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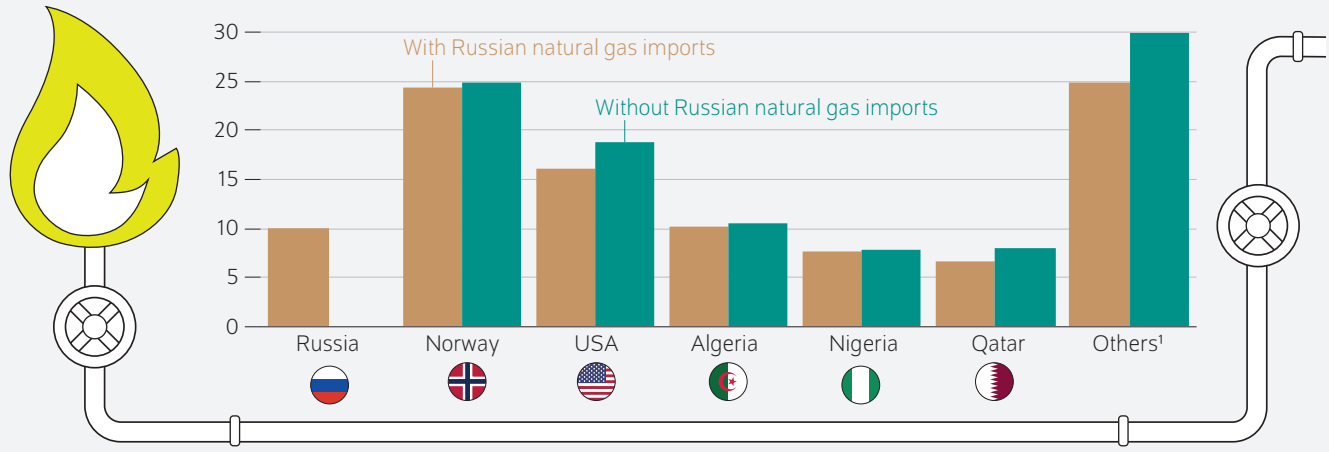
AT A GLANCE

Sanctions against Russian gas would not endanger EU or German gas supply

By Franziska Holz, Lukas Barner, Claudia Kemfert, and Christian von Hirschhausen

- Model-based analysis investigates if EU countries could compensate for a disruption of Russian natural gas imports in different demand scenarios
- It would be possible to completely forego Russian natural gas even if EU gas demand remains high in the EU until 2030
- In almost all scenarios, EU gas demand could be covered by pipeline imports from other countries and LNG without requiring infrastructure expansion
- Central and Eastern European EU countries heavily dependent on Russian natural gas could also have a secure supply without Russian imports
- Increased energy savings efforts and a timely natural gas phase-out would reduce dependency on Russia and contribute to climate change mitigation

An end to Russian natural gas imports could be compensated for by other suppliers
Share in EU imports in 2030, assuming stable natural gas demand in two model scenarios



Source: Authors' calculations. 1 Such as the Netherlands, Azerbaijan, Turkmenistan, and Egypt.

FROM THE AUTHORS

"No EU Member State needs to be concerned about its gas supply if Russian gas is sanctioned. Gas from other producers and small energy savings can compensate for the loss of Russian gas. Further expanding LNG capacities is not needed."

— Franziska Holz —

MEDIA

Audio Interview with Franziska Holz (in German)
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Sanctions against Russian gas would not endanger EU or German gas supply

By Franziska Holz, Lukas Barner, Claudia Kemfert, and Christian von Hirschhausen

ABSTRACT

As a result of the Russian attack on Ukraine, natural gas prices skyrocketed in 2022 and Germany in particular felt the impact of its strong dependency on Russia. Prices have since relaxed, the European natural gas industry has overcome the uncertainty due to the energy crisis in 2022, and the industry also survived the slump in Russian natural gas imports without supply interruptions. However, Russia continues to export liquefied natural gas (LNG) to Europe and still has some countries in Central and Eastern Europe under control in terms of energy policy, which has so far prevented EU sanctions on Russian natural gas exports. Both the German and European natural gas supplies would be secure in the long term without Russian imports, as shown by model calculations using the Global Gas Model which depicts the global natural gas industry in great detail. Security of supply is, thus, not standing in the way of further EU sanctions against Russia. Increased efforts to save energy and a timely natural gas phase-out would reduce dependency on gas imports, which will also contribute to climate change mitigation.

Russian natural gas exports to the European Union have reduced drastically over the course of the Russo-Ukrainian War. As a result, there have been concerns in the EU that Russian imports could not be adequately replaced. Member States were therefore not able to agree on sanctions against Russian natural gas, unlike for coal and pipeline-based oil exports. The EU is currently considering a new push for gas sanctions against Russia that are directed against the transshipment of Russian liquefied natural gas (LNG) in European ports.

As the gas transit agreement between Russia and Ukraine will expire at the end of 2024 and the Russo-Ukrainian war is still ongoing, a complete stop of all Russian imports to the EU is conceivable. In contrast, it is less likely that international relations will recover and that the volume of Russian gas imports will increase again. Therefore, this Weekly Report uses a model to analyze the effects of various scenarios on the European natural gas supply. The analysis also considers differentiated developments regarding the global natural gas supply and demand that could occur depending on various climate policy scenarios.

A disruption of Russian natural gas imports is a scenario that has been frequently analyzed, even before the Russo-Ukrainian War.[1] Theoretically, a reduction of supplies can be compensated for in three ways. First, Russian imports could be replaced by imports from other sources; second, demand can be reduced and energy can be saved; and third, infrastructure bottlenecks can be eliminated, for example through more efficient pipeline management. These measures are reflected in the political strategies from 2022, such as in the RePowerEU package.[2]

1 Cf. for example Hella Engerer et al. "European Natural Gas Supply Secure Despite Political Crises" *DIW Economic Bulletin* no. 8 (2014) (available online; accessed May 21, 2024. This applies to all other online sources in this report unless stated otherwise); Franziska Holz et al., "European Natural Gas Infrastructure: The Role of Gazprom in European Natural Gas Supplies," *DIW Politikberatung kompakt* no. 81 (2014) (available online). The topic has been discussed ever since, cf. for example Nikita Moskalenko et al., "Europe's independence from Russian natural gas — Effects of import restrictions on energy system development," *Energy Reports* 11 (2014): 2853–2866 (available online).

2 European Commission, *REPowerEU-Plan* (2022) (available online).

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EU countries were able to quickly compensate for lower Russian exports in 2022

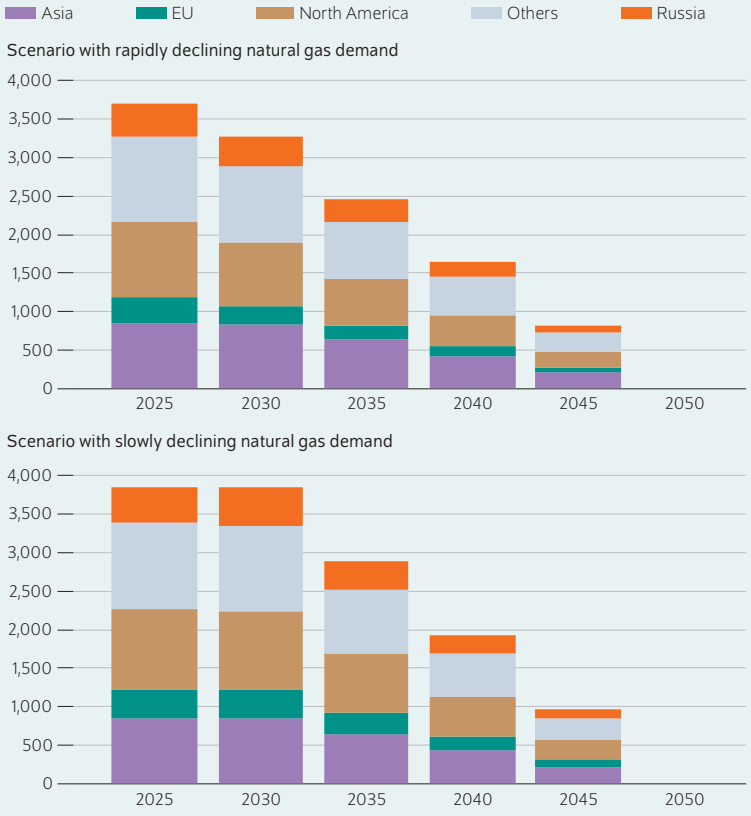
As a result of the ongoing Russo-Ukrainian War, Russia interrupted its supply of natural gas to pipelines exporting directly to Germany and Poland. Nevertheless, Russia is currently still supplying numerous EU Member States, both via Türkiye as well as via LNG and, paradoxically, via Ukraine (Box 1). For example, as of winter 2023–2024, more than 95 percent of Austria's gas imports are from Russia.[3] The ongoing dependency of Central and Eastern EU Member States on Russia is an important reason that the EU did not sanction Russian natural gas exports.

In each of the first two quarters of 2021—before the Russo-Ukrainian War began—the EU purchased over 40 billion cubic meters of natural gas from Russia, which corresponded to over 45 percent of the EU's total gas imports. In the same period in 2023, this amount was reduced to 10.5 billion cubic meters per quarter. Of that, three billion cubic meters were delivered via Ukraine and around 2.5 billion cubic meters via Türkiye. Moreover, around five billion cubic meters of Russian LNG are imported each quarter.[4]

However, the gas transit agreement between Russia and Ukraine will end on December 31, 2024. At the same time, it is unlikely that the Nord Stream and Nord Stream 2 Baltic Sea pipelines will be recommissioned in the near future due to the ongoing war and physical damage to the pipelines as a result of explosions in September 2022. Overall, this leads to the question of whether Europe would have a sufficient supply without Russian natural gas via Ukraine and Türkiye and LNG imports.

Figure 1

Development of global natural gas demand until 2050 by climate action scenario
In billion cubic meters per year



Source: Authors' calculations.

The current global natural gas demand of 3,800 billion cubic meters falls to zero by 2050 in both scenarios.

Development of European natural gas markets depending on supply and demand

This Weekly Report uses the Global Gas Model (GGM), which has been used in research and policy advice for many years (Box 2), to analyze the medium and long-term European natural gas supply. For Europe, the effects of global climate policy trends in particular are decisive for global natural gas production and demand as well as geopolitical developments related to Russia. Therefore, two global climate action scenarios on the demand side are combined with three scenarios for Russian exports on the supply side.

Scenarios for the development of EU gas demand and Russian supply limitations

The different climate policy ambitions are depicted in two exemplary scenarios. In the first scenario, which could be considered our reference scenario, global natural gas demand is reduced rapidly until 2050, as would be expected with ambitious climate policy (scenario with rapidly declining natural gas demand). In the second scenario, natural gas demand is reduced at a delayed pace until it falls to zero in 2050 (scenario with slowly declining natural gas demand). This would be conceivable if, for example, natural gas first had to compensate for the missing power generation from closing nuclear power plants. In this scenario, natural gas demand in the EU remains at a constant level until the 2030s. Simultaneously, there is a marked decline in European natural gas production. Thus, this scenario has the highest import dependency in the next years (Figure 1).[5]

3 Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie, *Österreichs Energie-Infoportal* (2024) (in German; available online).

4 Cf. the data in Ben McWilliams et al, *European Natural Gas Imports* (Bruegel Datasets) (available online), which has been continuously updated since June 2022.

5 Other scenarios are conceivable, such as those in which a complete natural gas phase-out is not achieved by 2050. Two scenarios were defined that do not meet the requirements of the Paris Agreement. In the Moderate Climate Ambition scenario, global natural gas demand declines and there are moderately improved climate action ambitions in Europe. In the No Climate Ambition scenario, in contrast, there is unlimited use of natural gas without climate action. Both scenarios result in lower medium-term import demand in Europe than the scenario with slowly decreasing demand described in this Weekly Report. Cf. the data specifications of these scenarios (available online).

Box 1

The history of natural gas and geopolitics

Natural gas has been a significant part of the European energy system since the 1970s. Since then, geopolitics has played a central role in issues such as price setting and security of supply. To secure the supply of Germany and other European countries, long-term contracts have been concluded with governments, such as one with the Netherlands in the 1970s and one with Norway in the 1980s.[1] As natural gas markets became globalized through the development of LNG transport, these agreements were expanded to other continents. As of 2024, the global LNG market is dominated by American, Australian, and Qatari suppliers.

Natural gas delivered via pipeline from the Soviet Union was part of the Western European energy mix even during the Cold War. However, it has been viewed critically by the USA from the beginning.[2] While the USA's embargo threats in the 1960s still blocked rapprochement, some Western European countries and the Soviet Union concluded long-term contracts from the early 1970s onward that established the delivery and financing of pipelines by Germany in exchange for the Soviet natural gas supplies.

Up until the 1990s, the Member States of the current EU obtained Soviet natural gas almost exclusively via Ukraine. Back then, this pipeline system had a capacity of nearly 150 billion cubic meters per year, more than one third of the current natural gas consumption in the EU.[3] Following the collapse of the Soviet Union, Russia diversified its export routes, primarily to avoid geostrategic dependencies on the newly independent Ukraine.[4]

This diversification began in the 1990s with the construction of the Yamal–Europe pipeline via Belarus and Poland and continued in the late 2000s with the first Nord Stream project through the Baltic Sea.[5] Since 2011, Germany and parts of Western and Eastern Europe have been supplied via the Nord Stream pipeline, which had a capacity of 55 billion cubic meters per year.[6]

From the outset, Nord Stream 2 also served to bypass Ukraine as a transit country without being necessary for the energy sector.[7] This also became clear in the transit agreement concluded between Russia and Ukraine in 2019. This agreement prescribes the transit of only 65 billion cubic meters in 2020 and 40 billion cubic meters each year in 2021 through 2024.

Recently, Russian export possibilities to Europe were further diversified by opening up the route via Türkiye as well as by building up substantial liquefaction capacities. At the same time, the sales of pipeline gas were diversified with the construction of the first pipelines connecting to China.

1 Anne Neumann, Sophia Rüster, and Christian von Hirschhausen, "Long-Term Contracts in the Natural Gas Industry – Literature Survey and Data on 426 Contracts (1965–2014)," *DIW Data Documentation* no. 77 (2015) (available online).

2 For more on this, see Otto Wolff von Amerongen, *Der Weg nach Osten: Vierzig Jahre Brückenbau für die deutsche Wirtschaft* (Munich: Droemer Knaur, 1992): 208ff (in German).

3 However, due to a lack of pipeline maintenance and the decommissioning of individual border-crossing points, this capacity has declined in the past decades.

4 Cf. Hella Engerer und Christian von Hirschhausen, "Ukrainische Energiewirtschaft: Beschwerlicher Weg in die Eigenständigkeit," *DIW Wochenbericht* no. 17 (1996): 277–284 (in German; available online).

5 For a game theory analysis, cf. Christian von Hirschhausen, Berit Meinhart, and Ferdinand Pavel, "Transporting Russian Gas to Western Europe — A Simulation Analysis," *The Energy Journal* 26, no. 2 (2005): 49–68 (available online); as well as Franz Hubert and Svetlana Ikonnikova, "Investment Options and Bargaining Power: Investment Options and the Eurasian Supply Chain for Natural Gas," *The Journal of Industrial Economics* 59, no. 1 (2011): 85–116 (available online).

6 Engerer and von Hirschhausen, "Ukrainische Energiewirtschaft."

7 See Anne Neumann et al., "Erdgasversorgung: Weitere Ostsee-Pipeline ist überflüssig," *DIW Wochenbericht* no. 27 (2018): 589–597 (in German; available online).

Both demand scenarios are combined with different assumptions about the availability of Russian natural gas in Europe: The New Normal Scenario roughly corresponds to the current situation as of 2024, with partially available capacities via Ukraine and Türkiye as well as unlimited imports of Russian LNG. This is compared to a scenario with a complete stop of Russian imports to Europe (Sanctions Scenario) and to a scenario assuming large volumes of imports from Russia (Pre-War Scenario). The last scenario is somewhat different from the situation before 2022 because it includes the increased diversification efforts of European imports compared to the 2010s.

Russian natural gas could be replaced in the entire EU

It became clear in 2022 that Russian natural gas could be largely replaced by a combination of imports from other sources and a decline in demand. However, Central and Eastern European countries are still purchasing Russian pipeline gas and LNG. As the New Normal Scenario shows, it is possible to continue this import strategy in the short term, both with rapidly declining demand (Figure 2, top) as well as delayed declining demand (Figure 3, top). The share of Russian gas would fall to around ten to 15 percent of the European natural gas supply in the long run.

The model calculations show that completely foregoing Russian natural gas (Sanctions Scenario) would be possible for the EU and would require demand to decline only slightly. This is made possible as a result of sufficient available import capacities and ample natural gas volumes on the global market (Figure 2, center).[6] In this case, more LNG would be

6 The prices calculated in the model increase only moderately in the EU Member States (approx. ten percent). However, it must be noted that equilibrium prices are calculated, which do not include factors such as uncertainty and short-term adjustments. However, such factors caused the enormous price increase in 2022 to, at times, almost ten times the pre-war price.

imported overall, for example from the USA. Even in a scenario in which natural gas demand in the EU remains consistently high until 2030, a complete supply stop of Russian natural gas to the EU would be possible (Figure 3, center).

In the Pre-War Scenario, in which a greater volume of Russian imports becomes available again in the EU, Russia would export more natural gas to Europe in a scenario with initially stable and high demand (Figure 3, bottom) than in the scenario with rapidly declining demand (Figure 2, bottom). However, due to greater diversification, Russia would not be as dominant as supplier as it was before the war.

Norway became the EU's most important natural gas supplier in 2022 and will remain so in the alternative scenarios and in the next decades. The share of EU imports coming from Norway will depend on the role of Russia, especially in the coming years. In the longer term, the extent of climate action will determine the volume of Norwegian imports, which is lower in the rapid phase-out scenario compared to the scenario with a slow decline in demand. The medium and long-term natural gas strategy is controversial in Norway, as deposits north of the Arctic Circle must be exploited to maintain the current annual production capacity of over 100 billion cubic meters. Due to its proximity to the EU and privileged political relations, Norway can also supply more than 50 billion cubic meters per year to the EU in the 2030s and retain an important role until Europe phases out natural gas use completely.

Current LNG import terminal construction plans are too large, even with high demand until 2030

LNG became a larger share of European imports than in previous years relatively quickly in 2022 in order to compensate for the decline in Russian natural gas. This was possible because, on the one hand, a significant amount of unused LNG import capacity was available along the European coasts. On the other hand, LNG supply and global liquefication capacities have increased since 2016, with the entry of the USA and Russia into the LNG trade being particularly significant.

Accordingly, LNG imports play a larger role in the model results than they did in the 2010s (Figure 4). In the New Normal and Sanctions Scenarios, other pipeline imports, especially from Norway, North Africa, and the Caspian Sea region, can only partially compensate for the marked decline in pipeline imports from Russa.

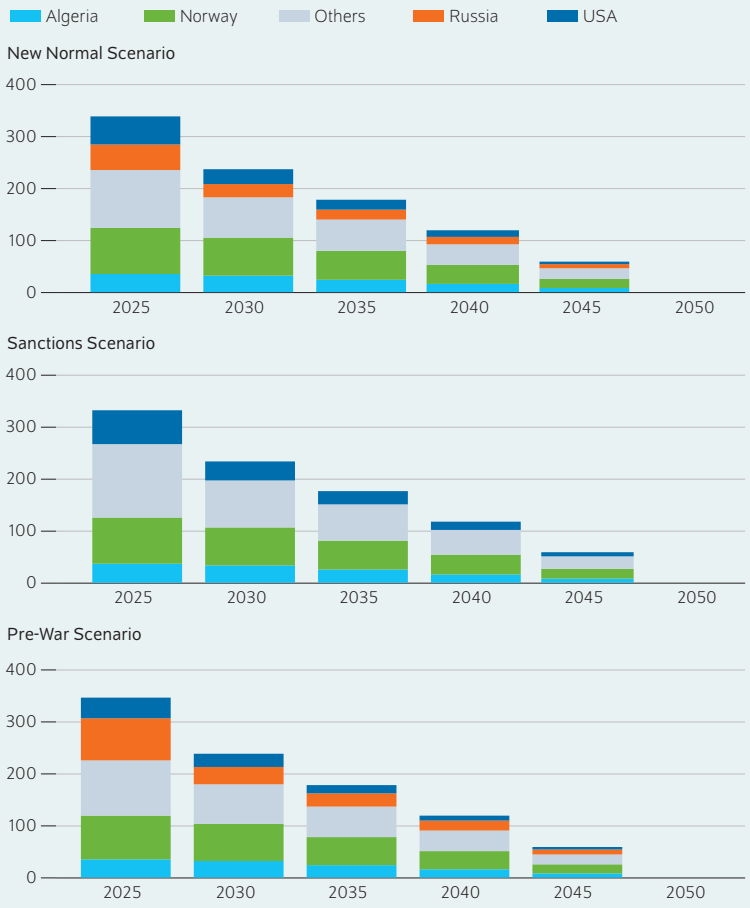
The share of LNG of total imports increases primarily in the scenario with a slow decline in demand that assumes continuously high consumption until the beginning of the 2030s with lower EU production. At its peak, up to 167 billion cubic meters of LNG would be imported to the EU in this scenario, which would be nearly 50 percent of total gas imports.

In almost all combined scenarios, however, these LNG imports could be realized without requiring the LNG terminal expansions currently being planned, which shall increase capacity in the EU to well over 200 billion cubic meters per year.[7] A small expansion of LNG import capacities, namely in Croatia and Italy, would be necessary only in the scenario with high demand and a complete end of Russian imports. The existing capacities in continental Northwestern Europe would be used with higher capacity utilization rates than they have been in past years, especially in the New Normal and Sanctions Scenarios with a low volume of imports and no imports from Russia, respectively. In the scenario where demand declines immediately, the EU would require at most 127 billion cubic meters of LNG imports if there were no Russian imports.

Figure 2

EU-wide natural gas consumption until 2050 with rapidly declining demand

In billion cubic meters per year by country of production depending on Russian supply scenario



Source: Authors' calculations.

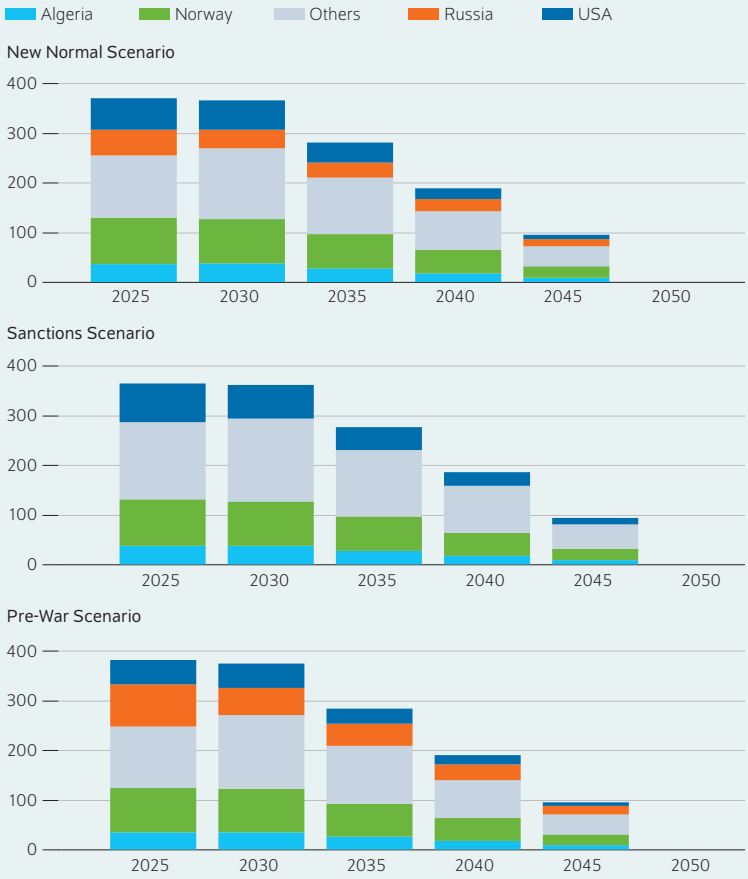
A complete loss of Russian imports, as in the Sanctions Scenario, could be compensated for by increasing the imports from other countries.

7 Institute for Energy Economics and Financial Analysis, *European LNG Tracker* (2024) (available online). Numbers excluding Spain and Portugal, as the LNG terminals there cannot be used for imports to the rest of the EU due to low pipeline capacities to France.

Figure 3

EU-wide natural gas consumption until 2050 with slowly declining demand

In billion cubic meters per year by country of production depending on Russian supply scenario



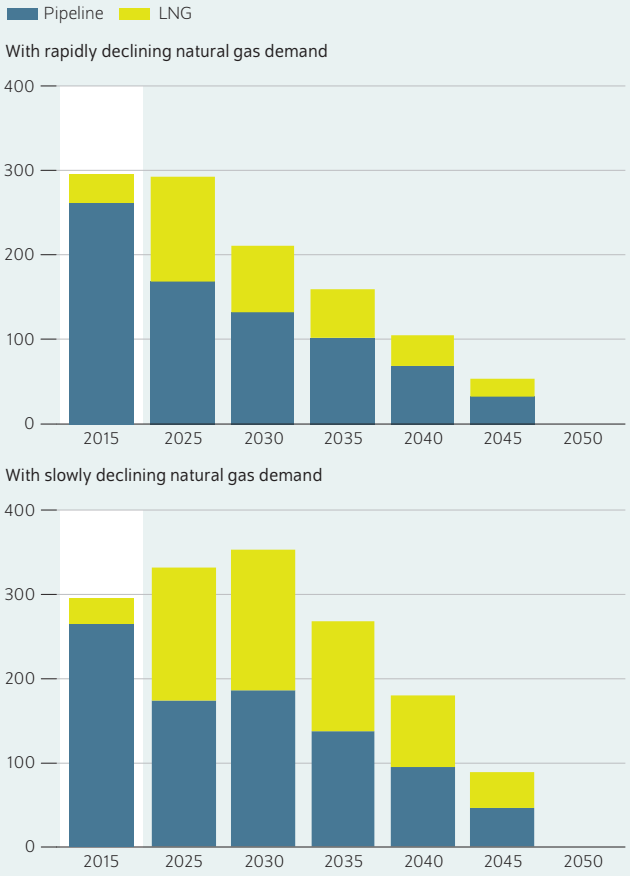
Source: Authors' calculations.

A complete disruption of imports from Russian can be compensated for, even in a scenario with high demand until 2030.

Figure 4

Pipeline and LNG imports to the EU in the Sanctions Scenario

In billion cubic meters per year depending on demand scenario



Sources: International Energy Agency (for 2015); authors' calculations.

LNG imports play a significant role, especially in the scenario with slowly declining demand.

Europe has an extensive pipeline network which enables importers in countries without LNG ports to purchase LNG from the world markets. Germany, for example, imported LNG without its own terminals via harbors in Belgium and the Netherlands. However, the large LNG import capacities of the Iberian Peninsula (Spain and Portugal, with a total of over 60 billion cubic meters of import capacity) are cut off from the rest of Europe due to limited pipeline capacities between Spain and France.[8]

Central and Eastern Europe can secure their natural gas supply without Russia

Many Central and Eastern European EU Member States, such as Hungary and Austria, continue to be heavily dependent on Russian natural gas. The model calculations show that these countries could also compensate for a complete end of Russian imports (Figure 5). LNG imports from the USA and Qatar would play a particularly important role, as would natural gas delivered via pipelines from Norway and the Caspian Sea region (for example Azerbaijan and Turkmenistan). For some countries, domestic gas production continues to be important, especially for Romania.

8 The problem of low cross-border capacity between Spain and France has been known for many years, cf. for example Engerer et al., "European Natural Gas Supply Secure Despite Political Crises." There were brief political efforts to agree on an expansion during the energy crisis in 2022, but nothing came to fruition.

Russia can increase exports to Asia, but will have to accept losses

Russia can only partially compensate for the end of its exports to Europe by redirecting natural gas exports to Asia. In the short term, the export possibilities are limited to LNG and the Power of Siberia pipeline running to China. It can be assumed that pipeline capacities can be expanded in the medium and long term.

Russian gas exports have been increasingly oriented towards Asia for some time now, regardless of the geopolitical situation.[9] This is the result of both growing demand in Asia as well as overall demand shrinking in Europe.

However, China has a lower willingness to pay than previous European importers, meaning a decline in Russia's revenue can be expected. Russia also obtains low prices (because they are set by the government) with the volumes that have shifted to the domestic market.

Efficient infrastructure utilization is a cost-effective option for improving security of supply

In addition to diversifying natural gas imports and reducing demand, more efficient use of existing natural gas infrastructure can also contribute to further easing the situation in Europe. Up until now, this infrastructure has not been used efficiently, especially in cross-border gas trade. In this case, the commercial pipeline capacities are negotiated bilaterally, meaning it may not be possible to use the entire available infrastructure.

Also within some Member States, the current congestion management scheme, the entry-exit system, prevents full infrastructure utilization and creates artificial scarcity.[10] With efficient use, in contrast, cross-operator optimization would be possible, as has long been the practice in the electricity sector in the USA.[11] Inefficient network management in the natural gas industry has been criticized since the market's liberalization in Europe in 1998, but has still not been resolved despite gradual progress.[12]

Box 2

Global Gas Model

The Global Gas Model was developed by researchers at the Norwegian University of Science and Technology (NTNU) and DIW Berlin and has been regularly updated for over ten years.[1] The model depicts all relevant actors in the natural gas industry: natural gas producers, natural gas traders, LNG export terminals (liquefaction), LNG ships, LNG import terminals (regasification), pipeline operators, storage operators, and a final demand comprised of different sectors. Costs, capacity assumptions, and assumptions about the costs of expanding infrastructure capacities are included in the model for each actor and each country. The model distinguishes between 136 regions (nodes) that are connected to each other via pipeline or LNG transport routes. In the model calculations, both the current import and transport capacities as well as the possibility of expanding pipeline or harbor capacities are considered. Natural gas suppliers can exercise market power, especially Russia, the USA, Qatar, Iran, Saudi Arabia, and Algeria. The model calculations are performed at five-year steps until 2060. Assumptions must be made about future demand and production volumes in all countries that are needed to parameterize the demand and supply functions. For the results presented in this Weekly Report, the model data were updated and the start year was set to 2020 in order to be able to calculate investments for the first observation year (2025). Furthermore, an updated and open-source version is now available.[2]

1 Ruud Egging and Franziska Holz, "Global Gas Model: Model and Data Documentation v3.0 (2019)," *DIW Data Documentation* no. 100 (2019) (available online).

2 The model code and data are available online.

Conclusion: Natural gas phase-out is the best instrument for avoiding future import dependency

Overall, the German and European energy industries survived the loss of Russian pipeline exports without major disruptions. Energy savings efforts, diversifying suppliers, and flexible network management have offset the bottlenecks. The wholesale prices of natural gas have declined sharply since September 2022, supply disruptions have not occurred, and the "crisis" in the natural gas industry has been over since at least spring 2023.

However, the EU is still purchasing gas from Russia via pipeline and as LNG. The issue of gas sanctions against Russia is not off the table in view of the ongoing war in Ukraine. Currently, the EU is considering sanctions against Russian LNG. Thus, the European Commission wants to ban the use of European harbors for the onward shipment of Russian LNG to third countries, which is currently happening, for example in Zeebrugge (Belgium).

9 Franziska Holz, Philipp M. Richter, and Ruud Egging, "A Global Perspective on the Future of Natural Gas: Resources, Trade, and Climate Constraints," *Review of Environmental Economics and Policy* 9, no. 1 (2015): 85–106.

10 [10] In the entry-exit system, the gas supplier must purchase network capacity on a piecemeal basis, which can be restricted relatively freely by the individual network operators.

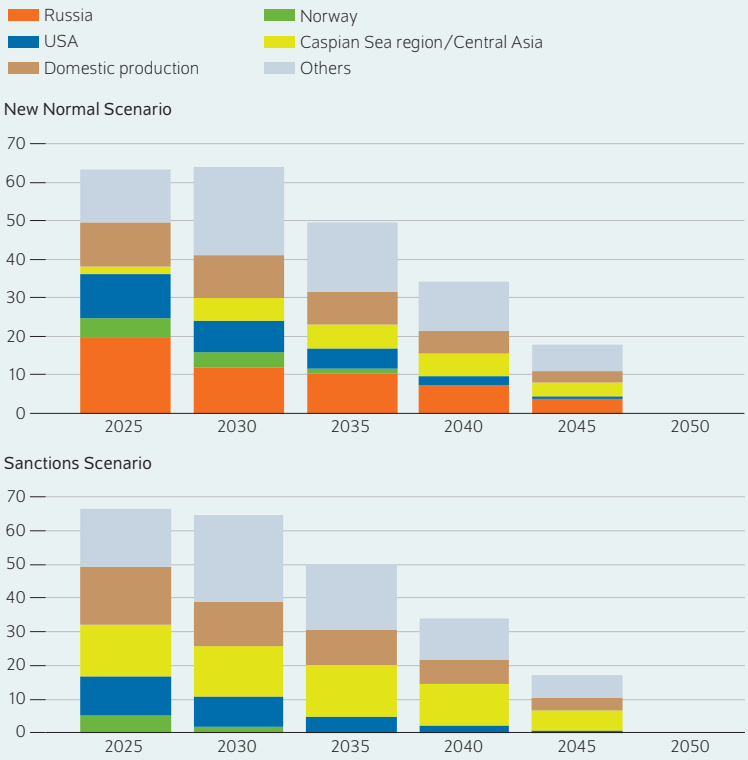
11 See Fred C. Schweppe et al., *Spot Pricing of Electricity* (Boston, USA: Kluwer, 1988); as well as William W. Hogan, "Contract Networks for Electric Power Transmission," *Journal of Regulatory Economics* 4, no. 3 (1992): 211–242 (available online).

12 For more on this, see Christian von Hirschhausen, "Infrastructure, Regulation, Investment and Security of Supply: A Case Study of the Restructured US Natural Gas Market," *Utilities Policy* 16, no. 1 (2008): 1–10 (available online); as well as Jeff D. Makholm, *The Political Economy of Pipelines: A Century of Comparative Institutional Development* (The University of Chicago Press, 2012).

Figure 5

Natural gas demand in Central and Eastern European countries with slowly declining demand

In billion cubic meters per year by country of production



Note: The countries included here are Estonia, Latvia, Lithuania, Poland, Slovenia, Croatia, Austria, Hungary, Czechia, Slovakia, Bulgaria, and Romania.

Source: Authors' calculations.

Even the Eastern European EU Member States that are still very dependent on Russia could compensate for a disruption of Russian imports.

Model calculations show that the EU can maintain a sufficient supply of natural gas without Russian imports even if demand remains at today's level. In the short term, additional deliveries from Norway and LNG imports at existing import terminals are contributing to diversification. In the medium and long term, the European energy sector is heading to a natural gas phase-out. The rapid switch to renewable energy sources can significantly contribute to reducing import dependencies and, thus, the supposed risk of some European countries to be blackmailed. Hence, security of supply is no reason for the EU to not sanction Russian gas imports.

European natural gas infrastructure, such as pipelines, LNG terminals, and compressor stations, has been significantly expanded since the 2005–2006 Russia–Ukraine gas dispute and only requires minor expansion, even with moderate climate action and continued high natural gas demand. In particular, the currently planned expansion of European LNG capacities seems to be too extensive. Efficient use of existing pipeline capacities, in contrast, strengthens security of supply and keeps costs low.

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LEGAL AND EDITORIAL DETAILS

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