

Impact of Russia-Ukraine war on European gas markets

28th February 2022



Executive Summary

In this free report we examine the impact of a delay to the Nord Stream 2 pipeline, and a delay combined with a halting of Russian natural gas transit through Ukraine, on supply in European markets

A Russian war on Ukraine could result in a disruption to Russian gas and coal supply to Europe. This report examines the impact of a delay to the Nord Stream 2 pipeline and a potential halt to Russian gas transit through Ukraine on gas markets in northwest and southern and eastern Europe

Europe depends heavily on Russian gas to meet its needs, around 30-40% of Europe's supply mix but higher in some southern and eastern countries. Russian gas to Europe has increased since the 1980s but dipped in 2020 and 2021

After tensions escalated and Germany halted certification of Nord Stream 2. European gas prices rose by 28% week-on-week¹, and power prices rose by 38%². We explore the impact on flows of three scenarios

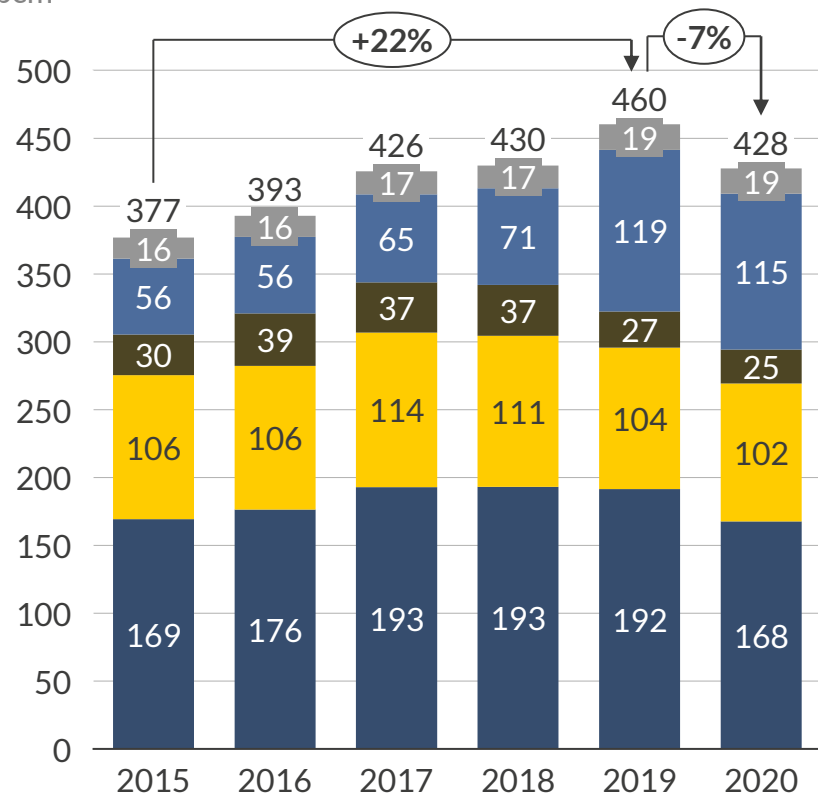
1. Nord Stream 2 comes online in 2025, a two-year delay relative to our previous Central scenario, and transit through Ukraine does not exceed 40bcm/a
 - With a two-year delay to NS2 to 2025, LNG deliveries to Europe reach 110bcm by 2024, but fall the next year as Russian supply rises. Regasification capacity reaches close to maximum in some periods
 2. Nord Stream 2 comes online in 2025, but transit through Ukraine ceases from 2022
 - A complete loss in Ukrainian transit boosts LNG imports, before NS2 starts up. Total Russian pipeline gas to Europe remains below historical levels for the next decade and there is a risk of not enough supply to Ukraine
 3. Nord Stream 2 is cancelled but transit through Ukraine can continue at 40bcm/a
 - Total Russian gas to Europe slips to 2020 pandemic levels, and remains broadly unchanged over the decade. LNG increases to compensate, and we expect this will come at higher cost, keeping European gas prices elevated
- There is insufficient LNG and downstream capacity available to offset a full loss in Russian gas supply to Europe. Other supplies would have to step up in this extreme case
 - Many questions over the war remain unanswered, and even deeper cuts or a complete halt to Russian gas deliveries could make it difficult, if not impossible, for Europe to meet its gas import needs without cutting demand

1) TTF front-month contract 2) German baseload power front-month contract

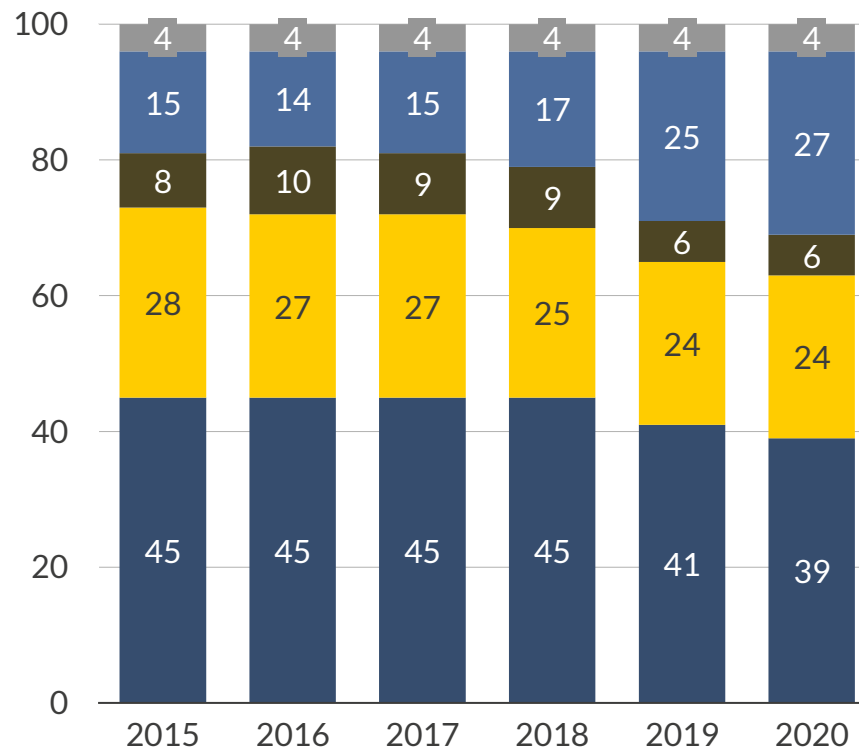
- I. European reliance on Russian gas and coal**
- II. Nord Stream 2 suspension and Ukraine war, and impact on gas and power prices**
- III. Russian gas transport medium-term scenarios**
 - 1. Suspension until 2025 of Nord Stream 2
 - 2. NS2 Suspension combined with disruption to Ukraine transit flows
 - 3. Full cancellation of Nord Stream 2
- IV. Potential for congestion in Europe and shortages**
- V. Takeaways**

Russia meets around 30-40% of gas demand in Europe and is the largest single supplier

Gross European gas imports¹
bcm



Percentage of European imports²
%



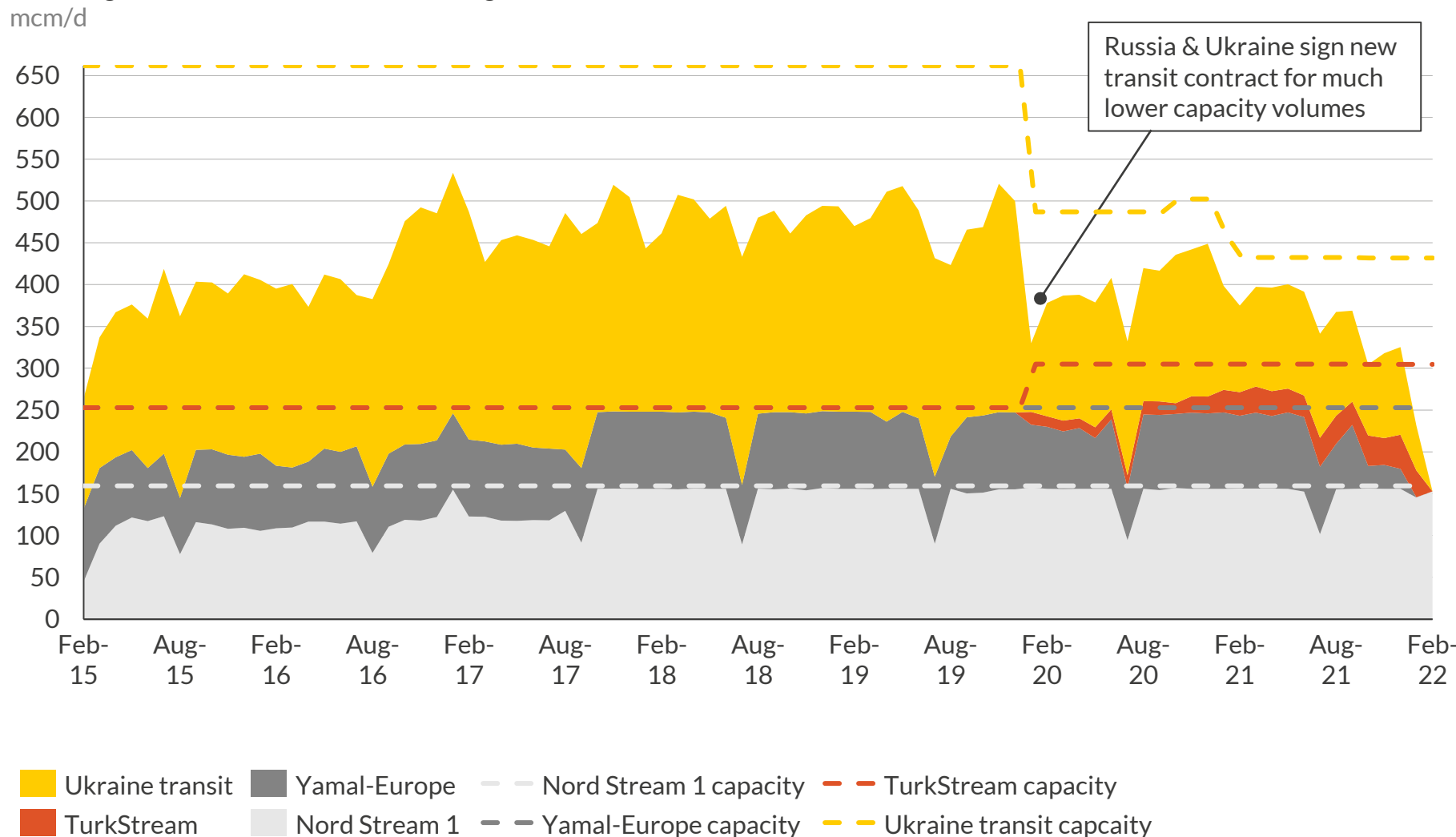
■ Russia ■ Norway ■ Africa ■ LNG ■ Other

1) Pipeline flows. Includes Turkey and Baltic states. 2) LNG import composition in 2020 by exporting country: Qatar 26%, US 22%, Russia 15%, Nigeria 13%, Algeria 12%, Norway 4%, Other 8%.

- Europe's gas demand is met through three primary sources, of which Russia is the largest single supplier. The share of Russian gas has been consistently above 40% on an annual basis
- European gas imports from Russia increased steadily year-on-year between 2015 and 2019, before dropping 7% in 2020 due to weak gas demand and prices due to the pandemic
- As a share of European pipeline imports, Russian supply remained relatively stable at about 45% in 2019 and 2020

Russian gas flows through the Ukraine route in 2021 more than halved compared to 2019, but Yamal flows fell even further

Russian gas deliveries to Europe, excluding Turkey and the Baltics vs capacity¹

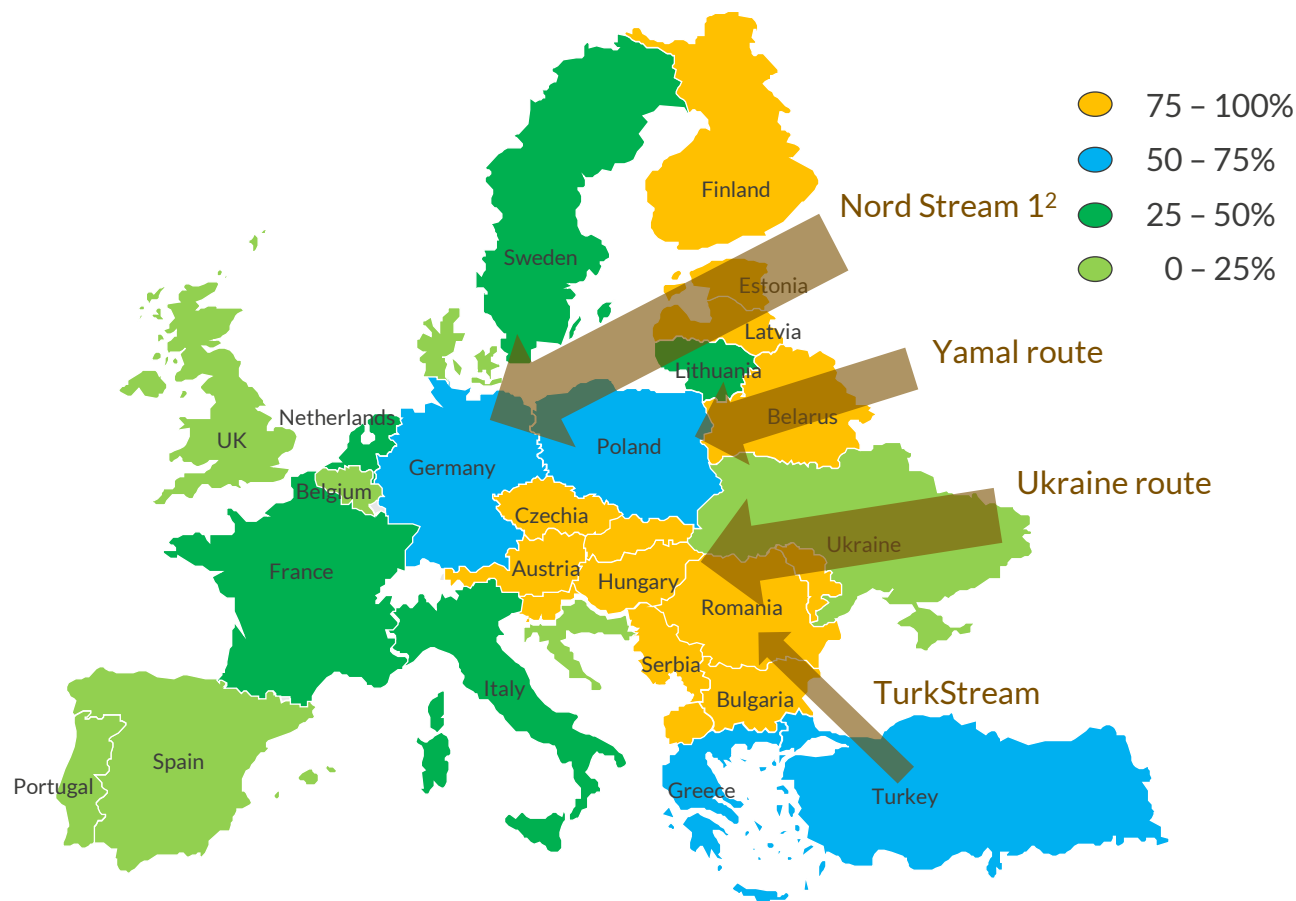


1) Shown capacities (dashed lines) are cumulative, starting from Nord Stream 1, Yamal-Europe, TurkStream and Ukraine. Other marginal routes, including about 15.7mcm/a of additional capacity at the Belarus-Poland border were excluded

Source: Aurora Energy Research

- In January 2020, Ukraine's transit flows fell sharply, to 82mcm/d, down from 245mcm/d on average in 2019. This was a result of Russia's long-term transit contract expiring
- Gazprom signed minor five-year booking for 2020-24
 - Sunk cost of Ukraine bookings encourages continued use
- The Yamal route also flowed close to maximum capacity until the middle of 2021:
 - Long-term pipeline capacity bookings expired in May-20
 - Shorter-term bookings continued through 1H21 but flows slowed in 2H21
 - Lack of long-term bookings leaves Yamal-Europe as Gazprom's flexible route
- Flows through Nord Stream 1 have remained relatively stable
- TurkStream has ramped up since starting in Jan-20

Several countries in Europe rely on Russia for over half of their gas needs, particularly in southern and eastern Europe



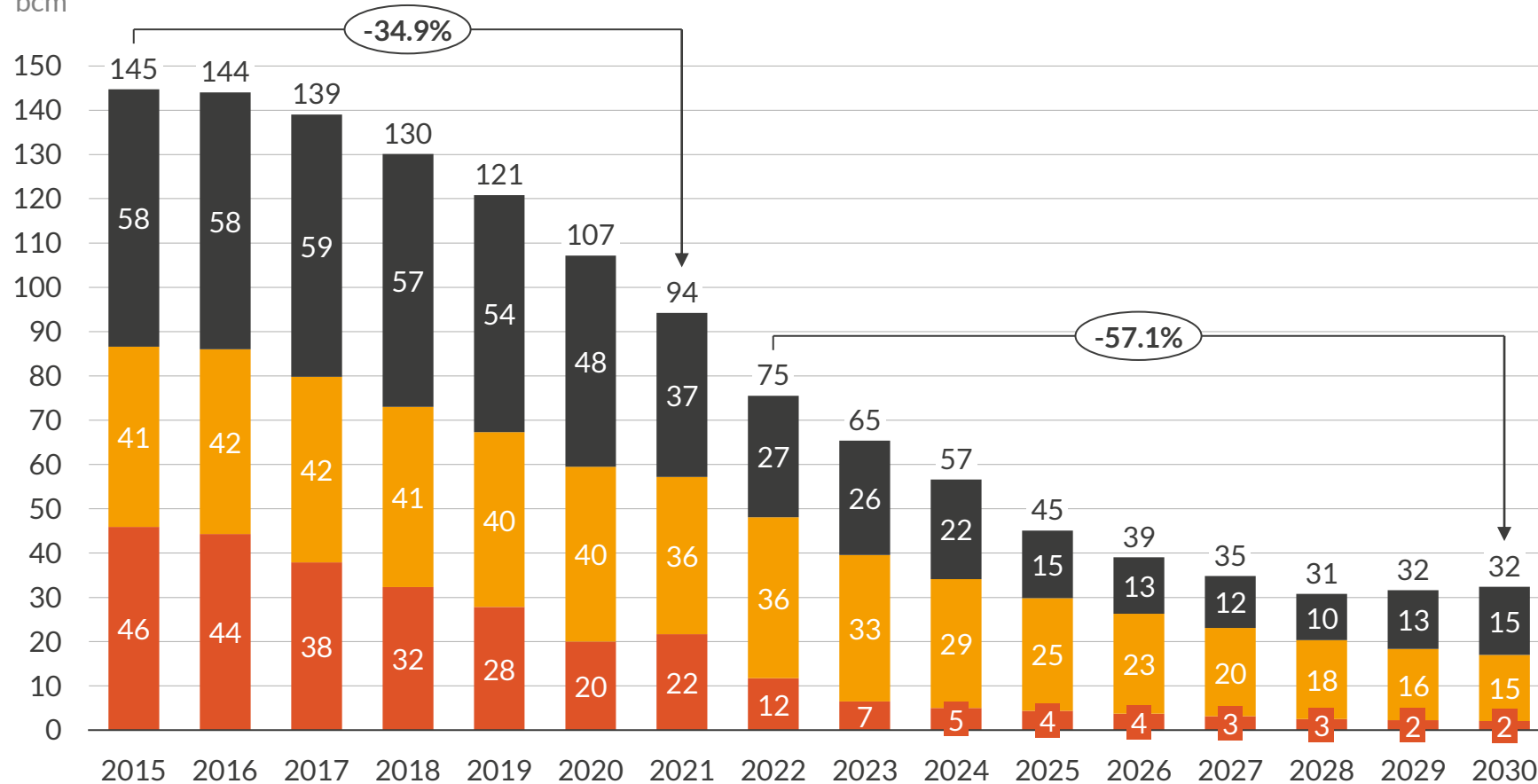
- Reliance on Russian gas is much higher in central and eastern Europe than in western Europe and is nearly 100% in some countries in south-east Europe. However, the integrated hub structure of European markets means that Eastern Europe gas fundamentals would impact NW European gas markets.
- Ukraine is an exception, as it does not directly import gas from Russia
 - It still relies on Russian gas delivered to its western neighbours through its territory and then redirected eastward
- Ten EU Member States (Bulgaria, Czechia, Estonia, Latvia, Hungary, Austria, Romania, Slovenia, Slovakia and Finland) sourced more than 75% of their gas imports from Russia in the first half of 2021

1) Pipeline + LNG flows. Share % of trade in value. Extra-EU trade flows (no intra-EU trading). 2) The Nord Stream 2 pipeline will follow a near identical route

European indigenous gas production is in significant decline, which will increase its reliance on imports including from Russia

European indigenous gas production, Aurora central scenario

bcm



■ Netherlands ■ UK ■ Other¹

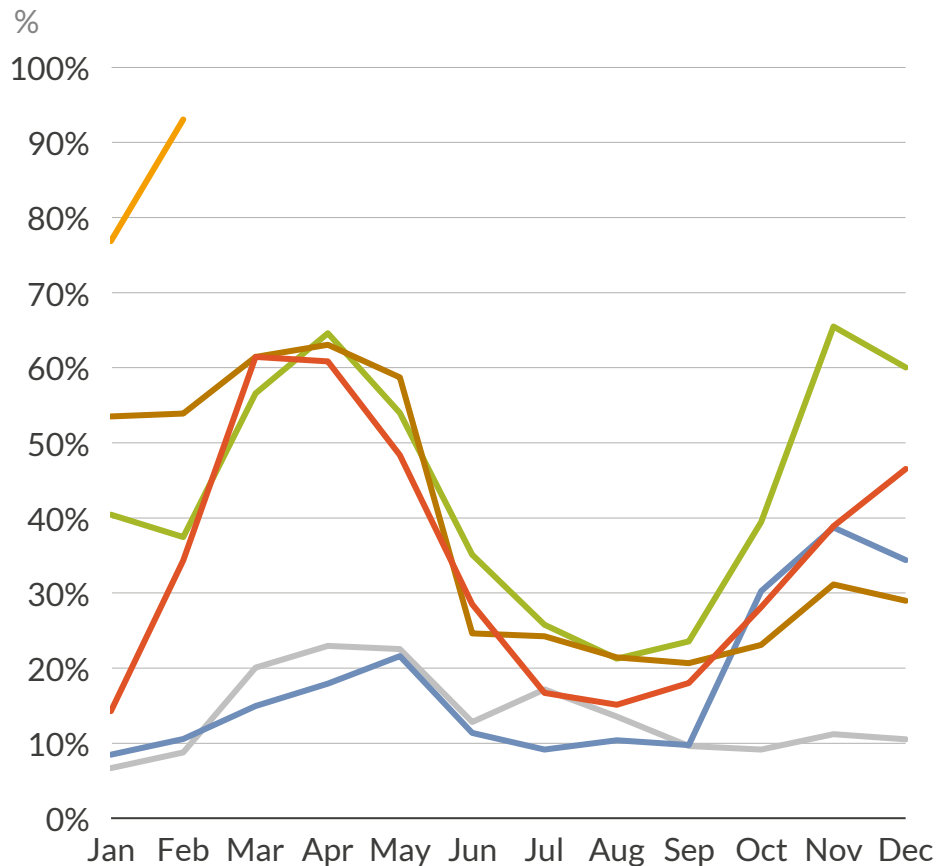
1) Other: Romania, Poland, Italy, Germany, Denmark.

Sources: Aurora Energy Research, BP Statistical Review of World Energy 2021, Jodi Gas database

- In our Central scenario, European gas production is in steady decline as fields mature
- By 2030, we expect gas production to have more than halved from 2022 forecast production
- In slides 24-26, we explore production forecasts under different Nord Stream 2 scenarios
- Production fell by 35% from 2015 to 2021 with a 6.9% compounded annual decline
- UK production has remained relatively stable from 2015 to 2021, but Dutch output declined by 52% over the same period
 - Lower Dutch output was driven by governmental actions to reduce output from the Groningen field and prevent local earthquakes

North West European LNG regasification facilities have been running near full utilisation in 2022, leaving little additional flexibility

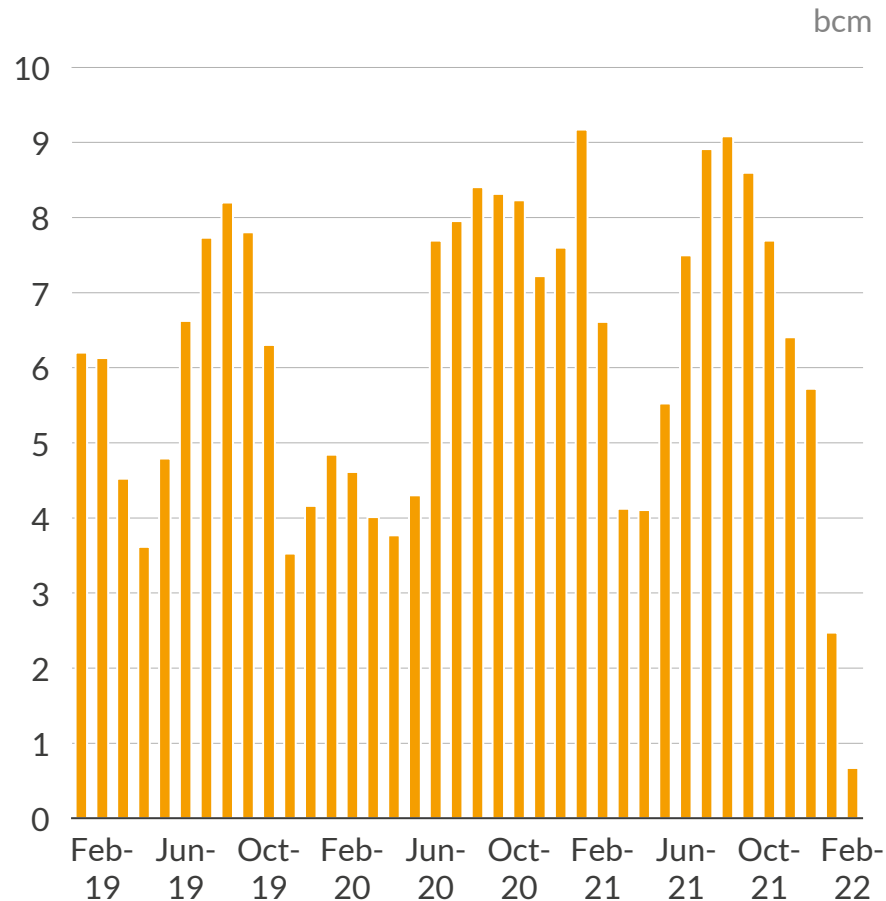
NW Europe LNG terminal utilisation rate



— 2017 — 2019 — 2021
— 2018 — 2020 — 2022

1) LNG utilisation reflects regasification send-out to the high pressure network and capacity in the UK, Netherlands, Belgium, and France.

NW Europe unused LNG regasification capacity



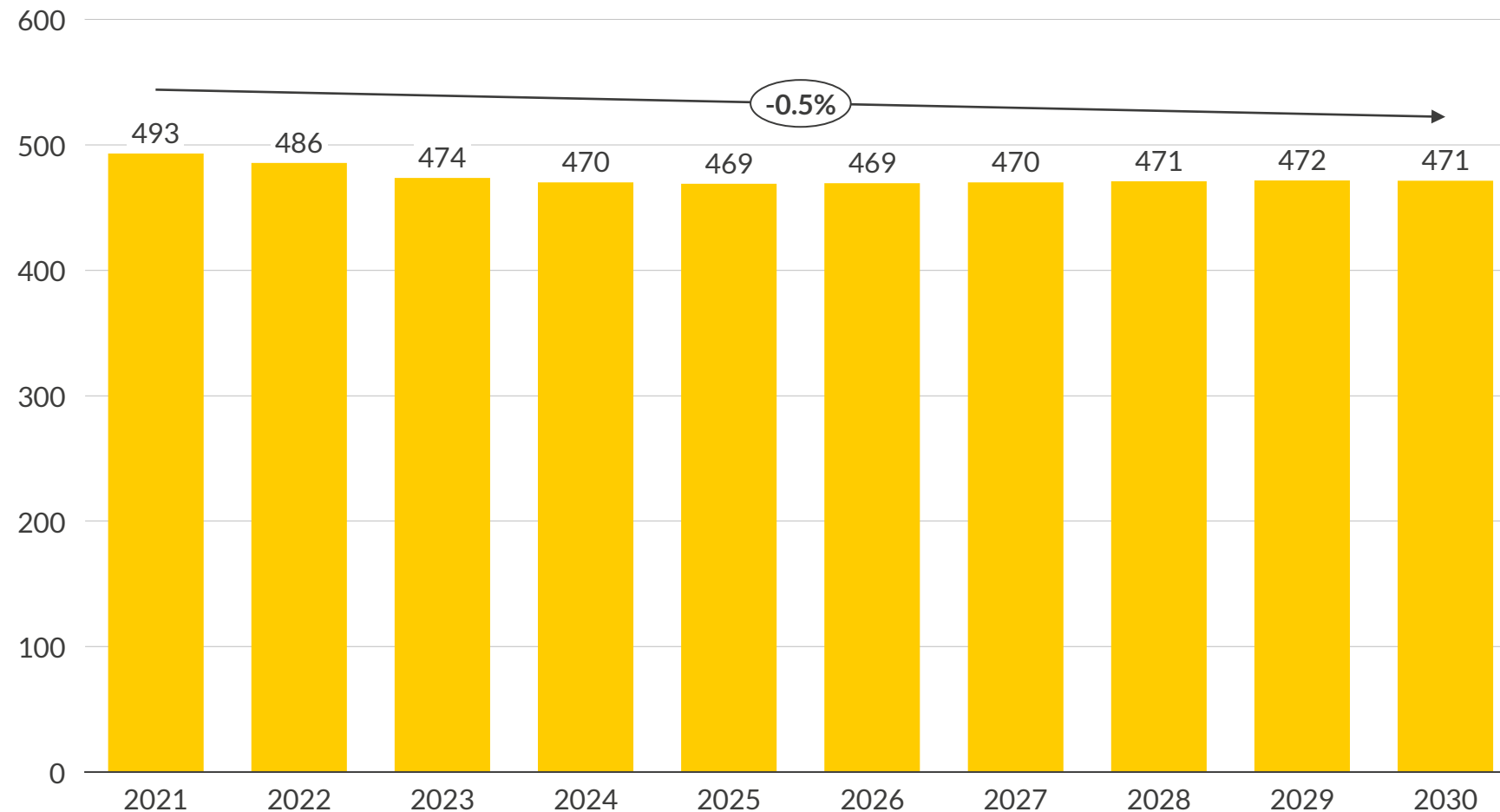
Little spare regasification capacity

- European LNG terminals typically underused
 - But varies seasonally, with the heaviest use in Feb-May
 - Much lighter use in summer
- But LNG receipts reached a record high in Jan-22, leaving sendout capacity almost fully utilised in Jan-22 to Feb-22
 - Little scope to lift LNG receipts further, even if global supply is available
 - Only could add 2.5bcm in Jan and under 700mcm in Feb
 - LNG capacity is insufficient to offset a total halt to Russian imports
 - LNG would mostly arrive in NW Europe and only add to congestion
 - CEE terminals are limited in capacity and routes to market

European gas demand is expected to be fairly stable to 2030, driven by coal and nuclear exits offsetting renewables growth

Natural gas consumption in Europe¹ in Central scenario

bcm



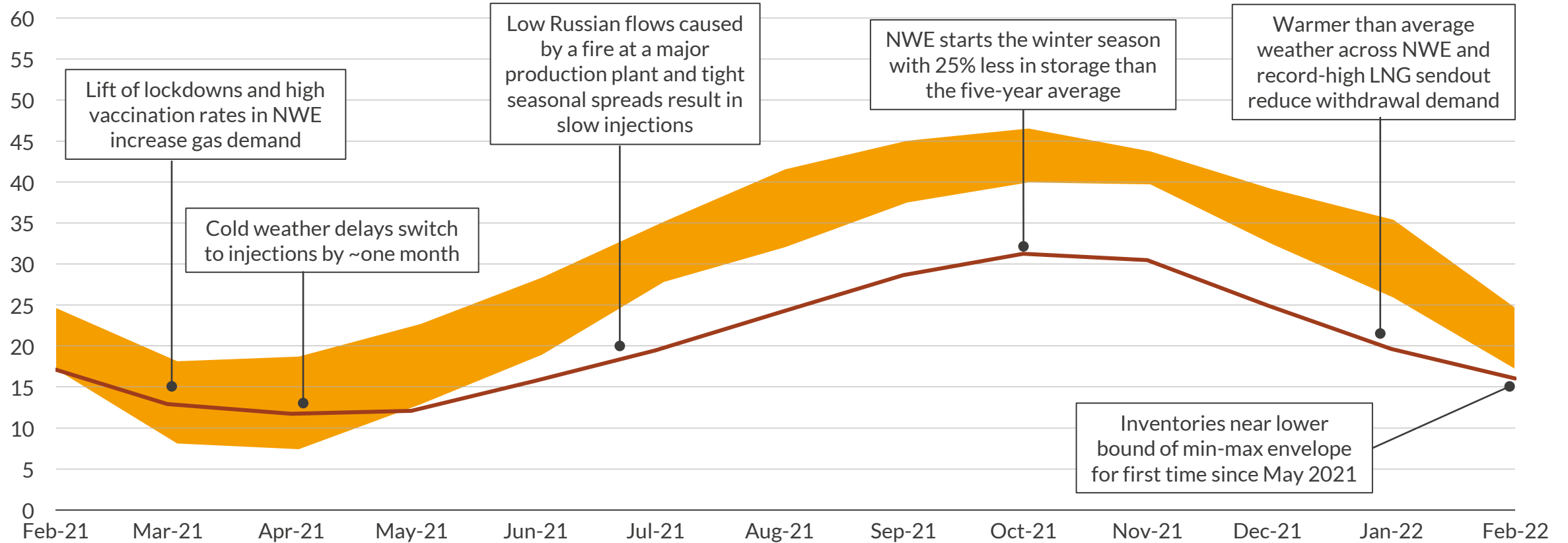
- Gas demand in Europe is expected to remain reasonably stable over the next decade
 - Demand in any given year is highly dependent on weather and fuel-switching levels between gas and coal
 - Pending coal and nuclear exits support some consumption growth in regional markets
 - Slower economic expansion and quicker deployment of renewables keep Europe's gas demand growth muted relative to other markets, despite the shift away from other power-sector fuels
- After 2030, demand gradually declines due to environmental policies and the continued growth in renewables

1) Europe includes the EU 27, United Kingdom, Switzerland and Norway

North West European storage inventories remain below the five-year range

NW Europe storage inventories

bcm

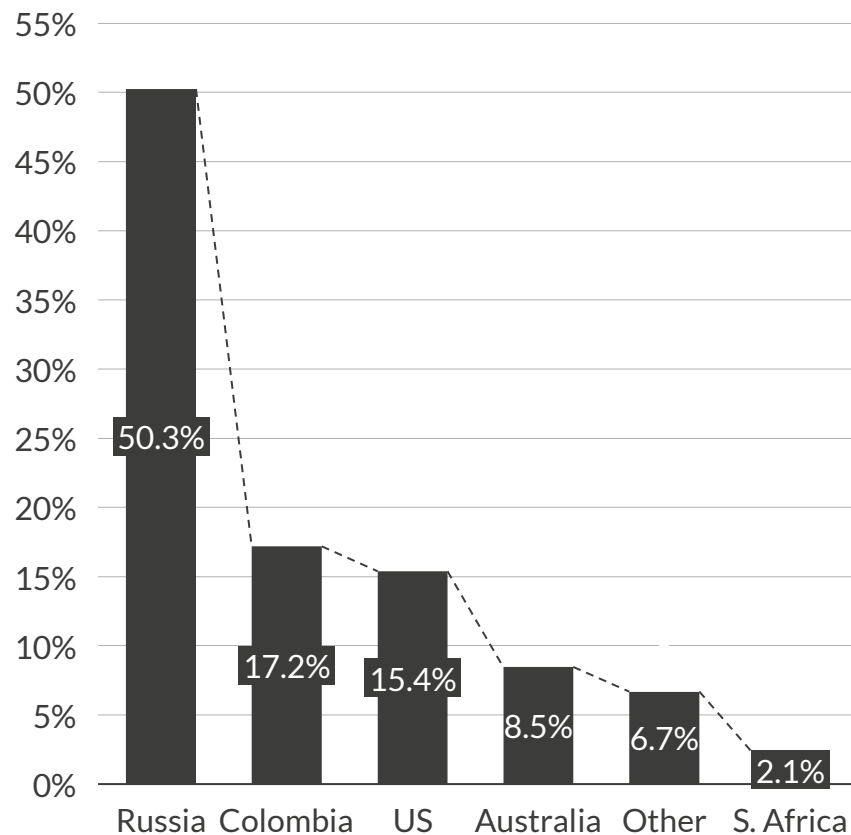


— Total inventories Min-max envelope (Dec 15- Feb 20)²

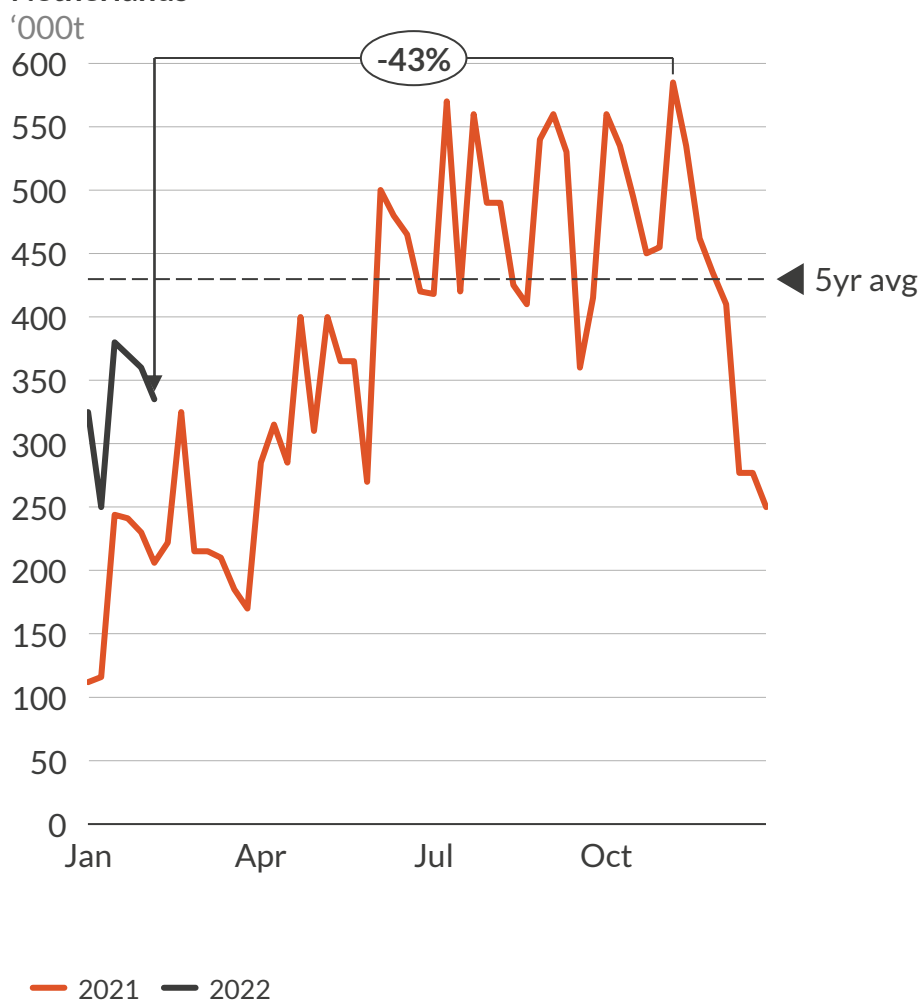
1) Storage data is based on net daily flows. Last update: 25 Feb 2022 2) Envelopes are calculated by taking the maximum and minimum monthly values between December 2015 and February 2020 (pre-pandemic).

Russia is also Europe's main supplier of coal, supplying over half of the total in 2021

European total coal imports¹ in 2020
%



ARA coal inventories at Ovet terminal in the Netherlands

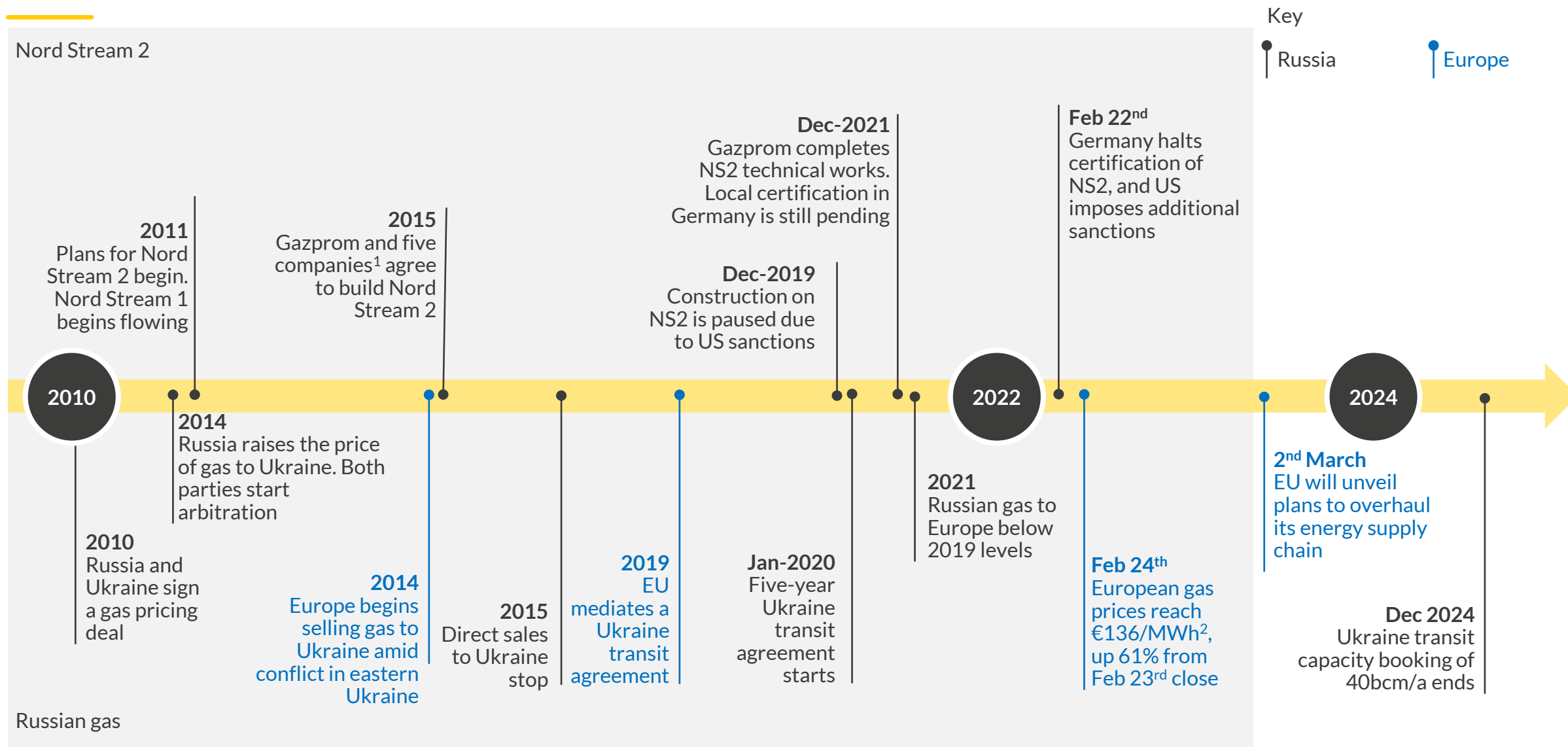


- Europe depends on Russia for most of its coal imports, in addition to gas and other fuel sources
- More than half of Europe's coal imports came from Russia in 2020
 - The largest importers were Germany and the Netherlands
- Shipping costs for potential alternative supply sources (Colombia, US, Australia, South Africa) are much higher due to the higher distances
- Import needs could be exceptionally high in 2022 due to low coal inventories
 - Strong gas-to-coal switching drew down inventories in Q4 2021
 - Coal stocks at the Dutch Vlissingen Ovet terminal in the ARA market were 30% below 5yr average

1) Thermal + coking coal




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Developments in Nord Stream 2 and Russian gas transit since 2010



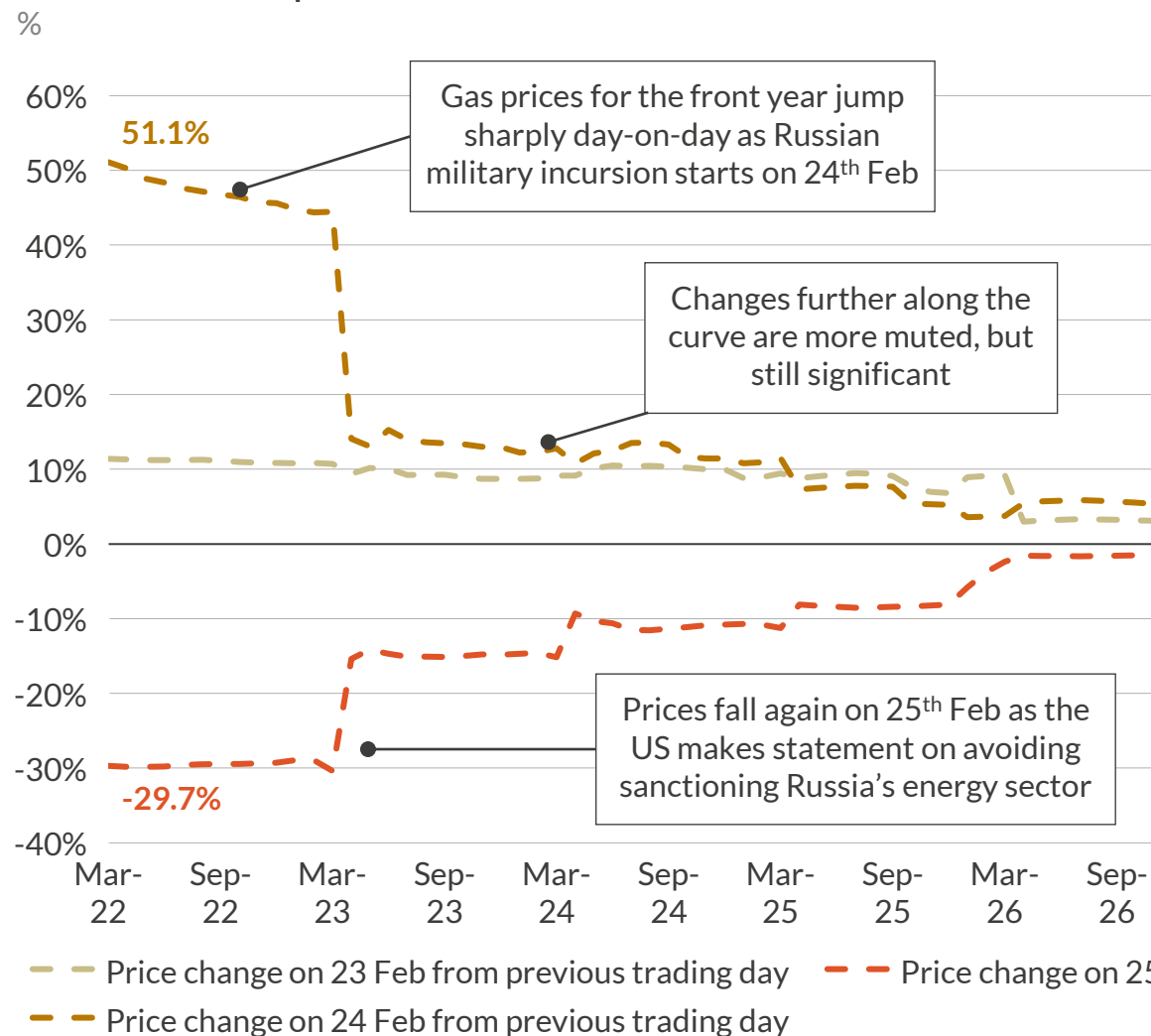
Timeline is not exhaustive. 1) Royal Dutch Shell, E.ON, OMV, Wintershall and Engie 2) TTF front-month

The Nord Stream 2 pipeline is halted indefinitely and western countries have imposed sanctions on Russia

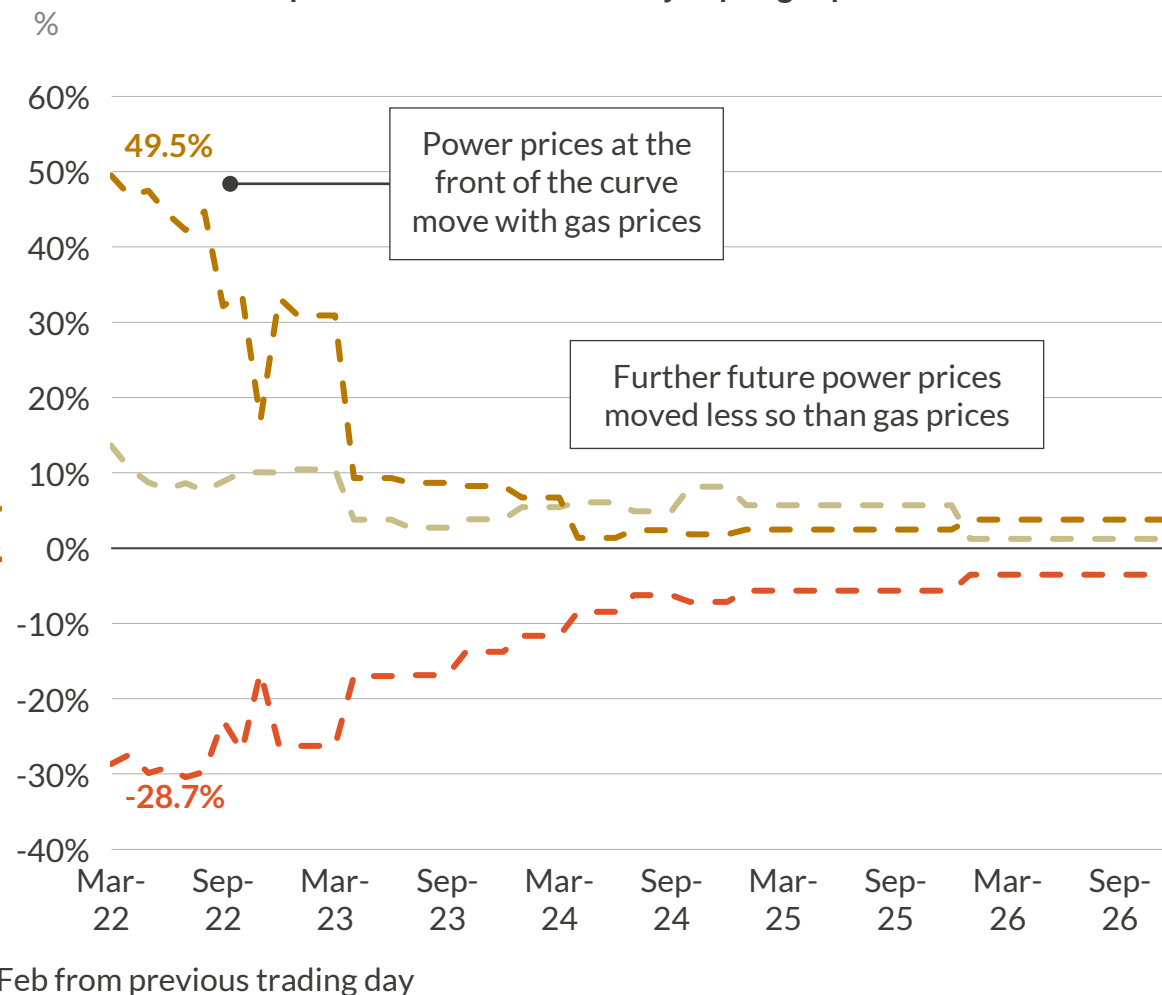
	Decision	Background
	Certification of the Nord Stream 2 pipeline was halted by Germany on February 22, 2022	<ul style="list-style-type: none"> On 22 February, the German Economy Minister, Robert Habeck, issued a statement that the certification of the Nord Stream 2 pipeline would be suspended The previous German government's security of supply assessment, which ruled that NS2 posed no risk to German and EU security of supply, was withdrawn. Habeck noted that the geopolitical situation requires the government to revisit the Nord Stream 2 project The security of supply assessment is a prerequisite for certification
	US, UK, and EU sanctions	<ul style="list-style-type: none"> The US imposed sanctions on Nord Stream 2's owner and proposed Gazprom subsidiary operator. This is on top of sanctions placed on companies constructing the pipeline in 2020-2021 The US, UK and EU imposed further sanctions on Russian individuals and companies, including financial entities Additional sanctions are still under consideration
	What's next?	<ul style="list-style-type: none"> The future of the pipeline, whether and when gas would flow is now uncertain The owner company completed technical preparations in December 2021, indicating that physical operation would be possible as soon as certification is approved The EU Gas Directive still means Gazprom will not use the pipeline's total capacity unless it meets certain conditions. The Directive requires that pipelines that connect the EU with non-EU countries are still required to abide by EU law when it comes to granting third-party access to capacity and unbundling of supplier and network operator

Gas and power prices reacted to news of the Nord Stream 2 suspension, military incursions into Ukraine, and Western sanctions

Dutch TTF forward prices¹ react to conflict escalation



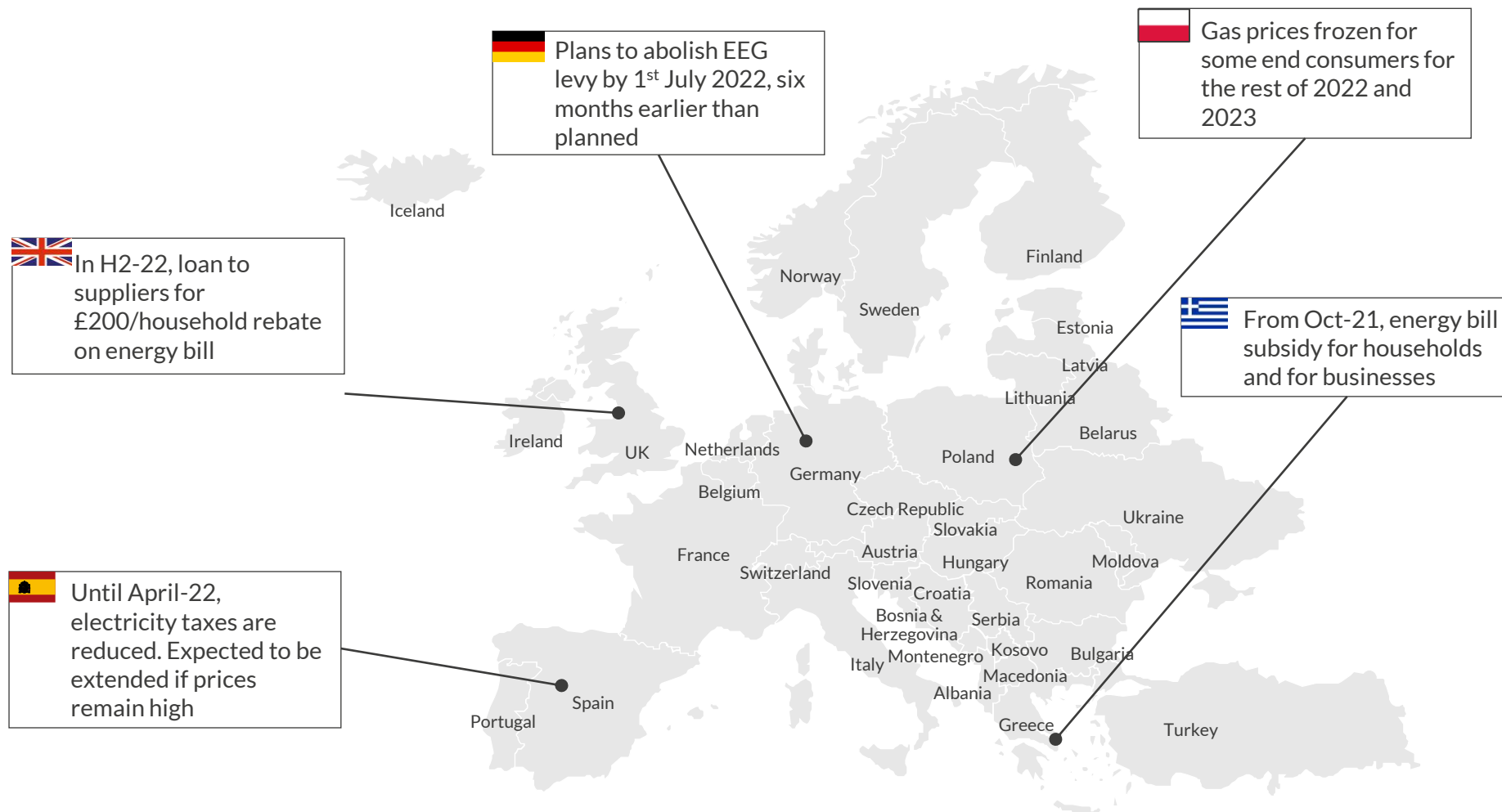
German baseload power futures² reflect the jump in gas prices



1) CME TTF futures settlements 2) EEX German baseload power futures

European governments had already responded to high energy prices in 2021 with a mix of tax reductions, subsidies and price controls

Selected government measures to tackle high wholesale and retail energy prices



Since 2021, many governments in Europe introduced energy subsidies. Further rises in wholesale prices will put more pressure on public budgets

- Countries across Western, Southern, and Eastern Europe have enacted measures to reduce the impact of high wholesale energy prices on households and industry
- Some of these were enacted in 2021, in response to rising gas and power prices
- Wholesale prices are rising again in 2022 (see previous slide), extending or even increasing these subsidies will become costly to public budgets

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We examine the impact of a delay to the Nord Stream 2 pipeline only, combined with continued Ukraine gas transit

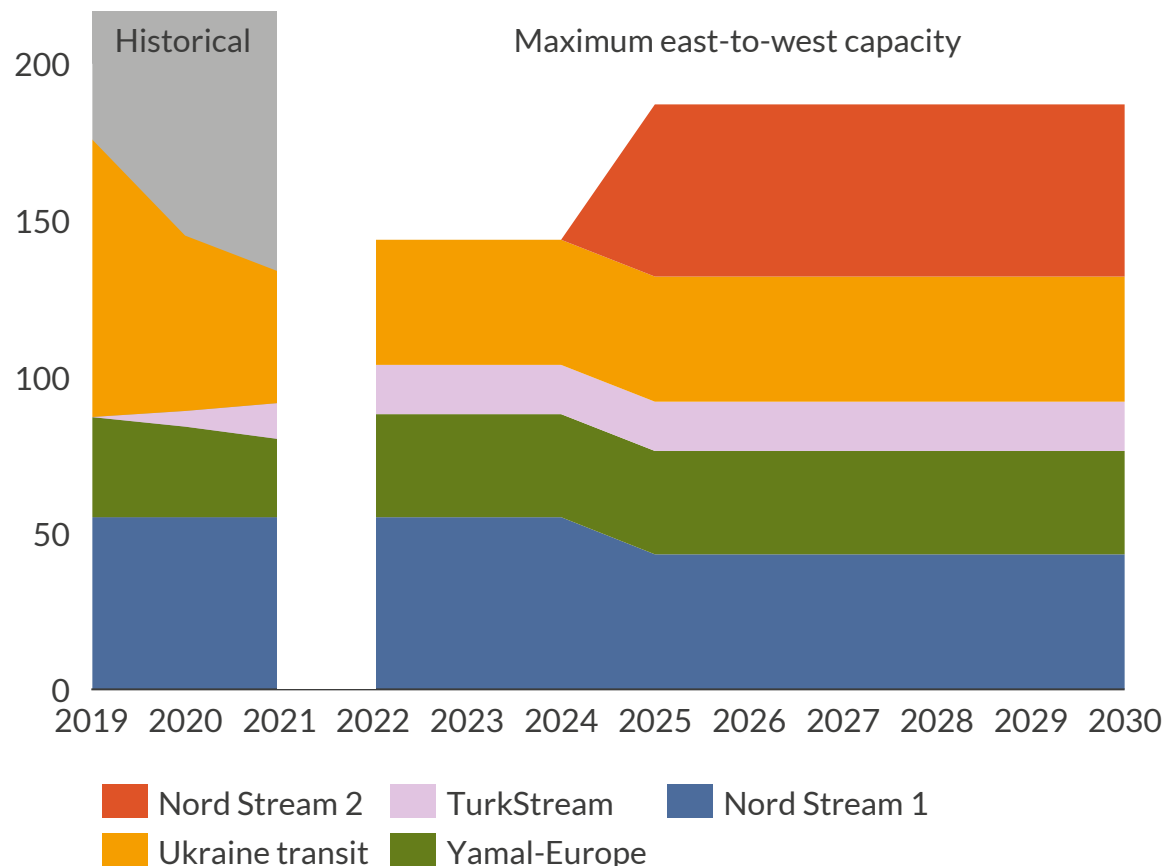
A U R  R A

Scenario 1 NS2 delay only

Nord Stream 2 comes online in 2025, and transit through Ukraine does not exceed 40bcm/a

Historical flows 2019-21, constrained capacity 2022-30

bcm/a



In this scenario, we assume there is a de-escalation of war between Russia and Ukraine, and only a two-year delay to NS2

This scenario is most similar to a return to the situation before the Russian military incursion into Ukraine. This is the most optimistic of the three scenarios.

Here, we assume:

- There is some form of agreement made between Russia, Germany and the US, which allows Nord Stream 2 to come online and start sending gas by 2025, a two-year delay compared to Aurora's previous Central scenario¹
- Russia continues to transit gas through Ukraine, albeit not exceeding 40bcm/a. This is the level of long-term transit capacity booked by Russia for the years 2021-24. While it is technically possible for flows to be higher, we assume that there is no incentive for Russia to use more capacity via Ukraine due to alternatives available via Poland, and from 2025, Nord Stream 2
- There is the possibility that Russia instates a favourable regime in Ukraine which leads to higher flows via Ukraine in the short-term. In the long-term, Russian gas production in the NPT region, which feeds the Ukraine pipeline, is in decline
- Nord Stream 1 flows are capped below maximum technical capacity once Nord Stream 2 starts up²

1) As published on 4 May 2021 on [EQS](#) 2) Nord Stream 1 flows are reduced below capacity of 55bcm/a from 2025 because of regulatory restrictions along its downstream Opal pipeline connection



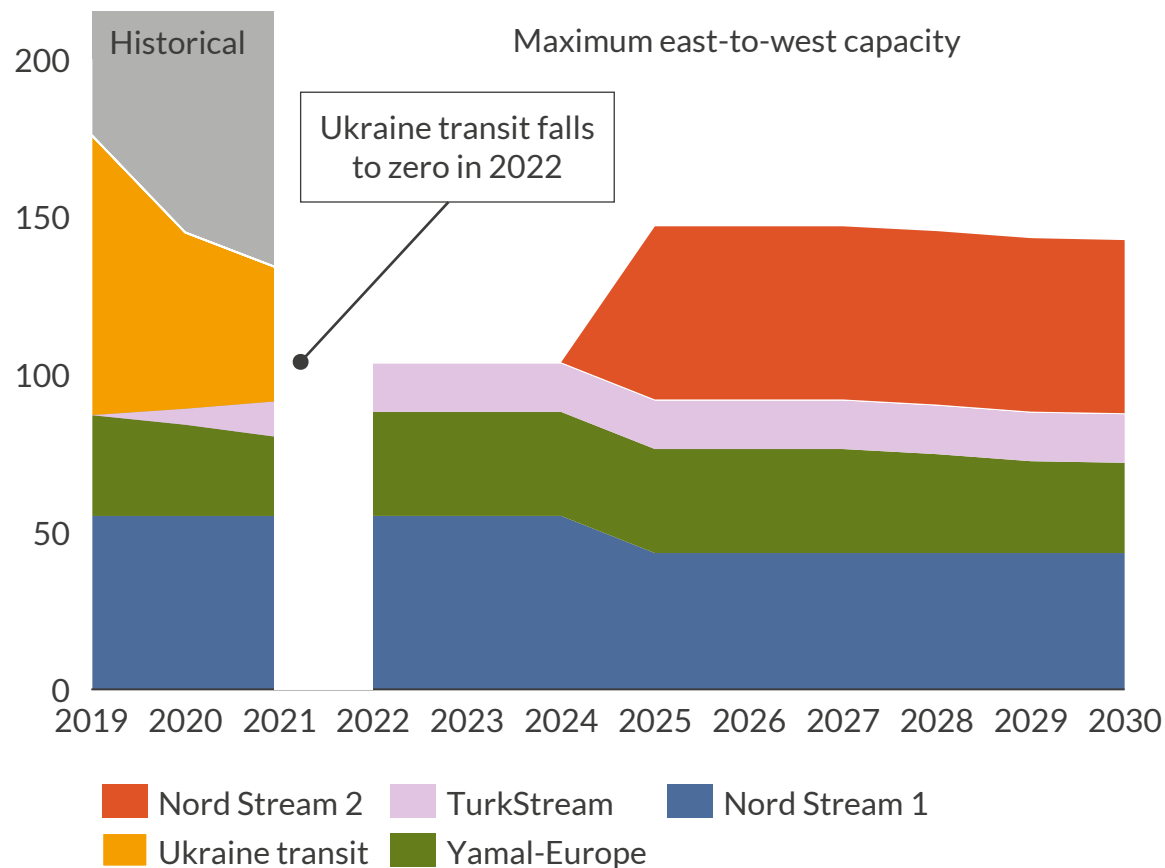
We then examine the impact of a halt to Ukraine gas transit combined with a delay to the Nord Stream 2 pipeline

Scenario 2 No Ukraine transit

Nord Stream 2 comes online in 2025¹ but transit through Ukraine ceases during 2022

Historical flows 2019-21, constrained capacity 2022-30

bcm/a



In this scenario, we assume that Russian gas to Europe is constrained significantly until 2025 because of a complete halt to Ukrainian transit

Russian supply into Europe is heavily constrained for 2022-24, due to a stop in flows via Ukraine and a delay to Nord Stream 2 until 2025

Here, we assume:

- Ukraine flows cease during 2022, and do not resume for at least the next decade. Russia has booked 40bcm/a of capacity until 2024, but will either not be able to use the route, or decide not to use the route. This will be the result of a physical disruption, or political decision. No capacity is yet booked for the years after 2024
- Nord Stream 1, TurkStream, and the Yamal route can be fully utilised, although Nord Stream 1 flows are capped below maximum technical capacity once Nord Stream 2 starts up¹
- This scenario leads to a significant reduction in how much Russian gas can arrive in Europe between 2022 and 2024 inclusive

1) Nord Stream 1 flows are reduced below capacity of 55bcm/a from 2025 because of regulatory restrictions along its downstream Opal pipeline connection.



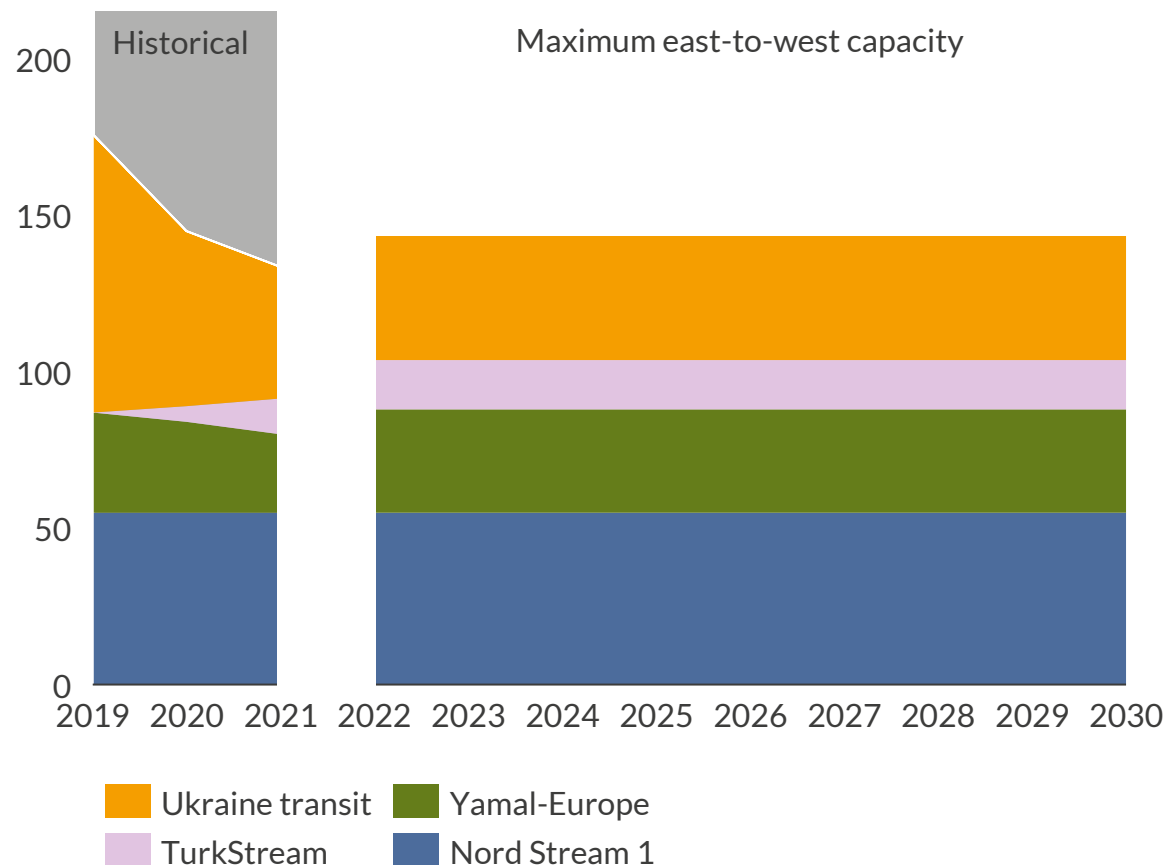
Lastly, we examine the full cancellation of the Nord Stream 2 pipeline, with other routes remaining available for use

Scenario 3 NS2 cancelled

Nord Stream 2 is cancelled but other routes continue

Historical flows 2019-21, constrained capacity 2022-30

bcm/a



In this scenario, Nord Stream 2 is cancelled which means a return to the 2022 status quo, with Ukrainian transit capacity unaffected

In this scenario, the Nord Stream 2 pipeline does not deliver gas for at least the next decade either due to long-term suspension or cancellation. This means Russian gas capacity to Europe does not increase beyond today's levels during the 2020s.

- There is precedence for the cancellation of a large Russian pipeline, when Gazprom abandoned the 63bcm/a South Stream project in 2014 due to EU action taken following Russia's annexation of Crimea
 - The project would have delivered Russian gas directly to Bulgaria
 - Construction had started earlier in 2014, but was not as advanced as Nord Stream 2

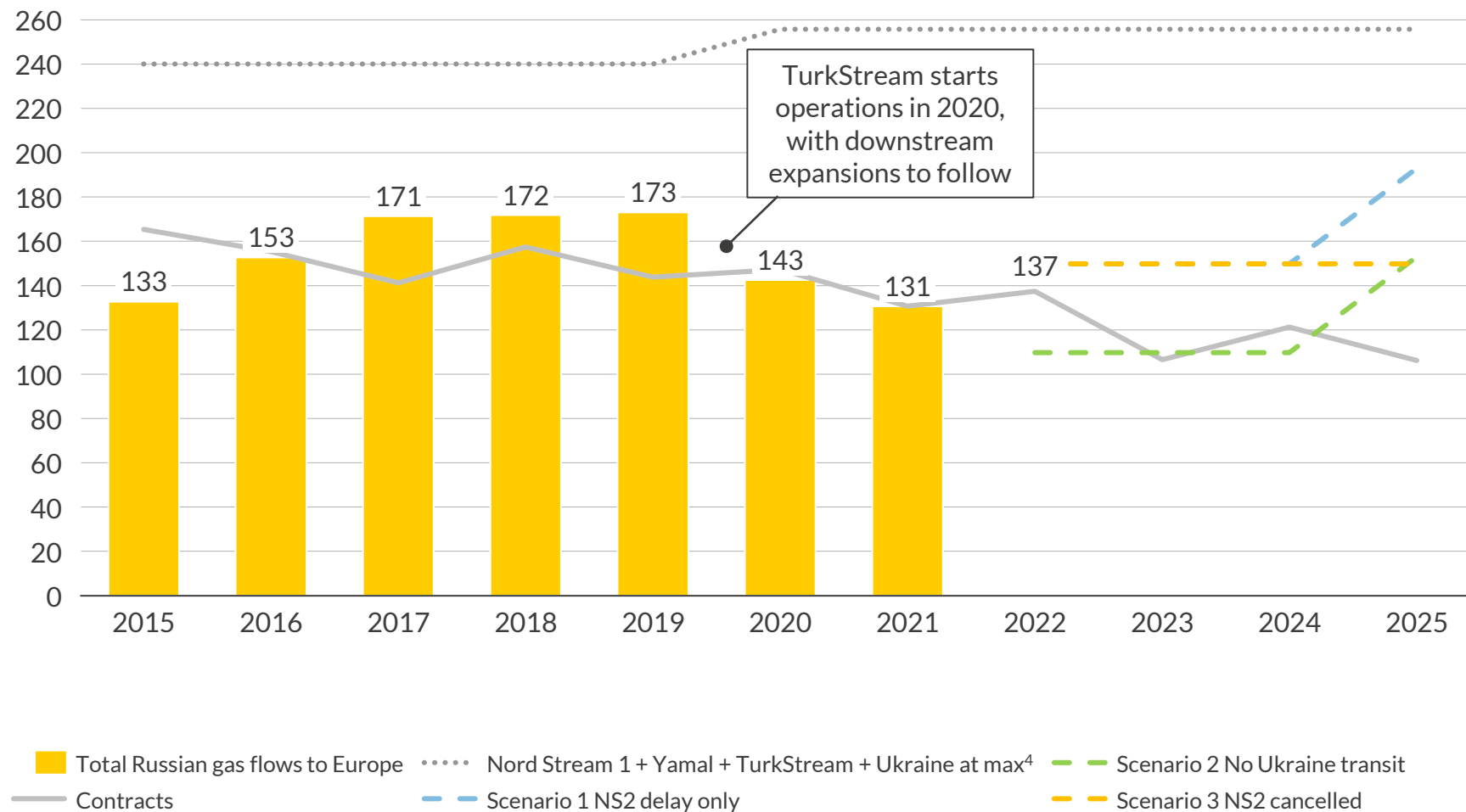
Here, we assume:

- Cross-party outrage in Germany is sufficient to stop the Nord Stream 2 pipeline from coming online indefinitely
- The cancellation of Nord Stream 2 is tempered by continued flows via Ukraine, although still capped at 40bcm/a
- Nord Stream 1¹, TurkStream and Yamal have no constraints, and can be used by Russia if economic

1) Nord Stream 1 capacity of 55bcm/a is fully available, as it can also make use of the Eugal pipeline in this scenario, which would otherwise receive all of Nord Stream 2's gas flows if the pipeline starts up

A halt in Ukrainian transit would keep Russian flows below 2020 and 2021 levels, as well as estimated contractual take in 2022

Russian gas deliveries¹ would not fit into Nord Stream 1 and Yamal² alone
bcm



Historical gas flows are higher than capacity without Ukraine

- Aurora estimates that European countries have 137bcm/a in total of pipeline supply contracts with Russia for 2022
- In Scenario 1, a delay to Nord Stream 2 will still result in enough capacity to meet 2021's Russian gas flows and contracted supply
 - This would still keep gas flows lower than in 2016-19
 - But Gazprom could still send about 5.5bcm/a more through Ukraine, in addition to its 40bcm/a long-term bookings
- In Scenario 2, losing the Ukraine route means capacity would be below the estimated contract level by over 27bcm in 2022
- Nord Stream 1 is already used at available³ capacity

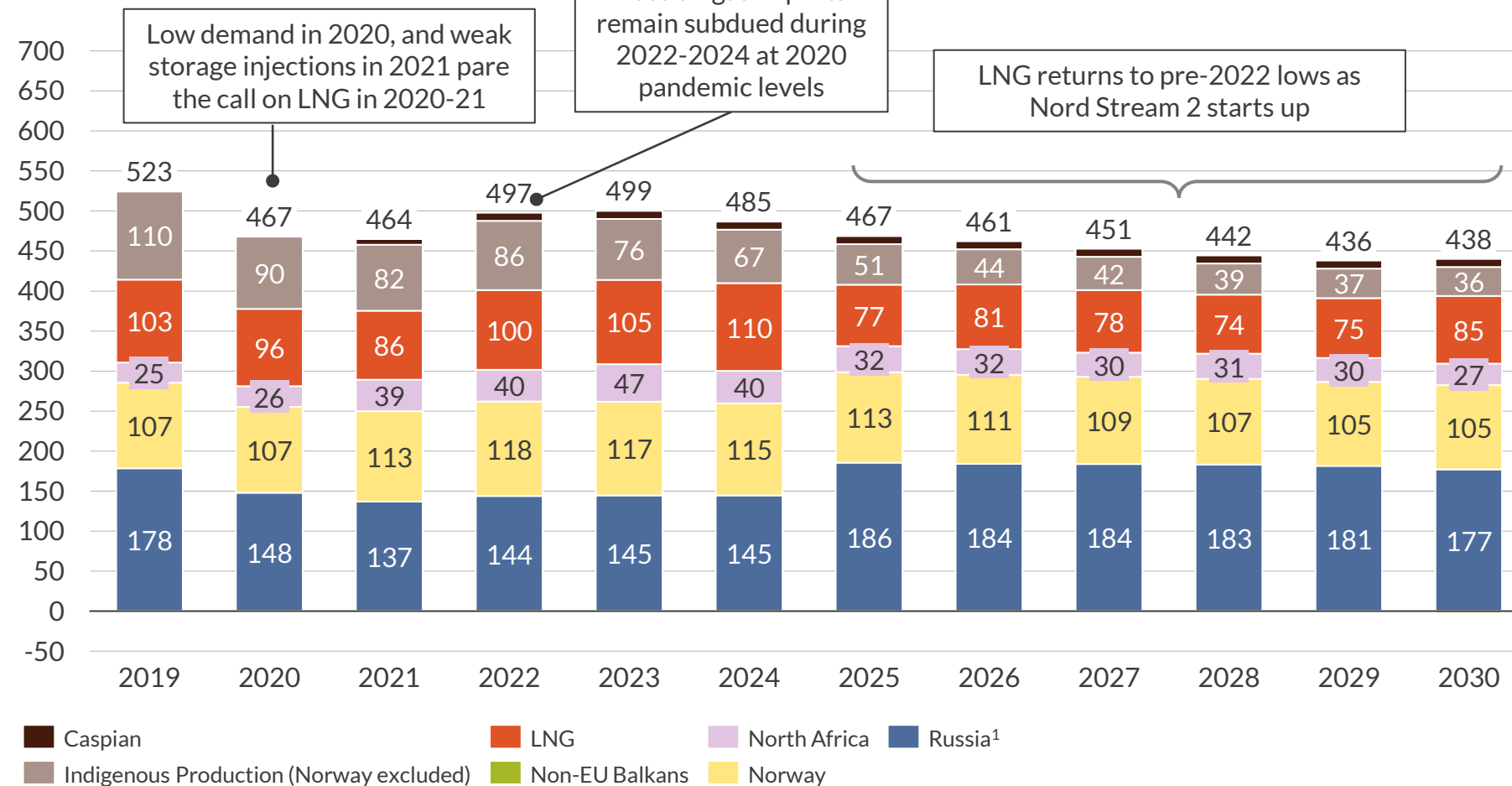
1) Excluding Turkey and the Baltic States. 2) Capacity at Polish-Belarusian border used. 3) Downstream regulatory restrictions would keep combined NS1 and NS2 flows below capacity. 4) Ukraine max capacity based on transit capacity provided by Ukrainian network operator TSOUA, which is partially mothballed.

With a two-year delay to NS2 to 2025, LNG deliveries to Europe reach 110bcm by 2024, but fall the next year as Russian supply rises

Scenario 1 NS2 delay only

European gas balance

bcm



1) Excluding Turkey and Baltics

LNG compensates for the two-year delay to Nord Stream 2

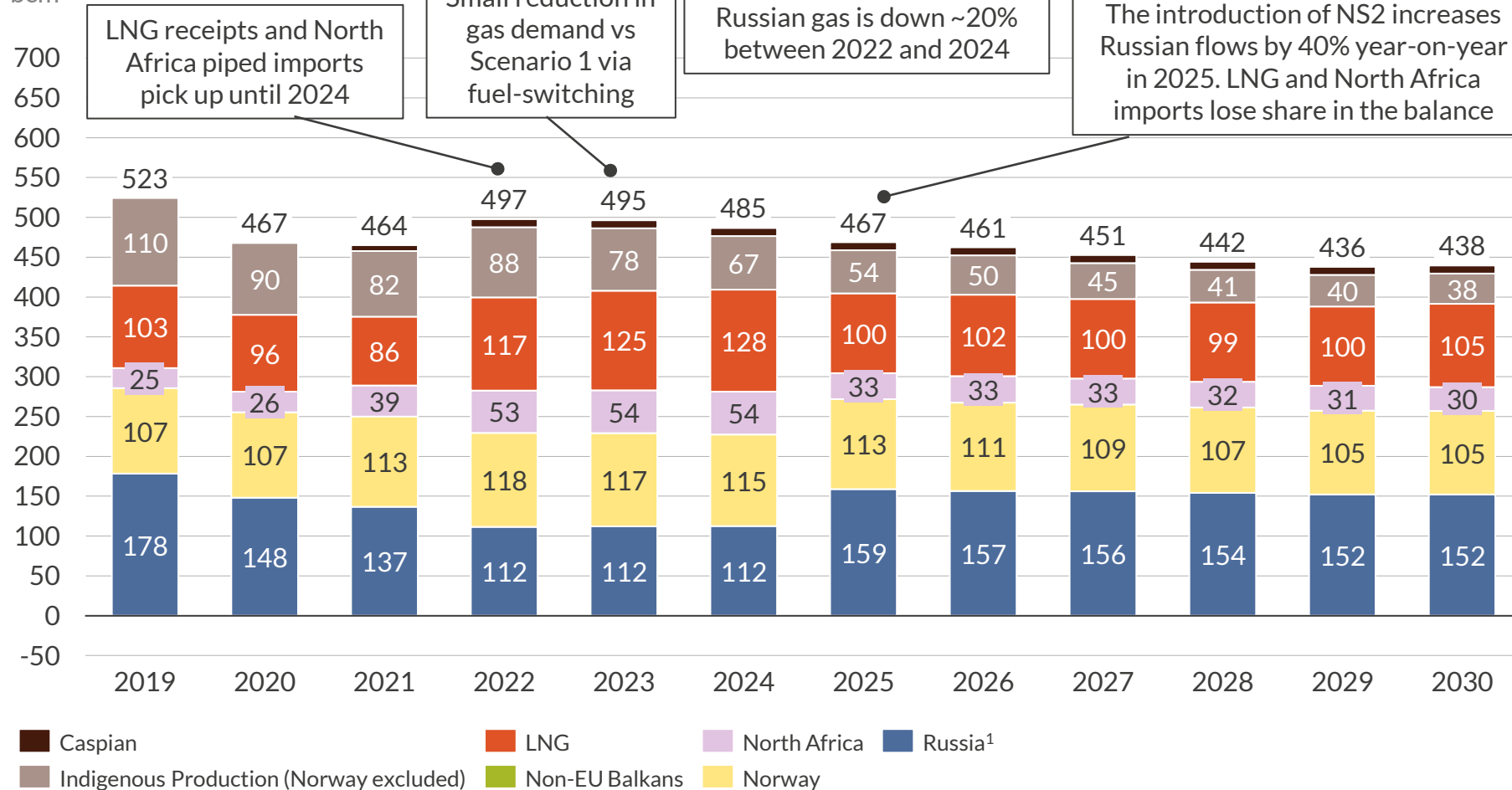
- LNG receipts step up in each scenario from 2022
 - This could result in maximum use of regasification capacity at times
 - Annual demand for LNG would still fall well below import and regasification capacity, north west Europe has about 127bcm/a of sendout capacity alone
- The increase is short-lived in this scenario, as Russian supply jumps to 183bcm/a in 2025-30 from 144bcm/a in 2020-24 once Nord Stream 2 is online
- Indigenous production continues to decline through the period, and falls by 16bcm in 2025 year-on-year with Nord Stream 2's startup

A complete loss in Ukrainian transit boosts LNG imports throughout the period, with a peak of 128bcm in 2024 before NS2 starts up

Scenario 2 No Ukraine transit

European gas balance

bcm



1) Excluding Turkey and Baltics

Source: Aurora Energy Research

Total Russian gas is down ~20% compared to the first scenario

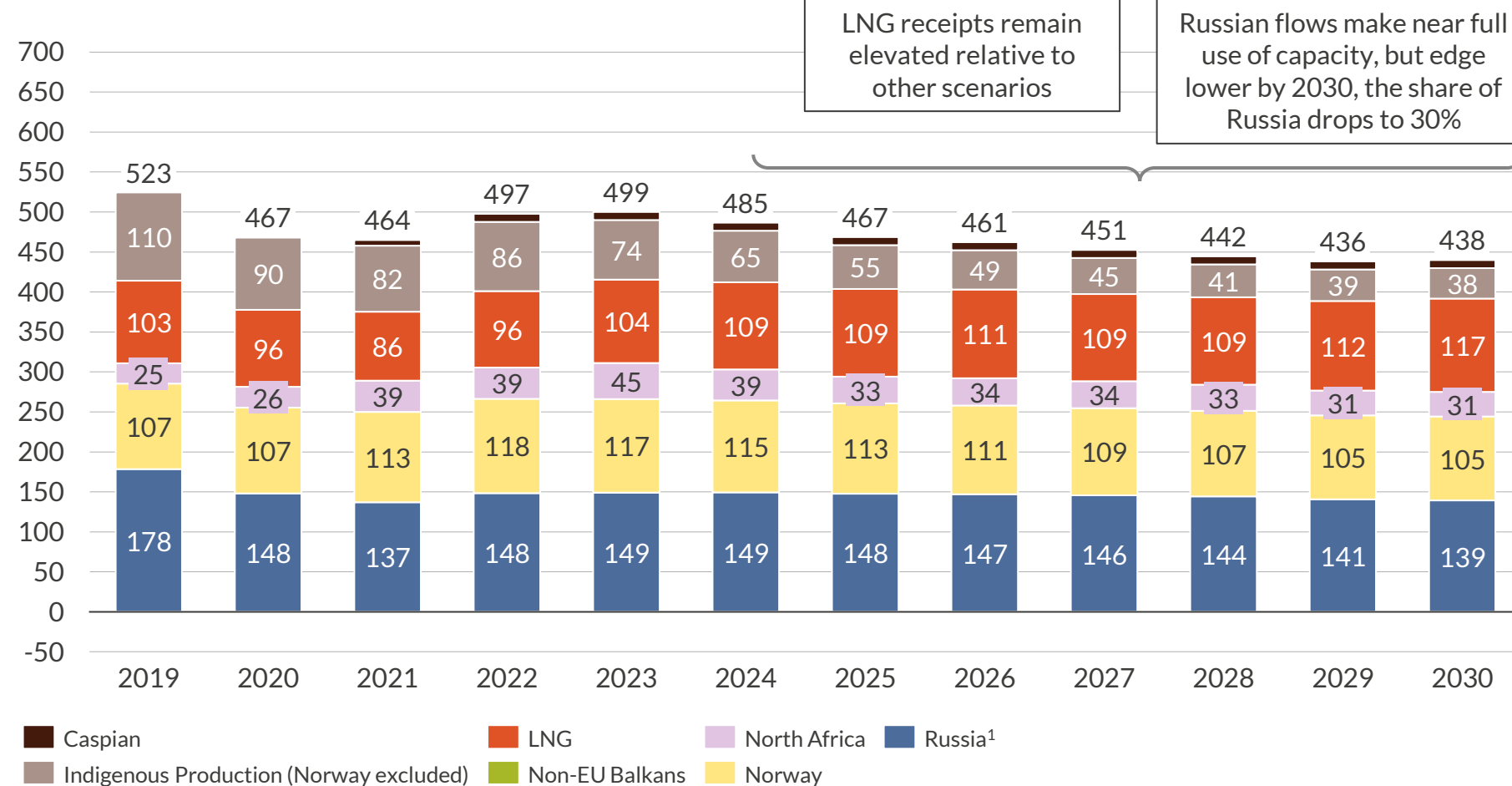
- LNG sendout increases yearly before and reach up to 128bcm in 2024
- Piped imports from North Africa are at 80% pipeline of capacity between 2022-24 before slowing down with the introduction of NS2
- Russian, Norwegian and Caspian flows are at relatively stable levels between 2022 and 2024 without much upside available
- Compared to scenarios 1 and 3, there is a ~2bcm drop in gas demand in 2023, driven by fuel-switching economics
- A drop in Russian gas means less is exported from the west to Ukraine, risking a supply shortage. This is despite there being enough west-to-east pipeline capacity to fill its supply gap (see [slide 30](#))

In a full Nord Stream 2 cancellation, Russian pipeline gas flows edge down throughout the 2020s, as LNG receipts climb

Scenario 3 NS2 cancelled

European gas balance

bcm



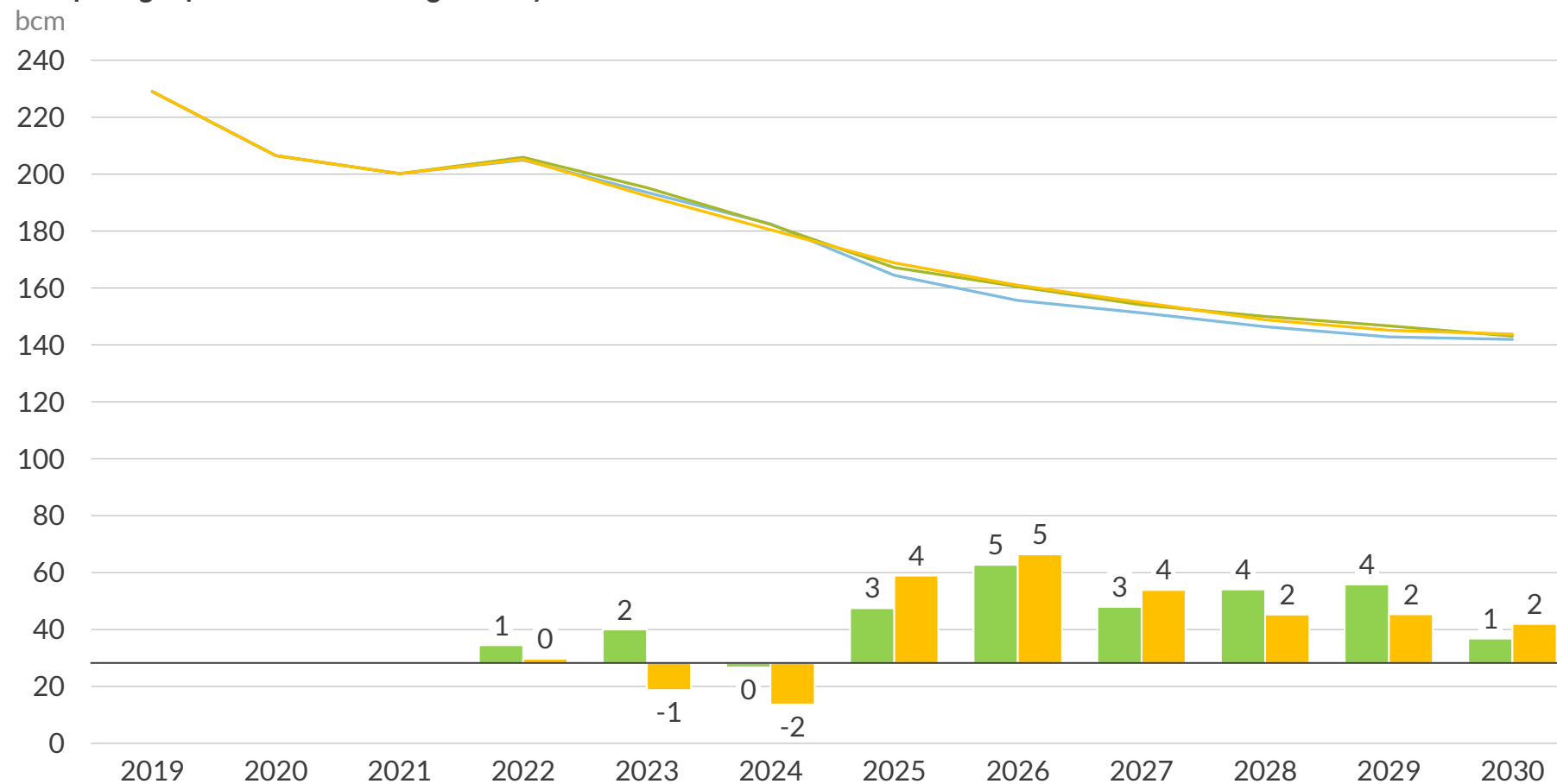
1) Excluding Turkey and Baltics

Without NS2 Russia's share of European supply falls to 30%

- Europe's Russian gas receipts remain steady at 2020's low levels in the event of Nord Stream 2's cancellation
- Almost all available Russian pipeline capacity is used, including 40bcm/a via Ukraine
- LNG receipts would remain much stronger than in the previous two scenarios later in the 2020s. We expect this would come at higher cost vs Russian supply, and therefore be bullish for European gas prices compared to the NS delay scenario
- There is scope for Russian pipeline flows through Ukraine to rise, depending on Gazprom and its Ukrainian counterparts' willingness to bring mothballed infrastructure at their shared border back online

Indigenous production in Europe has limited upside potential, but there is a small, up to 5bcm/a, increase in Polish production

European gas production including Norway¹



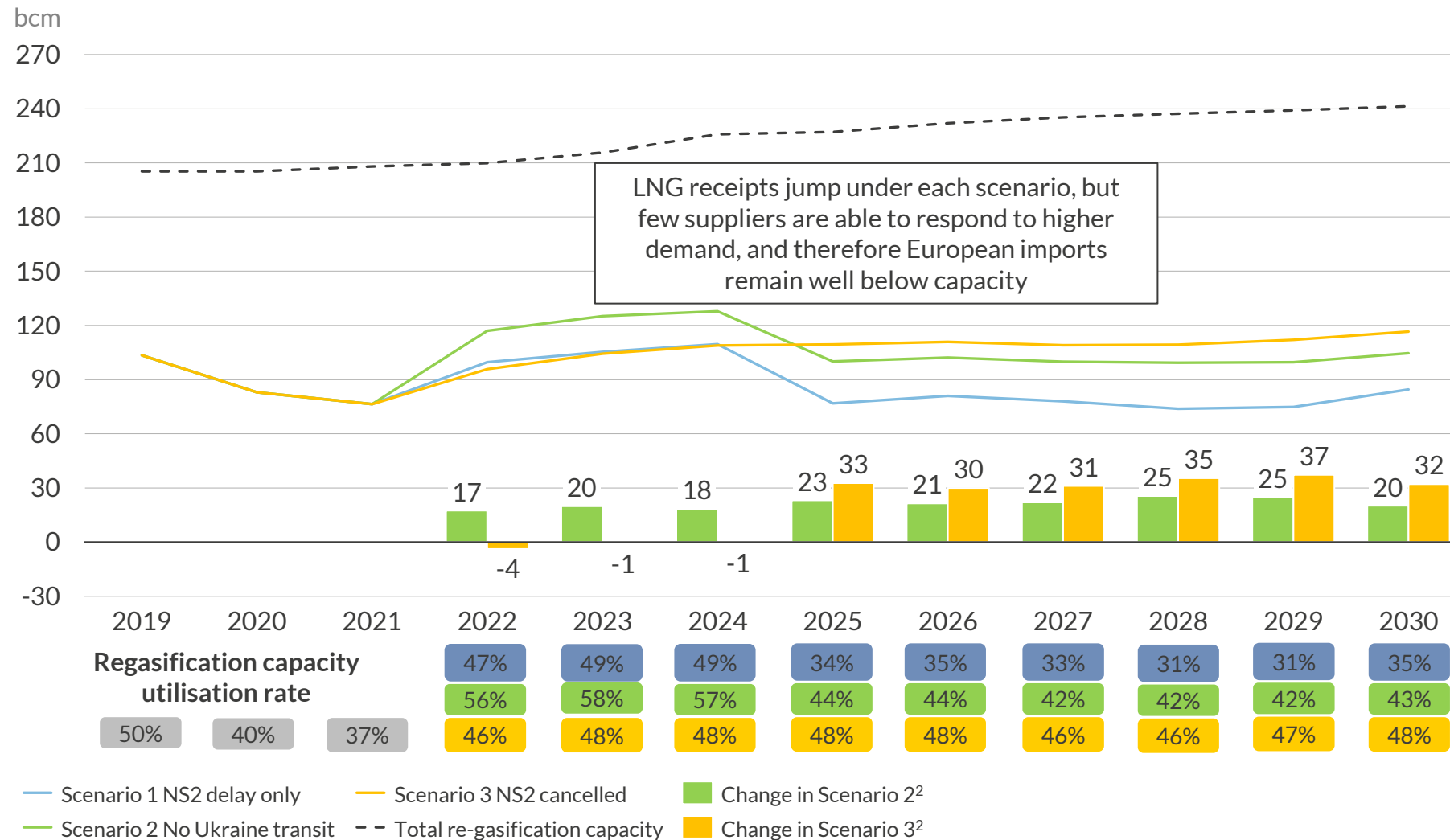
1) Countries include EU 27 and Norway 2) Compared with Scenario 1 which has just a Nord Stream 2 delay

Europe's domestic production is already close to maximum

- There is little scope for additional upward flexibility across all three scenarios from Europe's largest producers, including Norway, UK and the Netherlands
- What little flexibility remains could come from smaller suppliers, including Poland and Romania
- That said, the cap on Dutch production is regulatory-driven, and could be lifted in the event of a supply shortage or unexpected political change
- Norwegian production can also be shifted from one year to the next depending on technical needs and the prioritisation of gas versus oil extraction

LNG receipts climb in 2022-24 in each scenario, before plateauing or dropping in the late 2020s

European LNG imports¹



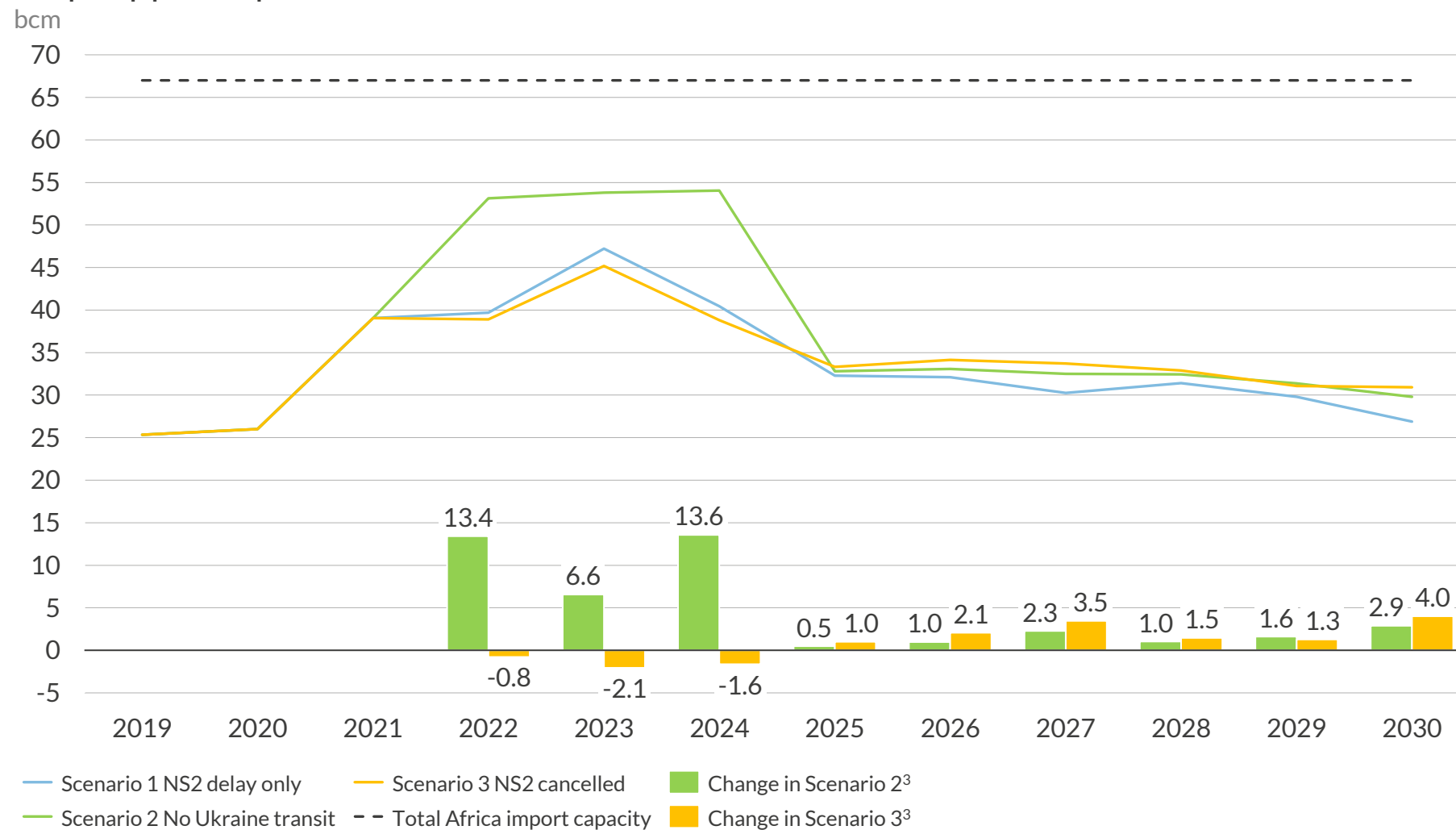
1) Countries include EU 27 2) Compared with Scenario 1 which has just a Nord Stream 2 delay

Europe's LNG receipts step up, but plateau well below capacity

- LNG sendout rises in 2022-24 from 2019-20 levels by
 - 17.2bcm/a in NS2 delay only
 - 35.7bcm/a in No Ukraine transit
 - 15.4bcm/a in NS2 cancelled
- But this leaves European regasification capacity still underutilised, with average unused capacity in 2022-30 of
 - 142bcm/a in NS2 delay only
 - 121bcm/a in No Ukraine transit and in NS2 cancelled
- We see a potential bottleneck in LNG export capacity in the USA and Qatar, where capacity growth is not fast enough to enable Europe to use more of its regasification capacity
- With stronger European LNG demand, we expect competition for upstream LNG supply to become the bottleneck

In all scenarios, imports from North Africa remain below pipeline capacity and fall gradually after 2025

European pipeline imports from North Africa^{1,2}



1) Countries include Italy and Spain 2) Capacity includes Libya to Italy (Green Stream), Algeria to Italy via Tunisia (Transmed), Algeria to Spain (Medgaz), and Algeria to Spain via Morocco (Magreb-Europe) 3) Compared with Scenario 1 which has just a Nord Stream 2 delay

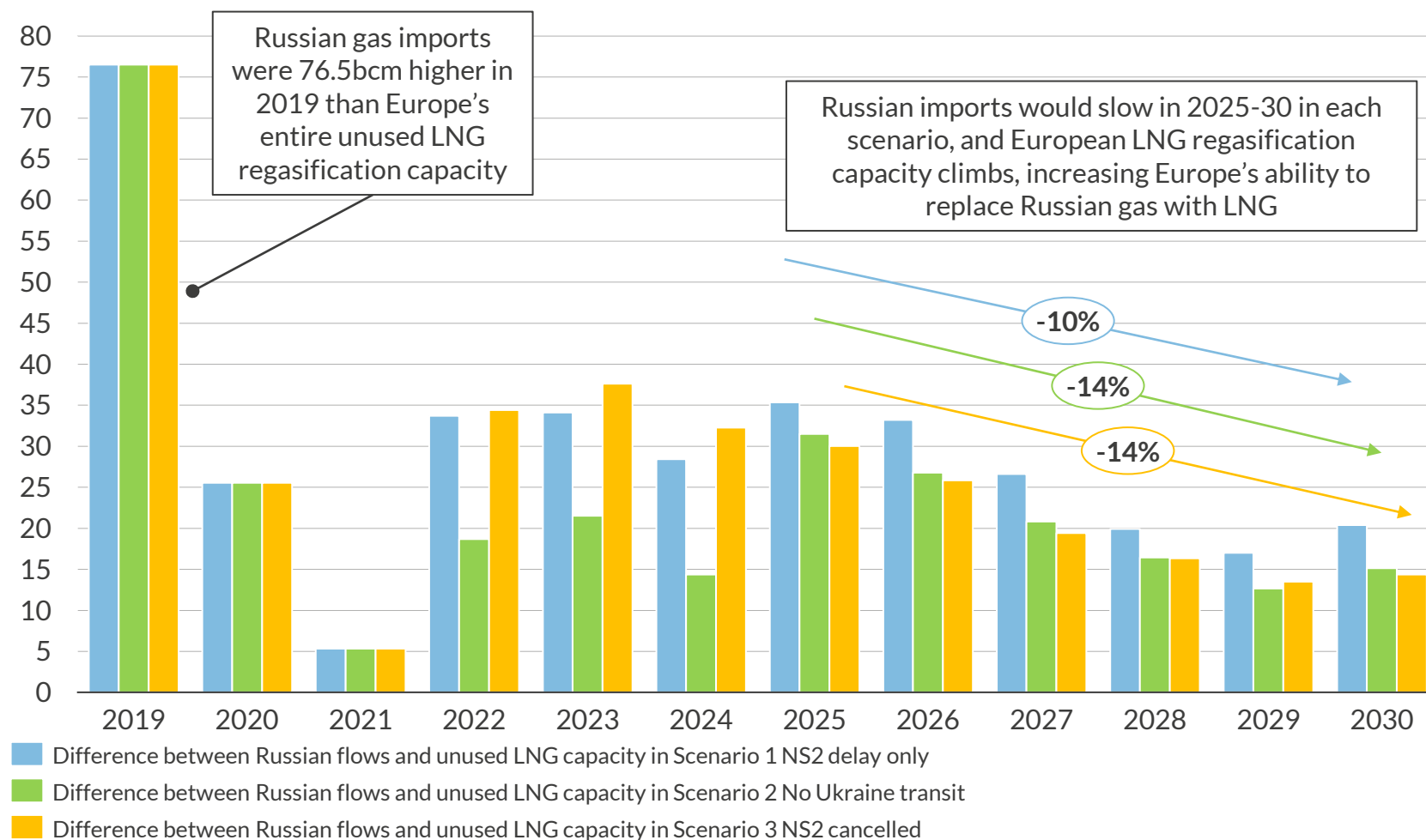
North African supply responds to low Russian flows in 2022-24

- Suspension of NS2 leads to North African imports increasing through 2024
- Once NS2 comes online in 2025 in Scenarios 1 and 2, North African flows drop again as they are replaced by increased Russian gas
- However, even in the scenario where NS2 is cancelled, elevated LNG receipts take the place of African imports, meaning that imports are fairly similar across all scenarios after 2025
- All scenarios assume a restart to the 12bcm/a Magreb-Europe pipeline
 - Flows halted Nov-2021 after the transit contract expired
 - A political dispute between Algeria and Morocco has blocked a new agreement needed to restart the line

Should Russian pipeline supply stop completely, there would not be enough LNG regasification and downstream capacity to offset it

Difference between Russian pipeline gas flows to Europe¹ and unused LNG capacity

bcm



Without any piped Russian imports, other sources besides LNG would need to step up

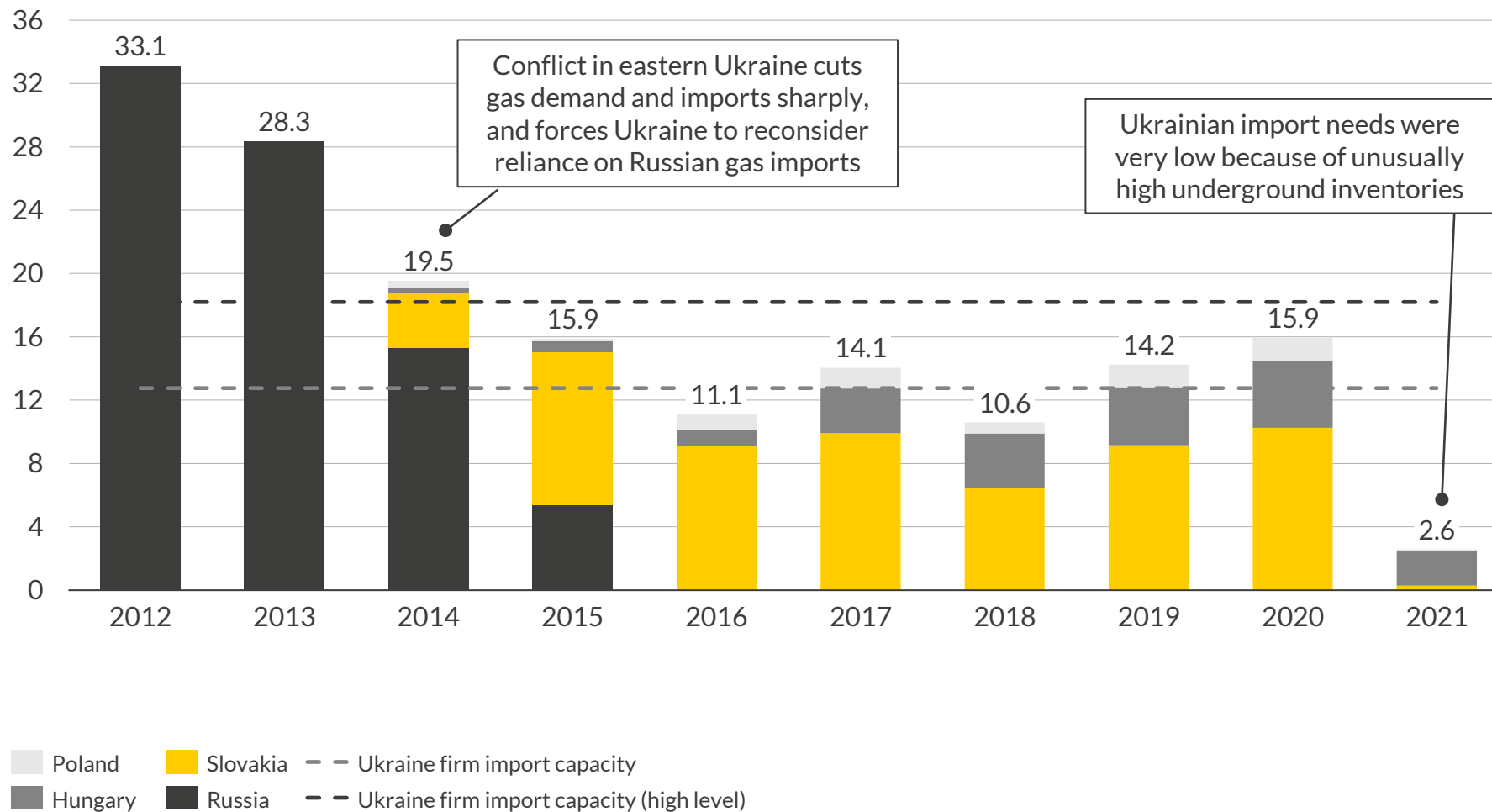
- There is not enough capacity for additional LNG regasification to replace all of Europe's Russian pipeline imports alone
- Downstream capacity from LNG terminals to demand centres would cut the amount of LNG accessible to most of Europe
- Iberia alone accounts for about 73bcm/a of Europe's LNG regasification capacity (34.7% in 2022 and 30.2% in 2030)
- In addition, pipeline infrastructure within Europe is insufficient to get gas from LNG imports terminals to everywhere it is needed elsewhere in Europe
 - For example, border capacity to France from Spain is only 7.74bcm/a

1) Excluding Turkey and Baltics

- I. European reliance on Russian gas and coal
- II. Nord Stream 2 suspension and Ukraine war, and impact on gas and power prices
- III. Russian gas transport medium-term scenarios
 - 1. Suspension until 2025 of Nord Stream 2
 - 2. NS2 Suspension combined with disruption to Ukraine transit flows
 - 3. Full cancellation of Nord Stream 2
- IV. Potential for congestion in Europe and shortages
- V. Takeaways

Even without Ukraine transit, there is sufficient pipeline capacity for Ukraine to import gas from the west to avoid a supply deficit ...

Ukrainian gas imports and capacity
bcm



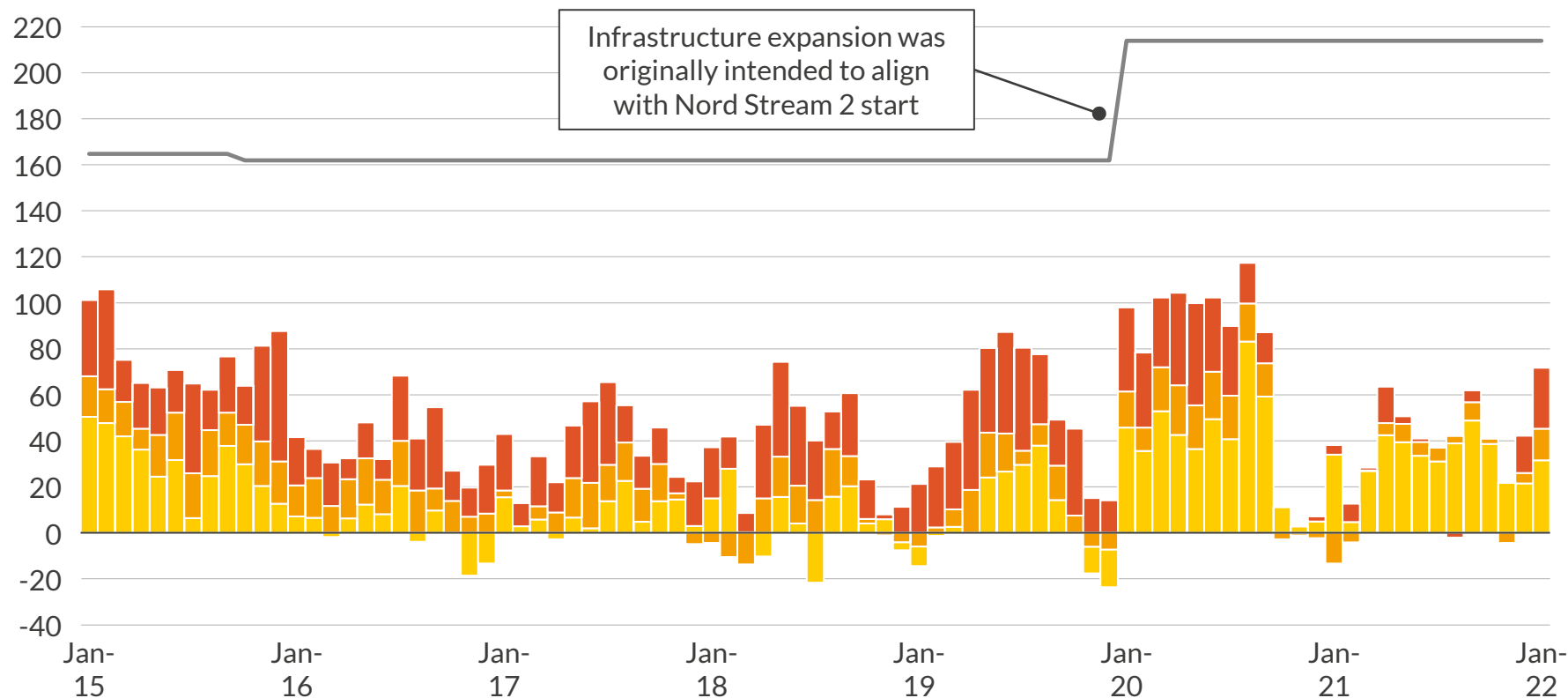
1) Firm (guaranteed) Slovak capacity was increased to 15.3bcm/a until the end of Mar-22 2) Firm Hungarian capacity was made available from Jan-22

A halt to Russian transit reduces Ukraine's access to gas

- Ukraine has relied entirely on domestic production and European imports since 2015
- Most gas arrives at the Slovak and Hungarian borders
- But most gas sold to Ukraine from Hungary and Poland is physical offtake of Russian supply
- Some import capacity is reliant on forward transit flows to enable backhaul to Ukraine
- Guaranteed physical import capacity is still 9.86bcm/a from Slovakia and 2.9bcm/a from Hungary, but imports can reach 15.3bcm/a from Slovakia
- Ukraine is not likely to need imports above the combined 18.2bcm/a in any given year
 - Gas demand is likely to fall in the short-term regardless following military action

... however, in order to offset a halt to Ukrainian transit, west-to-east flows within the European network would need to increase...

Eastward gas flows at key European network points were well below combined capacity
mcm/d



■ Switzerland¹ ■ Austria² ■ Czech Republic³ — Total technical capacity

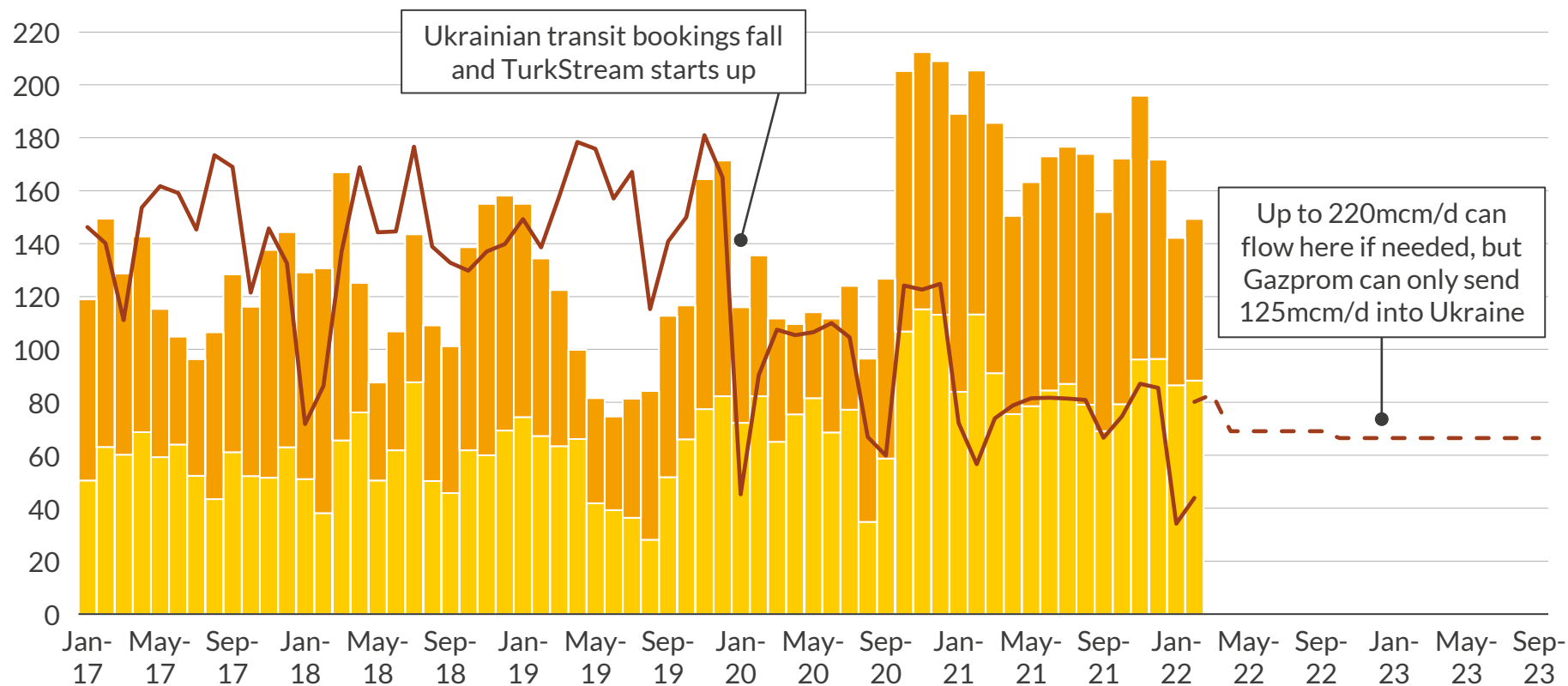
1) Switzerland to Italy (Passo Gries) 2) Germany to Austria (Oberkappel) 3) Lanza (Czech Republic to Slovakia)

Pipeline flows have been far below west-to-east capacity

- This leaves Europe with ample capacity to send gas eastwards to countries that are typically supplied through Ukraine
 - This includes Italy, Austria, Slovakia, and Ukraine
 - Gazprom uses TurkStream to feed most southeast European markets
- Russian gas delivered to northwest Europe through the NS1, NS2 (if available), and Yamal pipelines would have to travel east to replace gas sent to the Ukrainian border if Ukrainian transit halts
- Sending LNG to Germany and eastwards from Spain and France is much more difficult due to limited pipeline capacity between LNG terminals and central and eastern European markets

... and redirecting historical Russian gas flows eastwards through the European network could cause congestion

Gas transit through Ukraine to the Slovak border vs unused¹ west-to-east capacity
mcm/d



■ Unused west-to-east capacity at other key borders²
— Russian gas deliveries at the Ukraine-Slovak border
■ Unused west-to-east capacity at the Czech-Slovak border³
- - - Russian capacity bookings at the Ukraine-Slovak border

1) Spare capacity = technical capacity minus net physical eastward gas flows 2) Other capacity at Oberkappel (Austria) and Passo Gries (Italy) 3) Czech-Slovak capacity at Lanza

- In the case that Ukraine transit halts (Scenario 2)
 - Redirecting gas that had previously transited Ukraine through northwest Europe instead could create congestion
- There is enough west-to-east capacity in the European network to send Russian gas arriving in Germany eastwards instead of through Ukraine
 - But this depends on total demand for Russian imports on any given day
 - This capacity could fill during periods of high demand, increasing the cost of sending gas to affected markets
- Current pipeline bookings suggest Ukraine transit flows will be similar to unused Czech-Slovak west-to-east capacity

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We explored several Russian gas scenarios and their impact on European markets



Russian gas is key for European supply, making up ~40% of the total in Europe, but over 75% in some countries in the east and south. Tensions in Ukraine, and the suspension of Nord Stream 3 certification saw gas and power prices rise sharply



Less Russian gas into Europe can be offset by both more LNG, and higher imports from Africa, but we presume this will come at a higher cost than Russian gas. In Europe, LNG imports remain well below capacity, as we expect competition for limited upstream LNG supply to become the bottleneck



1 In our optimistic scenario with only a delay to NS2 until 2025, LNG imports reach closer to maximum regasification capacity, but drop again once NS2 is online. Overall, there is enough gas in Europe



Supply shortages in Ukraine are a risk especially in a scenario where there is no gas transit via the country, as there is less Russian gas available in Europe that can be shipped from west to east. This is despite there being sufficient pipeline capacity



2 Should Ukraine gas transit stop from 2022, and NS2 be delayed to 2025, Europe could compensate with a strong pick up in LNG and imports from Africa, but there may be insufficient western supply to Ukraine



3 In a scenario where NS2 is cancelled, Europe imports less Russian gas and more LNG and piped gas from Africa over the next decade, but we expect this will come at a higher cost

A disruption to Russian gas supply or capacity into Europe is expected to be bullish for European markets due to the high share of Russian gas in the supply mix. There may be enough nominal LNG import and pipeline capacity into Europe, but there are bottlenecks within Europe

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Power markets



Renewables



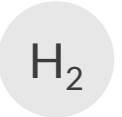
Storage



Electric vehicles



Hydrogen



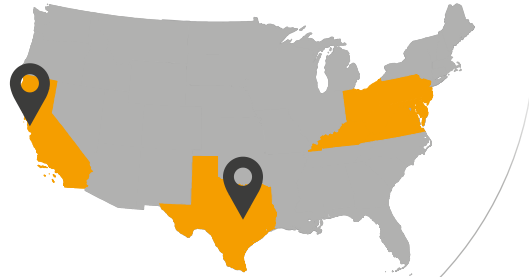
Carbon



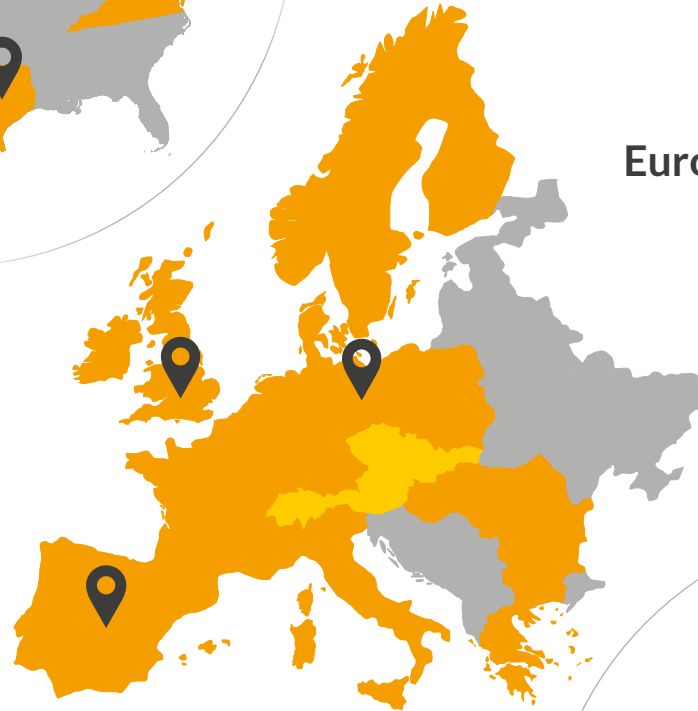
Natural gas



United States



Europe



Australia



 Regular detailed coverage  Analytics on demand



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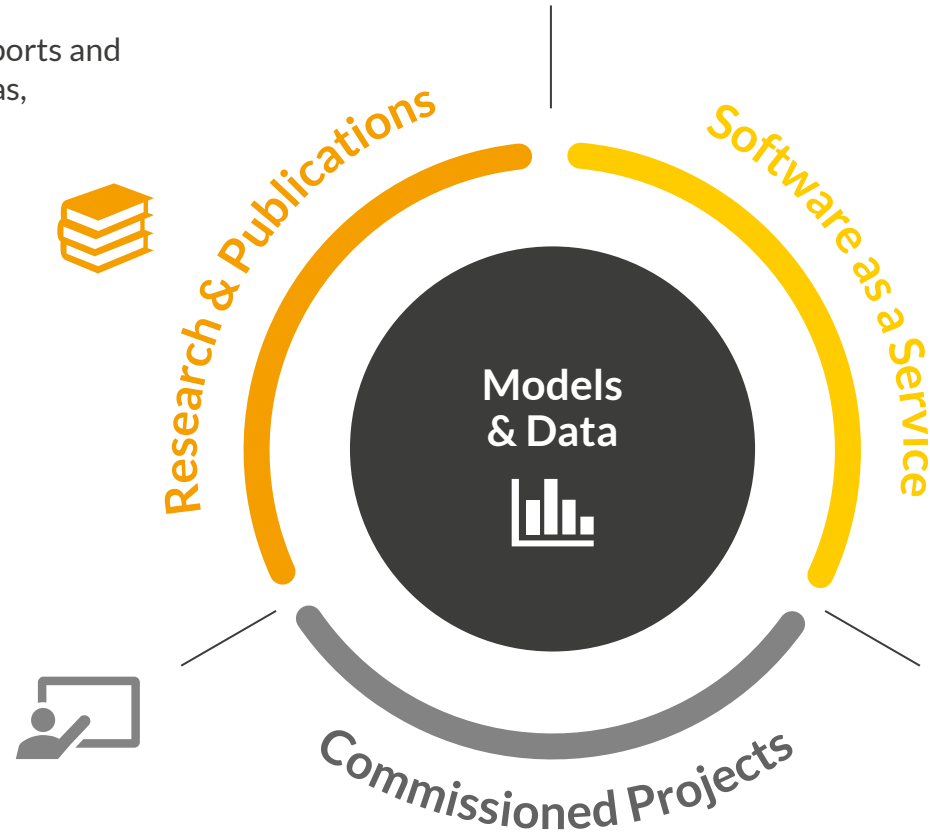
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