

Vienna, 9 November 2017

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

**Gas Coordination Group**

**9 November 2017**

**Stefan Greulich**



# Union-wide supply and infrastructure simulation

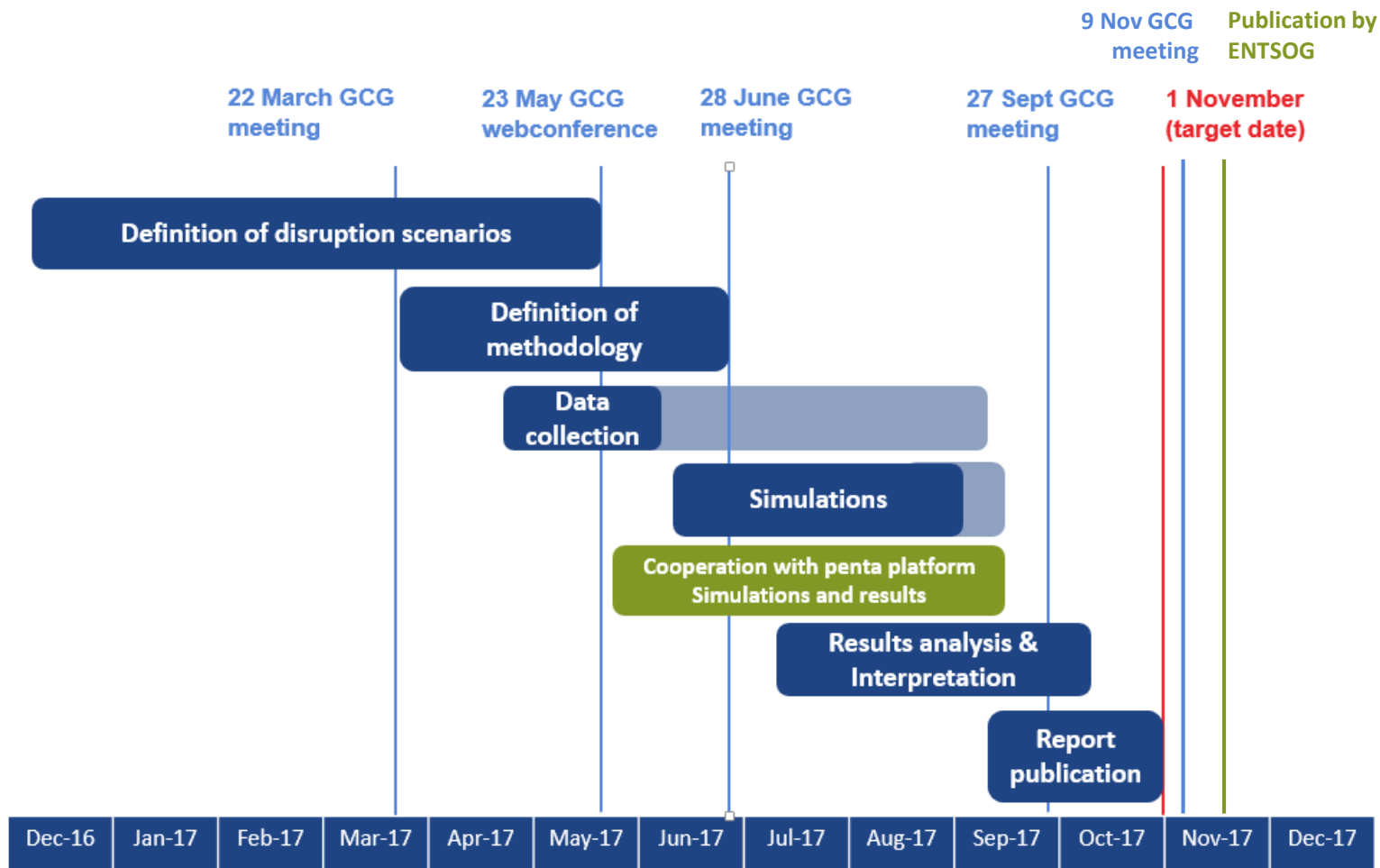


## ***Regulation 2017/1938:***

- > 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

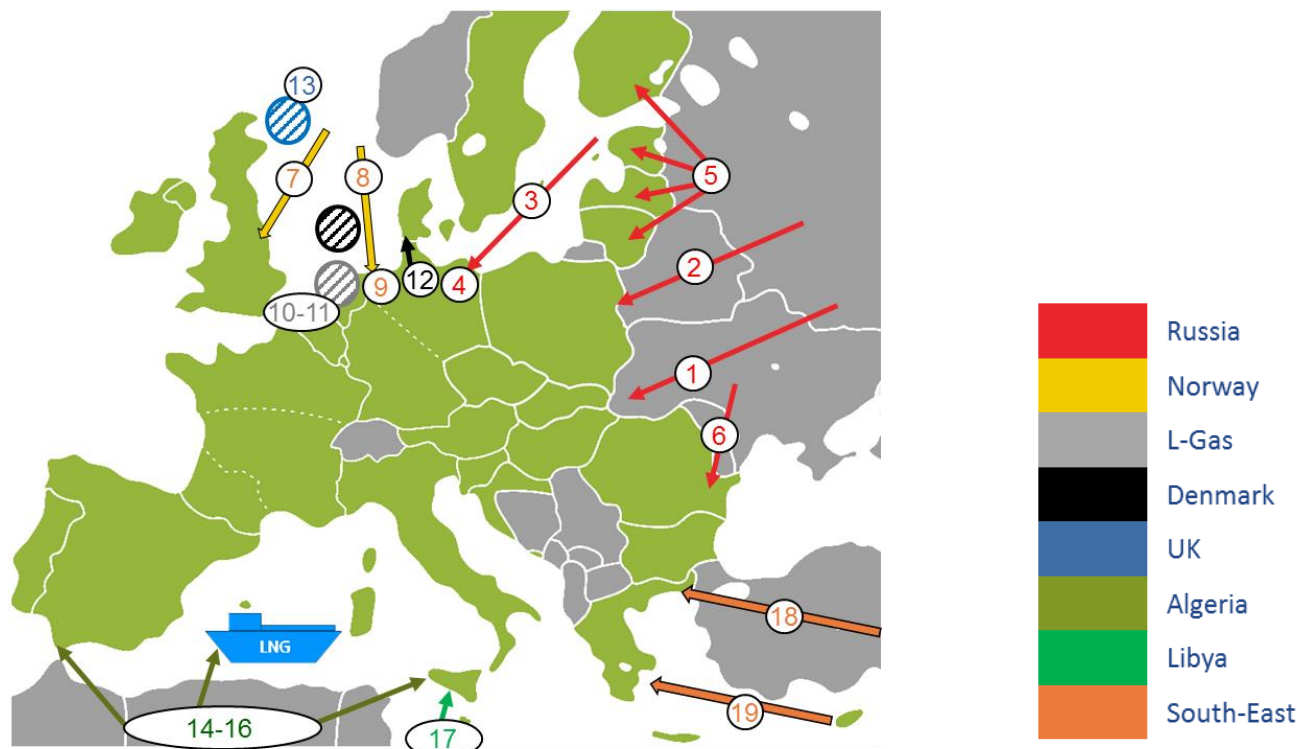




# **Scenarios and methodology**

# Gas supply and infrastructure disruption scenarios

*Defined with Gas Coordination Group until 23 May*



- > 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:***

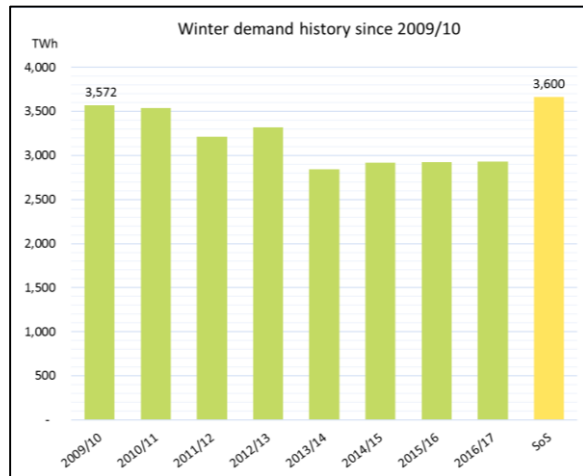
- > Level of demand
- > Disruption duration and timeframe
- > Initial gas storage level at beginning of the winter season



# Methodology for the simulation

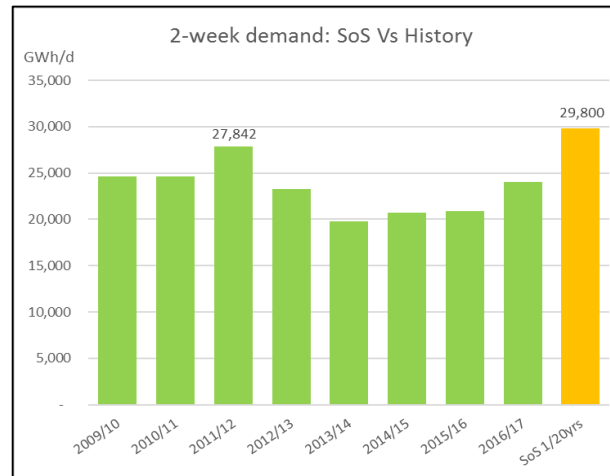
- ***Demand: 3 cases***

> Winter demand



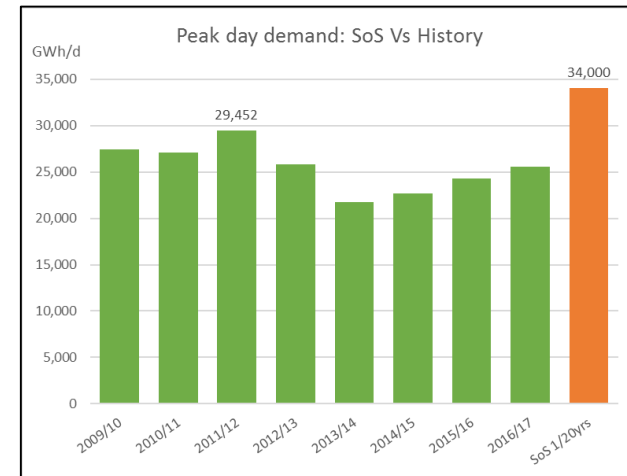
Highest historical

> 2-week in 20 years



Probability of 1-in-20 years

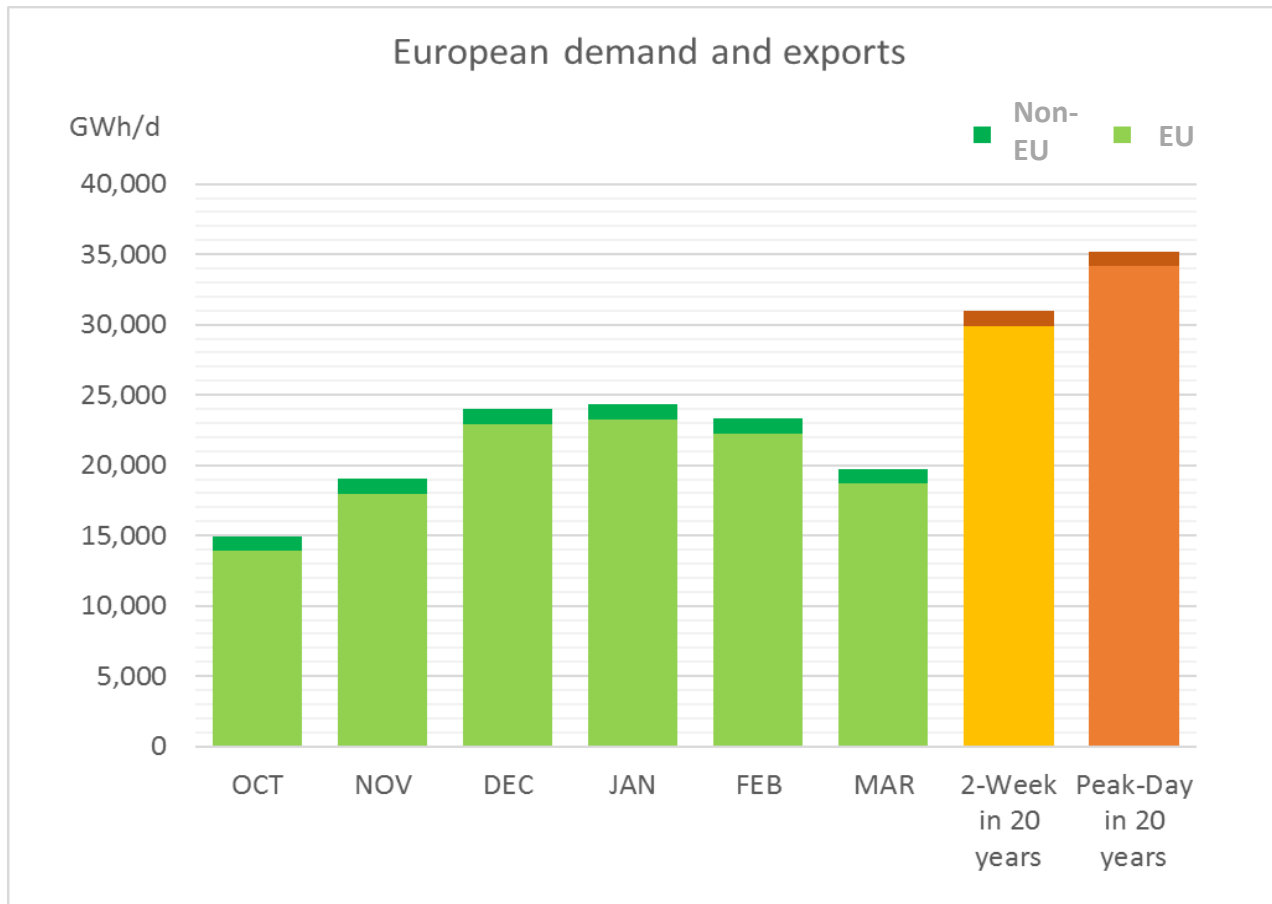
> Peak day in 20 years





# Methodology for the simulation

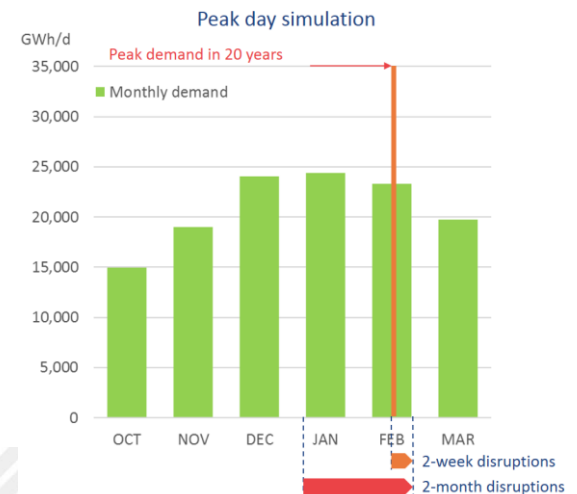
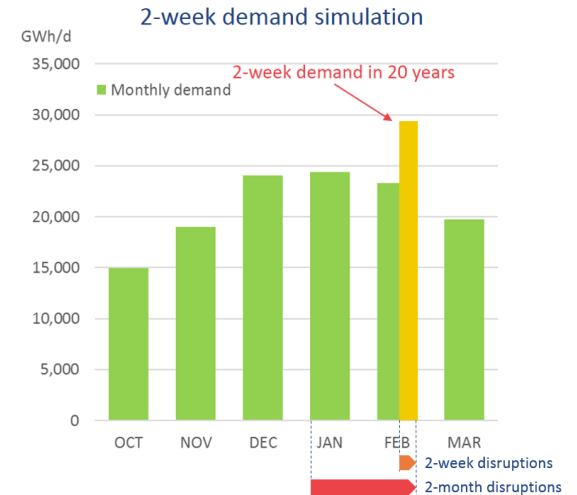
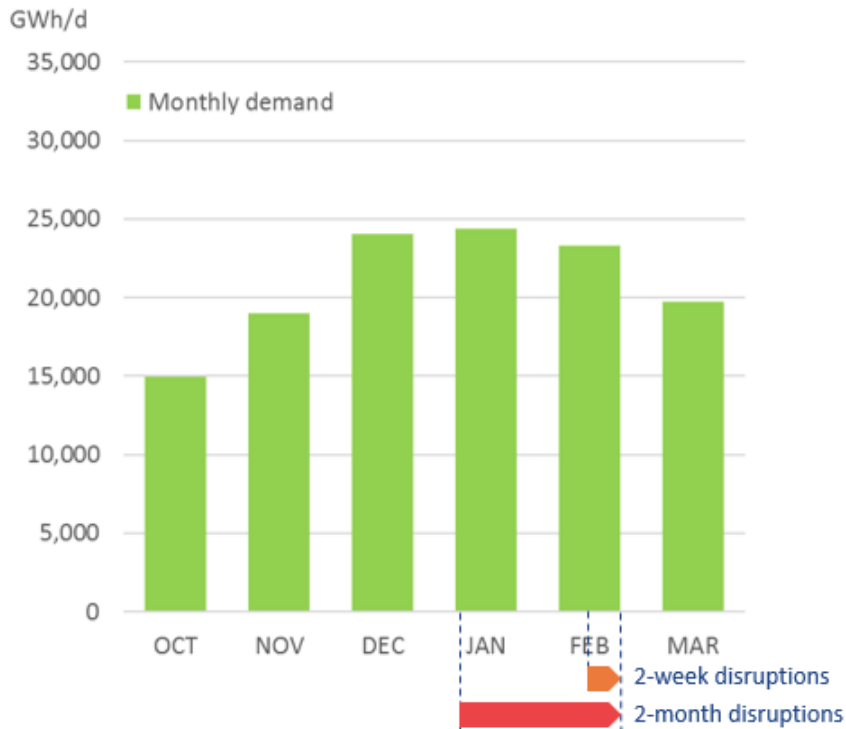
- ***Exports / Non-EU countries included***





# Methodology for the simulation

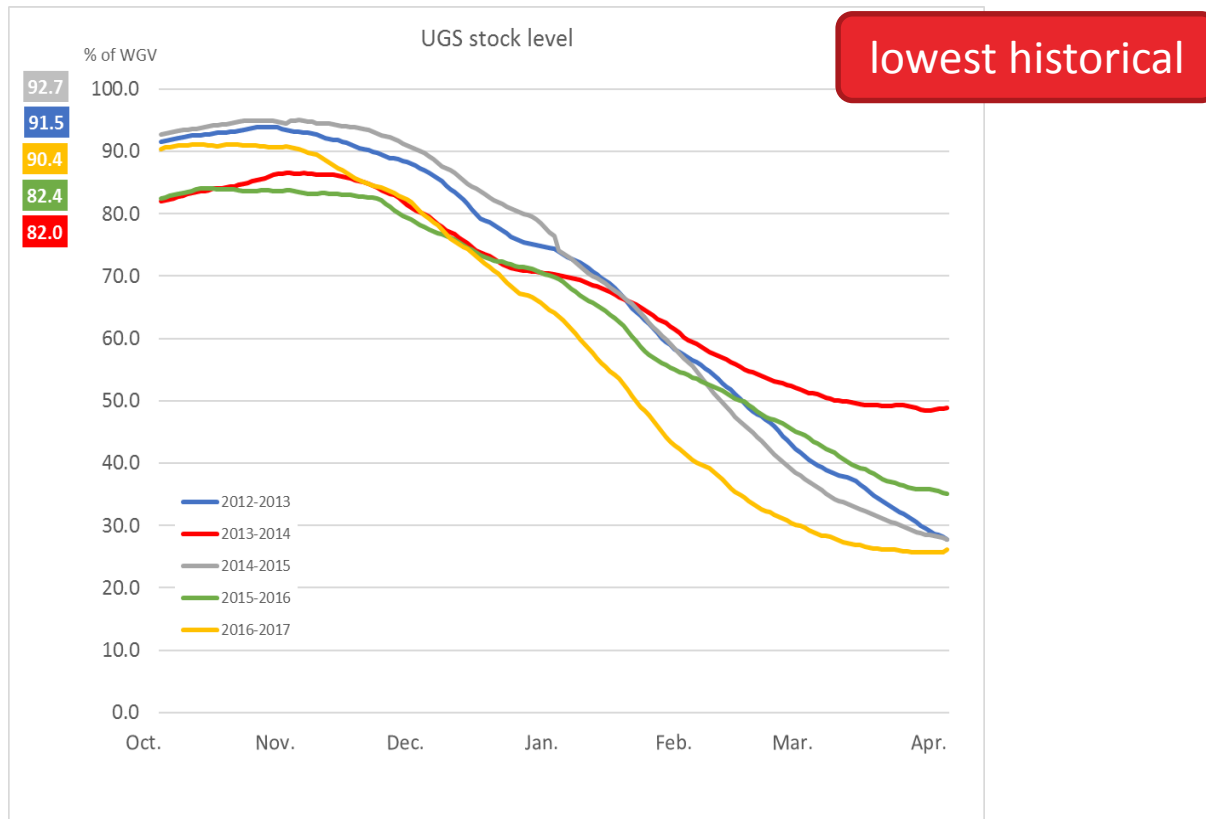
- Disruption timeframe**





# Methodology for the simulation

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



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

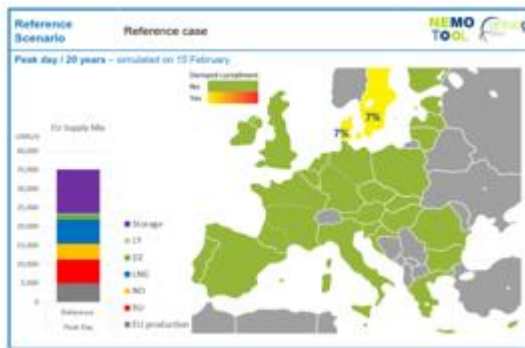


# **Results interpretation**

# Results interpretation

- > All scenarios are compared to a reference scenario

Reference



Scenario #...



# Results interpretation

*Objective: Identify which Member States can address identified risks*

***Risk of demand curtailment may depend on***

- > Import limitations
  - > Storage withdrawal limitation
  - > Infrastructure limitations within EU (bottlenecks)
- Cooperation can mitigate the impact, neighbouring countries can help each other
- Cooperation is limited





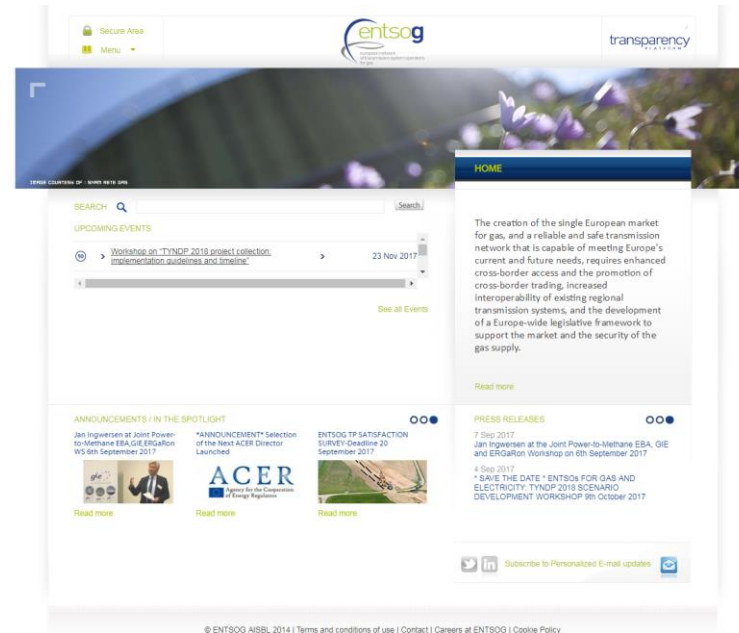
# **Results publication**

# 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

# What's next?

- > ENTSOG will publish the report shortly after the Gas Coordination Group meeting on 9 November



- > ENTSOG stands ready to support the Competent Authorities in understanding the simulation results!



# Thank You for Your Attention

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# Assumptions and methodology



- Supply assumptions**

	DZ	LNG	LY	NO	RU	EU production
<b>Winter season</b>	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
<b>2-Week</b>	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
<b>Peak-day</b>	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



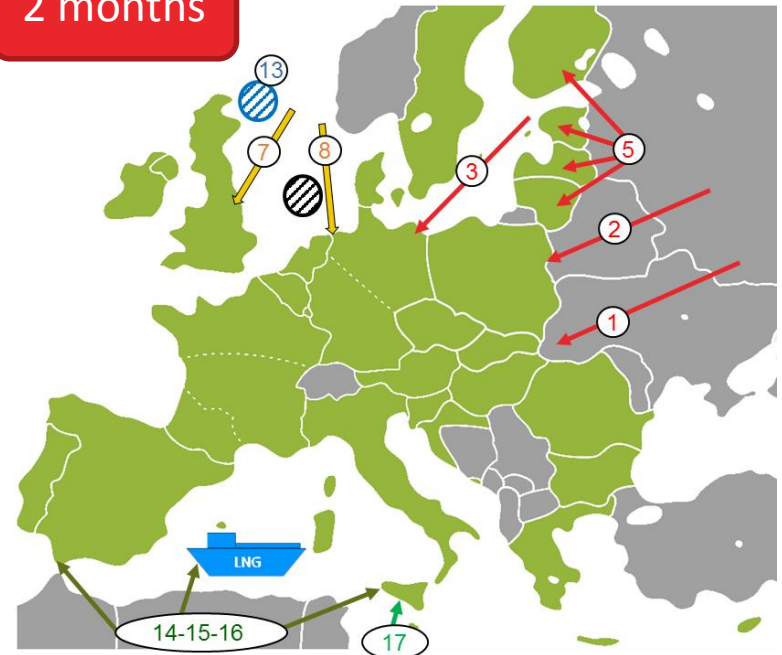
# Methodology for the simulation

- *Scenarios*

2 weeks



2 months



# Methodology for the simulation

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



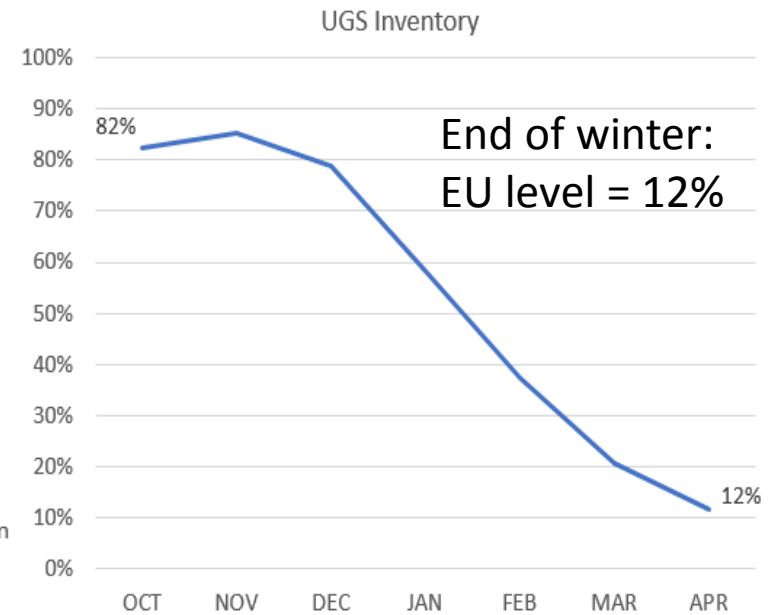
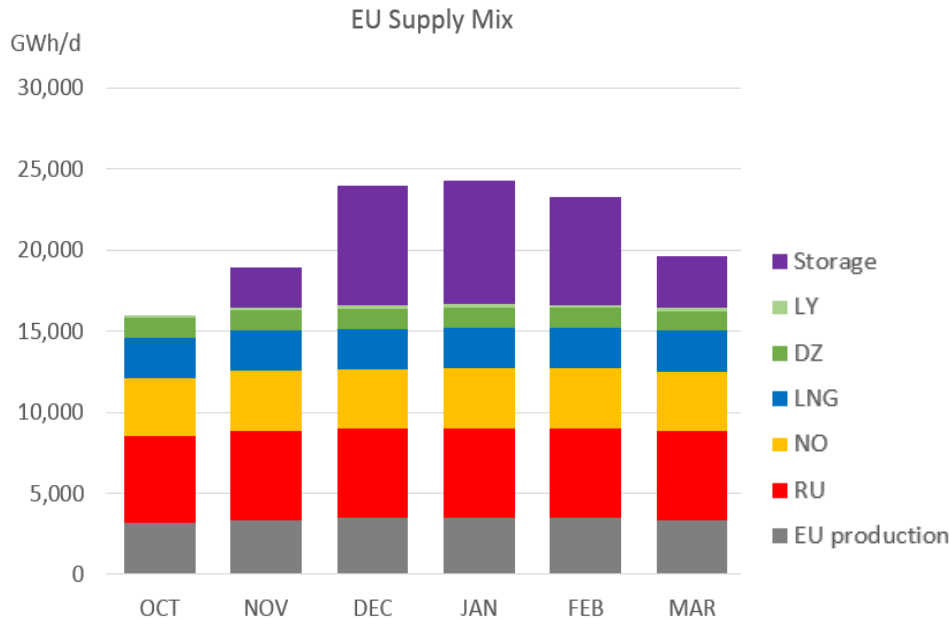
\*See back-up slide for actual figures



# Reference simulation

# Reference simulation

## Supply

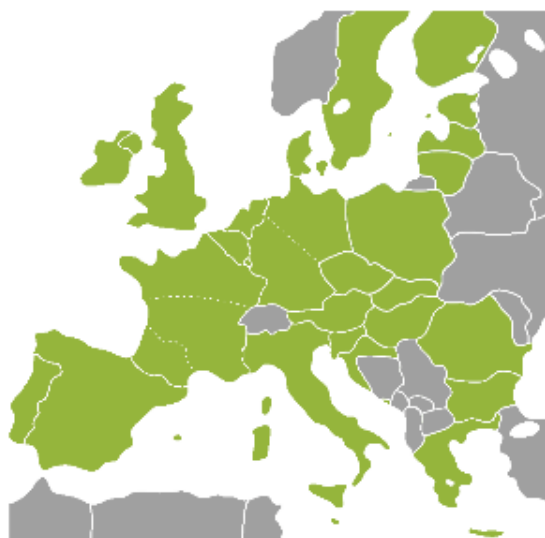


- > All supplies are imported up to their assumed maximum
- > Storages can provide the necessary flexibility

# Reference simulation

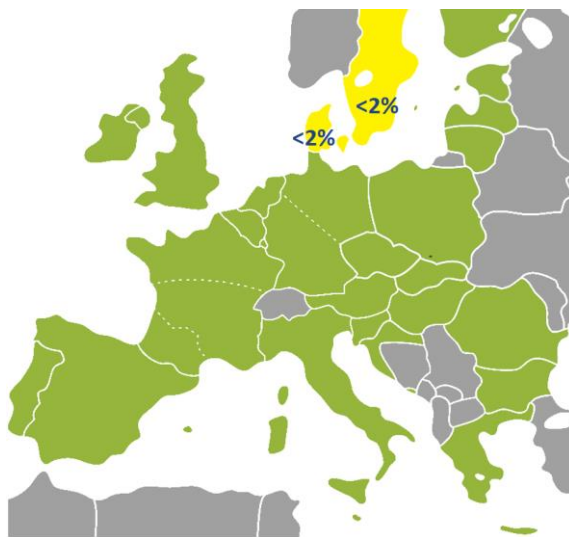
## *Curtailment exposure*

> Whole winter



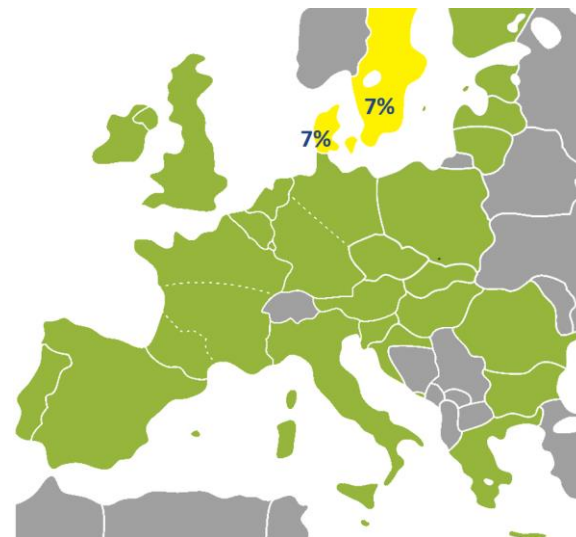
No curtailment

> 2-week in 20 years





<2% of demand curtailment for DK and SE\*

> Peak day in 20 years



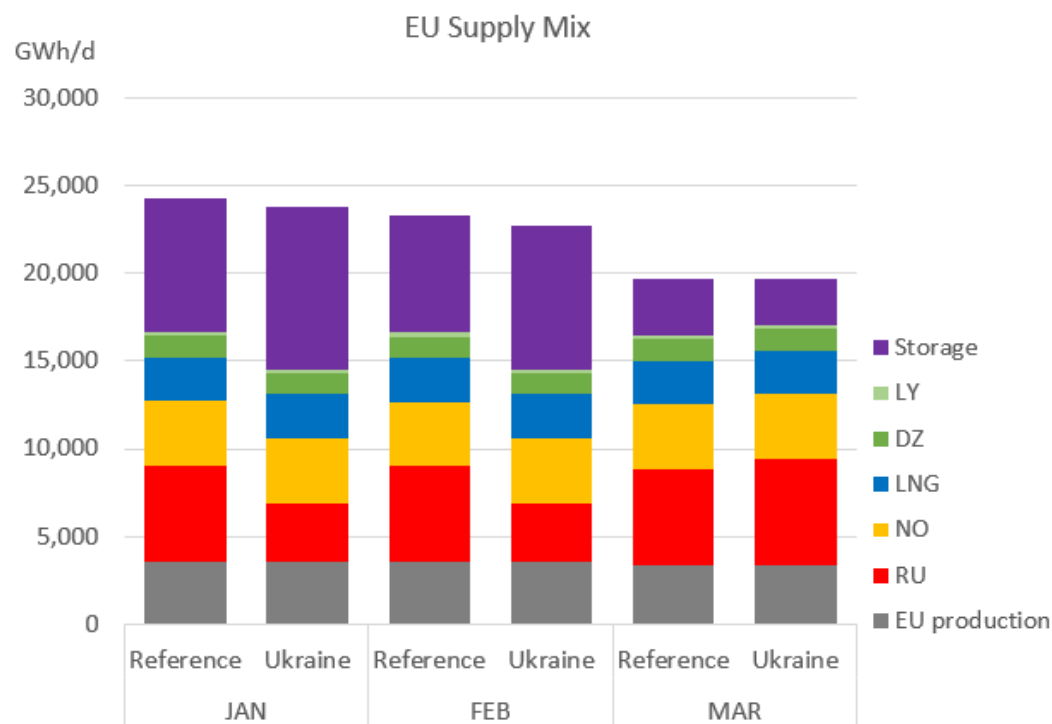
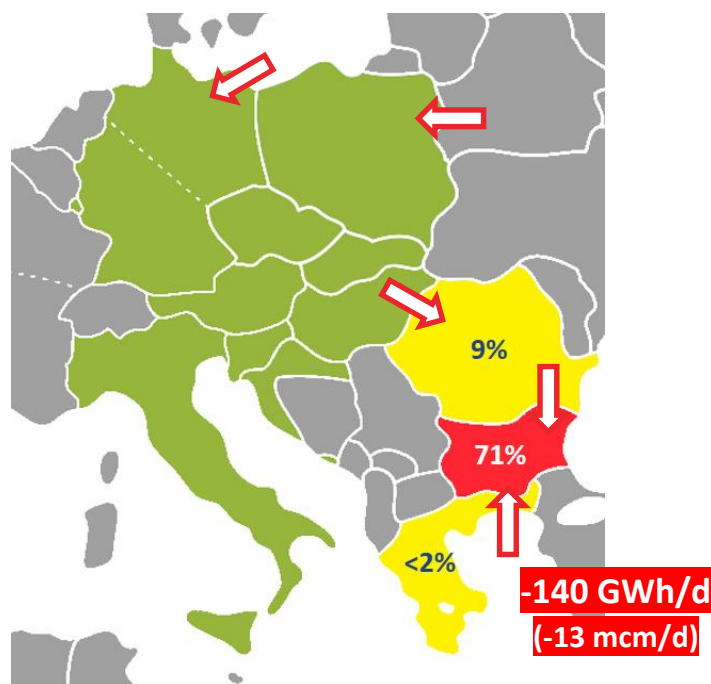
7% of demand curtailment for DK and SE\*

Demand curtailment  
No   
Yes 

- 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.

# Scenario #1: Ukraine disruption

## January - March



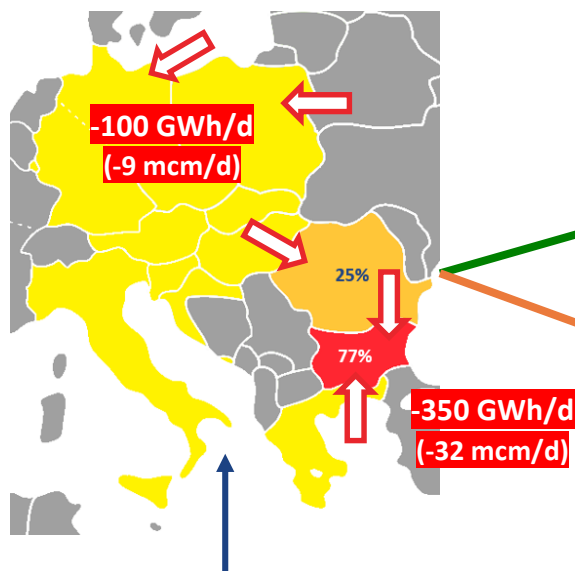
- > Belarus and Nord Stream transit routes used up to their technical maximum
- > Increased use of storages: level on 31 March down to 5%



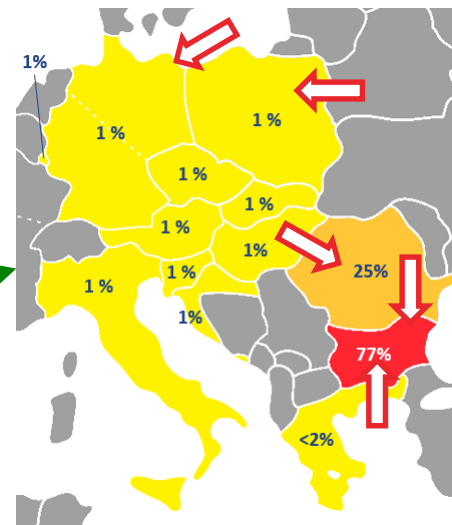
# Scenario #1: Ukraine disruption

## 2-week in 20 years

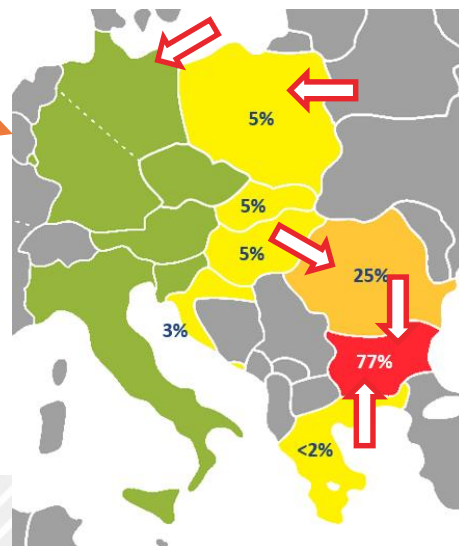
- > Infrastructure limitations in South-Eastern Europe
- > Storages are used to their maximum withdrawal capacities



Unified allocation



Distance-based allocation



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

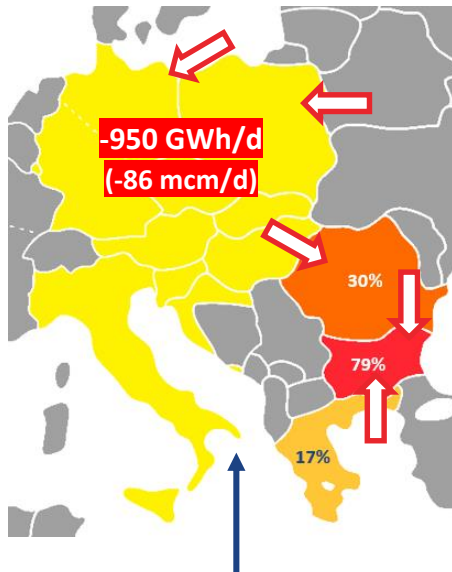
⇒ 100% used capacity



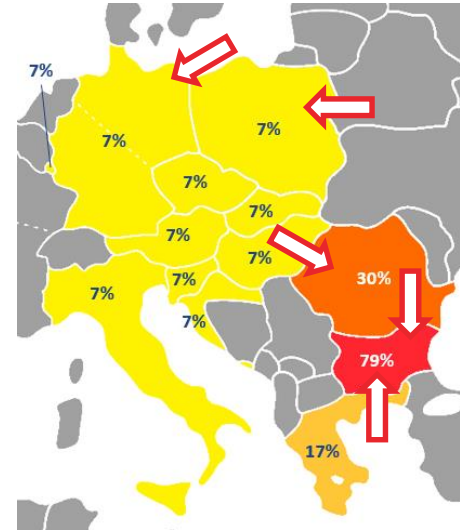
# Scenario #1: Ukraine disruption

## Peak day in 20 years

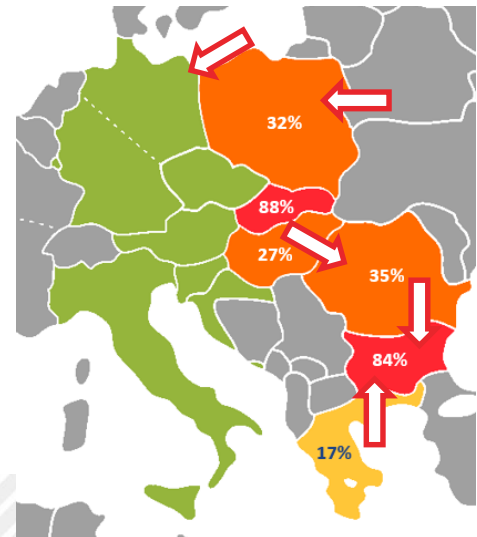
- > Infrastructure limitations in South-Eastern Europe
- > Storages are used to their maximum withdrawal capacities



Unified allocation



Distance-based allocation



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

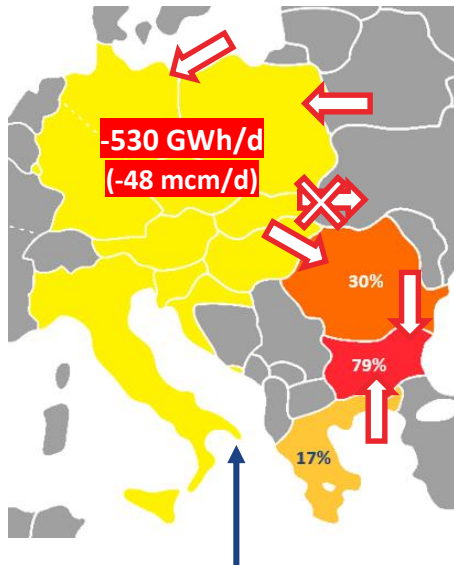
⇒ 100% used capacity



# Scenario #1: Ukraine disruption

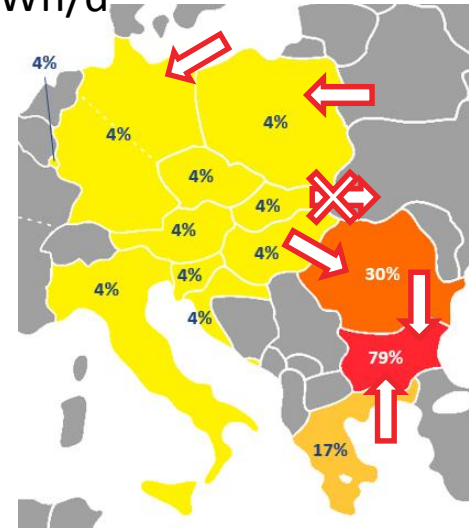
## Peak day in 20 years - Sensitivity to exports to UA

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

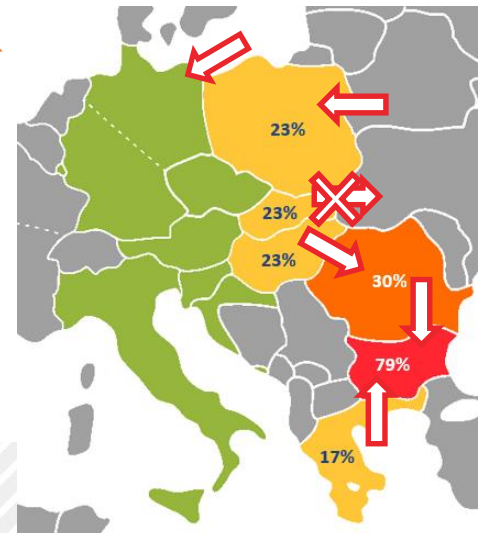


-400 GWh/d  
(-36 mcm/d)

Unified allocation



Distance-based allocation



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

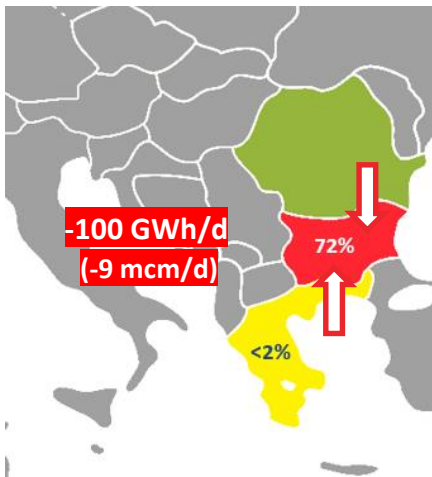
⇒ 100% used capacity



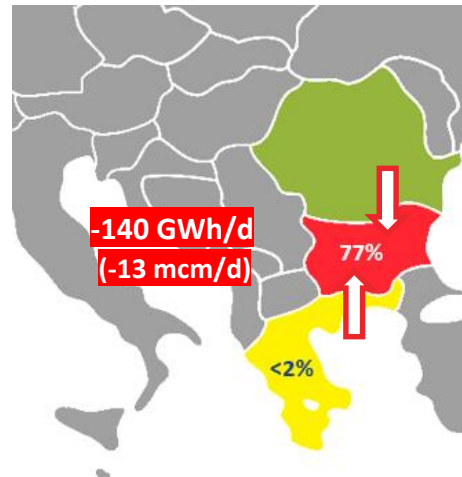
# Scenario #6: Balkan region disruption

- > Belarus route and Nord stream transit used up to their technical maximum
- > Increased use of storages, up to the maximum withdrawal capacity

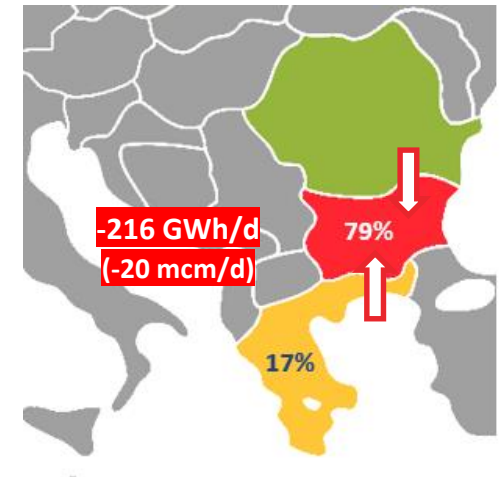
> January - March



> 2-week in 20 years



> Peak day in 20 years



Demand curtailment

No    $\Rightarrow$  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

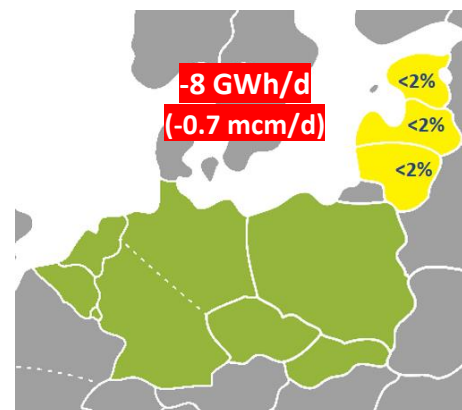
> January - March



> 2-week in 20 years



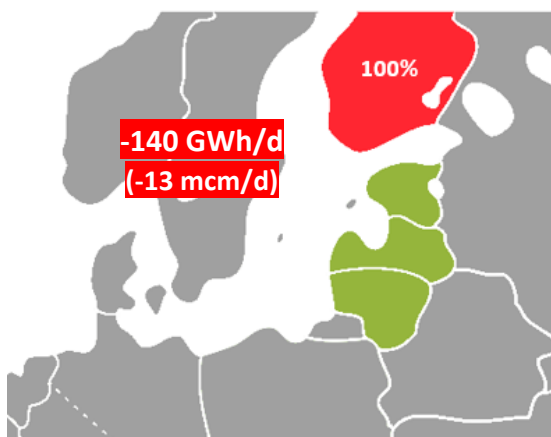
> Peak day in 20 years



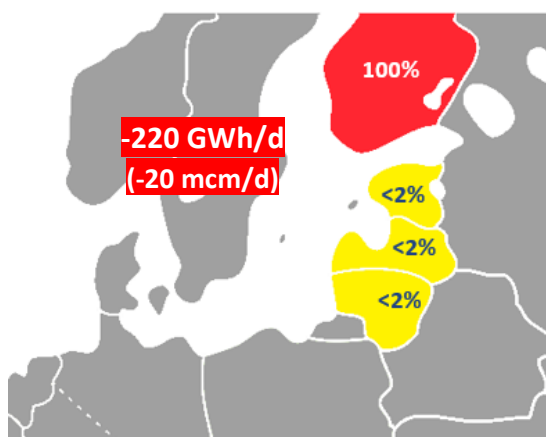
# Scenario #5: Disruption of all imports to the Baltic States and Finland

- > 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.

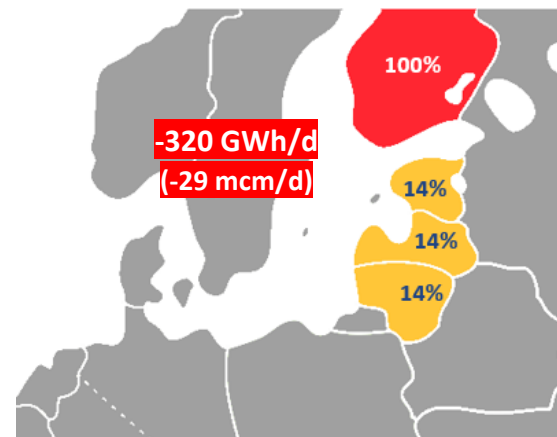
> January - March



> 2-week in 20 years



> Peak day in 20 years





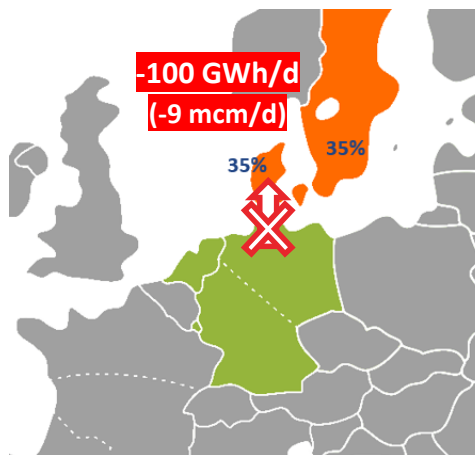
## Scenario #12: Ellund interconnection point disruption

- > 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.

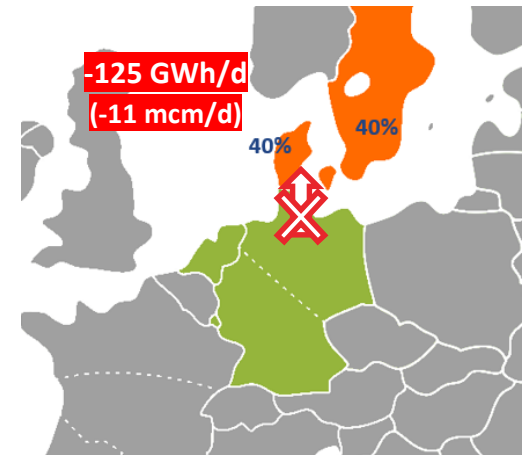
> January - March



> 2-week in 20 years



> Peak day in 20 years



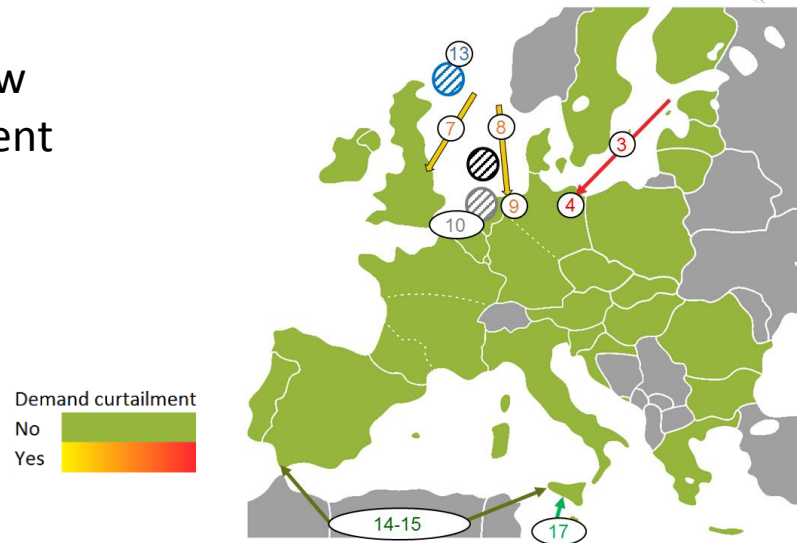


# **Disruption simulations**

## Other scenarios

# Other disruptions

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



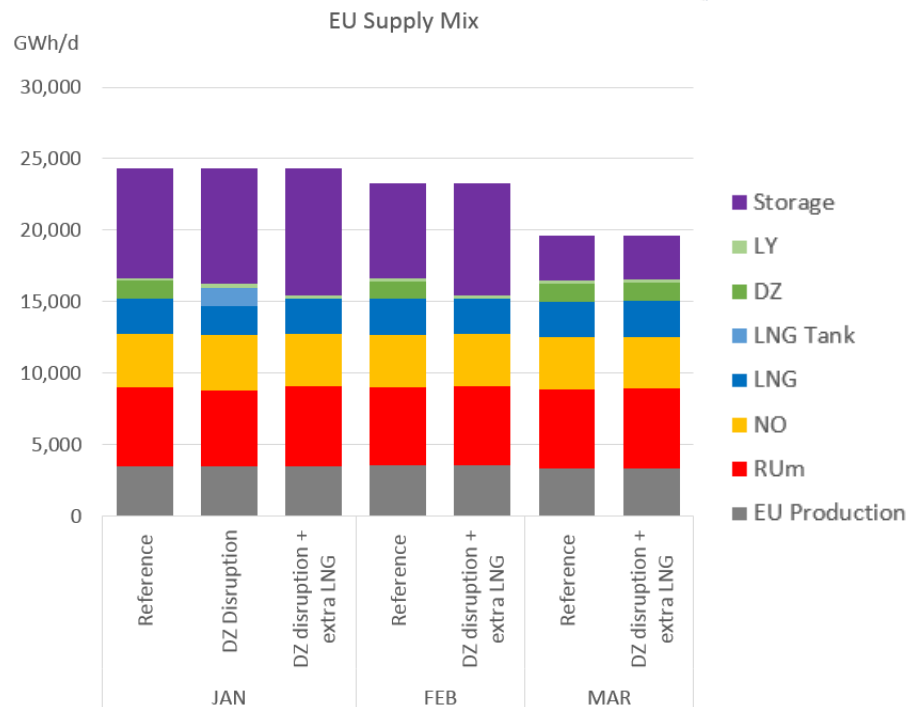
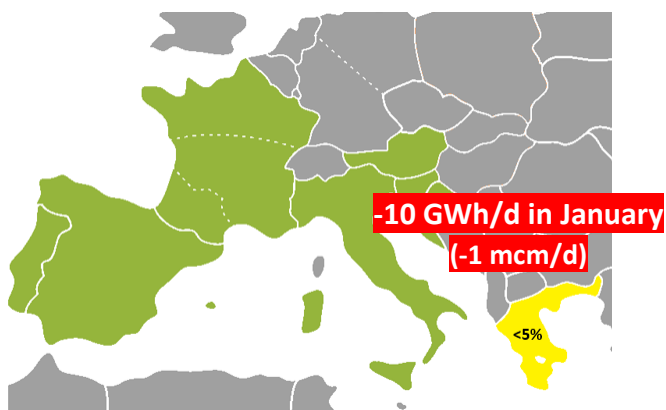
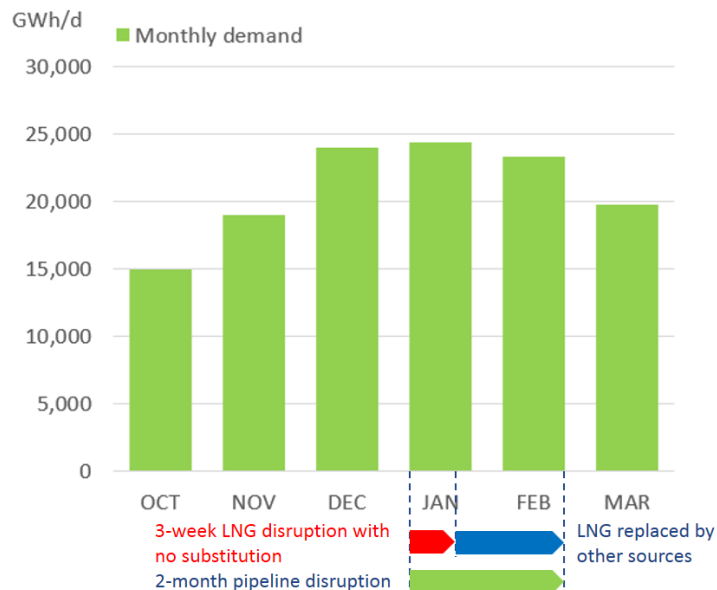
#	Scenario	Comparison with Reference scenario
3	Nord-Stream	Increase of imports from RU via BY and UA
4	Greifswald	Increase of imports from RU via BY and UA
7	Langeled	Imports from NO re-routed to other import points up to the maximum capacity and increase of LNG imports to UK
8	Europipe 2	Re-routed 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.

# Scenario #16: Algerian disruption

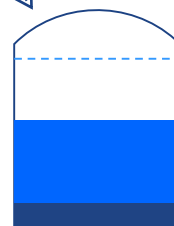
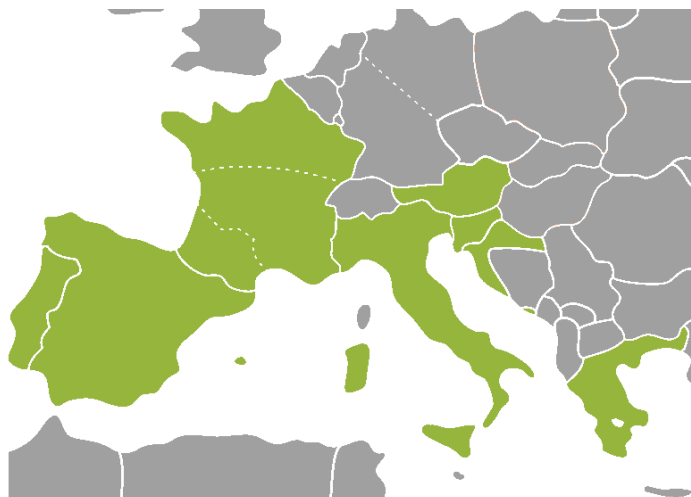
> January - March



- > 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

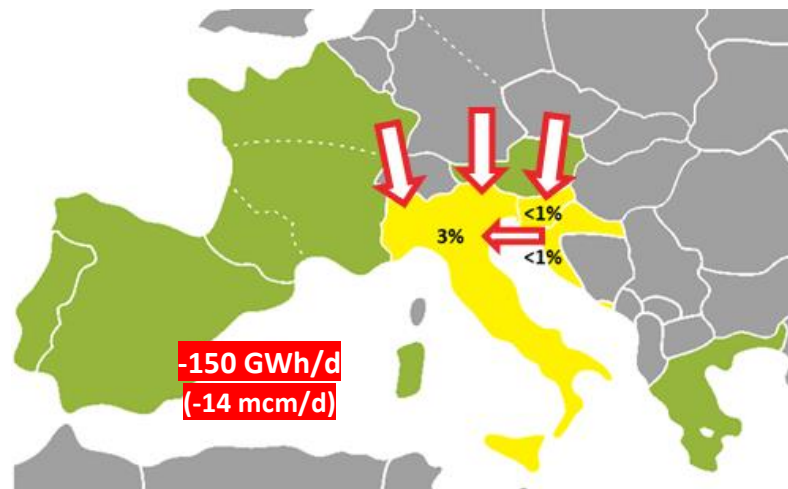


LNG Tanks

12 TWh necessary at the beginning of the cold spell

> Provided at least 12 TWh available in the LNG tanks

> Peak day in 20 years



> Peak day: all supplies used at their maximum

# 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