Shell LNG Outlook 2022

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Shell LNG Outlook 2022

01 Natural gas plays a significant role in progressing NZE ambitions

Around the world, more countries announced net-zero emissions targets, adding pressure to decarbonise energy systems. As a reliable, available and lower-emissions energy source, gas has an important role in supporting this transition, both as a partner to renewables for grid stability and an immediate option to lower emissions in hard-to-electrify sectors.

Multiple outlooks differ on the share of gas in the long-term energy mix, but there is agreement that it will continue to be needed. Decarbonising gas and liquefied natural gas (LNG) value chains and developing cleaner pathways will strengthen their role in the energy transition.

02 2021 showed fragility and interdependence of the energy system

A faster than expected economic rebound following the lifting of pandemic lockdowns, extended European winter and drought conditions in Brazil accelerated demand for LNG in 2021, a year which also saw gas supply constraints. Prices remained pressured all year, reaching record levels towards the end of the year with European gas storage levels at historical lows and continued uncertainty around Russian gas supplies. Rising coal prices and carbon prices added further pressure.

China overtook Japan as the world's largest LNG importer while US led growth in LNG exports.

03 Energy security, emissions and economic growth in Asia to drive future LNG demand

LNG has a key role to play as a reliable and lower-emission energy source, particularly in Asia, replacing declining domestic gas production, enabling coal-to-gas switching and supporting economic growth. The volatility in energy prices in 2021 shows how the energy market can destablise quickly without sufficient reliable supply. The global LNG market is expected to remain tight in the near term, with a supply-demand gap forecast to emerge in the middle of the current decade.

2021 saw increased momentum in efforts to decarbonise the LNG value chain, a crucial factor for its long-term role in the energy mix.

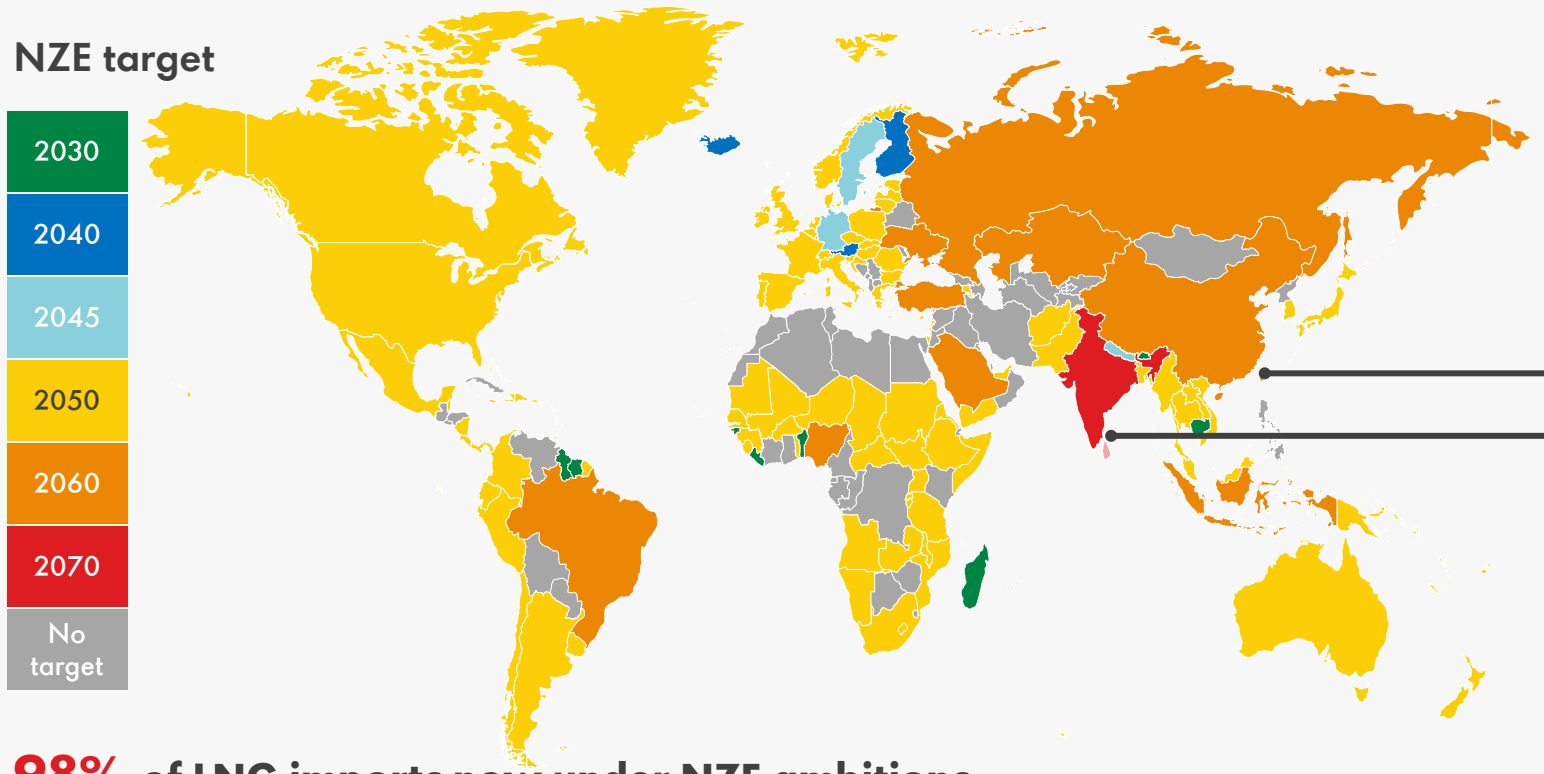
Shell plc

February 2022

01 Natural gas plays a significant role in progressing NZE ambitions

88% of global emissions now covered by country net-zero ambitions

Top carbon emitters set 2030 emissions targets



98% of LNG imports now under NZE ambitions

Source: Shell interpretation of Net Zero Tracker, IHS Markit and Global Carbon Atlas 2021 and 2022 data.
Recent national policy announcements have been added * base year

2030 emissions targets

CHINA

Carbon peaking by 2030

Policy aimed at limiting the increase in coal consumption and building gas power plants, encouraging use of gas in industry and LNG for vehicles and ships.

INDIA

Cut carbon emissions by 1 billion tonnes by 2030*

Plans focus on increasing zero carbon generation by 500GW, reducing carbon intensity by 45% and increasing LNG's share of gas demand to 70%.

Decarbonisation requires early action

Switching to gas can lower emissions today

Power

Switching just **20% of coal-fired power** in Asia to gas can potentially save:

EQUIVALENT TO ALL EMISSIONS FROM GERMANY

CO_2 EMISSIONS **680** MTPA

Indicative annual gas demand
310 BCM

Transport

Switching **10% of heavy goods vehicles and 10% of shipping fleet** to run on gas can potentially save:

EQUIVALENT TO 16.3 MILLION CARS TAKEN OFF THE ROAD

CO_2 EMISSIONS **75** MTPA

Indicative annual gas demand
120 BCM

Hydrogen use

Moving global energy mix to **5% hydrogen** of which 30% is blue hydrogen can potentially save:

EQUIVALENT TO EMISSIONS FROM MORE THAN 70 COUNTRIES

CO_2 EMISSIONS **475** MTPA

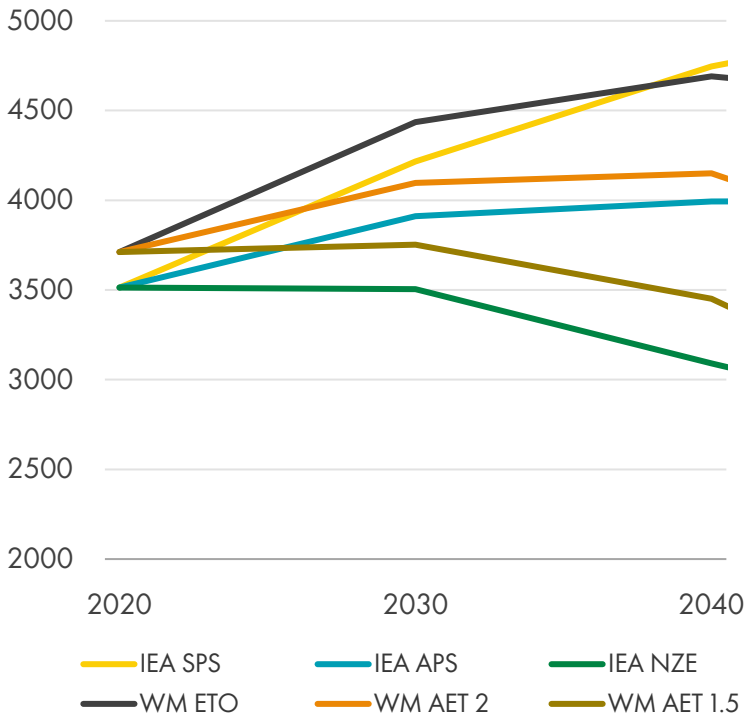
Indicative annual gas demand
350 BCM

Source: Shell interpretation of IHS Markit Sustainable Flame Study 2021

The role of gas in a changing energy system

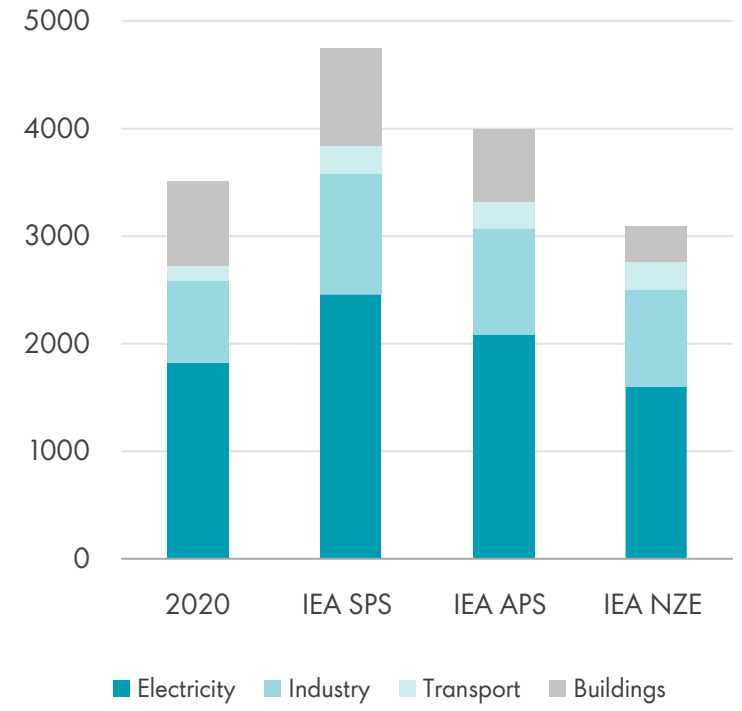
Gas scenarios 2020-2040

BCM

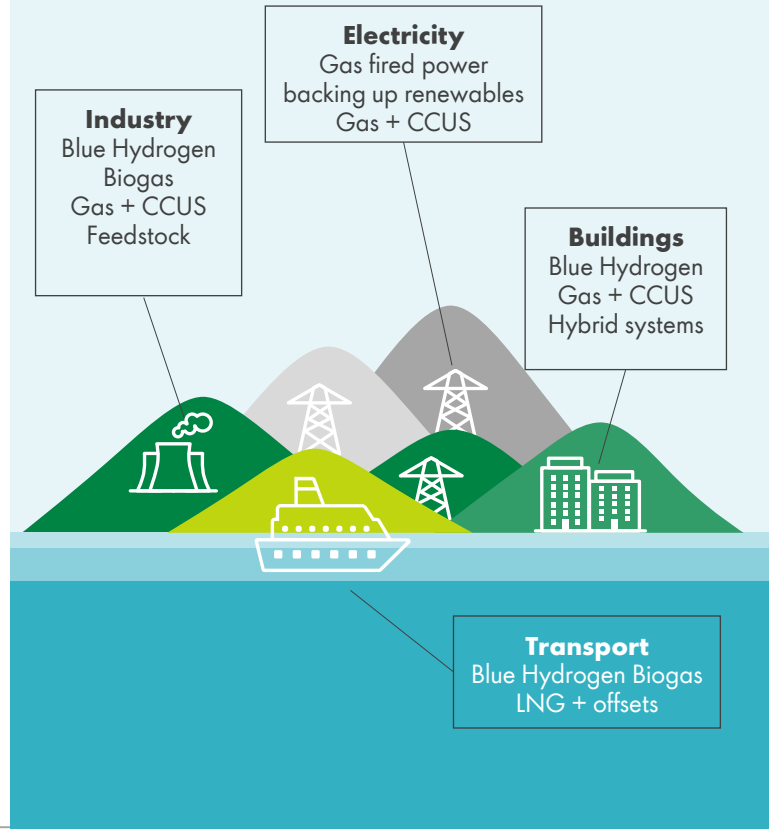


Gas demand by sector in 2040

BCM



Use of gas in a decarbonised world



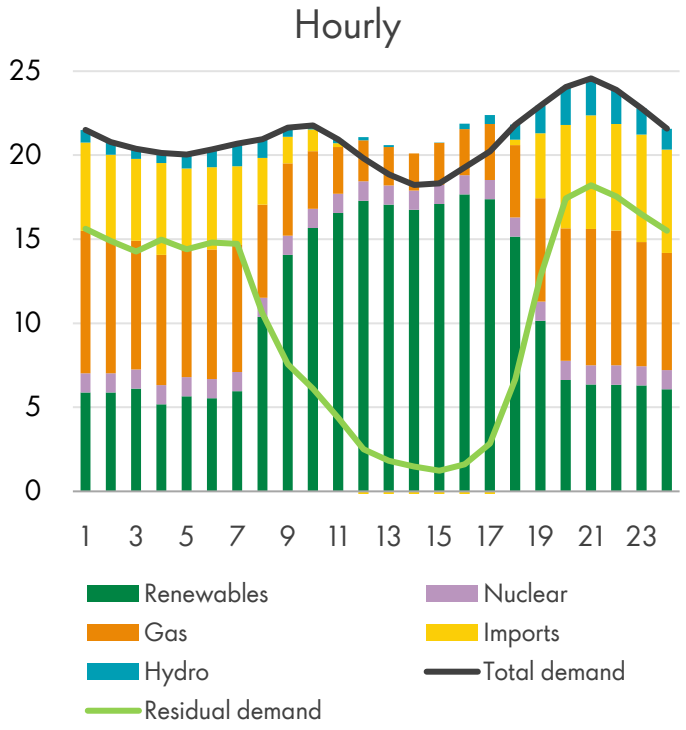
Source: Shell's interpretation of IEA World Energy Outlook 2021 and Wood Mackenzie 2021 data

Wood Mackenzie's Energy Transition Outlook (ETO) and Accelerated Energy Transition (AET); IEA's Stated Policies Scenario (SPS), Announced Pledges Scenario (APS) and Net Zero Emissions Roadmap (NZE).

Gas is there when the sun does not shine, wind does not blow or rain does not fall

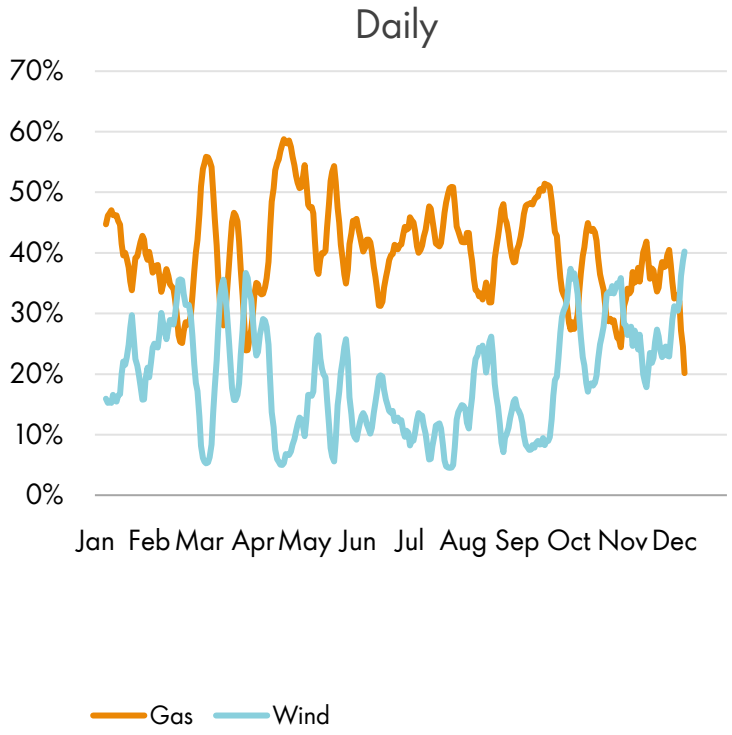
California electricity mix 24-04-2021

GW



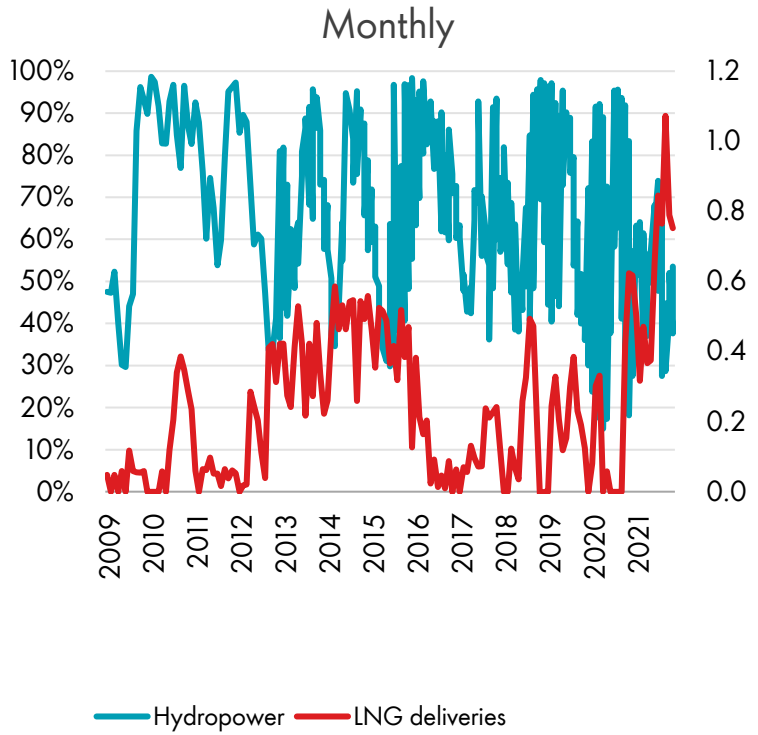
Share of UK generation 2021

7 day rolling average



Brazil hydro levels & LNG deliveries

% hydropower available LNG MT

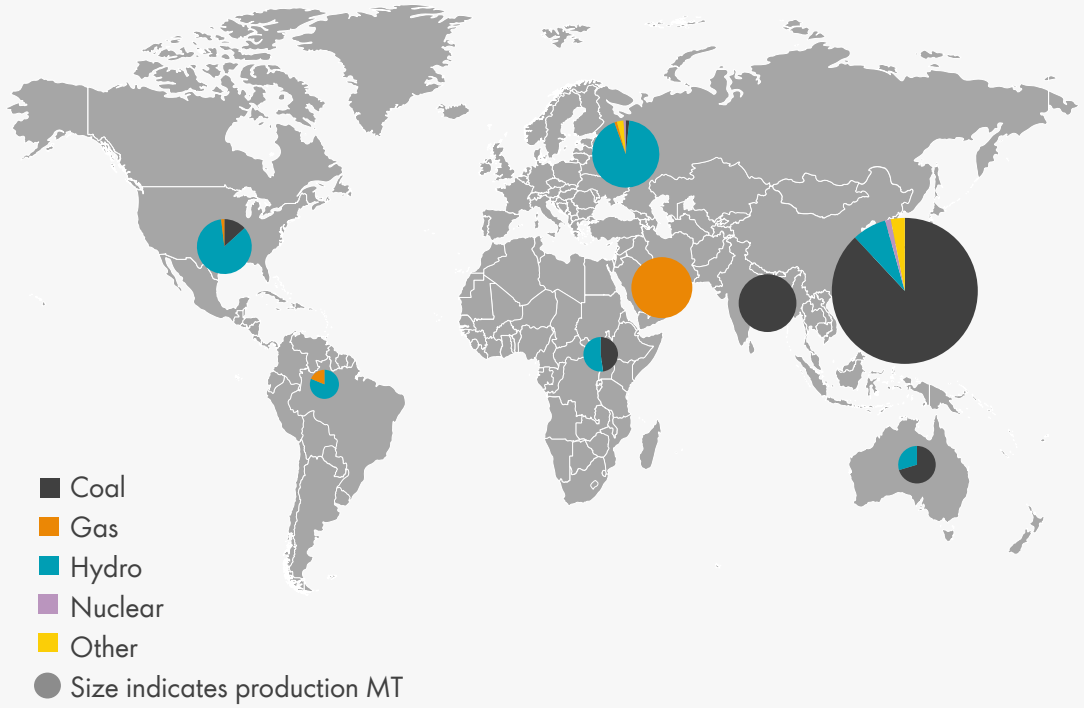


Source: Shell's interpretation of California Independent System Operator, National Grid, Grid Watch UK, IHS Markit, ONS and ANP 2021 and 2022 data

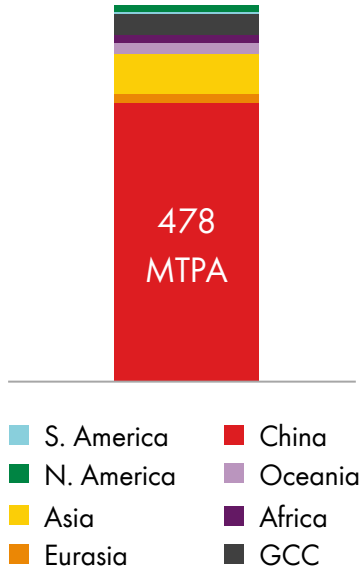
Electricity sector

Decarbonising power sources offers the largest opportunity for reducing emissions in aluminium production

Global aluminium production by energy source

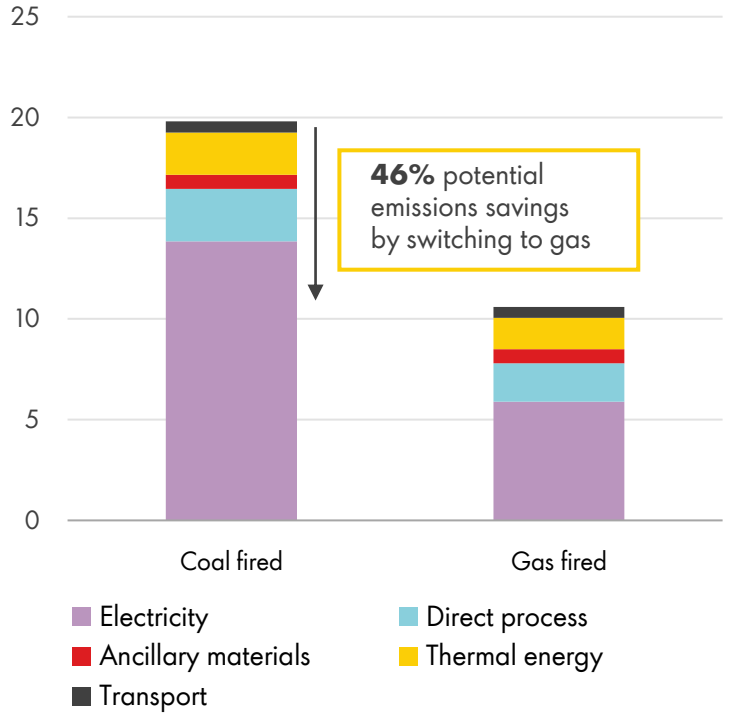


Global CO_2 direct emissions from aluminium production



CO_2 saving options

tCO_2 eq/t Aluminium



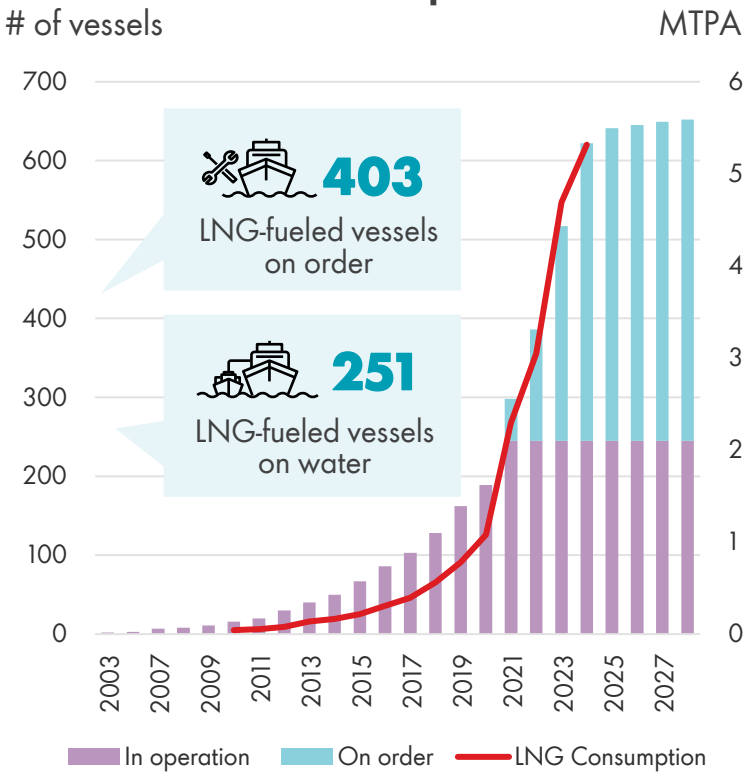
Source: Shell's interpretation of International Aluminium Institute 2020 and 2021 data
Note: GCC – Gulf Cooperation Council

Industry sector

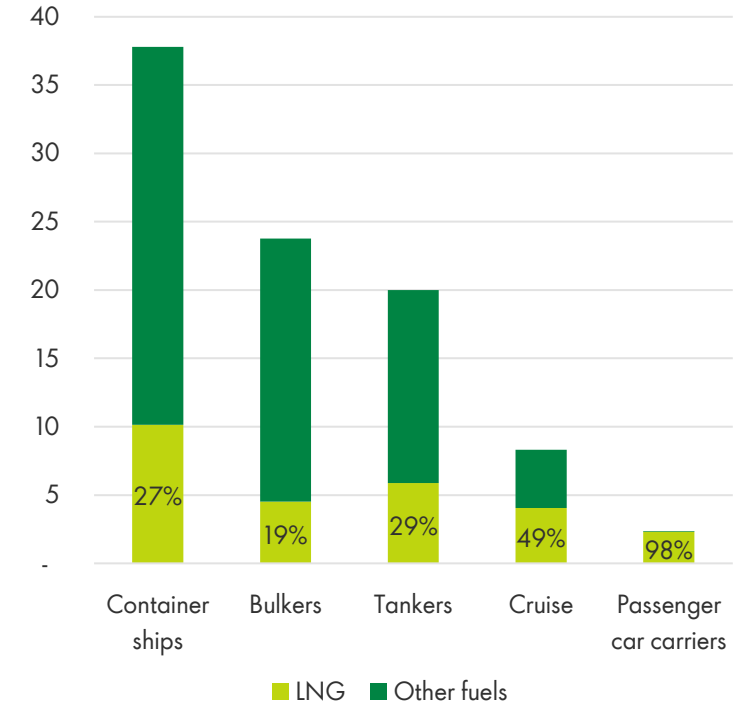
Marine LNG – a choice for today and tomorrow

30% of new vessel orders are LNG-fueled*

LNG vessels & fuel uptake

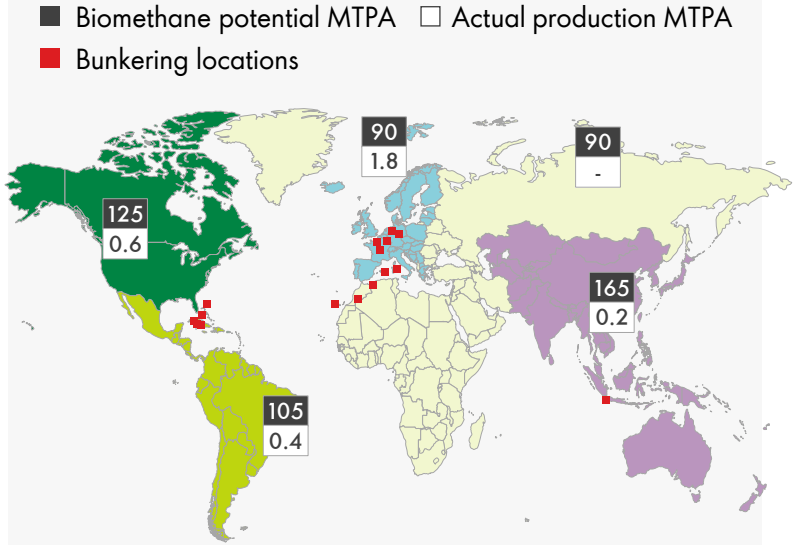


New ship orders by type**



Fuel pathway

Net-zero emissions fuel options such as BioLNG and synthetic LNG



Infrastructure pathway

Existing LNG infrastructure can be used for drop-in fuels (BioLNG and synthetic LNG)

Source: Shell interpretation of DNV GL 2020 data, World Fleet Register, Clarksons, Total Orderbook – Jan 2022 and various news reports

*Gross tonnage

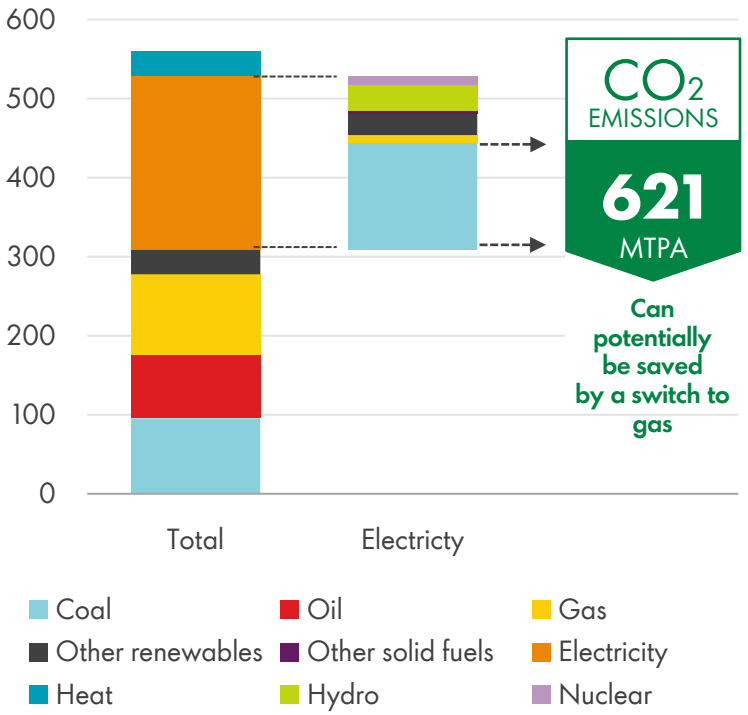
**Only larger size vessels: containers >12000TEU, tankers > 85000DWT, bulkers > 65000DWT

Transport sector

Gas is a scalable, flexible and competitive solution for the buildings sector

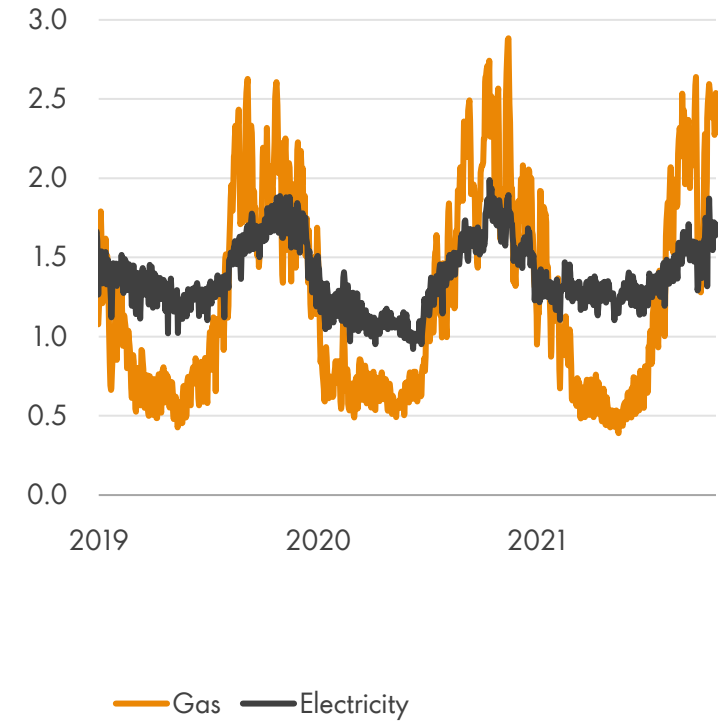
Use of energy in buildings (China)*

Mtoe



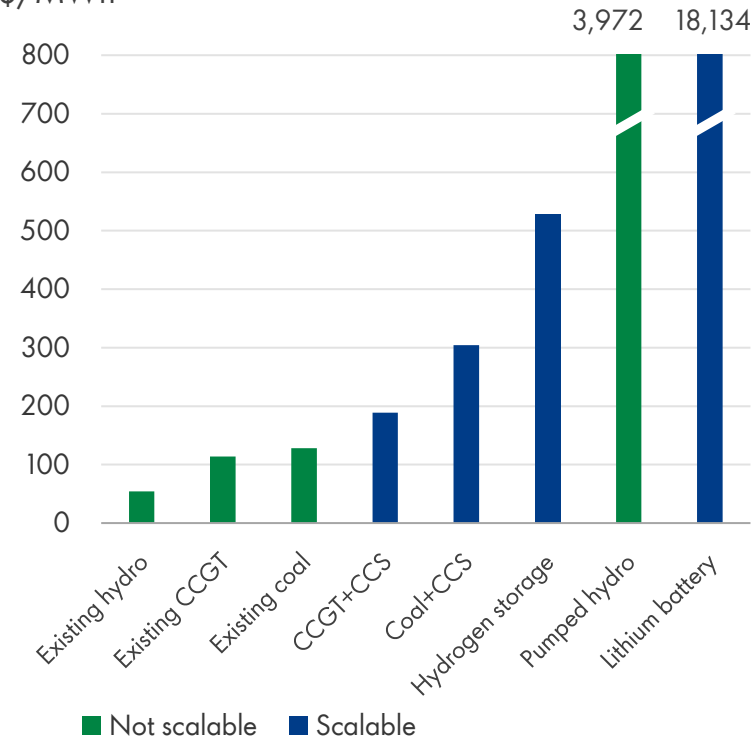
Gas and electricity use (France)

TWh



Indicative storage cost 2030

$/MWh



Source: Shell's interpretation of Wood Mackenzie, ENTSO-E, ENTSO-G and Imperial College SGI 2021 and 2022 data

* 2021-

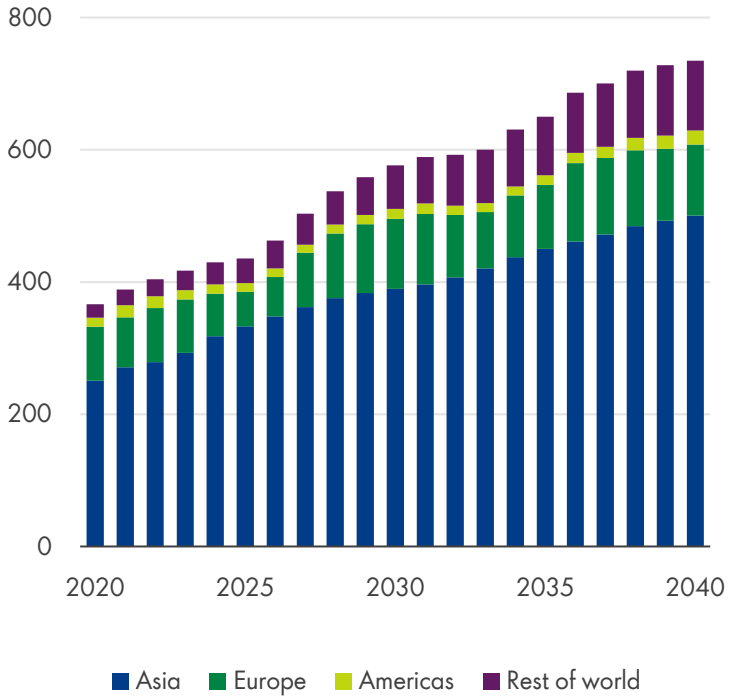
Buildings sector

Asian gas demand to drive future LNG growth

LNG needed to replace declining domestic gas and coal-to-gas switching

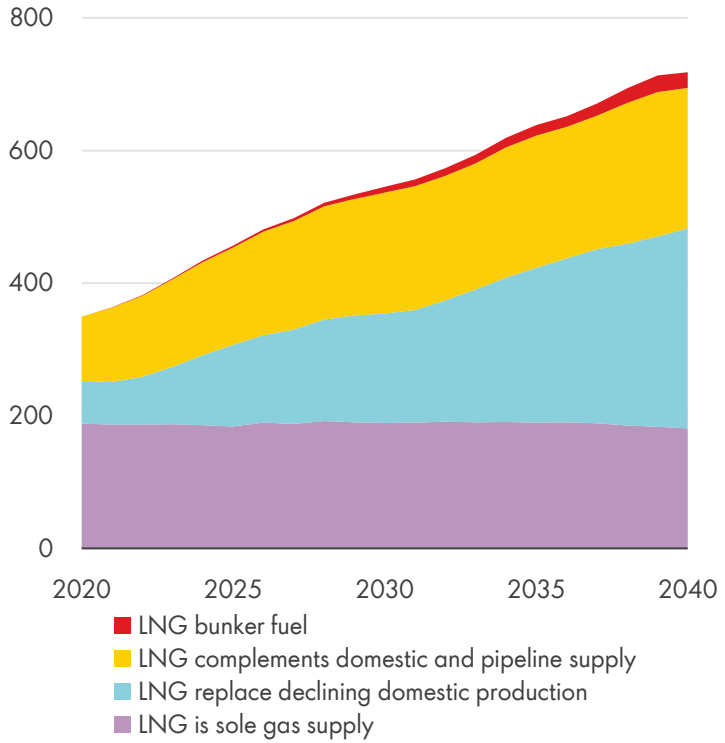
LNG imports by region

MTPA



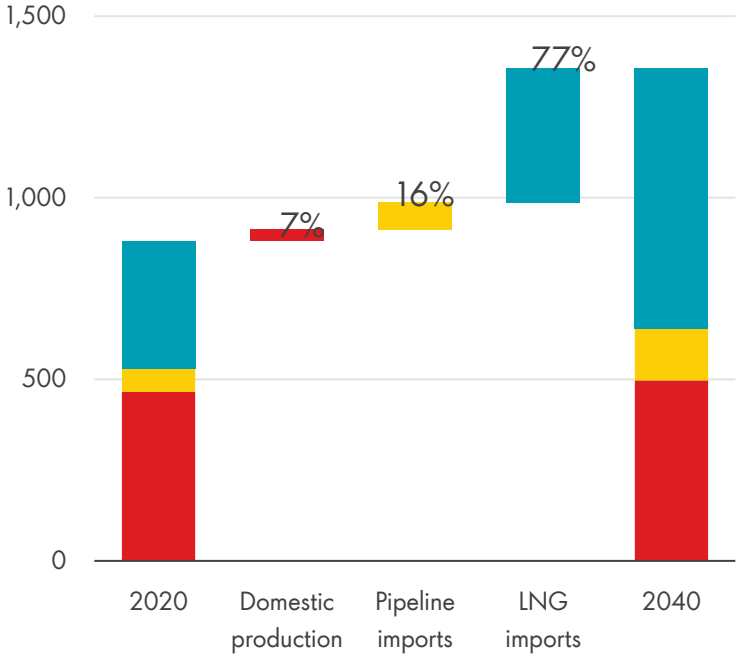
Demand drivers of LNG in Asia

BCM



Asian gas demand by supply source

BCM



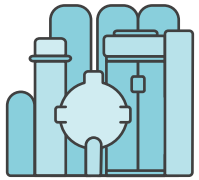
Source: Shell interpretation of Wood Mackenzie 2021 data

Domestic production is net of LNG exports

02 2021 showed fragility and interdependence of the energy system

Gas and LNG prices hit record highs in 2021

Supply constraints



- Several LNG projects underperform
- Limited discretionary Russian gas volumes
- Decline in European gas production

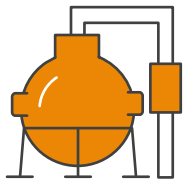
Economic rebound

- Faster than expected economic rebound following the lifting of pandemic lockdowns
- Robust Chinese LNG demand

Inventory balances

- European gas inventories at multi-year lows
- Major LNG buyers stock up

Pressured energy complex



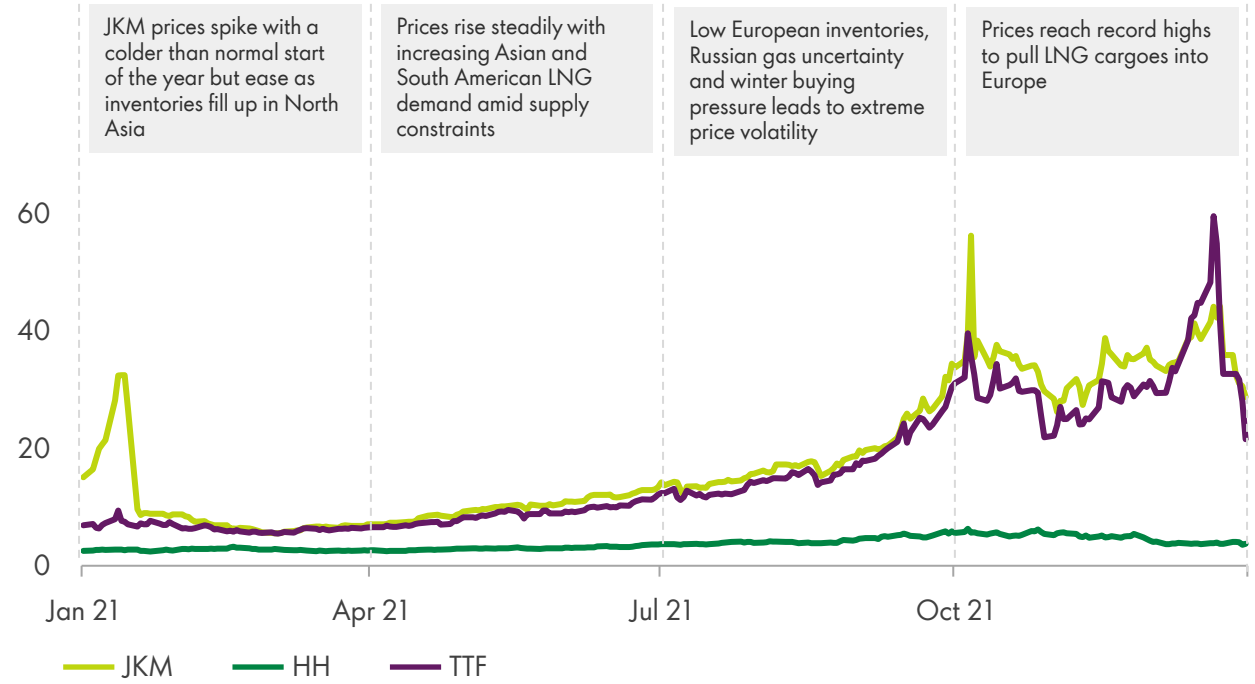
- Coal and carbon prices rally
- Limited gas-to-oil switching capacity
- New financial players in commodity markets

Weather events

- Prolonged 2020/2021 winter in Europe
- Drought in Brazil – low hydro power
- Lower wind energy in Europe

Global gas price markers

$/MMBTU



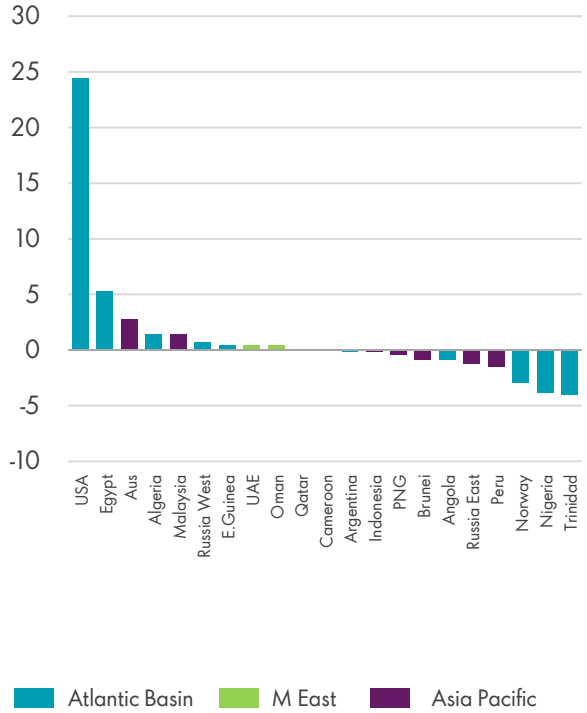
Source: Shell interpretation of ICE, CME, S&P Global Platts 2021 data

Global LNG supply increases by 21 million tonnes

US LNG export growth offsets supply constraints elsewhere

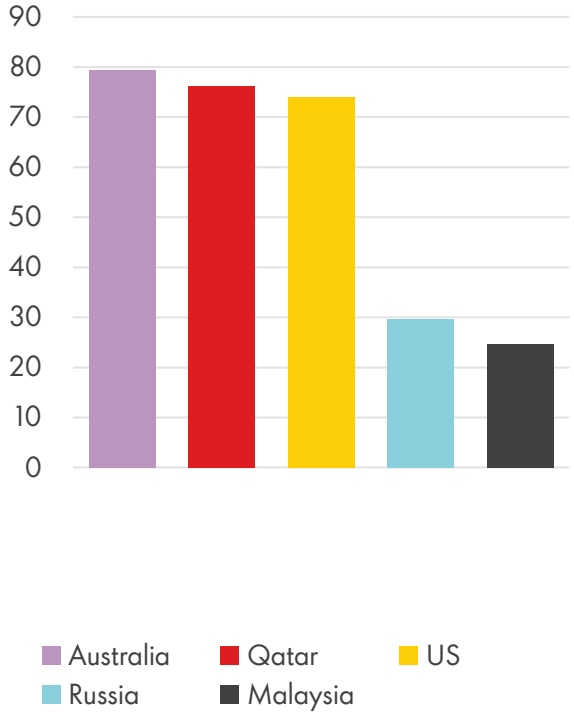
Net LNG exports 2021 y-o-y

MT



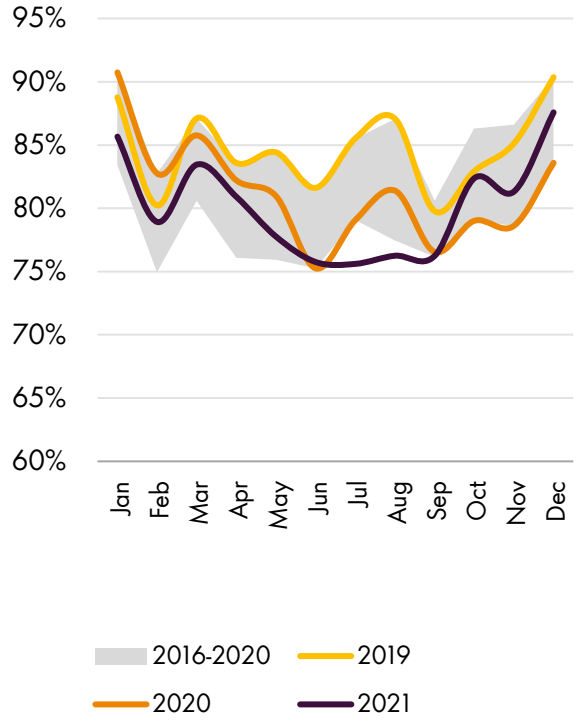
Top exporting countries 2021

MT



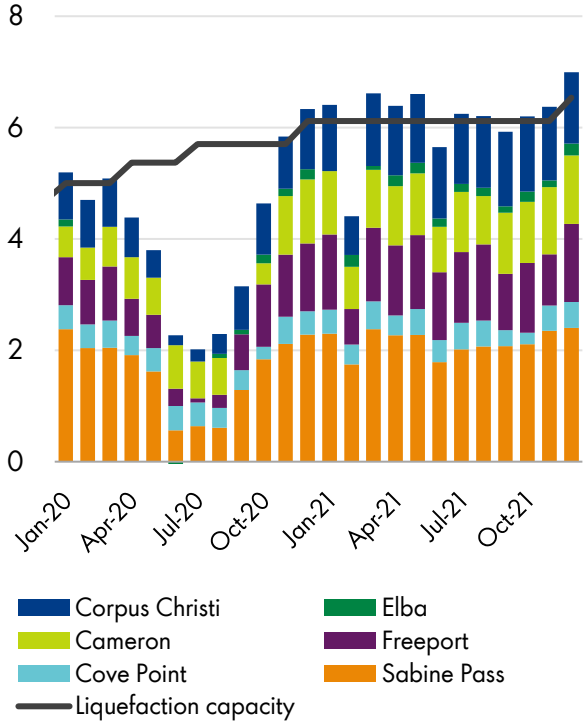
Non-US liquefaction utilisation

%



US exports by month vs capacity

MT

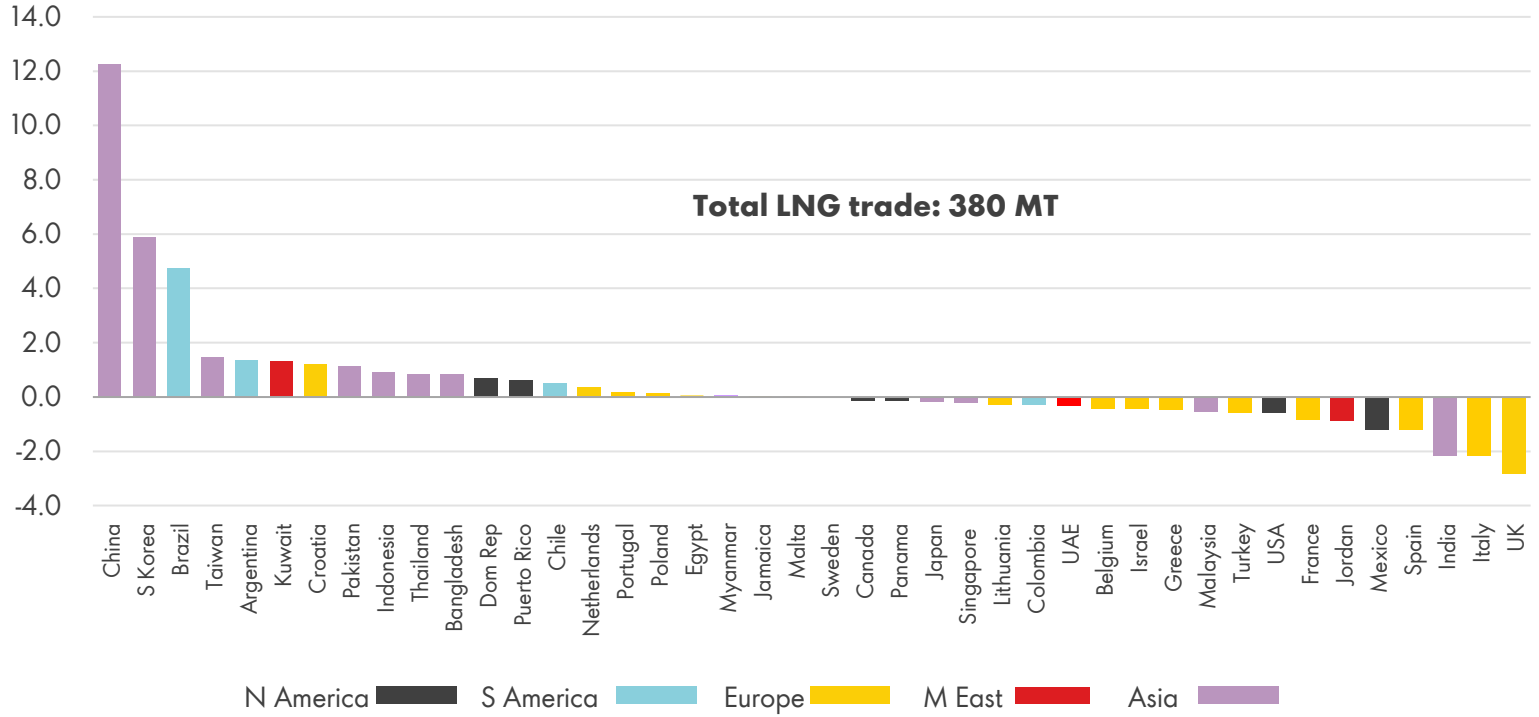


Shell interpretation of Kpler, Wood Mackenzie & Customs 2021 data

China becomes the world's largest LNG importer

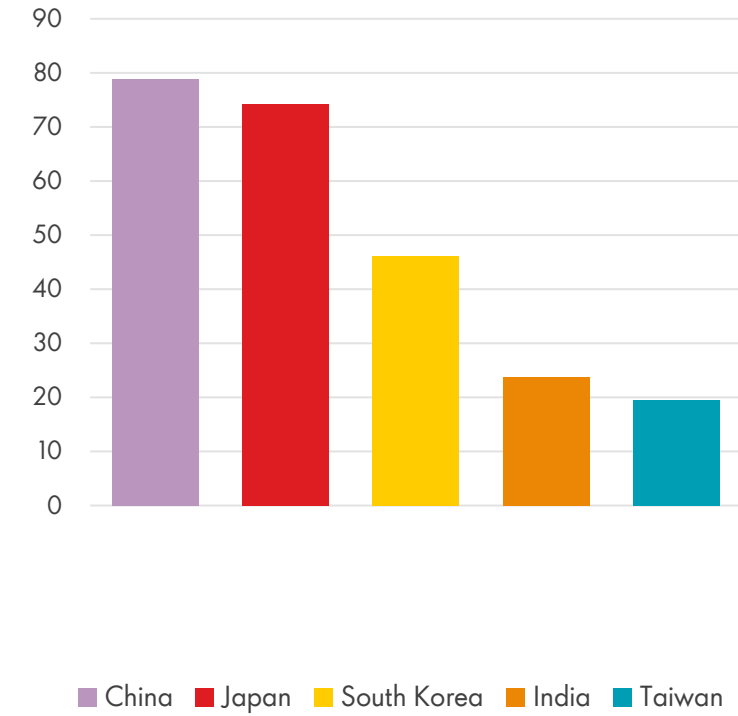
Net LNG imports 2021 y-o-y

MT



Top LNG importers 2021

MT

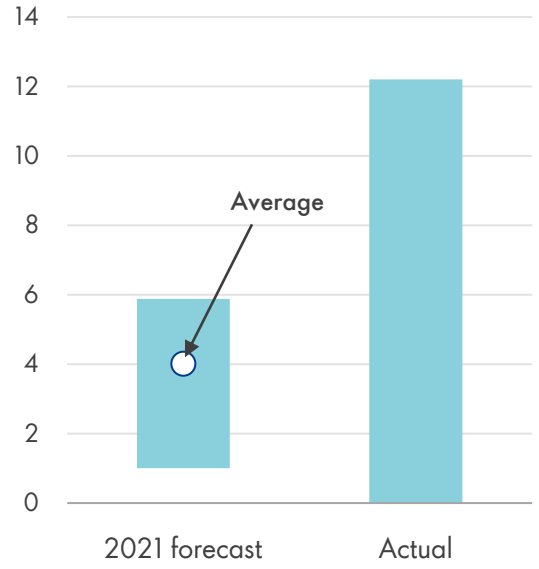


Shell interpretation of Kpler & customs 2021 data

Economic recovery post COVID-19 lockdowns leads to 18% LNG import growth in China

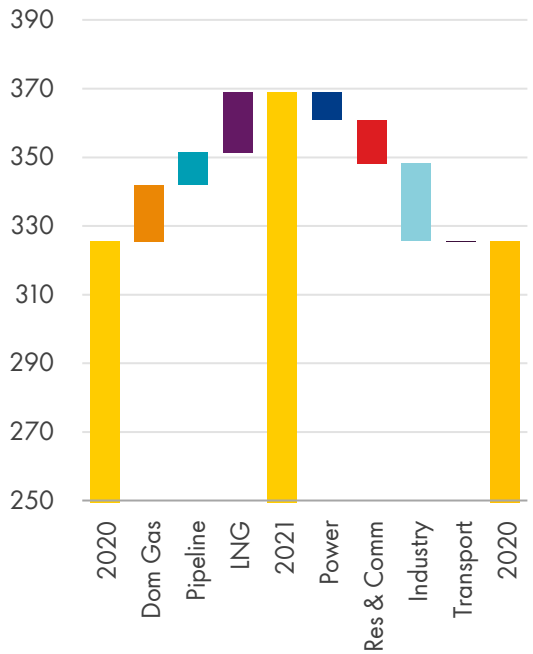
LNG demand growth

MT



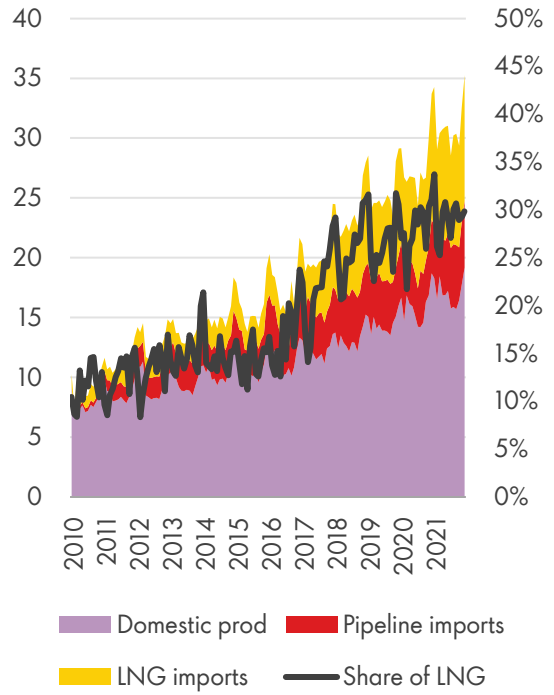
Gas supply & demand

BCM



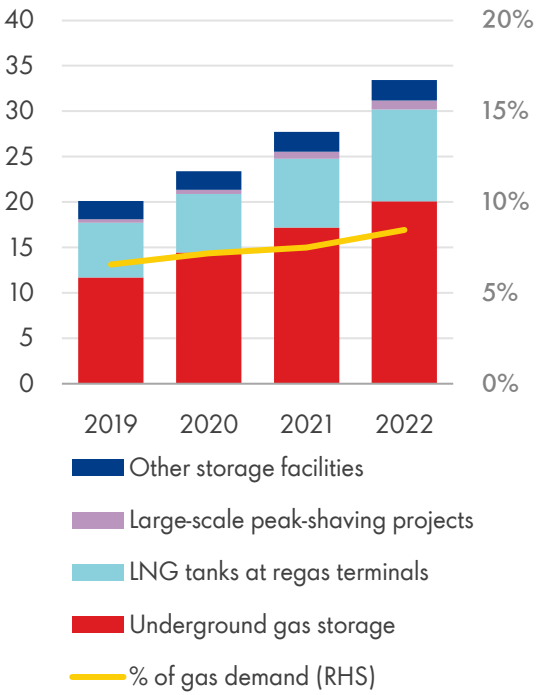
Gas production & imports

BCM



Gas storage capacity

BCM %

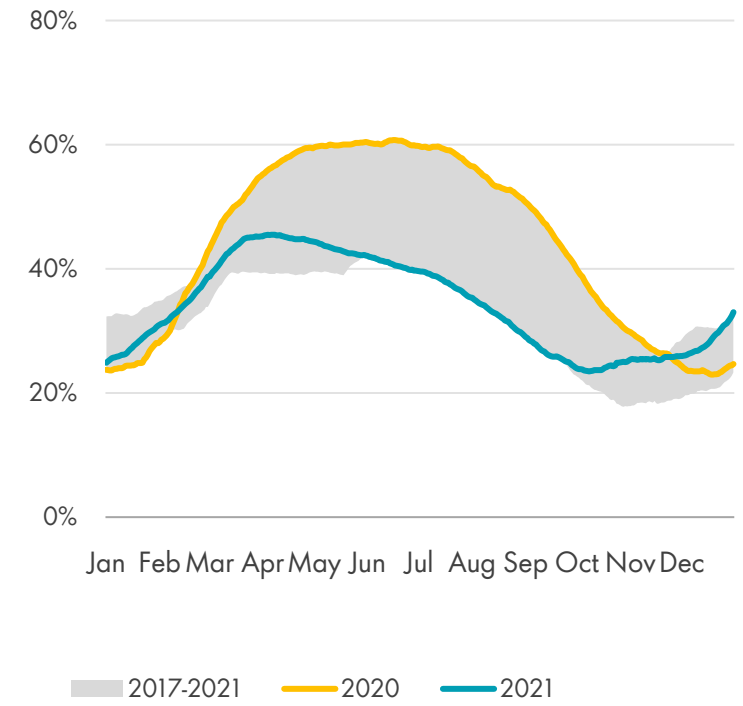


Source: Shell interpretation of GasTank, IHS Markit, Poten & Partners, Wood Mackenzie & China GAC 2020 and 2021 data

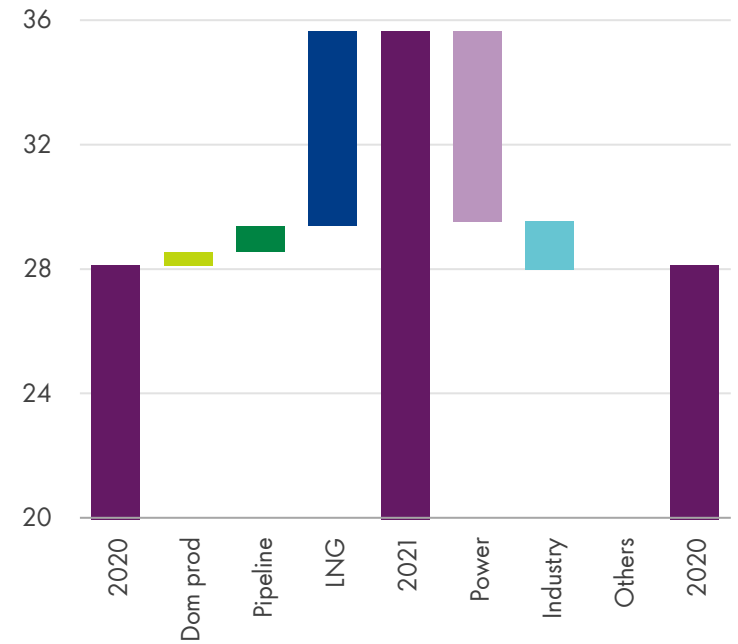
Brazilian LNG imports triple

Demand increases for gas-fired power as hydropower sources dry up

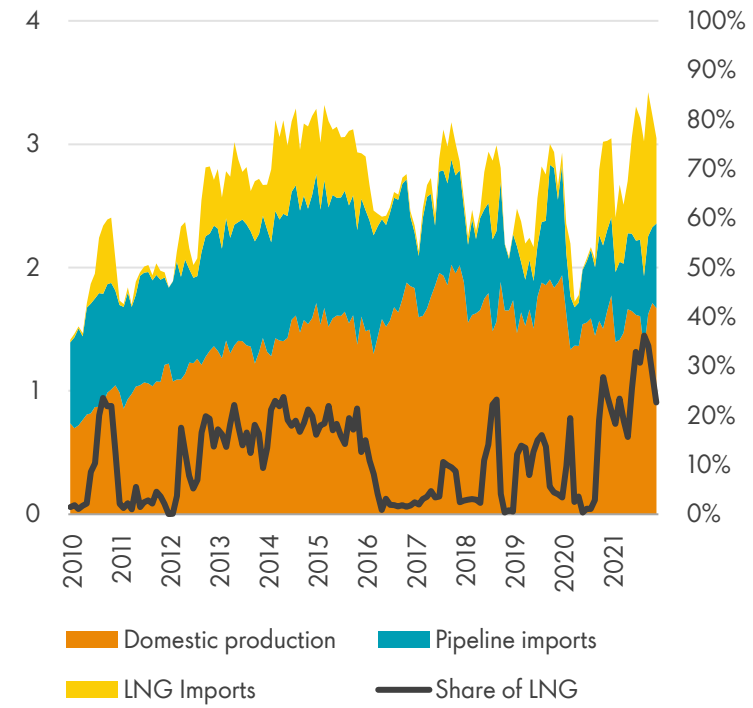
Reservoir fill



Brazil gas supply & demand



Brazil gas production & imports



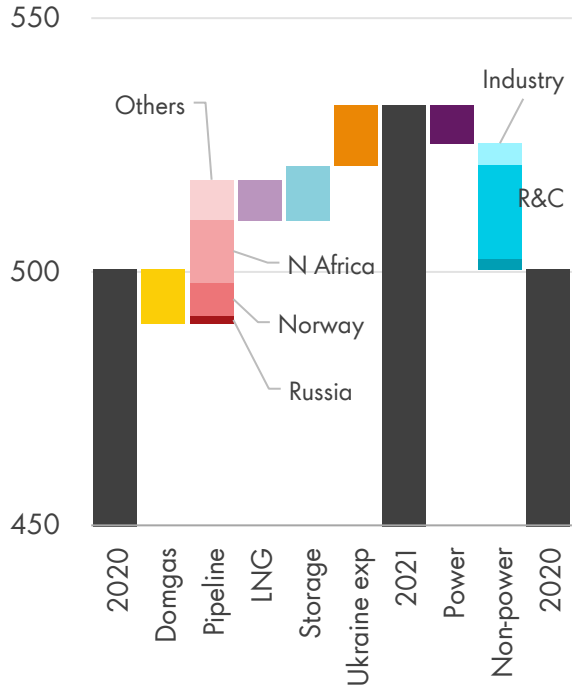
Sources: Shell interpretation of ONS, ANP, MME, Wood Mackenzie and Kpler 2021 data

Note: Reservoir level is weighted average

Extended winter, economic rebound and gas supply constraints kept European gas storage at historical lows

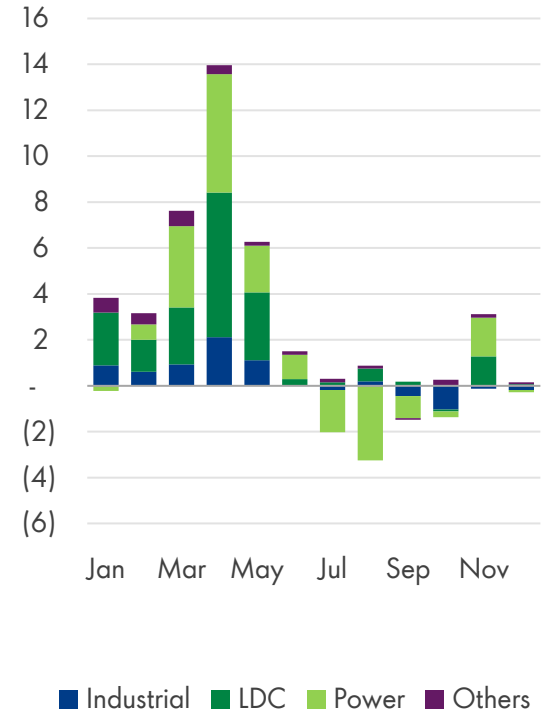
Gas demand & supply*

BCM



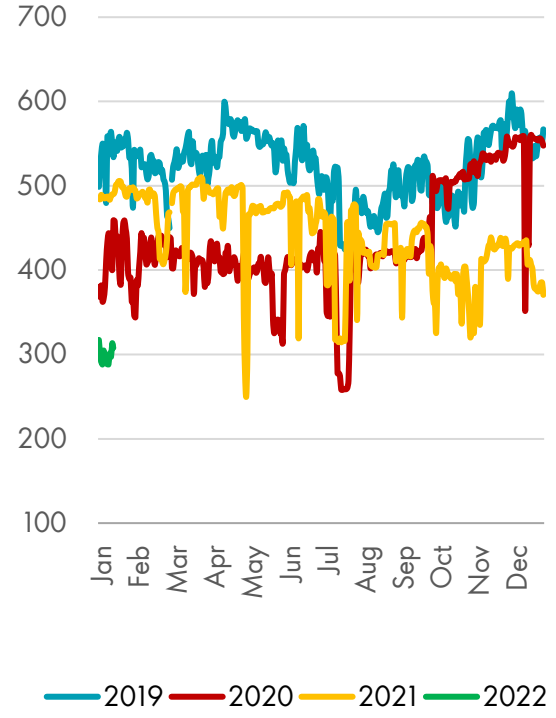
Gas demand y-o-y change*

BCM



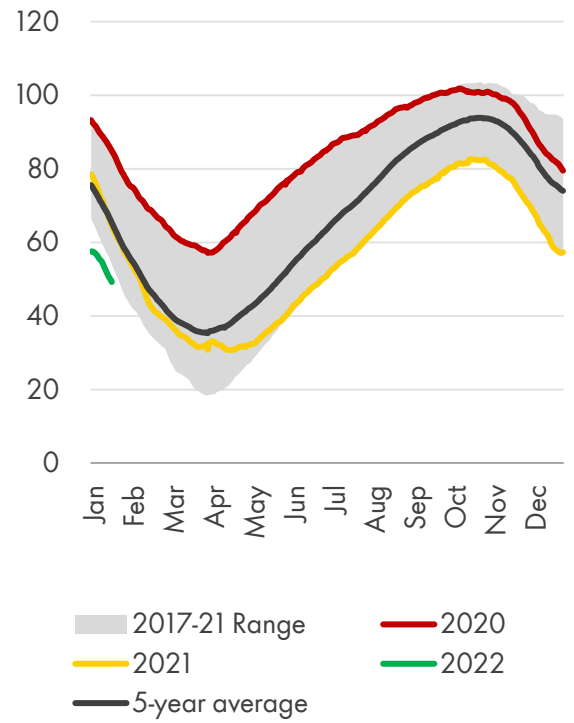
Russian pipeline supply

MMCM/d



Inventory level**

BCM



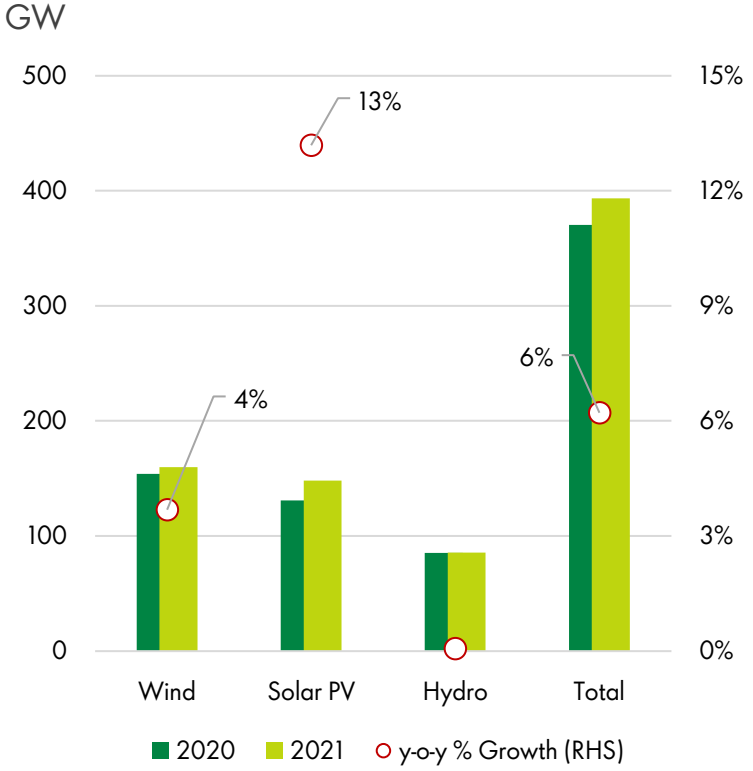
Shell interpretation of Wood Mackenzie, ENTSO-G and GIE 2021 data
* Europe 34 ** EU 27+UK

LDC: Local Distribution Company

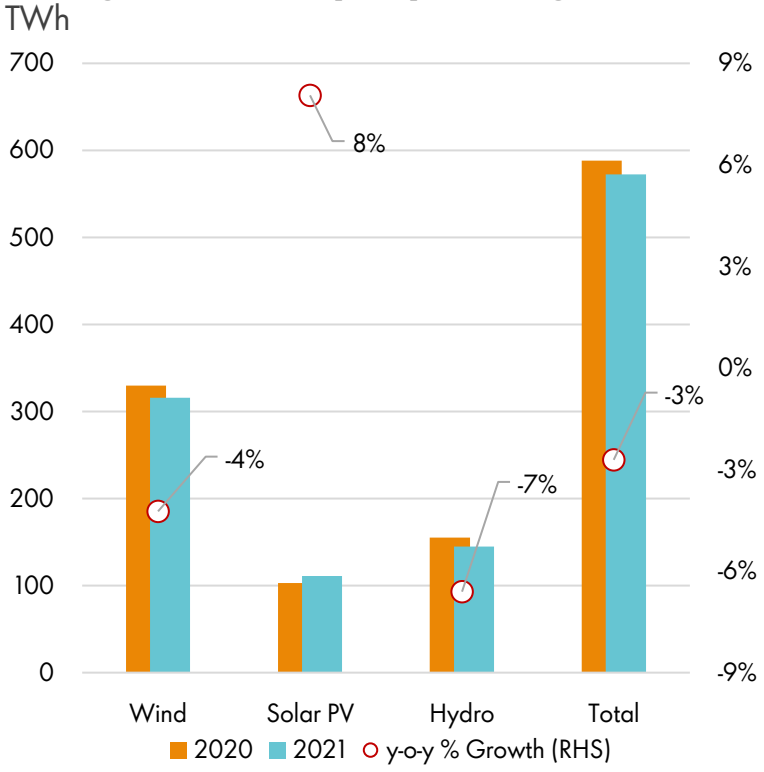
1 BCM = ~10.47 TWh

Renewable generation across Europe* declines despite increased installed capacity in 2021

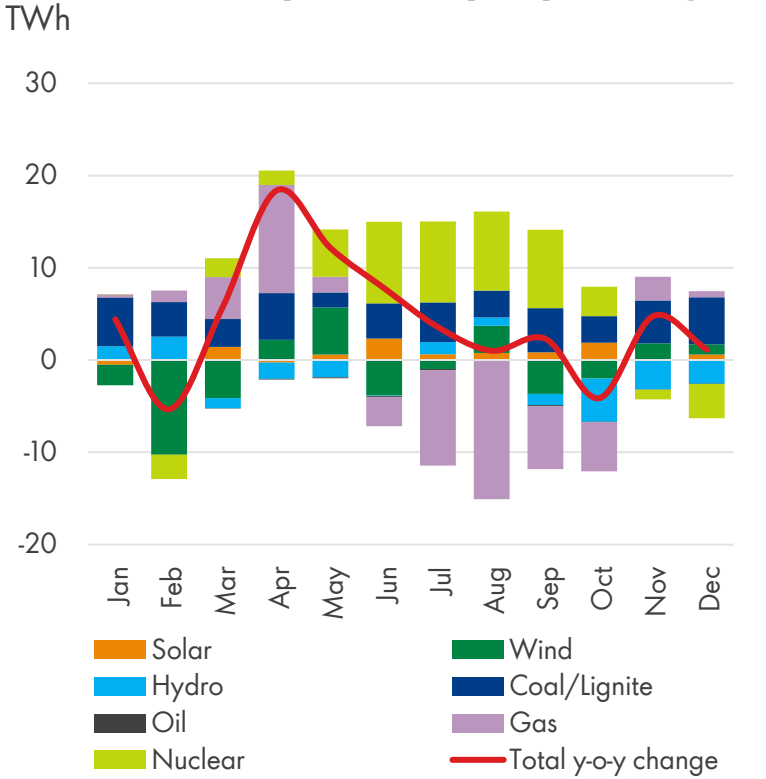
RES capacity y-o-y change



RES generation y-o-y change



Generation by source y-o-y change

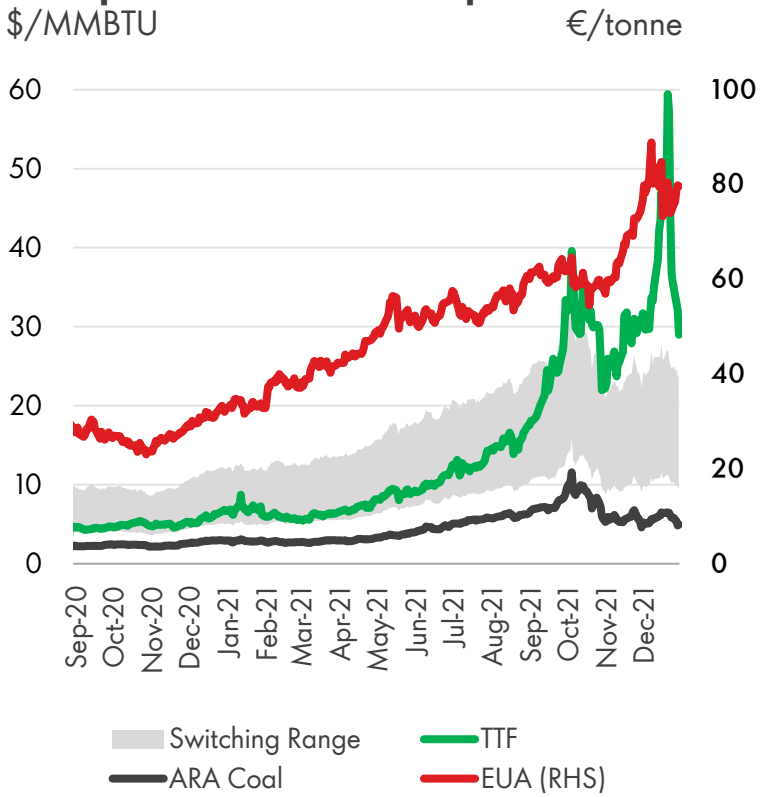


Source: Shell interpretation of Global Data TSOs / ENTSO-E 2021 data

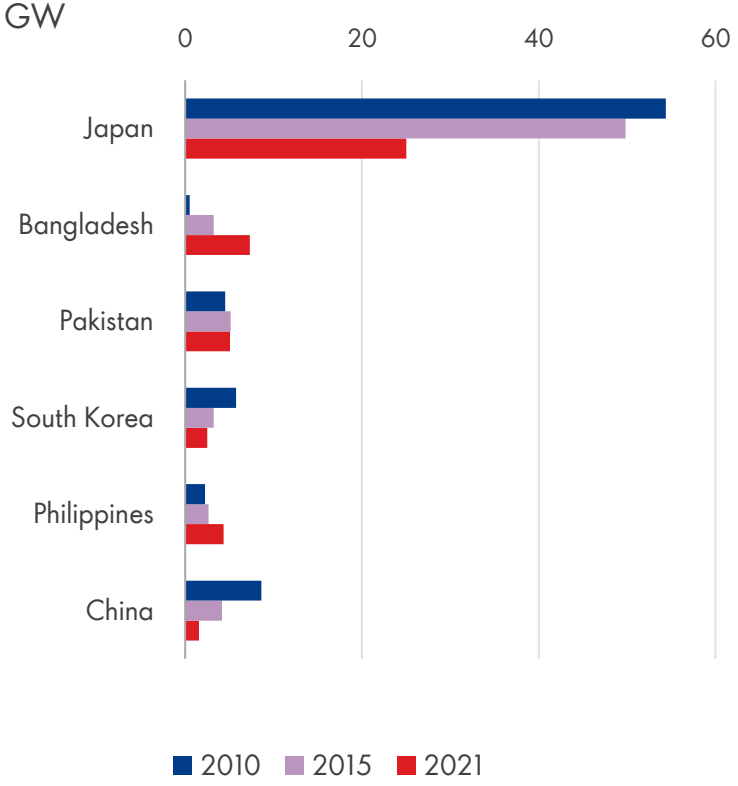
*EU7: DE, NL, ES, FR, BE, IT + UK

Gas in Europe at the centre of a pressured energy complex

Europe coal & carbon price

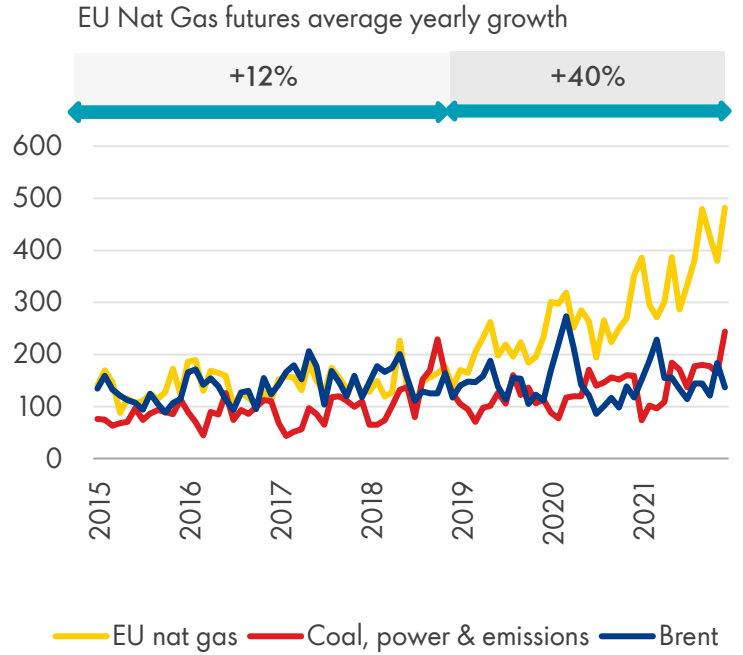


Oil-fired capacity



ICE Futures exchange data only – (excludes OTC)

Number of lots (base 2014*)



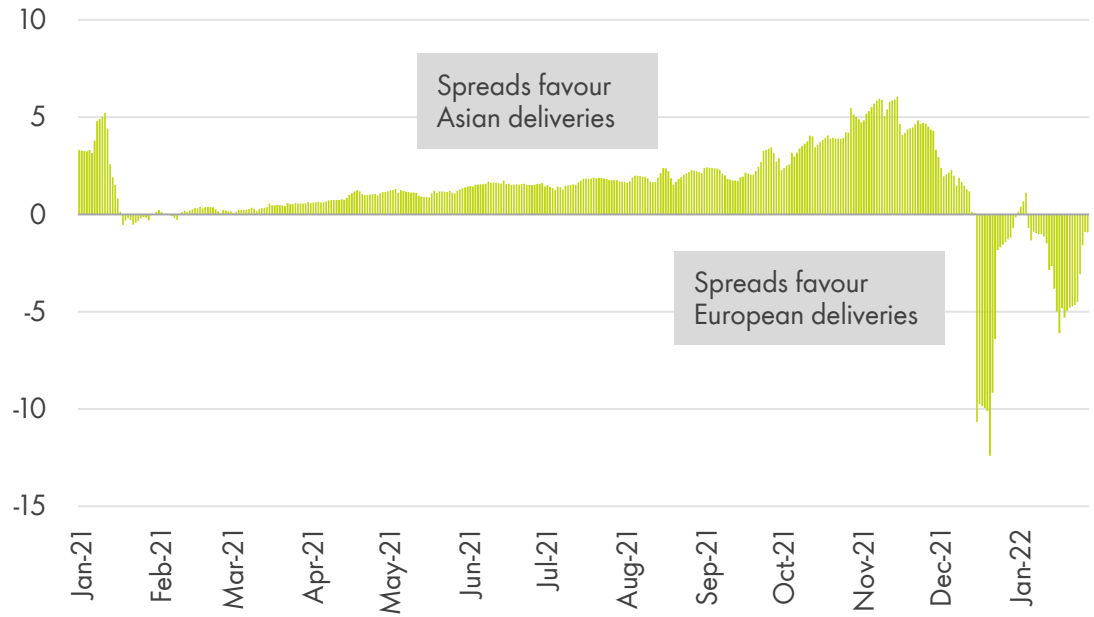
Source: Shell interpretation of Global Data and ICE 2021 data

Y-axis reflects change in monthly traded volumes vs volumes traded in the same month of the year 2014 (= 100)

Europe became the preferred destination for LNG only towards the end of 2021

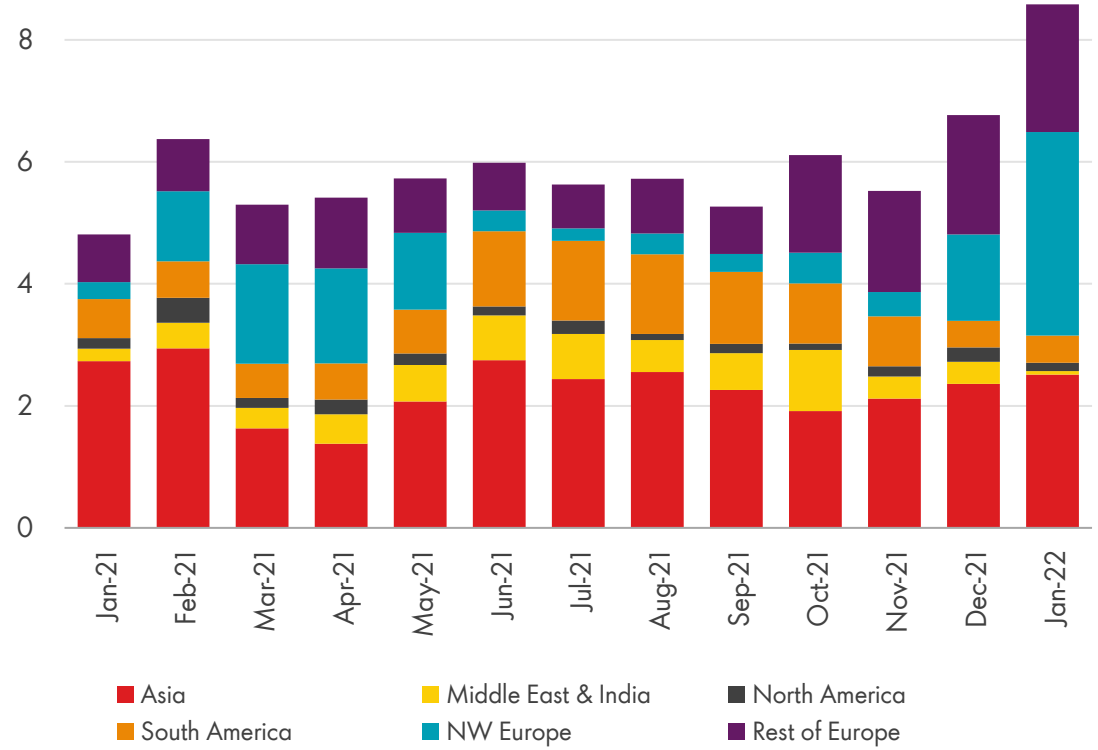
JKM/TTF spreads

$/MMBTU



LNG imports from US

MT (DES)

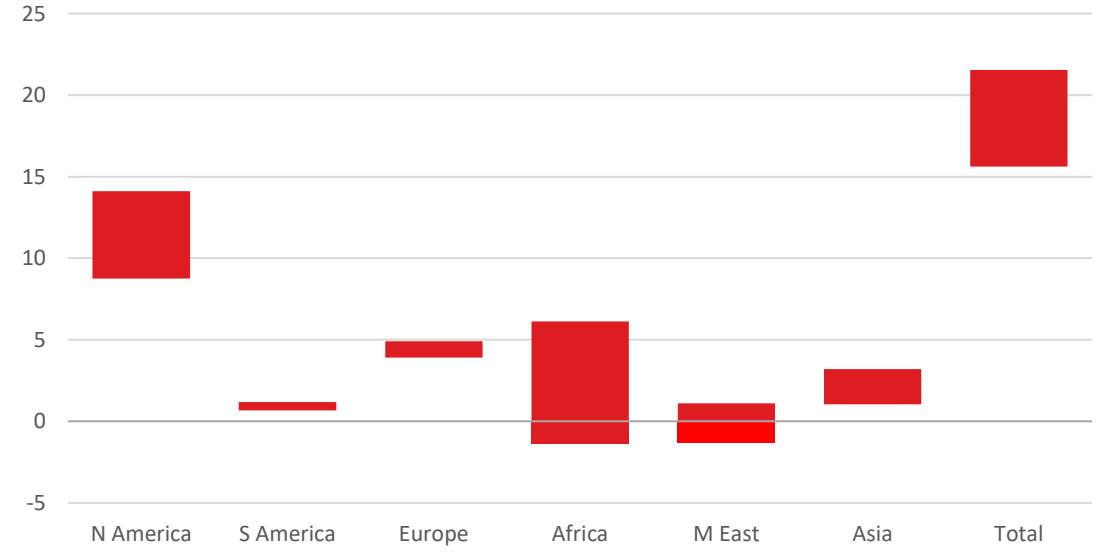


Source: Shell interpretation of ICE, Kpler & Customs 2021 data

Asia expected to continue leading LNG demand growth in 2022

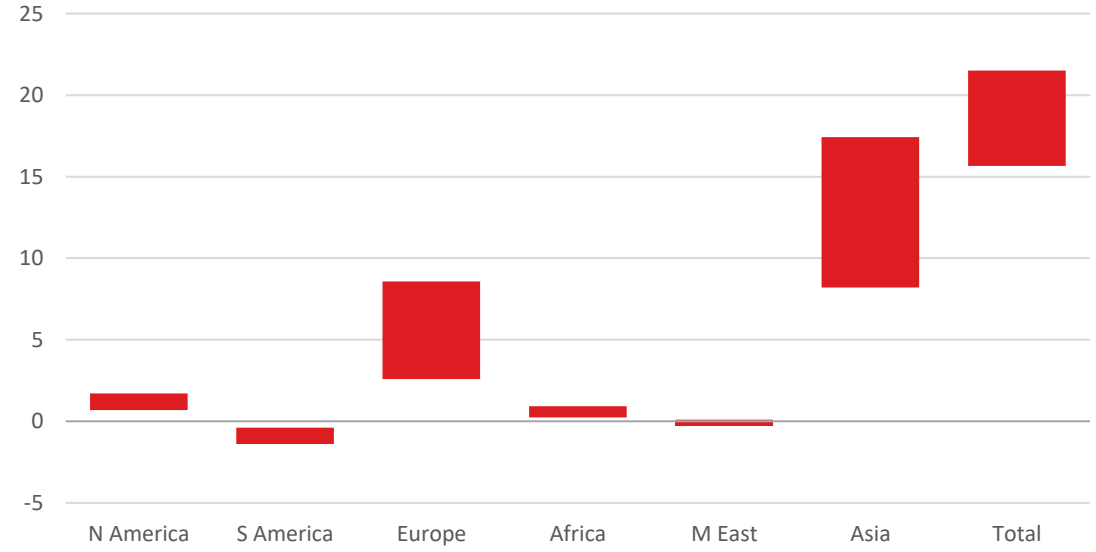
Forecast LNG supply growth 2022

MTPA



Forecast LNG demand growth 2022

MTPA



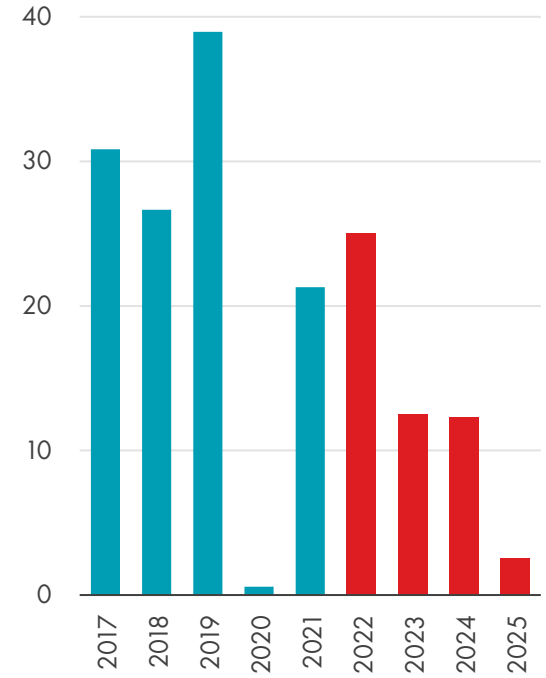
Source: Shell interpretation of Wood Mackenzie, IHS Markit and Poten & Partners 2021 and 2022 data

03 Energy security, emissions and economic growth in Asia to drive future LNG demand

Expectations of a tight near-term global LNG market drives new contracting

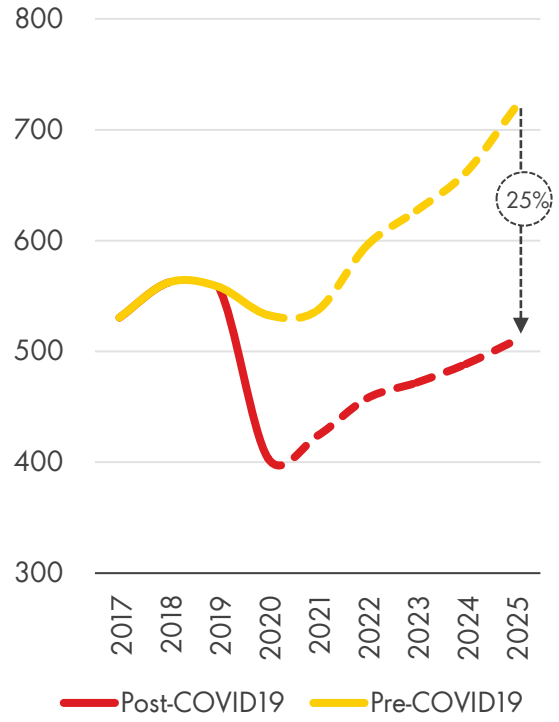
Global LNG supply growth

MT



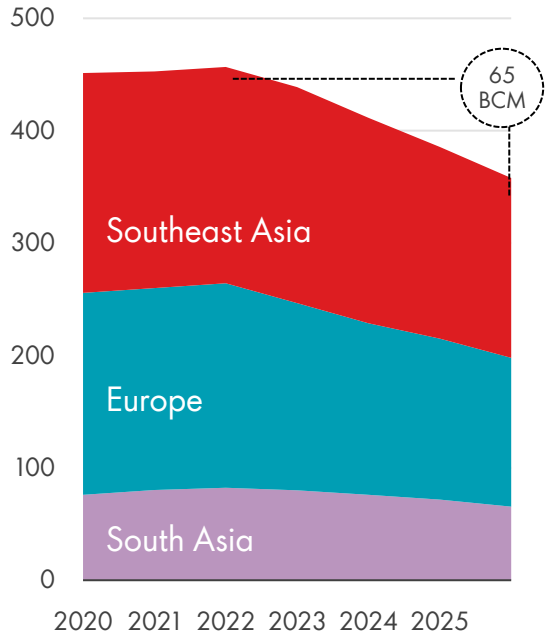
Global upstream capex

$billion



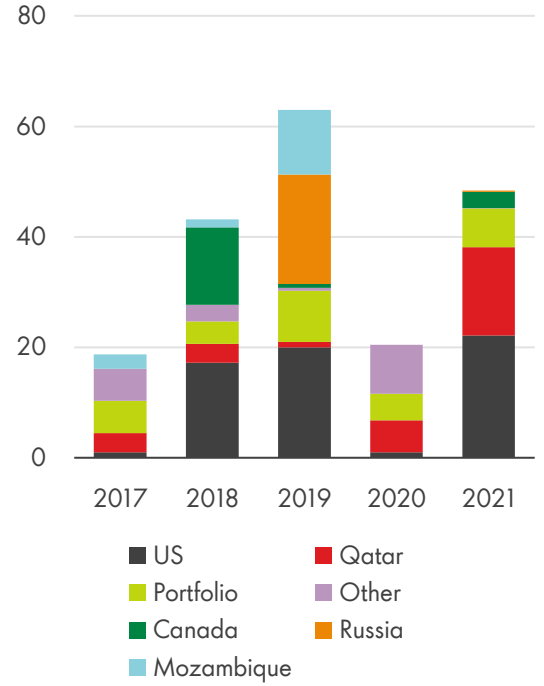
Domestic gas production

BCM



Term contracts for new liquefaction projects

MTPA



Source: Shell interpretation of Wood Mackenzie and Rystad 2021 data

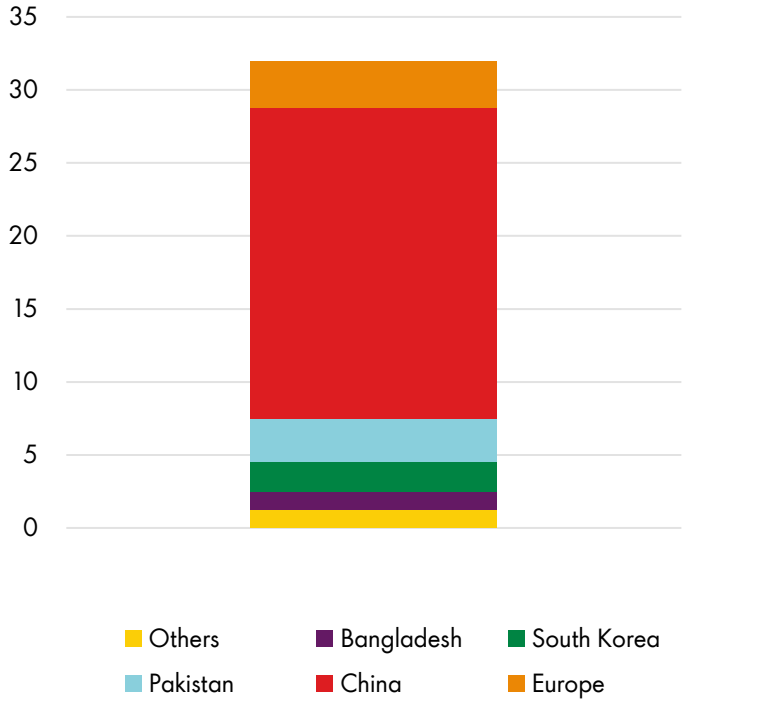
Excludes Heads of Agreement

China dominates term contracting last year

>20 million tonnes of LNG supply secured for coming decades

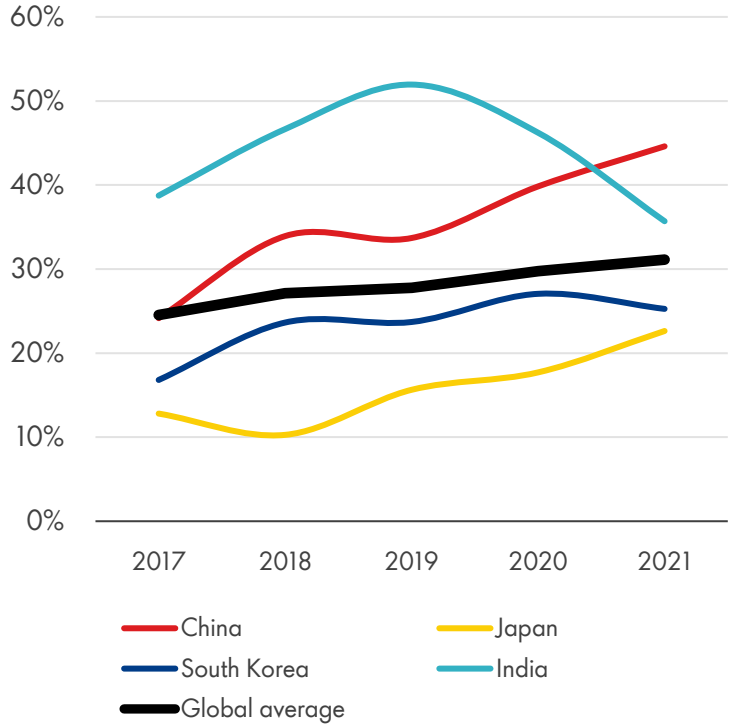
2021 new term contracts by importer

MTPA

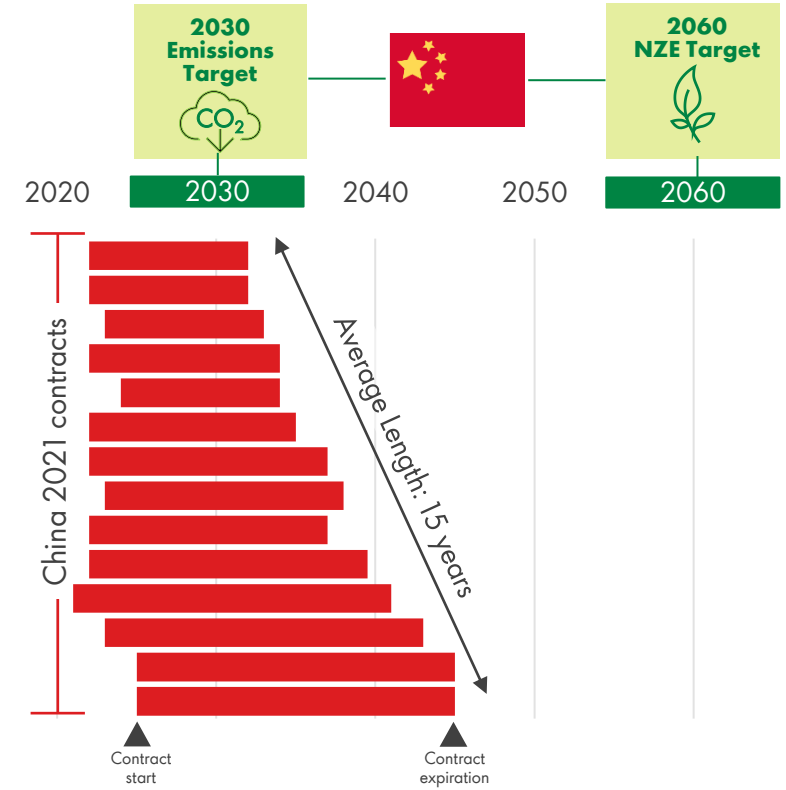


Spot purchases as % of imports

Spot as % of total



2021 China LNG contract lengths



Source: Shell interpretation of Wood Mackenzie and IHS Markit 2021 data

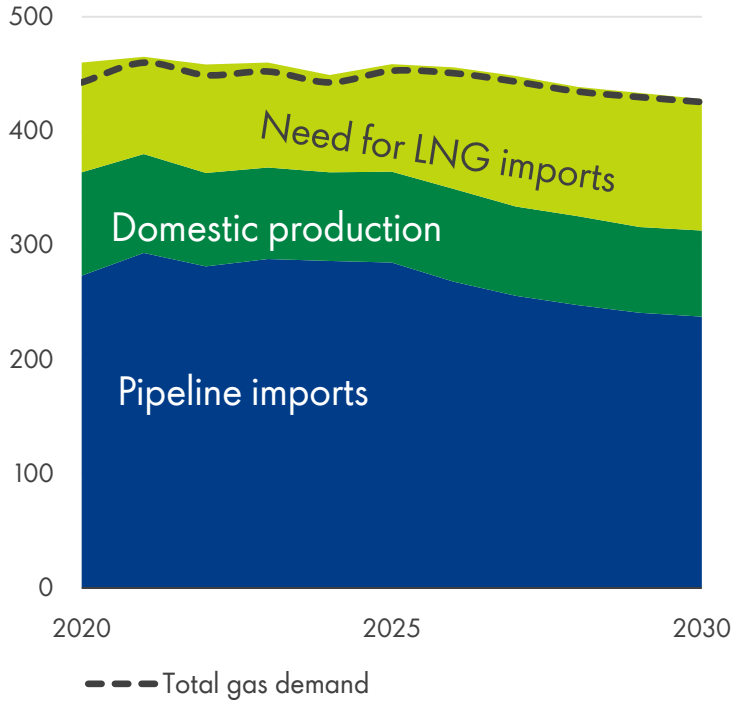
Excludes "portfolio" contracts that have no defined import market & excludes Heads of Agreement

Excludes Heads of Agreement

European * gas fundamentals point to continued exposure to price volatility

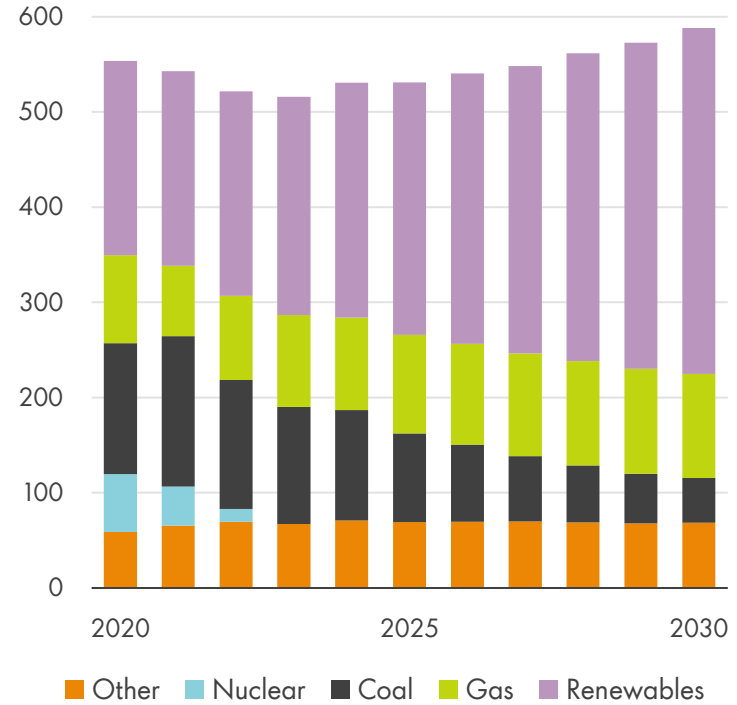
Europe gas balance

BCM



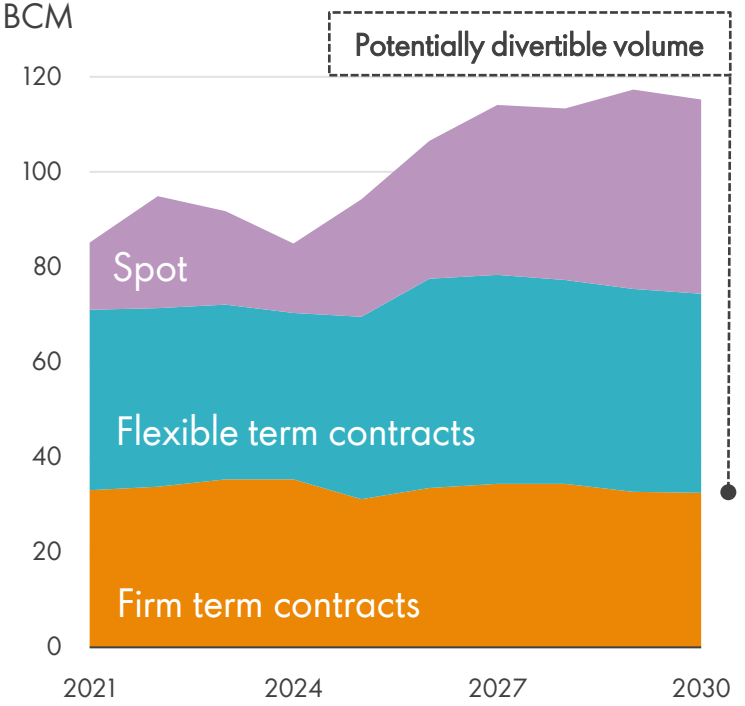
Germany power generation

TWh



Europe LNG supply contracts

BCM



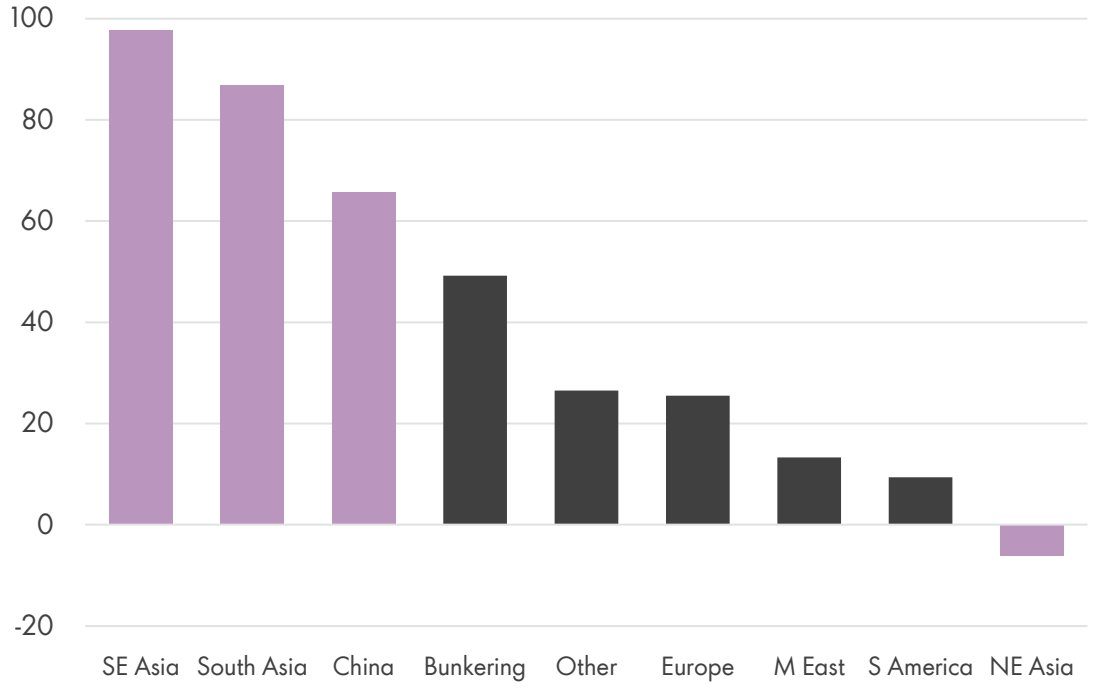
Source: Shell interpretation of IHS Markit and Wood Mackenzie 2021 data

* EU 27+UK

Expected rising demand for LNG in Asia requires investment in new supply

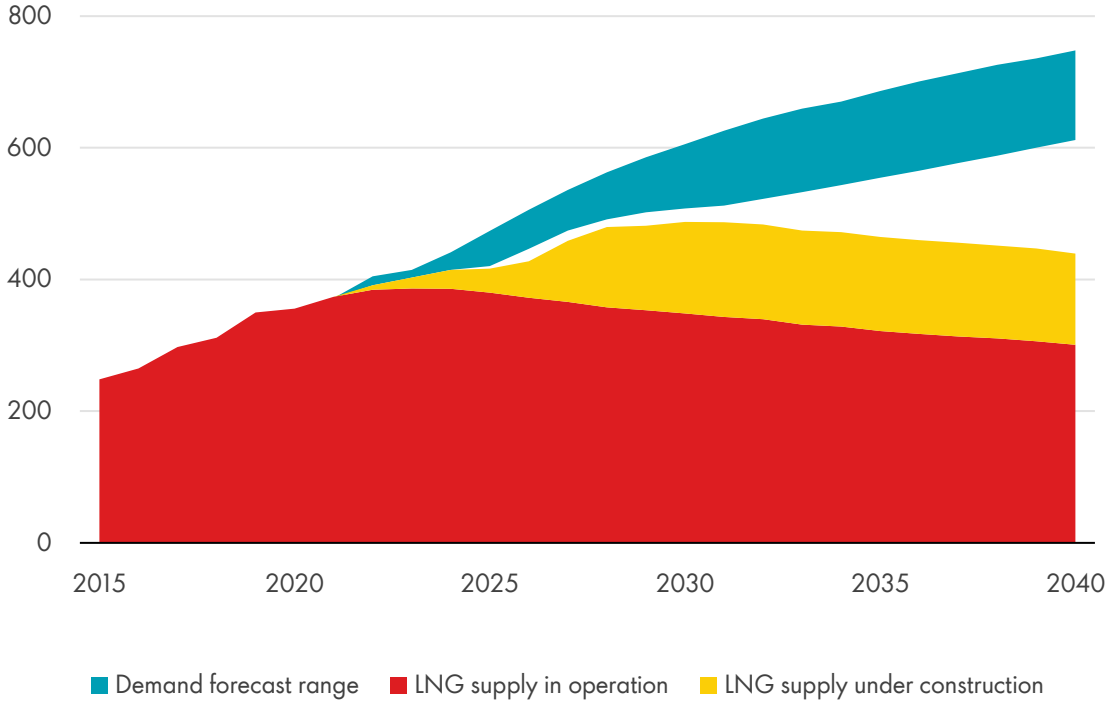
Incremental LNG demand 2020-2040

MT



LNG supply-demand gap

MTPA



Source: Shell interpretation of IHS Markit, Wood Mackenzie, FGE and Poten & Partners 2021 and 2022 data

Momentum builds in decarbonising the LNG value chain in 2021

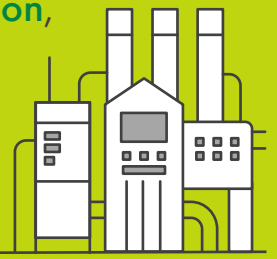
UPSTREAM > LIQUEFACTION > SHIPPING > REGASIFICATION > CONSUMPTION

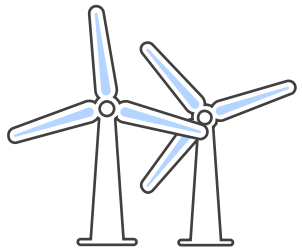
Carbon capture utilisation & storage (CCUS) projects planned with gas fields in **Indonesia** and **Malaysia**

Over **80%** increase in CCUS for gas with **63 MTPA** of new projects announced in 2021

CO_2

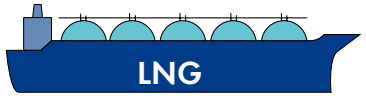
World's largest LNG liquefaction project under construction, North Field East, to feature CCUS and solar



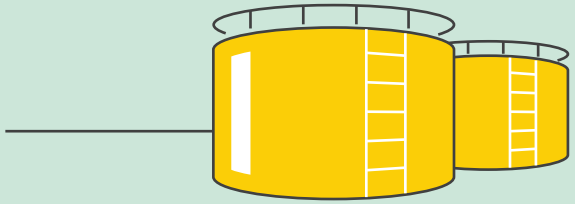


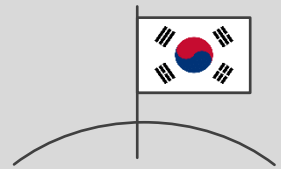
Pluto LNG and Cryogas-Vysotsk LNG share plans to use **renewable energy for liquefaction**

First commercial ME-GA low-speed, dual-fuel engines design for LNG carriers tested successfully



Agreement signed to begin pilot for **hydrogen blends into liquefaction** to reduce emissions from LNG





Liquid hydrogen plant using waste cold energy generated from regasifying LNG **to be built in South Korea**

Singapore LNG Regasification terminal goes solar

~30 LNG cargoes **offset with carbon credits** in 2021

GIIGNL establishes an MRV & GHG neutral LNG framework for the industry

15 **15 Japanese companies** form alliance to promote and improve processes for offsetting carbon emissions from LNG

Source: Shell interpretation of published announcements 2021

Summary

Natural gas plays a significant role in progressing NZE ambitions

- 88% of global emissions now covered by net-zero ambitions
- Switching to gas can significantly lower emissions: switching just 20% of coal-fired power in Asia to gas can potentially save 680 MTPA of CO_2
- Multiple energy scenarios have a role for natural gas
- Asian gas demand to drive future LNG growth

2021 showed fragility and interdependence of the energy system

- With historically low inventory levels, European gas price exceeded Asian LNG price to pull cargoes into Europe to meet winter gas demand
- LNG demand rebounded following the lifting of pandemic lockdowns – 21 MT growth
- China became largest LNG importer
- US LNG export growth offsets supply constraints elsewhere

Energy security, emissions and economic growth in Asia to drive future LNG demand

- With limited new supply growth expected in the near term, LNG contracting rebounded in 2021
- China dominated contracting activity last year, securing more than 20 MTPA of term supply
- European gas fundamentals point to continued exposure to price volatility
- Longer term, expected future Asian LNG demand growth requires investment in new supply
- Momentum builds in decarbonising the LNG value chain in 2021