Brussels, 28 February 2018

ENTSOG Union-wide simulation of gas supply and infrastructure disruption scenarios

SoS Gas Sub-group meeting

28 February 2018

ENTSOG System Development Team

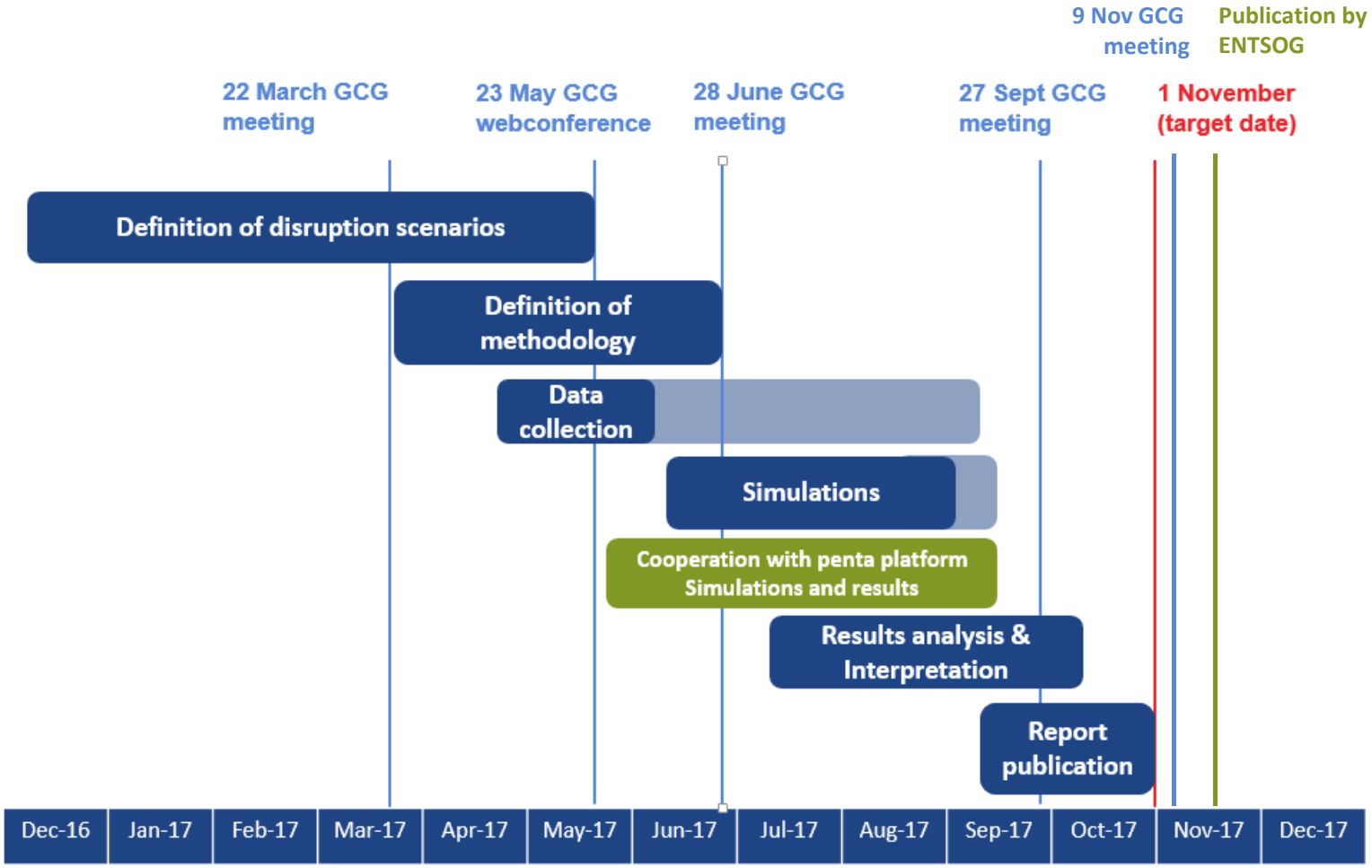
Union-wide supply and infrastructure simulation

Regulation 2017/1938:

- Art 7(1) “By 1 November 2017, ENTSOG shall carry out a Union-wide simulation of gas supply and infrastructure disruption scenarios. The simulation shall include the identification and assessment of emergency gas supply corridors and shall also identify which Member States can address identified risks, including in relation to LNG. The gas supply and infrastructure disruption scenarios and the methodology for the simulation shall be defined by ENTSOG in cooperation with the GCG. […]”

- Art 7(2) “[…] The competent authorities shall take into account the results of the simulation referred to in paragraph 1 of this Article for the preparation of the risk assessments, preventive action plans and emergency plans.”

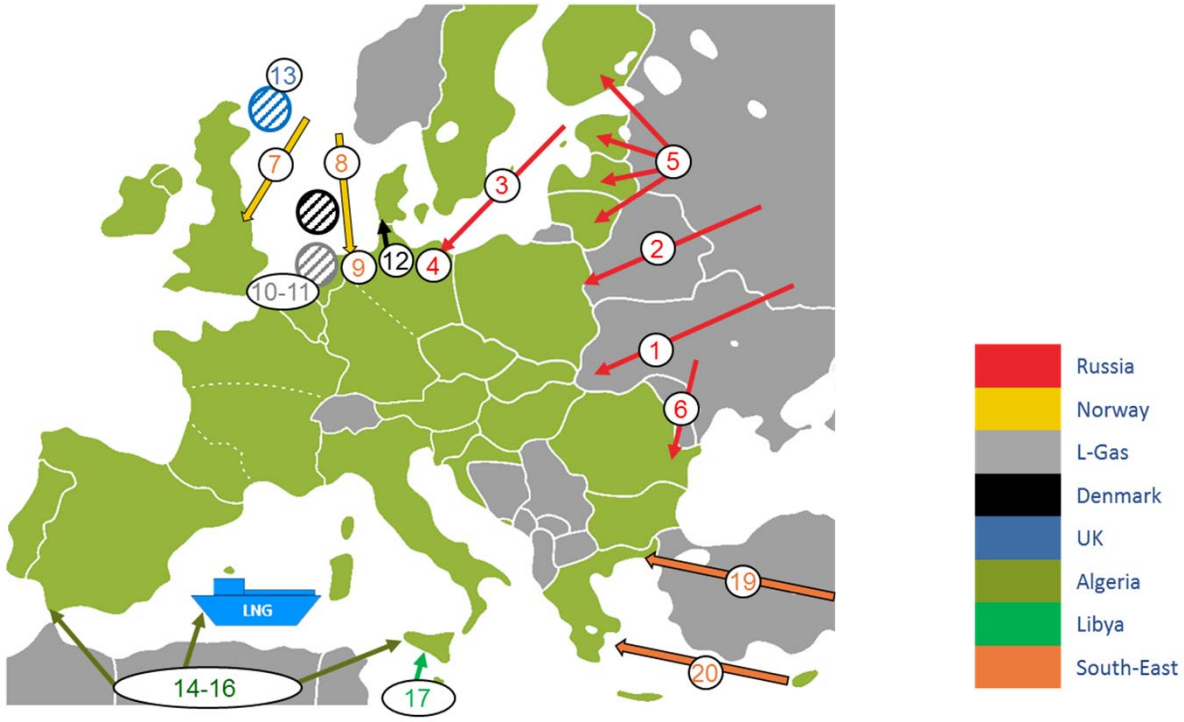
Overall timeline



Scenarios and methodology

Gas supply and infrastructure disruption scenarios

Defined with Gas Coordination Group



> Scenarios were defined considering the risk groups as defined in Annex 1 along the main supply corridors.

Methodology for the simulation

defined with Gas Coordination Group on 23 May and 28 June 2017

Union-wide simulation as defined with GCG meant to assess the gas system under situations challenging in terms of:

> Level of demand

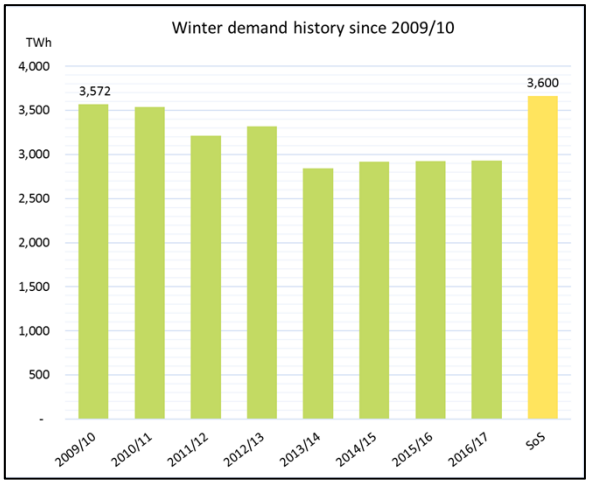
> Disruption duration and timeframe

> Initial gas storage level at beginning of the winter season

Methodology for the simulation

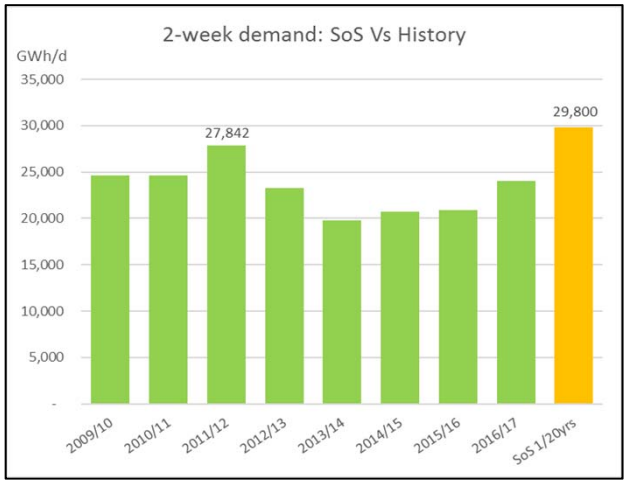
- ***Demand: 3 cases***

> Winter demand

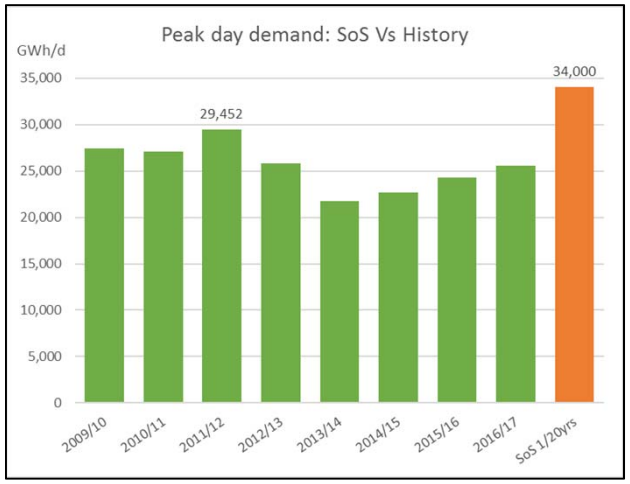


Highest historical

> 2-week in 20 years



> Peak day in 20 years



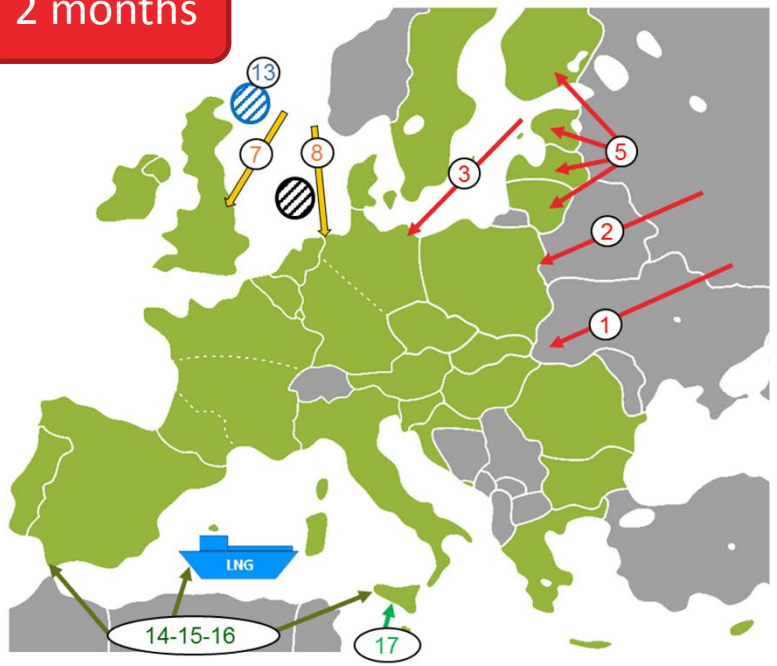
Probability of 1-in-20 years

Methodology for the simulation

- ***Scenarios***

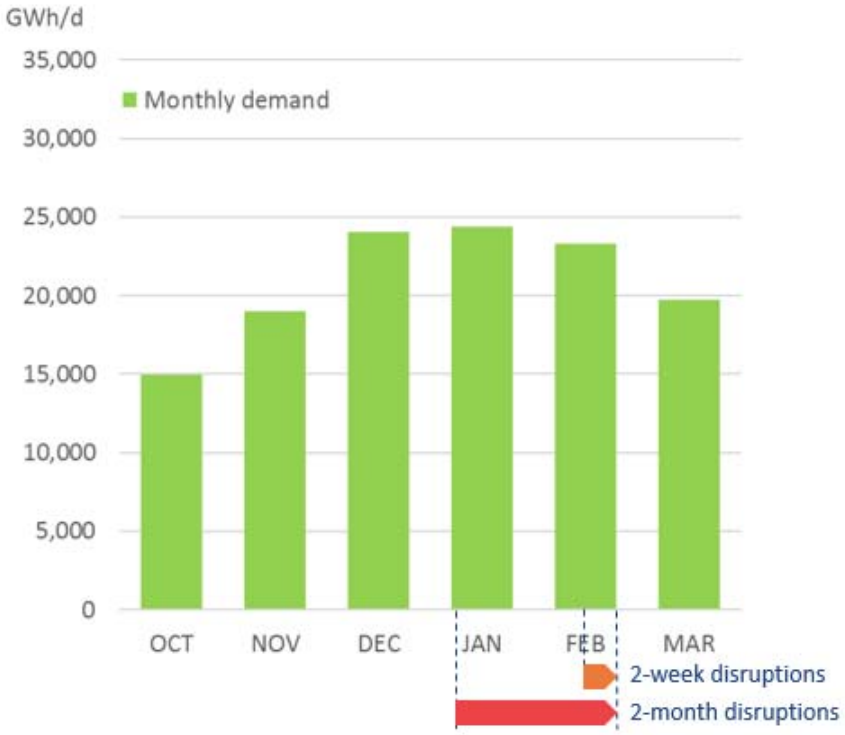
2 weeks

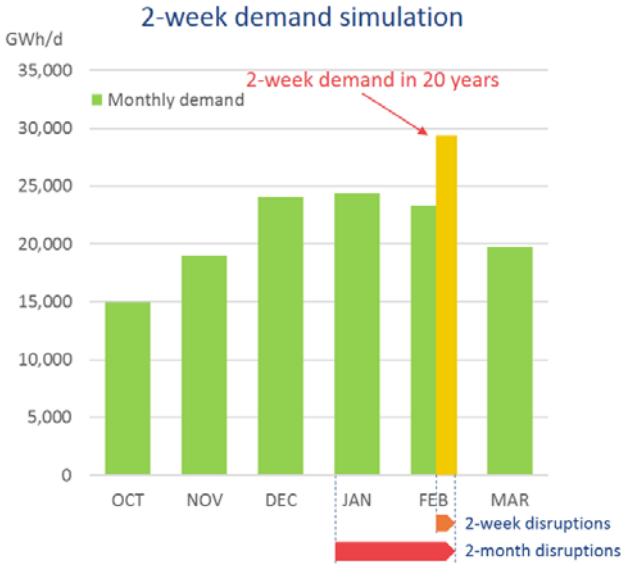
2 months

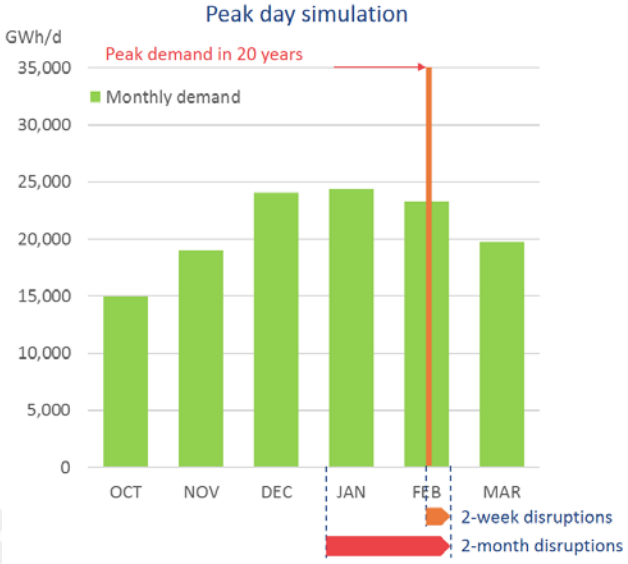


Methodology for the simulation

- ***Disruption timeframe***

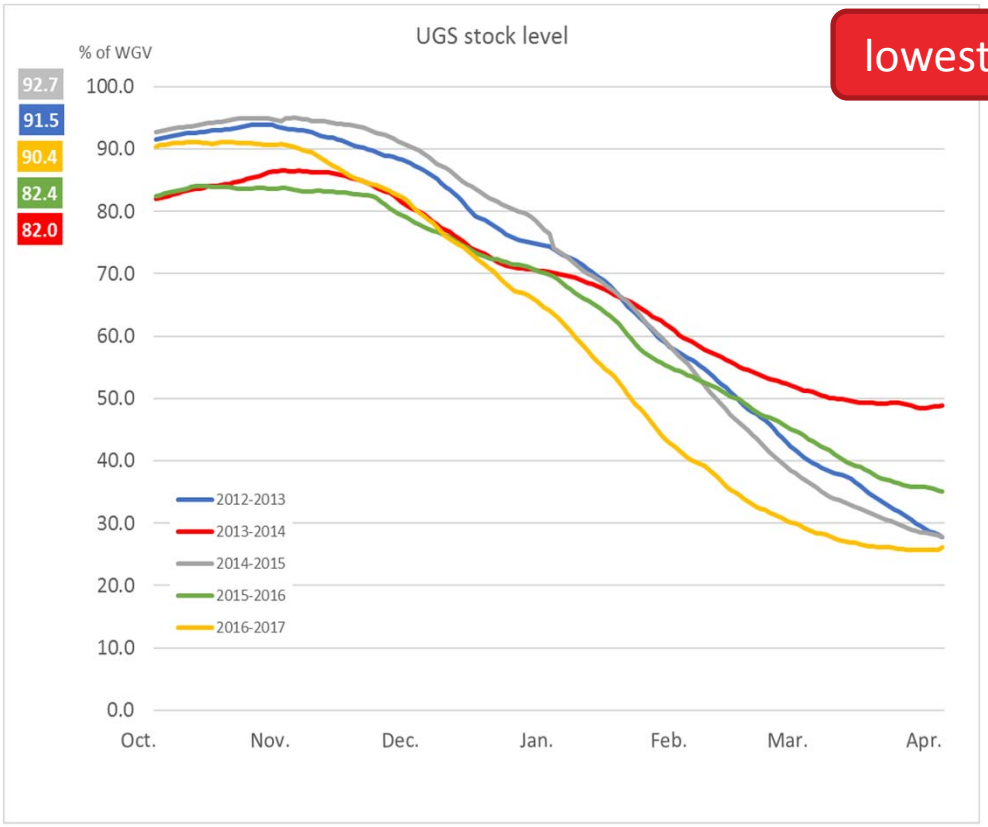






Methodology for the simulation

- ***Storage initial level: lowest over 5 last years = 82%***



lowest historical

- ***Storage withdrawal capacities depend on storage levels***

Methodology for the simulation

- ***Supply flexibility and LNG specifics based on recent history****
- ***Exports based on recent history****
- ***Infrastructure as of 1 October 2017***

*See back-up slide for actual figures

Results interpretation

Results interpretation

Objective: Identify which Member States can address identified risks

Risk of demand curtailment may depend on

> Import limitations

> Storage withdrawal limitation

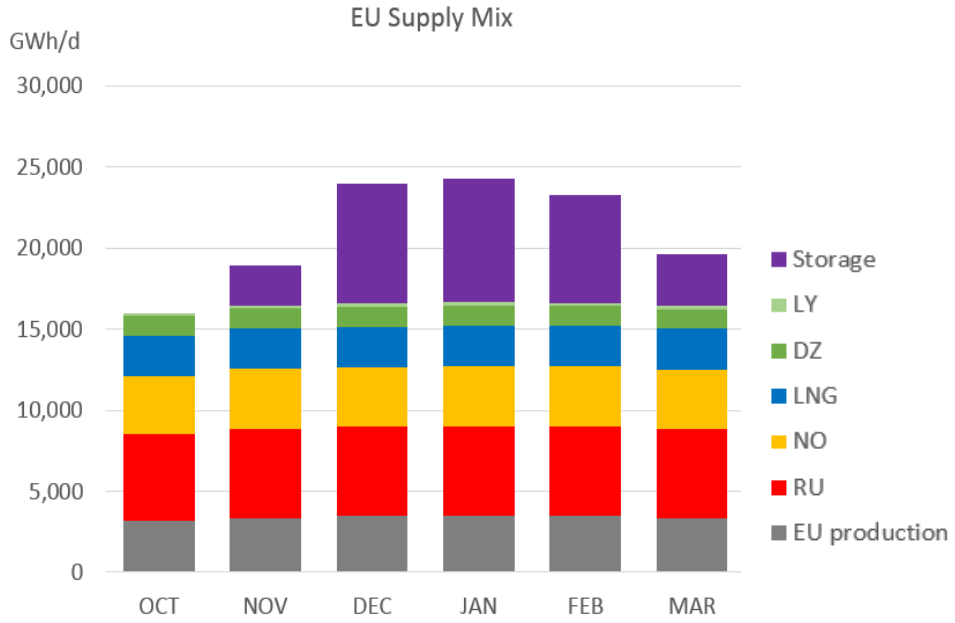
} Cooperation can mitigate the impact, neighbouring countries can help each other

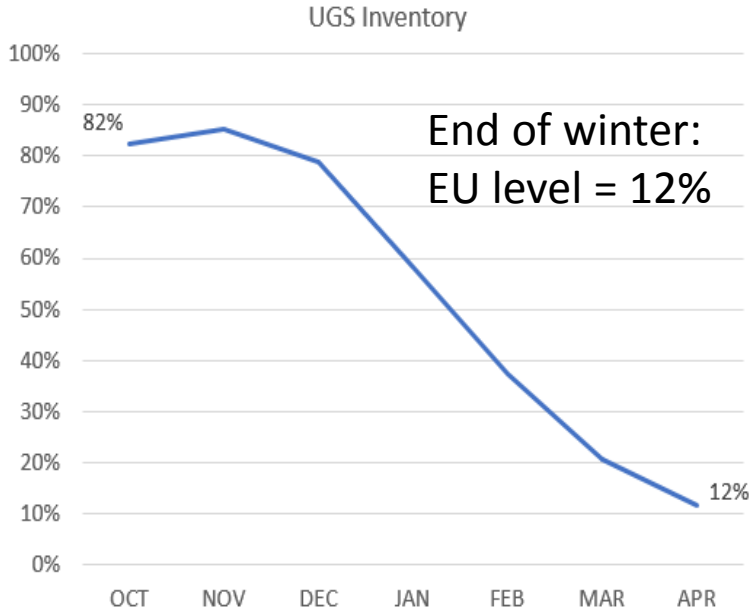
> Infrastructure limitations within EU (bottlenecks) } Cooperation is limited

Reference simulation

Reference simulation

Supply





> All supplies are imported up to their assumed maximum

> Storages can provide the necessary flexibility

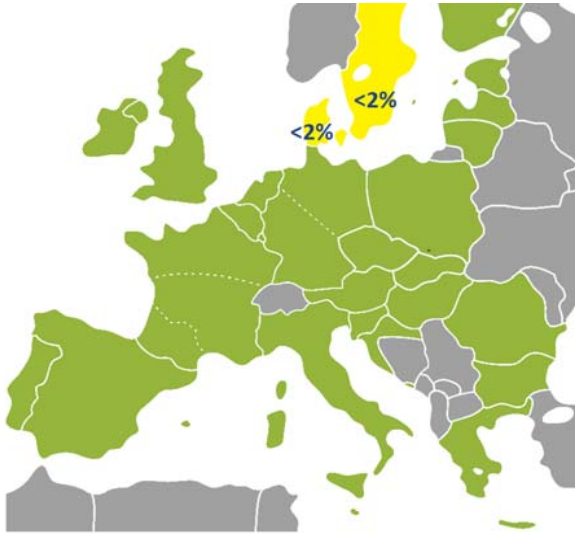
Reference simulation

Curtailment exposure

> Whole winter

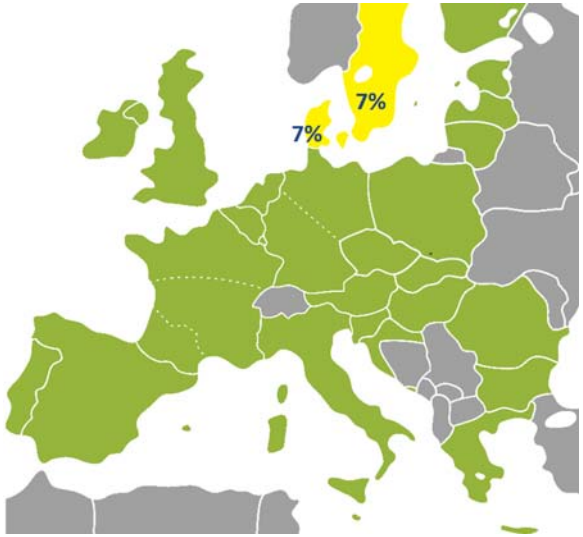
No curtailment

> 2-week in 20 years



<2% of demand curtailment for DK and SE*

> Peak day in 20 years



7% of demand curtailment for DK and SE*

- Impact for DK and SE is a result of the conservative assumptions made with GCG. This situation would be mitigated by the extra capacity at Ellund from January 2019 on.

Disruption simulations

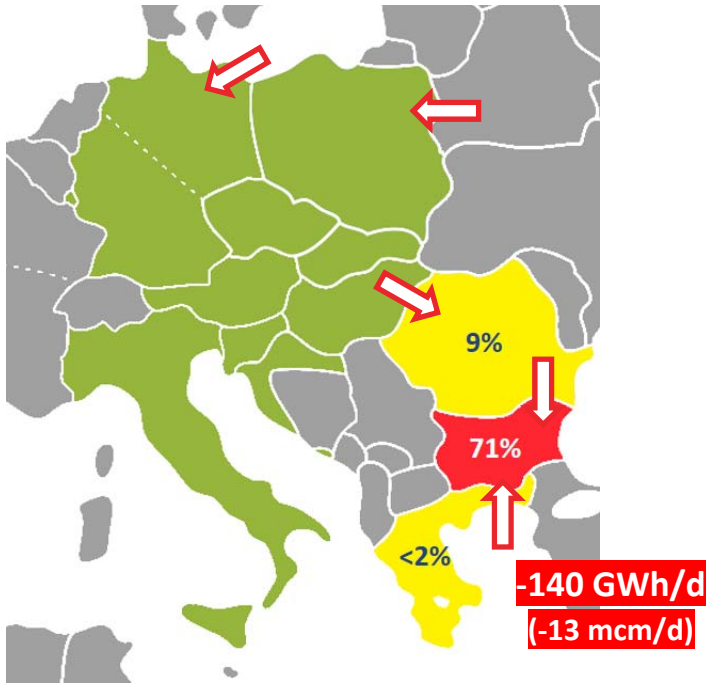
Scenarios with possible impact on demand

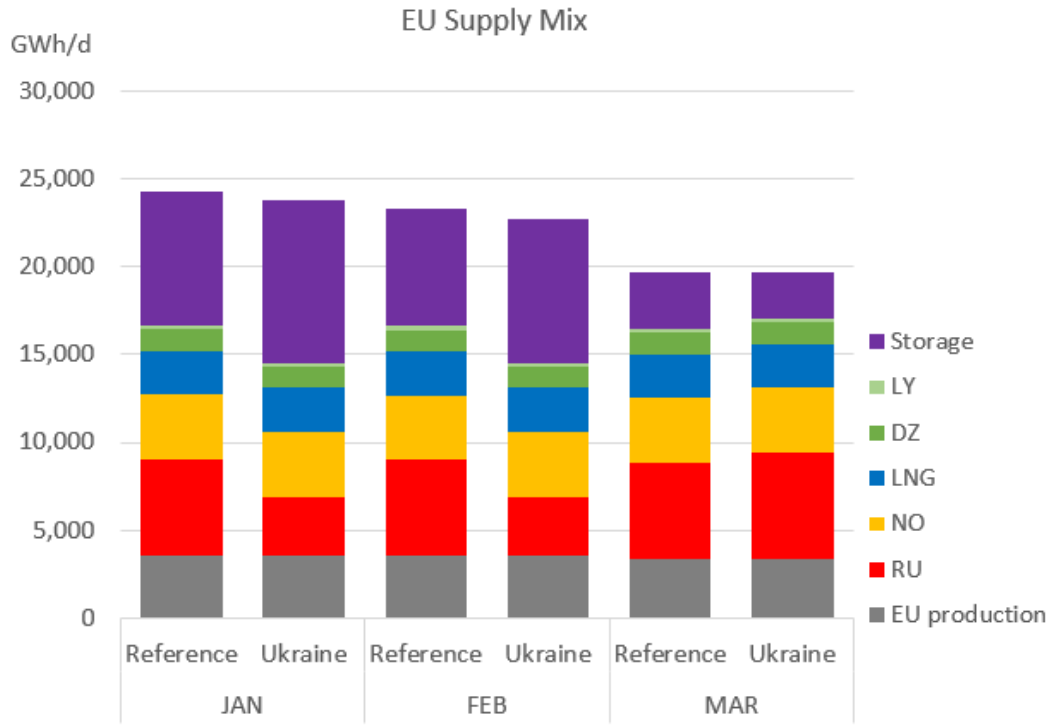
Scenarios impact - overview

Scenarios		Impact on demand (curtailment) Y/N
1	Ukraine	Y
2	Belarus	Y
3	Nord-Stream	N
4	Greifswald	N
5	Baltic States + Finland	Y
6	Trans-Balkan	Y
7	Langeled	N
8	Europipe 2	N
9	Emden	N
10	Largest L-gas storage	N
11	L-gas	To be communicated later on by Gas Platform
12	Ellund	Y
13	UK (forties pipeline)	N
14	Transmed	N
15	MEG	N
16	Total Algeria	Y
17	Libya	N

Scenario #1: Ukraine disruption

January - March





> Belarus and Nord Stream transit routes used up to their technical maximum

> Increased use of storages: level on 31 March down to 5%

Demand curtailment
No
Yes

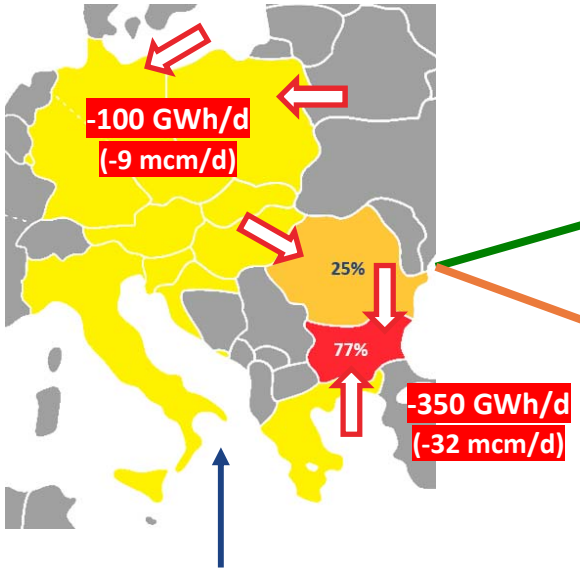
⇨ 100% used capacity

Scenario #1: Ukraine disruption

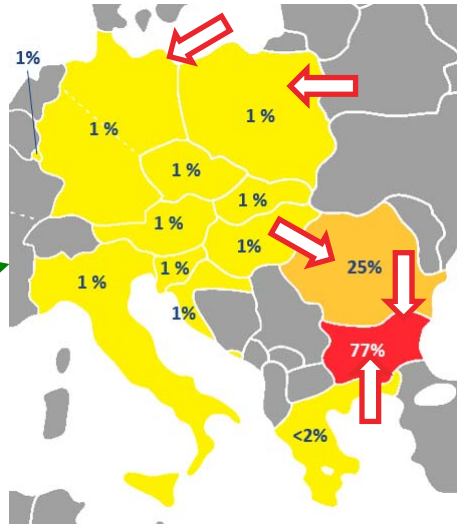
2-week in 20 years

> Infrastructure limitations in South-Eastern Europe

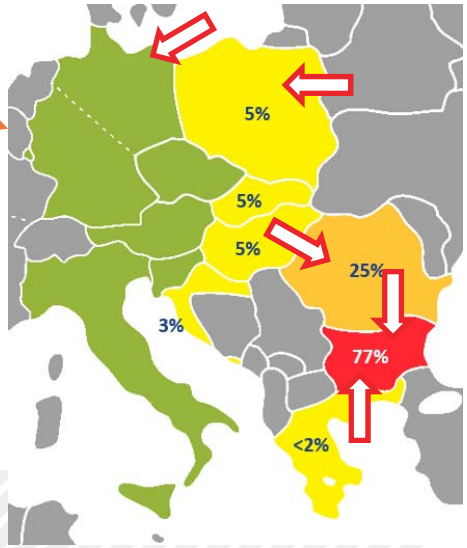
> Storages are used to their maximum withdrawal capacities



Unified allocation



Distance-based allocation



No infrastructure bottleneck in this area, countries can cooperate to mitigate the situation

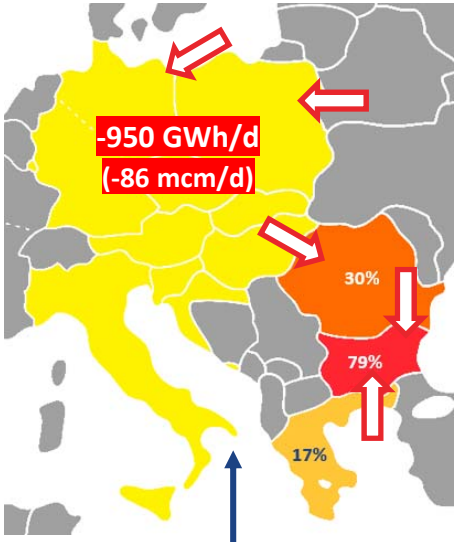
⇨ 100% used capacity

Scenario #1: Ukraine disruption

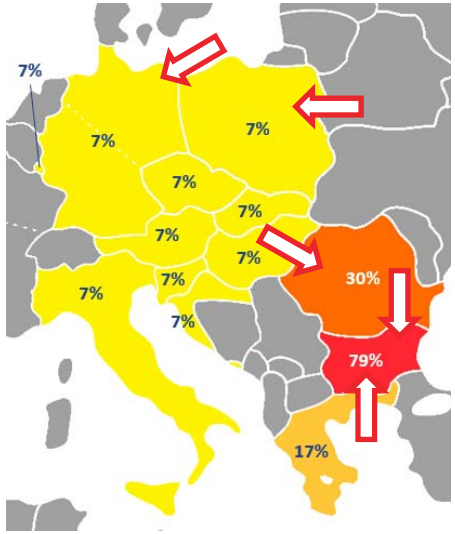
Peak day in 20 years

> Infrastructure limitations in South-Eastern Europe

> Storages are used to their maximum withdrawal capacities

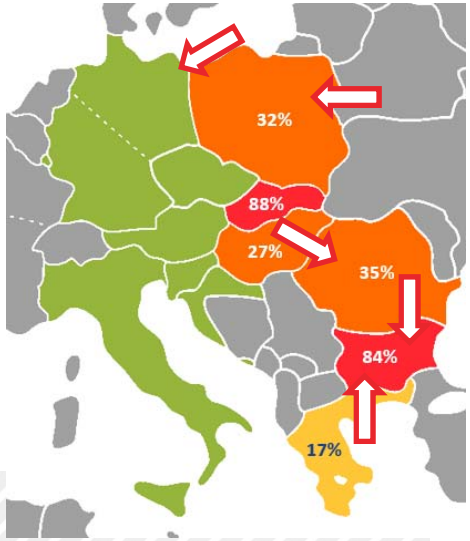


Unified allocation



-400 GWh/d
(-36 mcm/d)

Distance-based allocation



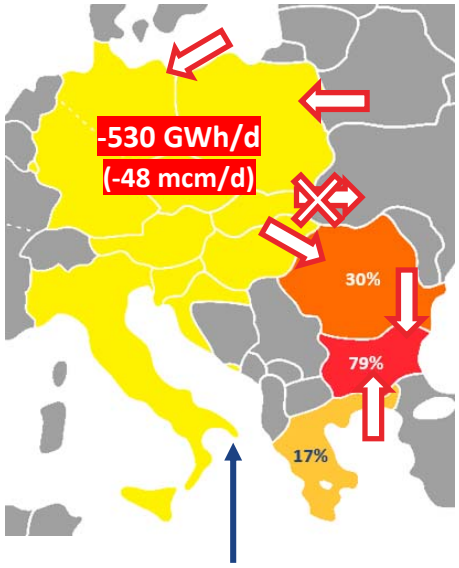
No infrastructure bottleneck in this area, countries can cooperate to mitigate the situation

⇨ 100% used capacity

Scenario #1: Ukraine disruption

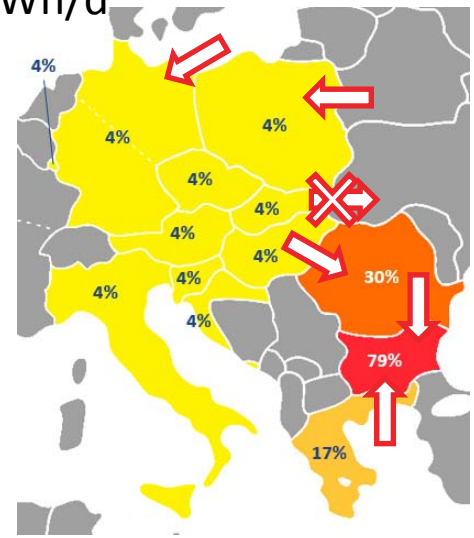
Peak day in 20 years - Sensitivity to exports to UA

> Demand curtailment allocation in case exports to UA = 0 GWh/d

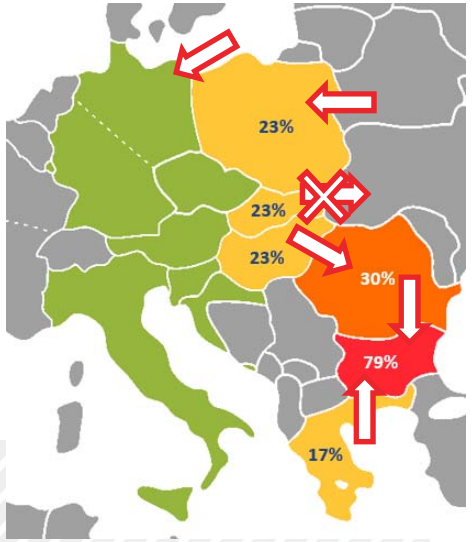


-400 GWh/d
(-36 mcm/d)

Unified allocation



Distance-based allocation



No infrastructure bottleneck in this area, countries can cooperate to mitigate the situation

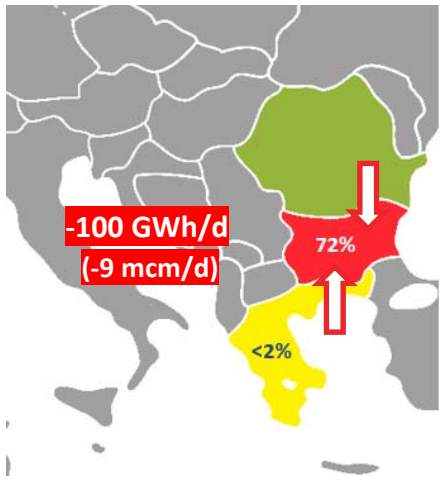
⇨ 100% used capacity

Scenario #6: Balkan region disruption

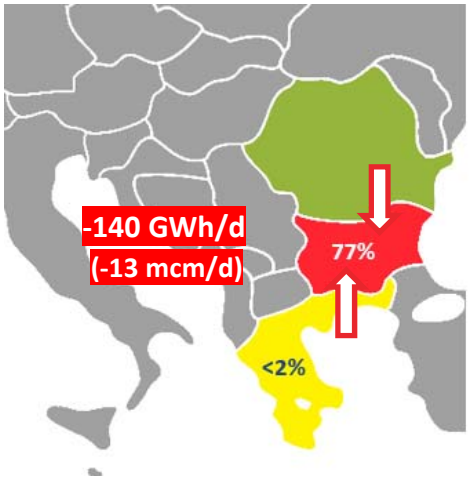
> Belarus route and Nord stream transit used up to their technical maximum

> Increased use of storages, up to the maximum withdrawal capacity

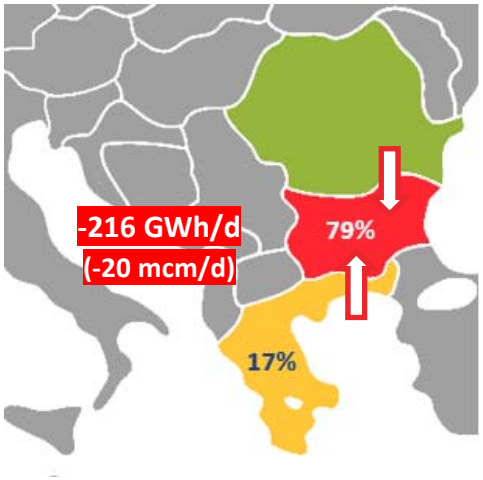
> January - March



> 2-week in 20 years



> Peak day in 20 years



Demand curtailment
No
Yes

⇨ 100% used capacity

Scenario #2: Disruption of all imports via Belarus

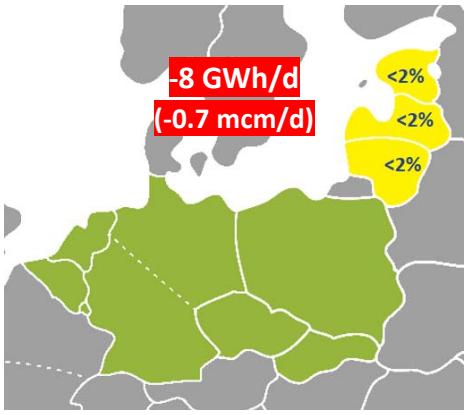
> Storages and LNG terminals within the risk group are 100% used.

> Baltic States are not connected to other countries. They are exposed to limited impact in case of a Peak day

> January - March

> 2-week in 20 years

> Peak day in 20 years



Demand curtailment
No
Yes

⇨ 100% used capacity

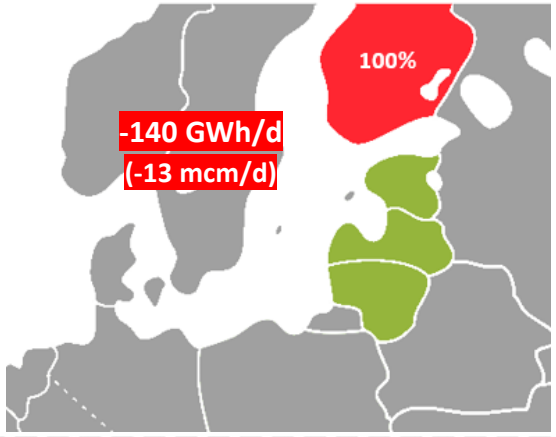
Scenario #5: Disruption of all imports to the Baltic States and Finland

> Storages and LNG terminals within the risk group are 100% used.

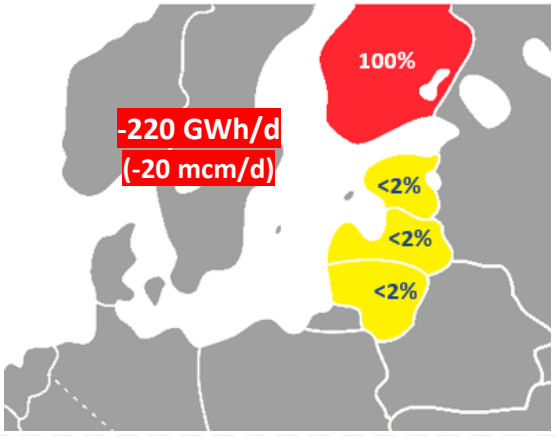
> Baltic States are not connected to other countries. They are exposed to demand curtailment in case of a Peak day.

> Finland is exposed to a 100% demand curtailment. The simulation does not consider possible country-specific use of back-up fuels.

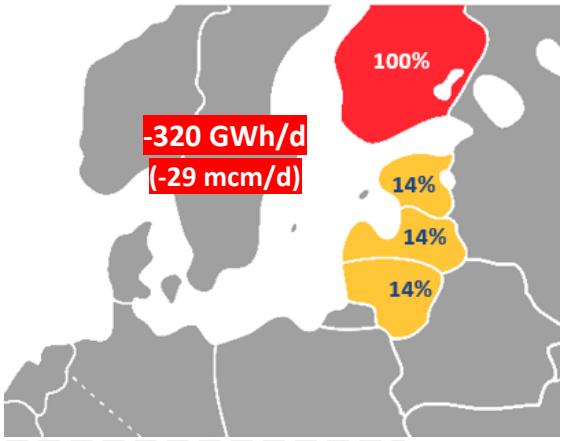
> January - March



> 2-week in 20 years



> Peak day in 20 years



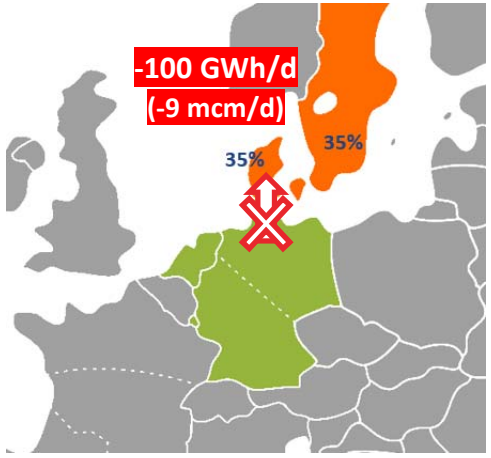
Demand curtailment
No
Yes

Scenario #12: Ellund interconnection point disruption

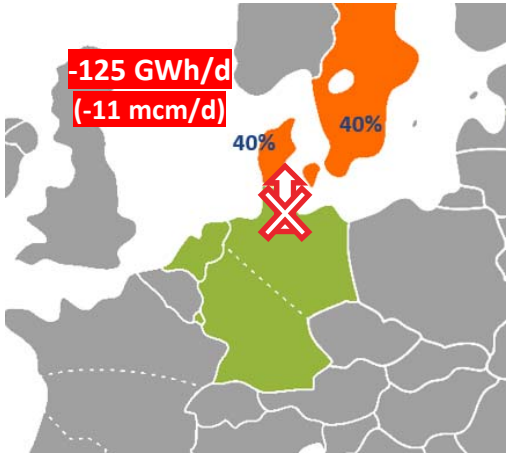
> Storages and National production are the only supply sources for DK and SE in case of Ellund disruption. They are used up to their maximum.

> January - March

> 2-week in 20 years



> Peak day in 20 years

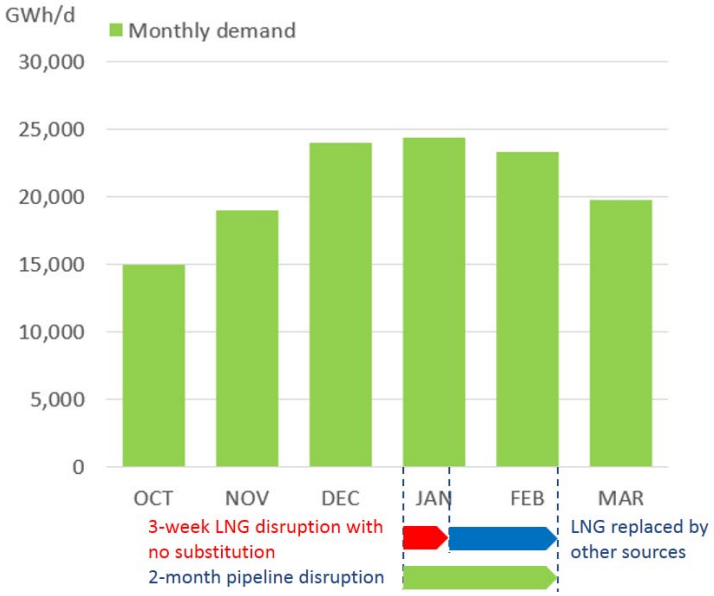


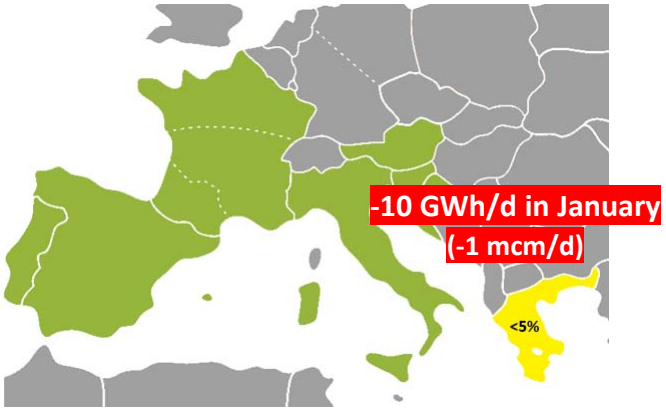
Demand curtailment
No
Yes

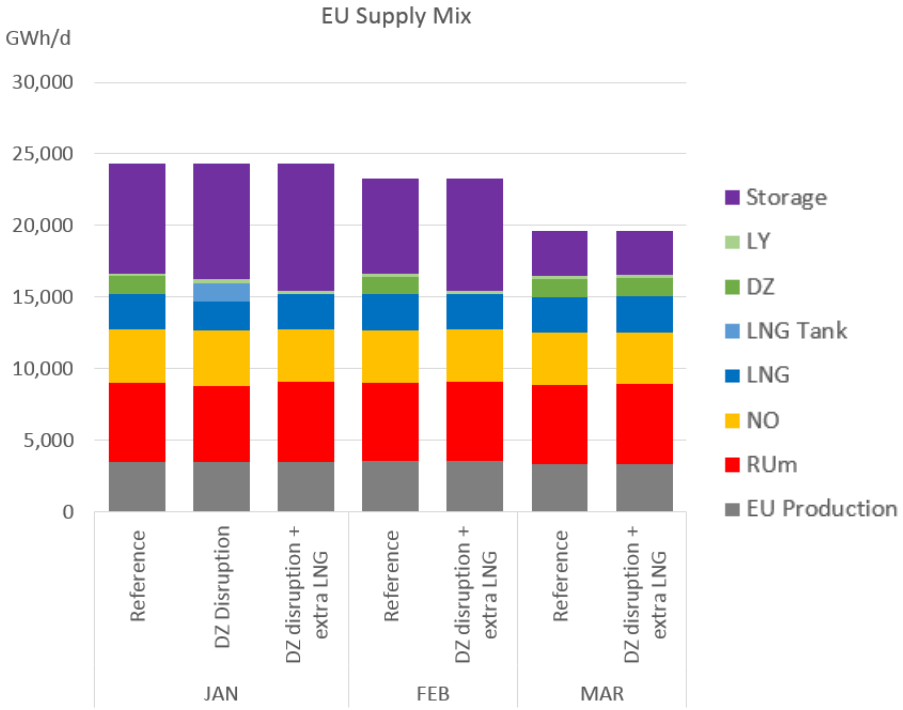
Disrupted capacity

Scenario #16: Algerian disruption

> January - March





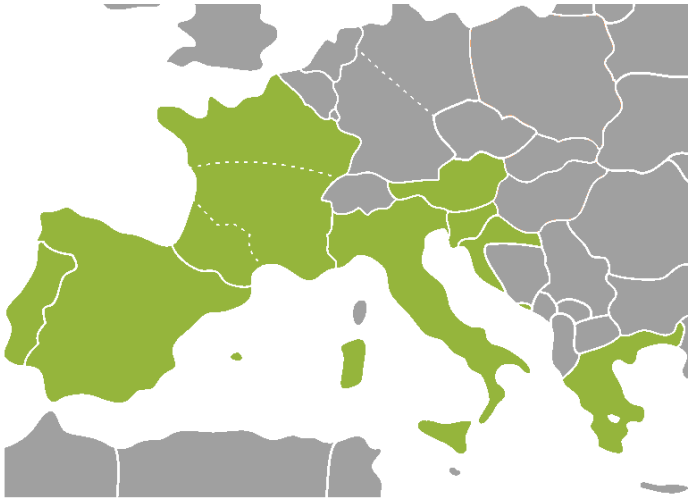


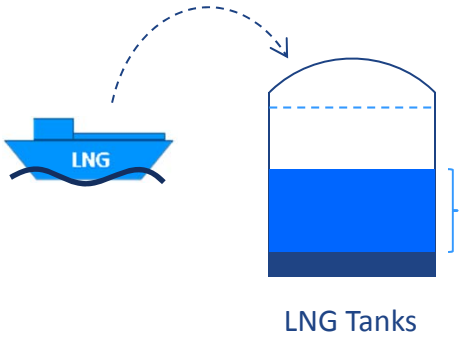
> Higher use of storages

> LNG tanks used to compensate missing LNG during the first 3 weeks

Scenario #16: Algerian disruption

> 2-week in 20 years

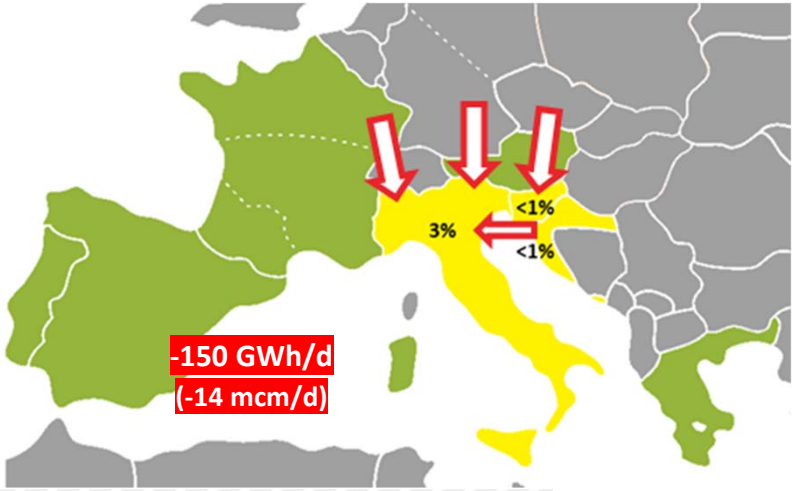




> Provided at least 12 TWh available in the LNG tanks

> Peak day: all supplies used at their maximum

> Peak day in 20 years



Demand curtailment
No
Yes

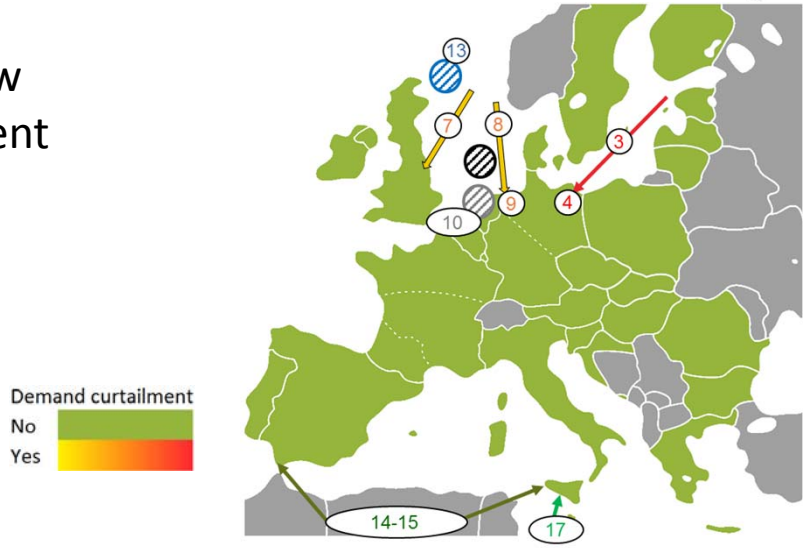
⇨ 100% used capacity

Disruption simulations

Other scenarios

Other disruptions

> The 10 other disruption scenarios show no additional risk of demand curtailment compared to the Reference scenario



#	Scenario	Comparison with Reference scenario
3	Nord-Stream	Increase of imports from RU via BY and UA
4	Greifswald	Increase of imports from RU via BY and UA
7	Langeled	Imports from NO re-routed to other import points up to the maximum capacity and increase of LNG imports to UK
8	Europipe 2	Re-routed but reduced imports from NO, higher storage withdrawal
9	Emden	Imports from NO re-routed to other import points up to the maximum capacity and increase of LNG imports to NL. Recently announced TENP temporary restriction does not worsen the situation.

Disruption simulations

#	Scenario	Comparison with Reference scenario
10	Largest L-gas storage*	Increased production of (mainly) Groningen field within the boundaries set by the Dutch government and pseudo L-gas production (enrichment and quality conversion).
13	UK (forties pipeline)	Increase of imports from NO and LNG, higher storage withdrawal.
14	Transmed	Storage withdrawal and LNG tanks used at their maximum in IT. Increase of Algerian imports in ES, up to the maximum capacity.
15	MEG	Increase imports from DZ in IT, higher LNG imports in ES and PT.
17	Libya	Increase imports from DZ and LNG. Higher flows from AT.

* Simulated by the Gas Platform

Disruption simulations
overview

Scenarios impact - overview

Scenarios		Impact on demand (curtailment) Y/N
1	Ukraine	Some infrastructure limitations
2	Belarus	Some infrastructure limitations
3	Nord-Stream	N
4	Greifswald	N
5	Baltic States + Finland	Some infrastructure limitations
6	Trans-Balkan	Some infrastructure limitations
7	Langeled	N
8	Europipe 2	N
9	Emden	N
10	Largest L-gas storage	N
11	L-gas	To be communicated later on by Gas Platform
12	Ellund	Some infrastructure limitations
13	UK (forties pipeline)	N
14	Transmed	N
15	MEG	N
16	Total Algeria	Y
17	Libya	N

What's next?

> ENTSOG published the report on 23 November 2017

> ENTSOG is currently helping the Competent Authorities in understanding/interpreting the simulation results.

Thank You for Your Attention

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WWW: www.entsog.eu

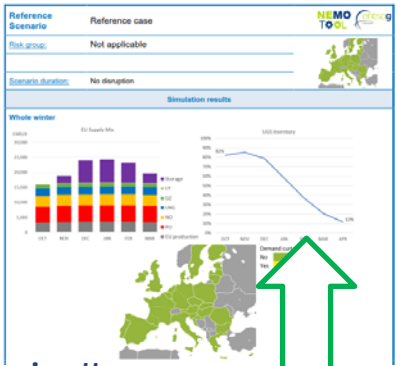
Results interpretation

> All scenarios are compared to a reference scenario

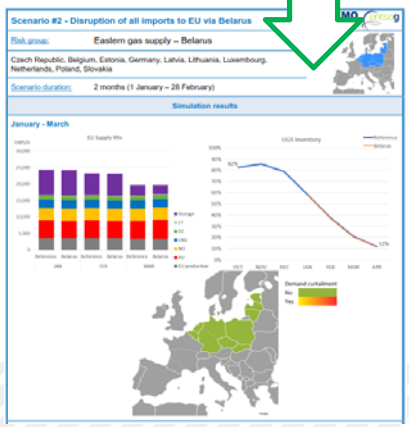
> The Reference scenario is simulated with same background assumptions without any disruption

> January - March

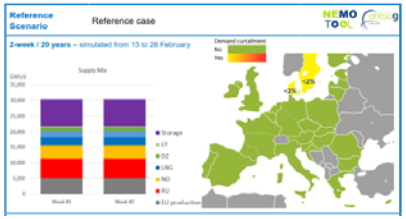
Reference

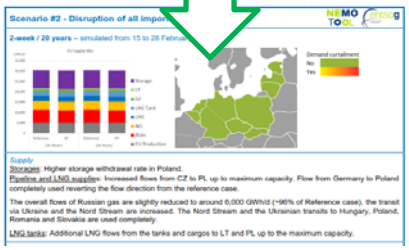


Scenario #...

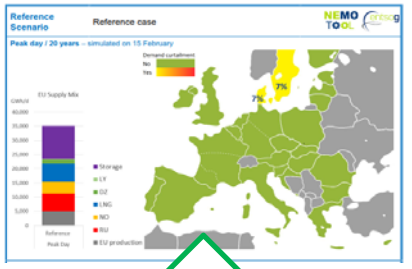


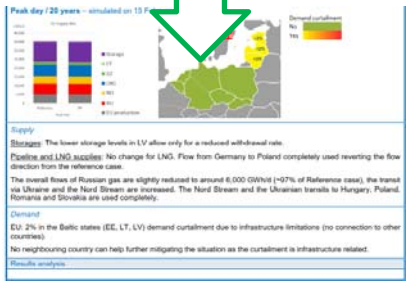
> 2-week in 20 yrs





> Peak day in 20 yrs





Assumptions and methodology

- ***Supply assumptions***

	DZ	LNG	LY	NO	RU	EU production
Winter season	1,214 GWh/d	2,500 GWh/d	208 GWh/d	3,677 GWh/d	5,473 GWh/d	3,388 GWh/d
	110 mcm/d	227 mcm/d	19 mcm/d	334 mcm/d	498 mcm/d	308 mcm/d
2-Week	1,391 GWh/d	2,500 GWh/d	303 GWh/d	4,100 GWh/d	6,238 GWh/d	5, 062 GWh/d
	126 mcm/d	227 mcm/d	28 mcm/d	373 mcm/d	567 mcm/d	460 mcm/d
Peak-day	1,391 GWh/d	6,082 GWh/d	303 GWh/d	4,100 GWh/d	6,238 GWh/d	5,062 GWh/d
	126 mcm/d	553 mcm/d	28 mcm/d	373 mcm/d	567 mcm/d	460 mcm/d

- ***Exports assumptions***

In GWh/d	OCT	NOV	DEC	JAN	FEB	MAR	2-Week	Peak day
BA	4	6	9	11	7	5	12	16
CH	109	151	184	219	162	119	225	230
MK	8	11	14	17	13	4	19	19
RU (Kaliningrad)	79	79	79	79	79	79	109	109
RS	62	62	62	62	62	62	95	104
TR	393	393	393	393	393	393	480	480
UA	363	363	363	363	363	363	416	416