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Do future Russian gas pipeline exports to Europe matter anymore?

Introduction

During 2022, a key concern within the EU and the global gas market was how the market might cope with a complete shut-off of Russian gas pipeline exports to Europe if a ban was implemented on Gazprom sales. For most of the year, it appeared that the market was very stretched and that gas demand rationing in Europe might be needed if Russian gas disappeared completely or if a cold winter caused a spike in demand. In addition, the economic impact of higher gas prices, which peaked at over $90/mmbtu in August 2022[1] and averaged over $40/mmbtu for the year as a whole, also prompted the question as to whether European politicians and companies might be tempted to concede to some of Gazprom's demands (for example on rouble payments) in order to increase imports and lower prices. The politics of the situation suggested that while the Ukraine war continued this would not be an acceptable outcome, but questions were being asked about how long the EU, or individual member states, would be prepared to take the economic pain.

Six months into 2023, a completely different set of questions can now be asked: is Russian gas that important to the EU and wider Europe anymore? Would it matter if volumes went to zero sooner rather than later, either by Russian or EU design? Will Russian gas ever have a significant role in western markets again? The noises coming from Brussels, where politicians and lawmakers have suggested introducing rules to prevent imports of Russian gas from re-starting via pipelines that have been shut down, would indicate that the strategy to reduce Russian imports to zero during this decade remains firmly in place and the aim of this paper is to review what the impact of that increasingly confident assertion might be.[2]

In one sense, imports of Russian gas via pipeline have already become much less significant for the European market. The flow of Russian gas averaged 60mmcm/d in the period from Jan 1 – May 20 2023, amounting to 8.5bcm during this period. This compares with 40bcm in 2022 and 59bcm in 2021 over the same period, implying 79 per cent and 86 per cent declines, respectively. If the current rate continues for the rest of 2023, then total imports to Europe[3] from Russia via pipeline will be approximately 22bcm for 2023, down from 63bcm in 2022 and 142bcm in 2021.

As a result of this decline, imports of Azeri gas are now running at 50 per cent of the level of Russian gas, a marked change from the time when Alexander Medvedev, a previous Head of GazpromExport,

[1] Platts European Gas Daily on 7th July 2023 cites August 2022 high as $319.98/MWh, equivalent to c.$94/mmbtu
[2] FT, 14 May 2023, "G7 and EU to ban restart of Russian pipelines"
[3] In this paper Europe refers to the EU27 plus the UK

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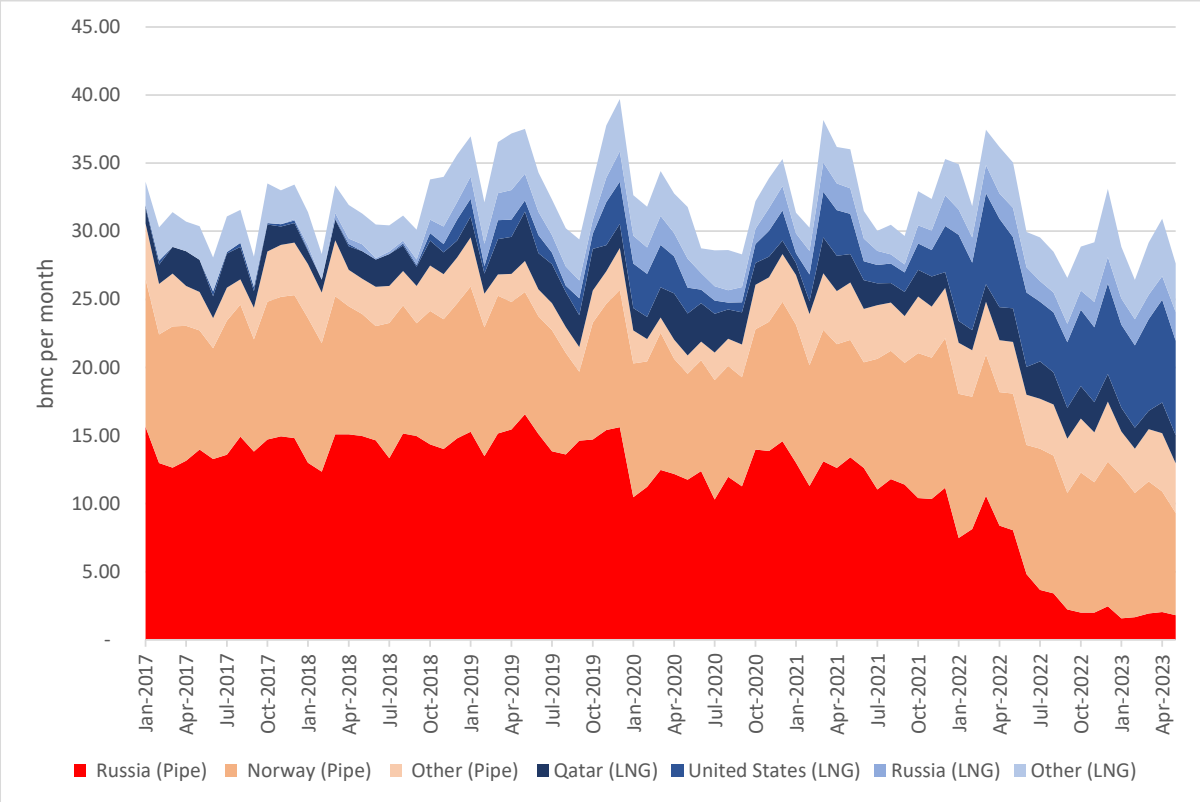
questioned Azerbaijan's ability to fill the TAP pipeline to Europe,[4] claiming that it hardly had enough gas to 'light a barbecue'.[5] Meanwhile imports from North Africa into southern Europe are now at or above Russian flows to Europe in most months, and they are, in turn, dwarfed by imports from Norway which have been as high as 340mmcm/d (equivalent to 124bcma).[6] Perhaps even more importantly, though, the send-out of LNG into the European market has averaged almost 450mmcm/d between Jan 1 – May 20 2023, seven times more than the amount of pipeline gas Europe received from Russia in the same period and higher than the levels seen coming from Russia in the equivalent periods in 2019/20 or 2020/21 when Russia was the largest single gas supplier to Europe.

Figure 1: Gas imports to Europe by source



Source: Kpler, Platts

Having said this, it remains relevant to ask what the impact of varying flows from Russia might be on the European and by implication, global gas markets. Although market conditions currently appear benign, the implications of a further decline - or a rebound - in Russian imports could still be significant. There are several key issues to be addressed in this regard. The first is the question of infrastructure availability, both physical and legal. Section 1 below discusses the main export pipeline routes, their theoretical capacities, their current availability, and the legal and regulatory issues surrounding their use.

The second question is the current status of Gazprom's long-term contracts (LTCs) with European buyers and their relevance to potential future sales. We categorise three levels of LTC relevance in Section 2 and discuss the implications for current and future Russian gas sales to Europe.

The third is the role of Russian LNG and whether its access to the European market could also be restricted.

[4] https://www.reuters.com/article/us-gazprom-eu-tap-idUSKBN15T1LC
[5] https://www.ft.com/content/174b403e-6c87-11e3-ad36-00144feabdc0
[6] OIES Gas Quarterly, April 2023, at https://www.oxfordenergy.org/publications/quarterly-gas-review-issue-21/

The fourth issue concerns the political drivers that could impact future demand patterns for gas in Europe, particularly the Fit for 55 and REPowerEU targets. We also discuss whether a rebound in Russian gas imports could be acceptable or a reduction to zero is more likely.

Against this background, the final section considers the impact of different scenarios for Russian gas flows on European and global gas prices to assess the importance (or lack thereof) of Russian imports to Europe over the rest of the decade. We end with a series of conclusions on the future relevance of Russian gas on the continent and the alternative markets for Gazprom and other Russian gas exporters.

1. Infrastructure capacity

Regarding infrastructure available to transport Russian gas to Europe, the picture has changed dramatically over the past 12-18 months. Potential routes to the EU and then onto the UK include the Nord Stream corridor, Yamal Europe through Belarus and Poland (although this may now have been integrated into the domestic Polish system and therefore no longer available for Russian exports – see discussion below) the Ukraine transit corridor, and the line from Turkey through Bulgaria into Southeast (SE) Europe which can bring gas delivered via the TurkStream pipeline that crosses the Black Sea from Russia to Turkey. In addition, the Blue Stream pipeline provides a direct route from Russia to Northeast (NE) Turkey but is irrelevant regarding the European mainland. Each of these routes and their possible future use will be discussed below.[7]

Nord Stream Corridor

Nord Stream 1, with a capacity of 55bcma via two parallel pipelines, has been operational since 2009 and a mainstay of Russian sales into Northwest (NW) Europe. However, following the start of the Russia-Ukraine war in February 2022, flows started to decline in response to sanctions, European buyer unwillingness to pay for imports in roubles and issues raised by Gazprom over compressor maintenance and a resulting inability to maintain the pipeline's full capacity.[8] As a result, flows had fallen to zero by the beginning of September 2022.[9] Subsequently, an explosion on 26 September blew holes in both strings of the Nord Stream 1 route (and one of the Nord Stream 2 strings), leaving the pipeline unusable for the immediate future.[10] It is unclear how long any repair might take (estimates range from six months to two years), but it seems almost certain that no attempt will be even contemplated until the war ends.

Nord Stream 2, which also runs from Northwest (NW) Russia to Germany, likewise has a capacity of 55bcma through two pipes and runs along a route close to Nord Stream 1 (see map). Both pipelines were completed by September 2021, but the German regulator and government delayed certification of the route while both to consider the energy security and market implications and also because the Nordstream operating company needed to establish a German subsidiary, as required under German law.[11] In February 2022, it halted the approval process altogether after Russia officially recognised two breakaway regions in eastern Ukraine.[12] The outbreak of war further confirmed this decision, while the explosion on 26 September made the use of one of the lines practically, as well as politically, impossible. One line, with a capacity of 27.5bcm, remains theoretically usable, but the German approval process is completely stalled and will not progress until the war in Ukraine is over at the earliest, and even then is extremely unlikely to be resumed.

Overall, although 110bcma of capacity is theoretically available, a realistic assessment is that the pipelines will remain empty for the foreseeable future. Indeed, the EU indicated that this could even be

[7] For a detailed discussion of Russian gas export routes and transit strategy see Yafimava, K. (2011) *The Transit Dimension of EU Energy security: Russian Gas Transit across Ukraine, Belarus and Moldova", Oxford Institute for Energy Studies*

[8] Fulwood, M., Sharples, J., Stern, J. & Yafimava, K., July 2022, "The curious incident of the Nord Stream gas turbine", Oxford Energy Comment

[9] https://www.theguardian.com/business/2022/sep/02/nord-stream-1-gazprom-announces-indefinite-shutdown-of-pipeline

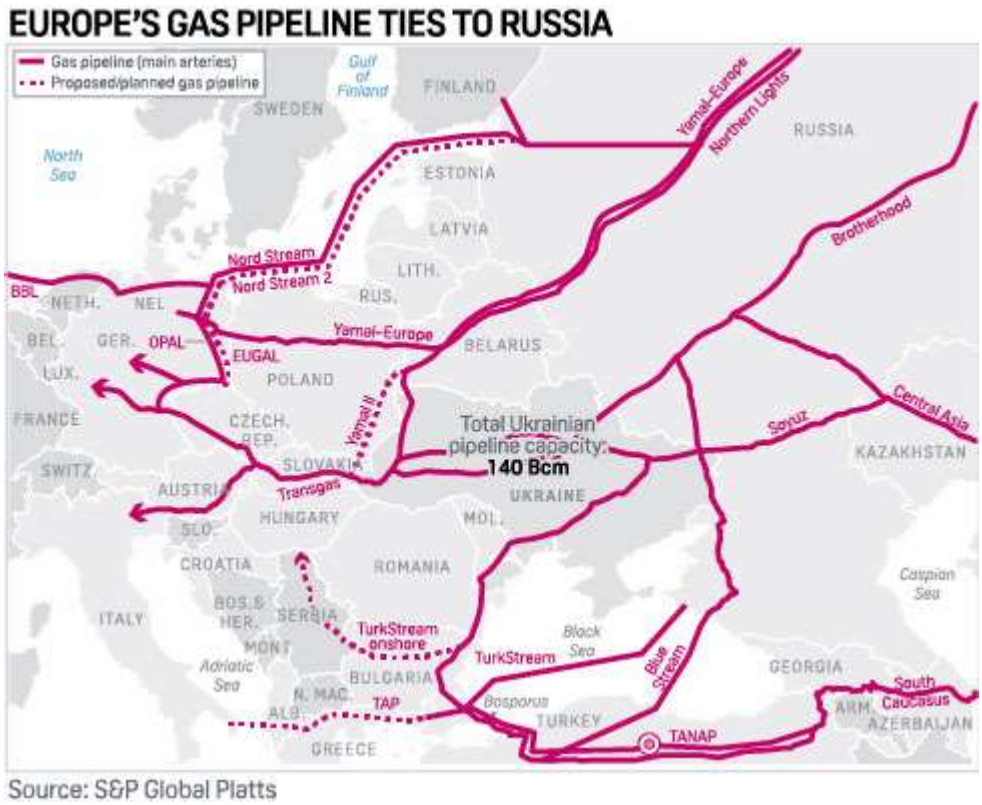
[10] https://www.ft.com/content/e246c590-e0c6-4d07-bf80-f35c22c40d91

[11] Reuters, 16 Nov 2021, "German regulator puts brake on Nord Stream 2 in fresh blow to gas pipeline"

[12] https://www.reuters.com/business/energy/germanys-scholz-halts-nord-stream-2-certification-2022-02-22/

written into law, suggesting that it could ban the future use of export pipelines from Russia that had been emptied since the start of the war in Ukraine.[13] Although this proposal has not been implemented to date, the mere fact that it has clearly been discussed would point to the fact that any recommencement of supply via the Nord Stream corridor would be highly politically sensitive, even in a scenario where the war in Ukraine had been concluded in a politically acceptable manner.

Figure 2: European pipeline routes from Russia



Source: S&P Global

Yamal Europe

The Yamal Europe pipeline runs from NW Russia through Belarus and Poland into northern Germany and has been another mainstay of Russian gas exports since its inception in 1999. It has a capacity of 33bcma, and for much of its life gas has flowed at or close to this figure. However, since 2020, when the long-term transit contract between Russia and Poland expired, it has been used on a much more flexible basis using short-term capacity booking.[14] When the pandemic hit in 2020, reducing gas demand in Europe, Gazprom began to use Yamal Europe as a 'swing' export route and may also have been looking to diversify exports away from a route through a country that was equally keen to reduce its reliance on purchases of Russian gas. The last time that the pipeline was used at close to full capacity was June 2021, when 94mmcm/d flowed versus a capacity of 97mmcm/d, but since then flows have been in decline as Poland started to implement its plans to reduce Russian gas purchases to zero in line with the expiration of its long-term contract at the end of 2022. For replacement supplies, it contracted gas from Norway via the new Baltic pipe,[15] expanded the LNG terminal at Swinoujscie to

[13] FT, 14 May 2023, "G7 and EU to ban restart of Russian pipelines"
[14] Yermakov, V. (June 2020), "Russia-Poland gas relationship: risks and uncertainties of the ever after", OIES Energy Insight No.70, p.26
[15] Euronews, 27 Sept 2022, "Norway-Poland Baltic pipe opens in move to cut Russia dependency"

buy more gas on the global LNG market[16] and commissioned interconnectors with Lithuania and Slovakia.[17]

The start of the war in Ukraine accelerated all these plans. Poland refused all demands from Gazprom for payment for gas in roubles and terminated its contract early. It also sanctioned Gazprom, and in return, the Russian authorities sanctioned EuRoPol Gaz,[18] the company which owns and operates the Yamal pipeline on Polish territory. This prevented Gazprom from making any payments to the company and effectively ended the transit of Russian gas via this route. Flows have been at zero since May 2022.

As to the future, although it is possible that flows could recommence in a benign political scenario, this seems unlikely. In 2022 Poland took over Gazprom's 48 per cent stake in EuRoPol Gaz. This company subsequently sued Gazprom for $1.45 billion for lost historic and future transit revenues through the transit contract 2045.[19] In addition, neither side would seem to have much incentive to prioritise the re-opening of the pipeline given that there is now no other commercial energy link between the two countries, and the political relationship is at a historic low. Furthermore, even before the war, Poland had plans to integrate the Yamal Europe pipeline into the Polish gas system rather than use it as an import or transit route, and this would also seem to mitigate its future use to bring Russian gas to Europe.[20]

Ukraine transit

The transit pipeline system through Ukraine is the historic artery through which Russian gas exports have flowed to Europe since the late 1960s.[21] The first sales of Russian gas to Austria in 1968 came via Ukraine, and over the remainder of the Soviet era, the system was expanded to its theoretical maximum capacity of 142bcma. However, when the Soviet Union disappeared in 1991, what had once been a unified export system became a source of fraught annual negotiations as the newly-independent Ukraine argued with Russia over transit fees balanced by the cost and volumes of imported gas. These regular disputes erupted into gas supply disruptions in 2006 and 2009, the second of which had a significant impact in SE Europe in the first two weeks of 2009 and accelerated Gazprom's plan to build new transit routes to circumvent Ukraine.[22]

The construction of Yamal Europe, Nord Stream 1 and TurkStream had some impact on gas flows, but with demand for Russian gas in Europe continuing to grow, the volumes transited through Ukraine remained in a range of 80-100bcma until 2014, when they fell to a low of around 60bcma (see Figure 3). Although they recovered somewhat by 2017, the decline then set in again before the most recent five-year transit contract signed in 2019, which confirmed throughput of Russian gas of 65bcm in 2020 followed by only 40bcma in 2021-2024.[23]

[16] https://www.hydrocarbons-technology.com/projects/swinoujscie/

[17] https://notesfrompoland.com/2022/06/06/poland-to-double-planned-size-of-gas-terminal-due-to-ukrainian-czech-and-slovak-interest/

[18] Interfax, 11 May 2022, "Russia imposes blocking sanctions on Yamal-Europe gas pipeline"

[19] Reuters, May 19 2023, "Poland's Europol Gaz files $1.45bn claim against Gazprom"

[20] Biznes Alert, 14 April 2021, "Polonization of the Yamal gas pipeline capacity" at https://biznesalert.com/polonization-of-the-yamal-gas-pipeline-capacity/#

[21] Hogselius, P., 2012, "Red Gas: Russia and the Origins of European Energy Dependence"

[22] Stern, J., Pirani, S. & Yafimava, K. (Feb 2009), "The Russo-Ukrainian gas dispute of January 2009: a comprehensive assessment), OIES Working Paper NG27, Oxford Institute for Energy Studies

[23] Pirani, S. & Sharples, J, Feb 2020, "The Russia-Ukraine Transit Deal: opening a new chapter", Oxford Energy insight 64, Oxford Institute for Energy Studies

Figure 3: Russian gas transit through Ukraine

*To end October.

Source: S&P Global Platts Analytics, UkrTransGaz, Gazprom

The current contracted capacity on a daily basis totals 110mmcm/d and should be flowing via two entry points on the Russia/Ukraine border (Sokhranivka and Sudzha) to the exit point at Velke Kapusany on the Ukraine/Slovakia border. A route in the south of Ukraine that previously flowed gas to Bulgaria is now empty following the opening of TurkStream. However, current gas flows are well below the contracted level due both to contractual issues with European customers (discussed below) and because of an issue at the Sokhranivka entry point. In May 2022 the Ukrainian TSO declared force majeure at this entry point because the region was under the control of Russian armed forces and because it could not guarantee the accuracy of flows from Russia, and Gazprom was asked to flow more gas through Sudzha as a result. Gazprom refused and has reduced its transit payments to Naftogaz (the middleman between Gazprom and the TSO). Naftogaz has responded by opening an arbitration case against Gazprom, and flows across Ukraine to Europe have fallen to around 30mmcm/d (equivalent to approximately 11bcma).[24]

The relevance of the arbitration case is not just that it might affect transit payments to Ukraine. More importantly, it could lead the Russian authorities to sanction the Naftogaz[25] (as it has done in Poland), meaning that Gazprom could be forced to reduce flows to zero at any moment. In addition, the arbitration case could also sour negotiations over a new contract, which will need to be signed before the end of 2024.[26] Of course, negotiations could be completely undermined by the state of political relations between Ukraine and Russia if the war is still ongoing, but there are differing views on the likelihood of a new contract, even if this is the case. On the one hand, it can be argued that Ukraine would not want to continue to facilitate export sales for a wartime enemy and would, in any case, demand an exorbitant transit fee. On the other hand, there is an alternative view that Ukraine would not want to interrupt any gas flows to its European allies and would continue to benefit both from transit fees and the ability to import gas from Europe via virtual rather than physical reverse flows. Of course, Russia's view is also important, as it may be keen to find an excuse to end flows and blame Ukraine for

[24] For the latest data on flows see the TSOUA Transparency Platform at https://tsoua.com/en/transparency/test-transparency-platform/

[25] See, e.g., https://www.rbc.ru/politics/06/07/2023/64a6b0bf9a7947222c5ca738?from=from_main_8

[26] See Gazprom Twitter feed, 28 Sept 2022, at https://twitter.com/GazpromEN/status/1575021274878791680?s=20

its intransigence in the negotiations. In any case, it is clear that the transit of Russian gas through Ukraine, even at the current low levels, is very much at risk over the next 12-18 months, with Ukrainian officials stating that there is little chance of a bilateral agreement being reached but that the EU might want to intervene in the negotiations. However, there has been no comment yet about whether the EU would be prepared to get involved.[27]

TurkStream to Europe via Turkey and Bulgaria

TurkStream is the final route for Russian gas exports to Europe, although it also brings gas specifically to the Turkish market. Originally conceived as a 63bcma, four-line route from the Black Sea coast of Russia to Kiyikoy in Northwest (NW) Turkey, to date only two of the lines have been constructed meaning that the current capacity is 31.5bcma. More importantly for Europe, though, is the interconnection between Turkey and Bulgaria and then into Serbia and Hungary bringing Russian gas into the European market.

Originally the Turkey-Bulgaria link flowed in the opposite direction, taking gas that had passed through Ukraine into Bulgaria and beyond, but since the construction of TurkStream this flow has been reversed. The capacity of the line, which crosses the Bulgaria/Turkey border at Strandzha-2, is 54mmcm/d or just under 20bcma, and it provides gas not only to Bulgaria but also for onward sale to Serbia, Hungary, North Macedonia, and Greece. Given that a significant portion of TurkStream gas is imported to serve Turkish demand, the export link has never been used to full capacity, with flows fluctuating between 20 - 40mmcm/d between June 2022 and June 2023, implying a maximum utilisation rate of 74 per cent.

Given the importance of TurkStream to Russia and the relatively friendly relations that Gazprom has with customers in SE Europe, this export route is the least likely to see further disruption. Indeed, there has been some discussion that it could become even more important if plans for Turkey to become a hub for expanded sales of 'blended' Russian gas into Europe become a reality.[28] This would theoretically involve Russia sending more gas to Turkey via TurkStream or Blue Stream, which is then blended with other imports from Azerbaijan or with LNG before being re-sold as Turkish exports to Europe.

However, although this would appear to be a neat way to potentially increase Russian sales to Europe, there are a number of issues. Firstly, the EU companies might be nervous about purchasing gas via Turkey that could be linked to Russia, at least while the war in Ukraine continues. Secondly, if implemented, the plan would require more infrastructure to be built to transit gas into Bulgaria by expanding or adding to the current system and possibly bringing more Russian gas via a third or fourth string of TurkStream. Whether these options would be economically viable or approved by regulators remains an open question. Finally, the status of Turkey as a gas hub for Russian or any other gas is undermined by the country's fraught relations with the EU, its inherent political risk, and the lack of institutional structure to manage such a process. It seems unlikely that many, if any, European buyers would take the risk of buying extra gas from a Turkish hub, especially if it might be classed as a proxy for extra Russian exports.

As a result, the most robust conclusion is that existing flows through Bulgaria will be maintained and could be increased to the full 20bcma capacity of the pipeline at some point, but further expansion beyond this is unlikely in the short- to medium-term. Creating a Turkish hub for Russian gas is likely to remain a theoretical proposal rather than a practical reality. However, a clear signal of intent would be any announcement of Russian plans to expand the capacity of the TurkStream pipeline.

Conclusion on infrastructure availability

Although the Nord Stream 1 and 2 pipelines, and possibly the Yamal Europe route if Poland reinstates its export capability, could be made available given some repair and/or removal of sanctions, this seems very unlikely in the next few years. This leaves the Ukraine system and the TurkStream extension to the EU as available for Russian gas exports. The former has potential contracted capacity of 40bcma,

[27] Financial Times, 22 June 2023, "Russia gas flows through Ukraine could stop next year, Kyiv says"
[28] Reuters, 8 March 2023, "Turkey's ruling party presents gas reform in step towards trading hub"

although this needs to be renegotiated in 2024 and is currently flowing around 35mmcm/d (13 bcma). This figure seems unlikely to increase in the short term, indeed, it could fall to zero if the contract is not renewed, but equally, it could increase in benign political circumstances. The TurkStream route is under less threat and has a capacity of just under 20bcma, with current utilisation of around 12.5bcma. As a result, there is a theoretical capacity to move 60bcma of Russian gas to Europe through the two routes currently being used. However, the availability of the Ukraine route could fall to zero in 2025 if no new transit contract is signed.

2. The relevance of Gazprom's long-term contracts

Historically Gazprom has sold gas in Europe using three forms of sales arrangement – long-term contracts (LTC), sales through trading companies on European hubs, and short-term sales on its Electronic Sales Platform (ESP). The first of these has been the traditional method for Gazprom to sell large volumes of gas for periods of 20-30 years using price formulae and take-or-pay volume agreements. For many years the pricing was based on a link to oil prices but since the change in European regulations catalysed by the Third Energy Package, an increasing proportion of market, or hub-based, pricing has been introduced.[29] These long-term contracts have formed the basis for the majority of Gazprom's sales to Europe. Any spare volumes of gas available due to low nominations by LTC customers or low domestic demand in Russia have generally been made available in the European market via Gazprom trading subsidiaries who have optimised Gazprom's revenues by offering gas on European hubs on a spot or short-term basis. Companies such as Gazprom Germania and Gazprom Marketing & Trading are two of the most well-known examples of these trading companies.

In 2018 Gazprom then set up its own trading platform, which it named the Electronic Sales Platform (ESP). It used this new vehicle to provide an alternative sales point for extra Russian gas that could be made available using spare capacity on the Nord Stream 1 pipeline. Gas was offered on a monthly basis in an auction process which saw as much as 43bcm being sold in the first two years of the ESP's operation, equivalent to around 15 per cent of Gazprom's LTC sales.[30]

However, the war in Ukraine has greatly impacted both the volumes and the form of Gazprom's sales in Europe. Firstly, in the second half of 2021, Gazprom began to wind down sales on the ESP by refusing to offer extra Russian gas to European customers as it cranked up the pressure on the European gas market. Volumes fell to zero on 13 October 2021 and have remained at that level ever since.[31] Secondly, after the start of the war in February 2022, all of Gazprom's trading companies in Europe were gradually forced to cease trading activity. A series of EU sanctions on Russian entities followed by Russian counter-sanctions on EU customers meant that Gazprom Germania and other Gazprom subsidiaries were prevented from concluding transactions with EU buyers.[32] Eventually, the key trading companies were either shut down, sold, or nationalised by EU governments,[33] and in all cases, they stopped trading Russian gas in Europe.

This means that the only Russian gas now being sold into Europe is being done so under LTCs, but the volumes have been reduced dramatically, and the future viability of many of the contracts is now at serious risk. We categorise the outlook for the contracts under three headings – terminated, under legal review, and active – which we outline below.

Terminated contracts

Seven countries had contracts with Gazprom that have been legally or effectively terminated and are unlikely to restart. In addition, another two Baltic counties had only been buying Russian gas on a short-

[29] Sharples, J. 2020, *The role of the ESP in Gazprom's sales strategy* Energy Insight 81, Oxford Institute for Energy Studies
[30] Sharples, J. & Henderson, J. (July 2019), "Gazprom's Gas Sales via its Electronic Sales Platform (ESP)", OIES Energy Insight 51, Oxford Institute for Energy Studies
[31] OIES Gas Quarterly, Feb 2022, *Impact of conflict in Ukraine and the Short-term Gas Markets,* Oxford Institute for Energy Studies, pp.20-21
[32] Reuters, 12 May 2022, "Russia puts sanction on Gazprom units in Europe, US"
[33] Reuters, 14 Nov 2022, "Germany nationalises SEFE to oust Gazprom"

term basis and have now stopped.[34] The largest of these contracts was with PGNiG in Poland, who had contracted to buy 10.2bcma via the Yamal pipeline. The contract was due to expire at the end of 2022 in any case, and the Polish company had stated that it would not be renewed,[35] but supplies were actually suspended on 27 April 2022 when PGNiG refused to pay for gas in roubles. With this suspension and the sanctions preventing transit gas flowing through the Yamal Europe pipeline on Polish territory the gas relationship between Russia and Poland has effectively come to an end.

Bulgaria was also a large buyer of Russian gas, with a 2.96bcma contract in place which again expired at the end of 2022. The Bulgarian state company refused to pay for gas in roubles, leading to the suspension of the contract, and Bulgargaz has now replaced the Russian volumes with flows from Azerbaijan via the TAP pipeline and with LNG bought via the Greece-Bulgaria interconnector.

Gasum, the Finnish state gas company, also had an LTC with Gazprom to purchase 3bcma, but flows were halted in May 2022 after the company became another to refuse to pay in roubles. A subsequent arbitration case ruled that Gasum had to pay for gas already received (although not in roubles), and the company has now decided to terminate the contract.[36] It remains to be seen if Gazprom takes legal action over this. Interestingly, it should also be noted that Gasum continues to buy Russian LNG from a Novatek plant rather than directly from Gazprom.[37]

In the Baltic States, neither Estonia nor Lithuania had an LTC with Gazprom in place when the war in Ukraine started, although both had historically been buying Russian gas on a short-term basis. Both have now banned the purchase of Russian gas by law, while Latvia, which had a contract to buy 1.4bcma to 2030, also passed a law in July 2022 banning imports from Russia from the start of 2023 and had its gas cut off by Gazprom two days later.[38]

In Western Europe, GasTerra, the Dutch company, had its 2bcma contract with Gazprom suspended in May 2022 for refusing to pay in roubles. The contract then expired in October 2022 and is unlikely to be renewed.[39]

Two Central European countries, the Czech Republic and Slovenia, also had contracts with Russia that were due to expire or be renewed at the end of 2022. Both suffered shortfalls due to the closure of the Nord Stream pipeline, and the contracts have now expired, but CEZ, the Czech state gas company, has now launched arbitration proceedings against Gazprom for the non-fulfilment of contractual obligations.[40]

As a result, a total of just under 30bcma of LTC volumes have effectively been terminated. It seems very unlikely that the countries named above will be buying Russian pipeline gas again soon, if ever.

Under legal review

A number of countries have had their gas contracts with Russia suspended (mainly due to a refusal to pay in roubles), but the agreements remain in place because they have not been officially terminated or reached their end date. The majority are either currently under legal review or could become so if the Ukraine war ends and there is an attempt to restart gas flows from Russia.

Germany is the most significant example. Shell Energy Europe (Germany) has a contract with Gazprom that expires in 2030/31, but supplies have been suspended because of a refusal to pay in roubles.[41] Meanwhile, the contracts held by VNG, RWE, Uniper, and WIEH (Wintershall) expire in 2030-2035, but supplies have been halted due to the disruption of flows through Nord Stream. Several of these companies are now pursuing arbitration claims against Gazprom for failure to deliver contracted gas,

[34] Ref April Quarterly
[35] Reuters, 23 May 2022, “Poland ends deal to receive Russian gas after rouble dispute”.
[36] Reuters, 222 May 2023, “Finnish Gasum terminates Gazprom pipeline contract”
[37] Interfax, 21 March 2023, “Finland’s Gasum continuing to import Russian LNG due to contract obligations to Gazprom”
[38] Reuters, 30 July 2022, “Gazprom halts gas supplies to Latvia”
[39] Reuters, 30 May 2022, “Gazprom suspends gas deliveries to Dutch trader GasTerra”
[40] Reuters, 9 Feb 2023, “CEZ seeks damages from Gazprom citing lower than contracted gas deliveries”
[41] Energy Live News, 6 June 2022, “Gazprom cuts off gas supplies to Shell Energy”

with the cases of Uniper and RWE being the largest and most high profile. The former launched its case on 30 November 2022, claiming €11.6 billion as compensation for having to purchase very expensive alternative supply on the market to replace Russian volumes to that date.[42] A week later, on 5 December 2022, RWE launched a smaller €400 million case using the same argument, and both companies reiterated that further losses were expected over the winter and into 2023.[43] All the German contracts could be reactivated if the pipeline capacity became available and the legal cases were settled, with volumes totalling around 35bcma, although the likelihood of this happening in the short-term is negligible.

Italy, France, and Denmark have also been significantly impacted by sharply reduced flows from Gazprom. ENI has a contract to buy 22bcma from Gazprom until 2035, equivalent to 60mmcm/d on a flat basis, but imports have declined from a high of around 90mmcm/d in December 2021 to zero in October 2022 before rebounding to an average of around 10mmcm/d since then. Interestingly, ENI was prepared to pay in roubles for its gas but has still received lower amounts of gas than it nominated under its contract throughout 2022 and early 2023, and finally in May 2023 it also launched an arbitration case against Gazprom claiming an unspecified amount of compensation to make up for the extra gas it had needed to purchase.[44] The company has also stated that it will aim to be free of any dependence on Russian gas by 2025, meaning that this contract is also unlikely to be revived, even though it is still in force.

In France Engie has a 13.5bcma contract with Gazprom which has been suspended since 1 September 2022, with Gazprom claiming that Engie did not pay for all the volumes received while the French company claimed that volumes were reduced due to the closure of Nord Stream. It subsequently also opened an arbitration case against Gazprom in February 2023, claiming unspecified damages for 'significant delivery shortages'.[45] Finally the Danish company Ørsted had its 1.9bcma contract suspended in June 2022 for refusing to make rouble payments.[46] This means that the overall volume of contracts that remain in place but have been interrupted is just over 70 bcma, with the majority of these volumes now being the subject of arbitration proceedings. None of these contracts will be reinstated until the demand for rouble payment has been removed and/or the Nord Stream and Yamal pipeline routes have been reinstated, neither of which is likely in the short-term.

Active

This leaves a small number of existing contracts that remain active with gas continuing to flow both through the Ukraine system and via TurkStream and its onward connection into Europe. The countries involved are all in Southern and Central Europe and supply has largely continued because of Russia's stronger relationships with the companies involved or because of the geography of the export routes.

Hungary is arguably the EU member state with the closest current ties with Russia and its gas relationship would seem to reflect this. It signed a 4.5bcma contract with Gazprom in 2021 and there have been no reports of shortfalls in deliveries since the Ukraine war began, with 3.5bcma being delivered via TurkStream and the remaining 1bcma via Ukraine.[47] Furthermore, in August 2022 the Hungarian state company MVM agreed to purchase an extra 5.8mmcm/d (2.1bcma) from Gazprom, although no timescale was mentioned.[48] Gazprom also showed some lenience in October 2022 when it reportedly agreed to let MVM defer payments if prices rose too high, repaying the balance over future years, underlining the close cooperation between the companies.[49] As a result, it is fair to assume that this contract will continue to be fully met.

[42] Reuters, 30 Nov 2022, "Uniper seeks billions of euros in compensation from Gazprom"
[43] Reuters, 5 Dec 2022, "RWE initiates arbitration proceedings against Gazprom"
[44] Bloomberg, 8 May 2023, "ENI opened Gazprom arbitration proceedings after gas supply cuts"
[45] Energy Intelligence, 22 Feb 2023, "Engie sues Gazprom"
[46] Reuters, 1 June 2022, Gazprom cuts gas supply to Orsted and Shell Energy"
[47] Politico.EU, 31 Aug 2022, "Hungary signs new gas deal with Gazprom"
[48] Euronews, 2 Sept 2022. "Hungary signs deal with Gazprom for 5.8M cubic metres of natural gas"
[49] Reuters, 12 Oct 2022, "Hungary finalises deferred payments deal with Gazprom"

Bordering Hungary, Austria has also continued to receive significant deliveries under its 6bcma contract with Gazprom, which runs to 2040. Some fluctuations in delivery were seen during 2022, but in early February 2023 the company's CEO reported that volumes were 'temporarily back to the full contracted amount'. The Austrian government has been reluctant to intervene to reduce dependency on Russia, which supplied 70 per cent of the country's gas even in December 2022,[50] and with OMV also agreeing to pay for sales in roubles it seems that this contract will also continue to be supplied.[51]

Elsewhere in Central Europe Slovakia's contract with Gazprom for 6.5bcma is in place until 2028 and the country has also agreed to pay for its gas in roubles.[52] There have been some fluctuations in flows since the start of the Ukraine war, but as Slovakia is the entry point for all current gas flows through Ukraine its imports would seem to be secure while the Ukraine transit agreement is in place. The concern, of course, is that this needs to be renegotiated in 2024.

Further to the south, Serbia, Croatia, Bosnia, and North Macedonia also continue to receive supply, mainly through TurkStream. The contract volumes vary in size, from Serbia's 2.2bcma deal through to 2026 to Croatia's 1bcma to 2027, North Macedonia's 0.43bcma to 2027, and Bosnia's 0.4bcma one-year deal. It is notable that all these contracts are relatively short-term in nature but given the link to TurkStream and the importance of the SE Europe market to Gazprom both politically and now commercially, one would expect most of these volumes to be rolled over when the time comes.

Finally, Greece is the only country to have signed a new contract with Gazprom in the past two years. In January 2022, DEPA signed a four-year deal to 2026 to purchase a mixture of pipeline gas via TurkStream and LNG delivered to the Revithoussa receiving terminal.[53] The volume of this contract is 2bcma and is in addition to the 0.6bcma ten-year contract signed by Mytilineos in 2020[54] and a 0.4bcma contract held by Public Power Corp (PPC), which expires in 2026. However, in a sign that Greece does not entirely trust the future of Russian gas supply, in September 2022, DEPA signed an option on LNG imports with TotalEnergies for the winter of 2023,[55] and the country has been seeking to expand its overall LNG import capacity.[56] Indeed, a new receiving terminal at Alexandroupoli will be operational in 2024.[57] As a result, although there is no current sign that Russian flows will be halted, this is clearly seen as something of a risk by the Greek authorities.

Overall, ten companies in eight countries have contracts with Gazprom that are currently being supplied with significant or complete contractual volumes, with all ten companies apparently having agreed to pay for the supply in roubles. The volumes under contract total 24.5bcma (ACQ or agreed annual contract quantity). There will be flexibility around this figure, most likely down to 60 per cent minimum or 105 per cent maximum, meaning that daily flows could be in the range of 40-71mmcm/d. This figure corresponds quite closely with the range of actual Russian gas flows during Q1 2023 of 42-71mmcm/d, suggesting that these ten contracts are currently active and will continue to be so unless there is a dramatic change in the political environment.

[50] Euractiv, 13 Feb 2023, "Austria hesitant to halt comeback of cheap Russian gas"
[51] Natural Gas World, 28 April 2022, "OMV to open rouble accounts to pay for Russian gas"
[52] Reuters, May 20, 2022 at https://www.reuters.com/business/energy/slovakias-spp-paid-russian-gas-euros-opened-rouble-account-2022-05-20/#:~:text=May%2020%20(Reuters)%20%2D%20Slovak,payment%20scheme%20demanded%20by%20Moscow.
[53] Reuters, 4 Jan 2022 at https://www.reuters.com/business/energy/greeces-depa-gazprom-agree-long-term-gas-deal-2022-01-04/
[54] Anadolu Agency, 2 June 2020, "Gazprom, Greek firm Mytilineos ink natural gas deal"
[55] Ekathimerini, 30 Sept 2022, "Greece ending Russian gas dependence"
[56] Bowden, J., 2022, *South-East Europe gas markets – reconfiguring supply flows and replacing Russian gas,* OIES Working Paper NG177, Oxford Institute for Energy Studies
[57] https://www.offshore-energy.biz/greeces-first-offshore-lng-terminal-coming-online-in-2024-to-bolster-europes-low-carbon-energy-mix/

Table 1: Status of Gazprom's long-term contracts to Europe

Country	Volume	Status
Terminated		
Poland	10.0	Expired
Bulgaria	3.0	Expired
Finland	3.0	Halted
Latvia	1.4	Halted
Netherlands	2.0	Expired
Czechia	9.0	Expired
Slovenia	0.6	Expired
Under legal review		
Germany	35.0	Arbitration
Italy	22.0	Arbitration
France	13.5	Arbitration
Denmark	1.9	Suspended
Active		
Hungary	4.5	Flowing
Austria	6.0	Flowing
Slovakia	6.5	Flowing
Serbia	2.2	Flowing
Croatia	1.0	Flowing
Bosnia	0.4	Flowing
North Macedonia	0.4	Flowing
Greece	3.0	Flowing

Source: OIES

Conclusion on Gazprom long-term contracts

Overall, of the estimated 135bcma of long-term contracts between Gazprom and customers in the EU in the gas year 2021/22, 30bcma are now terminated, 73bcma are under legal review, and 25bcma remain active. In addition, Gazprom also has 26bcma of LTCs with Turkish companies for delivery via the TurkStream or Blue Stream pipelines, although this figure will fall to 6bcma in 2026/27 unless some of the contracts are renewed. As a result, Gazprom currently has around 50bcma of active LTCs with Europe as a whole, although around 12 bcma of this (to Austria, Slovakia, and some flows to Hungary) would be at risk if Ukraine transit ceased in 2025 and a further 26bcma is only contracted to 2026/27.

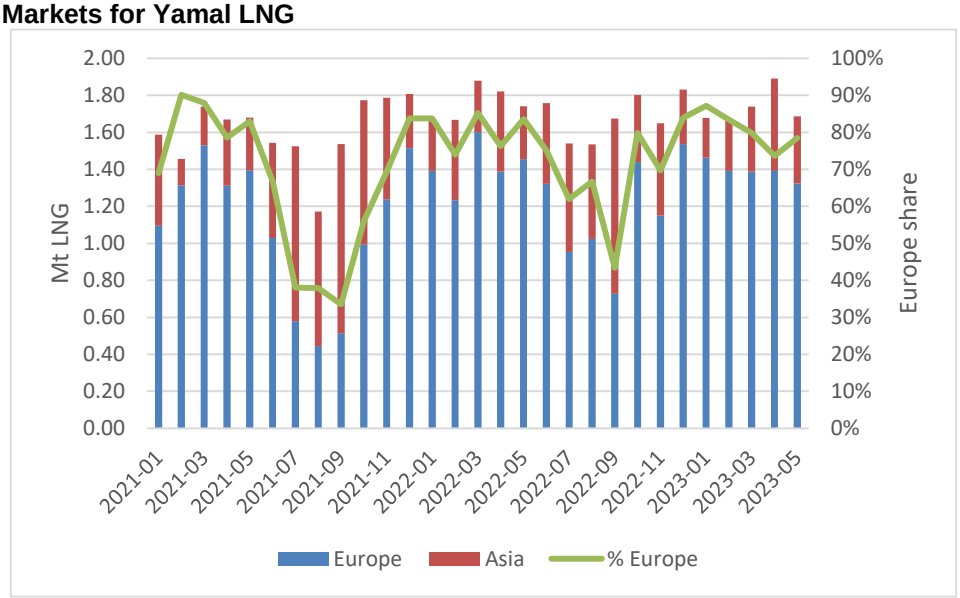
3. Impact of Russian LNG

LNG is now an increasingly important source of gas flows from Russia to Europe. In our modelling of future Russian flows (see Section 5) we only create alternative scenarios for the supply via pipeline based on the analysis of export routes and contracts described above, but it is important to understand the role that Russian LNG now also plays.

Russian LNG has been flowing to Europe since the start of production at the Yamal LNG project in 2017.[58] Unlike the Sakhalin 2 project in the Far East, where gas flows only to Asian markets, cargoes from Yamal LNG can flow west or east depending on market forces and ice conditions on the Northern Sea Route (NSR) through the Arctic Ocean.[59] For six months of the year the NSR can be used to take LNG to Asia, which has historically been the premium market for Russian LNG, but since the outbreak of war in Ukraine high prices in Europe have provided an incentive for the owners of gas from the Yamal project to send the majority of cargoes in a westerly direction. It is important to point out that a distinction needs to be made between the owners of the project (Novatek - 50.1 per cent; TotalEnergies – 20 per cent; CNPC – 20 per cent; and the Silk Road Fund – 9.9 per cent)[60] and the purchasers of the gas who then sell it into the market. The main shareholders (Novatek, TotalEnergies and CNPC) do sell cargoes but third parties such as Shell, Engie, and Gas Natural also have direct or onward sales contracts with the project to bring LNG into the global market.[61] As a result, although the project is clearly Russian in origin, the LNG sales are conducted by a mixture of Russian, Asian, and European entities.

Figure 3 shows the split of sales for Yamal LNG. Although there are seasonal fluctuations in the amount of gas sent east and west, based largely on the navigability of the NSR, the trend in 2022 is clear. During the fifteen months since the start of the war in Ukraine, 76 per cent of LNG cargoes have been sent to Europe, compared with 67 per cent in the calendar year 2021. Even in the most attractive weather window for sailings to Asia (June to September), the share of gas flowing to Europe only fell below 50 per cent on one occasion, and in many months 80 per cent or more went in a westward direction, attracted by the premium prices on offer.

Figure 3: Markets for Yamal LNG



Source: Kpler LNG Database

As a result of these flows, and the decline in Russian gas exports by pipeline, LNG exports now account for around 50 per cent of total Russian gas sales in Europe. In the first four months of 2023, for example, 5.64Mt of LNG arrived in Europe, equivalent to 7.78bcm or 64mmcm/d of gas flow. In the same period flows of pipeline gas averaged 60mmcm/d, underlining how important LNG has become to Russian gas exports to Europe.[62] With this in mind, EU politicians have been debating whether to ban imports of Russian LNG, following the lead set by the UK in October 2022 which became effective from 1 January

[58] The Independent Barents Observer, 5 Dec 2017, "Gas company switches on huge Arctic LNG plant"
[59] Yermakov, V. (2021) "The Northern Sea Route: A state priority in Russia's strategy of delivering Arctic hydrocarbons to global markets"
[60] See http://yamallng.ru/en/project/about/
[61] Henderson, J. & Moe, A. (2019), *The Globalization of Russian Gas: Political and Commercial Catalysts* Edward Elgar, London, p.140
[62] OIES Gas Quarterly, April 2023

2023.[63] In March 2023 EU leaders agreed in principle to seek legal action to stop Russian companies from sending LNG to the EU by blocking access to import infrastructure,[64] and this was further developed to allow member countries to prevent any gas network user from bidding to bring Russian LNG into the region.[65] An outright ban was not thought to be necessary, given security of supply considerations, but in any case many market participants believe that a ban would have little impact as the LNG would just be re-directed via non-EU markets with the equivalent supply still arriving in the region.[66]

Four countries would be primarily impacted if a ban was imposed: the Netherlands, Belgium, France, and Spain imported over 96 per cent of the 5.5mt of Russian LNG which arrived in the EU between January and April 2023, with French and Spanish companies having long-term contracts to take LNG from the project. The Netherlands, which only imported 0.3mt, has subsequently resolved to phase out Russian LNG and has already banned it from the Eemshaven receiving terminal.[67] Meanwhile the Spanish Energy Minister wrote to Spanish LNG importers in March asking them not to sign new contracts for Russian LNG once the existing ones expire.[68] France and Belgium have less incentive to change, given the involvement of TotalEnergies in the Yamal LNG project, and so although inflows of Russian LNG may decline over 2023 they are unlikely to disappear completely from the EU. In any case, for the purpose of our modelling exercise we have assumed that they remain constant on the basis that if they are removed then they will be redirected quite easily in a liquid global market, with Europe receiving counter-balancing supply from other redirected sources.

4. The geopolitics of Russian gas in Europe

No part of this analysis is intended to advocate for increased gas imports from Russia either during the war in Ukraine or even after it has eventually ended. It is merely an attempt to analyse potential outcomes. Having said that, it is impossible to ignore what the impact of the political situation on energy markets and gas flows could be, both in terms of geopolitical reactions and in terms of broader EU strategy. OIES claims no military insight, and so we would point to three scenarios proffered by analysts Samuel Charap and Miranda Priebe at the RAND Corporation in a paper entitled, "Avoiding a Long War: US policy and the trajectory of the Russia-Ukraine conflict."[69] Their scenarios are: absolute victory (for either side), armistice agreements, and political settlement.

We take each in turn and consider its possible implications for gas markets. Firstly, absolute victory for Russia, which is unlikely given the current state of the war, would likely mean an end to gas exports to Europe. It seems inconceivable that the EU and its member states could conceive of buying energy from a country which had conquered a near neighbour after an unprovoked assault, and so this scenario would seem to point to zero Russian gas flows to Europe, especially as Europe has already made significant progress towards replacing Russian gas with alternative supplies. The only possible exception might be countries that have adopted a more neutral or even pro-Russian stance and who receive gas via TurkStream (Hungary might be one example), although significant political pressure would likely be exerted to prevent this.

Absolute victory for Ukraine also seems unlikely, but if it were to occur, it might offer some small hope of a return of Russian gas to Europe. A defeated Russia might be keen to generate extra revenues in a post-war world, either to make reparations or to reinvigorate its economy, while a magnanimous Ukraine and EU might be prepared to encourage Russia back into a commercial arrangement that could

[63] Natural Gas Intelligence, 9 Jan 2023, "UK bans Russian LNG imports, looks to US and other producers to meet demand"
[64] Reuters, 28 Mar 2023, "EU countries seek legal option to stop Russian LNG imports"
[65] https://data.consilium.europa.eu/doc/document/ST-7909-2023-INIT/en/pdf
[66] Montel, 14 April 2023, "EU ban on Russian LNG would have little impact say analysts"
[67] https://www.highnorthnews.com/en/netherlands-phase-out-russian-arctic-lng
[68] https://www.reuters.com/business/energy/eu-will-ban-russian-lng-sooner-than-later-spains-energy-minister-says-2023-05-16/
[69] Avoiding a Long War: U.S. Policy and the Trajectory of the Russia-Ukraine Conflict | RAND

lead to political rapprochement. Alternatively, both sides could be so antagonistic after a bitter war that no transit or sales agreement is possible.

The armistice agreement scenario would involve a commitment to stop the fighting but would be unlikely to resolve the political drivers of the conflict. It would likely see a freezing of the front lines and an end to combat, preventing further Russian advances into Ukrainian territory but also stopping counter offensives and leaving Russian troops in areas of Ukraine that they already hold. Clearly, this would leave many political and economic disputes to be resolved between the two sides, with minimal trade being likely.[70] In summary, this would be something of an unsatisfactory outcome for both sides and would lead to a preservation of the status quo at the time of agreement. The implications for the gas market would likely be similar, namely the continuation of flows at or around current levels, with less risk of a fall to zero but equally little real hope of a significant rebound.

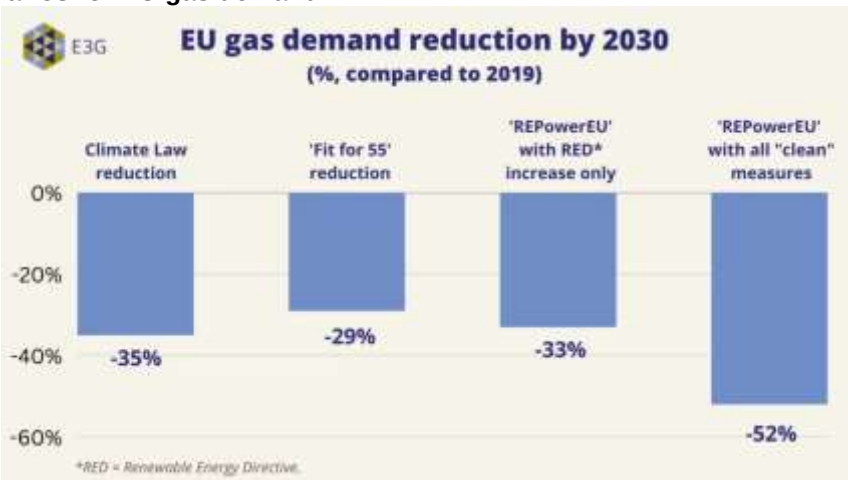
The political settlement scenario would involve the signing of a peace treaty and a more durable end to the fighting. At least some of the core political issues would be resolved and could cover concerns such as the geopolitical position of Ukraine, reparations and reconstruction, resumption of bilateral trade and the return of some or all Russian-occupied Ukrainian territory.[71] This more concrete agreement to end hostilities could have a more positive outcome on gas flows to Europe. It is very unlikely that the EU and any of its member states would want to find themselves as exposed to Russian gas as they were prior to February 2022. However, it is conceivable that a more balanced import strategy could still see pipeline flows increase from current levels, and this is explored in our gas market modelling and scenario analysis.

With all this said, one other important political factor is the EU's energy strategy and the new balance that has been established between energy security and environmental necessity. The EU had already committed to accelerating the decarbonisation of its energy system prior to the war, with the publication of the Fit for 55 strategy highlighting a focus on increasing the use of renewable energy, reducing the use of hydrocarbons (especially coal), developing the use of hydrogen in hard-to-decarbonise sectors, and encouraging the construction of infrastructure to facilitate the energy transition.[72] Following the outbreak of the war in Ukraine the EU effectively doubled down on this strategy by launching its REPowerEU targets, emphasising the need to move away from hydrocarbons faster for energy security and environmental objectives. Essentially, a quicker decarbonisation could allow the bloc to reduce its dependence on Russia's oil, gas, and coal at an accelerated pace by increasing the targets for renewables and other forms of decarbonised energy.[73]

This acceleration has potentially significant consequences for gas overall, but particularly for the import of Russian gas which is targeted to reach zero before the end of the current decade. Figure 4 shows the overall implications for gas demand in the EU under various scenarios, and clearly illustrates the plan to reduce it by over 50 per cent in the most aggressive scenario. Questions have been asked about how realistic the targets in the REPowerEU document are, with some (such as the growth in hydrogen demand) appearing completely impossible to achieve. Nevertheless, the direction of travel has been set and the implications for gas imports are that they would surely decline in this scenario, even if EU gas production also falls. In a scenario with falling gas imports, then supply from Russia would presumably be the first on the list for removal, at least from a political standpoint. Again, it should be reiterated that the targets are not forecasts and the actual outcome could be rather different – indeed the OIES forecast for gas demand in Europe by 2030 is considerably less pessimistic – and as a result the outlook for Russian gas imports could also be higher. Nevertheless, the downside risk for Russian gas is clear and, indeed, has been part of Gazprom's analysis for some years.

[70] Ibid, pp.13-14
[71] Ibid, p.14
[72] https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/#:~:text=The%20European%20climate%20law%20makes,EU%20climate%2Dneutral%20by%202050.
[73] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en

Figure 4: Scenarios for EU gas demand



Source: E3G

5. Modelling the impacts of Russian gas pipeline flows on European gas markets.

With all these factors in mind, we have modelled some potential scenarios for Russian gas exports to Europe in order to investigate how impactful they could be both on the European gas market and on global gas prices. This section first briefly describes the modelling methodology. It then discusses scenarios, assumptions, and modelling results.

5.1 Global gas and electricity market model

A co-optimised gas and electricity market model was used for this analysis. The model is set to simulate global gas (for details of the global gas model, see Chyong and Hobbs, 2014;[74] Chyong et al., 2023[75]) and regional power markets (for details of the power market model, see Chyong and Newbery, 2022[76]) up to 2030. The model explicitly considers the electricity market's demand-side response and inter-fuel competition dynamics. It uses projections of global supply, non-power gas demand, and electricity generation capacity and demand. European[77] gas and power markets are modelled explicitly. European gas demand is disaggregated into the residential, commercial, industrial, power sector, and energy industry use (for details, see Appendix). Supply capacity and demand are based on projections from IEA, ENTSO-e, ENTSO-g, Bloomberg, Refinitiv, European Commission JRC databases, and other public sources.

The distinctive feature of this global model is the ability to analyse the interaction of supply and demand at monthly resolution and the global scale. Given the assumptions about short-run variable costs and infrastructure capacities, the objective of the model is to find a least-cost solution to meet gas and electricity demand, taking into account various physical constraints, such as gas production capacities, transmission network capacities, LNG liquefaction and regasification/send-out capacities, storage injection, withdrawal and maximum working volume capacities as well as electricity market-related constraints. The model is a partial equilibrium model formulated as a quadratic programming problem in AIMMS and is solved using a commercially available IBM CPLEX solver. The outputs from the model

[74] Chyong, C.K. and Hobbs, B.F., 2014. Strategic Eurasian natural gas market model for energy security and policy analysis: Formulation and application to South Stream. *Energy Economics*, *44*, pp.198-211.
[75] Chyong, C.K., Reiner, D.M. and Aggarwal, D., 2023. Market power and long-term gas contracts: the case of Gazprom in Central and Eastern European Gas Markets. *The Energy Journal*, *44*(1).
[76] Chyong, C.K. and Newbery, D., 2022. A unit commitment and economic dispatch model of the GB electricity market–Formulation and application to hydro pumped storage. *Energy Policy*, *170*, p.113213.
[77] Throughout this section Europe means EU27.

are projections of supply, demand, equilibrium gas and electricity prices, pipeline and LNG flows, storage injection and withdrawal, electricity generation and CO_2 emissions by fuel and technology and inter-zonal power flow.

5.2 Scenarios

We model two sets of scenarios to measure the potential impact of Russian pipeline gas on European gas and power markets:

1. The **baseline** scenario assumes that the total pipeline gas flow from Russia to Europe can go up to 30.75 bcm/year through the Ukrainian (15 bcm/year) and TurkStream (15.75 bcm/year) routes. This is based on the available capacity through the TurkStream pipeline dedicated to Europe and the high end of recent gas flows via the Ukrainian system.
2. Four Russian supply **sensitivity** scenarios (S1-S4) then investigate different levels of pipeline supplies from Russia to Europe (ranging from zero flows up to more than 75 bcm/year).

Table 2 outlines the assumed maximum flow from Russia in the baseline and the four sensitivity scenarios. The actual flow from Russia may be less than these assumed maximum export capacity scenarios, as it depends on many factors, such as demand, costs and commodity prices, infrastructure bottlenecks, etc. (i.e., an endogenous outcome from the optimization model). The baseline flow scenario corresponds to the currently observed pipeline flows from Russia to Europe.

Table 2: Scenarios for Russian pipeline gas to Europe (bcm/year)

	Ukraine route	**TurkStream route**	**Total available capacity**
Scenario 1 (S1)	0 .00	0.00	0.00
Scenario 2 (S2)	0.00	15.75	15.75
Baseline	**15.00**	**15.75**	**30.75**
Scenario 3 (S3)	40.00	15.75	55.75
Scenario 4 (S4)	60.00	15.75	75.75

Source: Authors' analysis

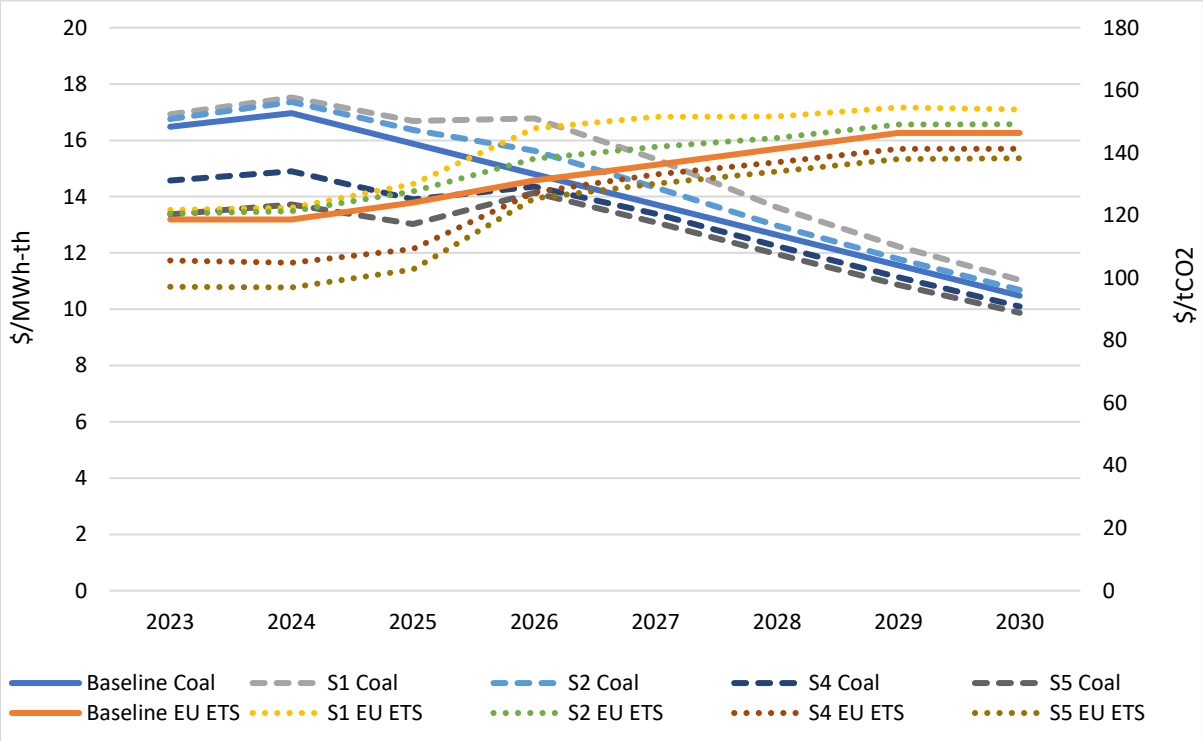
Figure 5 presents the scenarios for commodity prices. In the baseline scenario, coal and carbon prices are based on the most recent (at the time of writing) forward prices. Note that the gas price is an endogenous outcome from the model (global gas supply and demand optimisation is subject to constraints in both gas and electricity markets).

Coal prices in 2023 and 2024 are based on the forward price projection at the time of writing. In 2030, we assume that coal prices will decline to the average of 2020-21 to reflect a more stable situation, given that Russia can divert steam coal to Asia by 2025. Coal prices in 2025-2029 are based on linear interpolation between 2024 and 2030.

We apply a discount or markup above the European forward coal prices to calculate imported coal prices for Japan and China. These markups are based on the spot prices for coal (2011-2021) reported by BP (2022).[78] Thus, Japan's spot steam coal has an average markup of 17 per cent, whereas China's spot price has a markup of 22 per cent (average in 2011-2021) above the expected European forward price reported in Figure 5.

[78] BP Statistical Review of world energy 2022

Figure 5: Scenarios for coal and carbon prices



Source: baseline coal and EU ETS (carbon price) are forward prices from Eikon and Bloomberg terminal (as of Feb 23); forward coal price is the coal price delivered into Northwest Europe.

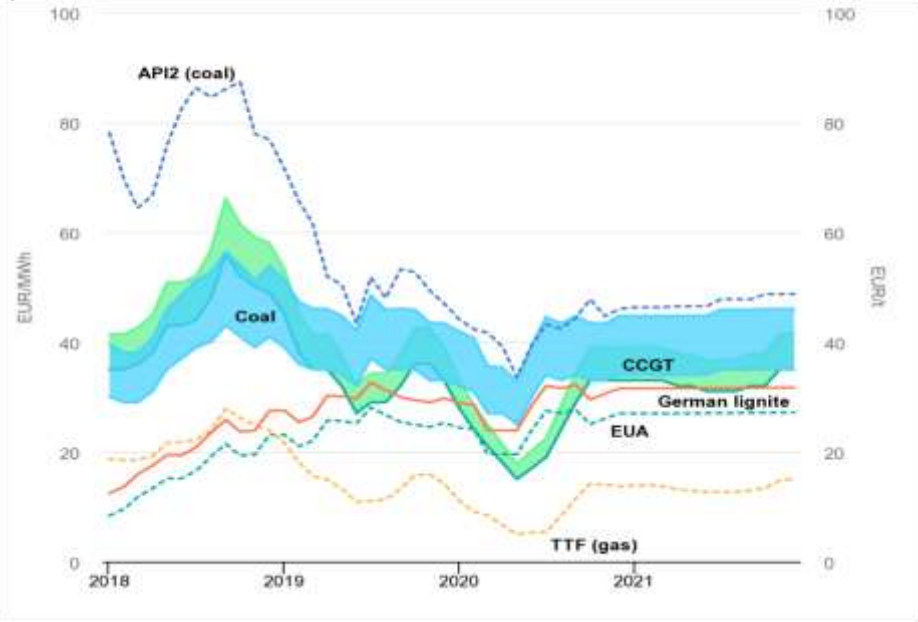
Notes: we also model oil-fired power generation and assumed crude oil price based on the Feb 23 forward curve with an expected price of $50/MWh in 2023 and $40/MWh in 2030; to estimate the impacts of Russian flows on coal and carbon prices, we first run the model under the baseline scenario assumptions to gauge the impacts of Russian pipeline flow scenarios on European gas prices. Then we compute changes to coal and carbon prices using these baseline gas prices and re-run the model to include these secondary effects.

In the sensitivity scenarios (S1-S4), coal and carbon price projections are based on a methodology which incorporates the relationship between gas, coal, and carbon prices in Europe's and the world's energy markets. Figure 6 highlights the European markets' gas, power, and carbon price dynamics. The economics of inter-fuel substitution as well as Europe's connection to the global gas and coal markets drive the relationship between coal (API 2), gas (TTF), and carbon (EUA) prices. For example, our simple estimates suggest that a 1.0 per cent increase in gas prices leads to a more than 0.47 percentage points increase in coal prices and a more than 0.45 percentage points increase in carbon prices.[79] Therefore, a complete halt of Russian gas exports (from the current level) will increase gas prices, encouraging switching to coal and increasing coal (and carbon) prices. Similarly, an increase in gas supplies from Russia (beyond the current baseline flow) will put downward pressure on Europe's gas prices, encouraging switching away from coal, thus reducing coal and carbon prices.[80]

[79] These estimates are based on simple linear regressions, and a more robust way to calculate would be to model all three commodity markets (gas, coal, and carbon) in a single model to avoid endogeneity problems. Nevertheless, these estimates give us some rationale and a starting point in constructing alternative commodity prices under different Russian gas export supply scenarios.

[80] As an example, API2 coal prices plunged in the first half of May 2023, with the front-month futures contract down 20.4 per cent w-o-w and settling at US$94.50/t on 31 May. This is unsurprising, given the observed dynamics in relation to fuel switching

Figure 6: Inter-fuel competition in the EU power market and relationships between coal, gas, and carbon prices



Notes: API = Argus/McCloskey's Coal Price Index; EUA = European Union Allowance. CCGT net efficiency: 49-58 per cent. Coal net efficiency: 35-46 per cent. Lignite net efficiency: 39 per cent.
Source: IEA (2021[81])

5.3 Modelling results

The key assumptions for European demand and optimised Russian gas flows to Europe by scenario can be found in Appendix 1. Figure 7 then summarises the impact of Russian gas supply scenarios on annual average gas prices in Europe.

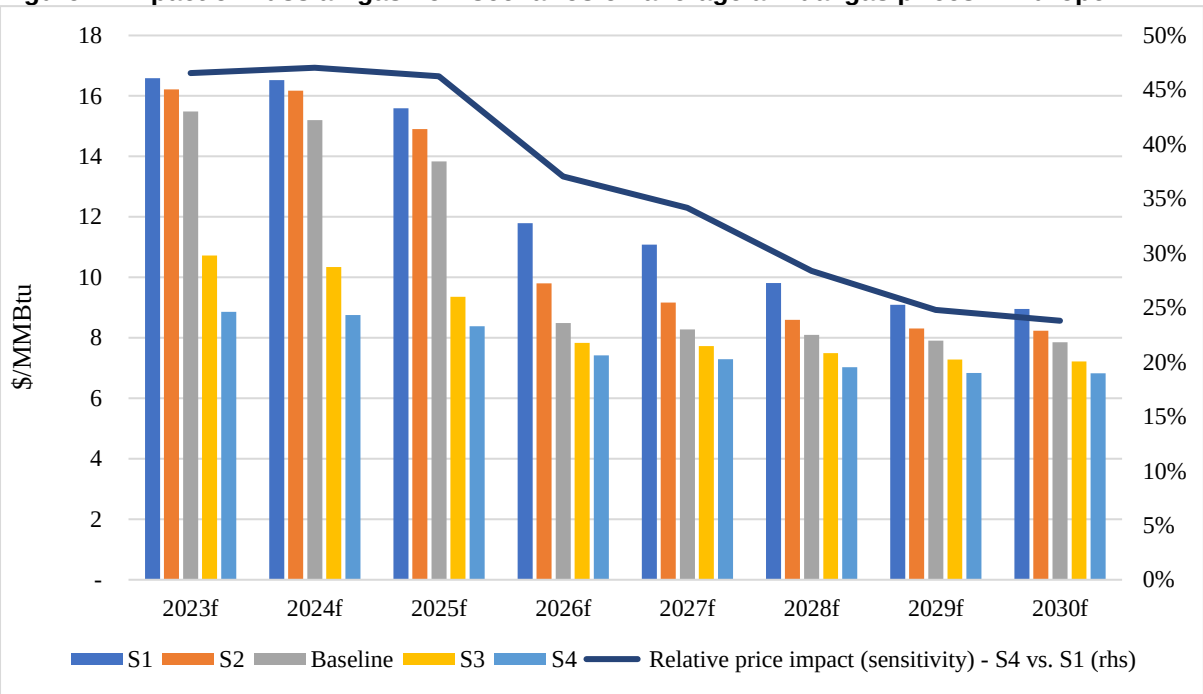
Regarding price impacts, the modelling results suggest that Russian gas exports to Europe will have a more limited impact after 2026 than before. The average price difference between the no-flows scenario (S1) and the 70-74bcm flow scenario (S4) in 2026-2030 is $3.07/MMBtu which is 30 per cent of the prices under the no-flows scenario (S1). However, the impact of Russian flow scenarios in 2023-2025 is more substantial. The average price difference between S1 and S4 is $7.57/MMBtu, or 47 per cent of the price in the no-flow scenario. Overall, as we move towards the end of this decade, the impact of the Russian gas weapon will substantially diminish. There are two main explanations for this result.

First, by 2026 we expect an addition of at least 171 bcm of LNG export capacity in the global gas market. Almost 90 bcm of LNG export capacity addition will come from North America (around 52 per cent of expected capacity addition by 2026). Qatar will add at least 49 bcm while Africa, South-East Asia, and Russia (Artic 2 T1) account for the rest. Consequently, the market will be much looser, and prices will be lower regardless of pipeline export from Russia. Most of these LNG export capacity additions were committed prior to the war in Ukraine.

in European power markets. The TTF forward curve remains in the lower end of the fuel switching range, meaning that high efficiency gas generation also pushes lignite from the European power mix. Further, as a result of falling gas prices in 2023, the Australian coal price fell to $84/tonne in mid-June, down 70 per cent from its record high of $280/tonne in March 2022 and the lowest since July 2021. See https://www.reuters.com/markets/commodities/asia-thermal-coal-prices-get-blues-europe-lng-russell-2023-06-20/

[81] https://www.iea.org/data-and-statistics/charts/european-union-marginal-coal-and-gas-fired-power-generation-costs-2018-2021

Figure 7: Impact of Russian gas flow scenarios on average annual gas prices in Europe



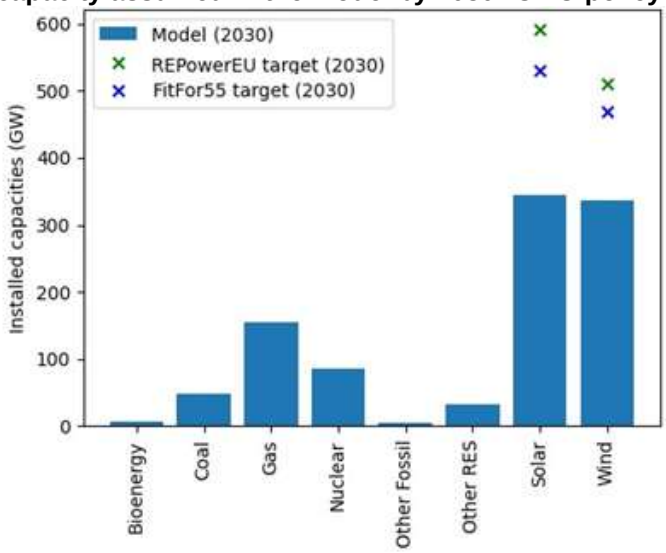
Notes: The model reports gas prices for all European countries, but the Dutch gas price is used for this analysis; "f" is forecast by the model.

Source: Authors' analysis

Secondly, even before the war in Ukraine, Europe had set on an ambitious course to decarbonise its energy system by banking on renewables and energy efficiency. While we did not model Fit For 55 (FF55) or REPowerEU renewable policy targets (Figure 8), our scenario of European electricity capacity expansion by 2030[82] lowers gas demand in the power generation sector to the point where it appears to be enough to support a phase-out of Russian gas at a minimal energy cost to Europe. For example, we model around 348 GW of wind capacity (vs 186 GW in 2022), which is 26 per cent lower than the FF55 target and 32 per cent lower than the REPowerEU target for wind generation. Similarly, we model approximately 338 GW of solar capacity (vs 135 GW in 2022), which is 36 per cent lower than the FF55 target and 43 per cent lower than the REPowerEU target for solar generation. We did not model other policy targets such as renewable gas, hydrogen, heat pumps, or energy efficiency contained in the FF55 or REPowerEU legislation.

[82] Based on NRA's inputs into the ENTSO-e ERAA 2021 study

Figure 8: Generation capacity assumed in the model by 2030 vs EU policy targets

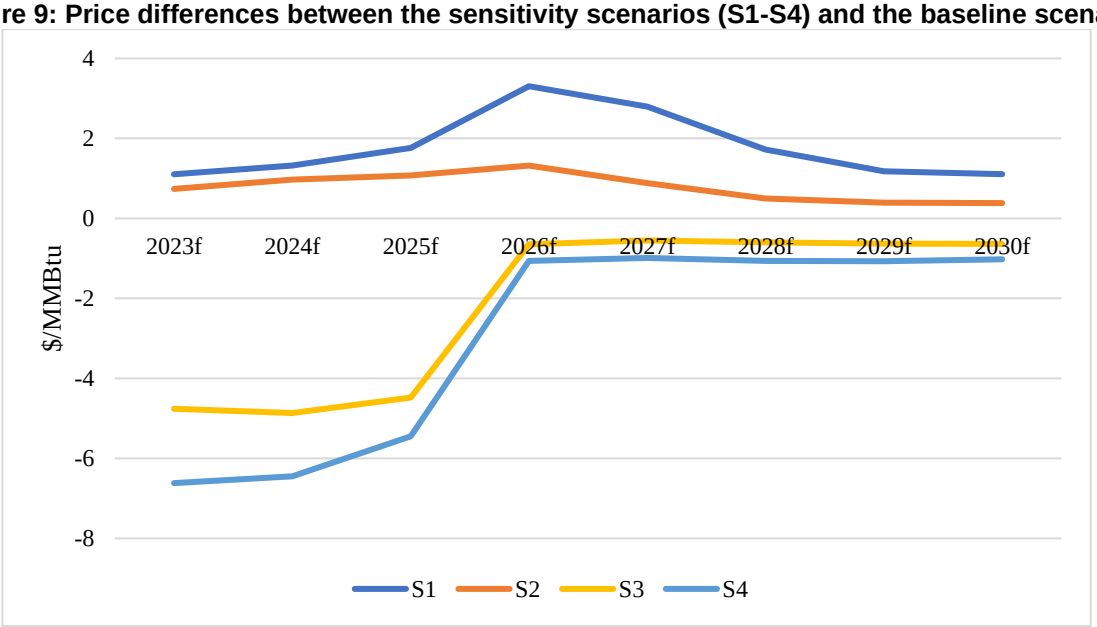


Source: Authors' analysis

It is also worth noting the potential impact of not extending the Ukrainian transit agreement on European prices. In this case, the price increases by an average of $1.20/MMBtu (S2, Figure 9) in 2025-26, and then the difference reduces to $0.54/MMBtu afterwards. Furthermore, extending the transit contract and securing the Sokhranivka entry point allowing Ukraine to offer Gazprom around 40 bcm/year of transit capacity after 2024 (S3, Figure 9), will mean a price drop of $5.6/MMBtu in 2025 and an average of $1.3/MMBtu afterwards compared to the price without the Ukraine transit. Additionally, Gazprom can acquire short-term transit capacity through Ukraine without extending the current transit contract.[83] In this case, Ukraine will have to decommission a large part of its transit infrastructure, and the transit capacity available on a short-term basis will likely be around 10 bcm/year[84] (in our baseline scenario, we have assumed a maximum of 15 bcm/year of transit capacity through Ukraine is available).

[83] https://tass.com/economy/1626535
[84] https://www.icis.com/explore/resources/news/2023/06/12/10895288/interview-ukraine-can-cope-without-russian-gas-transit-if-eu-bans-imports-ex-gtsou-ceo/

Figure 9: Price differences between the sensitivity scenarios (S1-S4) and the baseline scenario



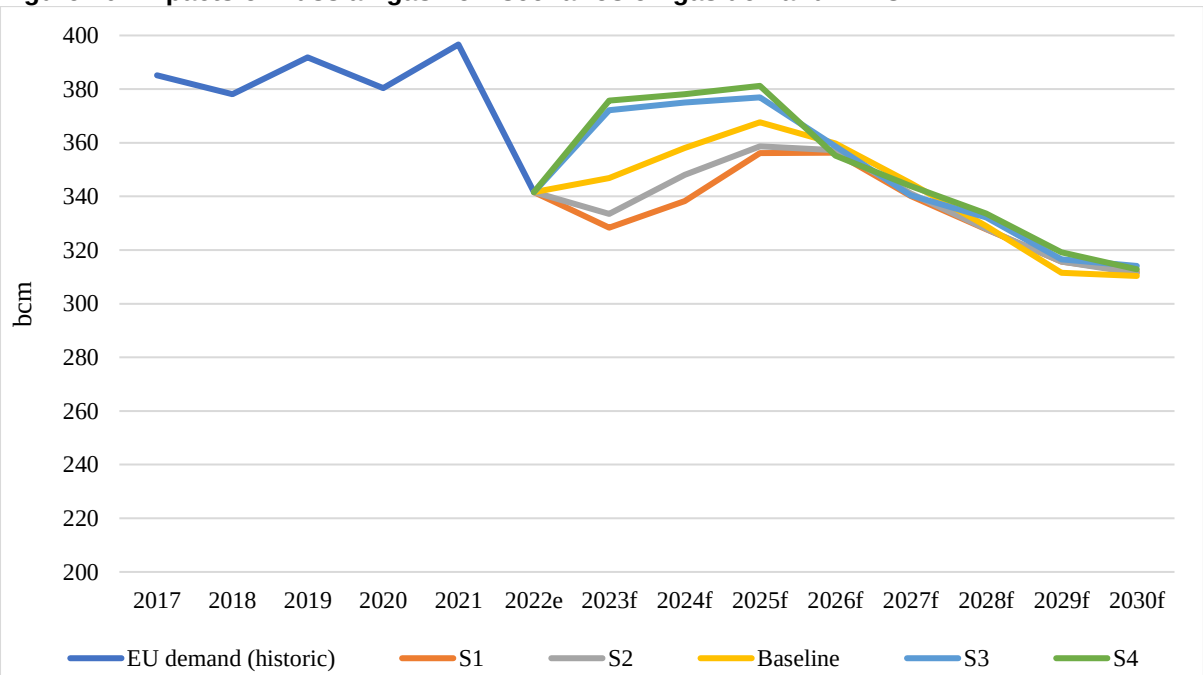
Notes: "f" is forecast by the model.

Source: Authors' analysis

While the impact of Russian gas on European gas prices will become more limited as we move closer to the end of this decade, Figure 10 shows that with any additional volume of (relatively cheap) Russian gas, European gas demand will rebound, especially before 2026. For example, of the potential 72 bcm of Russian gas exports in 2023 under Scenario 4, 47 bcm, or 65 per cent, could support incremental demand (at lower prices – an annual average of $8.9/MMBtu, see Figure 7), while 25 bcm would displace LNG. But in 2026 and beyond, almost the entire incremental Russian pipeline gas displaces other European supplies while only marginally supporting (creating) incremental demand.

All in all, in very tight energy market conditions before 2026, the incremental volume of pipeline gas from Russia (beyond the baseline scenario) will have a consequential impact both in terms of reducing prices (see Figure 7) and supporting additional demand in Europe (see Figure 10). Thus, there is a trade-off between the economic benefits and geopolitical implications of buying more from Russia in the next three years. Beyond 2026, any volume of gas coming from Russia will simply displace alternative supplies, bringing much more marginal economic benefits in terms of price reduction and supporting additional demand in Europe. That being said, then, the displaced LNG will likely end up in in Asia supporting phase out of coal while fueling gas demand (Figure 11 left panel) and economic growth at lower prices (Figure 11 right panel) than would be otherwise the case under a scenario of no pipeline flows from Russia to Europe.

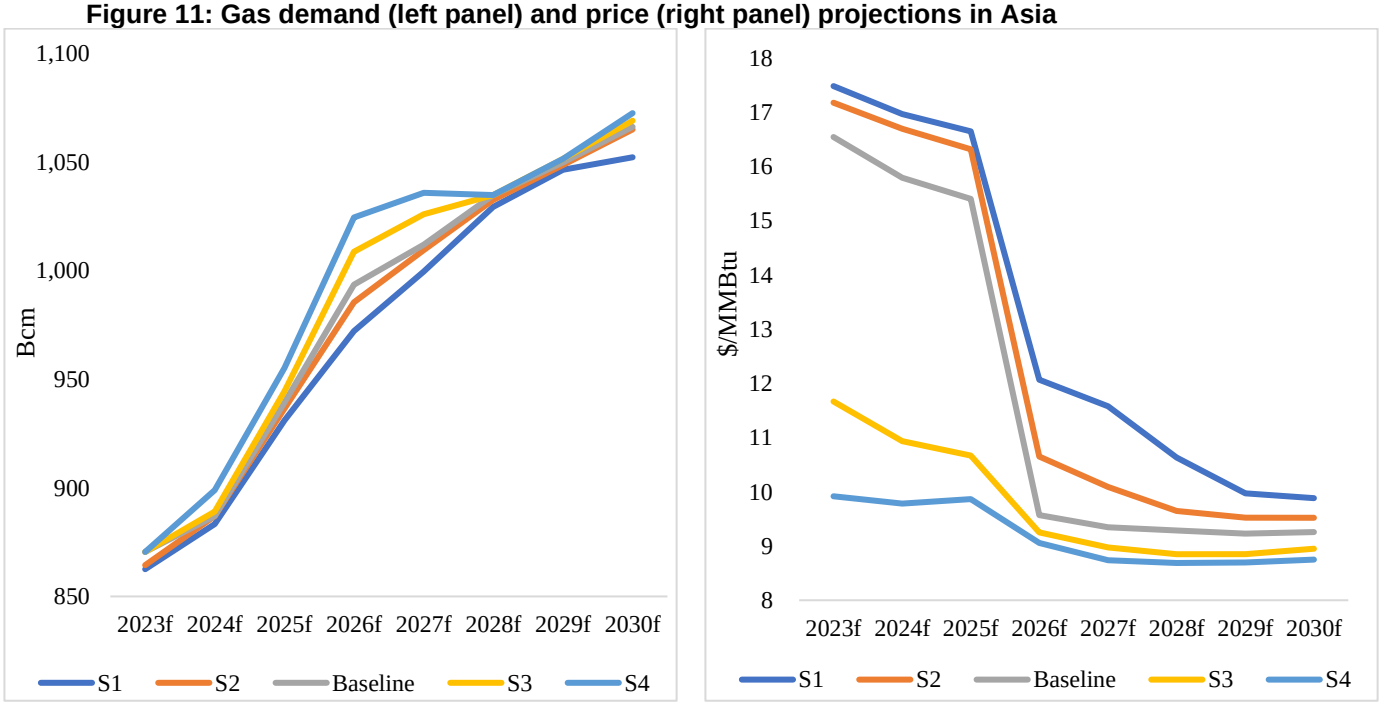
Figure 10: Impacts of Russian gas flow scenarios on gas demand in EU27



Notes: "e" is estimates; "f" is forecast by the model.

Source: Authors' analysis

Figure 11: Gas demand (left panel) and price (right panel) projections in Asia



Notes: "f" is forecast by the model; Asia includes China, India, Japan, South Korea, Taiwan, and Southeast Asia.

Source: Authors' analysis

In summary, Russian gas matters more before 2026 than after. This conclusion crucially depends on the assumption that an armada of new LNG capacity (around 171 bcma, more than enough to cover the pre-war level of Russia pipeline and LNG deliveries to Europe) will be delivered by 2026 and that Europe will continue its aggressive policy to roll out renewables in the power sector. Any delays in LNG

capacity addition or scaling up of renewables in Europe in line with what we have modelled will further shift the date by when Russian gas will become less important in Europe.

One final point on our scenarios and the results derived from them is a caveat that while the modelling framework is robust in capturing the 'steady-state' effects of dynamics in market fundamentals, there are limitations:

- The modelling estimates are reasonable steady-state impact estimations, but they are not good estimates of transitory, near-term impacts (such as imperfect foresight and trading imperfections, market power and speculative trading, and expectations).
- The modelling assumes average weather, a conservative gas demand estimate, and an average renewable generation and nuclear power performance. Extreme weather that pushes up gas demand (e.g., a combination of a colder than usual year with lower than usual wind and underperformance of nuclear and hydro generation) will likely amplify the difference between no-flow and more gas flow from Russia. Similarly, a weather situation that pushes down gas demand (e.g., a combination of a mild winter with higher wind and excellent nuclear and hydro generation profiles) will likely further marginalise the role of Russian gas in Europe.
- On the other hand, input assumptions for the power generation mix are very different to the ambitious FF55 or REPowerEU targets. If we believe those targets are achievable, this will push down gas demand in the power generation sector and limit the value of Russian gas significantly closer to the end of this decade. However, the policy targets will not alter the conclusions that Russian gas matters more before 2026 than after.
- Price impacts estimated by this modelling are average annual prices, but prices could be very high during winter when markets are tight. The difference between peak winter gas prices in the scenarios involving no-flows and more flows from Russia will likely be higher than the annual average prices.[85]

Overall conclusions

At present there is no likelihood of any increase in Russian gas exports to Europe. If anything, the most likely short-term risk is that flows through Ukraine are halted either by military activity, further sanctions, or the expiry of the transit contract at the end of 2024. However, depending on the ultimate outcome of the war some rebound in volumes cannot be excluded, although we believe it to be highly unlikely that they would return to their former pre-war levels.

A number of physical, contractual, and political factors need to be taken into consideration when considering possible scenarios for Russian pipeline gas exports to Europe. The first is available infrastructure. We conclude that it is very unlikely that flows through Nord Stream 1 or 2 will recommence soon, or that Yamal Europe will be used for Russian gas exports. The two available routes are therefore via Ukraine and via Turkey (the latter using one pipe on the TurkStream route). This limits the likely available capacity should European customers ever consider increasing purchases of Russian gas. We estimate that the maximum available level would be around 75bcma, and this would clearly only be possible in a very benign political post-war scenario.

The second key issue is Gazprom's sales strategy and the resolution of issues around long-term contracts (LTCs) with European customers. We have identified three types of LTC – those which have been cancelled, those under legal review, and those which continue to function. The latter covers flows of around 24-25 bcma at the contracted level, although there is flexibility around this level, while the contracts under legal review contain volumes of 80 bcma. The return of any of these volumes would be

[85] While we modelled inter-fuel competition in the power sector explicitly, the elasticity of gas demand in the residential and commercial sector is likely to be much lower in the winter months (heating season) than in the summer. Capturing this level of detail requires more data on behavioural responses and costs of those responses from households across Europe at a granular level, which is limited.

subject to significant legal debate and judgement, but even if the contracts are ultimately ruled to have expired or been terminated then some of the flows could be returned via the spot or short-term traded market.

Thirdly, geopolitics will also play a role. The question of the acceptability of Russian gas in Europe will no doubt be driven by the outcome of the war in Ukraine and by the moral stance taken by individual European countries in its aftermath. We make no attempt to judge this outcome, but obviously acknowledge its potential impact. The one concrete conclusion that can be reached is that the EU has doubled down on its strategy to diversify away from gas in its entirety by accelerating the energy transition and the deployment of renewable energy sources. We take this into account in our modelling of future Russian gas export scenarios.

A fourth factor which we acknowledge, but do not model, is the impact of Russian LNG imports. Volumes from the Yamal LNG project have increased sharply thanks to the attraction of premium prices in Europe, and they now account for 50 per cent of total current volumes of Russian gas delivered to the continent. While a debate about the future of Russian LNG imports is ongoing, we take the view that direct sanctions are unlikely, and we therefore assume that flows continue at their current levels. In addition, even if we are wrong and sanctions are imposed, this will have little impact on prices because Russian LNG will be re-directed in the global market and Europe will receive alternative supplies to balance any loss. It is the removal or addition of pipeline flows from Russia to Europe which makes a significant difference as they alter the overall global supply-demand balance.

With these major issues in mind, we then model a base case for Russian gas exports to Europe (at current flows) and compare it with four scenarios with flows ranging from zero to 75bcma in the period 2023-2030. Our overall finding is that the difference in price outcome is much more marked in the period to 2025, when the global gas market is tight, than in the period from 2026, when significant amounts of LNG come online. Indeed, in absolute terms the price impact in the 2023-2025 period is twice as large as the impact in the rest of the decade, leading to the overall conclusion that there are only two more years when European buyers would really benefit from increased availability of Russian gas but during these two years it is unlikely to be politically or morally acceptable to buy it. Beyond 2025, though, we would argue that the potential economic impact of Russian pipeline gas is set to decline sharply in the second half of the decade, to the extent that it may well become something of an irrelevance in terms of its ability to have a major impact on prices.

Appendix

The key assumptions for our European baseline gas demand scenario are as follows:

- **Industrial demand:** For the modelling years (2023-2030), we assume that European industrial gas demand is ca. **81 bcm/year**, 16 bcm lower than in 2021, in line with the recent IEA (2023)[86] analysis. The reduction of 16 bcm of industrial demand reflected the production curtailment (non-structural, 13 bcm) that happened in 2021-22 and efficiency improvements (structural, 3 bcm); thus, we assume that industrial production that was curtailed in 2021-22 will not come back to Europe in the modelled time horizon.
- **Residential demand:** For the modelling years, we assume normal temperatures and, therefore, our residential gas demand is around **90 bcm/year**, which is 18 bcm higher than the demand in 2022. In 2022, residential demand saw a reduction of 28 bcm in total (relative to 2021) (IEA, 2023). Energy efficiency accounted for a 3 bcm (2.93 per cent of 2021 levels) reduction (structural). In contrast, 7 bcm (6.83 per cent of 2021 levels) was due to the behavioural response and fuel switching, and the rest was due to warmer than usual weather in 2022.
- **Commercial demand:** for the modelling years, we assume normal temperature and therefore, our commercial demand is approximately **39 bcm/year**, which is 14 per cent lower than the demand in 2021.
- **Power sector:** The model endogenously optimises gas demand in the power sector based on commodity price assumptions, gas supply costs, and power generation capacity assumptions (Figure 8). In 2023 we assume 173.7 GW of gas generation capacity in Europe and 160.4 GW in 2030. As an illustration, gas demand in the power generation sector could be as high as 252 bcm in 2023 and 233 bcm in 2030, assuming baseload running mode with a capacity factor of 92 per cent and average efficiency of 50 per cent.
- **Energy industry own-use**: The model assumes this is 4.5 per cent of total gas demand in the residential, commercial, industrial, and power generation sectors.

Gas demand in Europe and other regions is endogenously optimised based on supply, demand, commodity prices, and cost assumptions. In particular, there are three sources of demand responses that we model: (1) 7 bcm of residential demand response (behavioural response) in Europe (IEA, 2023), (2) 7 bcm of industrial demand response in Europe (IEA, 2023), and (3) fully endogenous modelling of power sector inter-fuel competition in Europe and other regional markets.[87]

Meanwhile Table 3 outlines the optimised flows from Russia through Ukraine and TurkStream for each supply scenario.

[86] https://www.iea.org/commentaries/europe-s-energy-crisis-what-factors-drove-the-record-fall-in-natural-gas-demand-in-2022
[87] North America, Central and South America, Russia, Middle East, Africa, Southeast Asia, China, India, Japan, South Korea and Taiwan

Table 3: Russian gas pipeline export to Europe by scenario

	S2		Baseline		S3		S4	
	UA	TurkStream*	UA	TurkStream*	UA	TurkStream*	UA	TurkStream*
2023	0	11	15	11	40	12	60	11
2024	0	13	15	12	40	12	60	12
2025	0	14	15	14	40	13	60	13
2026	0	14	15	13	40	13	60	12
2027	0	15	15	15	40	14	60	14
2028	0	14	15	14	40	14	60	14
2029	0	14	15	14	40	14	60	14
2030	0	14	15	14	40	14	60	14

Notes: * flow to Europe

Source: Authors' analysis