings sector, the second largest by share, also witnessed a notable surge in natural gas consumption in 2021. This substantial 14% year-on-year growth was driven by a robust economic rebound, long cooling and heating seasons, and a constrained domestic coal market due to low stockpiles and surging coal demand in other sectors (IEA,2021).

The power and heat sector, the third largest demand share in the economy, had a steep increase in natural gas demand, with a 25% y-o-y growth reported in 2021. The surge in natural gas demand resulted from long heating and cooling seasons during the winter and summer and low hydropower

availability. Additionally, the tight coal supply in 2021 further increased natural gas demand to meet power and heat needs (IEA,2022).

Figure 2.6: Natural gas demand in China by sector, 2012-2022 (bcm)



Note: Sectorial data for the year 2022 was not available at the time of writing.

Gas demand in the “power and heat” sector considers gas consumption for electricity generation, heat production in combined heat and power cycles, as well as district cooling. Gas consumption for heating and cooling in residential and commercial buildings is included in the “building” sector.

Source: CEDIGAZ, EGEDA

#### 2-1-4 Gas demand in Northeast Asia

The Northeast Asia economies (Hong Kong, China; Japan; Korea; and Chinese Taipei) depend almost 100% on LNG imports to meet their natural gas needs. Japan is the dominant consumer in the region and was once the largest LNG importer in the world. Japan’s demand has been on a downward trend for the past decade, opposite to the one observed in Korea, Chinese Taipei, and Hong Kong, China. The opposing demand trends in the region have resulted in overall demand remaining somewhat flat for the past decade.

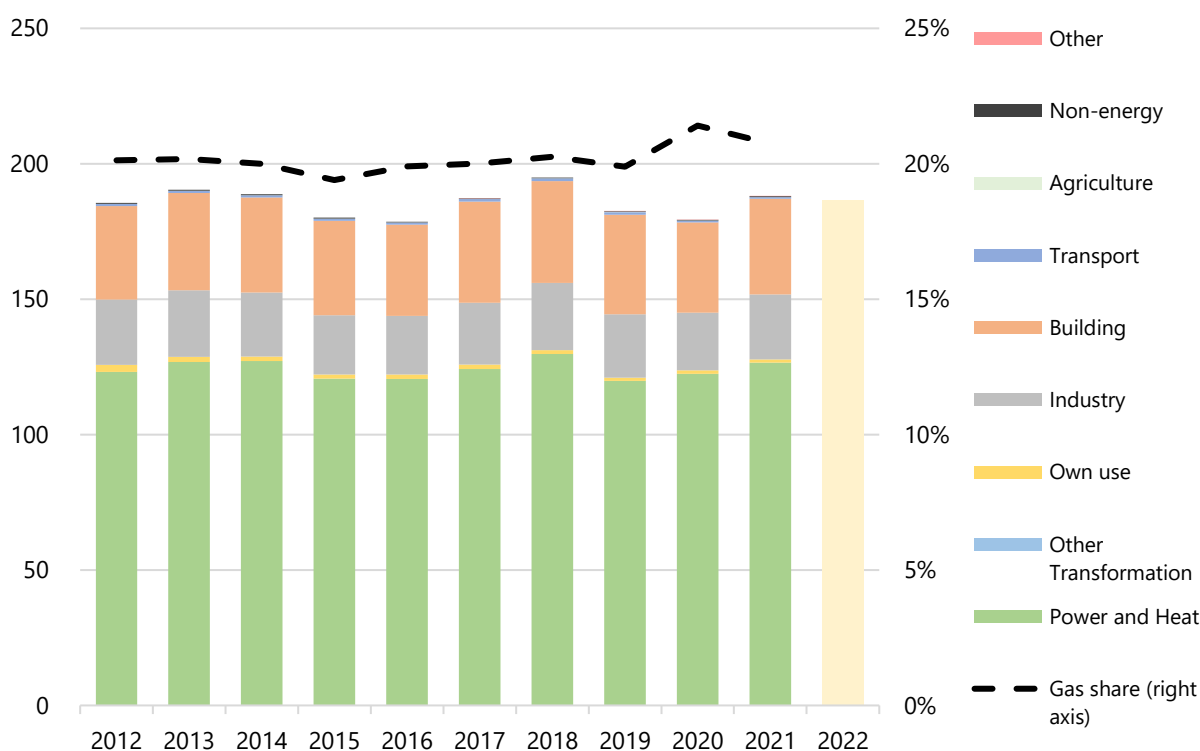
The Northeast Asia region experienced a 4.8% year-on-year increase in natural gas consumption in 2021, attributed to the economic rebound witnessed in the region, notably in Korea and Chinese Taipei in terms of volume. The demand growth in the region was driven primarily by the power and heat sector, and additionally by increased industrial demand.

In the case of the power sector, Japan showed a major y-o-y decrease of 9.7% in gas usage in 2021 because of higher use of nuclear and renewable generation during the year. Korea and Chinese Taipei reported substantial growth in natural gas use for power generation, offsetting Japan’s demand loss in this sector. Hong Kong, China, reported a slight decrease in natural gas for power generation.

In the industry sector, all Northeast Asia economies displayed substantial growth in gas usage as activities rebounded from the initial COVID-19 shock. With a y-o-y growth of 7% in 2021, Japan added the largest absolute demand volume to the industry sector. Chinese Taipei experienced a 15% surge in natural gas demand in its industry sector.

In 2022, the overall gas demand for the Northeast Asia economies decreased as the region was hit with extremely high gas import prices as the Russia-Ukraine war caused the global gas market to tighten.

Figure 2.7: Natural gas demand in NEA by sector, 2012-2022 (bcm)



Note: Sectorial data for the year 2022 was not available at the time of writing.

Gas demand in the “power and heat” sector considers gas consumption for electricity generation, heat production in combined heat and power cycles, as well as district cooling. Gas consumption for heating and cooling in residential and commercial buildings is included in the “building” sector.

Source: CEDIGAZ, EGEDA

### 2-1-5 Gas demand in Southeast Asia

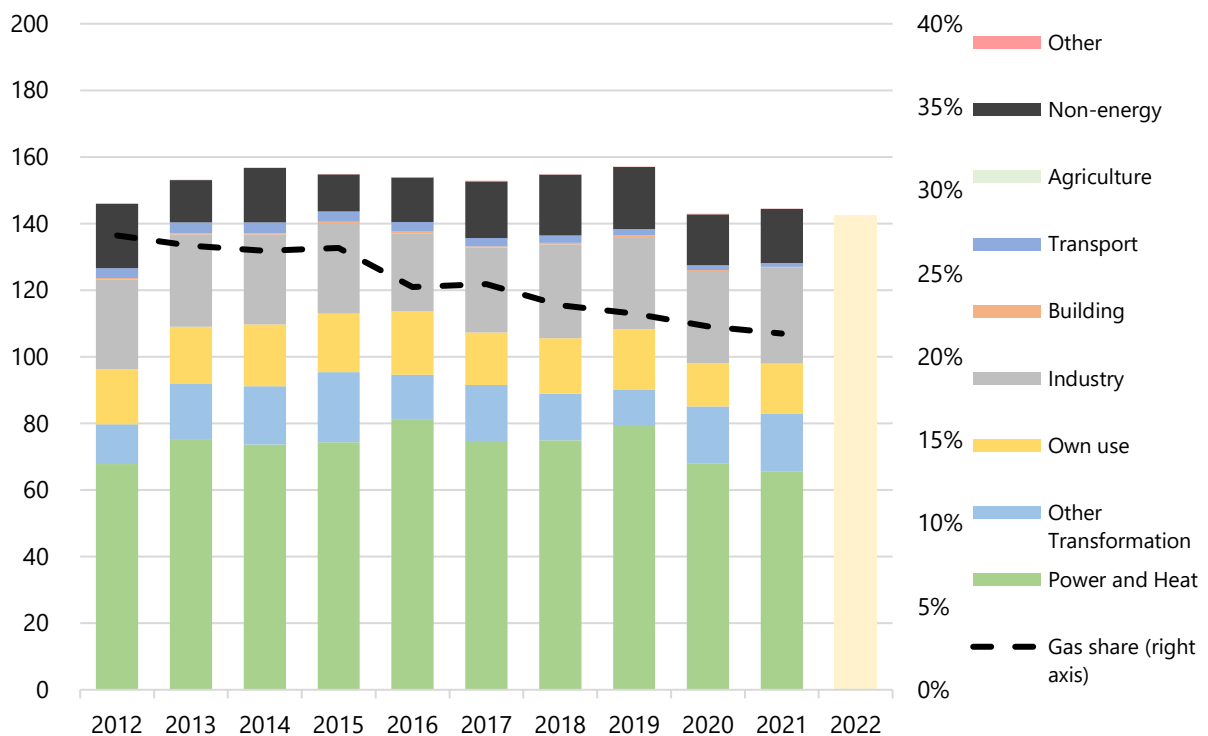
The Southeast Asia economies (Brunei Darussalam, Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam) displayed a mostly flat natural gas demand in the years since the start of the pandemic. In 2021, this region presented a y-o-y demand increase of 1% as its economic rebound was met with a tight natural gas market. The high natural gas prices of 2021 forced exposed economies to decrease consumption and opt for cheaper alternatives like coal.

In Southeast Asia, the power and heat sector is the leading gas consuming sector. In 2021, this sector presented a 3.5% y-o-y decrease as the LNG importer economies in the region were exposed to historically high prices on the spot market. The economies in the region implemented measures to counteract the impact of high fuel prices on the electricity market through efficiency and fuel exchange measures, which further suppressed natural gas demand.

The repercussions of the Russia-Ukraine war are anticipated to prolong the declining trend of natural gas consumption in the region, as concerns about energy security and economic viability influence short- and long-term policy decisions.

In 2022, the Russia-Ukraine war led to increased volatility in gas prices and tightened global supplies, which led to a decrease in natural gas consumption in Southeast Asia. Thailand, the largest gas consumer in the region, primarily drove the demand contraction, facing pressure on gas consumption due to declining domestic supply and high import prices.

Figure 2.8: Natural gas demand in SEA (Southeast Asia) by sector, 2012-2022 (bcm)



Note: Sectorial data for the year 2022 was not available at the time of writing.

Gas demand in the "power and heat" sector considers gas consumption for electricity generation, heat production in combined heat and power cycles, as well as district cooling. Gas consumption for heating and cooling in residential and commercial buildings is included in the "building" sector.

Source: CEDIGAZ, EGEDA

## 2-2 Gas demand outlook

The Russia-Ukraine war, that began in 2022, profoundly impacted the global natural gas market. After the EU (European Union) decided to limit Russia's pipeline gas imports, there was a higher demand for LNG, causing increased tightness in the gas market, which raised energy security concerns worldwide.

The latest natural gas demand projection published by APERC (Asia Pacific Energy Research Centre) in the 8th Outlook did not include analysis about the impact of the Russian-Ukraine war on the global energy market, so this edition of the APERC Gas Report utilizes other energy organizations' projections (CEDIGAZ, IEA, and BP) to assist with gas demand analysis.



Table 2-1: 2023 medium-term natural gas demand outlooks from different publishers.

Organization	Publication	Scenarios	Description
<b>CEDIGAZ</b>	2023 Medium- and Long-Term Gas & LNG Outlook	CEDIGAZ Scenario	Projection based on the acceleration of energy transition and significant energy efficiency gains.
<b>IEA</b>	World Energy Outlook 2023	Stated Policies Scenario (STEPS)	Projection based on current policy settings.
		Announced Pledges Scenario (APS)	Projection based on announced pledges which assumes GHG emissions targets are reached in time.
<b>BP</b>	BP Energy Outlook 2023	New Momentum Scenario	Projection based on the current trajectory of the energy system. It places weight on the recent global ambition for decarbonization.

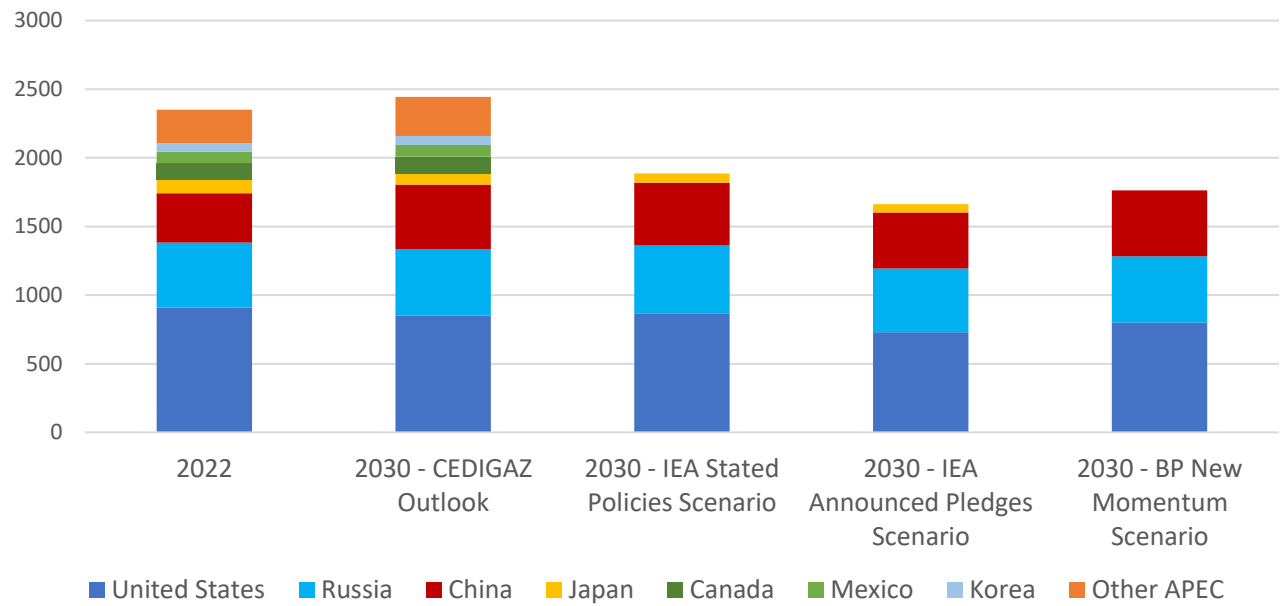
The CEDIGAZ 2023 Medium-term Gas & LNG Outlook offers the most comprehensive projection for gas production in the APEC region. It forecasts that by 2030, natural gas demand in the APEC region will increase by 4.1% from the 2022 baseline, mainly driven by increasing gas demand in China, Chinese Taipei, and Southeast Asia. China is projected to increase its demand by 30%, accounting for the majority of gas demand growth. More substantial gas consumption growth in the region is mainly limited by demand contractions in the United States and Japan. Also, according to CEDIGAZ, Russia’s demand is projected to have a 2.8% increase by 2030.

IEA’s STEPS forecasts a major increase in China’s gas consumption, with 27% growth in 2030 compared to 2022. This demand change alone would add 100 bcm in natural gas demand into the APEC region; however, the forecasted demand contraction in the United States and Japan would offset part of this volume, as natural gas consumption is forecasted to contract by 4.6% in the United States and by 32% in Japan. In contrast, Russia’s demand is projected to increase by 4.5% during the next decade.

IEA’s APS presents a highly optimistic trajectory for GHG emissions reductions in the current decade, resulting in demand contraction in most of the main markets in APEC. China’s demand is projected to increase by 14% in 2030 compared to 2022. This growth, however, is more than offset by demand contractions in the United States and Japan. U.S. demand is projected to contract by almost 20%, Japan’s by a staggering 39%, and Russia’s by 2.3% during the next decade.

BP’s New Momentum Scenario reflects the trajectory of the global energy system, emphasizing the increase in global ambition for decarbonization in recent years. According to this scenario, China’s demand is projected to grow by 33% in the next decade, while U.S. consumption is expected to contract by 12%. Additionally, Russia’s demand is forecasted to increase by 1.7% over the next decade.

Figure 2-9: Natural gas demand outlook in APEC economies, 2022-2030 (bcm)



Source: CEDIGAZ, IEA, BP

## Section 3: Gas supply

### 3-1 World and APEC natural gas supply

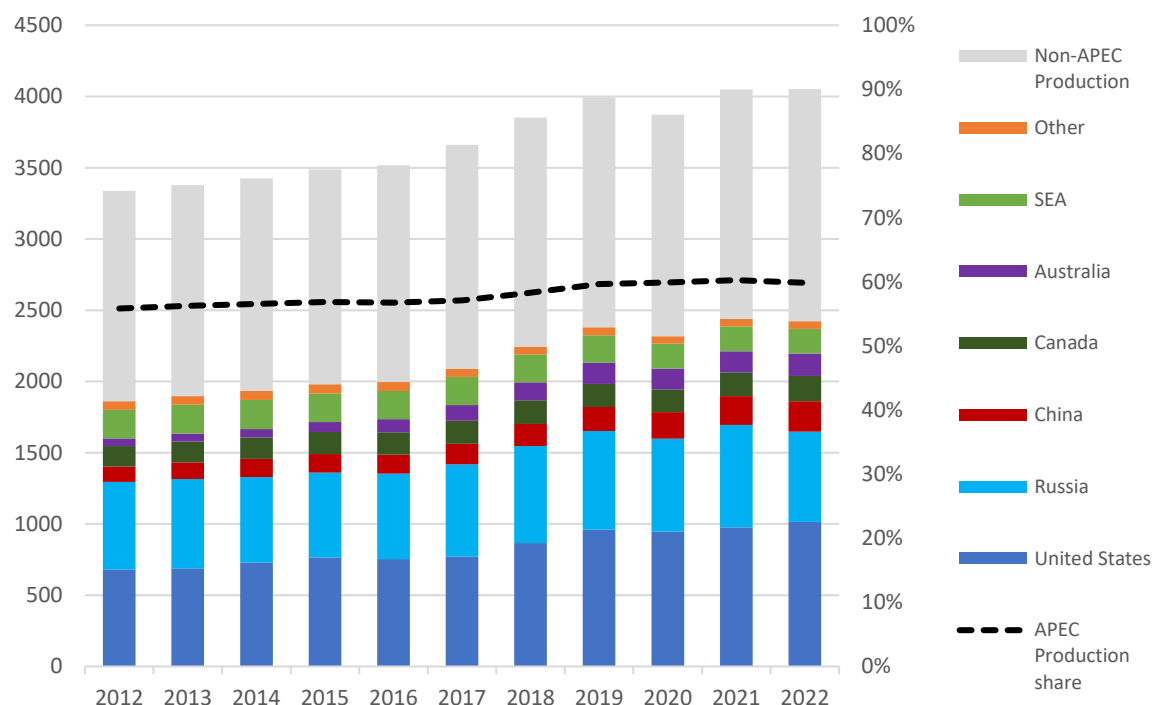
Over the last decade, the APEC region has been the dominant natural gas producer in the world. In 2022, the region accounted for 58% of total natural gas production. The region produced 2,422 bcm in 2022, representing a 30% increase over the volume produced in 2012. As a comparison, total world natural gas production in 2022 was 4,451 bcm, a 21% increase over the 2012 value.

The accelerated growth in production in the region during the last decade was mainly driven by volumes added by the United States, China, and Australia. The substantial production growth in the region was mainly supported by the shale gas revolution in the United States, conventional and unconventional gas in China, and conventional gas in Australia.

The producers in Southeast Asia (SEA) and others in the Americas had a diminishing role in natural gas volumes extracted. In SEA, Indonesia's and Thailand's production decreased by 26% and 33%, respectively, compared to the 2012 levels. In the Americas, Mexico had a gas production contraction of 44% during the same period.

Natural gas production in the region in 2022 showed a y-o-y decrease of 0.7%, primarily due to a decrease in Russian production as OECD Europe sought other sources. The contraction in Russia's gas production of 11.8%, or 84 bcm in 2022, was mostly offset by the United States, China, Canada, Australia, and Malaysia's gas production growth.

Figure 3-1: Natural gas production in APEC, 2012-2022 (bcm)



Note: The figure shows marketed volumes.

Source: CEDIGAZ

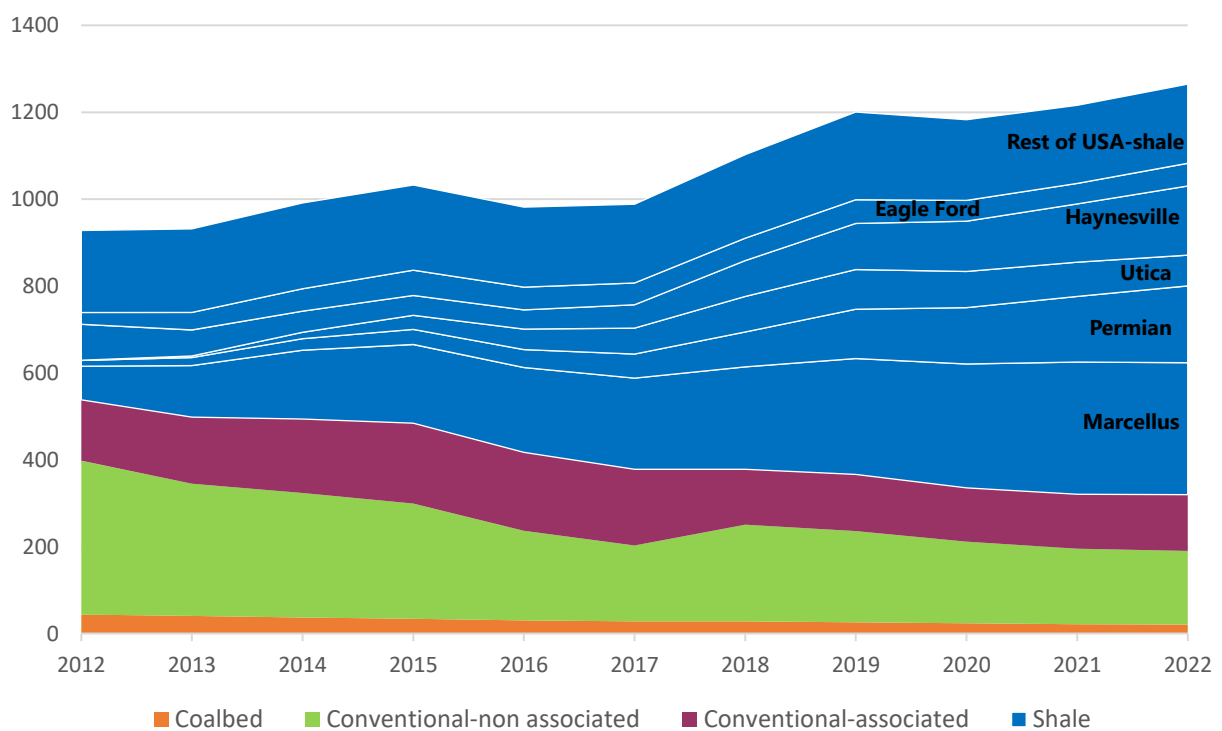
### 3-1-1 Gas supply in the United States

In 2022, the United States continues to be the largest natural gas producer in the region by a large margin. The gross gas production totalled 1264 bcm in 2022, an increase of 4% compared to the previous year.

Over the last decade, shale gas has been the main driver of U.S. gas production. Shale gas currently accounts for 74% of natural gas production in the United States compared to 42% in 2012. The Marcellus formation beneath the Appalachian Basin in eastern United States produced 303 bcm of dry gas in 2022, accounting for 32% of total shale gas production. The Permian basin, located in West Texas and Southeast New Mexico, accounted for the second largest shale gas production at 176 bcm, equivalent to 14% of total shale gas production.

The substantial increase in shale gas production coincides with declines in production from other sources of natural gas, a trend that has continued over the past decade. In 2022, the only other source that presented positive y-o-y growth besides shale gas was conventional associated gas, which resulted from increased oil production (EIA, 2023b).

Figure 3-2: Gross natural gas production in the United States, 2012-2022 (bcm)



Source: U.S. Energy Information Administration (EIA)

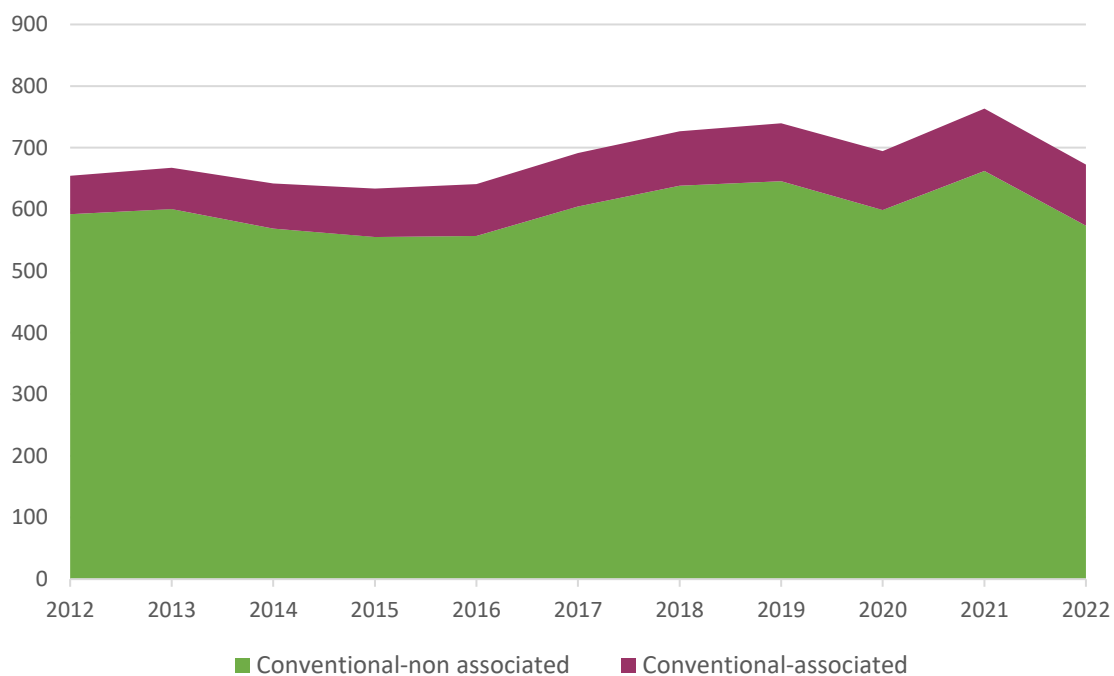
### 3-1-2 Gas supply in Russia

In 2022, Russia's gross natural gas production shrank to 672 bcm, marking a 11.8% decline compared to the previous year. This contraction followed a production recovery observed in 2021 after the initial impact of COVID-19.

The decrease in production in 2022 was a consequence of the abrupt reduction in pipeline exports to Europe in the wake of the Russia-Ukraine war. Russia is currently struggling to access new markets as that requires significant political wrangling and infrastructure development (Japan Times, 2023).

Russian domestic natural gas production comes from conventional sources, with non-associated gas comprising most of the volume produced. Currently, non-associated gas accounts for 85% of total production; however, associated gas share has steadily grown for the past decade as the ratio of associated gas produced in oil wells increases in the Eastern Siberia and Far East fields.

Figure 3-3: Gross natural gas production in Russia, 2012-2022 (bcm)



Source: ROSSTAT

### 3-1-3 Gas supply in Canada

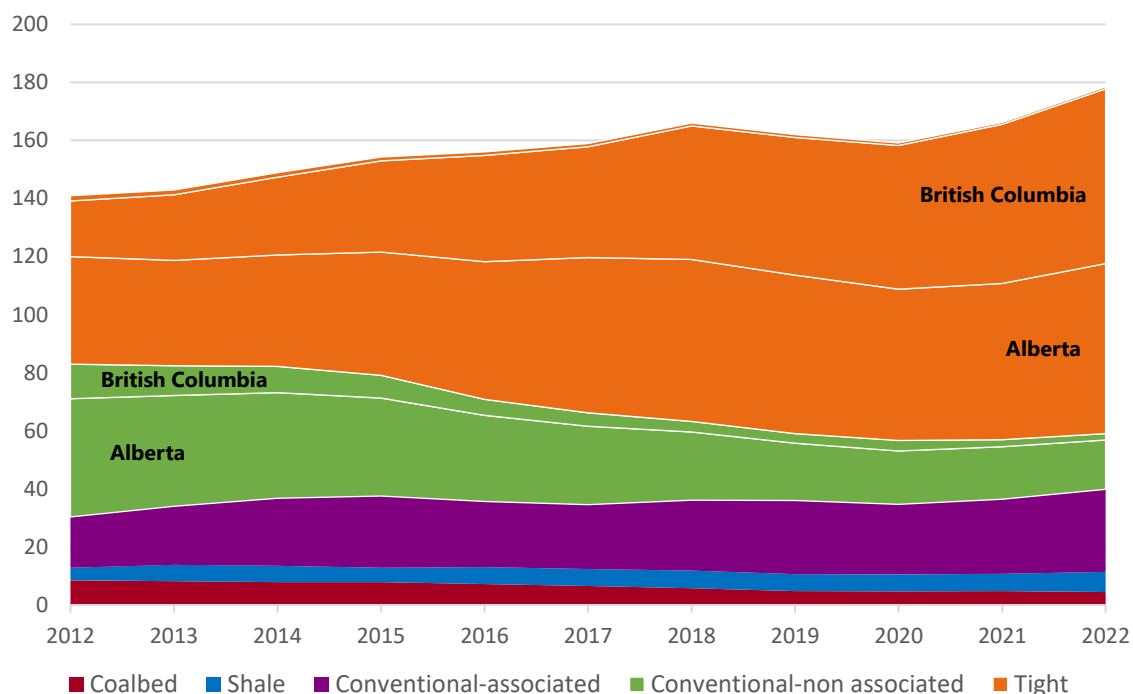
Canada's gas production reached 177 bcm in 2022, following a 7% y-o-y growth, mostly driven by tight gas production in the Alberta and British Columbia provinces.

Canada's current gas production portfolio mostly consists of tight gas formations in the Western Canadian Sedimentary Basin, covering the provinces of Alberta, British Columbia, and Saskatchewan. Over the last decade, the share of tight gas production has grown considerably from 43% in 2012 to 68% in 2022.

The increase in tight gas production helps offset declines in conventional-non-associated production from Alberta and British Columbia, which dropped by 64% between 2012 and 2022. The increase of 62%

in conventional-associated production during the same period has also contributed to the stability of Canada's total gas production. Also, shale gas and coalbed gas production remain low, accounting for 6.5% of total production in 2022.

Figure 3-4: Natural gas production in Canada, 2012-2022 (bcm)



Note: Shale gas refers to natural gas found in a type of sedimentary rock formed of very fine-grained particles, such as clay, that have been compacted to form a layered rock. Tight gas refers to natural gas found in low permeability reservoir rocks (DMP, 2023).

Source: Canada Energy Regulator, *Canada's Energy Future 2023*

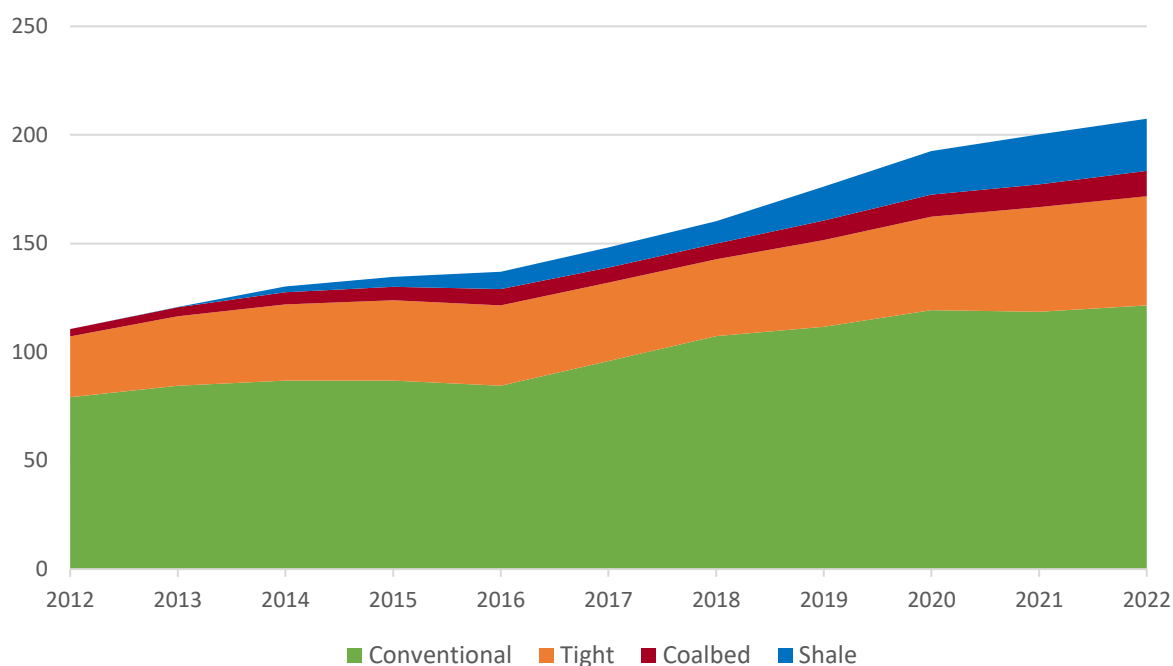
### 3-1-4 Gas supply in China

In 2022, natural gas production in China reached 212 bcm after a y-o-y growth rate of 6.3%, with most of the growth coming from conventional and tight gas. China's production portfolio mostly comprises of conventional and tight resources, accounting for 58% and 24% of total production in 2022.

Tight gas in China has cemented its place as the second most important gas source with its production increasing by 78% during the last decade. China's government is pushing for further development of unconventional sources to diminish its reliance on natural gas imports. In addition, China's national oil companies (CNPC, Sinopec, and CNOOC) are considering tight gas, shale gas, and coalbed methane as key components of their long-term strategies (Rigzone, 2023).

Since China commenced shale gas production in 2012, it has undergone significant growth, representing 11% of total production in 2022. Despite this growth, in 2022, shale gas production totalled 24 bcm, which was below the government's 2020 target of 30 bcm per year. To reduce costs and stimulate development in China's shale reservoirs, stakeholders must provide adequate fiscal and regulatory support and enhance domestic capabilities to address complex geology and ground-level challenges (Wood Mackenzie, 2021).

Figure 3-5: Natural gas production in China, 2012-2022 (bcm)



Note: Shale gas refers to natural gas found in a type of sedimentary rock formed of very fine-grained particles, such as clay, that have been compacted to form a layered rock. Tight gas refers to natural gas found in low permeability reservoir rocks (DMP, 2023).

Source: S&P Global Commodity Insights, National Bureau of Statistics of China, China National Development and Reform Commission

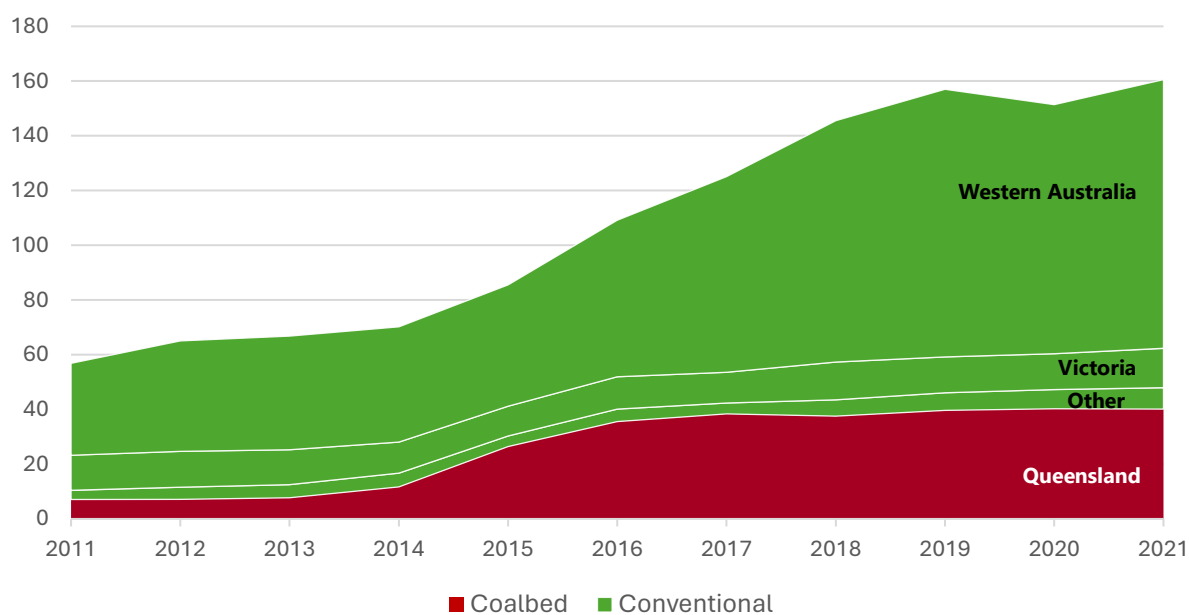
### 3-1-5 Gas supply in Australia

Australia's natural gas production increased marginally by 1.2%, reaching 156 bcm in 2022. This production originates from conventional and coalbed sources, mostly originating from conventional sources in Western Australia. Natural gas production in the economy is driven by LNG exports, with liquefaction capacity and gas output experiencing substantial growth since 2015 (EIA, 2022).

Conventional gas production in Western Australia accounted for 61% of the total production in 2021, while Victoria and other regions contributed another 14%. The overall production of conventional natural gas almost doubled since 2015, driven by a growth in LNG exports, mainly to Asian markets.

Coalbed gas production from the Queensland region accounted for 25% of Australia's gas production in 2021. Following the same line as conventional production, the volumes of coalbed gas have doubled since 2015, coinciding with the commissioning of the first coalbed gas-to-LNG export terminals in Queensland (EIA, 2022).

Figure 3-6: Natural gas production in Australia, 2012-2021 (bcm)



Note: Data for 2022 was not available at the moment of writing.

Source: Department of Climate Change, Energy, the Environment and Water, Australian Energy Statistics.

### 3-1-6 Gas supply in Southeast Asia

Southeast Asia natural gas production has been on a decline trend for the past decade, which was exacerbated by the COVID-19 crisis. The pandemic caused a marked decrease in gas consumption in the region in 2020, signalling producers in the region to ramp down production. As of yet, only Malaysia has recovered and surpassed pre-pandemic production levels. Gas production in the region contracted by 1.7% in 2022, mostly from production decreases in Indonesia and Thailand, the region's second and third-largest gas producers, respectively.

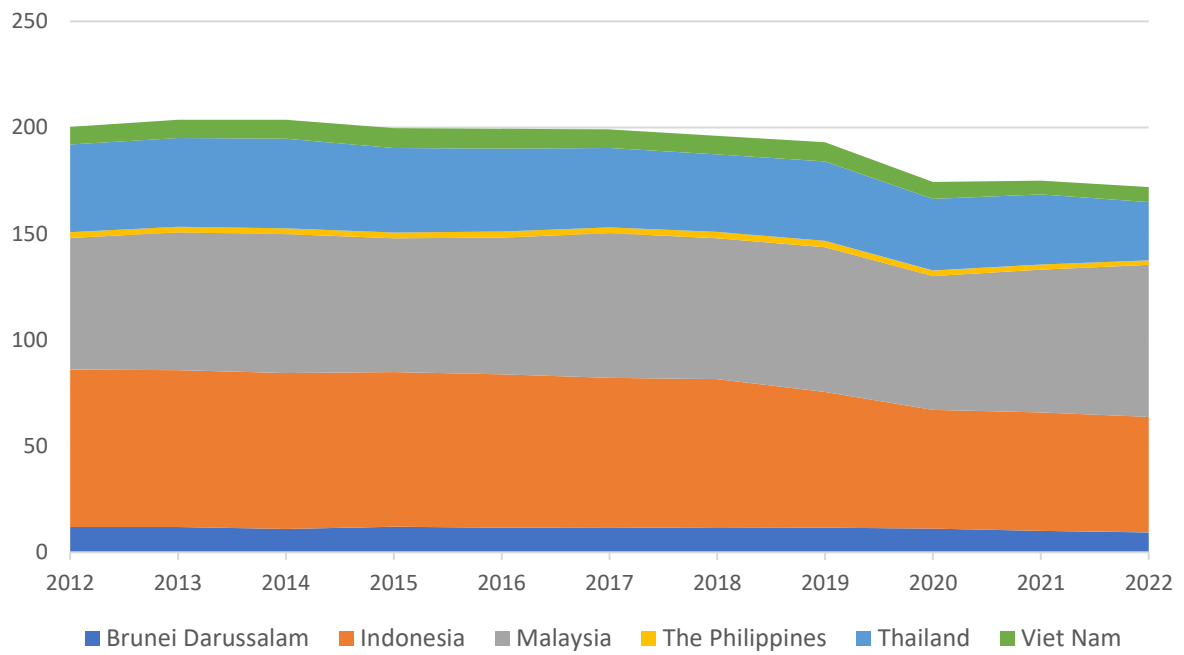
Indonesia showed a 26% decline in gas production between 2012 and 2022 and was overtaken by Malaysia as the largest producer in the region. The production contraction was partly due to policies and regulations that limit private sector participation. Additionally, the lack of new discoveries forced operators to continue exploiting mature fields.

Thailand, the third largest gas producer in Southeast Asia, experienced a peak in its total gas production in 2014 at 42 bcm. However, the decline in output from Thailand's largest gas condensate field, the Erawan asset, substantially influenced the overall production trend from 2014 onwards. As a result, Thailand is expanding its dependence on pipeline gas from Myanmar and LNG imports to meet its demand (CASE, 2023).

Malaysia registered a 15% increase in natural gas production over the last decade. Production in this economy is primarily influenced by the demand from the power and industry sectors, with domestic demand growth mostly observed in the industry sector. The increase in production was bolstered by projects that came online between 2017 and 2020, such as NC8 and Kanowit fields offshore Sarawak state and Telok, Bertam, and Damar fields off the coast of Peninsular Malaysia.



Figure 3-7: Natural gas production in Southeast Asia, 2012-2022 (bcm)



Source: CEDIGAZ

## 3-2 Gas production outlook

The Russia-Ukraine war, that began in 2022, profoundly impacted the global natural gas market. After the EU (European Union) decided to limit Russia's pipeline gas imports, there was a higher demand for LNG, causing increased tightness in the gas market, which raised energy security concerns worldwide.

The latest natural gas production projection published by APERC (Asia Pacific Energy Research Centre) in the 8th Outlook did not include analysis about the impact of the Russian-Ukraine war on the global energy market, so this edition of the APERC Gas Report utilizes other energy organizations' projections (CEDIGAZ and BP) to assist with gas production analysis.

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<b>BP</b>	BP Energy Outlook 2023	New Momentum Scenario	Projection based on the current trajectory of the energy system. It places weight on the recent global ambition for decarbonization.

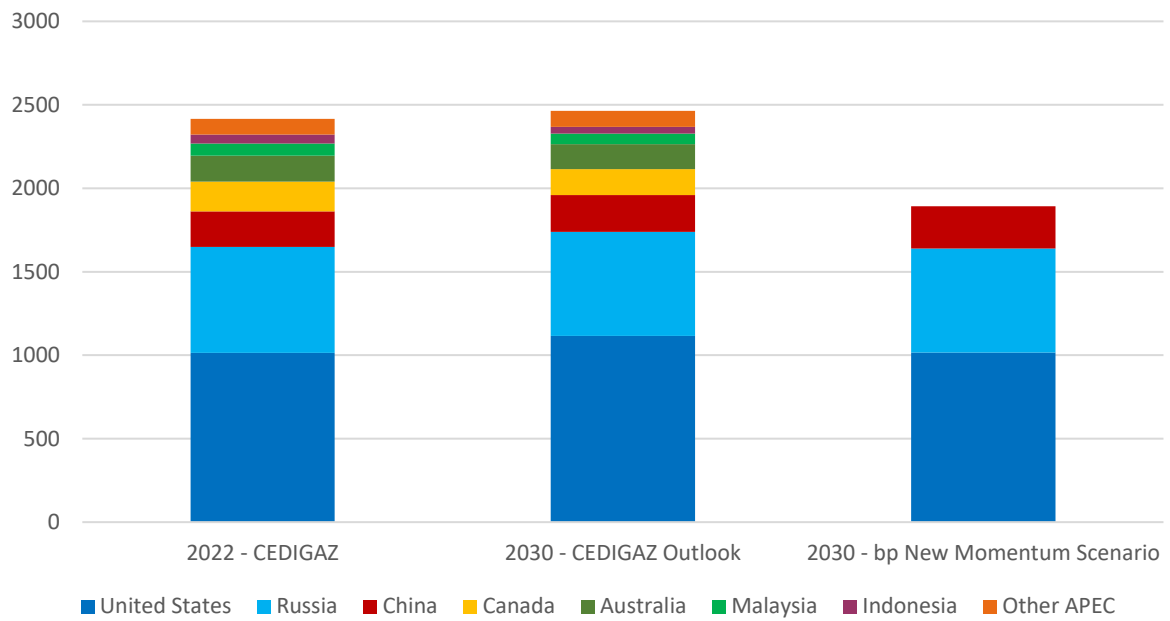
Natural gas production outlooks in the medium term indicate that regional production will increase during the current decade driven by the United States and, to a lesser degree, China. The extent of the increase and the production levels forecast for each economy vary from model to model.

The CEDIGAZ 2023 Medium-term Gas & LNG Outlook offers the most comprehensive projection for gas production in the APEC region. It forecasts that 2030 natural gas production in the APEC region will roughly be 2463 bcm, a 2% increase from the 2022 baseline. The low increase in production is expected to result from production contraction in several APEC economies offsetting the gas production growth in the United States. CEDIGAZ forecasts that a widespread decrease in production in Southeast Asia economies and in Russia will limit overall production growth in the APEC region.

CEDIGAZ forecasts that gas production in the United States is set to reach 1,116 bcm in 2030, a 10% increase from the 2022 volumes. Economies like China, Papua New Guinea (PNG), and Mexico are also expected to increase gas production in the current decade, albeit to a lesser extent. China is forecasted to increase its gas production by 3.2% in 2030, compared to 2022 levels. PNG and Mexico are forecasted to make substantial gains in production levels during the current decade increasing their gas production by 57 and 17%, respectively.

The BP Energy Outlook 2030 forecasts a different production growth rate for the largest economies in the region. BP anticipates that growth during this decade will be mostly driven by China increasing its production by 19% in 2030 compared to 2022. As for production in the United States, BP expects the growth to be marginal at 1% over the same period. On the other hand, gas production in Russia is expected to contract by 1.7% in 2030.

Figure 3-8: Natural gas production outlook in APEC economies, 2022-2030 (bcm)



Source: CEDIGAZ, BP

## Section 4: Gas trade

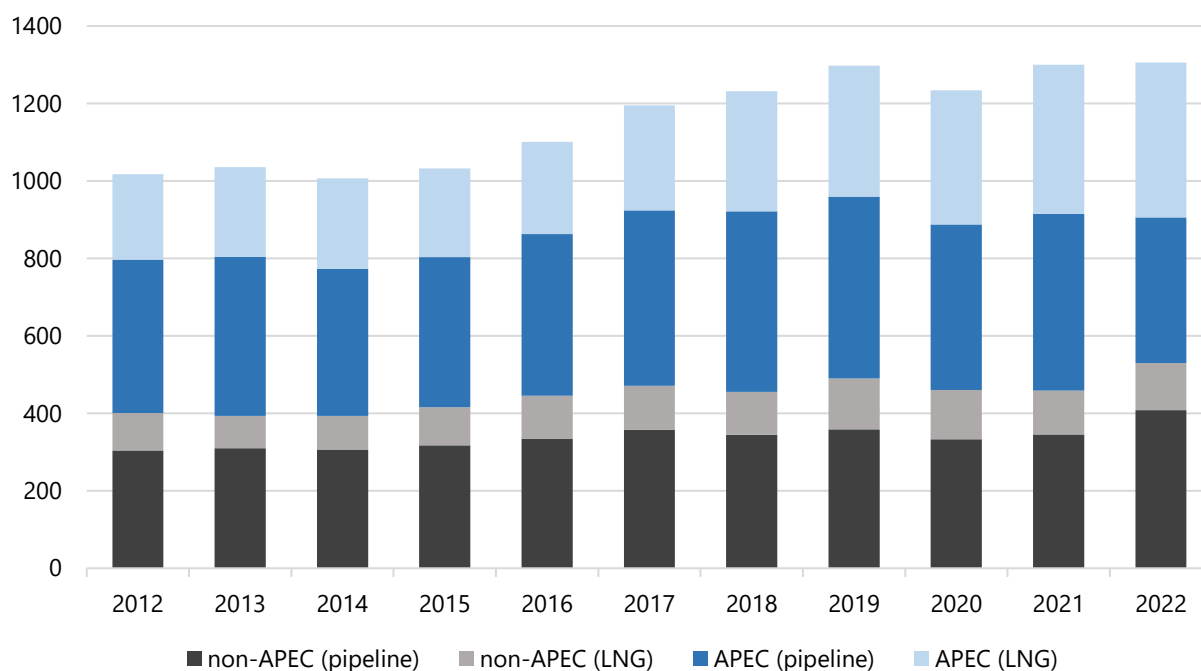
### 4-1 World and APEC natural gas trade

Global natural gas trade amounted to 1305 bcm in 2022 – an increase of 0.4% from the previous year. The marginal growth in the natural gas trade was due to high prices and tight supplies throughout the year originating from the Russia-Ukraine war and the resulting reorganization of the European natural gas supply.

Total natural gas trade involving APEC member economies shrank by 7.7% in 2022 due to the substantial decline in Russian pipeline exports flowing into Europe. The decrease in Russian exports resulted in a 17% decline in APEC pipeline trade in 2022. In the same year, APEC LNG trade increased by 4% as American LNG's share in the European supply portfolio increased.

The gap left by Russian gas in the European market caused trade activities involving other economies outside the APEC region to increase in 2022. Non-APEC pipeline trade presented an 18% y-o-y growth in 2022, mainly due to increased activity in Belgian and British pipelines. In the same year, non-APEC LNG trade increased by 7.1%, driven mainly by increased European LNG imports from non-APEC economies like Norway and Qatar.

Figure 4-1: Natural gas trade, 2012-2022 (bcm)



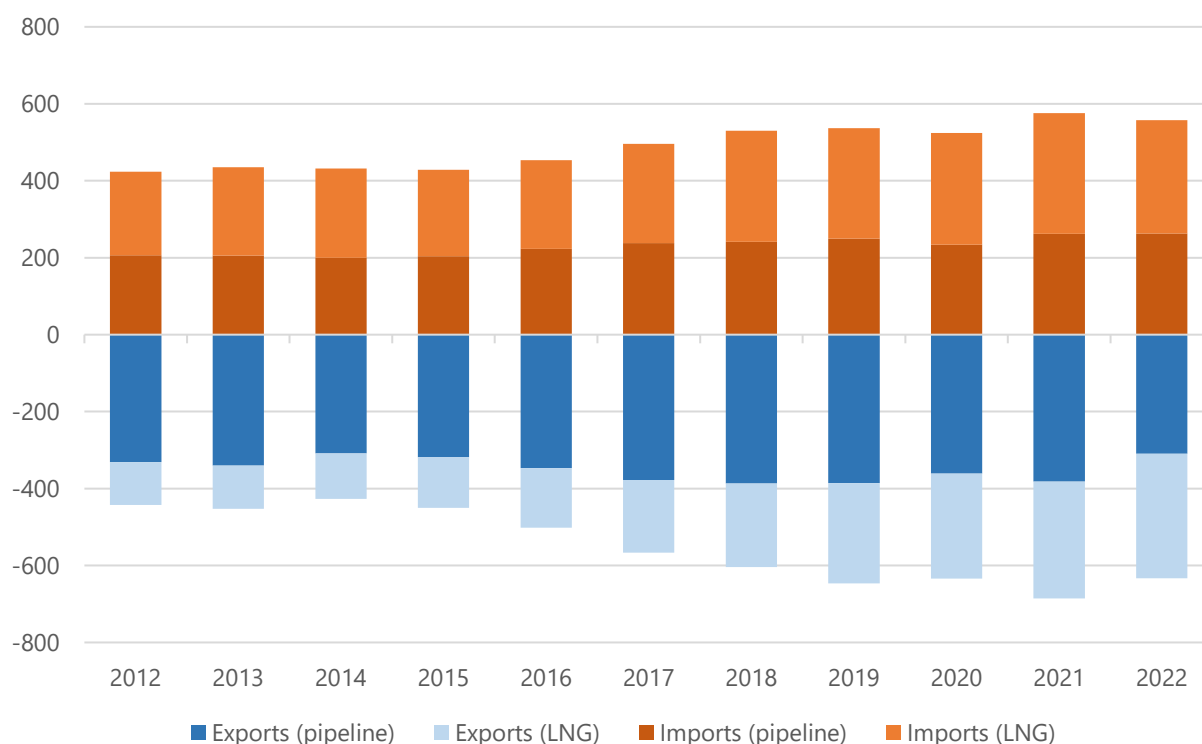
Note: The figure shows the gross amount of gas exported and imported.

Source: CEDIGAZ

Even though the APEC region presented less trading activity in 2022, it remained a net natural gas exporter. Total export volumes from economies in the APEC region amounted to 633 bcm in 2022 – a decrease of 7.6% compared to 2021. The decrease in exports originated in the abrupt decline of Russian natural gas exports flowing into Europe; and pipeline exports in the APEC region contracted by 19% as a result. On the other hand, LNG exports in the APEC region increased by 6.7% in 2022, mainly driven by increased American LNG cargoes going to Europe.

Natural gas imports in the APEC region amounted to 557 bcm in 2022 – a 3.1% decrease compared to the previous year. While pipeline imports remained flat in the APEC region, LNG imports fell by 5.9% in 2022. The reduction in LNG imports was driven by lower natural gas demand coupled with higher domestic production in China.

Figure 4-2: APEC natural gas exports and imports, 2012-2022 (bcm)



Source: CEDIGAZ

## 4-2 Gas imports in the APEC region

Natural gas imports in the APEC region increased by 32% between 2012 and 2022. The growth was mainly driven by China and Mexico, with Korea, Chinese Taipei, and Thailand also adding substantial import volumes into the region. The rising natural gas imports in China during the last decade are the result of rapid economic growth and decarbonization strategies. In the case of Mexico, the decline in domestic production levels and growing demand in the power and industry sectors resulted in an increase in natural gas imports.

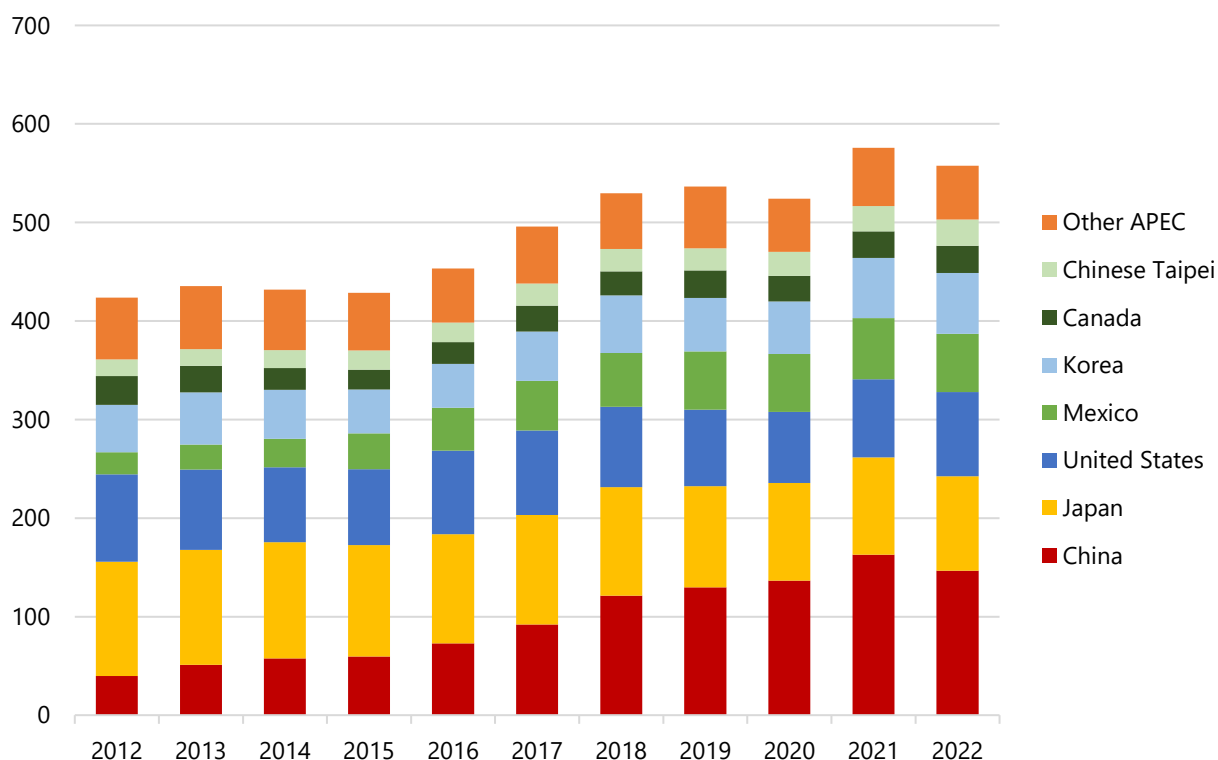
Northeast Asian economies like Korea and Chinese Taipei, without access to domestic natural gas reserves and growing demand driven by the power, building, and industry sectors, became increasingly reliant on natural gas imports during the last decade. In Southeast Asia, Thailand showed a continuous increase in natural gas imports in the face of dwindling domestic gas production during the last decade, even amid the contraction in natural gas consumption in 2022 that this economy experimented.

The year 2022 was marked by a tight natural gas market, with prices reaching record levels because of the Russia-Ukraine war and the resulting reorganization of the global LNG market. Imports in the APEC region presented a 3.1% y-o-y decline, mainly driven by imports and consumption contraction in China.

Mild weather, slowing economic growth, COVID-19 disruptions, and price-driven demand destruction in China resulted in a significant 9.9% y-o-y contraction in gas imports in the economy.

On the other hand, the United States saw the most significant increase in import volumes, with a 7.7 y-o-y increase in 2022. The increase was the result of rising consumption in the power and building sectors, especially for heating during the winter months. Growth was also observed in Southeast Asia, to a lesser extent in absolute terms, with Thailand, Malaysia, and Indonesia presenting double-digit y-o-y increases in their annual imports.

Figure 4-3: Total natural gas imports by APEC economy, 2012-2022 (bcm)



Source: CEDIGAZ

#### 4-2-1 LNG imports in the APEC region

LNG imports in the APEC region have increased by 36% between 2012 and 2022. Most of the growth in the region was driven by China, with South Korea, Chinese Taipei, and Thailand also experiencing significant growth during the past decade. During the same period, Japan displayed the most significant drop in LNG imports in the region, with an 18% decrease. The reduction in Japanese LNG imports reflects higher solar and nuclear power generation coupled with energy efficiency gains that reduced natural gas demand in the economy.

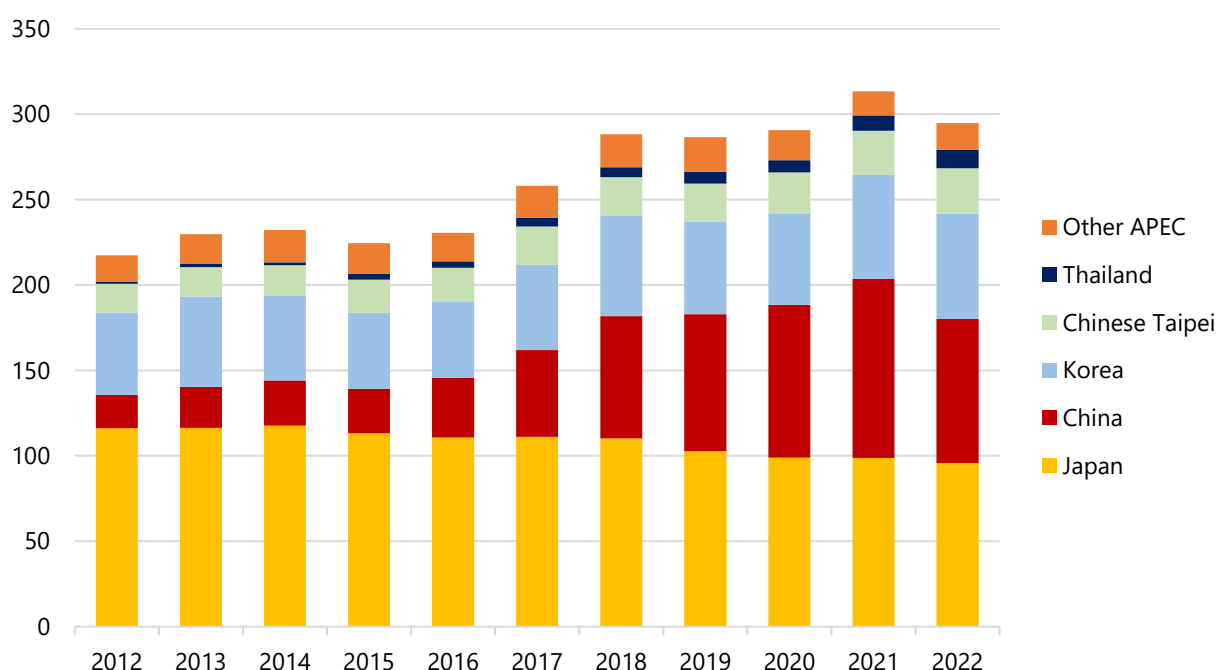
In 2022, LNG imports in the APEC region presented a 5.9% y-o-y decline resulting from a major contraction in China's LNG imports, offsetting the modest absolute growth observed in other economies. China presented a 19.6% y-o-y decrease, resulting from lower natural gas demand and increased domestic gas production. The contraction in Chinese LNG imports in 2022 meant that Japan regained its status as the largest LNG importer in the world, even amid the downward trend in gas consumption observed in this economy.

While markets like Korea and Chinese Taipei presented modest growth in 2022 in the face of high prices and tight supplies, Thailand and Malaysia experienced the region's most significant LNG import y-o-y percentual increases.

In 2022, Thailand, the largest natural gas consumer and importer in Southeast Asia, experienced a 21% year-on-year growth in LNG imports to meet its expanding demand. Meanwhile, Malaysia, a net exporter in the region, witnessed a 61% increase in its LNG imports during the same period. Both of these economies primarily sourced their LNG from Australia.

Malaysia's two-way LNG trade is caused by the geographical disconnection between gas production regions in Borneo and gas consuming regions in Peninsular Malaysia. The latter have been historically supplied by neighboring maturing fields whereas Borneo's production was underpinned by long term SPAs. As gas production in mature fields is no longer enough to meet demand in the peninsula, Malaysia was forced to source LNG from Australia.

Figure 4-4: LNG imports by APEC economy, 2011-2021 (bcm)



Source: CEDIGAZ

#### 4-2-2 Pipeline gas imports in the APEC region

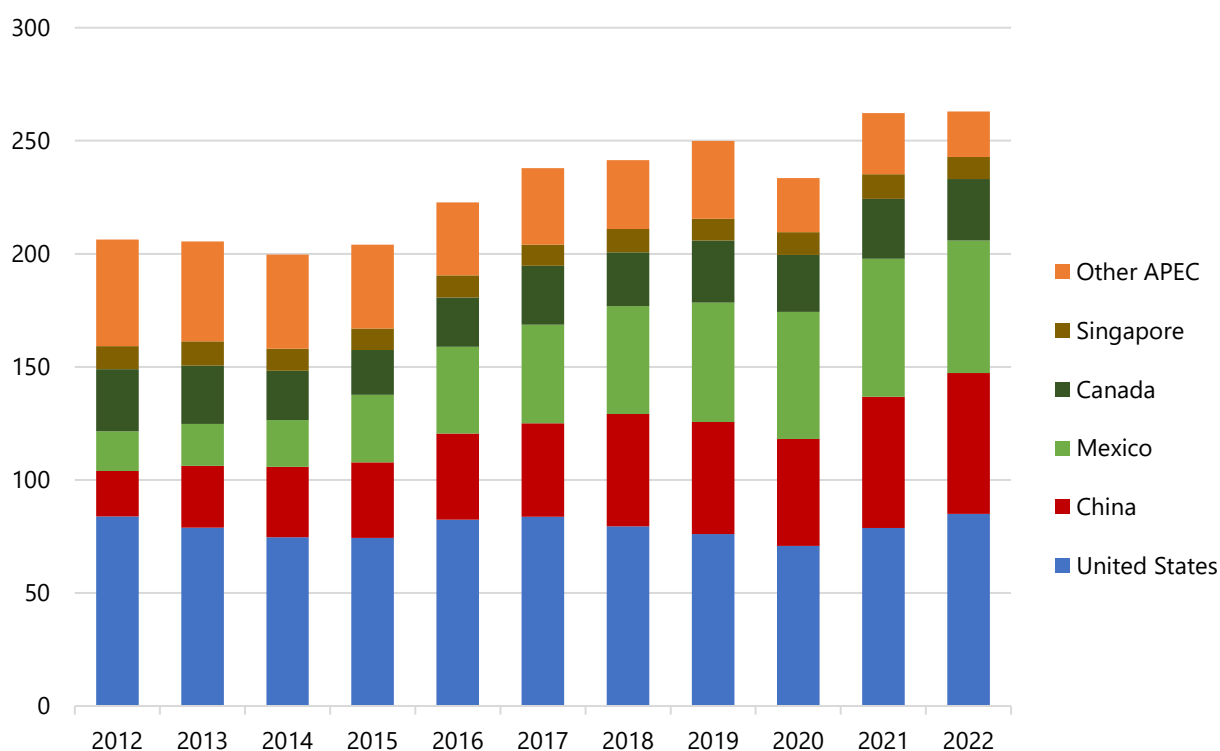
Pipeline natural gas imports in the APEC region have increased by 27.5% between 2012 and 2022, with China and Mexico driving most of this growth. Pipeline import increases in China were the result of accelerated economic growth paired with decarbonization efforts. In Mexico, energy consumption growth coupled with declining domestic production resulted in a substantial increase in gas imports from the United States.

In 2022, gas pipeline imports in the region showed a 0.3% y-o-y growth. These flat pipeline imports were the result of widespread contractions in the region, offsetting the growth observed in the United States and China. The United States presented a 7.7% y-o-y increase in Canadian pipeline imports to balance increased domestic demand, especially during the winter months (EIA,2023). China displayed a 7.5% y-o-y increase in pipeline imports as the economy favored pipeline natural gas over LNG imports

amid the high prices observed throughout 2022. The increase in Chinese gas pipeline imports was driven by larger imports from Russia and Turkmenistan.

Among the economies that decreased their pipeline imports in 2022, Russia, Australia, and Mexico had the most significant drops. Russia had a 37% y-o-y decrease in pipeline imports as overall consumption decreased in the economy; imports flowing from Kazakhstan were cut by more than half. Australia decreased its pipeline imports by 52.5% as production in Timor-Leste declined sharply in 2022. In the case of Mexico, the decrease in pipeline natural gas imports was the result of high prices, prioritization of the American market during winter, and a slight increase in domestic production.

Figure 4-5: Pipeline imports by APEC economy, 2012-2022 (bcm)



Source: CEDIGAZ

### 4-3 Gas exports in the APEC region

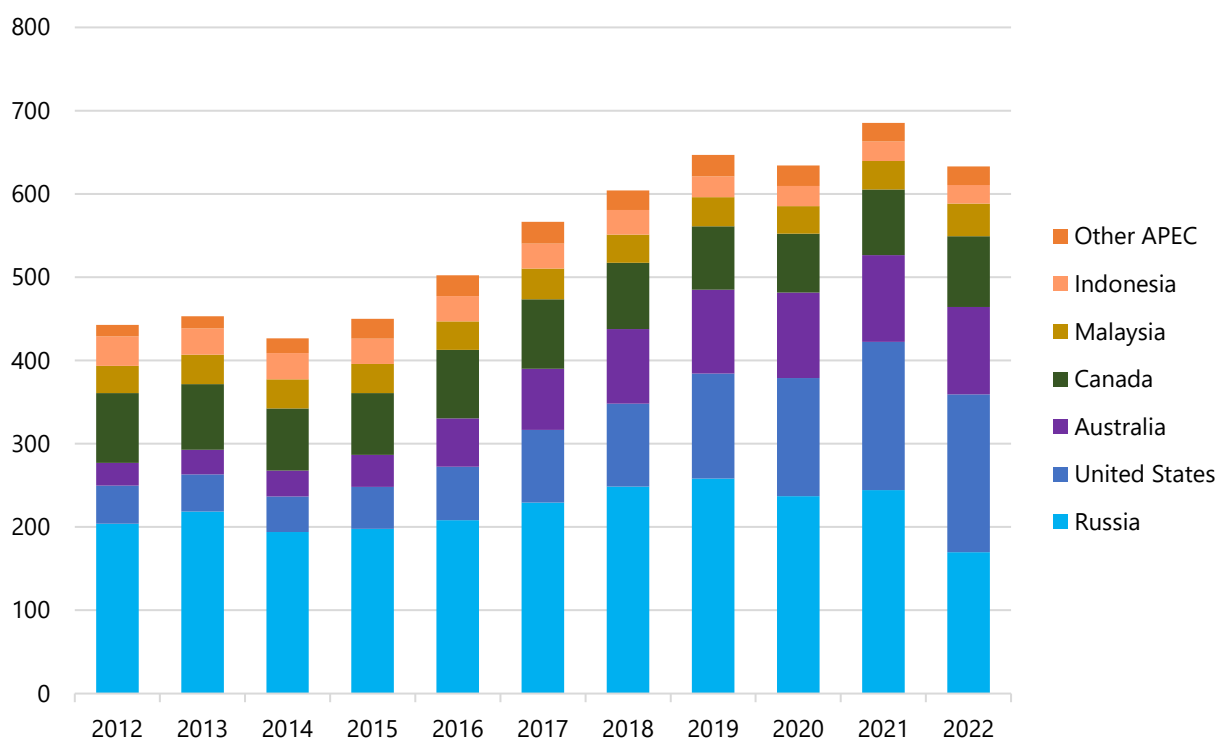
Natural gas exports in the APEC region increased by 43% between 2012 and 2022. Most of the growth was driven by the United States and Australia. During the same period, Russia and Indonesia showed the largest drop in exports in the region. Russia's decrease in exports was a consequence of the abrupt reduction in European gas imports in the wake of the Russia-Ukraine war. In contrast, Indonesia's decrease can be attributed to the gradual decline in gas production over the last decade.

In 2022, overall exports in the APEC region displayed a 7.6% y-o-y decrease, mainly driven by much lower exports from Russia into Europe. Russia's annual exports dropped by a dramatic 30% as the economy was no longer able to send gas volumes to its previous customers in Europe and it lacked the infrastructure to easily redirect its gas volumes. Indonesia and Brunei Darussalam also presented contractions in their exports by (negative) 5.1% and 15%, respectively. Brunei Darussalam's contraction in exports was due to a reduction in gas production caused by unscheduled maintenance and rejuvenation activities in existing wells.



The United States, Canada, and Malaysia saw their export volumes increase in 2022 by 6.4%, 7.7% and 14.3%, respectively. The United States expanded its role in the European gas market with a substantial increase in LNG exports as Europe looked for alternative suppliers to fill the gap left by Russian pipeline gas. These U.S. exports mainly went to France, Spain, the Netherlands, and the United Kingdom. The growth in Canadian exports was the result of high demand in the United States bolstered by the heating and cooling seasons. Malaysia's growth was mainly driven by increased exports to Japan, Korea, and Thailand.

Figure 4-6: Natural gas exports by APEC economy, 2012-2022 (bcm)



Source: CEDIGAZ

#### 4-3-1 LNG exports in the APEC region

LNG exports in the APEC region almost tripled between 2012 and 2022. The United States, Australia, and Russia drove most of the growth, with Papua New Guinea also adding substantial LNG export volumes since 2014. Malaysia continued to be a main player in the region with its LNG exports growing 16% since 2012. In the same decade, Indonesia experienced a 37% decrease in its outbound LNG volumes due to declining domestic production and falling upstream investment.

In 2022, LNG exports in the region saw a 6.7% y-o-y increase, driven mainly by the United States and Malaysia increasing their annual exports by 14% and 13%, respectively. As aforementioned, European markets scrambling to lessen dependence on Russian gas drove the expansion in U.S. exports. Also in 2022, France saw an almost four-fold increase in American imports, making it the largest buyer of U.S. LNG.

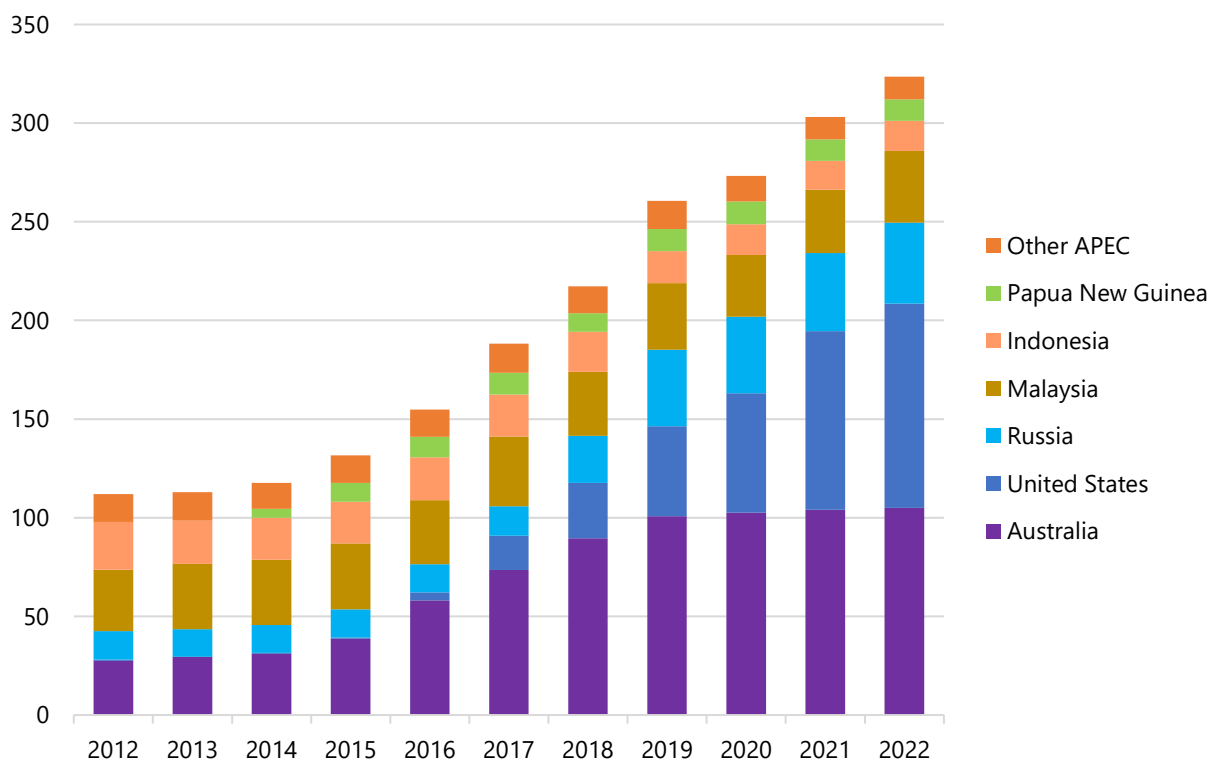
Malaysian LNG export growth in 2022 was driven by increased cargoes entering Japan (its largest buyer), Korea, and Thailand. These three economies saw double-digit y-o-y growth in Malaysian LNG imports

as they tried to offset lower LNG import volumes from the United States and Qatar. To a lesser extent, Indonesia also experienced LNG export growth to its Asian buyers, with Korea and Japan mainly driving the 4.7% y-o-y increase.

Australia, the largest LNG exporter in the region, reported flat LNG exports in 2022. This was the result of a 30% drop in LNG volumes sold to China, offset by increases (y-o-y) in volumes exported to other Asian markets such as Japan (15%), Korea (23%), Chinese Taipei (21%), and Thailand (73%), mainly. The growth in Australian LNG imports in these economies was also mainly due to reduced imports of American and Qatari gas.

Despite restrictions imposed on Russian fossil fuels, LNG exports from this economy presented a 4% y-o-y increase in 2022. Most of the increase came from exports going into China, which increased by 43% compared to the previous year. Imports going into Europe also saw a slight increase compared to the previous year. Increases in Russian LNG imports in Belgium, France, and Spain more than offset the sharp decline in LNG imports going into the United Kingdom. Out of the 41.1 bcm of LNG that Russia exported in 2022, 18 bcm, or 43%, were exported to the European Union.

Figure 4-7: LNG exports by APEC economy, 2012-2022 (bcm)



Source: CEDIGAZ

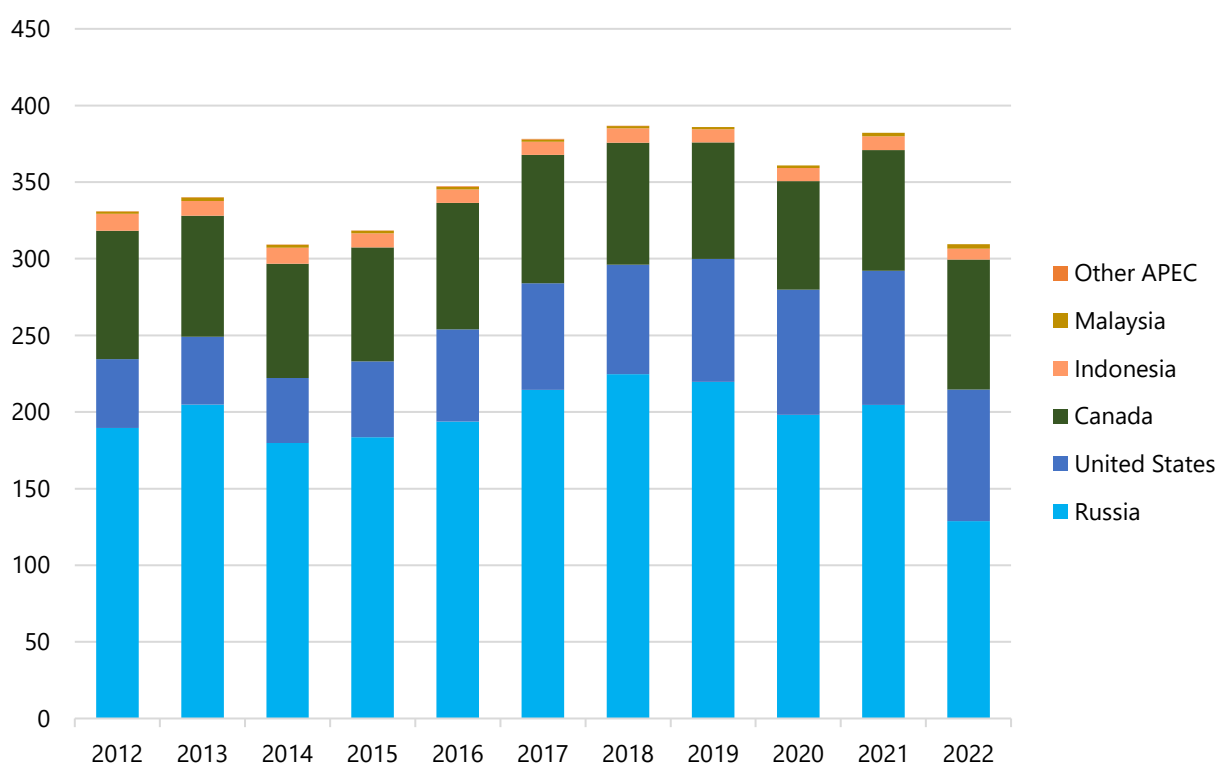
### 4-3-2 Pipeline gas exports in the APEC region

Pipeline natural gas exports in the APEC region decreased by 6.5% between 2012 and 2022. The COVID-19 pandemic and, especially, Russia's abrupt decrease in pipeline exports going to Europe put an end to the upward trend observed during the previous years. Indonesia's decrease in exports, resulting from the fall in domestic gas production, also contributed to the decline in pipeline exports in the region in the last decade. In an opposing trend, U.S. pipeline exports increase by 90% during the last decade, primarily due to Mexico's growing reliance on American natural gas.

In 2022, natural gas pipeline exports in the APEC region decreased by 19%, driven by the sharp decline in Russian pipeline exports flowing into Europe. Russian pipeline exports saw a 37% y-o-y decrease in 2022, mainly driven by the interruption of the Nord Stream operations. To a much lesser extent in absolute numbers, the United States and Indonesia also saw a contraction in their pipeline exports in 2022: U.S. pipeline exports declined by 1.7% as Mexican gas demand contracted, and Indonesia's pipeline exports contracted by 21% y-o-y, in line with the downward trend of its domestic production.

Conversely, Canada showed an increase in its natural gas pipeline exports to the United States. Canadian gas exports had a 7.7% y-o-y growth in 2022, driven by heating and cooling seasons in the United States. Malaysia saw a 31% y-o-y growth in its pipeline exports in 2022, driven by an increase in exports going into Singapore.

Figure 4-8: Pipeline exports by APEC economy, 2012-2022 (bcm)



Source: CEDIGAZ

## 4-4 Gas trade outlook in the APEC region

### 4-4-1 Net gas imports outlook in the APEC region

The Russia-Ukraine war, that began in 2022, profoundly impacted the global natural gas market. After the EU (European Union) decided to limit Russia's pipeline gas imports, there was a higher demand for LNG, causing increased tightness in the gas market, which raised energy security concerns worldwide.

The latest natural gas demand projection published by APERC (Asia Pacific Energy Research Centre) in the 8th Outlook did not include analysis about the impact of the Russian-Ukraine war on the global energy market, so this edition of the APERC Gas Report utilizes CEDIGAZ's projections to assist with gas trade analysis. The scenario analysis presented by CEDIGAZ bases its projections on the acceleration of the energy transition and significant energy efficiency improvements in the coming years.

CEDIGAZ's 2023 Medium-Term Outlook indicates that net imports in APEC economies will grow 29% by 2030 compared to 2022. Net exports in APEC economies will grow 15% during the same period. Even though net import growth is expected to outpace export growth in APEC, the region will remain a net natural gas exporter, mainly driven by U.S., Russian, Australian, and Canadian exports.

CEDIGAZ expects China, Chinese Taipei, Thailand, and Viet Nam to drive most of the growth in net imports within APEC during the current decade. China's net imports are expected to grow 70% by 2030 compared to 2022; in absolute terms, China is forecasted to add 102 bcm of net imported natural gas by the end of this decade. In comparison, Chinese Taipei, Thailand, and Viet Nam are expected to add 10, 9, and 9 bcm of net natural gas imports, respectively.

China's substantial regasification capacity expansion will enable the increase in LNG imports during this decade. The current annual regasification capacity in China stands at 161 bcm, and there is currently 155 bcm of annual capacity under construction expected to come online before the end of 2026. Among the largest projects under construction, phase 3 of the Tianjian PipeChina LNG regasification terminal and the Sinopec Longkou LNG regasification terminal will add 17 bcm of regasification capacity by the end of 2025 (EIA, 2023).

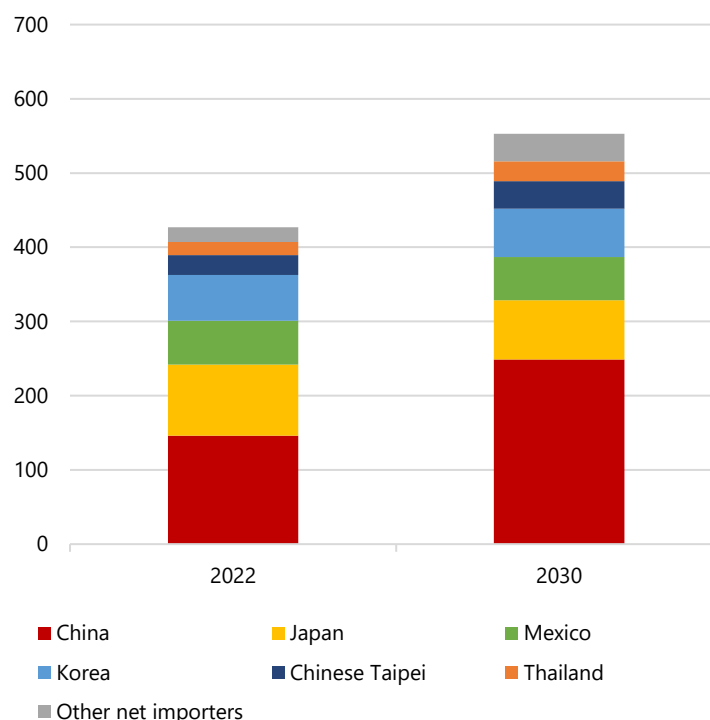
Other economies in Asia are also increasing their regasification capacity. Chinese Taipei's two LNG regasification terminals, Taichung and Yung-an, have announced expansion projects to meet growing demand. Yung-an expansion is currently under construction, and it is expected to be finished by 2027. There are also plans to build a new LNG regasification terminal in Taoyuan by 2025 (CPC, 2023) (JFE, 2023).

Thailand's recent regasification capacity additions confirm its interest in increasing LNG imports in the coming years. The Map ta Phut 2 LNG regasification terminal and the Nong Fab LNG regasification terminal added 15 Mtpa of regasification capacity in 2022 (S&P, 2022). Before these additions, regasification capacity in Thailand stood at 11.5 Mtpa (CEDIGAZ, 2023).

The largest regasification terminal in Viet Nam, Thai Vai LNG, started operations in the last quarter of 2023 with a designed capacity of 1 Mtpa. The terminal was created to help ensure gas supply amid falling domestic resources and soaring gas demand for power generation. LNG imports into the economy will aim to displace coal-fired generation to achieve the commitment of net zero emissions by 2050 (Vietnamplus, 2023). 8.1 Mtpa of additional regasification capacity is currently under construction in Viet Nam.

Despite the overall increase in net import volumes in the region, economies like Japan and Mexico are expected to reduce their natural gas imports by 2030 compared to 2022. With the most significant forecasted decrease, Japan is expected to reduce its net natural gas imports by 16%. Japan's demand for natural gas is expected to decrease due to rising generation from nuclear and renewables, GHG emissions targets, and demographic shifts. Mexico's net natural gas imports are expected to present a 0.91% contraction in the same period. Mexico's net imports in the mid-term are expected to contract slightly as domestic gas production is expected to increase.

Figure 4-9: Net imports outlook in the APEC region, 2022-2030 (bcm)



Source: CEDIGAZ 2023 Medium-Term Outlook

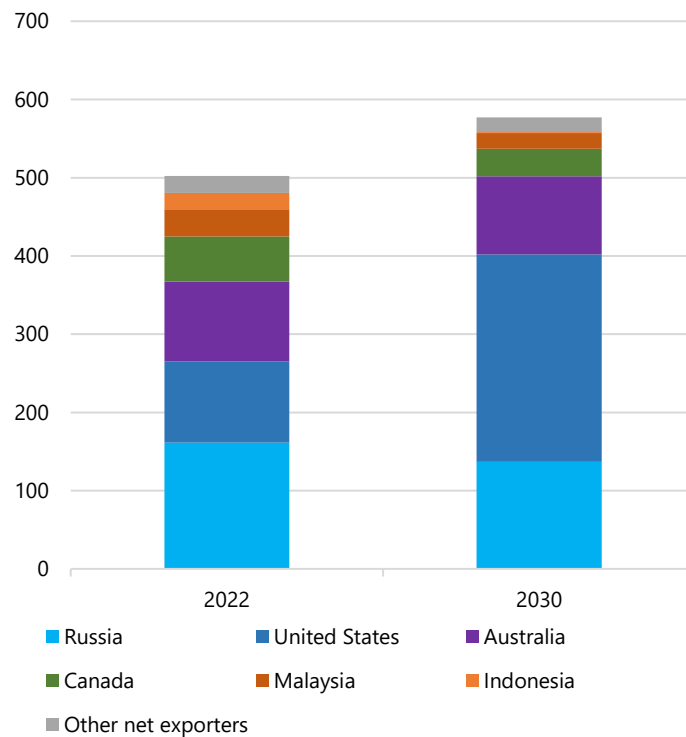
#### 4-4-1 Net gas exports outlook in the APEC region

Regarding exports, CEDIGAZ considers that Russian pipeline gas exports into Europe will never return to the pre-Russia-Ukraine war levels, resulting in decreased Russian net exports that will not recover this decade. Russia is trying to reroute the destination of a significant share of its pipeline gas exports to China. The planned Power of Siberia-2 pipeline aims to supply China with gas from the north-eastern Yamal peninsula, which historically served the European market. Gazprom, the pipeline operator, expects to start delivering gas to China by 2030; however, the two economies have yet to reach an agreement on key issues, including pricing (Reuters, 2024).

In addition to shifting pipeline exports to Asia, Russia is gradually increasing its liquefaction capacity to diversify its importers. As of early 2024, none of its traditional importers (the EU, Japan, and Korea) have sanctioned existing Russian LNG contracts. Furthermore, the European Council indicated in December 2023 that new regulations on natural gas would contain provisions to allow member states to restrict new Russian gas contracts. Despite this, Russia is currently building 44.7 bcm of yearly gas liquefaction capacity, with 27 bcm coming from the Arctic LNG 2 project expected to be online in 2024 (CGEP, 2024).

The United States is positioned to overtake Russia as the largest net gas exporter in the world and will drive net gas export growth in the APEC region. U.S. net exports are expected to grow by 155% between 2022 and 2030, reaching 265 bcm at the end of this decade. Most of U.S. gas export growth is expected to come from LNG, driven by additional liquefaction capacity under construction: Golden Pass LNG (18 Mtpa), Corpus Christi LNG III (11.4 Mtpa), and Plaquemines LNG (21.4 Mtpa), which are scheduled to begin operation by 2025. Additionally, two projects under construction, Port Arthur LNG (11 Mtpa) and Rio Grande LNG (31,5 Mtpa), will substantially increase liquefaction capacity by 2027 (CEDIGAZ, 2023).

Figure 4-10: Net exports outlook and in the APEC region, 2022-2030 (bcm)



Source: CEDIGAZ 2023 Medium-Term Outlook

The United States, in late January 2024, announced that it is temporarily pausing determinations on pending applications of LNG exports to non-FTA (Free Trade Agreement) countries until it can update the economic and environmental analyses used to determine whether additional LNG export authorization requests to non-FTA countries are in the public interest. Existing authorizations for LNG exports and projects that are already under construction will remain unaffected.

Presently, the United States has 14 FTAs, of which include seven APEC members: Australia, Canada, Chile, Mexico, Peru, Singapore, and Korea. As such, LNG exports to these countries will remain unaffected. While U.S. LNG exports have shifted to Europe since Russia’s invasion of Ukraine (over 60% percent versus a previous 15%), several APEC economies continue to be key consumers of U.S. LNG. Prior to Russia’s invasion of Ukraine, Korea, Japan, and China were the top three importers of U.S. LNG at 34% of total U.S. LNG exports. Neither Japan nor China have FTAs with the United States, so while their current LNG supply from the United States will not be impacted by this new policy, future U.S. LNG projects that were investing based on Japanese and Chinese consumption habits will now be under additional review. It is worth noting that the United States currently has 0.4 bcm/day of export capacity already online, 0.3 bcm/day under construction, and 1.4 bcm/day of already authorized exports to non-FTA countries.

## Section 5: Gas prices

### 5-1 Gas prices in 2022

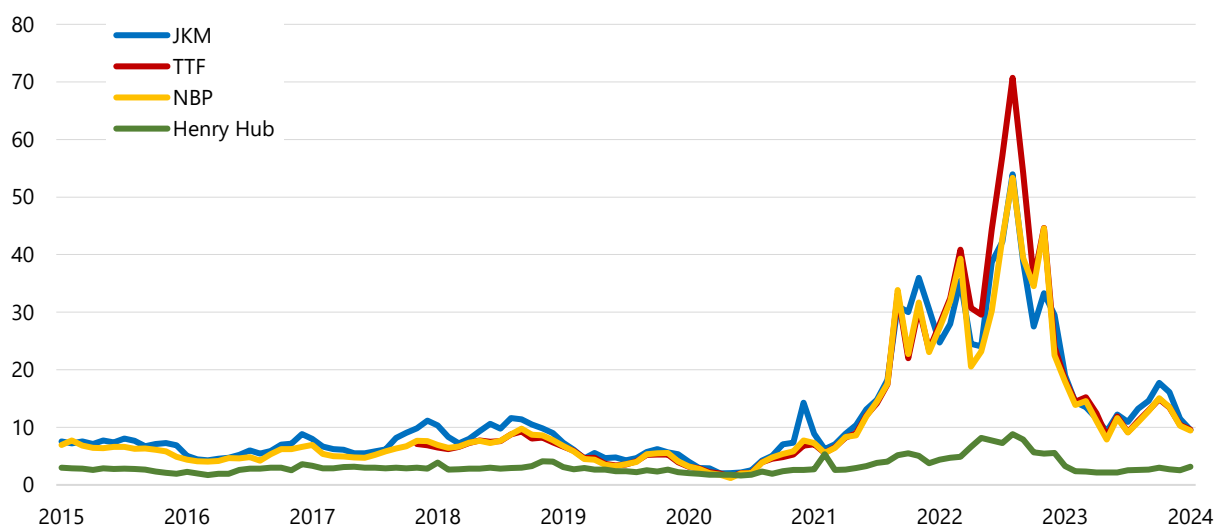
Monthly natural gas spot prices in Asia and Europe eased in the first two months of 2022 before surging in the following month due to the start of the Russia-Ukraine war on February 24. In March, Europe's concerns over the potential disruption of natural gas supply led to monthly natural gas spot prices, both TTF and NBP, reaching the highest historical level (at the time) at 40.83 and 39.31 USD/MMBtu, respectively. Asia's LNG spot market was also affected by the Russia-Ukraine war, as LNG competition on the spot market drove JKM to reach a new record high at 35.44 USD/MMBtu in the same month.

While natural gas spot prices remained moderate through Spring 2022, as Russian gas was still flowing to European customers, prices rebounded in June and surged to a new highest historical level in August 2022. In addition to the Russian-Ukraine war impact on the gas market, the disruption of gas supply from Norway and Algeria, storage refilling for the upcoming winter, and the announcement of discontinued natural gas supply from Nord Stream 1 and 2 triggered the TTF monthly natural gas spot price to reach a new record high at 70.71 USD/MMBtu.

In August 2022, the extremely tight supply and high natural gas prices in Europe, coupled with the increased demand for winter preparation in Northeast Asia, drove other hubs' monthly spot prices to a new high historically, with NBP recorded at 53.33 USD/MMBtu and JKM at 53.95 USD/MMBtu. The United States also experienced higher gas spot prices as LNG export volumes increased competition between the export and domestic natural gas markets. Consequently, Henry Hub's natural gas monthly spot price increased steadily and reached 8.81 USD/MMBtu in August.

In September 2022, global natural gas monthly spot prices started to decline as competition for supplies and regasification capacity was moderately relieved with the commissioning of the EmsEnergy LNG terminal in the Netherlands and the resumption of the Prelude LNG plant operation in Australia. At the same time, lower demand from the industrial and power sectors due to high gas prices and the increased gas storage level in Europe also eased the global gas supply tightness.

Figure 5-1: Monthly natural gas spot prices, January 2015-January 2024 (USD/MMBtu)



Source: Investing.com; EIA

## 5-2 Gas prices in 2023

Natural gas monthly spot prices in Asia and Europe were volatile in 2023 but remained well under the previous year's prices at under 20 USD/MMBtu throughout the year. The JKM benchmark had an average monthly price of 13.68 USD/MMBtu; in Europe, the TTF and NBP had an average monthly price of 12.72 USD/MMBtu and 12.39 USD/MMBtu, respectively.

At the beginning of 2023, natural gas monthly spot prices in Northeast Asia and Europe continued the downward trend observed during the final months of 2022. Mild winter temperatures, relatively weak demand, and abundant storage levels in Europe kept prices low in January and February. In addition, the expected production restart at Freeport LNG in the United States also contributed to low prices. However, in March, prices rose due to malfunctions at French nuclear plants and strikes at French LNG terminals. Prices though started to decrease again in April.

In May 2023, spot prices in Asia and Europe dipped below 10 USD/MMBtu, the lowest since May 2021, with JKM at 9.28 USD/MMBtu, and TTF and NBP at 8.41 USD/MMBtu and 7.90 USD/MMBtu, respectively, due to abundant supplies, weak demand, and mild weather. However, prices increased in June 2023 due to buying interest from China and India, and maintenance at Norwegian gas processing plants.

Prices decreased once again in July 2023. Short-lived heatwaves in Europe caused relatively lower demand and thus the fall of TTF and NBP prices. Prices in Northeast Asia declined, even amid a heatwave and maintenance on regional LNG export facilities; however, the JKM benchmark regained its premium over European prices.

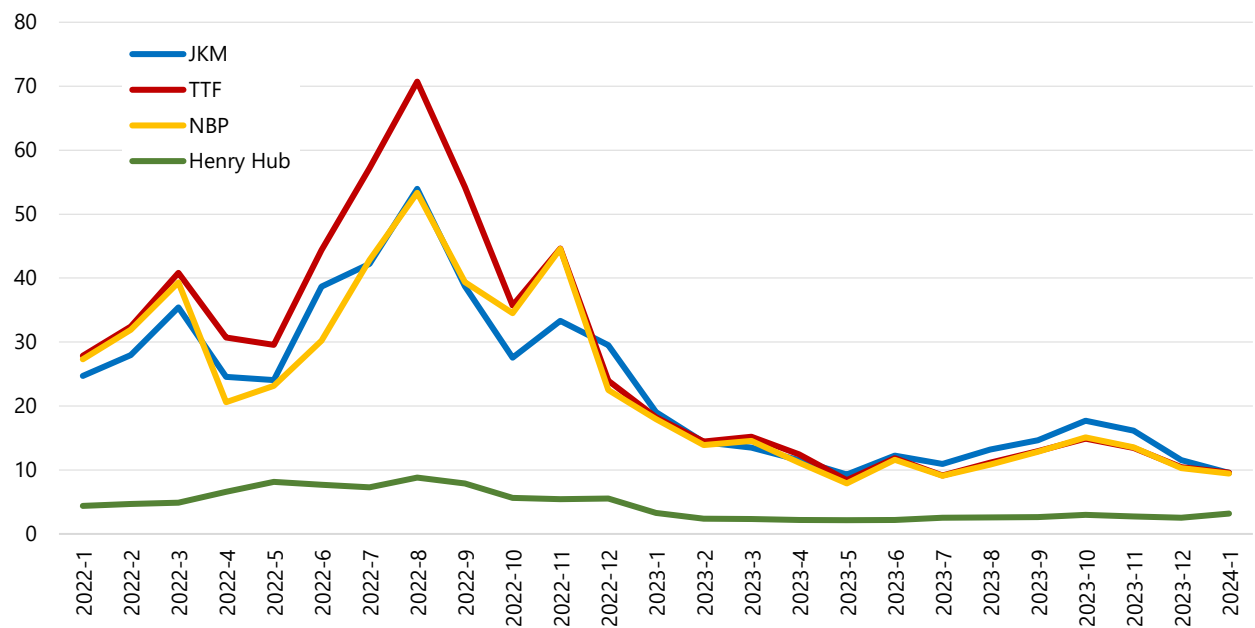
Prices in August and September 2023 were impacted by strikes at major Australian LNG facilities, maintenance in Norwegian gas fields, and rising temperatures in Northeast Asia and Europe. In October 2023, additional supply disruption concerns emerged from the Israel-Hamas conflict and the Baltic connector shutdown in Europe, resulting in the year's highest spot prices. In October, JKM reached 17.72 USD/MMBtu, while the TTF and NBP reached 14.88 and 15.08 USD/MMBtu, respectively.

After peaking in October 2023, spot prices decreased in November 2023 as unions in Australia agreed to endorse deals on pay and conditions at Chevron's LNG facilities (Reuters, 2023). The observed further decrease in price in December was a consequence of ample supply and weak demand in Northeast Asia. This lower spot price temporarily increased buying interest from China. Relatively low demand, ample supplies, and mild temperatures in Europe also contributed to the fall in prices. The JKM spot price closed in 2023 with a monthly average price of 11.52 USD/MMBtu for JKM; TTF and NBP closed at 10.46 USD/MMBtu and 10.27 USD/MMBtu, respectively.

The Henry Hub (HH) natural gas monthly spot price in the United States averaged 2.53 USD/MMBtu in 2023. The price reduction in the HH resulted from record-high production, slow growth in consumption, and rising natural gas inventories. Record-high natural gas production was the main driver for the fall in 2023 prices. Improved well-level productivity and high crude oil prices in 2023 benefited production in the Permian, Haynesville, and Appalachia regions. Additionally, the warm temperatures in January and February 2023 led to a fall in consumption in the building sector. The mild winter also decreased withdrawals from underground storage.



Figure 5-2: Monthly natural gas spot prices, January 2022-January 2024 (USD/MMBtu)



Source: Investing.com; EIA

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