



JRC TECHNICAL REPORT

Monitoring the gas storage filling trajectory in the European Union in 2022

Regulation (EU) 2022/1032

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2023



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JRC132366

EUR 31408 EN

PDF ISBN 978-92-76-98898-4 ISSN 1831-9424 doi:10.2760/299350 KJ-NA-31-408-EN-N

Luxembourg: Publications Office of the European Union, 2023.

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How to cite this report: Fernández-Blanco Carramolino, R., Rodríguez Gómez, N., Bolado Lavin, R., *Monitoring the gas storage filling trajectory in the European Union in 2022: Regulation (EU) 2022/1032*, Publications Office of the European Union, Luxembourg, 2023, doi:10.2760/299350, JRC132366.

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Abstract

The new Gas Storage Regulation (EU) 2022/1032 enhances the security of supply of the European Union (EU) and provides amendments to the previous Regulation (EU) 2017/1938 concerning measures to safeguard the security of gas supply and Regulation (EC) No 715/2009 on conditions for access to the natural gas transmission networks. The new legislative proposal sets out minimum underground gas storage obligations at the beginning of the heating season, i.e. 80% of the aggregated capacity on 1 November 2022 and 90% from 2023 onwards. Specifically, it provides a storage filling trajectory by means of a set of intermediate targets on 1 August, 1 September and 1 October 2022 that Member States must fulfil (from 2023 onwards, the intermediate targets are on the first of the months of February, May, July and September). Apart from storage obligations, the Gas Storage Regulation adds an article to certify storage system operators and reinforces the monitoring system of the storage filling targets. This report provides an overview of the new Regulation in place and is focused on the monitoring of the target filling levels. The report identifies the countries that may face, in principle, challenges to meet their targets in 2022 based on storage projections derived at the end of July 2022, just before the first intermediate target came into effect. Finally, it describes four snapshots of the storage situation in the EU for each of the intermediate targets considered in the Regulation.

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1 Introduction

The European energy crisis that started in the second semester of 2021 (Sheppard, 2021) has led to a dynamic regulatory framework in the European Union (EU) from a policy perspective. In this framework, regulatory measures are adapted based on the crisis evolution. Geopolitical and technical events took place simultaneously at the beginning of the energy crisis, thus largely affecting gas prices in European gas hubs (Fernández-Blanco Carramolino et al., 2022). The root causes are enumerated as follows:

- The 13.5-bcm Maghreb-Europe pipeline linking Algeria to Spain via Morocco stopped the supply of natural gas from 1 November 2021 because of a political dispute between the northern African countries (Reuters, 2021).
- Gas in underground gas storages (UGSs) in the EU reached their minimum of the last 11 years, i.e. 77% of storage filling level on 1 November 2021 (852 TWh at the beginning of the heating season) compared to 88.5% in the same day of the reference years 2016-2018 (976 TWh), according to the AGSI+ Transparency Platform (TP) (GIE, 2022a).
- High gas demand triggered by the post-pandemic economic recovery (ACER, 2021).
- Lower generation by wind and hydro, increasing the need of gas-fired generation in the electricity system (ACER, 2021).
- Declining EU indigenous gas production (ACER, 2021).
- Reduced liquefied natural gas (LNG) and pipeline gas supply to the EU (mainly from Norway and Russia) (ACER, 2021).
- Ukraine's invasion by Russia on 24 February 2022.

All these events have triggered the increase in gas and electricity prices. Thus, the security of supply of gas and electricity has been the focus of the EU political agenda during 2022.

The European Commission (EC) reacted to the rising energy prices on 13 October 2021 with a communication to tackle it with a comprehensive list of actions (European Commission, 2021a). Specifically, the EC adopted a toolbox with short- and medium-term measures to deal with the price hike and protect the vulnerable consumers and small businesses. Apart from economic measures to mitigate the impact of high energy prices, this toolbox spurred a series of actions towards a decarbonised and resilient energy system. On this regard, the communication put forward the revision of the EU gas market rules via the hydrogen and decarbonised gas market package released on 15 December 2021 (European Commission, 2021b), the revision of the security of supply regulation (European Commission, 2017) to ensure a better use and functioning of gas storage in Europe, the adoption of a delegated act to set up new cross-border regional gas risk groups, and the exploration of the design of a joint procurement of reserve gas stocks, among other measures. On 8 March 2022, the EC proposed the REPowerEU plan to end Europe's dependence on Russian gas (and other fossil fuels) before 2030 (European Commission, 2022a). Diversification of gas supplies (LNG and pipeline, increasing EU biomethane production, and boost hydrogen supply chain) as well as the roll-out of solar, wind and heat pumps, and the industry decarbonisation are among the most important measures to phase out rapidly from Russia's fossil fuels. In this plan, and for the first time, the EC recognised the insurance value of UGSs and announced a legislative proposal to fill up storages up to 90% of its capacity by 1 October each year. On 23 March 2022, the legislative proposal to secure gas for the next winters was published by the EC (European Commission, 2022b), wherein minimum storage obligations are proposed to ensure security of energy supply, i.e., 80% on 1 November 2022 and rising to 90% from 2023 onwards. The political agreement on this proposal between the European Parliament and EU Member States (MSs) was reached on 19 May 2022 (European Commission News, 2022; Council of the European Union, 2022) and the measures were adopted in the new Gas Storage Regulation (EU) 2022/1032 on 30 June 2022 (European Commission, 2022c), which is hereinafter referred to as the Regulation.

The new Gas Storage Regulation enhances the security of supply of the EU and comprises three main articles. Article 1 provides the amendments to the Regulation (EU) 2017/1938, article 2 amends Regulation (EC) No 715/2009 to add the certification of storage system operators (SSOs), and article 3 specifies the date when the Regulation should enter into force (30 June 2022). The Regulation is enhanced as follows:

- *Filling targets* are imposed at the beginning of the heating season (1 November) at 80% in 2022 and at 90% from 2023 onwards.

- *Intermediate filling targets* must be fulfilled during an extended injection season. The set of control points provided in the Regulation is referred to as *storage filling trajectory*.
- A *toolbox for filling storages* is provided to the MSs and it includes financial incentives or compensation, deterrent sanctions and fines, and certification of UGSs.
- A *monitoring system* is recommended to keep track of the fulfilment of the storage filling trajectory along the various targets.

The MSs are recommended to take all necessary measures to implement the Regulation and these measures can be:

- Obligation on gas suppliers to *store minimum volumes* of gas in UGS facilities and/or LNG storage facilities.
- Obligation on SSOs to *tender capacities* to market participants.
- Obligation on transmission system operators (TSOs) to *purchase strategic stocks* to safeguard the security of gas supply in case of emergency.
- The use of *coordinated platforms to purchase LNG* with other MSs so that its use is maximised and storages could be refilled by removing infrastructure and regulatory barriers.
- The use of voluntary mechanisms for the *joint procurement of natural gas*.
- Provision of *financial incentives* for market participants including SSOs (e.g. contracts for difference or compensation mechanisms).
- Obligation on capacity holders about a ***"use it or lose it" clause*** in order to release unused booked capacities.
- Adoption of *instruments for the purchase and management of strategic storage*.
- Appointment of a *dedicated entity* to make sure the targets are met.
- Provision of *discounts on storage tariffs*.
- *Incentive or compensation mechanisms* in regulated storages in case revenues collected through tariffs are lower than the allowed revenues.

One of the main articles amended into the Regulation (EU) 2017/1938 is article 6(c) related to the storage arrangements and burden-sharing mechanism. This article refers to the insurance value of the UGSs in the EU which can be used by other MSs without storage facilities in their territory. Eight EU countries, namely Estonia (EE), Greece (EL), Finland (FI), Lithuania (LT), Luxembourg (LU), Slovenia (SI), Ireland (IE), and Malta (MT) do not have storage facilities, although they represent less than 5% of the EU27 annual gas consumption (ACER, 2022). In addition, it provides a fair balance for those countries with high gas storage capacities. The targets for the MSs without storage could follow three criteria: (i) store 15% of the average annual gas consumption over the preceding five years in another EU country with storage facilities, (ii) other burden-sharing mechanism could be agreed bilaterally based on protected customer volumes or technical limitations, or (iii) derogation because the country is not directly interconnected to the gas network of any other MS.

This report provides a summary of the main articles of the new Gas Storage Regulation by indicating explicitly which countries are or may be bound by the articles. In addition, we derive projections of the gas stored in UGS facilities in 2022 before starting the monitoring of the filling targets. This could be of interest to identify the MSs which may face challenges in meeting intermediate filling targets. Moreover, we briefly discuss the monitoring tools and four snapshots of the storage situation in the EU in each of the intermediate targets provided in the Regulation.

This report is organised in four additional sections. Section 2 describes in detail the most important articles of the Regulation and provides the storage filling trajectory that should be monitored during 2022. Section 3 discusses EU and country-specific storage projections to anticipate potential issues to comply with the Regulation. Section 4 explains the monitoring tools and summarises the storage situation of each target highlighted in the Regulation. Section 5 concludes the report. Finally, Annex 1 provides the country-specific storage projections discussed in Section 3.

2 Practical implementation of the Gas Storage Regulation 2022/1032

This section is devoted to explaining which countries are affected by the main articles of the new Gas Storage Regulation. To monitor adequately the target filling levels, Section 2.1 provides data useful to understand the requirements expressed in some articles. Section 2.2 scrutinised the main articles of the Regulation one by one. Section 2.3 shows the target filling trajectory by Member State and describes the computation of the corrected filling targets for the concerned countries.

2.1 Data

On the one hand, the Regulation sets out minimum storage obligations in the form of target filling levels for August, September, October, and November in 2022. These targets are expressed in relative terms based on the corresponding aggregated storage capacity of each MS with UGSs. On the other hand, some articles take as a reference measure the average annual consumption over the preceding five years. Thus, Table 1 shows both the storage capacity in TWh, as given in AGSI+ TP (GIE, 2022) and the five-year average annual consumption (from 2017 until 2021) in billion cubic meters (Eurostat, 2022).

UGS capacity is approximately 1113 TWh (i.e. around 100 bcm)⁽¹⁾ in the EU and around 60% of this capacity is located in Germany (DE), Italy (IT), the Netherlands (NL) and France (FR). The EU storage capacity represents one fourth of the EU average annual consumption of the last five years (2017-2021) which amounts to circa 400 bcm. The largest gas consumptions are identified in the countries with the largest storage capacities, i.e. DE, IT, NL, and FR.

Table 1. Storage capacity and five-year average annual consumption by Member State.

Country code	Storage capacity (TWh)	5-year average annual consumption (bcm)
BE	8.7	18.0
BG	5.8	3.2
CZ	43.8	8.9
DE	244.8	90.5
DK	9.2	2.9
ES	35.3	32.5
FR	132.6	41.0
HR	4.8	3.0
IT	193.4	73.8
NL	139.0	43.5
PL	36.4	21.6
PT	3.6	5.9
RO	32.8	11.9
SE	0.1	1.2
AT	95.5	9.2
HU	67.7	10.5
LV	24.1	1.3
SK	36.0	4.9
EE	0.0	0.5
EL	0.0	5.5
FI	0.0	2.5
LT	0.0	2.3
LU	0.0	0.8
SI	0.0	0.9
CY	0.0	0.0
IE	0.0	5.3
MT	0.0	0.4

Source: AGSI+ TP and Eurostat (NRG_CB_GASM). Data collected on 15 September 2022.

⁽¹⁾ A unified gross calorific value (GCV) of 11 kWh/Nm³ has been used to convert energy units of storage-related parameters to volumetric units throughout the document.

2.2 Interpretation of articles

2.2.1 Article 6(a).2

The article shown in Table 2 refers to the reduction of the filling targets to a volume corresponding to 35% of the average annual gas consumption over the past five years in order to avoid a disproportionate impact on those countries with a storage capacity higher than their annual consumption. Table 3 summarises the computations needed to understand which countries are bound by this article. In columns 2 and 3, we provide again the data regarding the aggregated storage capacity and the five-year average annual consumption outlined in the previous section. Column 4 lists the 35% of this annual consumption. Columns 5 and 6 provide respectively the 80% and 90% gas in storage (GIS) target required in 2022 and from 2023 onwards. Columns 7 and 8 compare the corresponding target filling level with the 35%-demand ceiling. If the 35% of the five-year average annual consumption is lower than the target filling level, then the 35%-demand ceiling applies to the MS. This is indicated by a binary variable, i.e. 1 if the rule applies and 0 otherwise. The last column indicates which target should be considered by 1 November 2022.

As can be seen in Table 3, this article affects four countries, namely Hungary (HU), Latvia (LV), Slovakia (SK) and Austria (AT), which are highlighted in orange. The *pro rata* intermediate target for these countries should be calculated as the product of the value indicated in the table of Annex Ia of the Regulation and the limit imposed by the 35%-demand ceiling and the result divided by 80%. For instance, in the case of Austria, the target filling level on 1 November 2022 is equal to 0.35 times the 5-average annual consumption (9.2 bcm), which results in 3.2 bcm, i.e. 37% filling level of the corresponding storage capacity. Thus, the intermediate storage target on 1 August 2022 is computed as $(49 \times 37)/80 = 23\%$. It should be noted that these countries are prone to be affected by article 6(a).2 in 2023, however this is just a proxy since the five-year average annual consumption must be computed with the last five years for which full yearly consumption is available at the time of setting targets.

Czechia (CZ) deserves further attention because the 35%-demand ceiling may apply to its UGSs in 2022. However, this country is also affected by article 6(a).4 due to the storage ownership of the UGS Dolni Bojanovic, which is located in its territory but used by the Slovakian gas market. For this reason, the aggregated storage capacity in Czechia must be corrected by subtracting the capacity of UGS Dolni Bojanovic (6.9 TWh), thus resulting in a total capacity of 36.9 TWh (around 3.4 bcm). In this situation, the 35%-demand ceiling does not apply to Czechia in 2022 (see the row corresponding to CZ* in which the capacity of UGS Dolni Bojanovic has been subtracted from the total in Czechia).

Table 2. Article 6(a).2 of the Gas Storage Regulation 2022/1032.

2. Notwithstanding paragraph 1 and without prejudice to the obligations of other Member States to fill the underground gas storage facilities concerned, the filling target for each Member State in which the underground gas storage facilities are located shall be reduced to a volume corresponding to 35 % of the average annual gas consumption over the preceding five years for that Member State.								
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Source: Regulation 2022/1032.

Table 3. Target obligation on 1 November 2022 due to article 6(a).2 of the Regulation 2022/1032.

Country code	Capacity (TWh)	5-year average annual demand (bcm)	35% average annual demand (bcm)	80% GIS target in 2022 (bcm)	90% GIS target from 2023 (bcm)	Does 35% rule apply in 2022?	Does 35% rule apply in 2023?*	Target obligation on 1 November 2022
AT	95.5	9.2	3.2	6.9	7.8	1	1	35% av. demand
BE	8.7	18	6.3	0.6	0.7	0	0	80% target
BG	5.8	3.2	1.1	0.4	0.5	0	0	80% target
CZ	43.8	8.9	3.1	3.2	3.6	1	1	35% av. demand
CZ*	36.9	8.9	3.1	2.7	3.0	0	0	80% target
DE	244.8	90.5	31.7	17.8	20.0	0	0	80% target
DK	9.2	2.9	1.0	0.7	0.8	0	0	80% target
EE	0	0.5	0.2	0.0	0.0	0	0	80% target
EL	0	5.5	1.9	0.0	0.0	0	0	80% target
ES	35.3	32.5	11.4	2.6	2.9	0	0	80% target

FI	0	2.5	0.9	0.0	0.0	0	0	80% target
FR	132.6	41	14.4	9.6	10.8	0	0	80% target
HR	4.8	3	1.1	0.3	0.4	0	0	80% target
HU	67.7	10.5	3.7	4.9	5.5	1	1	35% av. demand
IT	193.4	73.8	25.8	14.1	15.8	0	0	80% target
LT	0	2.3	0.8	0.0	0.0	0	0	80% target
LU	0	0.8	0.3	0.0	0.0	0	0	80% target
LV	24.1	1.3	0.5	1.8	2.0	1	1	35% av. demand
NL	139	43.5	15.2	10.1	11.4	0	0	80% target
PL	36.4	21.6	7.6	2.6	3.0	0	0	80% target
PT	3.6	5.9	2.1	0.3	0.3	0	0	80% target
RO	32.8	11.9	4.2	2.4	2.7	0	0	80% target
SE	0.1	1.2	0.4	0.0	0.0	0	0	80% target
SI	0	0.9	0.3	0.0	0.0	0	0	80% target
SK	36	4.9	1.7	2.6	2.9	1	1	35% av. demand
SK**	42.9	4.9	1.7	3.1	3.5	1	1	35% av. demand

*CZ excludes the capacity of UGS Dolni Bojanovic in this row.

**SK includes the capacity of UGS Dolni Bojanovic in this row.

Source: JRC based on AGSI+ TP and Eurostat. Data collected on 15 September 2022.

2.2.2 Article 6(a).3

This article is shown in Table 4 and it refers to the discount of gas withdrawn used by third countries in order to satisfy the storage filling targets.

Table 4. Article 6(a).3 of the Gas Storage Regulation 2022/1032.

3. Notwithstanding paragraph 1 and without prejudice to the obligations of other Member States to fill the underground gas storage facilities concerned, the filling target for each Member State in which the underground gas storage facilities are located shall be reduced by the volume which was supplied to third countries during the reference period 2016 to 2021 if the average volume supplied was more than 15 TWh per year during the gas storage withdrawal period (October – April).

Source: Regulation 2022/1032.

The Netherlands (NL) may be subject to this article since there is a fraction of its storage capacity held by operators of the United Kingdom (UK). The average volume supplied by NL to third countries in the withdrawal period of the reference period 2016-2021 amounts to 23.2 TWh. This is computed based on the physical flows observed in the interconnector linking the Netherlands and United Kingdom with the data published in (ENTSOG Transparency Platform, 2022). Therefore, the *pro rata* intermediate targets should be calculated by multiplying the value indicated in the table of the Regulation by the storage capacity minus 23.2 TWh and dividing the result by the aggregated capacity of the Dutch UGSs.

2.2.3 Article 6(a).4: UGS Dolni Bojanovice

Article 6(a).4 is provided in Table 5 and it refers to the storage ownership of the different UGS facilities in the European Union. One example is the UGS Dolni Bojanovice which is located in Czechia but used by the Slovakian market (2). Therefore, its capacity and gas in storage level must be excluded from UGS facilities in Czechia and included in the aggregated UGSs in Slovakia. As a consequence, UGS Dolni Bojanovice is subject to the 35%-demand ceiling, as Slovakian aggregated storage.

Table 5. Article 6(a).4 of the Gas Storage Regulation 2022/1032.

4. For the underground gas storage facilities listed in Annex Ib, the filling targets pursuant to paragraph 1 and the filling trajectories pursuant to paragraph 7 shall apply. The details of the obligations of each Member State will be determined in a bilateral agreement in accordance with Annex Ib.

Source: Regulation 2022/1032.

(2) <https://www.eppowereurope.cz/en/business-areas/gas-storage/>.

2.2.4 Article 6(a).4: UGS Haidach and 7Fields

Article 6(a).4 also affects UGS Haidach and 7Fields which are both located in Austria but connected to both Austria and Germany. These storages are specifically referred to in Annex Ib of the Regulation, however the bilateral agreement of those Member States is unknown to the best of the authors' knowledge. In August 2022, AGSI+ Transparency Platform carried out some changes regarding the UGS Haidach (³). Before that date, UGS Haidach (GSA) reported a working gas volume of 21.3 TWh. After August 2022, RAG Energy Storage markets 14.1 TWh of working gas volume of UGS Haidach (GSA) (⁴) while UGS Haidach (astora) takes over the remaining 7.3 TWh of UGS Haidach (GSA).

Table 6. Annex Ib related to article 6(a).4 of the Gas Storage Regulation 2022/1032.

ANNEX Ib
Shared responsibility for the filling target and the filling trajectory
With regard to the filling target and the filling trajectory pursuant to Article 6a, the Federal Republic of Germany and the Republic of Austria share the responsibility concerning the storage facilities Haidach and 7Fields. The exact ratio and extent of that responsibility of the Federal Republic of Germany and the Republic of Austria is subject to a bilateral agreement of those Member States.'

Source: Regulation 2022/1032.

2.2.5 Article 6(a).5

Article 6(a).5 is shown in Table 7 and states that a Member State could partially meet the filling target by counting the LNG stocks if and only if the LNG storage capacity is greater than 4% of the five-year average consumption and that the Member State imposes an obligation on gas suppliers to store minimum volumes of gas in underground gas storages.

These conditions are met by Spain (ES). According to the ENaGaD database (Zaccarelli et al., 2021), the Spanish annual gas consumption amounts to 350.0, 348.5, 396.9, 358.1, and 377.3 TWh in years 2017-2021, respectively. This gives rise to a five-year average consumption of 366.2 TWh. Based on ALSI Transparency Platform (GIE, 2022b), the LNG storage capacity is $3316.5 \cdot 10^3 \text{ m}^3 \text{ LNG}$ (i.e. around 22718 GWh) (⁵) by considering the LNG regasification terminals in Barcelona, Huelva, Cartagena, Bilbao, Sagunto, and Mugardos. Therefore, the LNG storage capacity (22.7 TWh) is indeed higher than 4% of the average consumption (i.e. $14.6 \text{ TWh} = 0.04 \times 366.2 \text{ TWh}$). The condition described in article 6(a).5, point (b) is also met according to the Spanish Official State Gazette in 2022 (⁶).

Table 7. Article 6(a).5 of the Gas Storage Regulation 2022/1032.

5. A Member State may partially meet the filling target by counting the LNG physically stored and available in its LNG facilities if both of the following conditions are met:
(a) the gas system includes significant capacity of LNG storage, accounting annually for more than 4 % of the average national consumption over the preceding five years;
(b) the Member State has imposed an obligation on gas suppliers to store minimum volumes of gas in underground gas storage facilities and/or LNG facilities in accordance with Article 6b(1), point (a).

Source: Regulation 2022/1032.

2.2.6 Article 6(a).10

Table 8 shows article 6(a).10 that points out that the level of the filling trajectory could deviate up to minus 5 percentage points. This margin is not cumulative and it should be respected in every intermediate target. It

(³) <https://agsi.gie.eu/news>.

(⁴) <https://www.rag-energy-storage.at/en/>.

(⁵) "Anexo 2: Detalles de plantas de regasificación," <https://www.enagas.es/content/dam/enagas/es/ficheros/sala-de-comunicacion/publicaciones/informe-sistema-gasista/Informe-sistema-gasista-2021.pdf>

(⁶) <https://www.boe.es/boe/dias/2022/01/27/pdfs/BOE-A-2022-1310.pdf>.

should be emphasised that the filling level of a given Member State could go above the target filling level and this would be desirable to increase the security of gas supply.

Table 8. Article 6(a).10 of the Gas Storage Regulation 2022/1032.

10. The competent authority of each Member State shall continuously monitor compliance with the filling trajectory and shall report regularly to the GCG. If the filling level of a given Member State is more than five percentage points below the level of the filling trajectory, the competent authority shall, without delay, take effective measures to increase it. Member States shall inform the Commission and the GCG of the measures taken.

Source: Regulation 2022/1032.

2.2.7 Article 20

Table 9 shows article 20 specifying that articles 6(a) to 6(d) do not apply to Ireland (IE), Cyprus (CY), and Malta (MT) as long as they are not directly interconnected to the gas interconnected system of any other Member State.

Table 9. Article 20 of the Gas Storage Regulation 2022/1032.

(7) in Article 20, the following paragraph is added:

'4. Articles 6a to 6d shall not apply to Ireland, Cyprus or Malta for as long as they are not directly interconnected to the gas interconnected system of any other Member States.';

Source: Regulation 2022/1032.

2.2.8 Articles 6(c).1 and 6(c).2

Table 10 and Table 11 show article 6(c).1 and last paragraph of article 6(c).2, which are both listed under the section on storage arrangements and burden-sharing mechanism. These articles are addressed to Member States without storage facilities in their territories. Article 6(c).1 refers to the obligation to store gas volumes corresponding to at least 15% of the average annual gas consumption over the preceding five years for those EU countries without gas storage facilities, i.e. Finland (FI), Estonia (EE), Greece (EL), Lithuania (LT), Luxembourg (LU), and Slovenia (SI). The deadline to notify the burden-sharing mechanism was 2 September 2022. Note that Finland may be affected by the second paragraph of article 6(c).1 in order to replace gas by other fuels different from gas. Given the previous deadline, monitoring of filling target levels in August and September for the Member States without UGSs was not possible. However, they are required to store the quantities outlined in the first paragraph of article 6(c).1 by 1 November, i.e. no intermediate target filling levels need to be imposed.

Table 10. Article 6(c).1 of the Gas Storage Regulation 2022/1032.

Storage arrangements and burden-sharing mechanism
<p>1. A Member State without underground gas storage facilities shall ensure that market participants within that Member State have in place arrangements with underground storage system operators or other market participants in Member States with underground gas storage facilities. Those arrangements shall provide for the use, by 1 November, of storage volumes corresponding to at least 15 % of the average annual gas consumption over the preceding five years of the Member State without underground gas storage facilities. However, where cross-border transmission capacity or other technical limitations prevent a Member State without underground gas storage facilities from fully using 15 % of those storage volumes, that Member State shall store only those volumes that are technically possible.</p> <p>In the event that technical limitations do not allow a Member State to comply with the obligation laid down in the first subparagraph, and that Member State has in place an obligation to store other fuels to replace gas, the obligation laid down in the first subparagraph may exceptionally be met by an equivalent obligation to store fuels other than gas. The technical limitations and the equivalence of the measure shall be demonstrated by the Member State concerned.</p>
<p>Source: Regulation 2022/1032.</p>

Table 11. Last paragraph of article 6(c).2 of the Gas Storage Regulation 2022/1032.

Member States shall notify the burden-sharing mechanism to the Commission by 2 September 2022. In the absence of an agreement on a burden sharing mechanism by that date, Member States without underground gas storage facilities shall demonstrate that they comply with paragraph 1 and shall notify the Commission accordingly.

Source: Regulation 2022/1032.

2.2.9 Article 6(c).3

Table 12 provides article 6(c).3 and it states that LNG stocks could be used partially for meeting the storage obligation when the Member State without storage facilities has gas storages included in the last list of projects of common interest (PCI). This may affect Greece, however their maximum LNG stocks in Revithoussa (225000 m³ LNG = 0.13 bcm) (7) are lower than the target filling level, i.e. the 15% of its average consumption amounts to 0.8 bcm.

Table 12. Article 6(c).3 of the Gas Storage Regulation 2022/1032.

3. As a transitional measure, Member States without underground gas storage facilities, but which have underground gas storage facilities included in the last list of projects of common interest referred to in Regulation (EU) 2022/869 of the European Parliament and of the Council (***), may partially comply with paragraph 1 by counting LNG stocks in existing floating storage units, until their underground gas storage facilities are in operation.

Source: Regulation 2022/1032.

2.2.10 Article 6(c).5

Article 6(c).5 is shown in Table 13. This article may affect Estonia (EE) and Lithuania (LT) so they can store what they have used on average in the last five years in the Latvian UGS. However, it is difficult to monitor this article without knowing the pre-specified agreement among countries.

(7) <https://unit-converter.gasunie.nl/>

Table 13. Article 6(c).5 of the Gas Storage Regulation 2022/1032.

<p>5. Notwithstanding paragraph 1, where a Member State has underground gas storage facilities located on its territory and the aggregated capacity of those facilities is larger than the annual gas consumption of that Member State, the Member States without underground gas storage facilities that have access to those facilities shall either:</p> <ul style="list-style-type: none"> (a) ensure that by 1 November storage volumes correspond at least to the average usage of the storage capacity over the preceding five years, determined, <i>inter alia</i>, by taking into account the flows during withdrawal season over the preceding five years from the Member States where the storage facilities are located; or (b) demonstrate that storage capacity equivalent to the volume covered by the obligation under point (a) has been booked. <p>If the Member State without underground gas storage facilities can demonstrate that storage capacity equivalent to the volume covered by the obligation under point (a) of the first subparagraph has been booked, paragraph 1 shall apply.</p> <p>The obligation under this paragraph shall be limited to 15 % of the average annual gas consumption over the preceding five years in the Member State concerned.</p>

Source: Regulation 2022/1032.

2.2.11 Overview of implementation details

Table 14 shows an overview of the implementation details for fulfilling the storage obligations outlined in the new Gas Storage Regulation 2022/1032 to the best of the authors' knowledge. The first column of the table lists the articles of the Regulation, the second column shows the affected countries by those articles, and the third column briefly describes the main content of the articles.

Table 14. Overview of the implementation details in 2022 regarding Regulation 2022/1032.

Article	Affected countries in 2022	Content
Article 6(a).2	HU, LV, SK, AT	35% average annual gas consumption
Article 6(a).3	NL	Third-country exports
Article 6(a).4	CZ, SK, AT, DE	Storage ownership
Article 6(a).5	ES	LNG storages may be added to fulfil targets
Article 6(a).10	ALL MS	5 percentage point margin
Article 20	IE, CY, MT	Derogation
Article 6(c).1	FI, EE, GR, LT, LU, SI	MSs without UGS, burden-sharing 15% average annual gas consumption, alternative fuels
Article 6(c).3	EL	MSs without UGS but with UGS in the PCI list, LNG stocks can be used to fulfil obligations
Article 6(c).5	EE, LT	MSs without UGS but with access to neighbouring UGS to fulfil their obligations

Source: JRC, 2023.

2.3 Storage filling trajectory in 2022

The storage filling trajectory means a series of intermediate targets for the aggregated UGS facilities of each Member State. This series of intermediate storage filling targets is given in Annex Ia of Regulation 2022/1032 for the year 2022. The target on 1 November 2022 is set up at 80% as highlighted in article 6(a).1, while the target for subsequent years must be 90% on 1 November. However, the EU countries with gas storages must submit to the Commission, by 15 September of the previous year, a draft filling trajectory with intermediary targets for February, May, July and September, as outlined in article 6(a).7. This article also states that, based on the technical information provided by each MS and taking into account the assessment of the Gas Coordination Group (GCG), the Commission must adopt implementing acts setting the filling trajectory for each Member State by 15 November of the preceding year. This has already happened for setting the filling

trajectory with intermediary targets for 2023 by means of a Commission Implementing Regulation published on 25 November 2022⁽⁸⁾.

Table 15 shows the 2022 storage filling trajectory with intermediary targets for August, September, October and November. As specified in footnote 1 of Annex Ia of the Regulation and stated previously, the targets are subject to the *pro rata* obligations of each Member State, in particular Articles 6(a).2 and 6(a).3. For those EU countries falling under Article 6(a).2, the *pro rata* intermediate target must be computed as explained in Section 2.2.1.

Table 15. Storage filling trajectory in 2022 according to Regulation 2022/1032.

Member State	1 August intermediate target (%)	1 September intermediate target (%)	1 October intermediate target (%)	1 November target (%)
AT	49	60	70	80
BE	49	62	75	80
BG	49	61	75	80
CZ	60	67	74	80
DE	45	53	80	80
DK	61	68	74	80
ES	71	74	77	80
FR	52	65	72	80
HR	49	60	70	80
HU	51	60	70	80
IT	58	66	73	80
LV	57	65	72	80
NL	54	62	71	80
PL	80	80	80	80
PT	72	75	77	80
RO	46	57	66	80
SE	40	53	67	80
SK	49	60	70	80

Source: Regulation 2022/1032.

2.3.1 Corrected filling targets

The target filling level on 1 November 2022 in Austria, Hungary, Latvia, and Slovakia is modified based on article 6(a).2 since the 35% gas consumption rule avoids a disproportionate impact on those countries with a storage capacity higher than their annual consumption. The corrected target levels on 1 November are shown in Table 16. The intermediate filling targets for August, September, and October are modified by applying a rule of three according to footnote 1 of Annex Ia.

The Netherlands is affected by article 6(a).3 and its *pro rata* intermediate targets must be calculated by multiplying the value indicated in the table of the Regulation by the storage capacity minus 23.2 TWh and dividing the result by the aggregated capacity of the Dutch UGS facilities. For instance, the target level should be equal to $(139 * 0.8 - 23.2) / 139 = 63\%$ on 1 November 2022.

Table 16. Corrected filling targets – Articles 6(a).2 and 6(a).3.

Country code	1 August intermediate target (%)	1 September intermediate target (%)	1 October intermediate target (%)	1 November target (%)
AT	23	28	32	37
HU	38	45	52	60
LV	15	17	18	20
SK	35	42	49	56
NL	43	49	56	63

Source: JRC based on AGSI+ TP and Eurostat.

⁽⁸⁾ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022R2301&qid=1669911511115>

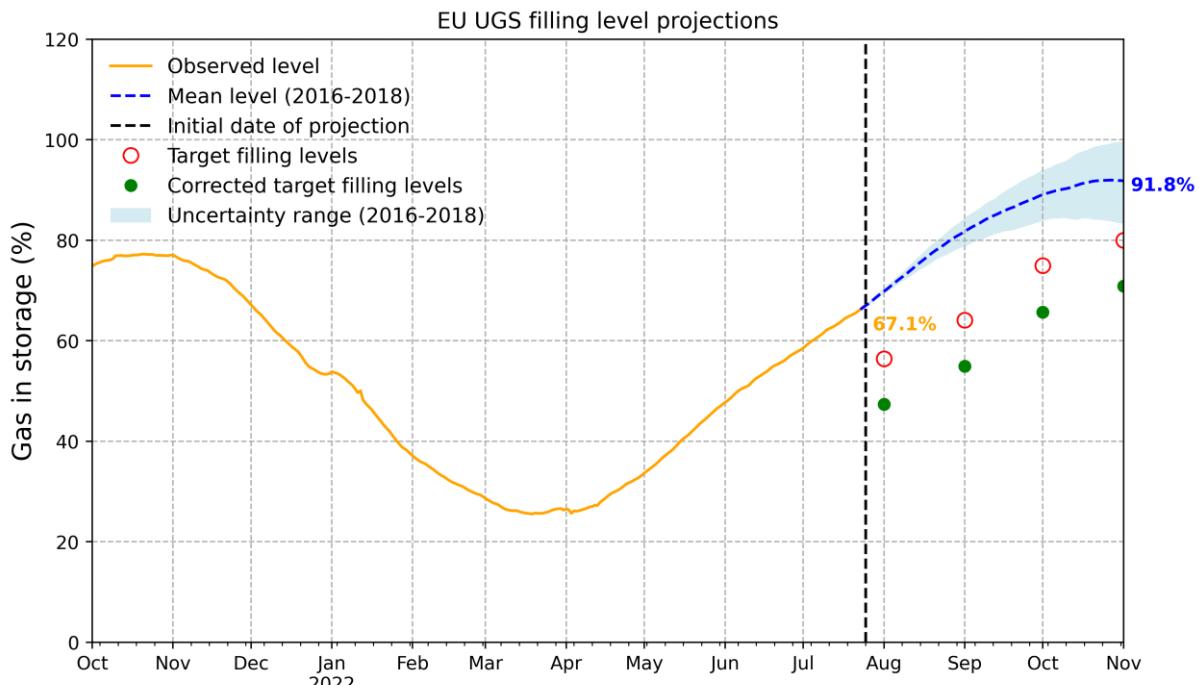
3 Underground gas storage projections

Storage projections become useful tools to determine whether a country may find it difficult to meet the intermediate filling targets outlined in the Gas Storage Regulation (European Commission, 2022c). The projections cannot be derived straightforwardly because we cannot predict the behaviour of market participants. However, we can rely on past information and assume that injections and withdrawals may follow a similar trend that the ones observed in the past. Our assumptions for deriving the storage projections are as follows:

- *Initial date*: 23 July 2022. This is the start of the projected trajectory and the filling level is known.
- *End date*: 1 November 2022. The projection could be extended further in time but we are interested in the comparison with the target filling levels until November 2022.
- We account for the *storage capacity curves for injection and withdrawal*. These curves account for the relationship between the current storage volume and the maximum injection/withdrawal capacity. The higher the volume, the lower the maximum injection rate and the higher the withdrawal rate.
- We assume average, minimum and maximum values of net injections during the *reference years 2016-2018*. Note that years 2019-2021 are characterised by an unusual management of storages due to the preparation in 2019 for the end of Russian gas transit contract with Ukraine in January 2020 and, due to the COVID pandemic in 2020-2021.

Figure 1 is the projection of the storage filling trajectory at EU level. The observed filling level is represented in orange while the blue dashed line shows the average filling level. The blue shadow region represents the uncertainty range of the storage filling level bounded by the minimum and maximum values. Moreover, the intermediate target filling levels as given in the Regulation are shown in red while the green dots correspond to the corrected targets. As can be seen, the projected storage filling levels are well above the corrected targets in the EU. The target filling levels have been modified in AT, SK, HU, LV, and NL, as outlined in the Regulation, and we have not considered the gas in storage that other countries without UGS facilities should store in those countries with UGSs. The estimated average filling level projected at the end of July is 92% on 1 November 2022, subject to the market participant behaviour and geopolitical developments. Eventually, the storage filling level exceeded the projection and reached 95% at EU level on 1 November 2022.

Figure 1. EU UGS filling projection on 23 July 2022 along with the corrected target filling levels.



Source: JRC based on AGSI+ and ENTSOG TP.

Annex 1 contains country-specific storage projections for EU Member States. We can observe that only three countries, namely Bulgaria (BG), Croatia (HR), and Romania (RO) may find difficulties in meeting intermediate targets, especially when starting the heating season around October-November. In Bulgaria, the first two set points are close to the projected average filling level while the last two set points in October and November are close to the maximum projected level. This means that Bulgaria should inject more gas than the quantity injected during the reference period 2016-2018. In Croatia, the first three set points are around projected average values while the target on November is slightly over the average. In Romania, the last set point is also over the projected average filling level. Based on these projections, we can identify which countries deserve a close monitoring of their UGS filling levels.

4 Monitoring target filling levels

4.1 Monitoring tools

To monitor the target filling level on a daily basis, we have used a table and a figure which are created by using data from AGSI+ TP (GIE, 2022a).

The table is a snapshot of the situation for a given day for all EU Member States with UGS facilities (see Table 17 as an example). The columns are described as follows:

- *First column*: country code for MSs with UGSs.
- *Second column*: gas in storage level in bcm.
- *Third column*: storage filling level in percentage
- *Fourth column*: target gas in storage level in bcm computed with the target filling level provided in the Regulation 2022/1032.
- *Fifth column*: target filling level in percentage as reported in the Regulation 2022/1032.
- *Last column*: it provides a string to point out whether the MS is on track with the target filling level. There are three options for all intermediate targets: (i) Yes if the third column is greater than or equal to the fifth column minus five percentage points, (ii) *To monitor* if the previous condition does not hold and the date is lower than the target date, and (iii) *No* if previous condition does not hold and target date has passed. If the target on 1 November were evaluated, the string would become Yes if and only if the third column is greater than or equal to the fifth column, i.e. the margin is only applicable to the filling trajectory.

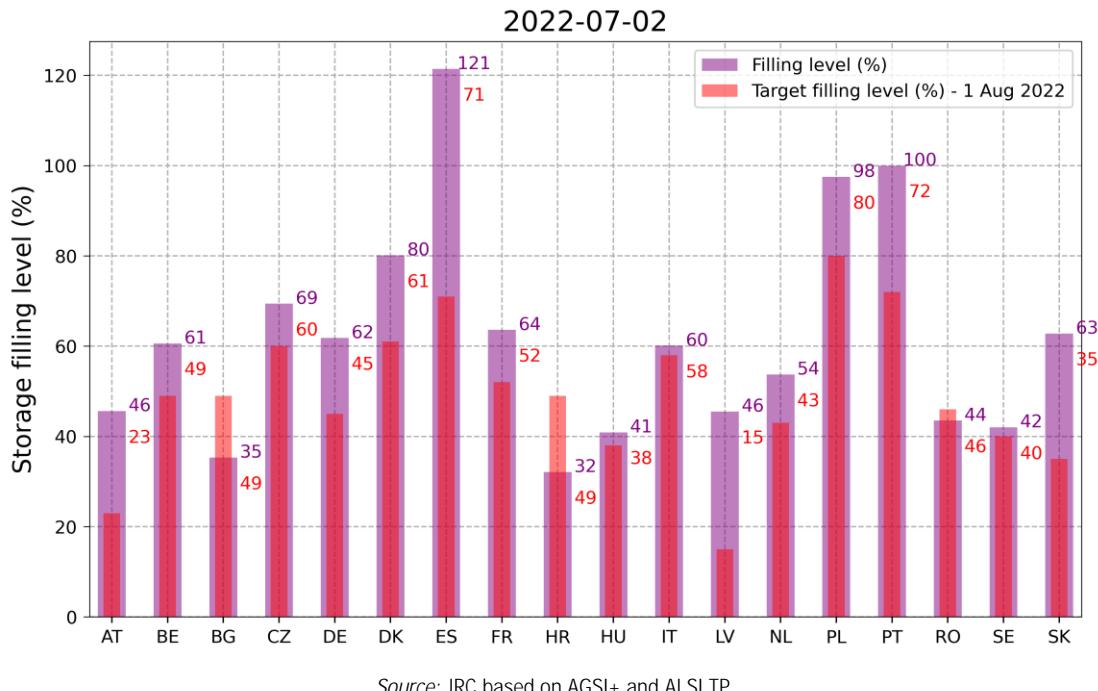
The figure is a vertical bar plot with two data arrays to reflect the storage situation in all MSs with UGSs in a given day. An example is given in Figure 2. The first array is the target filling level, which is shown in purple bars, while the second array represents the storage filling level, which is shown in red bars. In addition, the numerical values for both arrays are provided next to the bars in the corresponding colour codes.

4.2 Filling target on 1 August 2022

Figure 2 shows the bar plot on 2 July 2022 in order to monitor the first intermediate filling target provided in the Gas Storage Regulation. The targets in Austria, Hungary, Latvia, Slovakia, and the Netherlands have been modified as per articles 6(a).2 and 6(a).3. In addition, the filling level in Spain is computed as the gas stored in both UGS and LNG tanks divided by the UGS capacity. For this reason, values of the filling levels are higher than 100% for Spain. Surprisingly all countries except Bulgaria and Croatia were on track on 2 July 2022 according to the Regulation. Both of them must fill their storages up to 49% of their corresponding storage capacities and the filling level on 2 July 2022 was 35% and 32% in Bulgaria and Croatia, respectively. The fulfilment of the first intermediate target for most of the MSs with UGSs may rely on two aspects. On the one hand, the storage Regulation announcement at the beginning of March and the subsequent political agreement around mid-May has triggered awareness to fill storages on time according to the target levels pre-defined in the Regulation. Moreover, the mandatory certification scheme for gas storages and the possibility of relying on the “use-it-or-lose-it” clause have resulted in an increase of injections of storages previously owned or operated by the company Gazprom (⁽⁹⁾). On the other hand, the EU storage trajectory follows the 6-year average filling trajectory (2016-2021) since June 2022. Three countries (Denmark, Poland and Portugal) had already their storages filled up above 80%, which is the target to be reached at the end of the heating season.

⁽⁹⁾ <https://www.energymonitor.ai/tech/energy-storage/weekly-data-european-gas-storage-is-filled-to-67/>
<https://www.reuters.com/business/energy/austria-starts-eject-gazprom-gas-storage-facility-2022-07-06/>

Figure 2. Monitoring bar plot on 2 July 2022.



Source: JRC based on AGSI+ and ALSI TP.

Table 17 and Figure 3 show respectively the monitoring table and bar plot on 1 August 2022. All countries are on track, however the filling level in Bulgaria is still below the GIS level (-0.7 percentage points). Storage filling level in the EU is at 69.7%, which is around 11 p.p. higher than the one on 2 July 2022. In relative terms, the highest increase is observed in Croatia (21.5 p.p.) after Sweden (almost 50 p.p.). The storage capacity in Sweden is negligible compared to other storages in the EU and the one in Croatia is around 0.43 bcm. In absolute terms, storages in Italy were filled with 2.3 bcm of natural gas, around one fifth of the total gas stored during July in the EU. Almost one fifth of the total gas stored is assigned to the French storages. The Netherlands and Germany has stored around 1.6 bcm during July (each 15% of the total gas stored in this period). Therefore, the remaining 30% is distributed among the rest of the EU MSs with UGS.

Spain is the only MS that could benefit from article 6(a).5 and accounts for the LNG stocks in order to fulfil the filling target. For the first control point, this is not needed because the UGS stocks are over the corresponding target of 2.3 bcm. The aggregated LNG volume reached $2393.6 \cdot 10^3$ m³ LNG on 1 August 2022 in the Spanish LNG regasification terminals, which is approximately 16 TWh ⁽¹⁰⁾. The resulting filling level is $(27.5 \text{ TWh in UGS} + 16 \text{ TWh in LNG storage}) \times 100 / (35.25 \text{ TWh of UGS capacity}) = 123\%$.

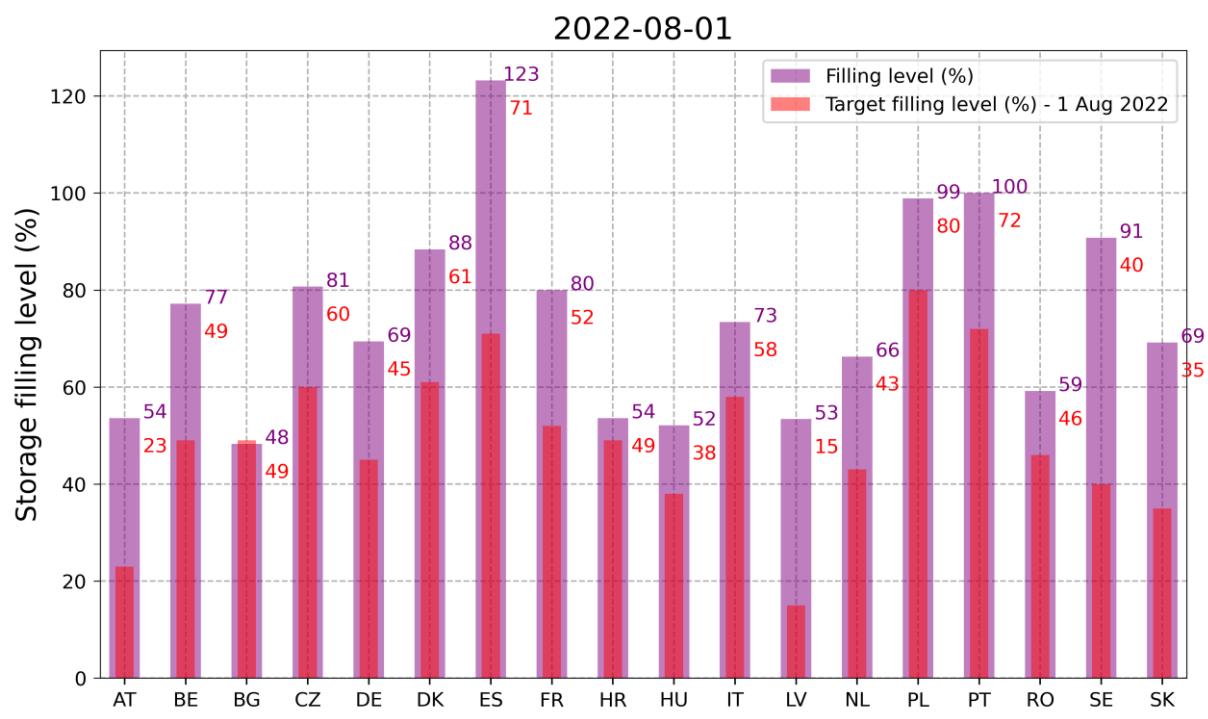
⁽¹⁰⁾ Conversion factors: 570 Nm³/m³ LNG and 11.7 kWh/Nm³ (<https://transparency.entsoe.eu/#/points/data?from=2021-11-01&indicators=GCV&points=es-tso-0003lng-00023exit%2Ces-tso-0006lng-00023entry%2Ces-tso-0006lng-00012entry%2Ces-tso-0005lng-00013exit%2Ces-tso-0006lng-00013entry%2Ces-tso-00021ng-00021exit%2Ces-tso-0009lng-00021entry>).

Table 17. Monitoring table on 1 August 2022.

Country code	GIS (bcm)	Filling level (%)	Target GIS (bcm) - 1 Aug 2022	Target filling level (%) - 1 Aug 2022	On track
AT	4.7	53.6	2.0	23	Yes
BE	0.6	77.2	0.4	49	Yes
BG	0.3	48.3	0.3	49	Yes
CZ	2.7	80.7	2.0	60	Yes
DE	15.3	69.4	9.9	45	Yes
DK	0.7	88.4	0.5	61	Yes
ES	2.5 / 3.9	78.0 / 123.2	2.3	71	Yes
FR	9.6	80.0	6.2	52	Yes
HR	0.2	53.6	0.2	49	Yes
HU	3.2	52.1	2.3	38	Yes
IT	12.9	73.4	10.2	58	Yes
LV	1.1	53.4	0.3	15	Yes
NL	8.5	66.3	5.5	43	Yes
PL	3.3	98.9	2.6	80	Yes
PT	0.3	100.0	0.2	72	Yes
RO	1.8	59.2	1.4	46	Yes
SE	0.0	90.8	0.0	40	Yes
SK	2.7	69.2	1.4	35	Yes

Source: JRC based on AGSI+ and ALSI TP.

Figure 3. Monitoring bar plot on 1 August 2022.

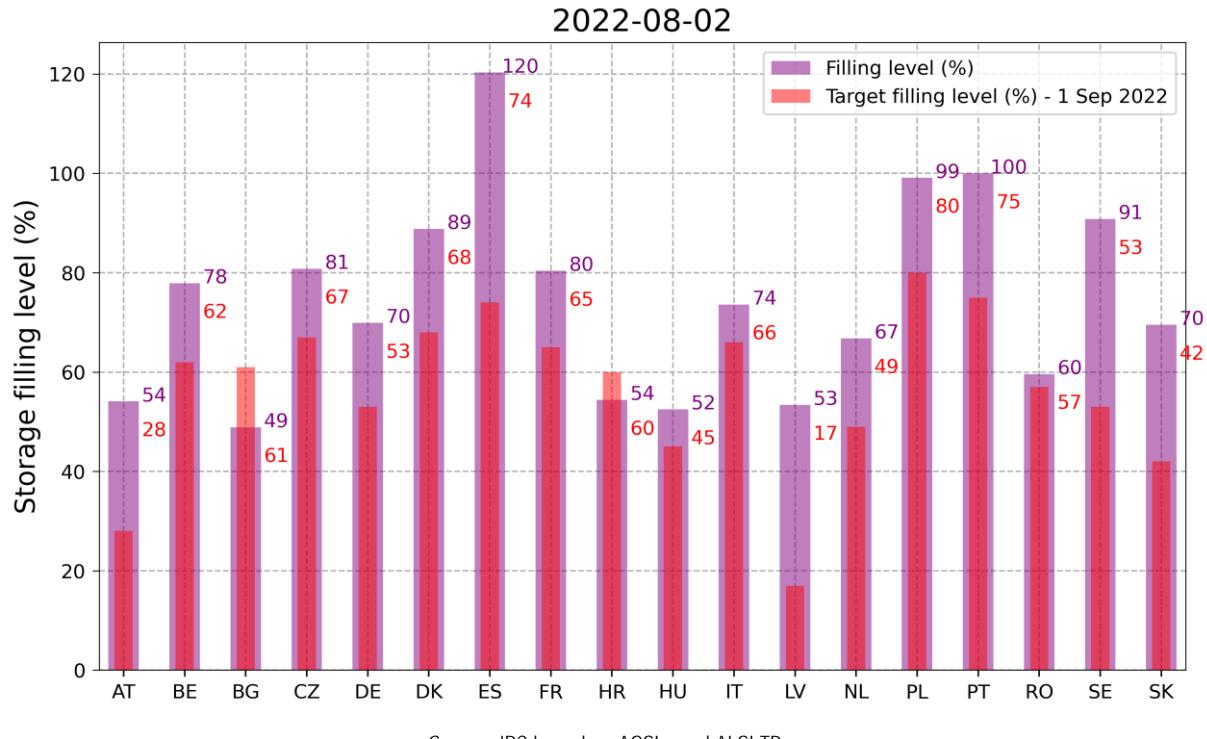


Source: JRC based on AGSI+ and ALSI TP.

4.3 Filling target on 1 September 2022

Figure 4 shows the bar plot on 2 August 2022 which is the first day monitoring the second intermediate filling target as provided in the Gas Storage Regulation. As done previously, the targets in Austria, Hungary, Latvia, Slovakia, and the Netherlands, have been modified as per articles 6(a).2 and 6(a).3. We can observe that all MSs with UGSs except Bulgaria and Croatia satisfy the new target in September.

Figure 4. Monitoring bar plot on 2 August 2022.



Source: JRC based on AGSI+ and ALSI TP.

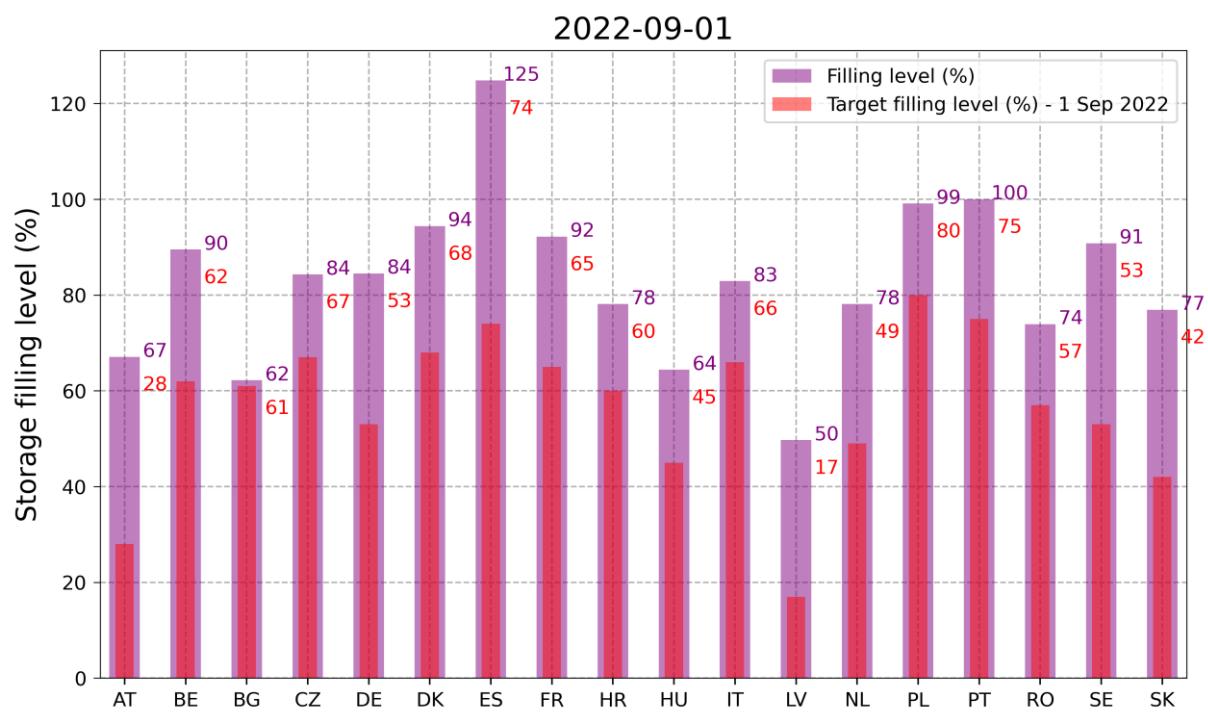
Table 18 and Figure 5 show respectively the monitoring table and bar plot on 1 September 2022. All countries are on track with the new Gas Storage Regulation. The EU reached the 80% storage filling level, which is the minimum target indicated in the Regulation for the year 2022. Specifically, the EU storage filling level was 81.7%, i.e. around 11.1 p.p. higher than the one on 1 August 2022 (+11.3 bcm). In relative terms, the highest increase is identified in Croatia (24.5 p.p.) followed by Germany (15.1 p.p.). It should be noted that Latvia has a decrease in relative terms with respect to the filling level in August because there was an increase of its storage capacity from 21.8 TWh to 24.1 TWh. In absolute terms, Germany was the MS storing more gas during August, i.e. storages were filled with 3.5 bcm, which represents almost one third of the monthly net injection. UGSs in Italy, the Netherlands and France experienced an increase of 1.7, 1.4, and 1.4 bcm, respectively, covering together 40% of the total gas stored in August. The remaining 30% is distributed among the rest of the EU MSs with UGS (10% allocated to Austria).

Table 18. Monitoring table on 1 September 2022.

Country code	GIS (bcm)	Filling level (%)	Target GIS (bcm) - 1 Sept 2022	Target filling level (%) - 1 Sept 2022	On track
AT	5.8	67.1	2.4	28	Yes
BE	0.7	89.5	0.5	62	Yes
BG	0.3	62.2	0.3	61	Yes
CZ	2.8	84.3	2.2	67	Yes
DE	18.8	84.5	11.8	53	Yes
DK	0.8	94.4	0.6	68	Yes
ES	2.7 / 4.0	84.9 / 124.8	2.4	74	Yes
FR	11.0	92.2	7.8	65	Yes
HR	0.3	78.1	0.3	60	Yes
HU	4.0	64.4	2.8	45	Yes
IT	14.6	82.9	11.6	66	Yes
LV	1.1	49.7	0.4	17	Yes
NL	9.9	78.1	6.2	49	Yes
PL	3.3	99.1	2.6	80	Yes
PT	0.4	100.0	0.2	75	Yes
RO	2.2	73.9	1.7	57	Yes
SE	0.0	90.8	0.0	53	Yes
SK	3.0	76.9	1.6	42	Yes

Source: JRC based on AGSI+ and ALSI TP.

Figure 5. Monitoring bar plot on 1 September 2022.

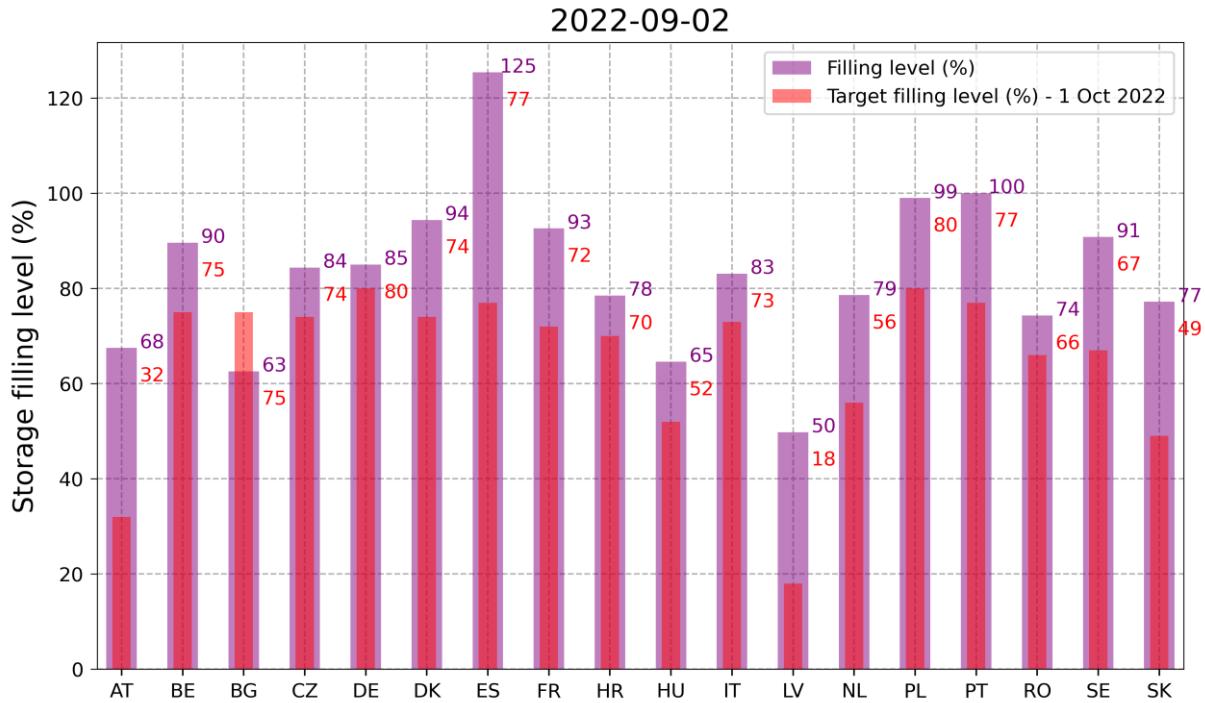


Source: JRC based on AGSI+ and ALSI TP.

4.4 Filling target on 1 October 2022

As similarly done in the previous sections, Figure 6 represents the bar plot on 2 September 2022 which is the first day monitoring the third intermediate filling target as provided in the Gas Storage Regulation. Once again, all EU Member States with UGS facilities except Bulgaria complied with the new targets in October.

Figure 6. Monitoring bar plot on 2 September 2022.



Source: JRC based on AGSI+ and ALSI TP.

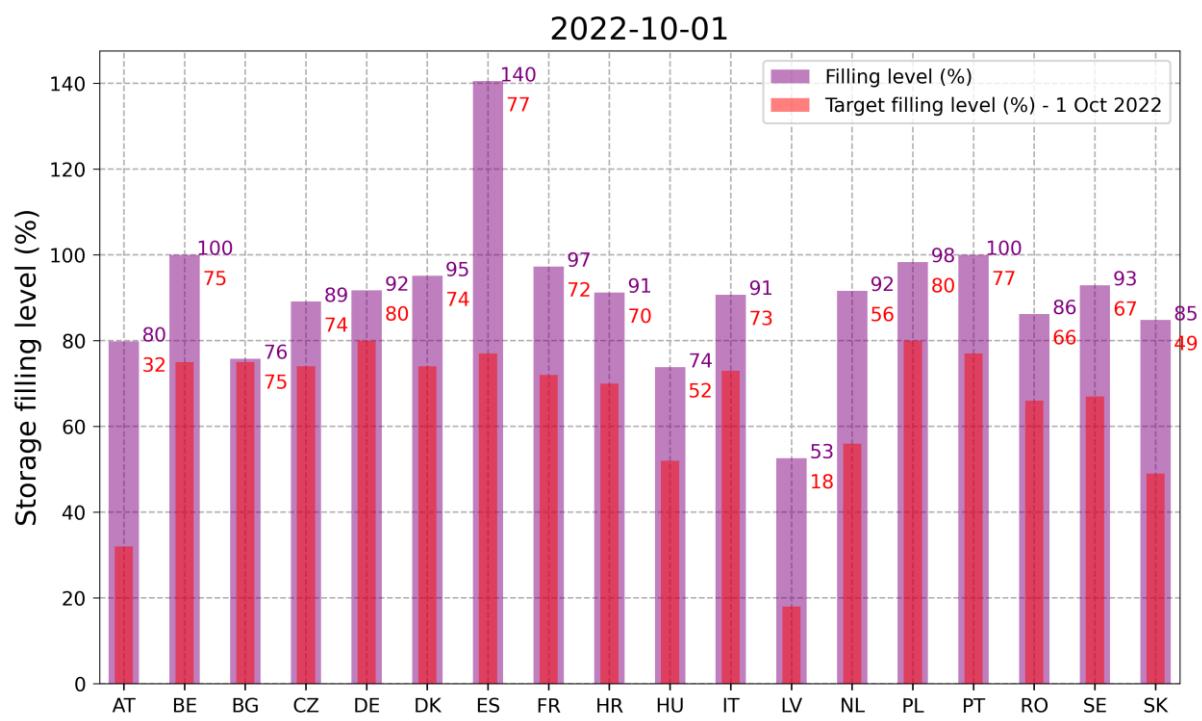
On 1 October 2022, all countries were on track with the new Gas Storage Regulation, as can be seen in Table 19 and Figure 7. The EU UGSs reached almost the symbolic 90% target and are filled up to 90 bcm. This is translated into an increase of 8.2 p.p. with respect to the one attained on 1 August 2022 (+8.2 bcm), i.e. storages were filled up at a slower pace than in July and August. The storage filling levels in Bulgaria, the Netherlands, and Croatia have increased respectively by 13.6, 13.5, and 13.1 p.p. with respect to the ones observed on 1 September 2022. The remaining countries have experienced increments lower than 12 p.p. In absolute terms, the UGSs in Germany and the Netherlands have injected 41% of the total gas stored during September in the EU (+1.7 bcm each). This is followed by Italy and Austria with a total net injection of 1.4 and 1.1 bcm in their UGSs, respectively, which represent 30% of the total net injection in the EU. The remaining 30% is distributed among the rest of the EU MSs with UGS (8.4% allocated to France).

Table 19. Monitoring table on 1 October 2022.

Country code	GIS (bcm)	Filling level (%)	Target GIS (bcm) - 1 Oct 2022	Target filling level (%) - 1 Oct 2022	On track
AT	6.9	79.8	2.8	32	Yes
BE	0.7	100.0	0.6	75	Yes
BG	0.4	75.8	0.4	75	Yes
CZ	3.0	89.1	2.5	74	Yes
DE	20.5	91.7	17.9	80	Yes
DK	0.8	95.1	0.6	74	Yes
ES	2.9 / 4.5	90.2 / 140.5	2.5	77	Yes
FR	11.7	97.3	8.7	72	Yes
HR	0.4	91.2	0.3	70	Yes
HU	4.5	73.8	3.2	52	Yes
IT	16	90.7	12.8	73	Yes
LV	1.2	52.6	0.4	18	Yes
NL	11.6	91.6	7.1	56	Yes
PL	3.3	98.3	2.6	80	Yes
PT	0.4	100.0	0.3	77	Yes
RO	2.6	86.2	2.0	66	Yes
SE	0.0	92.9	0.0	67	Yes
SK	3.2	84.8	1.9	49	Yes

Source: JRC based on AGSI+ and ALSI TP.

Figure 7. Monitoring bar plot on 1 October 2022.

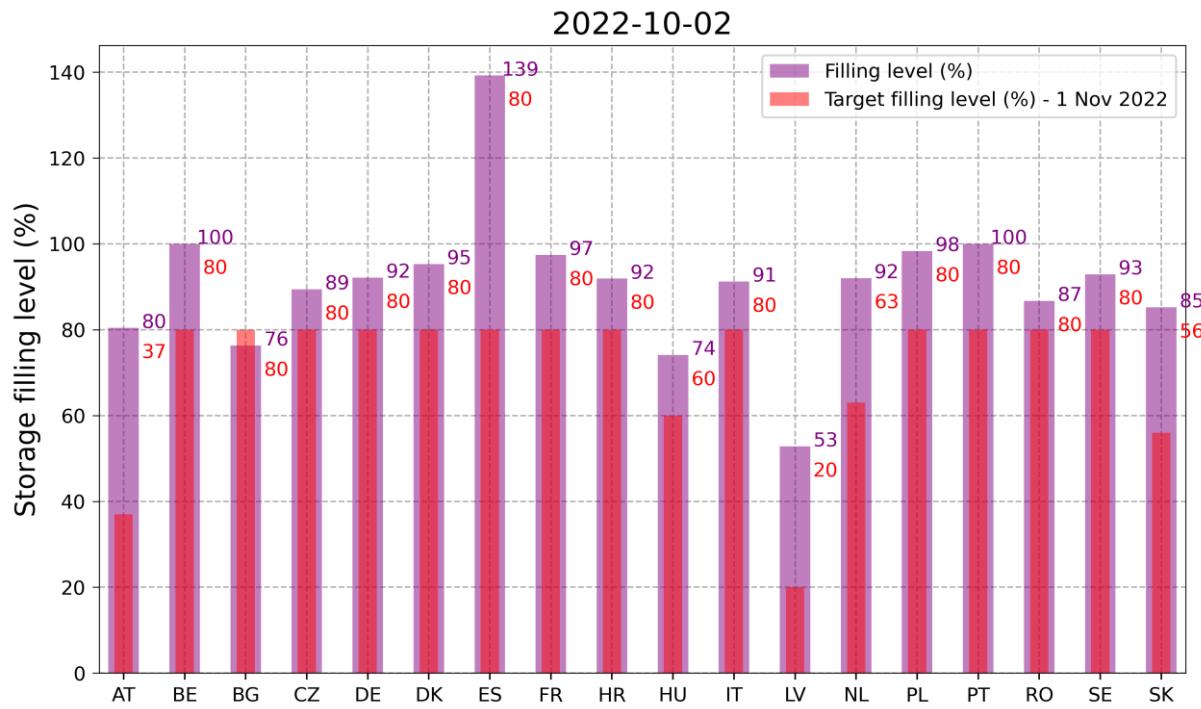


Source: JRC based on AGSI+ and ALSI TP.

4.5 Filling target on 1 November 2022

Figure 8 shows the bar plot on 2 October 2022 which is the first day monitoring the last filling target of the Gas Storage Regulation. As happened before, all EU Member States with UGS facilities except Bulgaria complied with the new targets in November. In this last point, the filling target must be fulfilled strictly, i.e. the margin of 5 percentage points is no longer applicable. As can be seen, Bulgaria was just 4 p.p. behind its corresponding target.

Figure 8. Monitoring bar plot on 2 October 2022.



Source: JRC based on AGSI+ and ALSI TP.

As expected, all EU countries with UGSs were on track with the new Gas Storage Regulation on 1 November 2022 (see Figure 20 and Figure 9). The EU UGSs attained a storage filling level of 95% (i.e. around 96 bcm), similar to the gas stored in 2020 and just slightly below the one observed in 2019. The relative change with respect to the EU filling level on 1 October amounts to 6 p.p. (+6.3 bcm), which is much lower than in previous months. Lower net injections have been observed due to several reasons: (i) most of the countries with UGSs have reached filling levels beyond 90% and their injection capacity curves may have affected the injection speed, (ii) in some countries, the heating season starts on 1 October, although Europe had its warmest October in the record, with temperatures nearly 2°C above the 1991-2020 reference period, as indicated by Copernicus Climate Change Service ⁽¹¹⁾, and (iii) lack of political incentives to reach 100% at EU level.

During October 2022, the higher relative changes are observed in Bulgaria (+14.6 p.p.), Austria (+13.3 p.p.), Hungary (+11.9 p.p.), and Romania (+10.6 p.p.). Positive relative changes below 10 p.p. are spotted in the remaining EU countries with UGSs. In absolute terms, the net injection in German UGSs is still the highest of all EU MSs with 1.6 bcm (i.e. around one fourth of the total injection in the EU). This is closely followed by Austria with 1.2 bcm (19% of the total gas stored in EU UGSs). Another one fourth of the total gas injected in EU UGSs is evenly distributed between Italy and Hungary. The remaining 30% of the total net injection in the EU can be attributed to the rest of the EU MSs with UGS.

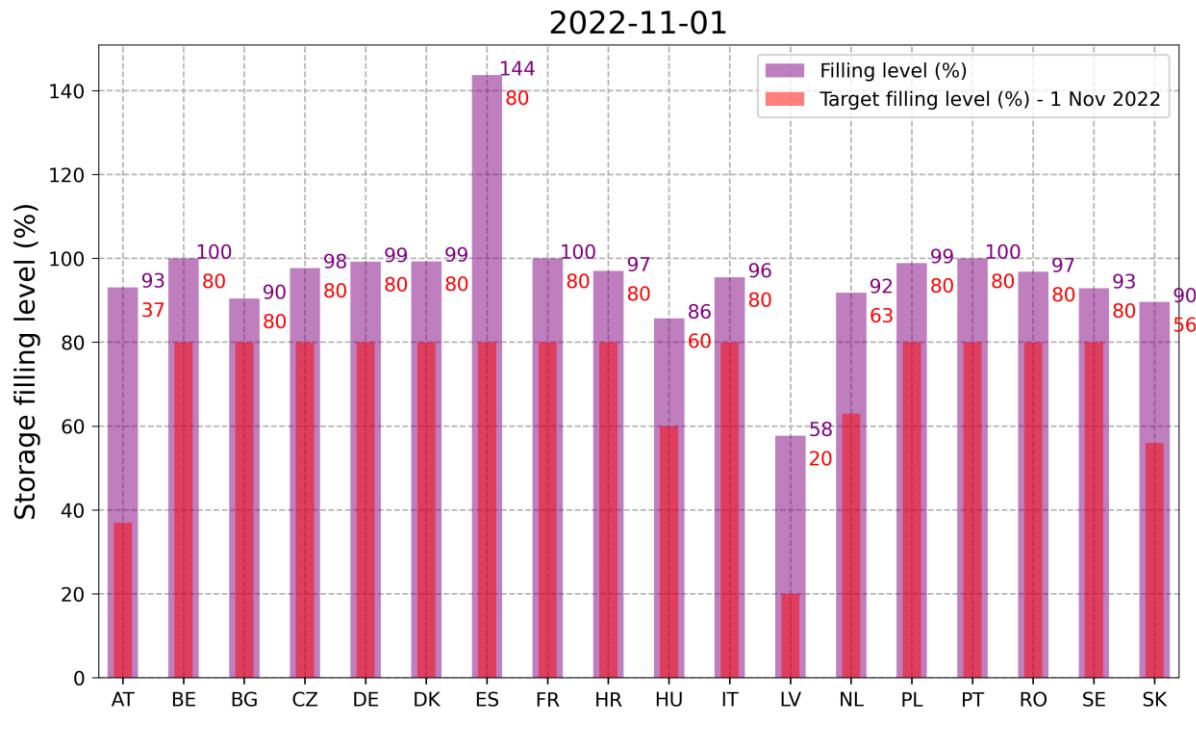
⁽¹¹⁾ <https://climate.copernicus.eu/copernicus-europe-experiences-warmest-october-record>.

Table 20. Monitoring table on 1 November 2022.

Country code	GIS (bcm)	Filling level (%)	Target GIS (bcm) - 1 Nov 2022	Target filling level (%) - 1 Nov 2022	On track
AT	8.1	93.1	3.2	37	Yes
BE	0.8	100.0	0.6	80	Yes
BG	0.5	90.4	0.4	80	Yes
CZ	3.3	97.7	2.7	80	Yes
DE	22.1	99.2	17.8	80	Yes
DK	0.8	99.3	0.7	80	Yes
ES	3.0 / 4.6	94.8 / 143.7	2.6	80	Yes
FR	12.1	100.0	9.6	80	Yes
HR	0.4	97.0	0.3	80	Yes
HU	5.3	85.7	3.7	60	Yes
IT	16.8	95.5	14.1	80	Yes
LV	1.3	57.7	0.4	20	Yes
NL	11.6	91.8	8	63	Yes
PL	3.3	98.9	2.6	80	Yes
PT	0.4	100	0.3	80	Yes
RO	2.9	96.8	2.4	80	Yes
SE	0.0	92.9	0.0	80	Yes
SK	3.7	89.6	2.3	56	Yes

Source: JRC based on AGSI+ and ALSI TP.

Figure 9. Monitoring bar plot on 1 November 2022.



Source: JRC based on AGSI+ and ALSI TP.

4.6 Historical overview

In this section, we compare the net injections during the gas summer (see Table 21) and the gas in storage level on 1 November for the last 7 years (see Table 22). We have chosen a seven-year period because the EU storage capacity has barely changed since 2016 and it remains around 100 bcm approximately.

Table 21 represents the EU net injections for each month of the gas summer and for each year since 2016. An extended gas summer has been considered to cover the month of October because the heating season starts later in some countries, although this may vary from year to year. The last column of this table reports the total net injection (i.e. the gas stored during summer) from 1 April until 31 October in the EU. The first important remark is that the EU net injections in 2022, which amount to 69.4 bcm, have been the highest on record, not only out of the last 7 years but since the beginning of the reporting in AGSI+ Transparency Platform (GIE, 2022a). This amount of gas is just slightly greater than the former historical maximum observed in 2018 (68.8 bcm). Looking at the disaggregated monthly net injections, it is remarkable the maximum gas stored in May and October compared to previous years. However, the quantities stored during the remaining periods (April, June, July, August, September) are within historical ranges.

Table 21. Net injections (bcm) in EU underground gas storages by month and year during an extended gas summer. The colour code of the months is independent from the one used for the total net injections of the last column.

Year	April	May	June	July	August	September	October	Total
2016	3.3	10.6	11.1	13.2	10.2	6.4	0.4	55.0
2017	4.4	9.5	10.5	12.7	13.6	7.6	4.7	63.0
2018	7.3	12.2	11.6	11.8	12.5	8.9	4.5	68.8
2019	7.6	11.1	13.1	10.1	9.4	4.8	1.3	57.5
2020	8.4	10.4	8.0	5.4	6.4	3.9	0.0	42.6
2021	-0.1	8.0	10.0	9.4	10.5	7.0	1.8	46.7
2022	6.7	13.9	11.1	11.3	11.5	8.4	6.5	69.4

Source: JRC based on AGSI+ TP.

Table 22 shows the storage filling levels on 1 November for all MSs with UGSs and for years spanning from 2016 until 2022. The last row of this table contains the aggregated filling level in the EU. As mentioned previously, the filling level on 1 November, i.e. 95%, is one of the highest of the last 7 years, similar to the one attained in 2020 and just behind the level achieved in 2019 (i.e. 97.3%). It should be noted that 16 MSs have reached filling levels above 90% of their corresponding capacities in 2022. However, 17 MSs went over this threshold in 2019 and 2020. These years were characterised by high storage levels at the beginning of the heating season. Nevertheless, country-specific storage filling levels have been improved with respect to the filling levels observed in 2021, except for Latvia (although it still complies with the new Gas Storage Regulation).

Table 22. Storage filling level (%) on 1 November by Member State and years 2016-2022.

Country	2016	2017	2018	2019	2020	2021	2022
AT	87.5	88.0	76.3	99.4	90.6	56.1	93.1
BE	85.2	83.2	54.1	96.8	97.6	92.5	100.0
BG	81.0	80.3	84.1	99.1	94.8	74.6	90.4
HR	89.6	94.3	92.3	98.1	94.0	81.9	97.0
CZ	98.1	97.4	92.0	97.5	96.7	86.3	94.9
DK	98.2	96.1	92.7	97.3	98.4	81.9	99.3
FR	91.1	74.8	93.1	98.5	100.0	94.6	100.0
DE	94.8	94.1	87.9	99.2	94.4	72.3	99.2
HU	54.5	73.1	70.5	97.7	97.1	76.5	85.7
IT	99.0	97.8	97.5	98.9	98.8	87.6	95.5
LV	59.3	61.7	54.6	73.9	98.0	78.5	57.7
NL	95.5	96.2	96.2	95.2	86.7	61.6	91.8
PL	98.6	98.3	96.5	99.5	97.2	96.6	98.9
PT	53.8	72.5	67.8	100.0	92.9	68.2	100.0
RO	75.9	70.2	71.5	95.8	93.0	74.4	96.8
SE	-	7.3	7.3	96.3	94.7	66.4	92.9
SK	94.2	91.8	65.4	94.5	92.9	70.8	91.3
ES	69.5	79.1	74.9	94.1	94.8	82.6	94.8
EU	90.0	88.8	86.8	97.3	95.0	77.0	94.9

Source: JRC based on AGSI+ TP.

5 Conclusions

This report is focused on the new Gas Storage Regulation (EU) 2022/1032, which was published on 30 June 2022. This Regulation sets out a number of measures to enhance the security of supply of the European Union (EU). Among these measures, the Regulation establishes a minimum storage obligation of 80% in 2022 at the beginning of the heating season (1 November) and 90% in 2023. In addition, a storage filling trajectory composed of three intermediate filling targets is imposed for each Member State with underground gas storages. This report briefly describes the storage projections made at the end of July 2022 to identify the countries that may fail to comply with the Regulation. Moreover, the report analyses the monitoring of the storage situation in the EU for each of the four targets pointed out there.

The main conclusions regarding the analysis of the storage situation are as follows:

- All EU Member States with underground gas storage facilities have fulfilled the intermediate storage targets on time and even above the required filling target, thus complying with the Regulation. The reasons behind the fulfilment of the minimum storage obligations in the first intermediate target (1 August) may rely on (i) the awareness triggered by the storage Regulation announcement in early March, and (ii) the mandatory certification scheme for gas storages.
- In general, the targets imposed by the Regulation seem to be very loose for all Member States except for Bulgaria and Croatia, when looking at the compliance of the intermediate targets one month in advance. In addition, the monthly net injections in the EU are within historical ranges for all months of the gas summer except for May and October.
- Spain is the only EU country affected by Article 6(a).5 by which the gas stored in liquefied natural gas tanks may count towards the fulfilment of the filling trajectory. Based on the data from AGSI+ Transparency Platform, Spain does not need to rely on such an article because it already complies with the Regulation when only looking at the gas storage data.

Some concluding remarks must be also highlighted regarding the barriers to monitor adequately:

- There is a lack of public information about the pre-specified agreements among countries without storage facilities with storage system operators in other Member States.
- There is a lack of public information about storage ownership and therefore the monitoring cannot be performed precisely according to the Regulation without the reporting from EU countries.

All in all, the AGSI+ and ALSI Transparency Platforms have been proved useful tools to perform this monitoring on a real-time basis.

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List of abbreviations and definitions

ACER	Agency for the Cooperation of Energy Regulators.
AGSI	Aggregated gas storage inventory.
AT	Austria.
BE	Belgium.
BG	Bulgaria.
CY	Cyprus.
CZ	Czech Republic.
DE	Germany.
DK	Denmark.
EC	European Commission.
EE	Estonia.
EL	Greece.
ENTSOG	European Network of Transmission System Operators for Gas.
ES	Spain.
EU	European Union.
FI	Finland.
FR	France.
GCG	Gas Coordination Group.
GCV	Gross Calorific Value.
GIE	Gas Infrastructure Europe.
GIS	Gas in storage.
HR	Croatia.
HU	Hungary.
IE	Ireland.
IT	Italy.
JRC	Joint Research Centre.
LNG	Liquefied natural gas.
LT	Lithuania.
LU	Luxembourg.
LV	Latvia.
MS	Member State.
MT	Malta.
NL	Netherlands.
PT	Portugal.
PL	Poland.
RO	Romania.
SE	Sweden.
SI	Slovenia.

SK	Slovakia.
SSO	Storage System Operator.
TP	Transparency Platform.
UGS	Underground Gas Storage.
UK	United Kingdom.

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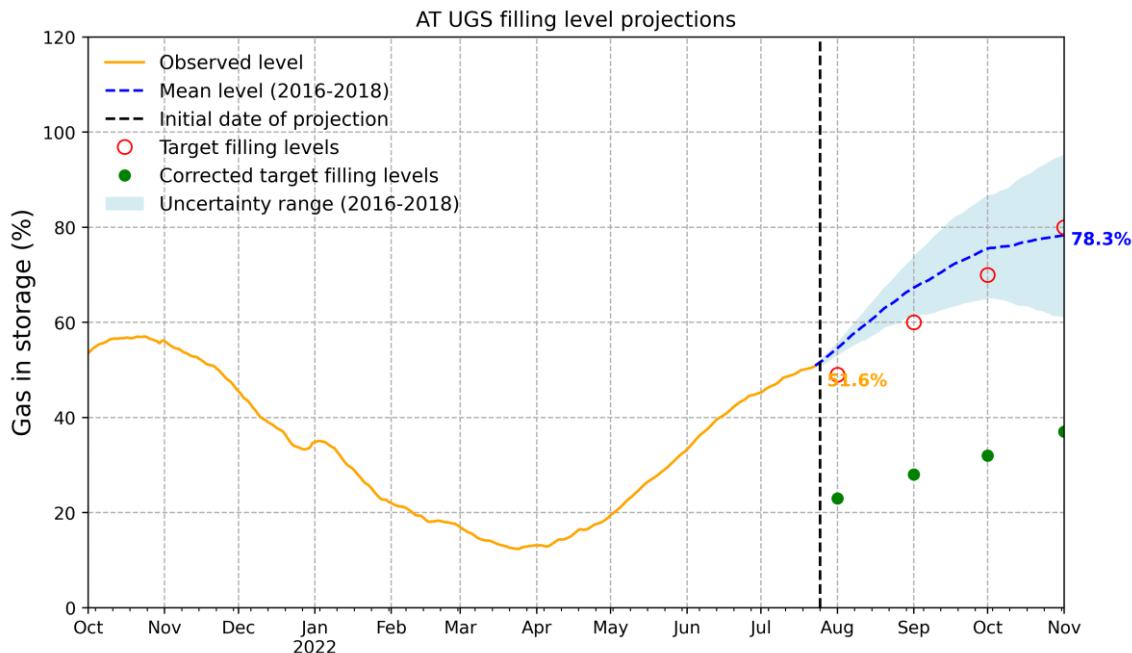
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Annexes

Annex 1. Storage projections – 23 July 2022

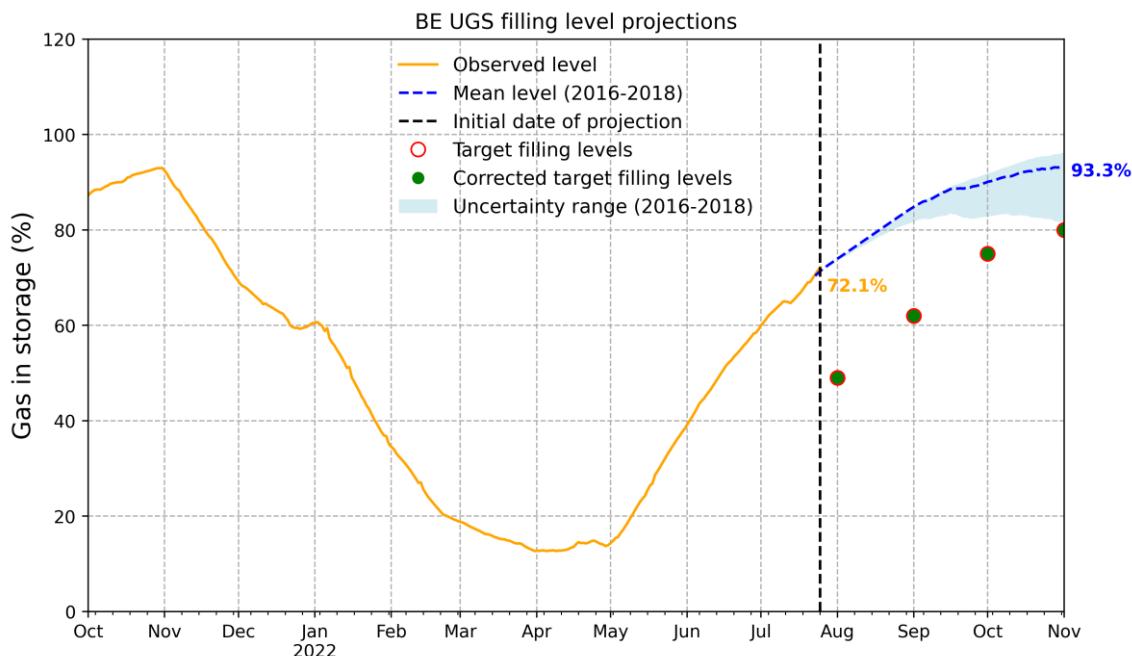
This annex includes the projections of filling trajectories by Member State made on 23 July 2022 with past information about injections and withdrawals. The projection spans from the date the projection was performed to 1 November 2022.

Figure 10. UGS filling projection on 23 July 2022 - Austria.



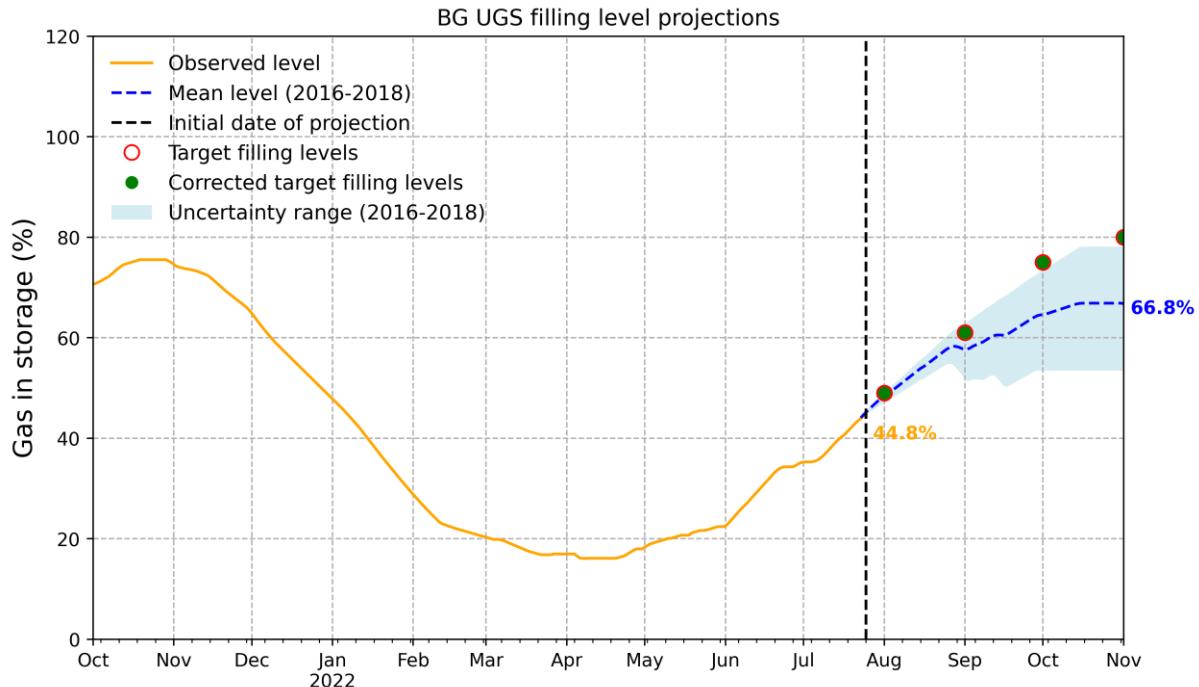
Source: JRC based on AGSI+ Transparency Platform.

Figure 11. UGS filling projection on 23 July 2022 - Belgium.



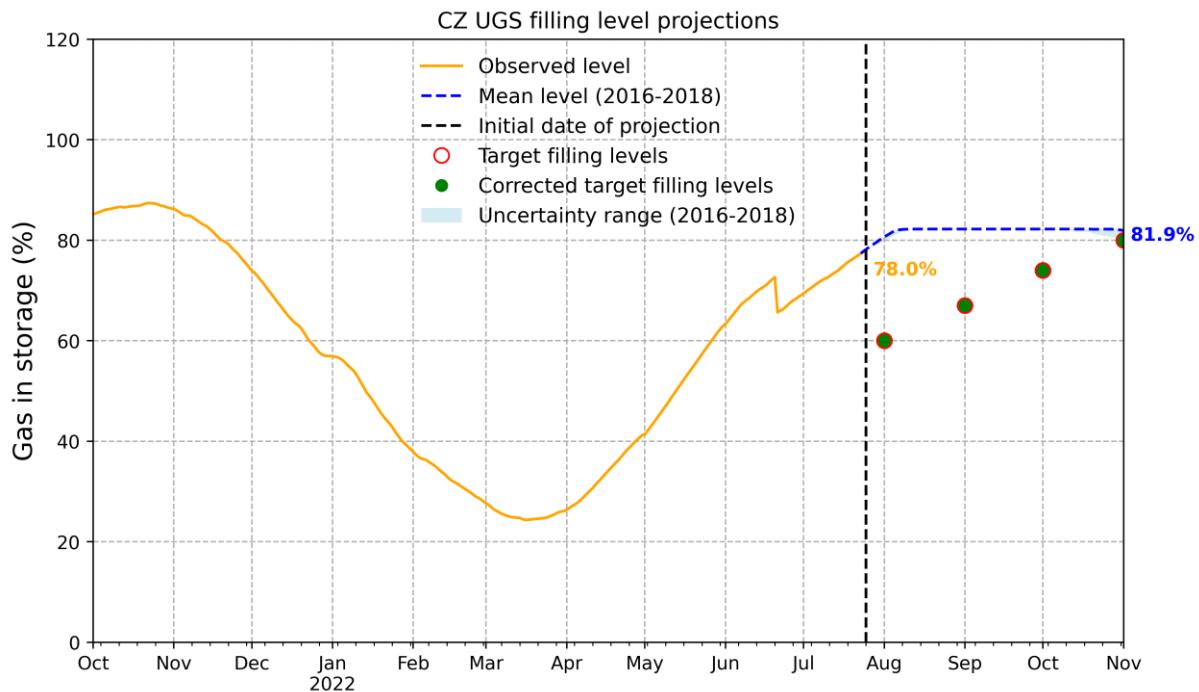
Source: JRC based on AGSI+ Transparency Platform.

Figure 12. UGS filling projection on 23 July 2022 - Bulgaria.



Source: JRC based on AGSI+ Transparency Platform.

Figure 13. UGS filling projection on 23 July 2022 - Czechia.



Source: JRC based on AGSI+ Transparency Platform.

Figure 14. UGS filling projection on 23 July 2022 - Germany.

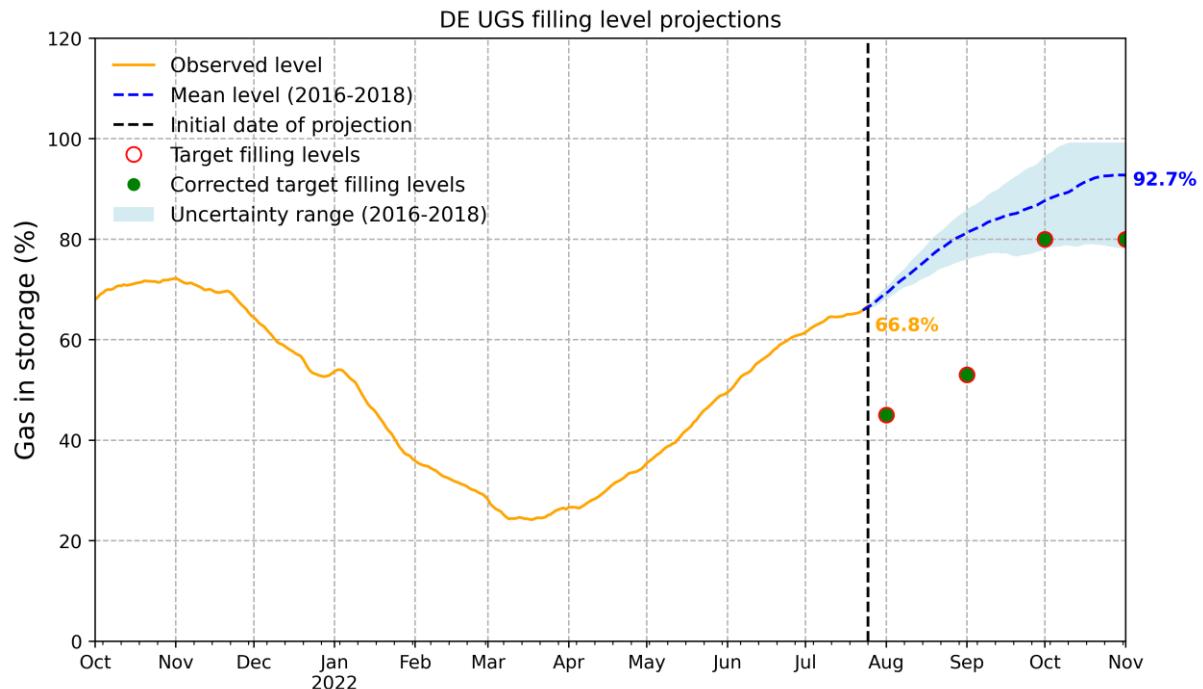


Figure 15. UGS filling projection on 23 July 2022 - Denmark.

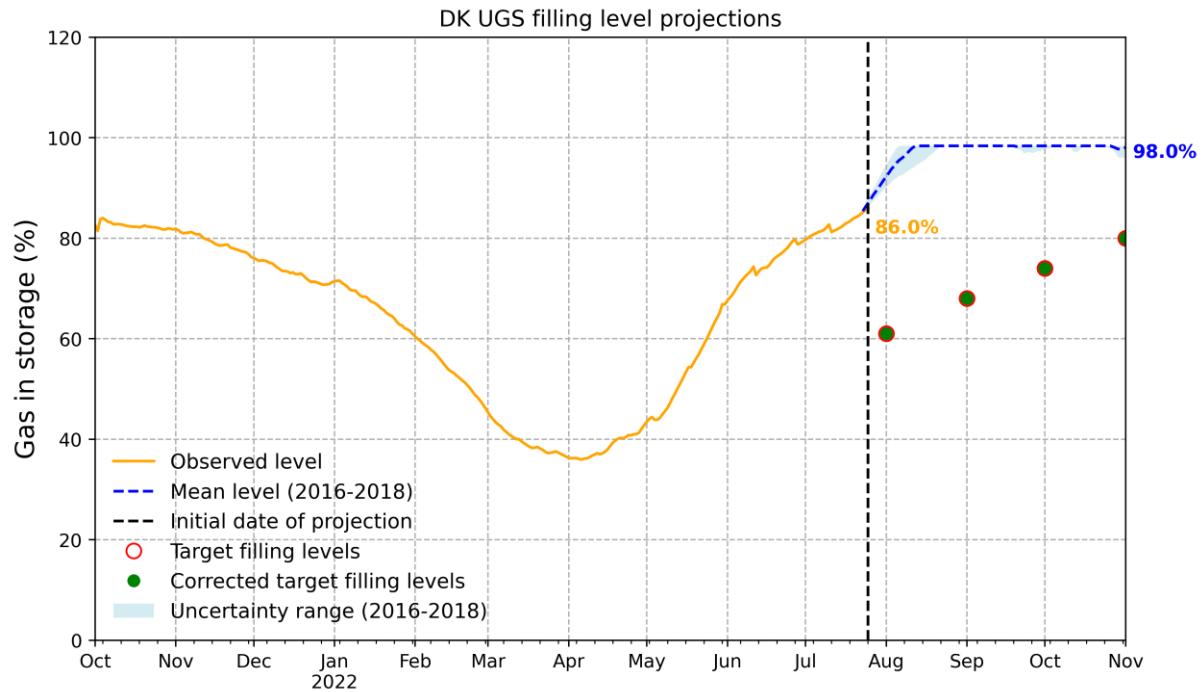


Figure 16. UGS filling projection on 23 July 2022 – Spain.

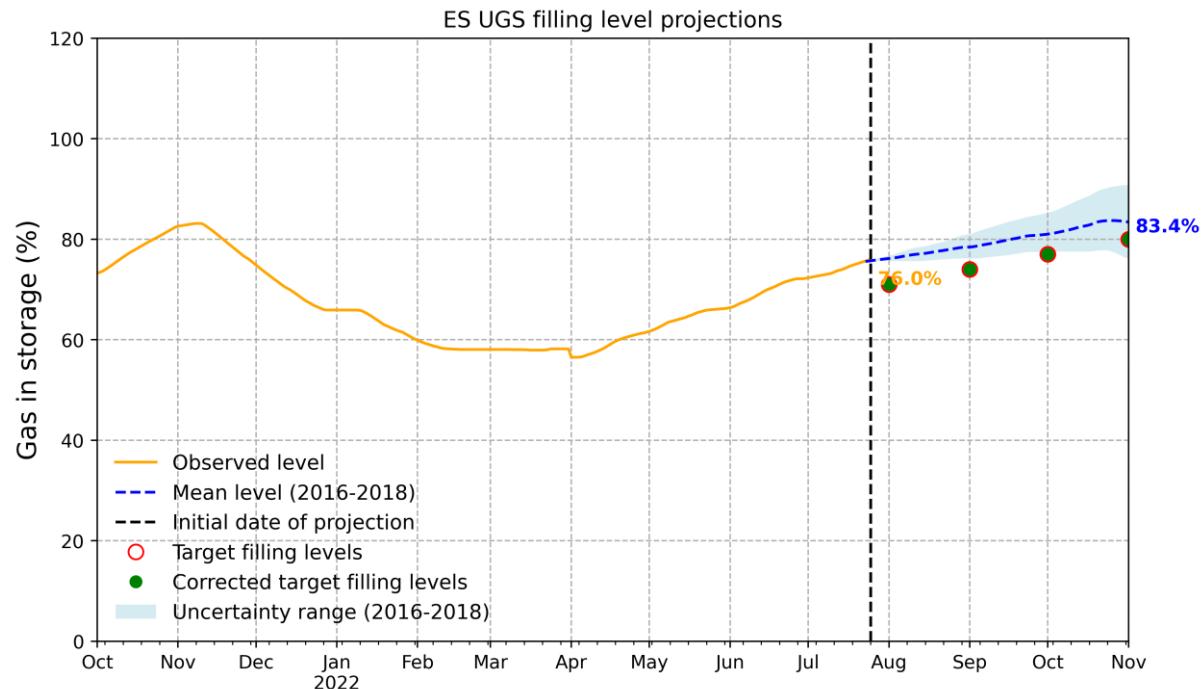


Figure 17. UGS filling projection on 23 July 2022 - France.

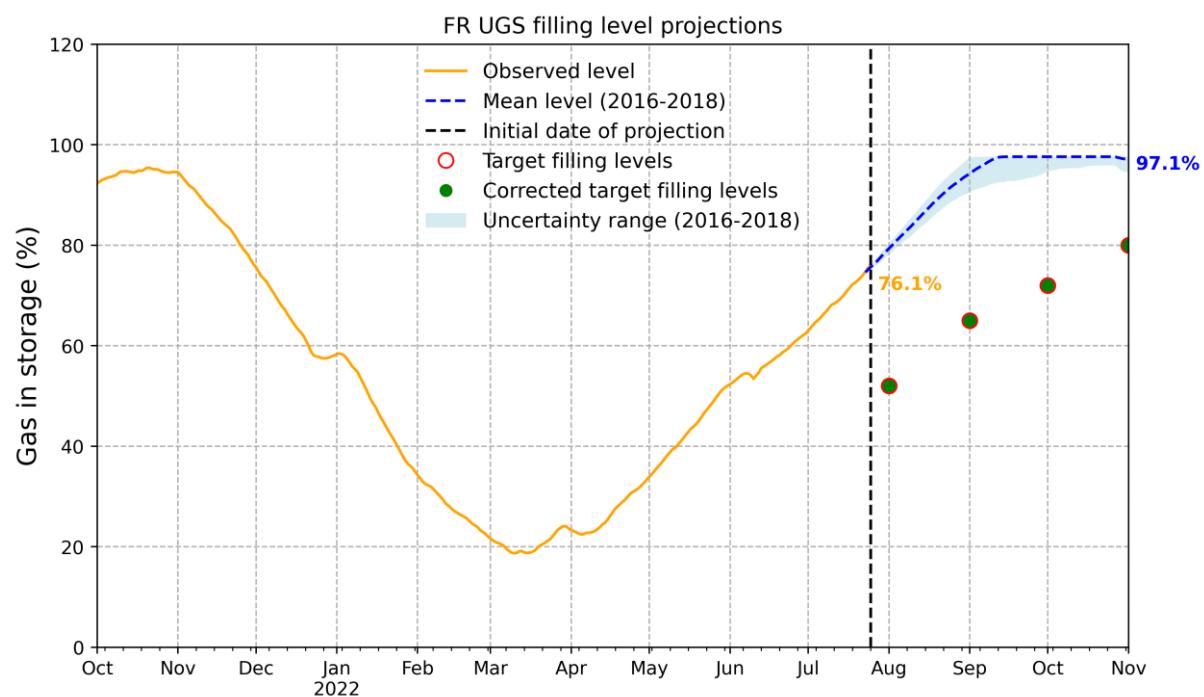
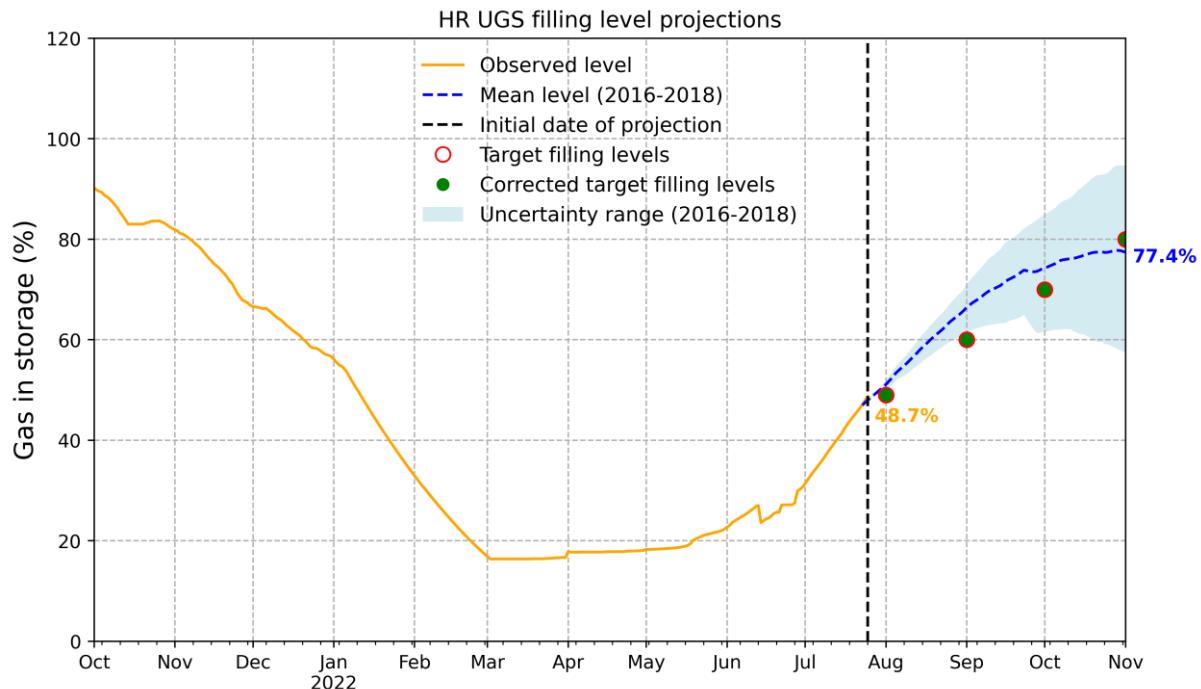
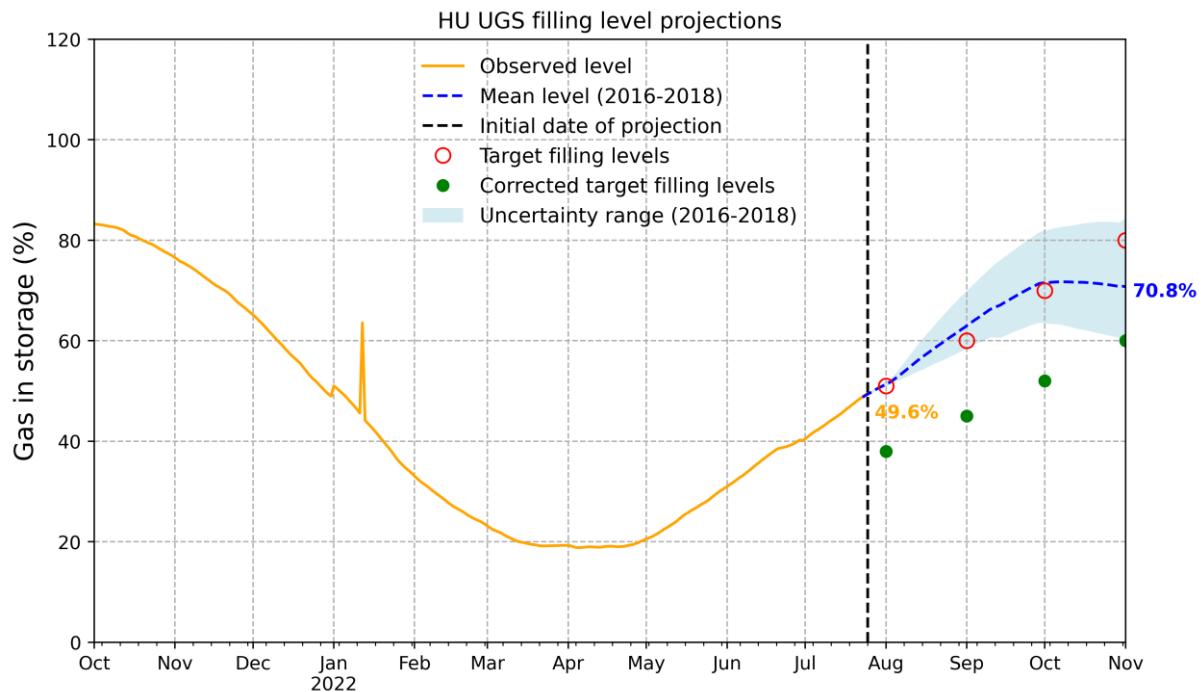


Figure 18. UGS filling projection on 23 July 2022 - Croatia.



Source: JRC based on AGSI+ Transparency Platform.

Figure 19. UGS filling projection on 23 July 2022 - Hungary.



Source: JRC based on AGSI+ Transparency Platform.

Figure 20. UGS filling projection on 23 July 2022 - Italy.

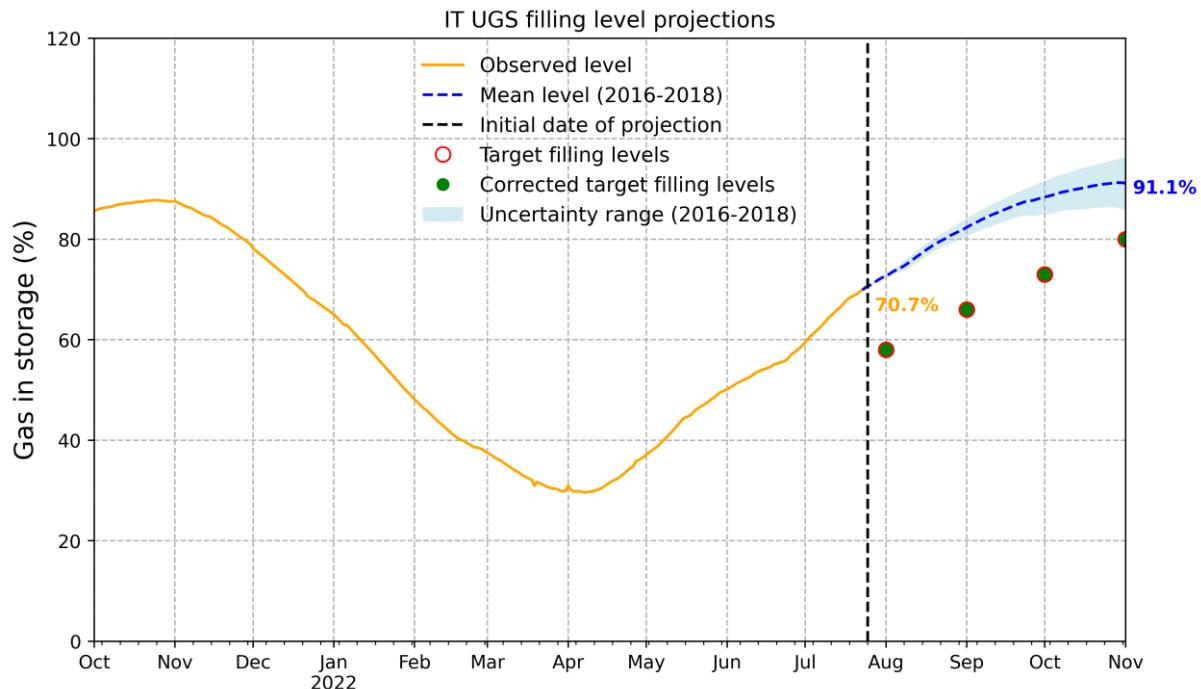


Figure 21. UGS filling projection on 23 July 2022 - Latvia.

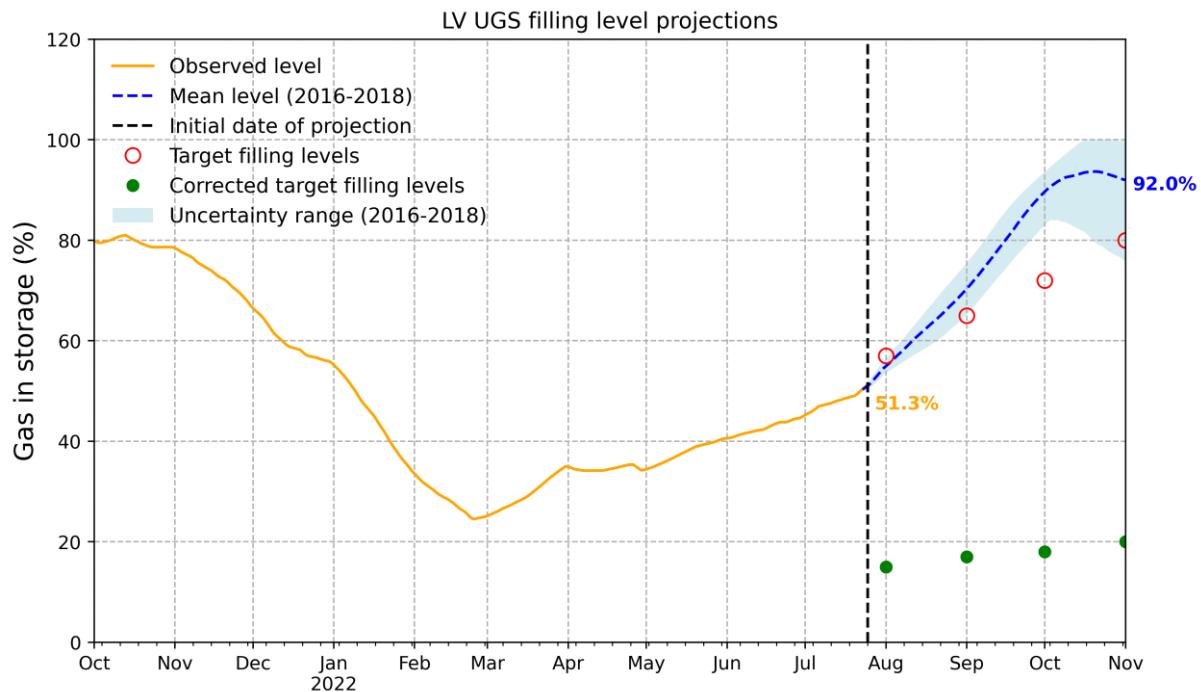
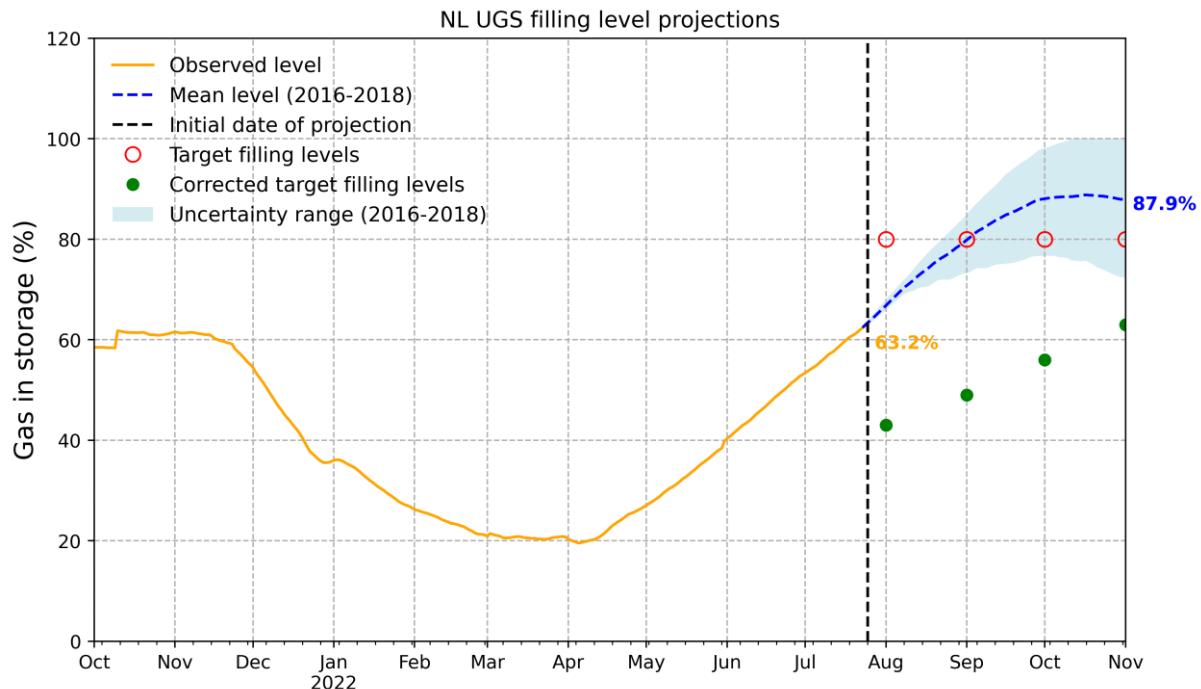
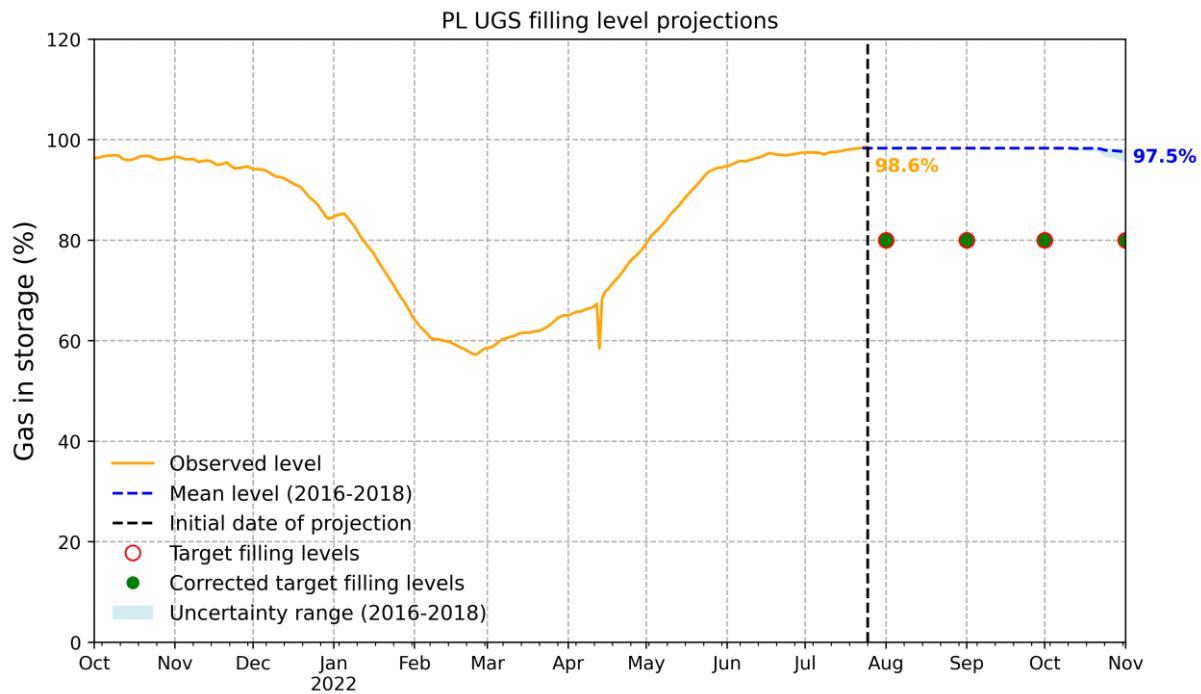


Figure 22. UGS filling projection on 23 July 2022 – the Netherlands.



Source: JRC based on AGSI+ Transparency Platform.

Figure 23. UGS filling projection on 23 July 2022 - Poland.



Source: JRC based on AGSI+ Transparency Platform.

Figure 24. UGS filling projection on 23 July 2022 – Portugal.

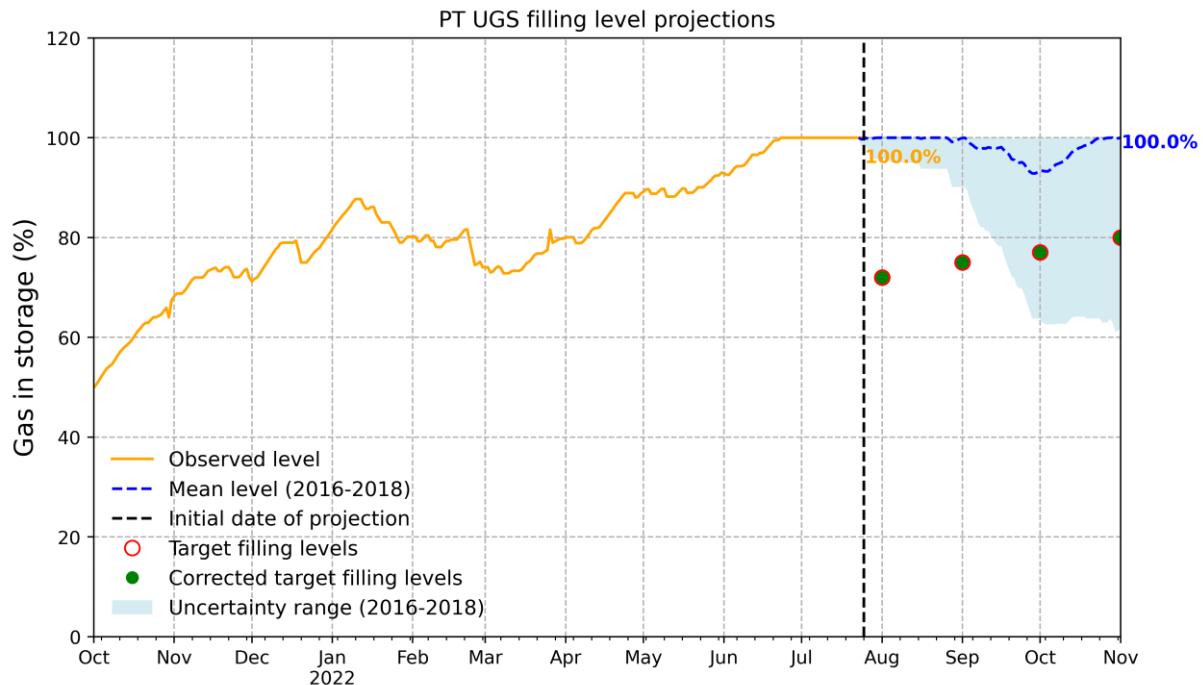


Figure 25. UGS filling projection on 23 July 2022 - Romania.

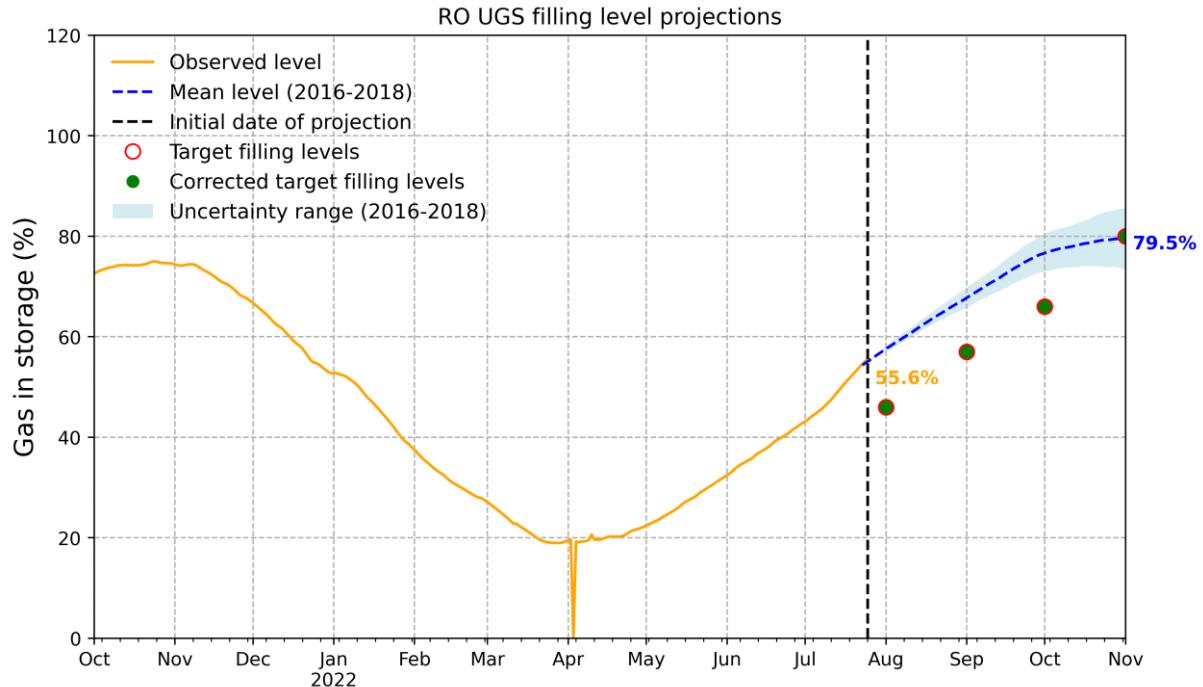


Figure 26. UGS filling projection on 23 July 2022 - Sweden.

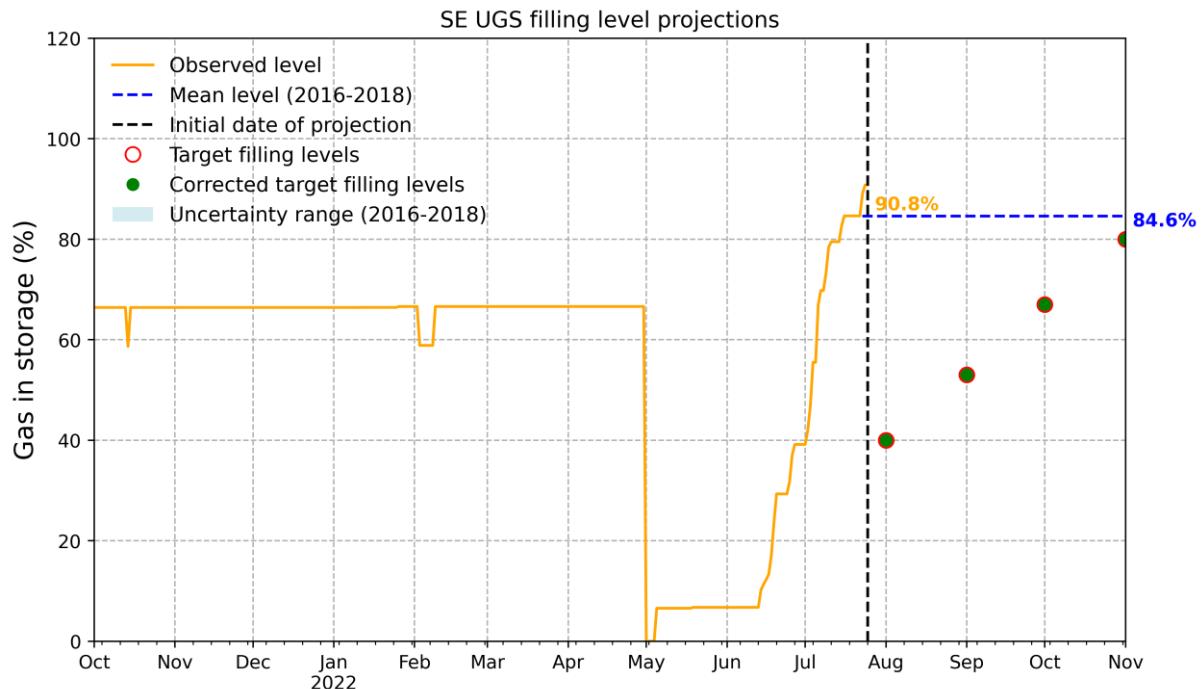
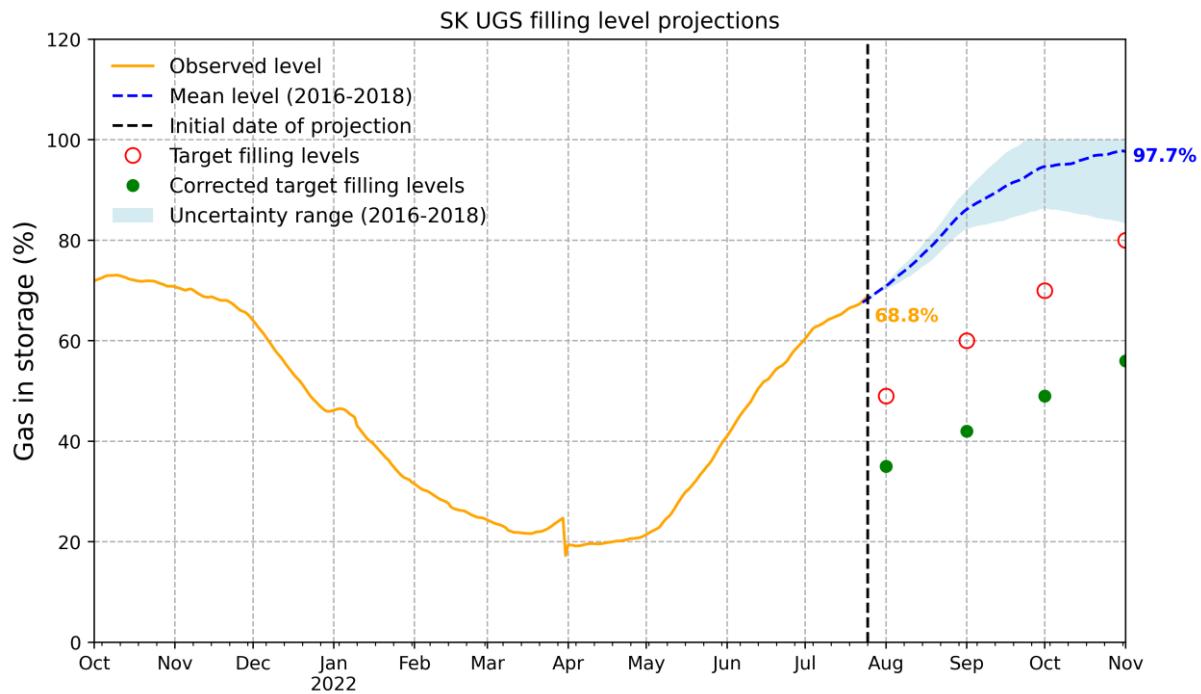


Figure 27. UGS filling projection on 23 July 2022 - Slovakia.



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