ENTSOG Summer Supply Outlook 2012

Executive Summary

ENTSOG has undertaken an assessment of the European gas network to analyse whether the grid is able to meet both demand and injection needs during Summer 2012 (April to September). The conclusions are:

The European gas network is sufficiently robust in all parts of Europe to <u>enable</u>:

- **Maintenance in order to ensure infrastructure safety and reliability**
- **Injection programme aiming at full filling of storage in preparation of the upcoming Winter**
- **Flexibility for network users**

A sensitivity study has been carried out to further illustrate the ability of the network to enable a shorter injection season and to face a wide range of supply patterns.

The integrated flow patterns used in the analysis are developed specifically for this Summer Supply Outlook. They should not be considered as forecast not withstanding they result from TSOs experience and ENTSOG modelling and supply assumptions.

Introduction

As part of ENTSOGs continuous efforts to ensure greater transparency and knowledge regarding the development and operation of the European gas transmission network, ENTSOG presents this Summer Supply Outlook 2012. This Outlook 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 storage 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 additional flexibility for injection under different supply scenarios.

Objective

As last year's report, the Summer Supply Outlook 2012 has checked if the capacity of the European gas network is sufficient to face demand and to achieve a 100% stock level by 30 September 2012.

In order to encompass the range of possible injection targets and supply patterns, an additional sensitivity study has been carried out around a Reference Case (see paragraph "Results of the sensitivity study").

The Reference Case is defined by a flat supply the level of which is defined by total Summer demand plus the difference between the European Working Gas Volume as an aggregate and the stock level on 1 April 2012.

The sensitivity analysis aims to assess the impact on certain injection levels (ranging from 85% to 100%) of the following supply scenarios:

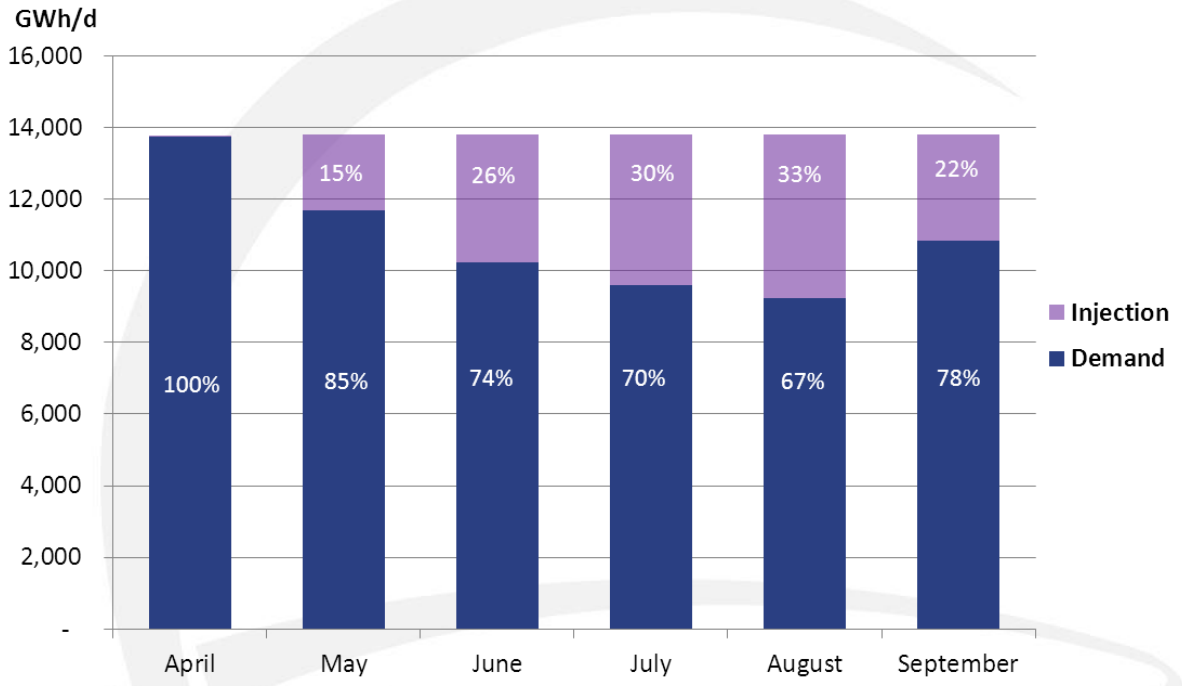
- different supply patterns (increase of import source by 10% in comparison to Average Daily Supply as defined under TYNDP 2011-2020) under the flat level of supply defined above
- different supply level (100 to 110% in comparison with demand and injection reference needs).

It measures the shortest time to fulfil the European storage Working Gas Volume as an aggregate.

Results of the sensitivity study

Reference Case

Definition of a fictitious flat supply for the whole summer has been selected in order to ease comparison between scenarios. The gas available for injection will depend on demand level as shown in the following graph (average daily values for each month):



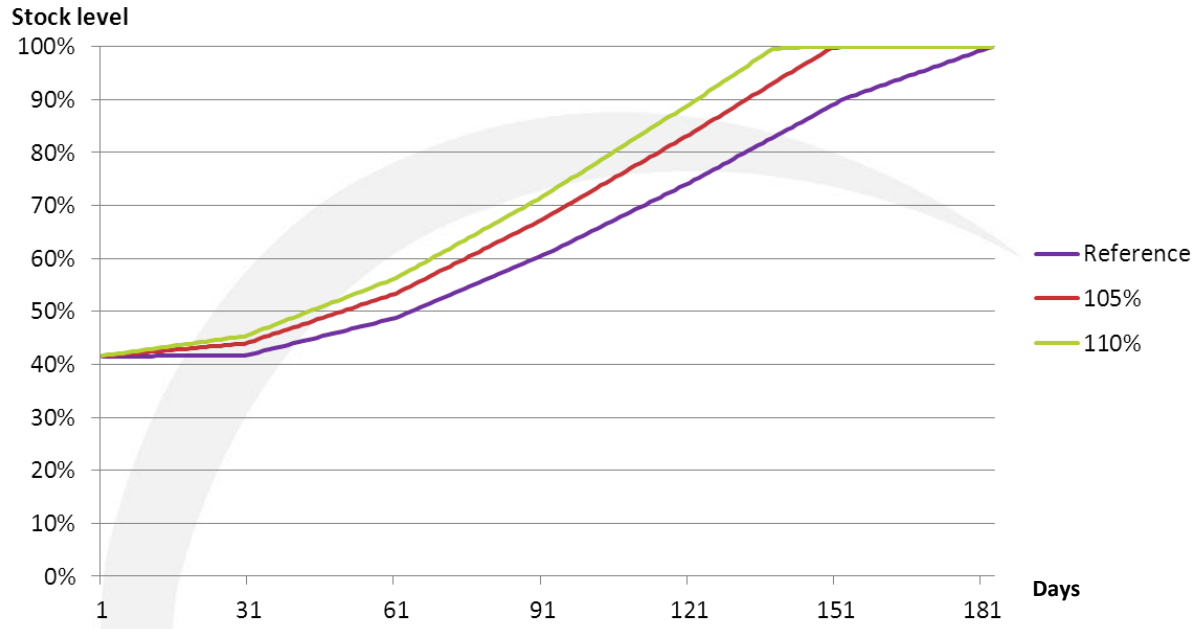
Modelling has been used in order to check if any physical congestion may limit the injection of this amount of gas.

The 183 daily simulations based on rules and assumptions (as defined in Annex A) show that a 100% aggregated European stock level may be achieved by 30 September 2012.

Sensitivity to oversupply

Additional gas brought to Europe enables faster injection season due to the flexibility offered by the European gas network allowing the additional injection. This is particularly efficient for the first part of the season when demand is still high impacting the availability of gas for injection.
Nevertheless the decreased injection capacity at the end of injection season (when storage is nearly full) reduces the added-value of additional gas when storage facilities are close to complete injection.

Below chart provides a comparison of injection curves between oversupply cases and Reference Case:



The results of the oversupply cases show that the European gas network indeed offers flexibility for fulfilling injection.

Sensitivity to supply pattern

The different supply shares analysed have little or no impact on the length of the injection season.
The concomitant reduction of LNG supply (induced by Russian supply predominance cases) and setting of a minimum send-out of 15% for each LNG terminal over Europe, leads to a reduced availability of LNG for Iberian Peninsula and South of France in comparison with the Reference Case and marginally extends the period needed for 100% storage filling. This shows the importance of LNG supply for this region.
Generally, the flexibility of the European transmission system is high enough to allow for different supply patterns while keeping the same period needed for injection.

Summary of the sensitivity analysis

The below chart provides a summary of the date at which injection can be completed depending on the supply case. These dates are only indicative and serve for comparison between scenarios as an average demand has been used for each day of a given month.

Cases	Date of x% filling achievement				Remarks
	85%	90%	95%	100%	

Reference case	20 Aug	30 Aug	15 Sep	30 Sep	
Oversupply 105%	02 Aug	10 Aug	19 Aug	28 Aug	
Oversupply 110%	23 Jul	31 Jul	8 Aug	17 Aug	
LNG predominance	Same as Reference Case				
North Africa predominance	Same as Reference Case				
Norway predominance	Same as Reference Case				
Russia predominance	Same as Reference Case (99% of European overall stock on 30 Sept.)				GRTgaz South & TIGF: 97% Iberian Peninsula: 99%

Conclusion

According to the ENTSOG modelling and supply assumptions, this Summer Supply Outlook confirms the ability of the European gas network to enable shippers to reach 100% full gas storage by the end of the Summer while ensuring the proper maintenance of the system. Higher and faster injections are possible depending on the level of European supply.

Please note that the integrated flow patterns used in this report are hypothetical just for the purposes of this Summer Supply Outlook.

ENTSOG plans to provide a preliminary review of potential major events occurring during the season next autumn. Comprehensive review of Summer 2012 dynamics will be released in spring 2013 together with the next Summer Supply Outlook.

Legal Notice

ENTSOG has prepared this Summer 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 with an enhanced tool using linear programming of flows. Priority has been given to the slowest storage facilities daily ranked according to the remaining amount of gas to be injected and the available injection capacity.

Simulation used country-based blocks except for:

- France: separate blocks for GRTgaz North, GRTgaz South and TIGF zones
- Poland: separate blocks for Gaz-System zone and Yamal Europe
- Romania: separate blocks for Transgaz zone and the pipe between Isaccea (UA/RO border) and Negru Voda (RO/BG border)

Reference Case

Modelling is based on 183 daily simulations taking into account the decrease of injection capacity with storage filling.

The overall Summer supply is defined as the sum of:

- demand forecast
- gas to be injected during the season (100% of working volume – stock on 1 April 2012)

The daily supply is defined as the overall summer supply divided by 183. Supply share per source is equal to the one used for 2012 in ENTSOG TYNDP 2011-2020.

If no physical congestion prevents injection, the overall Summer supply definition will induce a 100% filling of all storage on 30 September. Dates of intermediate filling (85%, 90% and 95% of European stock) are also provided by the modelling.

Oversupply

Same as Reference Case with an increase of 5% and 10% of the daily supply of each source (leading to lower supplies once the injection is completed).

Alternative supply patterns

Same as Reference case with each import source share increased by 10% while decreasing the other according to their share.

Data for Summer Supply Outlook 2012

Following tables show the assumptions used by ENTSOG

	Reference Case	Oversupply	Supply predominance
Demand	Average monthly demand forecast provided by TSOs		
Monthly injection	*Output**		
Overall supply	100%	105 & 110%	100%
Supply shares	TYNDP 2011-2020 (year 2012)		+10% for the predominant import source
Minimum supply	30% for each import pipe and 15% for each LNG terminal		
Cross-border capacity	Firm technical capacity as provided by TSOs taking into account reduction due to maintenance		

(*): result of the modelling

Average monthly demand forecast

GWh/d	April	May	June	July	August	September
AT	238	193	152	143	131	180
BE	507	457	386	357	348	406
BG	80	70	60	55	60	60
CH	86	75	68	69	66	88
CZ	215	140	106	92	96	137
DE	2,420	2,183	1,680	1,333	1,413	1,663
DK	140	87	76	63	69	84
EE	43	26	16	12	16	12
ES	1,026	968	1,060	994	889	1,001
FI	104	78	69	59	70	89

FRn	772	592	484	445	406	546
FRs	317	243	193	175	152	204
FRt	217	155	123	111	94	138
FY	1	1	1	1	1	1
GR	132	127	135	137	125	138
HR	101	87	70	93	96	103
HU	332	249	196	192	202	242
IE	153	131	129	124	114	134
IT	1,771	1,453	1,359	1,509	1,278	1,652
LT	81	63	46	44	48	58
LU	44	39	34	36	33	40
LV	34	23	24	20	26	26
NL	1,022	937	768	740	752	861
PL	402	335	300	268	278	318
PT	158	183	178	188	183	164
RO	308	224	199	200	191	254
RS	81	70	64	64	62	82
SE	30	22	17	16	17	21
SI	22	20	17	16	16	18
SK	150	88	80	76	72	94
UK	2,751	2,360	2,140	1,952	1,931	2,002
Total	13,738	11,680	10,227	9,585	9,234	10,816

(*): France split into 3 blocks: GRTgaz North (FRn), GRTgaz South (FRs) and TIGF (FRt) balancing zones

Supply share by source

	Reference Case	Over supply	LNG +10%	North Africa +10%	Norway +10%	Russia +10%

National Production	34%	34%	34%	34%	34%	34%
LNG	12%	12%	13%	12%	11%	11%
Algeria	7%	7%	7%	8%	7%	7%
Libya	2%	2%	2%	2%	2%	2%
Norway	20%	20%	19%	19%	22%	18%
Russia	25%	25%	23%	23%	24%	28%

UGS Declared storage Working Gas Volume capacity and level at the end of Winter 2011/2012

Country	DTMS*(GWh)	Stock level at the end of March 2012	Country	DTMS*(GWh)	Stock level at the end of March 2012
AT	39,886	47%	IE	2,398	18%
BE	7,480	33%	IT	173,514	49%
BG	4,950	39%	LV	25,520	18%
CZ	28,611	52%	NL	10,153	59%
DE	224,649	48%	PL	17,688	33%
DK	11,220	59%	PT	1,881	81%
ES	26,026	59%	RO	29,634	18%
FRn**	77957	18%	RS	3,300	18%
FRs**	31174	25%	SE	112	18%
FRt**	27918	23%	SK	31,950	47%
HR	7,119	18%	UK	52,316	59%
HU	67,430	30%	Total	**914,104**	**42%**

(*): Declared Total Maximum Technical Storage as defined on the GSE AGSI platform using a uniform GCV of 11 kWh/m^3 for conversion (Mm^3 into GWh)

(**): France split into 3 blocks: GRTgaz North (FRn), GRTgaz South (FRs) and TIGF (FRt) balancing zones

Replacement values

When exact data were not received or available, ENTSOG has used replacement data as following:

- Demand: annual figure from TYNDP 2011-2020 applying monthly ratio derived from 2009 & 2010 summers
- Stock levels at the end of March: minimum relative stock observed (18%)

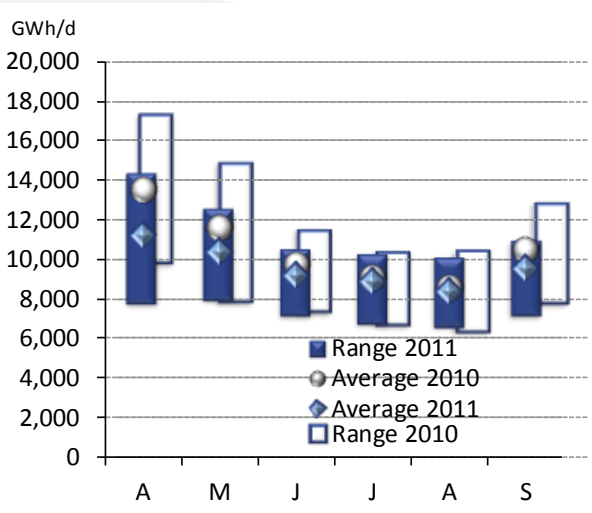
ENTSOG Seasonal Reviews[1]:

Summer 2011

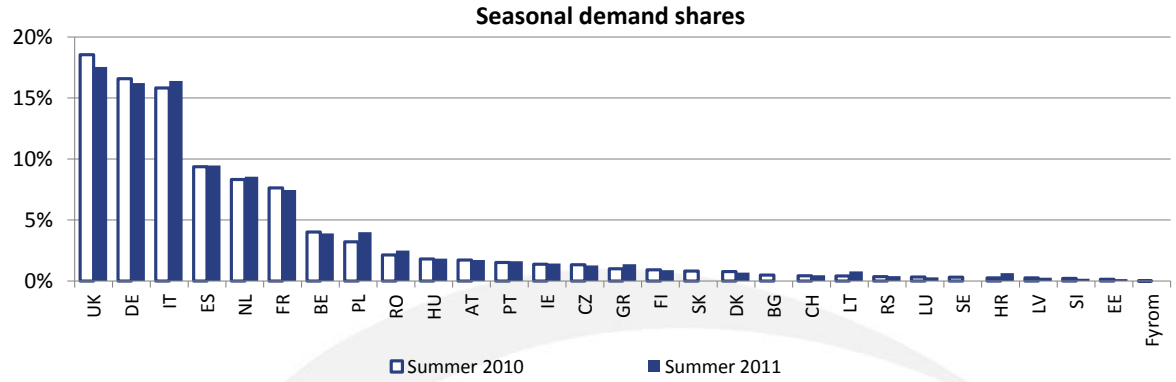
Demand

Actual 2011 Summer demand was moderately lower (-6.5%) than the gas demand of Summer 2010.

The graph reflects the difference between Summer 2011 and 2010. This deviation was neither homogeneous over the summer, achieving the highest difference in April (- 15%), while the gas demand in July and August were almost equal to the levels reached on the same months the previous year. These values are in line with the general reduction in gas consumption observed for the whole year 2011, driven mainly by the mild weather conditions - with the following reduction in residential and commercial sectors - and the decreased volume of gas consumed in the power sector, induced by the combination of a lower electricity demand, a higher output from alternative energies, and the economics of power generation favouring coal against gas. *(ref. Eurogas press release 29/03/2012)*



[1] ENTSOG prepares these seasonal Reviews on voluntary basis in order to provide information on the supply demand development in the previous seasons. Nevertheless, ENTSOG may decide to discontinue this publication at its discretion.



The demand composition and weather specificities determine the curve followed by the demand along the summer months. Defining the "Summer monthly load factor" (SMLF) as the relation between a summer month daily average demand and the summer daily average demand, ENTSOG has distinguished three different demand patterns in its Summer Reviews.

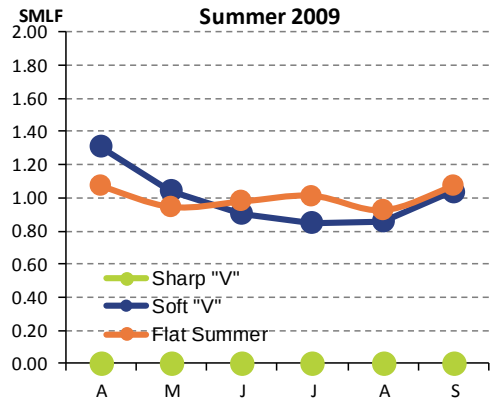
Type 1: Sharp "V" Summer: High share of residential demand in the demand composition combined with cold "summer-shoulder" months (April, May and September) may explain a well-defined "v" pattern.

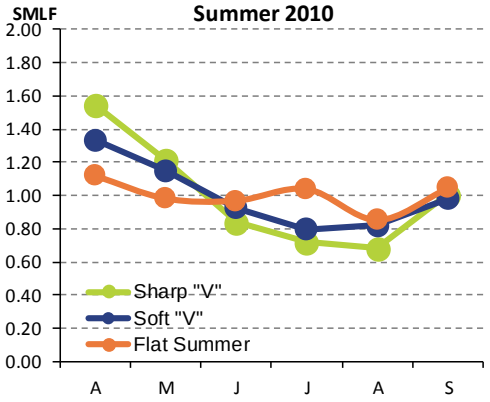
Type 2: Soft "V" Summer: Similar to type 1; moderately cold "summer-shoulder" months and a lower share of residential demand in the demand composition, may explain a softer "v" summer pattern.

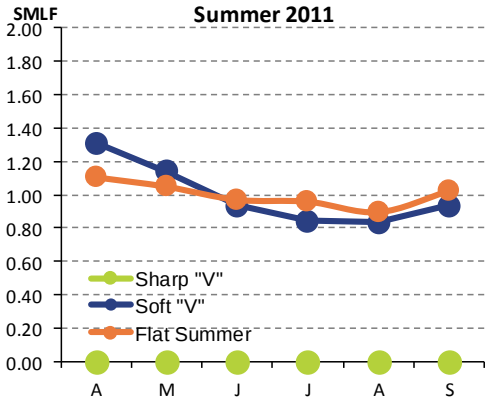
Type 3: Flat Summer: Warm "summer-shoulder" months with no heating requirements, combined with both a high share of gas demand for power generation in the demand composition and air conditioning during June, July and August, may explain a quite flat demand during the summer months.

This classification has been based on the qualitative analysis, and has seen different development from one year to the other. The following figure shows the evolution of the summer patterns followed during the last three summers:

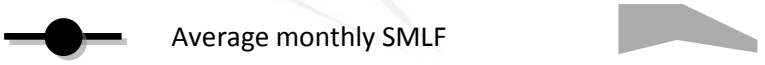
	2009	2010	2011
AT	Soft''V''	Soft''V''	Soft''V''
BE	Flat	Soft''V''	Flat
BG	Soft''V''	Soft''V''	Flat
CZ	Soft''V''	Sharp''V''	Soft''V''
DK	Soft''V''	Sharp''V''	Soft''V''
FI	Soft''V''	Flat	Soft''V''
FR	Soft''V''	Sharp''V''	Soft''V''
DE	Flat	Soft''V''	Soft''V''
GR	Flat	Flat	Flat
HU	Soft''V''	Soft''V''	Soft''V''
IE	Flat	Flat	Flat
IT	Flat	Flat	Flat
LT	Soft''V''	Sharp''V''	Flat
LU	Flat	Soft''V''	Flat
NL	Flat	Soft''V''	Flat
PL	Flat	Soft''V''	Flat
PT	Flat	Flat	Flat
RO	Flat	Soft''V''	Soft''V''
SK	Soft''V''	Sharp''V''	Soft''V''
SI	Flat	Soft''V''	Soft''V''
ES	Flat	Flat	Flat
SE	Soft''V''	Soft''V''	Soft''V''
CH	Soft''V''	Soft''V''	Soft''V''
UK	Soft''V''	Soft''V''	Flat
EUROPEAN DEMAND			
Sharp "v"	0.0%	11.0%	0.0%
Soft "v"	34.1%	58.5%	34.3%
Flat	65.9%	30.4%	65.7%



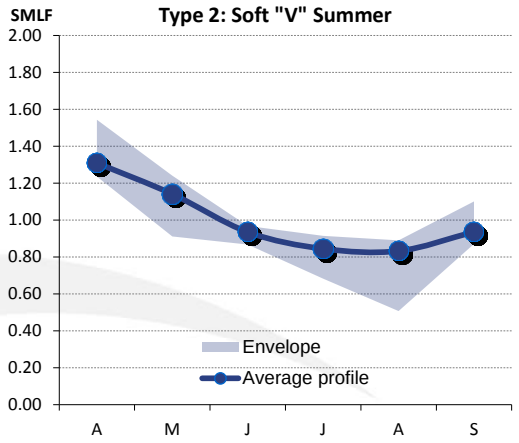




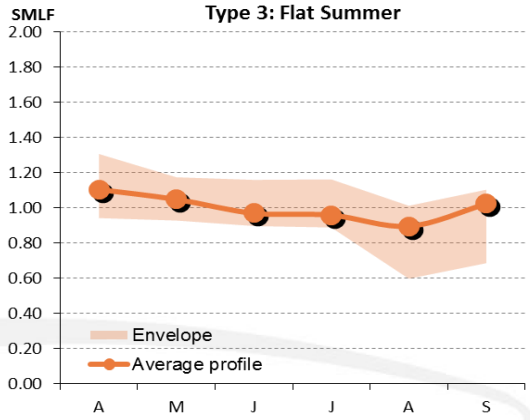
For each identified pattern in 2011, the following graph provides the average SMLF monthly value with the envelope showing the lowest and highest SMLF values of the countries following each pattern per month.



- Summer demand of Austria, Czech Republic, Denmark, Finland, France, Germany, Hungary, Latvia, Romania, Slovakia, Slovenia, Sweden and Switzerland follow a soft “V” pattern accounting for 34% of the European summer gas demand.



- The Flat Summer pattern accounts for 66% of the European summer demand and applies to Belgium, Bulgaria, Croatia, Greece, Italy, Ireland, Lithuania, Luxemburg, Netherlands, Poland, Portugal, Spain and UK.

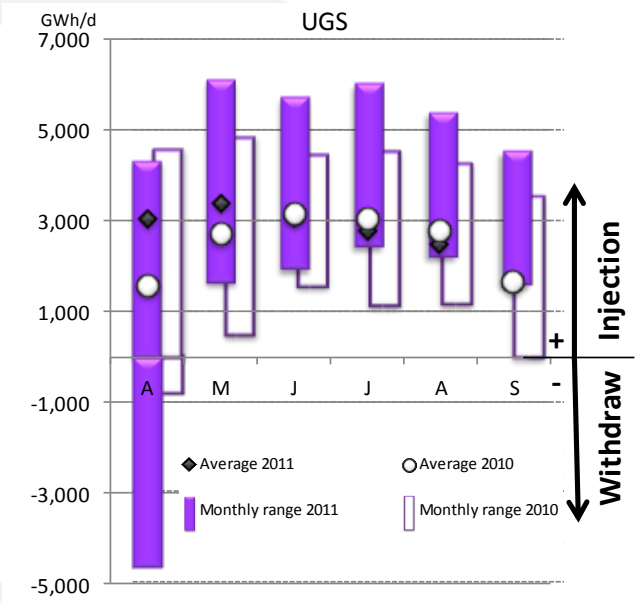


Underground gas storage

Injection season development 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 considerations having an impact on gas demand.

The next graph provides for every month of the Summer 2011 the average injection and the daily range between the lowest and highest injection for the whole Europe.

It is noticeable that the injection range was higher for April, when some considerable net withdrawals happened. This may be linked to the wide temperature range that occurred during this month impacting gas availability for injection.



The next table provides the level of stock during Summer 2011 for the GSE defined hub (source GSE AGSI platform).

It has to be noted that for many operators, injection continued in October 2011.

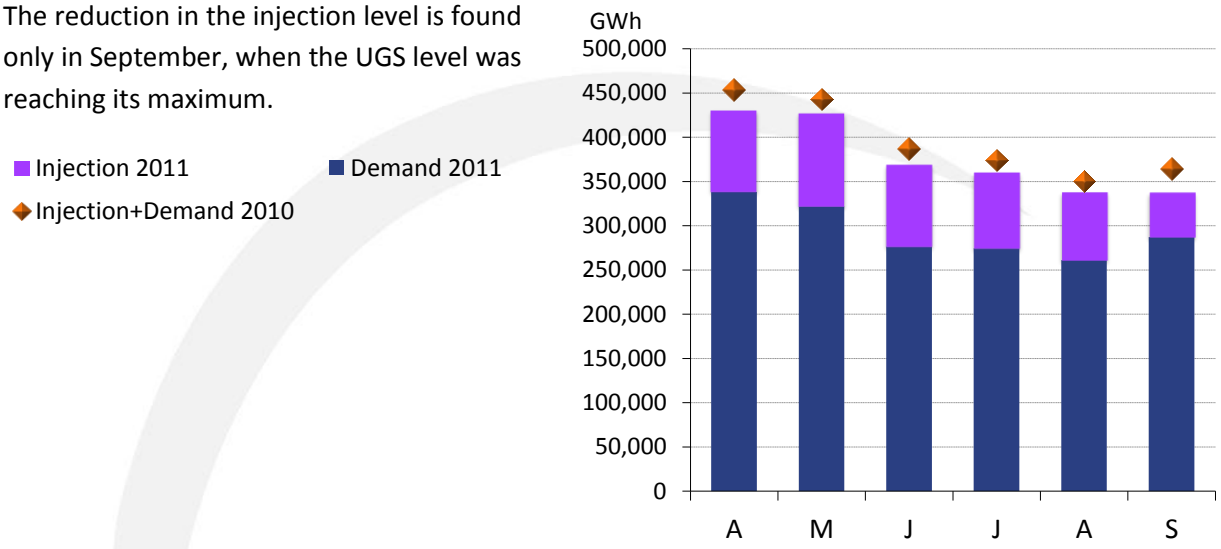
**: Areas are the ones defined under the AGSI platform*

Hub area *	Countries	Level on 31 Mar 2011	Level on 30 Sep 2011
Baumgarten	AT,CZ,SK,HU	42%	89%
France	FR	23%	86%
Germany	DE	43%	96%
Iberian	ES	44%	96%
NBP	UK	33%	96%
PSV	IT	49%	98%
TTF (Eurohub)	NL, DK	56%	90%
Zeebrugge	BE	17%	100%

Transported gas

The overall transported gas at the EU aggregated level is the sum of gas demand and injection for each month excluding transit to non-EU countries.

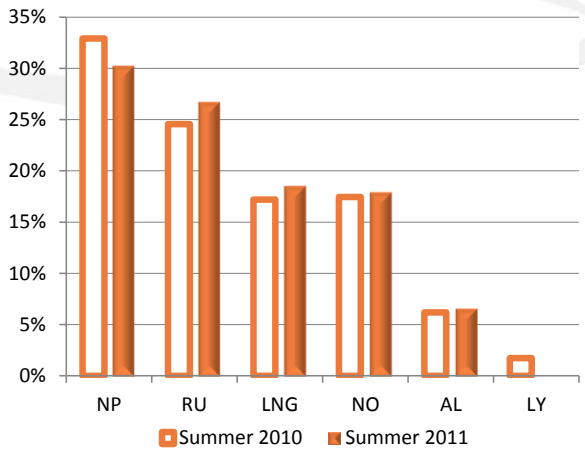
The reduction in the injection level is found only in September, when the UGS level was reaching its maximum.



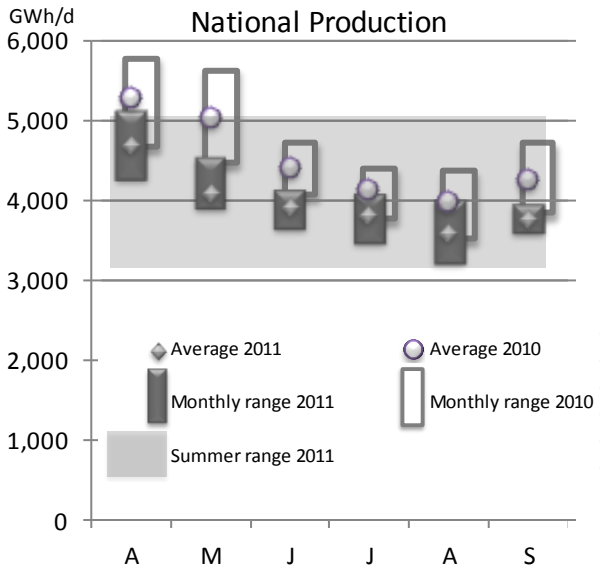
Supply

The next graph provides an overview of import and National Production supply shares during the Summers 2011 and 2010 in relative terms.

It is to be noted that National production reduced its share in the supply mix and the supplies from Libya were interrupted. That was compensated with slight increases of Russian imports and LNG.



The sources contribute to European supply at different levels and their use is very different in terms of seasonal and daily flexibility (linked among others to different underlying contractual flexibility). The graphs on the following pages illustrate for each supply source and month the average flow and the monthly and seasonal range (between the lowest and highest daily flow of each month and for the whole Summer 2011):


GWh/d
National Production
6,000
5,000
4,000
3,000
2,000
1,000
0
Average 2011
Monthly range 2011
Summer range 2011
Average 2010
Monthly range 2010
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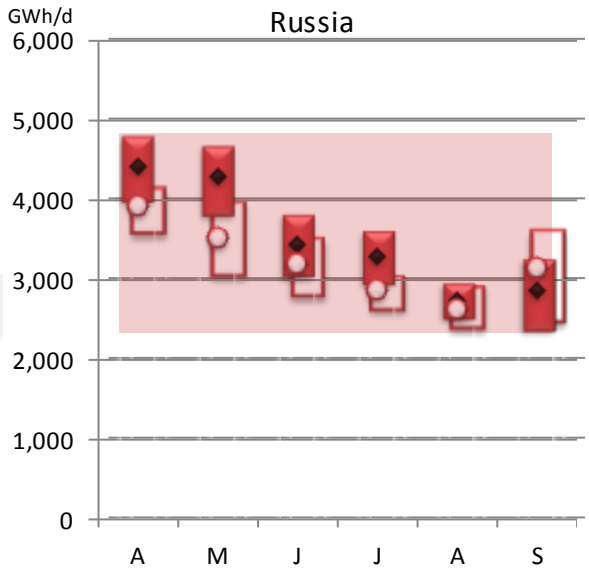
GWh/d
Russia
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5,000
4,000
3,000
2,000
1,000
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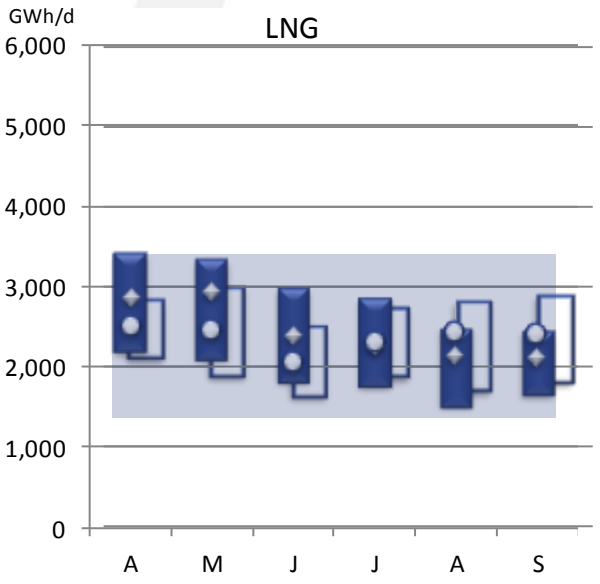
GWh/d
LNG
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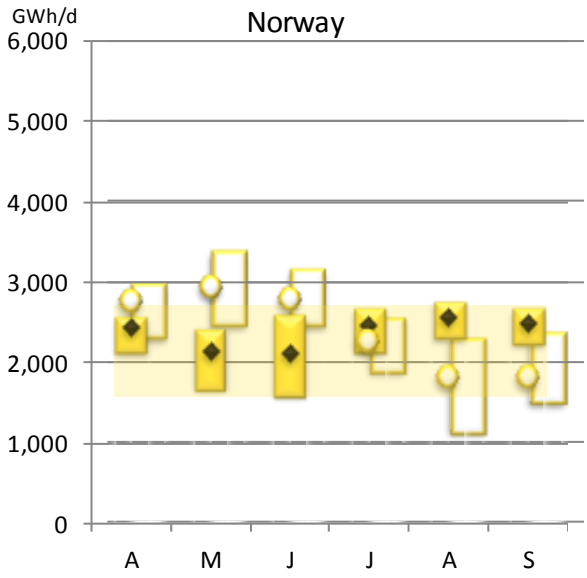
GWh/d
Norway
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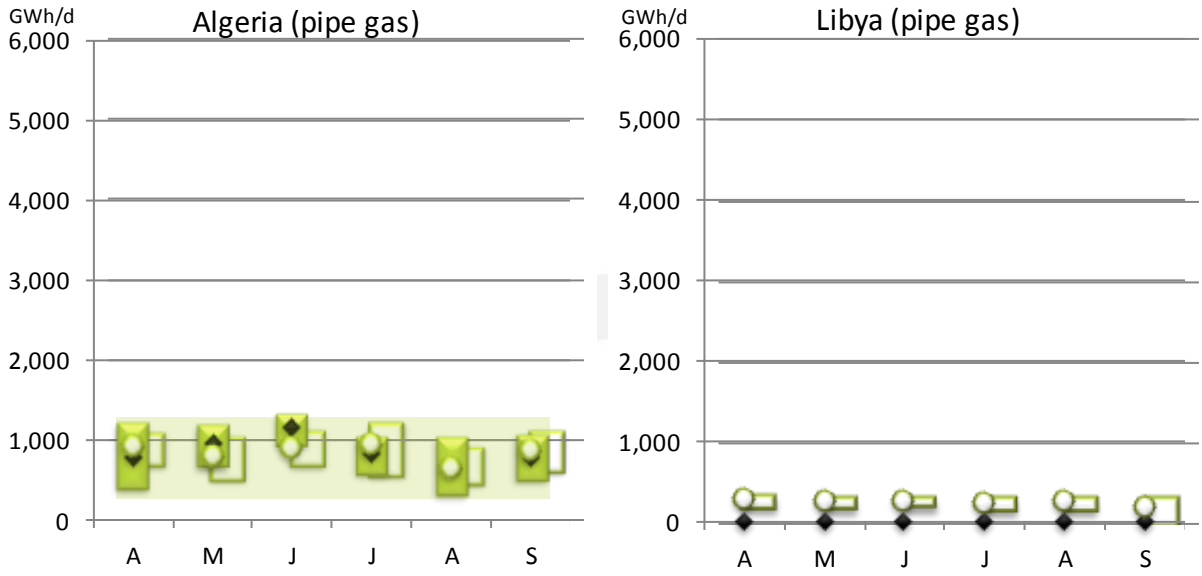
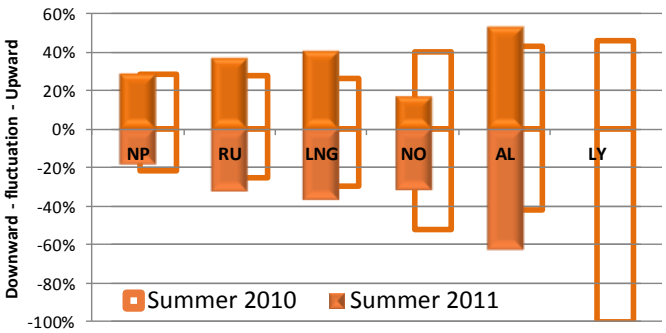


For each supply source two indicators measuring the actual supply fluctuation across the season have been defined as:

- The ratio between the highest daily flow compared to the average seasonal flow minus one (upward fluctuation)
- The ratio between the lowest daily flow compared to the average seasonal flow minus one (downward fluctuation)

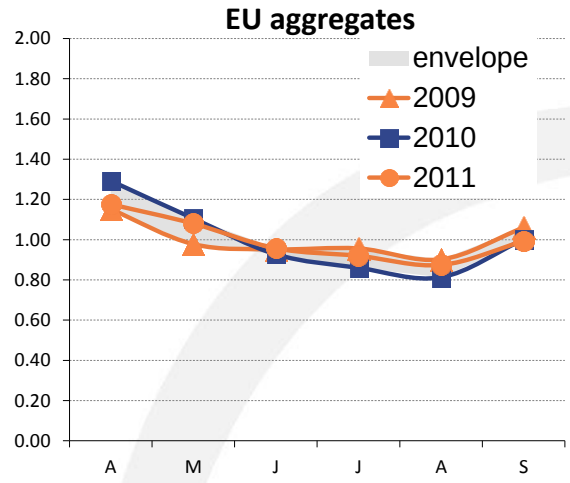
The next graph provides an overview of indicators for each supply source during Summer 2011:

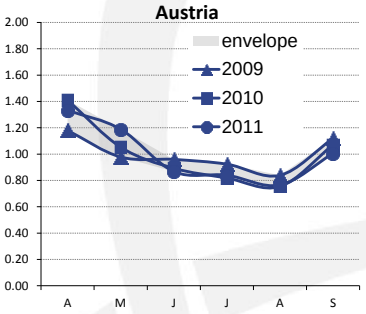
These indicators are impacted by many factors such as supply contract flexibility, maintenance, unexpected technical events etc.

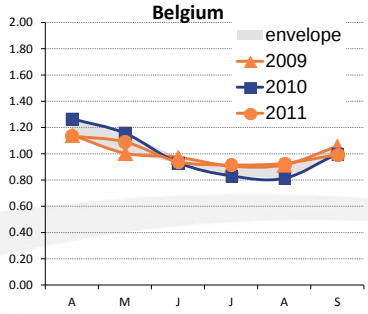


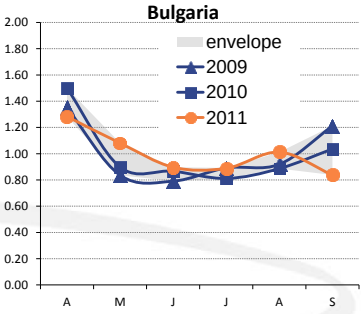
Annex

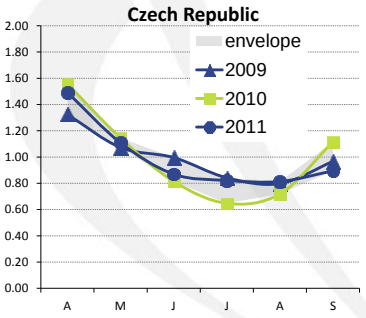
"Summer monthly load factor" (SMLF) by country

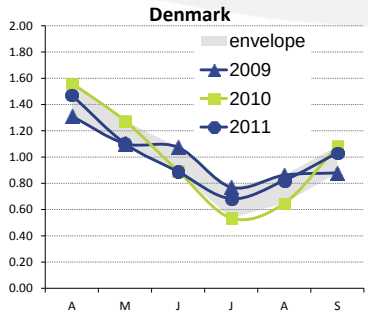


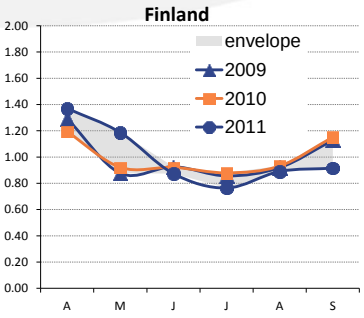


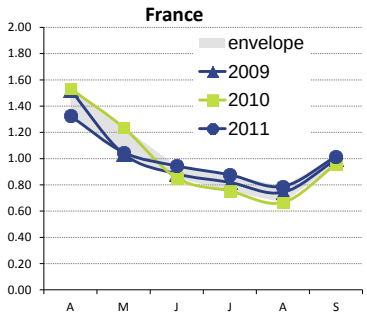








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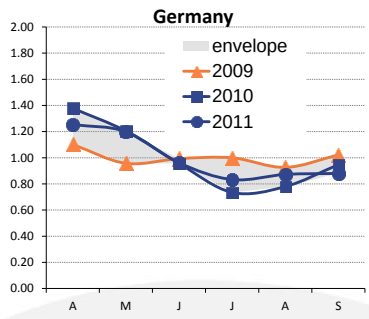
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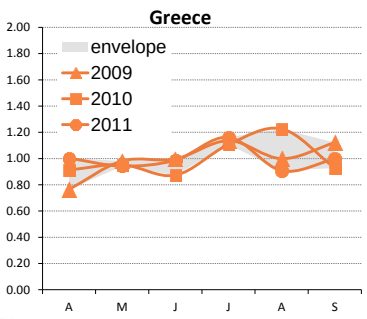
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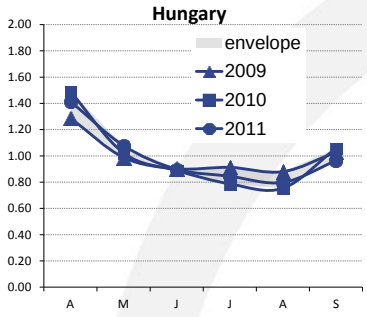
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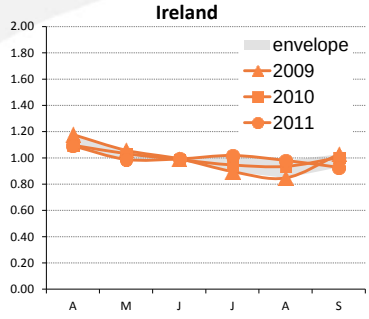
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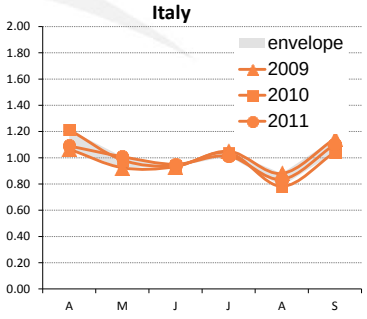
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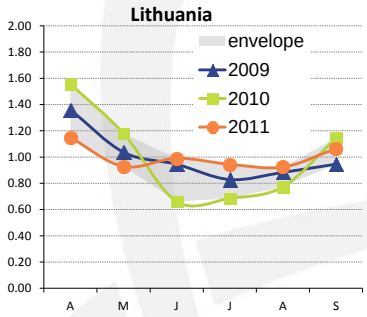
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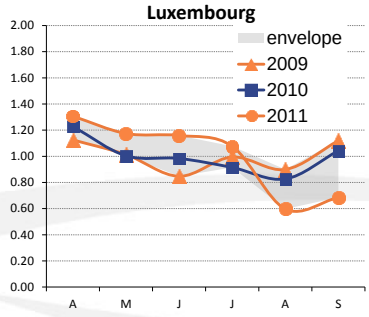
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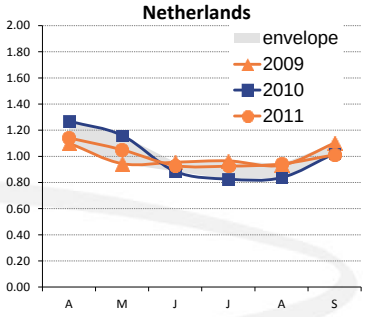
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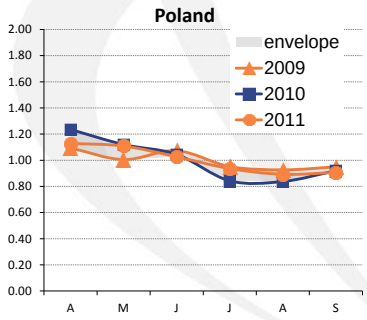
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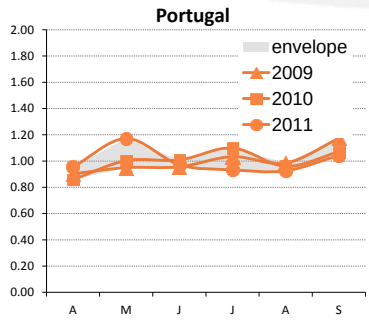
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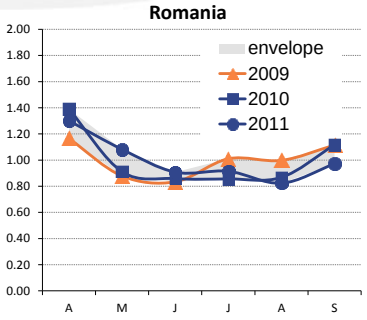
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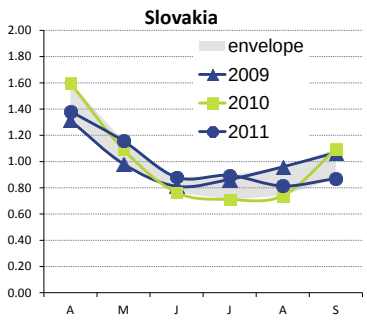
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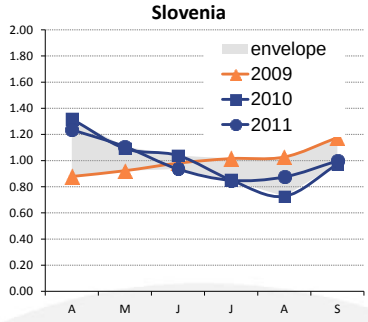
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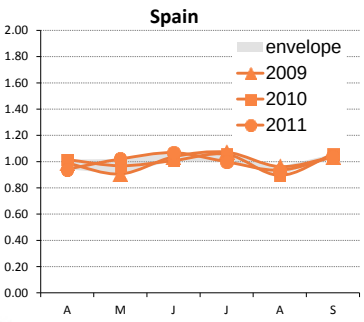
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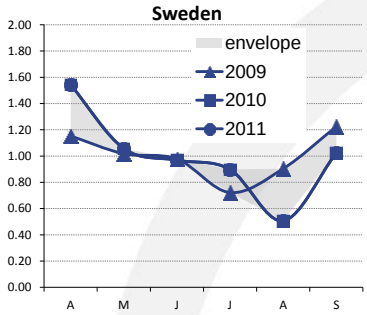
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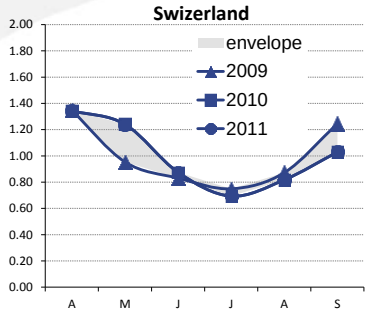
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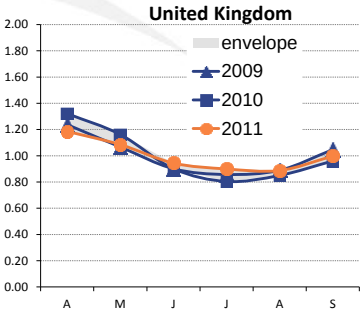
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Winter 2011-2012

Cold Spell: February 2012

This preliminary analysis of Winter 2011-2012 focuses on the cold snap that occurred in end of January – mid February 2012 and is based on provisional operational data. A deeper analysis on the confirmed demand and flow data will follow in full Winter Review 2011-2012.

Demand

The period of exceptionally high gas consumption occurred between 30 January and 14 February 2012. During those days, the average gas demand reached 27,077 GWh/d, a 12% increase over the 16-days highest average of the previous four Winters corresponding to Jan-Feb 2010.

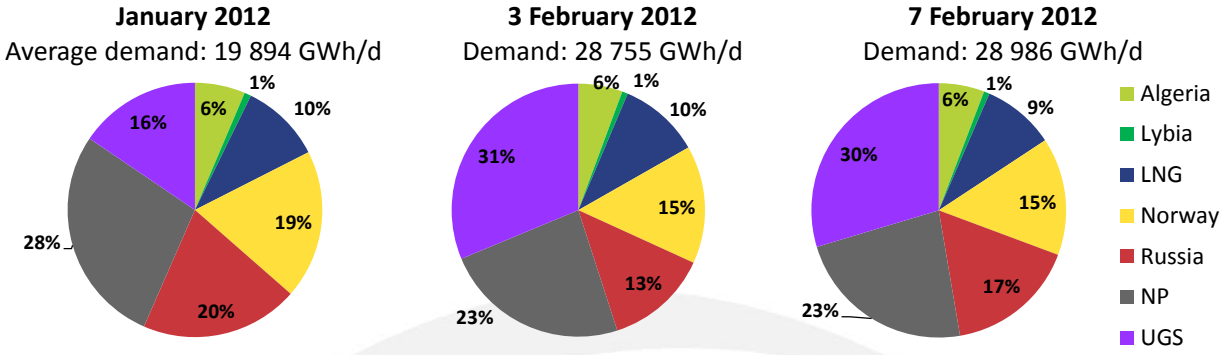
From the point of view of the daily peak, during the peak day the consumption reached 28,986 GWh/d. This value is a 7.8% over the historical peak that was reached in January 2010.

On this basis, it can be inferred, that this has been the most stressful cold spell for years, both in terms of scale and intensity, while any statistical conclusions at European level should be based on the analysis of climatic conditions.

Winter	30 Jan - 14 Feb		Highest 16-day				
	Average Demand (GWh/d)	UGS stock level 30 Jan.	Period	Average demand (GWh/d)	Peak day demand (GWh/d)	UGS stock level 1st day	UGS stock level 16st day
2008/2009	20,706	42%	01-16/01	22,813	25,436	70%	53%
2009/2010	23,580	60%	19/01-03/02	24,035	26,898	69%	58%
2010/2011	22,764	55%	07/12-22/12	23,999	26,568	81%	71%
2011/2012	27,077	67%	30/01-14/02	27,077	28,986	67%	51%

Supply

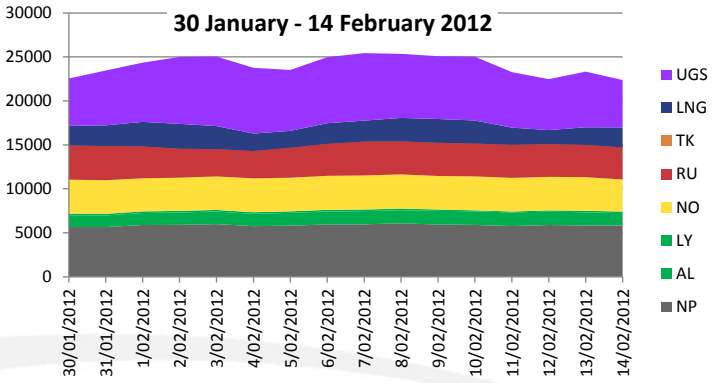
The comparison of the supply shares between the cold spell and the month of January shows the relevant role played by underground storage in covering the high peak consumptions. This strong contribution was backed by stock levels that were unusually high for the end of January induced by the mild climatic conditions during the first months of the Winter. Further investigations at national level are required to identify potential transmission limitation and their regional impact role.



Most of the flexibility required to close the gap between demand and available supplies was provided by storage (increase from 16% to 31% supply share) and, to a lower extent, by LNG (same relative share as in January).

GWh/d	January daily average	Maximum reached during cold spell (*)	
NP	5,492	6,080	(+ 10.7%)
UGS	3,050	7,903	(+ 159.1%)
LNG	2,019	2,836	(+ 40.5%)
AL	1,255	1,553	(+ 23.7%)
LY	168	197	(+ 16.8%)
NO	3,727	3,889	(+ 4.4%)
RU	3,950	4,630	(+ 17.2%)

(*) Non-simultaneously



The comparison between January and February shows that Russian gas has represented a large share of European supply during the cold spell but, the situation was heterogeneous between the different import routes:

Reference
January Average

Russian Routes	GWh/d
Poland (incl. Yamal to Germany)	688
Germany (Nordstream)	267
Slovakia	1,914
Hungary	194
Romania	685

Lowest Russian supplies
3 February

Russian Routes	GWh/d
Poland (incl. Yamal to Germany)	778
Germany (Nordstream)	297
Slovakia	1,212
Hungary	264
Romania	529

Highest daily demand
7 February

Russian Routes	GWh/d
Poland (incl. Yamal to Germany)	850
Germany (Nordstream)	296
Slovakia	1,857
Hungary	263
Romania	783

The cumulative effect of high gas demand and relative decrease in Russian delivery made the 2012 cold spell stressful for the network at European aggregated level, and local and regional situations will have to be further investigated.

The severity of the climatic event has to be considered in combination with supply and infrastructure availability. A deeper analysis that will be published as a part of the Winter Supply Outlook 2012-

2013 will help in the identification of the major factors in comparison with the Ukraine crisis in January 2011.