THE OXFORD INSTITUTE FOR ENERGY STUDIES

December 2021

A Series of Unfortunate Events

Supply-side factors in the European gas price rally in 2021 and outlook for the rest of winter

Introduction

European gas prices have been on a rollercoaster ride in the past two years. In 2019, oversupply on the global LNG market led to a gradual price decline that was subsequently intensified by the impact of the first wave of the COVID-19 pandemic in Europe in Q2-2020. This decline in prices was analysed in a series of papers at OIES by Mike Fulwood[1] [2] [3] [4] and in our regular OIES Quarterly Gas Review series.[5] As summer turned to autumn in 2020, prices recovered, but with European storage once again effectively full at the start of winter, the seasonal price increase remained modest.

In mid-winter 2020/21, a rolling wave of particularly cold weather spread across the northern hemisphere. In January 2021, it led to an Asian LNG pricing spike.[6] In February, snow storms impacted US Gulf Coast LNG exports, with cargo loadings being completely suspended for several days.[7] In Europe, spells of unusually cold weather occurred repeatedly between February and May, interspersed with shorter spells of warmer weather.[8] [9] [10] [11] Finally, in March, the Suez Canal was blocked for a week

---

[1] Fulwood, M., 2019. Could we see $2 gas in Europe in 2020? *Oxford Energy Comment*, 22 October. https://www.oxfordenergy.org/wpcms/wp-content/uploads/2019/10/Could-we-see-2-gas-in-Europe-in-2020.pdf

[2] Fulwood, M., 2020. $2 gas in Europe is here: who will blink first? *Oxford Energy Comment*, 12 March. https://www.oxfordenergy.org/publications/2-gas-in-europe-is-here-who-will-blink-first/

[3] Fulwood, M. & Sharples, J., 2020. $2 Gas in Europe (Part III): Down, Down, Deeper and Down. *Oxford Energy Comment*, 16 June. https://www.oxfordenergy.org/publications/2-gas-in-europe-part-iii-down-down-deeper-and-down/

[4] Fulwood, M. & Sharples, J., 2020. $2 Gas in Europe: Groundhog Day? *Oxford Energy Comment*, 16 October. https://www.oxfordenergy.org/publications/2-gas-in-europe-groundhog-day/

[5] The Oxford Institute for Energy Studies Quarterly Gas Review is available here: https://www.oxfordenergy.org/publication-topic/quarterly-gas-review/

[6] Fulwood, M., 2021. Asia LNG Price Spike: Perfect Storm or Structural Failure? *Oxford Energy Comment*, 17 February. https://www.oxfordenergy.org/wpcms/wp-content/uploads/2021/02/Asia-LNG-Price-Spike.pdf

[7] Platts, 2021. US LNG exports stall on arctic blast. *Platts*, 17 February. https://www.spglobal.com/platts/en/market-insights/latest-news/natural-gas/021721-us-lng-exports-stall-on-arctic-blast

[8] EUMetSat, 2021. February 2021: very cold first half in Europe and North America. *EUMetSat*, 11 February. https://www.eumetsat.int/february-2021-very-cold-first-half-europe-and-north-america

[9] Korosec, M., 2021. Colder than normal weather across Europe will extend for at least another week as new cold wave spreads across a large part of the continent. *Severe Weather EU*, 15 March. https://www.severe-weather.eu/europe-weather/pattern-change-europe-cold-wave-snow-winter-mk/

[10] Copernicus, 2021. Spring 2021 in Europe: was it really so cold? *Copernicus Climate Change Service*, 11 June. https://climate.copernicus.eu/spring-2021-europe-was-it-really-so-cold

[11] Barbiroglio, E., 2021. 2021 European Cold Spring Does Not Mean Climate Change Is Fake. *Forbes*, 19 May. https://www.forbes.com/sites/emanuelabarbiroglio/2021/05/19/2021-european-cold-spring-does-not-mean-climate-change-is-fake/

Jack Sharples, Research Fellow, OIES

as a container ship, the *Ever Given*, became lodged, causing further (albeit brief) LNG market disruption.[12] Yet, aside from a one-day spike on 12 January 2021 (26.47 EUR/MWh - 9.44 USD/MMBtu), the TTF Front-Month price – a European benchmark – did not exceed 22.50 EUR/MWh (8 USD/MMBtu) until 30 April. Rather, the TTF Front-Month price declined to a low point of 15.50 EUR/MWh (5.49 USD/MMBtu) on 3 March 2021, before starting to rise again.

Given that the European market did not experience any sustained pricing surges in Q1-2021 despite the global market conditions noted above, the fact that European prices subsequently rose continuously throughout the summer of 2021 took many by surprise, given that plentiful storage stocks had allowed Europe to cope with the winter developments noted above. By 21 June 2021, the TTF Front-Month price was at its absolute highest since January 2014, and its highest summer price since mid-2013 (29.40 EUR/MWh - 10.27 USD per MMBtu). Thereafter, the bull run continued until it peaked at 117 EUR/MWh (39.83 USD/MMBtu) on 5 October, before falling back slightly to around 30 USD/MMBtu, as illustrated in Figure 1. In the two months since then, TTF Front-Month prices have experienced extreme volatility, falling by 52.70 EUR/MWh (45 per cent) between 5 and 29 October, before rebounding and stabilising again at around 90 EUR/MWh (30 USD/MMBtu). The period of stability lasted until the beginning of December, when prices again surged, reaching 127.40 EUR/MWh on 14 December.

As Europe moves towards the coldest part of winter (January-February), uncertainty remains over whether prices will continue rising as mid-winter seasonal demand tightens the market, or whether the recent bull run has effectively 'priced in' a cold winter similar to that of 2020/21 and, by extension, a mild Q1-2022 could see prices either stabilise or even decline.

Figure 1. TTF Front-Month gas prices since December 2018 (EUR per MWh)

Source: Data from Argus

[12] Platts, 2021. Factbox: Suez Canal blockage sends ripples through global commodity markets. *Platts*, 24 March. https://www.spglobal.com/platts/en/market-insights/latest-news/oil/032421-suez-canal-blockage-sends-ripples-through-global-commodity-markets

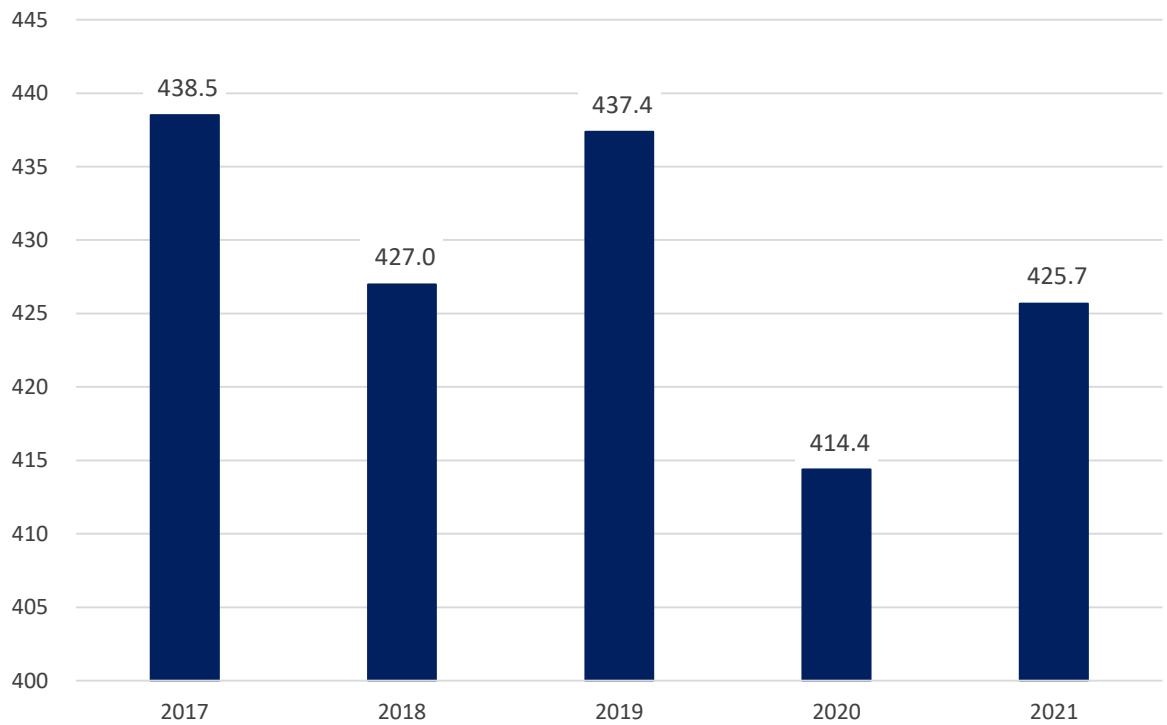
This article examines the causes of the dramatic price rally from a European supply-side perspective in terms of production, pipeline imports, LNG imports, and storage movements. In doing so, this article explains the supply-side factors behind the dramatic bull run of prices that has taken place in recent months and highlights key factors in the supply outlook for winter 2021/22. A key point of analysis used throughout this paper is the comparison between 2021 and 2019, with the latter being the last pre-COVID year. This avoids overly-optimistic conclusions being drawn from the year-on-year comparison between 2020 and 2021.

As European gas demand recovered in 2021 towards pre-COVID levels, supply has only partially rebounded year-on-year and has not yet returned to 2019 levels. As a result, the European market tightened significantly, and net storage withdrawals were required to balance the market. The main conclusion of this paper is that while the bull run of prices throughout 2021 was supported by supply-side fundamentals, the dramatic rise in prices upwards from 50 EUR/MWh from the end of August was not triggered by equally dramatic developments on the supply side. In short, supply side fundamentals go a long way to explaining general market tightness in 2021, but they do not fully explain the exceptional price developments of the past two and a half months. A fuller explanation further requires an analysis of the demand side and trading dynamics, which will be provided by the other two papers in this trilogy.

Implied European gas consumption

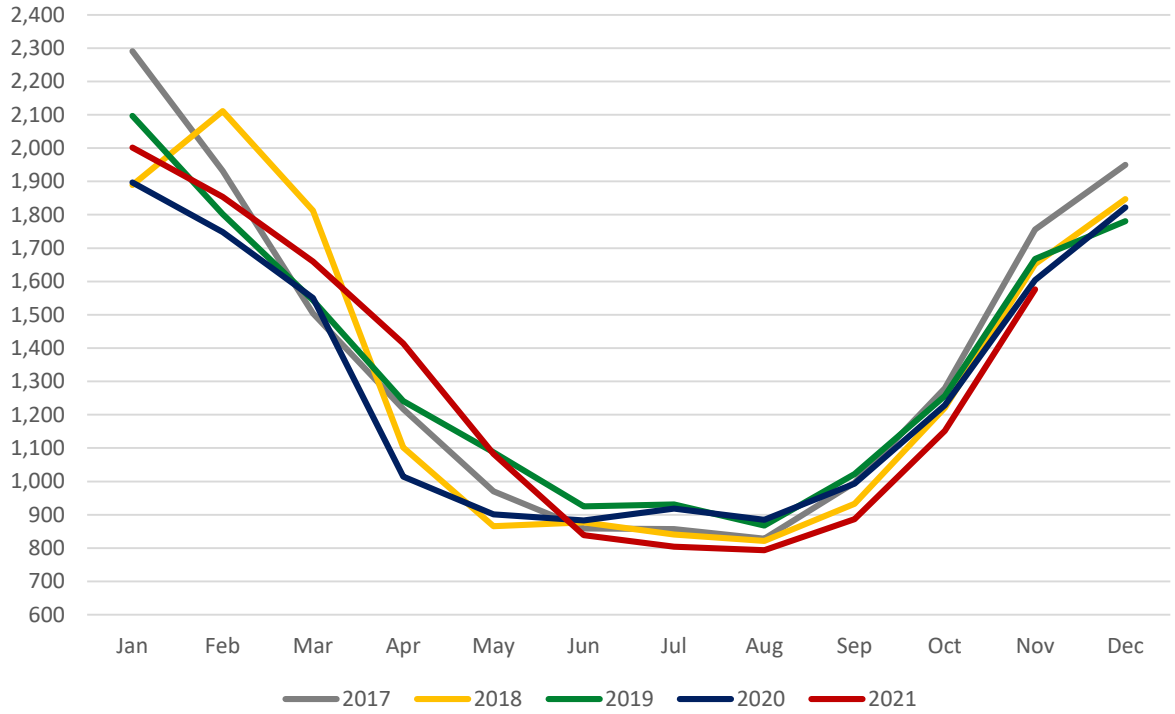
By aggregating data for gas production, net storage withdrawals, pipeline imports, and LNG imports, it is possible to create a picture of implied European gas consumption. Specifically, this refers to the EU and UK, and excludes Turkey due to a lack of timely and granular data. This implied consumption in the period January to November is illustrated in Figures 2 and 3. Figure 2 provides the year-to-date figures for 2017-2021, while Figure 3 provides a month-by-month comparison of 2017-2021. The dynamics of European gas demand will be analysed by Anouk Honoré in the second paper in the OIES trilogy, 'A Series of Unfortunate Events', of which this paper is the first part.

Figure 2. Total supply to the European (EU+UK) market in January-November (bcm)



Source: Data from ENTSOG Transparency Platform and Eurostat (production & pipeline imports), Gas Infrastructure Europe (storage), and Kpler (LNG imports)

Figure 3. Total supply to the European (EU+UK) market in 2017-2021 (mmcm per month)



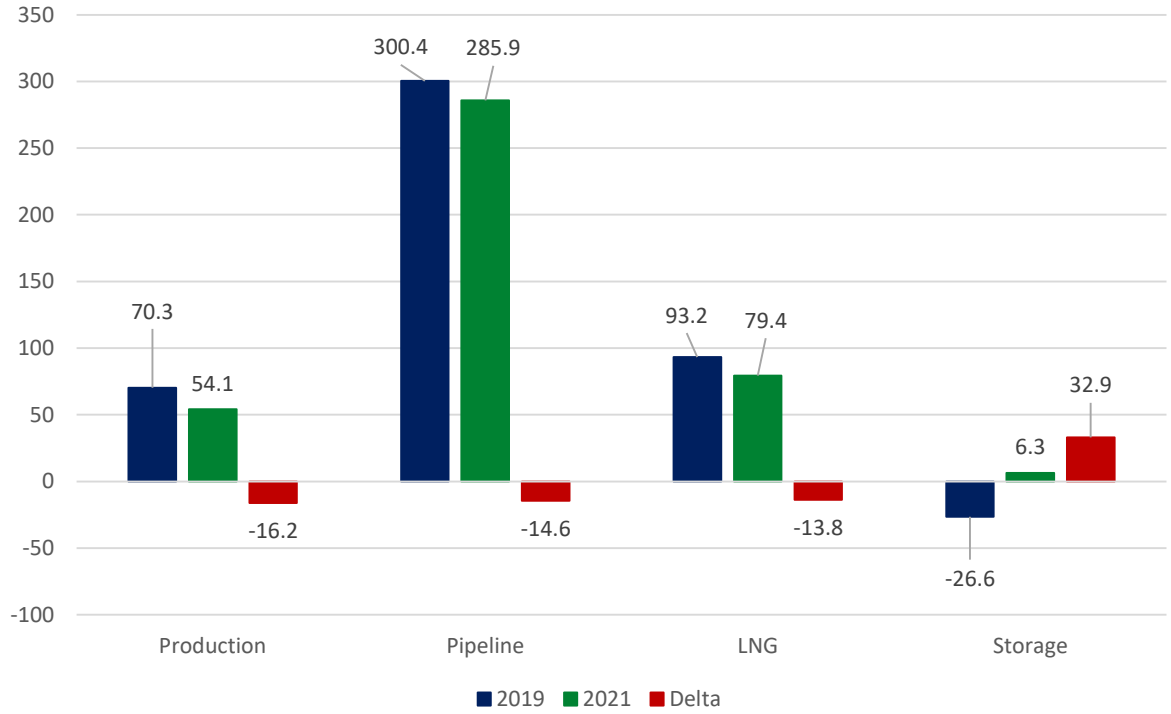
Source: Data from ENTSOG Transparency Platform and Eurostat (production & pipeline imports), Gas Infrastructure Europe (storage), and Kpler (LNG imports)

Overall, then, implied European gas consumption in January-November 2021 was marginally below 2018 levels, at a mid-point between the high of 2019 and low of 2020. On a month-by-month basis, implied European gas consumption was robust between January and May, being significantly surpassed only by the cold weather-driven months of January 2017 and February-March 2018. A notable factor was that the winter in early 2021 was not especially cold, but it was prolonged, with a late Spring thus delaying the start of the summer injection season. From June onwards, it appears that rising wholesale prices dampened demand, while the seasonal shape of that demand remained very similar to previous years, 2018 in particular.

In terms of how that demand is met, Figure 4 shows that pipeline imports provided 67 per cent of implied European gas consumption in January-November 2021, while production (13 per cent), LNG imports (19 per cent), and net storage withdrawals (1 per cent) provided the remainder. Notably, in both 2019 and 2021, LNG imports exceeded European production, which had never been the case before 2019 on a whole-year basis. In addition, storage plays a key role in absorbing excess volumes (as in 2019) or providing additional supply (as in 2021).

The contents of this paper are the authors' sole responsibility. They do not necessarily represent the views of the Oxford Institute for Energy Studies or any of its Members.

Figure 4. Gas supply to Europe (EU+UK) in January-November by source: 2019 vs 2021 (bcm)



Source: ENTSOG Transparency Platform and Eurostat

With the level and seasonal shape of implied consumption, and the balance between the different sources of supply, thus established, the analysis from this point onwards will focus only on these supply-side factors. As a reminder, a recurring analytical point raised throughout this paper is the comparison between 2019 (the last pre-pandemic year) and 2021, which thus avoids the distorting effects of the pandemic on the year-on-year comparison between 2020 and 2021.

European gas production

On the supply side, European gas production has continued its long-term decline, with little hope of that decline being reversed to any significant extent in the medium term. For Europe (EU+UK) as a whole, Figure 5 illustrates that gas production in Europe as a whole (EU+UK) declined from 70.3 bcm in January-November 2019 to 54.1 bcm in the same period in 2021.

In the Netherlands (the largest gas producer in the EU), the decline in gas production over the past decade is particularly dramatic: A drop of 50 per cent between 2010 and 2017, and a further 47 per cent decline between 2017 and 2020.[13] In the period January-November, production declined from 38.8 bcm in 2017 to 27.5 bcm in 2019, and 22.2 bcm in 2021.[14] Most of decline in recent years has been at the country's largest gas field, Groningen, where production is planned to effectively cease in mid-2022.[15]

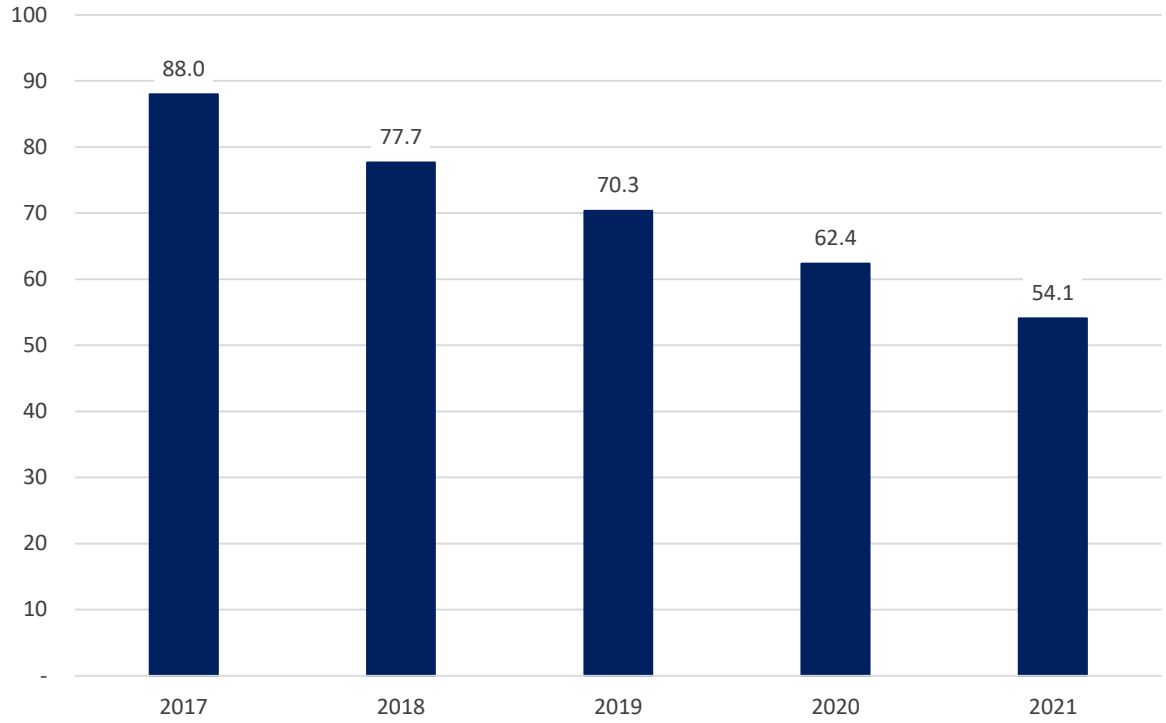
[13] IEA, 2021. *IEA online data* [subscription required). https://wds.iea.org/

[14] ENTSOG, 2021. *ENTSOG Transparency Platform – Netherlands production*. https://transparency.entsog.eu/#/points/data?points=nl-tso-0001prd-00196entry

[15] Platts, 2021. Netherlands rules out change to Groningen gas field policy despite high prices. *Platts*, 16 September. https://www.spglobal.com/platts/en/market-insights/latest-news/natural-gas/091621-netherlands-rules-out-change-to-groningen-gas-field-policy-despite-high-prices

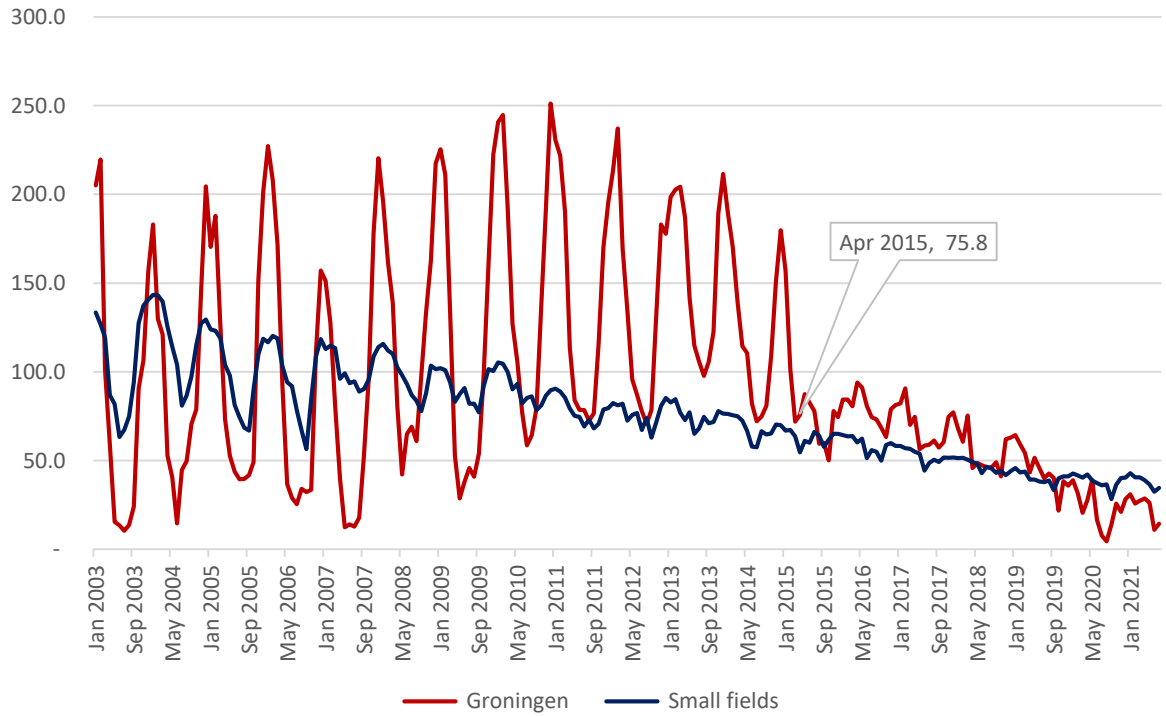
The contents of this paper are the authors' sole responsibility. They do not necessarily represent the views of the Oxford Institute for Energy Studies or any of its Members.

Figure 5. European (EU+UK) gas production in January-November (bcm)



Source: ENTSOG Transparency Platform and Eurostat

Figure 6. Dutch gas production at Groningen and other small fields combined (mmcm/d)

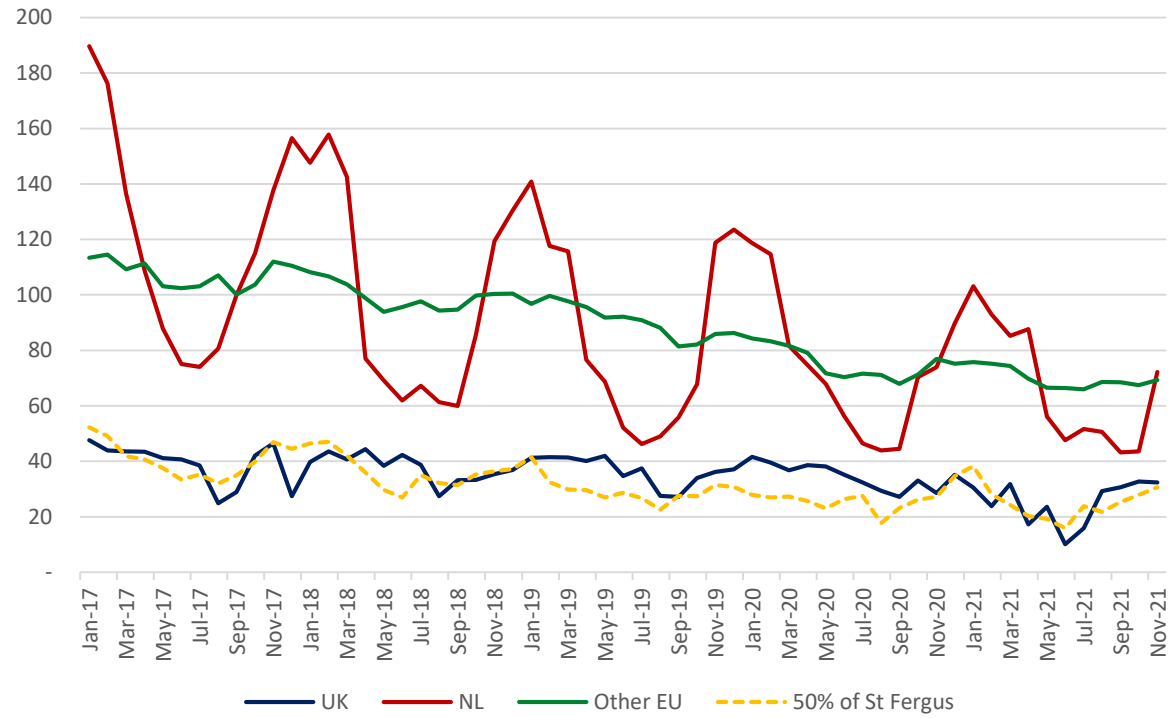


Source: Data from Argus

The Dutch government announced major restrictions on production at Groningen in January 2014, amid public concerns at earth tremors in the area.[16] Since then, successive government decisions have reduced the 'production cap', and gradually brought forward the deadline for the complete cessation of production at the field. As Figure 6 (above) illustrates, the impact of this was to curtail the ability of production at Groningen to swing upwards in the peak winter months, primarily due to the dramatic curtailment of production at well clusters around the town of Loppersum. The fact that production at the 'small fields' that account for the rest of Dutch gas production cannot perform seasonal swing means that swing in Dutch gas production overall was lost.

As Figure 7 illustrates, the seasonal swing in Dutch gas production has been further reduced from the already low post-2015 levels, while production in the UK and in the rest of the EU combined does not exhibit notable seasonal swing. As a result, the ability of total EU+UK gas production to swing upwards to meet winter peaks in demand has continued to decline since 2017, as highlighted in Figure 8. The labels in that graph state the difference between monthly average gas production at the height of winter and depth of summer in each gas year, expressed in mmcm/d. As that difference grows smaller, it represents a decline in swing in seasonal production.

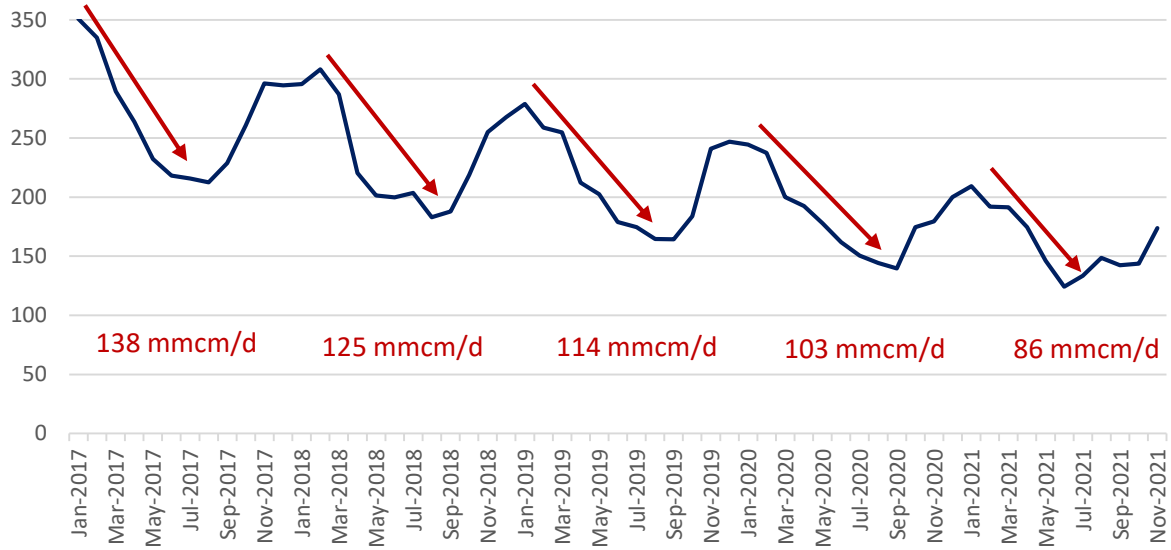
Figure 7. UK, Dutch, and Other EU Monthly Gas Production (mmcm/d)



Source: ENTSOG Transparency Platform. Originally sourced in kWh/d and converted to standard mmcm/d using the Gross Calorific Values (GCV) provided for each source

[16] Argus, 2014. Netherlands cuts Groningen gas cap. *Argus*, 17 January. https://www.argusmedia.com/en/news/884804-netherlands-cuts-groningen-gas-cap

Figure 8. Loss of swing in European gas production (mmcm/d)



Source: ENTSOG Transparency Platform. The figures in red are the differences between maximum winter and minimum summer gas production in mmcm/d.

Nuances regarding gas supply data for the UK and Norway

The gas production data for this paper has been gathered from the ENTSOG Transparency Platform, where UK continental shelf (UKCS) production brought ashore at St Fergus and Easington cannot be distinguished from pipeline imports from Norway brought ashore at the same points. In approximate terms, more than 90 per cent of volumes brought ashore at Easington are pipeline imports from Norway (via the Langeled pipeline), while the balance between UK and Norwegian supplies brought ashore at St Fergus is a roughly 50-50 split. In this paper, the volumes brought ashore at Easington and St Fergus have been entirely assigned to Norway as pipeline imports. This follows the practice of the quarterly gas market reports published by the European Commission. In Figure 7, volumes equal to 50 per cent of volumes brought ashore at St Fergus have been added to the graph for illustrative purposes (the dotted yellow line), to represent an estimation of UK production brought ashore at that location.

In the UK, gas production in January-November 2021 (excluding volumes brought ashore at Easington and St Fergus) was 31 per cent lower than in the same period in 2019, as the result of planned maintenance that had been delayed from mid-2020 by the COVID-19 pandemic. The impact of this was particularly felt in the period April-July 2021. Since August, production has rebounded to almost the usual level for that time of year.[17] Thanks to a combination of the completion of the maintenance and addition of production at new fields, production in 2022 is forecast to rebound to 2019/2020 levels.[18] However, looking further into the future, the latest forecast from the Oil & Gas Authority suggests that, in the absence of major new investment, UK gas production could decline by approximately one-third in the next five years.[19]

[17] ENTSOG Transparency Platform

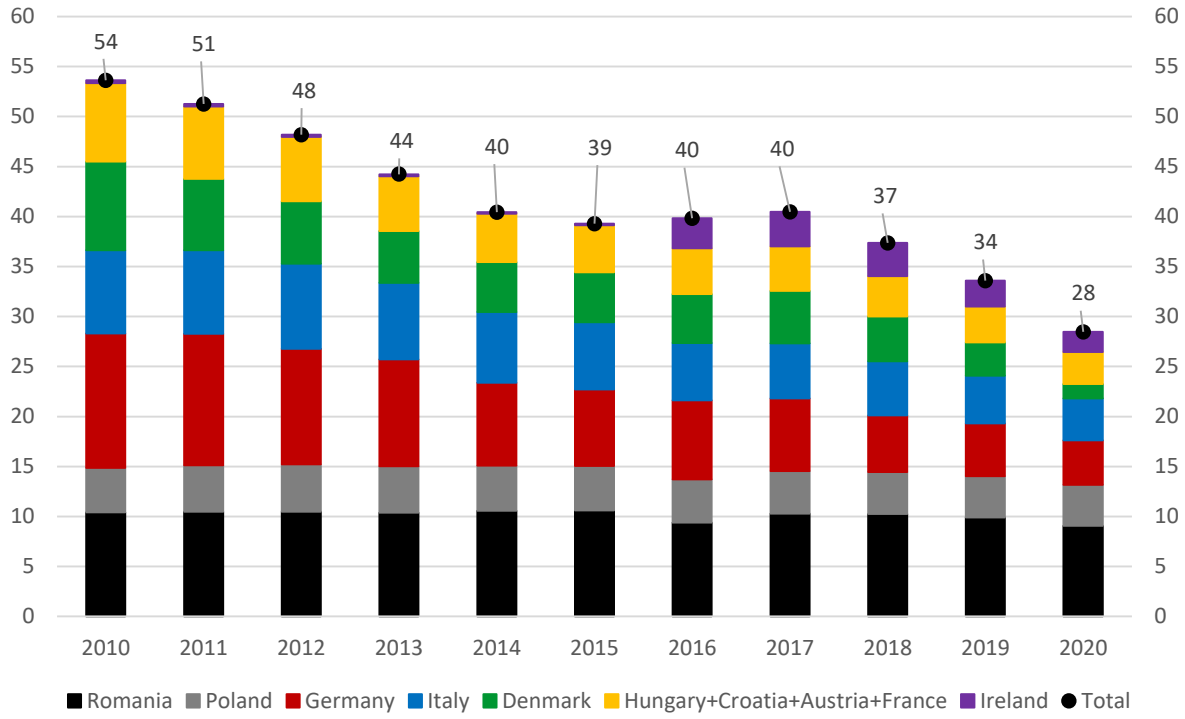
[18] Offshore Mag, 2021. North Sea gas producers responding to higher prices. *Offshore Mag*, 20 September. https://www.offshore-mag.com/regional-reports/north-sea-europe/article/14209935/uk-north-sea-gas-producers-responding-to-higher-prices

[19] Specifically, from 33.3 mtoe (2020), 27.5 mtoe (2021), and 29.7 mtoe (2022) to 20.7 mtoe (2026). At 40 MJ per standard m3, this equates to 34.9 bcm (2020), 28.8 bcm (2021), and 31.1 bcm (2022), falling to 21.7 bcm (2026). See: Oil & Gas Authority, 2021. *Projections of UK oil and gas production and expenditure - September 2021*. https://www.ogauthority.co.uk/media/7779/oga-medium-term-projections-sep-2021.pdf .

In Demark, reconstruction work that began in September 2019 at the offshore Tyra complex (which accounts for 90 per cent of Danish gas production) was planned for completion by mid-2022, but this has been pushed back to Q2 2023 because of the COVID-19 pandemic. As a result, the Danish Energy Agency revised its production forecast for 2021 down from 1 bcm to 0.74 bcm and its production forecast for 2022 from 2 bcm to 0.67 bcm.[20] In Denmark, the gas production peak of 12 bcma was reached in 2005, falling to 8.5 bcm in 2010 and 4.2 bcm in 2018, before being impacted by developments at Tyra. According to the Danish Energy Agency, Danish gas production will rebound to 2.8 bcm in 2025 and peak at 3.2 bcm in 2027, before a steady decline to around half that level by the late 2030s.[21] therefore, as with production in the UK, Danish gas production is expected to exhibit a post-maintenance rebound followed by a resumption of a long-term decline.

Outside the UK and the Netherlands, total gas production in the rest of the EU in January-November declined from 35.8 bcm in 2017 to 30.4 bcm in 2019 and 23.3 bcm in 2021. These figures represent a continuation of an ongoing decline in gas production across multiple EU countries. For example, according to Eurostat, between 2010 and 2020, gas production in the ten largest gas producers in the EU-27 after the Netherlands declined by 45 per cent between 2010 and 2020, as illustrated in Figure 9, below. Production in the rest of the EU-27 remained relatively constant, at around 0.5 bcm per year.

Figure 9. Annual gas production in selected EU member states, 2010-2020 (bcm)



Source: Data from Eurostat[22]

While production in Romania and Poland remained relatively constant, around 14-15 bcm per year, and the start of significant production in Ireland in 2016 added to supply, the decline elsewhere is significant. In Germany, Italy, and Denmark combined, production declined from 31 bcm in 2010 to 10 bcm in 2020.

[20] Argus, 2021. Denmark slashes gas production forecast. *Argus*, 6 September. https://www.argusmedia.com/en/news/2251350-denmark-slashes-gas-production-forecast

[21] Danish Energy Agency, 2021. *Ressourceopgørelse Og Prognose (Resource statement and forecast)*. 6 September. https://ens.dk/sites/ens.dk/files/OlieGas/ressourcer_og_prognose_2021_dk.pdf See pages 9 & 10 (in Danish).

[22] Eurostat, 2021. Supply, transformation and consumption of gas - monthly data [NRG_CB_GASM__custom_1312496]. https://ec.europa.eu/eurostat/databrowser/view/nrg_cb_gasm/default/table?lang=en

The contents of this paper are the authors' sole responsibility. They do not necessarily represent the views of the Oxford Institute for Energy Studies or any of its Members.

Only in Denmark is production likely to increase in the next couple of years, and even then, not by a significant amount. In the same period, production in Hungary, Austria, Croatia, and France combined fell from 8 bcm to 3 bcm, and is not likely to recover.

In terms of explaining the contribution of supply-side elements in the European gas price bull run of 2021, the ongoing production trends discussed above certainly contributed to the European market being more exposed to dependence on imports than in previous years, and the loss of seasonal swing in European production is of particular importance. It should also be noted that in a market as tight as that seen in Europe between late August and early October 2021, the failure of European production to ramp up in October as winter began is likely to have contributed to nervous market sentiment. Specifically, EU+UK gas production in October 2021 (4.5 bcm) was 1.2 bcm (21 per cent) lower than in October 2019 (5.7 bcm), with much of that shortfall (0.75 bcm) due to lower Dutch production. Dutch production did then ramp up in November, but it was a highly visible signal that European gas production was indeed short of 'winter swing'.

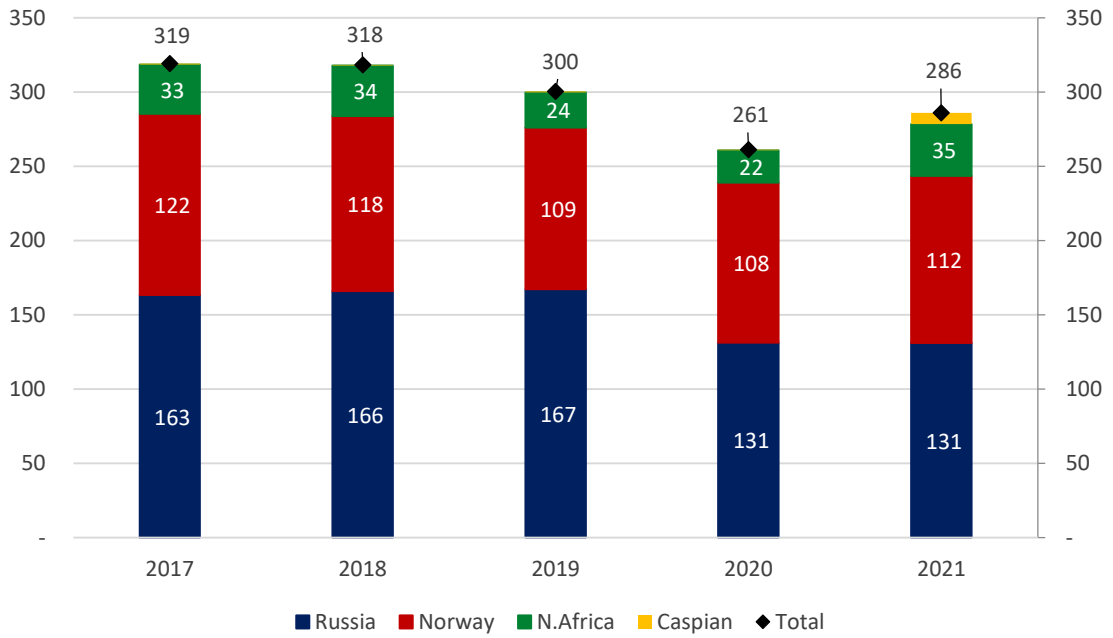
Looking ahead, while UK production is set to rebound in 2022, the scheduled closure of Groningen and delays at Tyra are likely to combine with ongoing declines in production elsewhere in Europe to result in EU+UK gas production in 2022 being even lower than in 2021, and lower still in 2023. As a result, Europe will become ever-more dependent on imports to meet its gas demand. Just as importantly, the decline in seasonal swing in European gas production will leave the European market particularly dependent on imports during periods of winter peak demand.

European pipeline gas imports

Overview

As Figure 10 illustrates, EU+UK pipeline gas imports – from Russia, Norway, North Africa, and Azerbaijan – in the period January-November declined substantially year-on-year in 2020, and the rebound in 2021 has still not brought total pipeline imports back to 2019 levels, despite the need to offset the decline in European production.

Figure 10. European (EU+UK) pipeline gas imports in January-November (bcm)



Source: ENTSOG Transparency Platform

The greatest increase from a single source concerned pipeline imports from North Africa, which rose by 11.2 bcm (47.2 per cent) between 2019 and 2021 as Algeria ramped up its pipeline exports. That brought North African gas flows to Europe back to the levels of 2017 and 2018.[23] That rebound occurred despite supplies from Libya to Italy falling by 2.1 bcm, from 5.1 bcm (January-November 2019) to 3.0 bcm (January-November 2021), while flows from Algeria to Spain and Italy rose by 13.3 bcm. At the same time, Algerian LNG exports in January-November remained within the corridor of 13.5-15.5 bcm that has been seen in nine of the eleven years since 2011.[24] The outlook for pipeline imports from North Africa is discussed in more detail below.

At the same time, the launch of the Trans-Adriatic Pipeline (TAP) from the Turkey-Greece border to Italy via Greece, Albania, and the Adriatic Sea caused European imports from Azerbaijan to surge from 0.7 bcm in January-November 2019 to 7.6 bcm in January-November 2021.[25] Taken together, the increase in pipeline imports from North Africa and Azerbaijan between January-November 2019 and January-November 2021 totalled 18.1 bcm.

Further upside was seen in imports from Norway (whose figures also include UK continental shelf production landed at Easington and St Fergus, as discussed earlier). However, the fact that pipeline imports from Norway in January-November 2021 increased only slightly – by 3.4 bcm (3.2 per cent) – despite the prevalent high prices suggests that Norway had only limited additional production to offer to the market.

This point was illustrated by the announcement by Equinor, on 20 September, that its production permits for the Oseberg and Troll fields had each been increased by 1 bcm for the gas year starting 1 October.[26] Although this was welcome news, it should be remembered that total Norwegian pipeline supply to Europe in the last three gas years (2018/19, 2019/20, and 2020/21) has averaged close to 120 bcm. Therefore, the additional supply from Equinor represents an increase of less than 2 per cent on an annualised basis. A further point of comparison is that Norwegian pipeline flows to Europe in January-November 2017 and 2018 were significantly higher than in 2021. Looking ahead, the forecast from Norsk Petroleum[27] suggests that Norwegian gas production will increase in 2022 and again in 2023, before stabilising out to 2025, as illustrated in Figure 11. However, even these increases will only bring Norwegian production marginally above 2019 levels.

Set against these increases in pipeline imports from North Africa, Azerbaijan, and Norway (a combined 21.5 bcm), European pipeline imports from Russia in January-November 2021 were 36.0 bcm (15.6 per cent) lower than in the same period in 2019. Indeed, the physical supplies from Russia to Europe in January-November 2021 were even 0.2 bcm *lower* than in the COVID-19-afflicted year of 2020. This relative lack of Russian flows to Europe has been a key factor in the tightness of the European market in 2021, and has sparked significant debates over its causes – this issue is addressed in more detail below. The monthly flow of Russian gas to Europe (expressed as monthly average mmcm/d) is presented in Figure 12. The key point illustrated by this graph is that since June 2021, monthly physical flows of Russian gas to Europe have declined relative to both 2019 and 2020.

[23] ENTSOG Transparency Platform

[24] Data from Kpler LNG Platform

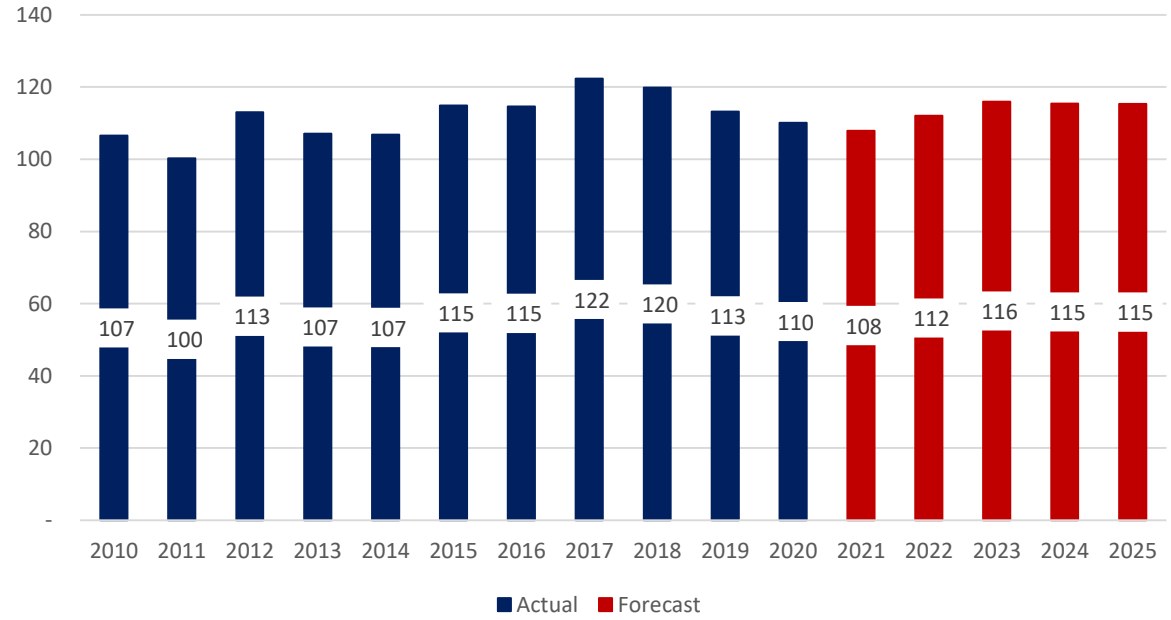
[25] ENTSOG Transparency Platform

[26] Equinor, 2021. Increasing gas exports to supply tight European market. *Press Release*, 20 September. https://www.equinor.com/en/news/20210920-increasing-gas-export-europe.html

[27] The website is run in cooperation by the Ministry of Petroleum and Energy and the Norwegian Petroleum Directorate

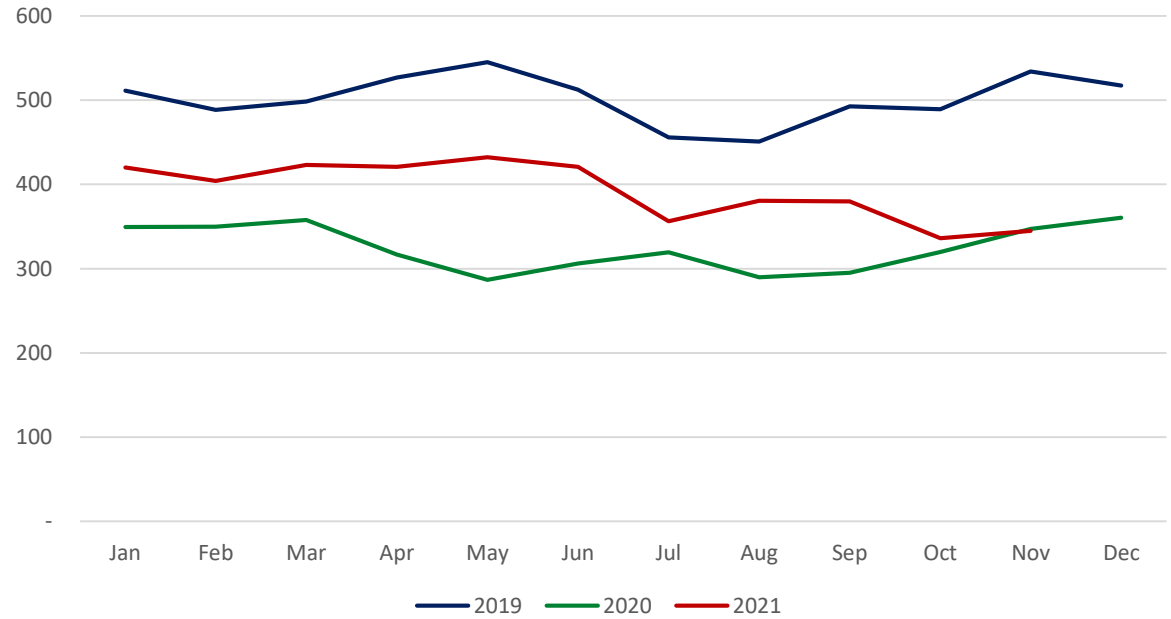
The contents of this paper are the authors' sole responsibility. They do not necessarily represent the views of the Oxford Institute for Energy Studies or any of its Members.

Figure 11. Norwegian actual and forecast gas production (bcm)



Source: Norsk Petroleum (Ministry of Petroleum and Energy and the Norwegian Petroleum Directorate), 2021. *Production forecasts*, 12 October. https://www.norskpetroleum.no/en/production-and-exports/production-forecasts/

Figure 12. Monthly average Russian gas flows to Europe (excluding Turkey) (mmcm/d)



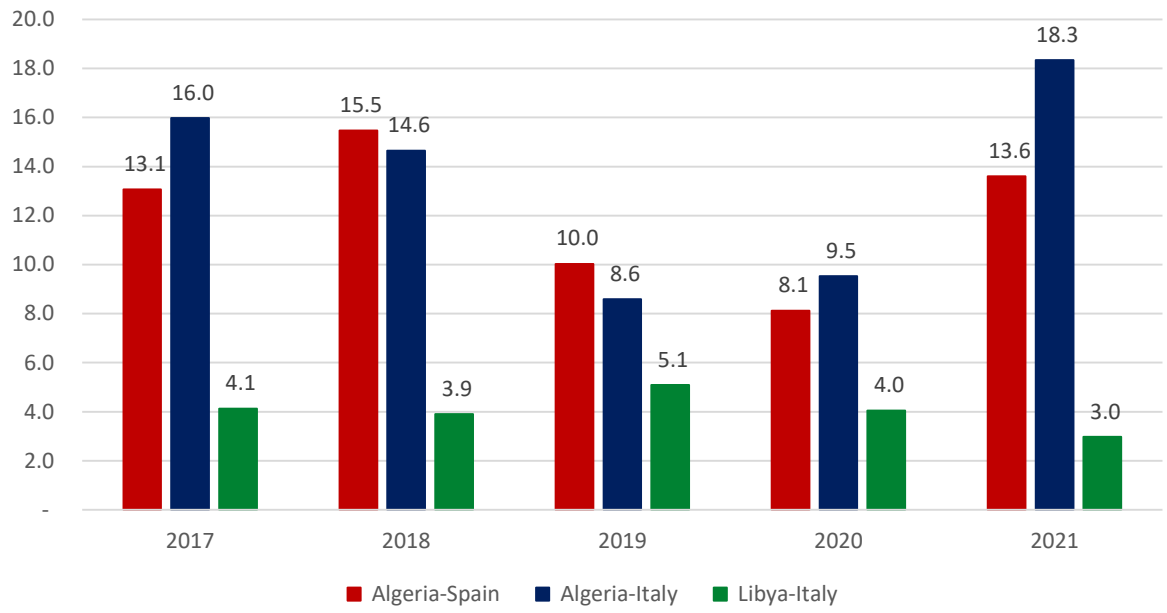
Source: Data from ENTSOG Transparency Platform

To summarise, the net decline in total European pipeline imports from Russia, Norway, North Africa, and Azerbaijan between 2019 and 2021 was 14.5 bcm (4.8 per cent), due to the decline in supplies from Russia being greater than the collective increase in supplies from the other three sources. When this decline is combined with the 16.2 bcm decline in European production in January-November 2021, relative to the same period in 2019, the effect was to remove 30.7 bcm of supply from the European market. In the near future, the two sources with the greatest potential to decrease or increase their supplies to Europe are Algeria and Russia, and these are addressed in more detail below.

European pipeline imports from North Africa

In January-November 2021, Libyan supplies to Italy accounted for 8.5 per cent of the total supply from North Africa. Algerian supplies to Italy via Tunisia accounted for 52.5 per cent, and Algerian supplies to Spain accounted for the remaining 39 per cent. The fluctuations of these flows are illustrated in Figure 13, below. The key point is that while supplies from Libya to Italy have been relatively stable in recent years, the supplies from Algeria to Spain and Italy have fluctuated significantly, while the split between Spain and Italy as Algerian export markets has remained relatively even. However, political developments in recent months have placed the analytical focus firmly on the delivery of Algerian gas to Spain.

Figure 13. Gas flows to from North Africa to Europe in January-November (bcm)



Source: Data from ENTSOG Transparency Platform

Until recently, the Algerian state-owned gas company, Sonatrach, exported pipeline gas from Algeria to Spain directly under the Mediterranean Sea via the Medgaz pipeline, and via Morocco using the GME pipeline. It also continues to supply pipeline gas to Italy via Tunisia and the Transmed pipeline. These pipeline exports are complemented by LNG exports to both southern Europe and the global market.

However, the balance between pipeline and LNG in Algeria's export portfolio could shift this coming winter. On 31 October 2021, Morocco took ownership of the transit pipeline on Moroccan territory, and the contract for the transit of Algerian gas to Spain via Morocco expired. The situation has been contextualised by a political dispute between Algeria and Morocco, which culminated in Algeria cutting diplomatic ties with Morocco on 24 August 2021. This dispute and its potential ramifications have been analysed in detail in a recent OIES Comment by Mostefa Ouki.[28]

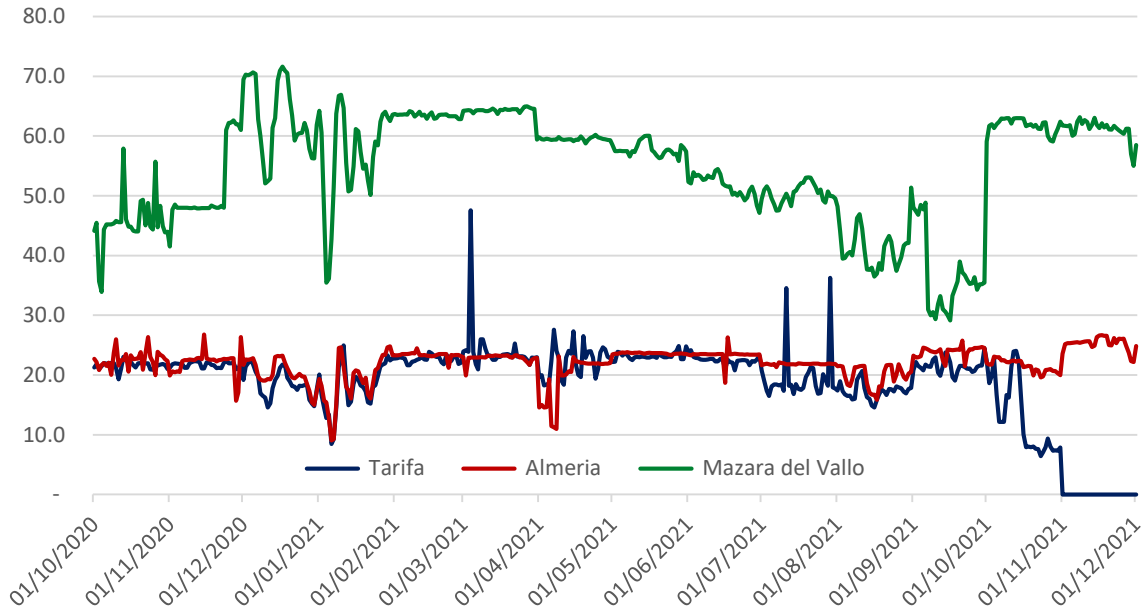
Sonatrach prepared for the non-renewal of the transit agreement by completing a 'loop' between the GME and Medgaz pipelines on Algerian territory that enables exports to be diverted to the Medgaz

[28] Ouki, M., 2021. Gazoduc Maghreb Europe (GME): another gas transit headache for Europe? *OIES Comment*, 20 September. https://www.oxfordenergy.org/publications/gazoduc-maghreb-europe-gme-another-gas-transit-headache-for-europe/

route, where Sonatrach identified spare capacity.[29] [30] In 2019, flows via Medgaz were 6.3 bcm (compared to a current capacity of 10.5 bcma), while flows via Morocco and GME were 5.2 bcm.[31] Although these annual flows combined (11.5 bcm) are just above the annual capacity of the expanded Medgaz pipeline, the peak monthly average flows in both January and December 2019 (24 mmcm/d via GME and 22.5 mmcm/d via Medgaz – a total of 46.5 mmcm/d) far exceed the daily capacity of the expanded Medgaz (28.8 mmcm/d).

As the transit contract was not renewed, the flow of gas from Algeria to Spain via Morocco (to Tarifa) fell to zero on 1 November 2021. Since then, flows on the Medgaz route (to Almería) have been approximately 25-27 mmcm/d for most of November (i.e., virtually full capacity).[32] Meanwhile, Algerian flows to Italy (at Mazara del Vallo) have ramped up to their normal winter level.

Figure 14. Algerian daily export flows by destination (mmcm/d)



Source: Data from ENTSOG Transparency Platform

As we move into the coldest part of winter, it remains to be seen whether Sonatrach will be obliged to make up any potential shortfall to counterparties in the Spanish and Portuguese markets with LNG deliveries. This is especially the case for Sonatrach's deliveries to Portugal via Spain, given that the Medgaz pipeline (which makes landfall at Almería in eastern Spain) does not readily facilitate deliveries to Portugal in the manner of GME (which makes landfall in Spain at Tarifa, close to the Portuguese border). While perhaps not a decisive factor in the surge in European gas prices between late August and early October 2021, anticipation of the impact of the expiry of the Algeria-Morocco gas transit contract is likely to have contributed to a more general market uncertainty that made itself felt in rising – and volatile – prices between August and October 2021.

[29] Platts, 2021. Algeria has taken 'necessary measures' to offset non-renewal of Morocco gas deal. *Platts*, 30 June. https://www.spglobal.com/platts/en/market-insights/latest-news/natural-gas/063021-algeria-has-taken-necessary-measures-to-offset-non-renewal-of-morocco-gas-deal

[30] Platts, 2021. Spotlight: GME pipeline transit renewal at risk as Algeria cuts diplomatic ties with Morocco. *Platts*, 1 September. https://www.spglobal.com/platts/en/market-insights/latest-news/natural-gas/082621-spotlight-gme-pipeline-transit-renewal-at-risk-as-algeria-cuts-diplomatic-ties-with-morocco

[31] ENTSOG Transparency Platform

[32] ENTSOG Transparency Platform

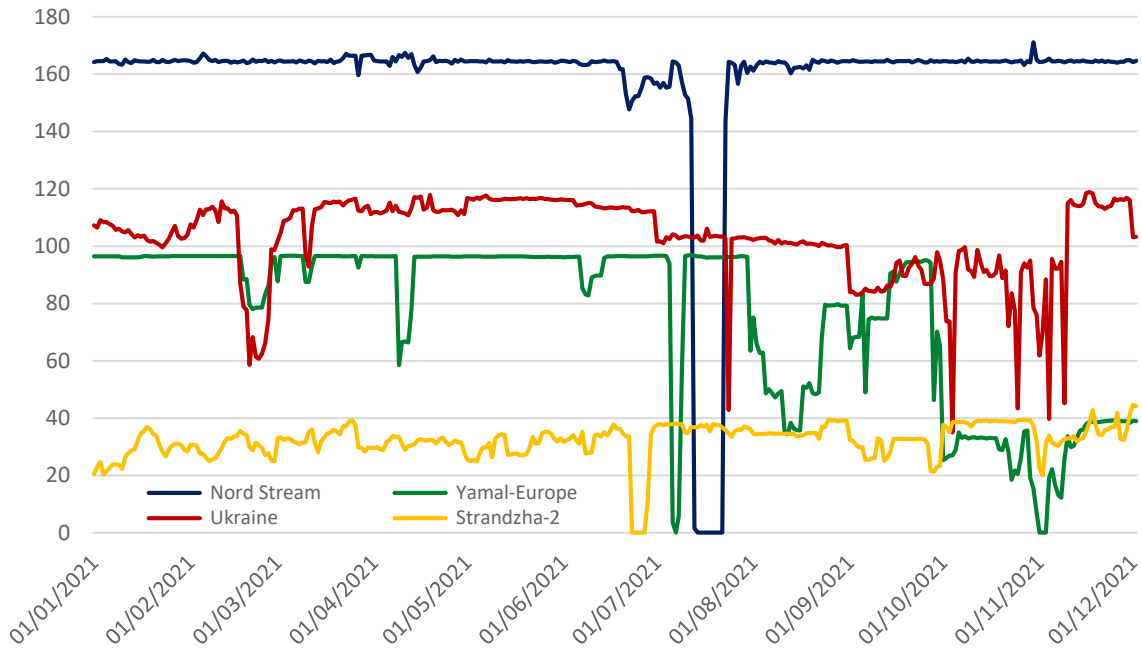
The contents of this paper are the authors' sole responsibility. They do not necessarily represent the views of the Oxford Institute for Energy Studies or any of its Members.

European pipeline imports from Russia

Gazprom has held its legal monopoly on pipeline gas exports from Russia since 2006.[33] Gazprom delivers its volumes to Europe via several routes. In North-Eastern Europe, it makes direct deliveries to Finland, Estonia, and Latvia, and deliveries to Lithuania via Belarus. The Nord Stream pipeline runs directly from Russia to Germany under the Baltic Sea, while the Yamal-Europe pipeline supplies gas to Germany via Belarus and Poland. Deliveries to Poland are also made via Belarus. In the south, Gazprom supplies the Turkish market via the Blue Stream and Turkish Stream pipelines, under the Black Sea from Russia to Turkey. Since January 2020, onward connections from the Turkey-Bulgaria border have enabled Gazprom to use Turkish Stream to supply Bulgaria, Greece, North Macedonia, Serbia (from 1 January 2021), and Hungary (from 1 October 2021). Finally, transit via Ukraine allows Gazprom to supply Poland, Slovakia, Hungary, and Romania. The flows to Slovakia include substantial volumes for onward delivery to Austria, Slovenia, and Italy.

The daily flows of Russian gas to Europe via multiple routes in January-November 2021 is illustrated in Figure 15. The comparison between 2021 and previous years is as follows. In 2019, Russian pipeline flows to NW Europe via Nord Stream and the Yamal-Europe pipeline (via Belarus and Poland to Germany) operated at full capacity except for maintenance periods and, in the case of Yamal-Europe, a downturn in August in line with a late summer decline in downstream demand. Given that this was the last year before the launch of the Turkish Stream pipeline (and its onward connection to South-Eastern Europe on the Turkey-Bulgaria border), all remaining volumes were delivered via Ukraine and directly to Finland and the Baltic states. This was also the last year of the long-term Russia-Ukraine gas transit contract, which was valid from 2009 to 2019.

Figure 15. Daily Russian gas flows to Europe (excluding Turkey) (mmcm/d)



Source: Data from ENTSOG Transparency Platform

In 2021, flows via Nord Stream remained at full capacity (except for planned annual maintenance in July). On the Yamal-Europe route, total flows at Kondratki on the Belarus-Poland border in January-November in 2021 (25.7 bcm) were notably lower than those in January-November 2019 (30.4 bcm).[34]

[33] Russian Federal Law of 7 July 2006, 'On the export of gas'. Sourced from Official Internet Portal of Legal Information of the Russian Federation. http://pravo.gov.ru/proxy/ips/?docbody=&nd=102108018&rdk=&backlink=1

[34] Data from ENTSOG Transparency Platform

Flows on this route were impacted in early August by a fire at a gas processing plant in North-Western Siberia that provides feedstock for that pipeline.[35] Since then, Gazprom has booked – and flowed – significantly less than usual on the Yamal-Europe route.

Gazprom's gas deliveries via the Yamal-Europe pipeline were previously made under a long-term contract for transit via Poland that expired in May 2020. In July 2020, Gazprom booked annual capacity for the gas year 2020/21 of 814 GWh/d, which was equivalent to 80 per cent of the capacity of the pipeline at Kondratki (on the Belarus-Poland border). Gazprom subsequently booked 103 GWh/d of quarterly capacity and a similar amount of monthly capacity. This allowed Gazprom access to most of the capacity of the Yamal-Europe pipeline, but with some flexibility around its quarterly and monthly capacity bookings.

However, Gazprom ceased booking monthly capacity on the Yamal-Europe route in March 2021. Then, in July 2021, it did not book any annual capacity for the gas year 2021/22, and in August 2021, it did not book any quarterly capacity for Q4-2021. On 20 September 2021, Gazprom booked 324.5 GWh/d of monthly capacity for October 2021, which equates to 30.5 mmcm/d (just under one third of the firm technical capacity of the pipeline, which is 97 mmcm/d). On 18 October, it booked the same capacity for November 2021. Finally, on 15 November, it did not book any firm monthly capacity for December. Instead, Gazprom has booked the same amount as day-ahead capacity every day from 1 to 14 December (the latest available data).[36] Therefore, over a period of several months, Gazprom has scaled back its commitment to using the Yamal-Europe route to deliver gas to Europe.

The Turkish Stream pipeline and its onward connections provided a delivery route for Russian supplies to Bulgaria, Greece, North Macedonia, and Serbia (10.8 bcm in January-November 2021). These destinations had been served by Ukrainian transit in 2019. Therefore, the downturn in Russian exports to Europe in 2021 vs 2019 mainly concerned the Ukrainian route, where flows in January-November dropped from 72.8 bcm in 2019 to 34.5 bcm in 2021 (a decline of 38.3 bcm, or 53 per cent). Even accounting for the shift in delivery route from Ukraine to Turkish Stream for sales to Bulgaria, Greece, North Macedonia, and Serbia, this still leaves a decline of 27.5 bcm.

A key element in the decline in Russian gas deliveries via Ukraine is the expiry of the 2009-2019 transit contract on 31 December 2019. This was replaced by a shorter contract, which is valid until 31 December 2024. The delivery volumes under that contract are calculated on a daily, rather than annual, basis. For 2020, Gazprom pre-booked 178.1 mmcm/d (equivalent to 65 bcma), and for the period 2021-2024 the pre-booked capacity is 109.6 mmcm/d (equivalent to 40 bcma).

The Interconnection Agreement that governs capacity on the Russia-Ukraine border commits the TSOs on each side of the border to provide 125 mmcm/d of firm capacity. Throughout 2021, the Ukrainian TSO, GTSOU, has offered the difference between the interconnection agreement and the long-term transit contract (15 mmcm/d) as firm capacity on monthly auctions. Aside from January (when an exceptional additional volume was made available), Gazprom booked that 15 mmcm/d of additional capacity every month for February to August 2021. However, Gazprom booked just 0.65 mmcm/d of additional capacity for September, and zero for October, November, and December.[37] As on the Yamal-Europe route, Gazprom scaled back its capacity commitments on the Ukrainian route.

In terms of total Russian flows to Europe – via all routes combined – as expressed earlier in Figure 12, two key points must be considered. Firstly, between January and August, the delta between monthly flows in 2019 and 2021 was fairly consistent, with the flows in 2021 being markedly lower. Given Gazprom's position as the single largest source of European imports, this undoubtedly contributed to

[35] Afansiev, V., 2021. Gazprom eases gas production curbs on fire-stricken Yamal-Nenets fields. *Upstream Online*, 9 August. https://www.upstreamonline.com/production/gazprom-eases-gas-production-curbs-on-fire-stricken-yamal-nenets-fields/2-1-1049763

[36] Gaz-System, 2021. *Auction results*. https://gsaplatform.eu/auctions?tab=A

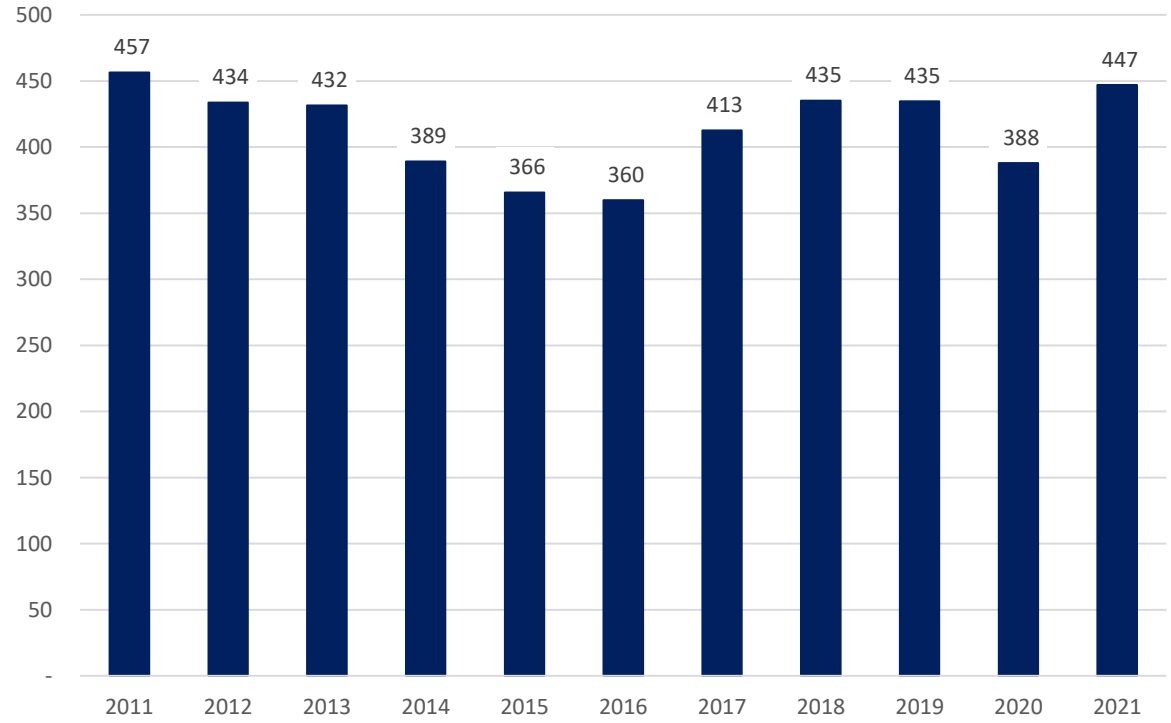
[37] Regional Booking Platform (RBP), 2021. *Capacity auctions*. https://ipnew.rbp.eu/rbp.eu/#capacityauctions. The results can be narrowed down by searching for 'OAO Gazprom' as the exit TSO and 'Gas TSO of Ukraine LLC' as the entry TSO

the general market tightness throughout 2021, and the gradual increase in prices throughout the year. Secondly, the fact that physical flows from Russia declined slightly between August and September, declined more substantially in October, and then rose only slightly in November meant that the decline in physical flows between August and November seen in 2021 ran counter to the usual seasonal increase during this period. This period also saw the sharpest increase in European prices, with the lower-than-usual availability of Russian gas a key contributing factor.

The lower capacity bookings and physical flows via Belarus-Poland and Ukraine, despite the high prices in Europe, sparked speculation in various media sources (and among some European politicians) that Gazprom has 'held back' volumes from the European market in order to either maintain the current high prices or pressure the German regulator and European Commission to approve the operation of the Nord Stream 2 pipeline, whose construction is now complete.

Conversely, it has been argued that Gazprom simply did not have sufficient gas available to increase its deliveries to Europe, despite increasing production to its highest level since 2011, as illustrated in Figure 16. The validity of that argument depends on the extent of the additional call on Gazprom's gas relative to the increase in production, when compared to 2019 (the last pre-pandemic year).

Figure 16. Gazprom gas production in January-November (bcm)



Source: Data from Argus

As a starting point for that analysis, Gazprom's gas production in January-November 2021 was 12 bcm higher than in January-November 2019. Most of this additional production in 2021 occurred in Q3, given that Gazprom's production in the first half of 2021 was just 0.8 bcm higher than in the first half of 2019.[38] Despite the increase in production, the call on Gazprom's gas was significantly higher in 2021, which left Gazprom obliged to allocate volumes in order of priority. Those priorities (in order) were 1) domestic storage replenishment and supply to the domestic market; 2) Exports under long-term contracts, including to Turkey; 3) Replenishment of storage stocks held in Europe; and 5) Spot sales in Europe.

[38] Argus, 2021. *Russian gas production and storage data* (subscription required)

Domestic Russian storage replenishment

Firstly, Russia experienced the same cold weather as the rest of Europe in the first 4-5 months of 2021, with gas demand for space heating accordingly higher. As a result, Gazprom's deliveries to the domestic Russian market in Q1-3 2021 (170 bcm) were 7 bcm (4.1 per cent) higher than in Q1-3 2019 (163 bcm).[39] [40] Most of this additional demand occurred in Q1 (+6 bcm) and was met by higher storage withdrawals. Gazprom's withdrawals from storage in Russia in Q1-2021 totalled 36.5 bcm, compared to 23.7 bcm in Q1-2019 – an increase of 12.8 bcm (54 per cent).[41]

The knock-on effect of these greater storage withdrawals in Russia in Q1 is that Gazprom was obliged to replenish those storage stocks in Q2 and Q3. In Q2-2021, Gazprom's net injections were 24.9 bcm, compared to 20.7 bcm in Q2-2019.[42] These storage injections in Russia continued throughout Q3 and into October, with Gazprom targeting 72.6 bcm in storage in Russia by 1 November.[43] Gazprom reached that target on 29 October, and announced that it would continue domestic injections until 8 November.[44]

Gazprom began winter 2020/21 with peak domestic Russian stocks of 72.3 bcm before withdrawing 23.6 bcm in Q4-2020 and 36.5 bcm in Q1-2021. Gazprom then injected 24.9 bcm in Q2-2021, meaning that it needed to inject 35.5 bcm in between July and October, to hit that target of 72.6 bcm on 29 October. In September, Gazprom announced that it was filling its domestic storage at a rate of 325 mmcm/d.[45] If that is applied to the 29 days of October, it can be estimated that Gazprom's domestic storage stocks on 30 September (the end of Q3) were 62.9 bcm, and that Gazprom had injected 25.9 bcm in Q3.

Therefore, it can be estimated that Gazprom's domestic injections in Q2 and Q3 combined were 50.8 bcm in 2021. For comparison, Gazprom's summer storage injections in Russia in Q2-3 have varied greatly over the past decade, from lows of 21-22 bcm in 2015 and 2016 to highs of 46.5 bcm in 2018 and 41.6 bcm in 2019. This means that Gazprom's domestic storage injections in April-October 2021 were around 9.2 bcm higher than in 2019. What may be particularly notable about 2021 is that domestic storage injections continued at full pace throughout October, while storage targets are usually met by the end of September. This suggests that Gazprom could not conduct its storage injections more quickly in Q2 and Q3, either due to the technical injection capacities of its storage facilities or because it did not have spare gas to inject.

Increased pipeline exports to Turkey under long-term contracts

A second factor that may have limited Gazprom's ability to offer additional volumes to Europe in 2021 is the increase in its pipeline deliveries to Turkey, whose imports in Q1-3 2021 are the highest since at least 2013 and likely to be the highest on record. In Q1-3 2021, Gazprom's pipeline supplies to Turkey totalled 20.8 bcm, similar to the record years of 2014 (20.5 bcm) and 2017 (20.9 bcm), and far higher than in 2019 (11.6 bcm) and 2020 (8.8 bcm).[46] Therefore, Gazprom's exports to Turkey in Q1-3 2021

---

[39] Gazprom, 2021. *Q3 2021 IFRS Report*. https://www.gazprom.ru/f/posts/23/378358/gazprom-ifrs-9mnth2021-presentation.pdf (see page 10)

[40] Gazprom, 2021. *Q3 2019 IFRS Report* https://www.gazprom.ru/f/posts/77/885487/gazprom-ifrs-3q2019-presentation.pdf (see page 6)

[41] Argus, 2021. *Russian gas production and storage data* (subscription required)

[42] Argus, 2021. *Russian gas production and storage data* (subscription required)

[43] RIA Novosti, 2021. Новак рассказал, когда в России закончится закачка газа в ПХГ. *RIA Novosti*, 14 October. https://ria.ru/20211014/gaz-1754541342.html?chat_room_id=1754541342

[44] Gazprom, 2021. Gazprom reaches set level of working gas inventories in Russian storages. *Press release*, 29 October. https://www.gazprom.com/press/news/2021/october/article541607/

[45] Gazprom, 2021. Gazprom ramps up gas production and supplies over 8.5 months of 2021. *Press release*, 15 September. https://www.gazprom.com/press/news/2021/september/article537599/

[46] EPDK, 2021. *Doğal Gaz Piyasası Aylık Sektör Raporu Listesi (Natural Gas Market Monthly Sector Report List).* https://www.epdk.gov.tr/Detay/Icerik/3-0-95/dogal-gazaylik-sektor-raporu. This data is also re-published by Argus (subscription required)

were around 8.8 bcm higher than in the same period in 2019, and it is likely that the increase between 2019 and 2021 will be even greater for the period January-November.

If Gazprom's exports to Turkey had not rebounded, these volumes would have been available for delivery to Europe. The rebound in Gazprom's supplies to Turkey were driven by increased Turkish gas demand and a shift in the balance of competitiveness between Gazprom's pipeline supplies to Turkey (which are oil-indexed) and the rising price of spot LNG cargoes. This is a reverse of the trend in the first half of 2020, when cheaper spot LNG cargoes led Turkish gas importers to push their receipts of pipeline supplies from Gazprom back into the second half of 2020 and even into 2021.

Absence of Gazprom's replenishment of its European storage stocks

Thirdly, in winter 2020/21 Gazprom withdrew 7.7 bcm from storage in Europe between mid-October and the end of March, compared to 2.6 bcm in winter 2018/19 and 2019/20. The 2020-21 withdrawal volume brought the stocks held by Gazprom in Europe down from 9.5 bcm at the start of winter to 1.8 bcm at the end of winter.[47] In the summer of 2021, Gazprom faced the task of refilling its own European downstream storage stocks. However, this is an area where Gazprom appears to have economised.

According to data from Gas Infrastructure Europe's Aggregated Gas Storage Inventory (AGSI+), Gazprom's estimated storage stocks in Europe peaked at 2.874 bcm on 21 November, compared to Gazprom's available capacity of 10.8 bcm. This suggests that not only did Gazprom strongly draw down its European storage stocks in winter 2020/21, but it subsequently replenished just 1 bcm of those stocks.[48] [49] This means that Gazprom's downstream European storage injections in 2021 were around 8 bcm lower than in 2019. Further analysis of Gazprom's stockholding in European gas storage facilities is discussed in more detail later, in the section on European gas storage.

Absence of spot sales on the Electronic Sales Platform

Faced with the question of why it has delivered less gas to Europe than expected in 2021, the most common response from Gazprom has been to stress that it continues to meet its long-term contract commitments – a stance echoed by its European counterparties. On 6 October, Reuters reported:

> "Eni is receiving from Gazprom all the quantity of gas which are nominated within the long-term contracts," the Italian firm said in emailed comments, echoing statements sent to Reuters by half a dozen other leading European energy companies.[50]

However, Gazprom has offered very little to the European spot market in 2021. A useful metric is how much Gazprom has sold on its Electronic Sales Platform (ESP) for delivery in the same calendar year. In January-November 2019, Gazprom sold 14.1 bcm for delivery in 2019, and that figure rose to 19.8 bcm in January-November 2020. By contrast, in January-November 2021, that figure was 1.0 bcm. This is a clear indication that Gazprom effectively ceased offering spot volumes to the European market.

Instead, Gazprom's ESP sales strategy in 2021 appears to be a continuation of its strategy in 2020: When prices on the spot market collapsed in 2020, Gazprom sold substantial volumes for delivery in the following calendar year (2021), rather than for prompt delivery. In 2020, Gazprom sold 7.4 bcm for delivery in 2021, of its total ESP sales that year of 27.4 bcm. In January-November 2021, of Gazprom's

---

[47] Gazprom, 2021. *Gazprom in Figures, 2016-2020*. https://www.gazprom.com/f/posts/45/961659/gazprom-in-figures-2016-2020-en.pdf (pages 59-60).

[48] Gas Infrastructure Europe, 2021. *Aggregated Gas Storage Inventory (AGSI+)*. https://agsi.gie.eu/#/

[49] Gazprom holds stocks at Haidach in Austria (via its wholly-owned subsidiaries, Astora and GSA), Dambořice in the Czech Republic (via its subsidiary, Moravia Gas Storage), Bergermeer in the Netherlands (where Gazprom holds 19 TWh of capacity in the 48 TWh-capacity facility through partnership with TAQA), and at Jemgum and Rehden (via Astora) in Germany. In addition, Gazprom has access to half the capacity at Katharina in Germany (via Astora) and one-third of the capacity held at Etzel in Germany by EKB (Gazprom being a 33 per cent shareholder in EKB).

[50] Golubkova, K., and Soldatkin, V., 2021. Analysis: Russia's Gazprom feels the heat over Europe's red-hot gas prices. *Reuters*, 6 October. https://www.reuters.com/business/energy/russias-gazprom-feels-heat-over-europes-red-hot-gas-prices-2021-10-06/

total ESP sales of 7.5 bcm, 6.5 bcm were for delivery in 2022 or 2023. [51] Finally, following months of lower sales volumes, Gazprom completely halted sales via the ESP on 13 October, and as of 15 December 2021 has not resumed them.

Therefore, when comparing January-November 2021 with the same period in 2019, Gazprom sold 13.1 bcm less for delivery in the same calendar year, but was obliged to deliver most of the 7.4 bcm that it had sold in 2020 for delivery in 2021.[52] Therefore, the call on Gazprom's gas from ESP sales in January-November 2021 could have been around 6.5 bcm less than in the same period in 2019.

Gazprom's supply-demand balance in January-November 2021

To summarise, in January-November 2021, Gazprom's gas production was around 12 bcm higher than in January-November 2019, while its Q1 storage withdrawals in Russia were 12.8 bcm higher. Together, this provided around 24.8 bcm of extra supply. However, deliveries to the Russian market were 7 bcm higher in Q1-3 2021 compared to 2019,[53] and domestic storage injections in Q2-3 2021 were an estimated 9.2 bcm higher. To this must be added the additional 9.4 bcm that Gazprom injected into Russian storage in October. Overall, this means that Gazprom supplied an additional 25.6 bcm for consumption and storage injections in Russia in January-November 2021, compared to 2019.

This supply-demand balance suggests that Gazprom already had 0.8 bcm less to supply to Europe, based on its activities in Russia. When the additional volumes supplied to Turkey (8.8 bcm) in Q1-3 are included, it can be estimated that Gazprom had around 9.6 bcm less to supply to the EU+UK in January-November 2021 compared to 2019. This deficit was accounted for by Gazprom's lower storage injections in Europe (around 8 bcm), and Gazprom scaling back of prompt ESP sales (which gave a saving of around 6.5 bcm). This would have left Gazprom with around 4.9 bcm of 'surplus', which must then be combined with a likely decrease in deliveries to the former Soviet Union (which were 3 bcm lower in Q1-3 2021 than in Q1-3 2019 according to the most recent data[54] [55]) and set against increased deliveries to China, which Gazprom forecasts to reach 8.5-9.5 bcm in 2021 compared to zero in January-November 2019.[56] [57]If Gazprom's deliveries to China in January-November were around 8 bcm, this would mean that Gazprom's supply (production and storage withdrawals) and demand (domestic and export) would more or less balance for the period January-November. This leads to the conclusion that, because of the additional calls on its supply, Gazprom did not have substantial additional volumes available to offer to the European spot market.

However, a major caveat is that Gazprom completed its domestic storage injection programme on 8 November 2021, and subsequently made extremely limited progress in replenishing its European storage stocks before reverting to net withdrawals from those stocks on 22 November. Given the volume of its daily storage injections in September and October (325 mmcm/d) it would have been reasonable to expect Gazprom to divert those volumes to Europe once its Russian stocks were fully replenished, given that it is unlikely that domestic Russian demand rose by such a significant amount in the weeks since then. Yet this has not happened, and has led to speculation that Gazprom is withholding volumes from the European spot market, either to exercise the market power that Gazprom only effectively possesses in a tight market, to maintain the current high prices for the wider benefit of its largely hub-indexed long-term contract portfolio, or to put pressure on the Nord Stream 2 approval process. Given

[51] Data from Argus and Gazprom Export, 2021. *Sales information*. http://www.gazpromexport.ru/en/esp/sales/

[52] Assuming around 0.8 bcm of the 7.4 bcm sold for delivery in 2021 would be delivered in December

[53] Data for Gazprom's supplies to the domestic market in Q3-2021 are not yet available.

[54] Gazprom, 2021. *Q3 2021 IFRS Report*. https://www.gazprom.ru/f/posts/23/378358/gazprom-ifrs-9mnth2021-presentation.pdf (see page 10)

[55] Gazprom, 2021. *Q3 2019 IFRS Report* https://www.gazprom.ru/f/posts/77/885487/gazprom-ifrs-3q2019-presentation.pdf (see page 6)

[56] Soldatkin, V., 2021. Gazprom says China gas exports continue despite fire at Amur plant. *Reuters*. 8 October. https://www.reuters.com/business/energy/russias-amur-gas-plant-puts-out-fire-interfax-2021-10-08/

[57] Although Gazprom's supplies to China are from the Chayanda gas field, which is not connected to the rest of the Russian pipeline system, the ramp-up of production at Chayanda is included in the increase in Russian production as a whole

that Gazprom's actions are currently highly influential on prices in the tight European market, it is worth noting several of the indicators of Gazprom's European sales strategy that may be observed in the near future.

Indicators of Gazprom's European sales strategy

In terms of what to expect from the ESP in the coming months, by the time it ceased trading on the ESP on 13 October, Gazprom had sold just 1.6 bcm for delivery in Q1-2022. For comparison, in 2020, Gazprom sold 3.4 bcm for delivery in Q1-2021.[58] If Gazprom is going to deliver more gas to Europe in Q1-2022, it will be on the basis of prompt-delivery sales on the ESP, even though such sales have been almost entirely absent since April 2021.[59] Indeed, even in Q1-2021, Gazprom sold just 95 mmcm on a day-ahead/weekend basis and nothing at all on a Balance of Month or Front-Month basis. Absent the launch of Nord Stream 2 before the end of winter (which is now highly unlikely), Q1-2022 could see a repeat of virtually zero prompt sales in Q1.[60]

A further indicator of Gazprom's supply availability can be found in Gazprom's firm monthly capacity bookings along the Yamal-Europe pipeline in Poland, for delivery to Poland and Germany, and via Ukraine, for delivery to Central Europe and Italy. The mid-month auctions on 20 December 2021 (for capacity in January 2022) and in January 2021 (for capacity in February 2022) will provide an indication of Gazprom's intentions. Given that – in the absence of downstream European storage stocks – Gazprom seems to be able to meet its delivery commitments regarding long-term contracts and volumes already sold on the ESP, it is likely that zero ESP prompt sales in Q1-2022 will be accompanied by zero additional capacity bookings via Ukraine and limited capacity bookings via Belarus-Poland.

On 18 October, Nord Stream 2 AG announced that the first line of the pipeline had been filled with technical gas – to bring it up to operating pressure – and was technically ready to begin operation.[61] If the timing of the announcement – on the same day that Gazprom booked no additional capacity via Ukraine and only one-third of the Yamal-Europe pipeline capacity via Poland – was a coincidence, its significance did not go unnoticed, not least by the CEO of the Ukrainian TSO, GTSOU, Sergey Makogon, who told Reuters: "Gazprom's statements about the first line of Nord Stream 2 being filled with gas is a direct hint that Europe may get additional volumes only via NS2".[62]

Given that the German regulator, BNetzA, has until 8 January 2022 to make its decision on the operation of Nord Stream 2, and there will be a period of ramping up the flows in any case, it remains unlikely that Nord Stream 2 will offer significant volumes to the European market before the end of winter. That likelihood decreased on 16 November, when BNetzA suspended its approval process while Swiss-based Nord Stream 2 AG forms a German-based subsidiary, so that the company certified by BNetzA operates under German law.[63] The chances of Nord Stream 2 being launched before the end of winter fell even further when the new German Foreign Minister, Annalena Baerbock, told German television (ZDF) on 12 December that the pipeline as it stands is not in accordance with European

[58] Data from Argus and Gazprom Export, 2021. *Sales information*. http://www.gazpromexport.ru/en/esp/sales/

[59] Between April and September 2021, Gazprom sold just 10 mmcm for day-ahead, weekend, balance of month, front-month, month-2, and month-3 delivery. By contrast, total sales amounted for 6,519 mmcm, with 99.85 per cent of that total for delivery on quarter, season, or calendar year basis

[60] Data from Argus and Gazprom Export, 2021. *Sales information*. http://www.gazpromexport.ru/en/esp/sales/

[61] Nord Stream 2 AG, 2021. The first Nord Stream 2 string filled with technical gas. *Press Release,* 18 October. https://www.nord-stream2.com/media-info/news-events/the-first-nord-stream-2-string-filled-with-technical-gas-154/

[62] Kobzeva, O., and Soldatkin, V., 2021. Gazprom books fraction of gas transit capacity via Poland, ignores Ukraine. *Reuters*, 18 October. https://www.reuters.com/business/energy/gazprom-books-fraction-gas-transit-capacity-via-poland-ignores-ukraine-2021-10-18/

[63] BNetzA, 2021. Certification procedure for Nord Stream 2 suspended. *Press Release*, 16 November. https://www.bundesnetzagentur.de/SharedDocs/Pressemitteilungen/EN/2021/20211116_NOS2.html

The contents of this paper are the authors' sole responsibility. They do not necessarily represent the views of the Oxford Institute for Energy Studies or any of its Members.

energy law, and that related security issues on the Russia-Ukraine border remain open: "In the event of further escalation this gas pipeline could not come into service".[64] [65]

This delay regarding Nord Stream 2 makes the scenario of zero ESP sales and limited capacity bookings via Ukraine and Belarus-Poland in Q1-2022 all the more likely. This, in turn, will contribute to the European market staying tight – with accompanying high prices – during that period.

Overall, it appears that Gazprom may not have intentionally held back supply from the European market prior to November 2021, but rather struggled to meet the call on its production from a combination of demand centres, by order of priority: 1) domestic Russian demand; 2) storage replenishment in Russia; 3) long-term contract commitments in Europe; 4) storage replenishment in Europe; and 5) spot market sales in Europe. It seems that Gazprom prioritised the first three and held back on both replenishing its European storage and on making spot sales in Europe.

However, the Russian government (if not Gazprom) sought to turn the lack of export volumes to its advantage, by implying that Russia would supply greater volumes to Europe once Nord Stream 2 had received approval. For example, in a government meeting on 6 October, the Russian Deputy Prime Minister, Alexander Novak, suggested that "an early completion of the certification and the issuance of a permit for pumping gas via the completed Nord Stream 2 pipeline" was – along with even modest additional ESP sales – one of two factors that "which could cool off the current situation". President Putin, who was chairing the meeting, responded:

> Mr. Novak, you have proposed increasing gas supplies to the market and selling more on commodity exchanges in order to cool down speculative demand and overcome the trading frenzy in Europe. This can and should be done, though not on the European spot market, but, as you have said, on the St Petersburg exchanges.[66]

The implied promise of more spot gas from Russia was sufficient to bring European prices back down from their 5 October peak of 116 EUR/MWh, to 96 EUR/MWh on 7 October, as illustrated in Figure 1.

The influence of Gazprom's supplies on a tight European market was seen again at the end of October. On 27 October, in another government meeting, the Gazprom CEO, Alexei Miller, promised President Putin that Gazprom would complete its domestic storage injections by 8 November, and would then start replenishing its European storage stocks.[67] Two days later, Gazprom announced that it had met its storage injection target in Russia, and was on track to finish domestic injections entirely by 8 November.[68] In response, the TTF Front-Month price fell significantly, from 88 EUR/MWh on 26 October to 64 EUR/MWh on 29 October. Although Russian supplies to Europe did increase from 9 November, it was a trickle rather than a flood. Then, following Gazprom's decision on 15 November to not book any firm monthly capacity for December on the Yamal-Europe route – and the BNetzA suspension of the Nord Stream 2 approval process the following day – the TTF Front-Month price rebounded to around 95 EUR/MWh on 16 November. Prices of 90-95 EUR/MWh were then maintained through the rest of November and into the first week of December. Finally, following the comments on Nord Stream 2 by the German Foreign Minister on 12 December, the TTF front-month price surged to 116 EUR/MWh on 13 December. Two days later, the TTF front-month reached 129.50 EUR/MWh, and the front-month

[64] ZDF, 2021. Außenministerin Baerbock im ZDF - Mit Russland "an Gesprächstisch zurückkehren". *ZDF*, 12 December. https://www.zdf.de/nachrichten/politik/aussenministerin-baerbock-russland-china-olympia-100.html

[65] France 24, 2021. No green light for Nord Stream pipeline if any Ukraine escalation: Germany. *France 24*, 12 December. https://www.france24.com/en/live-news/20211212-no-green-light-for-nord-stream-pipeline-if-any-ukraine-escalation-germany

[66] President of Russia, 2021. Meeting on development of the energy industry. *Press Release*, 6 October. http://en.kremlin.ru/events/president/transcripts/66866

[67] President of Russia, 2021. Meeting on developing Yamal Peninsula resource potential. *Press Release*, 27 October. http://en.kremlin.ru/catalog/keywords/83/events/67016

[68] Gazprom, 2021. Gazprom reaches set level of working gas inventories in Russian storages. *Press Release*, 29 October. https://www.gazprom.com/press/news/2021/october/article541607/

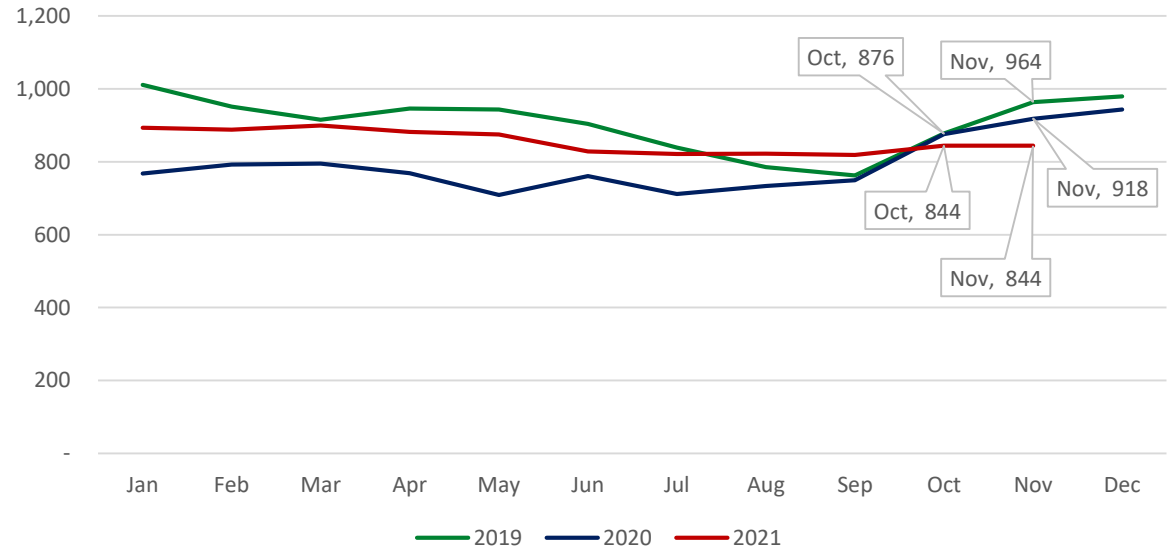
The contents of this paper are the authors' sole responsibility. They do not necessarily represent the views of the Oxford Institute for Energy Studies or any of its Members.

price on other European hubs in Germany and Central Europe surpassed 130 EUR/MWh, as prices rallied on forecasts of colder weather for the rest of December.[69]

Although Gazprom's supply-demand balance suggests there were perhaps legitimate reasons for its relatively limited flows of gas to the EU+UK until early November 2021, this is also little doubt that the relative lack of Russian supplies considerably tightened the European market and contributed to the pricing bull run. The situation became more intense in October and November, when uncertainties over Gazprom's decision to halt ESP trading in mid-October, limited downstream storage replenishment in November, the pattern of Gazprom's capacity bookings in both October and November, and uncertainties over Nord Stream 2 in November and December appear to have contributed significantly to European prices price movements in the past two months.

To conclude this section, the fact that physical supplies from Russia in January-November 2021 were lower than during the same period in 2019 was more than enough to offset the increase in non-Russian pipeline supplies in this period. The result was an overall decline in European pipeline imports, which contributed to the general tightness of the market. Indeed, as Figure 17 illustrates, from June 2021 onwards, total European pipeline imports (expressed in monthly average mmcm/d) remained virtually flat. They did not ramp up as winter began, and by October and November such flows were notably below the October-November flows in every year between 2017 and 2020. In this context, from late August onwards, as European prices surged towards their first peak on 5 October, the major pipeline-related factors were concerns over the transit of Algerian gas to Spain via Morocco, the relative decline in flows from Russia, and the limited additional flows from Norway. Those factors will persist into Q1-2022, contributing to market tightness and, in all probability, sustained high prices.

Figure 17. Total European pipeline imports (monthly average mmcm/d)



Source: Data from ENTSOG Transparency Platform

LNG imports – Europe's 'marginal molecule'

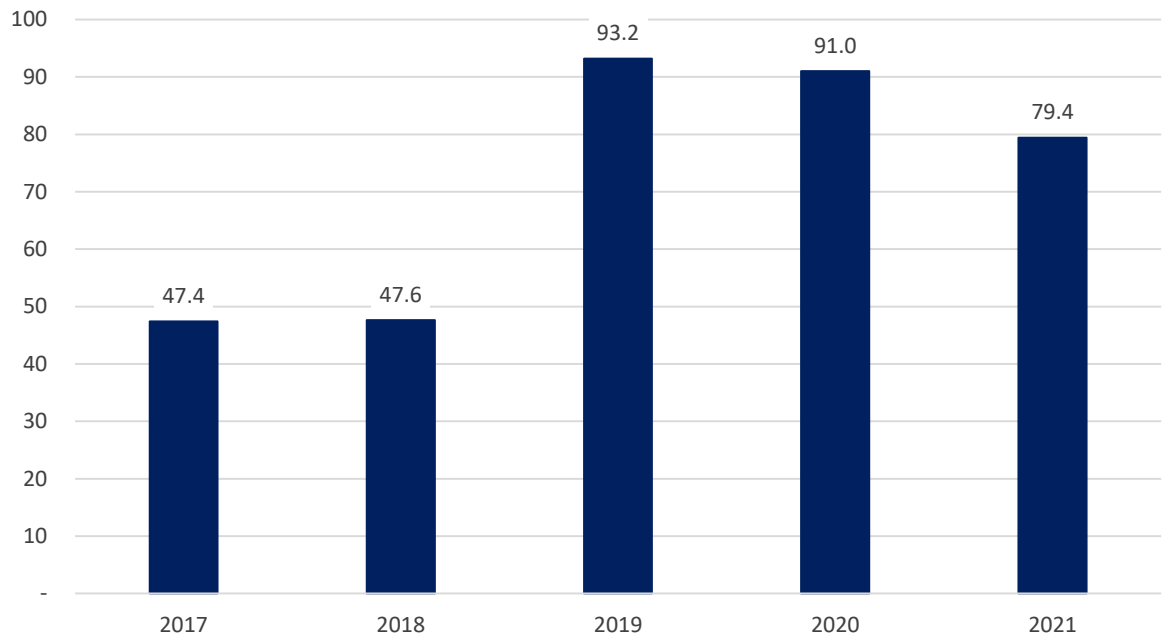
Europe is the 'balancing element' of the global LNG market. When that market is supply-long, the depth and liquidity of the traded market in Europe means that exporters are always likely to find a buyer. This proved to be the case in 2019 and 2020, when Europe absorbed excess volumes from the global LNG

[69] Argus, 2021. TTF: Prices rally on colder weather forecasts. *Argus*, 15 December. https://direct.argusmedia.com/newsandanalysis/article/2283681

market and effectively placed much of those volumes into storage. This explains why European LNG imports more than doubled in January-November 2019 compared to the same period in 2018, and declined only slightly in 2020. It also – at least partially – explains why European storage stocks at the start of winter in 2019 and 2020 were at record levels, with storage facilities effectively full. The combination of a liquid traded market and plentiful storage capacity relative to demand in Europe played a key role in balancing the supply-long global LNG market. In context of dramatic oversupply in 2020, this was complemented on the supply-side by the scaling back of Russian pipeline supplies to Europe (as discussed above) and the shut-in of LNG export cargoes in the United States.

By contrast, in the tight market of 2021, LNG cargoes were drawn away from Europe to the premium Asian market, causing a decline in European LNG imports despite the rising European hub prices presenting a clear signal that the market required greater supply volumes. Specifically, European LNG imports fell slightly from 93.1 bcm in January-November 2019 to 91.0 bcm in 2020, before falling to 79.4 bcm in 2021, as illustrated in Figure 18. The dynamics of the tighter global LNG market were analysed in a recent OIES Comment by Mike Fulwood and Jack Sharples.[70]

Figure 18. European (EU+UK) LNG imports in January-November (bcm)



Source: Data from Kpler LNG Platform

LNG is the 'marginal molecule' for Europe, to be called upon to serve unmet demand once domestic production, pipeline imports, and storage withdrawals have been fully utilised. In January-November 2019, LNG accounted for 20.1 per cent of total European supply (excluding storage movements), while in January-November 2021 its share fell to 18.9 per cent. Thanks to its place at the top of the 'cost stack', the price of LNG cargoes has significant influence on European traded hub prices. Therefore, it is worthwhile considering the dynamics that influenced the volume of LNG that arrived in Europe in 2021, compared to previous years.

Why there was less LNG available for Europe in 2021 than in 2019

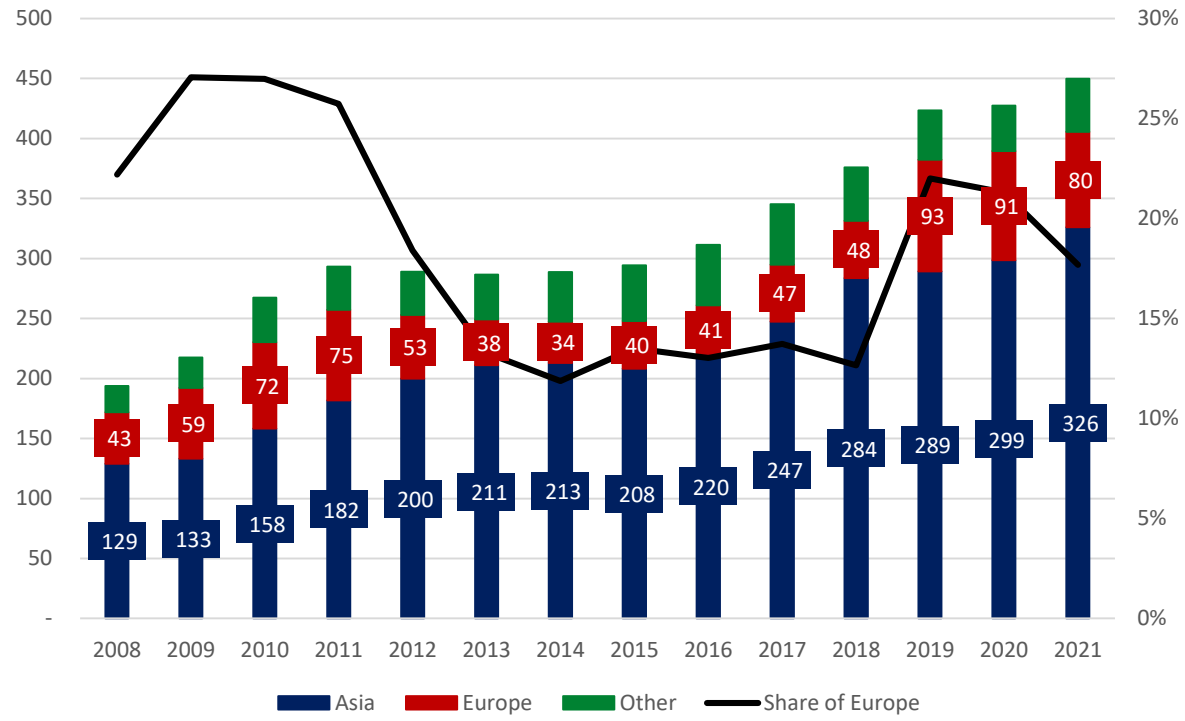
The long-run trend for the global LNG market is one of growth. Since 2008, global LNG exports in the period January-November grew every year except 2012 and 2013. Between 2013 (286.6 bcm) and 2021 (450.0 bcm), the increase was 57 per cent (163.4 bcm). On the supply side, that growth has been

[70] Fulwood, M., and Sharples., J, 2021. Why are gas prices so high? *OIES Comment,* 27 September. https://www.oxfordenergy.org/publications/why-are-gas-prices-so-high/

driven by an increase in export volumes from Australia (since 2014), the United States (since 2016), and Russia (since 2018). As a result, the supply growth was particularly strong in the period between 2016 and 2019.

As Figure 19 illustrates, this growth in supply was largely matched by an increase in Asian LNG imports between 2016 and 2018. But in 2019, the growth in Asian LNG demand stalled as supply continued to rise, and Europe absorbed the excess. As a result, the share of Europe (excluding Turkey) in global LNG imports from rose 13 per cent in 2018 to 22 per cent in 2019. This figure fell only slightly, to 21 per cent, in 2020, as Europe again absorbed volumes from a supply-long global market. However, that situation changed in 2021, and the share of Europe in global LNG imports fell back to 18 per cent. This was driven by two key factors. Firstly, Asian LNG demand surged and, secondly, LNG supply did not grow as quickly as expected.

Figure 19. LNG imports by region in January-November (bcm) and share of Europe in global LNG imports (%)



Source: Data from Kpler LNG Platform

Regarding the first factor, the year-on-year growth in Asian LNG demand in the period January-November 2021 (27 bcm) was equal to the year-on-year growth in January-November 2017, and second only to the growth seen in the same period in 2018. Therefore, the year-on-year LNG demand growth in 2021 was at a historically high level. Part of the reason for this is a reaction to the unexpected surge in weather-related demand in Asia between November 2020 and February 2021, which peaked with Asian LNG price spikes in January 2021. In a case of 'once bitten, twice shy', Asian buyers have replenished their storage (both underground gas storage and storage tanks at LNG import terminals) and sought to contract greater volumes ahead of time and rely less on spot cargoes during the winter of 2021/22. The rush for new long-term contracts was particularly evident with regard to Chinese LNG buyers, as China remained on course to become the world's largest LNG importer in 2021.[71] The Asian

[71] Platts, 2021. Analysis: China's rush for LNG deals amid high spot prices signals strong gas demand growth. *Platts*, 1 December. https://www.spglobal.com/platts/en/market-insights/latest-news/lng/120121-analysis-chinas-rush-for-lng-deals-amid-high-spot-prices-signals-strong-gas-demand-growth

regional economy also returned to growth in 2021, although the Asian Development Bank 2022 forecast for the developing economies was trimmed in mid-December over COVID-19 uncertainties related to the OMICRON variant.[72]

Regarding the second factor, global LNG exports in January-November 2019 (424 bcm) grew only slightly to reach 427 bcm in the same period in 2020, before rising to 450 bcm in January-November 2021. The issue is not that LNG supply did not grow in 2021. Rather, it simply did not grow as much as it could have done. On the upside, in the period January-November, year-on-year growth in US LNG exports reached 31.1 bcm. This was combined with a rebound in LNG exports from Egypt (+6.9 bcm), Malaysia (+3.0 bcm) and Algeria (+1.6 bcm). Another five suppliers (Australia, Cameroon, Equatorial Guinea, Oman, and UAE) added a combined further 1.8 bcm to global supply. Overall, LNG exports from these nine suppliers rose by 37.5 bcm year-on-year.

The problem is that LNG exports from the remaining ten suppliers fell by 21.9 bcm year-on-year. The largest reductions in supply were in Nigeria (-5.0 bcm), Trinidad & Tobago (-5.2 bcm), and Norway (-4.1 bcm). In Nigeria and Trinidad & Tobago, this was due to lower availability of feedgas for LNG plants. In Norway, the Hammerfest LNG export terminal is expected to be offline until March 2022, following a fire in September 2020.[73] Other notable declines in supply occurred in Peru (-1.7 bcm), Indonesia (-1.9 bcm) and Angola (-1.4 bcm). Finally, year-in-year declines in supply from Brunei, Papua New Guinea, Qatar, and Russia took a combined further 2.6 bcm off the market.

In the much tighter global LNG market of 2021, the volume of supply left for spot sales once the long-term contracts had been serviced was accordingly smaller. This particularly affected Europe, given its status as the 'balancing market' for global LNG. Caught between rising Asian demand and supply that did not grow as quickly as expected, European LNG imports in January-November fell from historic highs of 93.2 bcm (2019) and 90.0 bcm (2020) to 79.4 bcm (2021).

This 13.8 bcm decline in European LNG imports in January-November 2021 compared to the same period in 2019 combined with lower European production (-16.2 bcm) and lower European pipeline imports (-14.6 bcm) to create an overall decline in supply of 44.6 bcm. This decline was 9.6 per cent of the combined production, pipeline imports, and LNG imports in 2019 (463.9 bcm). As noted at the beginning of this paper, these shifts are illustrated in Figure 4. A final, key, element to consider in the European gas balance is storage, which absorbed the oversupply in 2019 and provided additional supply in the tight market of 2021.

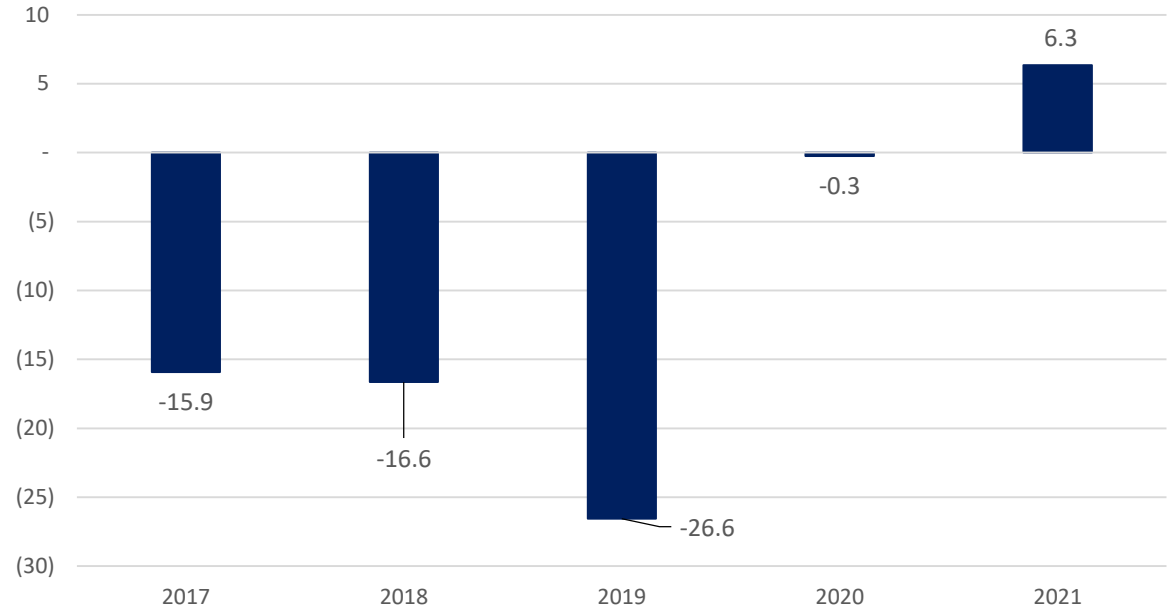
European gas storage withdrawals

A major difference between January-November 2019 and January-November 2021 relates to the use of gas storage to balance the market. As Figure 20 illustrates, in 2019 European (EU+UK) gas storage facilities accommodated a net injection of 26.6 bcm as the market absorbed excess volumes from the global LNG market. By contrast, 2021 saw a net withdrawal of 6.3 bcm, as the European market tightened and faced a loss of supply from other sources. These figures complement the analysis of supply from other sources (production, pipeline imports, and LNG imports) and thus allow an estimation of how much gas was actually consumed in Europe during this period.

[72] Foster, K., 2021. ADB trims Asia growth forecast on Covid resurgence risk. *Argus*, 14 December. https://www.argusmedia.com/en/news/2282950-adb-trims-asia-growth-forecast-on-covid-resurgence-risk

[73] IEA, 2021. *Quarterly Gas Market Report: Q4-2021*. https://www.iea.org/reports/gas-market-report-q4-2021 (See page 53-55)

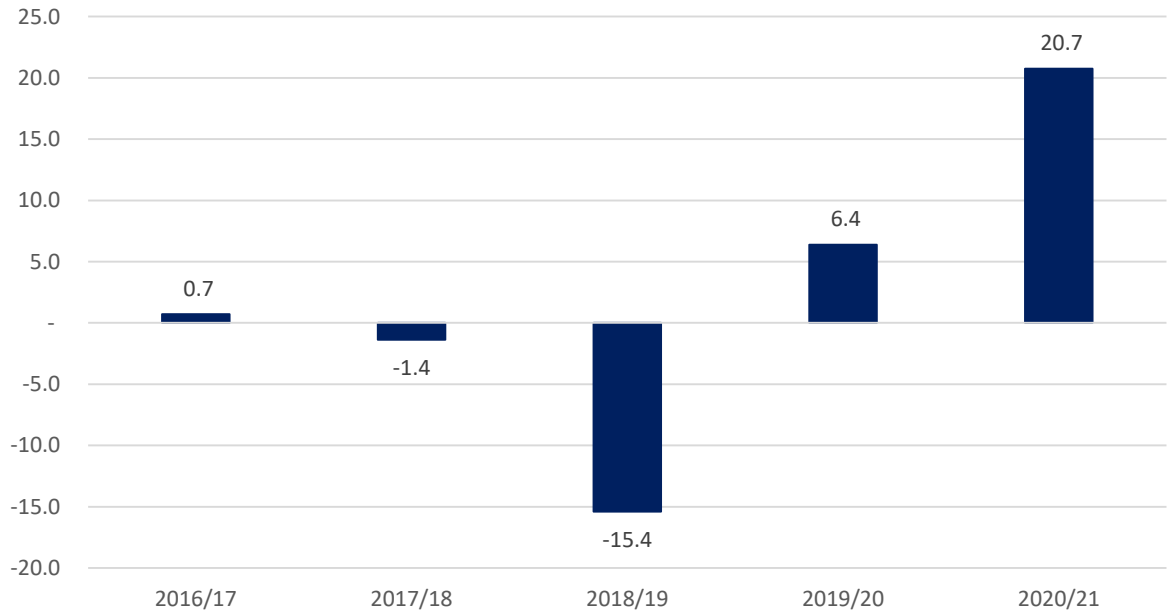
Figure 20. European (EU+UK) net storage withdrawals in January-November (bcm)



Source: Gas Infrastructure Europe Aggregated Gas Storage Inventory (AGSI+)

Given the seasonality of storage movements, it is useful to expand the period of analysis slightly. This is done by including data for the December of the previous year. In the period from 1 December 2018 to 1 December 2019, European storage stocks grew by 15.4 bcm, thus implying net injections during this period. By contrast, between 1 December 2020 and 1 December 2021, European storage stocks shrank by 20.7 bcm, implying a net withdrawal during that 12-month period. This comparison is presented in Figure 21.

Figure 21. Net withdrawal from European (EU+UK) storage stocks by year in the period from 1 December to 1 December of the following year (bcm)

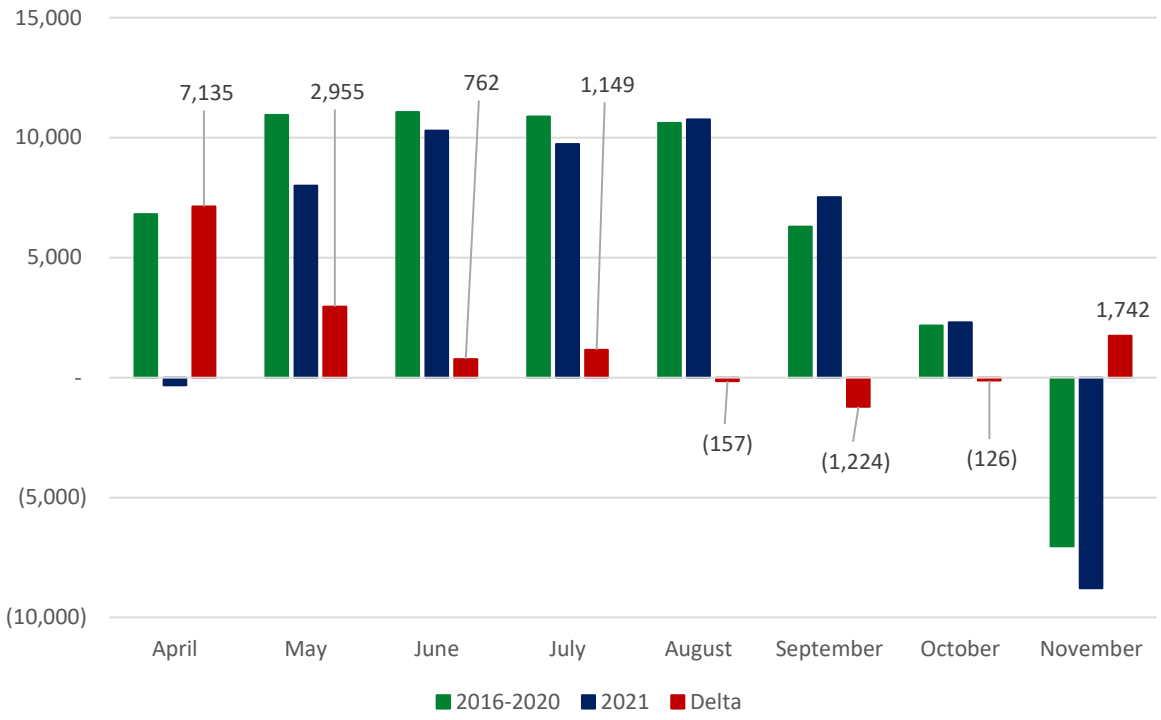


Source: Gas Infrastructure Europe Aggregated Gas Storage Inventory (AGSI+). For example, 2016/17 denotes that storage stocks on 1 December 2017 were 0.7 bcm lower than they had been on 1 December 2016, implying a net withdrawal in that period.

In 2019, the storage dynamic was driven by a mild Q1 with lower than usual storage withdrawals, followed by substantial injections over the summer as Europe absorbed LNG oversupply from the global market. Storage was also driven by concerns over the expiry of the Russia-Ukraine gas transit contract on 31 December 2019, and so withdrawals in Q4-2019 were lower than usual. The storage stocks were thus carried over into Q1-2020, when withdrawals were again lower than usual due to relatively mild weather. Smaller injections were then required in order to bring stocks back to full capacity for the start of winter. The accumulation of stocks began to unwind with strong withdrawals in Q4-2020 (21.1 bcm), which exceeded both quarterly European production (18.1 bcm) and quarterly LNG imports (19.5 bcm).

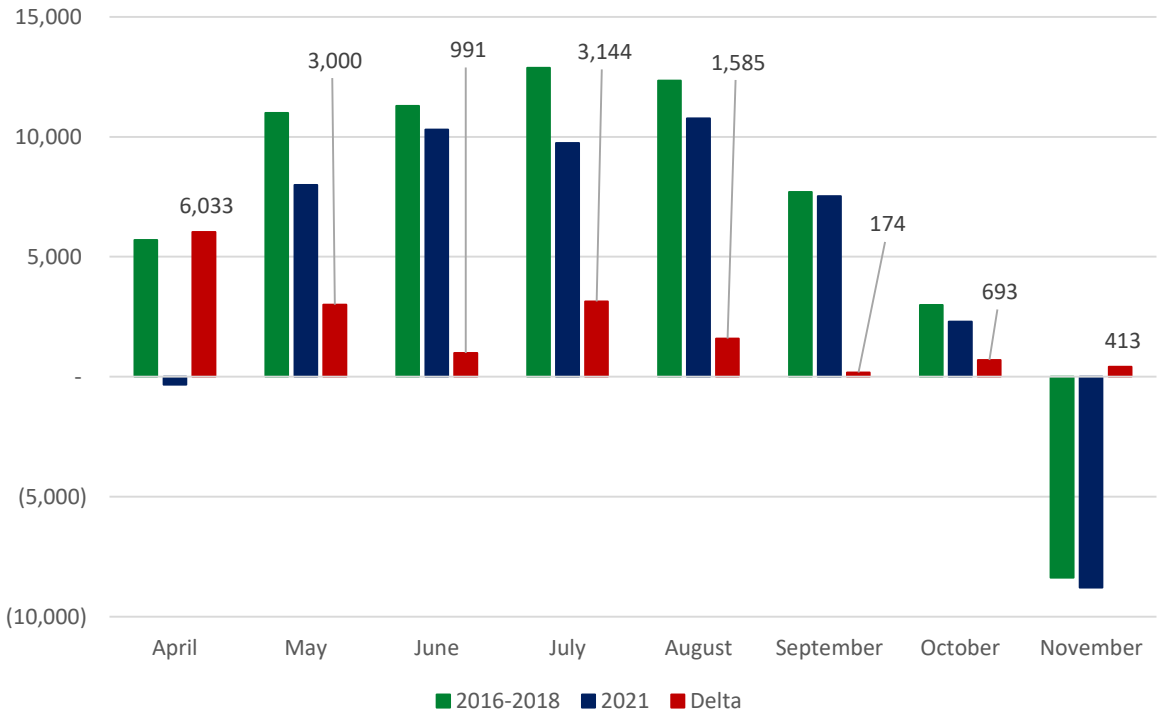
Moving into 2021, substantial withdrawals were made in January-March. This was followed by flat withdrawals in April: withdrawals in the early part of the month were balanced by injections in the later part of the month, leaving stocks on 1 May 0.6 bcm lower than on 1 April. In effect, Europe lost the whole month of April from its usual storage injection season. Subsequent injections between May and September were generally lower than the 2016-2020 average, as indicated in Figure 22. However, this picture is slightly distorted by the exceptional storage stock accumulation in 2019 and 2020. A comparison with the average for 2016-2018 in Figure 23 thus presents a more 'normal' basis for comparison. In both graphs, the green bars represent average monthly net injections for an average of several years, the blue bars represent net injections by month in 2021, and the red bars the difference between the two.

Figure 22. European (EU+UK) net storage injections: 2021 vs 2016-2020 average (mmcm per month)



Source: Gas Infrastructure Europe Aggregated Gas Storage Inventory (AGSI+)

Figure 23. European (EU+UK) net storage injections: 2021 vs 2016-2018 average (mmcm per month)



Source: Gas Infrastructure Europe Aggregated Gas Storage Inventory (AGSI+)

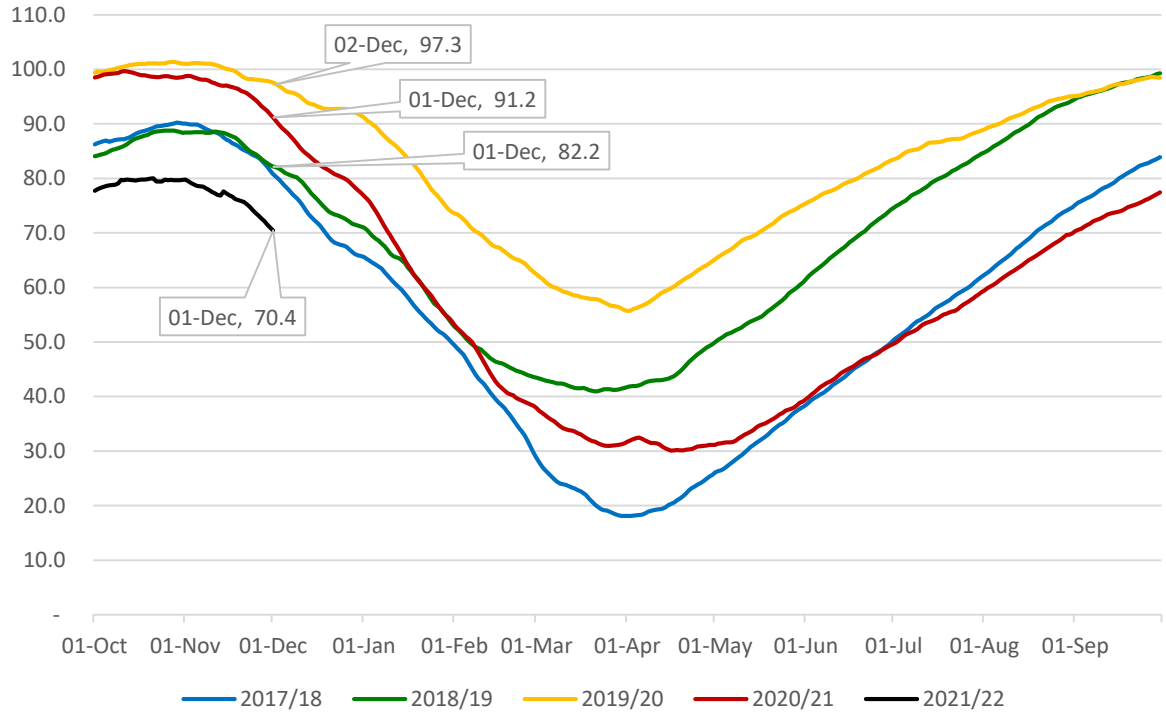
The comparison between 2021 and the 2016-2018 average shows that around 9.033 bcm less than usual was injected into European storage in April and May 2021. In June, July, and August 2021 combined, this shortfall in injections was 5.720 bcm, with a further shortfall of 0.867 bcm in September and October combined. Therefore, between April and October 2021, 15.62 bcm less was injected into European storage than the average for 2016-2018. Finally, in November 2021, 0.413 bcm more was withdrawn from European storage than the 2016-2018 average.

In April and May, the shortfall in injections was driven by a combination of two factors: colder than usual weather, and the fact that (as shown in Figure 1 back at the start of this paper) European prices had already begun to rise, thus hampering injections due to a forecast lack of seasonal spread. As prices continued to rise over the summer, those concerns over seasonal spreads increased and combined with a tighter market that limited volumes available for injection.

As shown in Figure 24, the result was that Europe began winter 2021/22 with storage stocks substantially lower than the 'normal' years of 2016/17 and 2017/18, and far lower than at the start of winter 2019/20 and 2020/21. In October 2017 and 2018, European stocks peaked at 90.2 and 88.8 bcm, respectively. In October 2019 and 2020, those peaks were 101.4 and 99.7 bcm, respectively. In October 2021, the peak was just 80.0 bcm.[74]

[74] Gas Infrastructure Europe, 2021. *Aggregated Gas Storage Inventory (AGSI+).* https://agsi.gie.eu/#/historical/eu

Figure 24. European (EU+UK) storage stocks by gas year (bcm)



Source: Gas Infrastructure Europe Aggregated Gas Storage Inventory (AGSI+)

Although the slower injections throughout 2021 freed up greater volumes of supply (from production and imports) for immediate consumption, it is also likely that concerns over lower-than-usual storage stocks by late summer contributed to market unease about the coming winter. Higher than usual storage stocks at the start of winter 2020/21 may have enabled the European market to cope with the surge in Asian LNG demand with barely a ripple in European hub prices, but lower stocks for winter 2021/22 precluded equanimity over developments in competing markets and likely contributed to the European price hike.

Figure 24 also shows that, by 1 December 2021, it had become clear that stocks were being drawn down more quickly than usual. Despite starting the winter with lower than usual stocks, the prevailing high prices are encouraging early withdrawals. By 14 December, European stocks had fallen to 64.1 bcm, with net withdrawals averaging 0.5 bcm per day. If withdrawals continue at that rate, European stocks could be as low as 55 bcm by 31 December 2021. This stock drawdown raises concerns over potential stock levels in mid-winter, should Europe experience either a weather-related surge in demand, or a decline in the availability of supply from other sources.

The role of Gazprom in European storage stocks

An interesting point to note is that the shortfall of 8-9 bcm between European storage stocks in late October 2017 and 2018 (88-89 bcm), and the storage stocks in late October 2021 (80 bcm) is very similar to the shortfall in storage stocks that are estimated to be held by Gazprom subsidiaries in October 2021, compared to stocks held by those subsidiaries in recent years.

In Austria, Gazprom holds storage capacity at the Haidach underground gas storage facility (UGSF) through Astora, which is a wholly-owned subsidiary of Gazprom Germania, which is in turn a wholly-

owned subsidiary of Gazprom Export.[75] Gazprom also holds capacity at Haidach through GSA, which is a joint-owned subsidiary of Gazprom Export and Gazprom Underground Gas Storage.[76] In the Czech Republic, Gazprom holds storage capacity at the Dambořice gas storage facility via its subsidiary, Moravia Gas Storage, which is a joint venture between Gazprom and MND (Moravské naftové doly), a Czech energy company. The Dambořice facility was launched on 1 July 2016.[77] Gazprom holds a contract to lease 90 per cent of the capacity of the facility for 15 years from its launch.[78] At Bergermeer in the Netherlands, Gazprom holds 19.6 TWh (1.8 bcm) of capacity in return for providing the cushion gas when the facility was launched in 2015 with a total capacity of 46 TWh.[79] In Germany, Gazprom holds storage capacity at the Rehden and Jemgum facilities via Astora. Gazprom also holds capacity in Germany at the Katharina UGSF through Erdgasspeicher Peissen GmbH, which is a 50-50 JV between Gazprom Germania and the German energy company, VNG (Verbundnetz Gas).[80] Here it is assumed that Gazprom holds capacity at the Katharina UGSF in line with its shareholding in Erdgasspeicher Peissen. Finally, also in Germany, Gazprom holds capacity at the Etzel UGSF through its 33 per cent stake in EKB (Etzel-Kavernenbetriebsgesellschaft mbH & Co. KG), a joint venture founded in 2007 between BP, Ørsted and Gazprom Germania.[81] Again, Gazprom's stocks are estimated in proportion to its shareholding.

Excluding Dambořice (for which data is not readily available and the storage capacity is just 0.3 bcm), and taking into account Gazprom's pro-rata capacity holdings at Bergermeer, Katharina, and Etzel, it can be estimated that Gazprom has access to approximately 10.4 bcm of storage capacity in Europe.

As Figure 25 shows, Gazprom usually begins the winter with a peak of around 9.5 bcm in European storage at the beginning of November. But in 2021, that figure was just 2.8 bcm. Gazprom's 'storage shortfall' of around 7 bcm compared to usual accounts for approximately 70 per cent of the shortfall in total European storage stocks at the start of winter 2021, compared to 'normal' years (taking 2017 and 2018 as examples). Therefore, storage injections in 2021 by market participants other than Gazprom were, in fact, only slightly lower than usual. For example, if 90 bcm is a 'normal' European stockholding at the start of winter, of which Gazprom holds 10 bcm and others 80 bcm, and of the 10 bcm shortfall in 2021 Gazprom accounts for 7 bcm and others 3 bcm, then stock holding by non-Gazprom entities is 3.75 per cent lower than usual. This decline may at least be partly attributed to lack of injections by speculative traders without commitments to final consumers, who did not foresee a commercially attractive seasonal spread in summer 2021 in the context of high summer prices.

Gazprom's withdrawals in Q4-2020 and Q1-2021 were slightly greater than usual, but it is the lack of replenishment that has made headlines. Gazprom's stocks bottomed out at 1.6 bcm on 22 April 2021, and by 22 August Gazprom had made a net injection of just 0.1 bcm. Thereafter, Gazprom's injections were slow, but continuous, until 22 November, when stocks peaked at 2.9 bcm. In the 10 days that followed, Gazprom withdrew 0.2 bcm. In September and October, Gazprom and Russian government ministers suggested that Gazprom would begin replenishing its European stocks once it had completed its domestic storage replenishment programme on 8 November. The fact that the increase in Gazprom's flows to Europe – and its European storage injections – after this date were a trickle rather than a flood exacerbated European concerns of winter supply from Russia.

[75] Gazprom Germania, 2021. *Gas storage*. https://www.gazprom-germania.de/en/de/business-areas/natural-gas-storage.html

[76] GSA LLC, 2021. *The Company*. https://www.gsa-services.ru/

[77] KKCG, 2016. Moravia Gas Storage opens a new gas storage facility. *Press Release*, 1 July. https://kkcg.com/en/moravia-gas-storage-opens-a-new-gas-storage-facility

[78] TASS, 2013. Gazprom acquires storage facility in south Moravia for 15 years. *TASS*, 19 September. https://tass.com/economy/700983

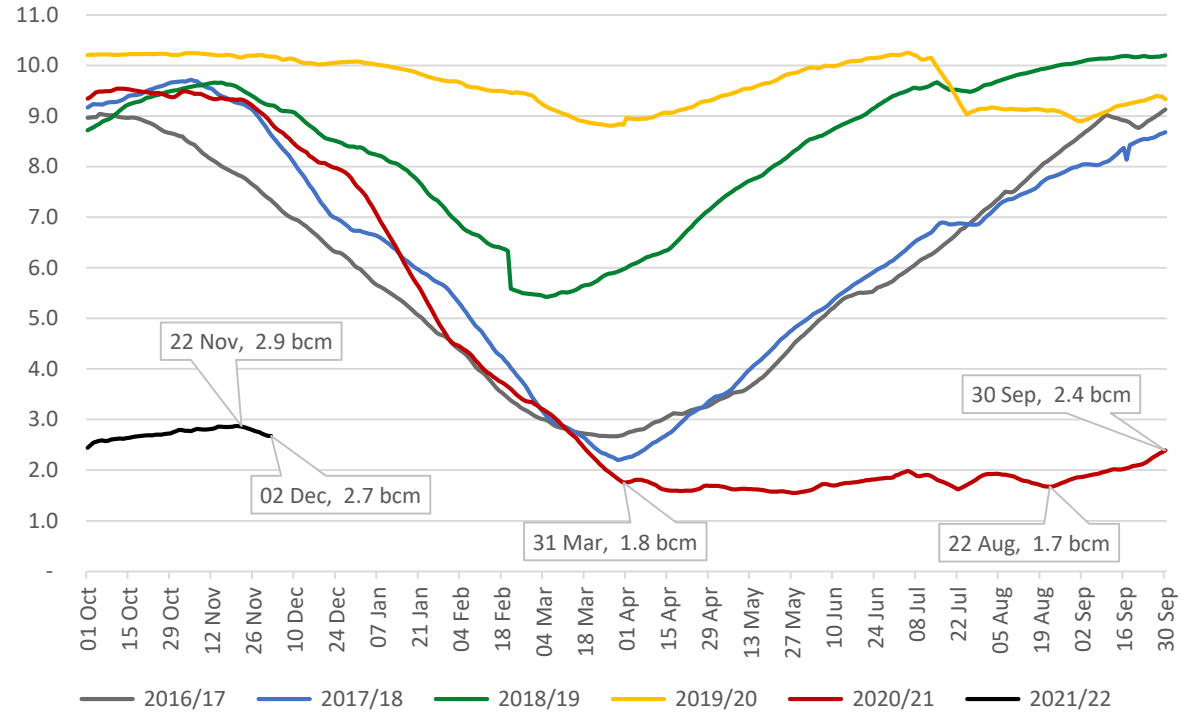
[79] Gas Storage Bergermeer, 2021. *Gas Storage Bergermeer partners*. https://www.gasstoragebergermeer.com/partners/

[80] Erdgasspeicher Peissen, 2021. *The company*. https://www.ugs-katharina.de/en/company/about-us

[81] EKB, 2021. *The company*. https://ekb-storage.de/en/the-ekb/company/

The contents of this paper are the authors' sole responsibility. They do not necessarily represent the views of the Oxford Institute for Energy Studies or any of its Members.

Figure 25. Gazprom's estimated European storage stocks by gas year (bcm)



Source: Gas Infrastructure Europe Aggregated Gas Storage Inventory (AGSI+); EKB (https://ekb-storage.de/en/ekb-storage/storage-usage/#snform)

Finally, Gazprom's non-replenishment of storage has implications for its supplies to the European market in the rest of winter. Gazprom is likely to act cautiously in terms of meeting its long-term contract commitments, by not using its limited downstream storage stocks to make ESP or hub sales during the winter. Nor is it likely to ramp up pipeline flows to offer additional volumes to the spot market, as discussed earlier. Instead, Gazprom may seek to maintain spare export pipeline capacity in order to flex flows in line with long-term contract counterparty nominations. This will affect the volume of gas available on the spot market, potentially supporting hub prices throughout the winter.

Conclusions

This analysis of why the dramatic rise in European gas prices in 2021 took place so shortly after the supply-long year of 2020 began with the key reminder that the current bull run is a global market issue. It is underpinned by the supply-demand balance on the global LNG market, where demand in the premium Asian market has bounced back, due to a combination of post-COVID economic recovery, cold weather in Q1-2021, and a determination on the part of LNG buyers not to be 'caught short' in winter 2021/22 as they were in winter 2020/21. On the supply side, the increase in global LNG export capacity has been at least partly offset by a number of unrelated supply outages at a variety of export plants which, in aggregate, took a significant volume of LNG supply off the market. In short, global LNG demand grew faster than global LNG supply, thus tightening the market.

In Europe (EU+UK), implied gas consumption in January-November 2021 (426 bcm) is notably lower than in 2019 (437 bcm). However, those two years provide markedly different market contexts. In 2019, European demand grew in the wake of a supply push as Europe absorbed LNG cargoes, substantial storage stocks were accumulated, and the market cleared at prices that declined throughout the year. By contrast, in 2021, supply declined and storage withdrawals balanced the market, while prices rose throughout the year.

The longstanding, and ongoing, decline in 'domestic' European production (especially in the Netherlands) was exacerbated in the short term by temporary maintenance in the UK and Denmark that took further volumes off the market. As a result, European production was 16.2 bcm lower in January-November 2021 than in 2019. The supply squeeze was tightened by the decline in pipeline imports, where the drop in supply from Russia was not fully offset by the rise in supply from Norway, North Africa, and Azerbaijan. The net decline in pipeline imports between January-November 2019 and January-November 2021 was 14.6 bcm. This decline in pipeline imports ran in parallel to a 13.8 bcm decline in LNG imports, as cargoes were pulled away to the premium Asian market and the global LNG market tightened generally. Therefore, total imports into Europe (pipeline and LNG combined) in January-November 2021 were 28.4 bcm lower than in the same period in 2019.

The combined decline in production and imports between January-November 2019 and the same period in 2021 was 44.6 bcm, yet total supply to the market (implied consumption) only fell by 11.7 bcm. The difference was met by swing in net storage withdrawals: in January-November 2019, net storage injections took 26.6 bcm off the market, while in 2021, net storage withdrawals added 6.3 bcm to supply.

Such a swing was made possible by the availability of storage capacity at the end of winter 2018/19. By late March 2019, European storage stocks totalled 41 bcm, leaving 61 bcm of storage capacity available for injections. Conversely, the dramatic drawdown of storage stocks in winter 2020/21 was made possible by the fact that Europe started the winter season with peak stocks of 99.7 bcm (effectively full capacity) on 11 October 2020 that were subsequently drawn down to 30.1 bcm by 16 April 2021 – a net withdrawal of 69.6 bcm. Given that Europe began winter 2021/22 with stocks of 80 bcm, a cold winter and attempts to meet demand by drawing down stocks in a manner similar to winter 2020/21 could leave Europe perilously close to empty storage by the end of winter. Concern over supply availability from storage in mid-winter – especially in the event of a spell of intensely cold weather similar to January 2017 or 'The Beast from the East' in February-March 2018 – is likely contributing to the sustained high gas prices, which appear to be 'pricing in' a cold winter.

This paper devoted particular attention to pipeline imports from Russia, Gazprom's supply-demand balance, and indicators of Gazprom's trading strategy. The simple reason for this is that no other single company has anything like the influence of Gazprom in a tight European market. In January-November 2021, pipeline supplies from Russia (delivered exclusively by Gazprom) accounted for 46 per cent of European pipeline imports, 36 per cent of combined European pipeline and LNG imports, and 31 per cent of European supply (production plus imports, excluding storage movements). By contrast, Norwegian gas is supplied by a variety of companies operating on the Norwegian continental shelf, and LNG is also provided by a portfolio of suppliers. Between January and November 2021, Gazprom shipped 131 bcm to Europe. The next largest individual suppliers, Sonatrach (pipeline plus LNG) and Qatargas (LNG), provided 45 bcm and 21 bcm, respectively.[82]

The extent of Gazprom's influence on market prices was seen in October, November, and December, in European price reactions to announcements of Gazprom's storage replenishment strategy, pipeline capacity bookings, and uncertainties over Nord Stream 2. The lesson to be drawn from that analysis in particular, is that while Gazprom may have faced calls on its production that limited its ability to offer additional volumes to the European spot market in summer 2021, since it completed its domestic storage replenishment on 8 November it has become clear that Gazprom regards it as commercially advantageous not to offer volumes to the European spot market. As a result, the outlook for the European market for the rest of winter ought not to pin its hopes on a surge of Russian pipeline supplies in Q1-2022. Rather, the expectation is that Russian supplies will not increase significantly until Nord Stream 2 begins operation, an event that is almost certain to take place after the end of winter.

[82] Data from Kpler LNG Platform and ENTSOG Transparency Platform

Returning to the broader aim of the paper, the supply-side elements analysed in this paper provide three key conclusions:

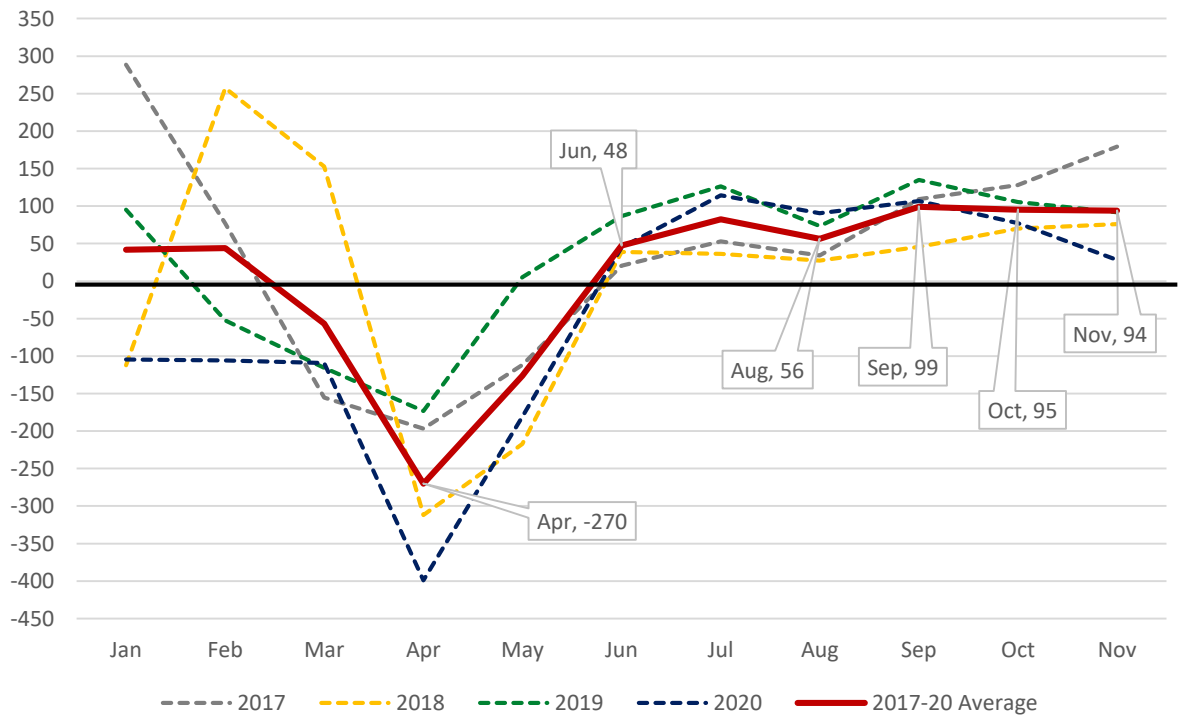
1) Thanks to its continuous decline, production now accounts for less than 15 per cent of European supply. This not only leaves Europe more dependent on imports, but also means that Europe has lost a substantial amount of seasonal swing in its supply, rendering storage all the more important;

2) Pipeline supplies remain the most important source of supply to the European market, and any fluctuation in these supplies has a significant impact on both supply volumes and price levels. In a very tight market, which is presently the case, even market signals from pipeline capacity bookings by major suppliers can have an outsized impact on price volatility;

3) LNG now accounts for a far greater share of European imports and consumption than was the case before 2019. While this benefitted Europe in 2019 and 2020, as plentiful supply washed up on European shores from a supply-long global LNG market, developments in 2021 have shown that Europe will need to compete for supply in a tight global market. In 2021, as the price of Europe's 'marginal molecule' rose, it contributed to the overall rise in European wholesale prices. Looking ahead, it will potentially contribute to greater European price volatility, given the greater 'destination flexibility' of LNG supplies relative to pipeline supplies and European production.

Having accounted for why the European market faced lower supply in January-November 2021 overall, thus contributing to a general rise in European prices throughout the year, it is now worth considering how the supply-side factors contributed to the acceleration of the increase in European prices between late August and the peak in October, and why prices have not come back down from that peak. The final graph – Figure 26 – shows the difference between total supply to the European market by month in 2021 and the same month in previous years (monthly average mmcm/d).

Figure 26. Difference between monthly average total supply to the European market in 2021 and in previous years, 2017-2020 (mmcm/d)



Source: Data from ENTSOG Transparency Platform, Kpler LNG platform, Eurostat, and Gas Infrastructure Europe Aggregated Gas Storage Inventory (AGSI+). Zero represents 2021, while the coloured lines represent the difference between 2021 and the given year (or, in the case of the red line, the average for 2017-2020).

What is notable is that in every month between June and November, total monthly supply (production plus imports and net storage withdrawals) in 2017, 2018, 2019, and 2020 was higher than in 2021. Moreover, compared to the 2017-2020 average, the shortfall in European supply grew from 56 mmcm/d in August to 99 mmcm/d in September and 94-95 mmcm/d in October and November. In other words, the relative decline in European supply in 2021 compared to previous years became particularly acute in these months, just as European prices skyrocketed.

Looking forward to the rest of winter, the supply outlook is unlikely to be significantly different from the situation at present. Production is unlikely to increase significantly, and the same remains true of imports from Norway (which already seem to be operating at full capacity) and from Algeria (which are now constrained by the cessation of Moroccan transit to Spain). Gazprom is also likely to continue limiting its supplies to the fulfilment of long-term contract commitments, with little or no additional offerings to the spot market pending the launch of Nord Stream 2, which almost certainly will not start flowing significant volumes until after the end of winter. LNG supply remains variable, and highly dependent on developments outside of Europe, in terms of both supply and demand. An optimistic scenario would see global LNG supply rebound from outages sooner rather than later, coupled with a mild winter in North-East Asia, while a pessimistic scenario would see the opposite. Finally, European storage stocks are already being drawn down significantly, and could feasibly fall to 55 bcm by the end of December, some 2-3 weeks earlier than usual. In effect, Europe will walk a tightrope in the coming months, and may be able to chart a path if the winter in Europe is mild and windy, and North-East Asia also avoids a surge in weather-related LNG demand. But any divergence from that path will potentially leave Europe exposed to price surges beyond the prevailing already high level.

While this paper has analysed the supply-side elements of the 2021 European price dynamics, it will be complemented by two other papers in our 'Series of Unfortunate Events' trilogy, to be published by the Oxford Institute for Energy Studies in early 2022. In the second paper of the trilogy, Anouk Honoré will analyse gas demand in 2021 in European countries, looking at the various factors that influenced gas in power generation in the context of rising coal and carbon prices and assessing the price-driven gas demand destruction in the industrial sector and the inelasticity of gas demand for space heating. The final paper, by Patrick Heather, will analyse the role of trading activity in price dynamics in 2021, from the steady growth between March and August, and the extremely rapid growth from late August to the first peak in early October, with prices subsequently remaining high and volatile in Q4.

Between the three papers, a general conclusion to be drawn is that while the European gas market in 2021 faced a 'perfect storm' of limitations on supply, a year-on-year rebound in demand in both Europe and elsewhere, and the market volatility linked to the uncertainties inherent in the post-COVID economic recovery, many of these factors are not unique to the present situation. Instead, European dependence on imports generally, and exposure to the dynamics of the global LNG market in particular, will continue to grow, as will the variability of gas demand as its role of 'balancing fuel' in European power generation grows. The result may be increased volatility, potentially exacerbated by a COVID-19 pandemic that is far from over, while such volatility will in turn influence the commercial strategies of market participants. Over the past two years, Europe has experienced a rollercoaster ride from oversupply and record low prices to exceptional market tightness and record high prices. In 2022, the situation may be less dramatic, but the supply-side factors identified in this paper will continue to influence the market balance, and by extension, European market prices.

The contents of this paper are the authors' sole responsibility. They do not necessarily represent the views of the Oxford Institute for Energy Studies or any of its Members.