



Quarterly Gas Review: Outlook for Gas Markets in 2023

Key signposts to look out for

Introduction

In this first Gas Quarterly of 2023 we review some of the key events in the global gas market in 2022 and outline a number of important signposts that we will be looking out for in 2023 as we continue to monitor the main implications of the Russia-Ukraine war. At the time of writing in January 2023 the gas prices in Europe and Asia would seem to indicate a level of calm after the volatile storm that engulfed the global gas market in the aftermath of the Russian invasion of Ukraine in February 2022. However, we highlight that although prices are currently well below their mid-2022 highs they nevertheless reflect a tight market within which a number of potential triggers for a sharp upward spike in prices still exist.

The most obvious signpost, of course, is the gas price itself, and we highlight that the forward curve currently suggests a benign outlook for the next 12 months and beyond. However, any one of a further cut in Russian supply, higher demand in Asia, a cold snap in Europe or an unexpected LNG supply outage could cause a sharp uptick. On the specific issue of Russian supply, the two pipelines which are currently in operation are sending around 25-30bcm to Europe on an annual basis. The flow through Ukraine, which accounts for half of this amount, seems particularly at risk and we will be monitoring the potential outcome of Naftogaz's arbitration case against Gazprom as a potential catalyst for problems.

Balancing the inevitable year-on-year decline in Russian supply in 2023 will be an expected increase in LNG availability to the global market, and we will be keeping a sharp eye on the growth in volumes expected each quarter. The main growth is backloaded towards the end of the year, and it will be interesting to see how the market deals with this fact. Increased LNG supply will not all be sent to Europe, though, and it will be vital to watch the trends in Asian demand as a key indicator of price movements. We estimate that if Asia needs to take more than an extra 10-15 bcm in 2023 compared to 2022 levels then availability of LNG to Europe will be threatened with inevitable upward price consequences.

This potential for a tighter market will be reflected in storage levels in Europe, which we will continue to monitor closely. At the moment storage levels are at record highs for this time of year, but the key moment will come at the end of winter when we see how much needs to be injected from April to October in order to meet EU targets. The achievability of this goal will depend on the starting point on April 1st and the overall availability of supply to Europe from pipelines and LNG, which we will also monitor both as a reflection of market tightness but also as an indicator of actual demand in Europe.

Finally in the Quarterly we also look at the trends in fuel use in European power generation, where gas demand actually increased in 2022 despite declines in other sectors. There were some very specific reasons for this, which we review and assess for potential indicators for 2023. Our overall conclusion



is that a number of the problems seen in 2022 may not be repeated in 2023, which could help to ease the pressure on the European, and therefore global, gas market.

If you would like to discuss any of these issues further then please contact Mike Fulwood (mike.fulwood@oxfordenergy.org), Jack Sharples (jack.sharples@oxfordenergy.org), or Anouk Honoré (anouk.honore@oxfordenergy.org).

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1. Key events in 2022 and signposts for 2023

In this first section of the quarterly review, we include our regular review of some key pricing trends for global LNG, Europe, and Asia.

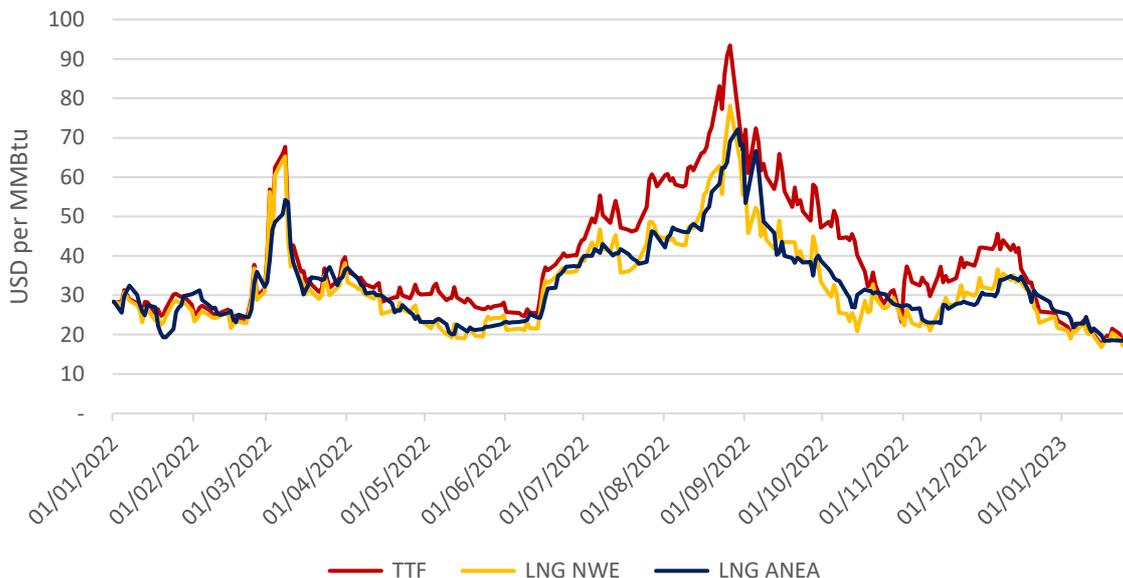
Gas prices

The path of wholesale gas prices in 2022 has been well documented. The sharp rise in prices as Russia invaded Ukraine was quickly dissipated as pipeline flows continued from Russia. The steady ramp up in TTF prices, dragging up LNG prices, began in mid-June as flows along Nord Stream were reduced, eventually stopping altogether. Even with much lower Russian pipe flows – now confined to the Ukraine route and Turkstream – prices started to fall rapidly as LNG continued to surge into Europe, while demand was down because of the mild weather and high prices curtailing industrial gas demand. The fall in prices has continued in 2023 with the mild weather returning and lack of LNG demand in Asia.

The other much discussed trend was the opening up of the gap between TTF and Northwest Europe LNG prices from early April 2022. This reflected the congestion in the Northwest Europe LNG import terminals – not that the TTF market was somehow broken as many EU politicians were claiming – with too much LNG trying to get into the market through a constrained system. A similar discount opened up between TTF and NBP as the UK began exporting at maximum along the Interconnector and BBL – again as a result of the congestion on the pipelines. This flawed analysis by the EU has led to the proposed price cap on TTF, which OIES has discussed in previous papers.¹

As the figure below shows, the discount from LNG NWE and TTF has now disappeared as the congestion went away with new terminals coming on in the Netherlands and Germany. The figure also shows that the LNG NWE price and the ANEA (Argus Asian spot price), have largely tracked each other through 2022, with the LNG NWE price generally at a level which attracted LNG cargoes to Europe.

Figure 1.1: Benchmark Gas Prices (TTF, LNG North-West Europe, and LNG Argus North-East Asia), Month-Ahead, USD per MMBtu



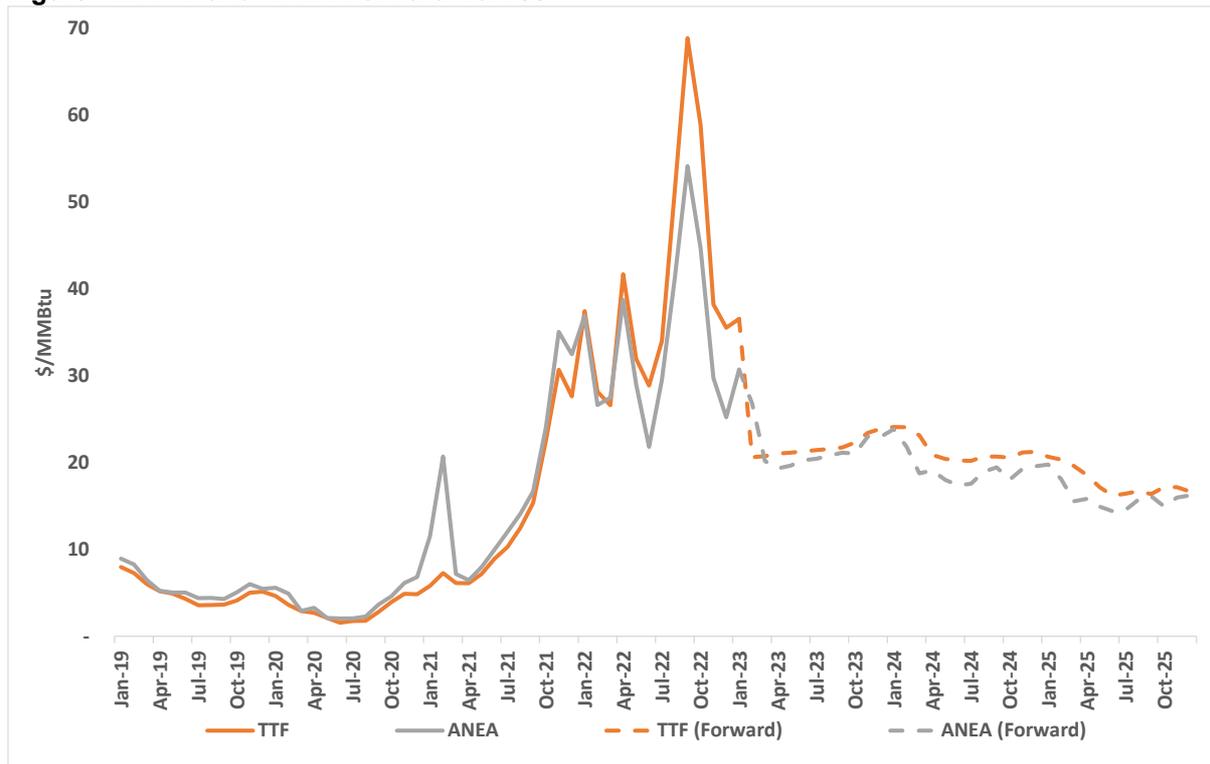
Source: Argus Media²

¹ For example Fulwood, M. (2022) The consequences of capping the TTF price, Oxford Energy Comment, OIES and Barnes, A. (2022) EU proposal for joint gas purchasing, price caps and collective allocation of gas: an assessment, OIES Paper NG 176, OIES to be found at <https://www.oxfordenergy.org/publication-category/gas-programme/>

² Argus Direct (subscription required). <https://direct.argusmedia.com/>

With TTF and the LNG prices converging again as the congestion disappeared what is the outlook? The figure below shows the market for TTF and the Asian LNG price stabilising at just over \$20 per MMBtu in 2023, declining slightly in 2024 and 2025.

Figure 1.2: TTF and ANEA Forward Curves



Source: Argus Media. Forward curve as at January 20th 2023

As we noted in our recent Key Themes paper³, the current and forward prices would seem to reflect a relatively benign outlook for the global gas market, with subdued European gas demand, Russia continuing to send pipeline gas via Ukraine and only a modest recovery in Asian LNG demand, especially in China. Any one or more of a sudden cold snap, industrial gas demand recovering in Europe, Putin deciding to cut gas flows through Ukraine and/or a much stronger than expected recovery in gas demand in Asia, could easily lead to a sharp upward correction in wholesale gas prices, wiping out much of the decline in the last month or so.

The average 2023 prices in the figure above are \$23 per MMBtu for TTF and \$22 for ANEA, declining to \$21.5 in 2024 and \$18 in 2025 for TTF and to \$19 in 2024 and \$16 in 2025 for ANEA. TTF remains at a premium to ANEA which would allow Europe to continue to attract LNG. At each quarterly update we will compare the actual outturn prices for TTF and ANEA plus the latest forward curves, with this start of the year outlook. Will the benign outlook continue or will there be further shocks to the market?

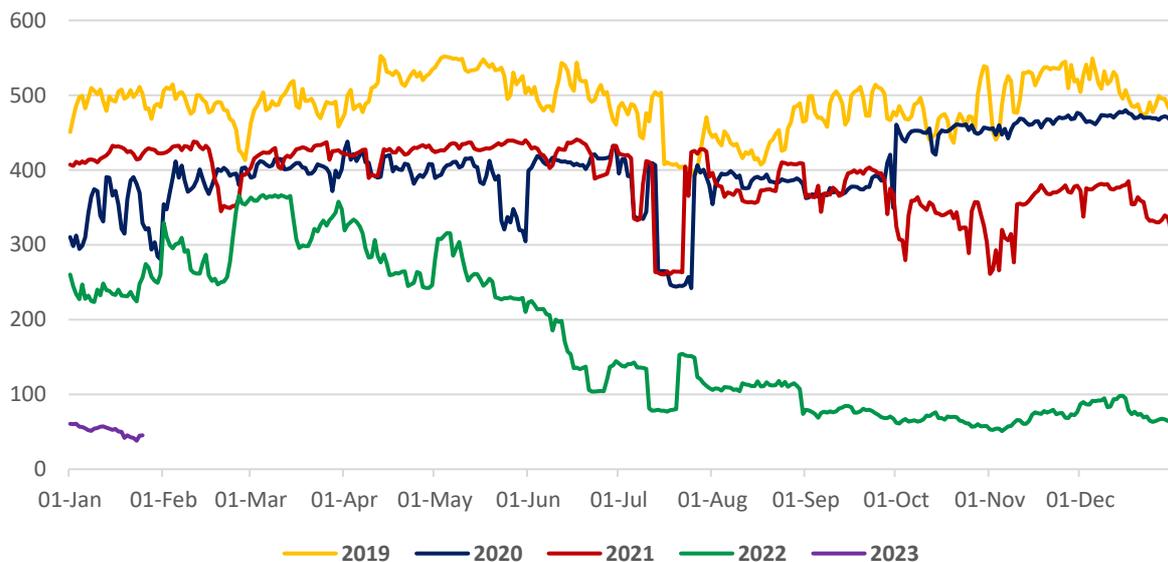
³ Key Themes for the Global Energy Economy in 2023, OIES Paper SP21 at <https://a9w7k6q9.stackpathcdn.com/wpcms/wp-content/uploads/2023/01/2023-Key-Themes-Global-Energy-Economy-in-2023-ET21.pdf>

Russian pipeline supply to Europe

In terms of the physical flow of Russian gas to Europe, the key events in 2022 occurred between March and August. In the first phase, characterised as sanctions and counter-sanctions in the three months following Russia's invasion of Ukraine, Gazprom's abandonment of its European downstream trading subsidiaries, most notably Gazprom Germania, signalled a withdrawal from the European spot market that had been presaged by the 2021 decline in spot sales on Gazprom's own Electronic Sales Platform. This was accompanied by the Russian government demand for payment in Russian rubles for gas supplied under Gazprom's long-term contracts. The suspension of supplies to those counterparties who did not accede to this demand contributed to the drop in Russian flows to Europe.

The second phase was characterised by a reduction in the capacity for the delivery of Russian pipeline gas to Europe. In April, the Polish government sanctioned Gazprom as a shareholder in EuRoPol Gaz (owner of the Yamal-Europe pipeline in Poland) and the Russian government responded in May by sanctioning EuRoPol Gaz, which prevented Gazprom from using the Yamal-Europe pipeline. Also in May, the capacity for the delivery of Russian gas via Ukraine was reduced with the suspension of flows via Sokhranivka, on the Russia-Ukraine border, leaving only one cross-border interconnection operational, at Sudzha. The process with the greatest impact on Russian flows to Europe was the compressor-related decline in the capacity of Nord Stream between June and August, followed by its complete suspension (ostensibly due to an oil leak at the Portovaya compressor station) at the end of August. The explosions that damaged Nord Stream 1 and 2 in late September did not immediately impact Russian pipeline flows to Europe, but did curtail the possibility of those flows resuming.

Figure 1.3: Total supply to the European market (MMcm/d)



Source: Data from ENTSOG.⁴ Graph by the author.

As it stands at the beginning of 2023, the volume of pipeline supplies from Russia to Europe (excluding Turkey) is far below that of recent years. The average flow in the first 25 days of January was 52 MMcm/d. For comparison, the average flow in this period was 495 MMcm/d in 2019, while recent years have seen average flows of 418 MMcm/d (2021) and 237 MMcm/d (2022).

The situation may be viewed in two ways. On the one hand, the 'worst has already happened', with pipeline flows from Russia currently less than 11 per cent of their January 2019 level. In this sense, the 'fear premium' generated by concern over how the European market would balance without substantial

⁴ ENTSOG (2022). *Transparency Platform*. <https://transparency.entsog.eu/#/map>

volumes of Russian gas has been replaced by high prices necessary to maintain physical balance in the current tight market. It is the tightness of the market that prompts an alternative view of Russian gas: given the tightness of the current market, the loss of volumes currently transiting via Ukraine to Central Europe (around 27 MMcm/d in 1-25 January) could have an outsized impact on prices relative to volume lost, and would disproportionately impact those countries that do not have access to alternative supplies in the form of LNG (primarily Austria and Slovakia).

Looking ahead to the rest of 2023, it appears unlikely that Russian pipeline supply will grow much beyond its present level. Nor does it appear likely that Gazprom will return to the European spot market, offering additional volumes. Although the Russian President signed an amendment to the decree requiring payment for gas in rubles on 30 December 2022, that amendment only allows the settlement of outstanding debts in non-ruble currencies. The amendment confirms that ruble payment remains a requirement for the resumption of suspended long-term contract supplies.⁵ Therefore, the only upside influence on Russian pipeline gas flows to Europe in 2023 could be higher daily nominations by Gazprom counterparties that currently pay in rubles. Conversely, lower nominations could provide a 'floor' level for those pipeline flows. Indeed, falling long-term contract buyer nominations caused the flow of Russian pipeline gas to Europe to decline from 60 MMcm/d at the beginning of January to an average of 43 MMcm/d in 19-25 January.

A key issue to look out for in the coming year is the Russian government reaction to the Naftogaz arbitration case against Gazprom, concerning the payment for gas transit via Ukraine. When the Ukrainian TSO, GTSOU (Gas Transmission System Operator of Ukraine) declared force majeure at Sokhranivka in May 2022, it offered alternative additional capacity at Sudzha. Naftogaz (as Gazprom's transit contract counterparty in Ukraine) considers this to be sufficient for Gazprom to continue paying in full for its ship-or-pay transit capacity (109.6 MMcm/d). Gazprom disagrees, and reportedly reduced its payments in proportion to the capacity lost at Sokhranivka. In response, Naftogaz began a process of commercial arbitration, to recover the partial non-payments by Gazprom.

On the day of the Nord Stream explosions, Gazprom released a short press release, noting that if Naftogaz continued with its arbitration case, it could face sanctions by the Russian government, leaving Gazprom 'unable to fulfil its contractual obligations to Naftogaz'.⁶ The implication is that, in such a situation, Russian gas transit via Ukraine would halt. Among industry observers and market participants, this announcement arguably had greater significance than the Nord Stream explosions, given that the operation of Nord Stream 1 was already suspended and Nord Stream 2 unlikely to launch in the foreseeable future in any case.

In short, the outlook for Russian pipeline gas supply to Europe has only limited upside potential, and there is a significant possibility of a further decline, in particular with regard to gas transit via Ukraine.

⁵ President of Russia (2022). *On Amendments to Decree of the President of the Russian Federation No. 172 dated March 31, 2022 "On the Special Procedure for the Fulfilment of Obligations by Foreign Buyers to Russian Natural Gas Suppliers"*. 30 December 2022. <http://actual.pravo.gov.ru/text.html#pnum=0001202212300102>

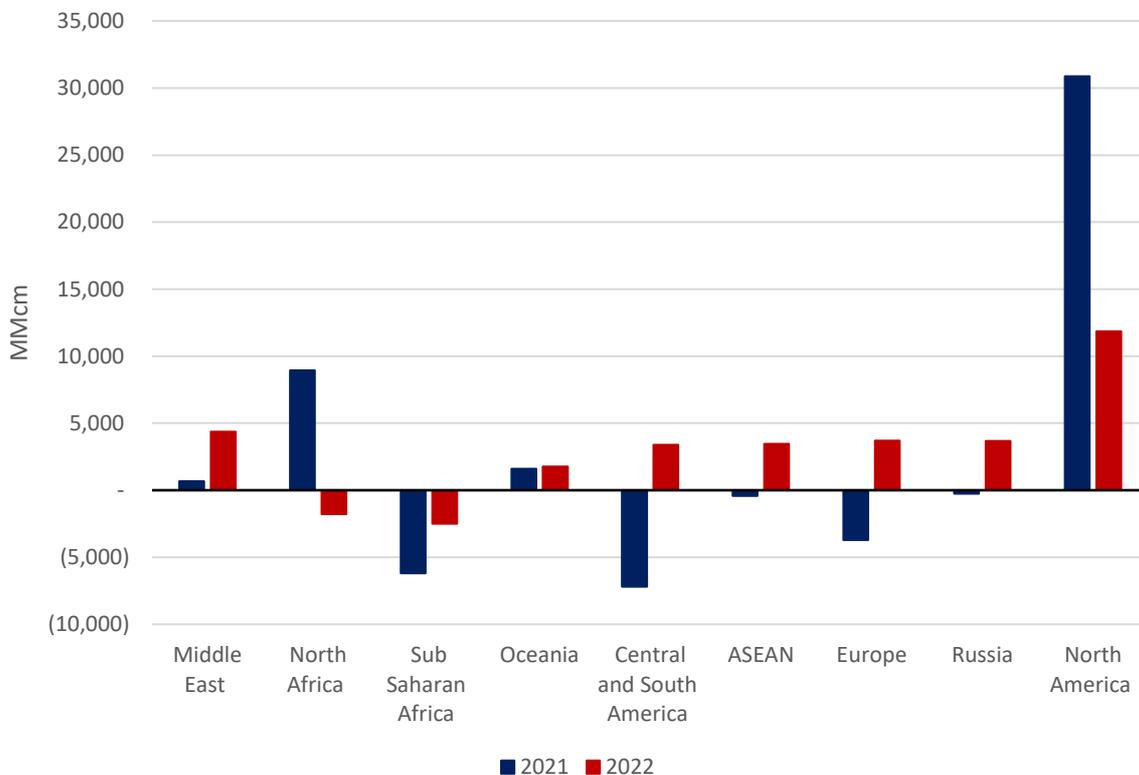
⁶ Reuters (2022). *Russia's Gazprom rejects Ukraine's Naftogaz claims in arbitration*. *Reuters*, 27 September. <https://www.reuters.com/business/energy/russias-gazprom-rejects-ukraines-naftogaz-claims-arbitration-2022-09-27/>

Global LNG supply

Global LNG trade increased by some 28 bcm in 2022, slightly higher than the 25 bcm rise in 2021. However, the drivers behind the increase in supply were very different. The rise in supply in 2021 reflected the strong recovery from the Covid-hit 2020, especially from the US terminals. Overall, LNG export capacity⁷ actually declined in 2021, with delayed maintenance at numerous plants, feedgas problems, especially in Trinidad and Nigeria, and technical problems, for instance the fire in Norway, taking some plants offline. In 2020 global LNG export plant utilisation was down to 90 percent as demand stalled because of Covid. In 2021 utilisation rose to some 97 percent, with output rising as overall capacity declined.

The story in 2022 was very different. Global LNG export capacity increased by some 22 bcm, with the unwinding of many of the technical issues which depressed available supply in 2021, bolstered by new supply, especially in the US (Sabine Pass Train 6 and Calcasieu Pass), coming on. This increase was despite the loss of some 10 bcm of output from Freeport in the US, as a result of an accident. With actual output in 2022 increasing by some 28 bcm, the global utilisation rate increased to 98 percent.

Figure 1.4: Change in Global LNG Supply 2021 and 2022



Source: Data from Kpler.⁸ Graph by the author

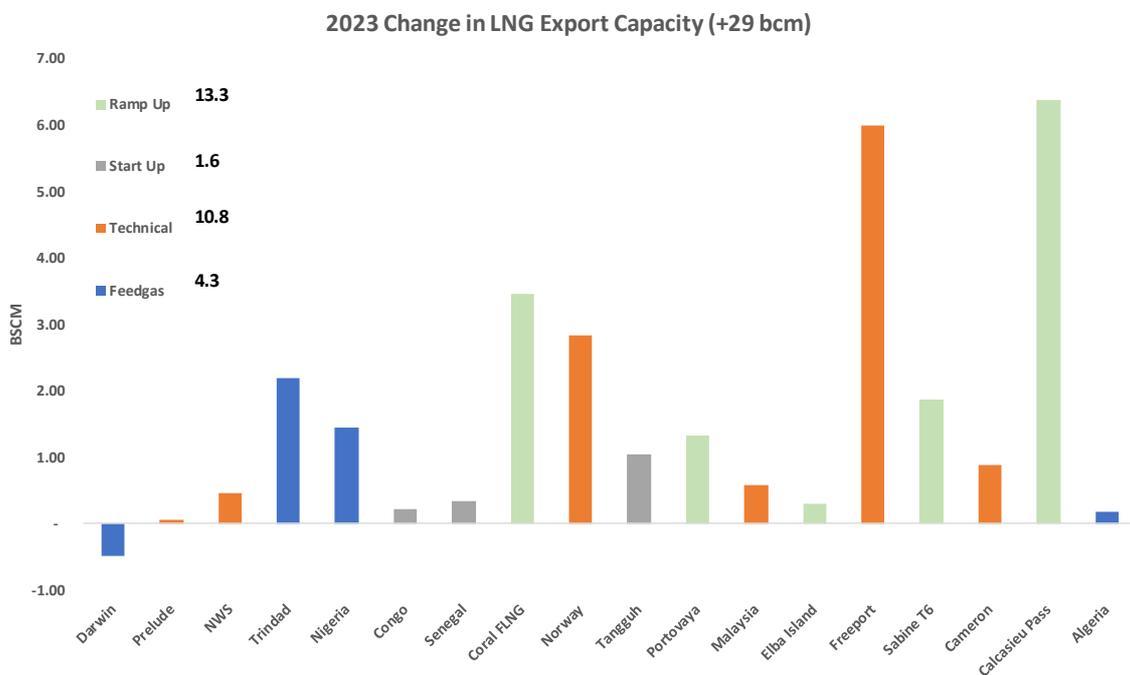
Despite the loss of Freeport output in the second half of 2022, US output still increased by some 12 bcm, although this was well below the 30 bcm rise in 2021 – which helped to offset declines elsewhere. There were also small increases in most other exporting countries, apart from Algeria and Nigeria where output declined because of continuing feedgas issues. Qatar also saw an increase in output following extended maintenance in 2021.

⁷ Available LNG export capacity which is nameplate adjusted for technical and feedgas issues, maintenance and the ability of some plants to produce more than nameplate capacity.

⁸ Kpler LNG Platform (subscription required). <https://lng.kpler.com/>

What is the LNG supply outlook in 2023? There aren't many brand new projects coming on this year, but despite that, we are expecting another robust year for supply growth. The only new start ups may be in Congo, Senegal/Mauritania (Tortue) and in Indonesia (Tangguh Train 3) and these seem likely to be towards the end of the year. Overall, LNG export capacity is projected to rise by some 29 bcm this year, with some 13 bcm coming from the ramping up of plants which came on in 2022 – Sabine Pass Train 6, Calcasieu Pass, Coral FLNG (Mozambique) and Portovaya (Russia). An additional 6 bcm could also come from Freeport resuming production and reaching full output in Q2. A full year of production can also be expected from Norway and fewer feedgas issues in Trinidad (where output is already ramping higher) and Nigeria.

Figure 1.5: Change in LNG Export Capacity 2023



Source: NexantECA World Gas Model, OIES Estimates

As we progress through 2023, we will look at how LNG supply is progressing. In 2022, the average monthly supply was some 44.5 bcm, against average available capacity of 45.6 bcm. In 2023, average available capacity is projected at some 48 bcm – an increase of some 2.4 bcm a month. However, the increase is more loaded towards the second half of the year. The average monthly year-on-year increases expected by quarter, in bcm, are:

Q1 +1.4, Q2 +2.2, Q3 +2.8, Q4 +3.3.

We will be monitoring flows against these targets on a regular basis, both the monthly increase and the actual volumes supplied. If the increases in capacity translated exactly into increase in actual supply (with utilisation kept at 98 percent), with the same profiling of LNG flow through the year, then the average monthly supply by quarter in 2023, in bcm, would be:

Q1 47.4, Q2 45.2, Q3 45.2, Q4 49.1

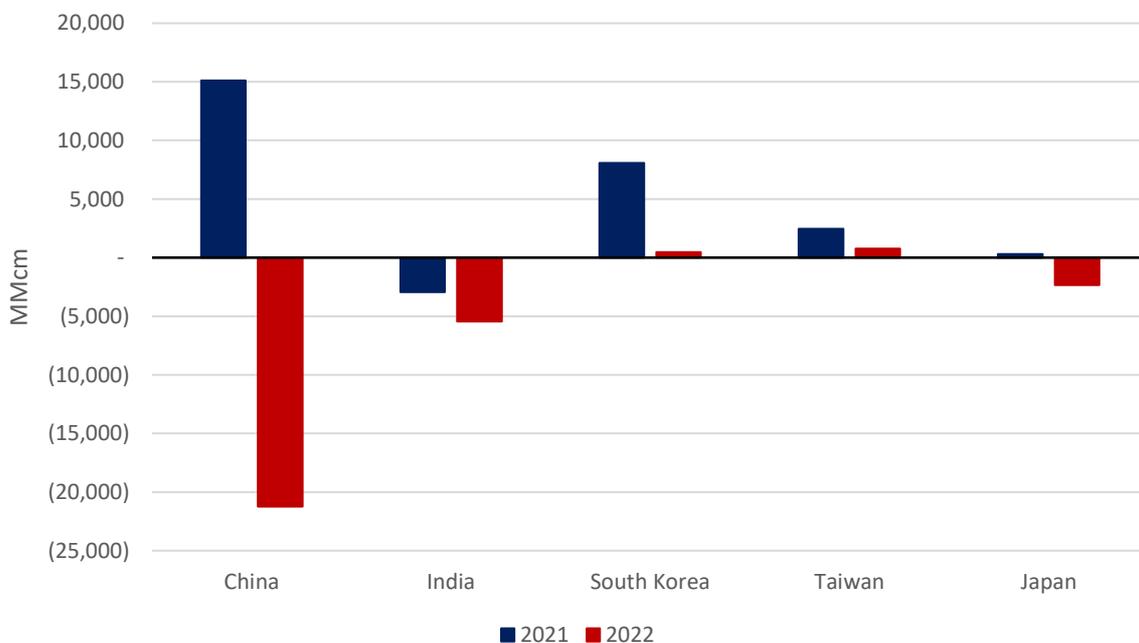
It should be noted that the January and December 2022 numbers for supply were over 50 bcm but these are the peak months.

Asian LNG demand

Before the Russian invasion of Ukraine, Europe was seen as a balancing market for global LNG, with Asia being the largest demand centre for LNG. This was well illustrated in 2019 to 2021 when the excess LNG in 2019 and 2020 came to Europe, filling European storage, and then when Asia needed more LNG in 2021, Europe reduced its LNG demand and withdrew gas from storage to meet the cold weather demand. In 2022 this was reversed with Europe now the primary demand centre and Asia seeing cargoes diverted away to satisfy Europe's needs.

What happens to Asia LNG demand is key in the development of the global LNG market. The figure below shows the contrasting fortunes for Asia LNG demand in 2021 and 2022. In 2021, Asian LNG demand grew by some 27 bcm, driven by China and South Korea as the global economy recovered from Covid-19. There was growth largely across the board apart from India – reacting to rising prices – and Malaysia and Singapore. The picture in 2022 was dramatically different with Asian LNG demand falling by 25 bcm largely driven by China, as flat domestic demand combined with rising production and pipeline imports. India, Pakistan and Bangladesh also saw declines as demand was hit by rising prices and, in some cases, sellers opting not to deliver under contracts. Japan demand continued its downward trend over the last 5 years or so – LNG imports are now lower than before the 2011 Fukushima incident. There were some growth areas though, especially the Southeast Asian countries, which were less exposed to the very high spot prices.

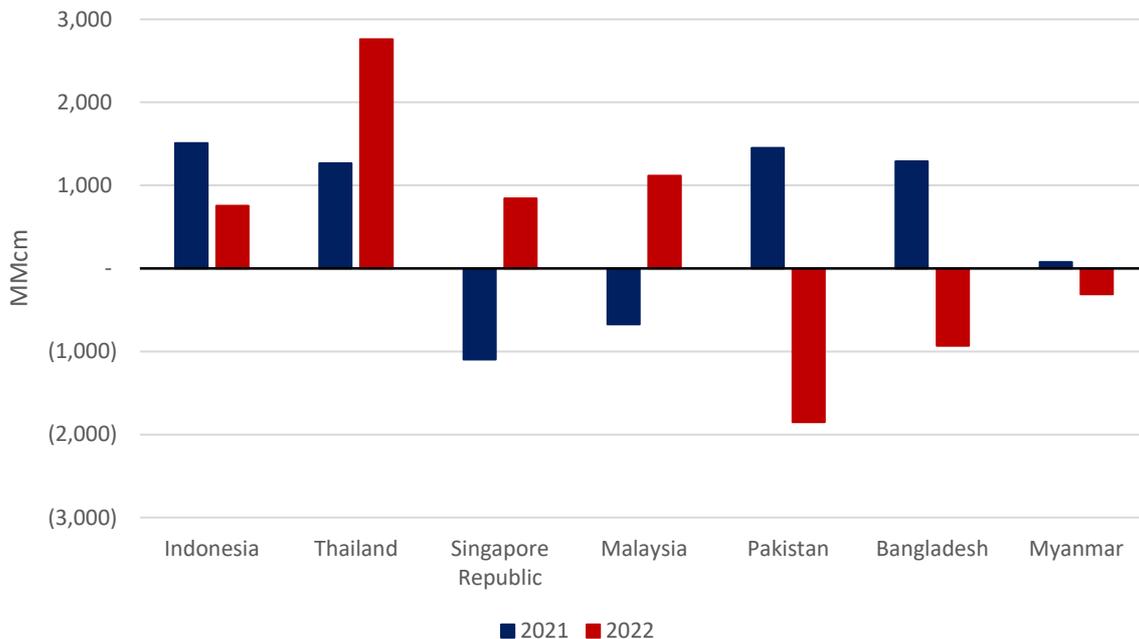
Figure 1.6: Year-on-Year Change in Asian LNG Demand (Major Importers) 2021 and 2022



Source: Data from Kpler.⁹ Graph by the author

⁹ Kpler LNG Platform (subscription required). <https://lng.kpler.com/>

Figure 1.7: Year-on-Year Change in Asian LNG Demand (Smaller Importers) 2021 and 2022



Source: Data from Kpler.¹⁰ Graph by the author¹¹

2022 remains, however a seminal year. It is the first year that total Asian LNG imports declined. China LNG imports were only just above 2019 levels, losing almost two years of growth. India's imports are back to 2017 levels and Pakistan back to 2018 levels.

In looking at 2023, China is likely to be the key to the resumption of Asian LNG demand growth. While China overall gas demand seems likely to grow, production growth remains robust and additional pipeline imports are expected from Russia along the Power of Siberia pipeline. This may limit the growth potential for LNG. If prices remain high then the prospect of any meaningful recovery in India, Pakistan and Bangladesh may be limited. South Korea and Taiwan have maintained demand and this seems likely to continue but, along with Japan, may not see much growth. The most likely region for more robust growth remains the ASEAN countries where the need for LNG is increasing the most.

It was noted in an earlier section that LNG supply is projected to rise by just under 30 bcm this year. Europe is expected to need maybe some 40 to 50 percent of this rise in supply to make up for the lower Russia pipeline imports, while being able to maintain storage levels. With the potential for some recovery in LNG imports in Central and South America, total Asian LNG imports may not be able to grow by much more than 10 to 15 bcm for the global gas market to balance in 2023, without putting a lot more pressure on prices. If Asian LNG demand were to be 1 bcm a month higher in 2023 than in 2022, then the average monthly demand by quarter, in bcm would be:

Q1 31.1, Q2 27.9, Q3 28.9, Q4 29.9

It should be noted that the January and December 2022 numbers for Asian LNG demand were around 32 to 33 bcm but these are the peak months of the year. Nevertheless, we will be keeping a close watch on the actual demand outturn in Asia, because if demand in each quarter is higher than the numbers seen here this will clearly put pressure on LNG supply available to Europe.

¹⁰ Kpler LNG Platform (subscription required). <https://lng.kpler.com/>

¹¹ Note that Indonesia and Malaysia are net LNG exporters, but still import LNG

Storage

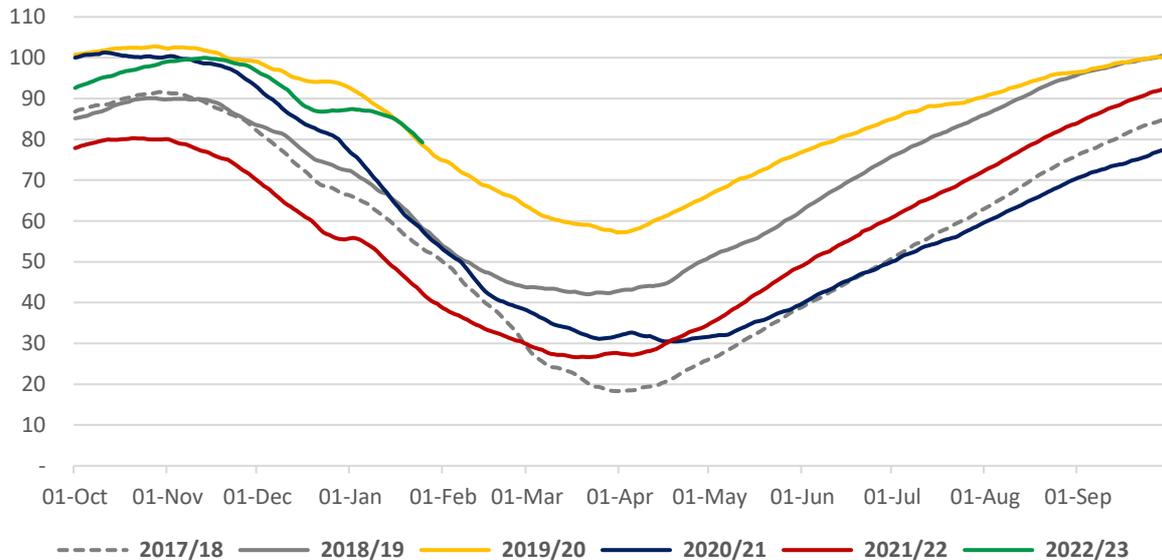
The accumulation of storage stocks was a key feature of 2022. In the aftermath of Russia’s invasion of Ukraine, and in anticipation of the possible curtailment of Russian pipeline gas supplies to Europe, the European Commission made the replenishment of European gas storage stocks a political priority.

This stockbuild took place in a context of varying conditions, some challenging (lower Russian pipeline supply and high prices) and some benign (higher LNG imports and lower overall demand). In broad terms, each quarter of 2022 represented a different balance of such conditions. Europe began 2022 with just 55.7 Bcm of storage stocks – the lowest since 2013 and 21 Bcm lower year-on-year.

The net withdrawal in Q1-2022 (28.3 Bcm) was the lowest since 2014, and just 72 per cent of the 2017-2021 average. This was followed by a net injection in Q2-2022 (21.6 Bcm) that was the highest ever for Q2, and 131 per cent of the 2017-2021 average. In Q3-2022, the net injection of 43.2 Bcm was the third-highest ever for Q3, and broadly similar to injections of 42-46 Bcm made in Q3 2015-2018. This Q3 injection was 114 per cent of the 2017-2021 average. Finally, Q4-2022 saw a net withdrawal of just 5.2 Bcm, which was just 30 per cent of the Q4 average for 2017-2021. The previous record low net storage withdrawal in Q4 occurred in 2011 (the first year for which data is available), when storage capacity was only 60 per cent of the present level and a net withdrawal of 6.5 Bcm was made.

In the winter periods of 2022 (Q1 and Q4), Europe effectively ‘gained’ 23 Bcm compared to the 2017-2021 average by taking less out of storage, while in the summer (Q2 and Q3) Europe ‘gained’ a further 10 Bcm by injecting more compared to the 2017-2021 average.

Figure 1.8: European gas storage stocks (Bcm)



Source: Data from Gas Infrastructure Europe (GIE) Aggregated Gas Storage Inventory.¹² Graph by the author

If one ‘key event’ can serve to encapsulate the storage experience in 2022, it is the fact that when European gas demand dipped between 24 and 31 December, Europe made a net storage injection for the first time ever during the Christmas/New Year holidays. The net injection began on 24 December 2022 and lasted until 2 January 2023, during which time around 0.5 Bcm was injected. As late as 8 January 2023, stocks were higher than they had been on 24 December. By 25 January, stocks of 79.2 Bcm were 0.6 Bcm higher than the record for that date (2020). In previous years, stocks on that date had never been higher than 59 Bcm.

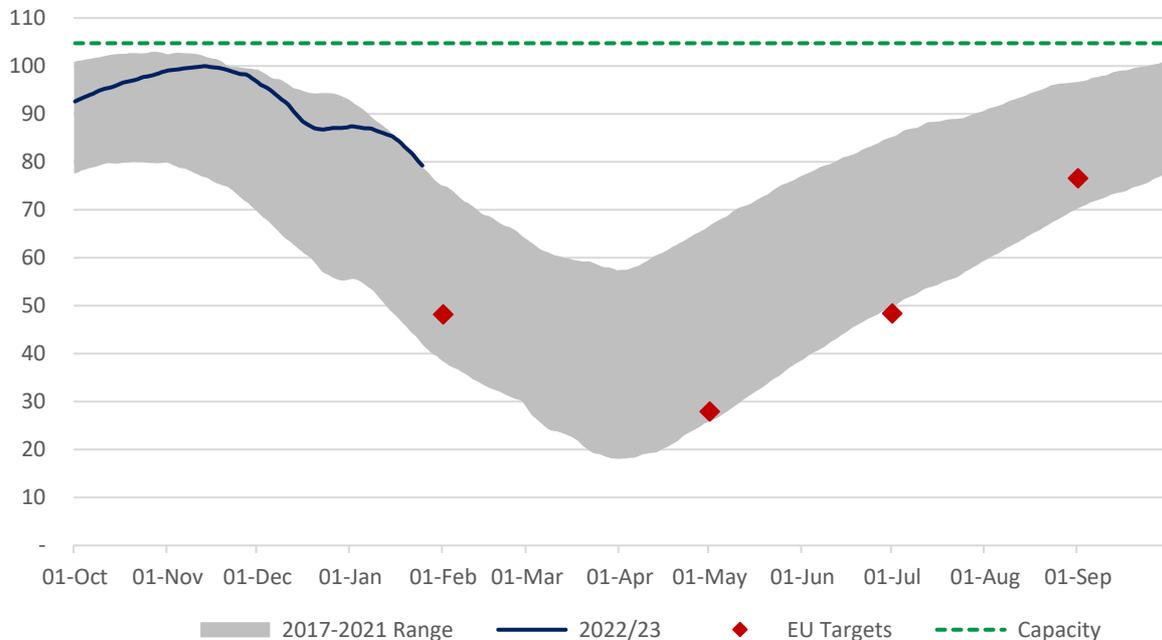
¹² GIE (2022). *Aggregated Gas Storage Inventory*. <https://agsi.gie.eu/data-overview/eu>

The physical market balance that made such record injections and limited withdrawals possible in 2022 was influenced by the surge in LNG imports, the decline in pipeline supply from Russia, and the year-on-year decline in European gas demand, all of which are discussed elsewhere in this review, in a context of the exceptionally high prices noted earlier.

In addition, there was a political imperative, backed by the setting of targets. Having surpassed the target of filling European storage to 90 per cent of its capacity by 1 November 2022, the European Commission subsequently set out its intermediate targets for storage stocks in each EU member state.¹³ Those targets set out the minimum percentages of the storage capacity that should be filled in each member state by each of the intermediate dates: 1 February, 1 May, 1 July, and 1 September 2023.¹⁴

By combining the targets for each individual EU member state, it is possible to calculate the implied EU-wide gas storage targets, which are represented by the red markers in the graph below, along with EU gas storage capacity (green), daily actual gas storage stocks in the current gas year (blue) and the range of minimum and maximum stocks held on each given day in the period 2017-2021 (grey).

Figure 1.9: European Storage Capacity, Historic Stocks, and EU Storage Targets (Bcm)



Source: Data from Gas Infrastructure Europe (GIE) Aggregated Gas Storage Inventory.¹⁵ Targets published by European Commission on 24 November 2022. Graph by the author

Looking ahead to the rest of 2023, these EU intermediary targets will provide signposts towards the overall target of stocks of 94.3 Bcm by 1 November 2023, which equates to 90 per cent of storage capacity. In addition, the volume of storage stocks remaining on 1 April (end of winter) will provide an indication of the size of summer storage injections required, as storage facilities move from net withdrawal to net injection mode.

¹³ European Commission (2022). Commission sets trajectories for filling gas storage in 2023. *Press Release*, 24 November. https://commission.europa.eu/news/commission-sets-trajectories-filling-gas-storage-2023-2022-11-24-0_en

¹⁴ Commission Implementing Regulation (EU) 2022/2301 of 23 November 2022 setting the filling trajectory with intermediary targets for 2023 for each Member State with underground gas storage facilities on its territory and directly interconnected to its market area. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022R2301&qid=1669911511115>

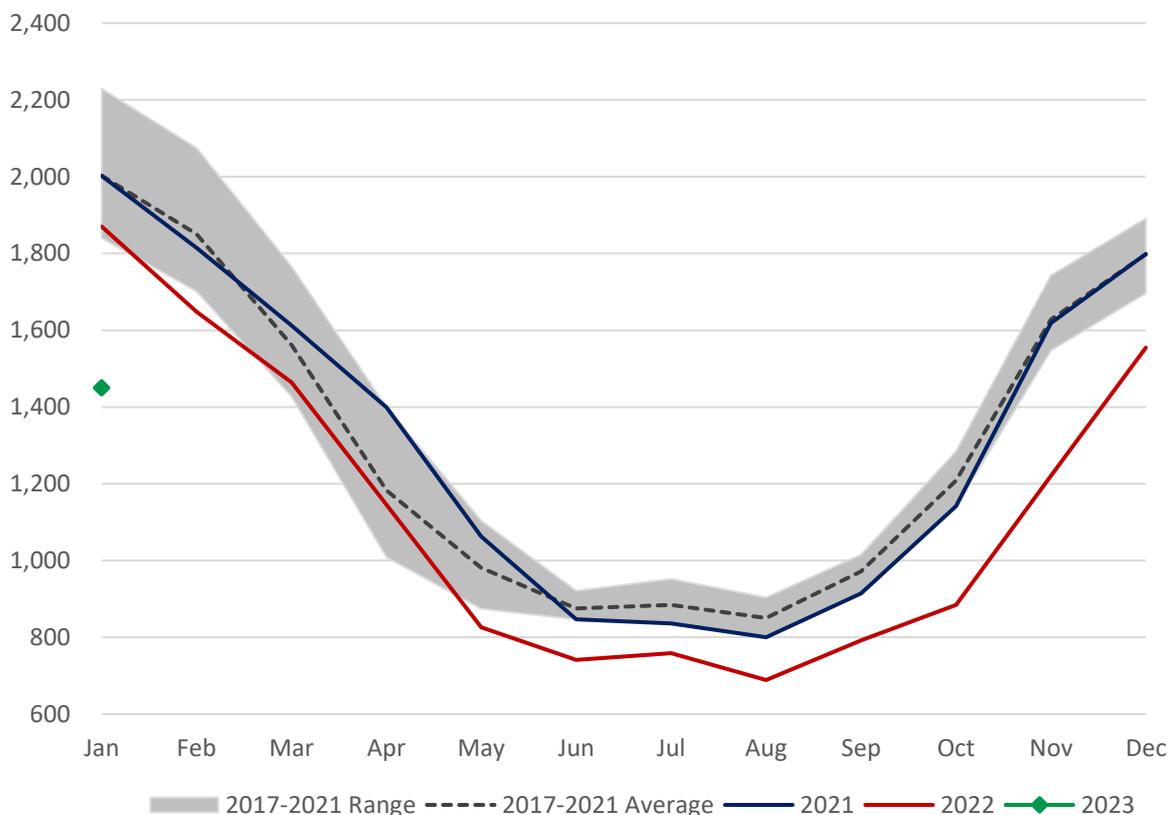
¹⁵ GIE (2022). *Aggregated Gas Storage Inventory*. <https://agsi.gie.eu/data-overview/eu>

Total supply to Europe (implied demand)

By gathering together data for European production, pipeline imports, LNG imports, and net storage withdrawals, it is possible to calculate Europe's 'implied gas demand'. This overall total supply/implied demand is presented in the graph below, which illustrates the extent to which such total supply in 2022 was substantially lower than both 2021 and the 2017-2021 average, especially from May onwards.

Throughout 2022, the year-on-year decline in monthly average 'total supply' ranged from -77 MMcm/d (July) to -397 MMcm/d (November), averaging -188 MMcm/d. Although that decline in total supply was influenced strongly by the decline in Russian pipeline supply, record summer storage injections also took substantial volumes off the market (as discussed in the previous section). The fact that such injections were possible even in a tight market with high prices suggests that demand also decreased substantially (as opposed to demand being unmet in a context of rationing).

Figure 1.10: Total Supply to Europe¹⁶ (MMcm/d)



Source: Data from ENTSOG¹⁷, Eurostat¹⁸, Kpler¹⁹, and Gas Infrastructure Europe²⁰. Graph by the author.

Note that 'Total Supply' refers to production plus pipeline imports plus LNG sendout plus net storage withdrawals. Note also that the implied total supply for January 2023 is preliminary, based on data for the period 1-25 January.

¹⁶ Europe is defined as the EU, UK, Switzerland, and non-EU Balkan states. It excludes Turkey and treats Norway as an external supplier to that European market.

¹⁷ ENTSOG (2022). *Transparency Platform*. <https://transparency.entsog.eu/#/map>

¹⁸ Eurostat (2022). *Supply, transformation, and consumption of gas - monthly data*. https://ec.europa.eu/eurostat/databrowser/view/nrg_cb_gasm/default/table?lang=en

¹⁹ Kpler LNG Platform (subscription required). <https://lng.kpler.com/>

²⁰ GIE (2022). *Aggregated Gas Storage Inventory*. <https://agsi.gie.eu/data-overview/eu>

With regard to the current level of total supply (implied consumption), the graph above includes data for 1-25 January 2023 (green), a period in which total supply was 1,450 MMcm/d. This was 414 MMcm/d lower than 1-25 January 2022. One reason for this is the year-on-year decline in Russian pipeline supply (-185 MMcm/d). A second reason is the year-on-year decline in net storage withdrawals, which averaged 532 MMcm/d in 1-25 January 2022 and just 320 MMcm/d in 1-25 January 2023 – a year-on-year decline of 212 MMcm/d. However, this year-on-year decline in storage withdrawals is unlikely to be sustained. A net injection was made on 1 January and the net withdrawals in 2-8 January averaged just 66 MMcm/d, followed by average withdrawals of 229 MMcm/d in the period 9-15 January. Thereafter, withdrawals in 16-25 January averaged 607 MMcm/d - a notable step up.

Therefore, while the year-on-year decline in total supply in the first half of January 2023 may appear dramatic, it is highly likely that the decline will narrow once the full-month data for January is available, and that the year-on-year decline in Russian pipeline supply will be the main factor in that decline.

Looking ahead to the rest of 2023, absent any unexpected and dramatic developments, the supply from European production and non-Russian pipeline imports is expected to be relatively stable year-on-year, lacking upside due to constraints on production and pipeline capacities. Therefore, one of the factors to look out for in total supply to the European market will be the extent to which LNG imports can be sustained or even increased, to make use of the new FSRUs that have recently been launched in the Netherlands, Germany, and Finland. Those LNG import volumes will be substantially influenced by the availability of global LNG supply and the strength of competing LNG demand outside Europe – two factors examined earlier in this review. Another factor examined earlier in this review is the level of pipeline supply from Russia which, as noted earlier, fell to record low levels in January 2023. A shift in long-term contract buyer nominations could herald a minor recovery, while a cessation in gas transit via Ukraine could cause total Russian pipeline supply to fall even further. Finally, given that the total supply also represents implied consumption, the level of European gas demand will be crucial in determining how much gas will be left available for injection into storage. Flipping that relationship on its head, it may be concluded that the volumes of gas injected into storage in summer 2023 (and the attainment of the EU storage targets) will be indicative of European demand (by virtue of how much is left over for storage injections) in what could be conditions of relatively stable year-on-year supply.

Dr Jack Sharples, Senior Research Fellow, and Mr Mike Fulwood, Senior Research Fellow, OIES

2. European gas demand: focus on the power sector

In this second section of the OIES Gas Quarterly, we focus on gas use for electricity generation in Europe (EU27 + UK).²¹

Total European gas demand collapsed in 2022 and according to first estimates based on the bottom-up analysis, it appears to have declined by 13 per cent year-on-year due to mild temperatures, high gas prices and an important demand response resulting from unprecedented changes in large and small consumer behaviour. Over the period from August to December, gas demand in the EU27 was even down by 18 per cent compared to the past 5 years average, putting the region on track to meet the EU target to reduce gas use by 15 per cent until next spring – *Save gas for a safe winter, July 2022*.²²

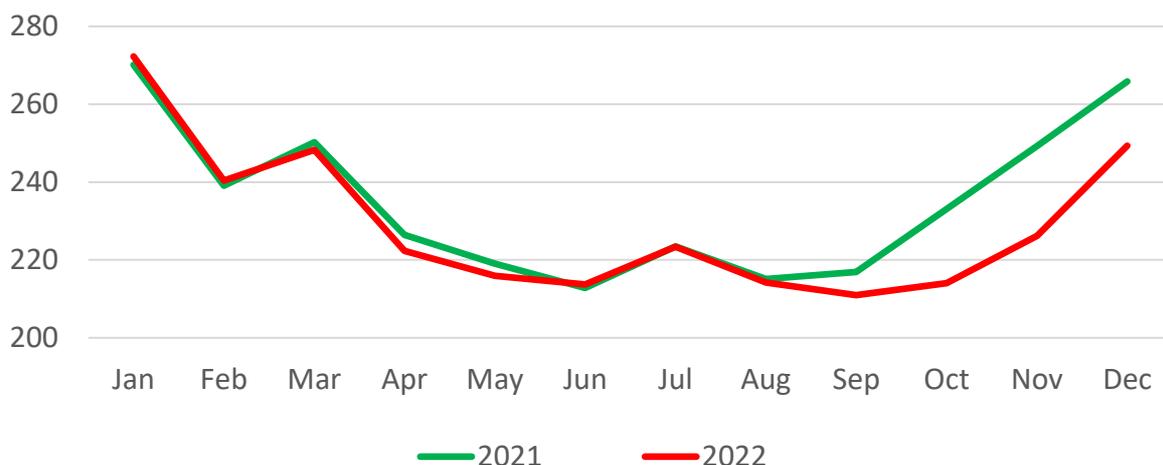
A sector-focused analysis shows that most of the demand reduction in Europe was concentrated in the industrial and in the heating²³ sectors in 2022, while gas use for electricity generation went up. The following paragraphs highlight the main factors behind the latter trend and offer some views on the main drivers in 2023.

Gas use to generate electricity up by 3 per cent in 2022: key factors

Gas demand for electricity generation increased by 3 per cent in 2022 despite aims to reduce gas consumption and high gas prices, which should have pushed gas down the merit order and favoured other sources.

Three main elements influenced the need to use more gas in the generation mix. First, continued high electricity demand in the first eight months of the year, before energy saving measures and economic slowdown finally started to have an impact from September onward [Figure 2.1] (exceptionally mild temperatures in the fourth quarter also contributed to limit the need for electricity demand).

Figure 2.1: Monthly electricity demand in the EU27 + UK (TWh)



Source: Data from Entsoe and Gridwatch. Calculations and graph by the author

Second, low availability nuclear power. Nuclear generation was down by 116 TWh (-16 per cent year on year), with most of the decrease concentrated in May-November [Figure 2.2]. About 69 per cent of the decline (80 TWh) originated from France alone. The French utility EDF faced a wave of repairs on the pipes affected by stress corrosion and delays to its scheduled 10-year maintenance due to the COVID pandemic (as well as strikes in France in October), which forced a record number of reactors

²¹ Unless otherwise specified, the sources of the data in these paragraphs are Entsoe and Gridwatch.

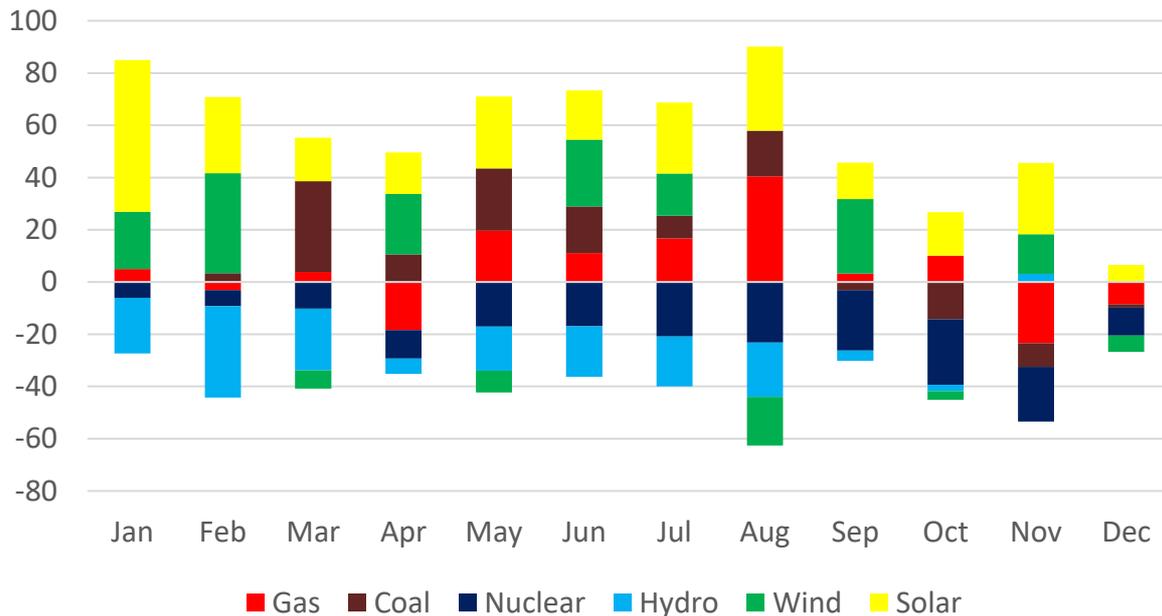
²² https://ec.europa.eu/commission/presscorner/detail/en/ip_22_4608

²³ Essentially residential and commercial users. See OIES Gas Quarterly published in December 2022.

offline for most of the year. As a result, French nuclear generation was down by 23 per cent in 2022, lifting thermal power generation in the country and in neighbouring markets.

Another important factor was the closure of three reactors in Germany at the end of 2021 as part of the country's phase-out process, which limited nuclear generation to 33 TWh in 2022 compared to 65 TWh in 2021 (about 28 per cent of the total nuclear generation decline in Europe last year).

Figure 2.2: Changes in electricity generation in the EU27 + UK, 2022 vs 2021 (%)



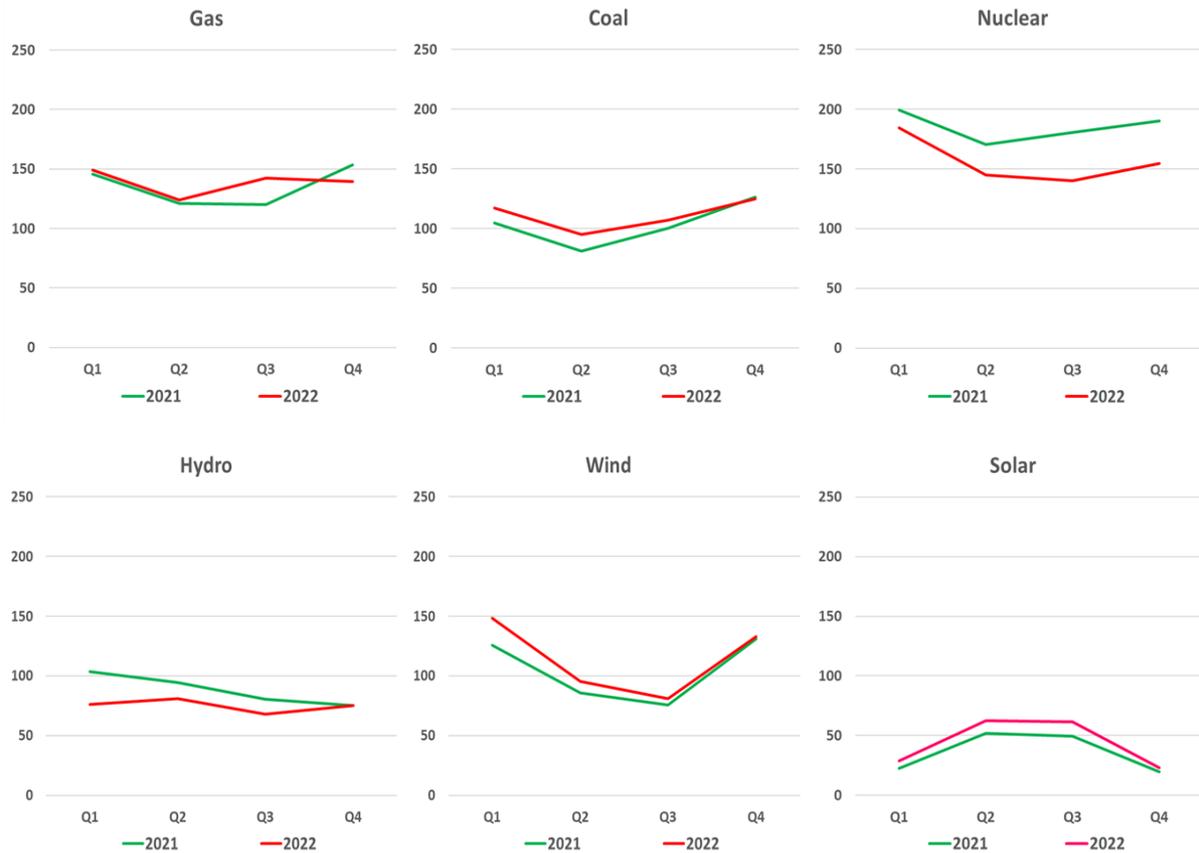
Source: Data from Entsoe and Gridwatch. Calculations and graph by the author

Thirdly, severe drought across Europe, especially in the South, depleted hydro stocks last year. Hydro power generation fell by 53 TWh (-15 per cent), with the bulk of the year-on-year decline concentrated in the first nine months, although this result is also explained by already very low hydro availability in Q4 2021.

The sharp fall in both nuclear and hydro generation was partly covered by lower electricity demand (-70 TWh). Higher generation from renewables covered about two thirds of the gap, helped by additional installed capacity (wind +39 TWh and solar with an impressive growth of +32 TWh). Electricity from coal and gas made up for the rest (+23 TWh and +14 TWh respectively) [Figure 2.3].²⁴

²⁴ Smaller sources are not mentioned in this paragraph.

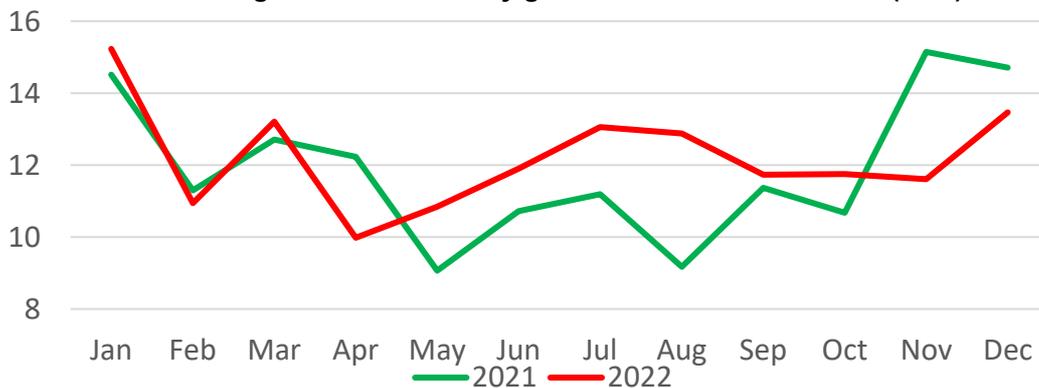
Figure 2.3 Quarterly electricity generation in the EU27 + UK (TWh)



Source: Data from Entsoe and Gridwatch. Calculations and graphs by the author

Most of the additional gas use for electricity generation was concentrated over the summer months [Figure 2.4]. This period was marked by concomitant low availability of nuclear and hydro -as already mentioned- and by lower clean dark spreads²⁵ that favoured gas-fired plants over coal-fired plants in late spring – early summer across Europe.

Figure 2.4: Estimates for gas use in electricity generation in the EU27 + UK (bcm)



Source: Calculations and graph by the author

²⁵ Coal prices reached record highs in Q2 and Q3 (especially in July and August) as a result of strong demand in Europe and Asia, due to supply diversification away from gas in national energy mixes and coal supply diversification from Russian coal which tightened the global market. (The EU adopted sanctions prohibiting imports of coal, solid fossil fuels and a range of industrial goods from Russia from August 2022),.

What to look for in 2023

Keeping gas demand low, and even potentially reducing it further, will be a key goal in 2023 in preparation for winter 2023/2024. How much more can be reduced in the industrial and heating sectors is uncertain, at least without any major impact on economic activity and consumers' wellbeing. We could even see a rebound in gas and electricity demand (especially from large industrials) as a result of lower gas/electricity prices, be it as a result of the market rebalancing or as a result of additional support measures, as announced in various countries, including toward large energy intensive industries.

On the electricity supply side, the main drivers to keep an eye on in 2023 include the usual suspects: the availability of (French) nuclear, the stabilization of hydro stocks, and the scale and speed of additional wind and solar capacity deployment across Europe.

First and foremost, the scale and pace of the French nuclear fleet. EDF is racing against the clock to put as many reactors as possible back in service as soon as possible. At the beginning of winter, 30 reactors out of 56 were offline. At the time of writing (20 January), this was reduced to 14²⁶ and it is expected that EDF's nuclear power plants should slightly exceed 45 gigawatts (GW) by the end of January. French nuclear generation still started 2023 at a record low, but thanks to strong renewables availability and low national electricity demand, France also started the year by exporting more electricity to neighbouring countries than it imports. For the rest of 2023, EDF confirmed late December its expectations for 300-330 TWh of nuclear generation, which would still be relatively low for the French nuclear fleet but around 18 - 19 per cent higher than 2022 levels.²⁷ However, uncertainties remain (the company revised its predictions for nuclear generation downwards four times in 2022). In addition, EDF still needs to carry out stress corrosion protection maintenance on six more reactors during 2023 and the nuclear fleet should fall again to 40-45 GW when the maintenance programme re- starts next month. RTE, France's Transmission System Operator, mentioned possible risk of tightness on the national electricity grid for the second half of February,²⁸ at a time when cold temperatures could hit Europe. A cold wave (and low wind) then would potentially mean substantially higher thermal generation in France and neighbouring countries to meet electricity needs.

Elsewhere, in the first quarter, Belgium's 1GW Tihange-2 reactor will be permanently shut down at the end of January (as planned as part of the previous policy to phase out nuclear by 2025); The remaining plants in Germany (Isar 2 in the southern state of Bavaria, Emsland in northwestern Germany and Neckarwestheim 2 in the southwestern Baden-Württemberg state, with a combined capacity of 4.2GW), that were initially due to be phased out by end 2022, will close by mid-April. These closures will be partly counterbalanced by Finland's new 1.6GW OL3 reactor that is set to finally start commercial operation in March and Slovakia's new reactor (Mochovce-3, 440 MW capacity), which is expected to come online in the next few weeks.

Hydro stocks are showing signs of slow recovery with most countries starting 2023 with higher levels than the same period in 2022, giving reasons to be cautiously optimistic for a slightly better availability of hydro in 2023. The continued deployment of renewables will also increase the availability of wind and solar, despite uncertainties created by inflation, supply constraints in sourcing some materials, revenue caps and looming market reforms, slow approval processes and supply chain disruptions. After an impressive growth in 2022, the solar sector is set to continue on its positive trend in 2023 with 53 GW of new installations after 41 GW in 2022 according to SolarPower Europe.²⁹

Further efforts to lower gas use in electricity generation will help to balance the market and free gas to fill storages in Europe in the summer. On the electricity demand side, the main drivers to keep an eye on in 2023 are the level of economic activity (impact on industrial demand for electricity of a slowdown, moderate / deep recession?), the willingness and ability of consumers to continue adapting their usual

²⁶ <https://energygraph.info/>

²⁷ <https://energynews.pro/en/edf-maintains-its-2023-production-range-with-the-next-winter-as-its-target/>

²⁸ <https://www.rte-france.com/actualites/previsions-systeme-electrique-hiver-2022-2023>

²⁹ [EU Market Outlook for Solar Power 2022-2026 - SolarPower Europe](#)

behaviour in order to use less electricity (especially during cold days in the winter but also during hot days in the summer) and finally, the level and extent of support measures from governments. The EU and national governments face a hard balancing act: incentivizing customers to save energy while, at the same time, protecting them (and the economy) from the worst impacts of continued-high energy prices.

Europe has been lucky so far this winter, with unseasonably mild temperatures that have limited the need for energy (gas/electricity) for heating. Keeping an eye on the temperatures both in the winter and in the summer (a heat wave boosts the need for air conditioning especially in Southern European countries, creating peak demand in the middle of the year at a time when wind and hydro availability is lower and gas is needed for refill storage) will be essential to anticipate any short term change in electricity and gas demand.

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