

2. Oil and Gas Security Studies (OGSS)

2-2. Potential Topics for OGSS21

The 7th APEC Oil and Gas Security Network Forum (OGSN)
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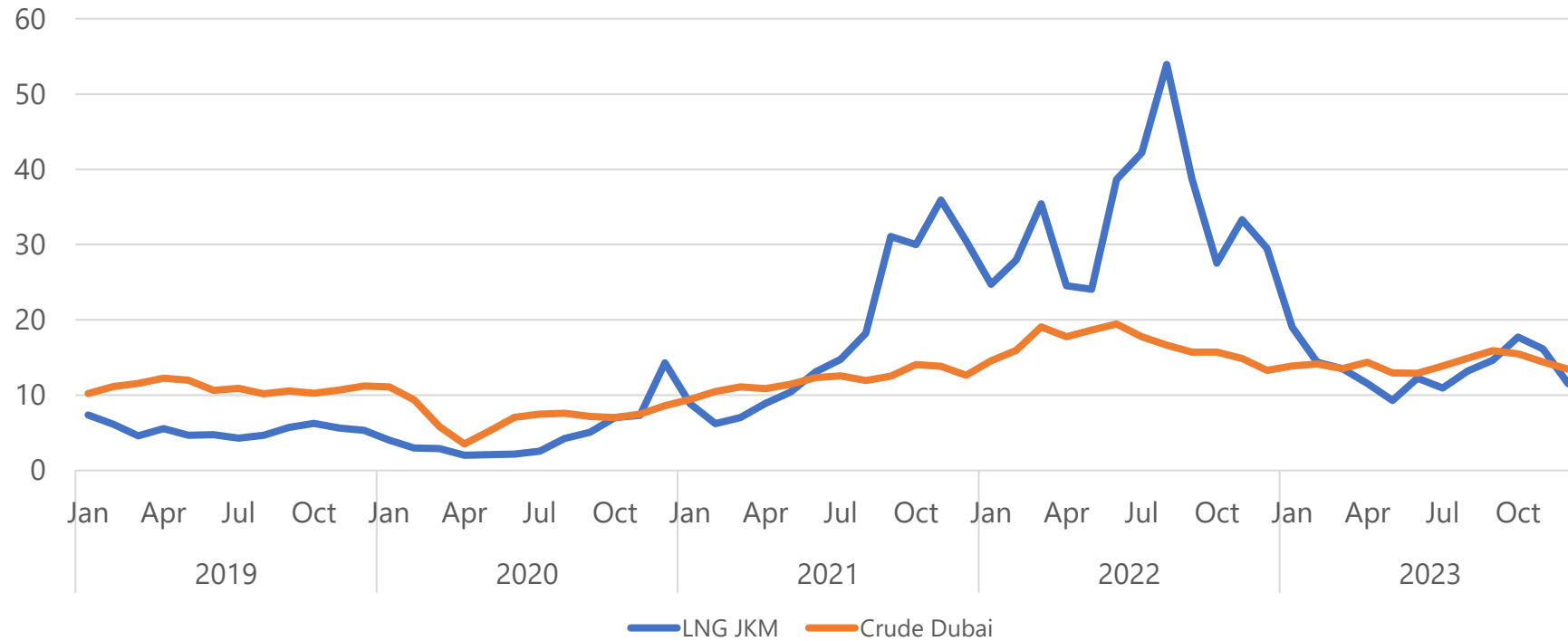


Outline

- Introduction
- Theme 1: The Implications of Underinvestment in the LNG Supply Chain for Gas Supply Security of APEC.
- Theme 2: The Implications of Underinvestment in the Upstream Oil Sector for Oil Supply Security of APEC.
- Questions and Answers

Recent price volatility highlights energy security risks.

Monthly LNG and oil prices, 2019 – 2023 (USD per MMBtu)



Source: Investing

- The COVID-19 pandemic depressed prices in 2020. By first half of 2021, prices had recovered.
- Substantial price volatility in the second half of 2021 and 2022 was due to a variety of factors.

Theme 1:

The Implications of Underinvestment in LNG Supply Chain to Gas Supply Security of APEC

Mr. Thanan Marukatat, Research Fellow

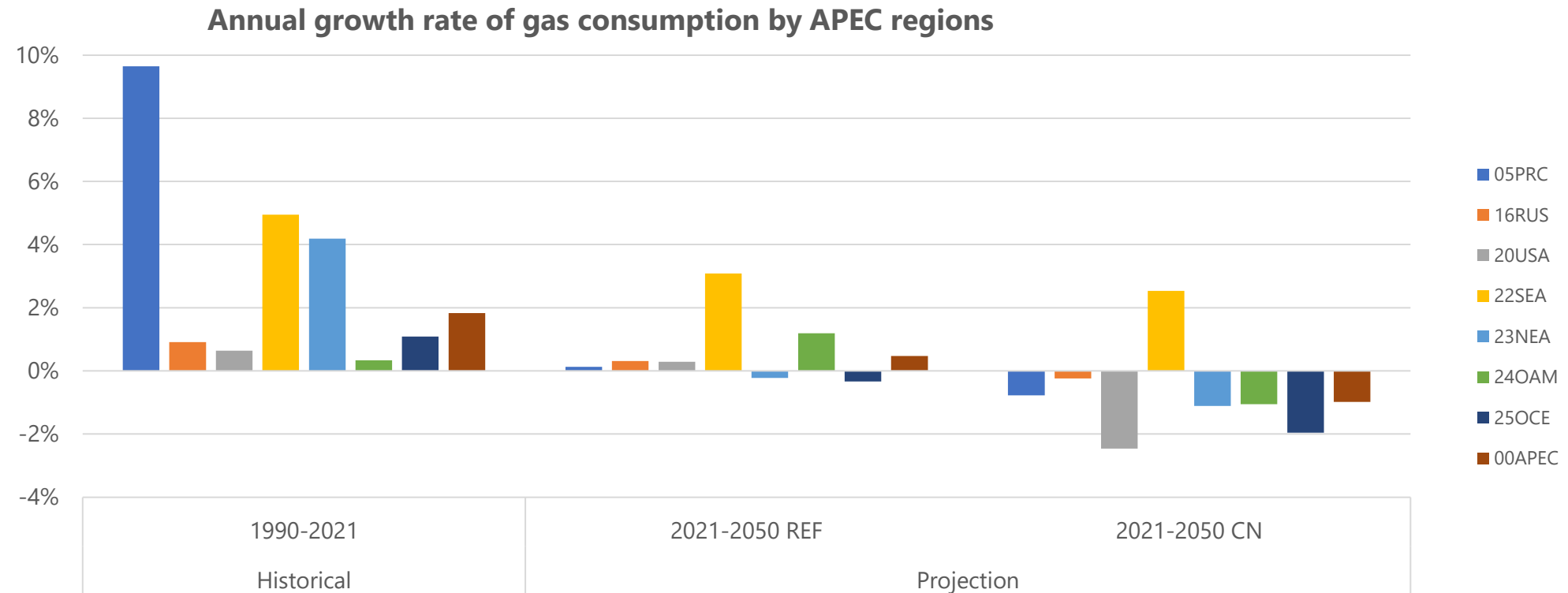


Outline

- Current situation and outlooks
- Analysis on impact from natural gas price volatility
- Key questions

Current situation and outlooks

Expected growth in APEC natural gas consumption

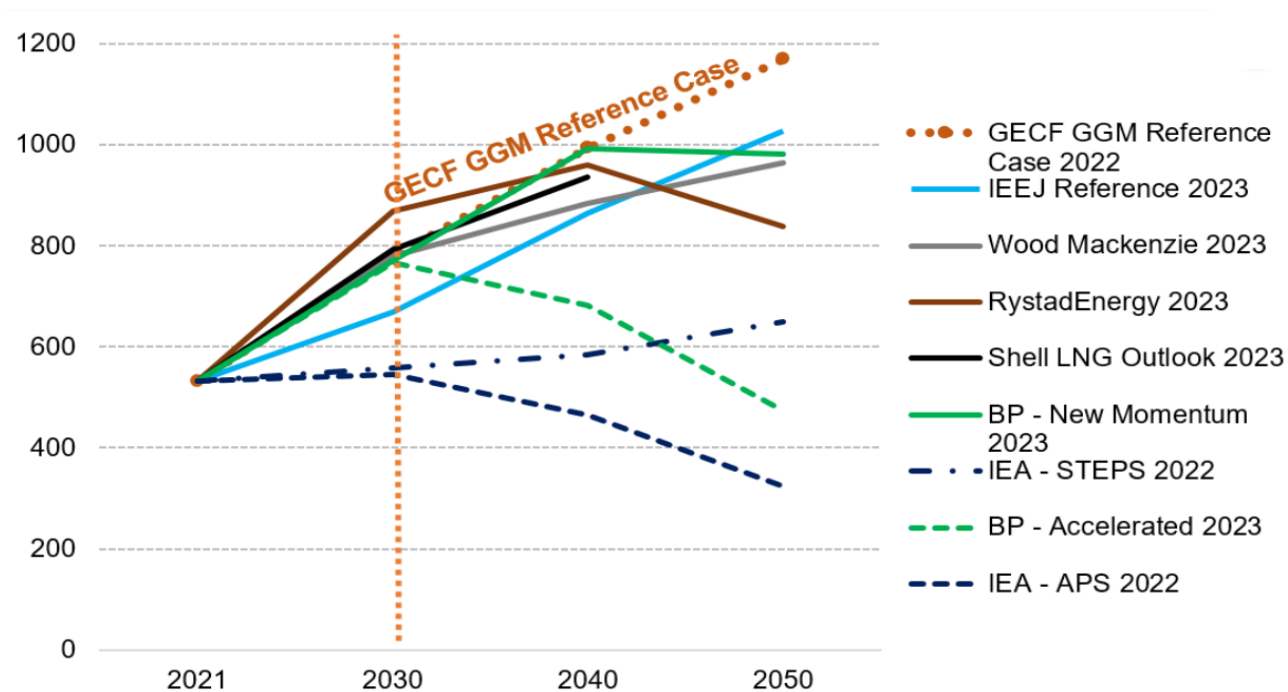


Source: APERC (2022)

- APEC natural gas consumption has been growing at 1.8% annually between 1990 and 2021.
- Based on APEC 8th Energy Demand and Supply Outlook, consumption is projected to grow at 0.5% and -1% per annum in Reference (REF) and Carbon Neutrality (CN) scenarios, respectively, by 2050.
- Anticipated growth is more prominent in Southeast Asia (SEA) and Other Americas (OAM) sub-regions.

Gas Export Country Forum (GECF) and other institutes expect gas demand to grow at least until 2030.

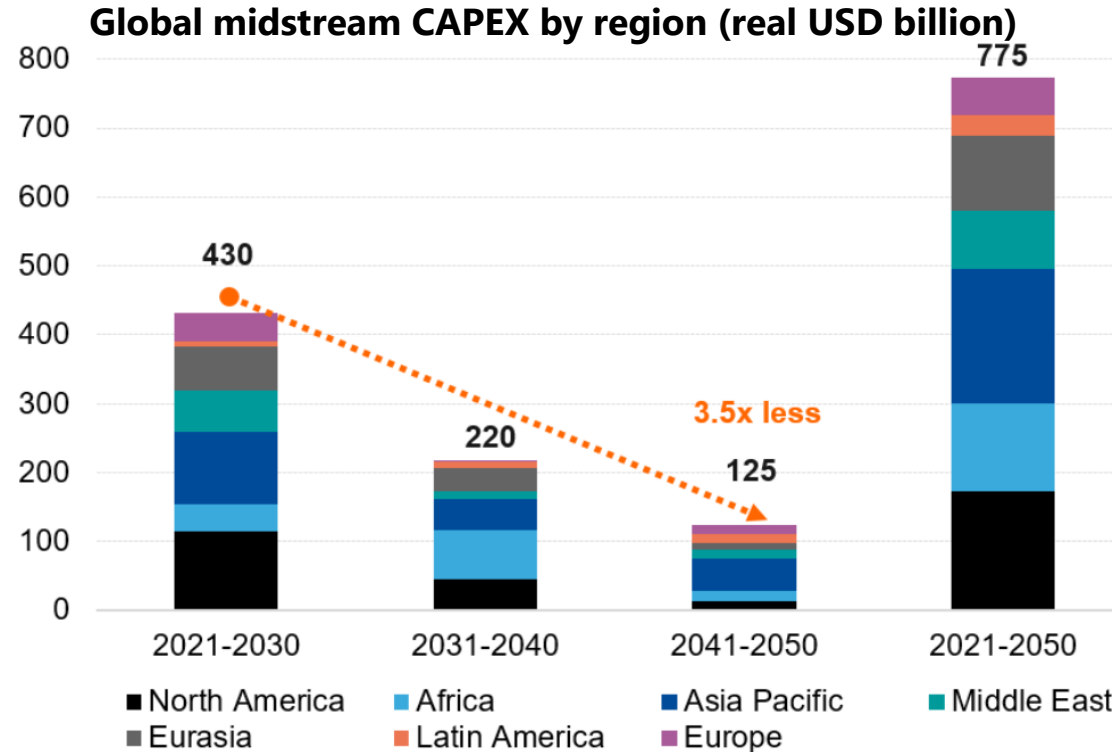
LNG demand forecast (bcm)



Source: [GECF](#) (2023)

- In the post-2030 era, the uncertainty for gas demand and LNG trade grows as different regions worldwide might take diverging paths toward energy transition and decarbonisation.
- The divergent views can pose challenges to investment and supply security in LNG supply chain.

The midstream natural gas sector is poised for significant investment in the coming decades, but longer-term investments are uncertain.

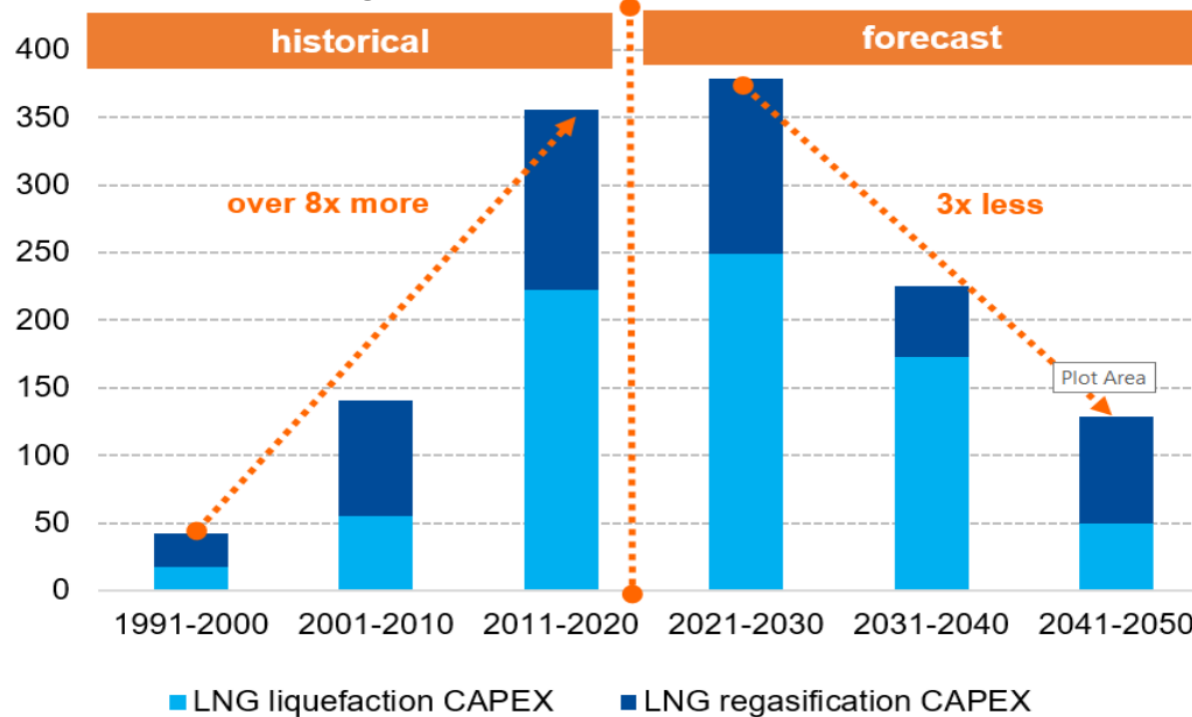


Source: GECF (2023)

- The projected cumulative investment of USD 775 billion between 2021 and 2050 underscores the pivotal role of natural gas in satisfying global energy requirements.
- Over a half, or US\$430 billion, is expected to take place in 2021-2030 to capture high demand growth.
- In the later stage, in the 2030s and 2040s, the gas midstream funding may witness a decline as existing infrastructure may be sufficient to handle the declining demand scenario.
- But, what if global demand of LNG continues to grow?

The midstream natural gas sector is poised for significant investment in the coming decades, but longer-term investments are uncertain.

Historical and future global trends of LNG investment (real billion USD)



Source: GECF (2023)

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- In the later stage, in the 2030s and 2040s, the gas midstream funding may witness a decline as existing infrastructure may be sufficient to handle the declining demand scenario.
- But, what if global demand of LNG continues to grow?

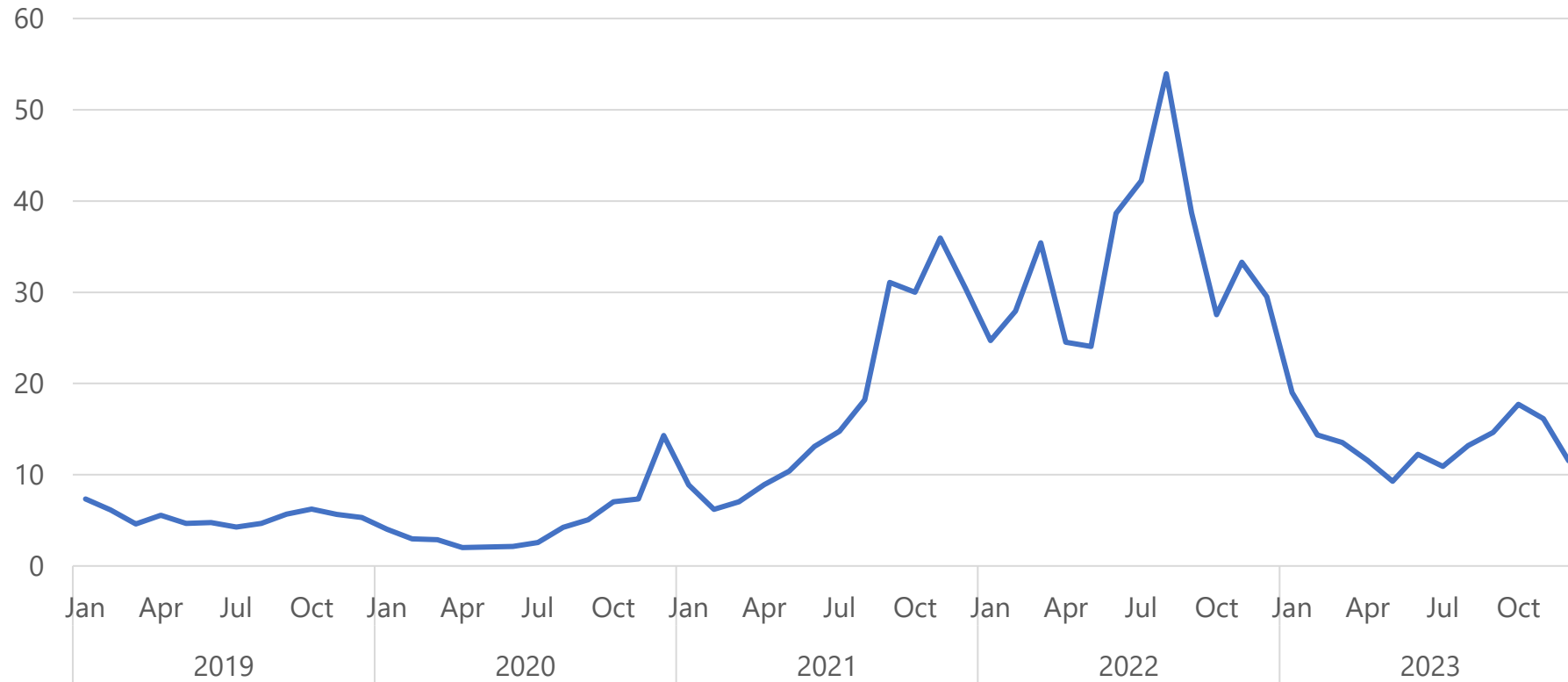
However, recent analysis from experts and institutions pointed out the possibilities of underinvestment in LNG supply chain

- The upcoming 2023 to 2030 decade is considered a golden age for LNG infrastructure, deployment, and investment. Therefore, timely execution and fast track project development will be crucial. Continuing underinvestment gap in natural gas supply chain is the single largest risk to global energy security. (Gas Exporting Countries Forum-GEFC, June 2023).
- The risk of lack of timely investment in the LNG carrier fleet could pose a threat to the market development and security of supply. (IEA, October 2022).
- A shortage of shipping capacity could limit the scope for LNG to meet demand. Another key constraint is shipyard capacity. (Lloyd's Register Gas Unit, August 2022).
- There has been a pronounced downward trend in upstream investment over the previous decade, setting in after the oil downturn in 2014. (2023 Global Gas Report, Rystad energy).

Analysis on impact from natural gas price volatility

LNG price volatilities in 2022 demonstrate adverse impact of gas supply disruption.

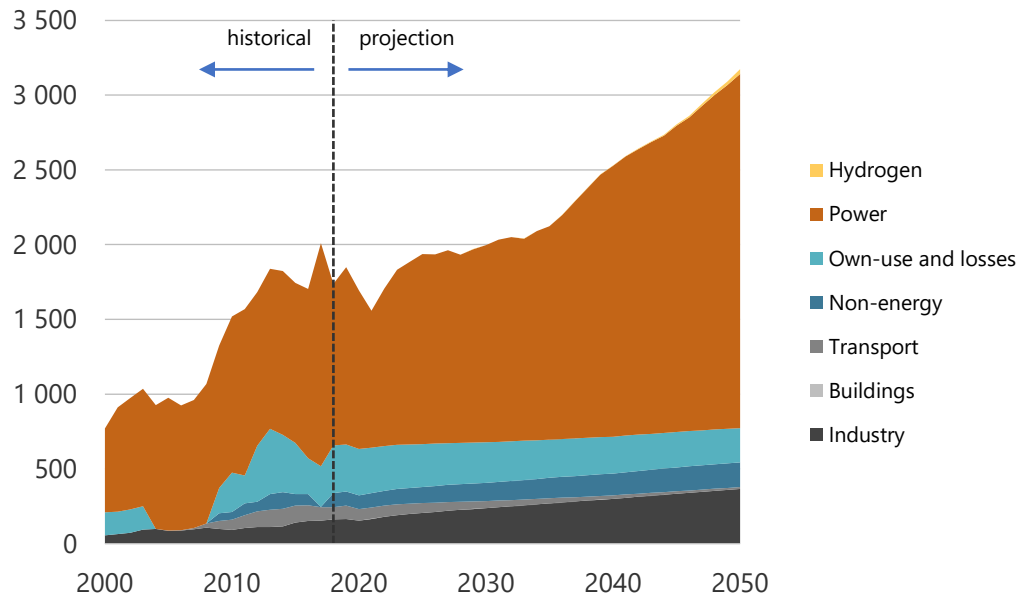
Monthly LNG Japan/Korea Marker price, Jan 2019 - Dec 2023
(USD/MMBtu)



Source: GECF (2023)

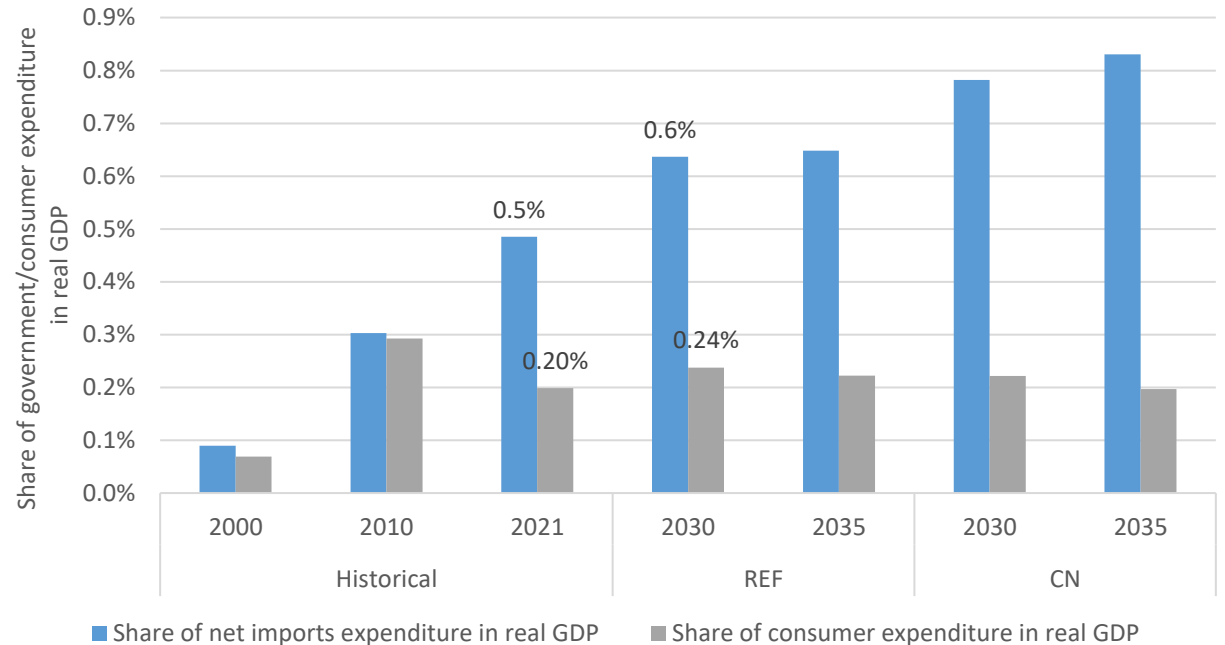
Developing economies with higher reliance on gas imports are exposed to impact from gas price volatility.

Thailand's natural gas consumption by sector in REF, 2000-2050 (PJ)



Source: APEC 8th Energy Demand and Supply Outlook (hereafter APEC 8th Outlook)

Share of Thailand's net import expenditure and consumer expenditure of natural gas in real GDP

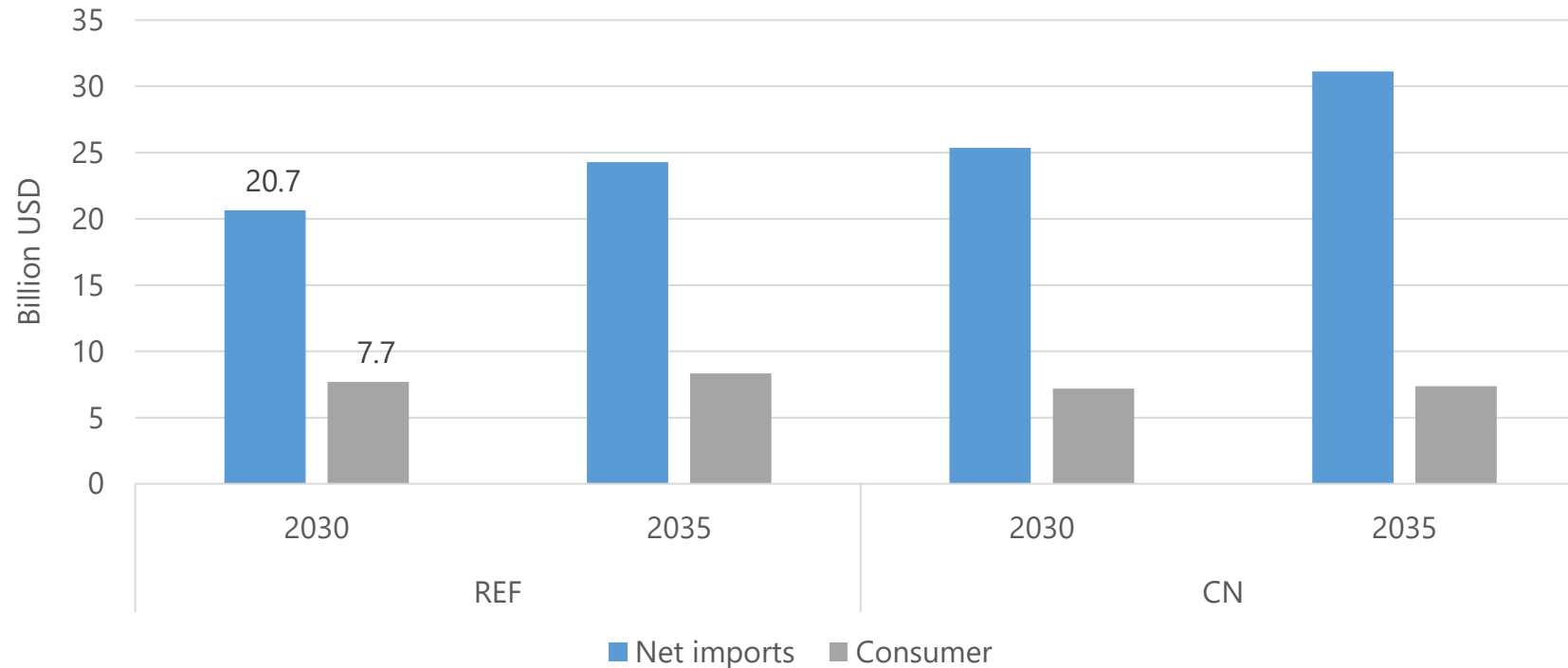


Source: APERC

- At 10 USD/mmbtu price, share of LNG import expenditure is 0.6% compared with GDP in 2030 in REF as against 0.5% in 2021, as LNG demand grows faster than the GDP due to declining domestic gas and economic development.
- Share of LNG import expenditure is higher in CN as Thailand requires more LNG to meet decarbonization targets.

Volatility in LNG price from 10 to 30 USD/mmbtu will result in significant impact in expenditures to gas importers and consumers.

Impact of changing LNG price on incremental expenditure of Thailand

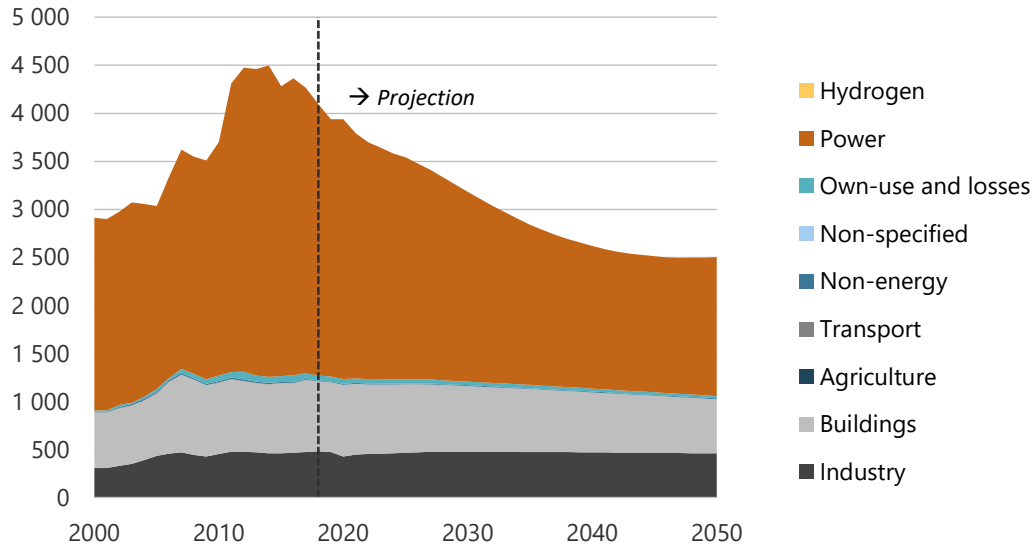


Source: APERC

- In 2030 REF, the increase in LNG price will result in 20.7 billion USD and 7.7 billion USD higher burdens to LNG importer and consumer, respectively.
- The increase in consumer expenditure is calculated based on total final consumption (TFC) of gas, and does not include the impact on transformation sectors such as increases in electricity generation costs.

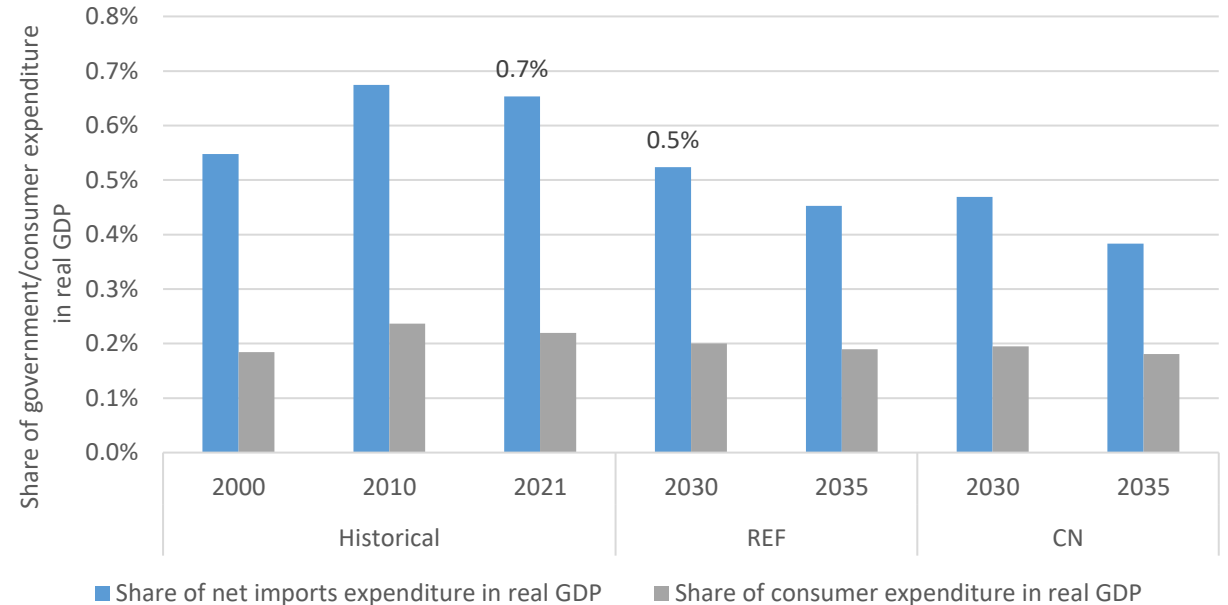
Similar impacts are likely in a developed economy with a high import of gas.

Japan's natural gas consumption by sector in REF, 2000-2050 (PJ)



Source: APEC 8th Outlook

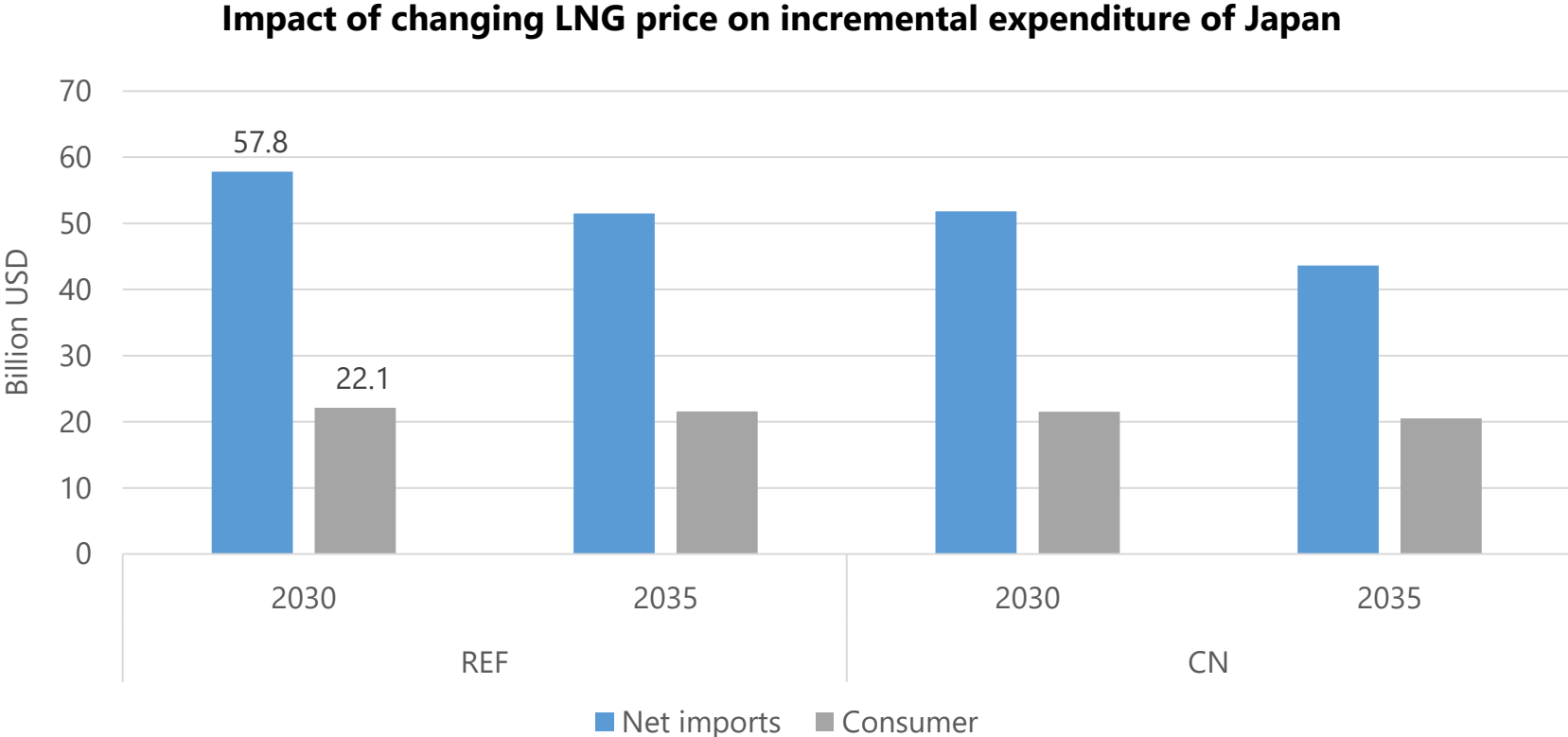
Share of Japan's net import expenditure and consumer expenditure of natural gas in real GDP



Source: APERC

- Share of LNG import expenditure is 0.5% compared with GDP in 2030 in for Japan, lower than 0.7% share in 2021 due to declining gas consumption.
- The share is lower in CN due to declining gas consumption in Japan.

Similar burdens but at larger in magnitude is observed for Japan from increased LNG import price due to larger amount of LNG consumption.

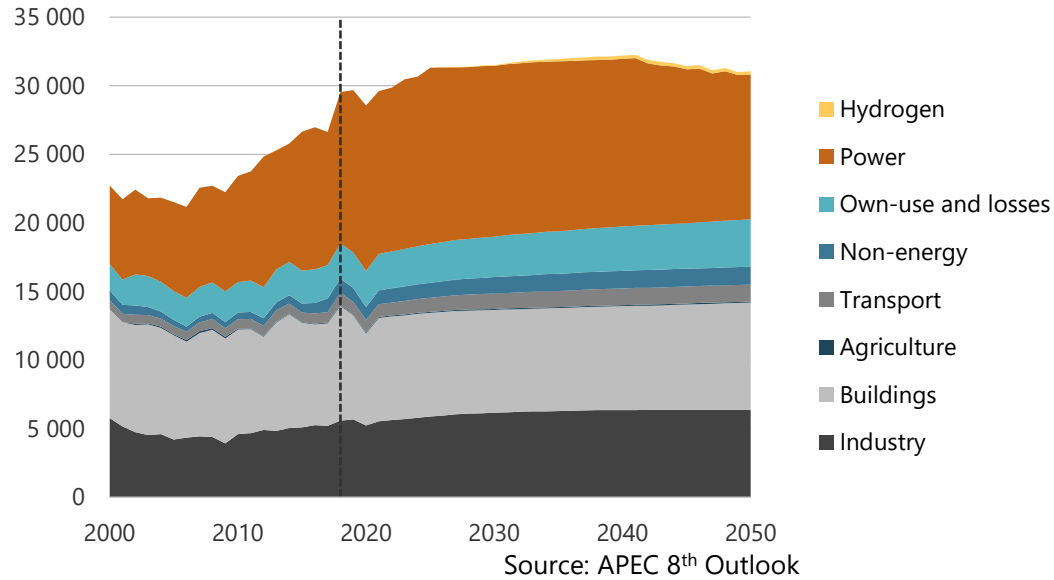


Source: APERC

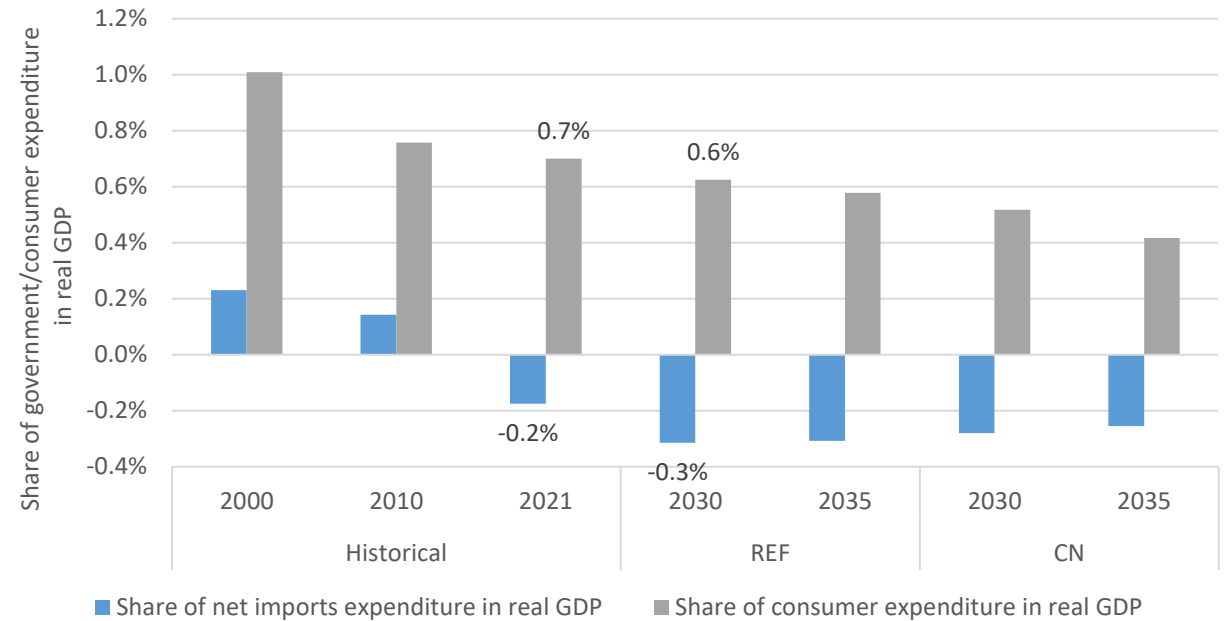
- The buildings and industry (excluding power sector) are main gas consumers in Japan which are subject to higher burden from price increase.

The US shares similar characteristics as a major natural gas exporter.

US's natural gas consumption by sector in REF, 2000-2050 (PJ)



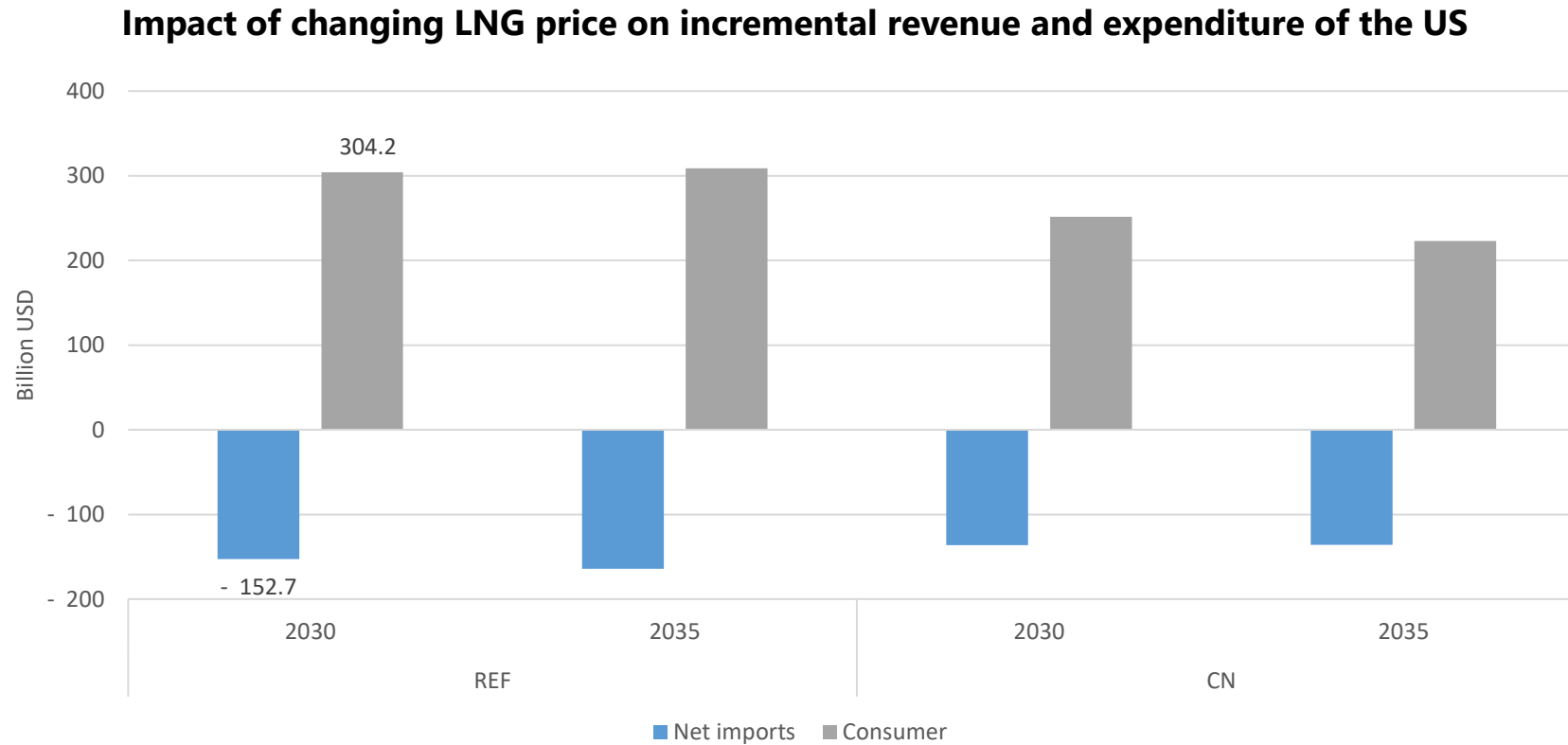
Share of the US's net export revenue and consumer expenditure of natural gas in real GDP



Source: APERC

- Revenues from net gas export of the US equal to 0.2% of GDP while expenditures of gas consumers equal to 0.7% of GDP in 2021.

Estimated impact to gas exporters and consumers of the US.

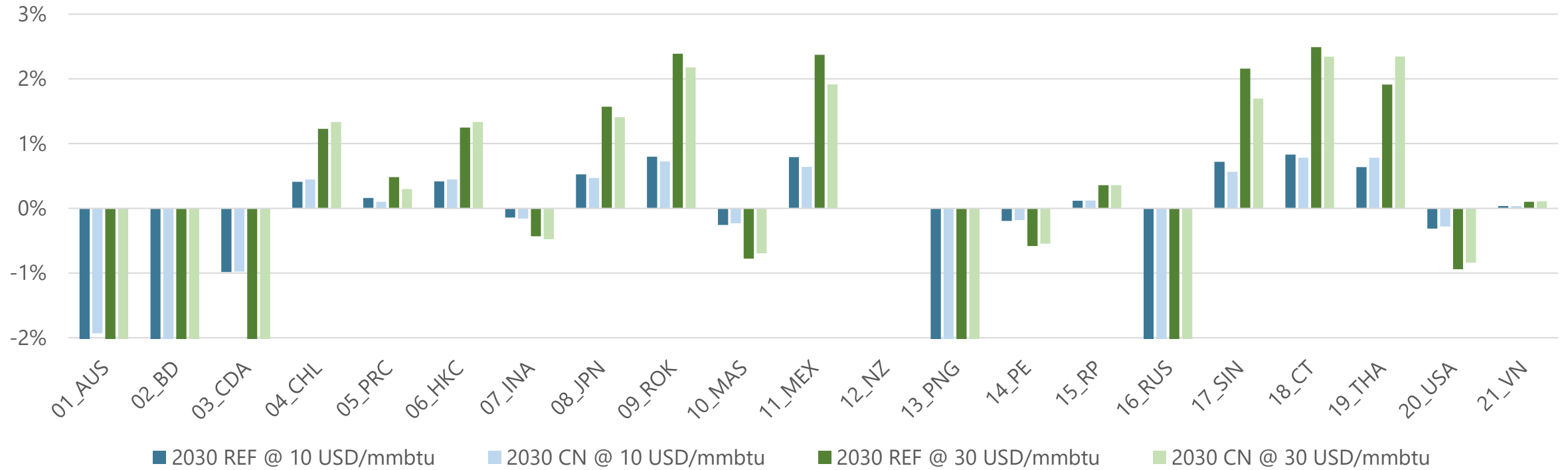


Source: APERC

- US's exporters gain 152.7 billion USD while consumers are burdened with additional 304.2 billion USD as gas price increases from 10 to 30 USD/mmbtu.

Exposure of risks to supply security and price volatility of gas imports varies significantly depending on economy's characteristics.

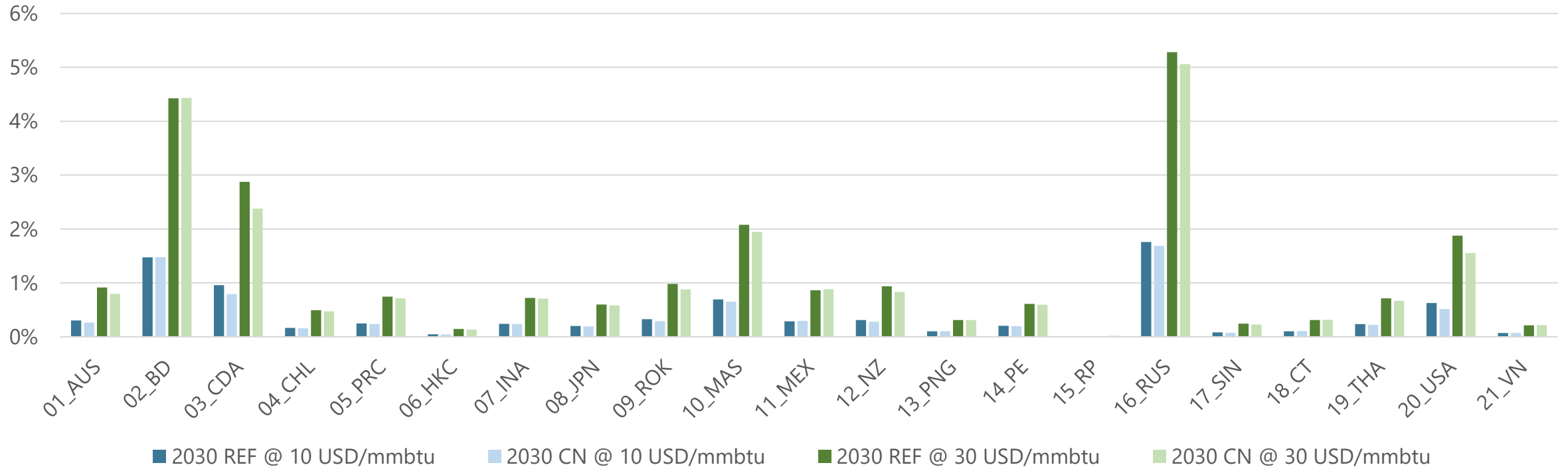
Share of net gas import expenditure to real GDP in 2030



Source: APERC

..So does the exposure for final gas consumers.

Share of consumer expenditure to real GDP in 2030



Source: APERC

- Consumer prices may subject to government subsidies.

Key questions:

- What will be the impacts from the supply disruption and price volatilities of natural gas/LNG to APEC economies?
- Although the near-term outlook for LNG infrastructure is positive, what is the outlook after 2030?
- How will decisions made today improve LNG capacity in the early 2030s?
- What is the latest outlook of global and APEC demand and supply of LNG in the long term?
- Are there any potential challenges or constraints in the supply chain of LNG in the long term?
- What measures can APEC economies take today to improve the security of natural gas and LNG supply after 2030?

Theme 2:

The Implications of Underinvestment in the Upstream Oil Sector for Oil Supply Security in APEC

Mr. Nabih Matussin, Researcher



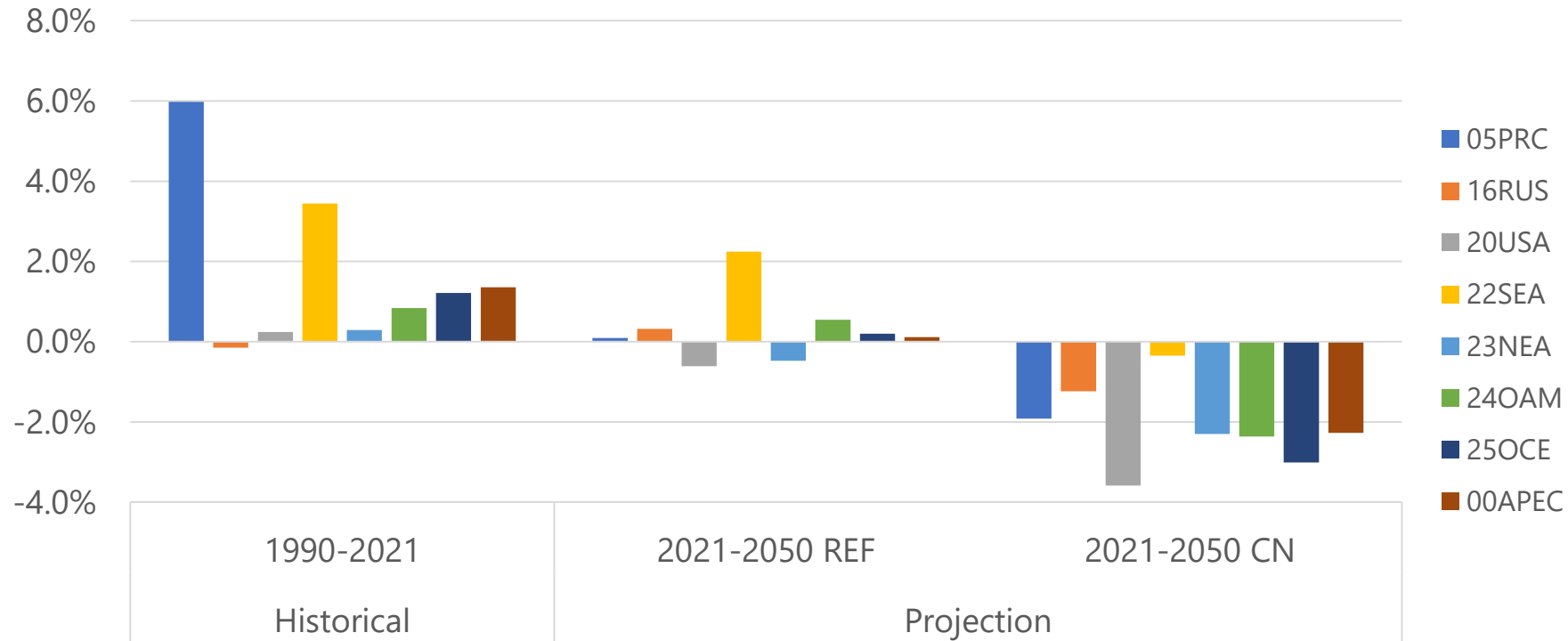
Outline

- Current situation and outlooks
- Analysis on impact from oil price volatility
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Current situation and outlooks

Like natural gas, APEC oil consumption is expected to increase in REF

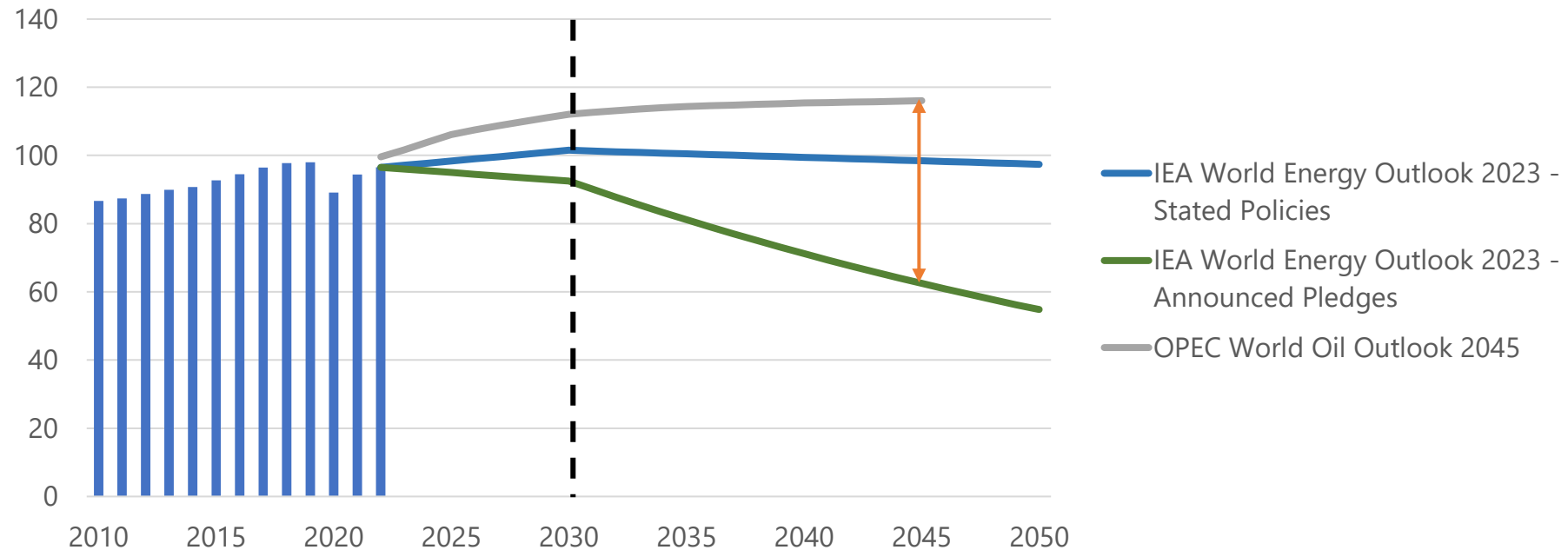
Annual growth rate of APEC oil consumption by subregion (%)



- APEC oil consumption grew at 1.4% annually from 1990 to 2021.
- Based on the 8th Outlook, consumption is projected to grow at 0.1% and -2.3% per annum in Reference (REF) and Carbon Neutrality (CN) scenarios, respectively, from 2018 to 2050. Prominent growth is anticipated in Southeast Asia (SEA)
- The large difference in oil consumption between REF and CN creates uncertainty about the future profitability of upstream investments across all subregions.

The uncertainty about future global oil demand causes wide variation among outlooks

World oil demand, 2010 – 2050 (mb/d)

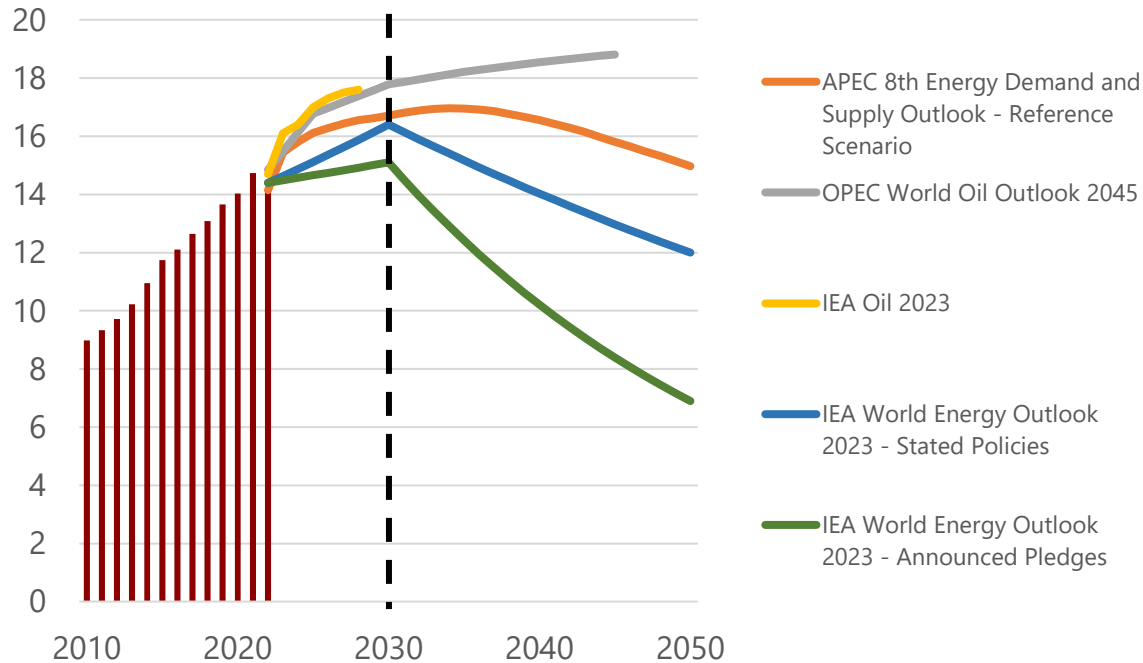


Source: EI (2023), IEA (2023), OPEC (2023)

- Both IEA (Stated Policies) and OPEC forecasted world oil demand to continue grow until at least 2030.
- The post-2030 oil demand is subject to a varying degree of uncertainty across scenarios.
- In 2045, world oil demand is estimated at 92 ± 26.8 mb/d

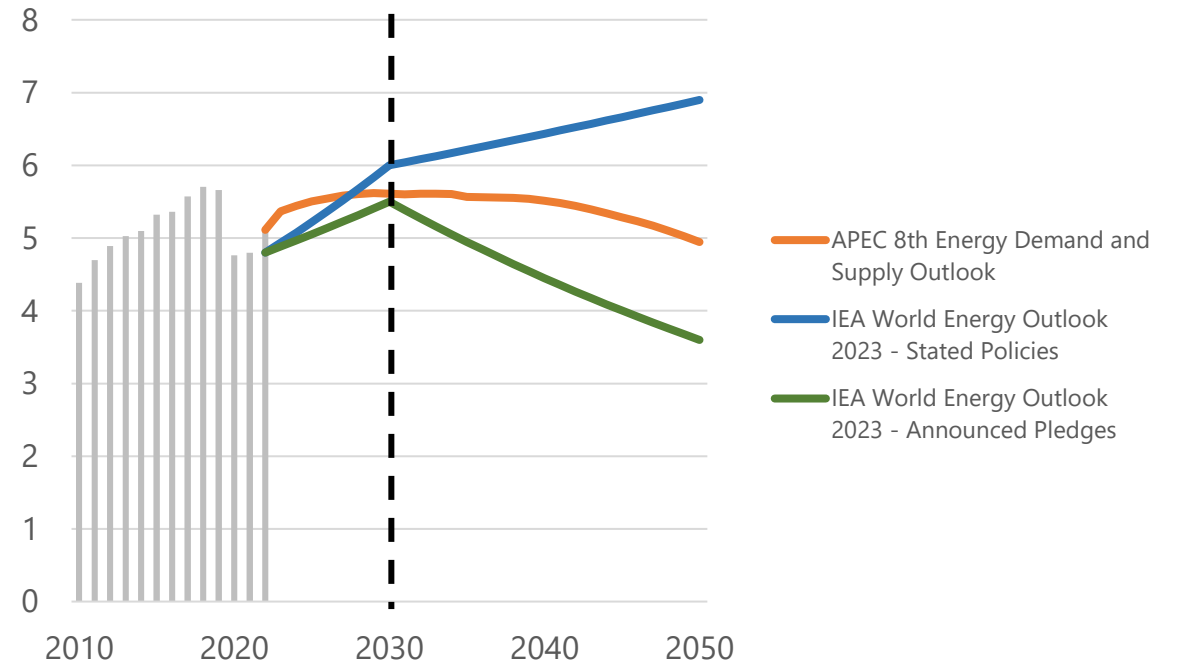
Similar variations are also present in APEC subregional outlooks

China oil demand, 2010 – 2050 (mb/d)



Source: EGEDA (2023), APERC (2022) IEA (2023), OPEC (2023)

Southeast Asia oil demand, 2010 – 2050 (mb/d)

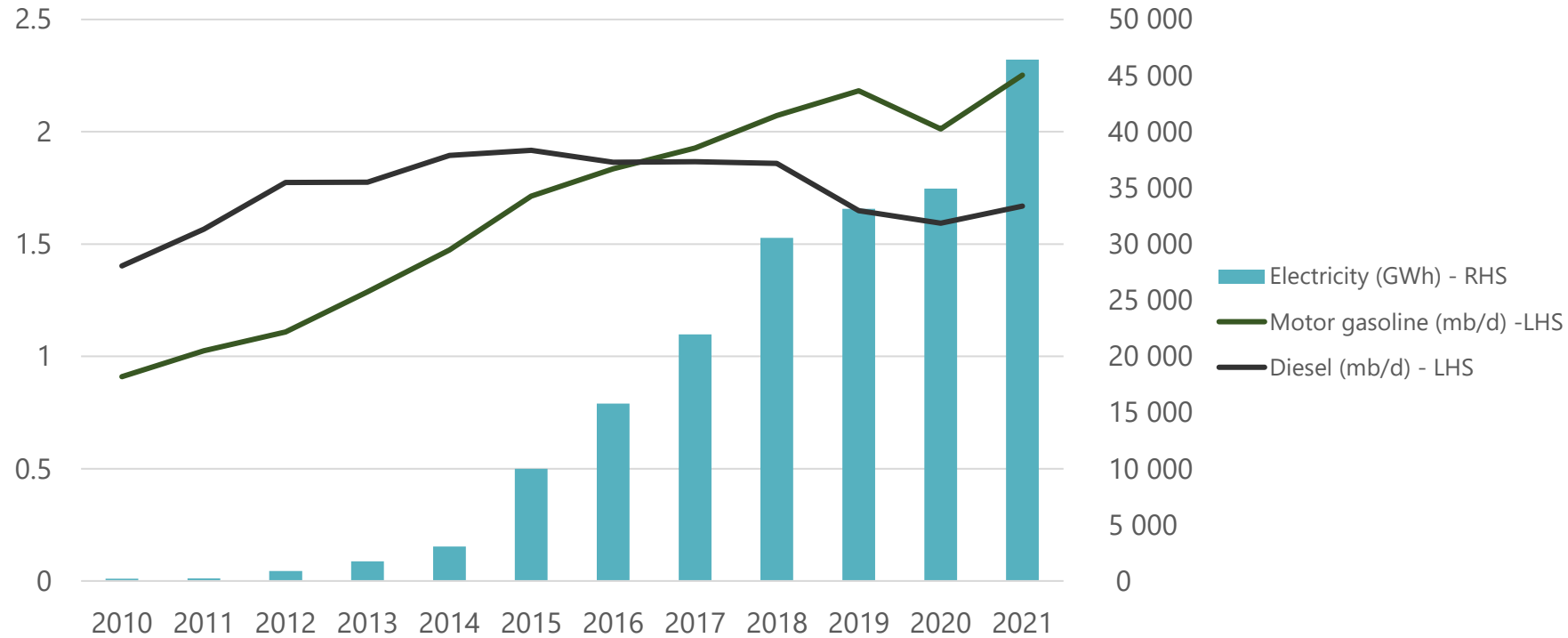


Source: EGEDA (2023), APERC (2022) IEA (2023), OPEC (2023)

- OPEC has a bullish outlook in China's oil demand beyond 2030, driven by growth in jet fuels and larger cumulative fleet of conventional vehicles than electric vehicles.
- IEA (Stated Policies scenario) expects oil demand to increase in Southeast Asia, driven by economic growth.

Paradoxically, increased EV sales has not (yet?) slowed China's oil demand growth

China road transport oil demand (mb/d) vs road transport electricity demand (GWh), 2010 – 2021

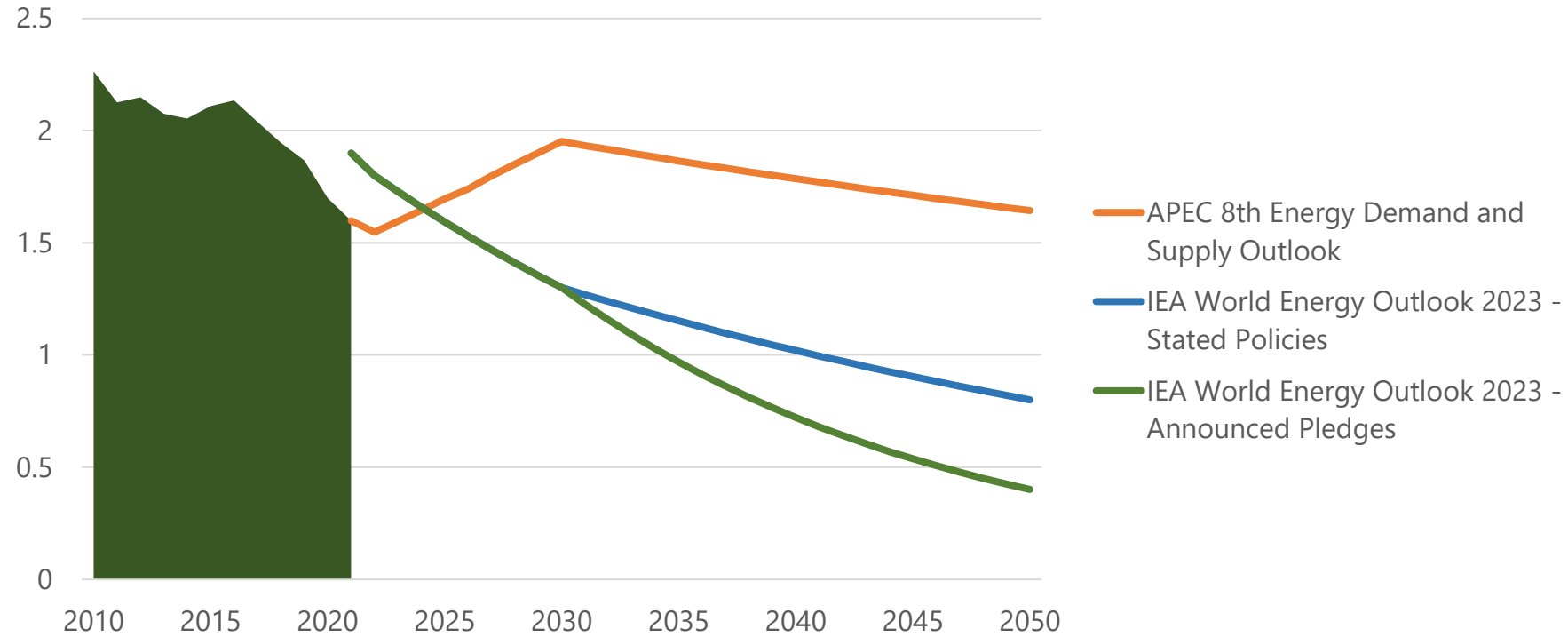


Source: EGEDA (2023), IEA (2023)

- China's motor gasoline demand more than doubled from 2010 and 2021, even if electricity demand from electric vehicles rose by almost 228 times between the same period.

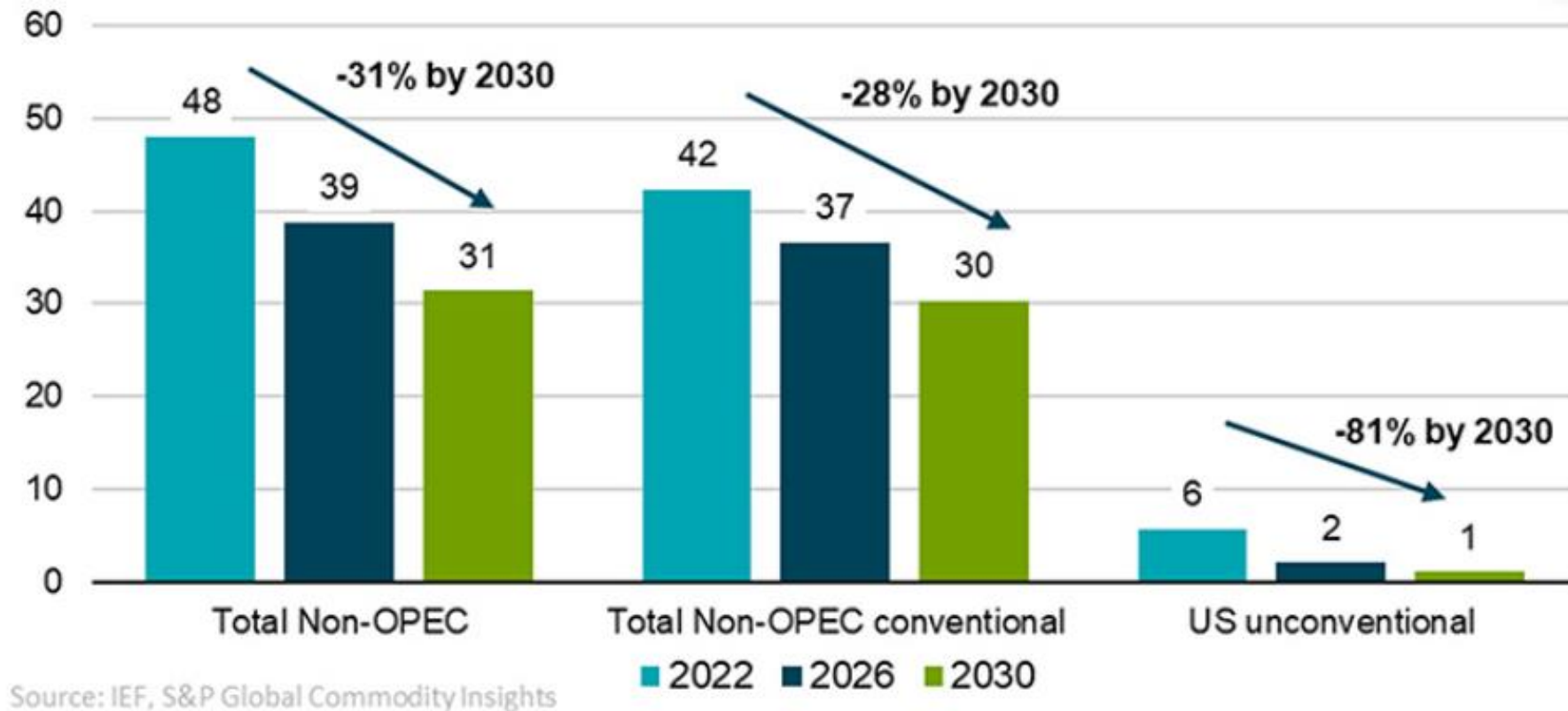
Maturing fields and underinvestment impact Southeast Asia crude oil production and import dependence

Southeast Asia crude oil production, 2010 – 2050 (mb/d)



- Southeast Asia's crude oil production declined by 0.67 mb/d from 2010 to 2021.
- Regional oil production is likely to continue declining if upstream investment is not increased.

IEF projects that non-OPEC oil output will decline rapidly if upstream investment stop



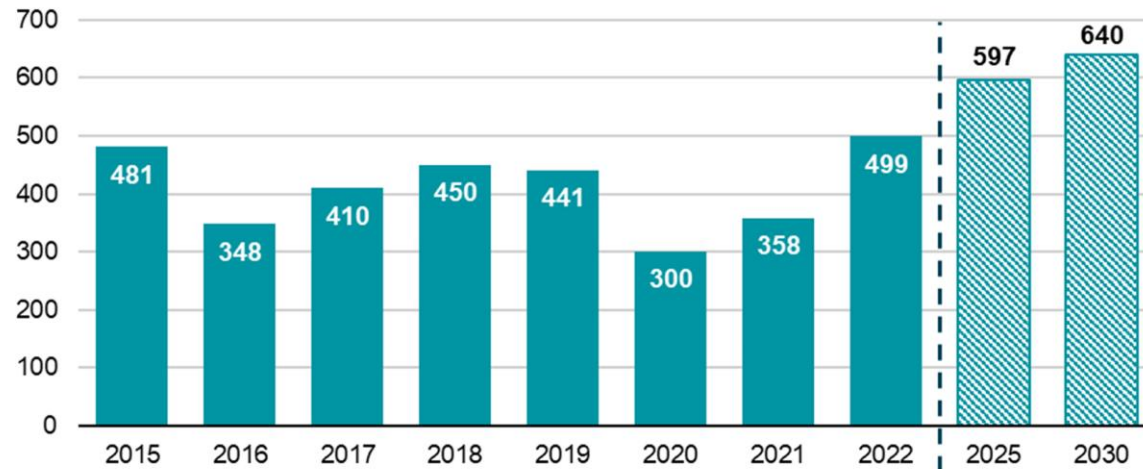
- Output is projected to decline across non-OPEC economies, including United States, if investment stops.
- By 2030, non-OPEC's production could decrease by 17 mb/d in 2030 from 2022 levels.

Upstream investment is required in both existing and greenfield assets

Global oil and gas upstream CAPEX, 2015 – 2030 (billion USD)

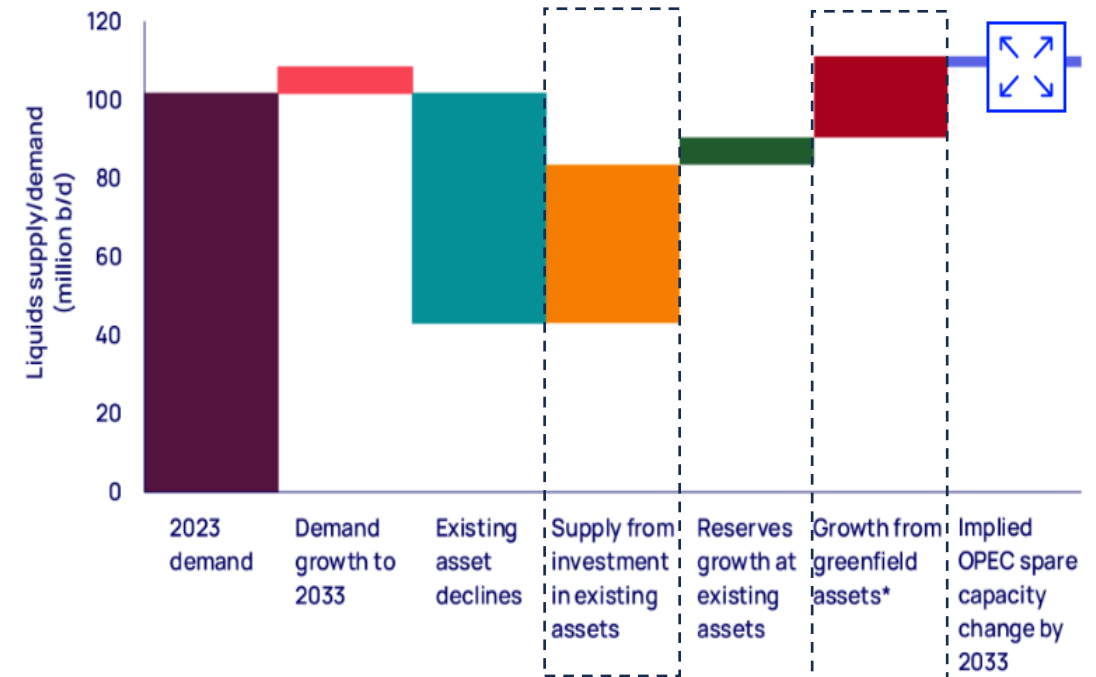
Global Oil & Gas Upstream Capex

Billion USD (nominal)



Source: IEF, S&P Global Commodity Insights

Volume of supply required to meet demand in 2023



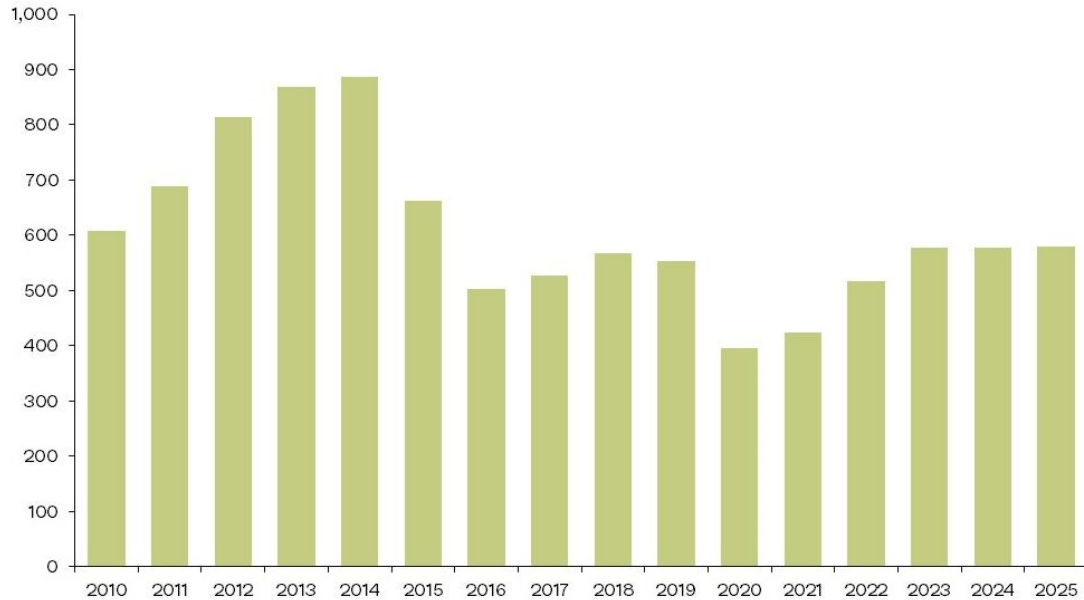
Source: Wood Mackenzie (2023)

Source: IEF, S&P Global Commodity Insights (2023)

- The International Energy Forum (IEF) and S&P projects annual upstream investment needs to grow to USD 640 billion in 2030 to meet future demand and offset declining production.
- Wood Mackenzie expects most investment growth from existing and new greenfield assets.

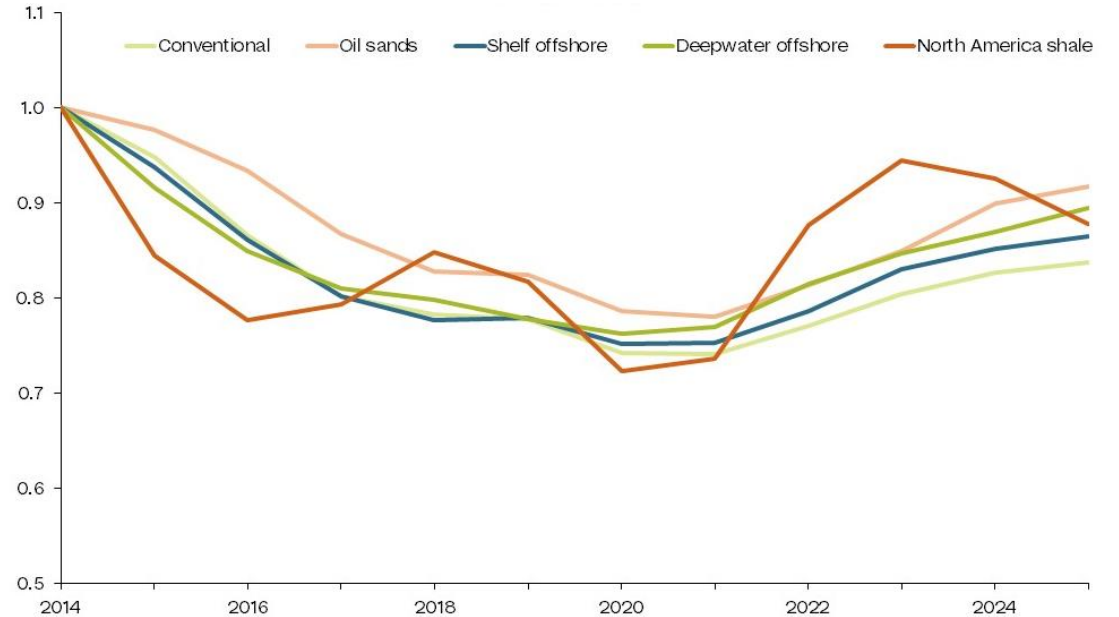
Some evidence of increased upstream productivity

Global upstream investments, 2010 – 2025 (billion USD)



Source: Rystad Energy (2023)

Change in unit price of oil since 2014



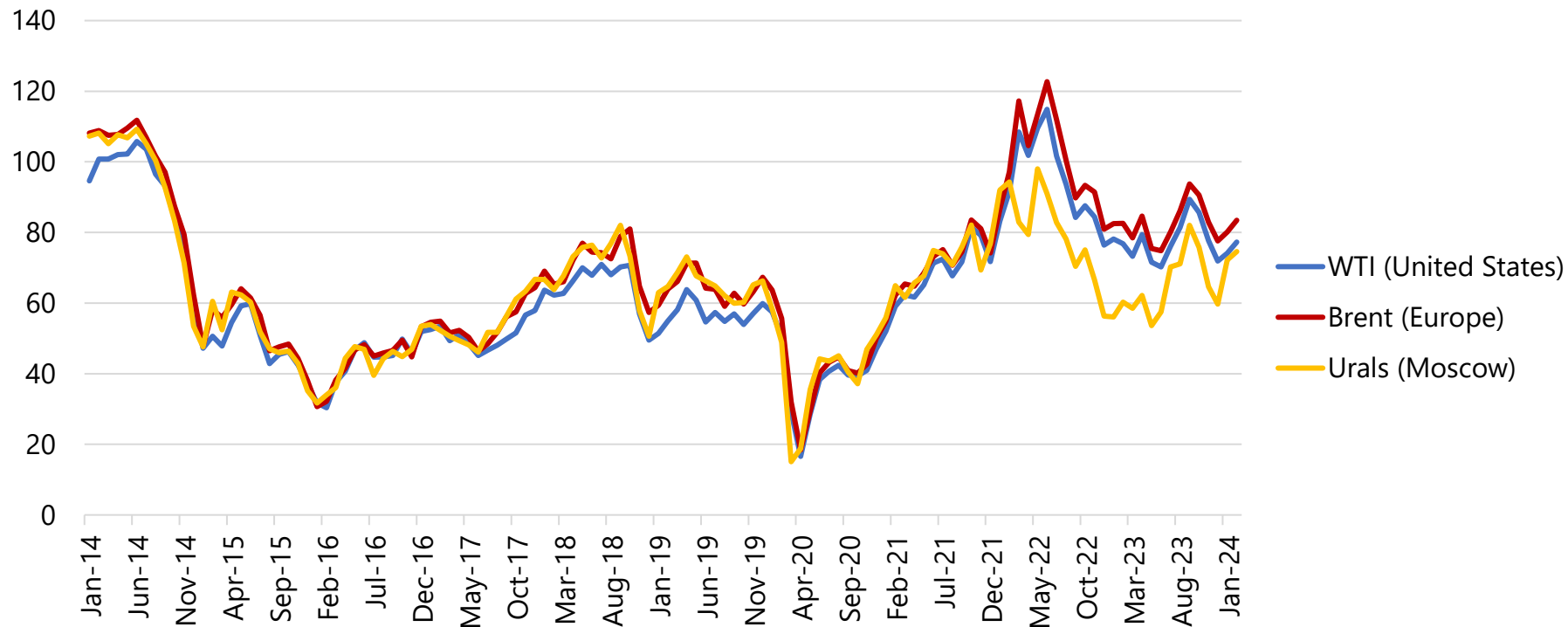
Source: Rystad Energy (2023)

- Global upstream investments almost reached USD 900 billion in 2014 due to high oil prices.
- Despite high oil prices in 2022 due to Russia-Ukraine conflict, upstream, investment only approached close to USD 500 billion.
- Falling unit costs since 2014 were attributed to improved productivity and efficiency, and evolving portfolio strategies.

Analysis on impact from oil price volatility

Crude oil prices volatilities generate concerns for both net-exporting and net importing economies

Crude oil prices, Jan 2014 – Feb 2024 (USD per barrel)



Source: EIA (2024), Investing (2024)

- Net importers are typically vulnerable to adverse shock when crude oil prices rise, thereby increasing their import expenditures.
- Net exporters, on the other hand, experience a favourable shock, i.e. increase in revenues.

APEC's net importers have high exposure to potential price disruption.

Share of net oil import expenditures (%) relative to real GDP

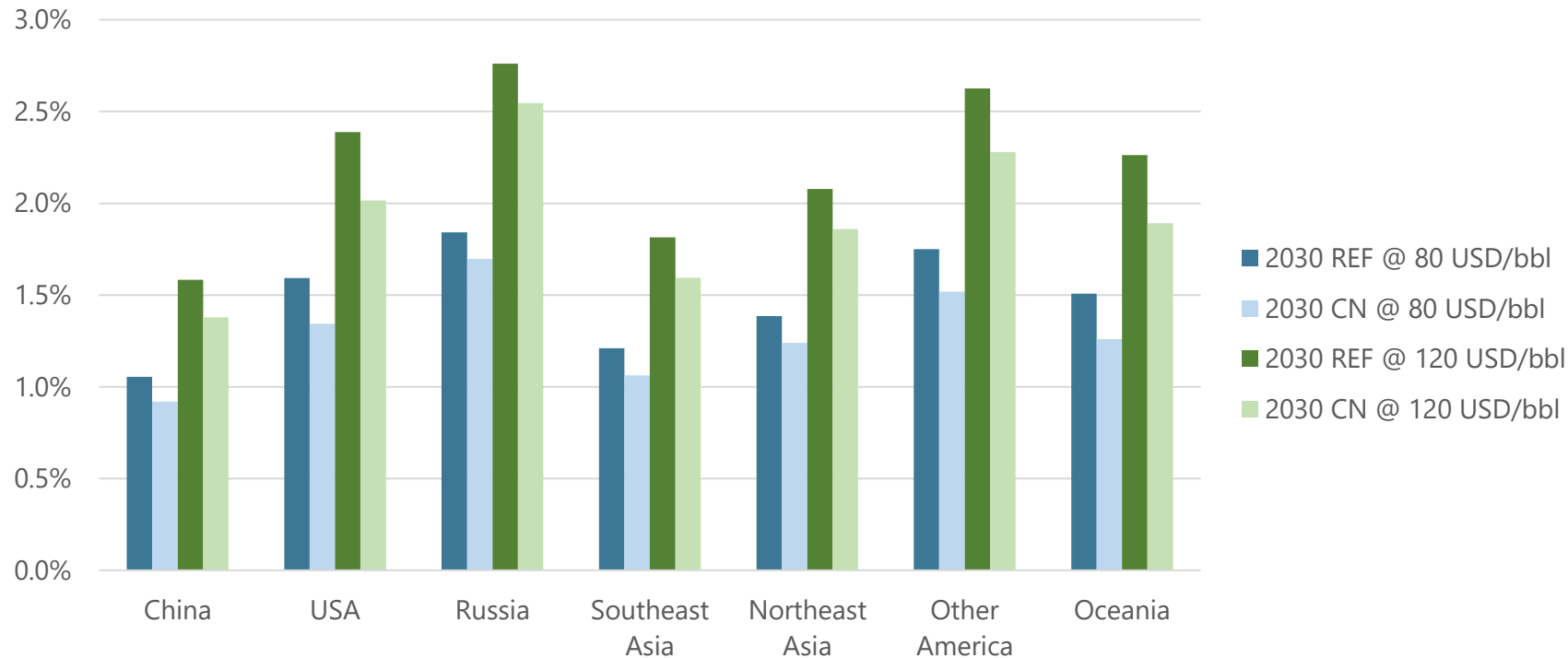


Source: APERC (2024)

- The impact of increased prices on net import expenditure is most pronounced in Northeast Asia, rising from 1.5% of its GDP when the price is at 80 USD per barrel to 2.2% when the price reaches 120 USD per barrel in 2030 REF.

Oil consumption expenditures range from 1% to nearly 3% of the region's GDP.

Share of oil consumption expenditures (%) relative to real GDP



Source: APERC

Total final consumption excludes transformation as well as losses and own-use

- Net-exporters, Russia and Other America, exhibit the two highest TFC expenditures, assuming that their domestic oil prices are influenced by the global market.

Key questions:

1. What is the likely future demand for oil in the mid- and long-term?
2. What are the likely effects of reduced investment in upstream oil?
3. Are increases in upstream productivity reducing the need for future investment?
4. What are the latest global and APEC investment outlooks for upstream oil?
5. What can APEC economies do to reduce oil supply risks?

Thank you.

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