

# Global Energy Market Forecast

April 2023



# Today's presenters and other key information

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## I. Market developments

1. Global gas
2. European gas

## II. Key assumptions

## III. Global energy markets Central forecast

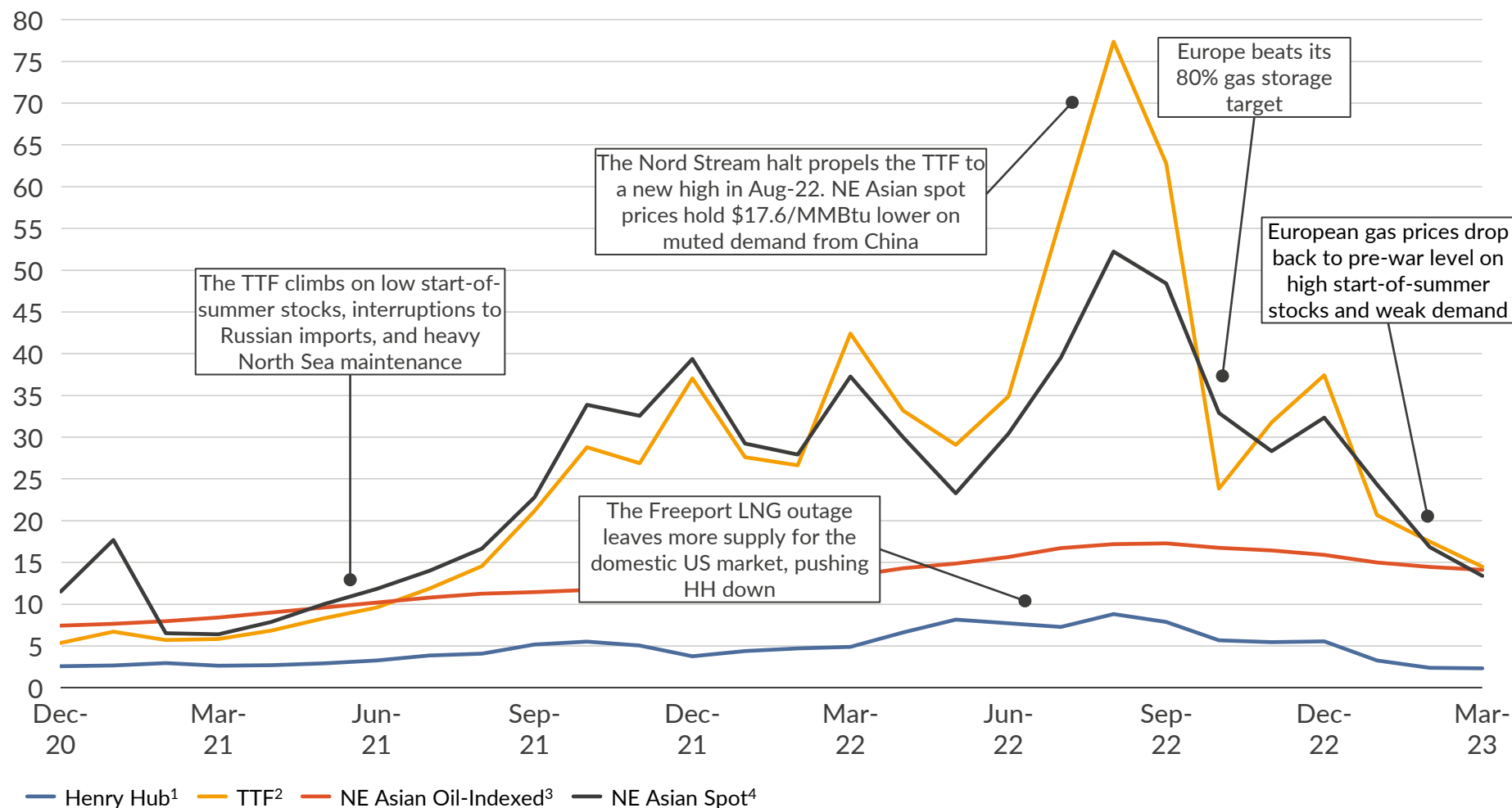
1. Emissions and total energy use
2. Global gas and coal
3. European gas

## IV. Takeaways

# Global spot LNG prices fell to pre-Ukraine war levels in early 2023, reaching parity with oil-indexed prices

## Traded average monthly gas prices

\$/MMBtu (nominal)



1) HH front-month. 2) TTF front-month. 3) Brent oil-indexed price for delivery to Japan under a six-month average, no lag, one delivery month contract. 4) JKM front-month.

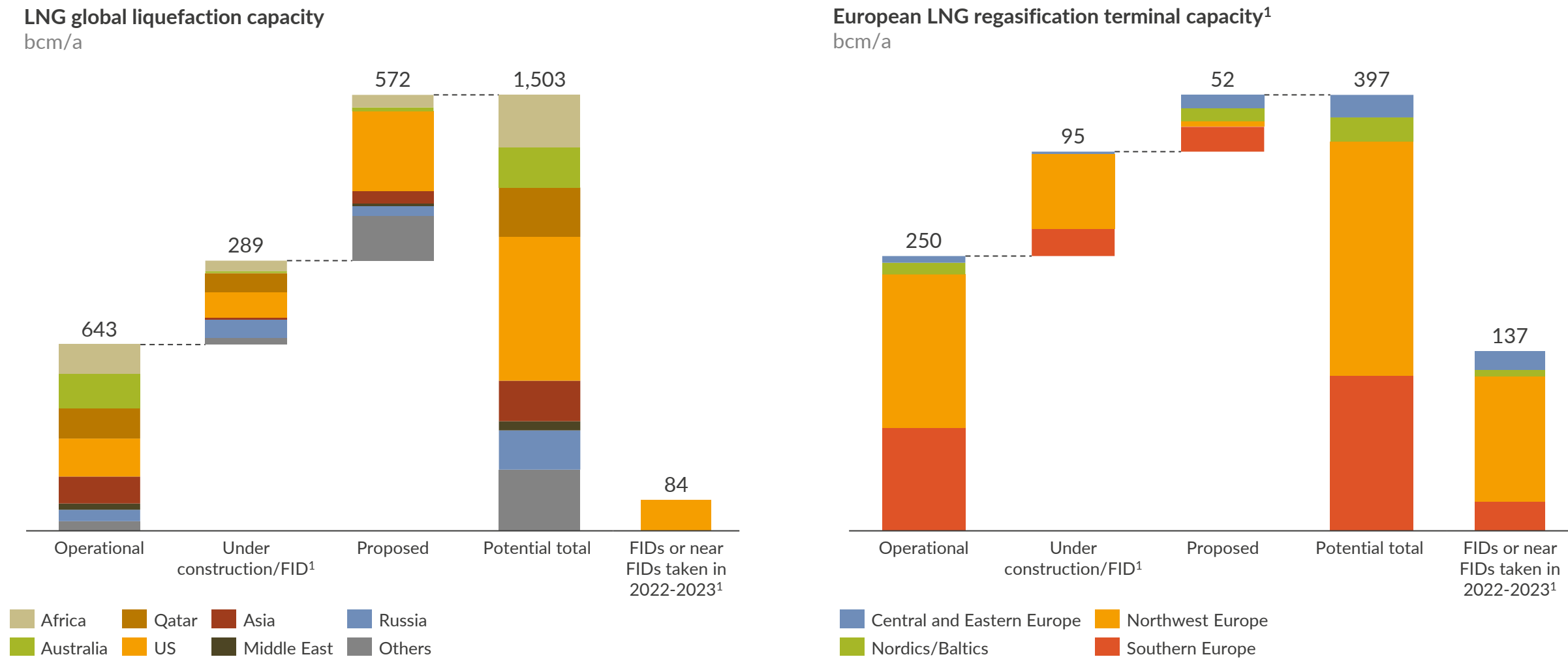
## TTF falls below oil-index

- The benchmark TTF tumbled by \$3/MMBtu (-17%) month-on-month and \$28/MMBtu (-66%) year-on-year in Mar-23, driven largely by milder weather.
- NE Asian spot prices also fell by \$3.4/MMBtu (-20%) m-o-m and \$24/MMBtu (-64%) y-o-y in Mar-23, cutting their discount to the TTF to \$1.1/MMBtu.
- NE Asian spot prices holding near or below European prices could keep more Atlantic-basin and Qatari LNG from heading to Asian destinations.
- US gas prices have also slipped, falling by 2.9% m-o-m and 53% y-o-y in Mar-23.
- Spot European and Asian gas prices at or below parity with oil-indexed supply could encourage higher imports via long term contracts and fewer spot purchases.

# High gas prices and global competition for LNG have driven additional global liquefaction and European regasification infrastructure buildout

A U R  R A

Following the invasion of Ukraine by Russia, many European countries have announced plans to reduce reliance on Russian gas by adding LNG regasification capacity, while the high-price environment has led to renewed interest in upstream LNG infrastructure activity, particularly in the US and Qatar.



1) Excluding Turkey. 2) Final Investment Decision (FID). 3) Northwest Europe includes Belgium, France, Germany, the Netherlands, and the UK. 4) Southern Europe includes Croatia, Greece, Italy, Portugal, and Spain. 5) Central and Eastern Europe includes Poland. 6) Nordics/Baltics includes Estonia, Finland, Lithuania, Norway, and Sweden.  
Sources: Aurora Energy Research, Refinitiv

CONFIDENTIAL 5

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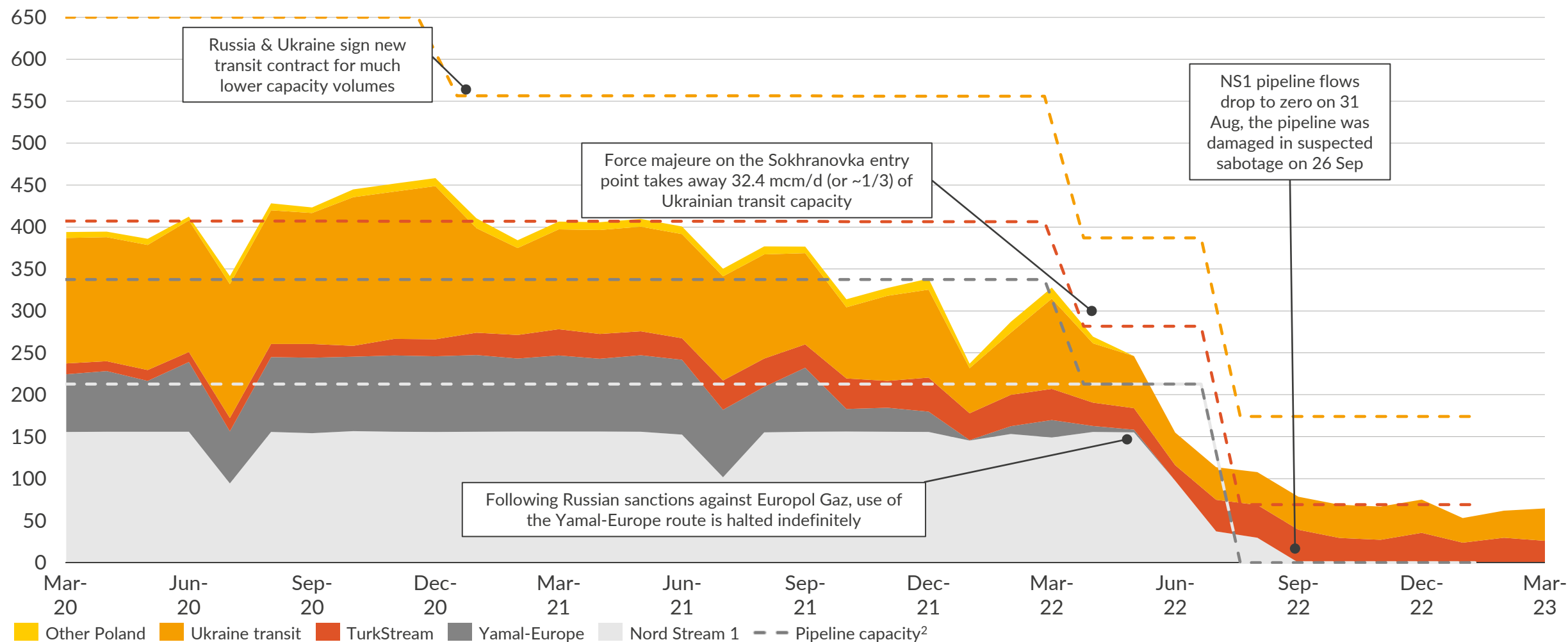
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# Russian gas deliveries to Europe of 64.5mcm/d in Mar-23 were 80% lower than a year earlier

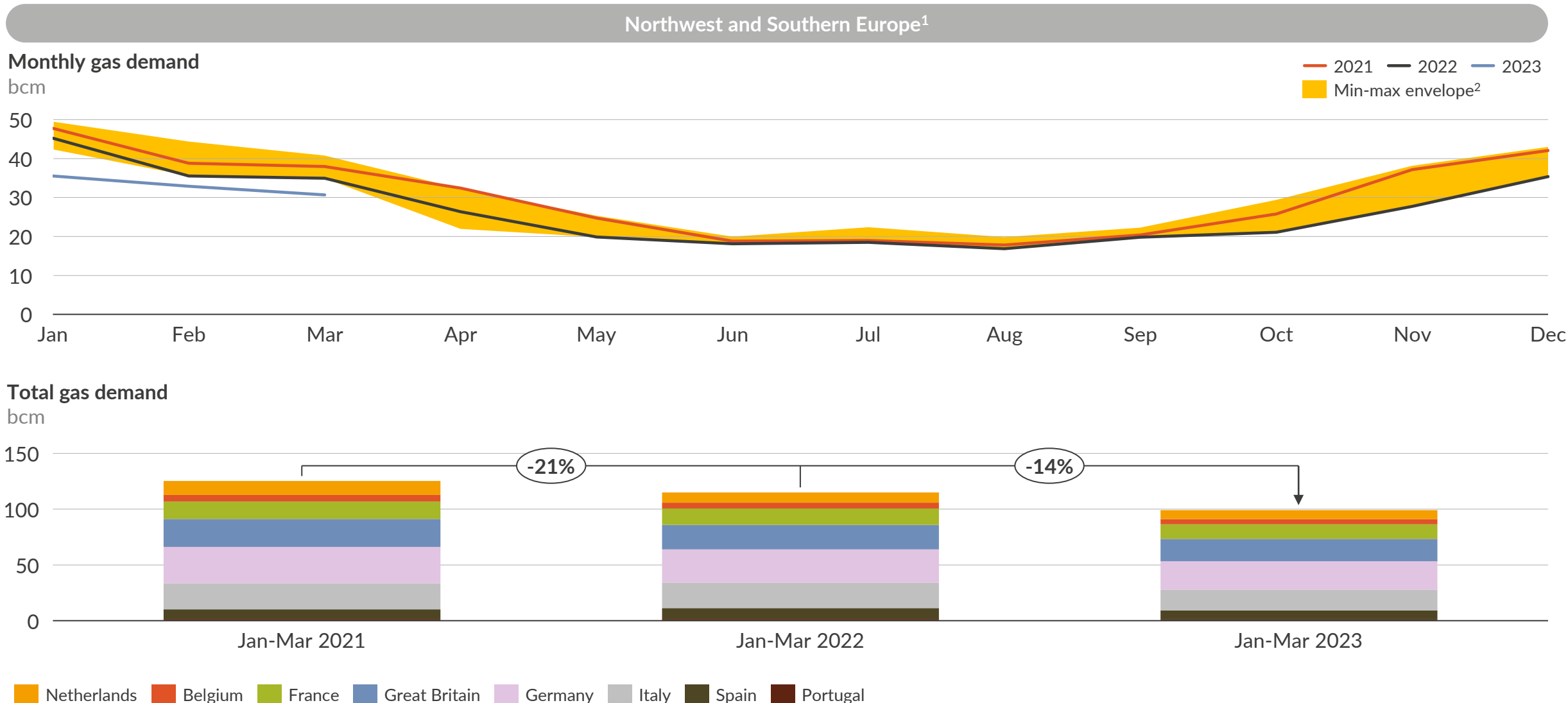
Average monthly Russian gas deliveries to Europe<sup>1</sup>  
mcm/d



1) Deliveries to the Baltics and flows to Turkey that have not transited on to Europe have been excluded. 2) Shown capacities (dashed lines) are cumulative, starting from Nord Stream 1, Yamal-Europe, TurkStream and Ukraine. Other marginal routes, including about 15.7mcm/d of additional capacity at the Belarus-Poland border, were excluded.

Sources: Aurora Energy Research, ENTSO-G

# Mild winter weather and price-induced demand destruction resulted in a 14% y-o-y decline in gas demand for Jan-Mar 2023

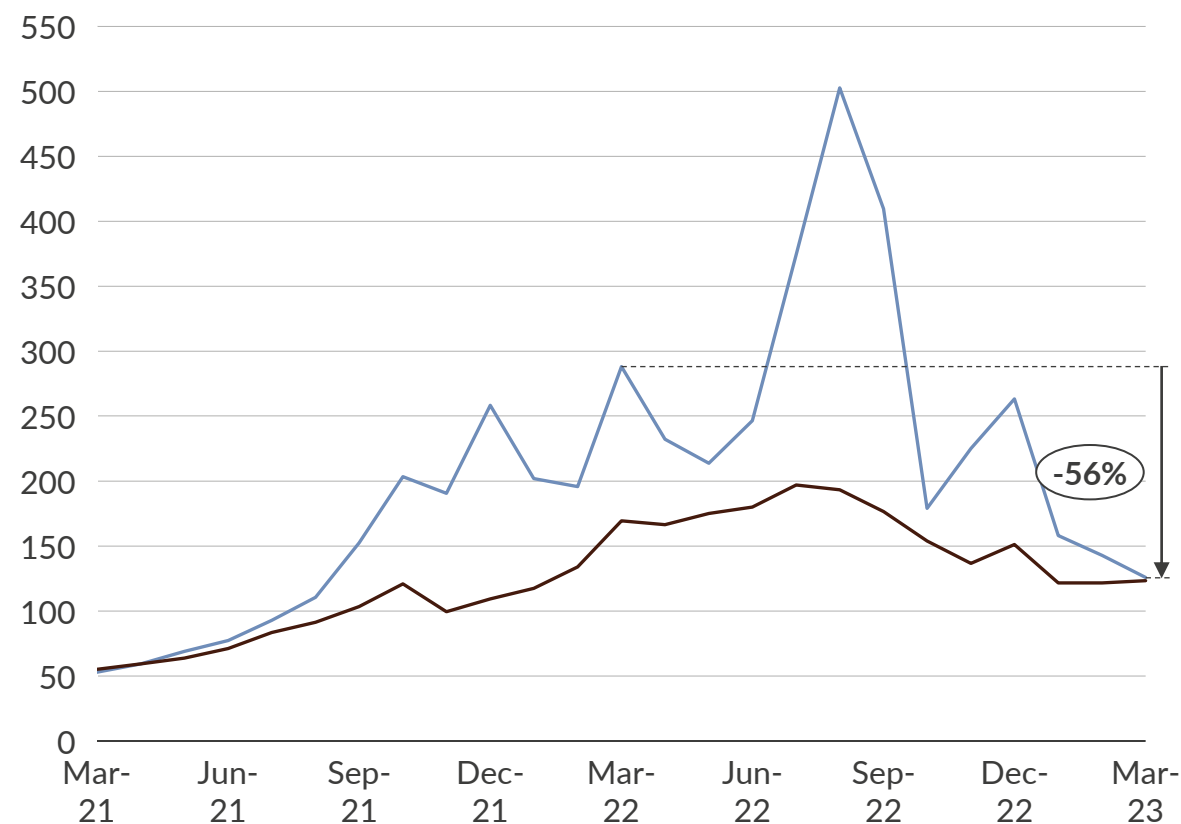


1) Belgium, France, Germany, Netherlands, UK, Spain, Italy, and Portugal. 2) Envelopes are calculated by taking the maximum and minimum monthly values from Jan-18 to Dec-22.

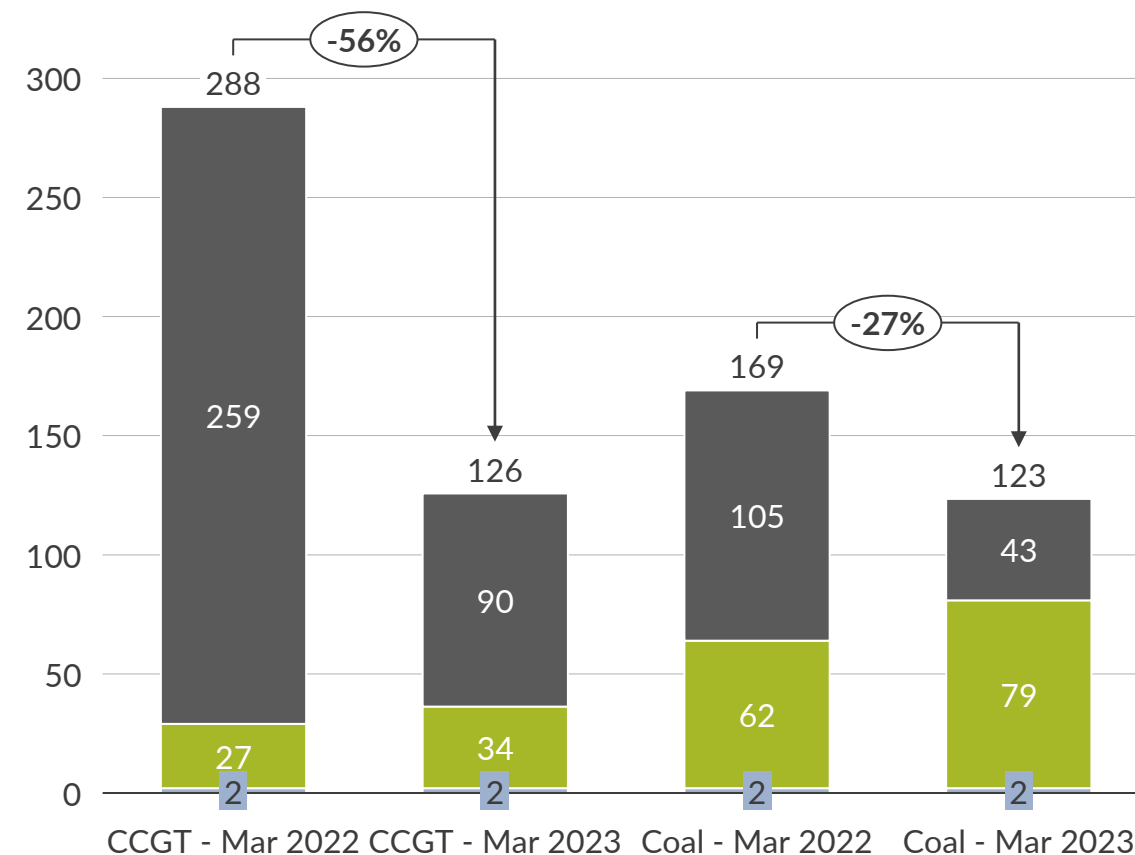


# The SRMC spread between CCGTs and coal-fired plants in Northwest Europe was the smallest in two years

German short-run marginal cost<sup>1</sup>  
€/MWh (nominal)



German short-run marginal cost components  
€/MWh



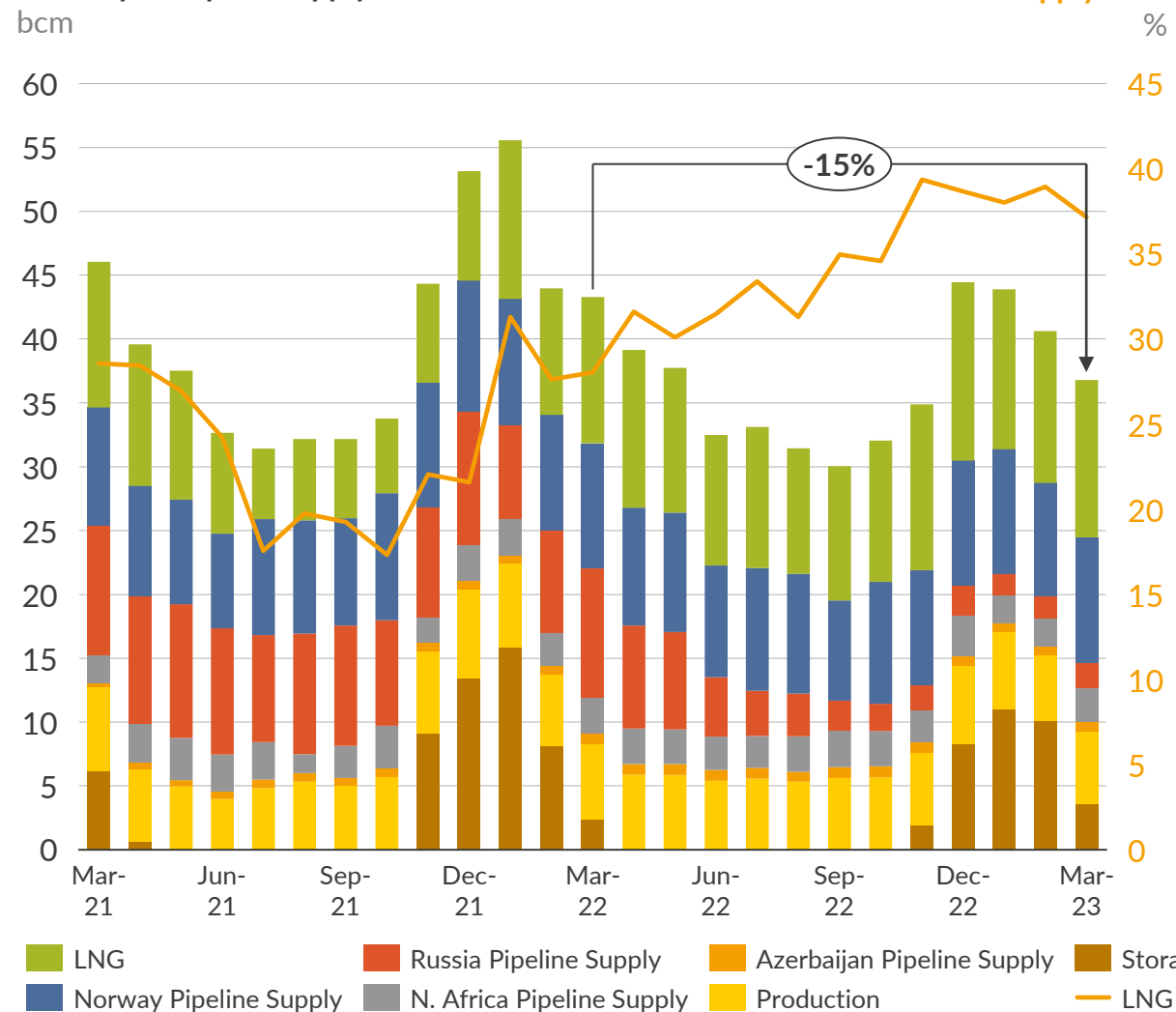
— SRMC CCGT<sup>2</sup> — SRMC Coal<sup>3</sup>

■ Fuel cost ■ Carbon cost ■ VOM

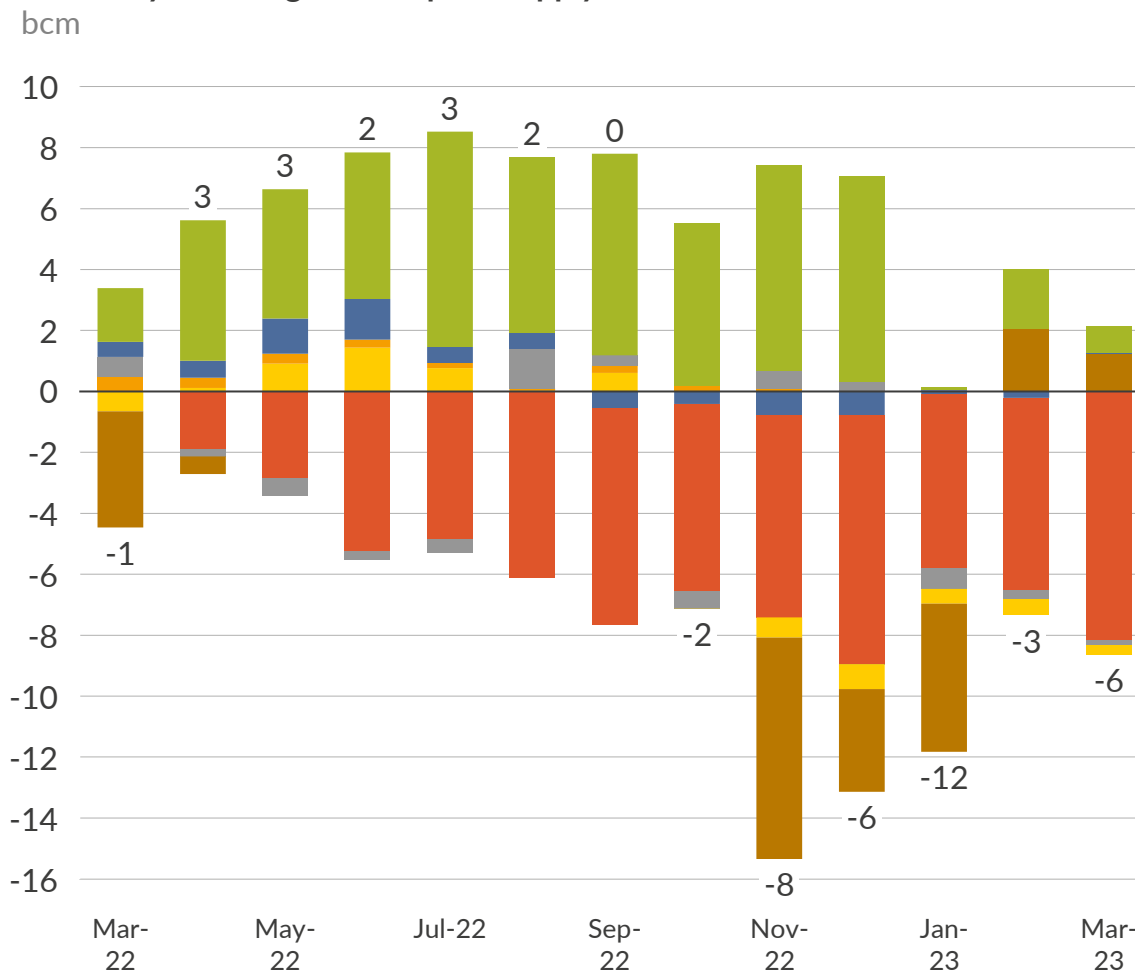
1) Short-run marginal costs consider the costs of fuel (THE front-month contract), carbon emissions (EU ETS), and variable O&M. 2) We assume thermal efficiency of 50% and CO<sub>2</sub> emissions intensity of 0.4 t CO<sub>2</sub>/MWh. 3) We assume a thermal efficiency of 36% and CO<sub>2</sub> emissions intensity of 0.8 t CO<sub>2</sub>/MWh.

Source: Aurora Energy Research

# Total European supply was 15% lower in Mar-23 than in Mar-22; LNG accounted for over 38% of supply in Q1-23, up 9pp from Q1-22

Monthly European supply balance<sup>1</sup>

Year-on-year change in European supply balance



1) Europe includes EU-27 and the UK. Storage injections are not included. 2) Excludes Denmark, Greece, and Lithuania. 3) LNG share does not include storage withdrawals/injections in the supply mix.

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# Since our last Commodities forecast, we have updated our Central scenario to reflect several key market developments

## Key changes to assumptions<sup>1</sup>

- Nord Stream 1 is mothballed permanently, while the available line of Nord Stream 2 never commences commercial operations.
- The Ukraine corridor keeps delivering gas at the current rate (~13bcm/a) until the end of 2024. Russia and Ukraine reach an agreement that allow transit flows to increase to 28bcm/a in 2025 and for the rest of the forecast.
- Downward revision of global annual GDP growth rates. By 2060, global GDP is 5% lower than our in our previous forecast.
- The European ban on Russian coal is in effect from 10 Aug-22. We continue to assume no Russian coal imports to Europe across the forecast horizon.
- Update of global LNG infrastructure to reflect latest market developments.
- European gas-for-power and heat demand revised down 9% on average in 2023-2060, driven by increased buildout of renewables and improved energy efficiency.

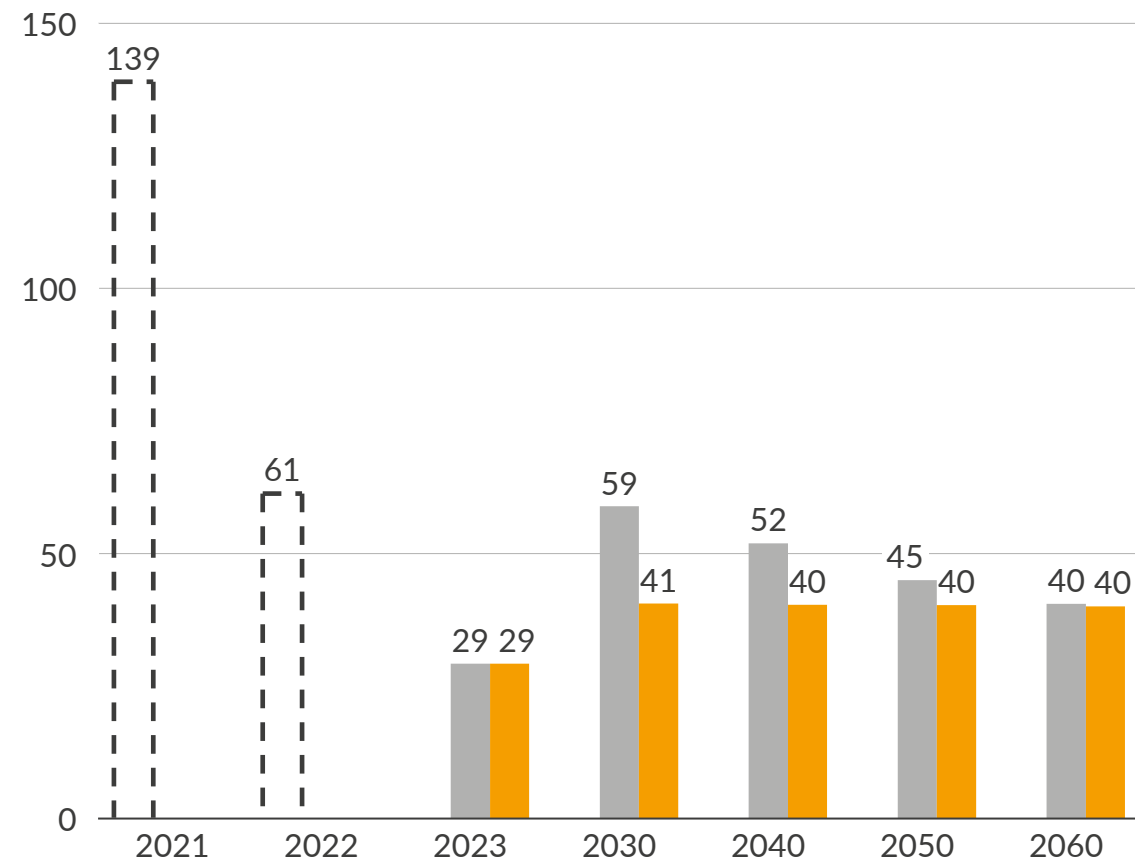
Deep dive in following slides




1) More details on the assumptions can be found in Aurora Energy Research's [Global Energy Markets Forecast April 2023](#).

# Europe's Russian gas imports hold consistently lower than previously forecast, with only the Ukrainian and Turkish routes remaining online

Gross Russian pipeline supply to Europe<sup>1</sup>

bcm

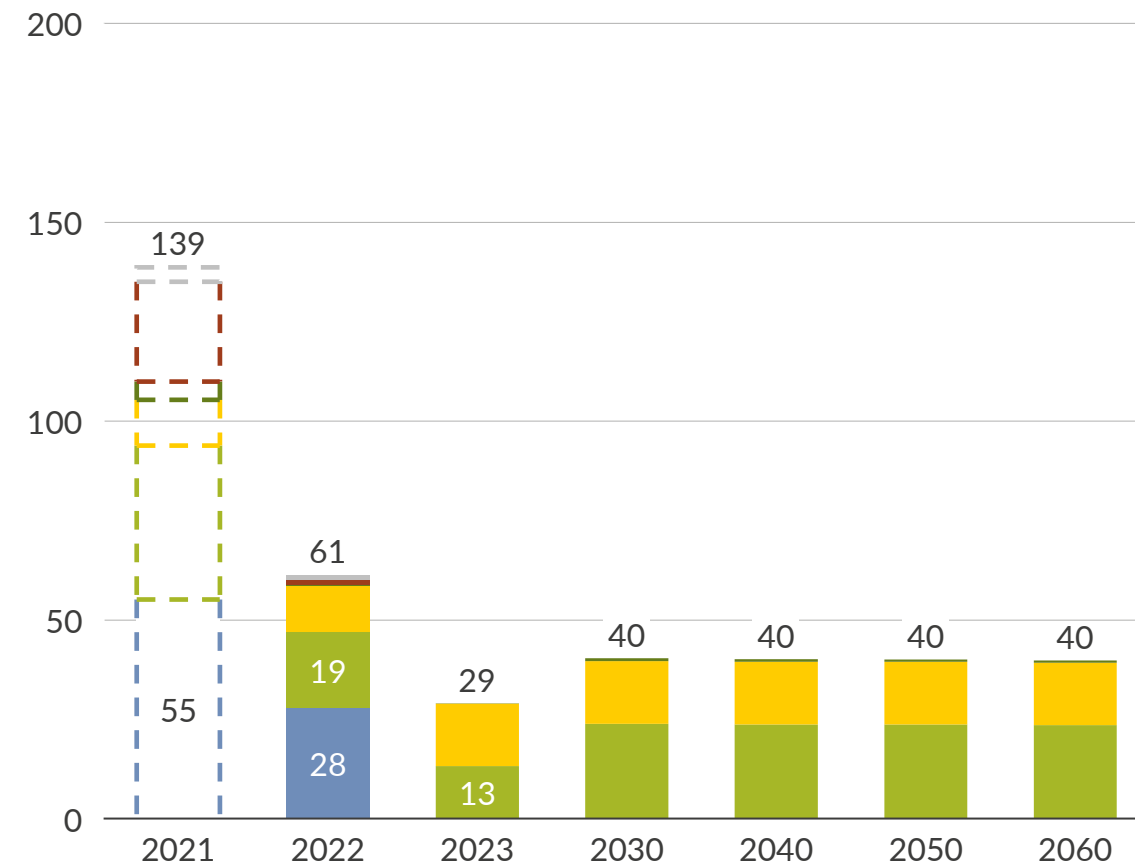


 Historical data<sup>1</sup>  Jan-23 Central  Apr-23 Central

1) Excludes Moldova and Turkey.

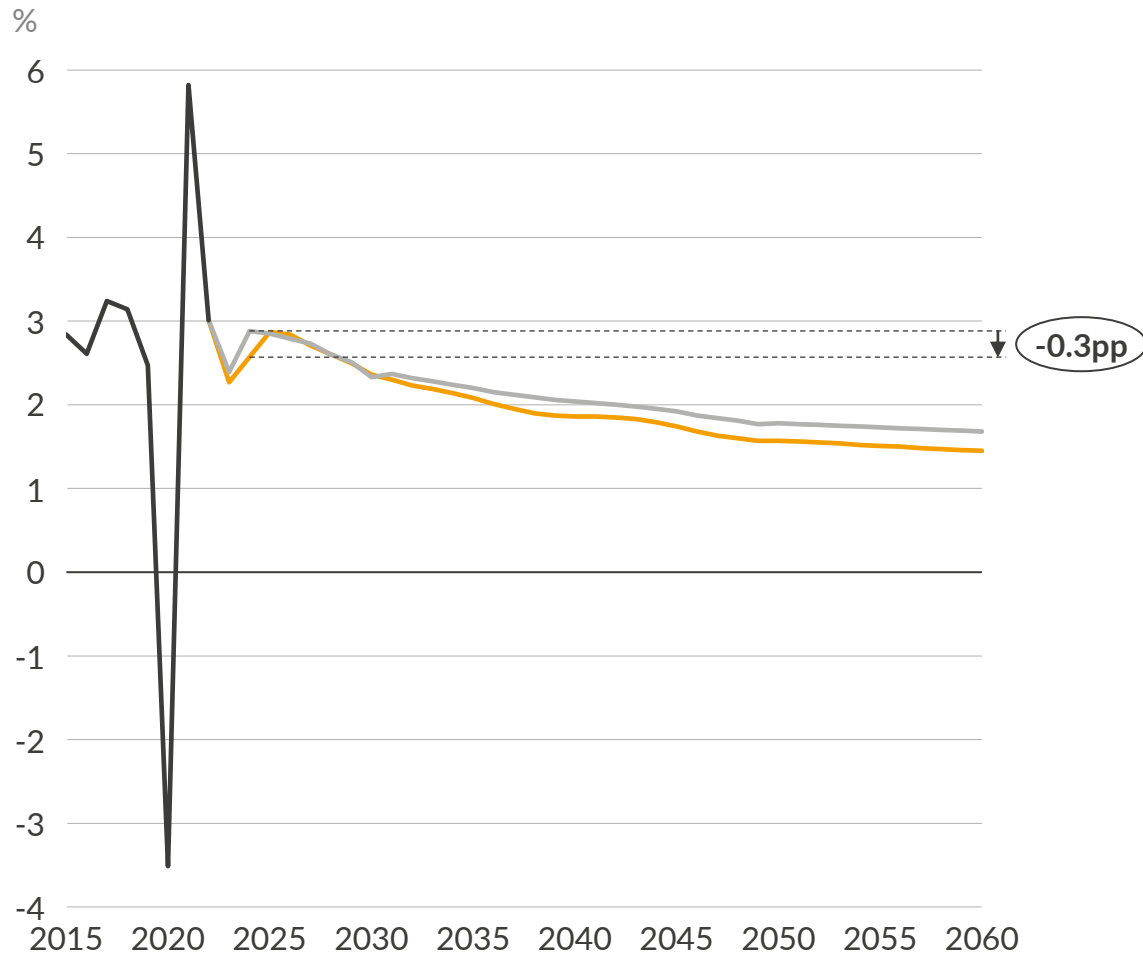
Split between Russian routes

bcm



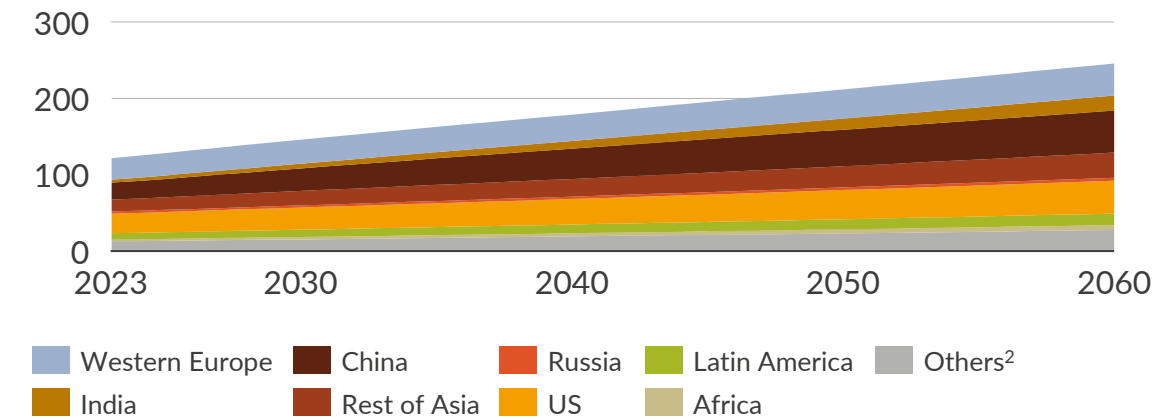
 Historical data  Yamal-Europe  TurkStream  Nord Stream 1 & 2  
 Other Poland  Baltics and Finland  Ukraine transit

# GDP growth forecast for 2023 and 2024 was revised downward as a consequence of the ongoing war in Ukraine

Annual growth of global real GDP<sup>1</sup>

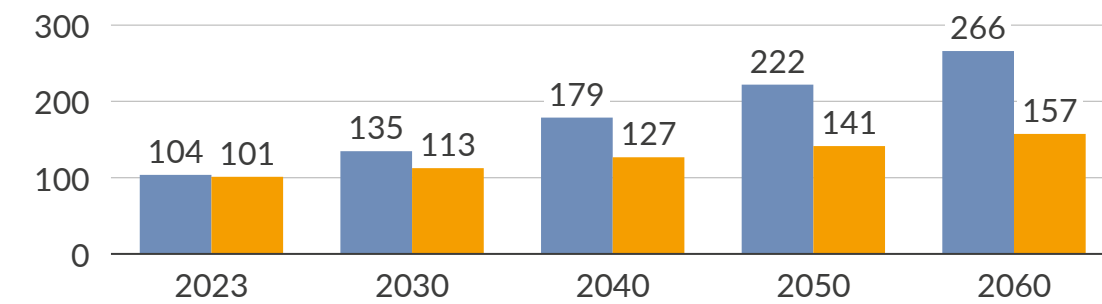
Global GDP

Trillion \$ (real 2022)



Global GDP

2022 world real GDP = 100



1) The global economic outlook for 2023 and 2024 is based on the IMF World Economic Outlook January 2023. The global economic outlook for 2025-2027 is based on the IMF World Economic Outlook October 2022. We assume an average annual growth of 2% thereafter. 2) The 'Others' region includes Australia & New Zealand, Canada, Iran, Iraq, Qatar, Saudi Arabia, Africa, rest of eastern Europe, rest of OPEC and rest of the Former Soviet Union.

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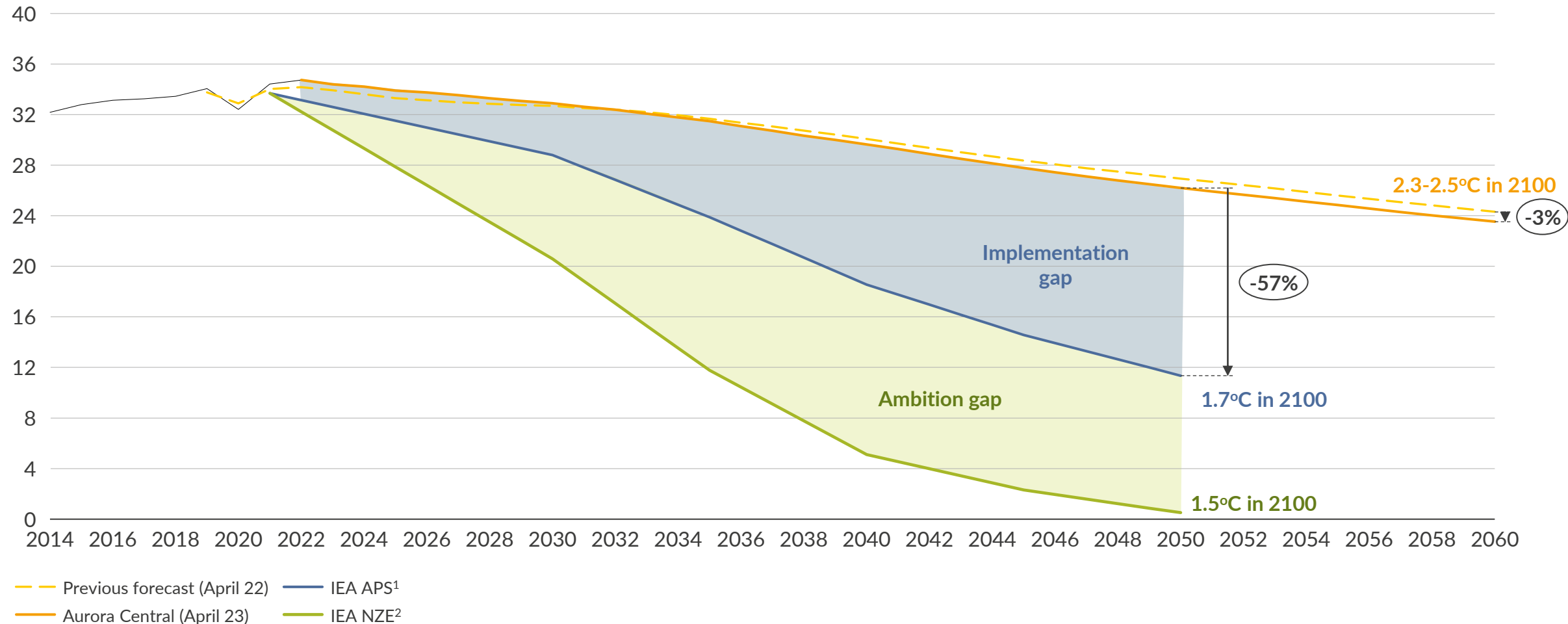
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## IV. Takeaways

# Carbon emissions fall by 3% in 2060 as a result of lower global fossil fuel demand

## Annual global carbon emissions from combustion

GtCO<sub>2</sub>

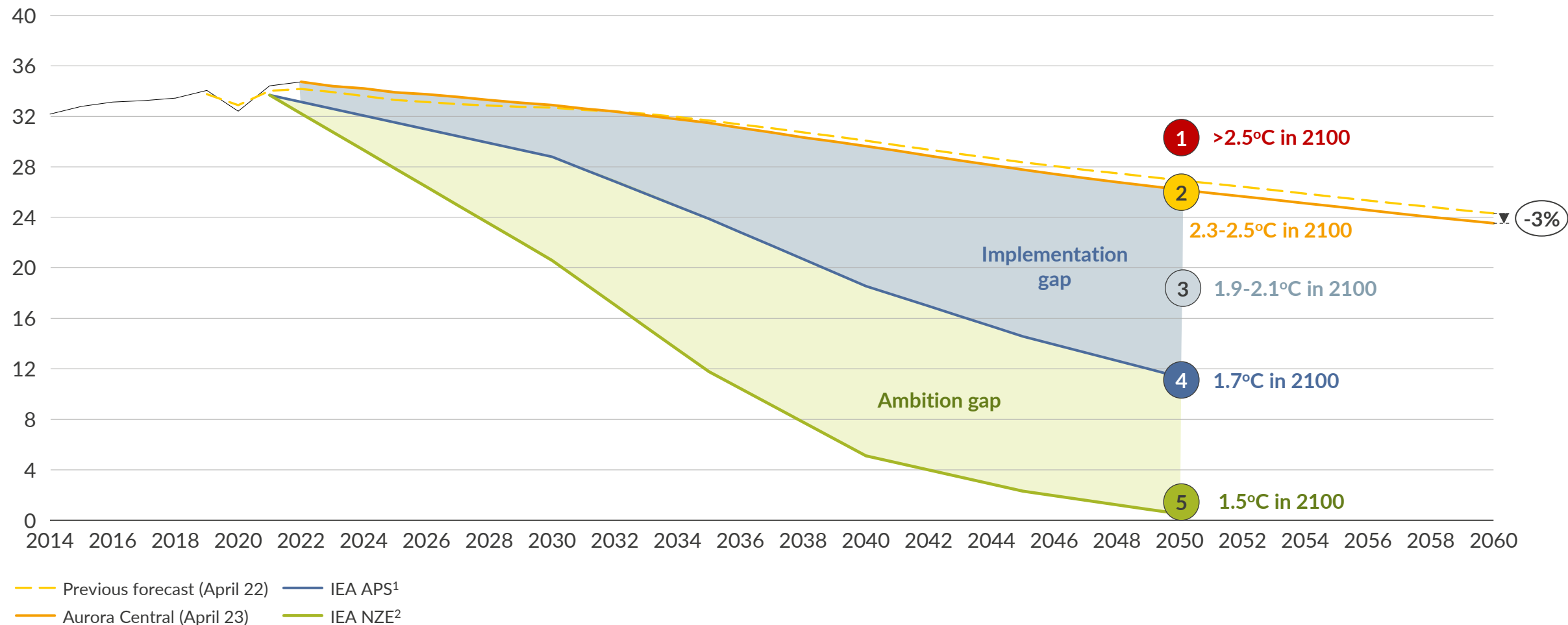
1) IEA Announced Pledge Scenario (APS) as of IEA WEO 2022. 2) IEA Net Zero scenario from the WEO 2022. The IEA includes emissions from combustion including industry and flaring. 3) This is well above the Paris Climate Agreement target of <1.5°C which is achieved by IEA's NZE scenario.

Sources: Aurora Energy Research, IEA



# Carbon emissions fall by 3% in 2060 as a result of lower global fossil fuel demand

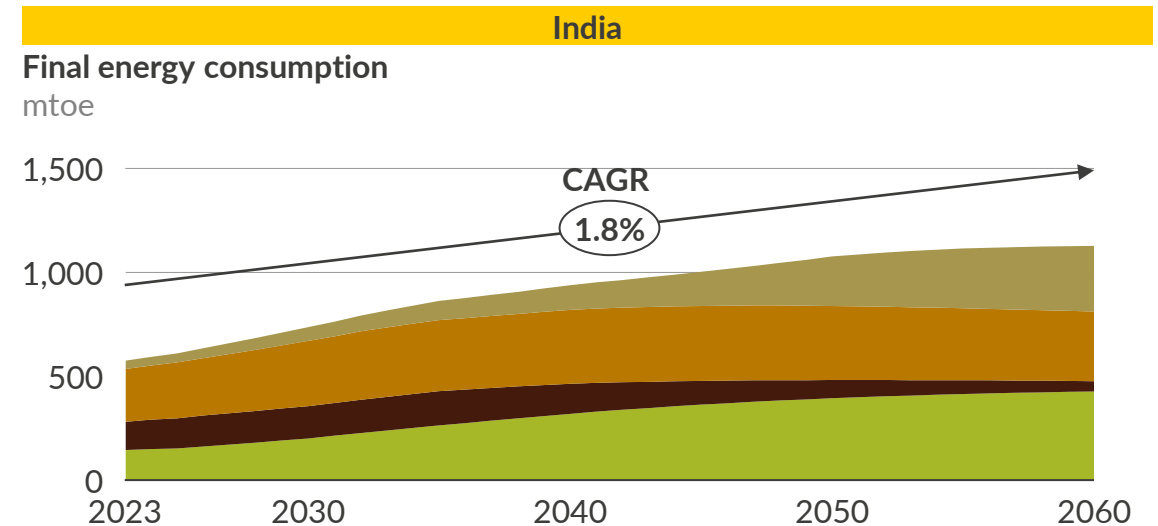
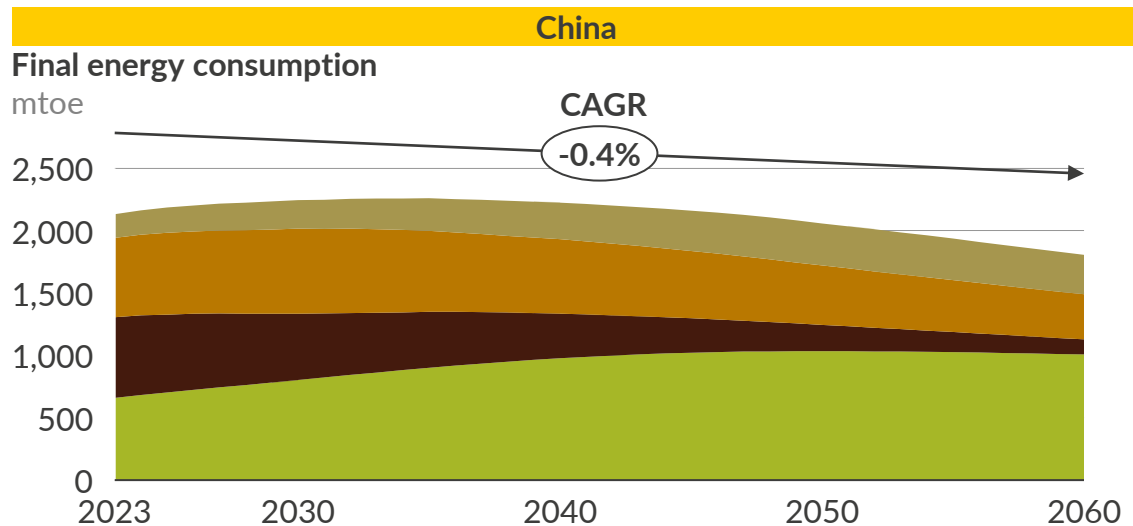
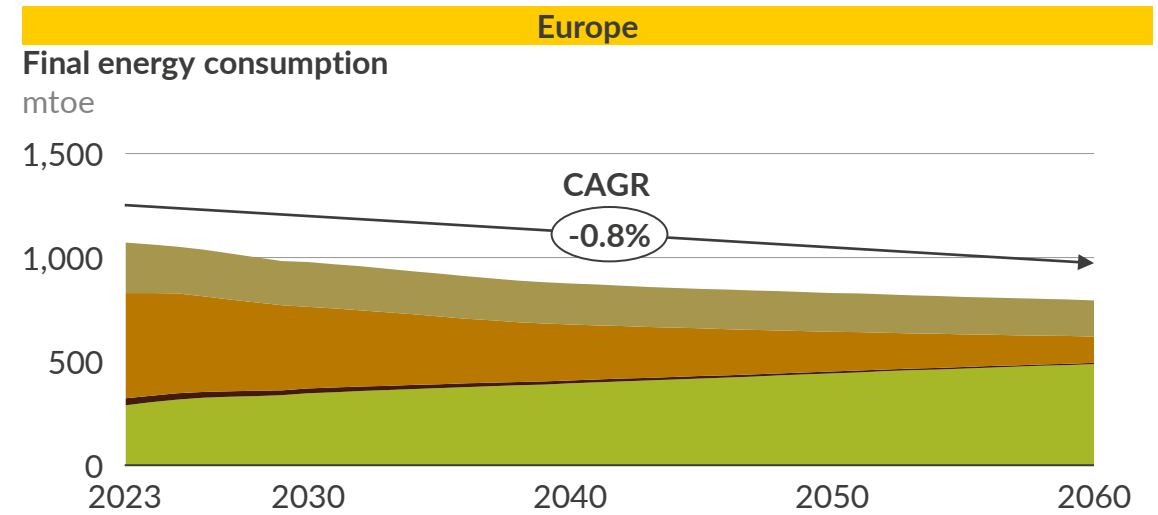
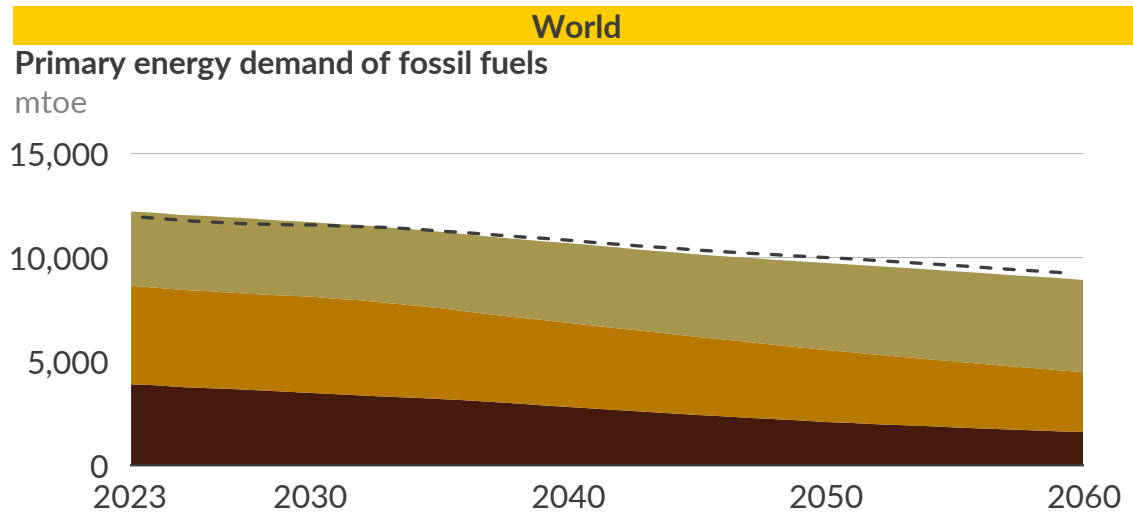
Annual global carbon emissions from combustion

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Sources: Aurora Energy Research, IEA

# Significant electrification cuts into regional final fossil fuel consumption



Gas Oil Coal Electricity -- Previous forecast

## I. Market developments

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## II. Key assumptions

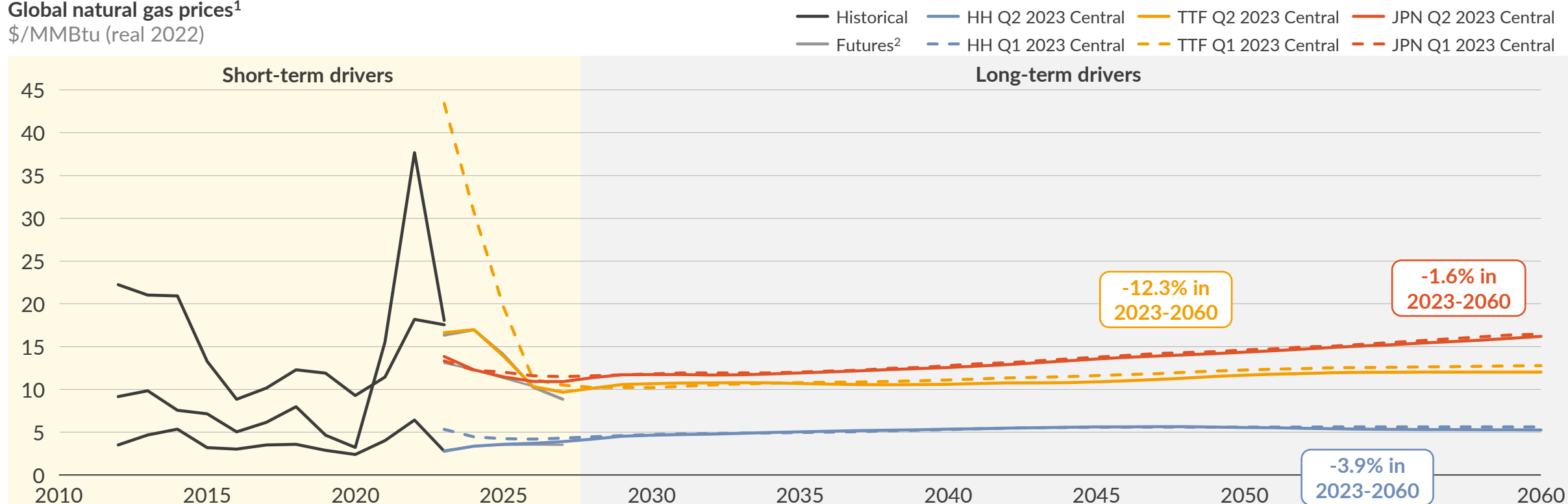
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## IV. Takeaways

# Global gas prices fall in the short-term relative to our previous forecast, and rebalance by 2027 before increasing again

Global natural gas prices<sup>1</sup>  
\$/MMBtu (real 2022)



- 1 Global gas prices fall in the short-term, lead by a sharp drop in European markets, as fears over the energy crisis recede due to lower demand and higher than expected storage levels. Prices in other markets also decrease.
- 2 European markets remain in strong backwardation until late 2020s due to high reliance on LNG imports.

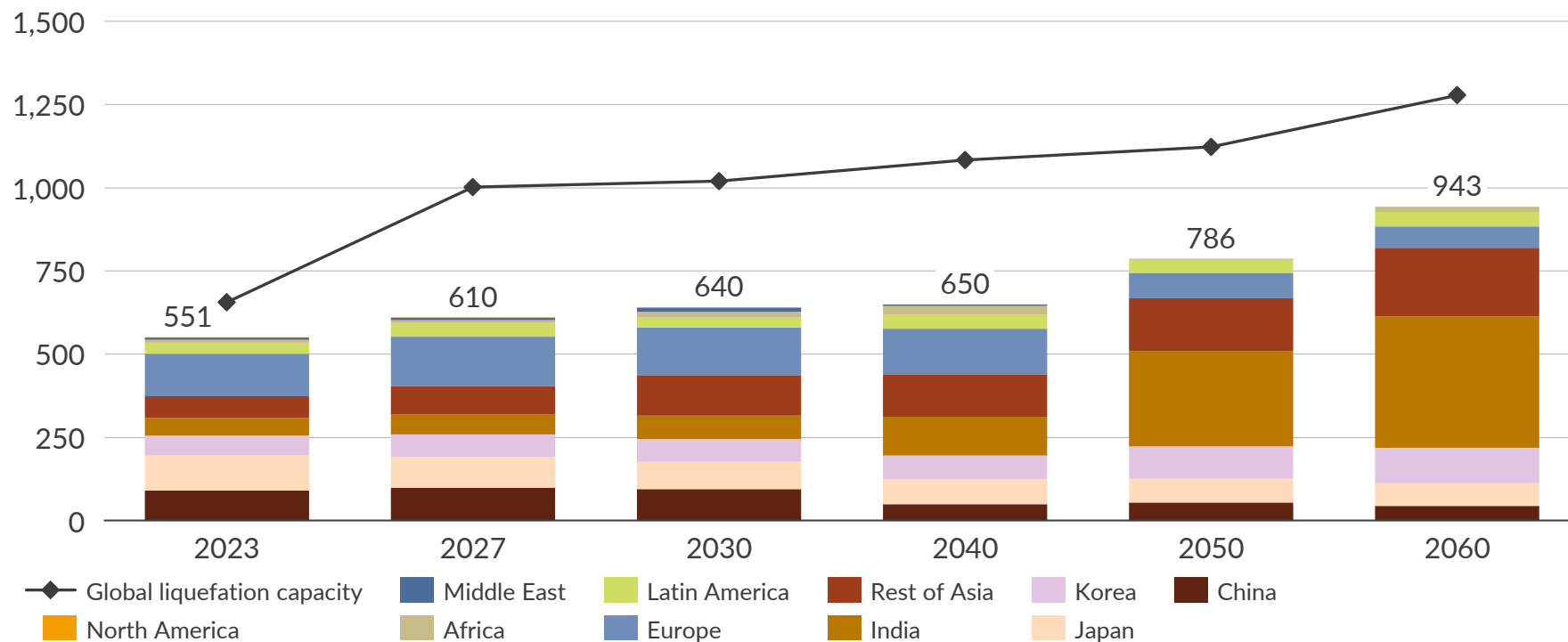
- 1 Markets rebalance as global LNG supply increases in the second half of the 2020s due to expanded liquefaction capacity.
- 2 US gas output rises steadily to meet Europe and Asia's increased need for LNG imports.
- 3 Asian gas prices regain a premium to Europe.

- 4 European and US demand fall, but global appetite for LNG drives gas prices higher, as China and India drive demand growth in Asia.
- 5 Europe's gas production declines faster than demand, leading to greater reliance on imports, and Russian output stays lower than previously forecast on weaker exports to Europe.

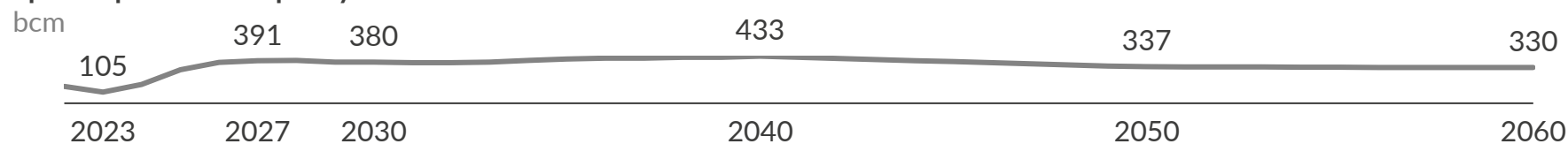
1) For years 2023-2028, the prices shown take into account current futures prices for the years in question, with declining weights. In 2023, forecast prices include historical prices up to Feb-23. 2) A rolling 14-day average as of 01/03/2023.

# Spare global liquefaction capacity increases quickly from just 105bcm in 2023 to a peak of 433bcm in 2040

Gross LNG imports and liquefaction capacity  
bcm



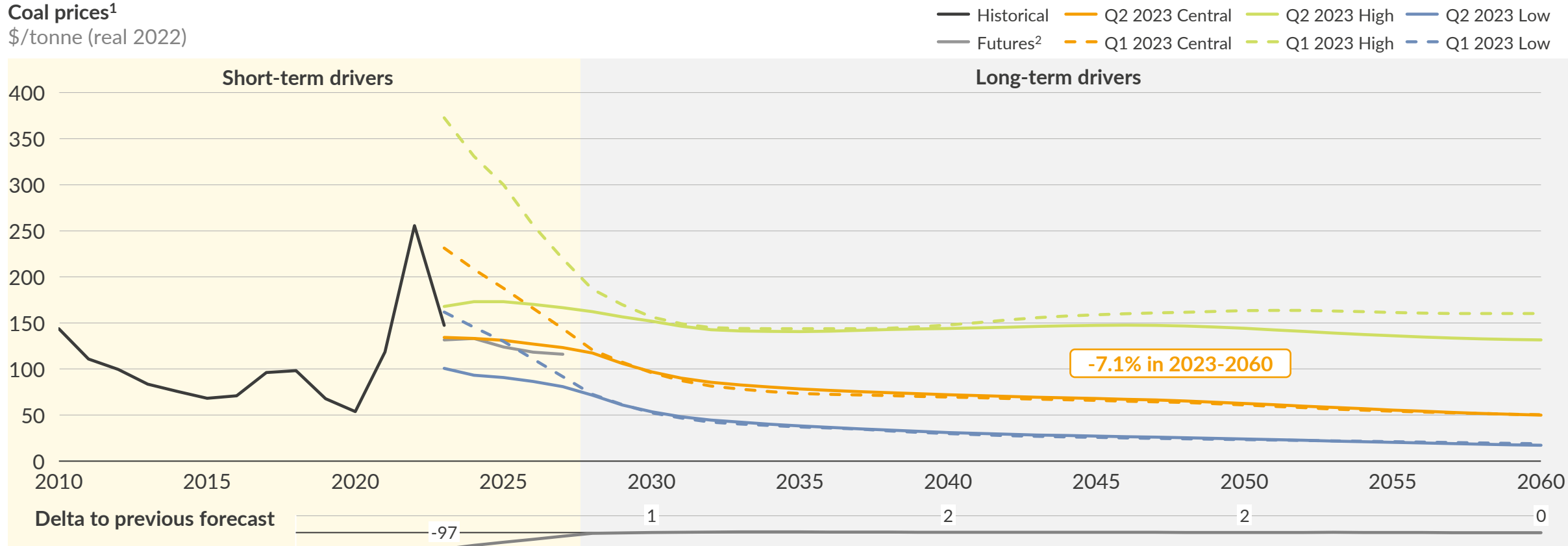
Spare liquefaction capacity



- Gross LNG imports are nearly flat around 581bcm/a until 2027 before rising to 943bcm in 2060 (+62%).
- Global liquefaction capacity utilisation peaks at 84% in 2023, but falls to 61% in 2027 as the market rebalances.
- Utilisation averages 63% in the 2030s, 60% in the 2040s, and 70% in the 2050s, with growing demand for LNG.
- Asian imports drive the increase, climbing by 445bcm (+119%) by 2060 from 2023. India accounts for most of the increase after 2040, rising from 53bcm in 2023 to an average of 201bcm/a in the 2040s and jumping to 341bcm/a in the 2050s.
- Europe's LNG imports rise from 127bcm in 2023 to an average of 140bcm/a in the 2030s before falling steadily to 106bcm/a in the 2040s and 70bcm/a in the 2050s.

# The ARA coal price is expected to average \$129.8/tonne in 2023-2027, 31% lower than in our previous forecast

Coal prices<sup>1</sup>  
\$/tonne (real 2022)



**1** The ARA coal price averages \$129.8/tonne in 2023-2027, 31% lower than the previous forecast.

**2** The price remains relatively high historically, but substitution of Russian coal with supply from South Africa and Colombia contributes to the decrease.

**1** China's pending economic recovery could keep coal prices from falling too quickly.

**1** Long term coal prices still decline, but average \$70.7/tonne, 3% higher than in our previous forecast.

**3** High gas prices and energy security concerns slow coal-to-gas switching in southeast Asia. This results in higher prices in the period, although the trend of price decline continues.

1) For years 2023-2028, the prices shown take into account current futures prices for the years in question, with declining weights. 2) A rolling 14-day average as of 01/03/2023.

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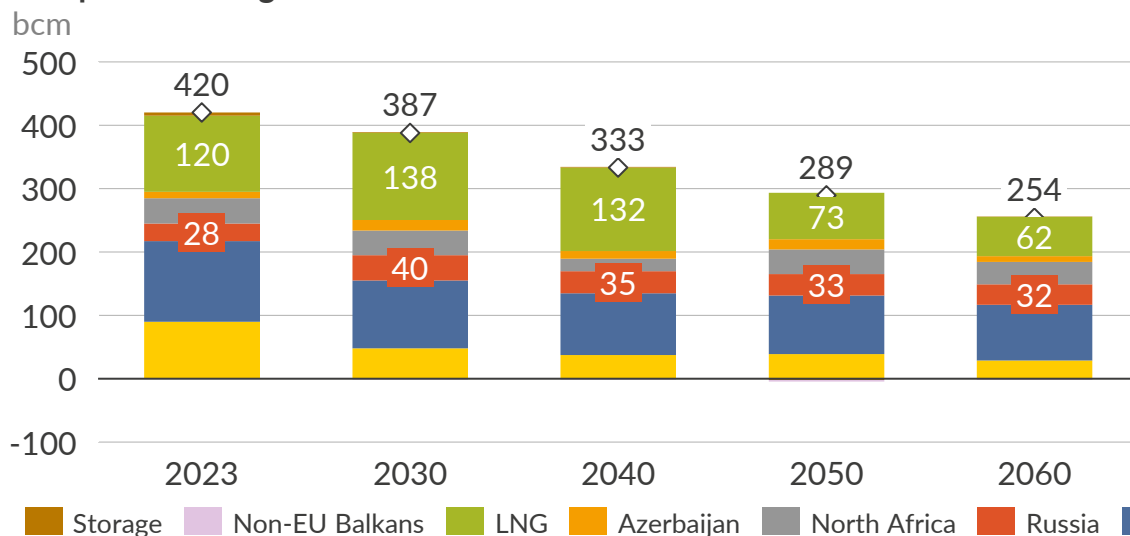
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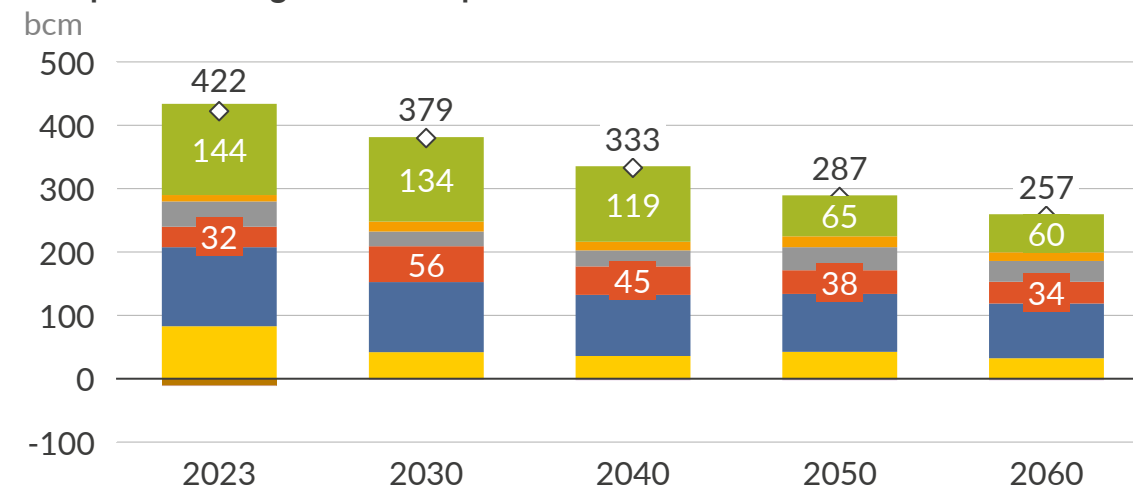
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## IV. Takeaways

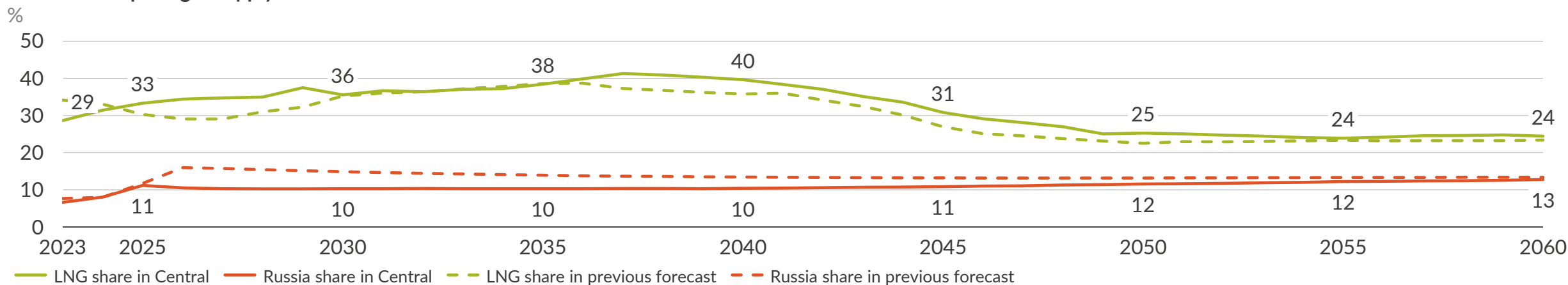
# Driven by the drop in Russian gas supply, LNG's share of the European gas balance averages 32% across the forecast, 2pp above our previous outlook

A U R  R AEuropean annual gas balance – Central scenario<sup>1</sup>

European annual gas balance - previous forecast



Share of European gas supply

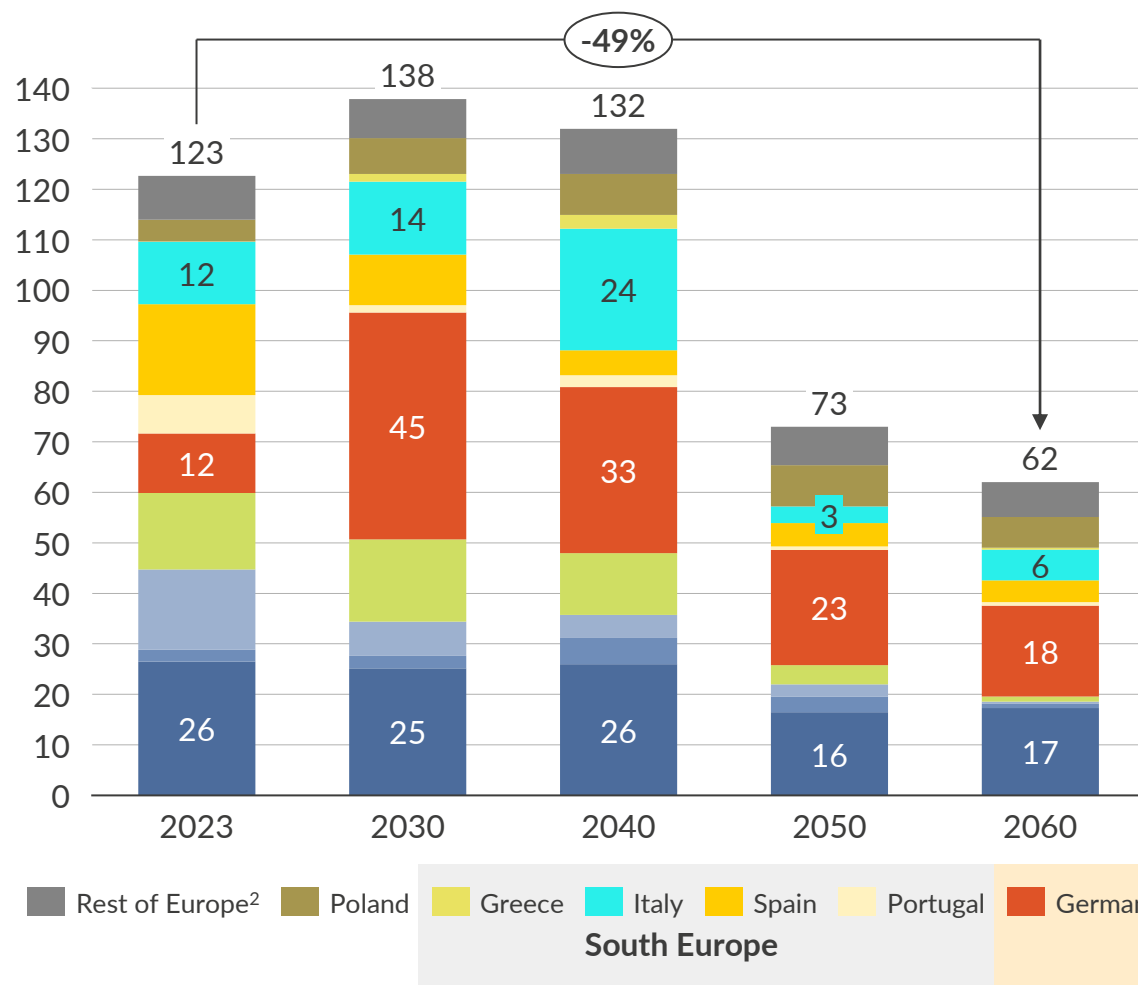


1) EU27 + GB + Switzerland. 2) Includes biomethane production.

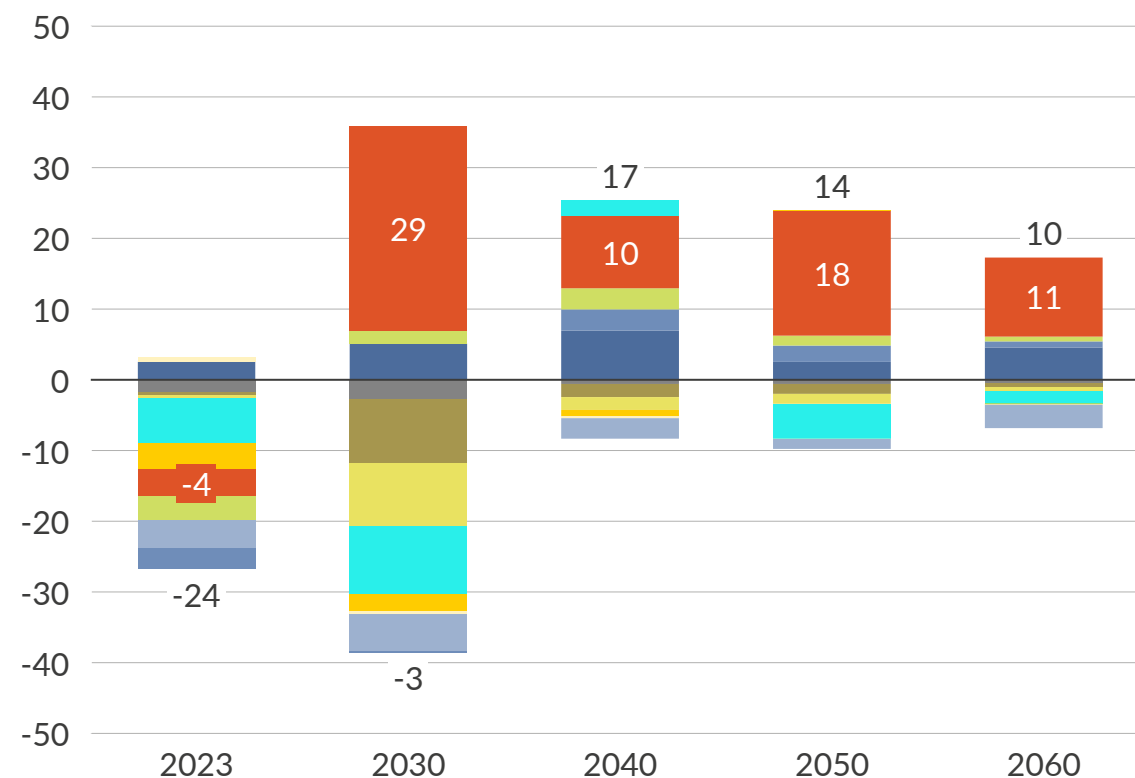


# As a result of the permanent shutdown of the Nord Stream 1 pipeline, Germany becomes Europe's largest LNG importer

European LNG imports by destination<sup>1</sup>  
bcm

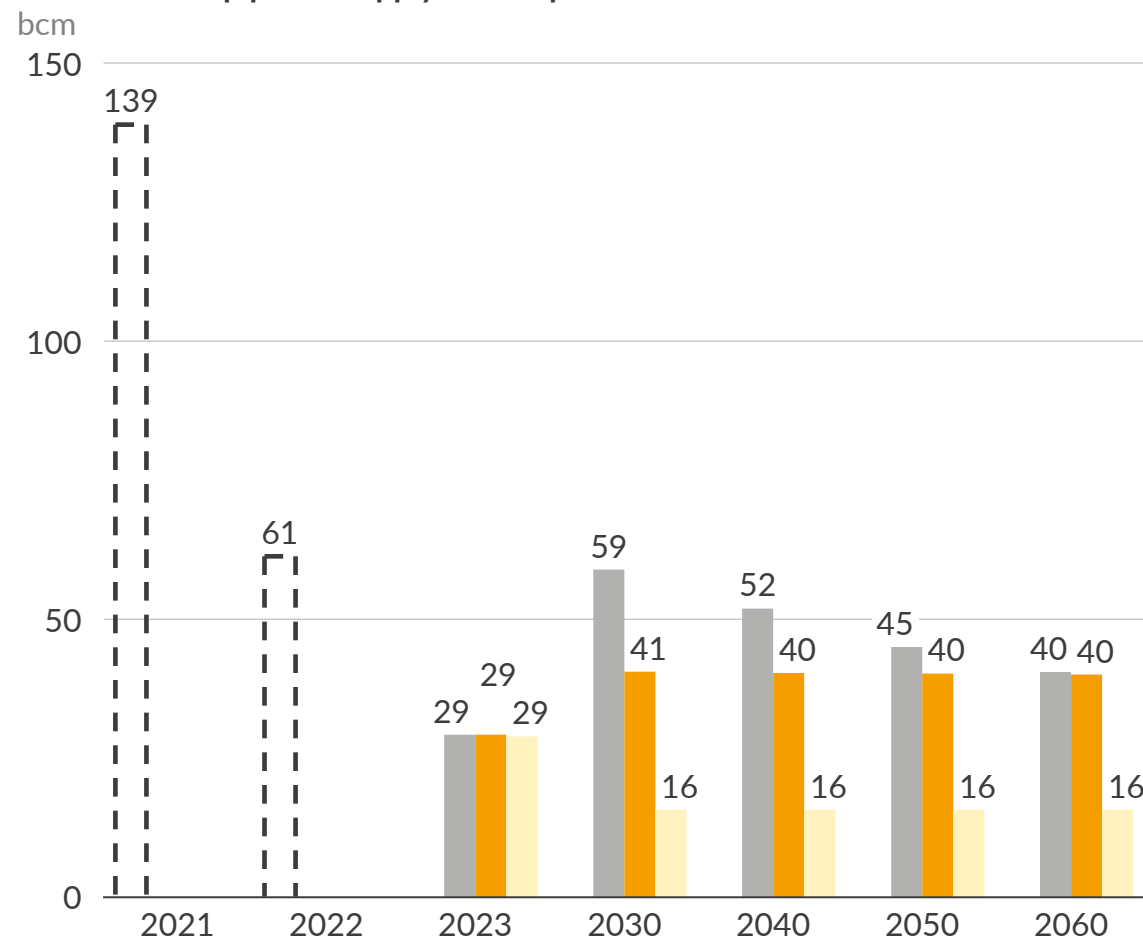


Change from previous forecast  
bcm

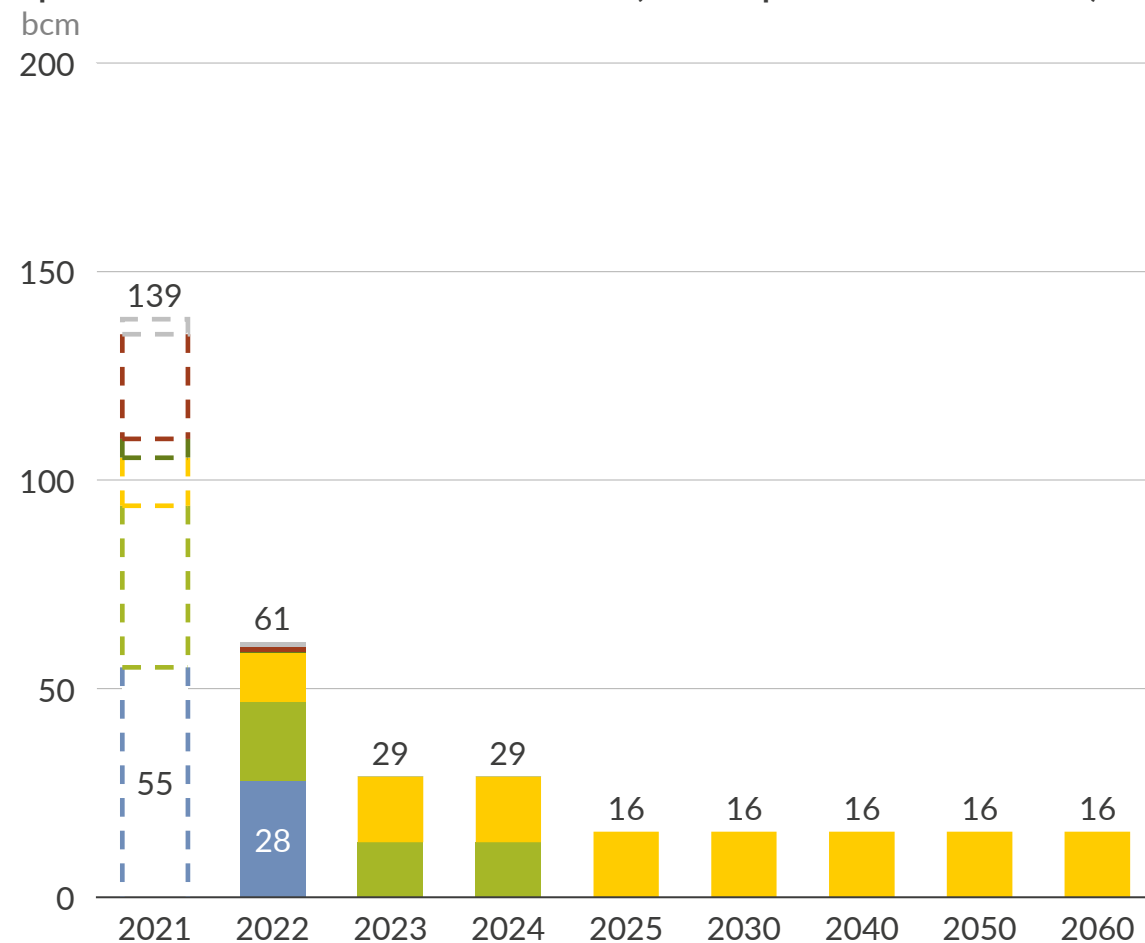





1) Europe includes EU-27, UK, Norway, and Switzerland, but not the Balkans. Numbers differ from LNG figures in EU Balance because the numbers here are gross LNG flows (before factoring in boiloff due to travel and re-exports), while the numbers in the EU Balance are net LNG flows. 2) Croatia, Estonia, Finland, Latvia, Lithuania, Norway, and Sweden.

# In our Alternative Russian Gas Halt scenario, Europe's Russian pipeline gas imports halt at the end of 2024, except for TurkStream

Gross Russian pipeline supply to Europe<sup>1</sup>

Split between Russian routes – Alternative (Unanticipated Russian Gas Halt)



 Historical data<sup>1</sup>
 Apr-23 Central  
 Jan-23 Central
  Apr-23 Alternative Russian Gas Halt

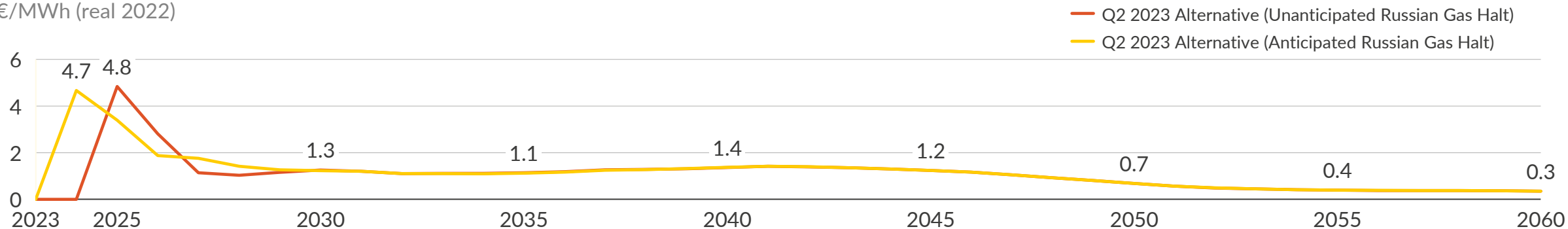
1) Excludes Moldova and Turkey.

 Historical data
  Yamal-Europe
  Turk Stream
  Nord Stream 1 & 2  
 Other Poland
  Baltics and Finland
  Ukraine transit

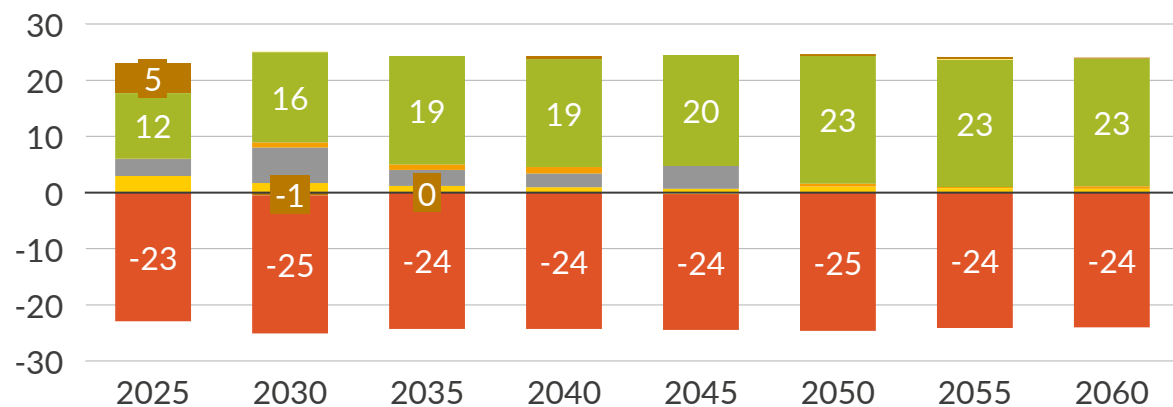
# Driven by increased reliance on LNG in the Alternative scenario, European gas prices would be significantly higher in the short term

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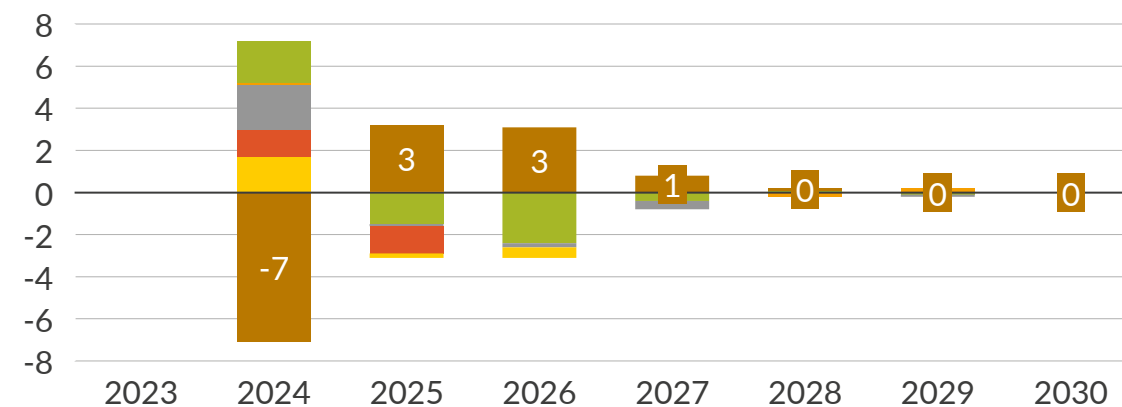
Change to TTF gas prices vs Central<sup>1</sup>  
€/MWh (real 2022)



Change to European gas balance in Alternative (Unanticipated) vs Central  
bcm



Change to European gas balance if the halt to Russian gas imports is anticipated  
vs unanticipated  
bcm



Storage Non-EU Balkans LNG Azerbaijan North Africa Russia Norway Indigenous Production

1) For years 2023-2028, the prices shown take into account latest futures prices for the years in question, with declining weights. For year 2023, forecast prices include historical prices up to Feb-23. 2) A rolling 14-day average as of 01/03/2023.

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Global gas prices have dropped from their late 2022 record highs and are lower than they were before the war, though still high relative to historical norms.

Futures and our short-term gas forecast are down globally, including in Europe, northeast Asia, and the US.



GDP growth is expected to remain muted in the upcoming years, reducing the size of the global economy relative to our previous forecast.

As a result, global gas prices will fall in the long term compared with our previous forecast, particularly in Europe.



However, we still expect global demand for gas to rise in the coming decades, driven by economic growth and climate policy switching emerging markets away from coal.



Gas prices still increase over time, as Europe will need to compete with other regions, especially northeast Asia, for LNG much more than it has in the past. This will require more infrastructure build out in demand regions like Europe and Asia, and new liquefaction capacity in supplier regions, like the US and Qatar.

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