Falling Like Dominoes: The Impact of Nord Stream on Russian Gas flows in Europe

Introduction

In 2020 and 2021, the Nord Stream pipeline was the largest single route for Russian pipeline gas deliveries to Europe. In 2021, Nord Stream supplied just over 40 per cent of Europe’s total pipeline imports from Russia,1 and 15 per cent of Europe’s total combined pipeline and LNG imports.2 Since October 2017, Nord Stream has generally operated at its full 165 MMcm/d capacity, outside the annual scheduled 10-day maintenance periods, which take place every July.

In the first 12 days of June, flows via Nord Stream fell from 165 MMcm/d to 140 MMcm/d. Between 12 and 16 June 2022, the flow fell to 67 MMcm/d. According to Gazprom, the reduction in Nord Stream flows since 12 June was due to reduced technical capacity at the Portovaya compressor station, where turbines were taken offline for maintenance. The impact was felt beyond Germany, where Nord Stream makes landfall. Moreover, the decline in flows via Nord Stream occurred in the context of a general decline in Russian pipeline flows to north-west and central Europe that had been taking place since mid-2021. The nuanced impacts of that ongoing decline caused a reconfiguration of Russian gas flows in Europe. As a result, when the flows via Nord Stream fell in mid-June 2022, it was not only the markets of north-western Europe that were affected. Gazprom’s counterparties in Slovakia, Austria, and Italy all reported receiving less than their nominations made under long-term contracts.

On 11 July, flows via Nord Stream halted entirely, as the scheduled annual 10-day maintenance period began. On 18 July, Reuters reported that Gazprom had retroactively declared force majeure with regard to supplies via Nord Stream – the force majeure was declared in a letter dated 14 July and retroactively applied from 14 June.3 When Nord Stream restarted after maintenance, it was just below the pre-maintenance level, at 65-66 MMcm/d. However, on 25 July, Gazprom announced that another gas turbine would be taken offline at Portovaya (leaving just one operational and probably one as back-up), and that, consequently, capacity of Nord Stream would fall again, to 33 MMcm/d from 27 July.4

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1 58.15 Bcm via Nord Stream of a total 142.3 Bcm supplied by pipeline from Russia to Europe (excluding Turkey).
2 Total European imports of 390.5 Bcm, of which 303.8 Bcm by pipeline and 86.6 Bcm as LNG. Data from ENTSOG Transparency Platform (pipeline) and Kpler LNG Platform (Subscription required)
4 Gazprom Twitter, 25 July 2022. https://twitter.com/GazpromEN/status/1551582192484106246?s=20&l=MdLgQys6RFSXYzRtVRdBQ
Between 27 and 31 July, the flow of gas via Nord Stream into the OPAL and NEL pipelines in Germany fell gradually from 35 MMcm/d to 30 MMcm/d.5 6

On 20 July, we published an OIES Comment in which we analysed the turbine and compressor issues at Portovaya.7 This follow-up Insight explains how Russian gas flows to Europe fell before the reduction of Nord Stream capacity in June 2022, and how the subsequent reduction in Nord Stream capacity (including the temporary complete suspension for maintenance) has impacted flows of Russian gas in Europe, specifically in north-western and central Europe.

Context: six factors that caused Russian gas flows to decline in 2021 and 2022

1. Gazprom did not replenish its downstream European storage stocks (summer 2021)

The first quarter of 2021 was cold across the northern hemisphere. As examined by several OIES publications at the time, including our Quarterly Gas Review, the cold snap in north-eastern Asia caused LNG cargoes to be drawn away from Europe, leaving Europe to heavily draw down its storage stocks.5 At the same time, Russia too experienced a cold winter and heavily drew down its own storage stocks. The summer of 2021 saw Gazprom replenish its own domestic (Russian) gas storage stocks, but not the downstream stocks it held in European gas storage facilities.6 Given that, through its various subsidiaries, Gazprom held roughly 10 per cent of European storage capacity, this caused considerable concern in Europe.10 One consequence of Gazprom’s non-replenishment of its European storage stocks was that it flowed less gas to Europe in the summer of 2021 – specifically, to Germany, Austria, and the Netherlands – where Gazprom held ownership stakes in storage facilities.11

2. Gazprom ceased selling spot volumes into the European market (winter 2021/22)

In addition to its long-term contracts, Gazprom also sold spot volumes into the European market. It did so on European hubs through its trading subsidiaries (such as Gazprom Marketing & Trading), and via its own Electronic Sales Platform (ESP), in St Petersburg. When the first wave of the COVID-19 pandemic caused European gas demand and prices to fall in 2020, Gazprom ceased selling prompt volumes on its ESP. After selling only limited forward volumes in the first three quarters of 2021, Gazprom ceased its ESP sales entirely on 13 October.12

In the context of the Russian invasion of Ukraine, sanctions, and the threat of an antimonopoly investigation by the European Commission, Gazprom abruptly announced its withdrawal from participation in its European trading subsidiaries from 1 April 2022. Gazprom Germania, the umbrella

10 Calculation by the author, based on Gazprom’s reported shareholdings in subsidiaries, and data for storage capacity held by companies reported at: Gas Infrastructure Europe. (2022). Aggregated Gas Storage Inventory (AGSI+). https://agsi.gie.eu/#/
11 Gazprom had 100 per cent of the capacity at Haidach (Austria) held its subsidiaries, Astora and GSA; 100 per cent of the capacity held by Astora at Rehden, Jemgum, and Katharina (Germany) and 30 per cent of the capacity at Etzel (Germany) held by EKB. Gazprom also leased 90 per cent of the capacity at Dambo (Netherlands). Gazprom did not have a shareholding in the Bergermeel facility but was granted 19.6 TWh of storage capacity in exchange for providing the cushion gas for the facility

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under which Gazprom’s trading and gas storage subsidiaries sat, was temporarily taken over by the German gas regulator, BNetzA.13

Therefore, Gazprom is flowing less gas to Europe because it is not selling spot volumes to European counterparties via the ESP, but also because it no longer provides gas to Gazprom Germania, Gazprom Marketing & Trading, or any other companies that used to be Gazprom subsidiaries.

3. The demand for payment in roubles and related contract terminations (March to May 2022)

On 31 March 2022, a Russian Presidential Decree stated that Gazprom’s counterparties must henceforth pay for their supplies in Russian roubles, rather than in US dollars or euros.14 15 Several companies refused, and had their physical supplies cut off. These cut-offs included PGNiG (Poland) and Bulgargaz (Bulgaria) on 27 April, Gasum (Finland) on 21 May, GasTerra (Netherlands) on 31 May, and Ørsted (Denmark) and Shell Energy Europe (Germany) on 1 June.16 On 30 July, Gazprom halted supplies to Latvijas Gāze (Latvia), ‘due to a violation of the conditions established for gas withdrawal’.17

Here it is worth noting that Gazprom’s contracts with PGNiG, Bulgargaz, and GasTerra were due to expire before the end of 2022 in any case. While the contracts in question are technically suspended, rather than legally terminated, given that none of Gazprom’s European counterparties are likely to backtrack and begin paying in roubles, the practical effect is the early termination of those contracts. Furthermore, those European companies are likely to consider the demand to switch currencies – and the suspension of supplies in the case of refusal – to be a breach of contract. In a press release published on 30 May (when the company had been informed that its supplies would be cut the following day), Ørsted made it clear that they did indeed consider the move to be a breach of contract.18 Looking ahead, the status of the contracts is unclear, but it is likely that the companies concerned are preparing legal action.

Regarding the impact of the suspension of supplies under those seven contracts, the PGNiG contract with Gazprom was for 10 Bcm/a,19 while the Bulgargaz contract was for 2.9 Bcm/a.20 The Gasum contract volume is not known, but Gazprom supplied roughly 1.5 Bcm to Gasum in 2021.21

17 Gazprom Twitter, 30 July 2022. https://twitter.com/GazpromEN/status/1553293368490426368?s=20&t=3CJECpkp3nLYJDdIcDuA
GasTerra contract was estimated at 6 Bcm/a. The Ørsted contract was estimated at 1.86 Bcm/a per year. The Shell Energy Europe contract for supply to Germany was estimated at 1.2 Bcm/a. Between 2017 and 2021, Latvia’s annual imports from Russia were in the range of 1.3-1.8 Bcm/a.

As a rough estimate, if these contracts were fulfilled on a flat daily profile, the volume supplied to north-western Europe (Ørsted, GasTerra, and Shell Energy Europe) would have been around 24.8 MMcm/d (9.06 Bcm/a). The termination of those contracts is the likely explanation for the 25 MMcm/d decline in flows via Nord Stream between 1 June and 12 June.

4. Russian sanctions against the Yamal-Europe pipeline (May 2022)

A fourth factor was the imposition of sanctions by the Russian government on EuRoPol Gaz, the owner-operator of the Yamal-Europe pipeline on Polish territory, on 11 May. Although the Yamal-Europe pipeline had not operated at full capacity since 30 September 2021, and only sporadically since then, the sanctions meant that this route could not be used to deliver gas to north-western Europe once the flows via Nord Stream declined.

5. Capacity for gas transit via Ukraine effectively reduced (May 2022)

A fifth factor concerned gas transit via Ukraine. Gazprom currently holds a transit contract for 109.6 MMcm/d across the territory of Ukraine. Gas entered Ukraine from Russia at two interconnection points (Sudzha and Sokhranivka) and exited at multiple points on Ukraine’s western border; Drozdovichi to Poland, Uzhhorod/Velké Kapušany to Slovakia, Bereg to Hungary, Isaccea to Romania, and smaller connections to Moldova. The cut-off of PGNiG means that Drozdovichi is no longer used, while the Turkish Stream pipeline means that Bereg and Isaccea are now little-used, and Moldova only imports relatively small volumes. Therefore, the main flow of Russian gas via Ukraine entered at Sudzha and Sokhranivka, and mostly exited to Slovakia at Uzhhorod/Velké Kapušany.

Of the 109.6 MMcm/d capacity for transit via Ukraine held by Gazprom, roughly 32.6 MMcm/d was allocated to Sokhranivka and 77 MMcm/d was allocated to Sudzha. On 10 May, the Ukrainian gas transmission system operator, GTSOU, issued a press release announcing force majeure in relation to part of the flow of Russian gas into Ukraine. Specifically, it concerned the Sokhranivka gas metering station (GMS) on the Russia-Ukraine border, and the Novopskov compressor station (the first on the pipeline system inside Ukraine after Sokhranivka). GTSOU announced that – in the context of the Russian military occupation of the area and reports of unauthorised local offtake from transit flows – it had lost control of the Sokhranivka GMS and Novopskov compressor station, and would therefore cease the offtake of gas at Sokhranivka from 11 May. Gazprom responded on 12 May with a

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25 Data from ENTSOG Transparency Platform


statement via Telegram that the company ‘has not received any confirmation of the circumstances of force majeure, [and] does not see any obstacles for continuing work in the previous mode’.

GTSOU also noted that while 77 MMcm/d of capacity was allocated to Sudzha, the actual physical capacity of that cross-border interconnection was much greater, at around 244 MMcm/d. As recently as December 2020, daily flows via Sudzha peaked at 160 MMcm/d. This suggests that the entirety of Gazprom’s pre-booked 109.6 MMcm/d could be delivered via Sudzha. However, as discussed later in this Insight, the flow of gas at Sudzha did not rise to compensate for the loss of Sokhranivka, but rather fell during May, and has yet to recover despite the Nord Stream capacity constraints.

Indeed, Gazprom has used the opportunity to reduce its capacity booking via Ukraine, from 109.6 MMcm/d to around 77 MMcm/d, by effectively removing Sokhranivka from the transit agreement. Ukrainian state-owned Naftogaz (which holds the transit contract with Gazprom, and then books the capacity with GTSOU) offered to reallocate the Sokhranivka capacity to Sudzha free of charge, and requested that Gazprom increase its capacity bookings at Sudzha. Gazprom declined, and proportionally reduced its transit payments. Naftogaz then launched pre-arbitration, claiming that Gazprom is in breach of the ‘ship-or-pay’ clause in their transit contract.

6. The reduction of Nord Stream capacity (June and July 2022)

The Nord Stream pipeline last flowed at full capacity (165 MMcm/d) on 1 June. In the first 12 days of June, the flows fell, as the impact of the contract terminations related to payment in roubles took hold. Nord Stream flows reached 140 MMcm/d on 12 June. Between 12 and 16 June, flows on Nord Stream fell substantially, reaching a new low of 67 MMcm/d. Gazprom attributed the decline in flows to a decline in capacity at the Portovaya compressor station (which feeds gas into Nord Stream). According to S&P Global, the Portovaya compressor station consists of six large (52 MW) and two smaller (27 MW) turbines, and Nord Stream needs five turbines to flow at full capacity, plus one in reserve.

On 14 June, Gazprom announced that only three of the eight turbines at Portovaya were operational, thus implying that five were offline, and stating that consequently, Nord Stream’s capacity had been reduced to 100 MMcm/d. The following day, Gazprom announced that another turbine would be taken offline, thus leaving only two operational and, as a consequence, Nord Stream’s capacity would be reduced to 67 MMcm/d.

On 27 July, Reuters quoted Gazprom’s Deputy Chief Executive, Vitaly Markelov, when he spoke to Rossiya 24 TV: ‘We had counted on receiving one repaired engine from Siemens (Energy) as far back as May, but as of today we haven’t got this engine’. The implication is that the first turbine should have been serviced and returned in May, and that at least one of the turbines taken offline on 14-15 June should have already been shipped to Canada for servicing in the first half of June, if not for the sanctions-related delays.

In its two statements, Gazprom attributed the decline in flows via Nord Stream to three factors: 1) one of the turbines being taken away to Canada and not returned to Russia due to Canadian sanctions against Russia; 2) the expiration of permitted time between services for turbines; 3) and malfunctions.

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detected in the turbines.\textsuperscript{35, 36} Taken together, it appears that by 27 July, one turbine was operational, with another in reserve, and one was in Germany, waiting to be sent back to Russia, having been serviced in Canada. If these were three of the six large (52 MW) turbines, that leaves three more large turbines plus two smaller (27 MW) turbines that are also offline. This was confirmed by Gazprom in a statement on its Telegram channel on 4 August.\textsuperscript{37}

According to S&P Global, the six larger turbines are numbered 071, 072, 073, 074, 075, and 076, while the smaller turbines are numbered 120 and 121. Turbine 073 is waiting in Germany, while turbines 072, 074, and 121 were taken offline for scheduled maintenance.\textsuperscript{38} This implies that of the three remaining larger turbines (071, 075, and 076), one is operational and one is in reserve, leaving one unaccounted for. Likewise, one of the two smaller turbines (121) was taken offline for servicing and one is unaccounted for (120). It is possible that these two unaccounted for are waiting for on-site servicing, or are damaged outside the regular service schedule and potentially require longer repair times.

Here it is worth noting the distinction between servicing turbines on-site, and taking them away to specialist service centres for a major overhaul. In June 2020, Siemens confirmed that it would be responsible for servicing nine 52 MW turbines and three 27 MW turbines from Portovaya over the following three years.\textsuperscript{39} It is likely that this refers to the practice of taking the turbines away to the Siemens centres for overhaul: the larger turbines in Montréal (Canada) and the smaller turbines in Aberdeen (UK).\textsuperscript{40}

This schedule suggests that of the six larger turbines, three would be serviced once and three would be serviced twice during the three-year contract, while one of the smaller turbines would be serviced twice and one of the smaller turbines would be serviced once during the three-year contract. This implies that each turbine would be overhauled every two years and that, in a given year, only half the turbines from Portovaya would be taken offline. In between these overhauls every two years, it is likely that the turbines would be serviced on-site every year, when Nord Stream is taken offline for maintenance in July. Under normal circumstances, this would mean that, at a minimum, three large turbines and one small turbine should be operational at Portovaya at present. Clearly, that is not the case. Part of the reason for this could be damage to at least one turbine, outside of its regular service schedule.

On 19 July, the Russian President, Vladimir Putin, stated that ‘One more turbine is actually out of order because of some crumbling of its internal liner’.\textsuperscript{41} However, on 27 July, Reuters quoted Siemens as stating that ‘it has not received any damage reports for Nord Stream 1 gas pipeline turbines from


\textsuperscript{37} Gazprom (2022). The current anti-Russian sanctions prevent the successful resolution of the situation with the transportation and repair of Siemens gas turbine engines for the Portovaya compressor station, which supplies gas to European consumers via the Nord Stream gas pipeline. Gazprom Telegram, 4 August. https://t.me/s/gazprom


\textsuperscript{40} MESIT. Compression Station Portovaya Gazprom. https://www.mesit.com/en/projects/2/compression-station-portovayagazprom.html


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Russia’s Gazprom and does not have access to turbines on site’. The latter point about Siemens not having access to the site could be crucial in terms of when the remaining turbines might be serviced.

Two days later, Reuters again quoted Gazprom’s Deputy Chief Executive, Vitaly Markelov, who stated that Siemens had not fixed all the technical problems with the turbine in question, that Gazprom did not give its consent for the turbine to be sent to Germany, rather than directly to Canada, and that with regard to the remaining turbines that require maintenance, ‘There is no clarity that the maintenance of the gas turbine engines will not fall under the sanctions’.

According to Reuters:

‘Siemens Energy declined to respond to Markelov’s comments. The company referred to a previous statement made on Wednesday in which it said it had no access to the turbines on site and had not received any damage reports from Gazprom and so had to assume the turbines were operating normally’.

In short, the situation remains unclear at the time of writing. With regard to the turbine that has already been serviced in Canada, Gazprom and Siemens appear to be blaming each other for the delay in getting the turbine shipped back to Russia and re-installed. Furthermore, it is not known how long it will take to service the remaining turbines and bring Nord Stream back to full capacity. Given Gazprom’s statement on 4 August, it seems that an impasse has been reached, and that there will be significant further delays in returning and reinstalling turbine 073, and in providing both off-site overhauls and on-site maintenance services for the remaining turbines. Therefore, the risk of the remaining turbine being taken offline for maintenance before any other turbines have been overhauled or serviced and reinstalled is considerable. Such an outcome would cause the physical flow of gas via Nord Stream to drop to zero.

In terms of those physical flows, Nord Stream operated at its reduced capacity of 67 MMcm/d from 16 June until the pipeline was closed for scheduled annual maintenance for the period 11–21 July. When Nord Stream resumed operation on 21 July, it was at 65-66 MMcm/d, slightly below the pre-maintenance level of 67 MMcm/d. Finally, as noted in the introduction to this Insight, on 25 July, Gazprom announced that another gas turbine would be taken offline and that capacity via Nord Stream would fall to 33 MMcm/d from 27 July. On 27 July, the physical flow via Nord Stream dropped to 35 MMcm/d, and subsequently decreased to 32 MMcm/d on 28 July and then decreased further to 30 MMcm/d on 31 July.

The combined impact of these six factors

Taken together, the decline and cessation of Gazprom gas flows for downstream storage replenishment, spot sales, supplies to former subsidiaries, and supplies to holders of long-term contracts that refused to pay in roubles meant that spare capacity opened up on Gazprom’s pipeline export system. However, this spare capacity was then reduced by the closure of the Yamal-Europe pipeline and the Sokhranivka Russia-Ukraine cross-border interconnection in May 2022.

With the Yamal-Europe pipeline closed and transit via Ukraine reduced, the suspension of Nord Stream for maintenance during 11-21 July brought Russian gas flows to north-western and central Europe down just 30 MMcm/d – a record low, equivalent to just under 11 billion cubic metres per year (Bcm/a).

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44 Gazprom Twitter, 25 July 2022. https://twitter.com/GazpromEN/status/1515152192484106246?s=20&l=MdLgQys6RFSXYzlnVRdbCQ
Russia’s only other operational pipeline route to Europe in mid-July was the Turkish Stream pipeline onward connections for the supply of Russian gas to Greece, North Macedonia, Serbia, and Hungary. Minor Russian pipelines gas flows to Latvia (the only country in north-eastern Europe that was still importing Russian gas in mid-July) of around 7-8 MMcm/d lasted from 21 July to 30 July.\(^\text{47}\) The restart of Nord Stream, and its subsequent decline to flows of 30-32 MMcm/d, meant that flows via Nord Stream in late July were lower than via Ukraine (around 37 MMcm/d since 1 June) and also lower than flows via Turkish Stream at the Turkey-Bulgaria border (42-43 MMcm/d since 12 July). With flows to Latvia of around 7-8 MMcm/d, this suggests that, from 27 July, total Russian pipeline gas flows to Europe (excluding Turkey) were around 117-118 MMcm/d. Of this volume, Nord Stream accounted for 26 per cent.\(^\text{48}\) With the flow to Latvia halted, the total volume delivered by pipeline from Russia to Europe on 31 July was 109 MMcm, of which 30 MMcm was delivered via Nord Stream, 37 MMcm via Velké Kapušany on the Ukraine-Slovakia border, and 42 MMcm via Turkish Stream on the Turkey-Bulgaria border.\(^\text{49}\) A key conclusion to be drawn at this point is that the decline in flows via Nord Stream cannot be seen in isolation. It is part of a broader decline in the physical flow of Russian pipeline gas to north-western and central Europe. With the Yamal-Europe pipeline closed and transit via Ukraine seemingly capped at 77 MMcm/d, the operation of Nord Stream at a reduced capacity of 33 MMcm/d means that the flow of Russian gas to north-western and central Europe is effectively capped at 110 MMcm/d. This is far below the 255 MMcm/d that was delivered via Nord Stream, via Yamal-Europe (at Mallnow), and via Ukraine (at Uzhhorod/Velké Kapušany, net of reverse flows at Budince) in Q4-2021.\(^\text{50}\) If the Nord Stream capacity is not raised before the end of summer, this paints a concerning picture for Russian gas supply to north-western and central Europe in the coming winter, as it foreshadows a significant year-on-year decline in Q4-2022.

Figure 1 shows the decline in total Russian pipeline gas flows to Europe (via all routes, including supplies to Finland and the Baltic region, but excluding flows to Turkey). This graph clearly shows the relative decline in total Russian flows to Europe in Q4-2021, compared to Q4-2020, and the substantial year-on-year decline in 2022. Figure 2 then shows the net flow of Russian gas to central and north-western Europe via three delivery points: Greifswald (Nord Stream), Mallnow (net flows from Poland to Germany along the Yamal-Europe pipeline), and the flow from Ukraine into Slovakia at Velké Kapušany (net of flows from Slovakia to Ukraine at the adjacent Budince interconnection point). This graph clearly shows the relative decline in Q4-2021 compared to the 2017-2020 range, and the continuation of that relative decline in 2022.

\(^{47}\) Data from ENTSOG Transparency Platform

\(^{48}\) Data from ENTSOG Transparency Platform and Conexus (Latvian TSO)

\(^{49}\) Data from ENTSOG Transparency Platform and Conexus (Latvian TSO)

\(^{50}\) The combined net flows at these three points in Q4-2021 totalled 23,456 MMcm over the course of 92 days, which equates to an average of 255 MMcm/d.
Where does Nord Stream gas flow? Why does it matter?

The Nord Stream pipeline makes landfall at Greifswald, on Germany's northern coast. From there, it connects to two pipelines: NEL and OPAL. The NEL pipeline runs west across northern Germany. The OPAL pipeline runs south to Brandov, on the German-Czech border. The EUGAL pipeline was constructed in parallel to OPAL, and was designed to receive gas from Nord Stream 2. These pipelines are illustrated on the map in Figure 3.
In the absence of Nord Stream 2, EUGAL has been linked to NEL at Greifswald. As a result, gas flowing into NEL can also flow south along EUGAL, instead of west along NEL. This use of EUGAL previously allowed Nord Stream to continue flowing at full capacity, despite the regulatory cap on Gazprom’s use of the OPAL pipeline exit capacity at Brandov. From Brandov, the gas either flows back into southern Germany at Waidhaus, effectively using the Gazelle pipeline across the western part of Czechia as a transit route, or it flows south-east across Czechia, to Lanžhot on the Czech-Slovak border.

From Lanžhot, the gas may either be supplied to the Slovak market, flowed east to the Ukrainian border for physical supply to Ukraine at the Budince cross-border interconnection, or flowed west to Baumgarten on the Slovakia-Austria border. At Baumgarten, flows mix with those arriving from Ukraine via Uzhhorod/Velké Kapušany on the Ukraine-Slovakia border. Therefore, the Russian gas flowing into Austria at Baumgarten (for either supply to the Austrian market or onward flow to Italy) could be sourced either from transit via Ukraine or from flow via Nord Stream and onward transit via Germany and Czechia. Finally, gas delivered onward from Austria to Italy crosses the border at Tarvisio.

These flows matter, because prior to the decline in Russian gas flows to Europe, there was a general division in Russian gas flows by route: Nord Stream and the Yamal-Europe pipeline served Poland, Czechia, Germany, and the rest of north-western Europe, while transit via Ukraine served Slovakia, Austria, and Italy.

Figure 3: Three key pipeline routes from Russia to north-western and central Europe - Nord Stream, Yamal-Europe, and Ukraine

Source: Screenshot from ENTSOG Transparency Platform, annotated by the author
As noted earlier, the fact that Gazprom no longer flows gas to replenish downstream storage, sell as spot volumes, supply to trading subsidiaries, or supply to those holders of long-term contracts that refused to pay in roubles, means that Gazprom now has substantial spare capacity on the pipeline export routes that previously served north-western Europe.

A consequence of this is that Gazprom has been flowing gas to Slovakia, Austria, and Italy via Nord Stream, and at the same time, less in net terms to north-western Europe. As a result, the recent decline in flows via Nord Stream led to a decline in physical flows to Gazprom’s counterparties in Slovakia (SPP), Austria (OMV), and Italy (Eni), even though those companies had agreed to pay for their long-term contract supplies in roubles. Furthermore, Gazprom has not raised the volume of supply via Ukraine along the main pipeline route between Sudzha and Uzhhorod/Velké Kapušany, despite having spare capacity on that route (for which it has already booked and paid), and despite the fact that Gazprom traditionally supplied Slovakia, Austria, and Italy via that route.

The title of this Insight refers to the fact that the flow of gas from Nord Stream can be traced from Germany to Italy via Czechia, Slovakia, and Austria, and that as the Nord Stream flow to Germany declined in June and July, so too did the supply to the other countries, like a line dominoes falling one after the other. The domino analogy also applies to the flows on multiple Russian export routes also declining one after the other: First Yamal-Europe, then Ukraine, the Baltics, and finally Nord Stream. The year-on-year decline in flows is seen in the graph below, which shows net Russian gas flows to five key markets via the routes discussed above during the period January-July in 2022 and the previous five years. The decline in net flows to Germany (for either consumption in Germany or delivery onward to other markets in north-western Europe) in 2022 is clear: from 38 Bcm in January-July 2021 to 15 Bcm in January-July 2022. These lower flows to Germany have opened up pipeline capacity for the delivery of Russian gas to Czechia, Slovakia, Austria, and Italy via Nord Stream. The decline in monthly and daily flows to these markets are discussed in more detail later in this Insight.

Figure 4: Net Russian gas flows to five key markets in central and north-western Europe in the period January-July (Bcm)

The decline in Russian gas flows on different routes

The total flow of Russian gas to north-western and central Europe via Nord Stream, the Yamal-Europe pipeline (measured at Mallnow on the Poland-Germany border, net of physical reverse flows from Germany to Poland), and via Ukraine (measured at Uzhhorod / Velké Kapušany, net of physical reverse flows from Slovakia to Ukraine at Budince) has followed a steady decline since mid-2021. In May 2021,
the total net flow on these three routes was just over 10 Bcm per month. In May 2022, it was 6.4 Bcm, and in June 2022 it fell to 3.95 Bcm. In H1-2021, the supply of Russian gas via these routes amounted to 57 Bcm, while in H1-2022 the figure was 35 Bcm – a 63 per cent year-on-year decline. In July 2022, the net flow on these routes fell to a record low of 2.1 Bcm, at an average of 67.5 MMcm/d. This was just 25 per cent of the net flow on the same routes in July 2021.

Until the beginning of June 2022, the Nord Stream pipeline continued to operate at its full capacity of 165 MMcm/d, outside its scheduled annual 10-day maintenance period. In that regard, Nord Stream is the last of several Russian export routes to Europe to experience a decline in flows.

**Figure 5: Net Russian gas flows via Nord Stream, Yamal-Europe (Mallnow), and Uzhhorod/Budince (MMcm per month)**

![Graph showing net gas flows](image)

Data source: ENTSOG Transparency Platform

The Yamal-Europe pipeline traditionally delivered gas to Poland and on to Germany. Flows measured at Kondratki on the Belarus-Poland border were close to full capacity (97 MMcm/d) until the beginning of August 2021, when they were affected by a fire at Gazprom’s gas condensate processing plant at Urengoy.\(^{51}\) Although they briefly recovered to full capacity at the end of September 2021, flows then fell to around 40 MMcm/d in Q4 2021, and to zero by 1 January 2022.\(^{52}\) Despite a brief (and volumetrically-limited) resurgence in late February and early March, flows again fell to zero on 11 May.

The east-to-west flows on the Yamal-Europe pipeline at Mallnow (on the Poland-Germany border) also peaked for the final time at around 80 MMcm/d at the end of September 2021. By November-December 2021, the flows had dropped to 20-25 MMcm/d. Since 21 December 2021, flows at Mallnow have generally been in physical reverse, from Germany to Poland, with the exception of the period 1-14 March 2022. In July 2022, that physical reverse flow amounted to 207 MMcm, or 6.7 MMcm/d.

Gazprom’s long-term contract for transit via Ukraine, valid until 31 December 2024, provides Gazprom with 109.6 MMcm/d of transit capacity, which equates to 40 Bcm/a. In addition to this ‘baseload’,

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GTSOU also offered additional transit capacity at auction, and provides gas transportation services for companies holding gas in Ukrainian storage that wish to re-export it to Ukraine’s western neighbours. As recently as March 2022, the flow of gas into Ukraine from Russia averaged 106 MMcm/d. As noted earlier, Russian gas flows into Ukraine at Sokhranivka fell to zero on 11 May, leaving only flows via Sudzha.\(^\text{53}\) Since then, flows at Sudzha have not risen to compensate. In fact, the opposite has happened, as flows at Sudzha have dropped by around 30 MMcm/d, and in June and July have been stable at around 40 MMcm/d, as illustrated in the graph below.

**Figure 6: Daily gas flows from Russia to Ukraine by route (MMcm/d)**

![Graph showing daily gas flows from Russia to Ukraine by route (MMcm/d)](image)

Data source: ENTSOG Transparency Platform

Finally, and to recap the Nord Stream flows noted earlier, the initial decline in flows via Nord Stream occurred during the first 12 days of June, when flows fell from 165 MMcm/d (full capacity) to 140 MMcm/d (9-12 June). As the impact of the reduction in compression capacity at the Portovaya compressor station took hold, flows on Nord Stream then fell to 67 MMcm/d by 16 June. That level was maintained until 11 July, when flows halted entirely as Nord Stream entered its annual maintenance period, which lasted until 21 July. Post-maintenance flows resumed at 65-66 MMcm/d, before falling to 35 MMcm/d on 27 July and 30 MMcm/d on 31 July.

The key point here is that despite the decline in flows via Nord Stream, flows via other routes did not increase. The Yamal-Europe pipeline is effectively closed to Gazprom, due to Russian government sanctions against EuRoPol Gaz, and transit to Poland via Belarus and Ukraine is permanently halted by Gazprom’s cessation of supplies to PGNiG. Flows via Turkish Stream are limited not by the capacity of the onward pipelines, but by the size of the markets they serve, given the relative lack of onward interconnections in central Europe. Finally, transit via Ukraine is capped by the stoppage at Sokhranivka, while Gazprom has not offset that loss by increasing flows at Sudzha.

Figure 7: Net Russian gas flows via Nord Stream, Yamal-Europe (Mallnow), and Uzhhorod/Budince (MMcm per day)

Data source: ENTSOG Transparency Platform

**Which markets are being impacted?**

With regard to the decline in flows via Nord Stream, five markets are particularly impacted. The net flows of Russian gas to each of these five countries are calculated as follows:

**Germany:** Entry flows from Nord Stream and the Yamal-Europe pipeline at Mallnow, minus exit flows at Mallow (back to Poland) and exit flows to Czechia (net of flows that re-enter Germany at Waidhaus).

**Czechia:** Entry flows from Germany (net of flows re-exported to Germany at Waidhaus) minus net exit flows to Slovakia at Lanžhot.

**Slovakia:** Net entry flows from Ukraine (Uzhhorod/Velké Kapušany minus exit flows to Ukraine at Budince) plus net entry flows from Czechia at Lanžhot, minus net exit flows to Austria at Baumgarten.

**Austria:** Net entry flows from Slovakia at Baumgarten minus net exit flows to Italy at Tarvisio.

**Italy:** Net entry flows from Austria at Tarvisio.

The impact on these markets is illustrated in the two graphs below: the larger markets of Germany and Italy in Figure 8 and the three smaller markets of Czechia, Slovakia, and Austria in Figure 9.

As can be seen in both figures, in terms of monthly net imports of Russian gas it is Germany and Italy that have seen the most significant decreases since the start of 2022. Conversely, Czechia, Slovakia, and Austria all saw increases in their net imports of Russian gas in the months leading up to May 2022, before the month-on-month declines in June and July. In July 2022, the monthly net imports of Russian

54 Here it should be noted that this analysis refers only to the net flow of Russian gas to each of these five countries. It does not imply that Russian gas is actually consumed in those countries. For example, Germany also trades gas across the border with The Netherlands, Belgium, France, Switzerland, and Austria. Slovakia and Austria have cross-border connections with Hungary, and both Austria and Italy have cross-border connections with Slovenia. Rather, the aim of this analysis is to illustrate how much Russian gas arrives in each of these markets, net of the volumes delivered onwards to other markets from this five-country list.
gas into Germany had become a net export of 335 MMcm, while net imports into Italy and Austria had fallen by half year-on-year, and net imports into Slovakia and Czechia were stable year-on-year.

**Figure 8: Net imports of Russian gas via Nord Stream, Yamal-Europe, and Ukraine (MMcm per month)**

![Graph showing net imports of Russian gas](image)

Data source: ENTSOG Transparency Platform

**Figure 9: Net imports of Russian gas via Nord Stream, Yamal-Europe, and Ukraine (MMcm per month)**

![Graph showing net imports of Russian gas](image)

Data source: ENTSOG Transparency Platform

By looking at the daily data from the beginning of May (taking into account the contract terminations at the end of May), the decline in net imports from Russia becomes more apparent. For Germany, the reduction in Nord Stream flows in mid-June caused net imports to fall below 20 MMcm/d. This is due to the continued flows out of Germany to Poland and Czechia. The suspension of Nord Stream for maintenance on 11 July tipped the German net imports of Russian gas into net negative. The reduction in Nord Stream flows from 27 July once again tipped German imports of Russian pipeline gas into net negative: the volume being re-exported to Poland and Czechia is currently greater than the volume...
arriving via Nord Stream. For example, on 31 July, Germany received 30 MMcm from Nord Stream, but re-exported 10 MMcm to Poland and 32 MMcm to Czechia, leaving net negative imports of 12 MMcm.

If flows via Nord Stream remain constrained at the current level, or even halt entirely, in winter 2022/2023, the notion of ‘solidarity’ expressed in EU plans to manage winter gas flows could be tested. On the one hand, it may be difficult for Germany to continue re-exporting gas to Poland and Czechia. On the other hand, Germany will rely on ‘solidarity’ from neighbours if Nord Stream halts entirely. There are currently plans for three Floating Storage and Regasification Units (FSRUs) to be launched in Germany by either the end of 2022 or beginning of 2023, with another two FSRUs to be launched by the end of 2023. However, the three FSRUs that could become operational in midwinter 2022/2023 may only have a combined capacity equivalent to the 30 MMcm/d that Germany is currently receiving via Nord Stream. Therefore, if Russian flows were curtailed, Germany would rely on the solidarity of importing LNG via the Netherlands, while also providing solidarity by continuing re-exports.

For Italy, the reduction in Nord Stream flows in mid-June and subsequent halt on 11 July brought net imports back to the level of around 20 MMcm/d seen between late May and late June. The initial restart of Nord Stream saw Italian gas imports at Tarvisio rise to 50 MMcm/d on 27-28 July, before a sharp drop to 26 MMcm/d on 30 July and 20 MMcm/d on 31 July, as the ‘domino effect’ of the reduction in Nord Stream supplies took effect. These daily net imports of Russian gas for Germany and Italy are illustrated in Figure 10. Taken together, the net imports for Germany Italy combined fell from 164 MMcm/d on 5 May to 8 MMcm/d on 31 July, as illustrated below.

**Figure 10: Net imports of Russian gas by Germany and Italy via Nord Stream, Yamal-Europe, and Ukraine (MMcm/d)**

![Figure 10](image)

Data source: ENTSOG Transparency Platform

Figure 11 shows the daily net imports of Russian gas by Czechia, Slovakia, and Austria. Net imports of Russian gas into Czechia fell from 40 MMcm/d on 5 May to 18 MMcm/d on 31 July, while for Slovakia the decline in the same period was from 13 MMcm/d to 9 MMcm/d. Net flows into Austria at Baumgarten remained volatile, with a decline from 37 MMcm/d to 22 MMcm/d. The combined net imports into these three markets therefore fell by 45 per cent, from 90 MMcm/d on 5 May to 49 MMcm/d on 31 July.

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Finally, by aggregating the daily net imports into these five countries (Figure 12), the initial decline from 250 MMcm/d in the first week of May to 170 MMcm/d on 12 June is clearly visible, followed by a further decline to around 90-100 MMcm/d from 16 June to 10 July. This was followed by the slump to just 30 MMcm/d during Nord Stream maintenance, a brief recovery to pre-maintenance levels, and the final decline to 56 MMcm/d since the reduction in Nord Stream flows in the final four days of July.
What does this mean for central and north-western Europe?

With the Yamal-Europe pipeline under Russian government sanctions, the only flows of Russian pipeline gas into north-western and central Europe are via a constrained Nord Stream and via Ukraine at Uzhhorod/Velké Kapušany, while gas continues to flow from Germany to Poland at Mallnow.

The total net flow of 30 MMcm/d of Russian gas in the period 11-21 July was lower than the combined daily net imports for the five countries by roughly 35 MMcm/d. Therefore, while Nord Stream was closed for maintenance and the Yamal-Europe pipeline was only being used to deliver gas from Germany to Poland, pipeline imports from Norway and LNG imported via the Netherlands were effectively being transited via Germany to Czechia, Slovakia, Austria, and Italy, along routes that were previously used to transport Russian molecules.

When Nord Stream was once again operational at 65-66 MMcm/d, the net supply of Russian gas to Germany, Austria, Slovakia, and Italy was 90-93 MMcm/d between 21 and 26 July – less than half the net volume delivered to these markets in the first two weeks of May.

Finally, with Nord Stream flows reduced to 30-32 MMcm/d and flows from Ukraine to Slovakia stable at around 36 MMcm/d since 20 July, the total flow of Russian gas to central and north-western Europe was just 66-68 MMcm/d at the end of July. When the flows from Germany to Poland (at Mallnow) and Slovakia to Ukraine (at Velké Kapušany) are taken into account, the net flow of Russian pipeline gas to central and north-western Europe was just 56 MMcm/d on 31 July – the equivalent of just over 20 Bcm/a. This is just 22 per cent of the net flow of 254 MMcm/d seen on 5 May. In short, the supply of Russian gas to central and north-western Europe fell dramatically between early May and late July.

As a reminder of a point raised earlier in this Insight, this lower flow (with Gazprom’s force majeure declaration in place) is taking place at a time when flows from Russia into Ukraine at Sudzha are around 40 MMcm/d, 37 MMcm/d below the volume that was allocated to Sudzha under the long-term transit contract (a level last seen in early May 2022), and far below the December 2020 peak flows at Sudzha of 160 MMcm/d.56

Political concerns and political responses

The decline in Nord Stream capacity in June and July should be seen in the context of a broader decline in Russian gas flows to Europe since Spring 2021, and the dramatic decline since early May. The decline is due to a combination of Gazprom’s strategy of neither holding storage stocks in Europe nor selling additional spot volumes into the European market, physical pipeline capacity being taken offline, and flows under seven long-term contracts ceasing as a consequence of the war and its related sanctions. Without the Russian invasion of Ukraine, and the related sanctions and counter-sanctions, it is unlikely that we would have seen pipeline capacity being taken offline due to 1) Russian sanctions against the Yamal-Europe pipeline; 2) the suspension of flows at Sokhranivka, and 3) the servicing of turbines at Portovaya being interrupted. It is also unlikely that we would have seen the demand for payment in roubles and the related suspension of supplies to those companies that refused.

The first turbine from Portovaya that was removed to Canada for maintenance has now been returned to Germany and is currently waiting to be shipped back to Russia for re-installation. Furthermore, the Canadian government has issued a time-limited exemption for the remaining turbines to be serviced in Canada. However, the continued public dispute between Gazprom and Siemens, the related delay in even getting the first turbine (which was serviced in Canada) back to Portovaya for reinstallation, let alone arranging the servicing of the remaining turbines, in the broader context of war, sanctions, counter-sanctions, Gazprom’s declaration of force majeure, and the decline in Nord Stream flows on

56 Note that the difference between flows into Ukraine at Sudzha and the exit flows to Slovakia at Velké Kapušany are currently accounted for by deliveries to Moldova via Ukraine.
27 July, means that significant concerns remain in Europe over the likely flows of gas via Nord Stream in the coming months, as Europe seeks to replenish storage stocks before the start of winter.

In this context, both the International Energy Agency (IEA) and the European Commission have already set out plans to prepare for a complete cessation of Russian gas flows to Europe. In the immediate aftermath of Russia’s invasion of Ukraine, on 3 March, the IEA published a 10-Point Plan to reduce EU dependence on Russian gas, 57 while on 8 March, the European Commission published a communication entitled ‘Joint European Action for more affordable, secure and sustainable energy’, which set out plans to reduce dependence on Russian gas imports. 58 More recently, on 18 July, the IEA set out five steps to prepare for a Russian cut-off, stating: ‘Europe is now forced to operate in a constant state of uncertainty over Russian gas supplies, and we can’t rule out a complete cut-off’. 59

Finally, on 26 July, the Council of the European Union 61 agreed a plan to institute voluntary targets of reducing gas demand in every EU member state by 15 per cent during winter 2022/2023, compared to the average of the previous five winters. In an emergency situation, the European Commission may propose activating a ‘Union Alert’. If the Council of the EU approves the proposal and so triggers the ‘Union Alert’, then the coordinated gas demand reduction becomes mandatory. 62

Where are we now?

As this Insight has demonstrated, the consequences of a long-term (partial or complete) cessation of flows via Nord Stream has consequences beyond Germany, where the pipeline makes landfall. Setting aside the flow of gas via Turkish Stream to south-eastern Europe, a long-term continuation of constrained flows via Nord Stream (let alone a complete suspension of those flows) would take northern-western and central Europe back to a situation last seen a quarter of a century ago, when a substantial proportion of its Russian gas imports were delivered via Ukraine. The difference today is that those volumes delivered via Ukraine are much smaller, and are currently being supplied by, and transited via, two countries that are now in a state of war.

The broader implication of this situation is that, in net terms at least, the flow of Russian gas to central and north-western Europe has declined substantially. On 5 May 2022, the net import of Russian gas by Germany, Czechia, Slovakia, Austria, and Italy combined peaked at 254 MMcm/d. By 31 July, that combined flow had fallen to 56 MMcm/d. During the Nord Stream maintenance, these combined net flows were even lower, at 25-30 MMcm/d between 11 and 20 July.

Since mid-June, Germany’s net import of Russian gas has been minimal, and even slipped into a net export of those flows while Nord Stream was offline for maintenance. This situation resumed when the flow of gas via Nord Stream was reduced to 30-32 MMcm/d in late July. The exports of gas from Germany back along the Yamal-Europe pipeline to Poland and the net exports to the Czechia, mean that Germany is now exporting more gas to Poland and Czechia than it is receiving via Nord Stream.


61 An EU-level formal meeting of Energy Ministers from every EU member state

This is important because if the flow via Nord Stream were to drop to zero, flows via Ukraine did not rise to compensate, and if Germany were not able to source additional imports or reduce its demand, that shortfall could be passed on to Czechia, Slovakia, Austria, and Italy. This is exactly the ‘domino effect’ that was seen when Nord Stream went offline for maintenance in mid-July.

Here it is worth recalling the bottlenecks seen in both the Norwegian pipeline system and regional LNG import terminals. With existing infrastructure for non-Russian gas supply to north-western Europe already operating at full capacity, in the context of a long-term decline in regional gas production, there is little supply-side upside potential until new regasification capacity is added in both Germany and the Netherlands. Given those bottlenecks, if Nord Stream flows were to decline to zero, German demand would be severely curtailed this coming winter, with some of the shortfalls being passed on to Germany’s neighbours.

The context is clear: the volume of Russian pipeline gas supplies to Europe has declined substantially over the past year, and especially in the last three months. European wholesale gas prices are at exceptionally high levels, and with only limited potential additional supply available, there are serious concerns over the stability of Russian pipeline gas flows to Europe in the coming winter. Europe now faces a ‘race against time’ in what remains of summer 2022 to accumulate storage stocks and prepare to curb winter demand, in anticipation of significant potential supply constraints.

**Outlook for Russian supplies and European storage stockbuild**

In this situation, two crucial questions remain: firstly, what is the near-term outlook for Russian pipeline gas supply to central and north-western Europe? Secondly, will those markets be able to both replenish storage in what remains of summer 2022, and subsequently ensure that supply meets demand in the coming winter? The analysis presented in this Insight offers tentative conclusions, although the situation remains highly uncertain.

With regard to the Russian pipeline supply outlook, it appears unlikely that Russian pipeline gas flows on any route that has stopped will be restarted. This applies to pipeline exports to Finland and the Baltic states, pipeline exports to Poland via Belarus and Ukraine, exports to Germany via the Yamal-Europe pipeline, and the flow at Sokhranivka on the Russia-Ukraine border. Furthermore, the situation with turbines at the Portovaya compressor station remains far from clear, and it appears reasonable to assume that Nord Stream will continue to operate at reduced capacity for the rest of summer, and potentially beyond. At the same time, the fact that Gazprom declared *force majeure* on supplies to counterparties in Slovakia, Austria, and Italy, while not increasing flows via Ukraine at Sudzha (despite having available pre-booked capacity at that interconnection) suggests that Gazprom will not substantially increase flows via Ukraine.

The most optimistic scenario could see one more turbine come back online at Portovaya, thus bringing Nord Stream flows back to 65-67 MMcm/d, and flows at Sudzha reaching the pre-booked capacity level of 77 MMcm/d. This would add roughly 70 MMcm/d of Russian pipeline supply compared to the flow on 31 July. Conversely, a pessimistic scenario would see flows via both Nord Stream and Ukraine halted entirely – the former could happen if the final turbine is taken offline and is not replaced, the latter could happen if there is any type of damage to transit pipeline infrastructure. Given that GTSOU issued a press release on 26 July, stating that Gazprom had, without warning, raised the pressure on the Urengoy-Pomary-Uzhhorod pipeline at Sudzha on the Russia-Ukraine border, adding that such a move ‘carries potential risks for the normal operation of the Ukrainian GTS’, fears for the security of gas supply via Ukraine cannot be dismissed.63

A ‘middle ground’ scenario would be for flows via Nord Stream and Ukraine to continue at their current level. This would imply Nord Stream flows in August and September at roughly 135 MMcm/d below the

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level of August-September 2021, and flows via Ukraine at Velké Kapušany 30-45 MMcm/d lower year-on-year. This year-on-year decline of 165-180 MMcm/d is in addition to the loss of 55 MMcm/d that was also delivered to north-western Europe via the Yamal-Europe pipeline at Mallnow in August-September 2021. Therefore, even this scenario implies the loss of 220-235 MMcm/d of Russian pipeline supply to central and north-western Europe in August-September 2022, compared to the same period in 2021. Such daily volumes equate to 13.4-14.3 Bcm in August and September combined.

The sheer size of this year-on-year decline leads to the second concluding question, concerning storage replenishment. Gas storage stocks in the EU as a whole on 31 July were 72 Bcm, which is 11 Bcm short of the target set by the EU for 1 November (83 Bcm – 80 per cent of storage capacity). In supply-constrained July, the EU added 11 Bcm of net injections. This needs to be repeated in August, and then net injections in September and October will represent efforts to exceed the target before seasonal demand picks up, not just in Europe, but in north-east Asia, where winter demand will provide competition for LNG cargoes. As it stands, the 80 per cent target remains achievable, but getting close to full stocks of around 100 Bcm (as seen at the start of winter in 2019 and 2020) appears rather unlikely.

Conclusion

To conclude, the outlook suggests that Russian pipeline supply will remain constrained in winter 2022/2023. In a context of limited upside potential from European production and non-Russian pipeline supply, the balance of the European market will rest on the availability of LNG cargoes, the potential for both bottlenecks in some EU member states and new regasification capacity (in the form of FSRUs) in others, and the extent to which a combination of high prices and government policy will curb demand, in parallel with the influence of seasonal weather factors that could support or undermine those conservation efforts.

In short, Europe will spend the next two-to-three months preparing for a winter in which it will undertake the gas market equivalent of performing a tightrope walk between two high buildings: if conditions are benign, the feat is achievable, albeit nerve-wracking. If not, Europe could be buffeted by strong winds that portend winter wholesale gas prices even higher than those seen in winter 2021/2022.