entsog

european network
of transmission system operators
for gas

ENTSOG
WINTER SUPPLY REVIEW

2021/2022

Contents

Winter Supply Review 2021/22

Executive Summary

ENTSOG has completed the review of the European gas supply and demand for Winter 2021/22 (October to March). The seasonal reviews aim to provide a deeper understanding of the development of the demand and supply of the previous seasons and the identification of trends that cannot be captured at national or regional level. They also help to build experience and a solid background for the assumptions considered in the Winter Outlook. Such knowledge is also factored in the recurrent TYNDP process to ensure consistency and continuous improvement in every ENTSOG report. The main findings of this Winter Review are:

- **The share of the European gas supply provided by Russia dropped to 24% in the winter season 2021/22 and lost its leading position in the gas supply mix. The decreasing supply from Russia as well as lower national gas production volumes were compensated by the increasing shares of LNG supply and supply from Norway, 24% and 32% respectively. The decreasing share of imports from North Africa, was compensated by the gas supply via Trans Adriatic Pipeline.**
- **The EU stock level remained at a ten-year low of 75% full (832 TWh) at the beginning of October. At the end of March, the storage level reached around 291 TWh. This corresponds to a relatively average volume of UGS utilisation (about 541 TWh). The mild winter, awareness of the potential problems related to storages depletion and a higher supply of LNG during the coldest winter months reduced the storage withdrawal.**
- **In Poland and Latvia, injection in the storage facilities started already in February 2022; in mid-March EU was on average net injecting to UGS.**
- **The average price increased significantly for the winter season 2021/22, showing higher price levels compared to the previous winter and reaching the maximum average value in March at 126 €/MWh, almost seven times higher than a year earlier.**
- **The total gas demand during the winter season 2021/22 was 3,129 TWh, which is 6 % less than during the previous winter season.**
- **The gas demand has been partly sustained by the power generation. In absolute terms, the electricity produced from gas in the winter season 2021/22 was 251 TWhe, and it increased by 10% compared to the previous season.**
- **Peak demand, similarly to the seasonal demand, decreased across Europe in winter 2021/22. The daily peak demand and the average daily demand for the highest 14-day**

demand period were reduced by 8.5% and 5.6% respectively compared to the previous winter.

Detailed data for the cross-border flows are available on the Transparency Platform[1].

Stakeholders' comments on this seasonal analysis are welcome and will enable ENTSOG to improve its knowledge of seasonal and market dynamics influencing the use of infrastructures in Europe.

1. Introduction

This review is published on a voluntary basis and aims at providing an overview of the demand and supply balance during Winter 2021/22. The report brings transparency to the internal analysis carried out by ENTSOG for the purpose of developing the seasonal Supply Outlooks and the Union-wide TYNDP.

More generally, the report aims to provide an overview of European trends that could not be captured at the national level and to build experience for future reports.

Regarding European dynamics, the report highlights the wide heterogeneity of national demand profiles and supply sources. These differences are linked, among others, to physical rationales such as climate, demand breakdown, or producing field flexibility.

Overview

Different events on the European gas market caused fluctuations in the supply and demand balance from October 2021 to March 2022. The major gas-related matters were[2]:

OCTOBER

- ⇨ Russian gas flows to Europe fell in October 2021. The main reason for the lower pipeline deliveries was a drop in supply via Belarus - flows through the Yamal-Europe pipeline into Poland. October also saw a change in the route of Russian gas imports to Hungary from Ukraine - Hungary received most of its Russian imports via TurkStream and dedicated onshore pipelines in Bulgaria and Serbia.
- ⇨ The European Commission adopted a Communication on Energy Prices to tackle the rise in energy prices driven by increased global demand.

NOVEMBER

- ⇨ Norway's pipeline gas supply to continental Europe and the United Kingdom remained robust in November 2022 as high prices incentivized operators to produce at maximum rates.

[1] Transparency Platform: https://transparency.entsog.eu/

[2] Source: Platts and official website of the European Commission

DECEMBER

- ⇨ Norwegian pipeline natural gas exports to continental Europe and the United Kingdom remained at a high level. Natural gas flows from the United Kingdom to Belgium surged at the end of 2021 as gas pricing at Continental Europe hubs had a premium to the United Kingdom. With a solid boost of imports from the Netherlands, flows of gas out of Belgium into neighbouring France had increased accordingly.

JANUARY

- ⇨ Nearly half of all imports of LNG to Europe's key hubs originated from the United States. The record-high influx of LNG volumes led to a fresh record high for regasification levels in Europe.

FEBRUARY

- ⇨ The invasion of Ukraine by Russia has triggered severe energy security concerns in Europe.
- ⇨ Russian pipeline export flows to Europe via its four main corridors — Nord Stream, Yamal-Europe, Ukraine, and TurkStream were strongly constrained from late December through January and into February due in part to the Yamal pipeline operating mostly in reverse mode eastward from Germany to Poland, resulting in a dramatic fall in Russian deliveries via Belarus.

MARCH

- ⇨ Norway's pipeline gas exports to continental Europe and the United Kingdom remained robust in March at sustained high prices though planned and unplanned maintenance work. Belgium increased natural gas exports to neighbouring countries to the east.
- ⇨ The European Commission published a communication on a Joint European Action for more affordable, secure, and sustainable energy. The communication outlines a plan to make Europe independent from Russian fossil fuels well before 2030, starting with gas. This plan also outlines a series of measures to respond to rising energy prices in the EU and to replenish gas stocks for next winter.

2. Gas Prices at European hubs

The following graphs show the evolution of gas prices in Europe during winter 2021/22 as well as the overall monthly ranges and averages in comparison to those of the winter season 2020/21.

Figure 1 displays the evolution of the monthly gas prices averages for the different European gas hubs. As in the previous winter review, most of the European hubs follow a similar trend by reacting in the same direction, with no significant exceptions.

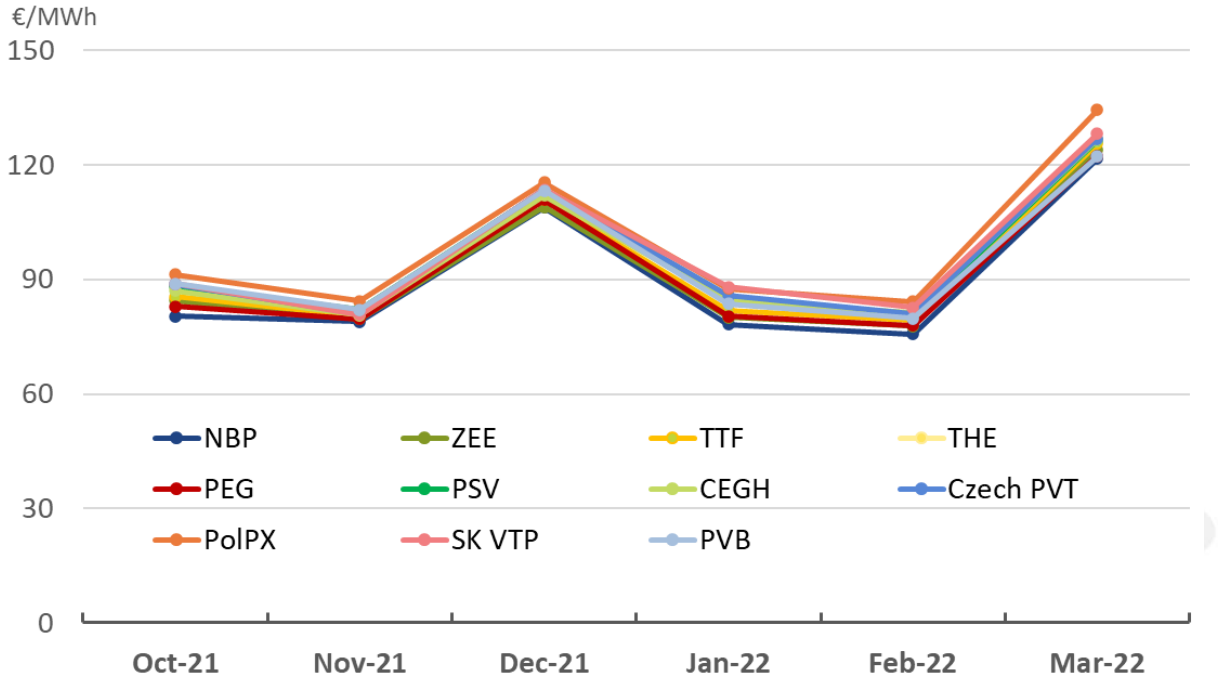


Figure 1 – Monthly gas prices averages at European hubs in €/MWh (Source: Platts)

The winter season 2021/22 started with the gas price hike at European hubs in early October and resumed its rise in November and December. This was driven by a combination of factors such as increased global energy demand caused by lifting COVID-19 restrictions, the lowest pre-winter European gas storage levels over the past 10 years, reduced European gas production capacity and supplies from Russia, and uncertainty surrounding Russian gas flows to the European markets following the suspension of the certification process for Russia's Nord Stream 2 pipeline system. After the drop at the end of 2021, gas prices were mostly fluctuating in a relatively stable range in January and most of February. The possible disruption of gas supplies from Russia to Europe following the invasion of Ukraine led to higher gas prices in late February and March.

Figure 2 compares the max – min range and average of the day-ahead winter price for the last two winter seasons at European hubs.

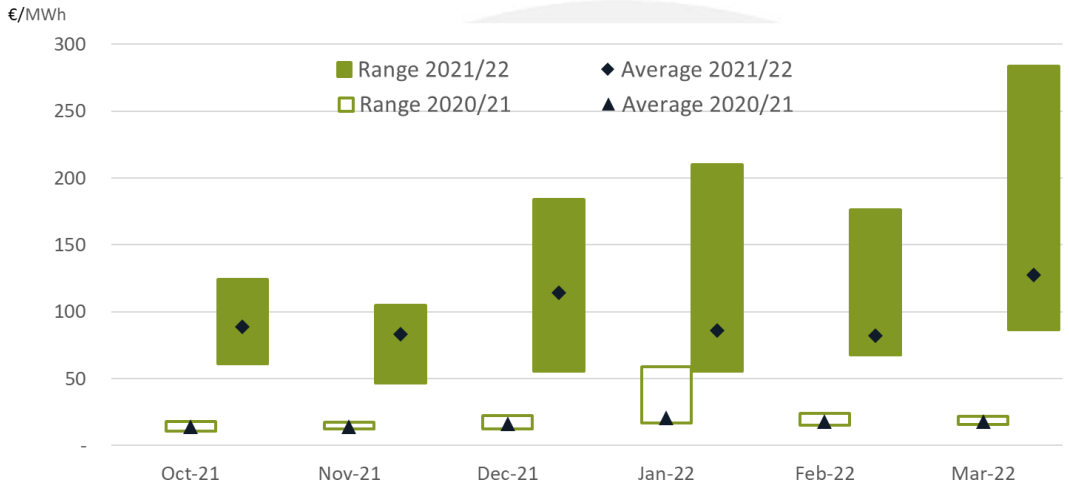


Figure 2 - Ranges and averages of the day ahead hub prices at European hubs in €/MWh (Source: Bloomberg)

The average price increased significantly for the winter season 2021/22, showing historical higher price levels and reaching the maximum average value in March at 126 €/MWh, almost seven times higher than a year earlier. In the first quarter of 2022, there was a high value of max range price with an average price close to the value of the min range. This is because there were significant price spikes on some days of the month.

3. Gas demand

3.1. European seasonal gas demand

The total gas demand during the winter season 2021/22 was 3,129 TWh, which is 6 % less than in the previous winter season (3,319 TWh).

Figure 3 shows how the daily averages of the monthly demand levels, for total demand in European countries, are lower in October, January, February, and March compared to the winter season 2020/21. The lower daily demand values decreased in December and January, but the higher daily demand values – in February, compared to the previous winter season as well. The strong increases in natural gas prices have prompted switching to other energy sources and the use of back-up fuels instead of natural gas in European countries where this is an option.

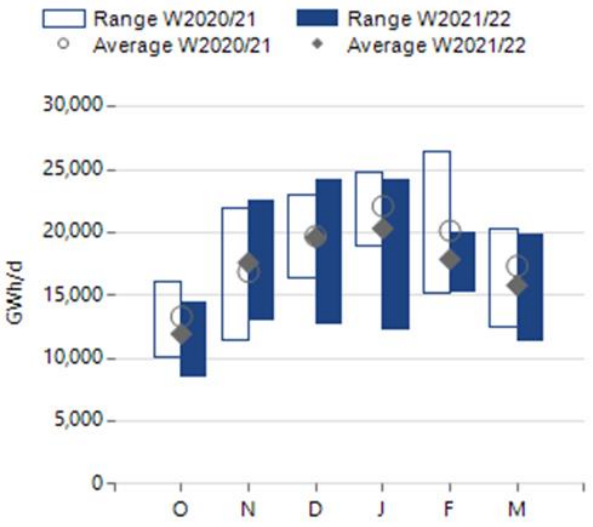


Figure 3 - Total gas demand. Winter 2020/2021 vs Winter 2021/2022

Figures 4 and 5 show the demand range and monthly average when split into final demand (residential, commercial, and industrial) and power generation sectors for the countries where the demand breakdown is available.

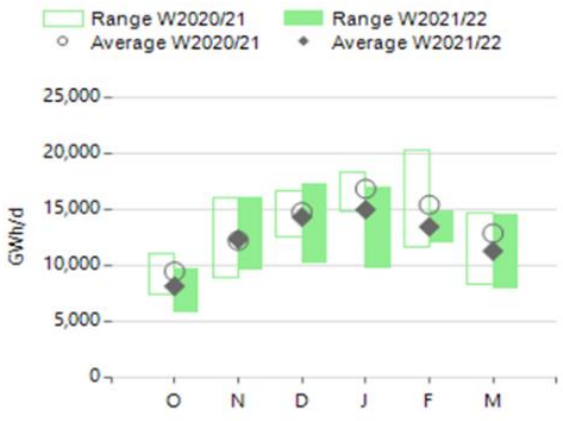


Figure 4 - Final gas demand *

Figure 5 - Power generation gas demand *

** These graphs refer to the countries for which demand breakdown is available (with exception of Austria, Bosnia and Herzegovina, Estonia, Latvia, and Poland). For the United Kingdom, data from Gas Winter Review by National Grid was used. In years and countries where the data breakdown has not been provided, then demand forms part of Residential, Commercial and Industrial.*

The final gas demand, i.e. residential, commercial, and industrial sectors, in the winter season 2021/22 represented more than 75% of the total gas demand. The same decreasing trend can been seen in final daily gas demand as well as in total daily demand when compared to the previous winter. In the meantime, the daily gas demand for power generation increased between November and January. The drop of hydro and nuclear output largely contributed to this.

> Electricity generation from gas

In the winter season 2021/22, the electricity produced from gas was 251 TWhe, and it increased by 10% compared to the previous season 2020/21. Meanwhile, coal use in the electricity mix increased by 15%, as shown in **Figure 6**. On the one hand, because energy markets select the lowest-priced resources to produce the electricity needed to meet demand, high gas prices have led to a jump in the use of coal as a fuel for power generation during the heating season 2021/22. On the other hand, the drop of hydro and nuclear output had been compensated by the use of the gas and coal-fired power generation despite the high fuel prices.

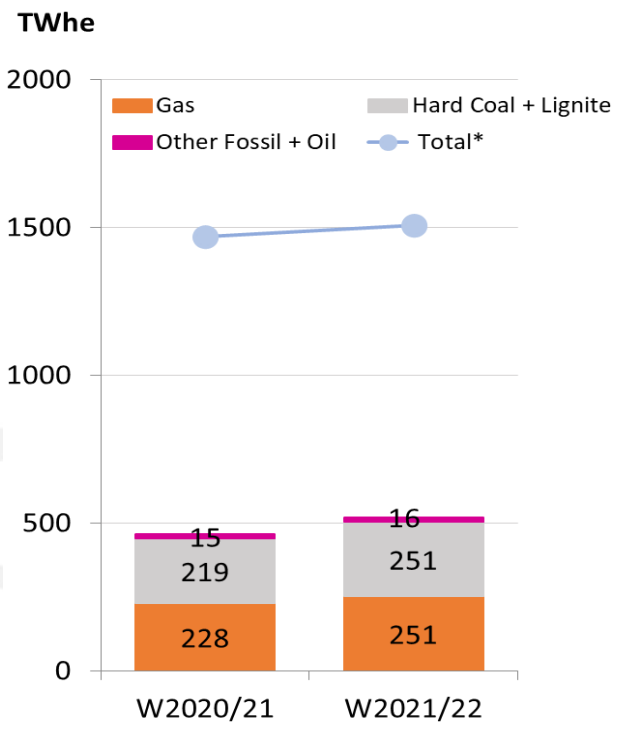


Figure 6 – Gas, coal and other sources in the electricity mix. Winter 2020/21 vs Winter 2021/22.
Source: own elaboration based on data from ENTSO-E (without the United Kingdom).

**the total electricity power generation mix is detailed in Figure 7*

Based on data from ENTSO-E, the electricity generation mix showed a slight rebound of 3% compared to the previous winter season, and gas represented 17% of the electricity generation in the winter season 2021/22 with a year-on-year increment of 1%, as shown in **Figure 7** and **Figure 8**. Falling hydro power and nuclear power have been compensated by the use of the gas- and coal-fired power generation. Gas-fired generation rose primarily in the hydro-rich European countries with limited coal-fired generation such as Spain and Italy.

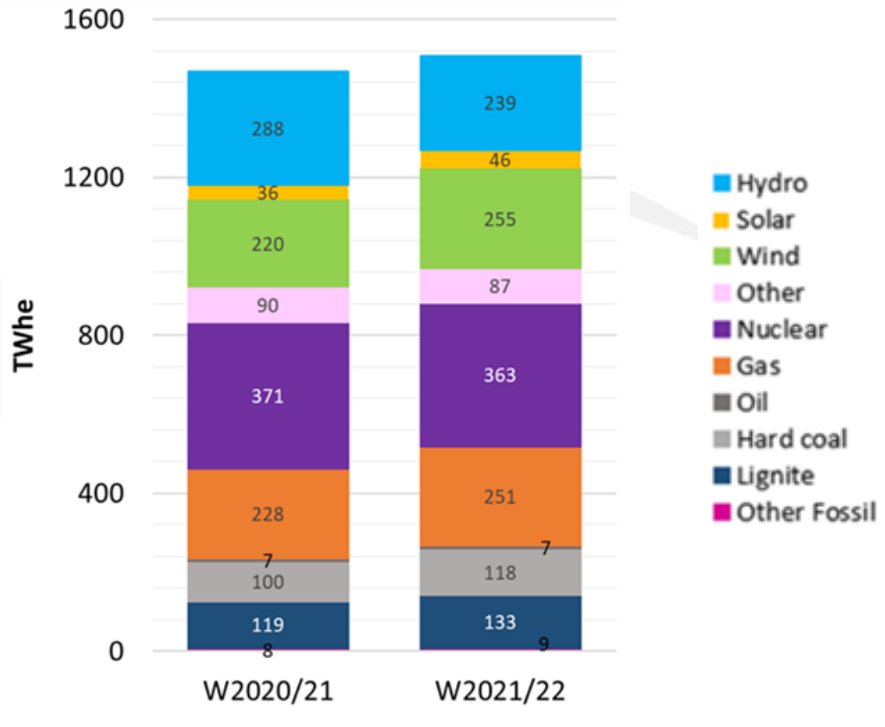


Figure 7 - Electricity generation mix in absolute values. Winter 2020/21 vs Winter 2021/22
Source: own elaboration based on data from ENTSO-E (without the United Kingdom)

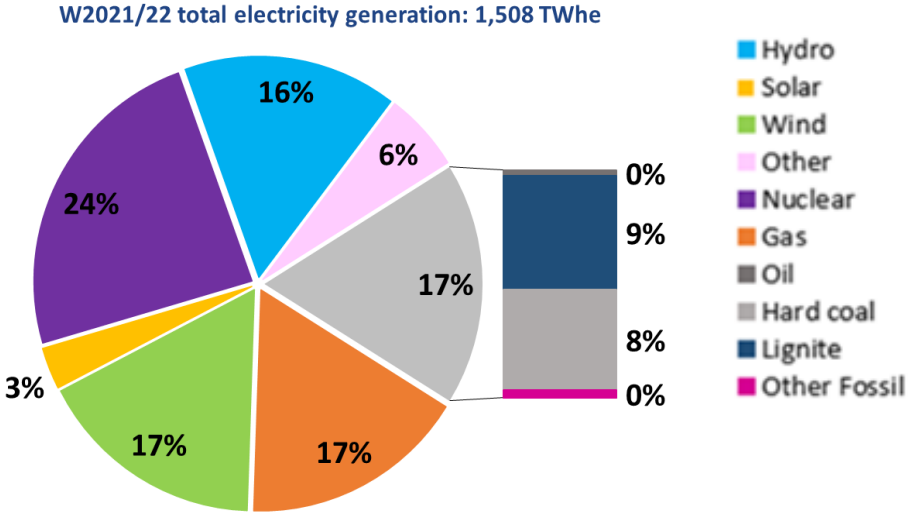


Figure 8 - Seasonal electricity generation share. Winter 2021/22
Source: own elaboration based on data from ENTSO-E (without the United Kingdom)

> Winter demand evolution 2017-2022

Figures 9 and 10 show the total consumption[3] and the demand monthly average for the winters 2017/18 - 2020/21. The demand for the winter 2021/22 was lower than in the winter 2020/21 (-5.72%), but it still stayed well above 3,000 TWh. The demand monthly average profile is in line with the previous three winters (winter 2018/19, 2019/20, and 2020/21) and follows a similar pattern.

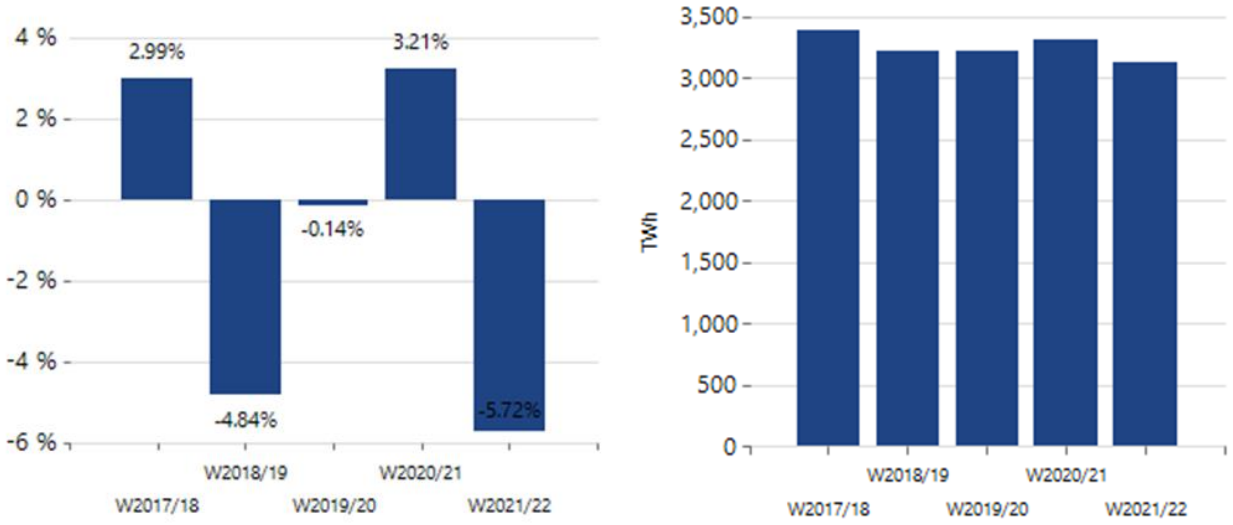


Figure 9 - Total consumption of gas. Winters 2017/18 – 2021/22

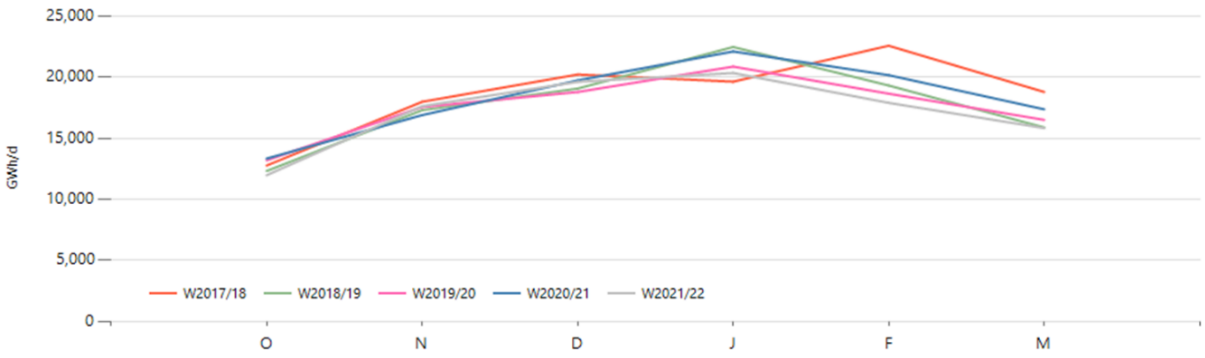


Figure 10 - Daily average of monthly gas demand. Winter 2017/18 – 2021/22

[3] Total consumption is commercial, industrial, residential and power generation consumptions

Figures 11 and 12 show the gas consumption by sector - final gas consumption (residential, commercial, industrial) and gas consumption for power generation - for those countries where the gas demand breakdown is available. Final gas demand in the winter season 2021/22 was down 9% from a year earlier. Increasing gas prices had led to decreasing final gas consumption for gas in industrial and residential sectors. Meanwhile, consumption for power generation significantly increased compared to the previous winter season and was around 10%. In Spain and Italy, increasing gas-fired generation was needed to compensate for the drop of hydro generation, and in France – to compensate for the reduction of nuclear plant capacity due to maintenance work.

Figure 11 - Final gas consumption (residential, commercial and industrial). Winters 2017/18 – 2021/22 *

Figure 12 - Gas consumption for power generation. Winters 2017/18 - 2021/22 *

** These graphs refer to the countries for which demand breakdown is available (with exception of Austria, Bosnia and Herzegovina, Estonia, Latvia, and Poland). For the United Kingdom, data from Gas Winter Review by National Grid was used. In years and countries where the data breakdown has not been provided, then demand forms part of Residential, Commercial and Industrial.*

> Country detail

Comparing with the previous season, the evolution of gas demand by country (**Figure 13)** shows a decreasing trend in most of the countries while it remains rather stable or even slightly up in some. Based on the received data, gas consumption - in the order of percentage changes - fell by the largest percentage in Finland (by 40%), Lithuania (by 34%), and Denmark (by 30%). Among the countries with the highest gas consumption, demand significantly dropped in the United Kingdom (by 18%) and the Netherlands (by 17%); gas consumption fell a bit in Germany and France (by 4% and 2% respectively) whereas it rose by 12% in Spain and by 4% in Italy.

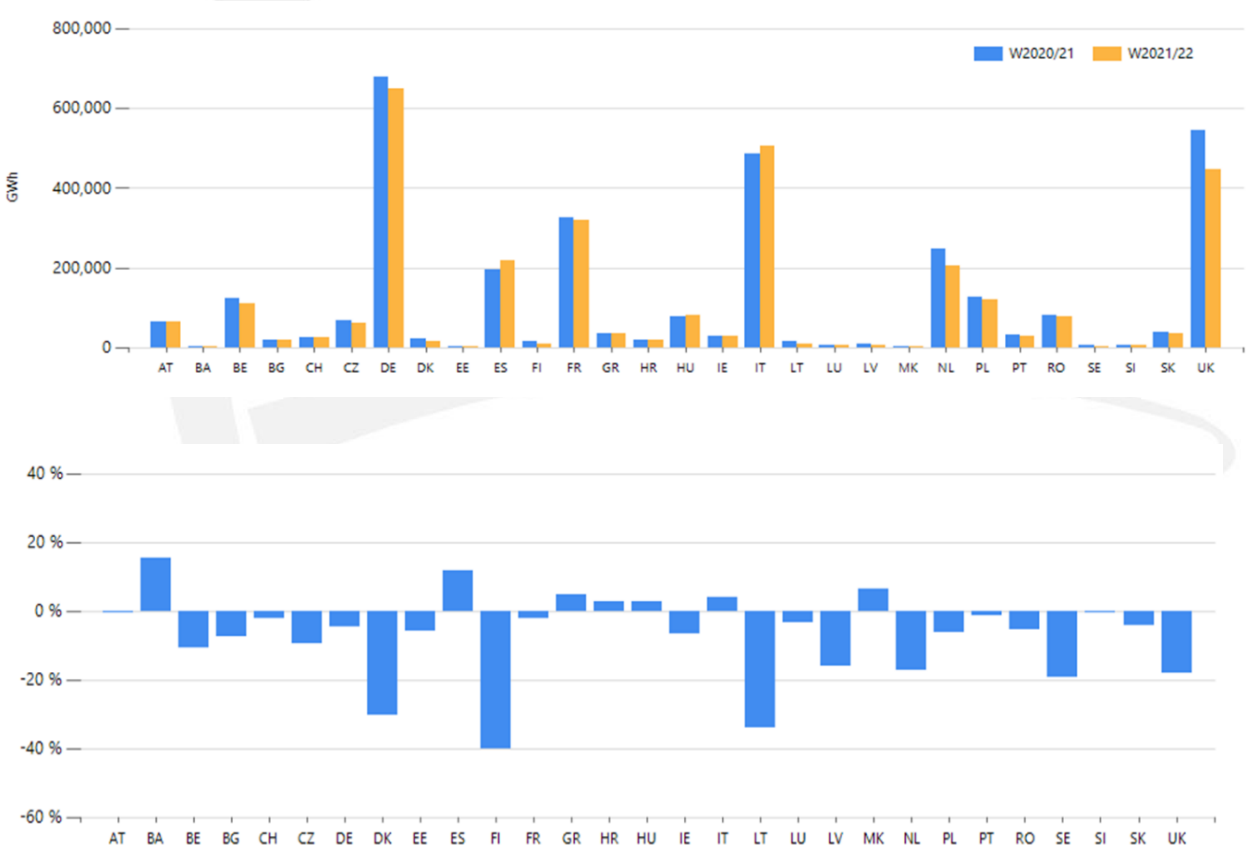


Figure 13 - Total winter demand and variation (%). Country detail. Winter 2020/21 vs Winter 2021/22

> Seasonal modulation

The winter demand pattern is strongly linked to the climatic conditions such as the presence of cold snaps or particularly mild conditions in one or several months during the whole winter season.

Figure 14 shows the deviation of the monthly average demand from the winter average for each of the last five winters:

- October is regularly the month with the lowest demand.
- Demand in December, January, and February are systematically higher than the average.
- November and March demand are closer to the winter average.

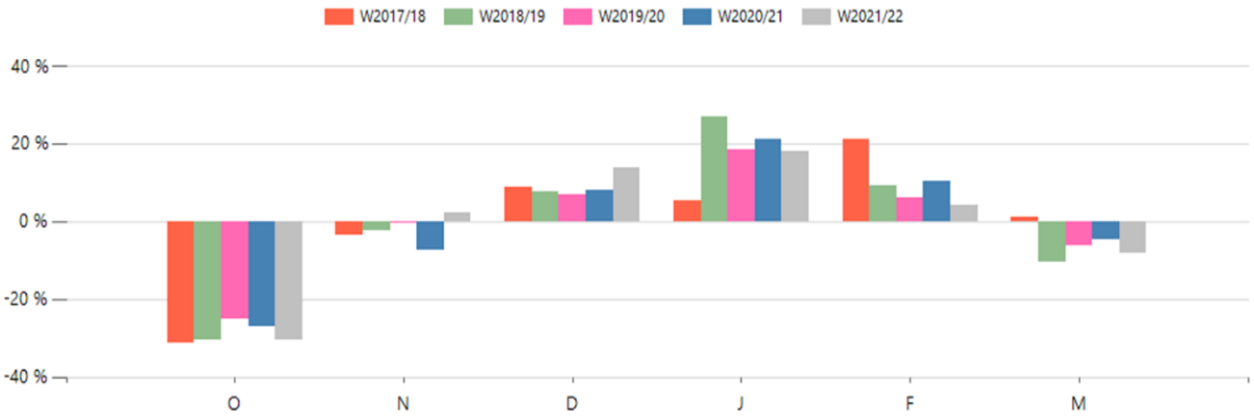


Figure 14 - Winter modulation 2017/18 – 2021/22

Figure 15 shows the monthly variation between the maximum and minimum daily demand and the average daily demand for each month of the last five winter seasons. The low temperatures in the coldest winter months (December, January and February) are reflected in the increased daily average demand in winter 2021/22.

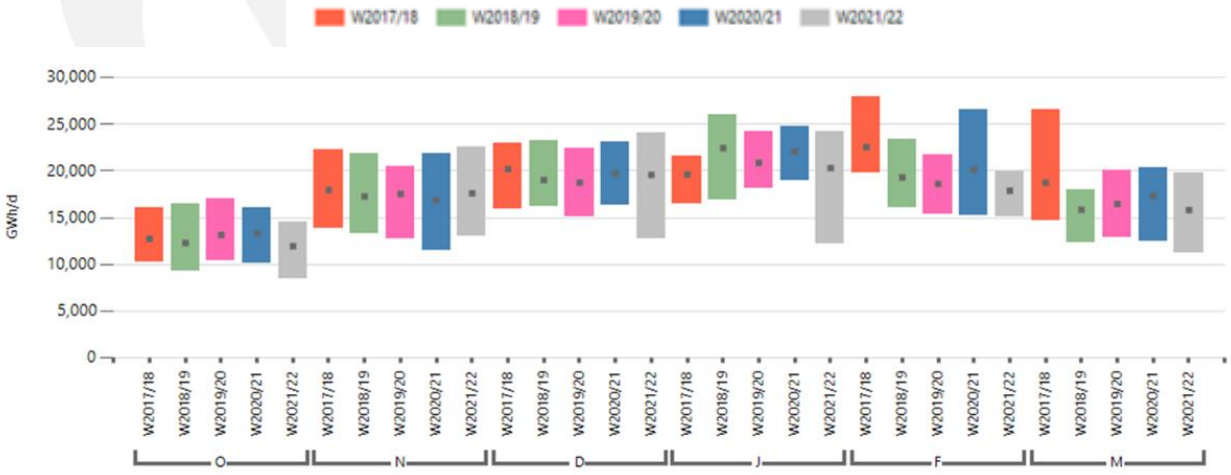


Figure 15 - Monthly demand ranges and average daily demand for each month. Winters 2017/18 – 2021/22

3.2. Peak gas demand 2021/22

Figures 16, 17, and 18 show the total demand in daily profile as well as the evolution of the daily demand split by sectors - final gas consumption (residential, commercial, industrial) and gas consumption for power generation.

The peak for total demand and for the power generation demand was reached in the second part of January 2022 and for final demand in the second part of December 2021. The highest 14-day demand period was noted in January 2022, as shown in **Table 1**.

Table 1 - Values and dates of high demand situations

14-day peak period	12/01/2022 to 25/01/2022	**Peak day**	25/01/2022
Average 14-day demand	22,218 GWh/d	**Peak demand**	24,242 GWh/d

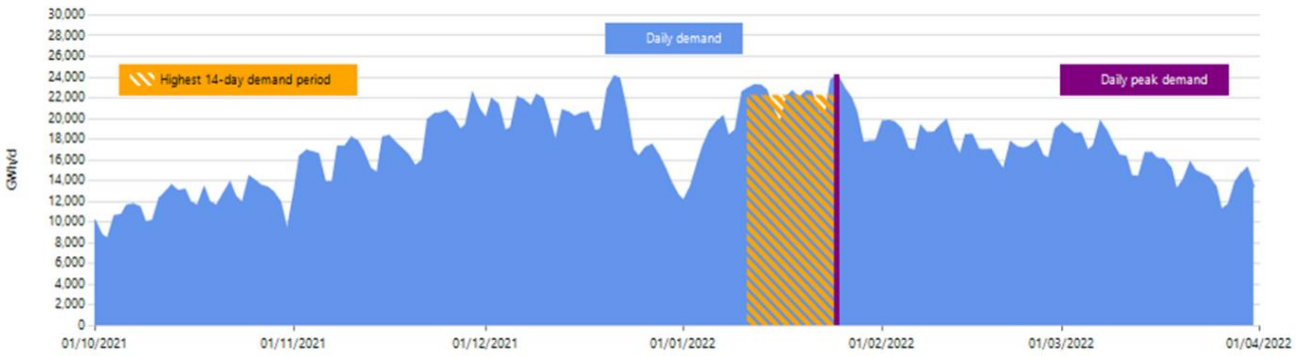


Figure 16 - Total demand daily profile. Winter 2021/22

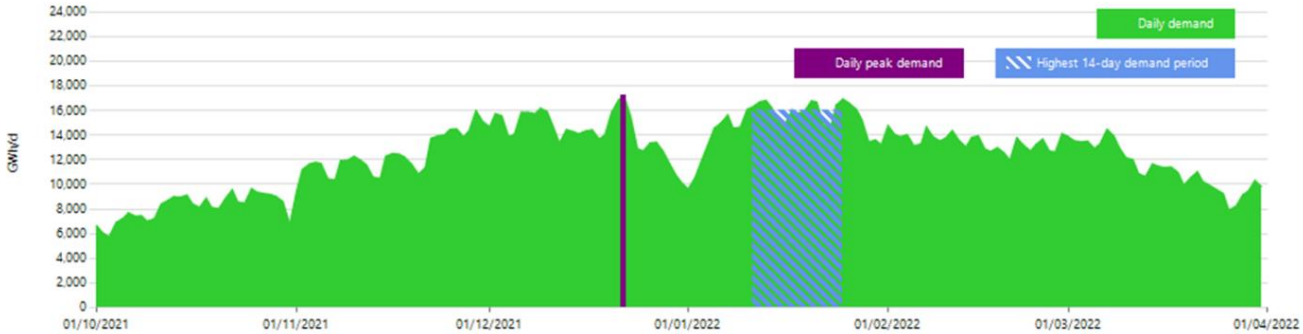


Figure 17 - Final demand (residential, commercial and industrial) daily profile. Winter 2021/22 *

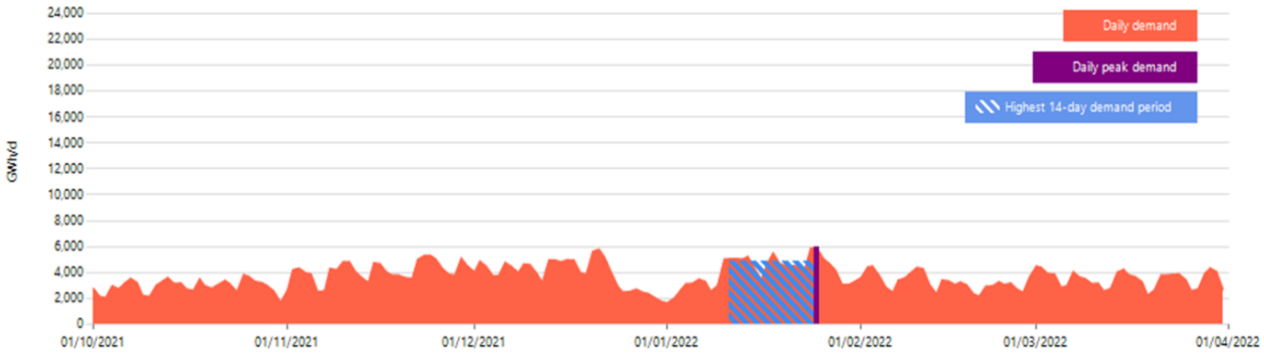


Figure 18 - Power generation demand daily profile. Winter 2021/22 *

** These graphs refer to the countries for which demand breakdown is available (with exception of Austria, Bosnia and Herzegovina, Estonia, Latvia, and Poland). For the United Kingdom, data from Gas Winter Review by National Grid was used. In years and countries where the data breakdown has not been provided, then demand forms part of Residential, Commercial and Industrial.*

> Peak demand evolution 2012-2022

Figures 19 and 20 show the daily peak demand and the average daily demand for the highest 14-day demand period. Peak demand, in the same way as the seasonal demand, decreased across Europe in winter 2021/22. The daily peak demand and the average daily demand for the highest 14-day demand period were reduced by 8.5% and 5.6% respectively compared to the previous winter. The peak demand in 2021/22 is comparable with the peak demand in winter 2019/20.

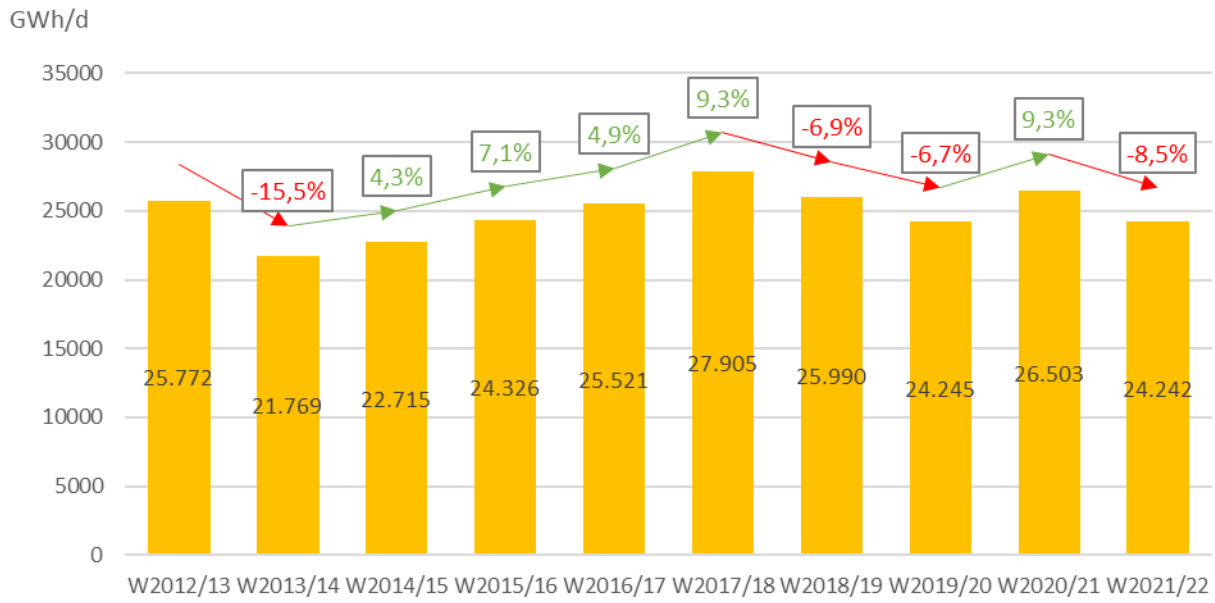


Figure 19 - Daily peak demand. Winters 2012/13 – 2021/22

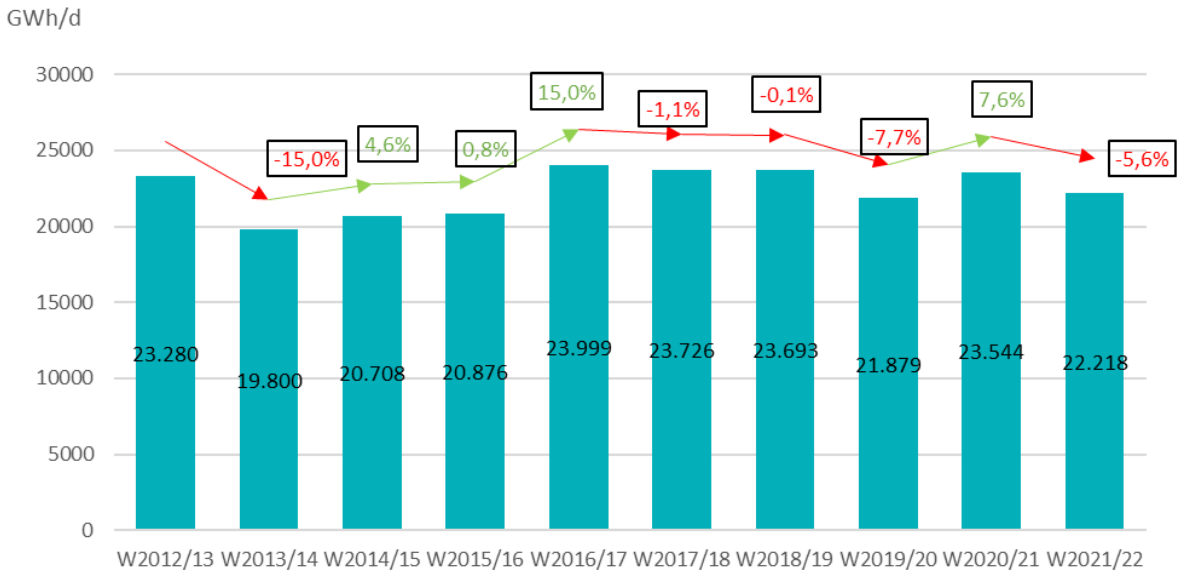


Figure 20 - Average daily demand for the highest 14-day demand period. Winters 2012/13 – 2021/22

Figures 21 and 22 show the gas average daily demand for the highest 14-day demand and the daily peak demand by sectors, i.e. final gas consumption (residential, commercial, industrial) and power generation for those countries that the gas demand breakdown is available. There is a slightly decrease in the ex-power generation demand compared to the previous winter season. At the same time, the demand for power generation had increased somewhat.

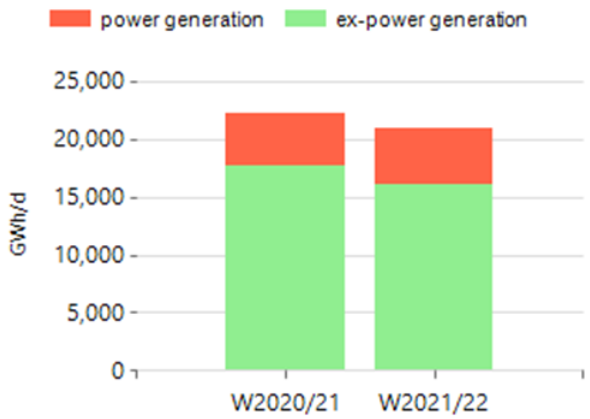


Figure 21 - Average daily demand for the highest 14-day demand period split *

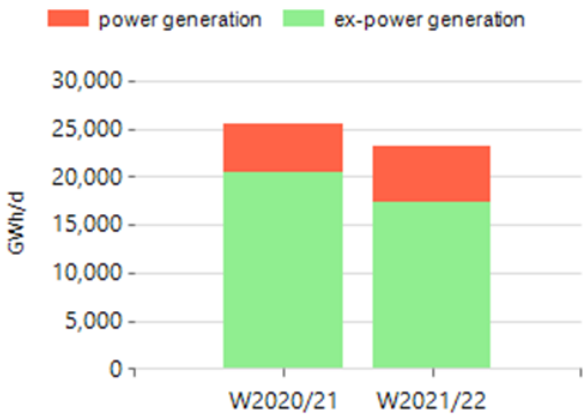


Figure 22 - Daily peak demand split *

** These graphs refer to the countries for which demand breakdown is available (with exception of Austria, Bosnia and Herzegovina, Estonia, Latvia, and Poland). For the United Kingdom, data from Gas Winter Review by National Grid was used. In years and countries where the data breakdown has not been provided, then demand forms part of Residential, Commercial and Industrial.*

> Country detail

The evolution of gas peak demand at country level shows a decreasing trend in almost all the countries as compared with the previous winter season except Estonia, Spain, Croatia, and Greece. Based on the received data, **Figure 23** shows a more than 20% drop in daily peak consumption in Denmark, Lithuania, Sweden, and the Netherlands.

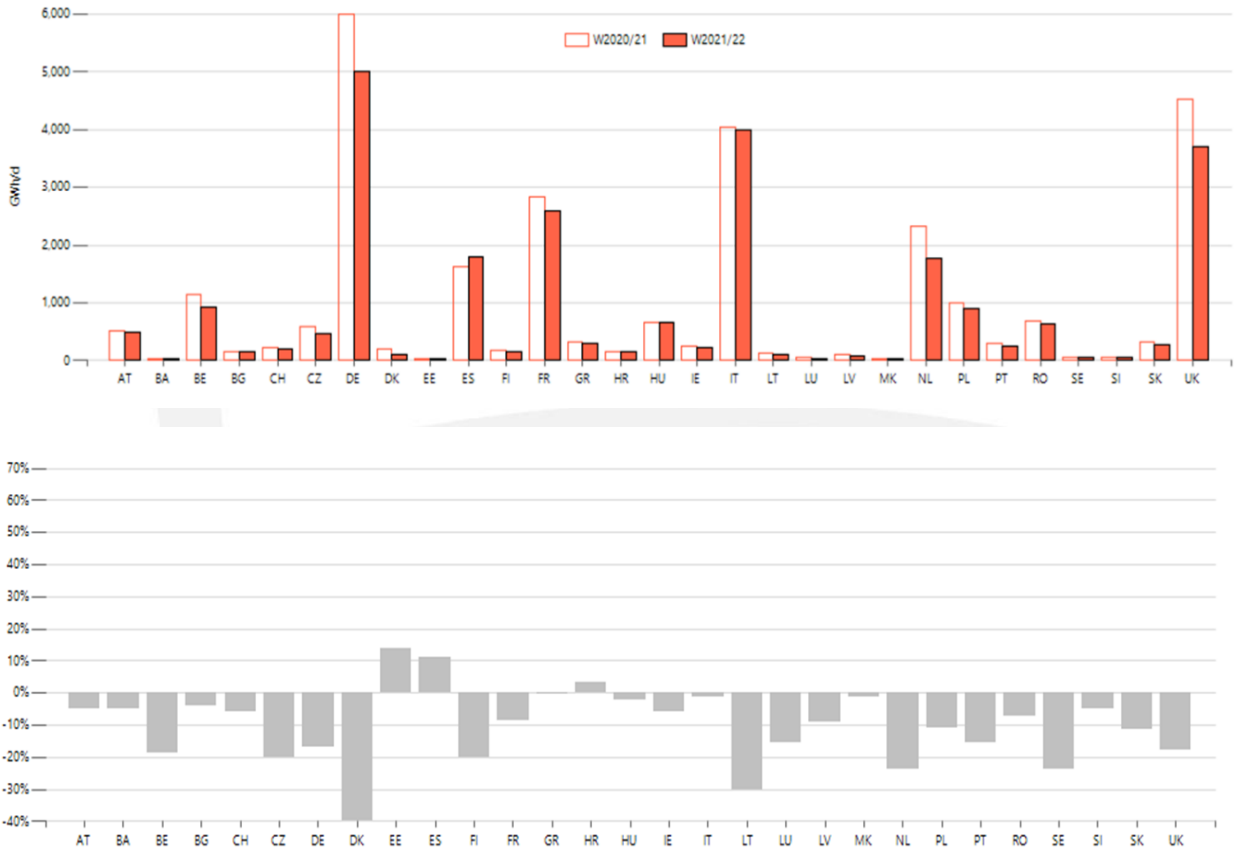


Figure 23 - Daily peak demand and variation. Winter 2020/21 vs 2021/22

Similarly to the daily peak demand, **Figure 24** shows that, for most countries, their 14-day high demand level went down as compared to the winter season 2020/21. Denmark, Finland, Sweden, Lithuania, and the Netherlands experienced the largest decrease in their 14-day high demand consumption.

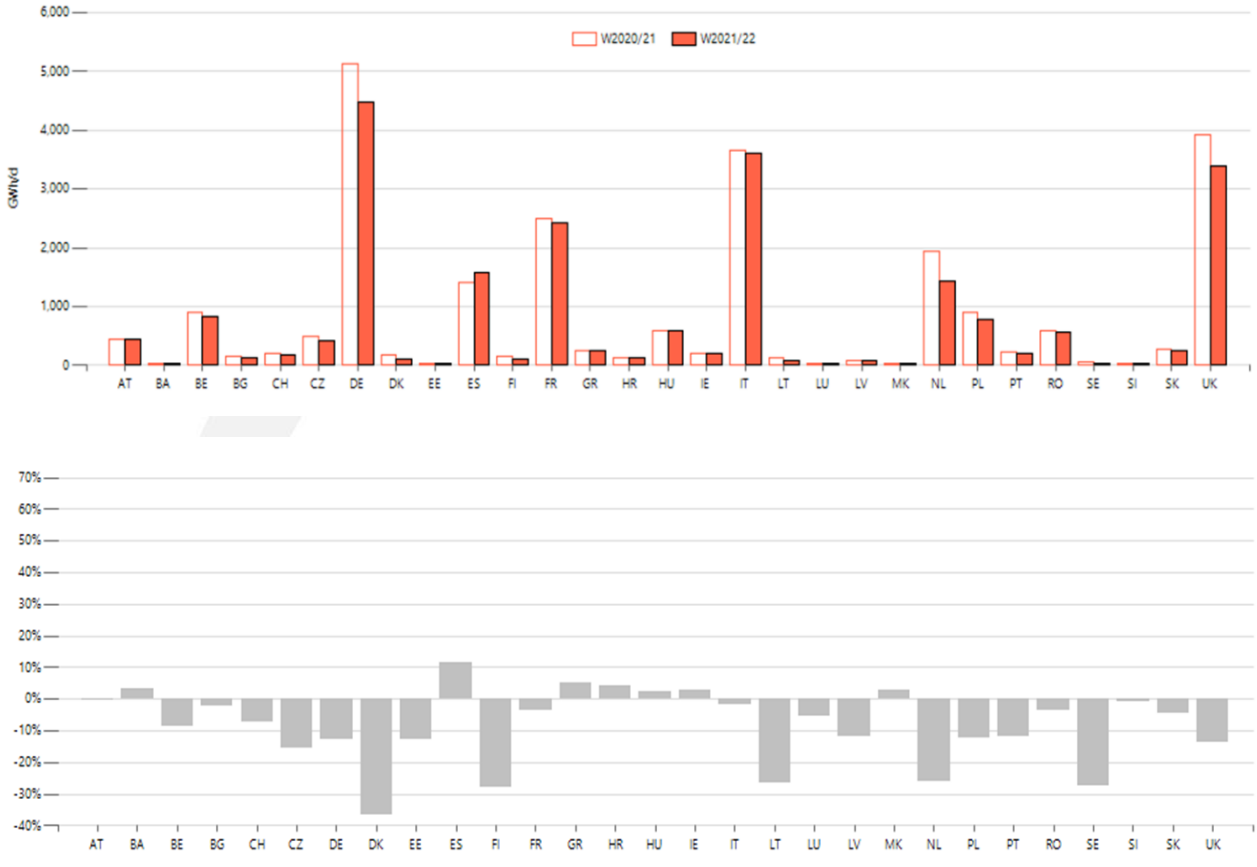


Figure 24 - Average 14-day demand and variation. Winter 2020/21 vs 2021/22

Figure 25 shows the minimum, maximum, and average daily demand during winter 2021/22 as well as the daily maximum and minimum demand of the last six winters per country.

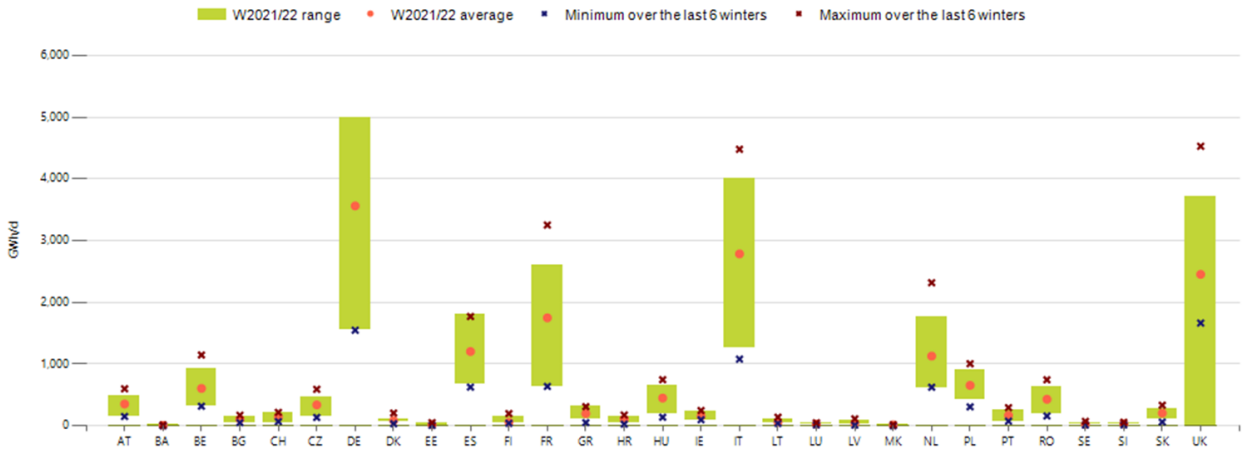


Figure 25 - Winter maximum, minimum and average demand

> Simultaneity

To measure the simultaneity between the peak days in different countries, the "Un-simultaneous Peak" is described as the sum of the peak day demands of the individual countries having occurred un-simultaneously:

- The European Peak Simultaneity (EPS)
  - EPS = European Peak Demand / Un-simultaneous Peak (%)
- The simultaneity of an individual country in the European peak day (CPS)
  - CPS = Country demand on the European peak day/Country peak demand (%)

The European peak simultaneity during the peak day on 25 January 2022 was 96%, the same as the average for the 5 winter seasons from 2017 to 2022.

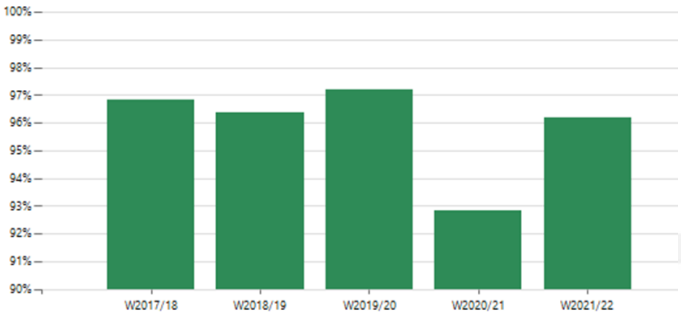


Figure 26 – The European peak simultaneity

Table 2 - Peak demand and the European peak simultaneity. Winters 2017/18 – 2021/22

Winter	Day	Peak Demand (GWh/d)	EU Peak Simultaneity (%)
W2017/18	28/02/2018	27,905	97%
W2018/19	23/01/2019	25.990	96%
W2019/20	22/01/2020	24,245	97%
W2020/21	12/02/2021	26,503	93%
W2021/22	25/01/2022	24,242	96%

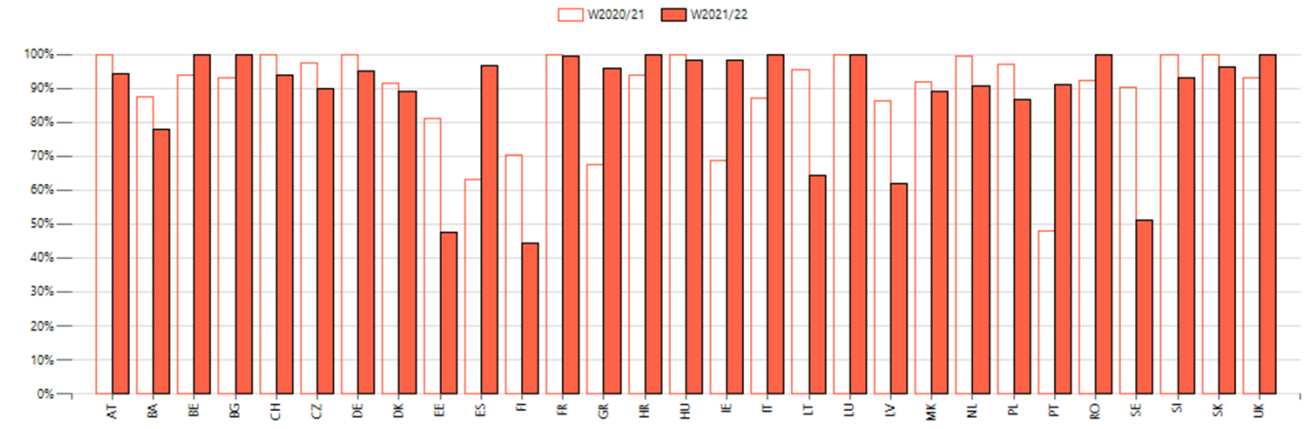


Figure 27 - Simultaneity of the highest single day between last 2 winters

4. Gas supply

> European seasonal gas supply

Figure 28 shows the evolution of the aggregated gas supply in European countries during the last winter season 2021/22.

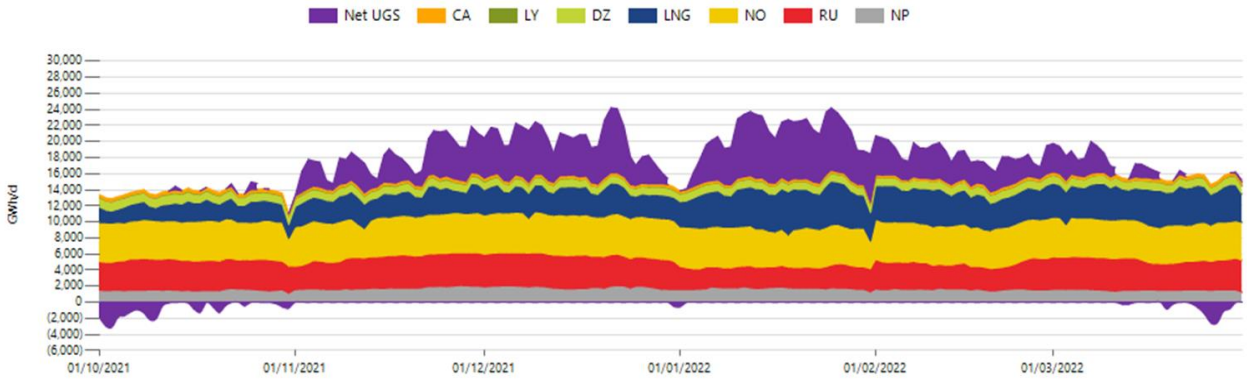


Figure 28 - Supply profile. Winter 2021/22

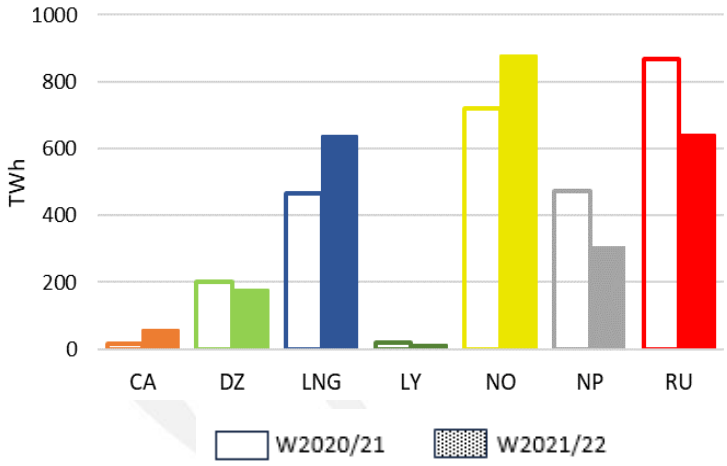


Figure 29 shows the seasonal supply by source, including national production, during the Winter 2020/21 and Winter 2021/22.

Figure 29 - Total supply by source. Winter 2020/21 vs 2021/22

In the winter season 2021/22, EU gas production reached approximately 300 TWh, falling by 35% compared to the previous winter. This reduction was driven by falling domestic production in some European countries, including the largest gas producer in the EU - the Groningen gas field in the Netherlands.

LNG supply was up by 37% in the winter season 2021/22 reaching more than 630 TWh. Strongly increasing LNG supply was due to premium European gas hub prices compared to the Asian markets, which provided an incentive to substantially increase the LNG send-out to the European gas grid. Gas supply from Norway had also increased by 22%, compared to the winter 2020/21,

and reached 878 TWh as high gas prices incentivized Norway to produce gas and supply it at maximum rates.

Compared to the winter season 2020/21, pipeline gas supply from Russia saw a steep fall, especially in January 2022 and February 2022. Russian gas flows to Europe experienced a decrease of more than 25% at around 640 TWh in winter 2021/22. Russian pipeline flows to Europe via its four main corridors - Nord Stream, Yamal-Europe, Ukraine, and the TurkStream were strongly constrained from late December through January and into February due in part to the Yamal pipeline operating mostly in reverse mode eastward from Germany to Poland at high gas spot prices, resulting in a fall in Russian deliveries via Belarus.

Additionally, pipeline gas imports from North Africa - both Algeria and Libya - showed a decrease by 11% and 34% respectively. Libyan flows were impacted with unplanned maintenance at Libya's Mellitah Complex.

In the meantime, the supply from the Caspian sea ensured around 60 TWh during the winter season 2021/22 and had increased more than threefold compared to the previous winter season. The new Trans Adriatic Pipeline supply route, operational since November 2020, provides access to Caspian area gas resources and increased the supply volume in the winter season.

Figure 30 shows the supply shares in winter 2021/22 compared to the winter 2020/21. The share of the European gas supply provided by Russia dropped to 24% in the winter season 2021/22 and lost its lead in the supply mix. The decreasing share of imports from Russia as well as lower national gas production volumes was compensated by the increasing shares of LNG supply and supply from Norway. The decreasing share of imports from North Africa, in turn, was compensated by the gas supply via Trans Adriatic Pipeline.

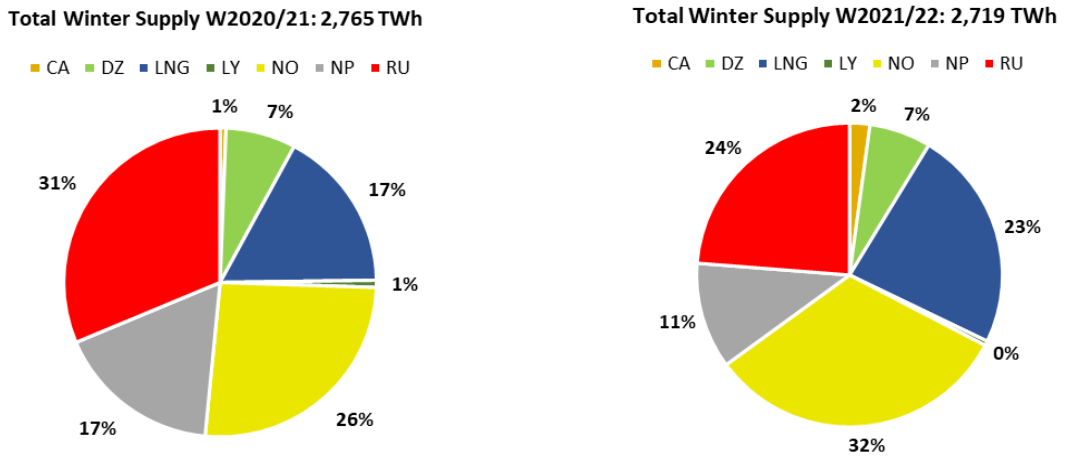
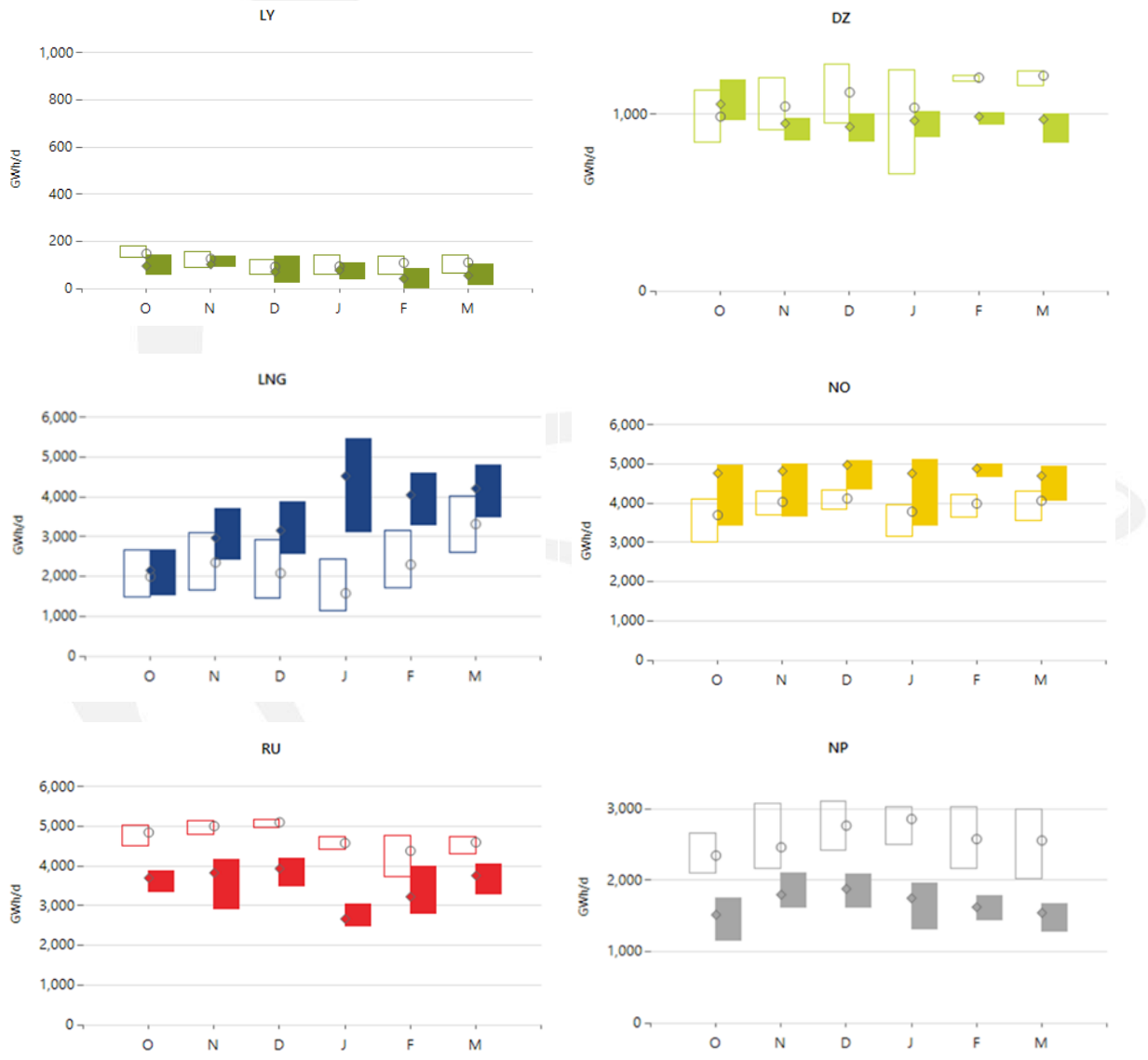


Figure 30 – Shares in supply mix. Winter 2020/21 vs Winter 2021/22

> Supply Modulation

The following graph (**Figure 31**) illustrates the average flow per month and the monthly range of the last two winter season (the lowest and the highest daily flow of each month for the winter season) for each import supply source as well as for indigenous production.



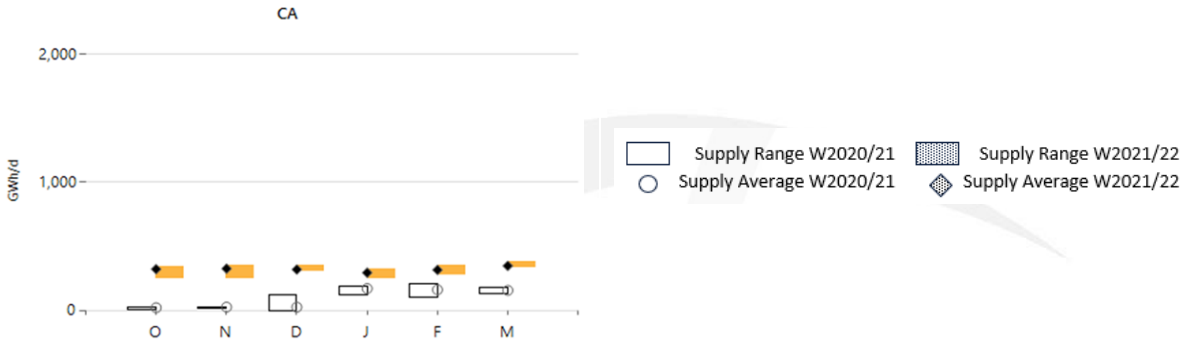


Figure 31 - Supply daily range

> Underground Storage

Utilisation of underground storage depends on many factors linked to price signals such as summer-winter spread, storage filling levels as well as climatic and economic considerations having impact on gas demand. **Figure 32** shows UGS injection and withdrawal profile of European storage facilities. The deliverability of UGS peaked on 21 December 2021 at 8,092 GWh/day, a 25% decrease from the previous year (10,774 GWh/day). **Figure 33** provides the average withdrawal and the daily range of withdrawal and injection for European countries for every winter month in 2020/21 and 2021/22. On few days in late December and early January, the gas injection in the storage exceeded the withdraw from the storage, which is due to lower gas consumption on those days. Between January and March, the daily withdrawal value decreased as compared to the previous winter and was compensated by an increase in LNG daily supply and daily supply from Norway.

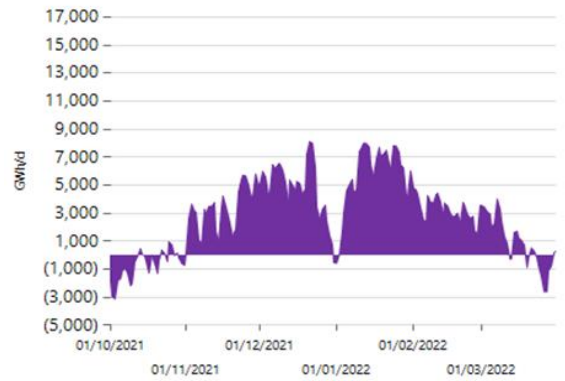


Figure 32 - UGS injection/withdraw profile. Winter 2021/22

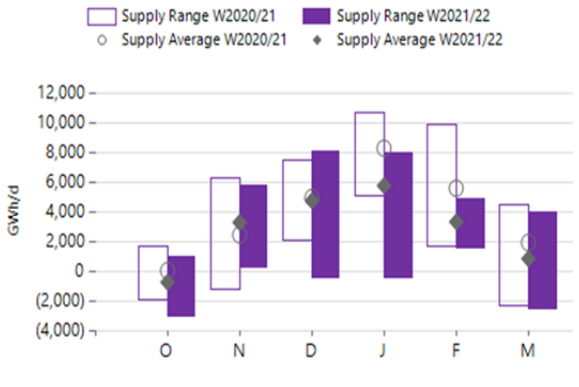


Figure 33 - UGS daily range of withdrawal and injection. Winter 2020/21 vs Winter 2021/22

Table 3 provides the stock level at the beginning and the end of the winter season of the last ten seasons.

	Gas in the storages 1-Oct (TWh)	Gas in the storages 31- Mar (TWh)	UGS Utilisation (TWh)
W2012/13	741.0	225.7	515.2
W2013/14	749.1	445.4	303.6
W2014/15	893.3	283.1	610.1
W2015/16	862.9	372.9	490.0
W2016/17	1000.5	288.8	711.8
W2017/18	928.4	193.8	734.6
W2018/19	910.5	437.8	472.7
W2019/20	1077.7	611.1	466.7
W2020/21	1069.7	336.9	732.8
W2021/22	832.2	291.3	540.9

Table 3 - UGS Utilisation (TWh). Winter 2012/13 – 2021/22. (Source: AGSI+)

Figure 34 compares the stock level evolution curve of the last 10 winters. According to data from AGSI+, the gas storage platform operated by GIE, EU storage levels at the beginning of the withdrawal season were around 22% below the winter season 2020/21 volumes. The EU stock level remained at a ten-year low of 75% full (832 TWh). Gas prices were steep for the summer season and limited the injections of gas into storage. At the end of the winter season, the storage level reached around 291 TWh. This corresponds to a relatively average volume of UGS utilisation (about 541 TWh). The mild winter and a higher supply of LNG during the coldest winter months reduced the storage withdrawal volume.

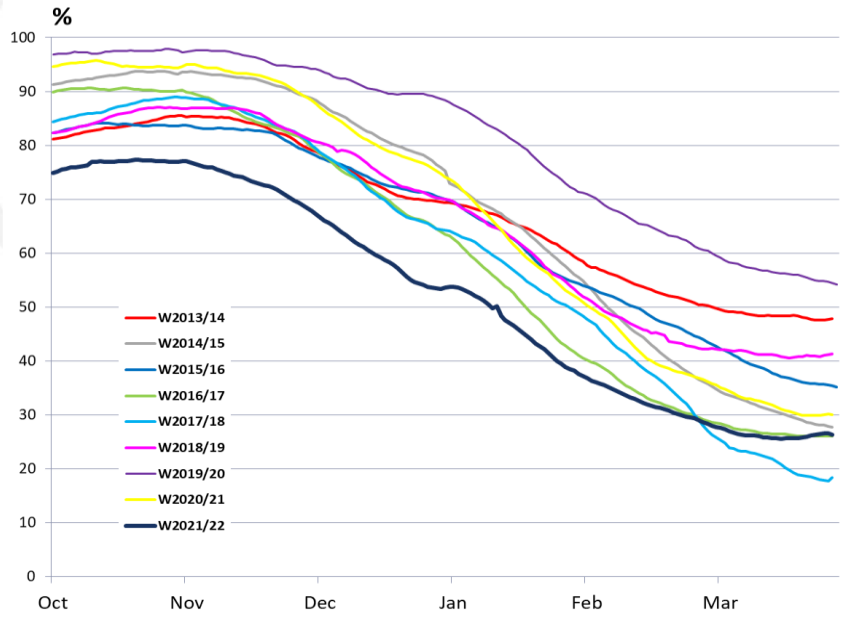


Figure 34 - Evolution of UGS stock level. Winters 2013/2014 – 2020/2021 (Source: AGSI+)

> Supply coverage of high daily demand

Figure 35 compares the supply level of the various sources under different demand conditions in the winter season 2021/22. It reflects the ability of the sources to increase or decrease the supply levels in response to demand changes, varying the supply mix significantly depending on the demand level. As well as in previous winter periods, daily demand data shows that especially underground storage facilities are the main source of flexibility in high demand situations.

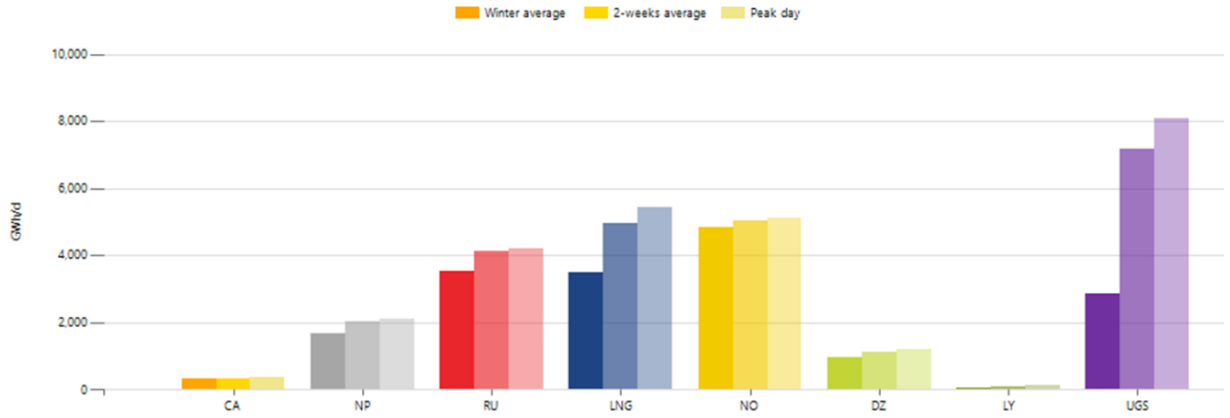


Figure 35 - Daily average supply / Average daily supply for the highest 14-day demand period / Supply for peak day demand. Winter 2021/22

> Winter supply evolution of gas supply. Winters 2017/18 - 2021/22

Figure 36 shows the evolution of the different supply sources during the last five winters. When comparing the last five winters, national production and supply from Russia have decreased year-by-year while LNG supply and Norwegian imports increased in the winter season 2021/22 as compared with the previous one.

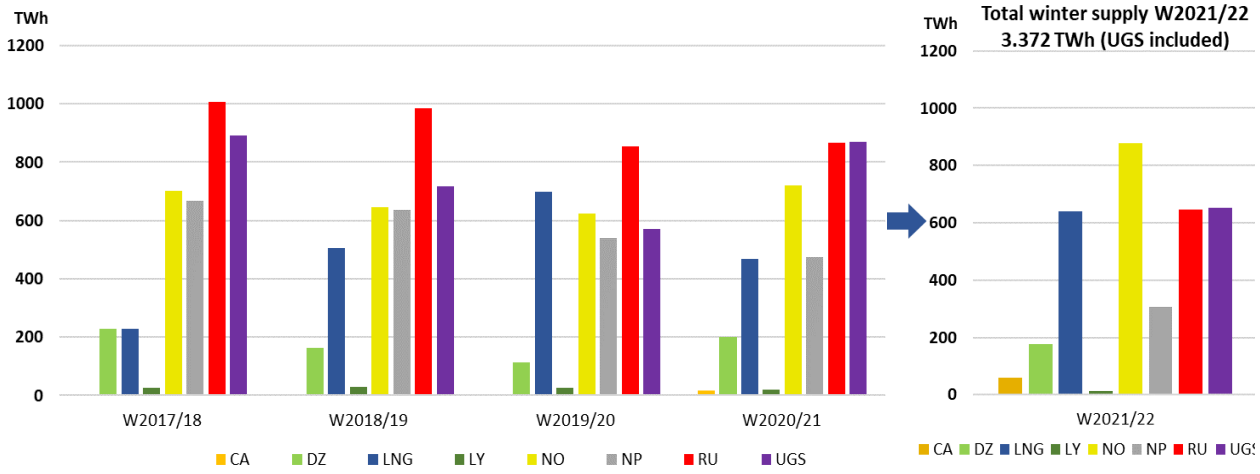


Figure 36 - Evolution of winter gas supplies. Winters 2017/18 – 2021/22

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