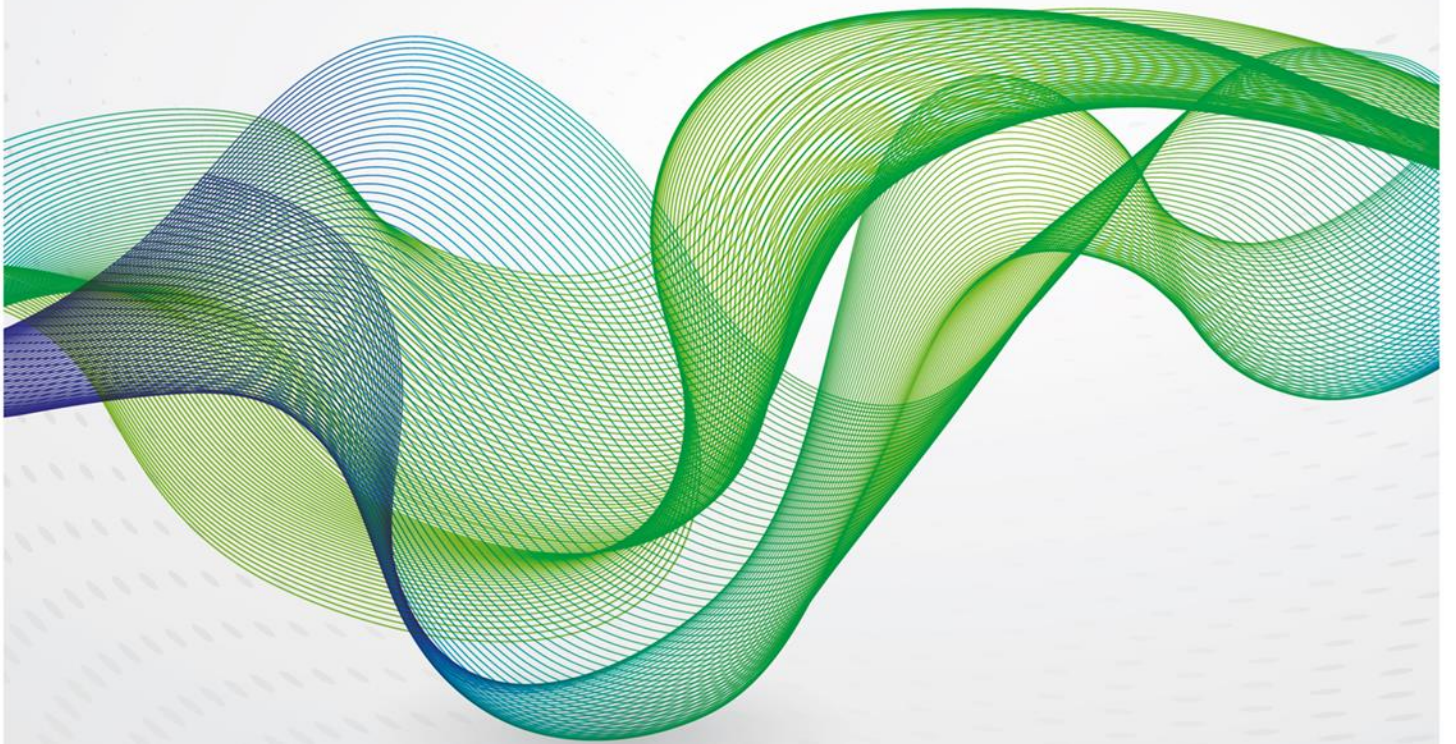


September 2022

Europe's Infrastructure and Supply Crisis



Introduction

The latest OIES Quarterly Gas Review, included a section – In the Bleak Midwinter – which looked at the EU’s plans to reduce gas consumption in the face of rapidly declining pipeline imports from Russia, with the prospect of flows being curtailed completely.¹ The EU were looking for a 15 per cent reduction in winter gas consumption. Taken over a year as a whole a 15 per cent reduction amounts to some 60 bcm. The modelling undertaken by the OIES, using the NexantECA World Gas Model, suggested that, if there were a complete curtailment of pipeline imports from Russia, then this would lead to a decline in demand of around 60 bcm in a full year, compared to the scenario where Russian flows continued. Europe demand is already some 12 per cent down in 2021, in the first 8 months of 2022, and this 60 bcm decline would be in addition to the fall this year.

If Russian flows were cut completely, the reduction in supplies would, according to the modelling, be heavily focused in Germany and Central Europe, with minimal impact outside a core group of countries. Germany could expect to reduce demand by around half the 60 bcm, on an annual basis. Slovakia, Hungary, and the Czech Republic were amongst the most heavily impacted countries, with Austria also potentially impacted. These five central European countries are most at risk because of the reliance on imports from Russia, and the absence of alternative infrastructure and supply to replace the loss of Russian supply.²

If there are no pipeline imports from Russia, these five countries are almost totally dependent on pipeline gas from Norway and the pipeline connections from Belgium and the Netherlands. In turn, while the Netherlands still has a reasonable level of gas production, albeit declining, it now depends on pipeline imports from Norway and the UK as well as LNG imports, as does Belgium.

The five most impacted countries – Germany, Czech Republic, Slovakia, Austria and Hungary – together with Belgium and the Netherlands (plus Luxembourg), form a sub-region of the EU, where the real infrastructure and supply constraints begin to bite with limited or no supply from Russia. This Comment looks at the infrastructure and connectivity for this sub-region, the supply and demand balance, both annual and the winter peak, and how flows might change once the anticipated additional LNG capacity comes on in the Netherlands and Germany.

Regional Infrastructure

Figure 1 shows the pipeline and LNG import capacity into the sub-region, in billions of standard cubic metres. This is the absolute maximum potential capacity, but there is no guarantee that gas will actually flow to fill the capacity in extreme circumstances. France has been exporting some volumes to Belgium this year, directly from the Dunkerque LNG terminal, but the actual flow historically is from Belgium to France – it was some 3.6 bscm in 2021. Similarly, the connections between Switzerland and Germany and Italy and Austria typically flow gas from Germany and Austria to Switzerland and Italy respectively. The connection between Serbia and Hungary takes Russian gas via Turkstream into Hungary, and if Russian flows to the EU were completely cut then Hungary would be very short of gas.

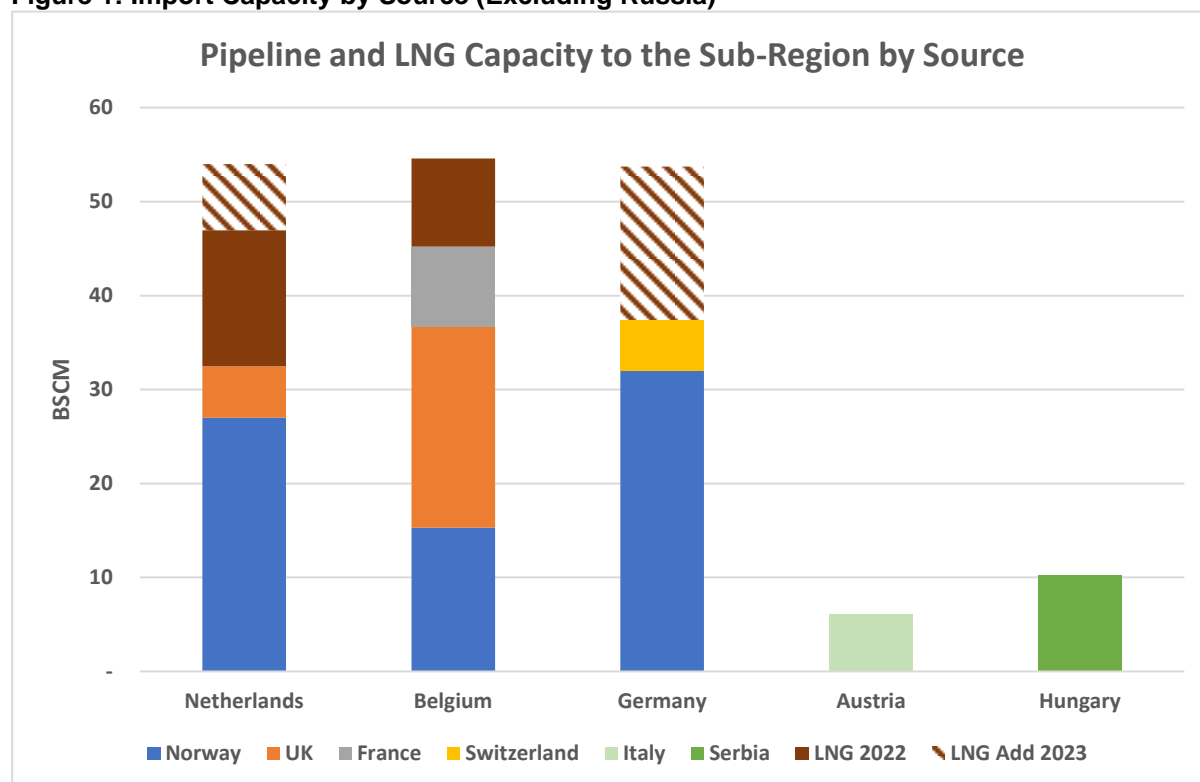
The sub-region is fundamentally dependent on pipe imports from Norway and the UK and LNG imports into Belgium and the Netherlands – at least in 2022. The total capacity from Norway, the UK and LNG is some 125 bcm³ – around 340 mmcmd. Additional LNG import capacity for 2023 is planned – this is discussed further below.

¹ <https://www.oxfordenergy.org/wpcms/wp-content/uploads/2022/08/Gas-Quarterly-Review-Issue-18.pdf>

² Italy, Romania and Bulgaria are also countries impacted by the loss of Russian supply but they all have wider alternative supplies to mitigate the impacts.

³ This includes the Zeebrugge and Gate LNG import terminals operating at some 17 per cent above nameplate capacity which they have been doing in 2022.

Figure 1: Import Capacity by Source (Excluding Russia)



Source: ENTSOG, GIIGNL, NexantECA World Gas Model

Within the sub-region, there is significant capacity to flow gas from Belgium and the Netherlands into Germany amounting to some 50 bcm. The capacity to flow gas from the UK to the Netherlands and Belgium is some 27 bcm. However, in normal times, the UK exports to the EU in the summer and imports from the EU in the winter, so the total annual flow – netting off imports and exports – is often in balance. In 2022, with the EU being short of gas and the UK importing record volumes of LNG, the flows have often been close to the maximum daily capacity. In the first eight months of 2022, the UK exported over 12 bcm to the EU and this could increase to some 15 bcm or more for the year as a whole – depending on the level of LNG imports into the UK and UK gas demand. This is only just over half the theoretical capacity from the UK. Assuming imports from the UK of 15 bcm then, if Norway and LNG imports are at maximum, the real “effective” capacity into the sub-region, excluding Russian gas, is some 113 bcm. An additional 23 bcm is estimated to become available in 2023 from new LNG regas terminals.

Sub-Region 2022 Supply-Demand Balance

Table 1 shows the estimated demand and production by country for 2022 for the sub-region, leading to an import requirement of about 152 bcm. This compares with the maximum 2022 import capacity of some 125 bcm, or 113 bcm with lower UK flows.

To fill the gap between the requirement of 152 bcm and the available non-Russian effective capacity of 113 bcm, would require a minimum of almost 40 bcm from Russia or other sources, and a larger amount if there were continued exports out of the sub-region, to France and Switzerland for example – see below.

Table 1: Sub-Region Demand and Production 2022

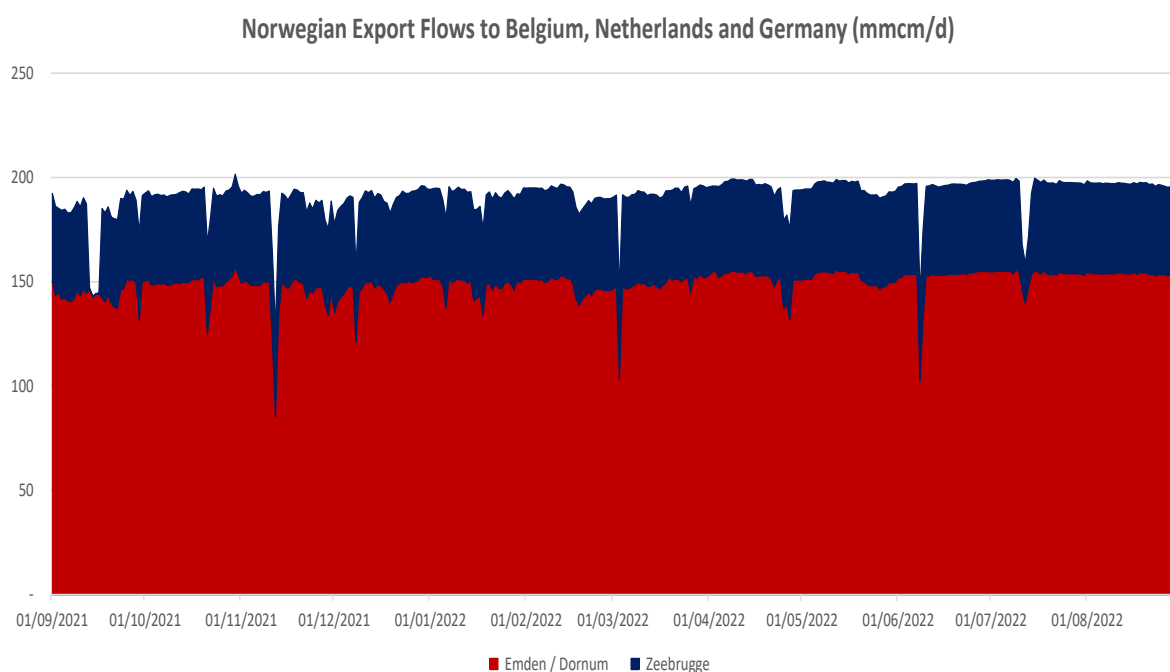
BSCM	Demand	Production	Imports Required
Austria	9.3	0.8	8.5
Belgium	18.0		18.0
Czech Republic	9.0	0.2	8.8
Germany	85.0	5.0	80.0
Hungary	10.0	1.5	8.5
Luxembourg	0.8		0.8
Netherlands	40.0	17.5	22.5
Slovak Republic	5.5	0.1	5.4
Total	177.5	25.1	152.5

Source: IEA, NexantECA World Gas Model

Recent Flow Rates to Sub-Region

The 74 bcm of pipeline capacity from Norway to Belgium, Netherlands and Germany works out at some 200 mmcmd. Figure 2 shows that the actual flows to Zeebrugge (Belgium) and to Emden/Dornum (the joint Netherlands and Germany import points), have amounted to almost 200 mmcmd since September 2021, so running at or around capacity.

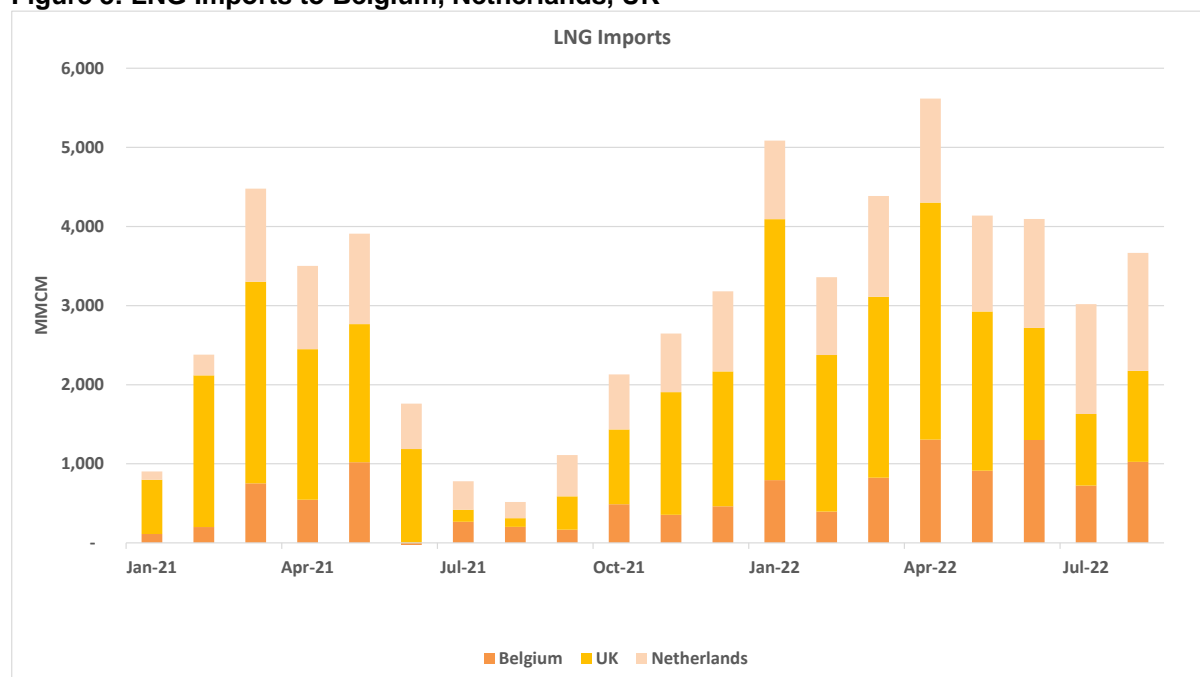
Figure 2: Norwegian Exports



Source: ENTSOG

LNG imports to Belgium and the Netherlands have averaged over 2 bcm per month (some 67 mmcmd) since the beginning of 2022, and have been above this amount in some individual months. In 2021, the average was just over 1 bcm per month, so there has been a doubling of LNG imports.

Figure 3: LNG Imports to Belgium, Netherlands, UK



Source: Kpler

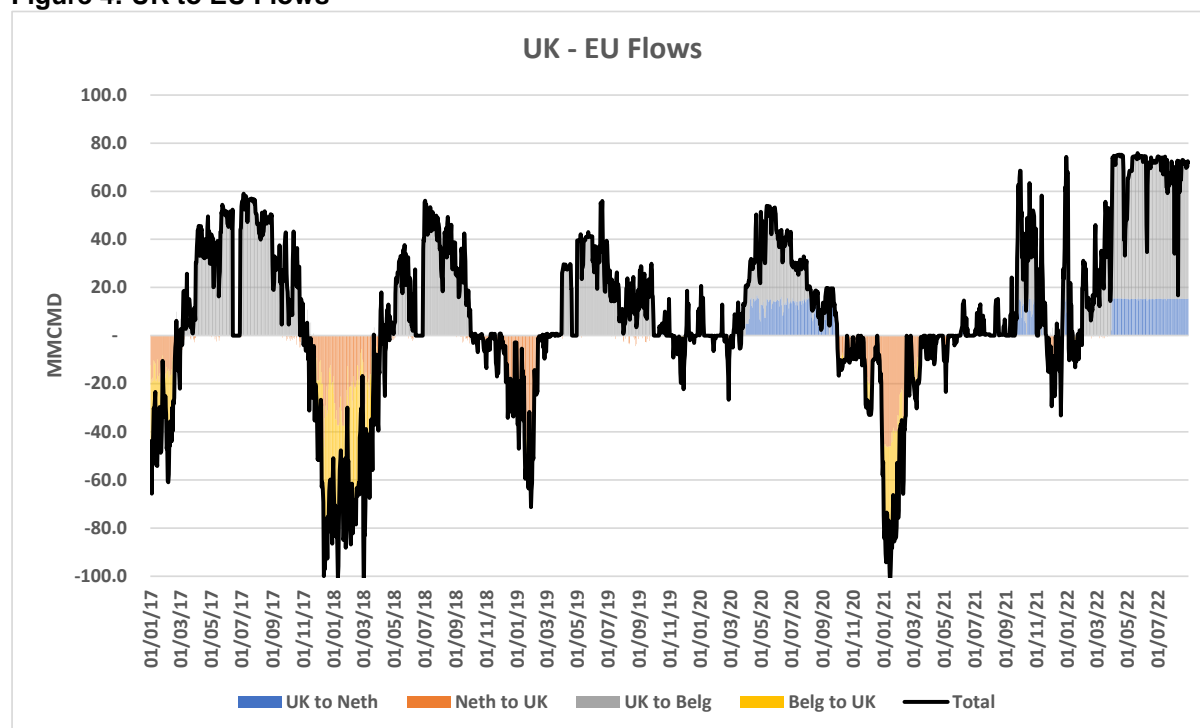
The estimated LNG import capacity for Belgium and the Netherlands is around 2 bcm per month and this is 17 per cent above nameplate. It is possible that slightly more could be achieved, but total Norway pipeline imports and LNG imports are running at the current capacity.

LNG imports into the UK in 2022 have totalled some 16 bcm so far (to July) – over 2 bcm per month, or the same as Belgium and Netherlands combined. Imports so far this year equal total 2021 LNG imports and are some 6 bcm higher than in the year to July comparison. If the UK continued importing at 2 bcm a month, then total LNG imports would be just under 30 bcm or double the 2021 level.

As noted earlier, the UK has exported over 12 bcm via the Interconnector (to Belgium), and the BBL (to the Netherlands) in the first eight months of 2022. The average rate since April seems to have been around 65 mmcmd, while the highest rate has been around 70 mmcmd, which is 25.5 bcm at an annual rate – slightly below the annual capacity of 27 bcm in Figure 1.

If flows continued at some 65 mmcmd for the rest of this year then total UK exports to the EU could come close to 20 bcm for 2022 as a whole. However, the prospects for Q4 of this year are uncertain. Last year there were imports into the UK from the EU, which is the normal direction of flows in the winter, so it seems to be optimistic to expect exports to reach 20 bcm this year. As winter approaches, a target of 15 bcm of exports from the UK to the EU for the year as a whole may be achievable – another 3 bcm or so in addition to exports up to end August.

Figure 4: UK to EU Flows



Source: ENTSOG

The sub-region’s capacity to import by pipeline from Norway and by LNG into Belgium and the Netherlands is just under 100 bcm per year and flows are running at around this capacity level. The ability to achieve export capacity of 25 bcm plus from the UK, seems unlikely however. At best total exports of some 15 bcm in 2022 seems achievable. At this level, the shortfall of gas is almost 40 bcm once Russia flows are excluded.

The potential shortage could, however, be worse if there is some “leakage” out of the sub-region to other countries. In 2021, Belgium exported some 7.5 bcm to France and has continued to export this year albeit at around 1/3rd of last year’s rate. This has been partly offset by increased flows directly from the Dunkerque terminal in Northern France into Belgium at Alveringem. Some of the Belgium exports to France are low CV gas, however, and these seem likely to continue – they were 4.3 bcm in 2021 but are running at half this rate in 2022. Germany exported some 3 bcm to Switzerland in 2021 and that rate has continued in 2022. Finally, Austria flowed some 27 bcm to Italy in 2021, but this was effectively Russian gas, and has dropped dramatically in 2022. It would therefore be reasonable to assume that this would drop to zero in the event that there were no Russia flows to the EU. Italy has been sending some gas to Austria, with volumes this year actually up on 2021, although if there is no Russian gas, then Italy will need to protect its own market as it will be faced with severe shortages.

Overall, there is potential of between 2 and 5 bcm of exports from the sub-region, to France and Switzerland, adding slightly to the almost 40 bcm shortage from imports. The demand reduction estimated by the modelling in the latest quarterly review,⁴ for 2023 as a whole, was some 43 bcm.

Additional 2023 Capacity

As shown in Figure 1, there is potential additional LNG capacity to be added in 2023, in the Netherlands (7 bcm) and Germany (16 bcm). The additional capacity coming on is at Eemshaven in the Netherlands

⁴ <https://www.oxfordenergy.org/wpcms/wp-content/uploads/2022/08/Gas-Quarterly-Review-Issue-18.pdf>

(8 bcm nameplate in September 2022), with some 6 terminals in Germany – 2 at Wilhelmshaven, 2 at Lubmin, 1 at Brunsbuttel and 1 at Stade. Three may come on in Q1 2023 with the rest phased in through the year. Total nameplate capacity for the German terminals is some 28 bcm but this will not come on immediately in each terminal as they ramp up, and some are coming on later in the year, so the available capacity is around half of total nameplate in 2023 but will be higher in 2024.

In the event of no Russian pipeline import into the EU in 2023, Germany receives some 58 bcm less than if Nord Stream 1 was operating at full capacity and some 35 bcm or so less than in 2022 with reduced Nord Stream 1 flows this year.⁵ The new LNG import capacity will in part alleviate the loss of imports from Russia, but there is no way that this loss of capacity can be completely replaced. The additional LNG imports help a little. However, while global LNG export capacity is expected to rise significantly, there is rising demand for LNG in the rest of the world, especially in China, as it rebounds from the Covid lockdowns. The new LNG into Germany will largely divert cargoes which would have gone elsewhere, mainly to the UK. Compared to the situation where imports from Russia into the EU continue, albeit at much lower than the 2021 levels, LNG imports into the UK are 7 bcm lower if there are no Russia flows into the EU. As a consequence, the UK exports 7 bcm less into the sub-region, to Belgium and the Netherlands. The additional LNG imports into the Netherlands and Germany are partly offset by lower pipeline flows from the UK.

Germany could also be affected by the start-up of the Baltic pipeline from Norway to Poland via Denmark. The Baltic pipeline receives gas in Norway from the pipeline running to Germany, so leads to potentially lower flows into Germany from Norway. However, this largely means that Germany ceases to export gas to Poland via the reverse flow at Mallnow. For 2023 as a whole though, Germany might lose some 4 bcm of imports from Norway, reducing the effective capacity into the sub-region, from Norway, to 70 bcm in total

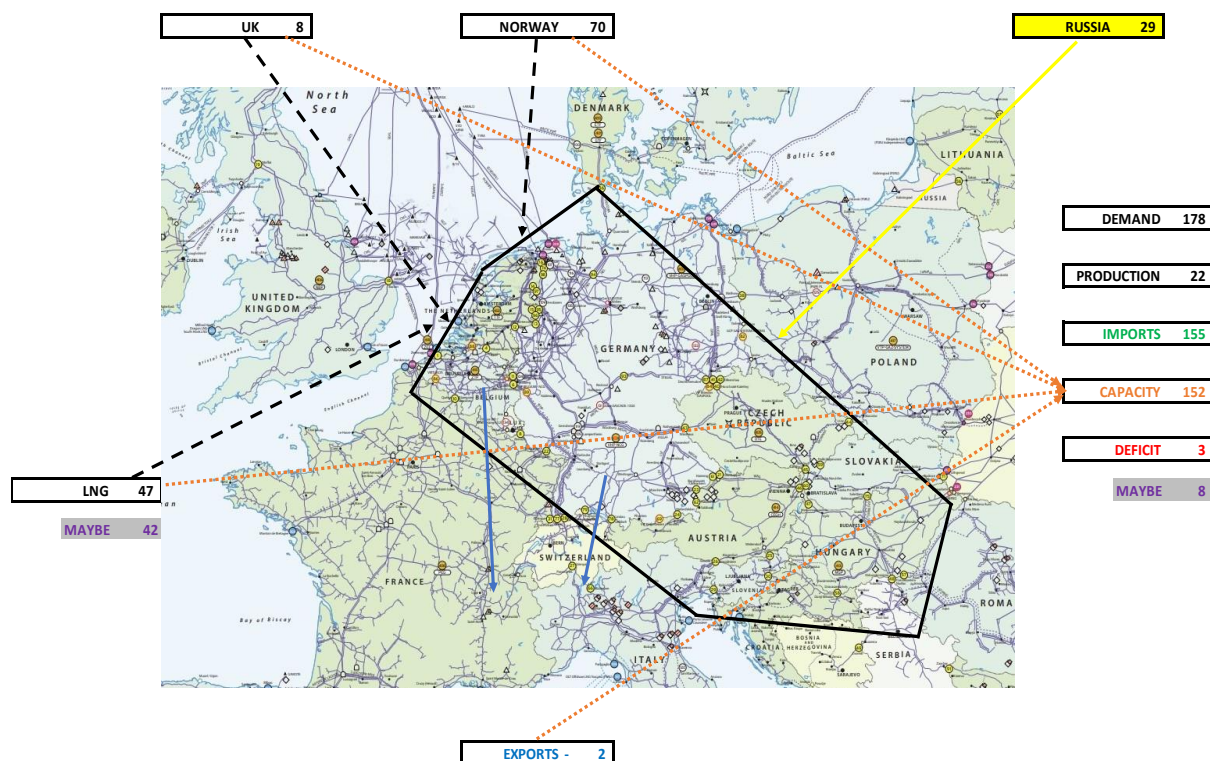
Finally, gas production in the sub-region in 2023 is likely to be lower, mainly as Groningen in the Netherlands reduces flows to minimal levels prior to complete closure.

Overall, the additional LNG capacity in Germany and the Netherlands may only provide a small increase in the effective infrastructure capacity into the sub-region, with lower production and reduced pipeline imports from the UK because of LNG diversions. This is summarised in Figure 5 for 2023 with demand assumed to be the same as in 2022. Flows from Russia are assumed to be some 40 mmcmd via Ukraine and some 40 mmcmd via Turkstream into the EU. On an annual basis this is some 29 bcm.

If all the LNG capacity into the sub-region was fully utilised, even with reduced imports from the UK, reflecting some LNG diversions, then there might only be a small deficit on an annual basis. However, to the extent that the LNG terminals did not fill up to capacity, the deficit would start to become significant. The sub-region remains significantly at risk if Russian flows remain at current rates, and this is based on a demand assumption incorporating a mild winter. The downside risks, therefore, are considerable – a cold winter, inability to get enough LNG, potentially lower imports from the UK and the distinct possibility that Russian flows may fall further.

⁵ The Yamal-Europe route through Belarus and Poland to Germany is also down to zero flows but this happened much earlier this year.

Figure 5: Mapping the Flows – Expected 2023 Demand and Supply (BCM)



Source: ENTSOG, OIES Estimates

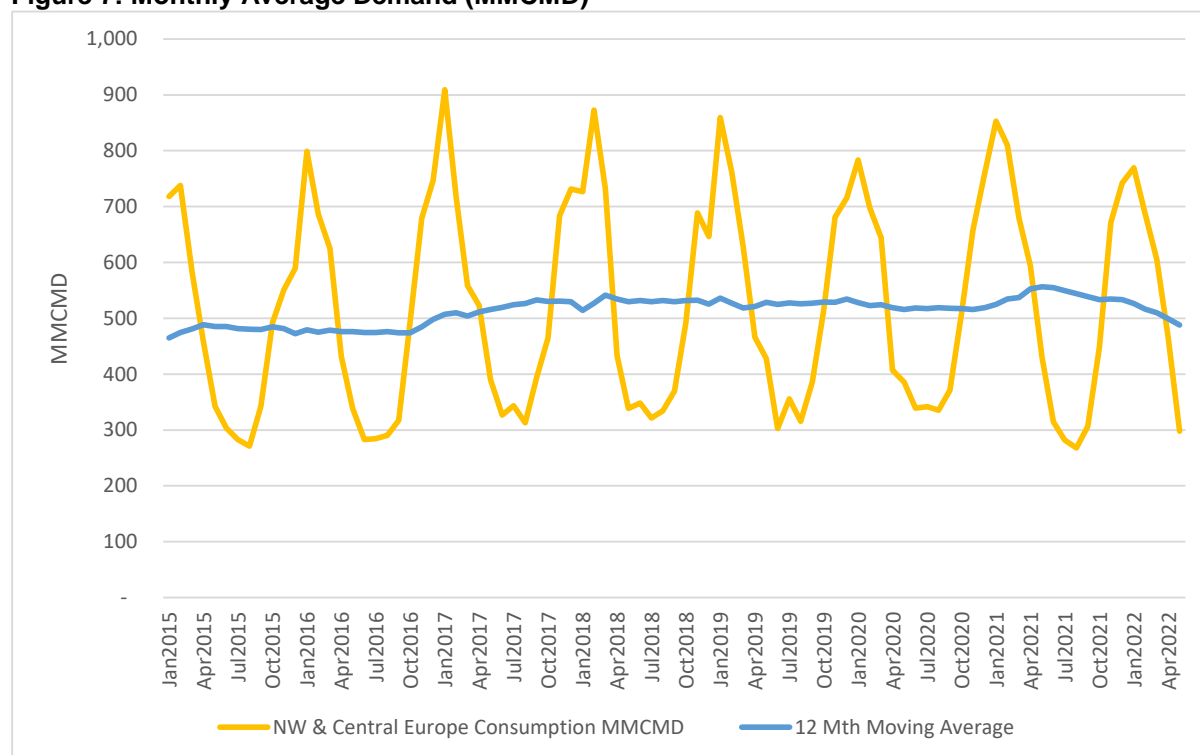
Peak Flows

The analysis so far has focussed on the annual balances, and suggests that the best outcome might be a small shortfall in annual import capacity.

In looking at the peak winter flows, the role of storage needs to be brought into the analysis. The sub-region as a whole has some 55.5 bcm of total working capacity, with Germany having the most, followed by the Netherlands and Austria. This represents just over half of total EU capacity. As of 12th September, sub-region storage was 82 per cent full with 45 bcm of gas in storage. Germany, Czech Republic, Netherlands and Belgium have high levels of utilisation while Austria and Hungary are lower. The maximum withdrawal capacity is around 1.1 bcm per day, but historically most storage facilities rarely withdraw much more than 1/3rd of the maximum withdrawal capacity. The EU's 80 per cent of capacity target would result in 44.5 bcm of gas in storage and at 90 per cent of capacity it would be 50 bcm of gas in storage.

Figure 7 shows the monthly average demand in mmcmd for the sub-region. The peak month is typically January. In January 2022, the average daily demand was 769 mmcmd. However, this was a relatively mild winter and in January 2021, a cold winter, it was 853 mmcmd. The three highest demand months are December through February and demand in 2020/21 was 10 per cent higher than in 2021/22 – on average 807 mmcmd compared to 733 mmcmd. Peak daily flows on very cold days could be much higher.

Figure 7: Monthly Average Demand (MMCMD)

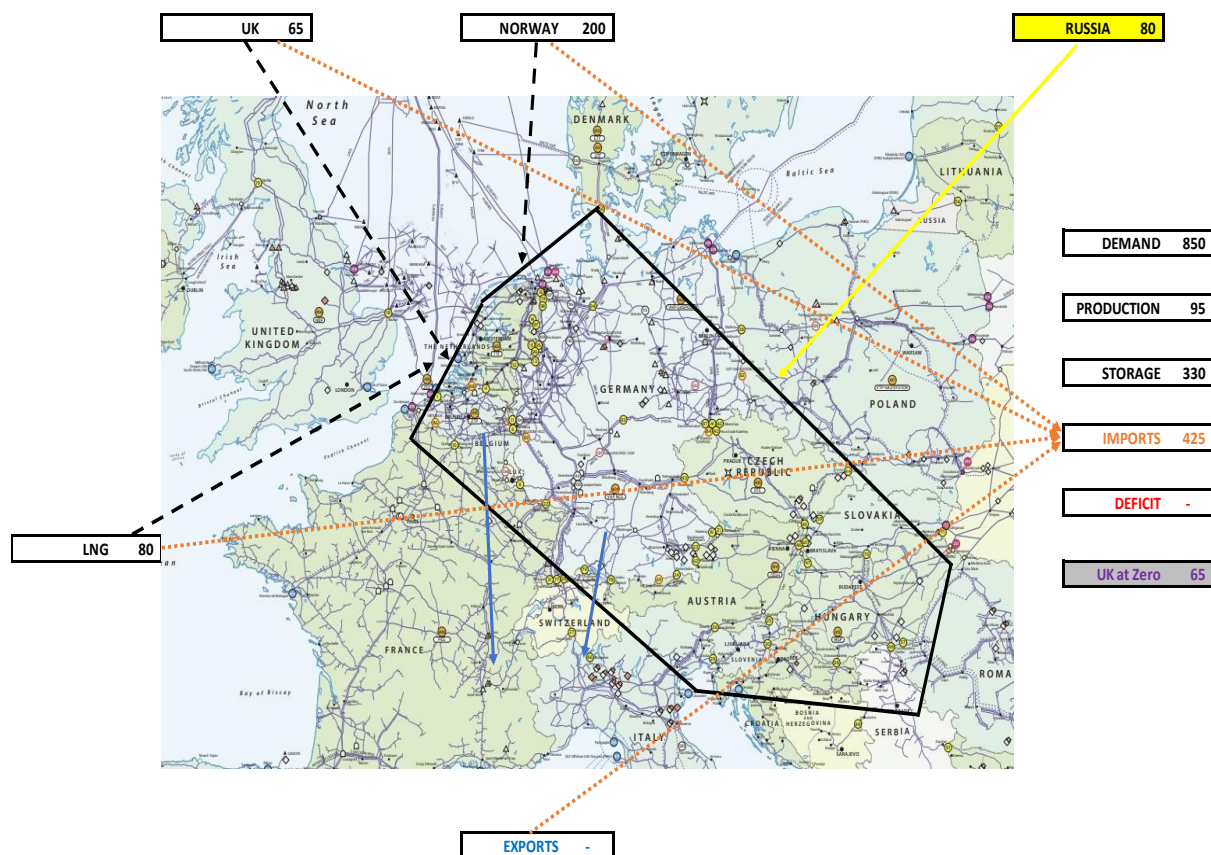


Source: IEA

Let us assume that imports from Russia are 80 mmcmd in the coming winter, and that pipeline import capacity from Norway is some 200 mmcmd, although this could be reduced if the Baltic pipe to Poland reduces flows to Germany. LNG import capacity into the Netherlands and maybe Germany, if some new sites come online in Q1 2023, could reach 80 mmcmd. Potentially imports from the UK could flow at 65 mmcmd, but in the peak winter period could be zero if UK demand is strong. Potential “leakage” out of the sub-region to France and Switzerland of maybe 20 mmcmd on coldish days reduces availability. With the UK exporting and no leakage, maximum import flows would be 425 mmcmd. But with no UK exports to the EU the flows would be down to 360 mmcmd. Production in the region has averaged some 75 mmcmd over the last year but was over 95 mmcmd in January.

Including production at 95 mmcmd the absolute maximum from imports and production would give a daily flow rate of 520 mmcmd. Compared to a peak monthly demand of some 850 mmcmd, this would require storage withdrawal of some 330 mmcmd. This is slightly below a storage withdrawal rate of around 1/3rd of maximum withdrawal capacity of some 370 mmcmd. If there were no imports from the UK – highly likely in a cold winter – then the storage withdrawal rate would rise to 395 mmcmd.

Figure 8: Mapping the Shortfall – Expected Cold Winter Peak January 2023 (MMCMD)



Source: ENTSOG, OIES Estimates

Another issue is the duration of the winter. Between October 2021 and March 2022, the average demand in the sub-region was some 650 mmcmd, while between October 2020 and March 2021, average demand was some 710 mmcmd – a much colder winter. Gas production last winter averaged just under 80 mmcmd, so at the cold winter rate, the total import and storage requirement is some 630 mmcmd. Imports from Norway and LNG amount to some 280 mmcmd, Russia to 80 mmcmd, and if the UK is included at 65 mmcmd then the total is 445 mmcmd. The required withdrawal from storage, therefore, would be 205 mmcmd (650 less 445). Excluding imports from the UK in a cold winter, increases the storage withdrawal requirement to some 270 mmcmd, over a six-month period. The storage capacity in the sub-region is some 55.5 bcm and if it reached 90 percent full then there would be 50 bcm in storage at the beginning of winter. Withdrawing 270 mmcmd over the six months would deplete storage by some 49 bcm, leaving storage effectively empty as we entered the summer filling period, unless there were at least some imports from the UK.

Even with Russian flows continuing at 80 mmcmd a cold winter pushes the sub-region right to the edge in terms of import capacity and storage withdrawals. A mild winter would ease the situation but, as with the annual balance, there are considerably more downsides to the outlook if there were difficulties in attracting LNG and further curtailments from Russia

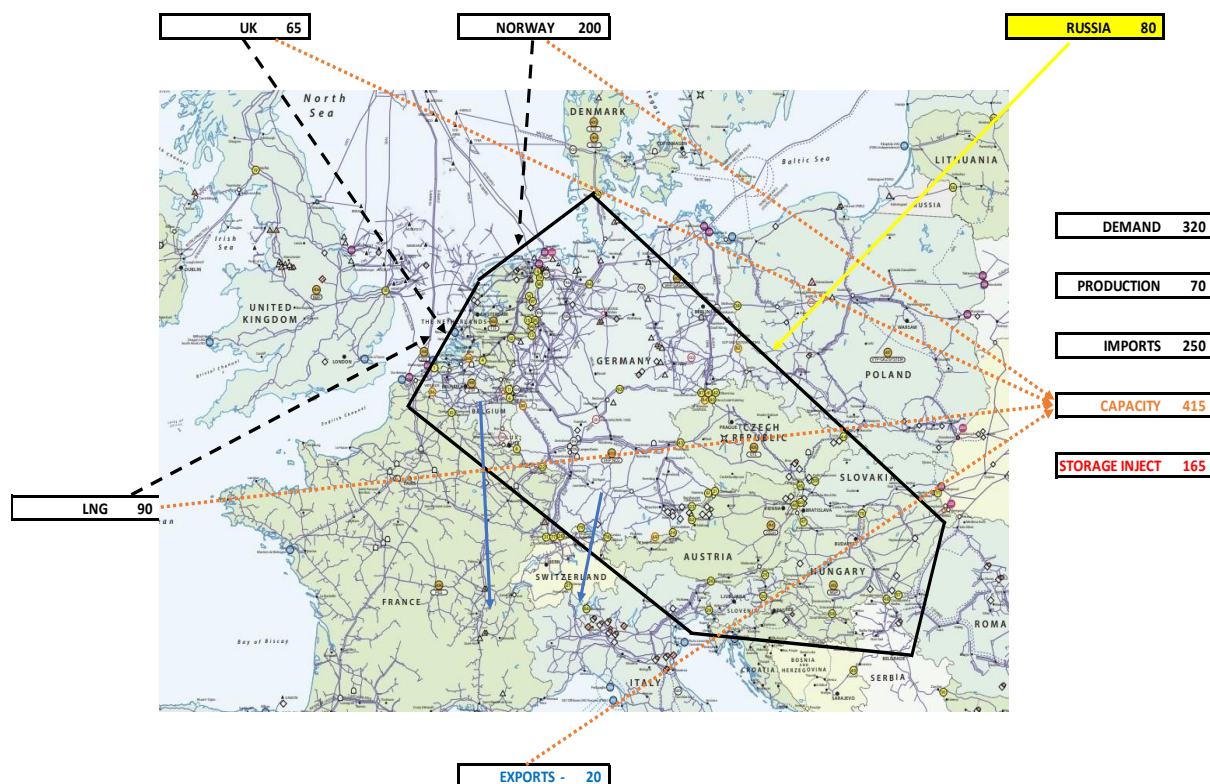
Summer 2023

The potential almost complete depletion of storage in the coming winter turns attention to the refilling of storage next summer. Based on the lower level of demand we are experiencing, the average sub-region demand this summer is around 320 mmcmd. Production is running at some 70 mmcmd but could

be lower in 2023 if Groningen is reduced to a minimum. The net import requirement is some 250 mmcmd. With new LNG plants coming on during 2023 the import capacity could be up to 90 mmcmd, and together with maximum flows from Norway and the UK, plus Russia at 80 mmcmd, then total import capacity could be some 415 mmcmd, accounting for summer exports to France and Switzerland. This exceeds the required level of imports of 250 mmcmd by some 165 mmcmd and would be available for injection into storage. Over the summer period this would lead to some 30 bcm injected into storage in the sub-region. However, this would leave the amount of gas in storage at 55 per cent of capacity as we enter winter 2023. This also assumes that the LNG terminals in Belgium, Netherlands and Germany operate at full capacity and the UK still imports enough to re-export at 65 mmcmd into Belgium and the Netherlands. As noted above the UK and the Northwest Europe terminals are “fishing in the same pond” for the LNG so it is likely that the UK may not import as much LNG and therefore not export as much in 2023 as it is currently doing. Any reduction in UK exports and/or less LNG going into Northwest Europe would simply reduce the ability to inject into storage. If only, say, 110 mmcmd is available for injection (one-third lower), with lower LNG and/or lower imports from UK, then the storage fill would only be 20 bcm leaving gas in storage at only 35 per cent of capacity.

This brings us to the key issue. While the sub-region might be able to get through a mild 2022/23 winter with low Russian gas flows – a cold one would be more challenging – the lack of gas to undertake any meaningful storage refilling next summer leaves the countries in a very constrained situation at the start of the 2023/24 winter, even with the most optimistic assumptions on LNG imports and imports from the UK.

Figure 9: Mapping the Shortfall – Summer 2023 (MMCMD)



Source: ENTSOG, OIES Estimates

Conclusions

The most recent OIES Quarterly Gas Review noted that the countries that are most impacted by reduced or no imports of pipeline gas from Russia are all in Central Europe – Germany, Czech Republic, Slovakia, Austria and Hungary. If flows from Russia were to halt completely, then this area would be reliant on a small amount of its own production and imports from Norway (into Germany), Belgium and the Netherlands. There is little or no prospect of any imports from southern Europe or from France. The Netherlands still has its own production from Groningen, although this is declining, and together with Belgium also imports from Norway, the UK and LNG. The five impacted countries plus the Netherlands and Belgium (as well as Luxembourg), form a sub-region of the EU which, without Russian gas, is heavily dependent on imported gas into a narrow area of Northwest Europe.

If Russian flows were to continue broadly at current levels – some 80 mmcmd (29 bcm for the year as a whole), then if 2023 demand remained at the anticipated 2022 level – which is expected to be more than 10 per cent lower than the 2021 level – the sub-region is projected to be marginally short of the capacity to import gas. This assumes that Norwegian volumes flow at full capacity as does LNG into the Netherlands and Belgium terminals, plus the new German terminals. The UK is able to export some 8 bcm to the EU, which is lower than in 2022 as LNG is diverted to the new German and Netherlands terminals.

For the coming 2022/23 winter, the available supply, including withdrawals from storage, looks to be short of the volume required to meet a cold January peak, without full imports from the UK, which are unlikely in a cold winter. For the winter as a whole, if it is cold, then the sub-region may just about get through by fully depleting storage, without any serious demand destruction. This would, however, depend on imports from Russia continuing at current rates of 80 mmcmd.

This scenario, however, would mean starting the summer of 2023 with nothing in storage and much reduced capacity to fill storage through the summer. The addition of substantial amounts of LNG import capacity in Germany especially, helps but some of the LNG seems likely to be diverted from the UK, with the UK exporting less. Even with Russian pipe imports, storage may only be 35 per cent full by the beginning of the 2023/24 winter. This suggests that getting through that winter would be impossible without severe gas demand destruction in the impacted countries. Lower, or no, Russian flows to the EU would be very problematic for this coming winter and catastrophic for the 2023/24 winter.