entsog
european network
of transmission system operators
for gas

ENTSOG
SUMMER SUPPLY OUTLOOK

2021

Contents

Executive Summary

In line with Art.8(3)(f) of Regulation (EC) 715/2009, ENTSOG has undertaken an assessment of the European gas network for the upcoming summer (April 2021 to September 2021). The analysis investigates the possible evolution of the supplies and the injection in the storages across the season as well as the ability of the gas infrastructures to meet the demand, the exports and the above mentioned storage injection needs during summer 2021. ENTSOG has used a sensitivity analysis to cover different injection targets and to provide flexibility of injection to reach storage levels.

The **main findings of the Summer Supply Outlook** highlight that the European gas network is sufficiently robust in most parts of Europe to enable:

- At least 90% stock level of the gas storages in preparation of the upcoming winter;
- maintenance to ensure infrastructure reliability in the long term;
- flexibility for the network users' supply strategy;
- supply gas to Ukraine with volumes comparable to previous summer seasons.

Special Note:

Summer Supply Outlook 2021 situation in a context of COVID-19 pandemic

In March 2020 lockdown measures related to COVID-19 pandemic were introduced in Europe. Widespread lockdown measures related to the COVID-19 pandemic across the EU deeply impacted the lifestyles, the economy and the energy markets – for more details please see the Summer Supply Review 2020. The further development of COVID-19 pandemic might influence both, demand assumptions provided by European TSOs and gas supply potentials from the different sources. Influence of the above-mentioned circumstances on gas supply and demand situation in Europe will be described in subsequent editions of Summer/Winter Supply Outlook and Reviews Reports.

Disclaimer:

The content of this Summer Supply Outlook is subject to future changes, depending on the outcome of ENTSOG's assessment of the EU/UK Trade and Cooperation Agreement.

1. Introduction

This edition builds on previous Summer and Winter Supply Outlooks as well as on the supply assumptions of the TYNDP. It aims to assess the ability of the European gas network to provide sufficient flexibility to shippers during their storage injection season.

The summer months (from April to September) provide shippers the opportunity to refill storages in anticipation of the winter months ahead. The level of injection targeted by shippers varies from one country to the other and from one season to the other due to climatic, price and legal parameters.

Modelling has been used to confirm the ability of the European gas network to provide flexibility of injection under different scenarios around a Reference Case targeting a 90% storage level by 30th September 2021. Additional scenarios cover alternative injection targets, to provide flexibility of injection to reach storage levels between 80% and 100%.

Like the previous edition and in order to cover the latest development since the beginning of the summer, the modelling takes as a starting point the factual storage levels on 1st April 2021.

For an accurate consideration of the reduction of injection capacity when a storage reaches high stock levels, ENTSOG uses injection capacity curves provided by Gas Storage Europe (GSE) members.

The topology of the network model has been upgraded in order to reflect the new situation in Europe.

2. Assumptions and results of the modelling

The simulations consider the existing European gas infrastructure and the maintenance plans to be completed during the upcoming summer [1] as of 31st March 2021.

The modelling tool for the Summer Supply Outlook 2021 is PLEXOS.

The Summer Supply Outlook 2021 is developed based on assumptions specific to the upcoming summer season as detailed in the annexes and short term trends. In any case actual injection and supply mix will result from shippers' decisions. The demand data has been provided by TSOs on a monthly granularity level. An averaged daily demand has been considered within each month.

For comparison purposes, **Figure 1** shows the European aggregated demand for the summer 2021 compared to the historical demand over the last nine summers (from April 1st to September 30th). The demand for this coming summer is forecasted to decrease 3.2% (from 10,036 GWh/d in S2020 to 9,711 GWh/d in S2021) being similar to the level from 2017. Despite this expected marginal reduction, the demand is expected to rank third over the last 10 years.

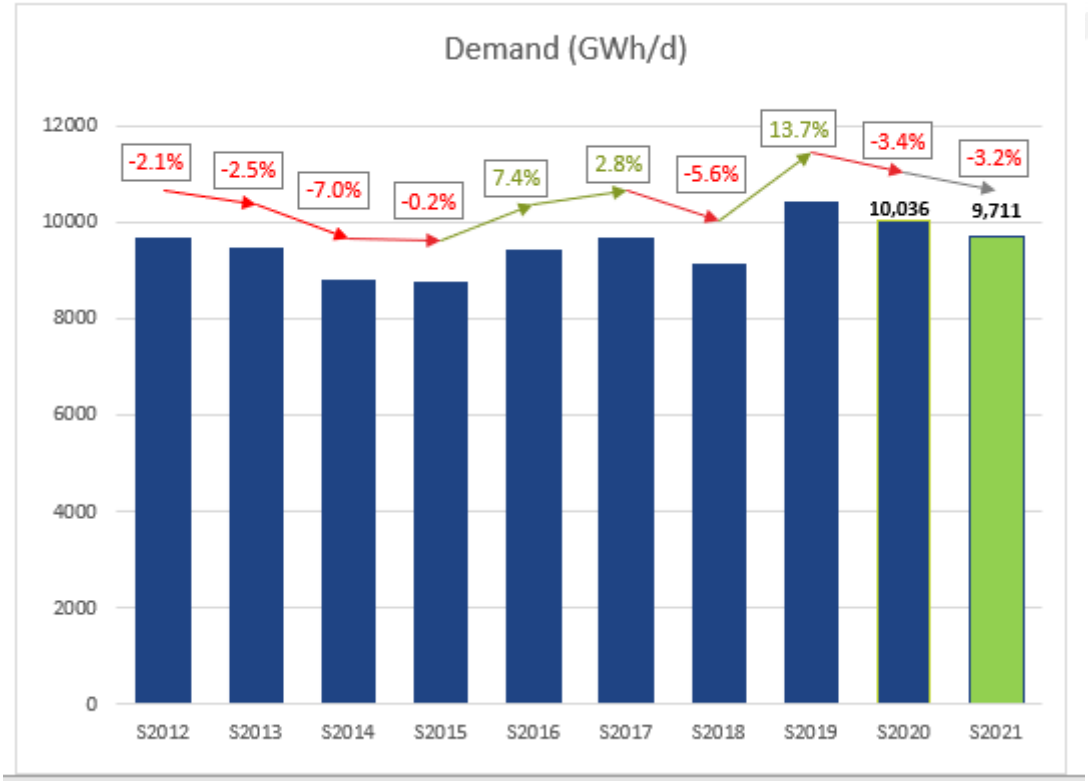


Figure 1. - European daily average demand comparison (forecast for summer 2021).

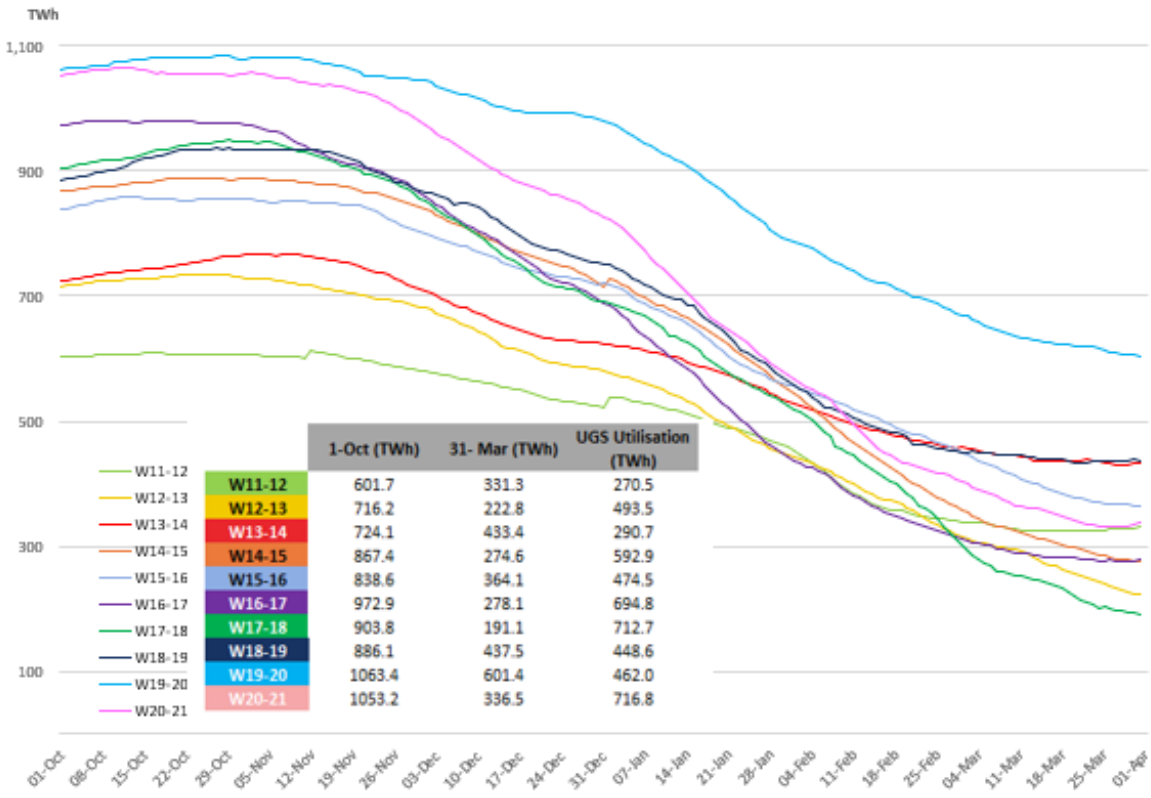
[1] Technical capacities and maintenance plans are updated by TSOs.

The maximum supply potentials of the different sources providing gas to EU (Algeria, Libya, Norway, Russia and LNG) are based on a six years history (historical availability). Regarding different LNG basins, it is based on the maximum supply potential defined in TYNDP 2020. The detailed data is provided in the annexes.

3. UGS inventory

According to AGSI+, the gas storage platform operated by GIE, the storage withdrawals reached 10.8 TWh on the 15th January 2021, the highest during the whole winter. This value is almost as high as the 11.4 TWh reached on 28th February 2018, which is still the highest value since 2011 due to the cold spell on March 2018.

Figure 2 compares the stock level evolution of the last nine winters in volume, starting the injection period with 336.5 TWh gas in the storages as of March 31st 2021 versus 601.4 TWh in W20-21 [March 31st 2020].



	1-Oct (TWh)	31- Mar (TWh)	UGS Utilisation (TWh)
W11-12	601.7	331.3	270.5
W12-13	716.2	222.8	493.5
W13-14	724.1	433.4	290.7
W14-15	867.4	274.6	592.9
W15-16	838.6	364.1	474.5
W16-17	972.9	278.1	694.8
W17-18	903.8	191.1	712.7
W18-19	886.1	437.5	448.6
W19-20	1063.4	601.4	462.0
W20-21	1053.2	336.5	716.8

Figure 2. - Evolution of UGS stock level. Winters 2012-2021 (TWh) (Source: AGSI).

Figure 3 shows the evolution of total working gas volume (WGV) on October 1st and winter utilization for the last eight winters. The storages utilization is during the winter 2020-2021 higher than in the previous year (where mild temperatures were observed): 717 TWh in W20-21 versus 462 TWh in W19-20.

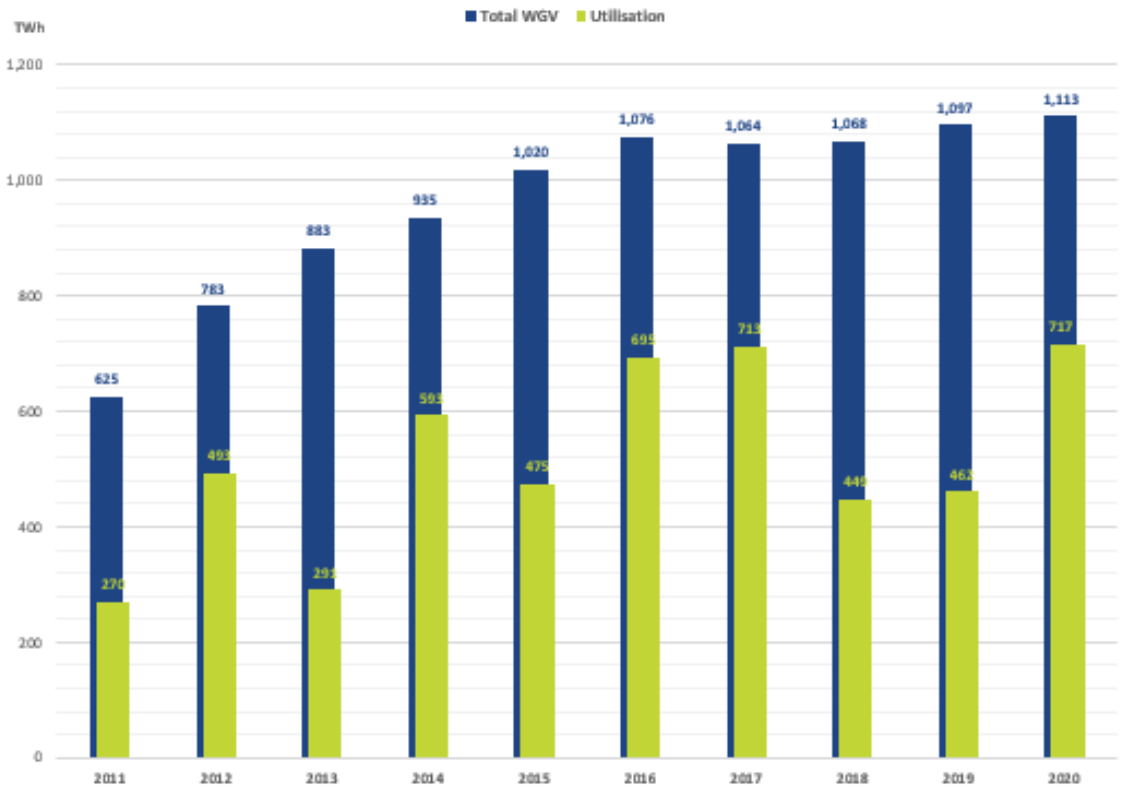
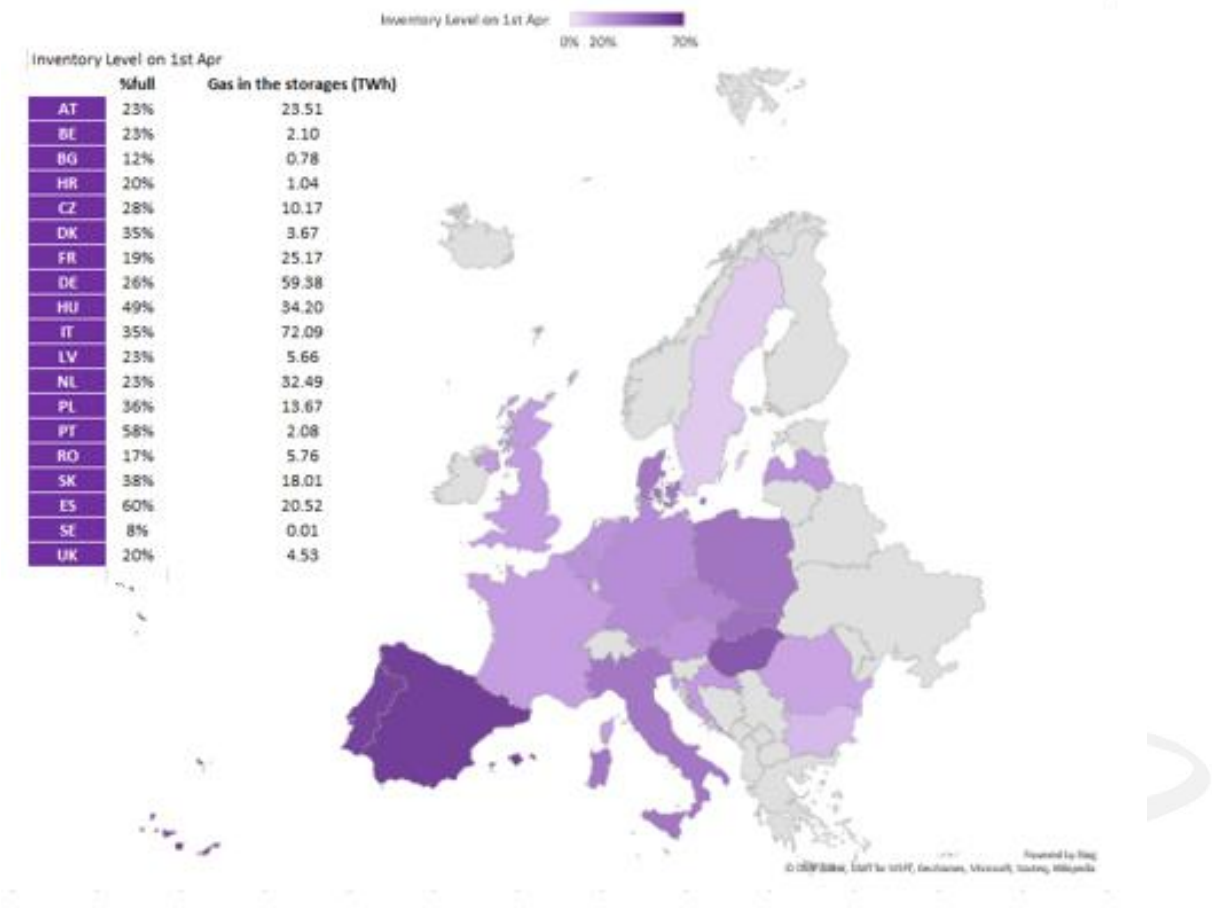


Figure 3. - Evolution of total WGV and winter utilisation.

The Summer Supply Outlook considers the actual storage inventory level per country on 1st April 2021 as the initial situation exposed in **Figure 4.** As shown on the map below the storage inventory levels differ depending on the country.



Inventory Level on 1st Apr

	%full	Gas in the storages (TWh)
AT	23%	23.51
BE	23%	2.10
BG	12%	0.78
HR	20%	1.04
CZ	28%	10.17
DK	35%	3.67
FR	19%	25.17
DE	26%	59.38
HU	49%	34.20
IT	35%	72.09
LV	23%	5.66
NL	23%	32.49
PL	36%	13.67
PT	58%	2.08
RO	17%	5.76
SK	38%	18.01
ES	60%	20.52
SE	8%	0.01
UK	20%	4.53

Figure 4. - Actual storage inventory levels on 1st April 2021 (For some countries, the initial level includes strategic stocks).[2]

In terms of **absolute volumes** in gas storages and considering the higher total capacity of storages in these countries, the largest volumes on 1st April are stored in Italy, Germany and Hungary. The initial average UGS inventory is lower than the one from the previous year (28.6% vs. 53.4%[3].).

The actual levels for each country show substantial differences from one country to the other. These levels per country have been used as a starting point for the Summer Supply Outlook 2021.

[2] The gas in storage on 1st April 2021 for each country is based on the AGSI platform. For Serbia, the initial storage is considered 0% due to no availability of data. The %Full has been calculated using the gas in the storage from AGSI+ platform and the Working Gas Volume from GSE Storage MAP database; since the last update was January 2018, updated AGSI values for WGV have been taken into account for those storages with remarkable difference.

[3] The WGV of the UGS with no firm injection capacity is not considered, but still they can be used by the market participants and would increase the total volume of gas stored in EU.

4. Reference Case (90% storage target)

The overall "summer injection" is defined as the quantity of gas necessary to reach a 90% stock level at each storage of EU on 30th September 2021 starting from the above mentioned actual stock level of 28.6% on 1st April 2021.

The repartition of injection and supply along the summer months result from the modelling and the following assumptions (further detailed in Annex A and B):

- The monthly gas demand forecast by TSOs;
- The monthly national gas production forecast by TSOs;
- Exports towards Ukraine[4]; and
- The overall summer injection as defined in Annex A and D.

The flexibility given to the model for the definition of the supply patterns derives from the supply mix of the last six summers (See Annex B-Supply assumptions).

Based on these assumptions, the modelling has been used to check if any physical congestion or dependence on an import source may limit the injection.

The simulations show that a 90% stock level may be achieved by 30th September 2021 for all balancing zones.

[4] The exports to Ukraine are assumed to be on the average levels from last 5 summer periods.

Table 1 shows the evolution of the stock level per country as a result of the model for the Reference Case simulation.

Country	01/04/2021*	01/05/2021	01/06/2021	01/07/2021	01/08/2021	01/09/2021	30/09/2021
AT	25%	29%	40%	52%	65%	79%	90%
BE	23%	23%	38%	56%	66%	80%	90%
BG	12%	25%	39%	52%	66%	81%	90%
CZ	23%	23%	36%	49%	63%	77%	90%
DE	24%	29%	40%	53%	66%	80%	90%
DK	35%	35%	42%	54%	67%	80%	90%
ES	60%	63%	68%	74%	79%	86%	90%
FR	19%	26%	40%	52%	64%	80%	90%
HR	20%	30%	43%	56%	69%	82%	90%
HU	49%	54%	62%	69%	76%	83%	90%
IT	35%	37%	47%	58%	69%	81%	90%
LV	23%	23%	37%	50%	64%	77%	90%
NL	23%	31%	43%	55%	67%	78%	90%
PL	36%	38%	45%	57%	68%	81%	90%
PT	58%	67%	79%	86%	86%	87%	90%
RO	17%	29%	42%	54%	66%	79%	90%
RS	0%	14%	29%	44%	60%	76%	90%
SE	8%	8%	8%	8%	90%	90%	90%
SK	38%	42%	50%	60%	70%	83%	90%
UK	20%	20%	20%	39%	66%	87%	90%

Table 1. - Storage Evolution Reference Case.[5]

The main finding of the Summer Supply Outlook is that the European gas network is capable to enable shippers to reach at least a 90% stock level in all underground gas storages by the end of this summer 2021 while ensuring the proper maintenance of the system. Comparing Summer Supply Outlook 2021 results with previous year simulations results, Latvian gas storage reaches the 90% of WGV since it is not longer assumed that the gas coming from Russia will not be injected and thus the limited capacity between Lithuania and Latvia will not prevent the storage to reach the target.

Figure 5 shows the breakdown of transported gas for each month (average daily values for each month including exports) for the **Reference Case**.

[5]For 1st of April, the actual stock level has been calculated as indicated in point 3 UGS Inventory.

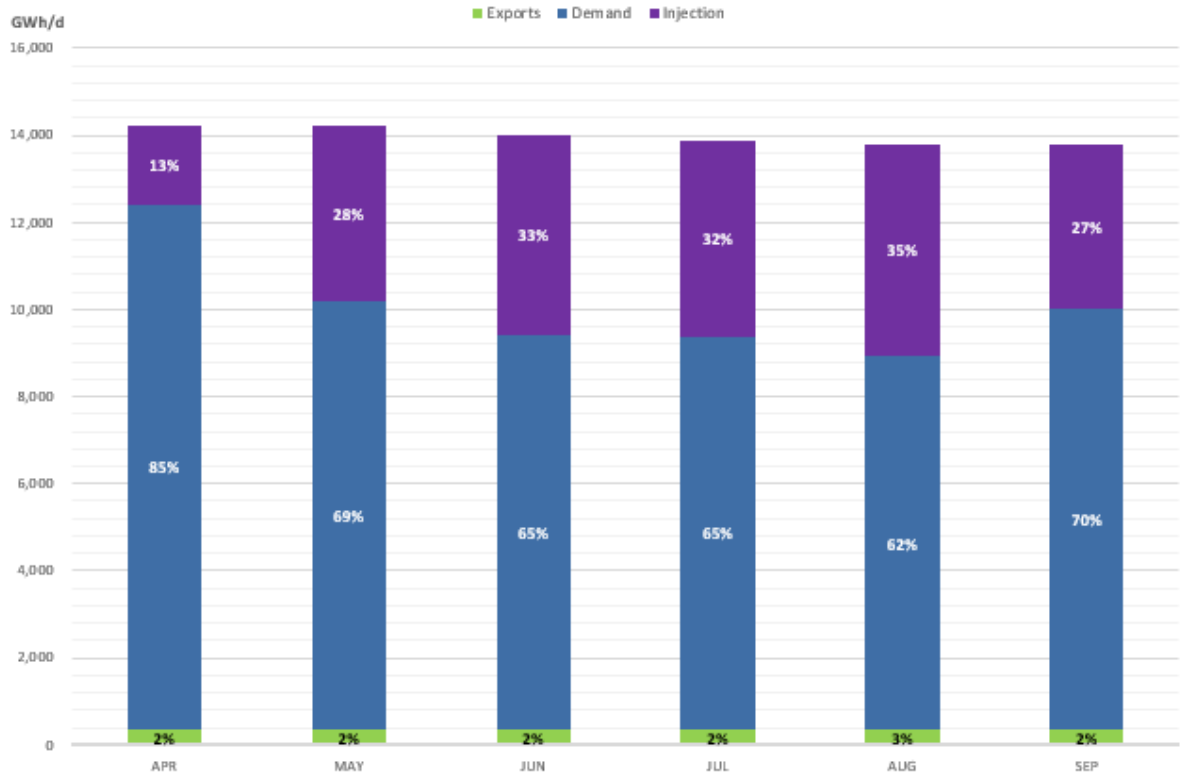


Figure 5. - Transported Gas on Reference Case.

Figure 6 shows the level and composition of the supply mix for every month in the Reference (90%) case. The monthly supply mix is stable over the summer 2021 period and if Russia source is used at 95%, the other sources are used at 20% leaving 30% of flexibility.

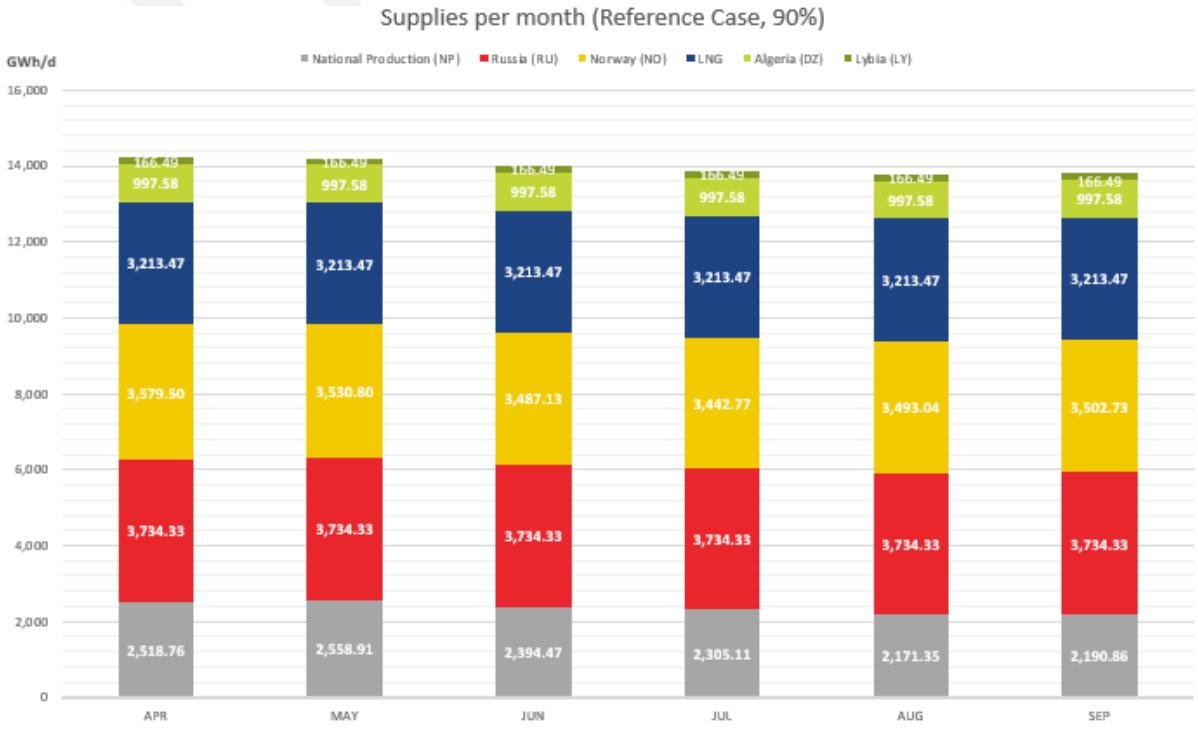


Figure 6. - Monthly supply mix.

5. Sensitivity-analysis – Alternative injection targets (80% and 100% targets)

Given the uncertainty on the stock level at the end of the season resulting from the behaviour of market participants, two alternative targeted levels of storage have been considered: 80% and 100% on 30th September 2021.

The definition of the monthly injection and supply is following the same rules as for the Reference Case. The assumptions for the demand, export and indigenous productions are kept on the exact same level as in the Reference Case.

Figure 7 provides the stock level evolution curve as resulting from the modelling of Summer Supply Outlook 2021 (actual injection curve will derive from shippers' behaviour) and actual curves of last five summers.

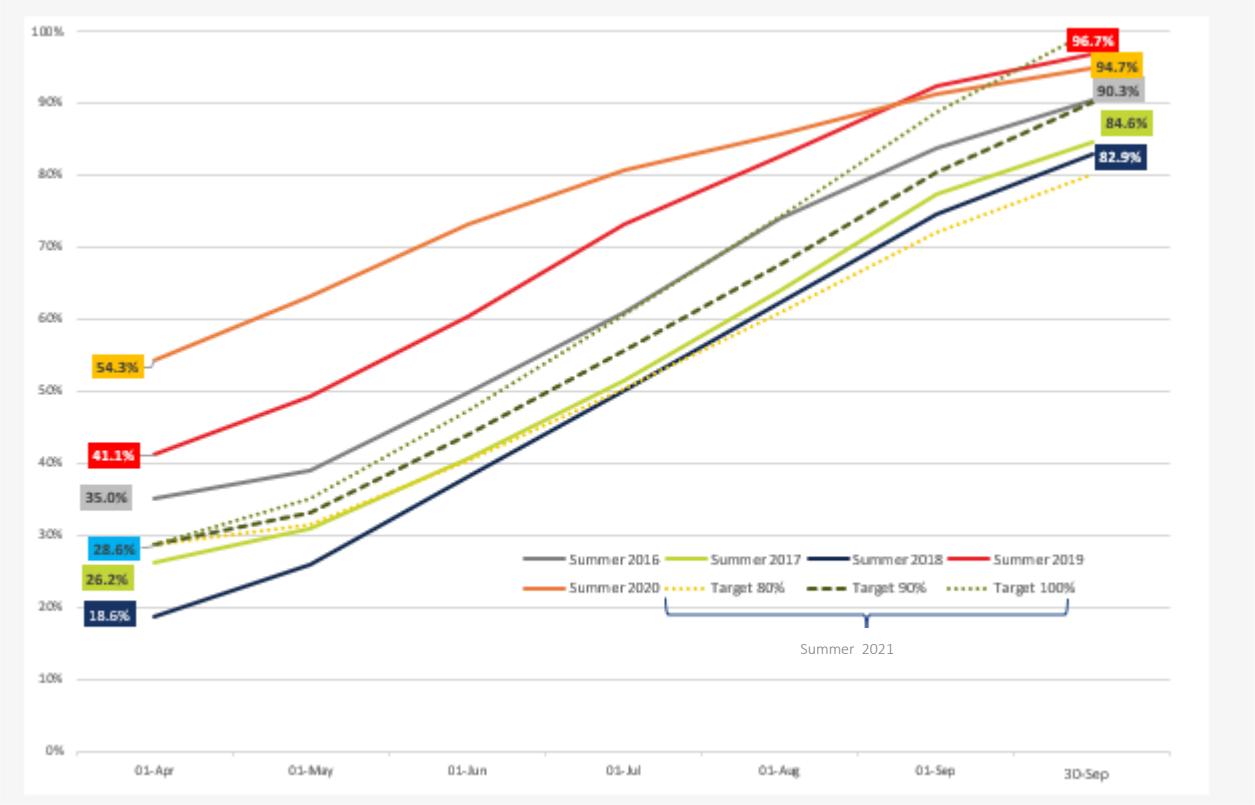


Figure 7. - Stock level development curve (% WGV).

In absolute terms, the target level of 90% represents a quantity of 1055 TWh of gas in the storages at the end of the summer 2021. By comparing this value with the result of the previous Summer Outlook (1026.5TWh), we observed that is slightly lower, mainly driven by the fact of lower gas in the storage at the beginning of the summer season.

Considering the two alternative targeted levels of storage, all the European gas storages can achieve the 80% of the WGV and also the 100% of WGV at the end of summer (except for Bulgaria which can reach up to 98% in spite of the low storage level at the beginning of summer).

Still, for many operators the injection season continues in October enabling a full injection if decided by market players.

Given the supply constraints detailed in Annex A, the different injection targets are reached through fluctuation of the supply levels.

As shown in **Figure 7**, the flexibility of the European transmission system is high enough to allow for different supply patterns while reaching 80%, 90% and 100% stock level at the end of September 2021 (except for Bulgaria reaching 98% at the maximum).

Figure 8 compares the maximum and minimum supply per source of **TYNDP 2020** Scenario Report[6], with the results of the supply shares modelled for summer 2021 .

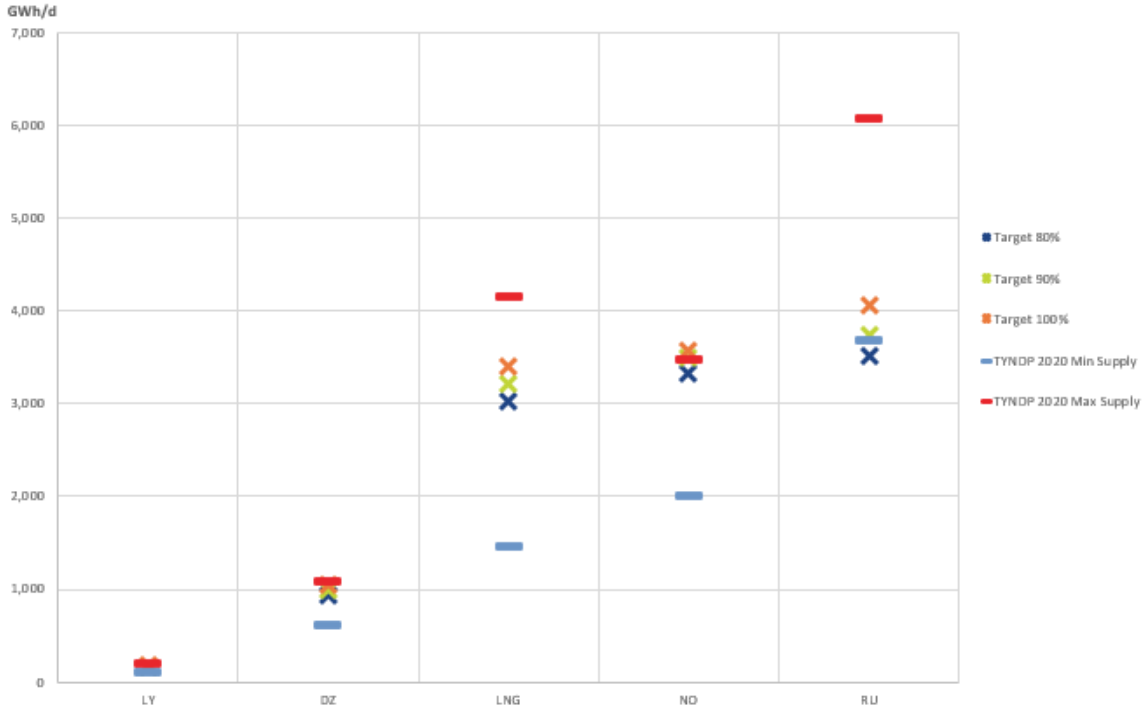


Figure 8. - Fluctuation of the supply patterns in the sensitivity analysis on the stock level.

Figure 9 shows a comparison between the supply shares in the Reference Case and the two alternative stock level targets (on a daily average basis) compared with historical supplies for four previous seasons. The supply utilisation in summer season 2021 is showing that the Russian supply is used up to 95% of their maximum flow and up to 70% for Norway (85% for the target 100%), leaving some flexiblity in Reference Case.

[6] Supply potentials forecasted for year 2020.

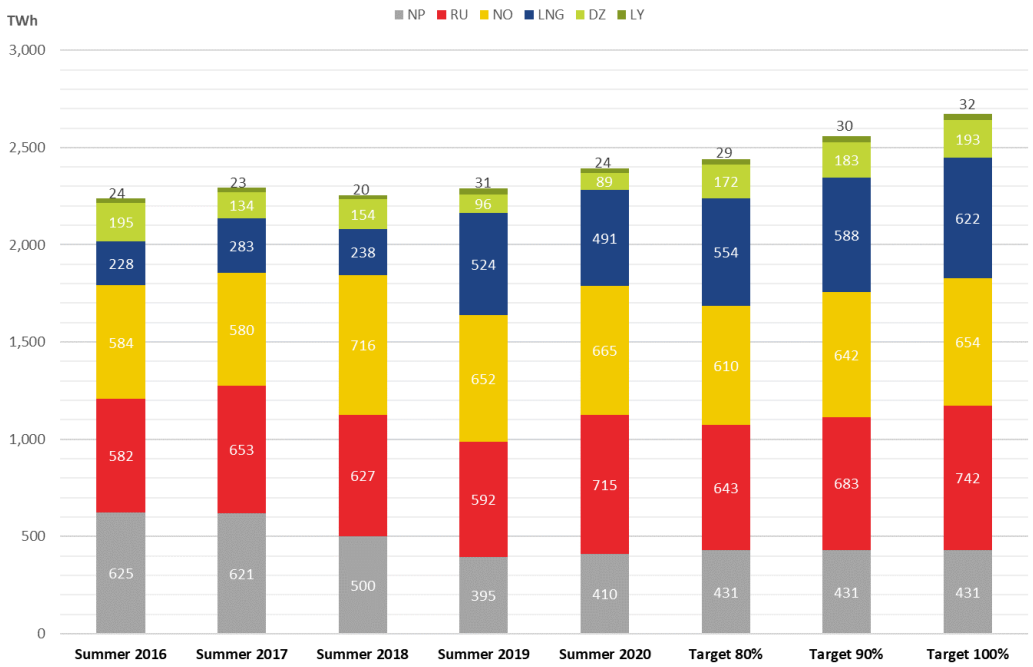


Figure 9. - Comparison between the summer supplies in the Reference and the two alternative stock level targets with historical data (TWh) [7].

Regarding the national production, **Figure 10** provides a comparison between the last five seasons and the national production forcasted by the TSOs for summer 2021. The decrease in the summer national production is around 9% (424.18 TWh in Summer Outlook 2021 vs 464.86 TWh in Summer Outlook 2020 following the decreasing trend observed in previous summers due the falling domestic production in the Netherlands, Denmark and other European countries.

[7] The supply utilisation given by the simulation results should not be taken as a forecast.

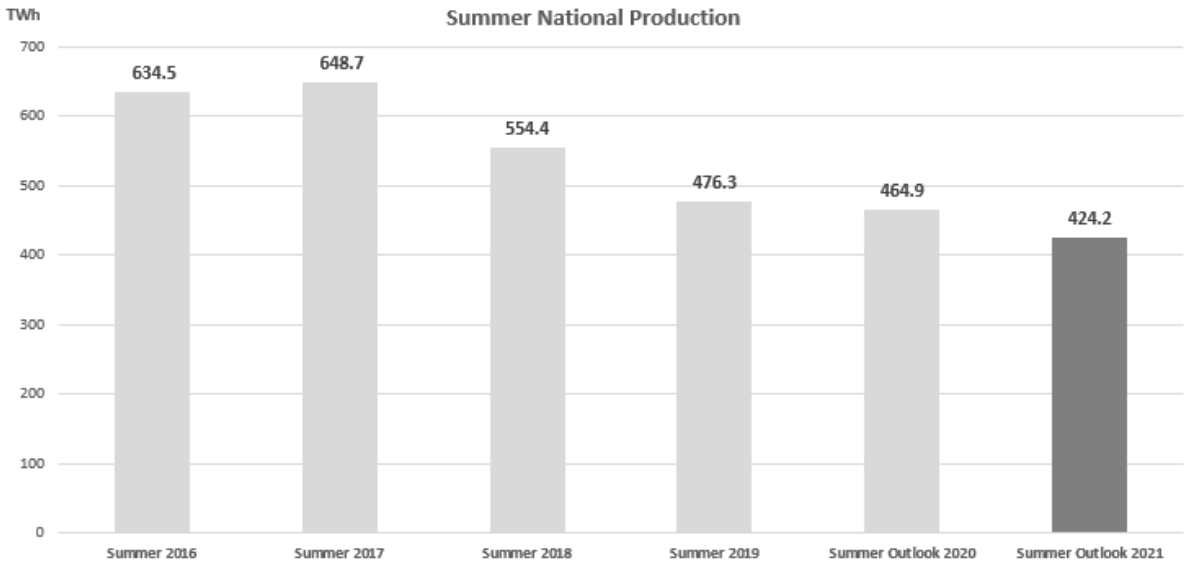


Figure 10. - National Production comparison (TWh).

Finally, **Figure 11** shows the difference between the supply shares in the Reference and the two alternative stock level targets.

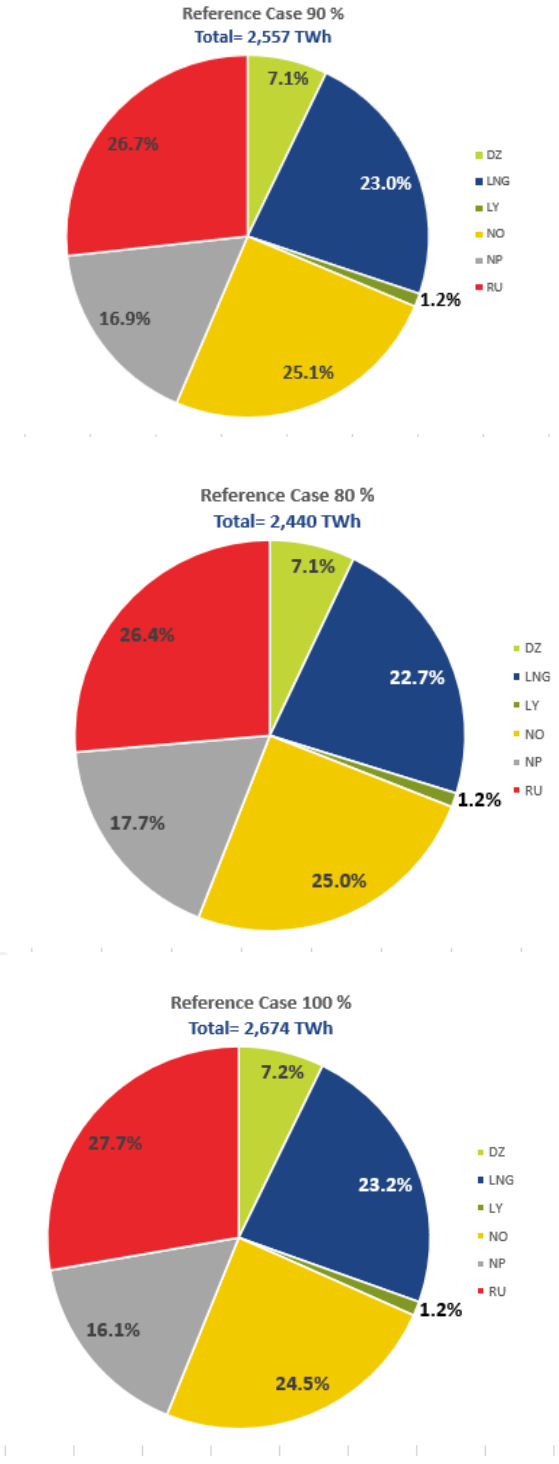


Figure 11. - Summer supply average share.

6. Conclusion

According to the ENTSOG modelling, under the given supply assumptions, this Summer Supply Outlook confirms the capability of the European gas network to enable shippers to reach at least a 90% stock level in all underground gas storages by the end of this summer 2021 while ensuring the proper maintenance of the system.
The sensitivity analysis shows that also an 80% and a 100% stock level could be achieved as well in all countries except for Bulgaria reaching 98%.

Legal Notice

The current analysis is developed specifically for this Summer Supply Outlook. It results from TSOs experience, ENTSOG modelling and supply assumptions and should not be considered as a forecast. The actual supply mix and storage level on 30th September 2021 will depend on market behaviour and global factors.

ENTSOG has prepared this Summer Supply Outlook in good faith and has endeavoured to prepare this document in a manner which is, as far as reasonably possible, objective, using information collected and compiled by ENTSOG from its members and from stakeholders together with its own assumptions on the usage of the gas transmission system. While ENTSOG has not sought to mislead any person as to the contents of this document, readers should rely on their own information (and not on the information contained in this document) when determining their respective commercial positions. ENTSOG accepts no liability for any loss or damage incurred as a result of relying upon or using the information contained in this document.

Annex A – Underground storages assumptions

The total quantity of gas to be injected from 1st April to 30th September 2021 is defined as the difference between:

- the sum of the working volume of all European UGS times the targeted stock level, and
- the stock level of European UGS on 1st April 2021[8]

This quantity will be split per month by the model based on the temporal optimisation, considering the limits set by the linearization of the injection curves.

Figure 12 shows the average injection curve, based on the storage profiles provided by GSE members. Default values are used in case specific country profiles are not available, calculated based on the WGV-weighted average of the provided ones. The detail of the curves defined at country level is included in Annex D.

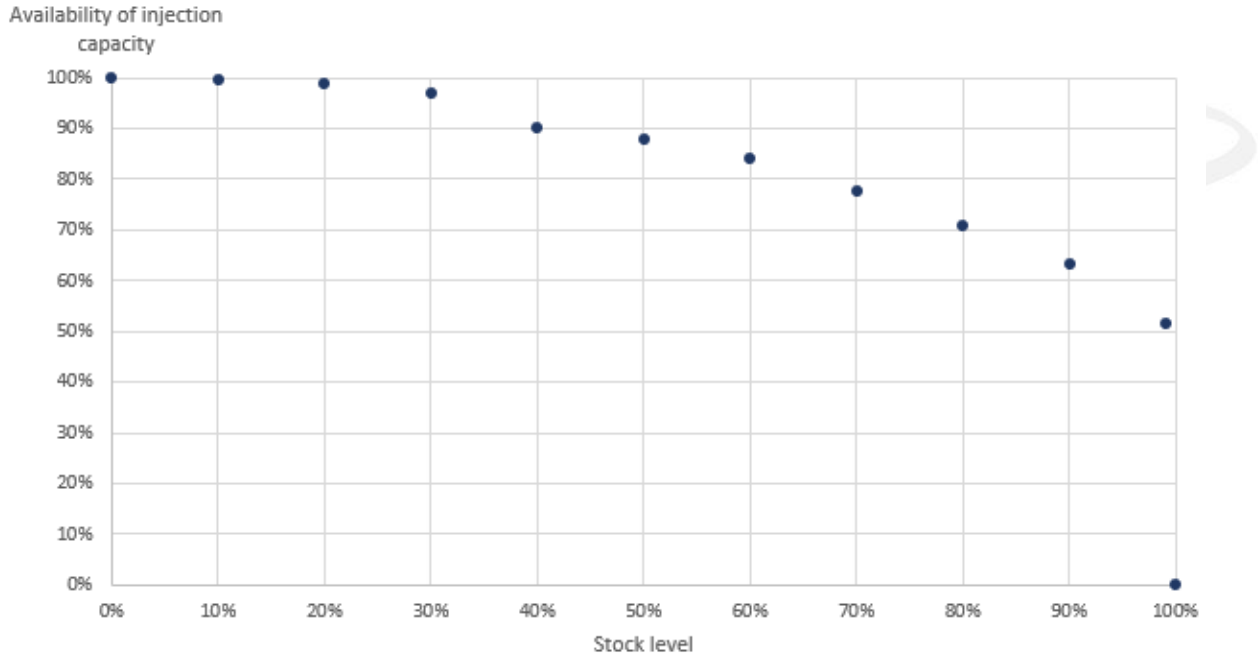


Figure 12. - Injection average curve.

[8] The %Full has been calculated using the gas in the storage from AGSI+ platform and the Working Gas Volume from GSE Storage MAP database; since the last update was January 2018, updated AGSI values for WGV have been taken into account for those storages with remarkable difference.

Annex B – Supply assumptions

Minimum supply per source: The minimum supply per source, on daily average, is set as the average of minimum monthly supply of the last 6 summers (April to September for years 2015, 2016, 2017, 2018, 2019 and 2020) for each supply source.

Maximum supply per source: The maximum supply per source, on daily average, is set as the average of maximum monthly supply of the last 6 summers (April to September for years 2015, 2016, 2017, 2018, 2019 and 2020) for each supply source.

Use of Supplies: Modelling is handled as to ensure use of the different supply sources pro-rata of their maximum.

The model can access additional flexibility on LNG, Russia and Norway only once all sources have reached their maximum. This way, the access to higher levels than these maximums will imply they will only be used by the model when it is necessary to avoid demand disruptions.

Additional Flexibility: The additional flexibility is based on the difference between the maximum supply per source (calculated as noted above) and the maximum of the maximum monthly supply of the last 36 summer months. We allow this flexibility only for the sources that have a difference higher than 150 GWh/d between the average of maximum monthly supply and the maximum of the maximum monthly supply.

Sources (GWh/d)	Minimum	Maximum	Maximum+ Additional Flex.
Algeria	330.17	1,140.09	1,140.09
LNG	1,144.33	3,672.54	3,672.54
Libya	4.82	190.28	190.28
Norway	2,371.13	4,153.89	4,153.89
Russia	2,633.01	4,393.32	4,393.32
Turkey	0.00	30.14	30.14

Table 2. - Minimum, maximum and additional flexibility per supply source.

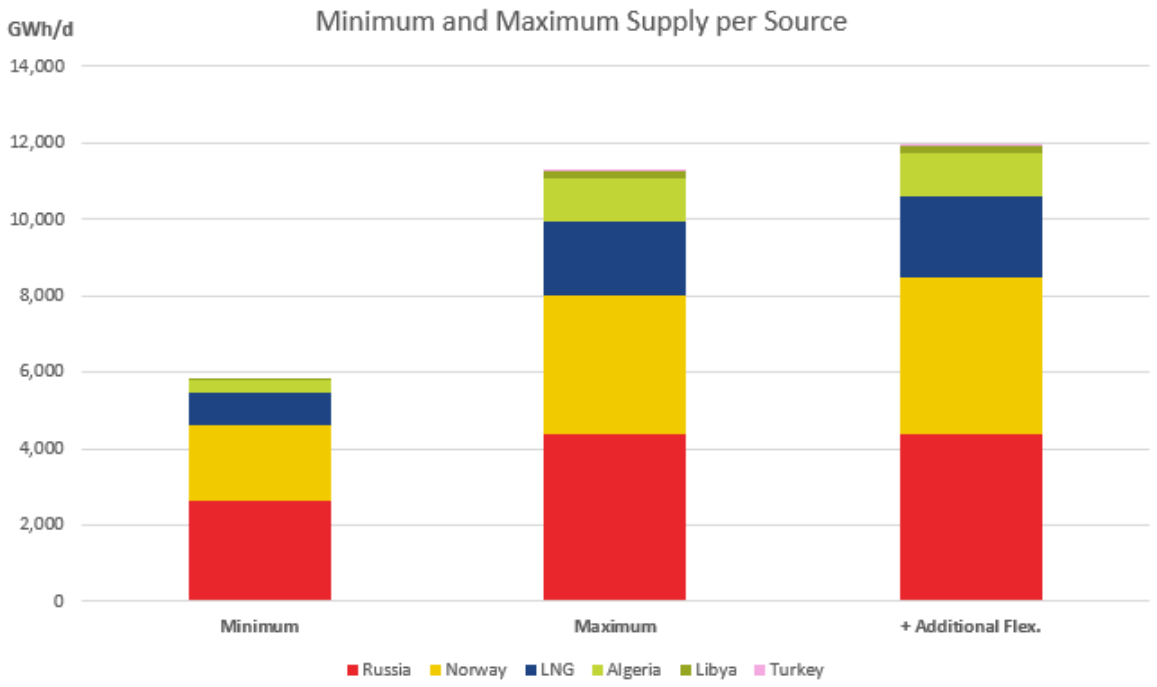


Figure 13. Minimum, maximum and additional flexibility per supply source.

Note: The gas supplies are a modelling result that depends on the supply assumptions, which are derived from the Summer Reviews.

Annex C – Summary of Summer Supply Outlook 2021 assumptions

Assumptions	Reference case
Demand and National Production	Average monthly demand and production anticipated by TSOs.
Monthly injection	> European aggregated injection over the summer: quantity necessary to reach injection target (80%, 90% or 100%) on 30th September 2021. > Monthly injection (aggregated and per Zone) is a result of the modelling.
Overall supply	Sum of demand and injection for the whole summer.
Supply shares	Supply shares is a result of the modelling.
Import routes	Split between import routes is a result of the modelling.
Cross-border capacity	Firm technical capacity as provided by TSOs considering reductions due to maintenance.
Exports towards Ukraine	344.9 GWh/d over the Summer Outlook 2021 period.

Annex D – Data for Summer Supply Outlook 2021

The data for Summer Supply Outlook 2021 is available online as an annex of this report. The data available is specifically:

- Linearization curves of the injection in the storages (source GSE members).
- Average monthly national production forecast.
- Average monthly demand forecast.
- Average monthly final and power demand forecast.

Annex E – Modelling approach

The network used in this report is the up to data collection time and reflect changes in topology submitted by TSOs.

The following elements are part of the modelling:

- Definition of six temporal periods, representing the months from April to September.
- Temporal optimization means the optimisation of the summer as a whole period in a single simulation. This implies that the model anticipates an event, adapting the flows in the previous months and mitigating its impact.
- Use of linearization curves for storage injection capacities, as provided by GSE Members, to consider the reduction of injection capacity when the stock level increases.

Modelling enables the identification of potential capacity and supply limitations, if any, preventing the targeted stock level in each European storage by 30th September 2021 being reached.

Annex F – List of Figures and Tables

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Publisher ENTSOG AISBL
Avenue de Cortenbergh 100
1000 Brussels, Belgium

Co-Authors Magdalena Bogucka, Paula Di Mattia and Jacques Reberol

Cover picture Courtesy of REN

ENTSOG AISBL
Avenue de Cortenbergh 100 | 1000 Brussels, Belgium
Tel. +32 2 894 51 00

info@entsog.eu | www.entsog.eu