December 2023

European Gas Market Supply & Demand: Winter Outlook 2023/24

1. Introduction

European gas balances look comfortable heading into the winter months of December to March on the back of record storage levels, as colder weather arrives. European hub prices have stabilized since April, with prompt TTF futures trading around the 40-45 EUR/MWh level, well down from the mid-2022 peaks but still well above pre-crisis levels, when gas prices were typically below 30 EUR/MWh.[1]

Absent a major supply outage in European production or pipeline imports, the holding of 100 Bcm of storage stocks at the start of December means there is no prospect of any physical shortage this winter, although cold snaps are likely to push prices higher for periods as the market continues to be tight. We expect gas demand to remain subdued through the winter, despite some apparent recovery in industrial and commercial consumption in the second half of 2023.[2] The main drivers of this subdued demand will be low gas use in the power sector given the combined impacts of the weak macroeconomic outlook; a recovery in French nuclear output; and higher hydro and other renewables generation.

Yet the winter outlook is not completely rosy. In terms of Europe's own gas production and pipeline imports, there is limited upside flexibility, with producers operating close to capacity. Any surge in European gas demand driven by colder weather[3] or curtailment of LNG supplies[4] would cause an increase in European storage withdrawals. This would not only lift prices for prompt gas, but also reduce the winter-summer price spread by implying the need for higher storage fills in mid-2024, which would push summer 2024 prices higher than they might otherwise have been. The prospect of an end to Russian transit gas to Europe through Ukraine from 31 December 2024, worth around 12.5 Bcma, will make those storage fills as strategically important in summer 2024 as they were in 2022 and 2023.

On the positive side, Europe's capacity to import LNG has increased with the addition of several new regasification terminals across the continent since late 2022. Furthermore, new Floating Storage and Regasification Units (FSRUs) at Wilhelmshaven, Stade, and Lubmin in Germany, and at Alexandroupoli in Greece are due to be commissioned over the course of winter 2023/24. In 2022, higher LNG imports allowed European buyers to mostly replace Russian pipeline gas. With gas demand still well below pre-crisis levels, we assume that LNG imports will be steady at 2022/23 winter levels, when sendout averaged 426 MMcm/d between December and March, peaking at 456 MMcm/d in December 2022.

[1] Price data from Argus Direct [subscription required]. For further details, see the OIES regular publication "Quarterly Gas Review", https://www.oxfordenergy.org/publications/quarterly-gas-review-analysis-prices-recent-events/

[2] For more information, see Honoré. A., 2023. *European Gas Demand Fundamentals: Q3 Review, October 2023 First Glance, and Winter 2023/24 Outlook*, https://www.oxfordenergy.org/publications/european-gas-demand-fundamentals-q3-2023-review-october-2023-first-glance-and-winter-2023-2024-outlook/

[3] As happened in January 2017 and during 'The Beast from the East' in February/March 2018

[4] As happened in January 2021 during a spell of very cold weather in the LNG-dependent markets of North-East Asia

Bill Farren-Price, Mike Fulwood, Anouk Honoré, and Jack Sharples, OIES

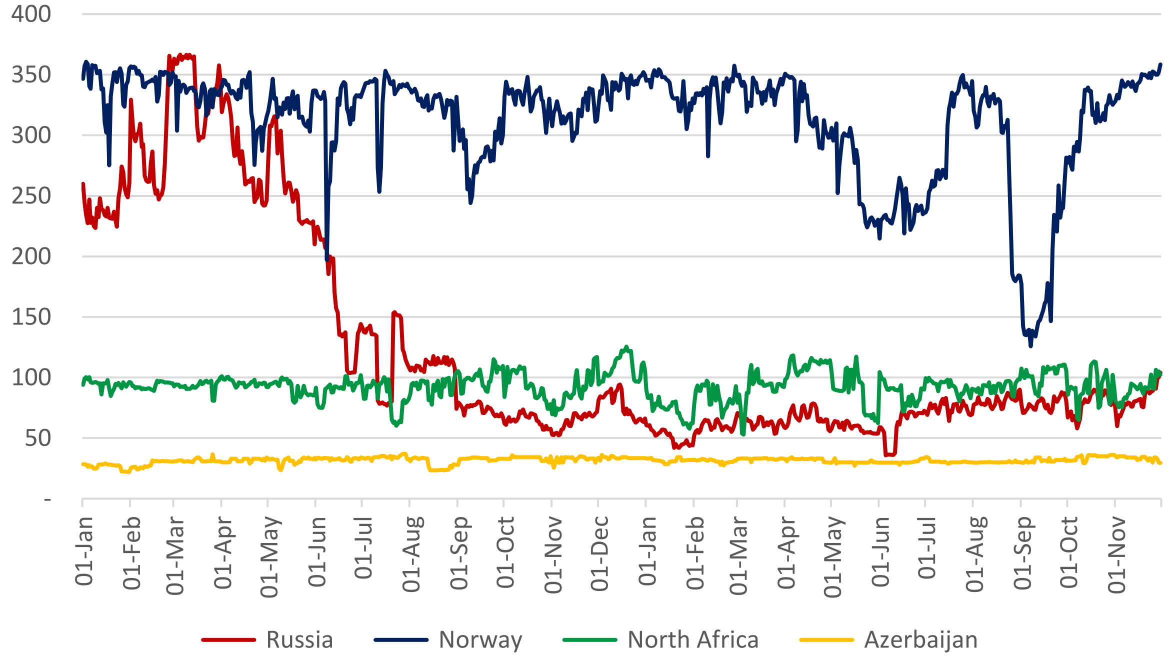
Any sustained recovery in demand would require LNG imports to rise further from these levels, which in turn would imply higher spot prices to pull spot cargoes or divert cargoes heading elsewhere.

2. Limited flexibility for flat-out pipeline imports

With Europe's gas production on a gentle downwards slope and curbed by the halt in production at Groningen in the Netherlands since 1 October 2023, there is little scope to increase production at short notice in the case of either a surge in demand or curtailment of another source of supply.

In terms of pipeline imports, it is a mixed picture. In 2022, amid declining Russian pipeline supply and record high prices, Norwegian production ramped up as maintenance was deferred, gas usually injected back into oil fields for enhanced oil recovery (EOR) was exported, and total Norwegian pipeline exports to Europe for the year as a whole reached a record 119.5 Bcm. The cost of deferring maintenance and pushing the capacity to produce, process, and export gas was felt in summer 2023, as the impact of that deferred maintenance was exacerbated by unplanned outages, as noted in our Quarterly Gas Market Review series. That maintenance is now complete, and Norwegian pipeline exports to Europe averaged 313 MMcm/d in October and 344 MMcm/d in November. We expect Norwegian exports to average 335 MMcm/d over the four months from December to March, close to the average for that period in the years from 2017 to 2022, and similar to winter 2022/23.

Figure 1: European daily pipeline imports by source since January 2022 (MMcm per day)



Data from ENTSOG Transparency Platform.[5] Graph by the authors.

Gas imports from North Africa, principally from Algeria to Spain and Italy, could average 92 MMcm/d, in line with their average over both the past 12 months and winter 2022/23. Of this North African total, Libya will account for 8 MMcm/d through the Green Stream system to Italy and the remainder will be through Algeria's Medgaz system to Spain (23 MMcm/d) and its Transmed pipelines to Italy (61 MMcm/d). Average volumes from Algeria have remained relatively stable, with exports to Italy somewhat more volatile than exports to Spain. Azerbaijan exports to Europe via the Trans-Adriatic Pipeline (TAP) – as measured on the border between Turkey and Greece – have been consistent in the 30-34 MMcm/d range so we are assuming winter supply of 32 MMcm/d.

[5] ENTSOG, 2023. *Transparency Platform.* https://transparency.entsog.eu/#/map

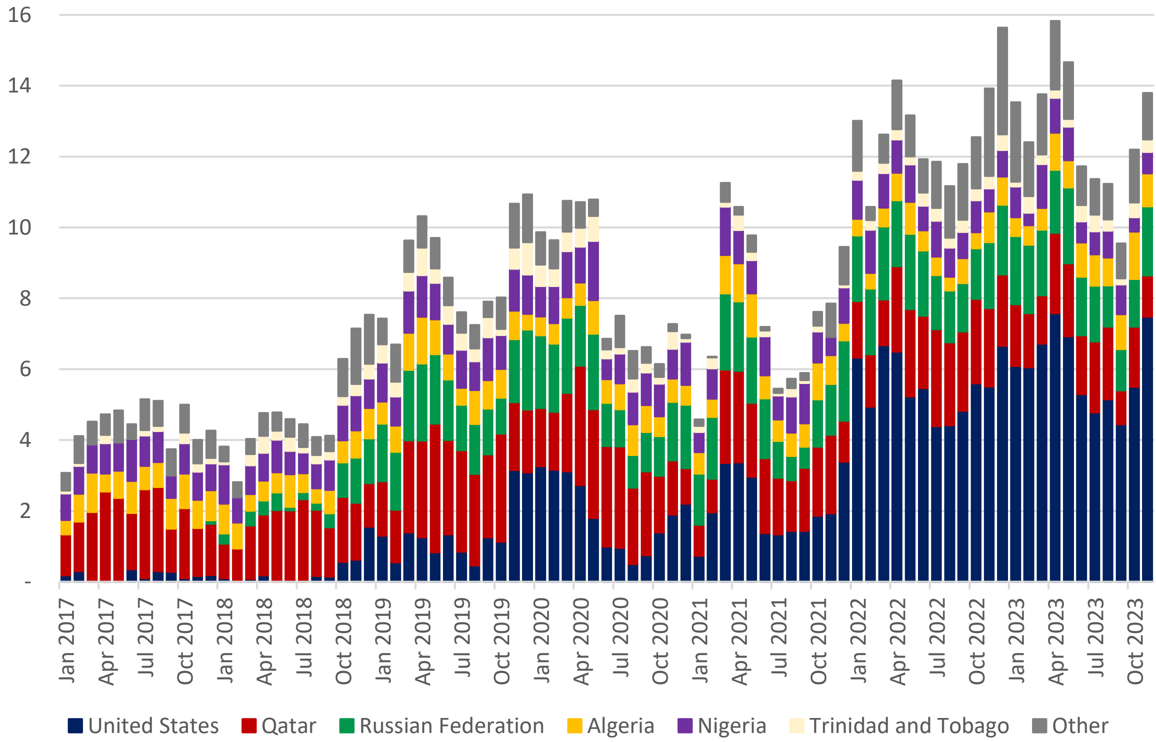
We assume that despite the adversarial politics between Moscow and Europe over Russia's invasion of Ukraine, residual Russian pipeline flows of ~25 Bcma are sustained through to the end of 2024. Supply transiting Ukraine to central European customers and supply via Turkish Stream to southeast Europe have seen combined monthly averages of 75-82 MMcm/d since July, and our scenario for winter 2023/24 assumes that this supply continues at 75 MMcm/d. Looking further ahead, future prospects for Russian gas imports via Ukraine are uncertain once the transit contract expires on 31 December 2024. Even before that, flows are subject to some physical security risks as the Ukraine war rumbles on.

In 2022, Russian pipeline supply to Europe declined by 79 Bcm year-on-year, while combined pipeline imports from Norway, North Africa, and Azerbaijan rose by 5 Bcm. On the supply side, the loss of Russian pipeline supply was mostly offset by a 60 Bcm year-on-year increase in LNG imports, with LNG cementing its role as a core component of European gas supply. That trend continued into 2023, with LNG providing 36 per cent of European non-storage supply, and LNG will play a major role in meeting European gas demand in winter 2023/24.

3. European LNG imports

As illustrated in the graphs below, European LNG imports were already growing in 2019/20, on the back of rising global supply, and especially in line with the growth in LNG exports from the United States. The brief dip in those imports in January 2021 – when cargoes were pulled away to North-East Asia and Europe instead drew heavily on its storage stocks – is clear to see. However, from mid-2021 onwards, rising European prices attracted supply, and Europe emerged as a premium market in its own right, no longer a 'market of last resort' for cargoes that could not find a home in Asia.

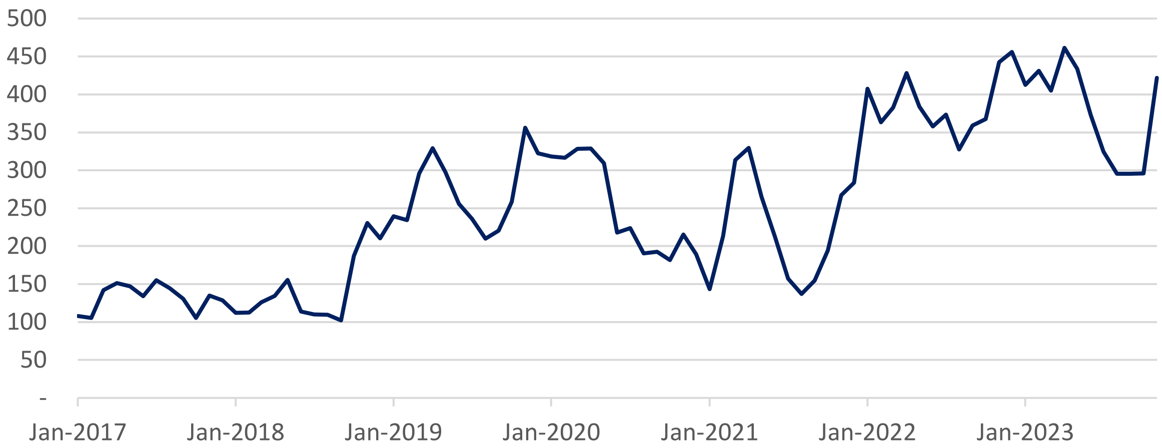
Figure 2: European LNG imports by source to November 2023 (Bcm per month)



Data from Kpler LNG Platform.[6] Graph by the authors. Note that these are gross LNG imports, and therefore do not account for re-exports.

[6] Kpler, 2023. *LNG Platform.* https://lng.kpler.com/

Figure 3: European monthly average LNG sendout to November 2023 (MMcm/d)



Data from GIE ALSI[7] and National Gas Transmission (UK).[8] Graph by the authors.

Since January 2022, European LNG imports have fallen below 10 Bcm per month just once, in September 2023, as European storage facilities were approaching full capacity, but seasonal winter demand had not yet picked up. Likewise, sendout from European LNG regasification terminals only fell below 325 MMcm/d in August-September 2023, when it averaged 295 MMcm/d. As winter demand has started to climb, LNG sendout has risen accordingly. By November 2023, monthly average sendout (424 MMcm/d) was only slightly lower than in November 2022 (443 MMcm/d).

Between September 2022 and February 2023, Europe added 8 Bcma of regasification capacity in the Netherlands (at Eemshaven), 15 Bcma in Germany (at Wilhelmshaven, Brunsbüttel, and Lubmin), and 5 Bcma in Finland (at Inkoo). In May and September 2023, a further 5 Bcma each was added in Italy (at Piombino) and in France (at Le Havre). Taken together, this amounts to an additional 38 Bcma of regasification capacity, sufficient to raise European regasification capacity from just over 210 Bcma (around 17.5 Bcm per month) in August 2022 to almost 250 Bcma (around 20.75 Bcm per month) in September 2023. As noted in the introduction, a further 20 Bcma of regasification capacity is scheduled for launch in Germany and Greece during the present winter, which will raise European regasification capacity to 22.5 Bcm per month. For comparison, the record for monthly European LNG imports is 15.3 Bcm in April 2023, when the utilisation rate of total European LNG import capacity reached 75 per cent.

This new regasification capacity will not necessarily equate to additional supply in equal measure. Rather, we are likely to see lower volumes of LNG being regasified in the UK and re-exported to Belgium and the Netherlands, compared to winter 2022/23. We may also see lower utilisation rates at the previously existing terminals in North-Western Europe (Dunkerque, Zeebrugge, and Gate Rotterdam) as some cargoes are delivered directly to Germany, rather than being regasified elsewhere in North-Western Europe before being re-exported to Germany by pipeline.

Finally, the volume of LNG available for Europe in winter 2023/24 will also depend on both the volume of LNG produced globally, and LNG demand outside Europe. Supply continues to grow, with global exports in January-November (492 Bcm) up 2.4 per cent (11.4 Bcm) year-on-year, which is notably lower than the growth of just over 5 per cent (22-24 Bcm) seen in 2021[9] and 2022.[10] In that regard, the world is still waiting for the next big supply wave, which will hit in 2025-2028.

---

[7] GIE, 2023. *Aggregated LNG Storage Inventory (ALSI).* https://alsi.gie.eu/#/historical/1

[8] National Gas Transmission, 2023. *Gas Transmission Data.* https://data.nationalgas.com/find-gas-data

[9] The rise in 2021 in supply reflected a sharp rise in utilisation of LNG export terminals as demand recovered post-Covid19. In fact, available export capacity was lower in 2021 than in 2020.

[10] Note that these volumes are only exports from exporting countries, and thus exclude re-exports from importing countries (such as re-exports from Belgium). The volumes referenced here therefore include volumes that exporting countries supply to themselves, such as Indonesian LNG supplies from one part of the country to another.

On the demand side, the world's largest importer, China, saw 14 consecutive months of imports being lower year-on-year, between December 2021 and January 2023, but has now returned to growth. China's LNG imports in January-November 2023 (85 Bcm) were 9 Bcm higher year-on-year, although the fact that this was not sufficient to bring China's LNG imports back to the level of January-November 2021 (96.5 Bcm) suggests that there is still room for further growth. At the same time, LNG imports by the world's second-largest importer, Japan, in January-November 2023 (80 Bcm) were 8 Bcm lower year-on-year. Elsewhere, a 3 Bcm year-on-year decline in South Korean LNG imports was more than offset by 9 Bcm of growth in the rest of Asia (mostly in Thailand, Singapore, India, and Bangladesh), giving 6 Bcm of Asian growth outside China and Japan, and 7 Bcm in Asia overall. Outside Europe and Asia, net LNG imports in January-November declined from 45.7 Bcm in 2021 to 37.3 Bcm in 2022 and 34.9 Bcm in 2023 (a 2.4 Bcm year-on-year decline).

As a result of this market balance, with limited supply growth and rising Asian demand being only partially offset by demand falling elsewhere, European LNG imports in January-November 2023 (124.2 Bcm) grew by just 2.2 Bcm (1.6 per cent) year-on-year. However, this relatively modest growth should be seen in the context of European LNG imports in January-November 2023 being 58.4 Bcm (74 per cent) higher than in the same period in 2021. The 'boom' in European LNG imports has already happened (in 2022), and the 'boom' in global LNG supply will come later (in 2025-2028). For now, the market is in a more finely balanced interim period.

Overall, the balance of the global market outside Europe, which appears set to remain tight, and the fact that Europe experienced its surge in imports in 2022 but has shown only limited year-on-year growth in 2023, suggests that Europe may expect only a limited increment in its LNG imports in winter 2023/24, despite the growth in regasification capacity. For this reason, our Winter Outlook scenario assumes sendout from LNG regasification terminals between December 2023 and March 2024 at the same level as between December 2022 and March 2023.

4. European gas demand – down but not out

If the supply picture is relatively stable this winter, the demand side of the equation is more dynamic and poses interesting questions. Overall, for 2023 to November, we estimate that total European gas demand was down 8.1 per cent year-on-year. Power sector demand was down a sharp 19.1 per cent but industry a more moderate 5.1 per cent (and rising from Q3 as illustrated in Table 1), while residential and commercial rose by 2.7 per cent, based on a recovery in gas use from business in Q2 and Q3 and short periods of cold weather in the second half of October and November that balanced lower heating demand in Q1. We estimate an 8 per cent decline in European gas demand for full year 2023, taking into account the icy start to December.

Table 1: Year-on-year changes in sectoral gas demand in Europe (per cent)

	2022 vs 2021	Jan-Nov 23 vs 22	Q1 23 vs Q1 22	Q2 23 vs Q2 22	Q3 23 vs Q3 22	Oct-Nov 23 vs 22
Power	+2.7	-19.1	-16.5	-18.9	-21.0	-20.7
Industry	-18.4	-5.1	-14.7	-8.4	+1.2	+11.9
Residential & Commercial	-22.0	+2.7	-8.3	+5.2	+38.7	+21.9
Total	**-12.7**	**-8.1**	**-12.0**	**-9.2**	**-7.7**	**+1.8**

Source: Data from author's calculations. Table by the authors.

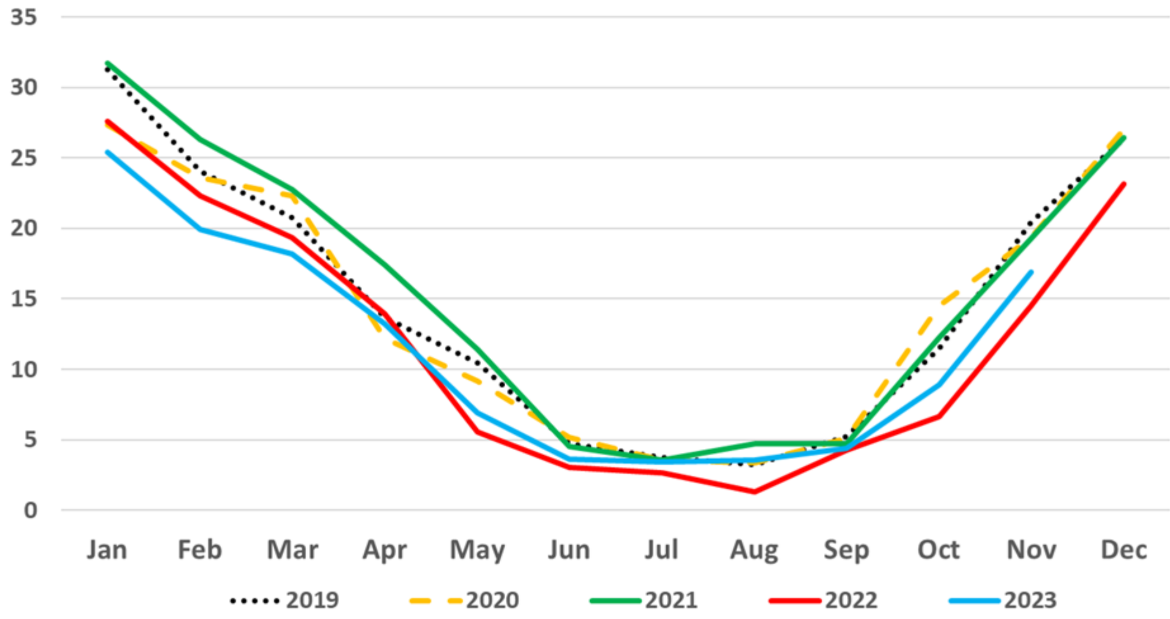
While we caution that the macro-economic outlook in Europe remains weak, with Germany on the brink of a recession and other major economies close to contraction, the industrial sector apparent recovery since this summer does suggest that *some* of the losses seen in 2022 may not be structural. In other words, gas demand from Europe's industrial sector has been temporarily diminished, with only limited destruction, at least for now. The extent to which this sectoral recovery trend continues through the winter months will help confirm this assumption, although demand for end-products (chemicals, steel, glass, and nonferrous metals) may well place a cap on any industrial gas demand recovery over the coming months.[11]

But if industrial gas demand is showing the green shoots of recovery, the same cannot be said of the power sector, where gas demand remains markedly weaker than a year ago. The progressive return of French nuclear plants after extensive maintenance work, the continued build-out of renewables across the continent, and the healthier water levels supporting hydro capacity utilisation suggest a more structural squeeze to gas' market share in the sector.

5. Winter temperatures critical to residential/commercial heating demand

The largest variable for winter gas demand remains space heating, especially in the residential and commercial sector, which alone accounts for close to half of winter gas demand in Europe, in the period between December and March. In January-March this year, unusually mild temperatures kept gas demand for space heating well below long-term averages. But the arrival of colder temperatures in the second half of October has kicked off the heating season as illustrated in Figure 4.

Figure 4: Gas demand in the residential and commercial sector in Europe, 2019-2023 (Bcm)



Source: Data from author's calculations. Graph by the authors.

However, it also seems likely that consumers in this sector will be less influenced this winter by the government conservation campaigns that were widespread in 2022/23 and by price signals, given that wholesale gas prices this winter are around 65 per cent lower year-on-year, although retail prices do not necessarily directly reflect the large fluctuations seen at the hubs. While affordability remains challenging given the macro headwinds and tight monetary policy in Europe, it may not be as strong an incentive for gas-saving measures as last year during record-high gas (and electricity) prices. Colder temperatures than the ones experienced last winter could also further erode consumers' willingness, and more importantly their ability, to maintain energy savings efforts in the coming months, and induce some level of rebound in gas use for heating that we estimate at about 5 Bcm (and potentially up to 20 Bcm in a much colder winter than last year). Because of its size and relative unpredictability, this sector presents the largest uncertainty relating to gas demand this winter.

[11] For more information, see Honoré. A., 2023. *European Gas Demand Fundamentals: Q3 Review, October 2023 First Glance, and Winter 2023/24 Outlook*, https://www.oxfordenergy.org/publications/european-gas-demand-fundamentals-q3-2023-review-october-2023-first-glance-and-winter-2023-2024-outlook/

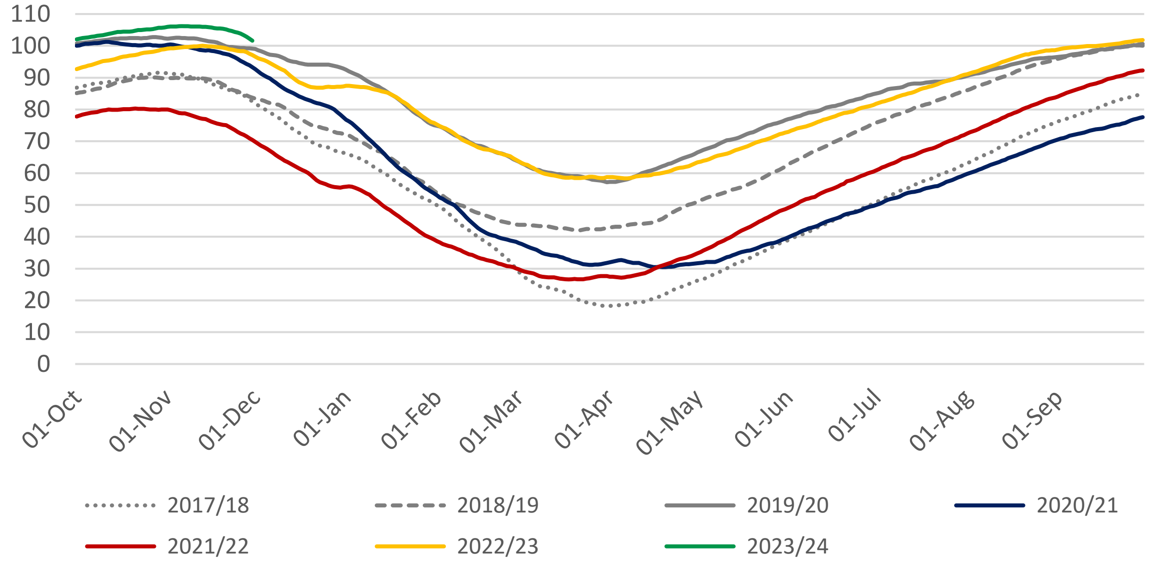
6. European storage at record for start of winter

Storage remains the short-term balancing item for European gas balances through the winter, the most flexible source of incremental supply, which can be ramped up and down at short notice. The key point regarding storage is that daily withdrawal has the ability to exceed daily pipeline imports or daily sendout from LNG regasification terminals, and therefore contribute a substantial proportion of daily supply during the coldest winter months. Indeed, this has already happened at the end of November.

At the beginning of this winter season on 1 October, European storage stocks stood at 102 Bcm. Continued net storage injections in October brought stocks to 106 Bcm on 1 November and further still to a record high of 106.2 Bcm on 6 November. In the rest of November, net withdrawals began slowly and then accelerated towards the end of the month, reaching a high of 620 MMcm/d on 29-30 November. For comparison, in 2023 to date, daily LNG sendout in November peaked at 490 MMcm/d on 28-29 November (the highest since late April) and total pipeline imports (from all suppliers combined) peaked at 594 MMcm/d on 30 November, having not been higher than 575 MMcm/d prior to 27 November. By 30 November, stocks were 101.6 Bcm.

In this winter outlook scenario, we begin from our baseline assumptions regarding supply (from European production, pipeline imports, and LNG imports) and demand, leaving storage as the balancing item. Given the baseline assumptions discussed earlier, the result is a total storage net withdrawal of 50.4 Bcm between 1 December and 31 March, leaving end-of-winter stocks at 51.2 Bcm. For comparison, stocks at the end of last winter, on 31 March 2023, were 58.7 Bcm, which was followed by a net storage injection of 47.3 Bcm between 1 April and 1 November 2023. Our scenario would therefore necessitate summer 2024 storage injections of 54.8 Bcm – 7.5 Bcm higher than in 2023.

Figure 5: European daily gas storage stocks (Bcm)



Data source: GIE Aggregated Gas Storage Inventory (AGSI).[12]

As can be seen above, an example of storage drawdown meeting demand during a cold northern hemisphere winter can be seen in 2020/21, when LNG cargoes were diverted from Europe to Asia to meet a cold snap that peaked in January, snowstorms curtailed US LNG exports in the Gulf of Mexico in February, and the *Ever Given* blocked the Suez Canal in March. European storage stocks tumbled from 99 Bcm in late November to 31 Bcm at the end of March, signifying a net withdrawal of almost 70 Bcm. Moreover, the continued cold weather in Europe in April 2021 led to additional gas demand that delayed the start of the summer storage injection season. That situation occurred in a context of much

[12] GIE, 2023. *Aggregated Gas Storage Inventory (AGSI).* https://agsi.gie.eu/#/

higher volumes of Russian pipeline supply than will be available next summer (with the offtake flexibility embedded in its long-term contracts) but also much higher underlying European gas demand.

The example of winter 2020/21 is a cautionary tale showing how rapidly storage can be depleted. According to our estimates, compared to a baseline scenario of around 50 Bcm of net storage withdrawal between 1 December 2023 and 31 March 2024, a ‘normal’ cold northern hemisphere winter, potentially bringing an additional 20 Bcm of European gas demand (driven by additional space heating requirements), or a more modest increase in demand combined with the loss of LNG to the Asian market compared to European LNG imports in winter 2022/23, would be sufficient to replicate the 70 Bcm of net storage withdrawals seen in winter 2020/21.

Looking ahead, even a ‘normal’ (one in four or five years) cold winter, without any major outages[13] would necessitate much more substantial storage replenishment in summer 2024, which would likely raise summer prices, while any resultant shortfall in summer restocking could generate upside price risk for winter 2024/25, especially with regard to a scenario in which Russian gas transit to Central Europe via Ukraine does indeed halt on 31 December 2024.

Conclusion: Winter scenario based on current trends in supply and demand

The scenario below combines the assumptions regarding supply and demand discussed above, with storage withdrawals as the balancing item. The figures for October and November are historic data for actual supply and demand,[14] while the figures for the period from December 2023 to March 2024 are the result of our scenario. As noted in the previous section, any surge in demand or curtailment of production or imports will most likely be met by additional storage withdrawals, with the consequence being the need for greater volumes of net storage injections in summer 2024.

Considering how the reality may turn out different from our scenario, with the market either tighter or looser, with prices higher or lower, the risk of deviation from this scenario and consequent impact on prompt prices is mostly in the direction of a tighter market with higher prices.

On the supply side, the risk of a tighter market is underpinned by the limited amount of potential extra supply available. Compared to our scenario, we could perhaps see an additional 5-10 MMcm/d of Norwegian supply and 5-10 MMcm/d of Russian supply over the course of the winter. Conversely, an unexpected return to heavy Norwegian maintenance could reduce Norwegian pipeline supply by substantially more than that upside, while an early halt to Russian gas transit via Ukraine (also unexpected) could cut 35-40 MMcm/d of supply.

On the upside, additional LNG supply would only be attracted by higher European prices, and with the caveat of there being both sufficient global LNG supply and a lack of competing buyers elsewhere, who would be largely from Asia. Conversely, the risk of lower supply is focused on the unexpected curtailment of LNG supply availability due to cuts in supply or increased demand outside Europe. Therefore, the possibility of diversion from scenario is largely weighed on the side on lower supply, leading to a tighter market.

On the demand side, the risk of a tighter market is mainly driven by the possibility of a cold winter, which could potentially add up to 20 Bcm of extra demand over the course of four months between December and March, compared to a mild winter, such as that seen in 2022/23. The potential for a looser market is due to our scenario assuming that winter 2023/24 is slightly colder than the (mild) winter of 2022/23. Therefore, a mild winter in 2023/24 would result in 5 Bcm less gas demand between December and March, compared to our scenario (and a return to 2022/23 levels of total gas demand). Therefore, the situation on the demand side is very much in parallel with the situation on the supply side, insofar as the likelihood of deviation from our scenario appears to be weighted in the direction of a tighter market.

[13] Such as the loss of Russian supply via Nord Stream or loss of LNG supply associated with the fires and subsequent closures of Hammerfest and Freeport LNG in recent years.
[14] Gas demand data for November are our estimates based on preliminary data, as are the data for EU-27 gas production.

Figure 6: European gas supply and demand in winter 2023/24: a scenario (MMcm/d)

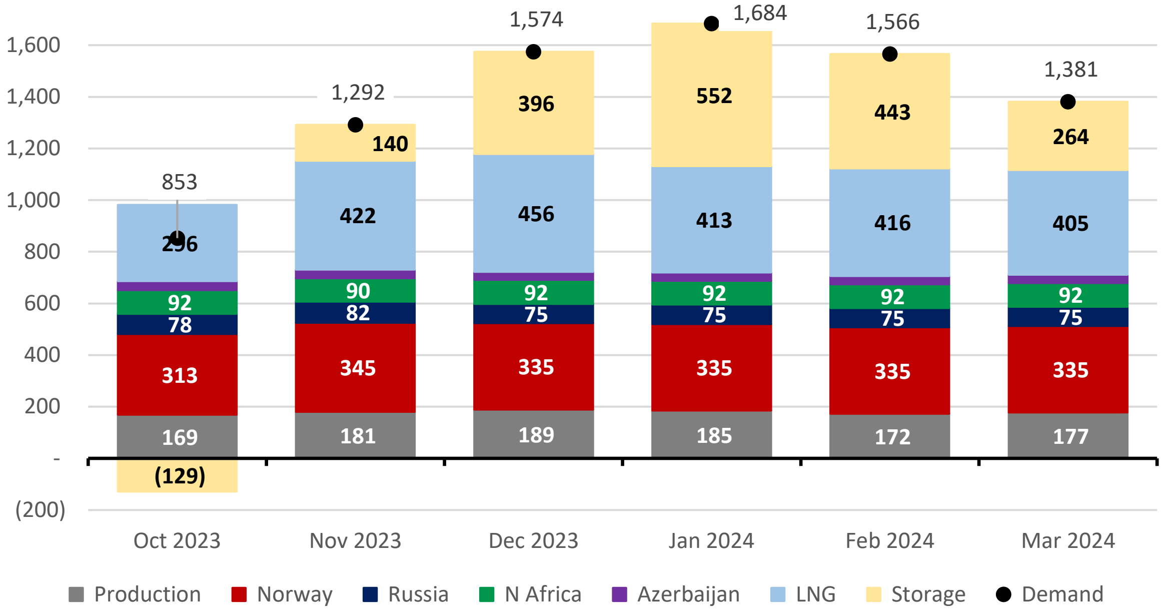
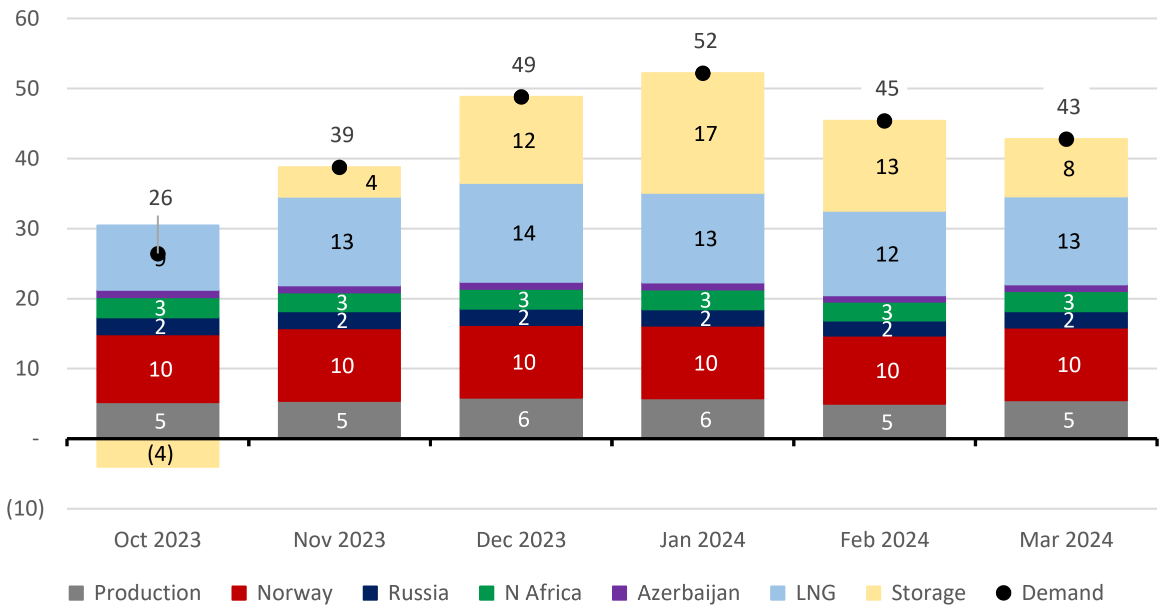


Figure 7: European gas supply and demand in winter 2023/24: a scenario (Bcm)



Historic data from various sources for October-November 2023.[15] Scenario assumptions for December 2023-March 2024 by the authors. Graphs by the authors.

15 Eurostat, National Gas Transmission (UK), ENTSOG Transparency Platform, Gas Infrastructure Europe (Aggregated Gas Storage Inventory & Aggregated LNG Storge Inventory), and Kpler LNG Platform