european network
of transmission system operators
for gas

Brussels – 18 October 2016

TYNDP17 identification of problems

Contribution to the 3rd PCI process

Preliminary Low Infra Level results

Webinar - 18 October 2016

ENTSOG System Development Team

Image Courtesy of Thyssengas

Webinar – 18 October

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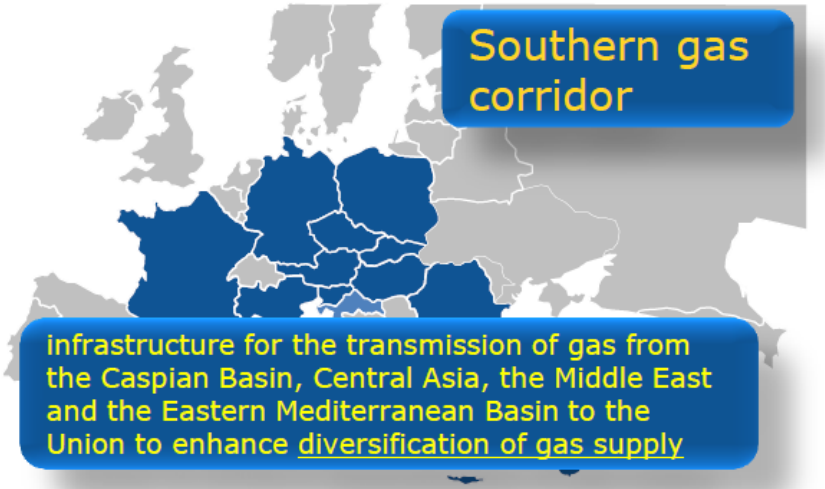
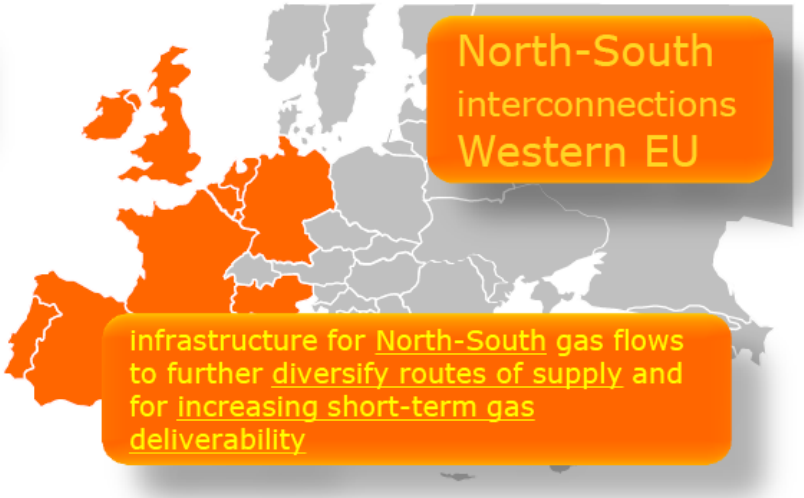
Priority corridors: gas



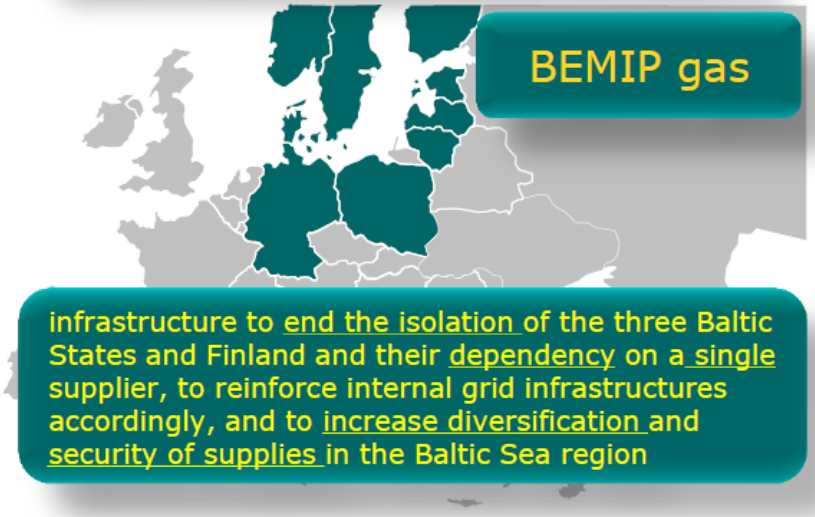
Southern gas corridor

infrastructure for the transmission of gas from the Caspian Basin, Central Asia, the Middle East and the Eastern Mediterranean Basin to the Union to enhance diversification of gas supply



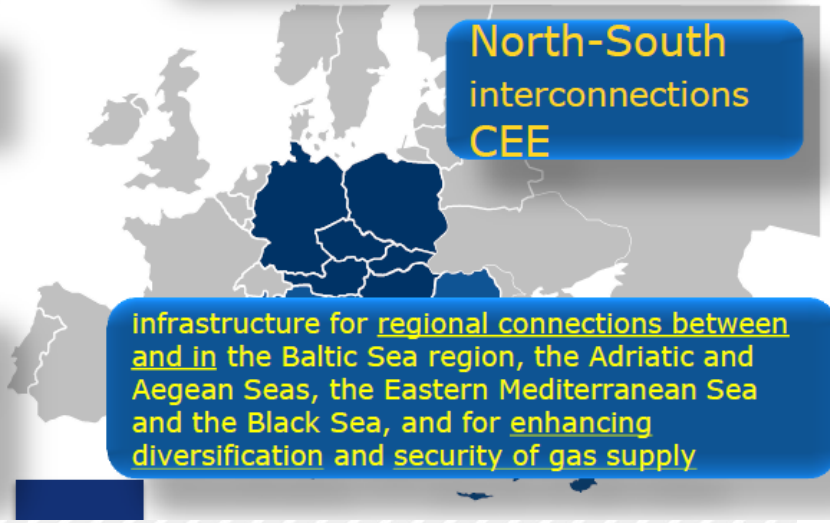
North-South interconnections Western EU

infrastructure for North-South gas flows to further diversify routes of supply and for increasing short-term gas deliverability



BEMIP gas

infrastructure to end the isolation of the three Baltic States and Finland and their dependency on a single supplier, to reinforce internal grid infrastructures accordingly, and to increase diversification and security of supplies in the Baltic Sea region



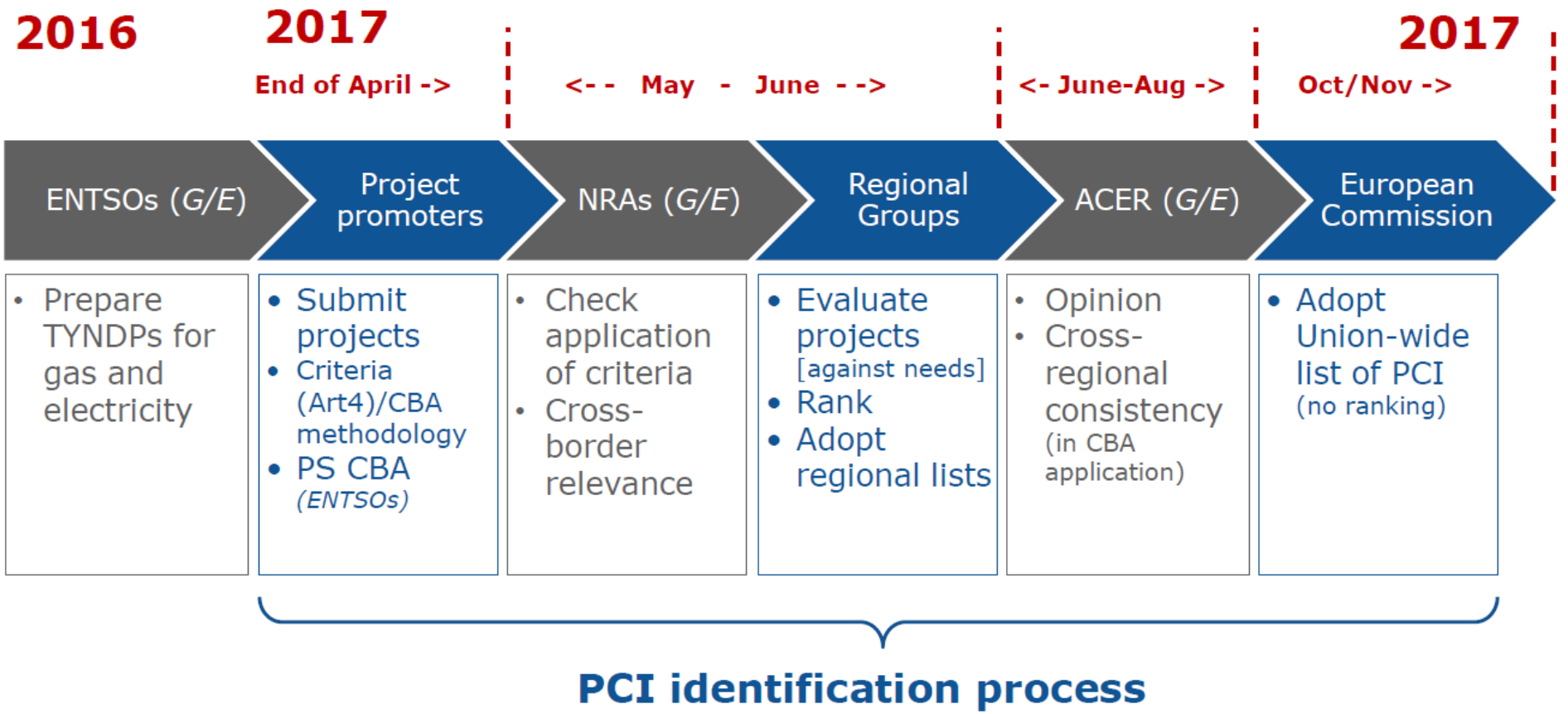
North-South interconnections CEE

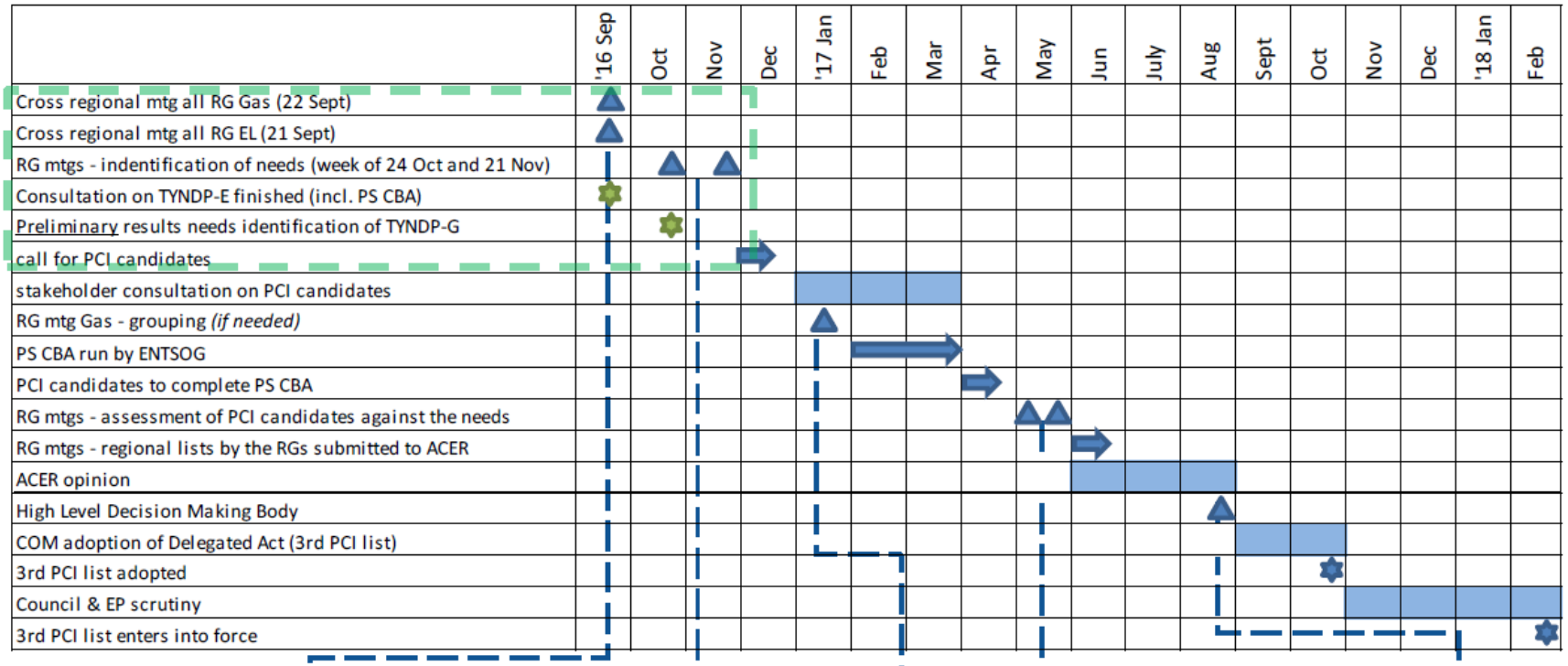
infrastructure for regional connections between and in the Baltic Sea region, the Adriatic and Aegean Seas, the Eastern Mediterranean Sea and the Black Sea, and for enhancing diversification and security of gas supply

Projects of Common Interest

- Issues of Common Interest
  - **Cross-border relevance (cross-border impact)**
  - **Significant contribution to Market Integration, Interoperability and System Flexibility, Security of Supply, Competition or Sustainability**
  - **Not any gas asset (not upstream or distribution; storages connected to high-pressure pipelines; LNG/CNG reception)**

Overview of the process





Cross-regional mtg G/E

Objective:
- Agreement on process
- Dividing assignments
- Draft list of *problems*

RG and Cross-regional mtgs

Objective: Agreement on *problems* and corresponding infrastructure *needs* per Region

Gas RG mtg

Objective: Grouping of PCI candidates

[if needed]

RG mtgs (2 per RG)

Objective: Assessment of PCI candidates in the framework of what Region *needs*

RG mtg

Objective: Technical level DMB – agree Regional lists

Use of Project Portals of ENTSOs to collect PCI candidates submissions – under consideration

Indicative planning

	'16 Sep	Oct	Nov	Dec
Cross regional mtg all RG Gas (22 Sept)	▲			
Cross regional mtg all RG EL (21 Sept)	▲			
Preparatory work (first two weeks of Oct)		▲		
Documents on CIRCABC (by 18 Oct)		✿		
RG mtgs - indentification of needs (week of 24 Oct)		▲		
Preparatory work (10/11 Nov)			▲	
Documents on CIRCABC (by 17 Nov)		✿		
Cross regional mtg - all RG Gas (week of 21 Nov)			▲	
Cross regional mtg - all RG EL (week of 21 Nov)			▲	
Preliminary results needs identification of TYNDP-G		✿		
Call for PCI candidates				➡

Cross-regional mtg G/E

Objective:
- Agreement on process
- Dividing assignments
- Draft list of *problems*

Homework mtgs (NRA/Promoters/Stakeholders) – **per corridor**

Objective:
- Each sub-group coordinates its views on *problems* per Region

RG mtgs

Objective:
- Views of stakeholders
- Consensus on list of problems in the Region
- Discussion on thresholds/parameters to frame a *need*

Homework mtgs (NRA/Promoters); possibly MSs

Objective:
- Proposal on filtering the *needs* from the identified *problems* – per Region
- Consensus on list of problems

Cross-regional mtg G/E

Objective:
- Discussion on the infrastructure *needs* per region
- Consensus on list of *needs* per Region

Defining the *needs*

Needs in terms of relevant criteria, such as of security of supply, market integration, system flexibility, interoperability, competition, or sustainability that are due to infrastructure shortcomings and that prevent the implementation of a given priority corridor or thematic area.

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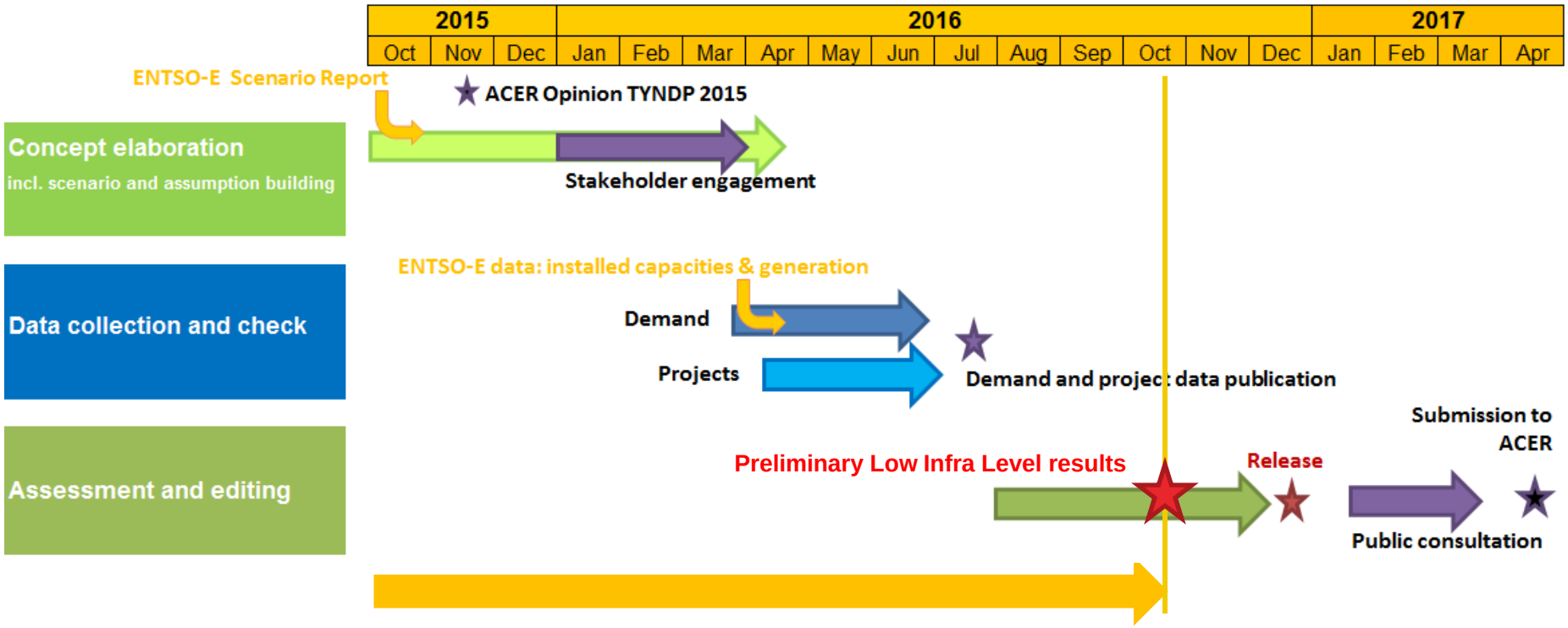
Where are we in the TYNDP process?

- **Strong cooperation with ACER and European Commission** all along the process
- An **intense interaction with Stakeholders**
- **Dialogue with ENTSO-E on TYNDP Scenarios**



ENTSOG preliminary Low Infra Level results supports the PCI process identification of needs

TYNDP 2017

Application of the CBA Methodology in force (EC approval Feb-15)

> http://www.entsog.eu/public/uploads/files/publications/CBA/2015/INV0175-150213_Adapted_ESW-CBA_Methodology.pdf

ENTSOG has <u>complemented</u> the CBA Methodology on voluntary basis on some aspects

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4 Demand Scenarios

Scenario		Slow Progression	Blue Transition	Green Evolution	EU Green Revolution
Category	Parameter				
Macroeconomic trends	EU on track to 2050 target?	Behind	On track	On track – National ambitions	On track / beyond – EU level ambitions
	Economic conditions	Limited growth	Moderate growth	Strong growth	Strong growth
	Green ambitions	Lowest	Moderate	High	Highest
	CO2 price	Lowest	Moderate	Highest	Highest
	Fuel prices	Highest	Moderate	Lowest	Lowest
Heating sector	Energy Efficiency improvement	Slowest	Moderate	Fastest	Fastest
	Competition with electricity	Limited gas displacement by elec. (new buildings)	Limited gas displacement by elec. (new buildings)	Gas displaced by electricity (district heating, heat pumps)	Gas displaced by electricity (district heating, heat pumps)
	Electrification	Lowest	Moderate	High	Highest
Power sector	Renewables develop.	Lowest	Moderate	High	Highest
	Gas vs Coal	Coal before Gas	Gas before Coal	Gas before Coal	Gas before Coal
Transport sector	Gas in transport	Lowest	Highest	Moderate	Moderate
	Elec. in transport	Lowest	Moderate	Highest	Highest

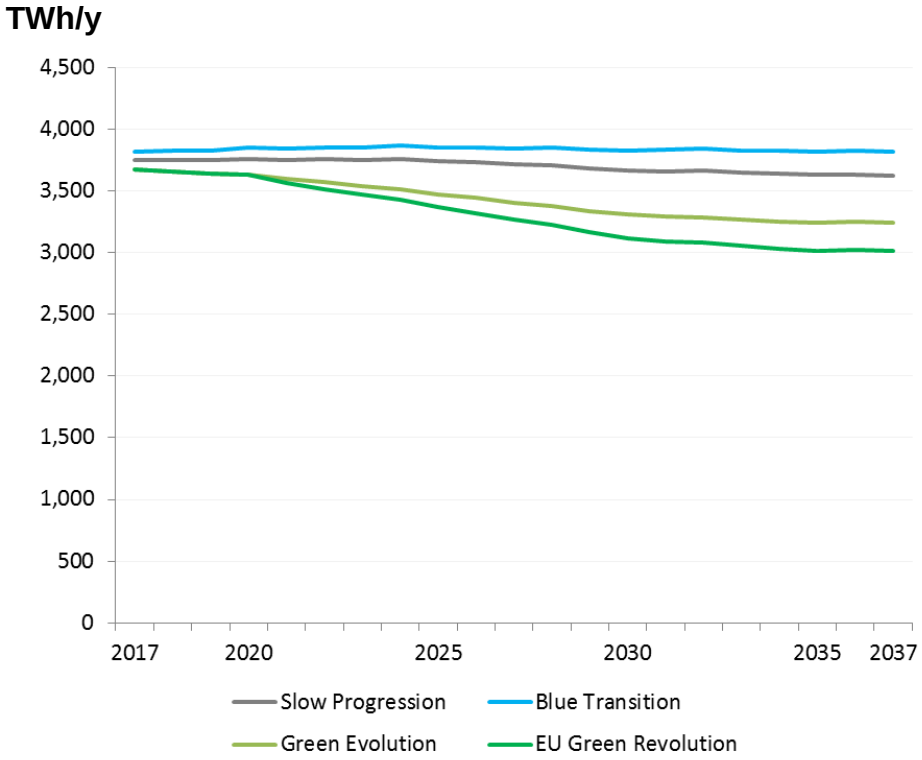
Related ENTSO-E 2030 Visions

Vision 1 | Vision 3 | Vision 4 | Vision 4

Sectoral demand

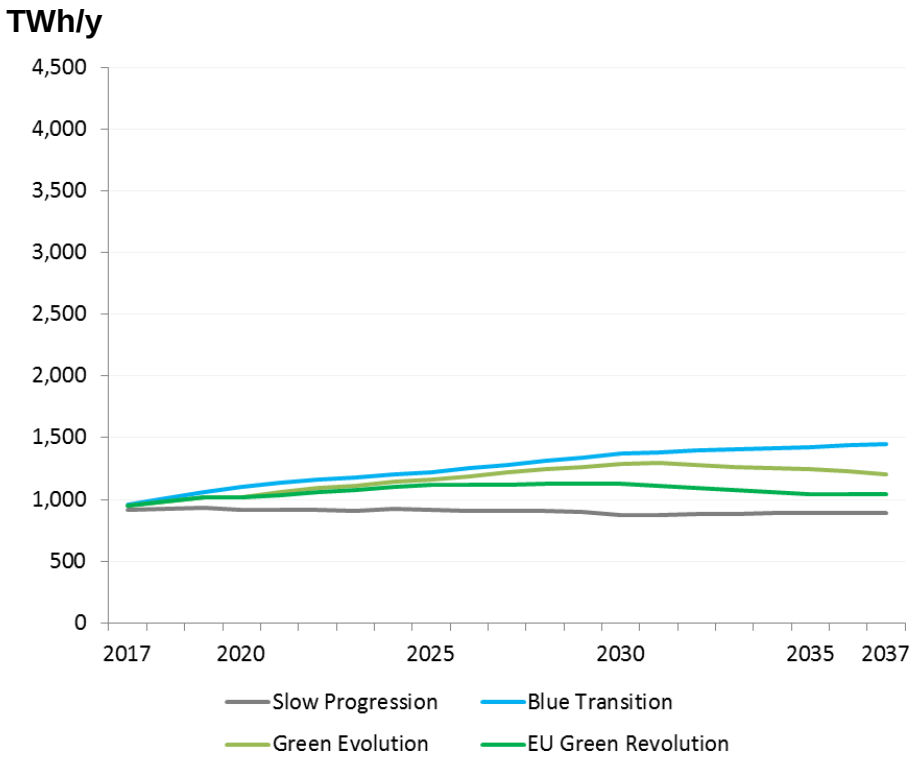
End-user demand

Stable to decreasing demand depending on **energy efficiency gains** and **electrification** of the heating sector



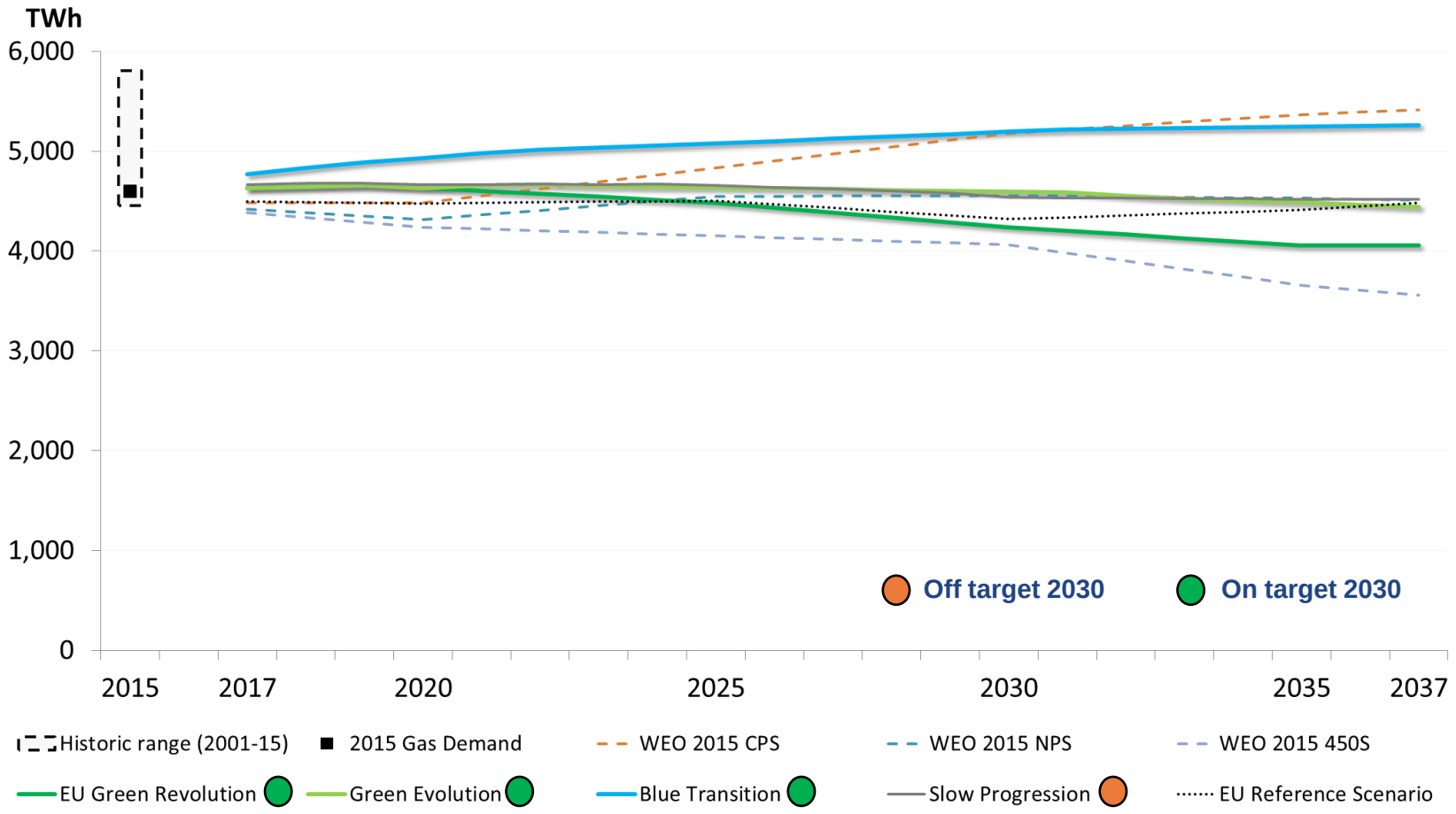
Gas for power demand

Stable to increasing demand depending on role of gas in **RES back-up** and **subsituting coal-fired generation**



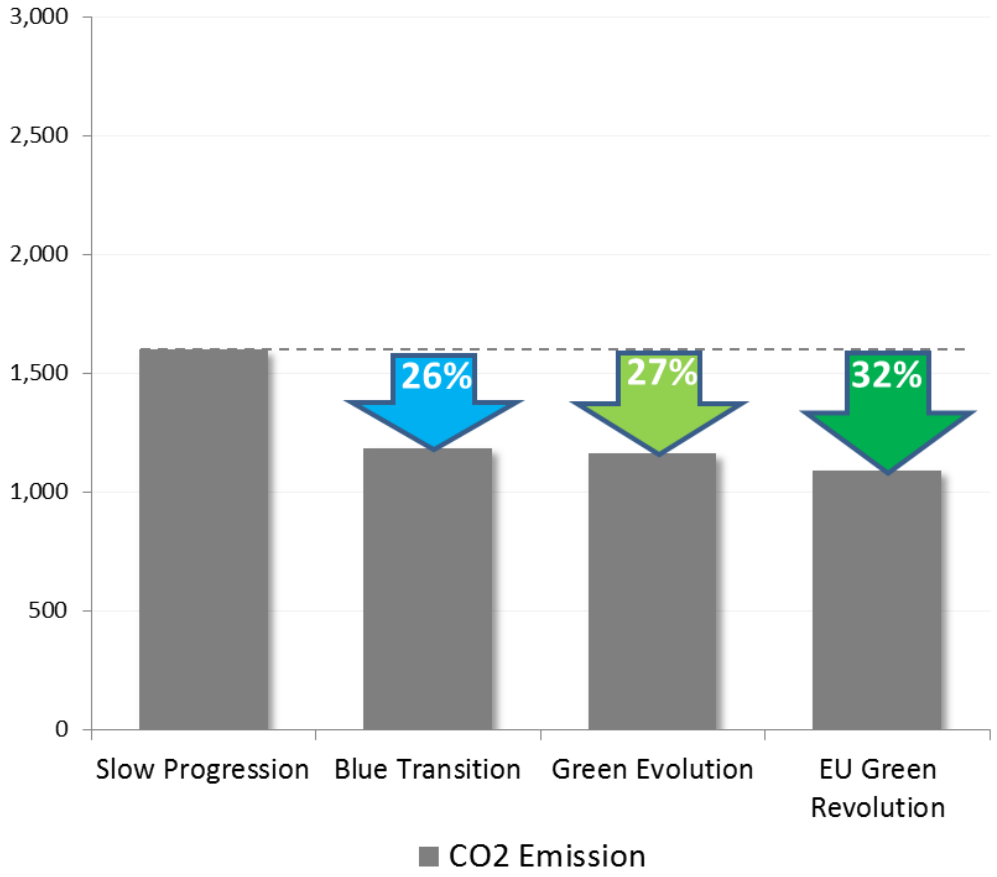
Overall demand

TYNDP assessment performed for the 3 on target scenarios



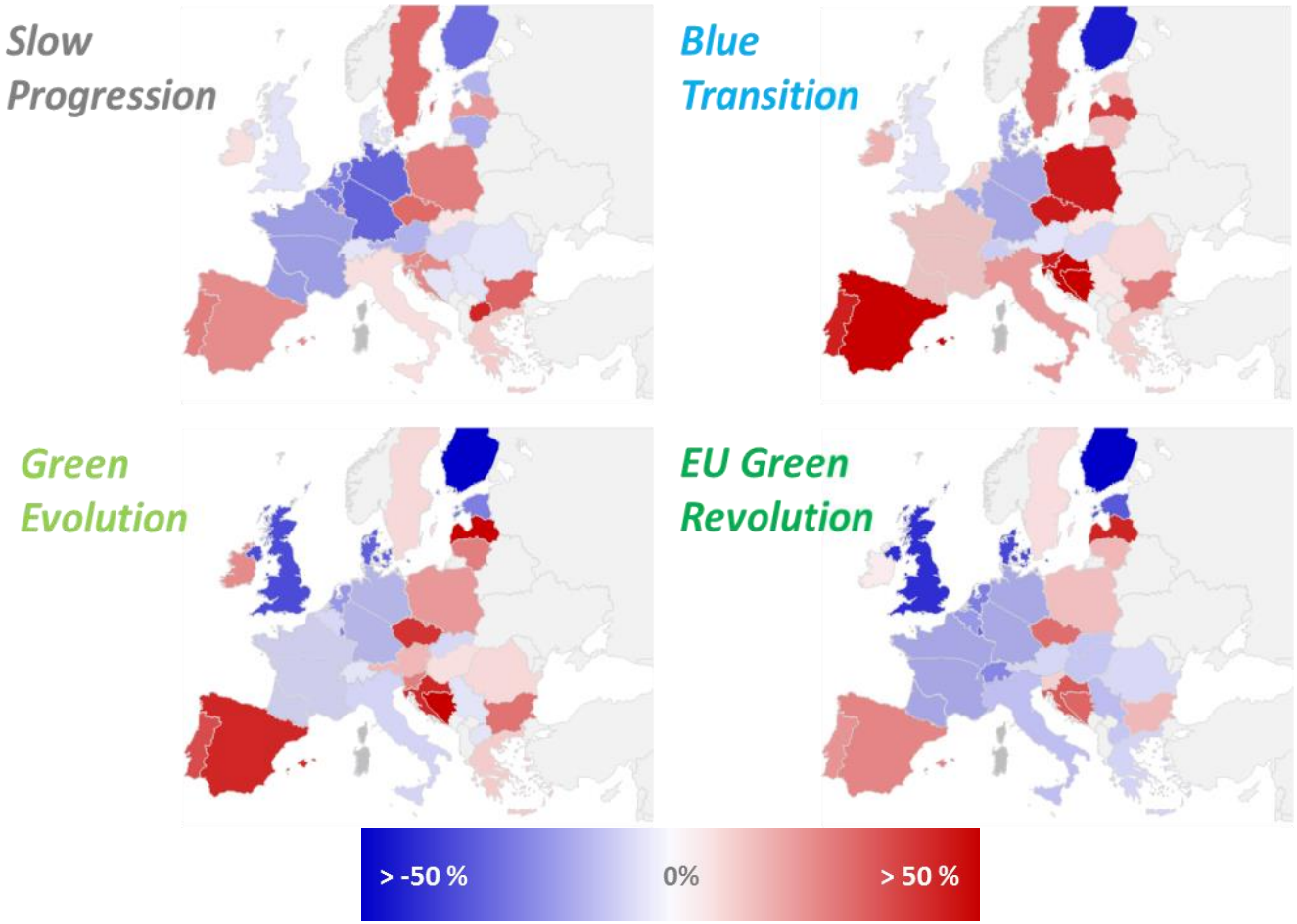
Several paths to decarbonisation

Gas grid assessement for the different paths



CO2 emissions in 2030 – overall power demand and gas end-user demand

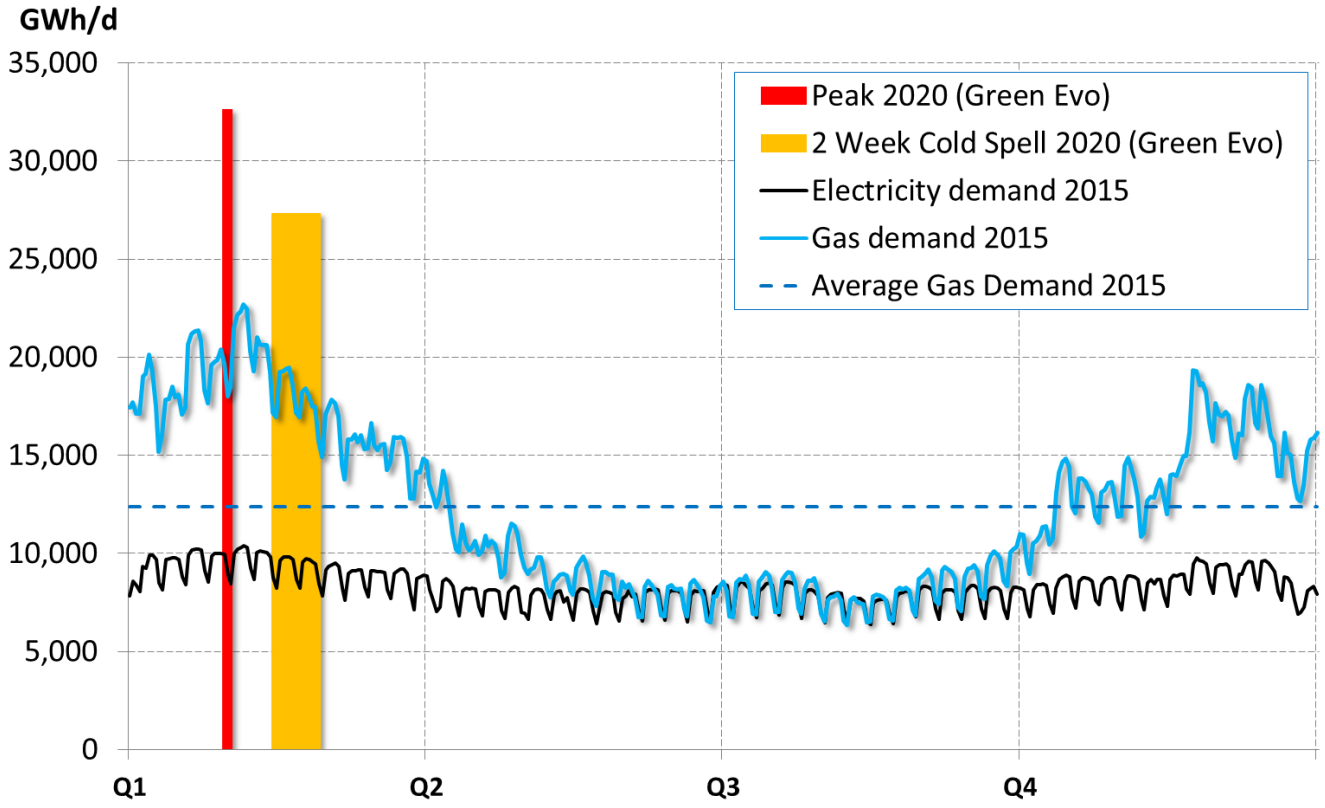
Country-level demand evolution



Total annual gas demand evolution – 2017 to 2035

Gas network designed for peak situation

Gas grid assessed both from an annual volume and high demand situation perspective



European gas and electricity demand – over the year and peak perspectives

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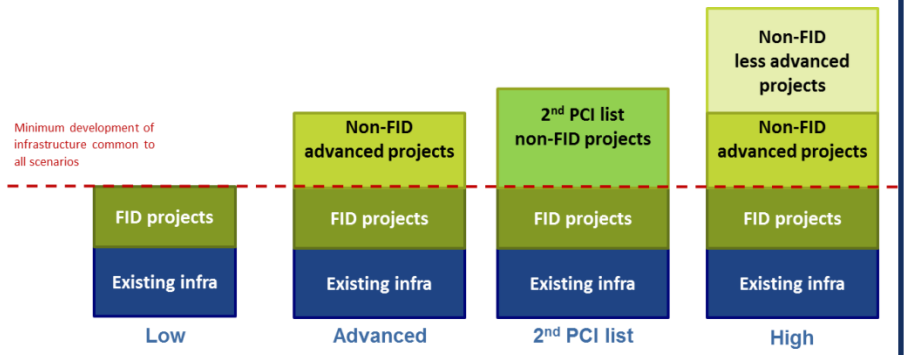
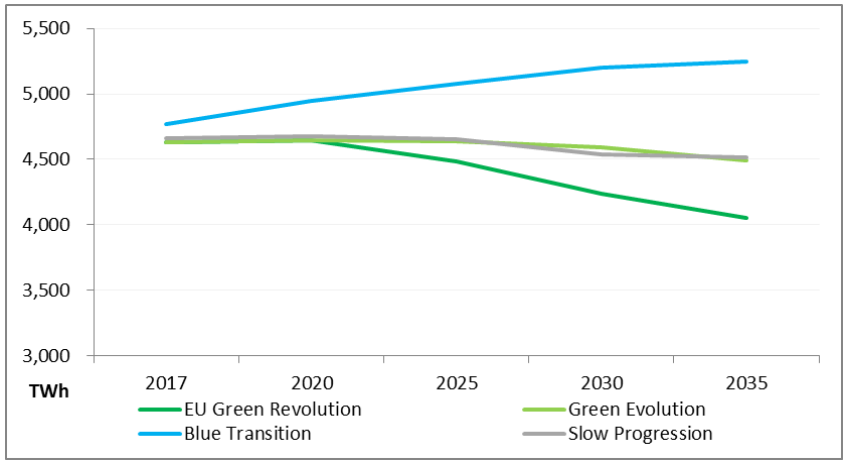
The TYNDP 2017 assessment frame

4 infrastructure levels

Dynamic over time based on projects commissioning date



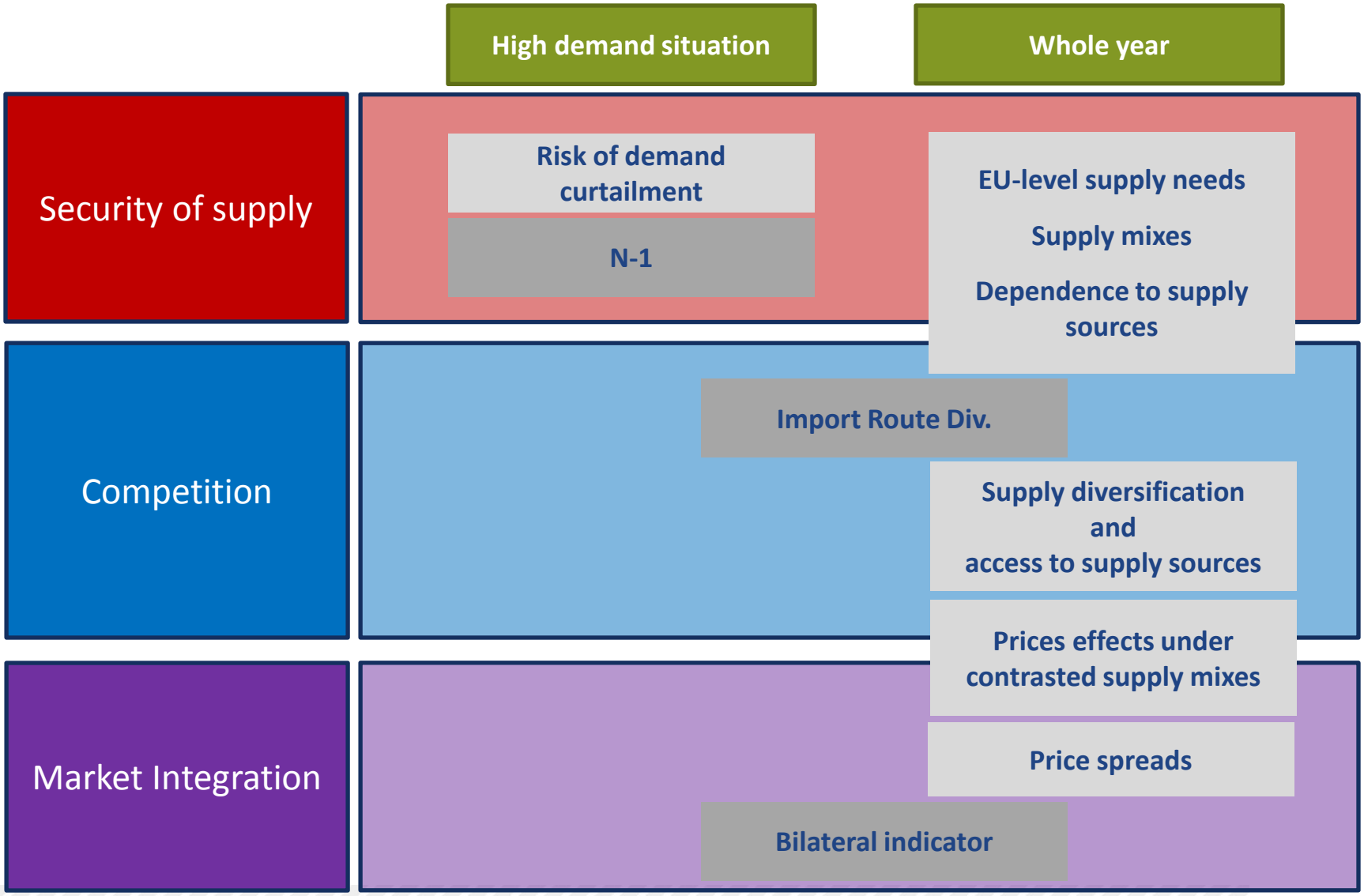
3 scenarios assessed



	Low	Advanced	2nd PCI list	High
Blue Transition				
Green Evolution		Multi-criteria analysis		
EU Green Rev				

Low infra level analysis:
Focus of today presentation

A multi-criteria analysis



Not covered in the preliminary results

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Identication of problems

Objective: share the TYNDP identification of problems

> TYNDP assessment performed under an assumption of perfect market functioning
  - To avoid identifying needs where better market functioning would solve the issue
  - The assessment focuses on the **infrastructure needs**

The results allow to identify

> The most impacted countries

> The infrastructure limitations

> Identified issues may be mitigated by different types of gas infrastructure

> Additional results still pending, including on L to H-gas conversion issues

The focus is the identification of problems

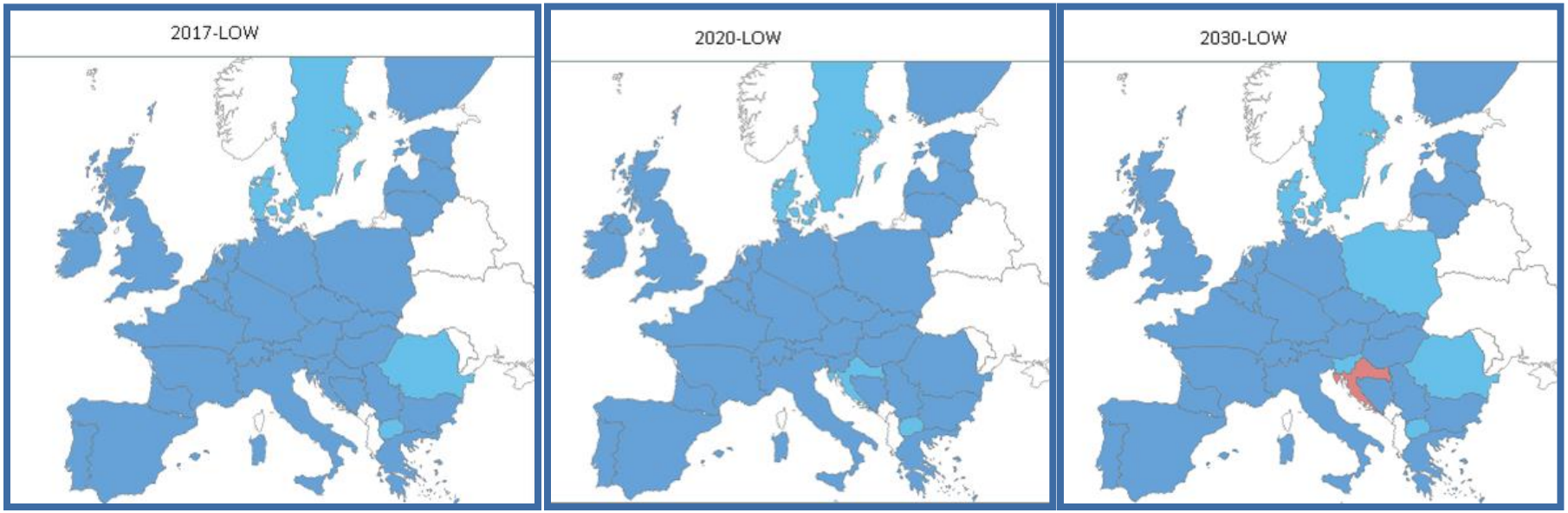
> **We will not talk about projects**

Security of supply

Exposure to demand disruption (normal situation)

High demand situation (peak day)

Blue Transition



Remaining Flexibility
20% - 50%
0% - 20%

Share of curtailed demand
50% - 100%
20% - 50%
0% - 20%

Disrupted rate:
curtailed demand share
Remaining Flexibility:
additional share of demand the infrastructure would allow to cover
(calculated non-simultaneously for each country)

	BEMIP	NSI West	NSI East + South. Corridor
Exposure to demand disruption under normal situation	Low Rem Flex: SE, DK, PL *GRev: only SE*		**Disruption: HR** ***GRev: HR less disrupted*** Low Rem Flex: HR, SI, RO *GRev: only RO*

Security of supply

Exposure to demand disruption - under route disruption cases

> Under route disruption cases, we are interested in the **additional impact** com
to the normal situation case

High demand situation

No significant additional impact for following route disruption cases:

> Langeled disruption
> Franpipe disruption
> Transmed disruption
> MEG disruption
> TANAP disruption

> No further exposure to demand curtailment
> Only very marginal remaining flexibility decrease

Security of supply

Exposure to demand disruption – under Belarus route disruption

High demand situation (peak day)

Blue Transition

Remaining Flexibility
20% - 50%
0% - 20%

Share of curtailed demand
50% - 100%
20% - 50%
0% - 20%

HR unchanged from normal situation

	BEMIP	NSI West	NSI East + South. Corridor
Exposure to demand disruption under Belarus route disruption	Disruption: PL *GRev: PL low Rem Flex*		

Security of supply

Exposure to demand disruption - under Ukraine route disruption

High demand situation (peak day)

Blue Transition

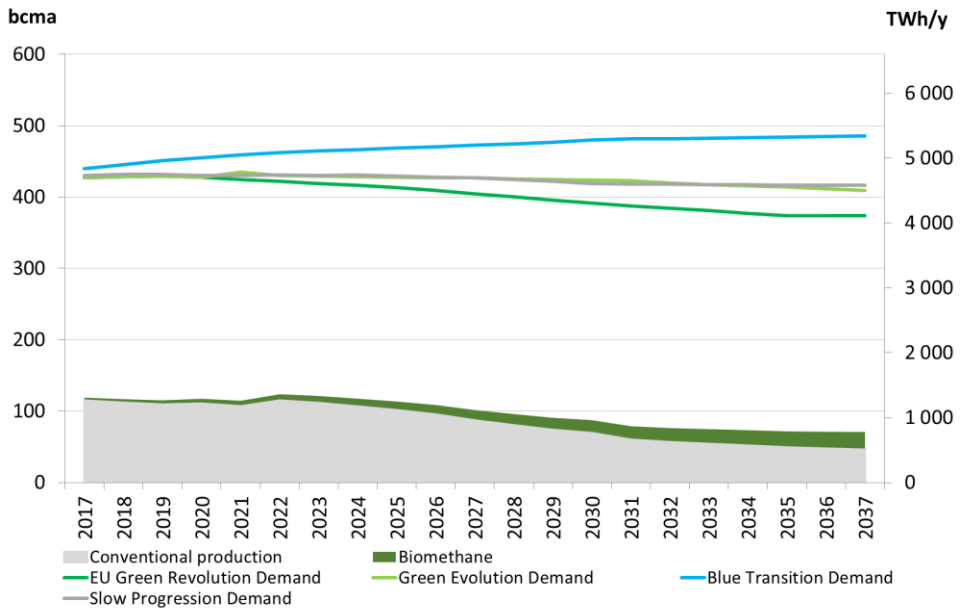
HR unchanged from normal situation

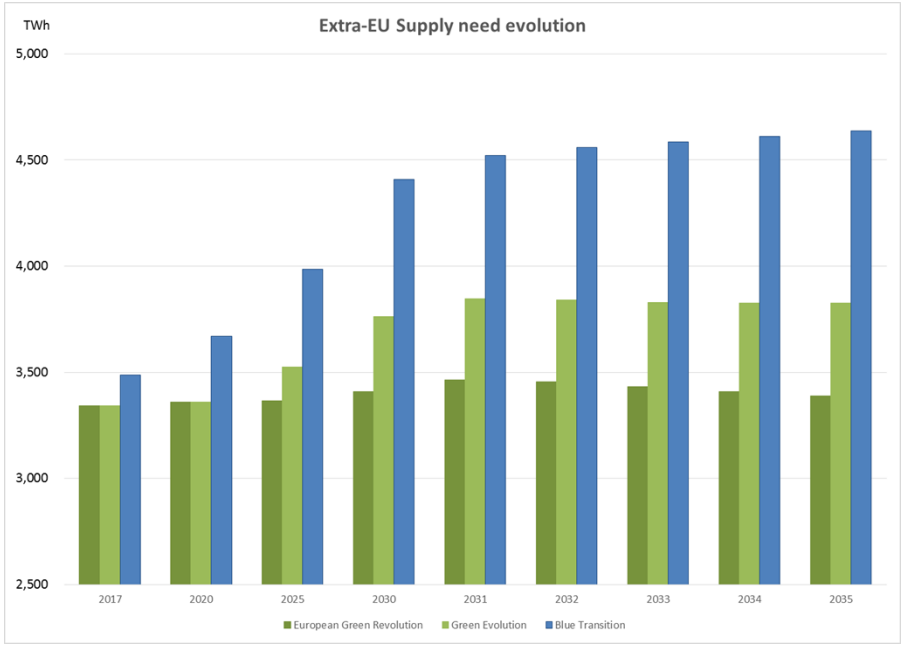
	BEMIP	NSI West	NSI East + South. Corridor
Exposure to demand disruption under Ukraine route disruption			Disruption: BG, HR, HU, RO *GRev: same*

Security of supply / Competition

EU supply needs

Whole year





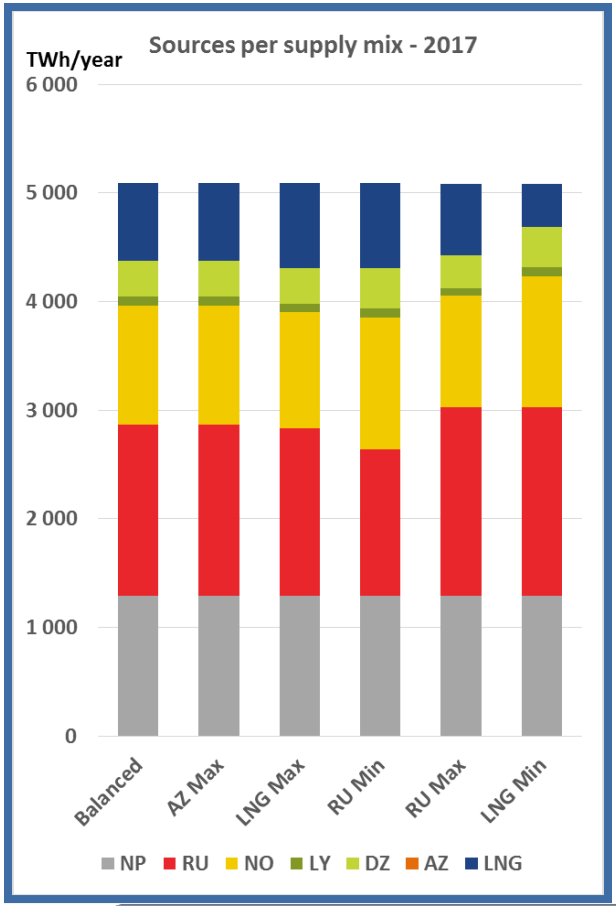
Decline of indigenous production leads to increased supply needs over time for 2 out of the 3 scenarios

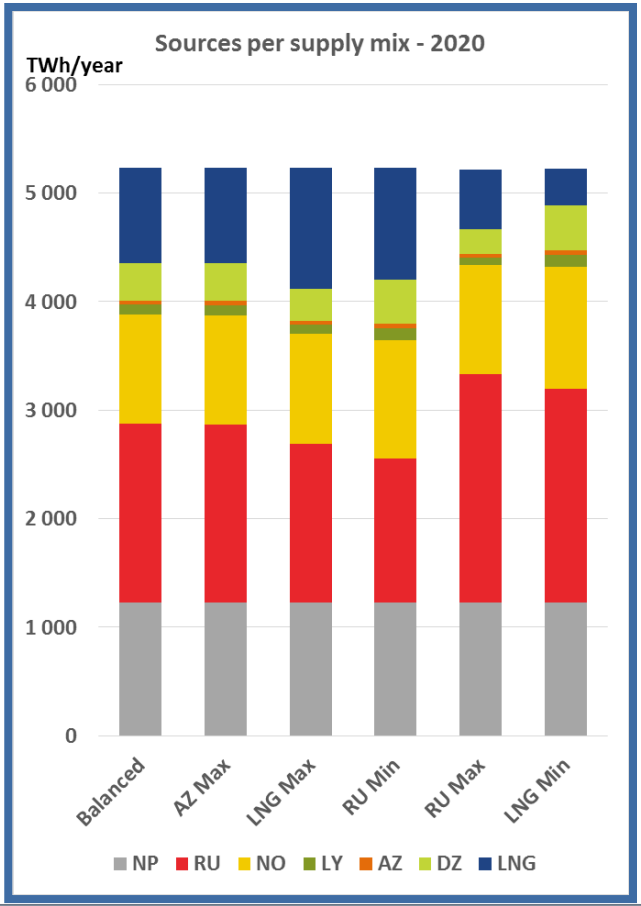
Security of supply / Competition

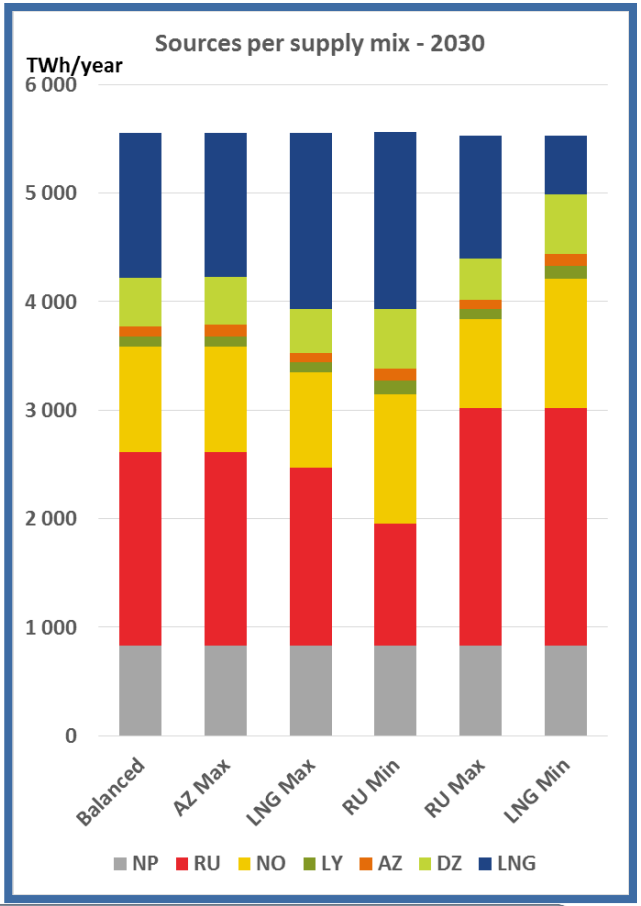
EU supply mixes

Whole year

Blue Transition







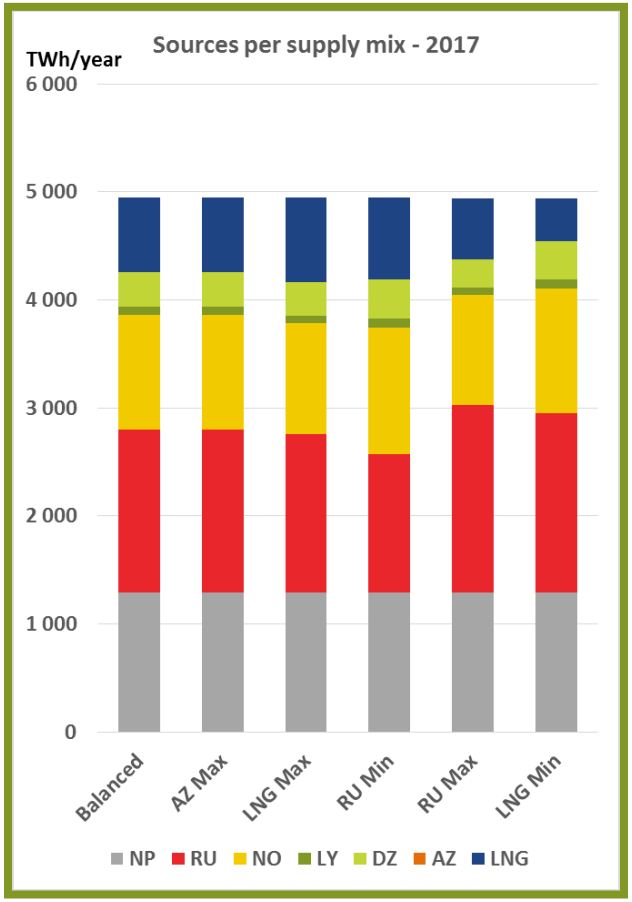
The low infrastructure level enables a wide range of supply mixes.

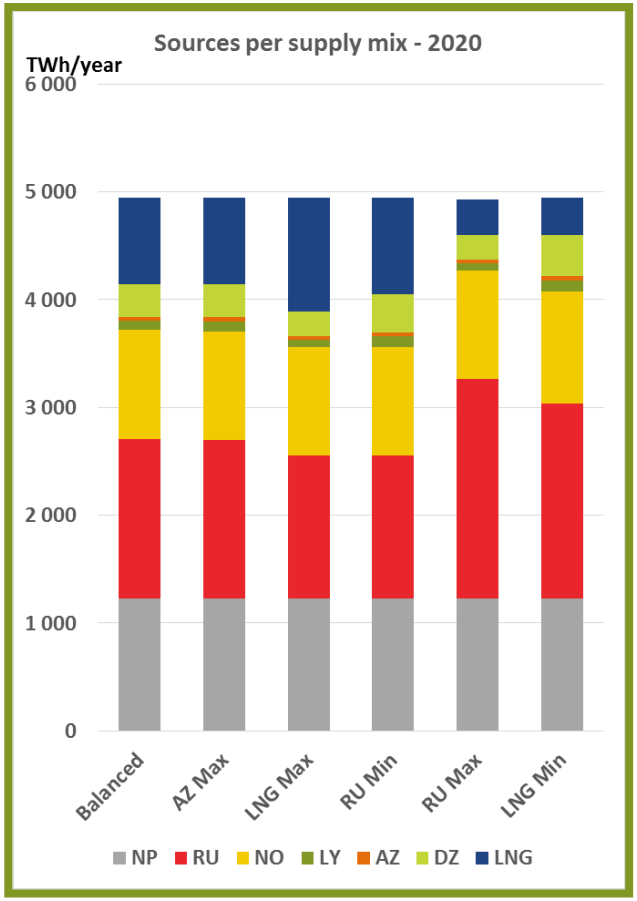
Security of supply / Competition

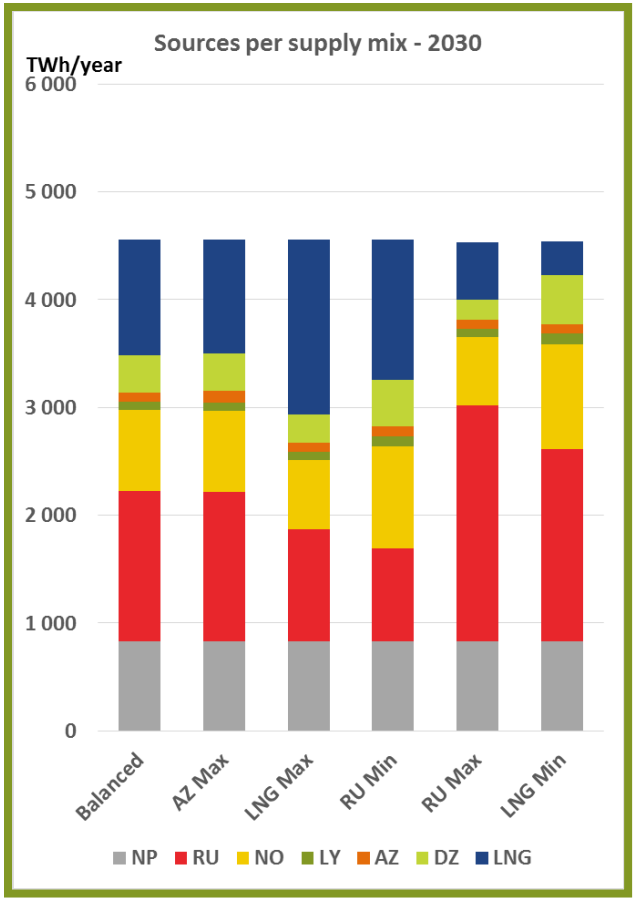
EU supply mixes

Whole year

Green Revolution







The low infrastructure level enables a wide range of supply mixes.

Security of supply / Competition

Dependence to supply sources

Whole year

> Dependence **to a given supply source** (CSSD) should be understood as the **minimum share of this source** necessary for a country to cover its demand on a yearly basis

> Dependence is presented under **cooperative behaviour** between countries
- Countries will align their mimimum source share (CSSD) if infrastructures allows for it
- Non-alignement between countries indicate an **infrastructure bottleneck**

> High CSSD level can inform both on **security of supply** and **competition**
- In the case of LNG, being a multi-source supply, security of supply is not at stake

Results show no dependence to Norwegian*, Algerian, Lybian or Azeri gas
- Neither at EU-level nor at country-level

***In 2017: limited EU-level dependence on Norwegian gas due to restricted supply flexibilities for this time horizon, no infrastructure bottleneck**

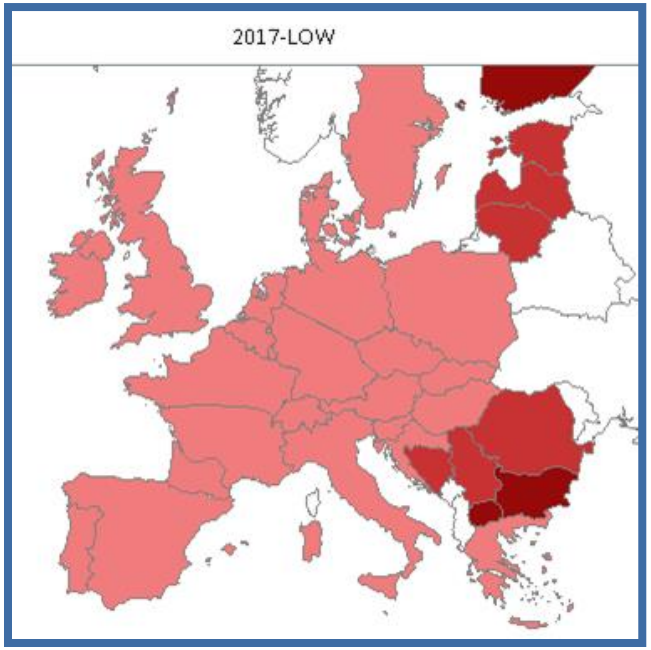
Security of supply / Competition

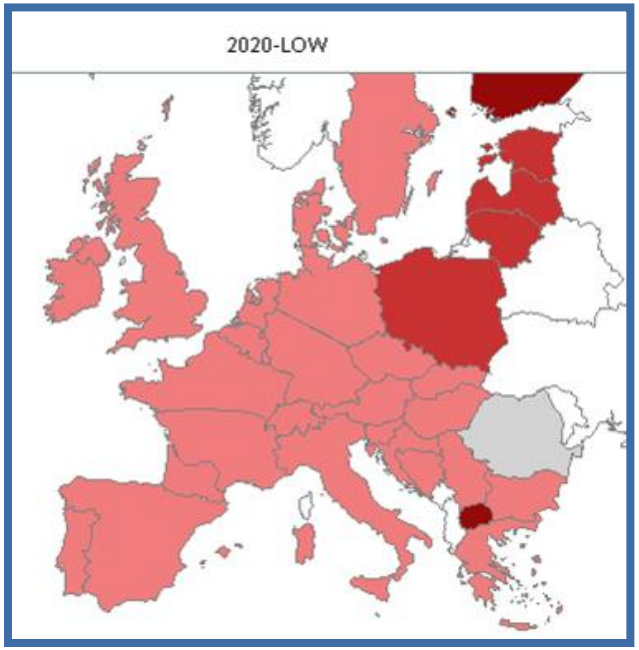
Dependence to Russian supply

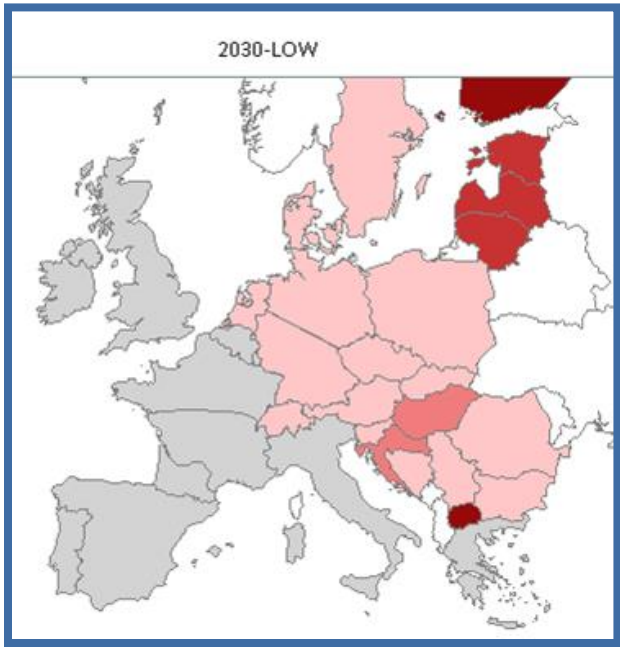
Whole year

Blue Transition

- **At EU level**, no infrastructure limitation preventing full access to the other supply sources*
- **At country-level**, some highly dependent countries indicating infrastructure bottleneck







	BEMIP	NSI West	NSI East + South. Corridor
Dependence to Russian supply above 25%	EE, FI, LV, LT, PL *GRev: PL below 25%*		BG, RO *GRev: RO below 25%*

CSSD

50% - 100%
25% - 50%
15% - 25%
5% - 15%
0%-5%

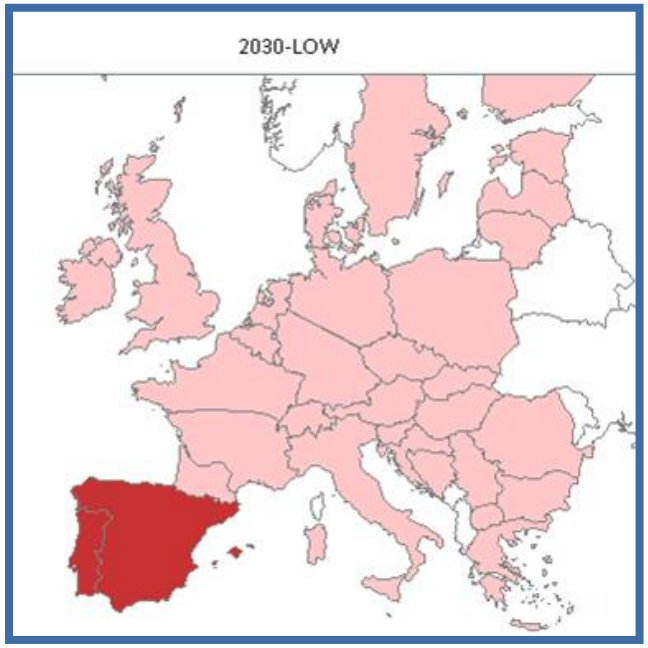
*the EU-level dependency derive from the maximum supply potential from the other sources

Security of supply / Competition

Dependence to LNG supply*

Whole year

- **At EU level**, no infrastructure limitation preventing full access to the other supply sources**
- **At country-level**, some highly dependent countries indicating infrastructure bottleneck



*LNG is a multi-source supply: results should be interpreted accordingly

	BEMIP	NSI West	NSI East + South. Corridor
Dependence to LNG supply (25% - 50%)		ES, FR***, PT	

CSSD

50% - 100%
25% - 50%
15% - 25%
5% - 15%
0%-5%

**the EU-level dependency derive from the maximum supply potential from the other sources
***The FR situation is remedied by 2020 thanks to the commissioning of a project

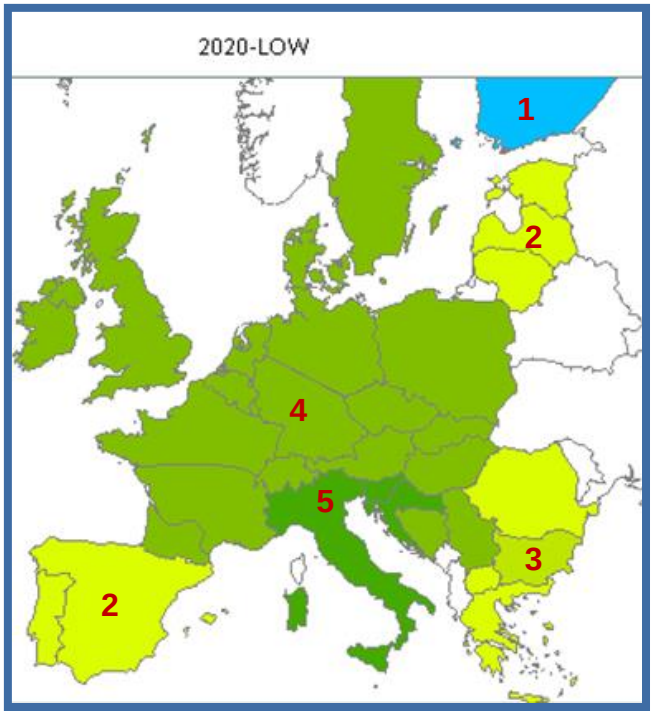
Competion - Access to Supply Sources

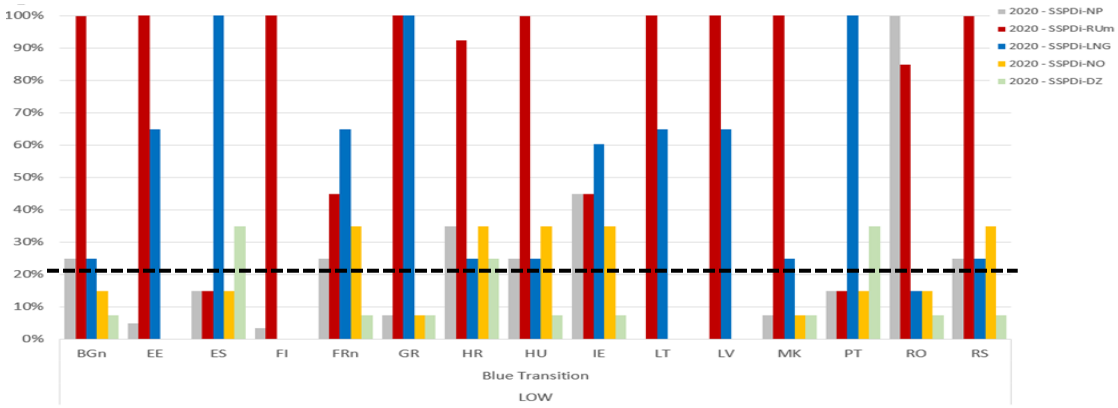
Whole year

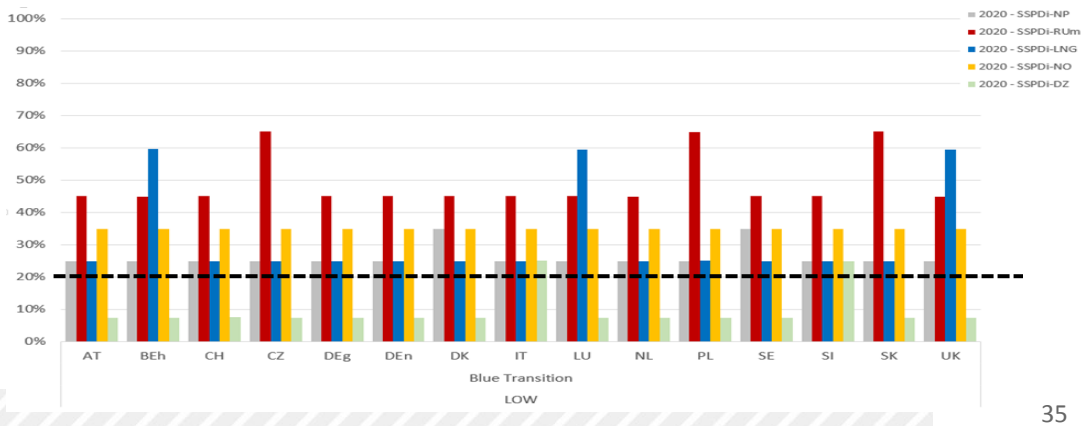
Access to Supply Sources is based on the **SSPDi** indicator

- SSPDi: capacity of a country to reflect a given source low price in its supply bill (SSPDi: supply bill share impacted)
- **At EU-level, Lybian and Azeri volumes are too low to have any significant impact on prices**
- **Access to Supply Sources** indicates the **number of sources** for which SSPDi exceeds a 20% threshold

Blue Transition – Access to sources







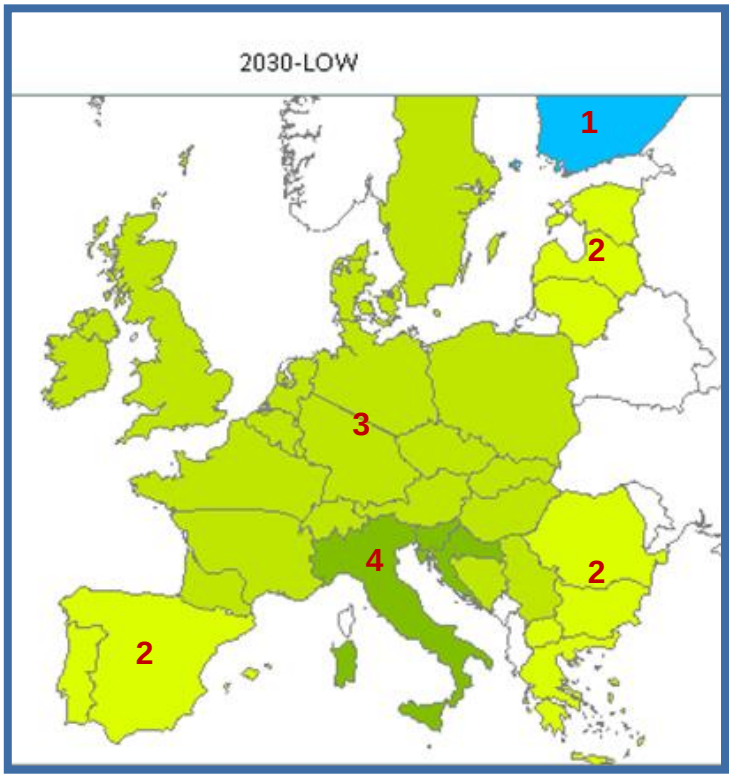
LNG is a multi-source supply: results should be interpreted accordingly

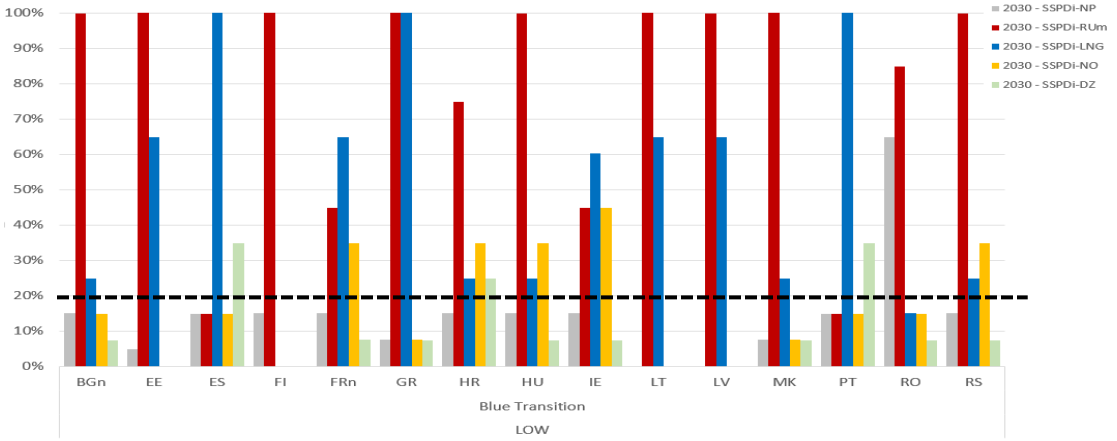
Competion - Access to Supply Sources

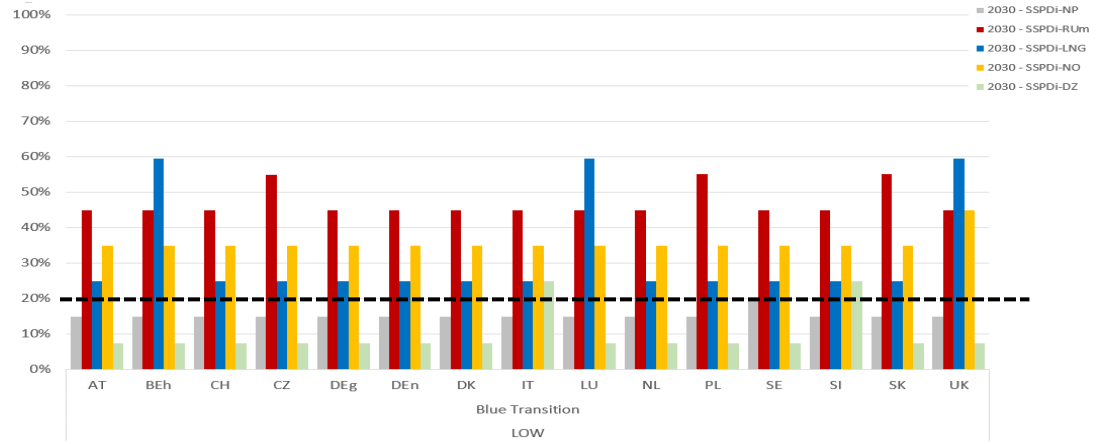
Whole year

Indigenous production fades out as a diversification option

Blue Transition – Access to sources







LNG is a multi-source supply: results should be interpreted accordingly

Competion - Access to Supply Sources

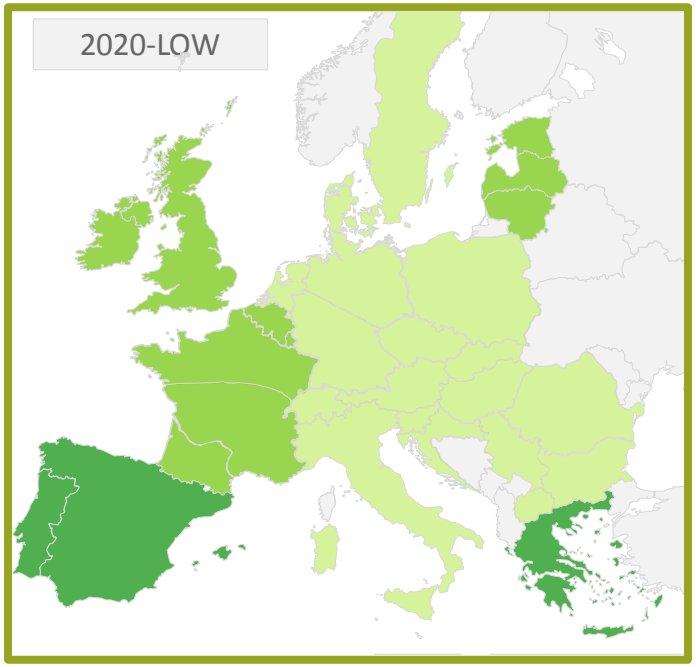
	BEMIP	NSI West	NSI East + South. Corridor
Access to less than 3 supply sources (* including LNG)	EE*, FI, LV*, LT*	ES*, PT*	BG, GR*

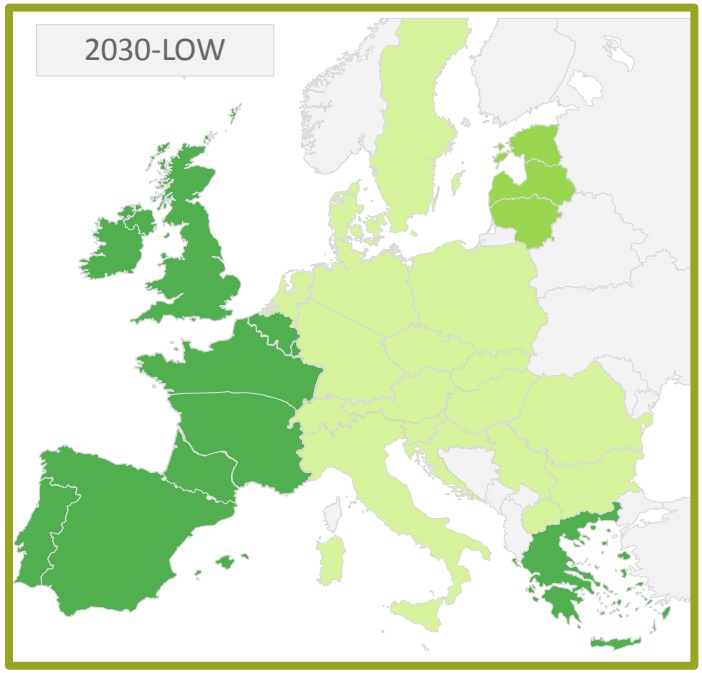
> Most of the countries accessing a limited number of supply sources also show high dependence to either Russian or LNG supply

Price effects - LNG

Whole year

LNG supply maximisation* (low LNG price) - Green Evolution





LEGEND	
price decrease compared to the balanced price configuration [EUR/MWh]	
	>2.00
	>1.00, <2.00
	<1.00, >0.50
	<0.50
	ca. 0

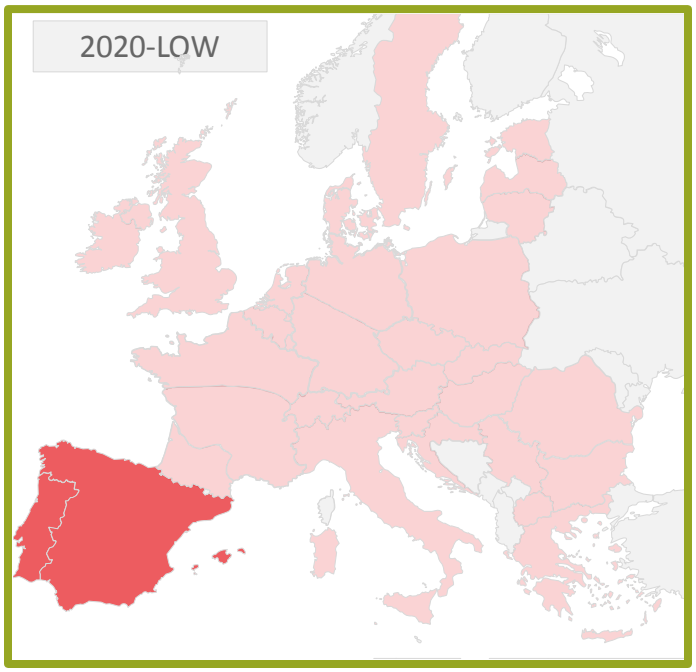
LNG is a multi-source supply: results should be interpreted accordingly

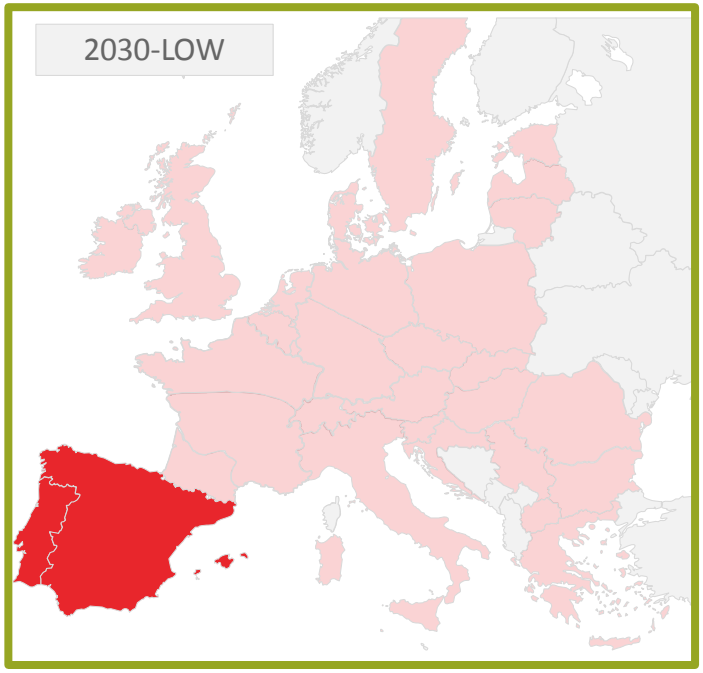
*Price effects under supply maximisation configuration based on SSPDi

Price effects - LNG

Whole year

LNG supply minimisation (high LNG price) - Green Evolution**





LEGEND	
price increase compared to the balanced price configuration [EUR/MWh]	
	>2.00
	>1.00, <2.00
	<1.00, >0.50
	<0.50
	ca. 0

LNG is a multi-source supply: results should be interpreted accordingly

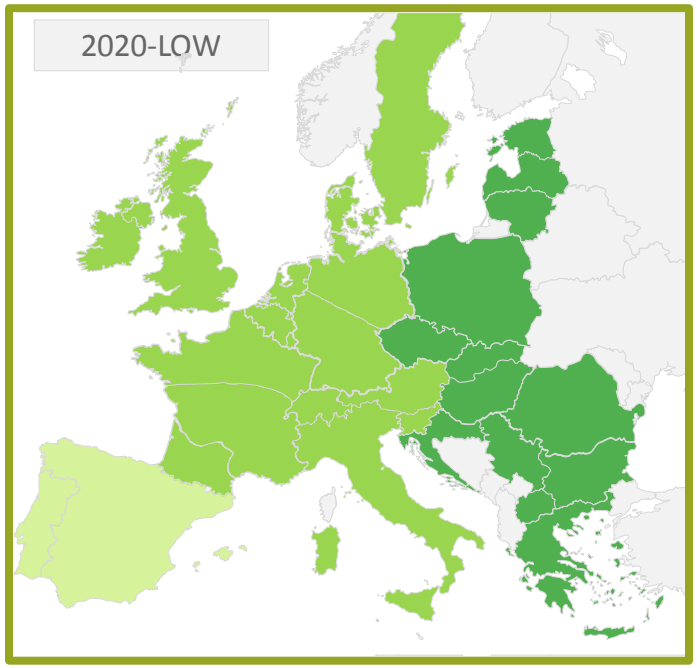
> No further information compared to CSSD to LNG supply

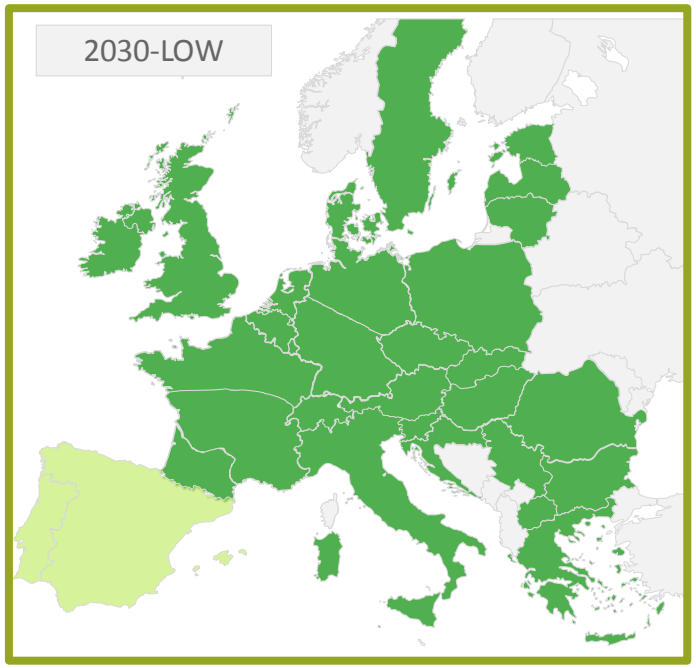
****Price effects under supply minimisation configuration based on CSSD**

Price effects – Russian gas

Whole year

Russian supply maximisation* (low RU price) - Green Evolution





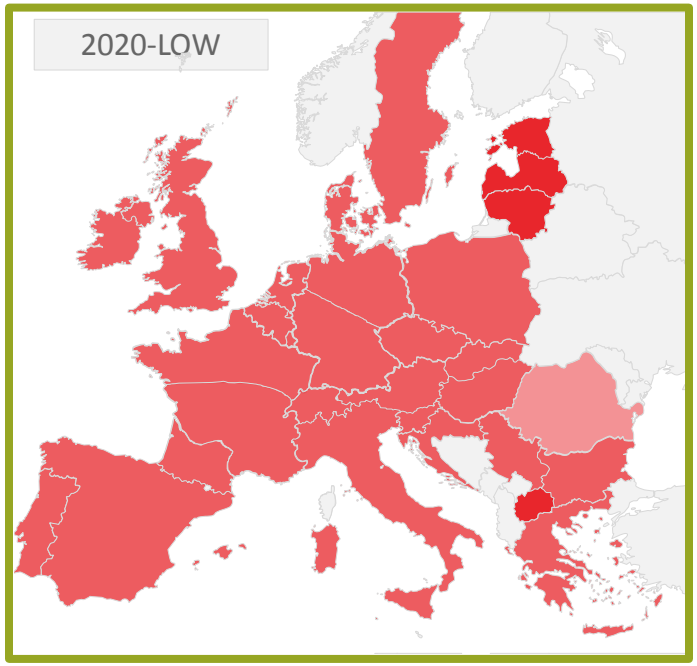
LEGEND	
price decrease compared to the balanced price configuration [EUR/MWh]	
	>2.00
	>1.00, <2.00
	<1.00, >0.50
	<0.50
	ca. 0

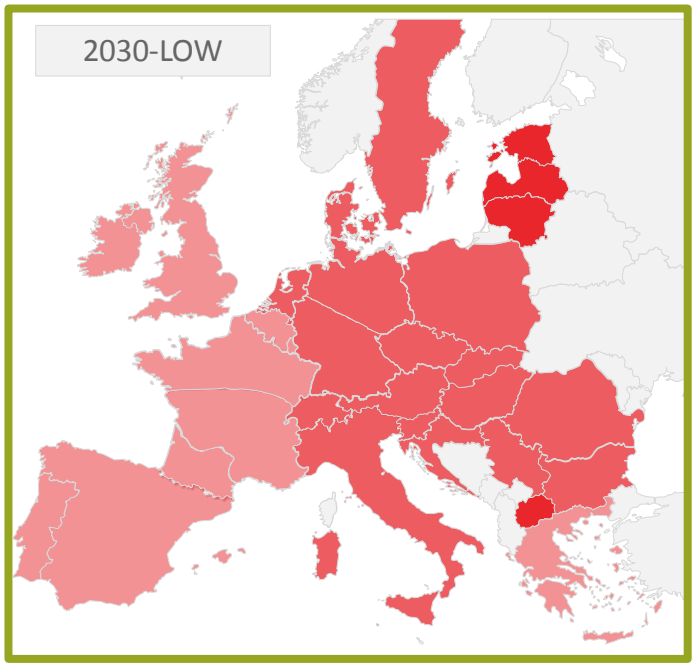
*Price effects under supply maximisation configuration based on SSPDi

Price effects – Russian gas

Whole year

Russian supply minimisation (high RU price) - Green Evolution**





LEGEND	
price increase compared to the balanced price configuration [EUR/MWh]	
	>2.00
	>1.00, <2.00
	<1.00, >0.50
	<0.50
	ca. 0

> No further information compared to CSSD to Russian supply

**Price effects under supply minimisation configuration based on CSSD

Price effects – wrap-up

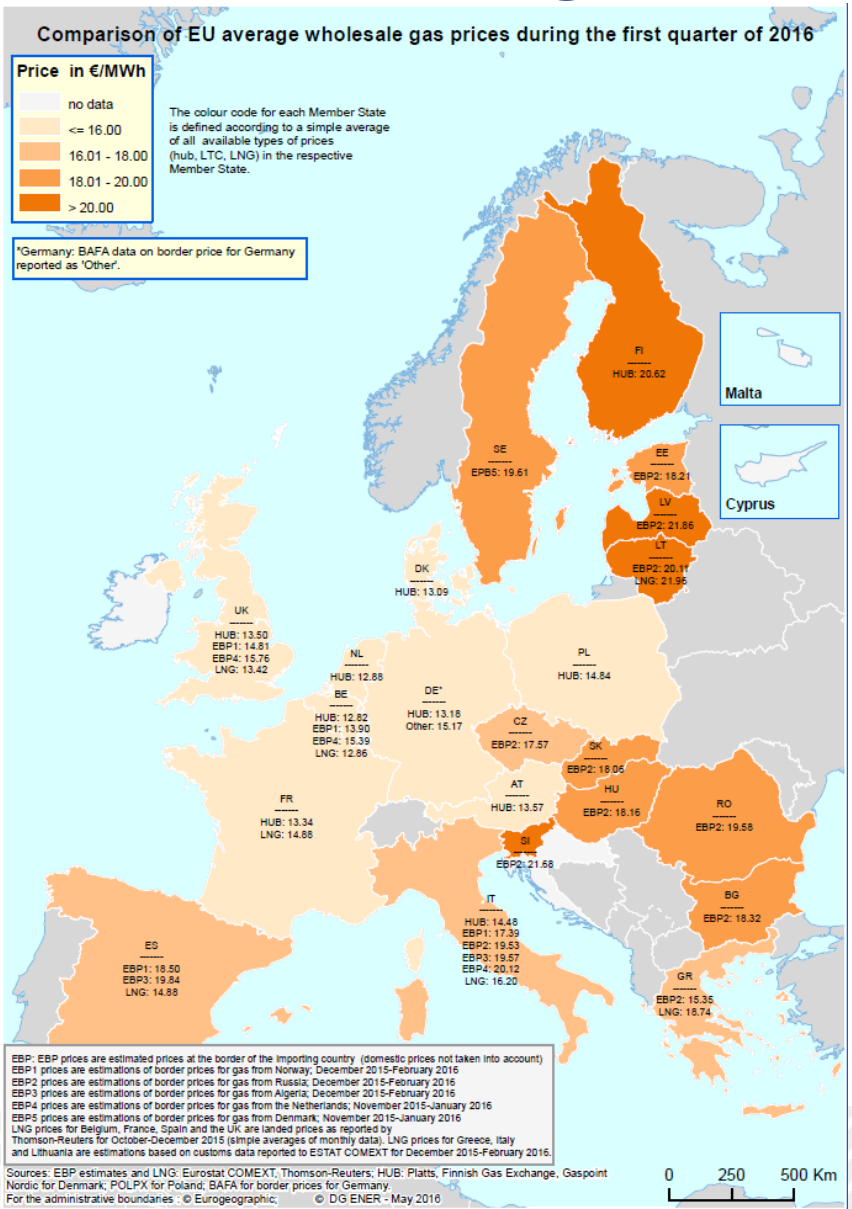
Price effect: barriers to low price propagation	BEMIP	NSI West	NSI East + South. Corridor
LNG Maximisation (low LNG price)	FI *vs Baltic states* PL *vs Blatic states*	FR *vs ES* East *vs West*	BG *vs GR* East *vs West*
Russian gas Maximisation (low RU price)		ES, PT *vs FR* West *vs East*	West *vs East*

These results should be interpreted taking due account of SSPDi results

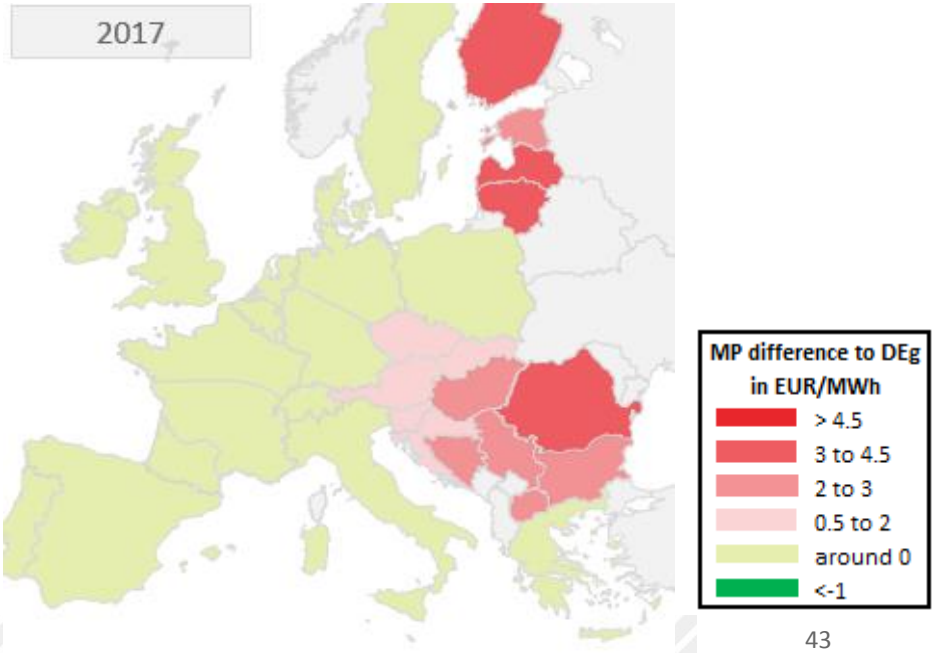
Barriers to high price mitigation	BEMIP	NSI West	NSI East + South. Corridor
LNG Minimisation (high LNG price)		Same as CSSD to LNG supply	
Russian gas Mimimisation (high RU price)	Same as CSSD to RU supply		Same as CSSD to RU

> **At EU-level, Azeri volumes are too low to have any significant impact on prices**

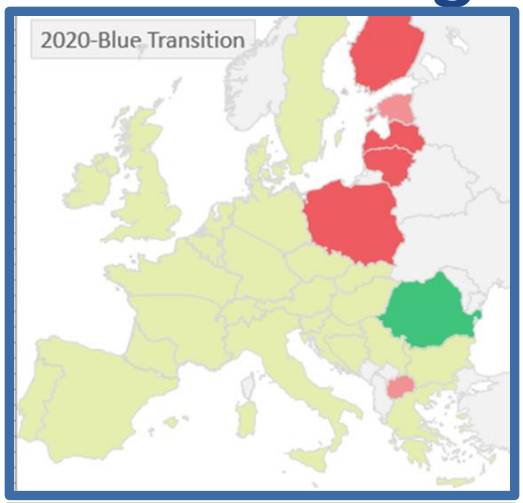
Market integration - Price spreads

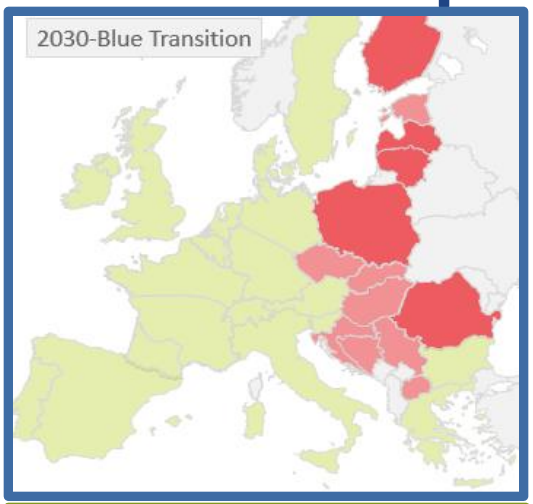


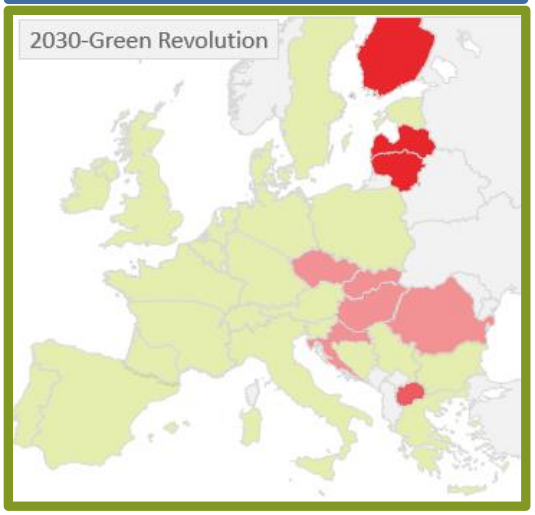
- Handled through a simulation focusing on Russian supply price information
  - Input: EC quarterly report Q1-16 EBP2 information (European Border Price: Russia)
  - Price spreads measured to German border price
- Marginal prices simulated for 2017



Market integration - Price spreads







Market integration

Whole year

MP difference to DEg in EUR/MWh
- > 4.5
- 3 to 4.5
- 2 to 3
- 0.5 to 2
- around 0
- <-1

	BEMIP	NSI West	NSI East + South. Corridor
Price spreads	EE, FI, LV, LT, PL		CZ, HR, HU, RO, SK

Conclusions

	BEMIP	NSI West	NSI East + South. Corridor
Exposure to demand disruption	**PL**		**BG, HR, HU, RO**
Increased supply needs due to decrasing indigenous production	**All countries**		
Dependence or access to limited number of supply sources (* including LNG)	**EE*, FI, LV*, LT*, PL**	**ES*, PT*,** FR in 2017	**BG, GR*, RO**
Price effects			
- **Barriers to low price propagation**	**FI *vs Baltic states* PL *vs Baltic states***	**FR *vs ES* East *vs West* ES, PT *vs FR* West *vs East***	**BG *vs GR* East *vs West* West *vs East***
- **Barriers to high price mitigation**	***Same as CSSD***	***Same as CSSD***	***Same as CSSD***
Price spreads	**EE, FI, LV, LT, PL**		**CZ, HR, HU, RO, SK**

> The results allow to identify the **most impacted countries** and **infrastructure limitations**

> Identified issues may be mitigated by **different types of gas infrastructure**

Thank You for Your Attention

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