

Nord Stream 1 impacts and outlook

27th July 2022



Executive Summary

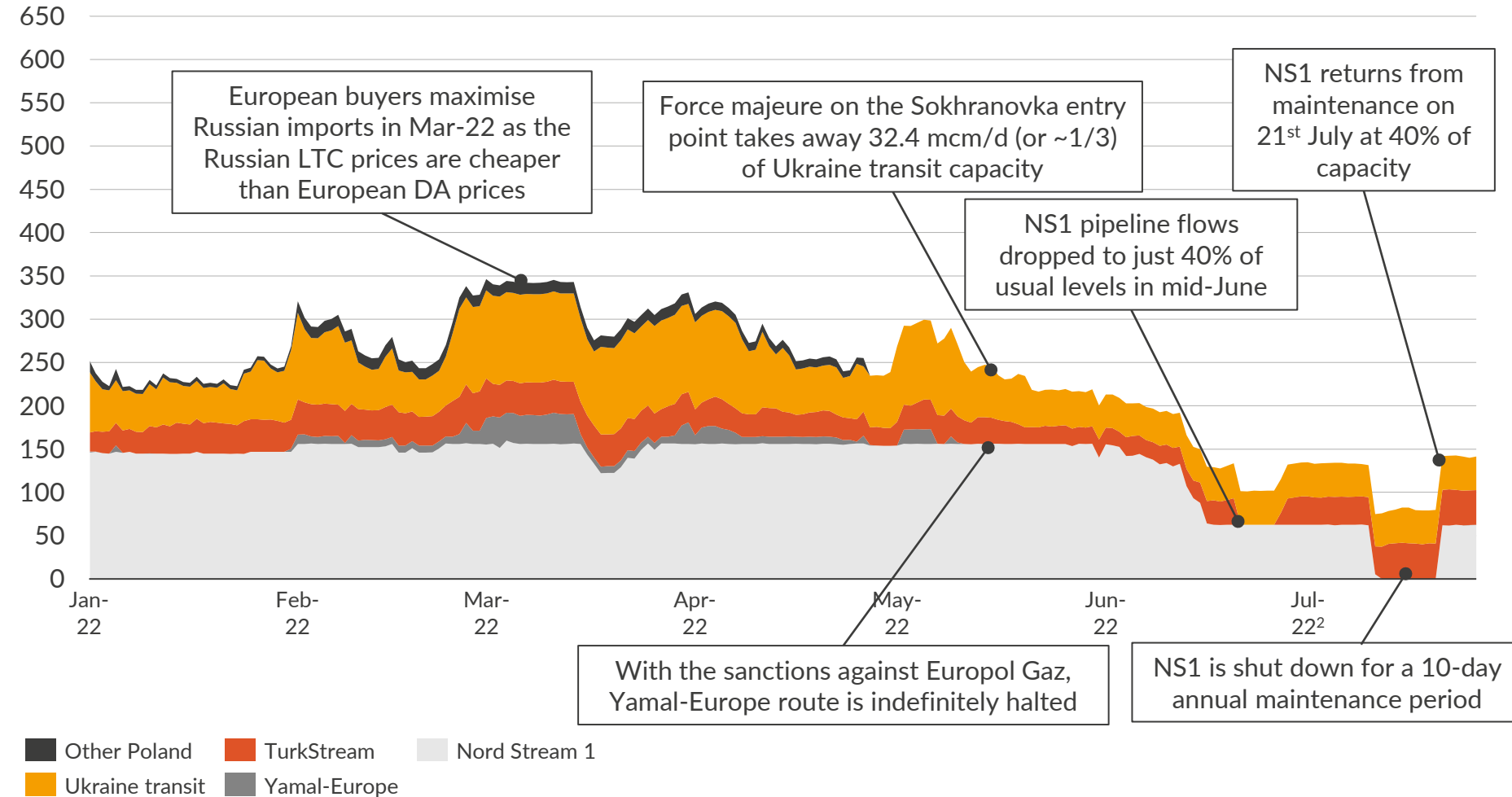
This short policy note summarises the price and policy reaction to reduced Nord Stream 1 flows of Russian gas to Europe, and the outlook for gas storage filling ahead of winter

- Gazprom has announced that it would reduce deliveries of Russian gas to Europe through the Nord Stream 1 pipeline from 27th July to 33 mcm/d (~20% of capacity), down from about 62 mcm/d in recent days, for an unknown duration
- European gas prices jumped following the announcement, closing in on record highs set shortly after the start of the Russia-Ukraine war
- Gazprom has not redirected lost NS1 volumes through other import routes, and is not likely to make up for missing volumes via other sources of supply
- The reduction will make it more difficult for EU member states to reach their storage targets of 80% full by 1st November, and harder for those countries that have set even higher targets, such as the 95% set by Germany
- However, member states were in total as much as 3 bcm ahead of their 1st September intermediary stock target, which would be enough to offset the reduction in Russian gas imports, even if reduced NS1 flows continue until 1st November
- The EU has also committed to voluntarily reducing winter gas demand by 15% (~45 bcm) in 1 Aug-22 to 31-Mar-23, which would more than offset the drop in NS1 flows
 - The measures could include reductions of gas consumed in power sector, fuel switch in industry, national awareness campaigns to reduce consumption, targeted obligations to reduce heating and cooling and market-based measures such as tenders or auctions to cut consumption
 - Member states will be able to implement measures of their own choosing, and the EU has outlined several exemptions and possibilities to request a derogation from the reduction target
 - The target is ambitious and contentious, with several member states opposed to the original proposition. It could require substantial reductions to industrial activity if governments seek to preserve gas use by households and other protected customers

After annual maintenance, NS1 started flowing again on 21st July at 40% of capacity; Capacity due to drop again to 20% on 27th July

Average daily Russian gas deliveries to Europe¹ since Jan 2022

mcm/d



1) Shown capacities (dashed lines) are cumulative, starting from Nord Stream 1, Yamal-Europe, Turk Stream and Ukraine. Other marginal routes, including about 15.7mcm/a of additional capacity at the Belarus-Poland border, were excluded. Additionally, Turkey and the Baltics have been excluded. 2) Latest update: 26 Jul-2022

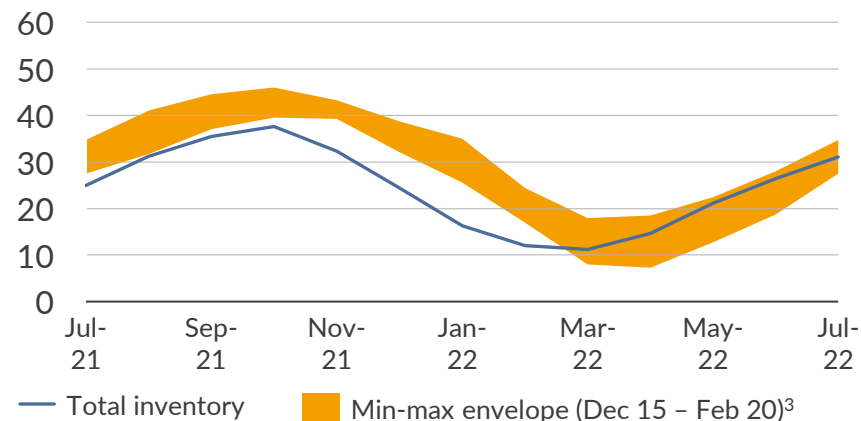
Sources: Aurora Energy Research, ENTSO-G

- On 14th June, NS1 flows dropped to 100 mcm/d when Gazprom announced that 5 out of the 8 turbines in the Portovaya compressor station are offline
- On 16th June, NS1 flows were further reduced to just 62 mcm/d (or 40% of capacity) after another turbine went offline, leaving the compressor station with only two operational turbines
- NS1 was restarted from maintenance on the 21st of July, flowing at similar levels before the maintenance (62 mcm/d). However, Gazprom announced further reductions to flows that will reach 33 mcm/d (~20% of capacity) on 27th July
- There has been no redirection of the lost NS1 volumes through other import routes; Yamal-Europe has been halted since May-22, the UA corridor was utilised at 37% of contract capacity, and TurkStream went briefly offline in Jun-22 for maintenance

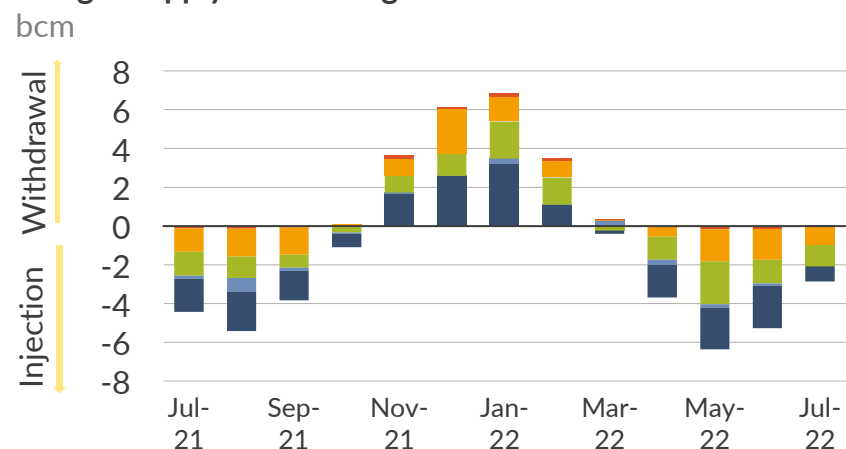
European gas inventories ended 20th July at robust levels (65% full) and are still within target of achieving 80% full by 1st Nov

Northwest Europe¹

Storage inventory bcm



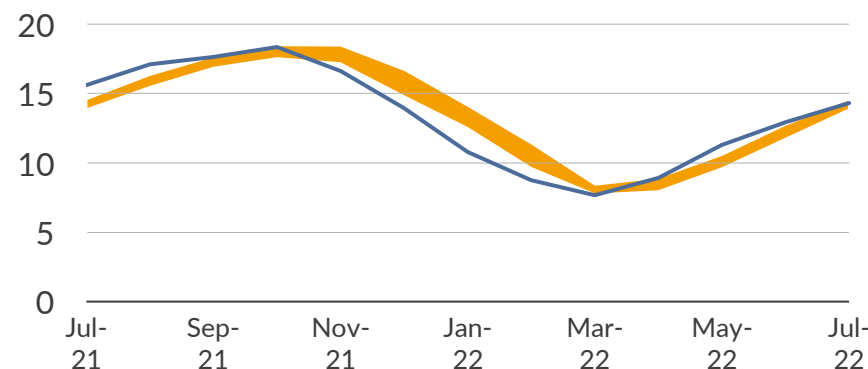
Net gas supply from storage bcm



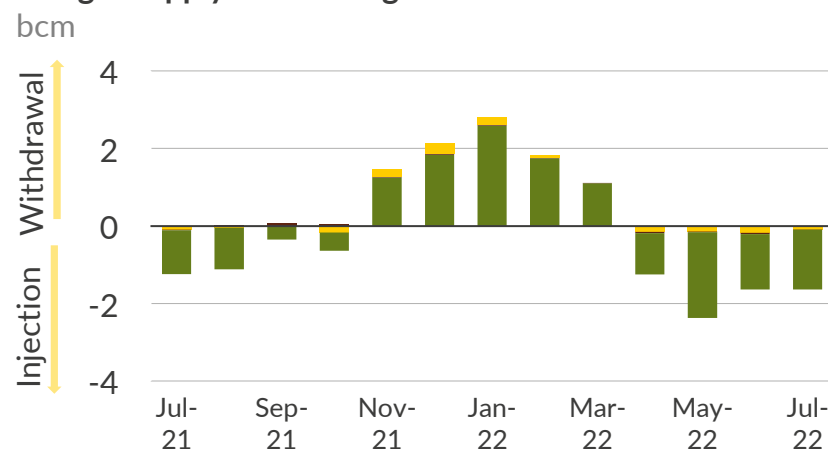
Belgium Netherlands France Great Britain Germany Spain Portugal Italy

Southern Europe²

Storage inventory bcm



Net gas supply from storage bcm

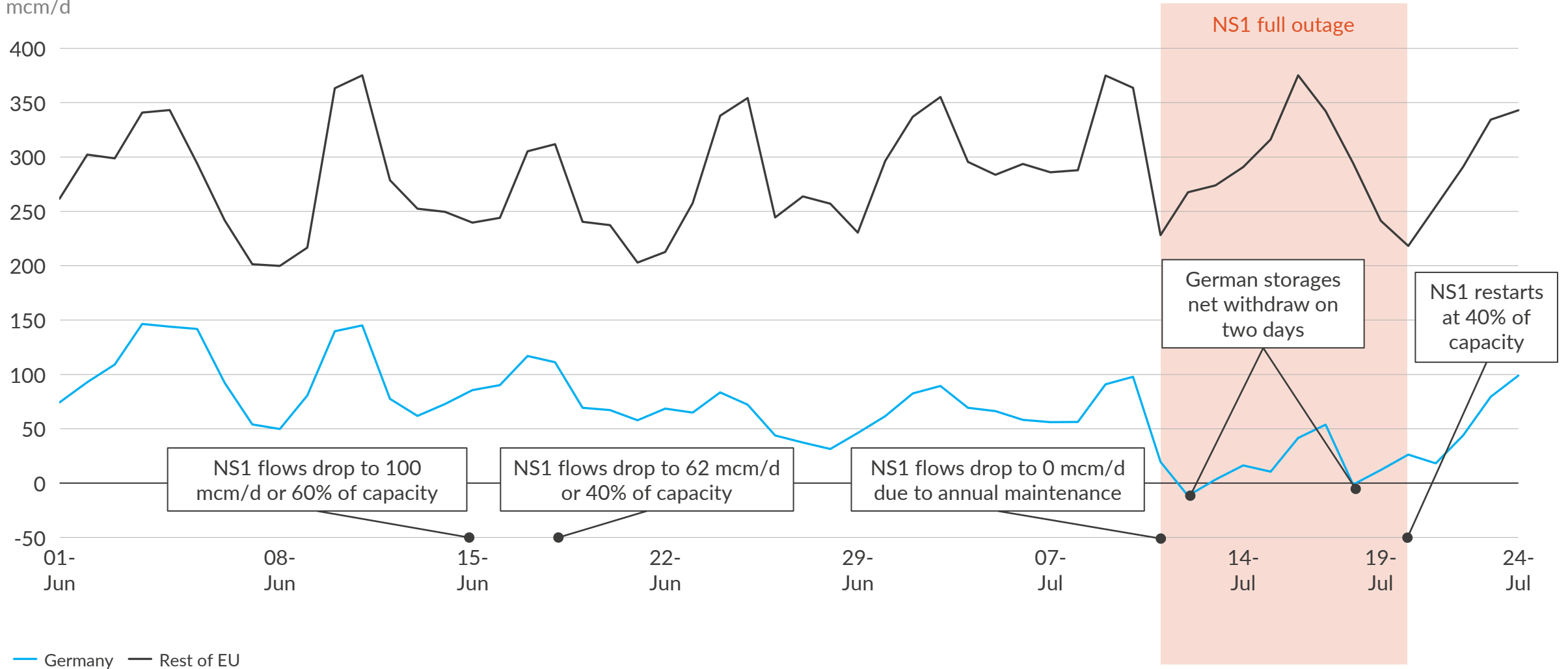


- Gas inventories in Northwest Europe ended 20th of July at 31.1 bcm (or 65% full), in line with the 5-year average
- Robust storage injections in April, May and June were followed by slower injections in July due to declining Russian pipeline flows amid the annual maintenance of NS1
- Several underground gas storages that Gazprom used to hold capacity have started filling for the first time since 2019 but at a slow rate; by the 20th of July, Rehden (DE) was 34% full, Bergermeer (NL) 45% and Haidach (AT) 57%
- EC's proposal that EU storage sites should be 80% full by 1 November 2022 and 90% full by 1 November 2023 and onwards has been ratified in Jun-22

1) Belgium, France, Germany, the Netherlands and UK. 2) Spain, Italy and Portugal. 3) Envelopes are calculated by taking the maximum and minimum monthly values from Dec-15 to Feb-20 (Pre-pandemic)

German storage injections slowed when NS1 flows reduced whilst injections in the rest of the EU were largely stable

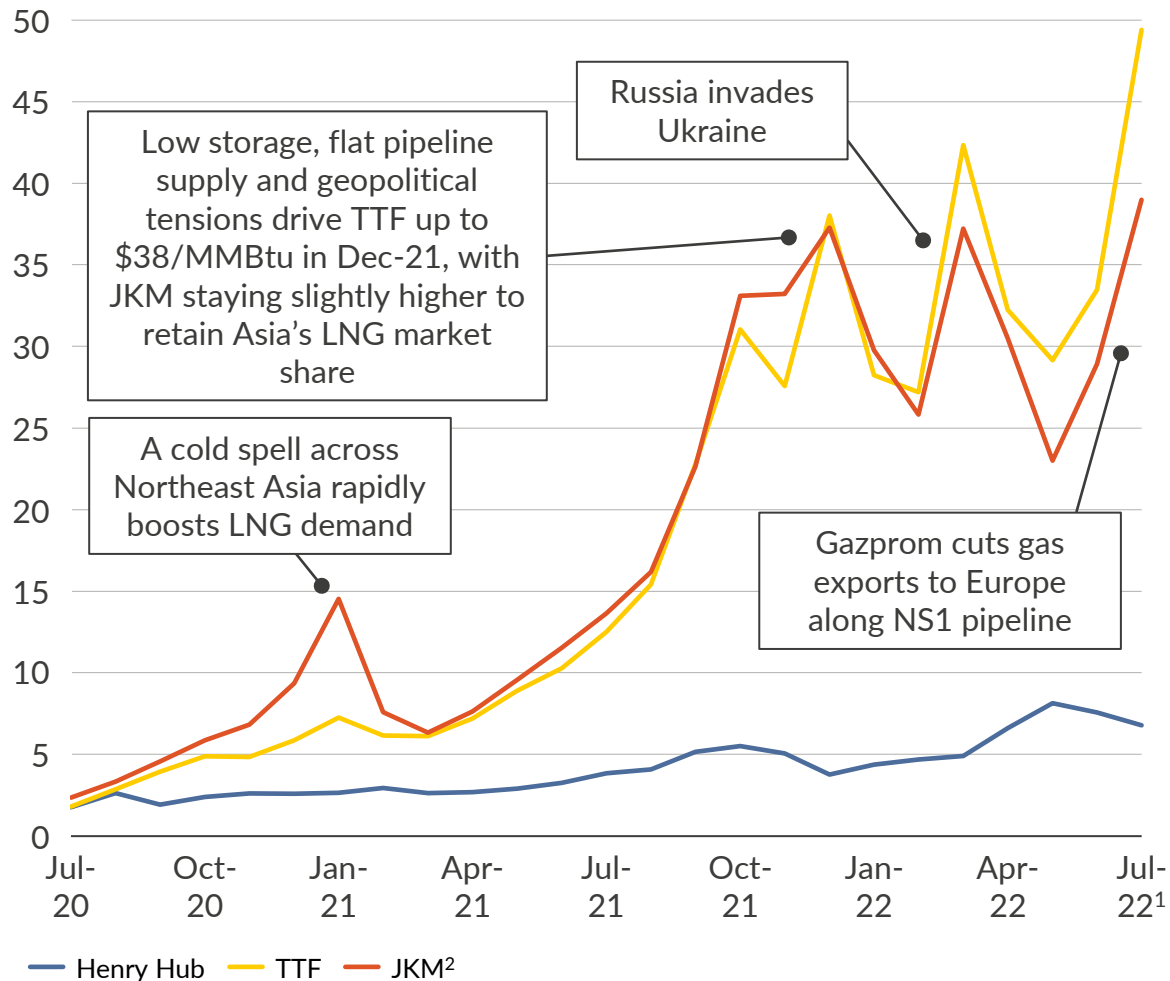
Daily European UGS net injections¹
mcm/d



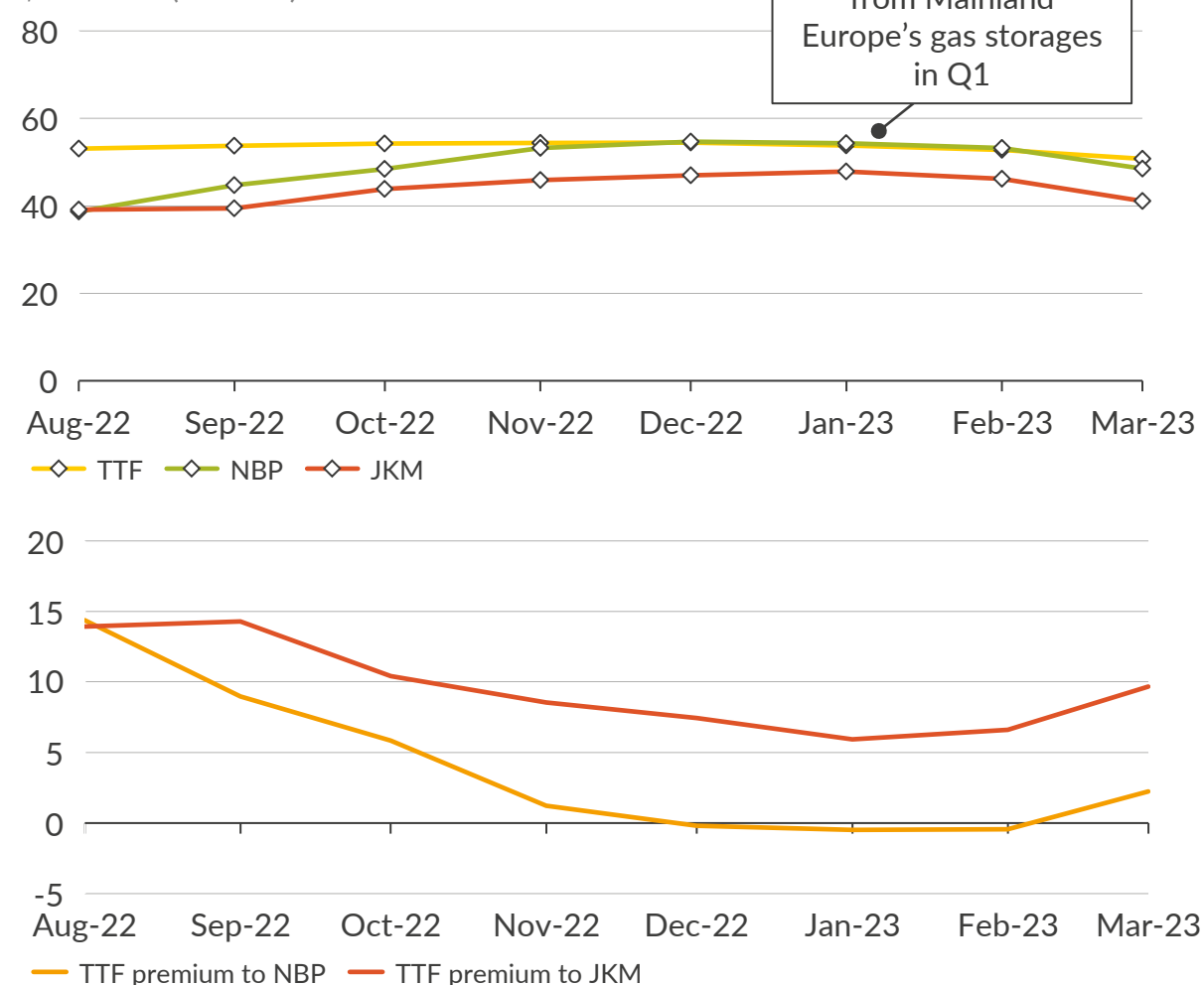
1) Negative figures suggest withdrawals

TTF futures remain well above JKM for the rest of winter and prices have been above NE Asian prices since March on lower Russian imports

Traded average front-month gas prices
\$/MMBtu (nominal)



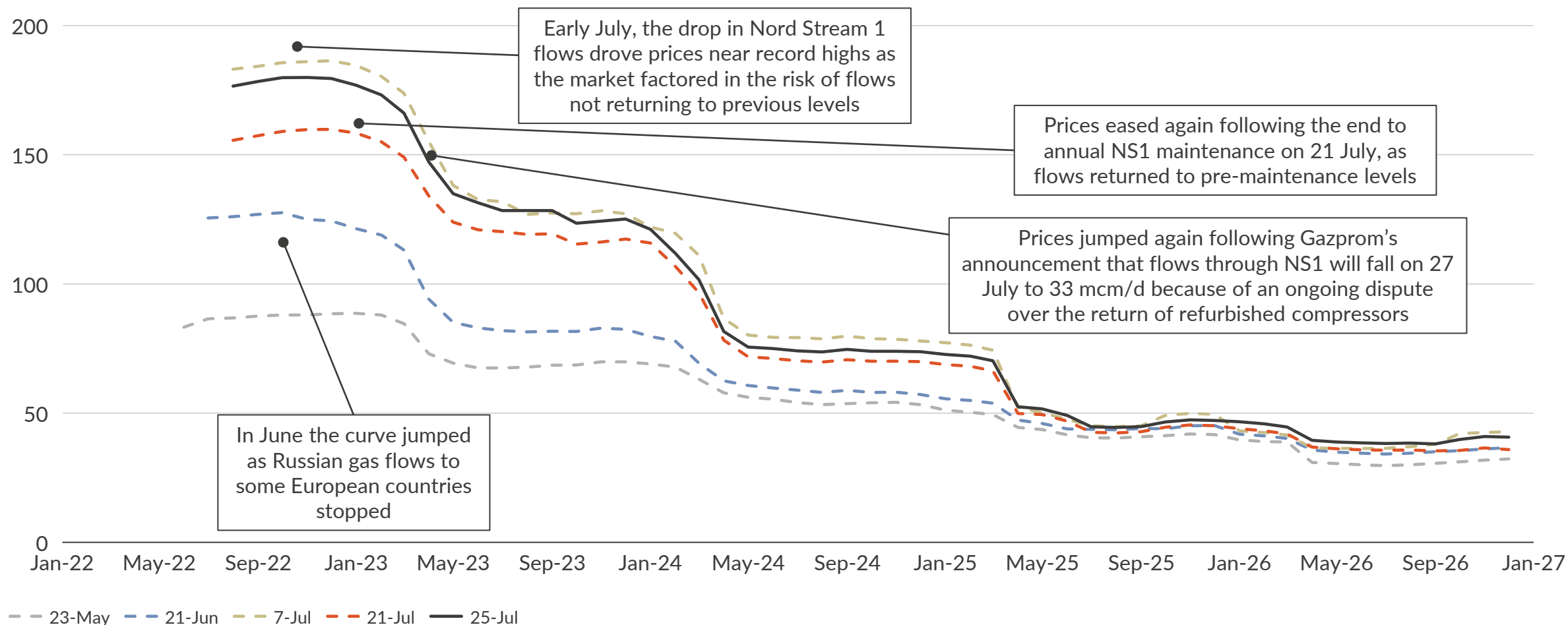
Monthly futures prices at 25th July settlement
\$/MMBtu (nominal)



1) Average settlement prices for 1-20 July. 2) JKM is the Platts Japan/Korea Marker LNG price

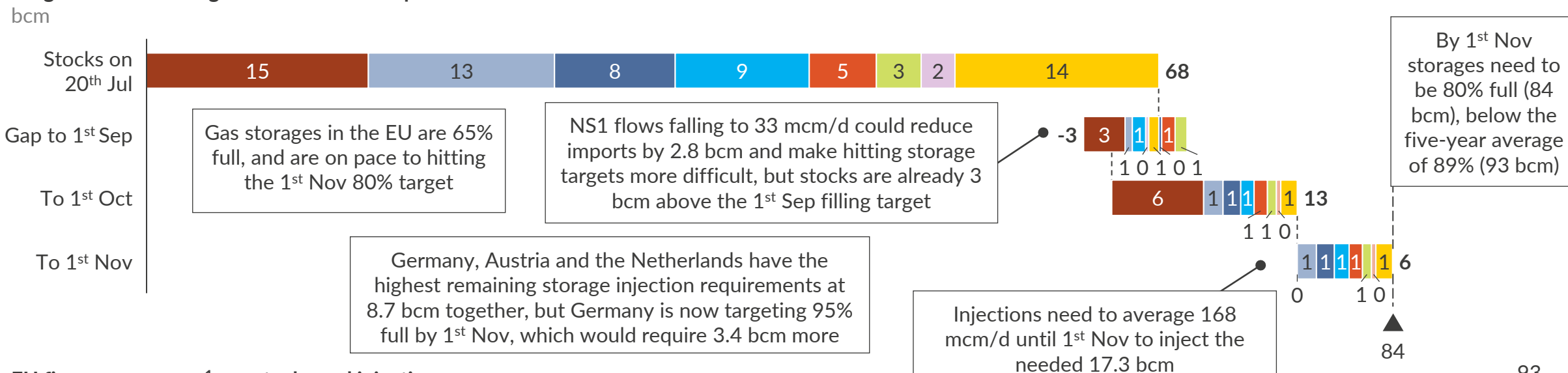
Gas prices on the curve have remained in deep backwardation with Nord Stream 1 flows set to fall even further below capacity

Dutch TTF future prices¹ react to conflict escalation
EUR/MWh



Gas storages in the EU need to inject at least 17.3bcm by 1st Nov-22, and Germany upped its own filling target by 3.4 bcm

EU gas stocks and targets in the draft European Commission law for 2022



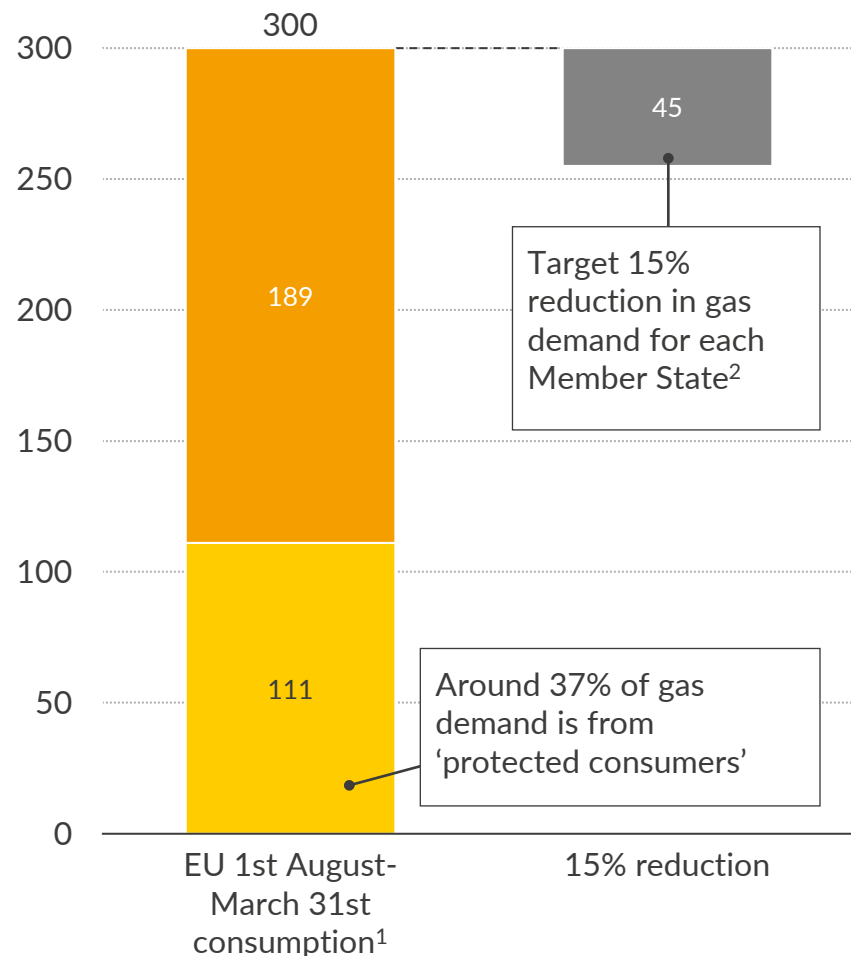
EU five-year average¹ gas stocks and injections



1) Five-year average is an average of values on the same date for 2017-2021. 2) Others includes PL, CZ, ES, RO, LV, DK, BE, BG, HR, PT, SE





On 26th July Members States agreed to voluntarily reduce winter gas demand by 15%, prompted by the drop in NS1 flows

EU winter gas demand
bcm



The EU's Save Gas for a Safe Winter plan sets out three stages

1. **Pre-Alert:** Make best efforts to reduce gas demand by 15%. The EU is currently at this stage
2. **Alert level:** Mandatory reduction by 15%
3. **Emergency:** Follow emergency plans, e.g. releasing gas from strategic storage, introduce an administrative price for gas

The EC's suggested measures to reduce demand		Aurora believes a 15% cut will be challenging
	Priority should be given to switching to renewables or cleaner, less carbon-intensive or polluting options but switching to coal, oil or nuclear is allowed as long as it avoids long term carbon lock-in	The power sector has a lot of flexibility to reduce gas demand, but this is highly dependent on weather, French nuclear availability, wind generation, rainfall, and coal and EUA prices affecting switching dynamics
	Auctions or tender systems by which States incentivise large gas consumers to turn down demand, mainly industry	Industrial demand has already dropped e.g. steel and fertiliser sectors, in response to high prices, further cuts will need time
	Protected consumers will be the last to be curtailed	The demand reduction potential by turning down thermostats in households and businesses was estimated to be 10bcm
	Flexible power capacity in the system could reduce EU imports of Russian gas by 5% ³	A 5% cut in Russian gas is 3-5bcm ⁴ but it is not clear in the plan how this could be achieved by winter

Exemptions or derogations to the 15% cut possible if an EU country has:

- Limited interconnections to other member states and their pipeline or LNG capacity to other EU states is being fully used. This is seen e.g. in Spain which has limited interconnection with France
- Overshot their gas storage filling targets. Germany, Italy and Slovakia have already reached their 1st Sep target
- Heavily dependent on gas as a feedstock for critical industries or if their gas consumption has increased by at least 8% in the past year compared to the average of the past five years

Several countries have expressed reservations about the plan including Spain, Portugal, Greece, Italy and France, and are likely to request an exemption or derogation

1) Estimated EU gas demand based on average consumption between 1 August and 31 March during the last five years. 2) Member States may request to limit the mandatory demand reduction by a maximum of 5% in case of low interconnectivity. 3) Based on industry estimates gathered by the European Commission. 4) Compared to Russian gas under continued flow at ~150 bcm/a
Sources: Aurora Energy Research, European Commission

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A U R  R A

Power markets



Renewables



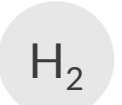
Storage



Electric vehicles



Hydrogen



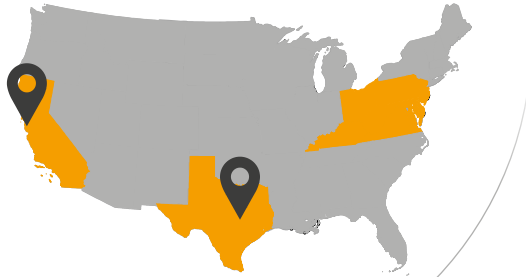
Carbon



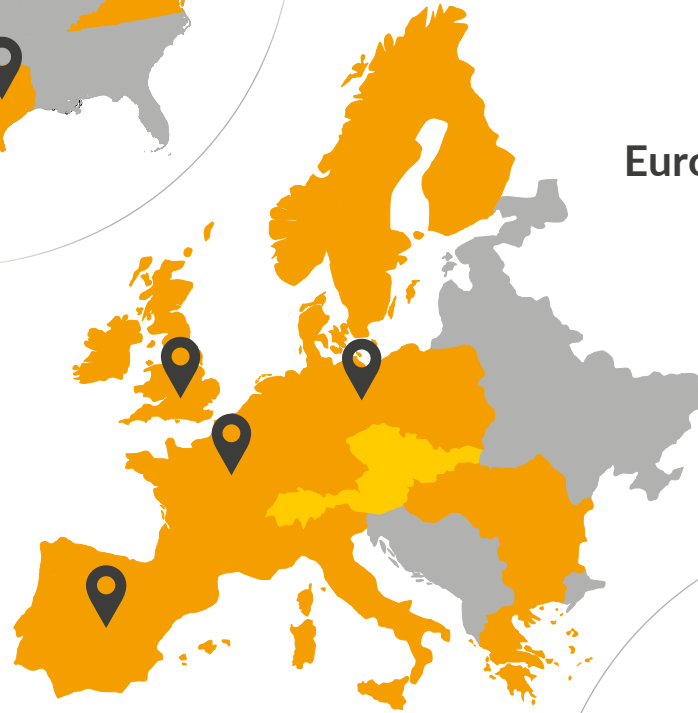
Natural gas



United States



Europe



Australia



 Regular detailed coverage  Analytics on demand



7 Offices

Oxford | Berlin | Madrid | Paris
Sydney | Austin | SF Bay Area



225+

market experts



550+

subscribing companies



100+

transactions supported in 2021

Offices in Stockholm, Athens and Milan opening soon.

Aurora brings a sophisticated approach to the provision of analysis and insight to the energy industry

Research & Publications

- Industry-standard market outlook reports and price forecasts for power, gas, carbon and hydrogen markets
- Strategic insights into major policy questions and new business models
- Read and constantly challenged by 350+ subscribers from all industry sectors



- Bespoke analysis, drawing upon our models and data
- Trusted advice for all major market participants proven in 400+ projects: transaction support, valuations, strategy & policy engagement



Commissioned Projects

Software as a Service

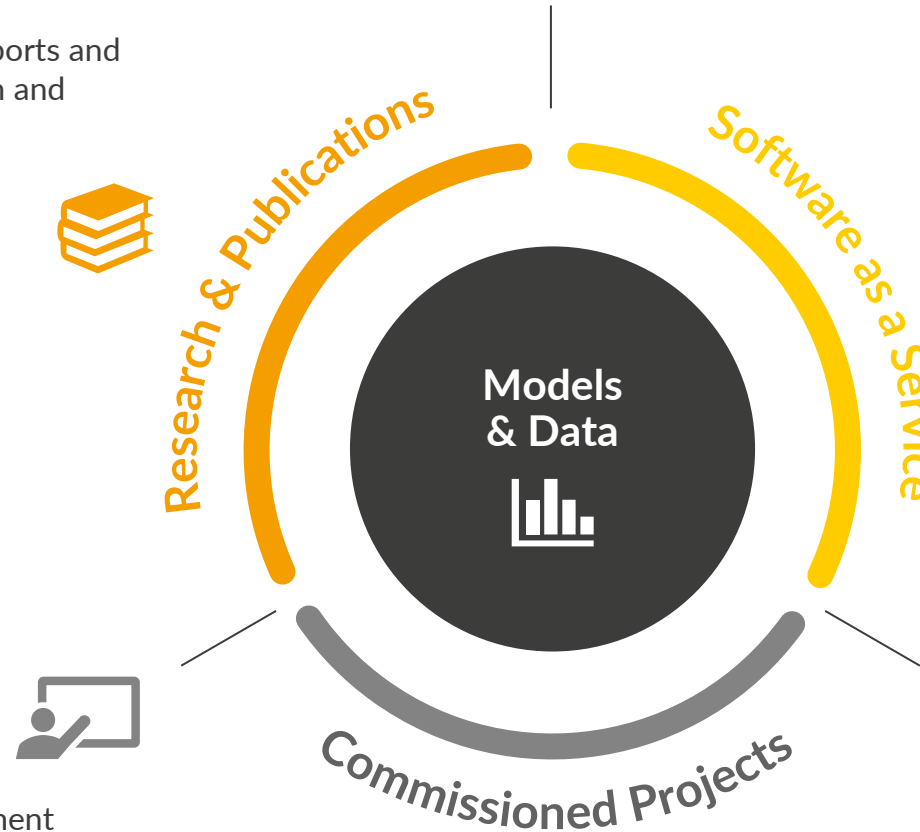
- Cloud-based tools for quick, accurate, asset- and site-specific valuations using Aurora's trusted forecasts
- First-of-a-kind wind valuation tool launched in 2019 and already widely adopted in GB, Germany, Ireland, France, Iberia, Poland and Australia



Models & Data

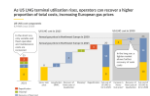
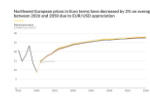
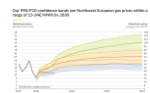


- Market-leading long-term models for power, gas, hydrogen carbon, oil and coal markets
- Continuous model improvements through client feedback



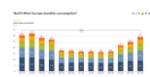
Aurora's Global Energy Markets Service provides market analysis and forecasts for all participants in the gas markets

1 Global Energy Market Forecasts



- Aurora's long-term forecasts for gas, oil and coal markets presents a fully consistent view on fuel prices, production, and consumption by major countries and regions
- Provides Central, High, Low, and P10/P90 price sensitivity analyses, based on historical variation in key sources of uncertainty
- The long-term forecasts are updated every year,. Each quarter there is a market and forecast update on the short-term (traded horizon)
- Specific deep dive on European gas markets:
 - European gas market development until 2060 for key gas hubs (see map on next slide) including monthly hub prices, seasonal spreads and geographical spreads
 - Monthly forecast for production, demand, LNG imports, pipeline flows and storage for the key European markets
- Uses our in-house global energy market model, which allows full substitution between commodities and regions (e.g. European gas price impact if India builds more coal plants) ...
- ... and our in-house European gas flow dispatch model that includes 430+ pipelines, all storages and LNG import facilities as well as detailed modelling of demand zones
- Our global market model underpins BP's Energy Outlook and the scenarios they present
- The annual main report (~160 pages) provides a full outlook on the expected supply and demand balance going forward, published once a year with quarterly updates

2 Monthly market summaries



- Monthly summary reports (~20 pages) on latest developments in the European gas markets
- Key data covered are hub prices, volumes, trade, suppliers market share, indigenous production, storage stock levels, LNG imports and demand

3 Analytics and data platform EOS



- Access to detailed historical and real-time European gas market data
- Data with daily granularity includes
 - Demand, supply and production
 - Pipeline flows and imports/exports
 - Storage utilisation and LNG sent-outs
 - Regional gas prices and commodity price data
- Data can be viewed, charted and downloaded

4 Bilateral meetings & analyst support



- Bilateral workshops with senior members and subject experts of Aurora' team to discuss Aurora's analyses and views on the market
- Short-notice support by our analysts on questions arising from our research

5 Invitation to Aurora's annual Spring Forum



- In our by-invitation-only annual Spring Forum industry leaders discuss the challenges of the energy industry of tomorrow
- Being held at distinguished venues at the University of Oxford
- Key note speakers of our 2022 Forum included Kwasi Kwarteng MP (Secretary of State, BEIS), Ben van Beurden (CEO, Shell) and Egbert Laege (MD, Securing Energy for Europe) among others

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