Understanding the current strengths and future competitiveness of European Gas

Gas Storage Perspective

9th Annual European Gas Summit,
Brussels, 17th September 2015

[redacted],
RWE Gasspeicher GmbH

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Gas storage demand drivers

negative impact

- warm winter and increasing annual mean temperature
- gas less favourable as a generation fuel
- declining demand for heating gas
- availability of other flexibility sources, such as:
  - gas hubs
  - pipeline flexibility
  - LNG

positive impact

- higher Min-take obligations in Russian LTC lead to reduction of flexibility supply?
- production cut Groningen field 2016 again under review
- increasing security of supply (SoS) requirements?
- higher s/w spreads due to more LNG supply in Europe in the summer?

Additional storage capacity 2010-2015

Published storage investments

year	Country	storage name	storage type	gas type	company	WC (mcm/day)	WGV (bcm)
2011	A	7 fields	Depleted field	H-Gas	RAG/E.ON Gas Storage	22	1.733
2011	A	Aigelsbrunn	Depleted field	H-Gas	RAG Energy storage	1	0.130
2014	A	Nussdorf/Zaglin	Depleted field	H-Gas	RAG Energy storage	1	0.117
2011	A	Haidach	Depleted field	H-Gas	RAG/Wingas/Gazprom	12	1.200
2013&15	F	Saline / Etrez expansion	Salt cavern	H-Gas	Storengy	93	0.000
2014/15	F	Izaute/Lussagnet expansion	Aquifer	H-Gas	TIGF	8	0.200
2011	D	Epe E.ON expansion	Salt cavern	H-Gas	E.ON Ruhrgas AG	0	0.235
2013	D	Epe Essent Exp. / GEC	Salt cavern	L-Gas	RWE GS	10	0.168
2012	D	Epe KGE	Salt cavern	H-Gas	Kommunale Gasspeicher Epe	5	0.085
2012	D	Epe Eneco	Salt cavern	L-Gas	Eneco	10	0.100
2012-15	D	ESE Etzel (EGS/OMV/VNG/Gas-Union)	Salt cavern	H-Gas	E.ON Gas Storage	53	1.967
2012/13	D	Etzel Crystal (EnBW+EDF)	Salt cavern	H-Gas	FSG Crystal	14	0.398
2012	D	EKB Etzel (BP/DONG/Gazprom)	Salt cavern	H-Gas	EKB Storage	17	0.700
2013	D	Jemgum-1	Salt cavern	H-Gas	EWE AG	6	0.172
2012	D	Katharina	Salt cavern	H-Gas	Erdgasspeicher Peisen	2	0.106
2011/12	D	Kraak expansion	Salt cavern	H-Gas	E.ON Hanse GmbH	10	0.288
2012	D	Krummhörn expansion	Salt cavern	H-Gas	E.ON Ruhrgas AG	2	0.125
2014	D	Stassfurt expansion	Salt cavern	H-Gas	RWE GS	28	0.294
2015	NL	Bergermeer	Depleted field	H-Gas	TAQA/EBN/Dyas/Suncor	57	4.100
2012	NL	Zuidwending	Salt cavern	L-Gas	Energy Stock	43	0.300
2012	UK	Holford (formerly Byley)	Salt cavern	H-Gas	E.ON Gas Storage UK	22	0.168
2014	UK	Stublach	Salt cavern	H-Gas	E.ON Gas Storage UK	11	0.100
Sum						**425**	**12.686**

Source: GSE storage map 2010-2015

Germany: BMWi study indicates overcapacity

- SoS in the German gas system depends on the storage filling level

60% filling level

February 2016 Withdrawal capacity

in %	No external effects	Technical problems	Russian Embargo
Normal winter	72%	66%	39%
Cold spell	20%	5%	-40%
Cold winter	41%	28%	-63%

+ = overcapacity

- = undercapacity

30% filling level

February 2016 Withdrawal capacity

in %	No external effects	Technical problems	Russian Embargo
Normal winter	61%	51%	-62%
Cold spell	-19%	-45%	-133%
Cold winter	-42%	-68%	-149%

+ = overcapacity

- = undercapacity

Source: bbh study; “Möglichkeit zur Verbesserung der Gasversorgungssicherheit und der Krisenvorsorg durch Regelungen der Speicher, einschließlich der Kosten sowie der wirtschaftlichen Auswirkung auf den Markt”, Berlin 2015

Germany: BMWi study expectation for 2026

- Similar market situation in 2026
- No major changes of storage capacities till 2026
  - ➔ Similar SoS situation expected as in 2016

Germany: Federal Ministry of Economics (BMWi) is reviewing SoS support measures

- SoS standard in Germany is very high
- Further measures like strategic reserves or filling obligations are only necessary if a 100% risk avoidance is required.
- Suggested more market based measures are:
  - Revision of balancing regime; higher fee for imbalance
  - Reducing Demand in case of SoS issue by improving Demand-Side-Management

> Consultation procedure went until July 2015; final decision to be announced in October 2015

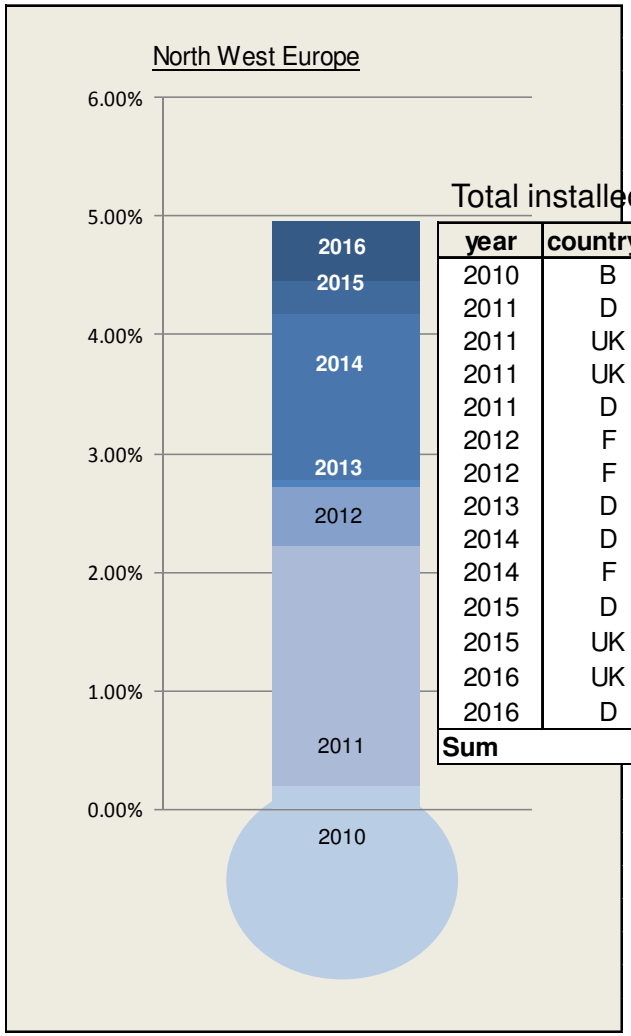
Results DG ENER study on SoS

- Storage filling levels continuously high despite low seasonal spread & spot price volatility and increasing competition of flexibility sources
- So far no market failure has been noticed
- strategic gas reserve: Natural gas reserve far more costly than oil reserve.
- storage measures: partly effective, costs normally exceed benefits
- **Ignored insurance value may lead to reductions of storage capacity and of their usage in the future**
- Advice to internalize insurance value:
  - as a penalty for suppliers in case of disruptions or
  - as incentives and premiums offered for physical or virtual storage

Gas Storage Perspective:

Higher prices achievable in the medium and long term ?

Reaction of storage operators in Northwest Europe



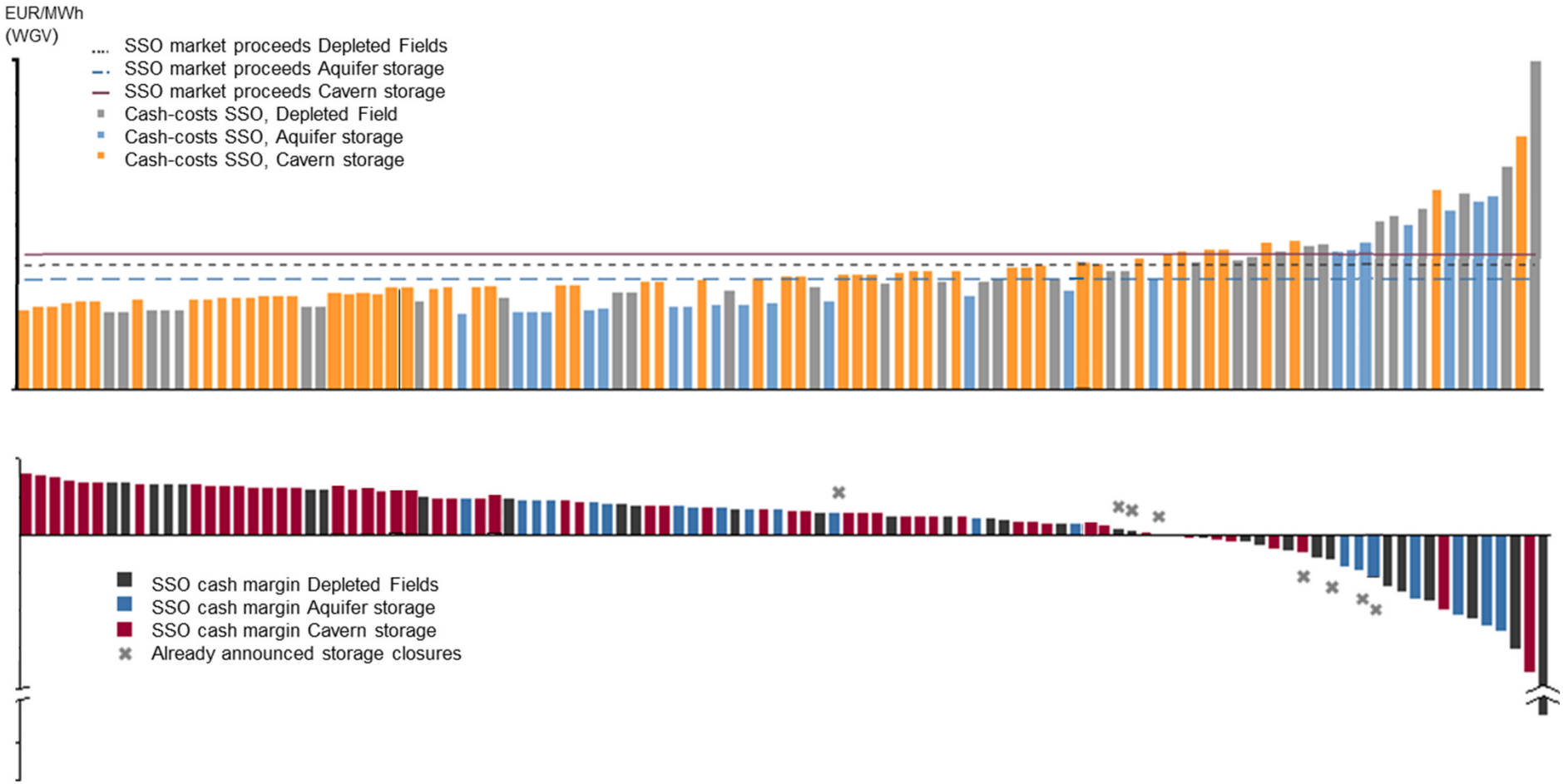
Published storage closures

Total installed capacity: WGV 60 bcm / WC 1.4 bcm/d => **4%** **4,95 %**

year	country	storage name	storage type	gas type	company	WC (mcm/d)	WGV (Bcm)
2010	B	Zeebrügge	LNG peak shaving	H-Gas	Fluxys	n/a	0.115
2011	D	Dötlingen	depleted gas field	H-Gas	Exxon Mobil / BEB	13	1.065
2011	UK	Partington	LNG peak shaving	H-Gas	National Grid	n/a	0.095
2011	UK	Glenmavis	LNG peak shaving	H-Gas	National Grid	n/a	0.043
2011	D	Nievenheim	LNG peak shaving	L-Gas	RWE Gasspeicher	n/a	0.014
2012	F	Trois Fontaine	depleted gas field	H-Gas	Storengy	2	0.080
2012	F	Soings-en-Sologne	aquifer	H-Gas	Storengy	2	0.220
2013	D	Lehrte	depleted oil field	H-Gas	E.ON Avacon	3	0.035
2014	D	Reitbrook	oil field with gas cap	H-Gas	Storengy	8	0.350
2014	F	Saint-Claire-sur-Epte	aquifer	H-Gas	Storengy	6	0.485
2015	D	Buchholz	aquifer	H-Gas	VNG Gasspeicher	2	0.175
2015	UK	Hornsea	cavern	H-Gas	SSE	6	0
2016	UK	Avonmouth	LNG peak shaving	H-Gas	National Grid	n/a	0.081
2016	D	Kalle	aquifer	H-Gas	RWE Gasspeicher	11	0.215
Sum						**53**	**2.973**

Source: RWE Gasspeicher, public information NWE= North-West Europe

Not all storages are covering operational costs…



Source: RWE Gasspeicher, public storage data

Additional SoS for L-Gas achievable

- Gas quality requirement for L-Gas in Germany and L-Gas (respectively Groningen Gas) in the Netherlands are different: Wobbe-Index
  - GER: 39.6 – 46.8 MJ/Nm³
  - NL: 43.1 – 44.8 MJ/Nm³ (permitted range GTS border to Germany near Gronau/Epe)
- Harmonised gas quality requirements on both sides would:
  - enhance cross-border flows in both directions
  - simplify cross-border facility usage e.g. for storages
  - increase flexibility of L-Gas-Systems and add a positive impact on SoS

Challenges for L-Gas – The Netherlands

Where are we coming from?

- Supply of end customers, power plants and industrial customers with Groningen gas (L-Gas) in NL
- Export of L-Gas to Germany, Belgium and France
- Export of flexibility out of the gas production to Germany

What has been changed?

- Growing number of tremors around the Groningen field
- Structuring of the production by gas storages already implemented
- Production cuts:
  - 2014 cut from 49 to 42,5 bcm
  - 2015 cut from 39,4 to 30 bcm
    - in 02/15 16,5 bcm for first half of 2015
    - in 06/15 13,5 bcm for second half of 2015

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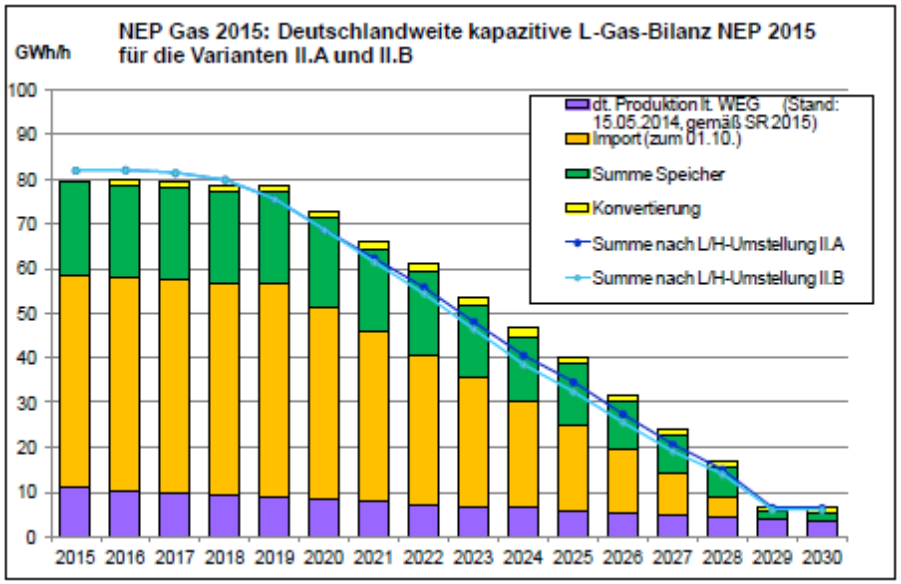
Niche market for L-Gas-Storages in Germany?

- L-Gas flexibility demand is covered by Dutch imports and declining German production
- Change from L- to H-Gas: Germany: Starts in 2015 and is scheduled until 2030
- German network development plan does not differentiate between market areas NCG and Gaspool yet
- Few L-Gas storages in NCG
- 30 bcm, including flexibility, to be replaced by H-gas by 2030



Source: NEP 2015, page 95

Conclusion

In any case, SSOs have to …

… follow the discussion of the EU, National Governments and Regulators on future gas storage regulation

… foster transparency about correlation between availability of withdrawal capacity and working gas filling level

… check continuously cash flow balance and closing/mothballing options for gas storages to be prepared for cut throat competition

… use L-gas niche market opportunities

Security of supply will not be cheap forever!