Regional Group North Sea

Stakeholder workshop

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TYNDP 2014 workshop

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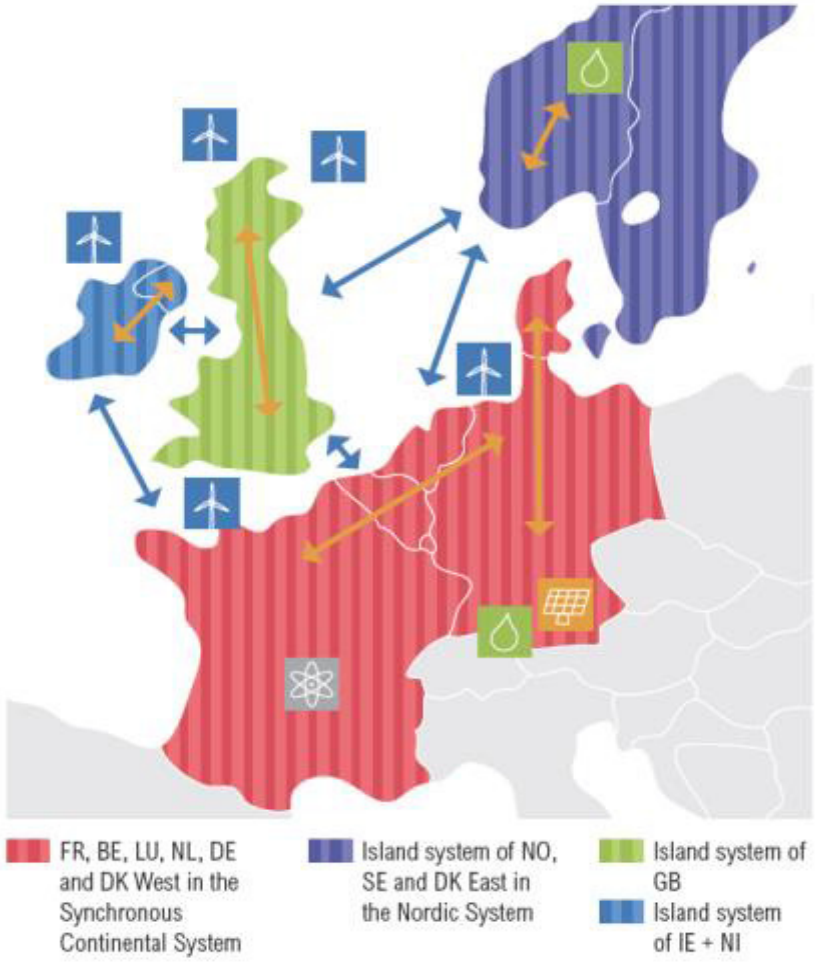
entsoe

Reliable Sustainable Connected

RGNS perimeter

- RGNS consists of 4 seperate synchronous areas:
  - Mainland Europe
  - Scandinavia + Danemark East
  - Great Britain
  - Ireland and Northern Ireland.

- Sub-parts are operated in AC and interconnceted by DC links.



Main Topics RGNS

- Major challenges RGNS:

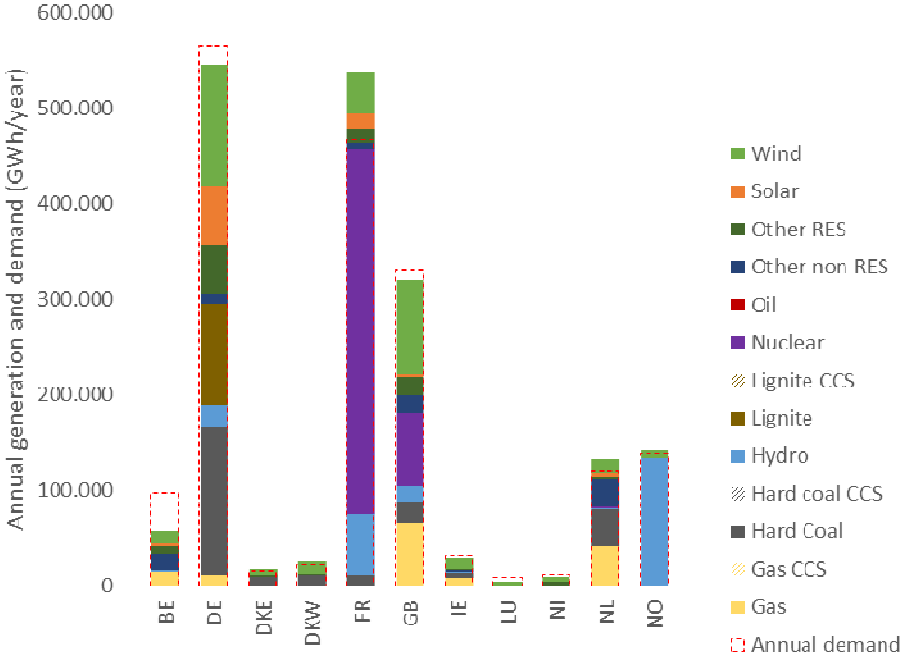
  - Security of supply
  - Integrate the European Energy Market with
  - Large RES increase.

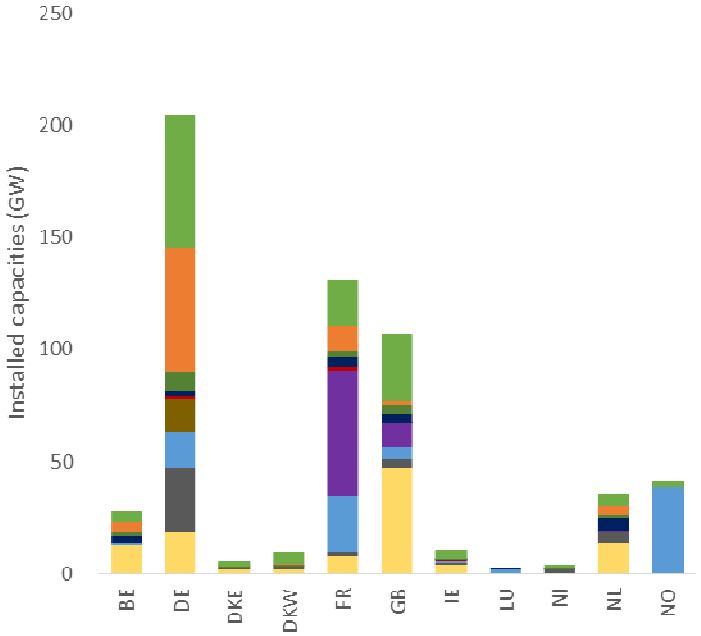
- Towards 2030 generation portfolio will shift from
  - thermal to renewables and
  - from coal to gas

- More interconnectors are needed to:
  - avoid additional curtailment of RES
  - to contribute to the increased required flexibility.

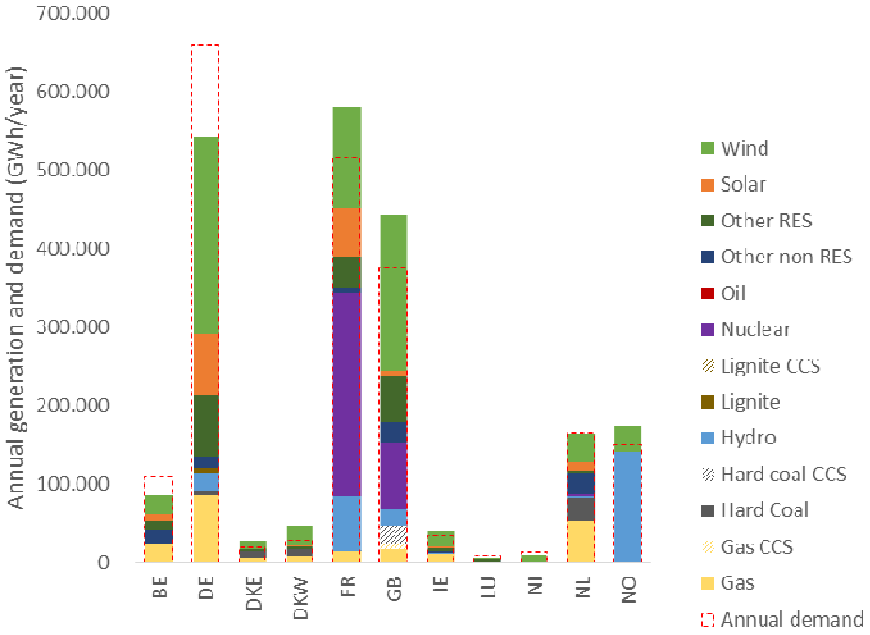
- Given siting the RES generation (outside load centres) major challenges for realising suitable infrastructure.

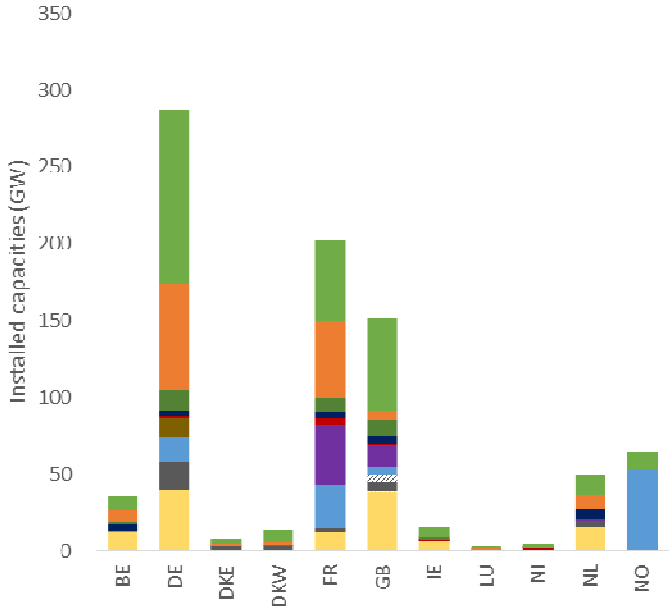
RGNS Vision 1: Demand, generation and installed capacity



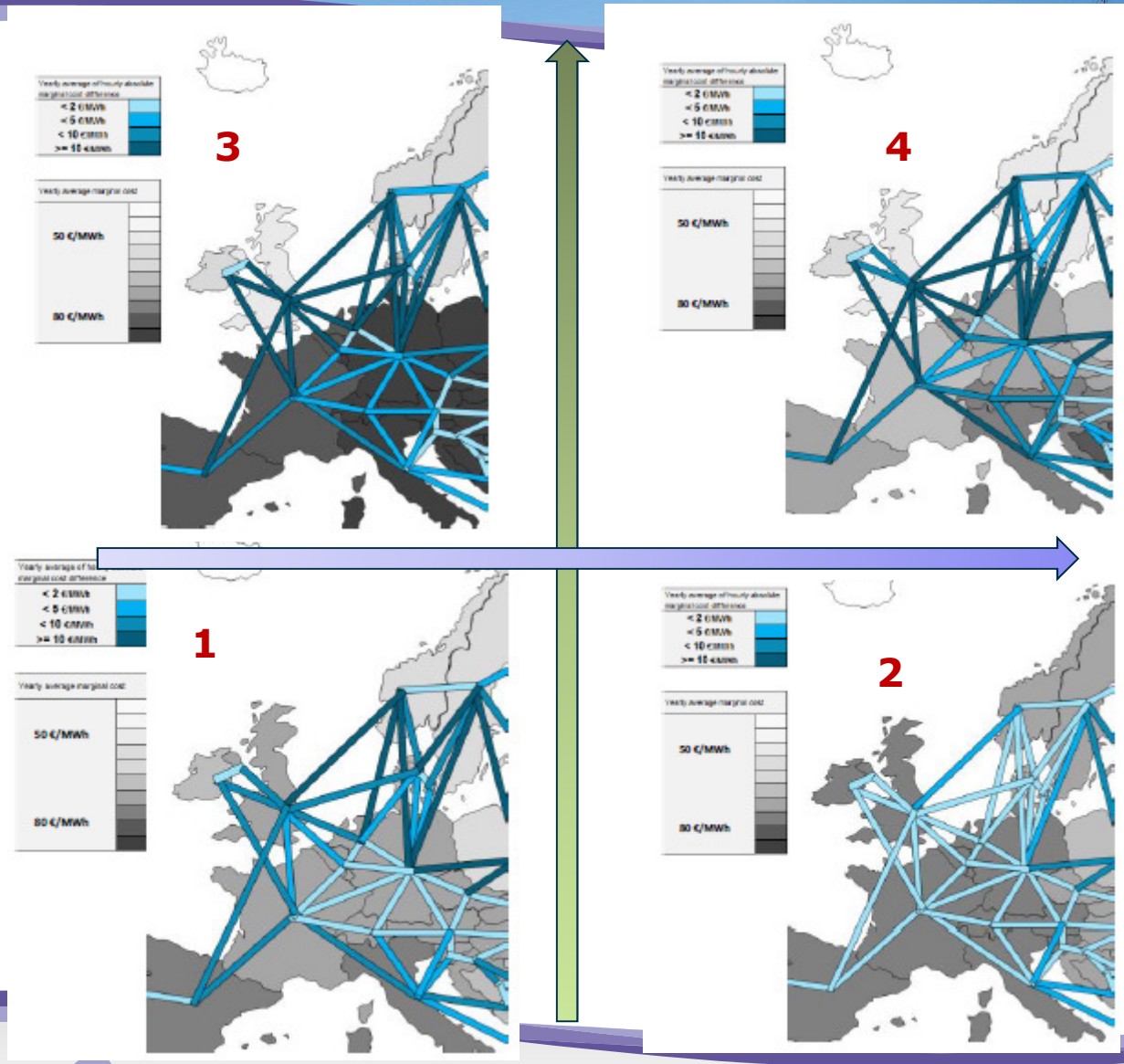


RGNS Vision 4: Demand, generation and installed capacity

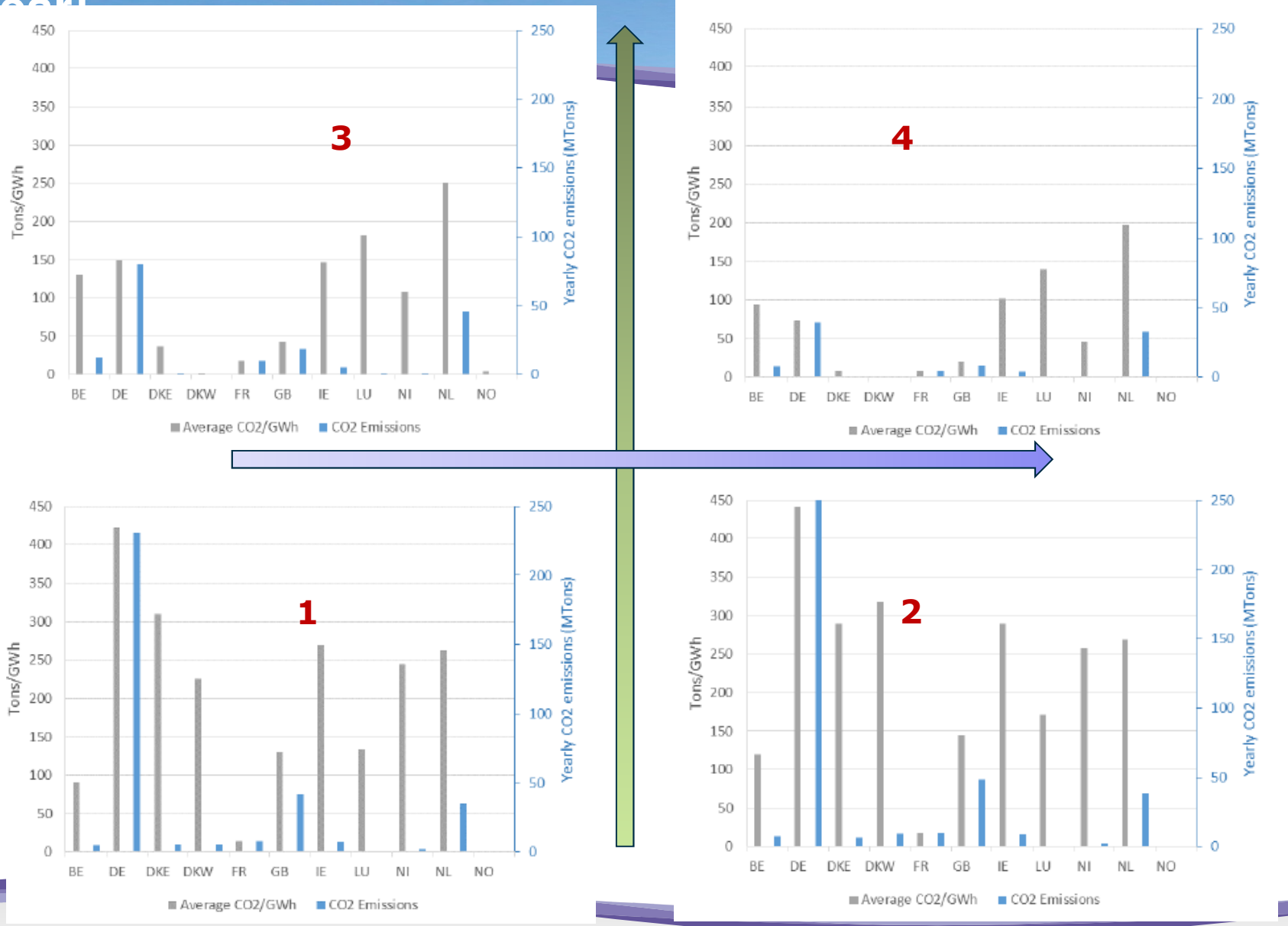




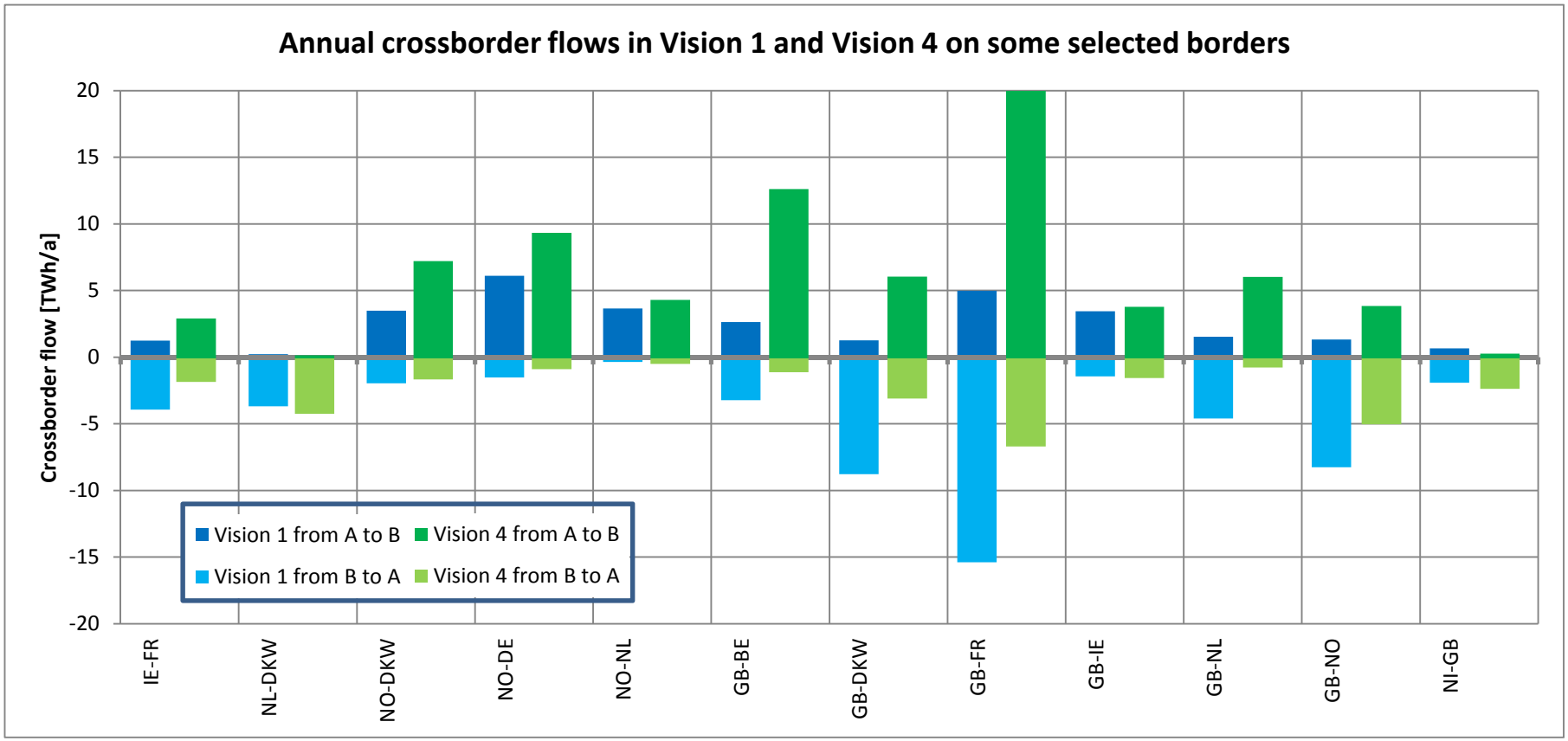
RGNS: Annual MC per country & average price difference between countries



RGNS:Visions 1- 4 CO2 emissions Power-generation [MT/ year]



RGNS: Annual Cross border flows Vision 1 and Vision 4



RGNS: Overview of the projects

Total Project costs per country

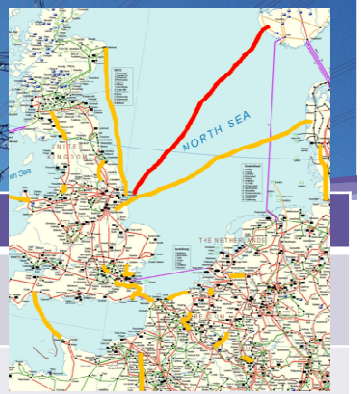
Country	Total cost (bn Euros)
BE	2.0 - 4.0
DE	34.8 - 54.2
DK	3.7
FR	8.4
GB	15.9-16.2
IE	2.0
LU	0.2
NL	3.3
NO	7.9

Detailed Information on single Projects

Project 110, Norway-Great Britain

A 650 km long subsea interconnector between Norway and Scotland is planned to be realized in 2021. The main driver for the project is to integrate the hydro-based Norwegian system with the thermal/nuclear/wind-based British system. The interconnector will improve security of supply both in Norway in dry years and in Great Britain in periods with negative power balance (low wind, low solar, high demand etc.). Additional the interconnector will be positive both for the European market integration, for facilitating renewable energy and also for preparing for a power system with lower CO2-emission. The interconnector is planned to be a 500 kV 1400 MW HVDC subsea interconnector between western Norway and eastern Scotland.

The results for NorthConnect (Norway-Scotland) is the same as for project 110 NSN (Norway-England), this because Great Britain in the analysis is modelled as one node. In practice there would have been price-differences between England and Scotland, making the values different for the two projects. Additional NorthConnect is planned realized after NSN, which will make this project NorthConnect less valuable. Both the NSN and the NorthConnect are showing very high values regarding RES-integration. The reason for this is that the projects leads to both decreased spillage in Great Britain (when windy) and in the Nordic countries (when wet).
The load factor of the cable is similar in all Visions, leading to the same and very high additional losses.



Norway – Great Britain				
Short description	Interconnector Norway-England			
Investments	HVDC cable			
GTC Increase	1.400 MW			
Investment cost	2.175 M€			
Vision	Vision 1	Vision 2	Vision 3	Vision 4
B1: Security-Of-Supply	0	0	0	0
B2: SEW	+185M€ (+/-32 M€)	+130M€ (+/-40 M€)	+320M€ (+/-38 M€)	+291 M€ (+/- 10 M€)
B3: RES Integration	+1.136 GWh	+1.005 GWh	+3.002 GWh	+2.380 GWh
B4: Power Losses	+ 846 GWh	+ 846 GWh	+ 846 GWh	+ 846 GWh
B5: CO2 emissions variation	-399 kT	-215 kT	-1.843 kT	-1.643 kT
B6: Transmission Resilience	4			
B7: Robustness and Flexibility	4			

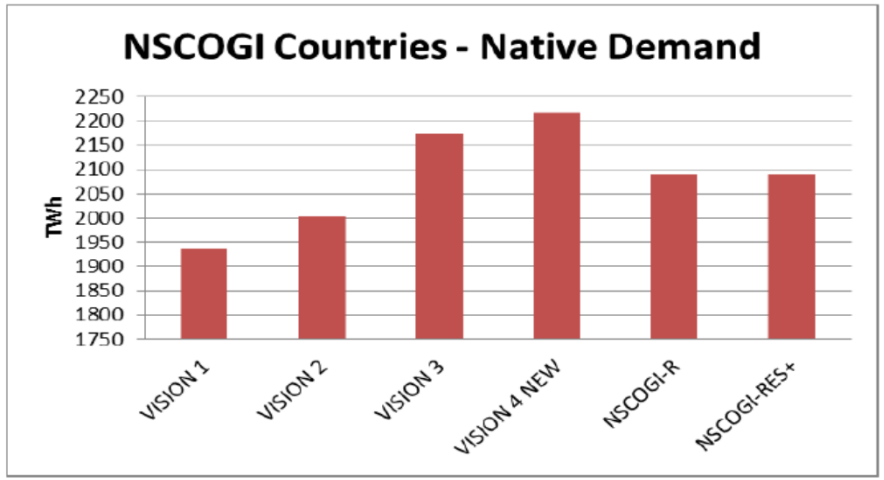
Detailed Information on single Projects

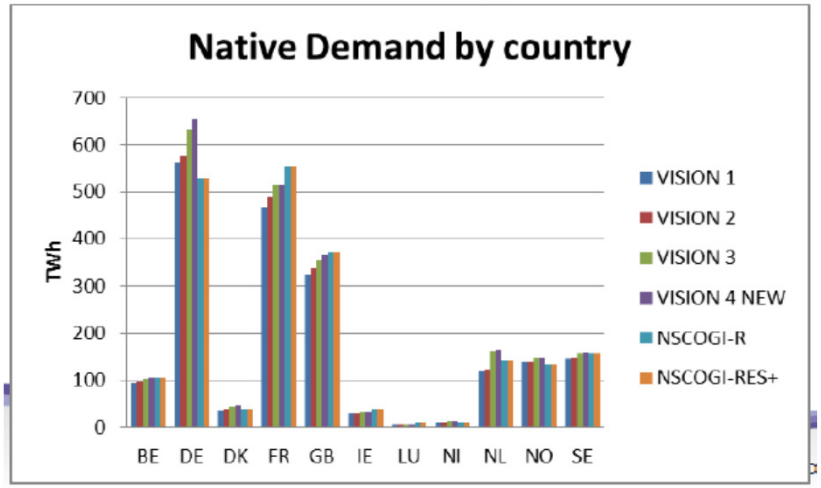
107: Ireland – France interconnector

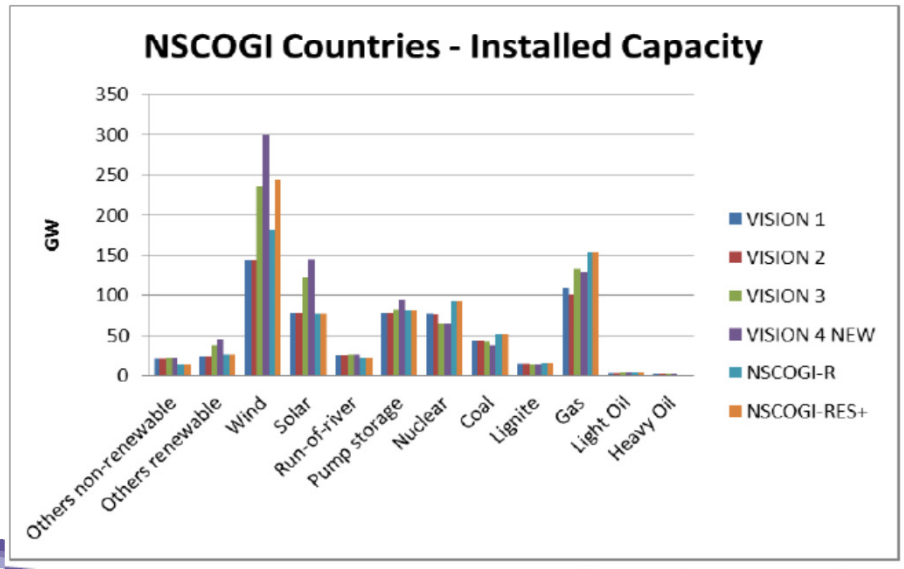
Celtic Interconnector will be the first interconnection between Ireland and France. This HVDC (VSC)link with 700 MW capacity will connect Great Island or Knockraha (Ireland) to the Finistère in France. It will not only create a direct link between the French and Irish markets, but also increase RES integration, especially wind in Ireland

Celtic Interconnector				
Short description	New Ireland-France interconnection			
Investments	HVDC cable			
GTC Increase	700 MW			
Investment cost	1.050 M€			
Vision	Vision 1	Vision 2	Vision 3	Vision 4
B1: Security-Of-Supply	0	0	0	0
B2: SEW	+50M€ (+/-20 M€)	+25M€ (+/-5 M€)	+155M€ (+/-15 M€)	+170 M€ (+/- 25 M€)
B3: RES Integration	+295 GWh	+185 GWh	+1.285 GWh	+1.620 GWh
B4: Power Losses	+ 250 GWh	+ 250 GWh	+ 220 GWh	+ 220 GWh
B5: CO2 emissions variation	70 kT	-30 kT	-880 kT	-840kT
B6: Transmission Resilience	1			
B7: Robustness and Flexibility	4			

Comparison NSCOGI scenarios vs ENTSO-E visions (1)







Demand	V1/2	NSCOGI	V3/4
Thermal	V1/2	V3/4	NSCOGI
RES	V1/2	NSCOGI	V3/4

Comparison NSCOGI scenarios vs ENTSO-E visions (2)

- NSCOGI RES+ scenario lies within the envelope of the 4 ENTSO-E Visions, thus it is one version of the possible futures.

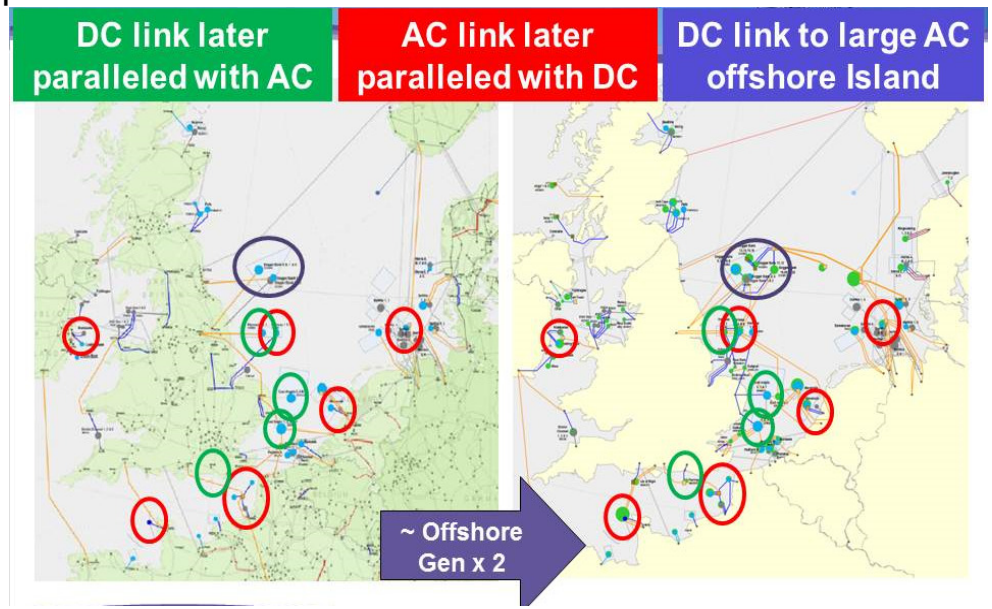
- The only exception is in the area of thermal units, the national governments' expectations of the future use of thermal generation were above the ENTSO-E Visions.

- ENTSO-E Visions' thereby take, based on stakeholders' comments the low amount of running hours for thermal units, into account which will result in smaller amount of thermal units in the European energy system.

Towards an Offshore Grid – further analyzing the NSCOGI results

Today: classical DC interconnections, classical AC interconnections and offshore wind power plants connected by AC or DC, first “new” DC interconnectors.

Three main developments become visible:



- All solutions which are used today are a way of integrating the four synchronous areas towards a meshed solution … be it AC or DC regarding either integrating offshore wind or interconnections.

- Thus a meshed solution can be AC or DC or a combination. Inside single projects combining one offshore wind power plant to one interconnector or seen from a system wide perspective like visualized in the picture above.

Main conclusions RGNS

- Resulting net bulk powerflows in the RGNS are form North to South and West to East.
- Offshore infrastructure mainly radial or locally coordinated to connect windparks and point to point interconnectors to connect market areas.
- Meshed grids consists of radial, local coordinated solution combined with interconnectors.
- Large scale meshed infrastructures based on broader regional coordination not yet seen as prerequisite for the economic accomodation of currently foreseen off-shore wind generation levels.
- Every proposed new interconnector will become part of the offshore grid anyway.