Summer Supply Outlook 2017

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Executive Summary

As part of its obligation under Art.8(3)(f) of Regulation (EC) 715/2009, ENTSOG has undertaken an assessment of the European gas network to analyse whether gas infrastructures enable to meet both demand and storage injection needs during Summer 2017.

The conclusions highlight 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 in order to ensure infrastructure reliability on the long term,
- flexibility for the network users' supply strategy,
- supply gas to Ukraine with volumes comparable to previous summer seasons

The report also emphasises:

In order to achieve the 90% storage inventory level, more supply would be needed in comparison to previous summer due to the current lower storage level (35%), compared to last year (45%), and also due to the lower National Production expected.

UK's Rough storage facility is currently offline and hasn't been considered in this report. Considering a conservative approach, ENTSOG developed this outlook assuming it will not start operations at least until the end of the injection period.

Ireland's Kinsale storage facility ceased operations last year 2016.

The actual supply mix and storage level on 30 September 2017 will depend on market behaviour and global factors.

Introduction

This edition builds on previous Summer Supply Outlooks as well as on the TYNDP 2017. The report aims to assess the ability of the European gas network to provide sufficient flexibility to shippers during their storage injection season.

The summer months 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 time to time 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 30 September 2017. 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 take into account the latest development since the beginning of the summer, the modelling takes as a starting point the factual storage levels on 1 April 2017.

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

Assumptions and results of the modelling

The modelling tool for the Summer Supply Outlook is the same as the one used in the TYNDP and the Winter Supply Outlook. It is handled at least at country level and takes into account the existing gas infrastructure[1] and the maintenance plans to be completed during the upcoming summer.

The Summer Supply Outlook 2017 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' decision.

[1] Technical capacities are updated by TSOs. For the OPAL pipeline a partial availability taking into account the current exemption is considered.

Reference Case (90% storage target)

Supply under the Reference Case has been defined essentially based on the actual data of the last 4 summers.

The overall “Summer injection” is defined as the quantity of gas necessary to reach an aggregated 90% stock level at EU level on 30 September 2017 starting from actual stock level of 34% on 1 April 2017 (Source: GSE AGSI platform).

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, Kaliningrad and Turkey[2]
- The overall Summer injection as defined above

The flexibility given to the model for the definition of the supply patterns derives from the supply mix of the last 4 summers (See Annex A-Methodology).

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

The Summer Supply Outlook takes into account the actual storage inventory level per country as of 1 April 2017[3] as the initial situation exposed in **Figure 1.** As shown in the map the storage inventory levels differ depending on the country.

[2] The exports for Ukraine, Kaliningrad and Turkey were assumed to be on the summer 2015 and 2016 average levels.
[3] The initial storage level on 1 April 2017 for each country is based the AGSI platform captured on 1 April 2017.

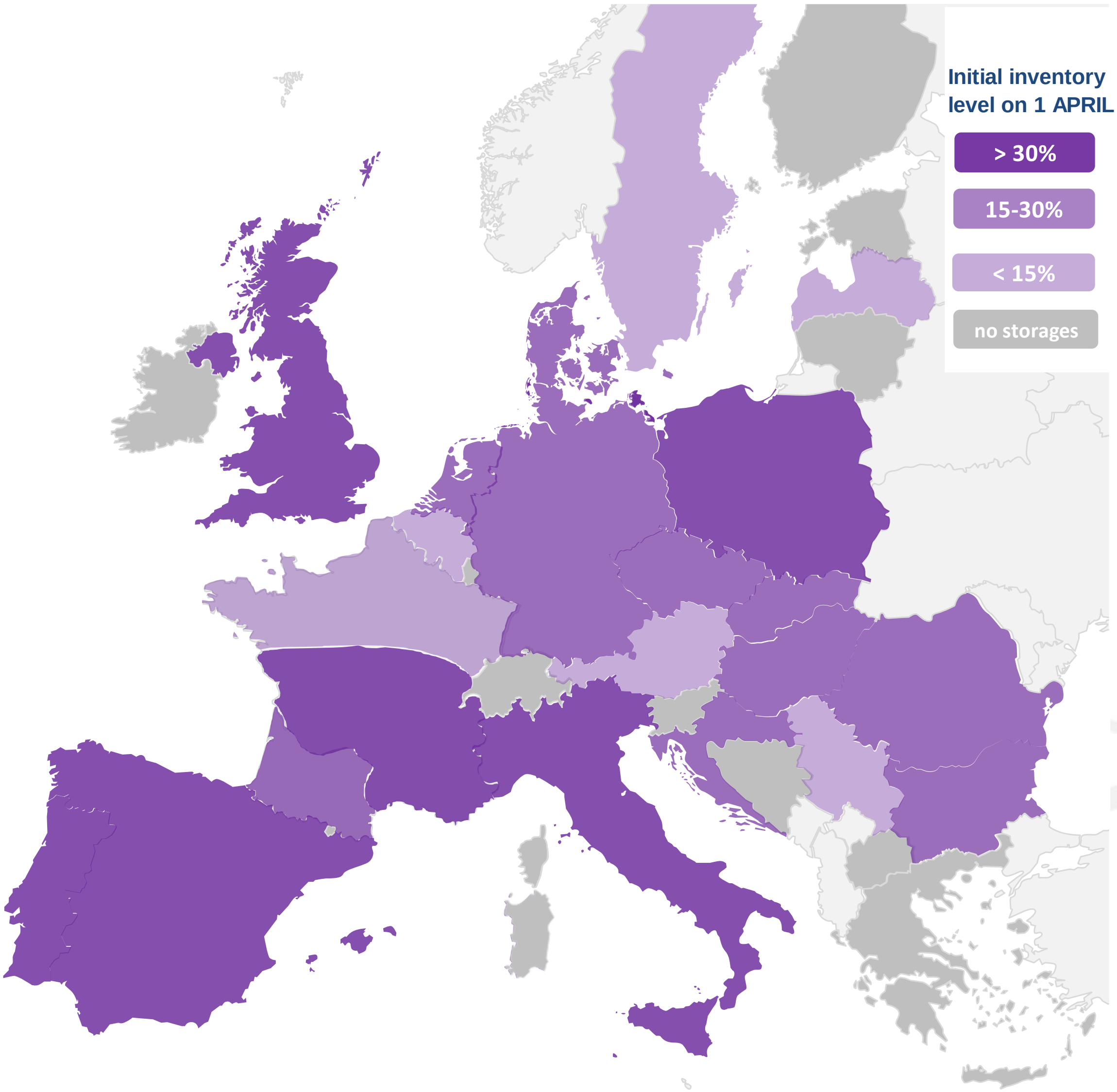

Figure 1: Actual storage inventory levels on 1 April 2017

(For some countries, the initial level includes strategic stocks)

In terms of absolute volumes in gas storages, the largest volumes are located in Germany, Italy and the Netherlands. UK current Working Gas Volume (WGV) levels have been considerably reduced by the well testing of their largest storage field Rough, which is currently offline and hasn't been considered in this report.

The simulations show that a 90% stock level may be achieved by 30 September 2017 in all the balancing zones.

Figure 2 shows the evolution of the stock level per country as a result of the model.

	01/04/2017 *	01/05/2017	01/06/2017	01/07/2017	01/08/2017	01/09/2017	30/09/2017
AT	15%	23%	35%	49%	62%	79%	90%
BEh	14%	14%	26%	42%	60%	78%	90%
BGn	29%	37%	46%	54%	67%	80%	90%
HR	28%	35%	46%	57%	69%	80%	90%
CZd	87%	87%	87%	87%	87%	90%	90%
CZ	13%	17%	32%	46%	61%	76%	90%
DK	22%	24%	35%	49%	65%	80%	90%
FRn	14%	19%	30%	45%	62%	79%	90%
FRs	41%	41%	47%	58%	69%	79%	90%
FRt	28%	34%	44%	56%	67%	79%	90%
DE	26%	31%	42%	53%	66%	80%	90%
HU	20%	28%	39%	52%	65%	78%	90%
IT	40%	40%	50%	61%	72%	83%	90%
LV	0%	6%	12%	33%	54%	74%	90%
NL	15%	21%	32%	45%	61%	79%	90%
PL	31%	31%	41%	53%	67%	80%	90%
PT	36%	48%	60%	72%	77%	90%	90%
RO	17%	28%	41%	54%	64%	77%	90%
RS	0%	14%	30%	47%	63%	78%	90%
SK	16%	28%	40%	51%	63%	79%	90%
ES	56%	58%	63%	70%	78%	85%	90%
SE	8%	8%	8%	8%	90%	90%	90%
UK	31%	31%	31%	31%	72%	90%	90%

Figure 2 - Storage Evolution Reference Case [4] - * (Actual stock level on GSE AGSI platform, complemented by other information sources for storages not reported on AGSI. For some countries, the initial level includes strategic stocks)

Figure 3 shows the breakdown of transported gas for each month (average daily values for each month including exports) for the **Reference Case**.

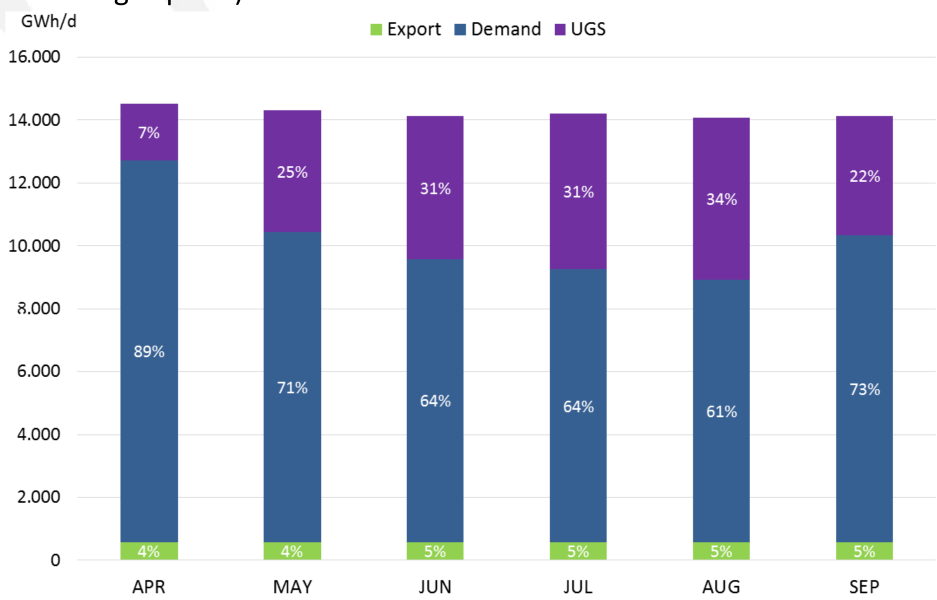

Figure 3 - Transported gas

[4] Note: CZd corresponds to SPP Storage UGS Dolni Bojanovice which is located in Czech Republic territory but connected only to Slovakia gas system network. Assumption to start UGS at 0% level when there is no data available in the AGSI platform.

Figure 4 shows the level and composition of the supply mix for every month in the Reference (90%) case:

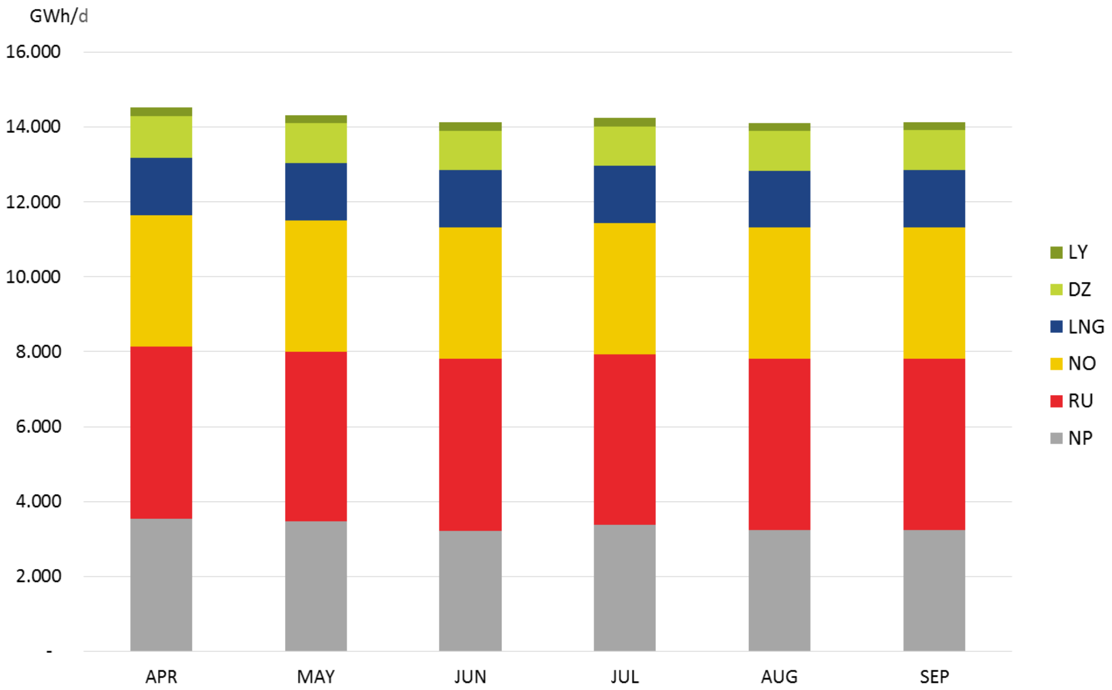

Figure 4 – Monthly supply level

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

Given the uncertainty on the level of stock 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 30 September 2017.

The definition of the monthly injection and supply is following the same rules than 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 5 provides the daily aggregated stock level evolution curve as resulting from the modelling of Summer Supply Outlook 2017 (actual injection curve will derive from shippers' behaviour) and actual aggregated curves of last three summers.

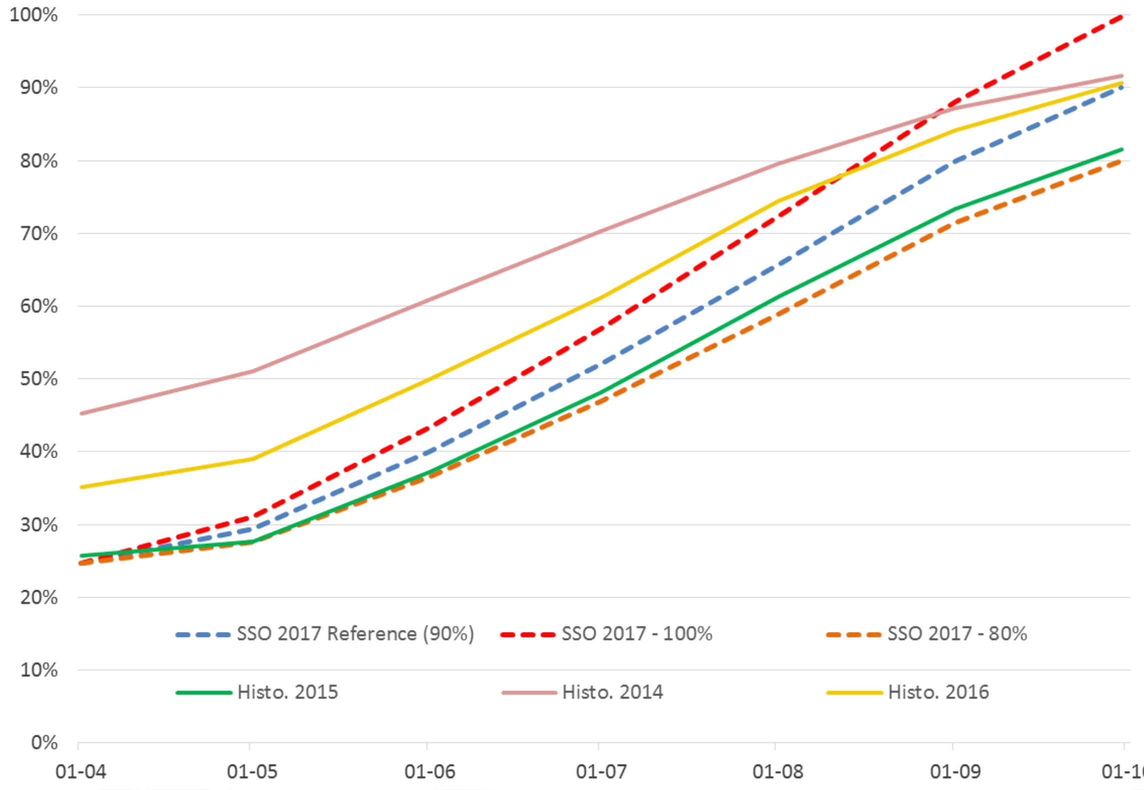

Figure 5 - Stock level development curve

The simulation shows that a 100% stock level is achievable by 30 September 2017 in almost all of the countries. Residual limitations have been identified for Latvia, that can reach only up to 90%, and Serbia reaching 93%, both due to limitations in the injection capacity, but mainly triggered by the conservative assumption to consider a starting level of 0% for the storages for which no data is reported on AGSI platform.

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

Given the supply constraints detailed in **Annex A**, the different injection targets are reached through fluctuation of the supply levels. Some additional flexibility has been considered for LNG and Norway to be able to reach the higher stock levels targets.

As shown in **figure 6**, the flexibility of the European transmission system is high enough to allow for different supply patterns while reaching 80% stock level at the end of September 2017. On the other side, reaching a 100% storage level would imply an increase in the imports from LNG and Norway while the other supply sources would reach their maximum deliverability set.

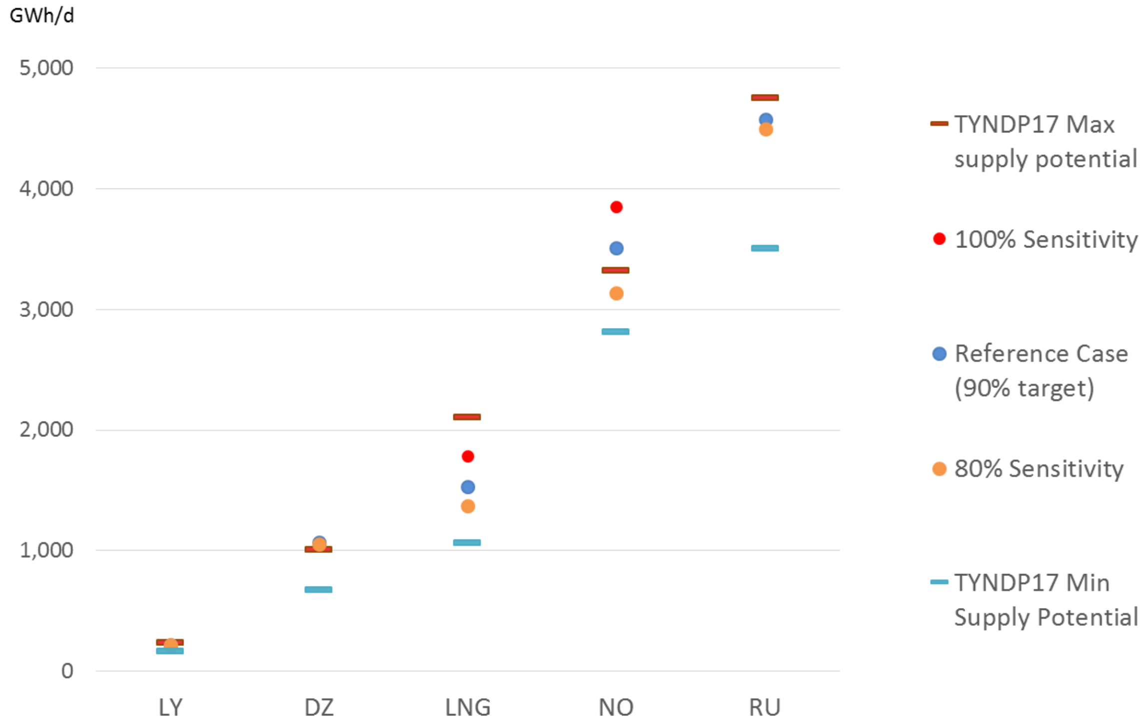

Figure 6 - Fluctuation of the supply patterns in the sensitivity analysis on the stock level [5]

Figure 6 compares the supply potentials built for the first year of the assessment of **TYNDP 17** taking into account the "tomorrow as today" methodology proposed by stakeholders by using the maximum and minimum per source observed in the previous Seasonal Supply Outlooks.

Figure 7 shows the difference between the supply shares in the Reference and the two alternative stock level targets (on a daily average basis).

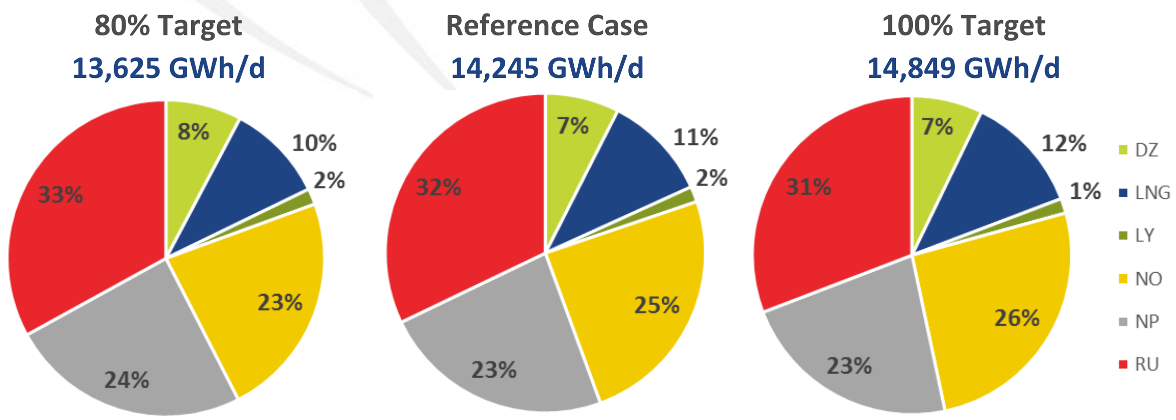

Figure 7 - Summer supply average share on a daily basis

[5] TYNDP 2017 figures refer to the min/max "tomorrow as today" methodology for year 2017

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 the underground gas storages by the end of this Summer 2017 while ensuring the proper maintenance of the system.

The sensitivity analysis shows that also a 100% stock level could be achieved in almost all of the countries. Only Latvia and Serbia have limitations and they reach 90% (LV) and 93% (SR) respectively, basically because the assumption used to start the injection season empty, when no data is available on the AGSI platform, has impacted on the end level.

Note the supply assumptions and the integrated flow patterns used in this report are hypothetical and have been designed for the purposes of this Summer Supply Outlook. Please also take into account that the actual storage levels will depend on shippers' decision and the deliverability of supply sources.

The Latvian TSO Conexus indicated to ENTSOG that the expected storage level after injection season may only reach 30-50% filling rate for the Incukalns storage facility, due to market participants' behaviour. If this would be the case this storage being the only one in the East-Baltic Region, this could impact on the reliability of gas supplies in winter 2017/2018 for the Baltic Countries, and especially for Latvia.

Legal Notice

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 – Methodology

Modelling tool

Modelling has been carried out using the ENTSOG NeMo Tool based on linear programming of flows.

The network and market topology used in this report is similar to the one used in ENTSOG TYNDP 2017, as well as the use of temporal optimization. The only difference is a more detailed topology for storages in Austria, Germany and France.

The following elements are part of the modelling:

- Definition of 6 temporal periods, representing the months from April to September.
- Temporal optimization means the optimization 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 preventing to reach the targeted stock level in each European storage by 30 September 2017, if any.

The different parameters are defined as below:

Demand

Average monthly demand forecast provided by TSOs

Injection

The total quantity of gas to be injected from 1 April to 30 September 2017, is defined as the difference between:

- the sum of the working volume of all European UGS times the targeted stock level
- the sum of the stock level of European UGS on 1 April 2017 (source: GSE AGSI platform)

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

Figure A shows the average injection curve. 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 B.

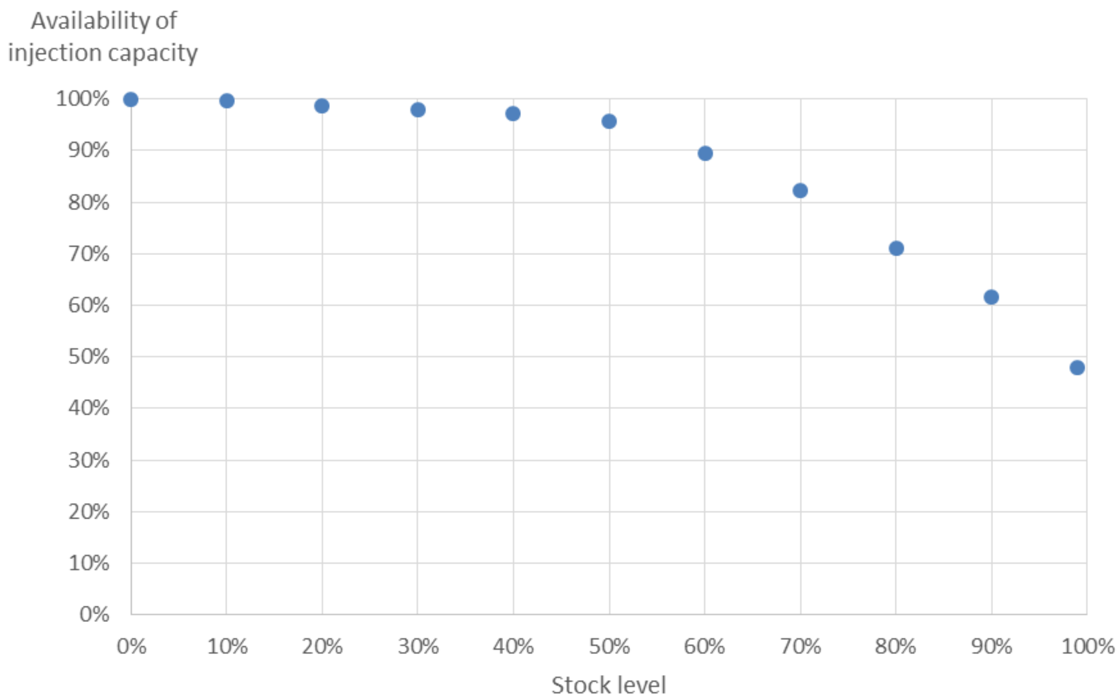

Figure A – Injection Average curve.

Supply constraints

Minimum supply per source

The minimum supply per source, on daily average, is set as the minimum monthly average supply of the last 24 summer months (April to September for years 2013, 2014, 2015, 2016) for each supply source. The detailed figures are included in Annex B.

Maximum supply per source

The maximum supply per source, on daily average, is set as the maximum monthly average supply of the last 24 summer months (April to September for years 2013, 2014, 2015, 2016) for each supply source. The detailed figures are included in Annex B.

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 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.

Summary of Summer Supply Outlook 2017 assumptions

Demand and production	Average monthly forecasts provided by TSOs
Monthly injection	> European aggregated injection over the Summer: quantity necessary to reach injection target (80%, 90% or 100%) on 30 September 2017 > Monthly injection (aggregated and per Zone) is a result of the modelling
Overall supply	Sum of demand and injection for the whole summer, limited by a maximum supply per source.
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 taking into account reduction due to maintenance
Exports towards Ukraine	256 GWh/d (Average of two previous seasons)
Exports towards Turkey	279 GWh/d (Average of two previous seasons)
Exports towards Kaliningrad	46 GWh/d (Average of two previous seasons)

Annex B – Data for Summer Supply Outlook 2017

Minimum and Maximum supply per source

GWh/d	Minimum	Maximum	Additional Flex
Algeria	479	1,066	No
LNG	543	1,384	Yes*
Libya	81	223	No
Norway	2,002	3,190	Yes*
Russia	3,267	4,577	No

* **Maximum LNG supply**, including the additional flexibility used for the 100% sensitivity analysis: **1,789 GWh/d**

* **Maximum NO supply**, including the additional flexibility used for the 100% sensitivity analysis: **3,852 GWh/d**

Average monthly national production forecast

GWh/d	April	May	June	July	August	September
AT	34.8	32.5	32.5	35.3	34.7	34.8
BG	1.6	1.6	1.6	1.6	1.6	1.6
CZ	4.5	4.5	4.5	4.5	4.5	4.5
DEg	223.0	220.0	217.1	214.1	211.2	208.3
DEn	8.9	8.9	8.9	8.9	8.9	8.9
ES	2.8	2.8	2.8	2.8	2.8	2.8
FI	0.4	0.3	0.4	0.3	0.3	0.4
HR	31.6	33.4	33.3	35.2	36.2	26.9
HU	40.0	37.0	37.0	35.0	35.0	40.0
DK	119.9	119.0	122.0	116.8	117.5	121.2
IE	92.1	87.9	98.4	90.0	88.2	86.9
IT	168.0	168.0	168.0	168.0	168.0	168.0
NL	1,360.1	1,360.6	1,241.1	1,240.5	1,272.9	1,142.4
PL	67.7	67.7	67.7	67.7	67.7	67.7
RO	260.0	240.0	235.0	237.0	246.0	242.0
SE	0.5	0.5	0.5	0.5	0.5	0.5
SK	74.3	80.0	81.5	78.8	80.5	72.6
UK	1,046.4	996.1	866.6	1,033.7	856.3	1,004.3
Total	**3,536**	**3,461**	**3,219**	**3,371**	**3,233**	**3,234**

Average monthly demand forecast

GWh/d	April			May			June			July			August			September		
GWh/d	Total	Final	Power	Total	Final	Power	Total	Final	Power	Total	Final	Power	Total	Final	Power	Total	Final	Power
AT	230			171			129			138			137			177		
BA	3			2			1			1			1			2		
BEh	340	229	111	268	172	95	245	154	91	234	133	101	240	141	100	306	163	143
BEl	133			82			66			51			53			66		
BGn	80	47	34	78	45	32	70	41	29	55	32	23	55	32	23	69	40	29
CH	96			65			44			33			35			53		
CZ	229	224	5	148	145	3	115	112	3	84	81	3	101	98	3	138	135	3
DEg	1,162	968	195	919	765	154	886	738	148	834	694	140	828	689	139	905	754	152
DEn	1,162	968	195	883	735	148	786	654	132	696	580	117	688	573	115	856	713	143
DK	152	147	5	127	125	2	115	113	2	99	98	1	118	116	2	123	118	4
EE	14	14	0.1	8	8	0.1	6	6	0.1	6	6	0.1	6	6	0.1	7	7	0.1
ES	819	694	125	810	646	164	750	594	156	778	571	207	690	517	174	800	635	165
FI	64	50	14	48	37	10	47	37	10	46	36	10	47	37	10	40	31	9
FRn	741	661	80	532	454	78	416	335	80	372	295	78	334	256	78	448	368	80
FRs	288	244	45	207	164	43	162	117	45	145	102	43	130	87	43	174	130	45
FRt	82			52			36			30			27			37		
GR	97	34	64	101	29	72	111	28	83	98	29	69	107	26	81	104	32	71
HR	72	62	10	59	53	6	48	43	5	36	29	7	53	46	8	62	54	9
HU	207	187	20	165	140	25	131	106	25	131	106	25	130	100	30	150	120	30
IE	136	69	67	113	55	58	116	45	71	98	36	61	89	37	52	108	45	63
IT	1,587	1,102	485	1,318	861	457	1,288	783	506	1,395	724	672	1,124	583	541	1,467	808	659
LT	59	58	1	52	50	3	50	43	7	35	33	2	33	31	1	52	45	7
LU	27			19			17			15			13			16		
LV	23			18			15			14			15			25		
MK	2	1	1	1	1	0	1	1	0	2	1	1	2	1	1	3	1	2
NL	903	775	128	712	599	112	652	514	138	620	479	141	638	487	150	724	550	175
PL	449			369			312			291			309			363		
PT	157	111	46	150	107	43	183	104	79	200	105	95	181	95	86	203	107	96
RO	188	175	13	147	131	16	155	125	29	179	115	65	175	114	61	174	118	56
RS	33			33			33			33			33			33		
SE	24	21	2	18	18	1	17	17	0.1	17	17	0.3	18	17	0.3	20	20	0.2
SI	22	22	0.1	19	19	0.1	18	17	0.1	16	16	0.1	16	16	0.1	18	18	0.1
SK	131	128	4	68	65	3	65	62	3	58	55	3	58	55	3	69	65	4
UK	2,381	1,795	586	2,058	1,581	477	1,887	1,328	559	1,806	1,338	468	1,820	1,354	466	1,930	1,426	504
Ukn	41	22	19	31	14	17	29	10	19	23	9	14	25	9	16	27	11	15
Total	12,718			10,432			9,583			9,253			8,909			10,328		

Note: Final demand includes Residential, Commercial and Industrial.

Linearization curves (GSE)

Country	Injection availability when working gas volume is at xx% level											
	100%	99%	90%	80%	70%	60%	50%	40%	30%	20%	10%	0%
AT	0%	60%	73%	81%	90%	94%	98%	99%	99%	99%	100%	100%
BE	0%	37%	50%	50%	100%	100%	100%	100%	100%	100%	100%	100%
BG	0%	48%	56%	56%	100%	100%	100%	100%	100%	100%	100%	100%
HR	0%	48%	61%	71%	82%	89%	96%	97%	98%	99%	100%	100%
CZ	0%	30%	30%	35%	70%	75%	99%	100%	100%	100%	98%	96%
CZd	0%	48%	61%	71%	82%	89%	96%	97%	98%	99%	100%	100%
DK	0%	56%	61%	68%	79%	85%	93%	96%	98%	99%	100%	100%
FRn	0%	71%	74%	80%	90%	91%	93%	94%	96%	99%	100%	100%
FRs	0%	62%	66%	69%	71%	75%	80%	84%	88%	95%	97%	100%
FRt	0%	75%	82%	89%	96%	100%	100%	100%	100%	100%	100%	100%
DE	0%	46%	59%	69%	81%	89%	98%	98%	99%	99%	100%	100%
HU	0%	48%	61%	71%	82%	89%	96%	97%	98%	99%	100%	100%
IT	0%	30%	49%	66%	77%	91%	98%	100%	100%	100%	100%	100%
LV	0%	48%	61%	71%	82%	89%	96%	97%	98%	99%	100%	100%
NL	0%	57%	67%	74%	82%	88%	93%	95%	96%	97%	99%	100%
PL	0%	53%	76%	77%	81%	81%	81%	85%	87%	88%	99%	100%
PT	0%	48%	61%	71%	82%	89%	96%	97%	98%	99%	100%	100%
RO	0%	48%	61%	71%	82%	89%	96%	97%	98%	99%	100%	100%
RS	0%	48%	61%	71%	82%	89%	96%	97%	98%	99%	100%	100%
SK	0%	48%	61%	71%	82%	89%	96%	97%	98%	99%	100%	100%
ES	0%	48%	85%	90%	90%	90%	95%	100%	100%	100%	100%	100%
SE	0%	48%	61%	71%	82%	89%	96%	97%	98%	99%	100%	100%
UK	0%	48%	61%	71%	82%	89%	96%	97%	98%	99%	100%	100%

Note: default average values are used in case specific country profiles are not available:

WGV Level	100%	99%	90%	80%	70%	60%	50%	40%	30%	20%	10%	0%
Average	0%	48%	61%	71%	82%	89%	96%	97%	98%	99%	100%	100%

ENTSOG Summer Review 2016

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Executive Summary

ENTSOG has completed the review of the European gas picture for Summer 2016, April to September. The seasonal Reviews aim at a deeper comprehension of the development of the demand and supply in the previous seasons and the identification of trends that cannot be captured at national or regional level.

Summer Reviews help to build experience and a solid background for the assumptions considered in the Summer Outlook. Such knowledge is also factored in the recurrent TYNDP process in order to ensure a consistent improvement over ENTSOG reports, as well as in the ongoing R&D plan.

The key findings of this review are:

- Seasonal Gas demand in Europe was higher (+7.4%) than the one from previous summer.
- European indigenous production grew (+11%) for the first time in many years, after decreasing (-15%) during last summer season.
- The stock levels increased enough along the season to reach a high level of 91% by the end of September.

Detailed data for the cross-border flows is available on the Transparency Platform[6].

Stakeholders' comments on this seasonal analysis are welcome and would enable ENTSOG to improve its knowledge of seasonal and market dynamics influencing the use of infrastructure. Comments would serve as basis for the R&D plan and be beneficial to the quality of further reports.

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

Introduction

This review, as part of the ENTSOG Annual Work Program 2017, is published on a voluntary basis and aims at providing an overview of the demand and supply balance during summer 2016. The report brings transparency on the internal analysis carried out by ENTSOG for the purpose of developing the seasonal Supply Outlooks as well as the Union-wide TYDNP.
The report aims to provide an overview of European trends that can not be captured at national level or regional level and to build experience for future reports. This report should not be seen as a direct review of previous Seasonal Outlooks as outlooks do not aim to provide a forecast but to better explore infrastructure resilience.
Regarding European dynamics, the report highlights the wide heterogeneity of national demand profiles and supply sources. These differences are linked among others to physical rationales such as climate, demand breakdown or producing field flexibility for example.

Seasonal Overview

Different technical events on the European gas market caused fluctuations in the supply and demand balance from April to September 2016. The major ones were:

- France outage at Dunkirk receiving terminal in May.
- Stocks at the UK's largest gas storage facility, Rough, dropped to historical lows and the outage extension shocked the markets in July.
- Norwegian flows suffered due to planned work at the Karsto gas processing plant in August. September overlapped with maintenance at several Norwegian gas facilities, which caused a drop in flows to the European continent.

Market Overview

Other general gas related topics and news were also noticeable during the summer period, standing out:

- Norwegian gas flows hit a record of 9.5 bcm in pipeline exports in April.
- Algerian unexpected surge in pipeline exports to Italy and Spain in April.
- First LNG cargos coming from US headed to Portugal and Spain.
- First ever backhaul flow exported from Greece to Bulgaria in July.
- Norwegian shortage and gas-for-power demand drove price swings in the main European gas hubs in August and September.
- Dutch Economic Affairs Minister confirmed a further restriction to the production of the Groningen gas field, from 27 to 24 bcm for the next five gas years.

Gas Prices at European hubs

The following graphs show the evolution of gas prices in Europe during Summer 2016 compared to those of 2015:

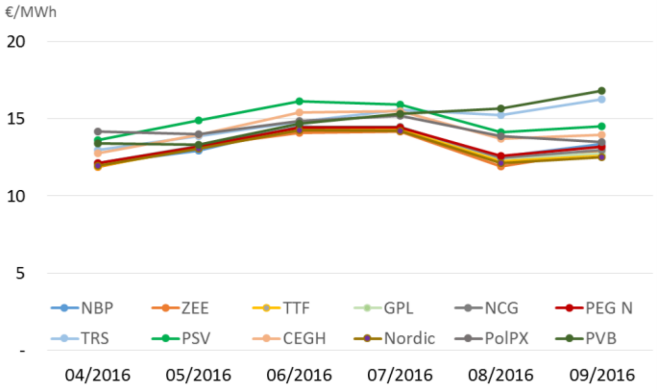

Figure 1 - Month-ahead average price at EU Hubs [7]

Figure 1 displays the evolution of the month-ahead average prices for the different European gas hubs. It shows how the majority of the European hubs follow a similar trend as they usually react in the same direction when facing related events. Only TRS and PVB registered a different trend in August ending on higher values at the end of the season.

Figure 2 compares the maximum range and average of the month-ahead summer price for the last two summers over all the European hubs (source Bloomberg).

The average price over all hubs dropped in 2016, showing a general trend much lower to the one seen in the previous summer.
The price range was also constantly smaller than the one for summer 2015. The price convergence between the European hubs continued, Italian PSV remained slightly above the others from May to July. PVB and TRS exceeded the rest in August and September.

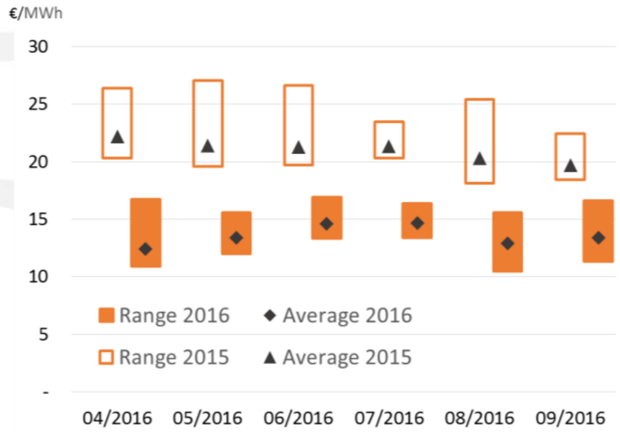

Figure 2 - Range and average of the prices

[7] Source: Bloomberg and MIBGAS

Demand

> European seasonal gas demand

Total gas demand was 1,603 TWh in Summer 2016, +7.4% higher than the one in the previous summer.

Figure 3 shows how the average demand levels in April were very close to those from the previous summer. From May to September the average experienced significant increases, in line with the maximum level reached.

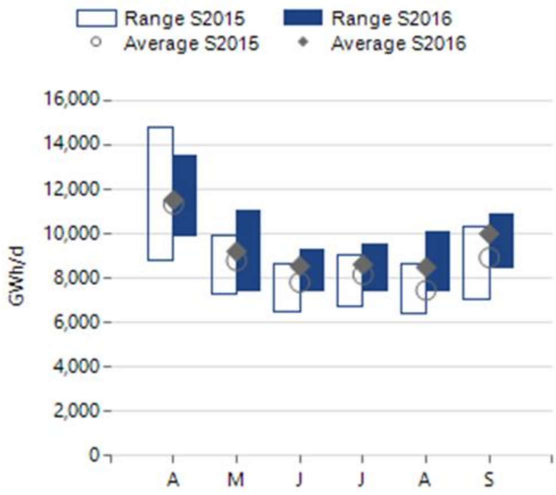

Figure 3 – Total gas demand

Figures 4 and 5 show the demand range and average on a monthly basis when split into Residential, Commercial and Industrial or Power Generation sectors, for the countries where the demand breakdown is available.

Figure 4 - Residential, Commercial and Industrial (*)

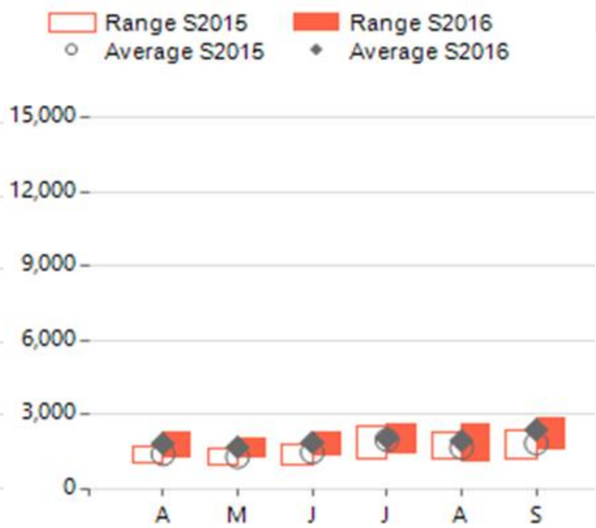

Figure 5 - Power Generation gas demand (*)

(*) *These graphs use data from the countries for which demand breakdown is available (Belgium, Switzerland, Estonia, Spain, Finland, France, Greece, Croatia, Hungary, Ireland, Italy, Lithuania, Luxembourg, Netherlands, Portugal, Sweden, Slovenia, Czech Republic and United Kingdom).*

Electricity power generation from gas (TWhe)

The generation of electricity from gas has followed a significant fall for many years. This decrease follows both the increasing generation from RES source and the stable market preference for coal generation to the detriment of gas. The data shows the decline in the thermal gap (the volume of power generation coming from fossil fuels) since 2010, then stabilized during the four following summers. 2016 marked the first year of recovery of gas for power generation in the EU resulting from a significant coal to gas switch.

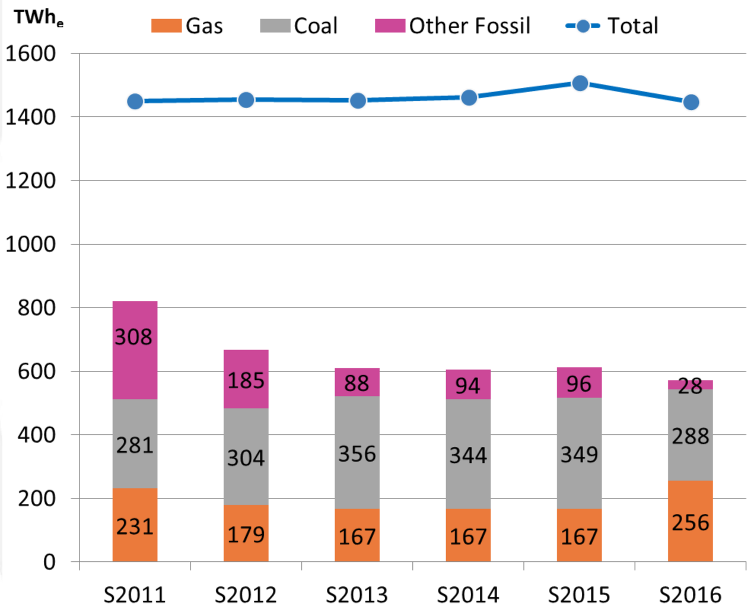

Figure 6 - Gas and coal in the electricity mix Summers 2011 - 2016

Source: own elaboration based on data provided by ENTSO-E

In absolute terms, the electricity produced from gas was 256 TWh in summer 2016, representing 18% of the generation mix. According to ENTSOE figures, compared to 2015, gas demand for power generation increased 53%. This represent the highest gas demand for power generation since 2010.

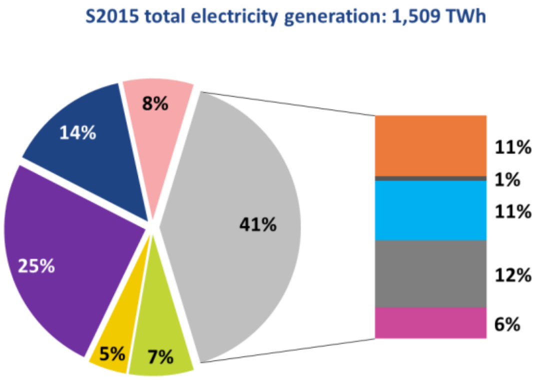

Figure 7 - Summer 2015 Electricity generation mix

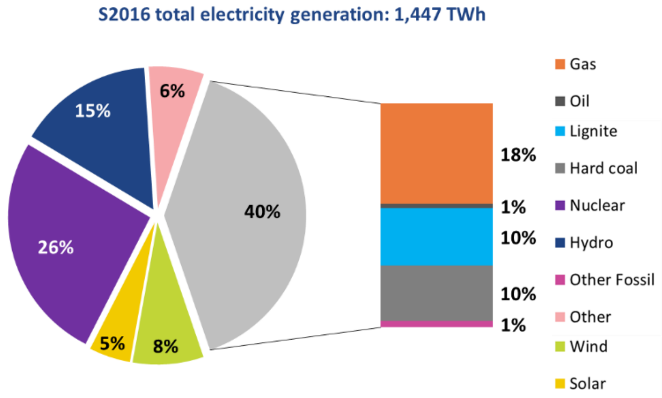

Figure 8 - Summer 2016 Electricity generation mix

As shown in **Figures 7 and 8**, there was an increase in Wind, Hydro, Nuclear and a small decrease in the fossil fuels share from 41% to 40%. Gas increased from 11% to 18%.

> Summer demand evolution 2011-2016

In summer 2010 the demand reached 1,945 TWh (maximum not shown in the graph). Since then, the demand has decreased for five years in a row with an accumulative decrease of 18% since 2010. Finally, summer 2016 has registered a significant increase for the first time in many years (+7.4%).

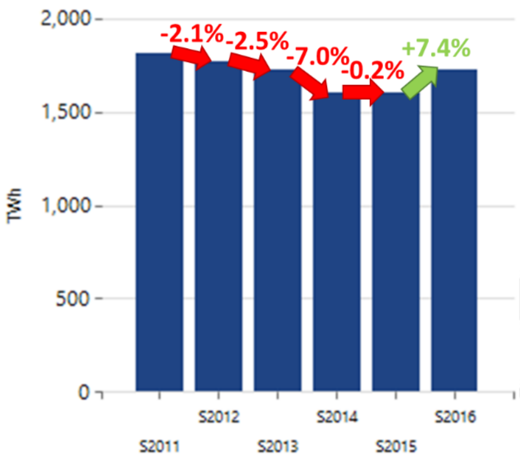

Figure 9 - Total consumption Summer 2011-2016

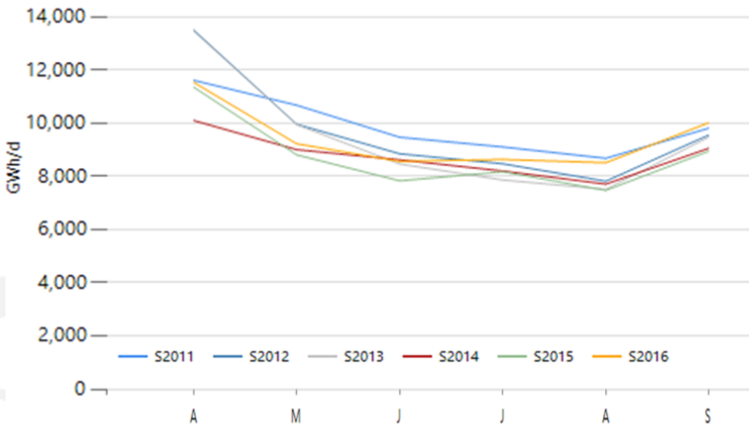

Figure 10 - Demand Monthly average. Summer 2011-2016

By sector, for those countries where the gas demand breakdown is available, Residential, Commercial and Industrial consumption increased (+0.6%) during summer 2016. As shown below, in **Figure 12**, demand for power generation increased (+21.9%) after a slight decrease in year 2014.

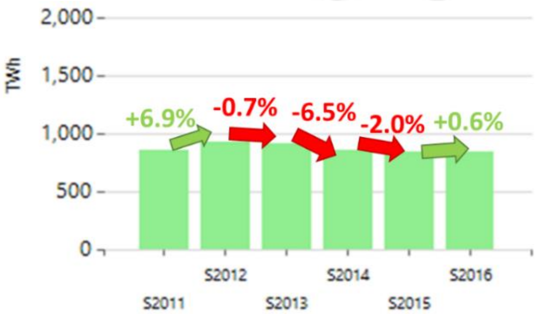

Figure 11 - Residential, commercial and industrial consumption. Summer 2011-2016 (*)

Figure 12 - Gas consumption for power generation. Summer 2011-2016 (*)

(*) *These graphs use data from the countries for which demand breakdown is available (Belgium, Switzerland, Estonia, Spain, Finland, France, Greece, Croatia, Hungary, Ireland, Italy, Lithuania, Luxembourg, Netherlands, Portugal, Sweden, Slovenia, Czech Republic and United Kingdom).*

Country detail

The evolution of gas demand on a country level was diverse and showed significant variations in both directions. FYROM, Greece, Portugal and UK were the countries with the higher rate of gas demand increase. The countries where the rate of demand decreased were Bosnia, Finland, Lithuania and Latvia.

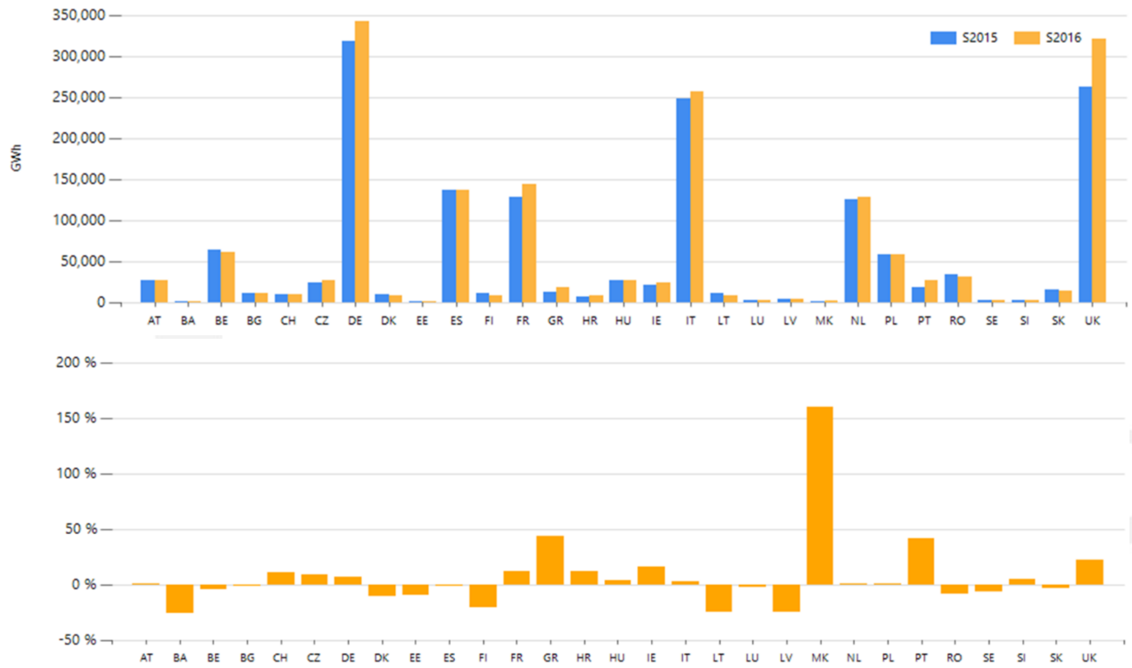

Figure 13 – Summer total gas demand. Country detail

Seasonal modulation

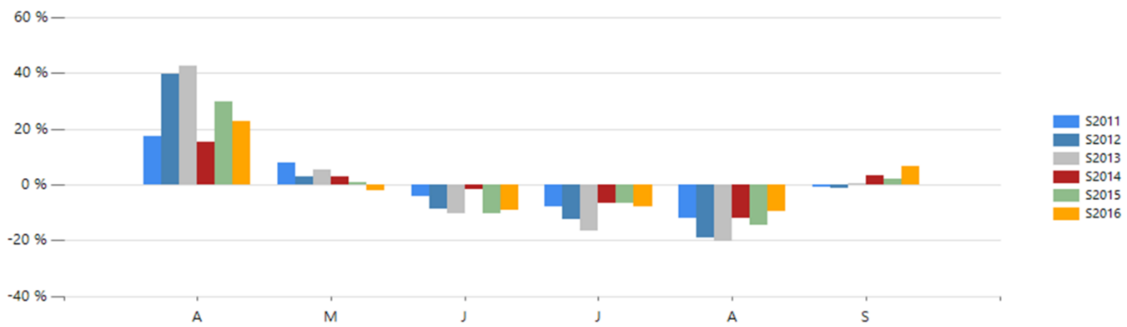

Figure 14 - Summer modulation 2011-2016

The pattern followed by demand is linked to the climatic conditions from April to September. **Figure 14** shows the deviation of the monthly average demand from the summer average for each of the last six summers:

- April is regularly the month with the highest demand
- Demand in June, July and August has been systematically lower than the average
- May and September gas demand is usually close to the summer average.

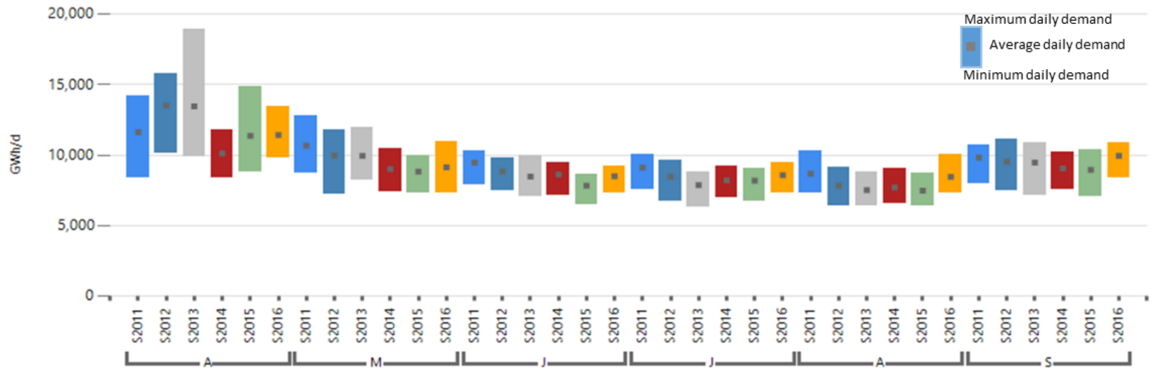

Figure 15 - Monthly demand: average and ranges

Figure 15 shows the monthly variation between the maximum and the minimum daily demand. Comparing the evolution of the daily average per month there has been a gradual decrease in the summer gas demand since 2009 (not shown in the graph). The trend followed in the last years continued until 2015, increasing over again in 2016.

Supply

> European seasonal gas supply

Figure 16 shows the evolution of the aggregated gas supply in Europe during the summer 2016.

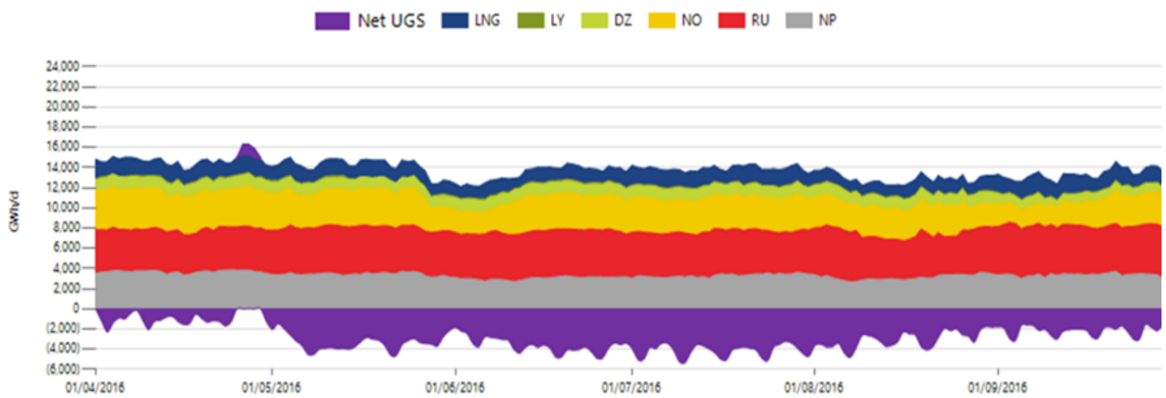

Figure 16 - Summer 2016 supply profile

The next graphs give an overview of National production and supply imported shares during the summers 2016 and 2015 in both absolute and relative terms.

The total summer supply in 2016 was 2,521 TWh.
Figure 17 shows the seasonal supplies by source for the last two summers in absolute figures.
The increase in the total national production, despite the cap to the Groningen field, was notable (+11%) mainly due to the growth observed in UK's indigenous production.

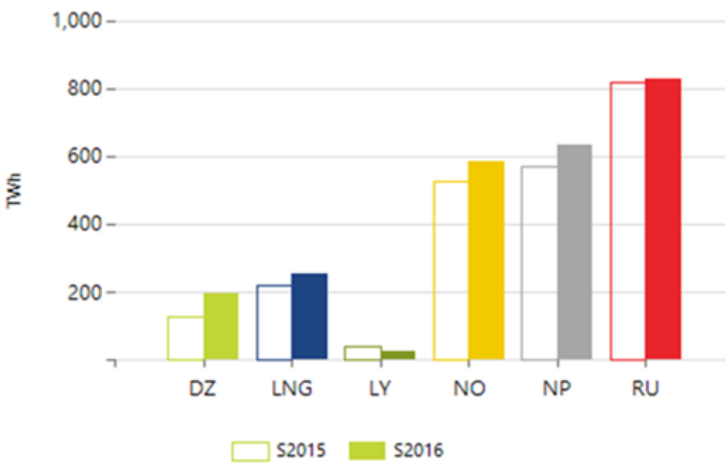

Figure 17 - Seasonal supply

Algerian imports registered a massive increase during summer 2016 (+51%), as did LNG (+15%). Imports from Norway performed a considerable increase of (+11%), for second year in a row. Libya suffered a drastic drop (-41%) compared to last summer season.

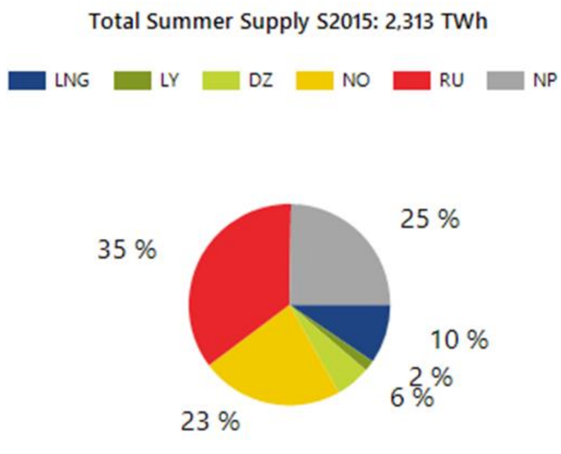

Figure 18 - Supply shares. Summer 2015

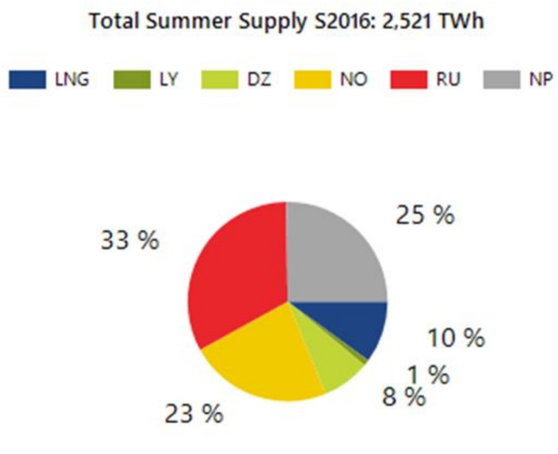

Figure 19 - Supply shares. Summer 2016

Indigenous production stabilised this year, after three years decreasing. This means Norway and LNG remained at similar levels to the ones from 2015. Algerian share experienced a high growth in the supply mix when compared to last year (+2%), just the opposite way to the Russian one (-2%).

Supply modulation

The following graphs illustrate for each of the import supply sources, as well as for national production, the average flow per month and the monthly and seasonal range of the last two years (lowest and highest daily flow of each month for the summer).

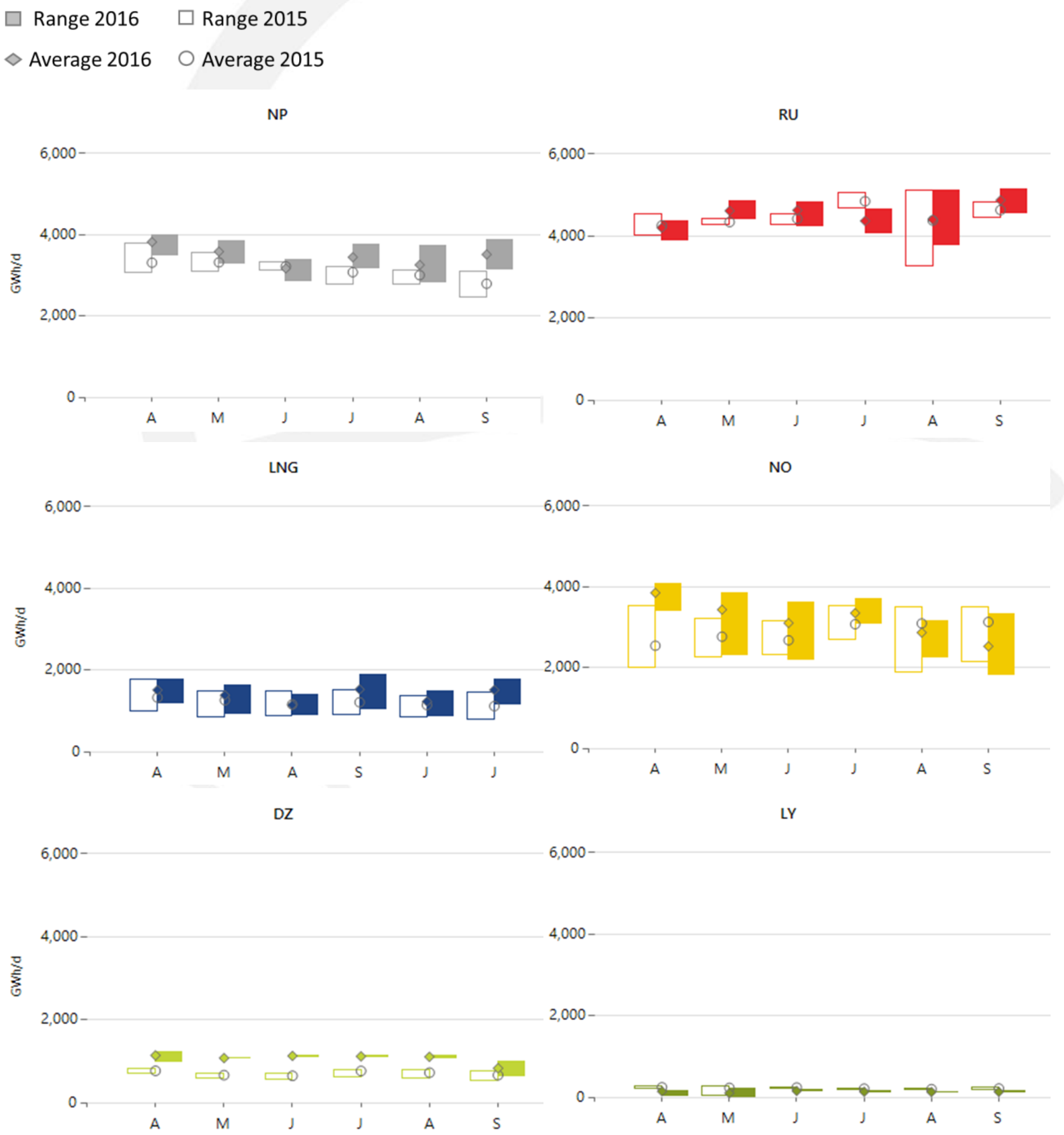

Figure 20 - Supply modulation

> Summer supply evolution 2011-2016

The following graphs show the evolution of the different supply sources both in absolute and relative terms during the last six summers.

Supply (absolute values) Supply share

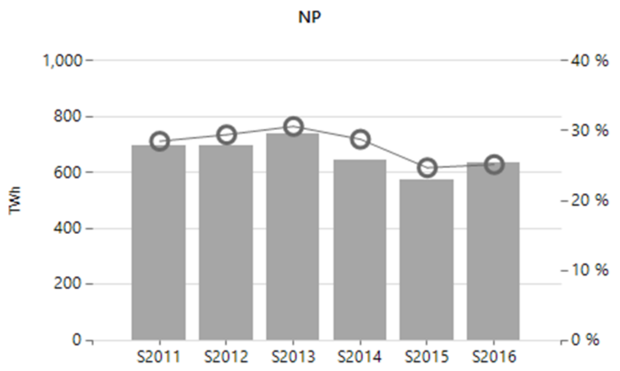

Figure 27 - Evolution of gas supplies during Summer

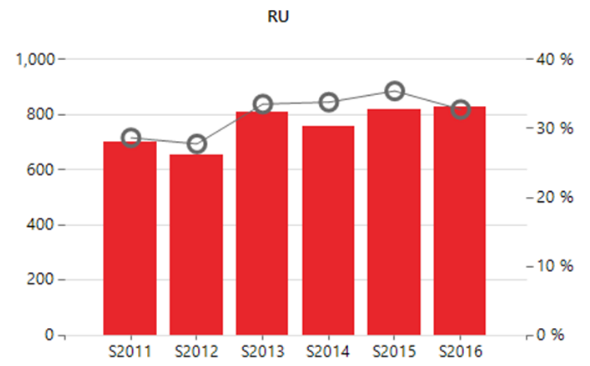

Figure 27 - Evolution of gas supplies during Summer

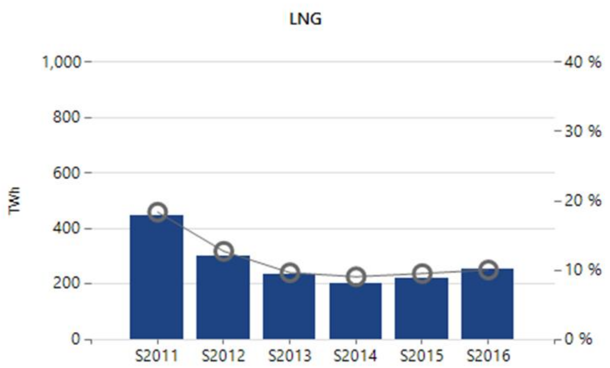

Figure 27 - Evolution of gas supplies during Summer

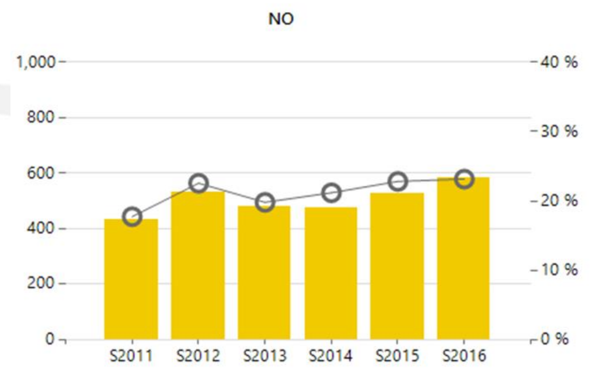

Figure 27 - Evolution of gas supplies during Summer

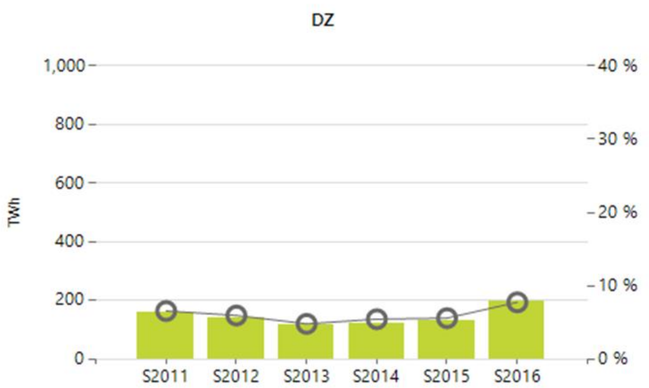

Figure 27 - Evolution of gas supplies during Summer

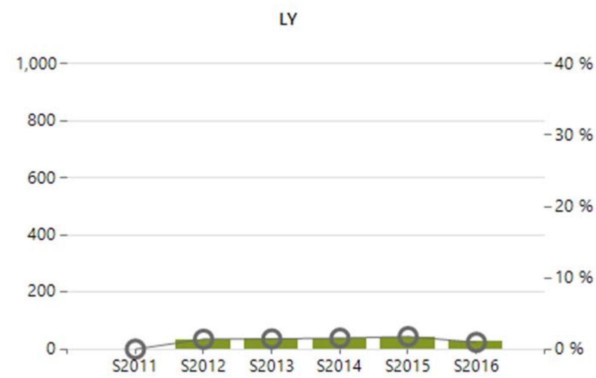

Figure 27 - Evolution of gas supplies during Summer

Figure 21 - Evolution of summer gas supplies 2011-2016

Underground Storages

The evolution of the injection season depends on many factors, in particular the willingness of shippers to inject gas and the actual amount of gas available for injection when considering gas demand. The first factor may be linked to price signals such as summer/winter spread unless the national regulatory framework implies some mandatory injection. The second one is linked to climatic and economic consideration having an impact on gas demand.

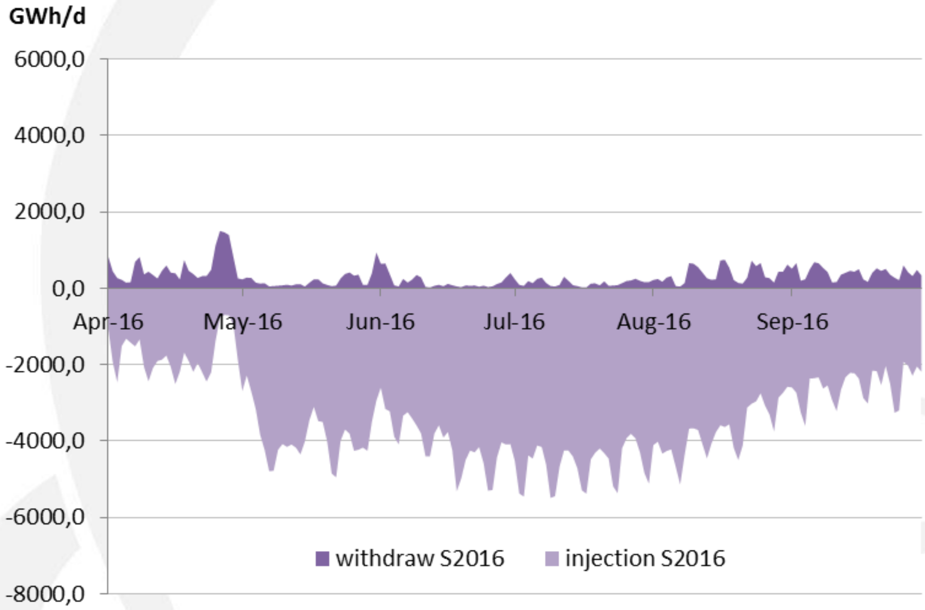

Figure 22 - UGS injection/withdraw profile EU-28 storages.

Figure 23 provides the average injection and the daily range between the lowest and highest injection for the whole Europe for every month of the Summers 2016 and 2015.

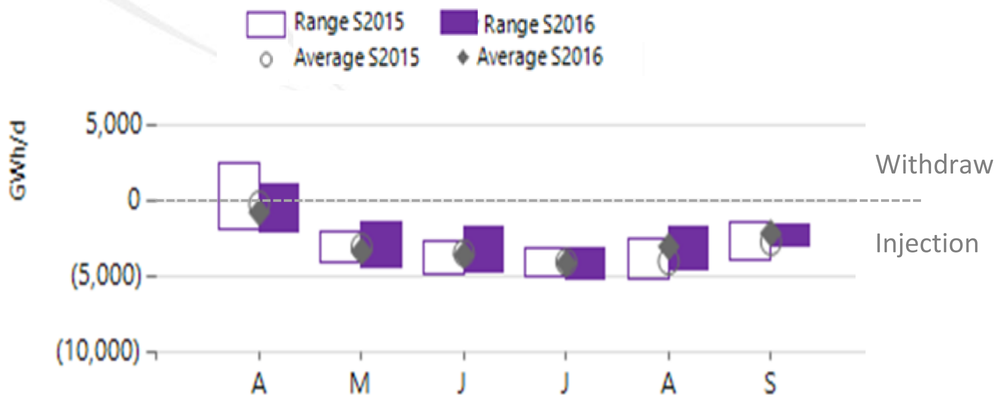

Figure 23 - UGS net injection (negative figures mean positive net injection)

The next table provides the evolution of the stock level as a percentage of the WGV during summer (source GSE AGSI platform):

Country	1-Apr-16	1-May-16	1-Jun-16	1-Jul-16	1-Aug-16	1-Sep-16	1-Oct-16
AT	35.6	41.1	49.5	60.5	74.7	84.4	90.3
BE	17.6	16.7	30.5	37.6	55.2	75.6	83.6
BG	43.2	46.5	51.8	63.6	76.1	87.2	92.4
CZ	35.9	35.4	47.2	67.8	85.3	94.0	100.0
DE	51.4	51.4	61.3	69.0	80.1	88.4	93.8
DK	38.9	38.0	54.4	68.1	80.4	93.3	94.6
FR	21.0	25.8	38.6	50.1	65.7	80.6	88.4
ES	53.4	55.4	57.4	64.7	68.4	71.4	73.0
HR	43.2	46.5	51.8	63.6	76.1	87.2	92.4
HU	17.2	19.0	25.2	32.9	41.6	50.5	57.1
IT	37.7	44.3	56.2	68.1	78.6	88.7	95.3
NL	29.5	35.0	50.7	65.1	82.3	89.7	99.2
PL	30.8	32.4	43.0	57.1	72.3	86.3	97.4
PT	30.6	36.8	34.2	33.6	32.0	41.8	31.8
SK	27.3	31.9	46.2	61.9	78.9	90.8	95.7
UK	47.9	30.8	28.6	54.9	91.5	85.5	92.5
EU Total	**35.2**	**39.0**	**49.9**	**61.2**	**74.4**	**84.1**	**90.7**

Figure 24 - Stock level (%WGV)

Figure 25 compares the stock level evolution curve of the last five summers (source AGSI).
Having started from an average level compared to the previous summers, 35% on the 1st April, the stock level increased enough to reach a high level, 91% by the end of September.
For many operators, the injection season continued in October 2016.

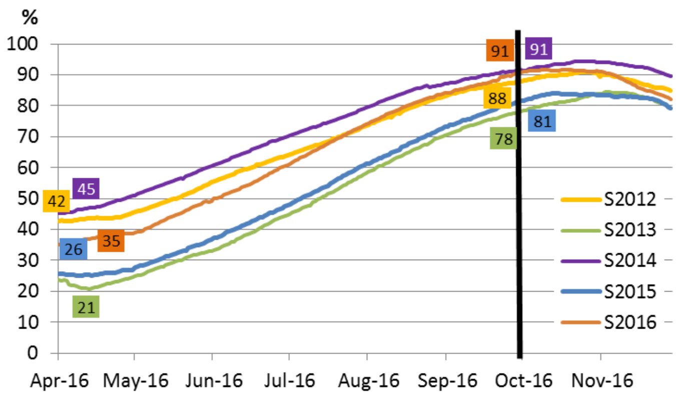

Figure 25 - Evolution of stock level. Summers 2012-2016 (AGSI)

	30-sep	maximum stock level	
S2012	88%	91%	26/10/2012
S2013	78%	85%	03/11/2013
S2014	92%	94%	23/10/2014
S2015	81%	84%	13/10/2015
S2016	91%	92%	09/10/2016

Figure 26 - Stock level: 30 Sept vs. max (AGSI)

Figure 26 shows the stock level on the 30th September in comparison with the maximum stock level setting the end of the injection season. The maximum stock level reached in 2016 was 92%, the highest one excluding 2014, when the storages started from a 45% level.

Transported volumes

The overall transported gas at the EU aggregated level is the sum of gas demand, exports and injection for each month.

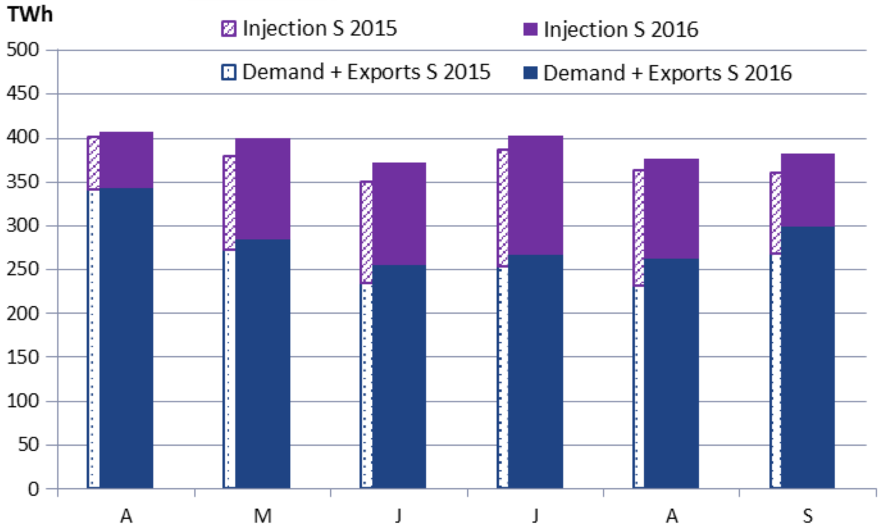

Figure 27 - Transported gas

Figure 27 shows the transported volumes during Summer 2016 in comparison with those of the previous year. Total transported volumes from April to September in 2016 (2,340 TWh) were 4.2 % higher compared to 2015 (2,245 TWh).

The transported volumes during April, May and June were lower than the ones from the previous summer, while they turned to be higher from July to September due to an increase in the UGS injection.