



MAINSTREAM
RENEWABLE
POWER

Offshore Wind and the European Supergrid – from vision to reality

EUFORES, Parliamentary Kick-off 2010

16th September 2010

Tilman Schwencke, Head of Offshore Germany

Mainstream's On- & Offshore Wind Development Pipeline

Canada (Onshore)
▪ Pipeline: 1067MW

Scotland (Offshore)
▪ "Neart na Gaoithe": 420MW

UK (Offshore)
▪ UK R3 zone "Hornsea":
ca. 4000MW (JV with
Siemens (SMart Wind))

Germany (Offshore)
▪ "Horizont I, II, III": 1000MW

United States (Onshore)
▪ Pipeline: 937MW

Chile (Onshore)
▪ Pipeline : 400MW

South Africa (Onshore)
▪ Pipeline : 500MW

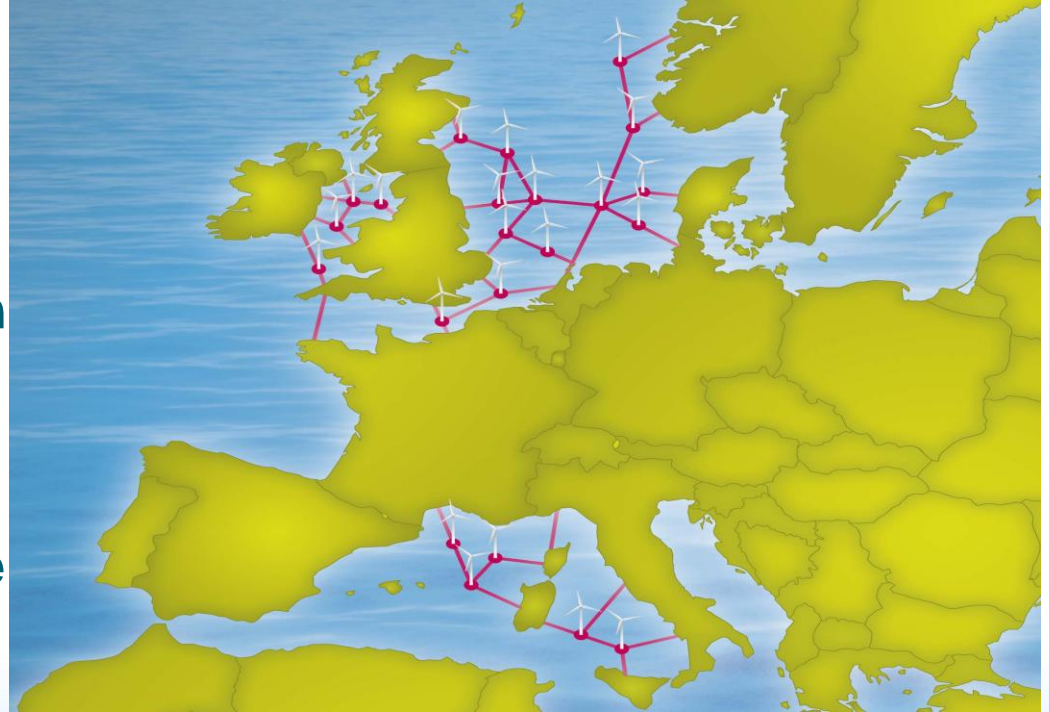
Overview

- From vision...
 - Ideas and high-level studies
 - EU commitment, energy policy and targets
- ...to reality
 - Initiatives and detailed studies
 - Offshore grid planning in UK and Germany
 - Offshore Grid-Masterplan

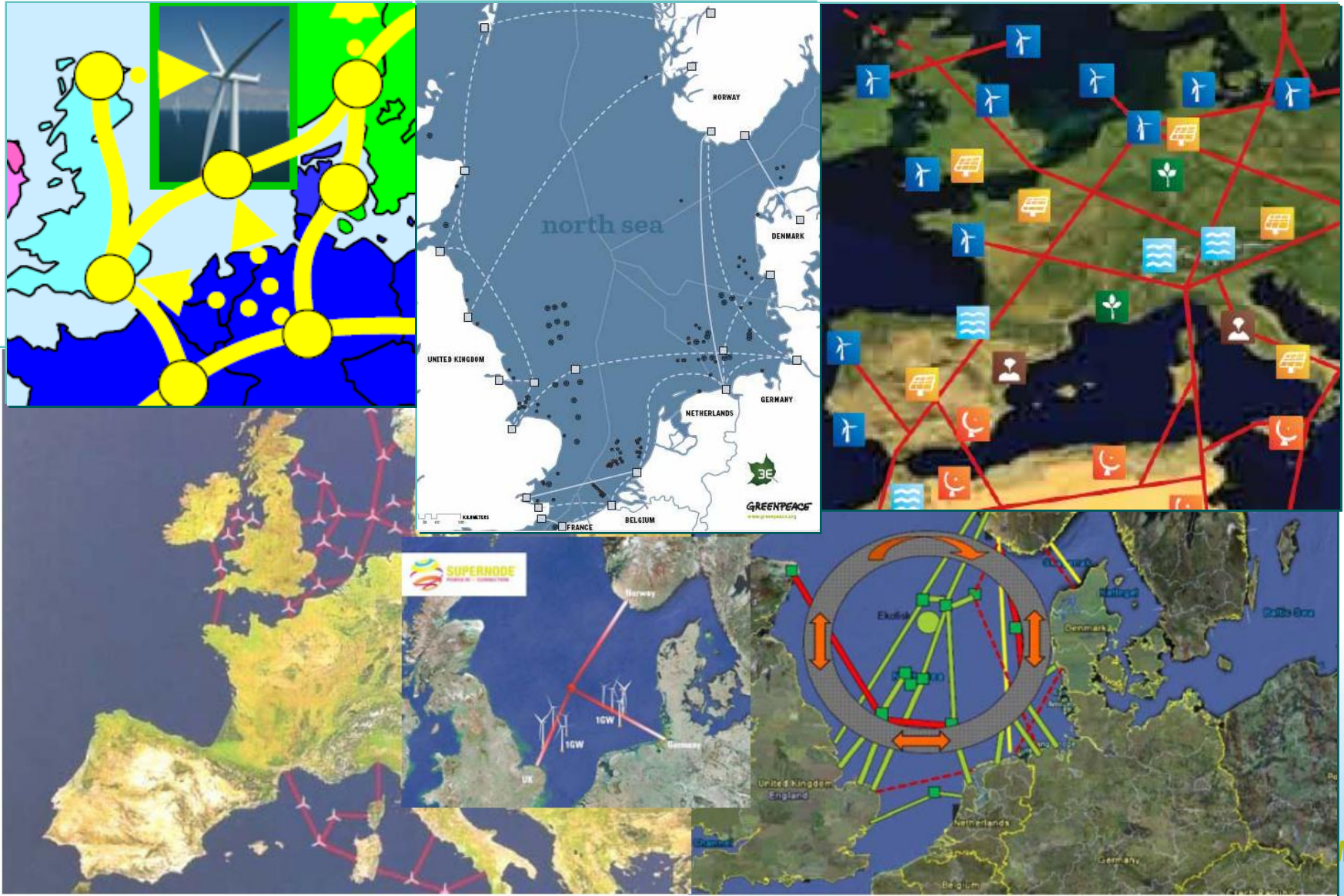
Let's start with a definition...

Supergrid is defined as:

“an electricity transmission system, mainly based on direct current, designed to facilitate large-scale sustainable power generation in remote areas for transmission to centres of consumption, one of whose fundamental attributes will be the enhancement of the market in electricity.”



Supergrid ideas and studies ...



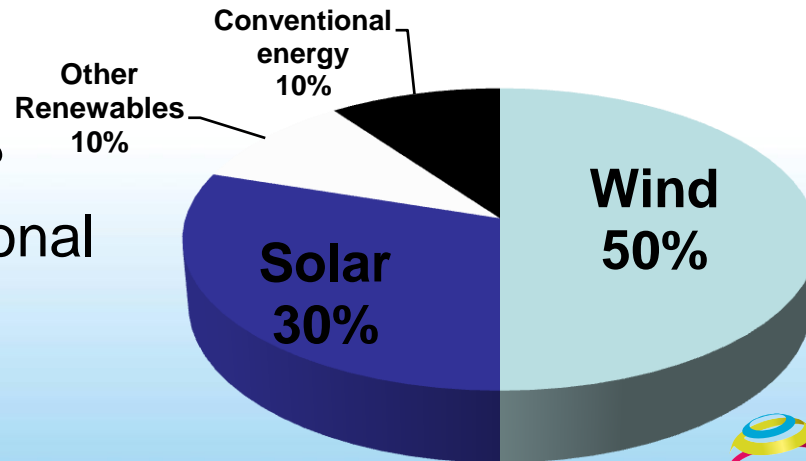
Drivers

- Single Market for electricity and gas (competition)
- Energy Security
- Sustainability

- Binding Renewable Energy Targets for Europe

- Project with priority (EU Commission/EP/Council): Energy package/"Strategic Energy review"; TEN-e; Energy Infrastructure package (incl. "Blue Print for a North Sea offshore grid" etc))

- Generation Mix in 2050?
(Transition from conventional to renewables)



Initiatives

- North Seas Countries Offshore Grid Initiative (9 EU MS plus Norwegen)
- Adamowitsch Working Group (EU-co-ordinator)
- Super Smart Grid (PiK)
- ENTSO-E (42 TSOs from 34 countries)
- ERGEG/CEER (Regulator)
- Friends of the Supergrid (Industry / Supply chain)

Friends of the Supergrid



The Friends of the Supergrid:

“is a group of companies and organisations with a mutual interest in promoting the policy agenda for a European Supergrid.”



Visser & Smit Marine Contracting



What's Up?

- New smart grid infrastructure capable to transport large scale renewables is needed
- Move Offshore (over 45GW by 2020 in the EU)
- On-Shore Grids
 - Existing will be shortly congested
 - Local opposition
- Offshore Wind Capacity Average = 40%
 - Good but
 - Unused Expensive Assets
 - Increase Utilisation Factor
 - New trading opportunities

The key messages of the OffshoreGrid study

1.) Clustering at hubs vs. radial connections

- For wind farms over 50 km from their connection point to shore, a joint connection with other wind farms via a hub is usually more economically beneficial (Cluster with 500-1000MW by 2020, from 2020 with 2000MW)
- In countries where hubs can be easily defined, this can lead to reduced grid connection costs for offshore wind power of up to 34%. Hub solutions may also be beneficial for the mitigation of the environmental and social impact of laying multiple cables through sensitive coastal areas (savings for Europe: ca. 14bn€, in Germany: ca. 10 bn€) .

2.) Connecting wind farms to interconnectors

- Interconnectors that are required for international exchange or improving security of supply should not be delayed and they should be rated as optimal for these purposes.
- If the investment decisions for wind farms along the interconnector cable route are firm, a fully integrated solution with optimal hub and cable sizing should be pursued from the beginning.

3.) Integrating interconnectors into hubs

- When hub connections for offshore wind farms are developed, the plans should be reviewed by the TSO in order to identify possible connection options to other wind farms hubs or countries for which there is demand for international exchange. Equally, when developing interconnectors, TSOs should review the identified concession areas for offshore wind and consider the option to develop a hub in such an area as a starting point for the interconnector.

4.) General

- Offshore grid development should be a joint or, at least, coordinated activity of the developers of the wind farm hubs connections and TSOs. The North and Baltic Seas' countries should adapt their regulatory frameworks to foster such a coordinated approach.



2030 North & Baltic Sea

Total Connected Capacity = 126GW

Radial Connections

- Total connection cost = €83.2bn
- 660k€/MW

Hubs where adequate

- Total connection cost = €69.1bn
- 550k€/MW

Wind Farms Germany

Total Connected Capacity = 26.6 GW

Radial Connections

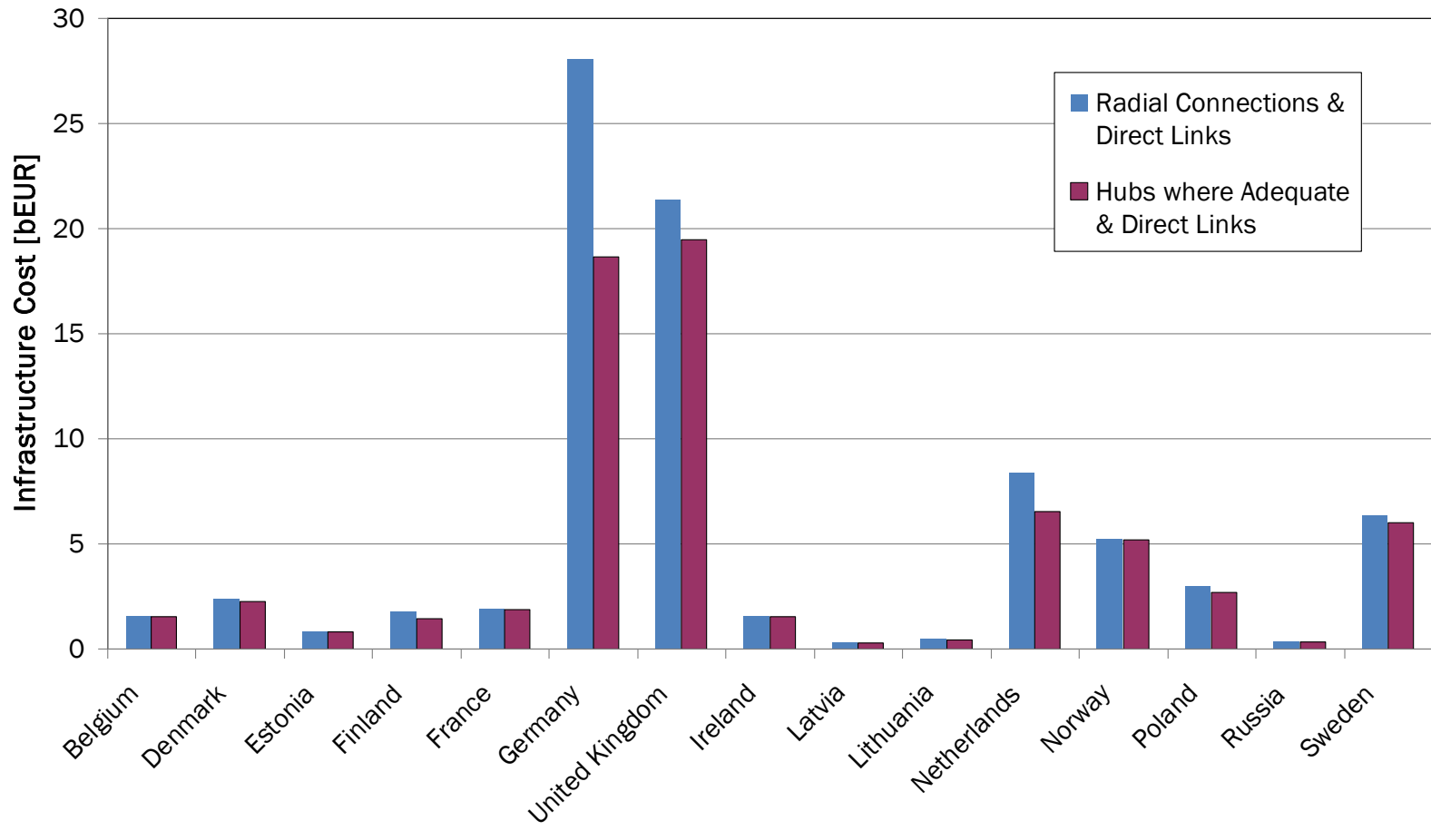
- Total connection cost = €28.1bn
- 1060k€ per MW offshore wind

Hubs where adequate

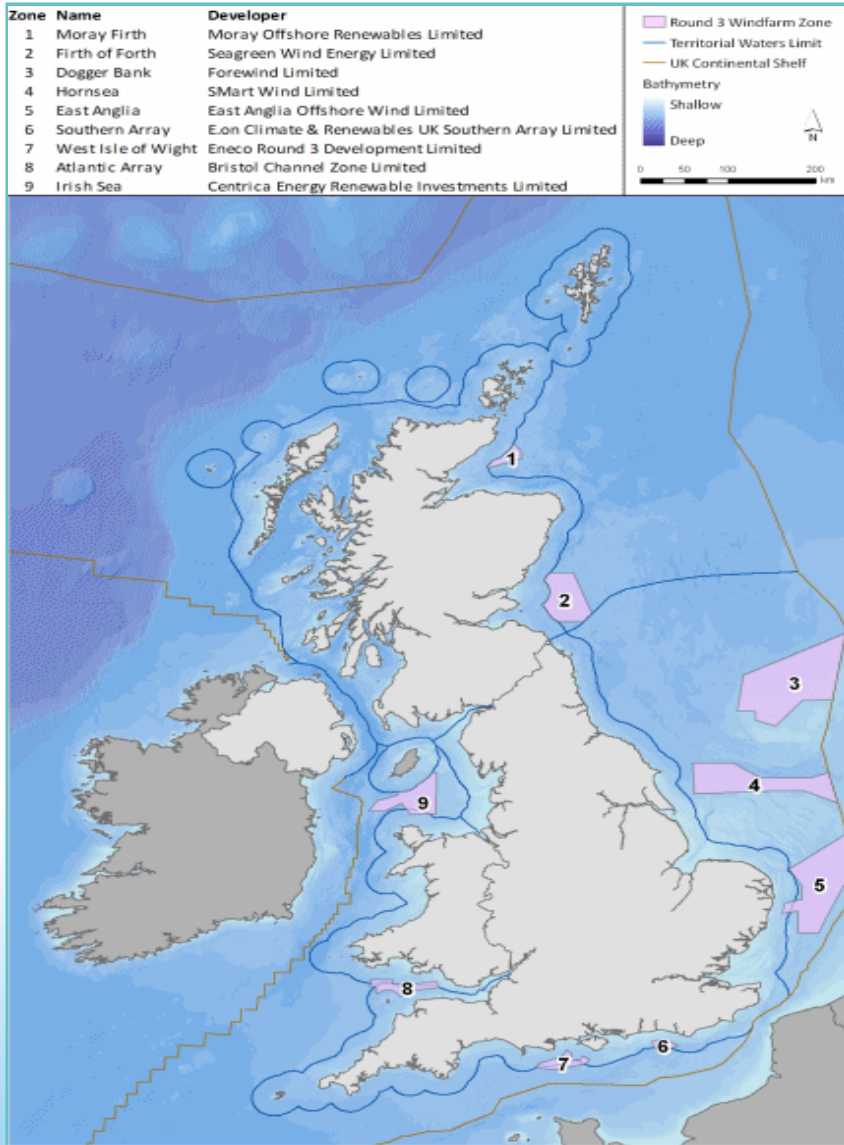
- Total connection cost = €18.7bn
- 700k€ per MW offshore wind



Connection costs: Radial vs. Hubs



UK R3, at least 30GW by 2020

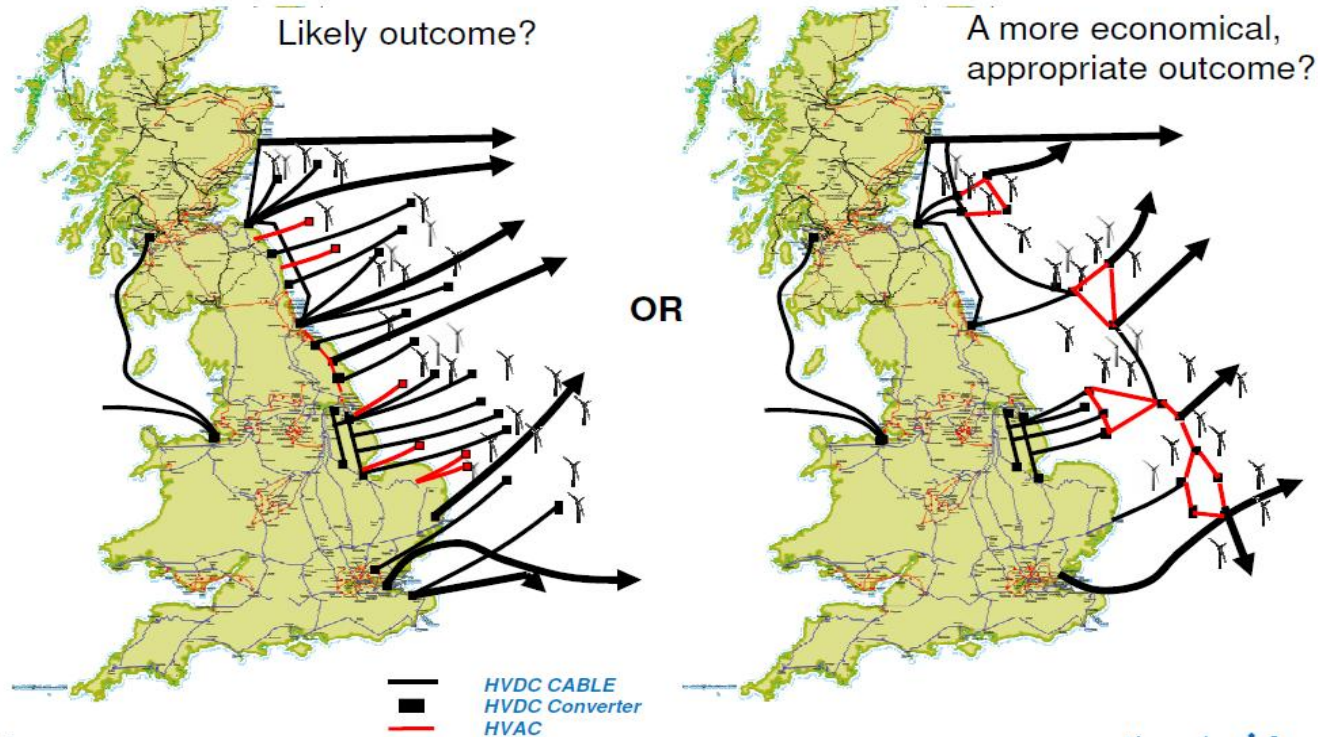


UK- Offshore Grid infrastructure

- UK government will present an „Energy Plan“ incl. Offshore/Grid
- R3 Zonen are already „Clusters“ (in R2: depends on size and distance to shore)
- Consultation (DECC / OFGEM) on Offshore Grid infrastructure
- Developer will use the largest available capacity of VSC HVDC

UK National Grid's thoughts

What will the regime deliver?



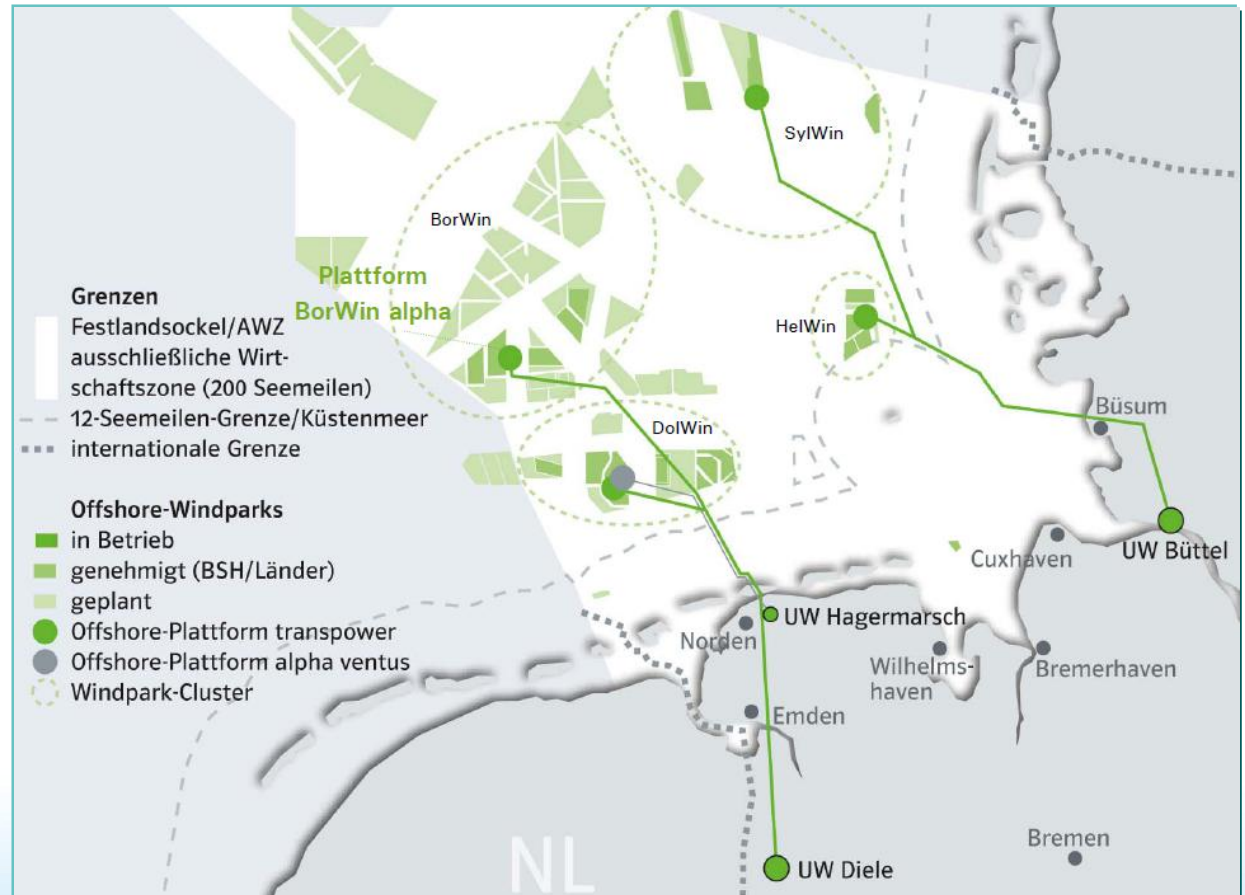
7

Source: National Grid

nationalgrid
The power of action.

Germany's offshore grid plans

- So far individual planning
- Now: Cluster approach
- Future: Link to UK?
- Offshore Grid Masterplan is needed (under preparation?)



Is the technology available?

YES!

- DC Cables
 - Higher Voltage, Cluster with 500-1000MW by 2020, from 2020 with 2000MW
- Converter Development
 - Lower Costs, Lower Losses and Higher Current
- DC Switchgear
- Control & Protection
 - Multi-terminal HVDC Links
- Onshore Connections
 - Super-Conducting Pipes

Technology is available when it's needed...

How much will the „first link“ cost?

Gearing 70/30

Total Capex €34bn

Nameplate Wind Capacity 21GW

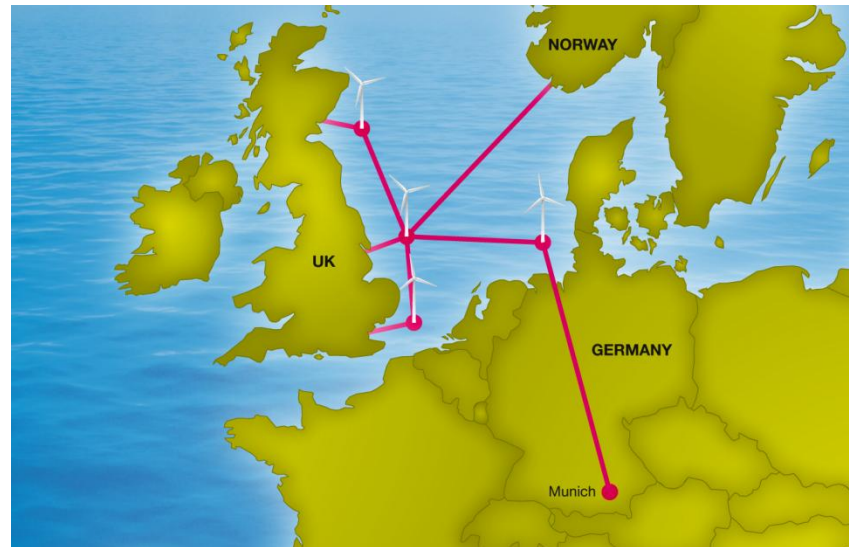
Wind Capacity Factor 40%

Return on Equity 10%

TUoS charge €35 /MWh

(Transmission Use of System)

With a 90% cap factor
(trade): €15/MWh

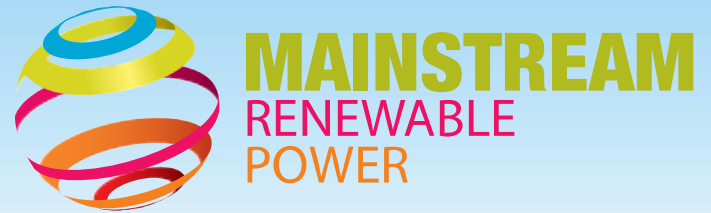


Offshore Grid Masterplan

- **Building cluster at national level**
- **European approach (*ONE Grid – ONE Code - ONE Regulator - ONE Plan*)**
 - EU Masterplan 2050 (Supergrid Phase 1: 2020/2030)
 - EU Regulator (coordinated and compatible regulatory framework)
 - Offshore Transmission System Operator (Management)
 - Single Grid Code
- **Masterplan – European Offshore Grid „Phase 1“**
 - Masterplan of the North Seas Countries Offshore Grid Initiative
 - UK and Germany as „driving force“ –
Establishing an „OffshoreGrid“ Organisation together with
 - UK und Germany (possibly on the base of the RES Dir („flexibility mechanisms“: joint projects/support schemes)
 - EU Commission
 - Supply Chain / Industry(similar to the German Offshore „test field“ Alpha Ventus (DOTI))
 - Identifying and setting of conditions for the first offshore link
 - Tender for the first offshore link

Conclusion

- Political support from EU and national level is there
- Initiatives and studies are paving the way towards the realisation of a Supergrid
- Cost-benefit calculations are in favour of a Supergrid
- Technology is available, supply chain is ready to go!
- Regulation needs to be adjusted, „flexible mechanisms“ could be an option
- Organisational framework needs to be established
- Let's define the masterplan and build the first link by 2020!



**Thank you very much for
your attention!**

Questions?

tilman.schwencke@mainstreamrp.com