



# Shell LNG

Outlook 2020



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# 01

Seoul



# 02

Nigeria LNG



# 03

LNG-powered cruise ship

### Gas continues to provide more and cleaner energy solutions

The last decade has seen rapid growth in energy demand and corresponding greenhouse gas emissions which have created the need for more and cleaner energy options. A combination of new policy, favourable economics and partnership with renewables is driving the momentum for coal-to-gas switching.

### 2019 was a year of record LNG supply growth

2019 saw record LNG supply growth as the recent wave of new LNG liquefaction projects nears completion. Most of this growth was absorbed by Europe. Year-on-year growth in Asian imports slowed from highs of 2017 and 2018, but Asia still remains a growth region. Increased liquidity, new spot trading mechanisms and a wider variety of indices being used for long-term contracts point towards LNG becoming an increasingly flexible commodity.

### Record supply investment due to confidence in long-term LNG demand growth

2019 was also a year of record final investment decisions (FIDs), with 71 million tonnes of new capacity being sanctioned, indicating belief in long-term LNG demand. Increasing uncontracted and flexible supply is set to offer more options for customers in the future.

## Overview

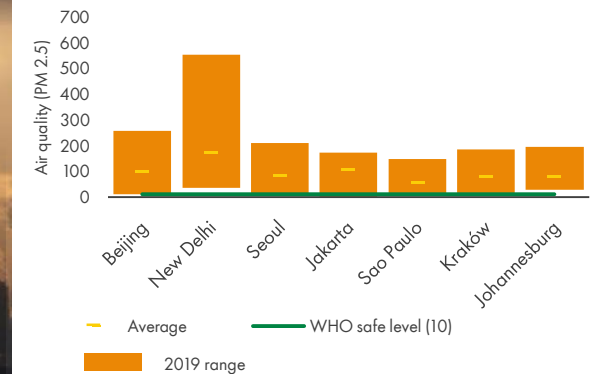
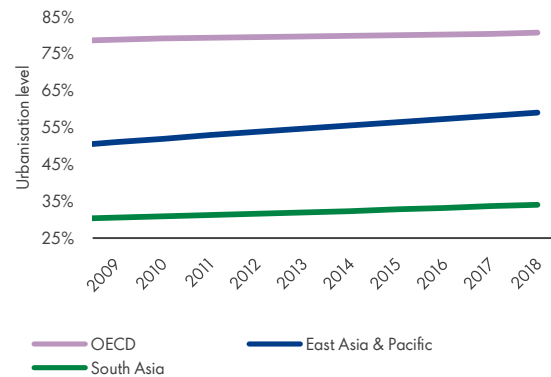
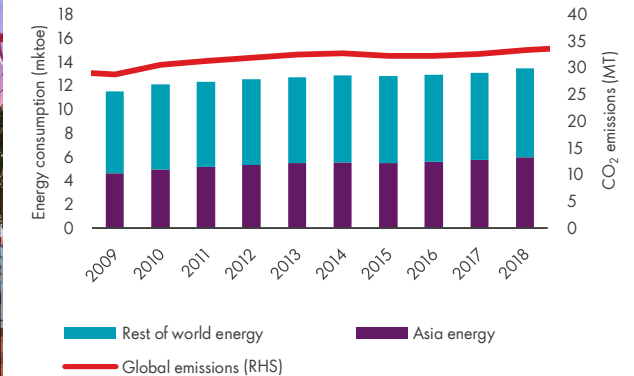
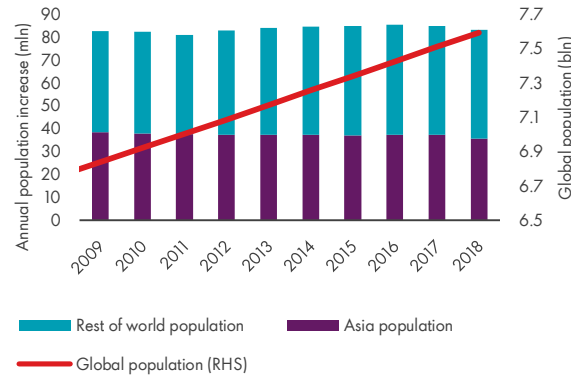


01

Queensland Curtis LNG

# Gas continues to provide more and cleaner energy solutions

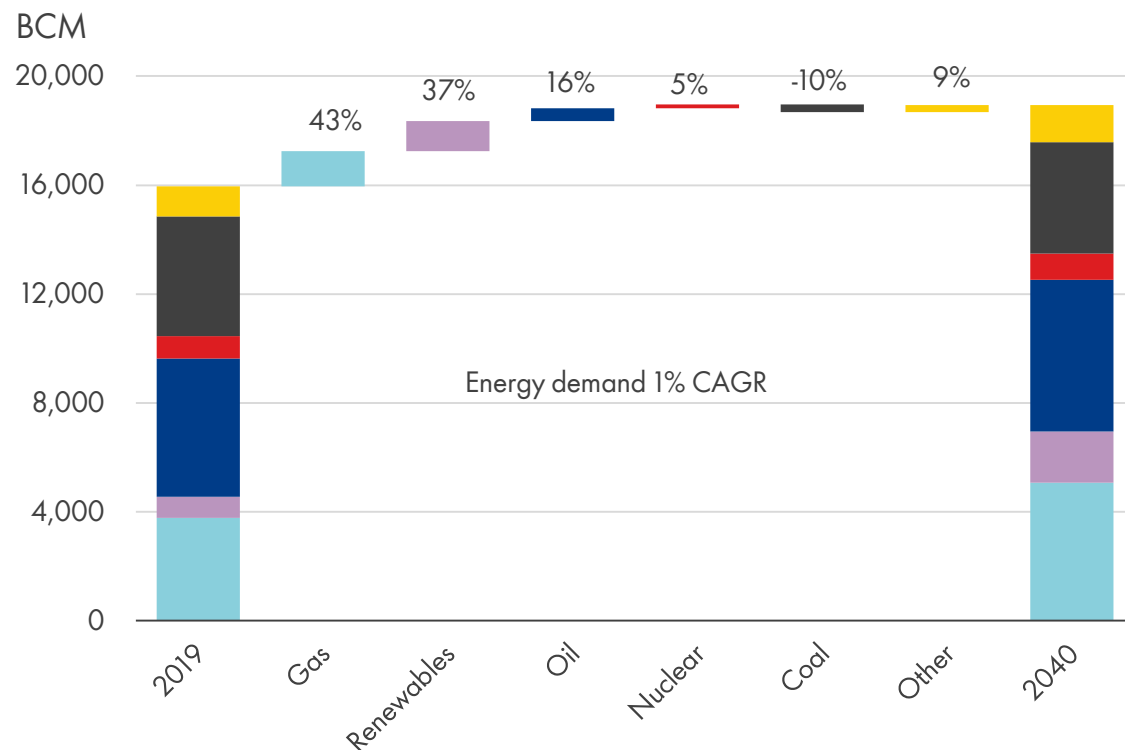
# Growing population and rising living standards drive demand for energy with lower emissions



Source: Shell's interpretation of Wood Mackenzie H1, World Bank, The World Air Quality Index 2019 data

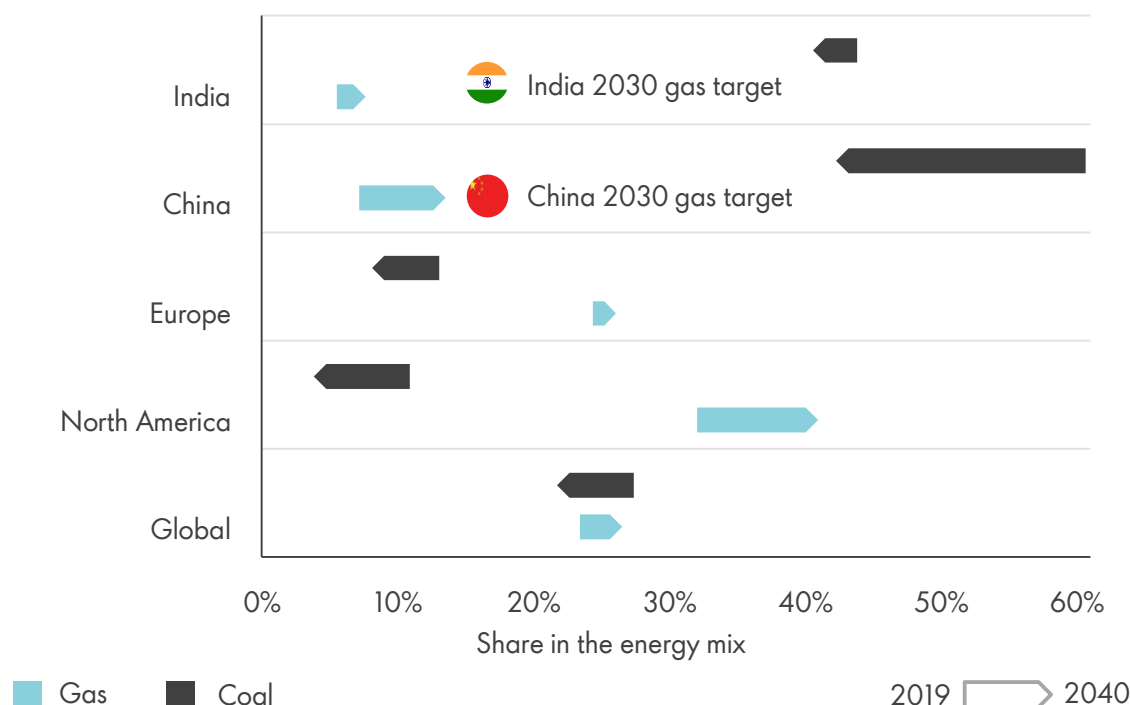
# Renewables and gas expected to replace coal in the global energy mix

## Global energy demand growth by fuel type



Source: Shell interpretation of Wood Mackenzie H1 2019 data CAGR - Compound annual growth rate

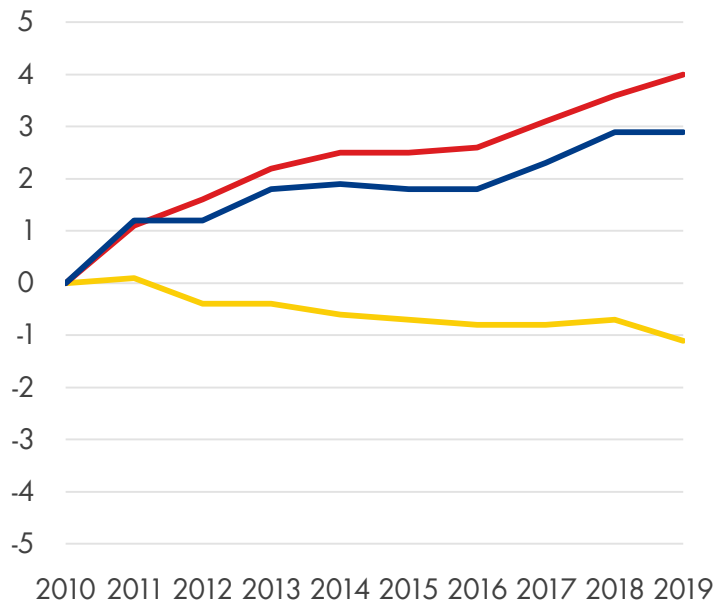
## Gas and coal share in the energy mix 2019-2040



# Coal-to-gas switching helping level global CO<sub>2</sub> emissions

## CO<sub>2</sub> change

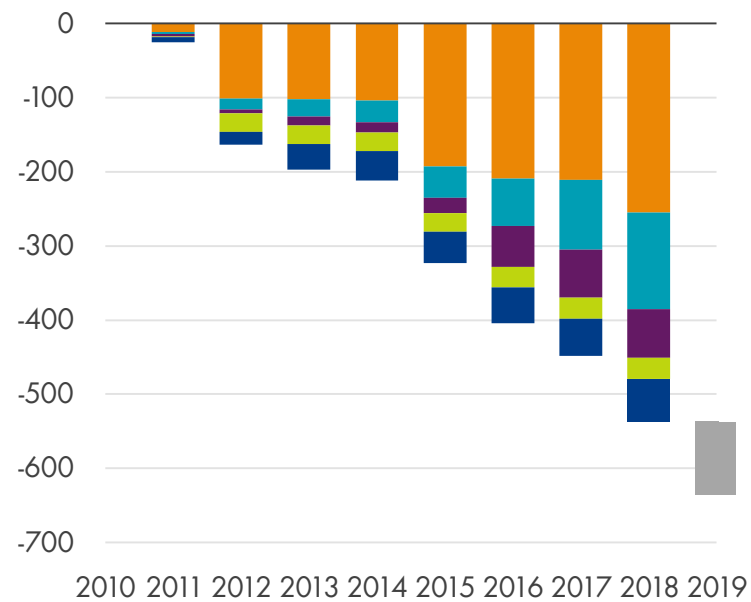
CO<sub>2</sub> GT, 2010=0



\*Advanced economies Rest of world Global

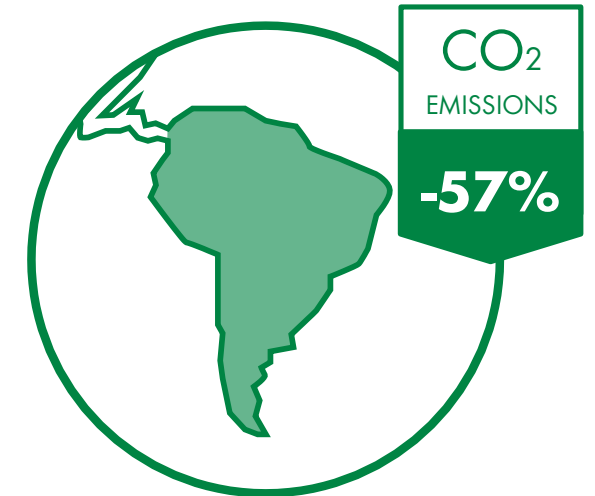
## Coal-to-gas switching CO<sub>2</sub> savings

CO<sub>2</sub> MT, 2010=0



United States China Europe  
India Rest of world Global\*\*

Equivalent to  
**over 50% of**  
**CO<sub>2</sub> emissions**  
from South America for a full year



Source: Shell interpretation of Wood Mackenzie, IEA World Energy Outlook, IEA Carbon Report 2019 data \*\*Power sector coal-to-gas switching in Advanced economies only

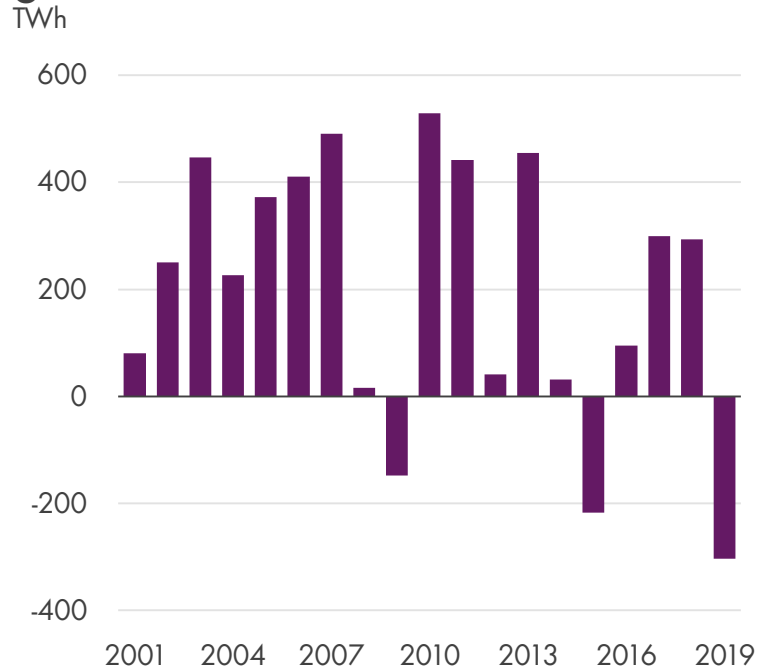
\*Advanced economies include United States, European Union, Australia, Canada, Chile, Iceland, Israel, Japan, South Korea, Mexico, Norway, New Zealand, Switzerland & Turkey



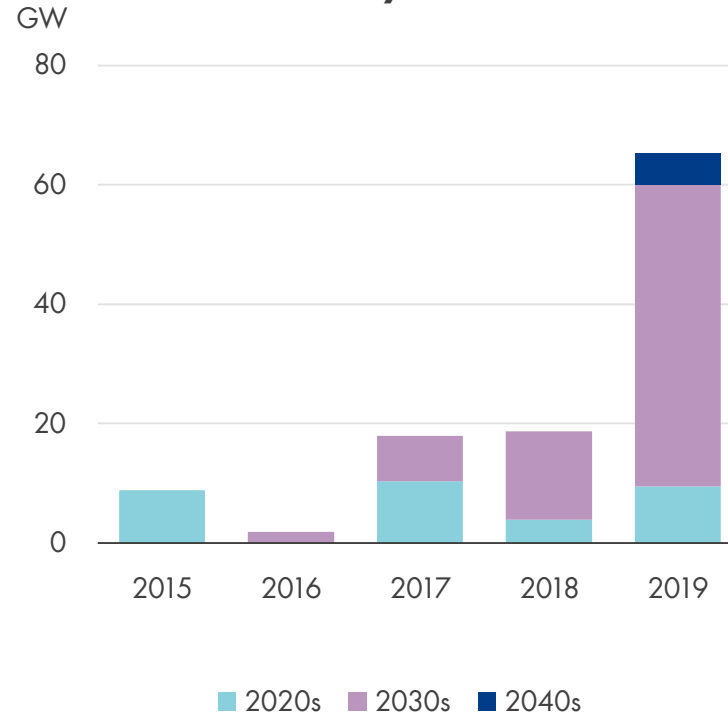
# Record coal phase-out and generation reduction in 2019

Opportunity for more displacement of coal in the power sector

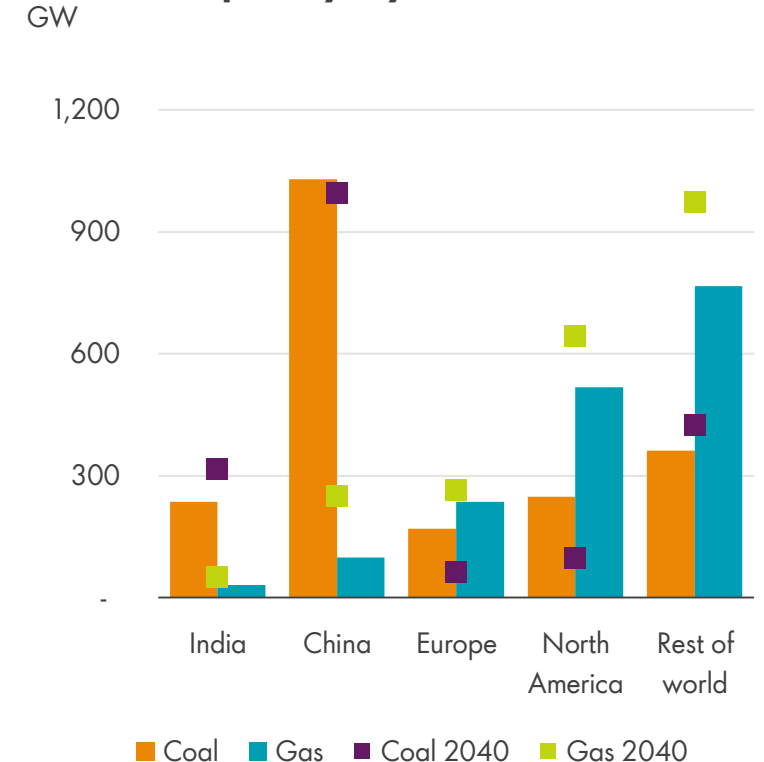
## Net change in global coal generation



## Global coal phase-out capacity announcements by date



## Power capacity by fuel



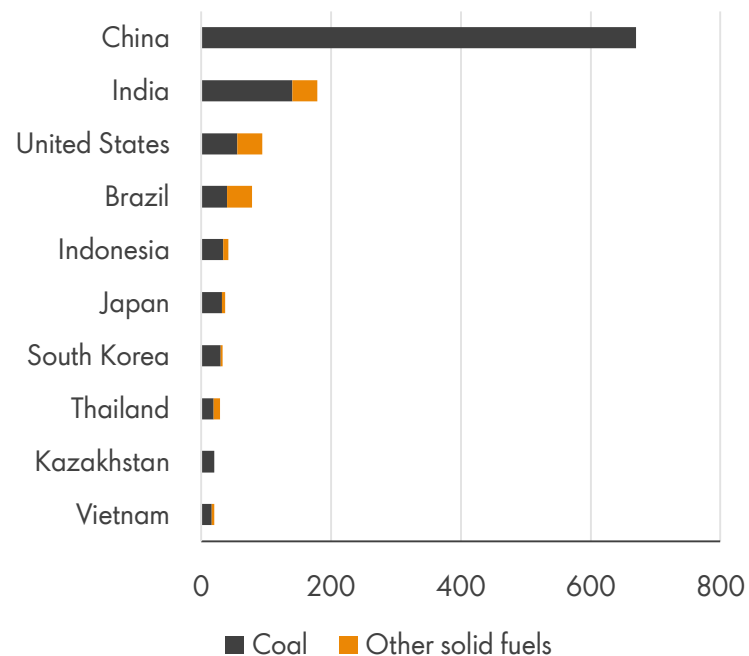
Source: Shell interpretation of national government policy announcements, Carbon Brief, Global Energy Monitor, GlobalData plc and Wood Mackenzie 2019 data



# Use of coal and other solid fuels outside the power sector also impacts air quality

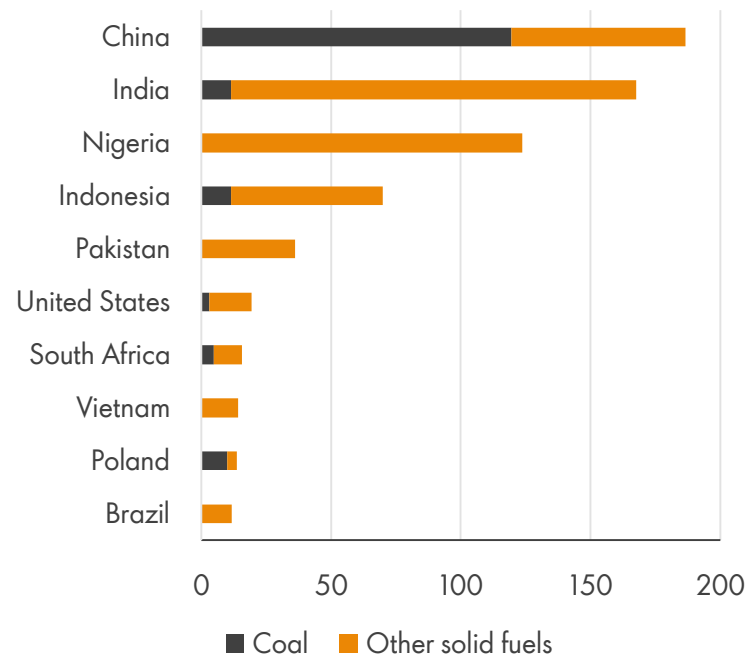
## Coal and solid fuel use in the industrial sector

BCMe

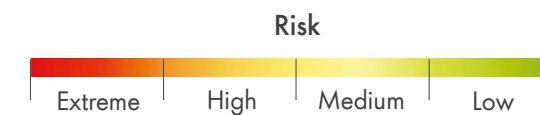
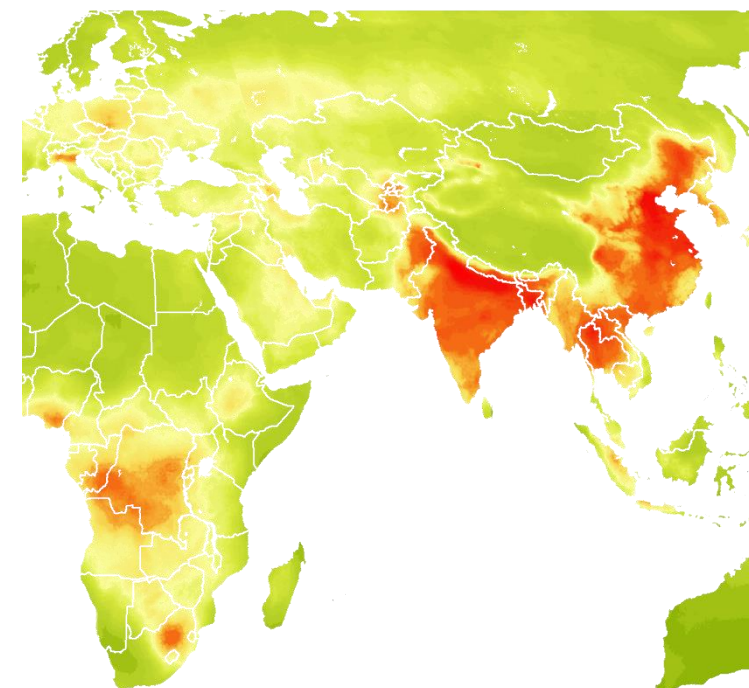


## Coal and solid fuel use in res & comm\* sector

BCMe



## Air quality index 2018



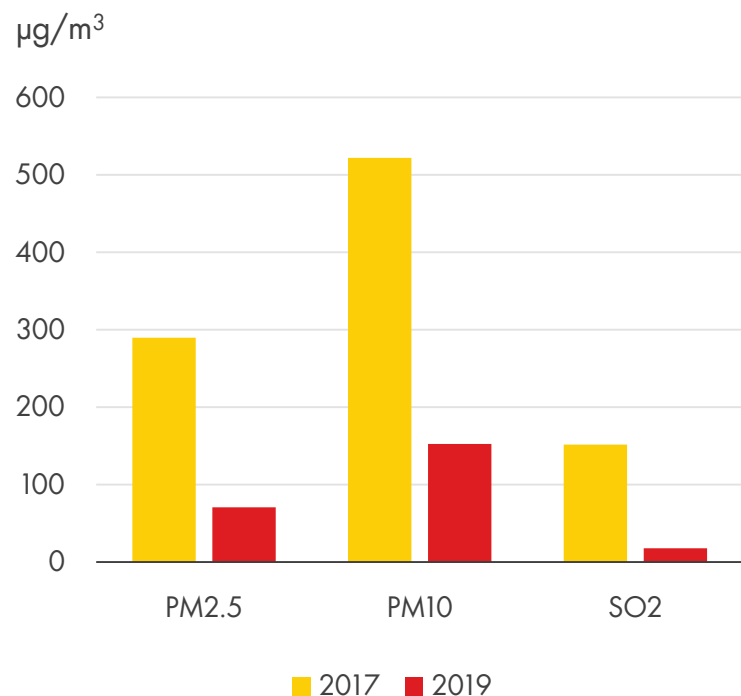
Source: Maplecroft 2018 and Shell interpretation of Wood Mackenzie data H1 2019

\*Res & comm: residential and commercial sector and also includes use in cooking and heating

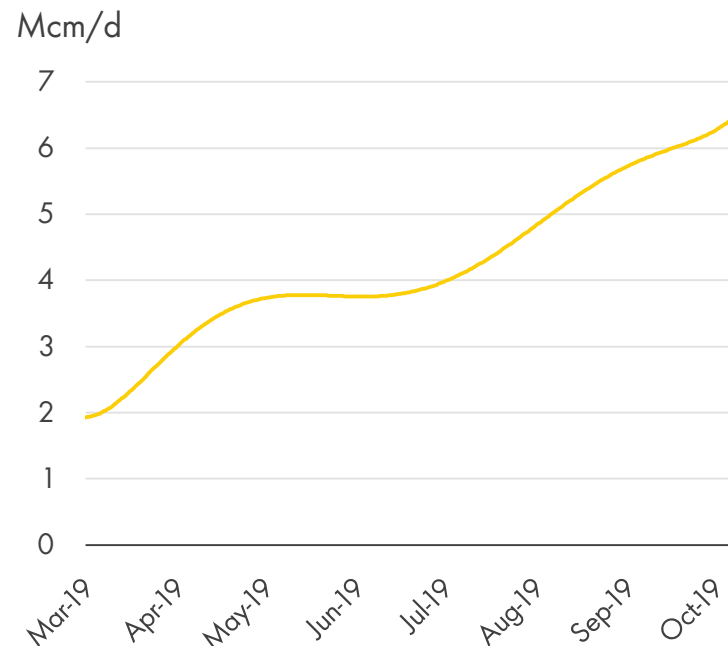
BCMe - Billion Cubic Metres equivalent

# Coal-to-gas switching in the industrial sector can improve air quality

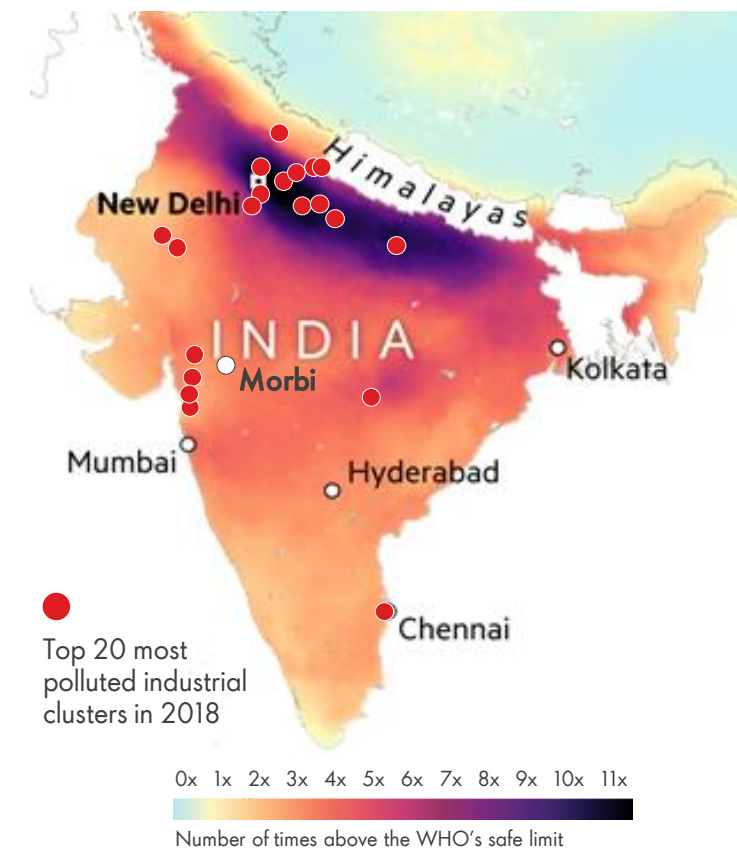
## Air quality levels in Morbi, Gujarat



## Gas demand post-ban on coal units in Morbi industrial sector in 2019



## Air quality in India

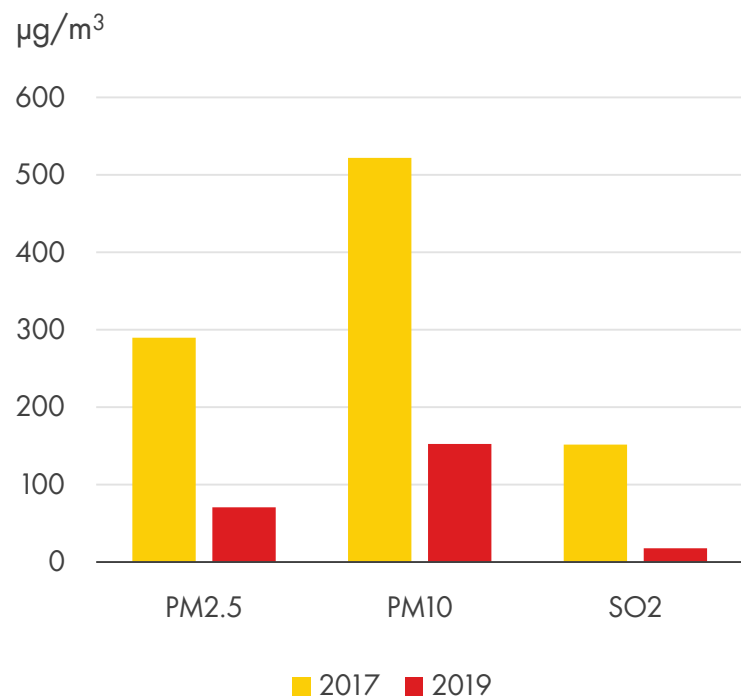


Source: Shell's interpretation of International Gas Union, Financial Times, Central Pollution Control Board (India) data 2018 and 2019

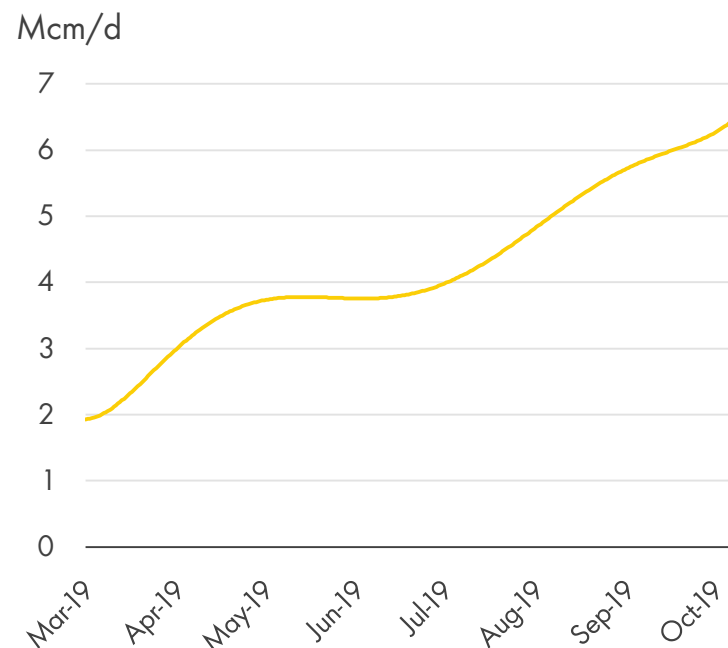
PM: particulate matter SO2: sulfur dioxide

# Coal-to-gas switching in the industrial sector can improve air quality

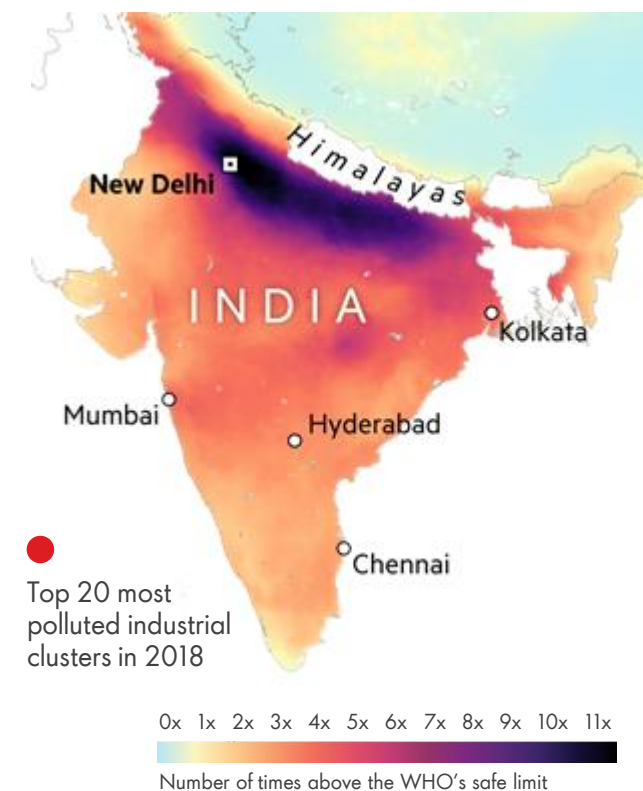
## Air quality levels in Morbi, Gujarat



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Source: Shell's interpretation of International Gas Union, Financial Times, Central Pollution Control Board (India) data 2018 and 2019

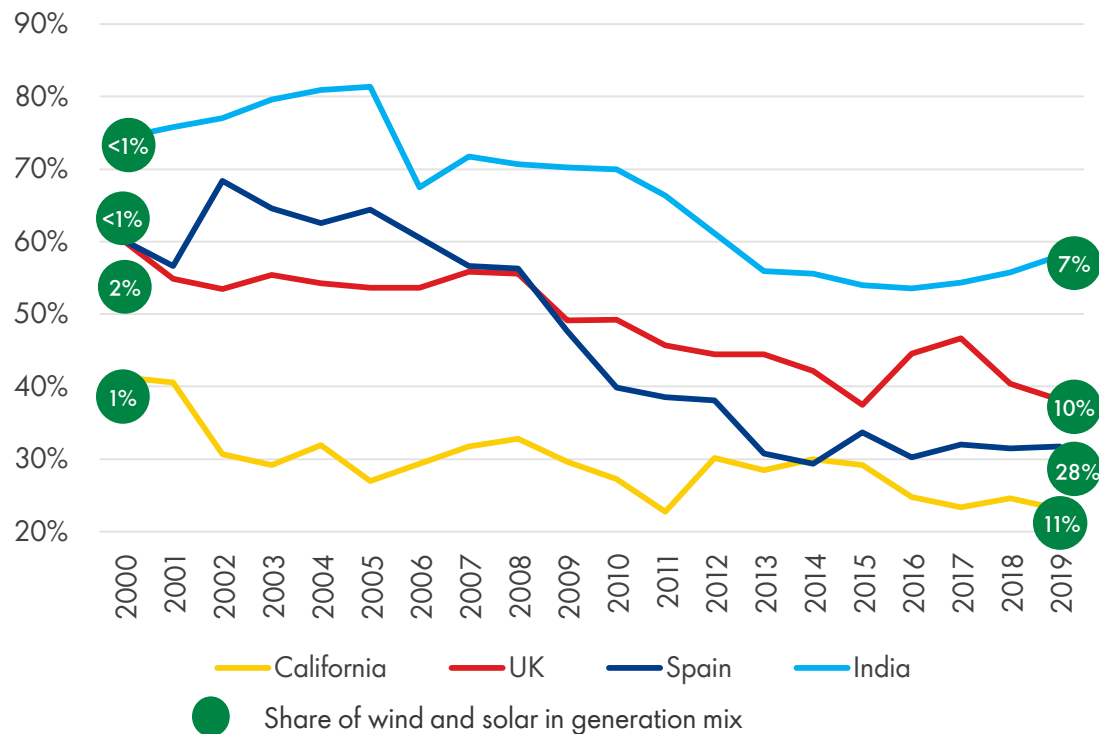
PM: particulate matter SO2: sulfur dioxide



# Growth of renewables favours gas in the power mix

## Average thermal load factors

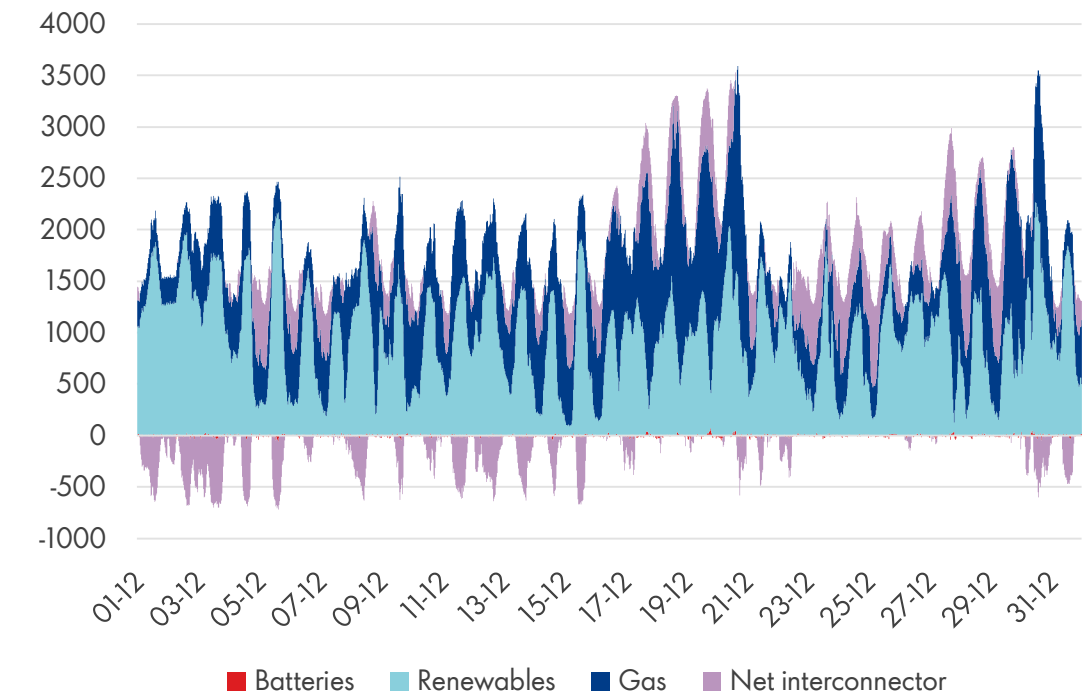
Thermal load factors



Source: Shell interpretation of Wood Mackenzie H1, national data and OpenNEM 2019 data

## South Australia electricity supply December 2019

MW



# Challenges to the role of gas in the energy transition

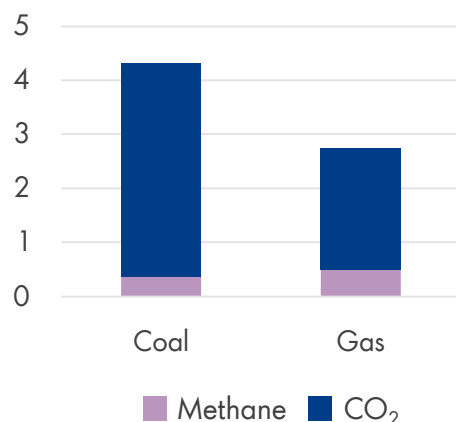
## Industry to address

### Methane emissions

Need for improved measurement and reporting and continual reduction in methane emissions

#### Emissions from coal and gas

Tonnes of CO<sub>2</sub>e/toe

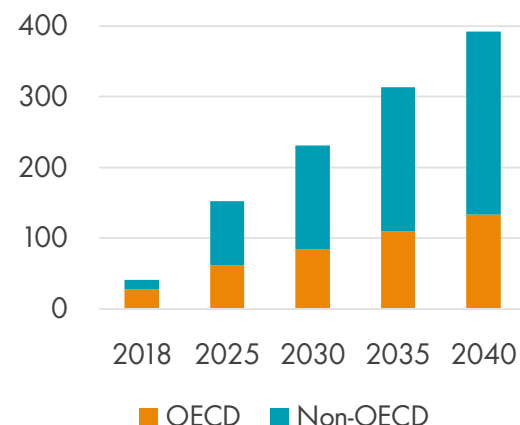


### Future pathways

Credible routes to deploy clean gas at scale such as carbon capture and storage (CCS) and biogas are needed

#### Biogas production

BCM



### Cost control

Need to drive cost reductions to make natural gas more affordable for customers, ensuring it remains highly competitive compared to other energy sources

### Policies

To accelerate change, governments need to introduce long-term policies that enable development of lower-carbon and renewable sources of energy, supported by technologies like CCS. Also, carbon-pricing mechanisms can help reduce emissions and encourage the use of cleaner sources of energy.

## Driven by influencers

### Public perception

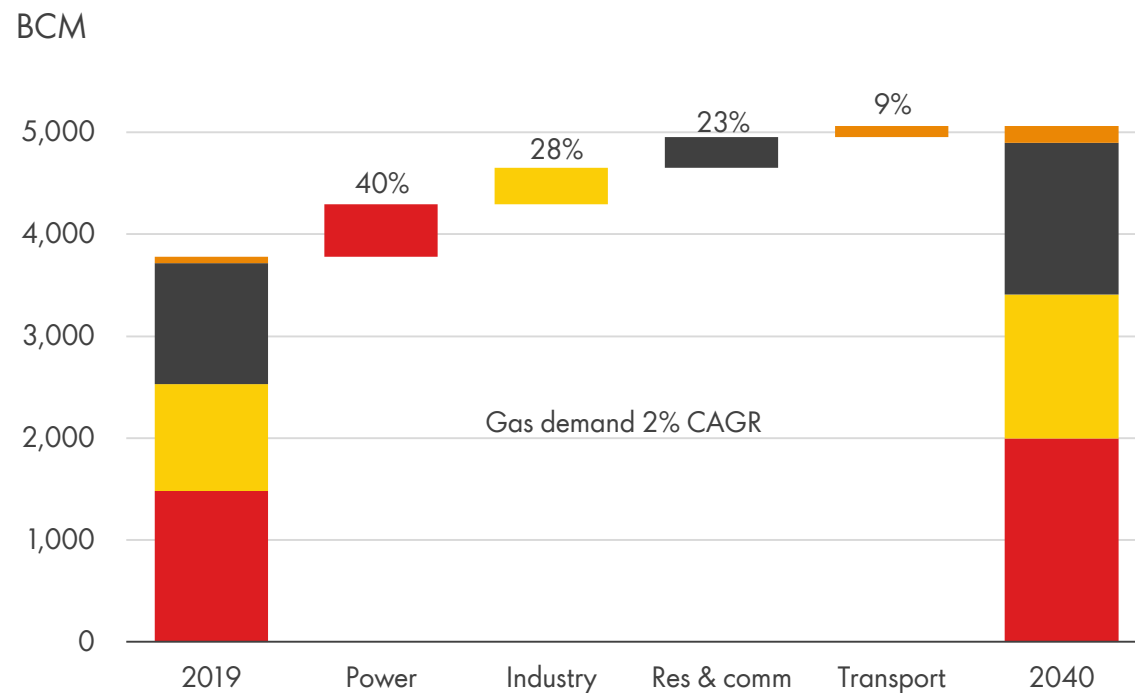
Gas faces a challenge from those arguing to remove all fossil fuels from the global energy mix. However, the supply of reliable energy cannot all be met by renewables - at least not yet.

Gas is a fuel for today and tomorrow. It can act as a partner for renewable sources to offer reliable, flexible and cost-effective access to more and cleaner energy at scale, and all stakeholders must work harder to ensure public support for gas to play its full role.

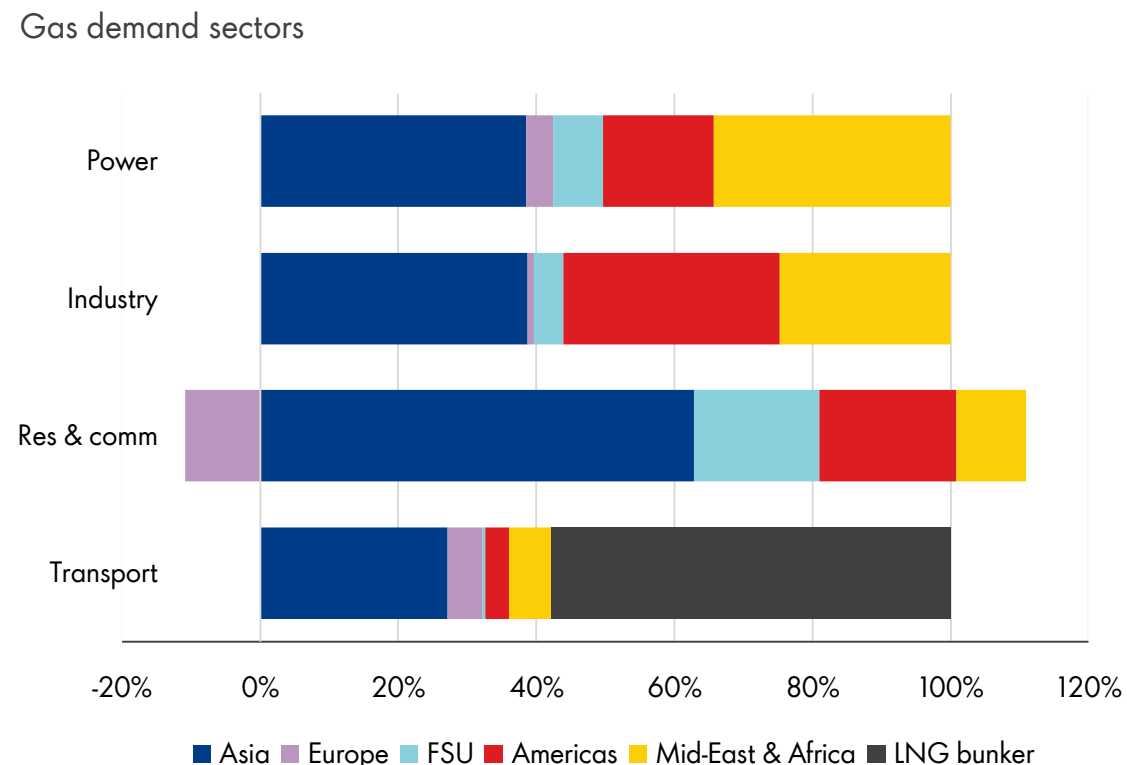
Source: Shell interpretation of IPCC Emissions factors and IEA World Energy Outlook data 2019

# Gas to play a key role in reducing emissions from hard-to-electrify sectors

## Global gas demand growth by sector



## Share of gas demand growth by sector 2019-2040

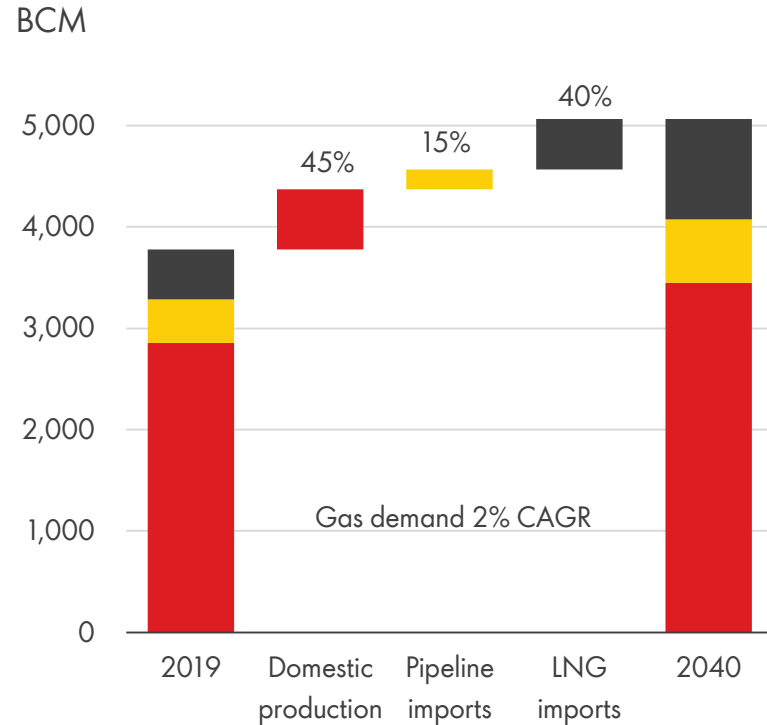


Source: Shell interpretation of Wood Mackenzie H1 2019 data

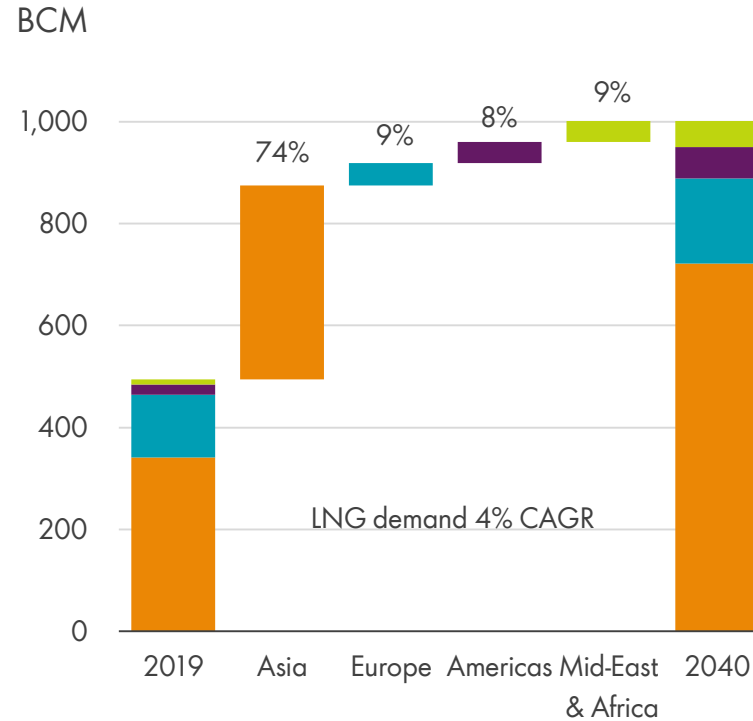


# Asia set to be the key growth region for LNG

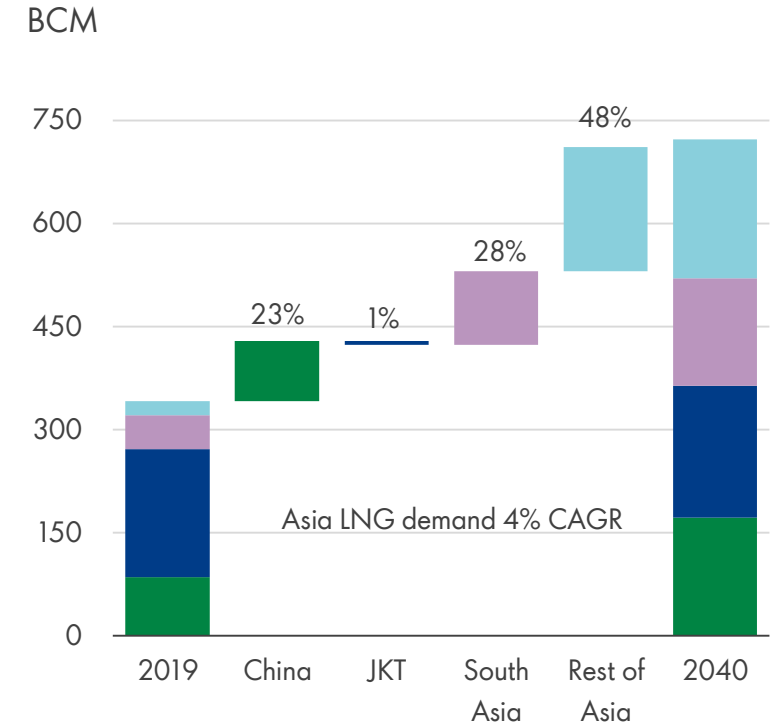
## Global gas supply by source



## LNG imports by region



## LNG imports into Asia



Source: Shell interpretation of Wood Mackenzie H1 2019 data

02

Gibraltar – small-scale LNG import terminal

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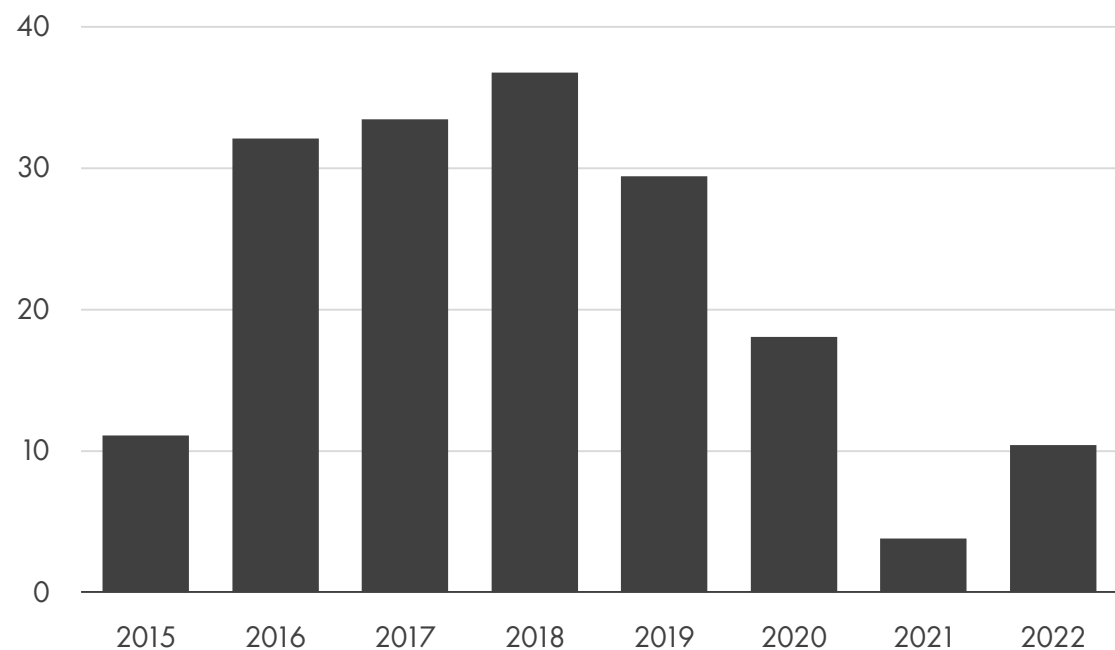
## 2019 was a year of record LNG supply growth

# Current wave of LNG capacity additions coming to an end

85% now online

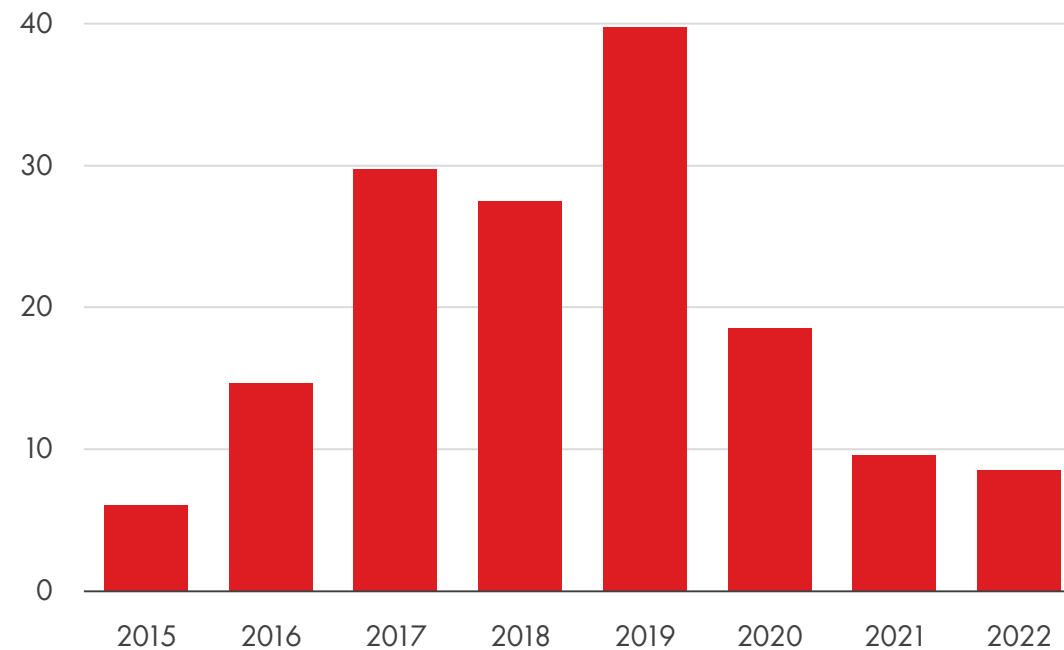
## LNG liquefaction capacity additions

MT



## LNG trade volume growth

MTPA (DES)



2019 LNG trade volume: 359 MTPA

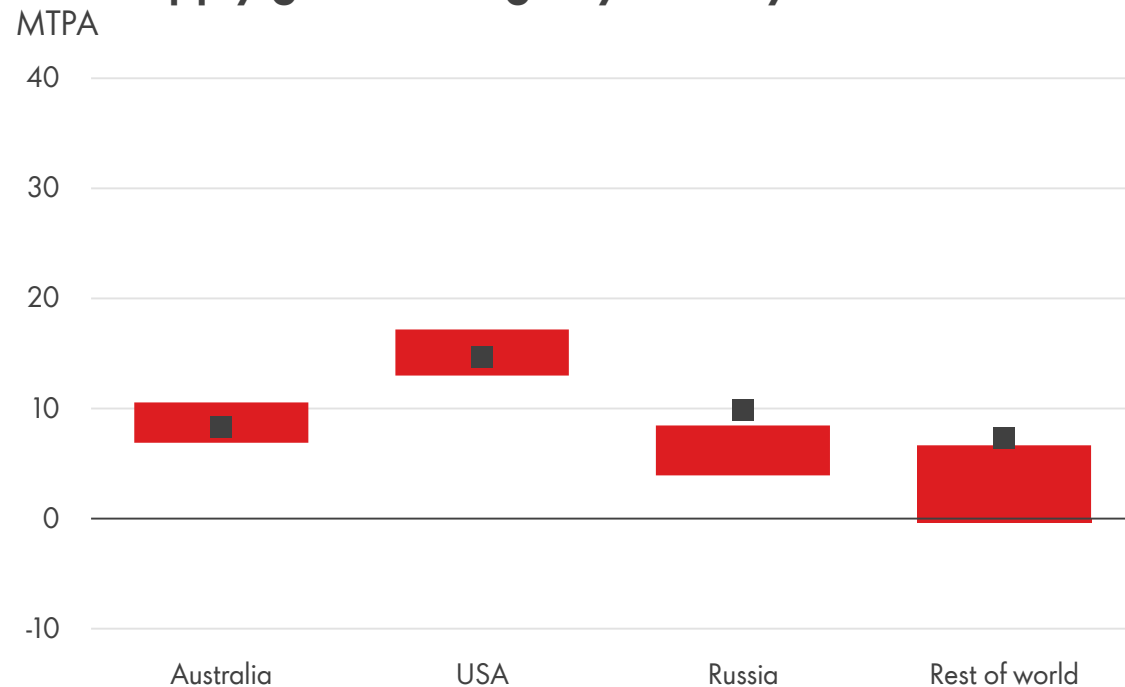
Source: Shell interpretation of IHS Markit 2019 data

DES: delivered ex-ship

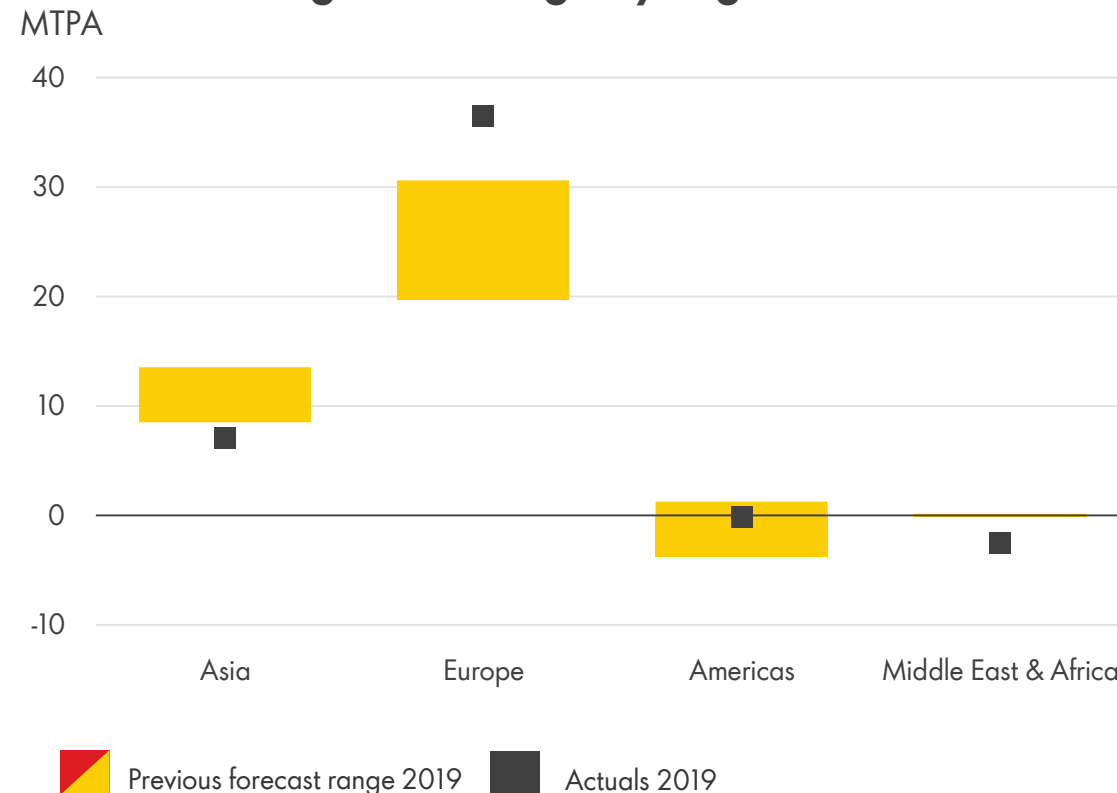


# Record LNG supply growth absorbed mainly in Europe

## LNG supply growth range by country



## LNG demand growth range by region



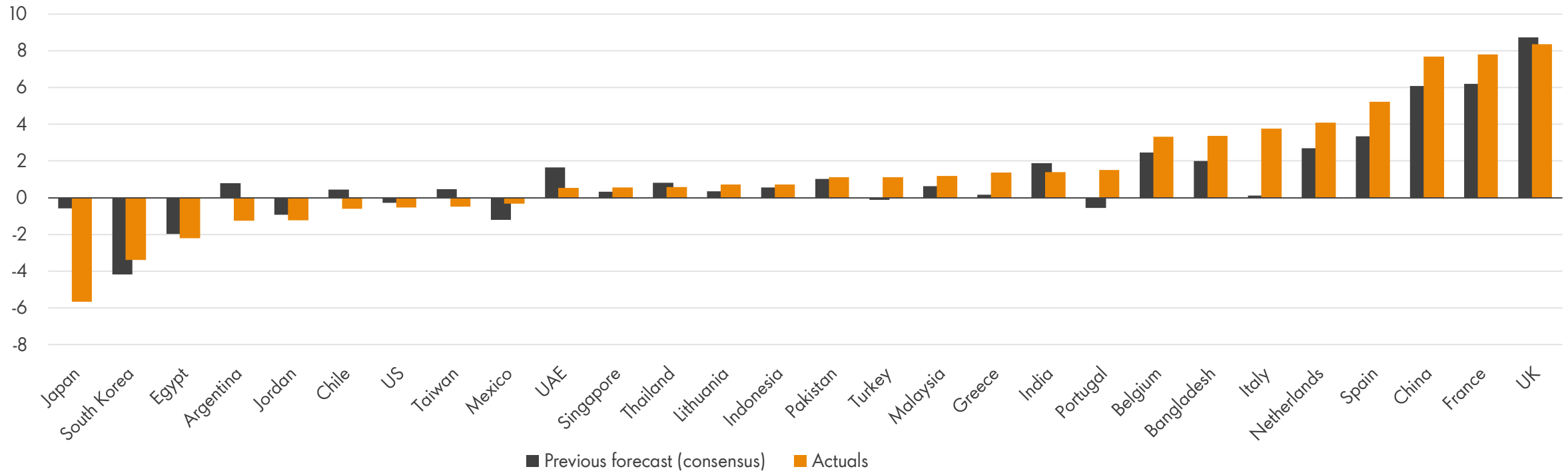
Source: Shell interpretation of IHS Markit, Wood Mackenzie, Poten & Partners Q4 2018 and 2019 data

# LNG imports rise by 40 million tonnes in 2019

China continues to be among top three global LNG growth markets

## Net imports: 2019 YoY

MTPA (DES)



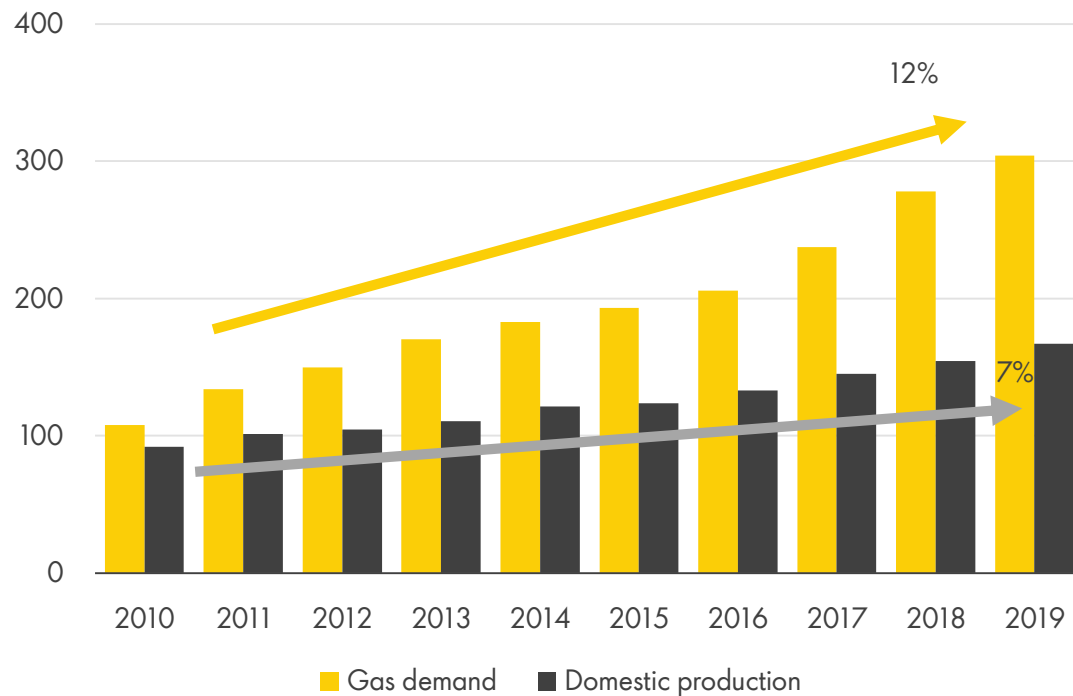
Source: Shell interpretation of IHS Markit, Wood Mackenzie and Poten & Partners 2018 and 2019 data

Note: Sweden, Canada, Colombia, Norway, Finland, Malta, Israel, Jamaica, Puerto Rico, Kuwait, Brazil, Panama, Poland and Dominican Republic are not included in the above chart as change is minimal

# LNG imports continue to meet China's growing need for cleaner energy

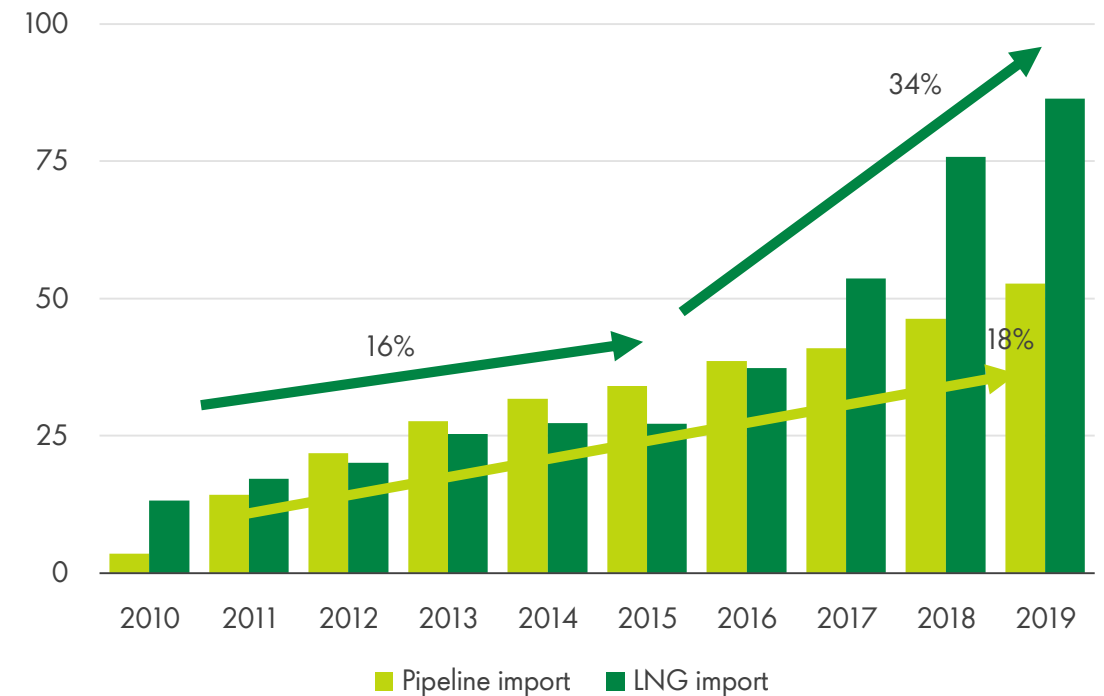
## China gas demand vs domestic production

BCMA



## China LNG and pipeline gas imports

BCMA



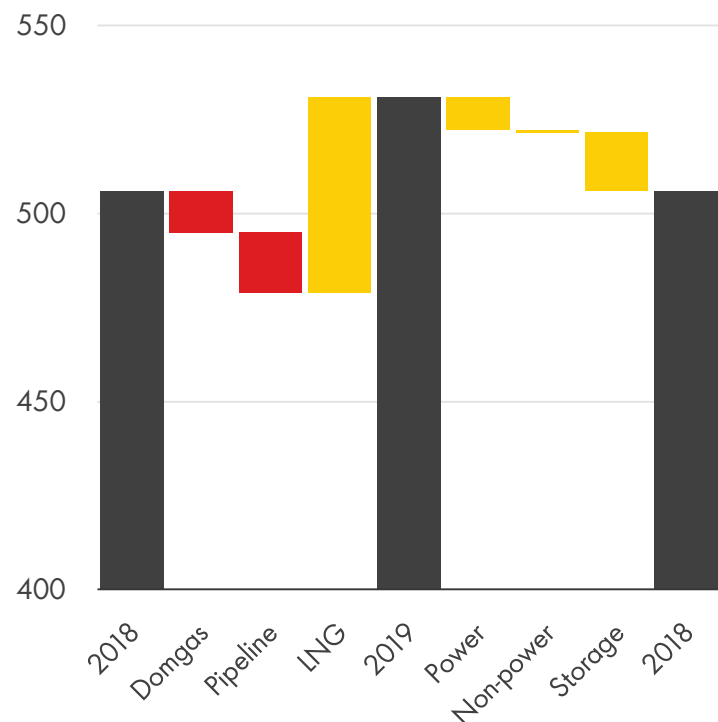
Source: Shell interpretation of NDRC 2019 data



# European LNG imports increased by 74% in 2019 with declining domestic production and pipeline imports ...

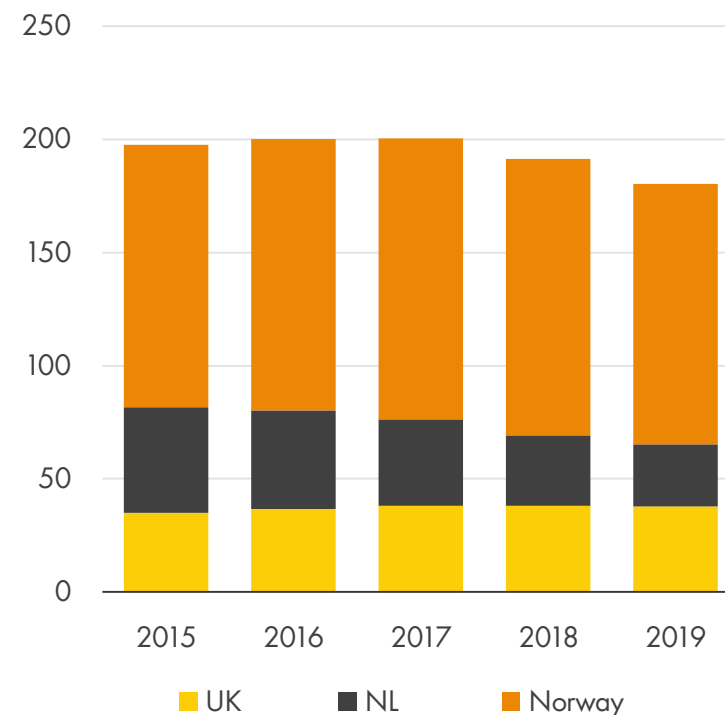
## Gas balance

BCMA



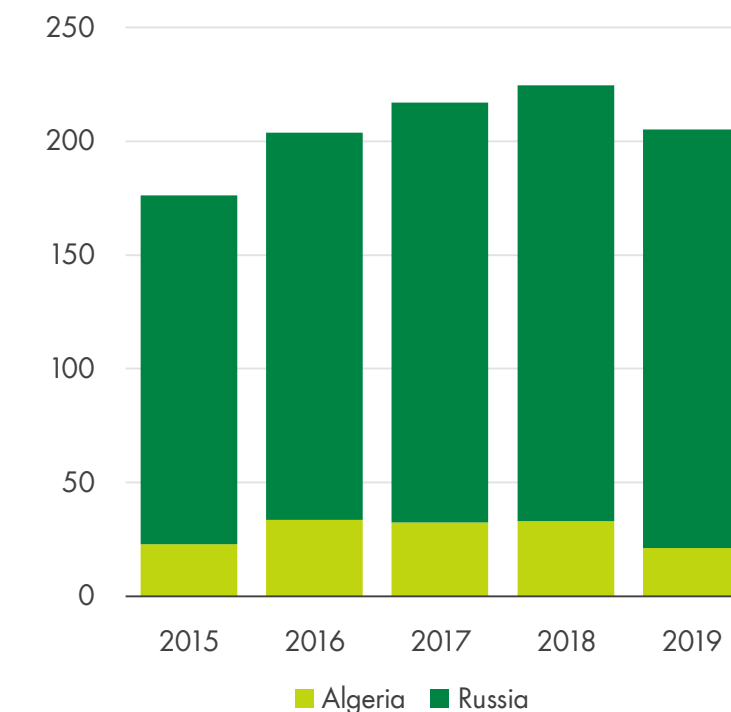
## Domestic gas production

BCMA



## Algerian and Russian pipeline sales

BCMA

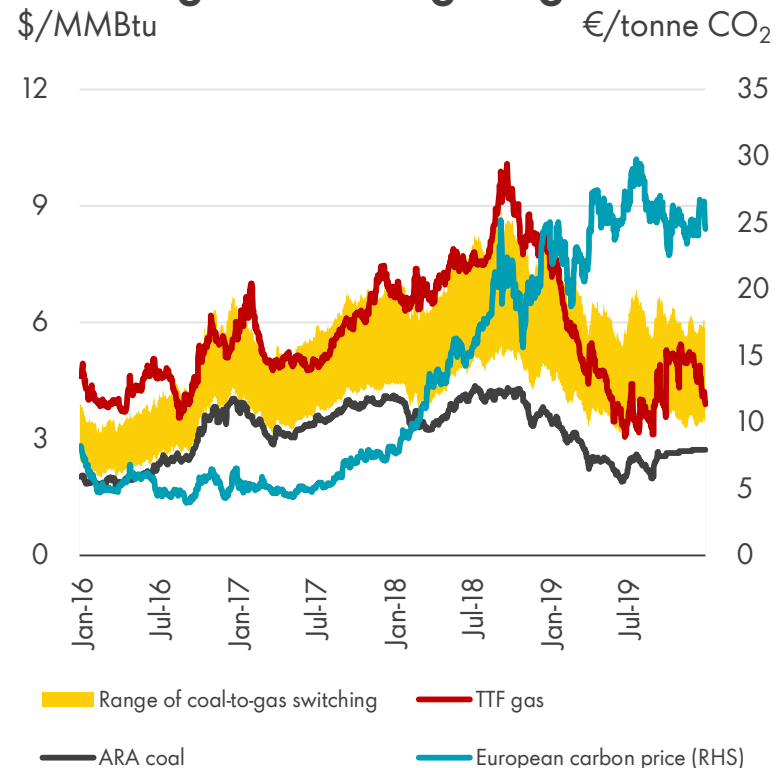


Source: Shell interpretation of Wood Mackenzie, S&P Global Platts and Gazprom Export LLC 2019 data

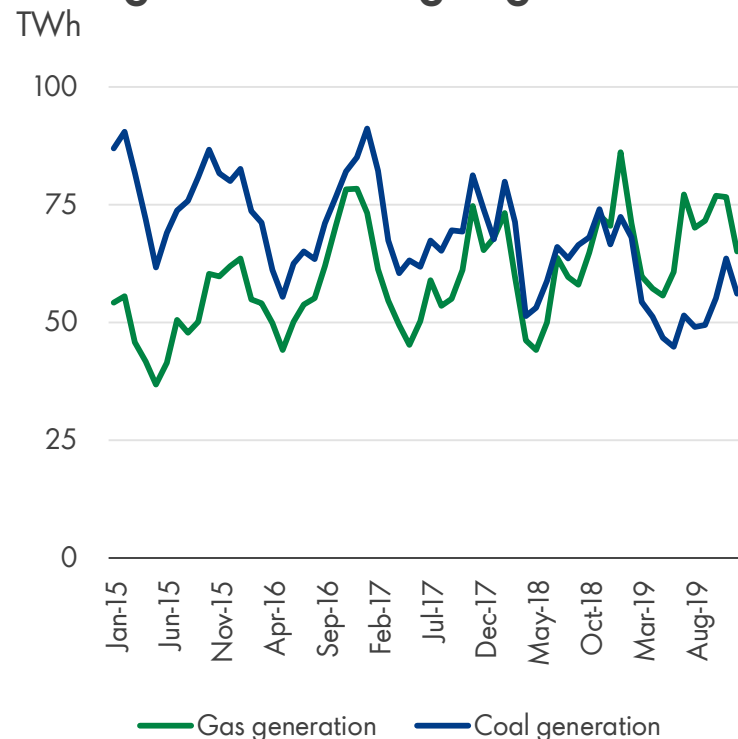
Russian sales volumes adjusted to reflect standard calorific value (40MJ/m<sup>3</sup> at 15°C)

# ... and increased coal-to-gas switching in the power sector and storage due to mild winter

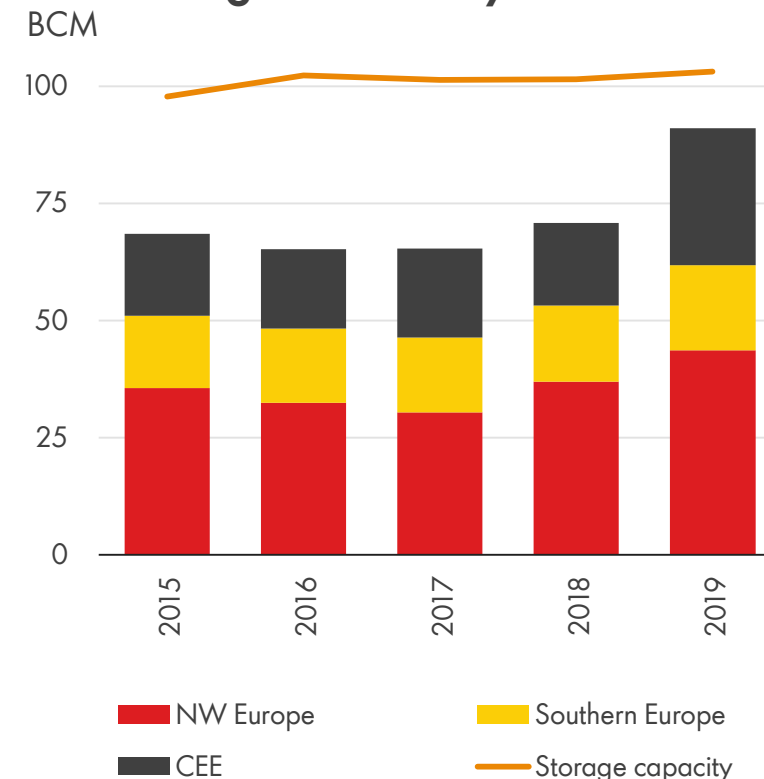
## Coal-to-gas switching range



## Coal generation vs gas generation



## Year-end gas inventory

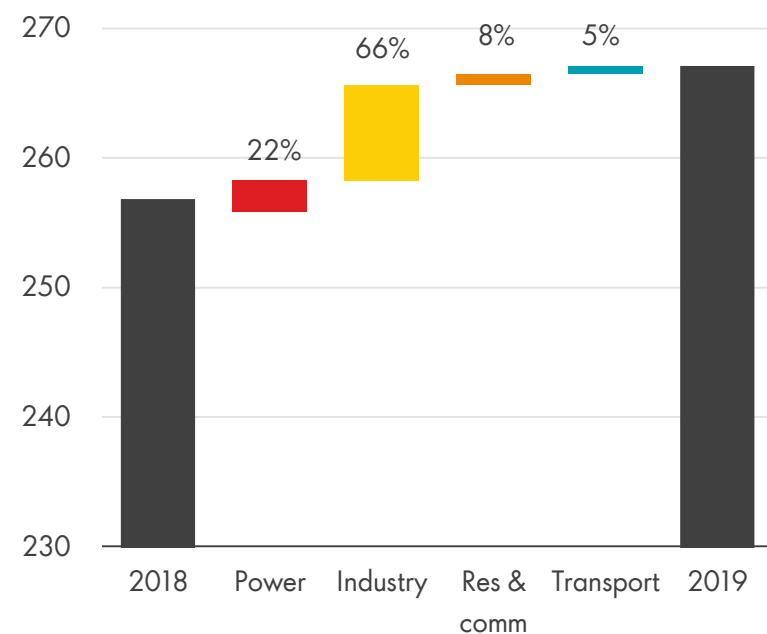


Source: Shell interpretation of IHS Markit, Wood Mackenzie and Gas Infrastructure Europe (Aggregated Gas Storage Inventory) 2019 data

# Growing industrial gas demand and declining domestic gas spurs LNG demand in South and South-east Asia

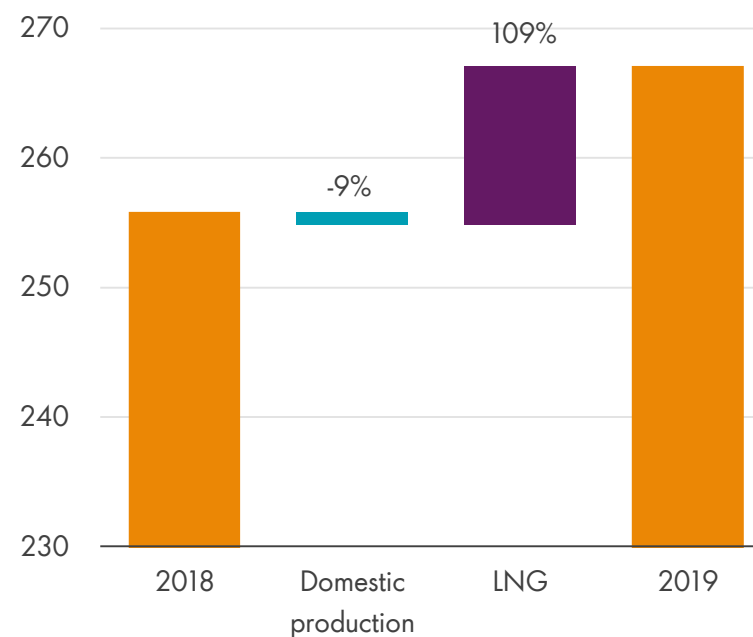
## Gas demand growth by sector

BCMA



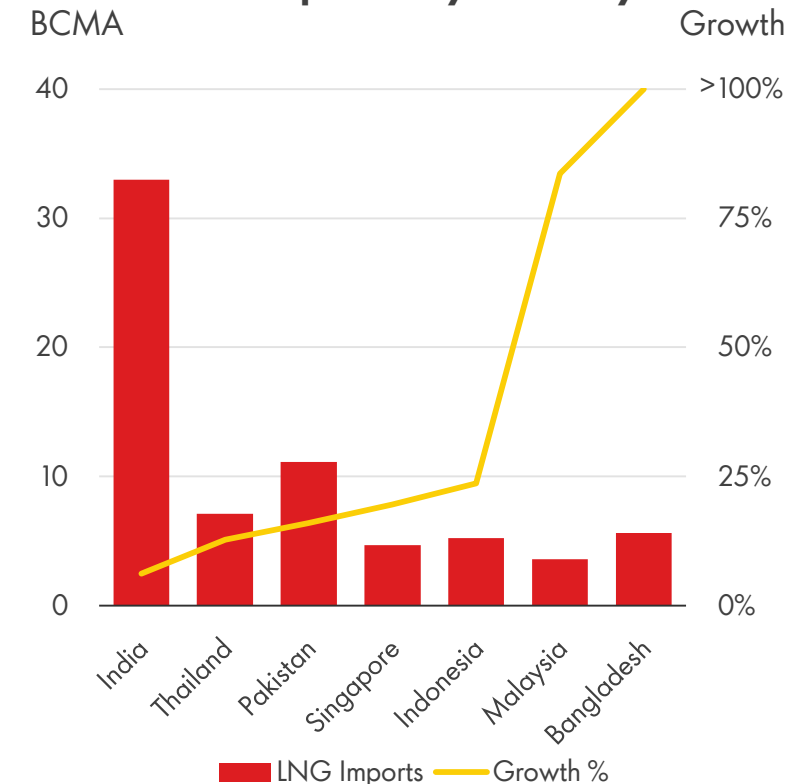
## Gas supply growth by sector

BCMA



## 2019 LNG imports by country

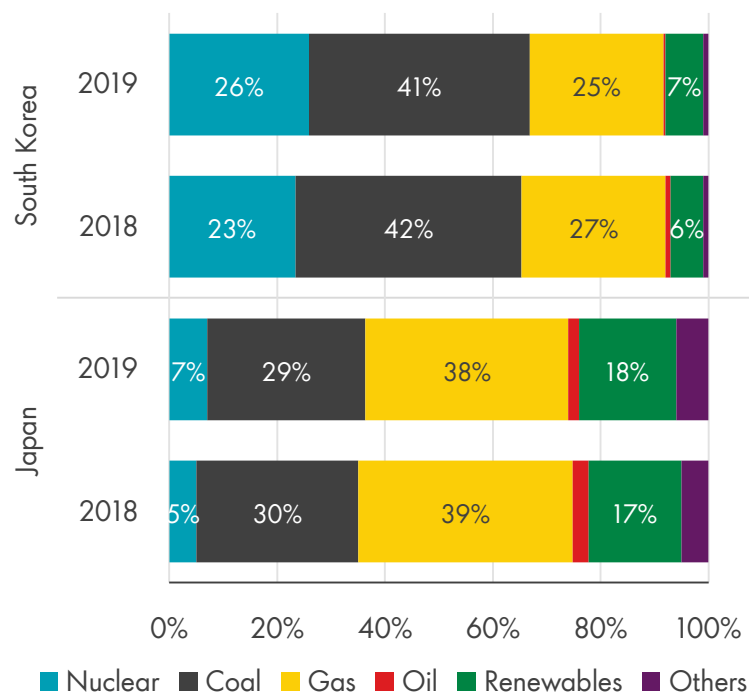
BCMA



Source: Shell interpretation of Wood Mackenzie and IHS Markit 2019 data

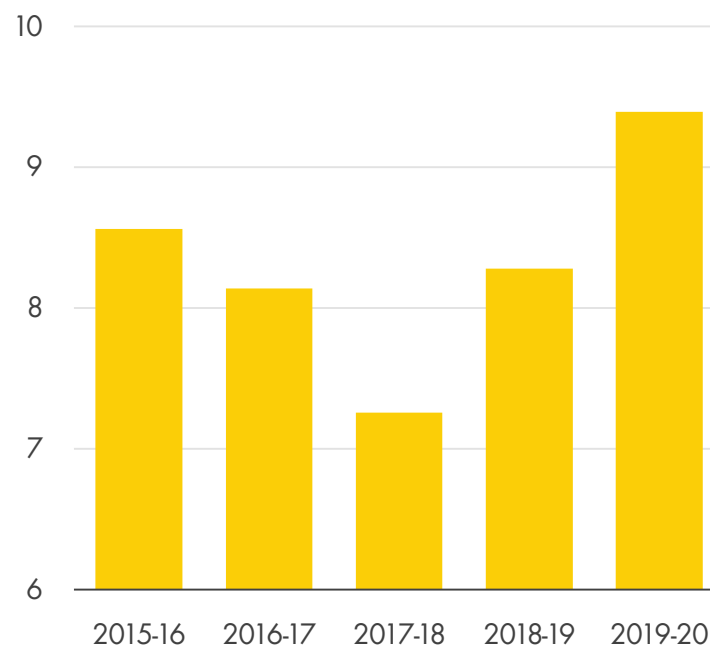
# Higher nuclear availability and mild winters reduced imports into Japan and South Korea

## Power generation mix



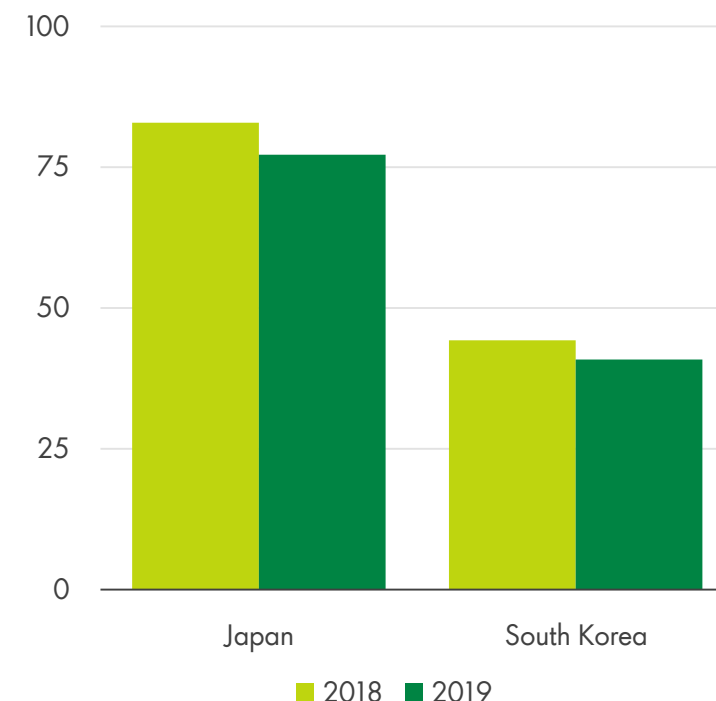
## Winter\* average temperature

Degree Celsius



## LNG imports

MTPA



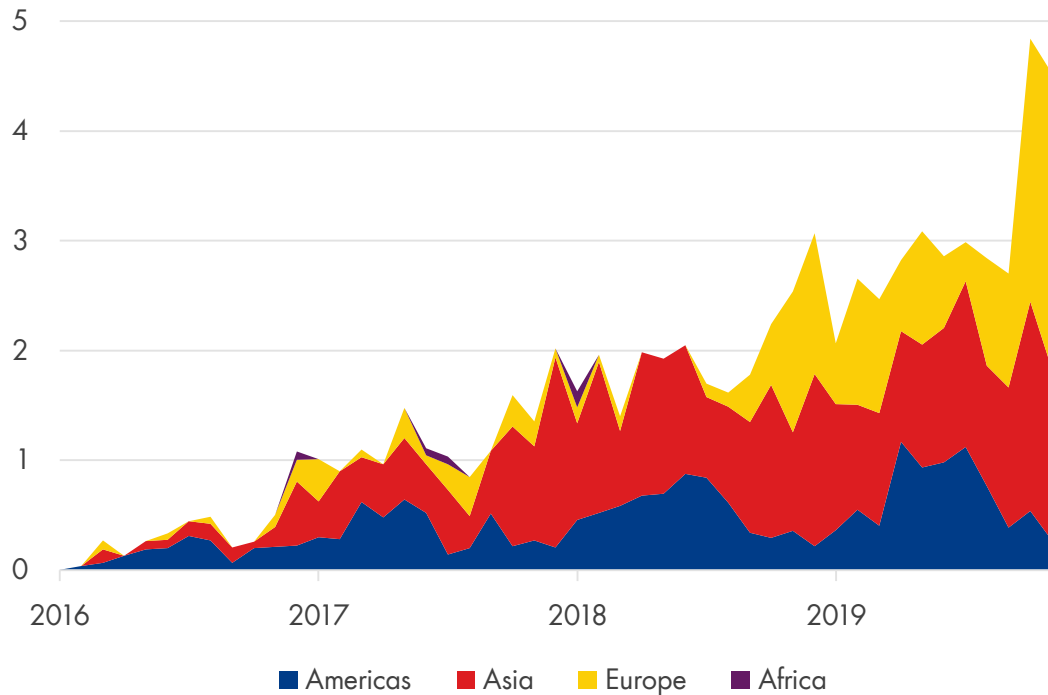
Source: Shell interpretation of IHS Markit, Japan Ministry of Economy, Trade and Industry, Korea Energy Economics Institute 2019 data  
Power generation mix includes January through October data. \*Winter months are from October through March. 2020 includes YTD data



# US supply adds volume and flexibility to the global LNG market

## US LNG exports by destination

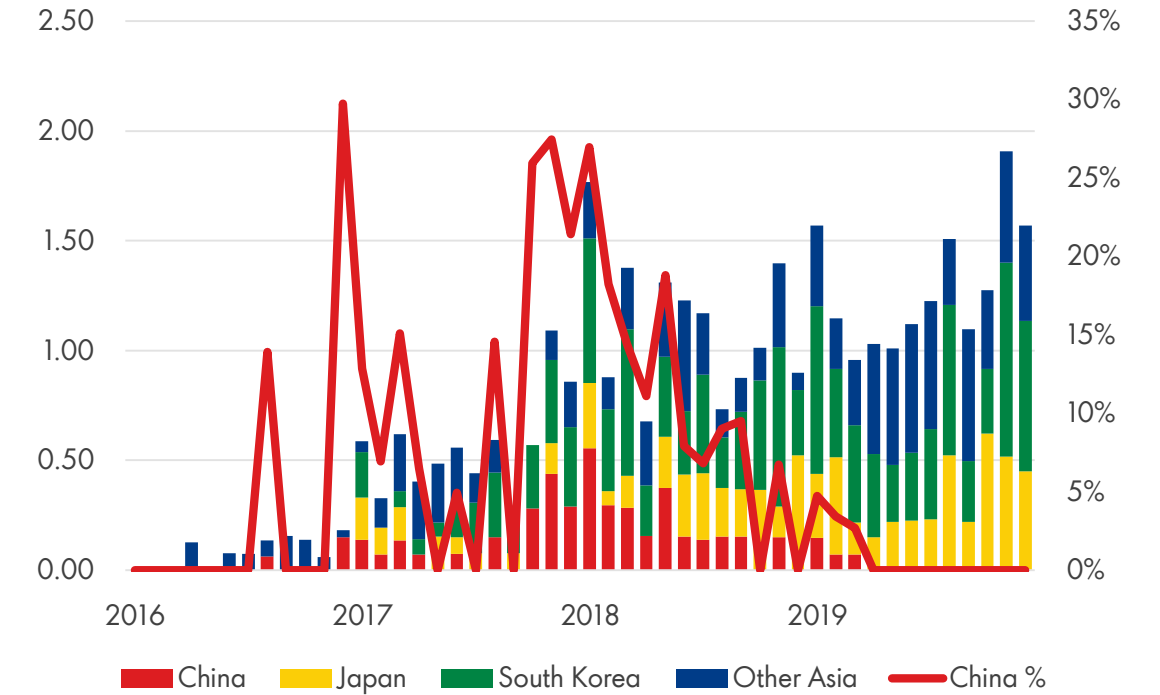
MT



## US LNG deliveries to Asia

MT

China % of total US deliveries

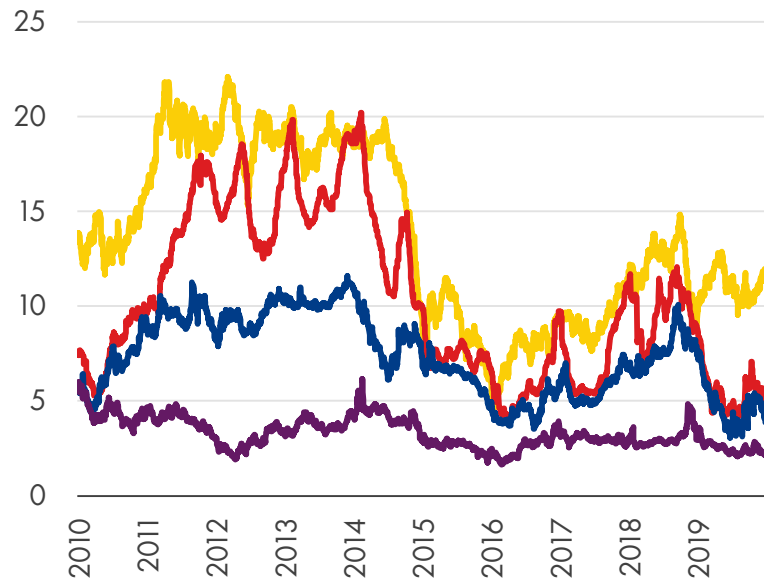


Source: Shell interpretation of IHS Markit, US Department of Energy 2019 data

# Global gas prices softened in 2019

## Global gas prices

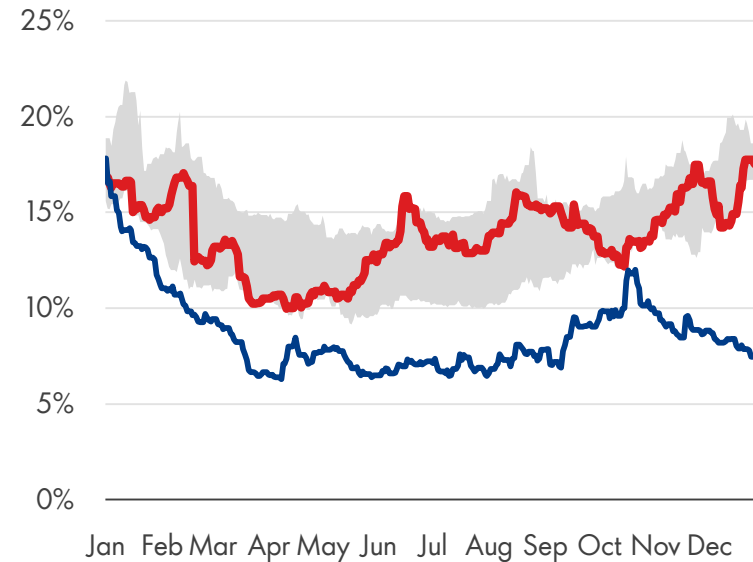
\$/MMBtu



— Dated Brent — JKM — TTF — Henry Hub

## Asia spot price

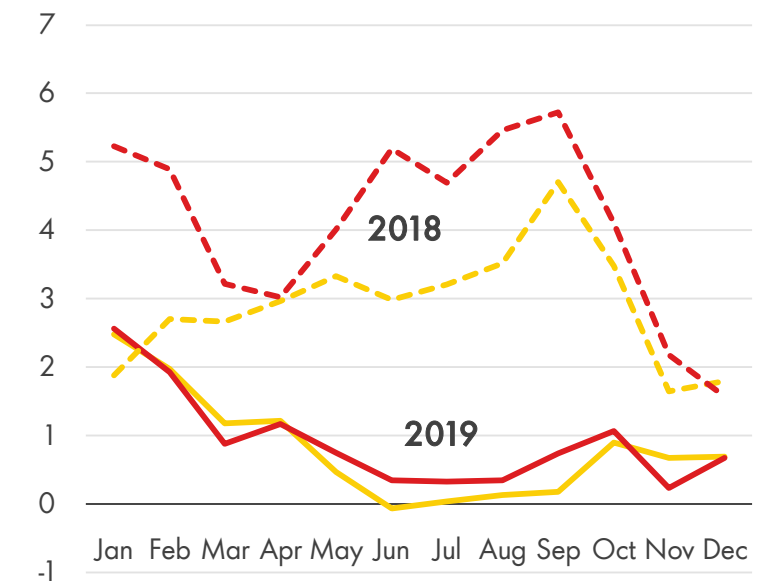
JKM as % of Brent



— Range 2013-2018 — 2018 — 2019

## US LNG export margins\*

\$/MMBtu



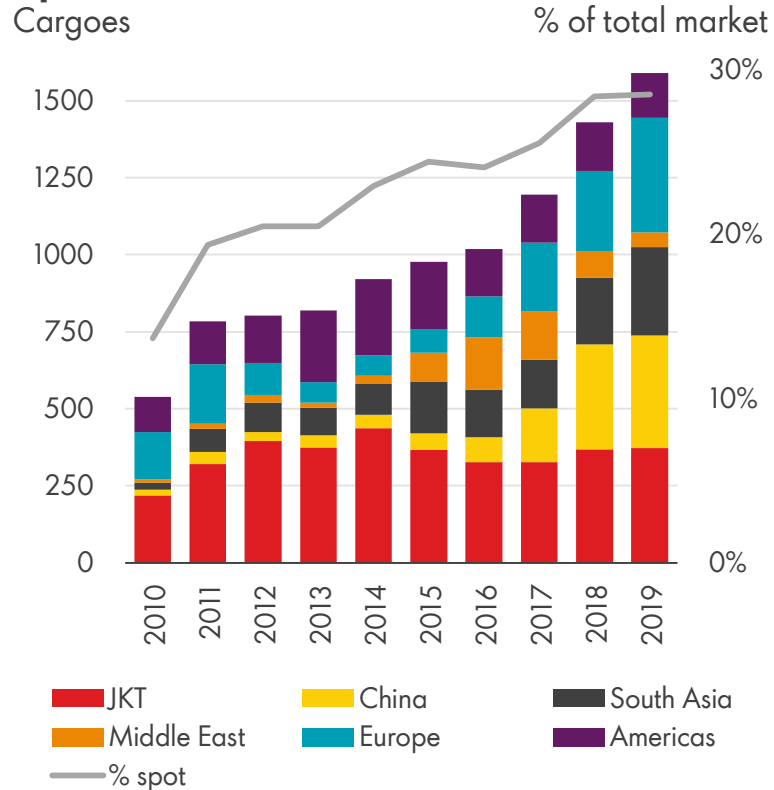
— TTF netback — JKM netback

Source: Shell interpretation of ICE, CME, S&P Global Platts 2019 data

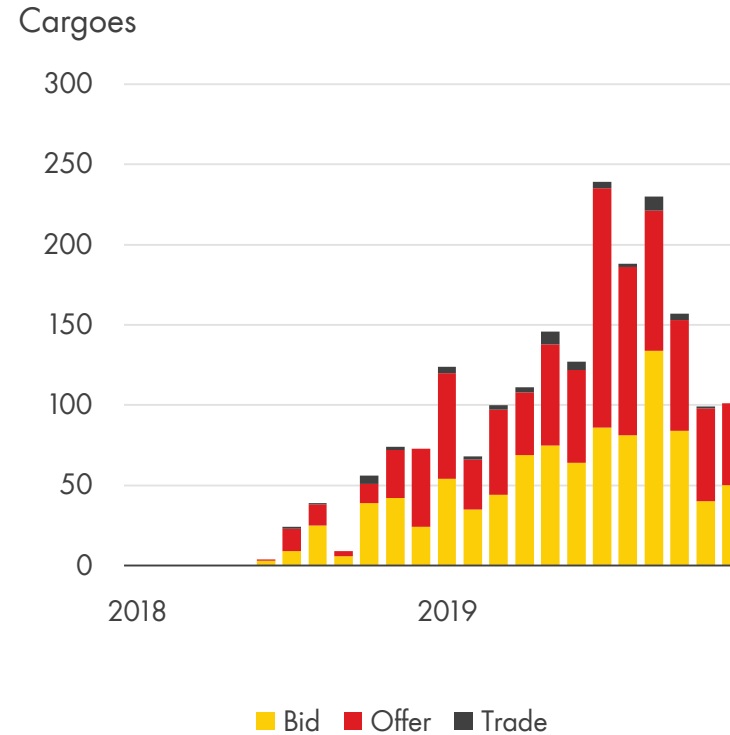
\*Excludes liquefaction fee; netback calculated as: JKM and TTF minus regasification and transportation cost minus 115% Henry Hub

# Increasingly liquid and transparent spot market

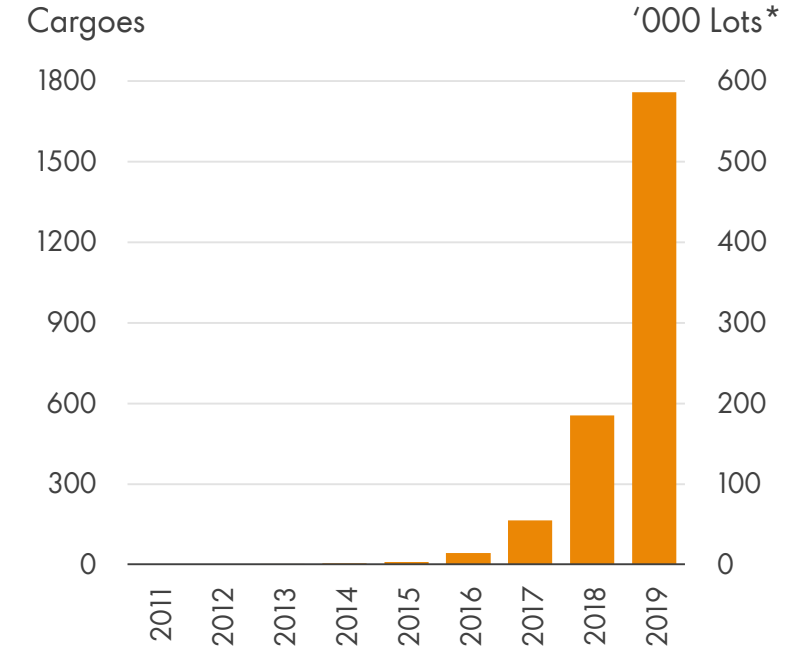
## Spot LNG deliveries



## JKM eWindow/Market on Close



## ICE JKM LNG futures

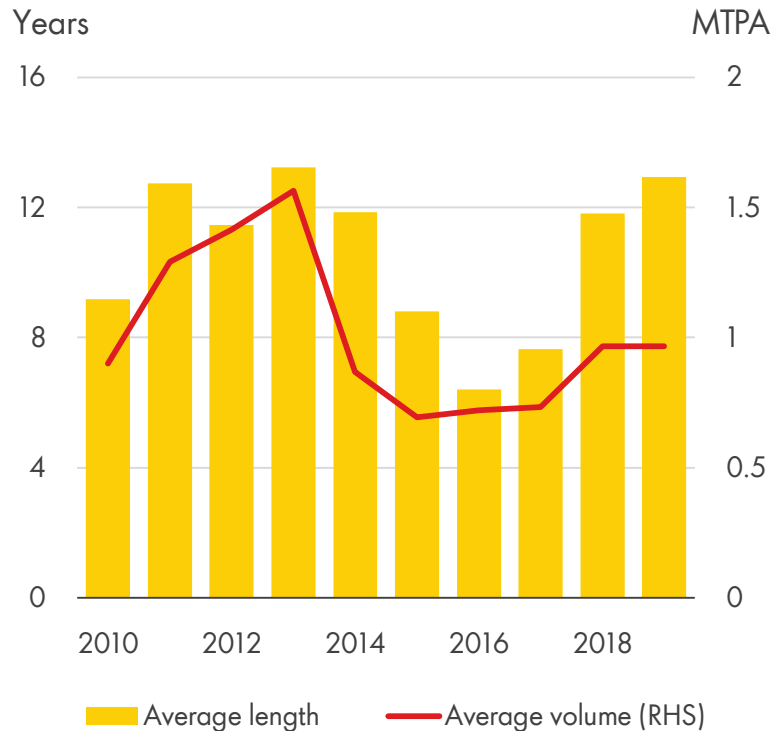


Source: Shell interpretation of IHS Markit, S&P Global Platts and ICE 2019 data

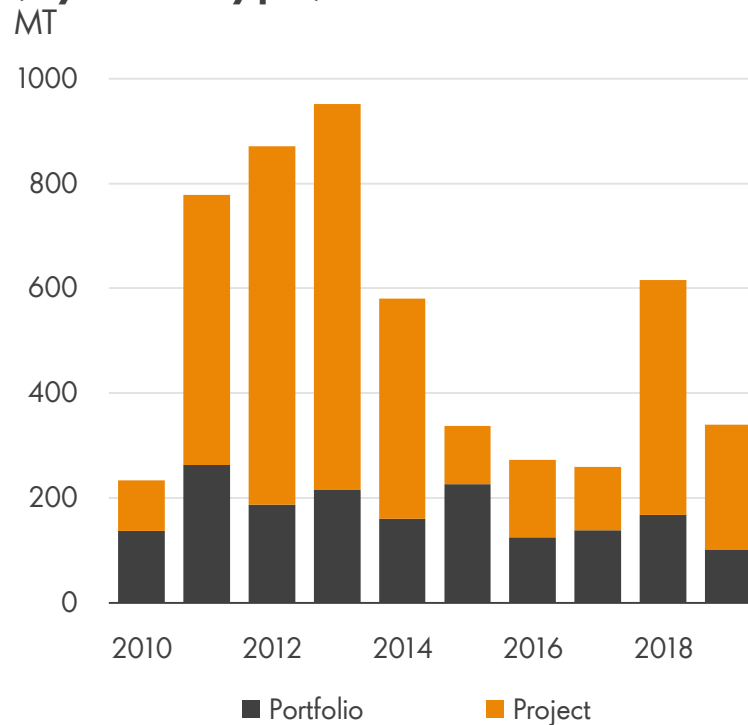
\*About 300 lots is equal to 1 cargo

# Evolving contracting structures

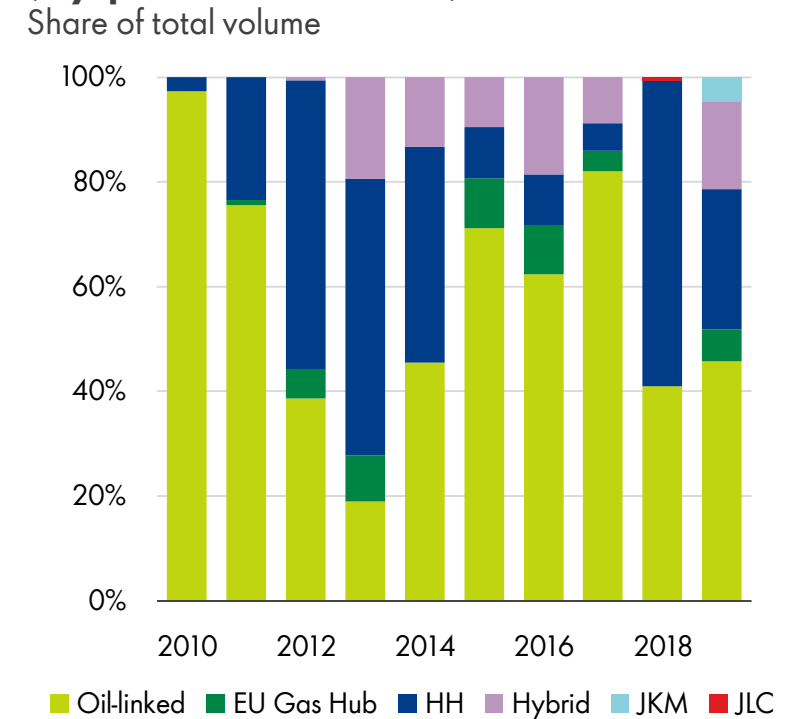
## Average volume and length of new contracts



## New LNG contract volumes (by seller type)



## Share of new LNG contract volumes (by price indexation)

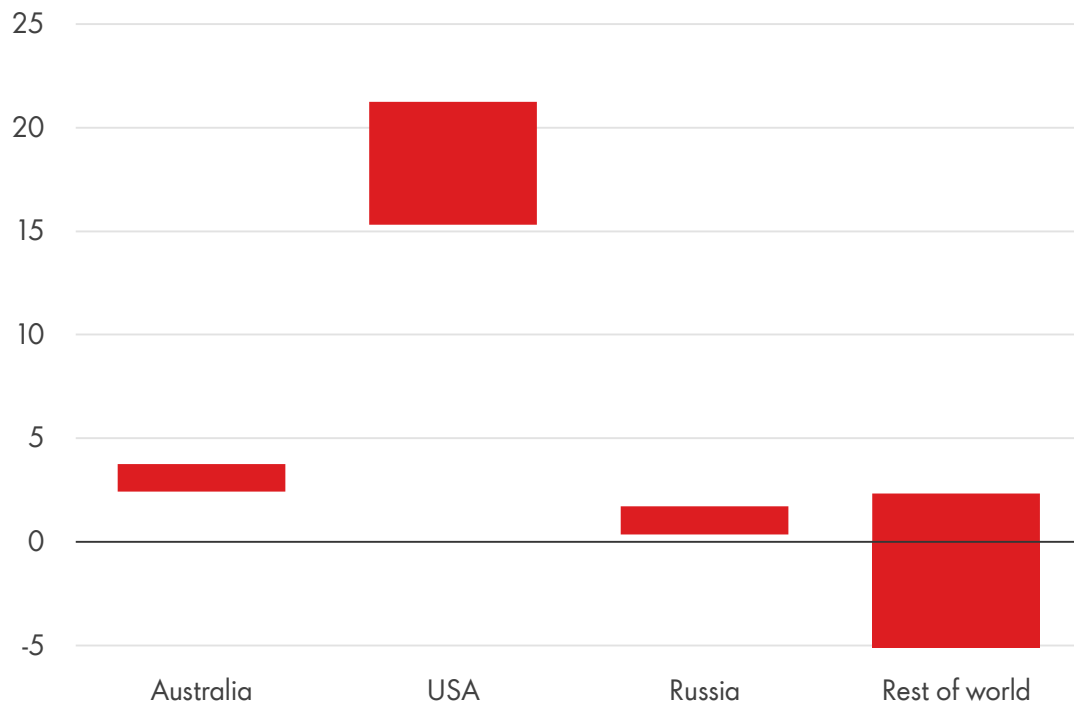


Source: Shell interpretation of Wood Mackenzie and IHS Markit 2019 data

# End of the current supply wave in 2020

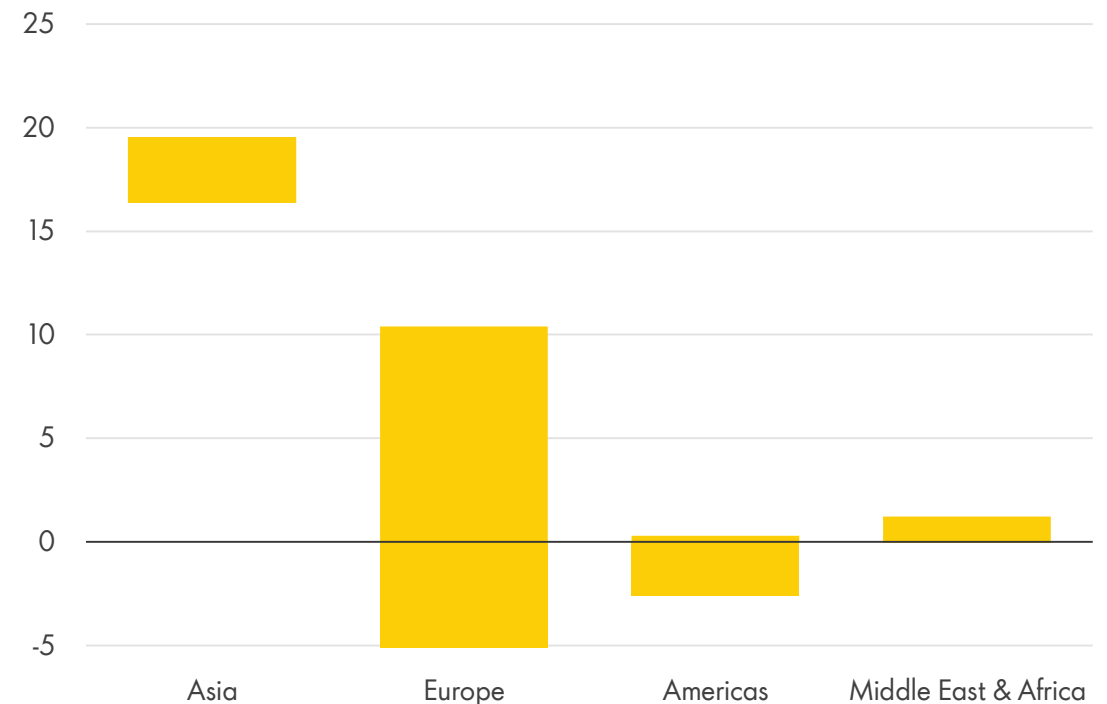
## LNG supply growth range by country

MTPA



## LNG demand growth range by region

MTPA



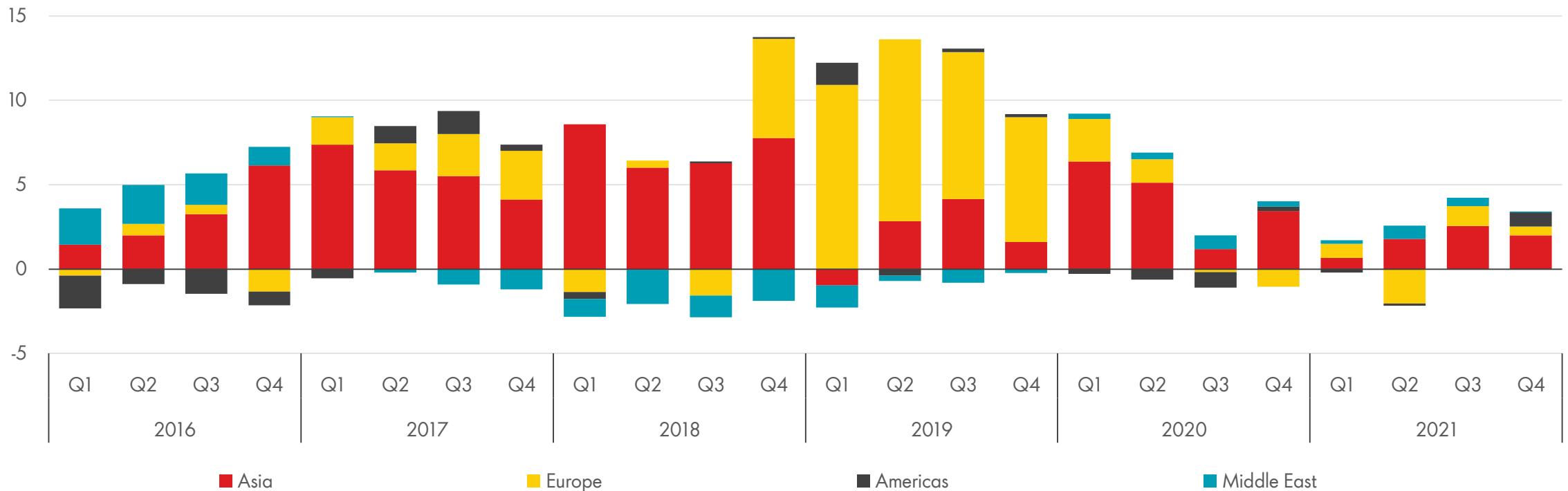
Source: Shell interpretation of IHS Markit, Wood Mackenzie, Poten & Partners 2019 data



# Global LNG market equilibrium expected to be restored

## LNG import growth by region

MT



Source: Shell interpretation of IHS Markit 2019 data

# 03

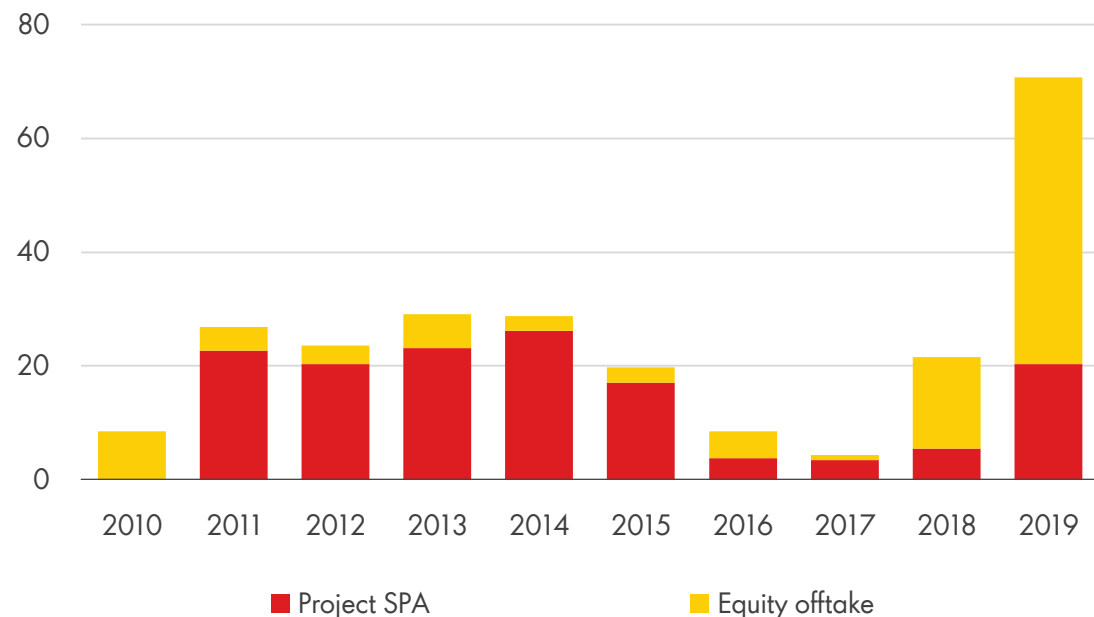
LNG London bunkers a containership in Rotterdam

## Record supply investment due to confidence in long-term LNG demand growth

# Expected supply shortage in mid-2020s resulted in record FIDs

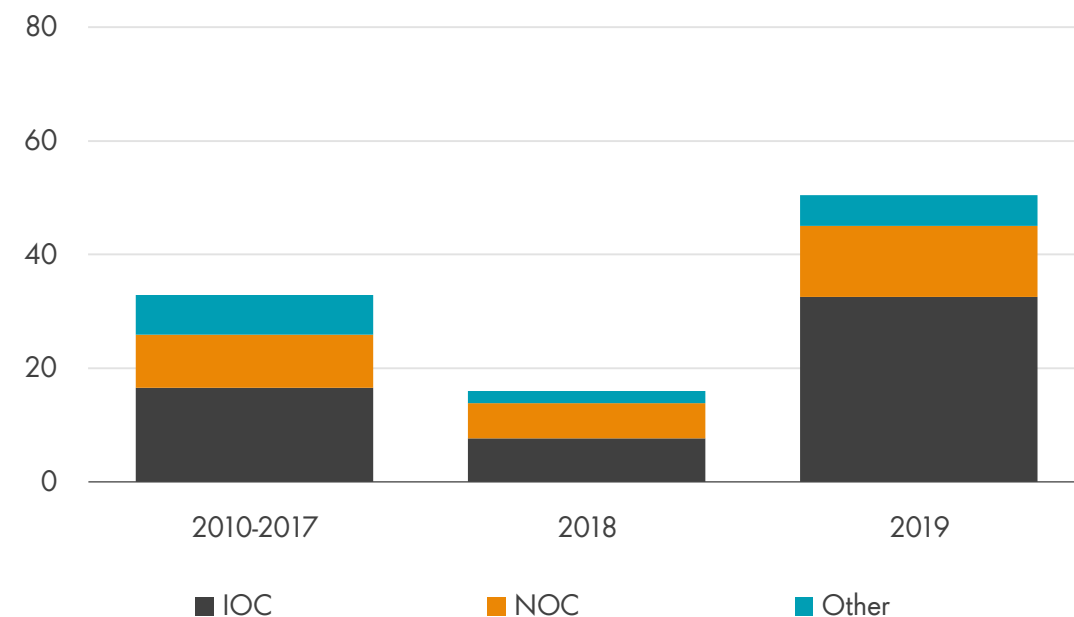
## Investment in liquefaction capacity by contract type

MT



## LNG equity offtake by buyer type

MT



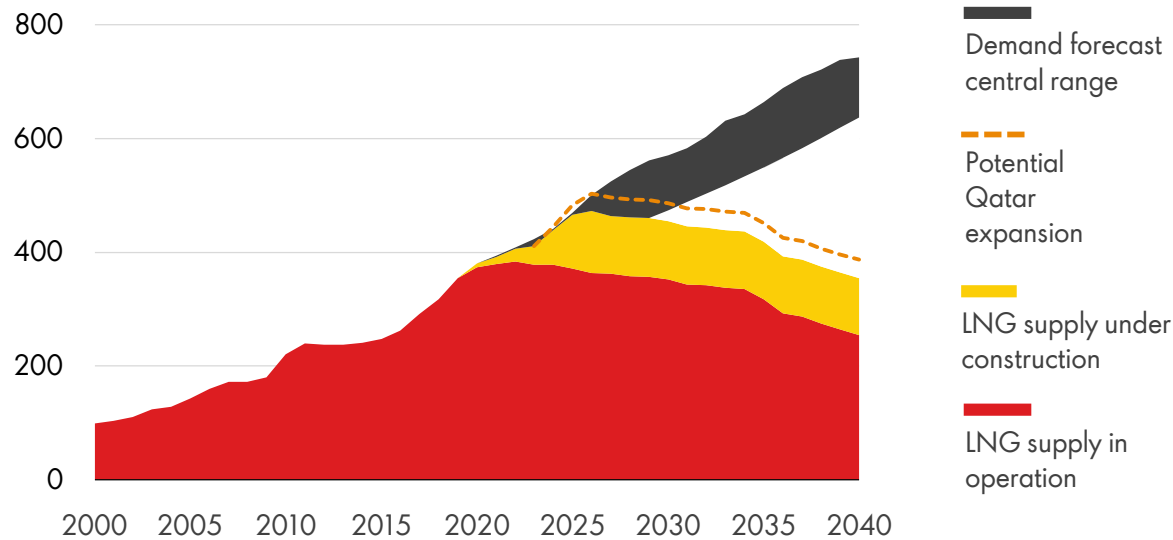
Source: Shell interpretation of IHS Markit 2019 data

# Record FIDs delay expected supply-demand gap

## LNG demand estimated to double by 2040

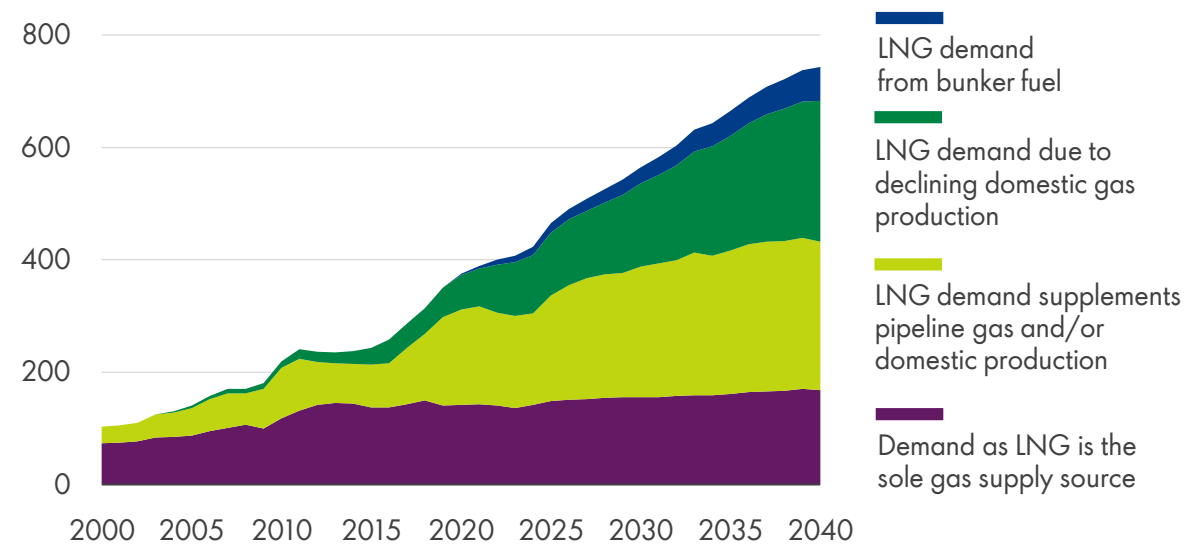
### Emerging LNG supply-demand gap

MTPA



### Demand drivers for LNG

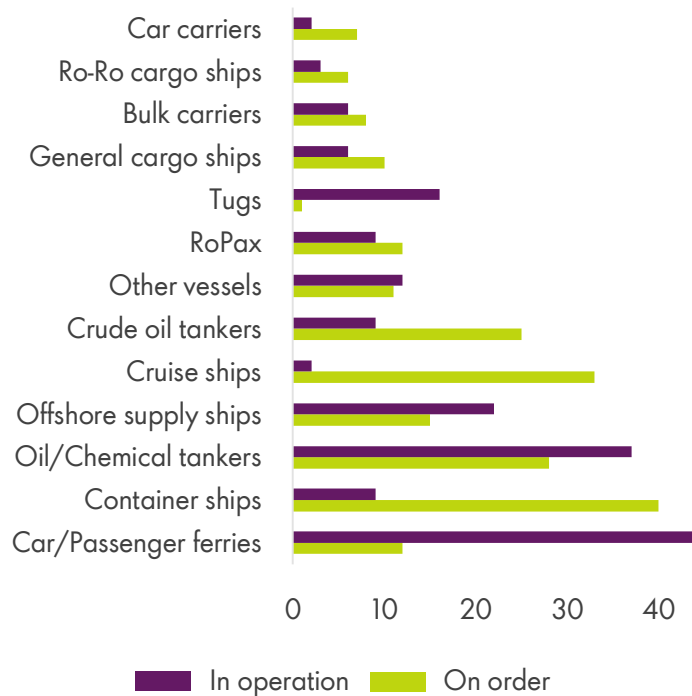
MTPA



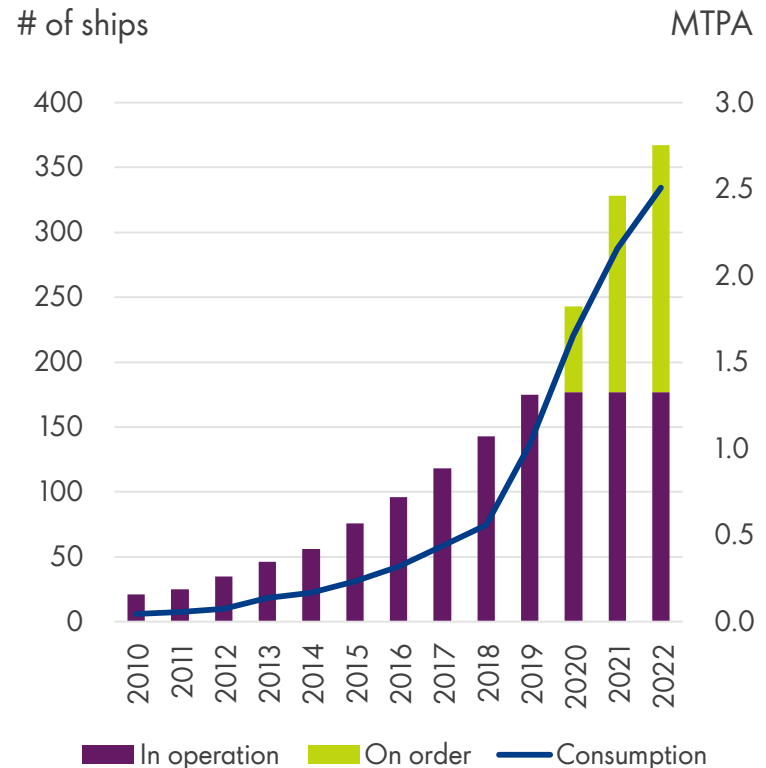
Source: Shell interpretation of IHS Markit, Wood Mackenzie, FGE and Poten & Partners Q4 2019 data

# LNG bunkering demand accelerating

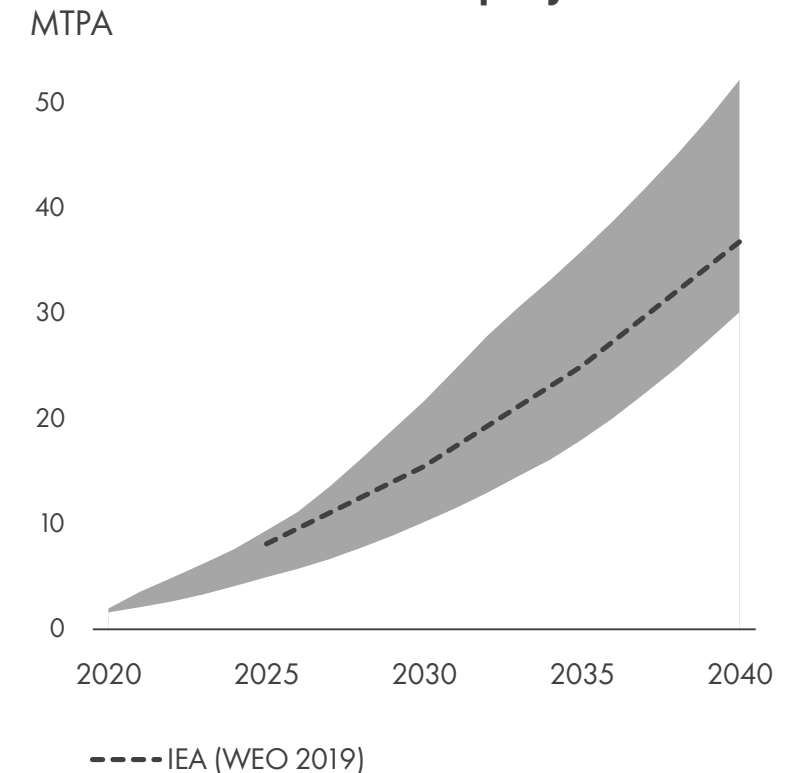
## 385 LNG ships currently in operation/on order\*



## Confirmed LNG demand



## LNG bunker demand projection



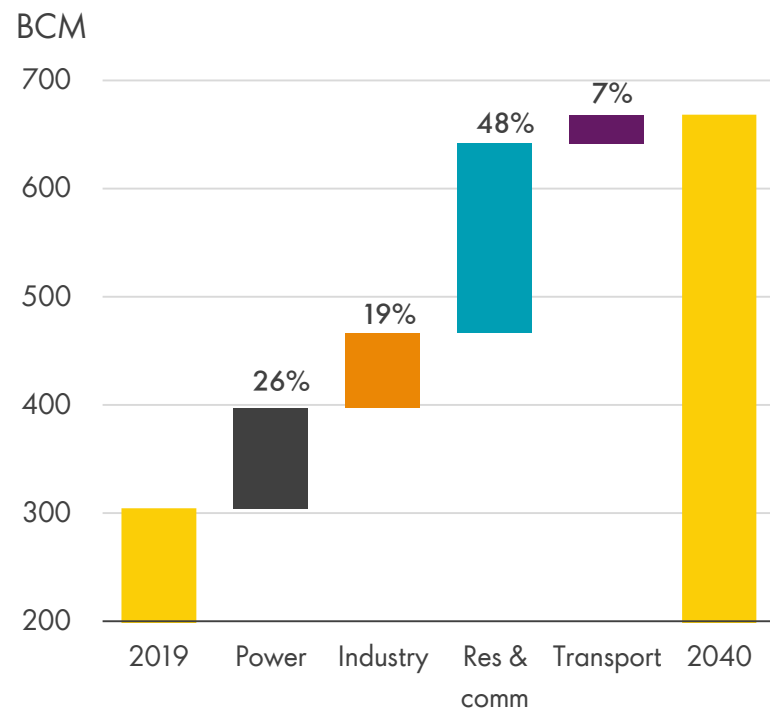
Source: Shell interpretation of DNV GL, Woodmac, IHS Markit & IEA 2018 and 2019 data

\* Based on announcements with deliveries going out to 2027. Does not include 150 LNG-ready ships

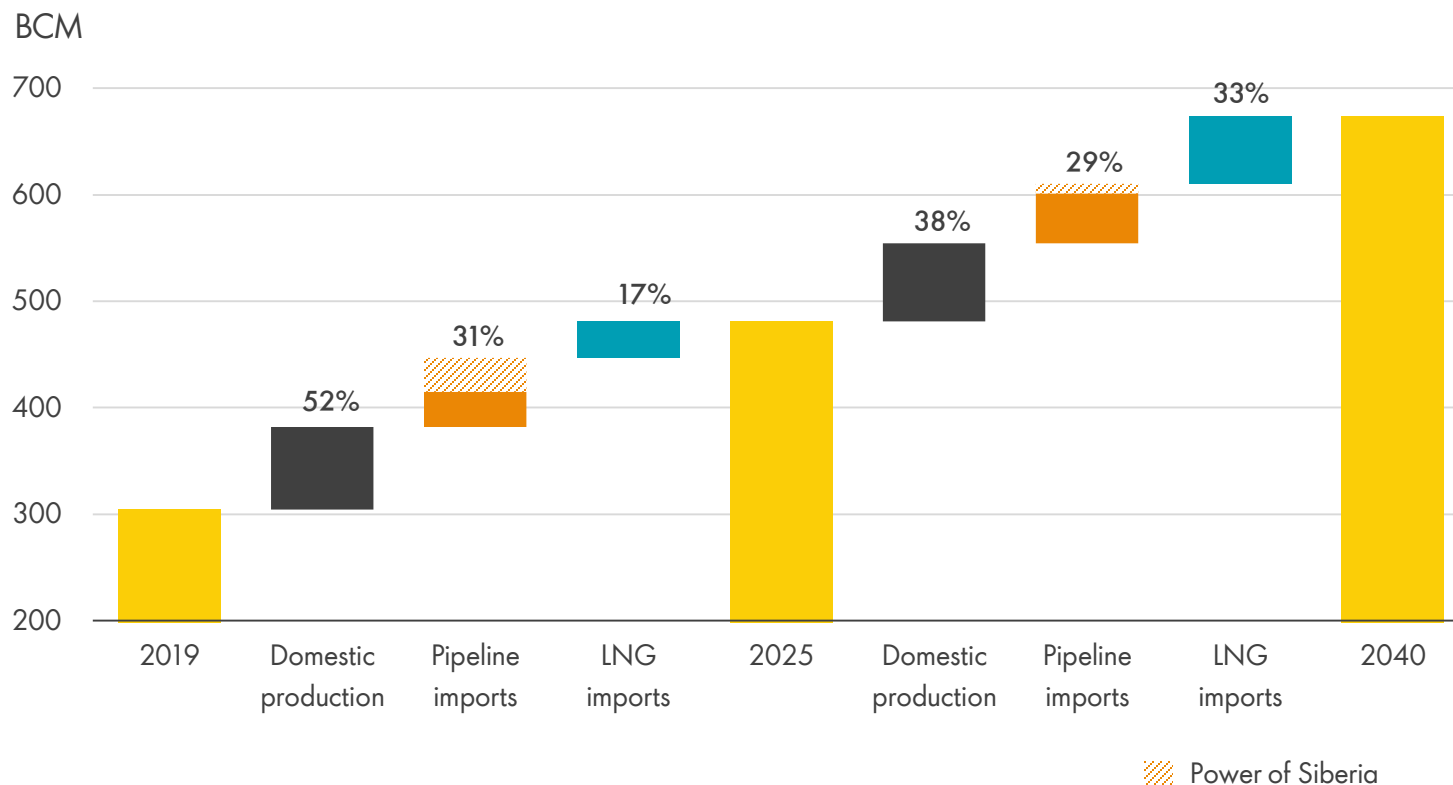


# China gas demand expected to double

## China gas demand by sector



## China supply by source

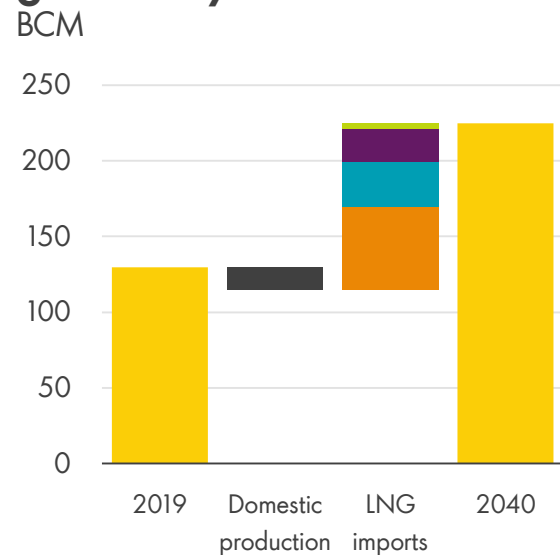


Source: Shell interpretation of Wood Mackenzie 2019 H1 data

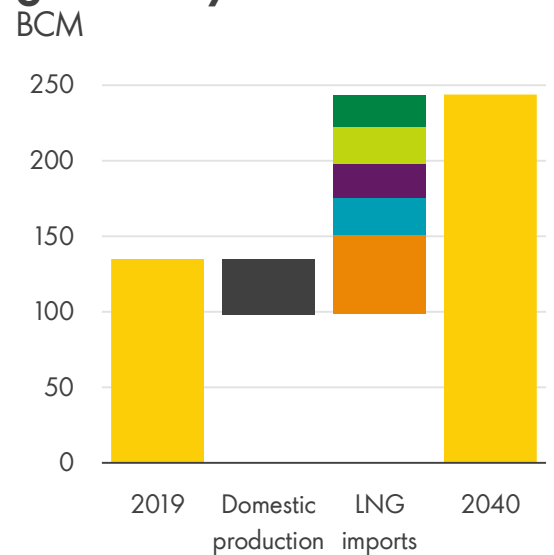
# Growing gas demand expected in South and South-east Asia

More LNG infrastructure investment needed

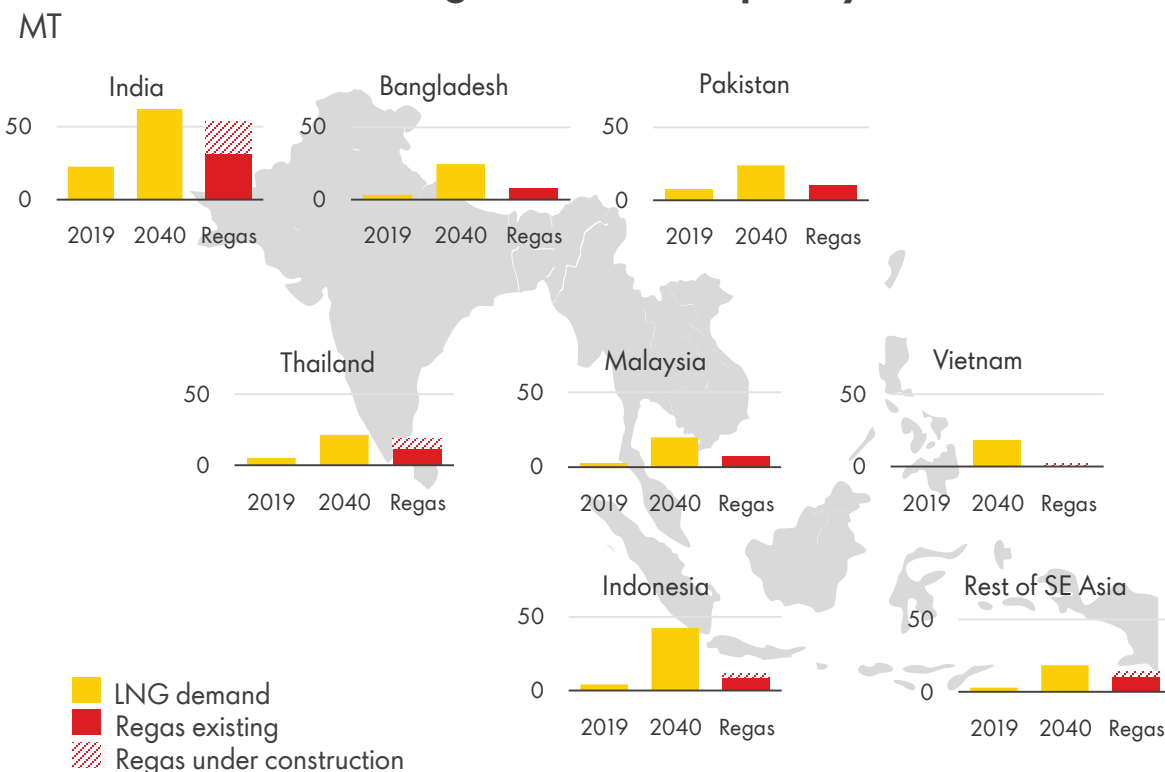
## South Asia gas supply growth by source



## South-east Asia gas supply growth by source



## LNG demand and regasification capacity



Source: Shell interpretation of Wood Mackenzie and IHS Markit 2019 data



# 01



# 02



# 03

Shell LNG  
Outlook 2020

## Gas continues to provide more and cleaner energy solutions

- 80% of energy demand growth expected to be met by renewables and gas
- Coal-to-gas switching helping level global CO<sub>2</sub> emissions
- Record coal phase-out and generation reduction in 2019

## 2019 was a year of record LNG supply growth

- European LNG imports increased by 74%
- Higher nuclear availability and mild winters reduced imports into Japan and South Korea
- End of the current supply wave in 2020
- Global LNG market equilibrium expected to be restored

## Record supply investment due to confidence in long-term LNG demand growth

- Expected supply shortage in mid-2020s resulted in record FIDs
- Record FIDs delay expected supply demand gap
- LNG demand estimated to double by 2040

## Summary

