High capacity offshore networks for collective wind farm connections

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K. Burges / Ch. Nabe, Ecfoys Germany GmbH, Berlin
H. Brakelmann, University Duisburg-Essen, Department ETS
M. Jensen, GEO Gesellschaft für Energie und Oekologie mbH, Enge-Sande

Agenda

- The technical challenge of offshore connections
- Possible technical solutions
- Regulatory challenges of collective offshore connections
- Summary and conclusions

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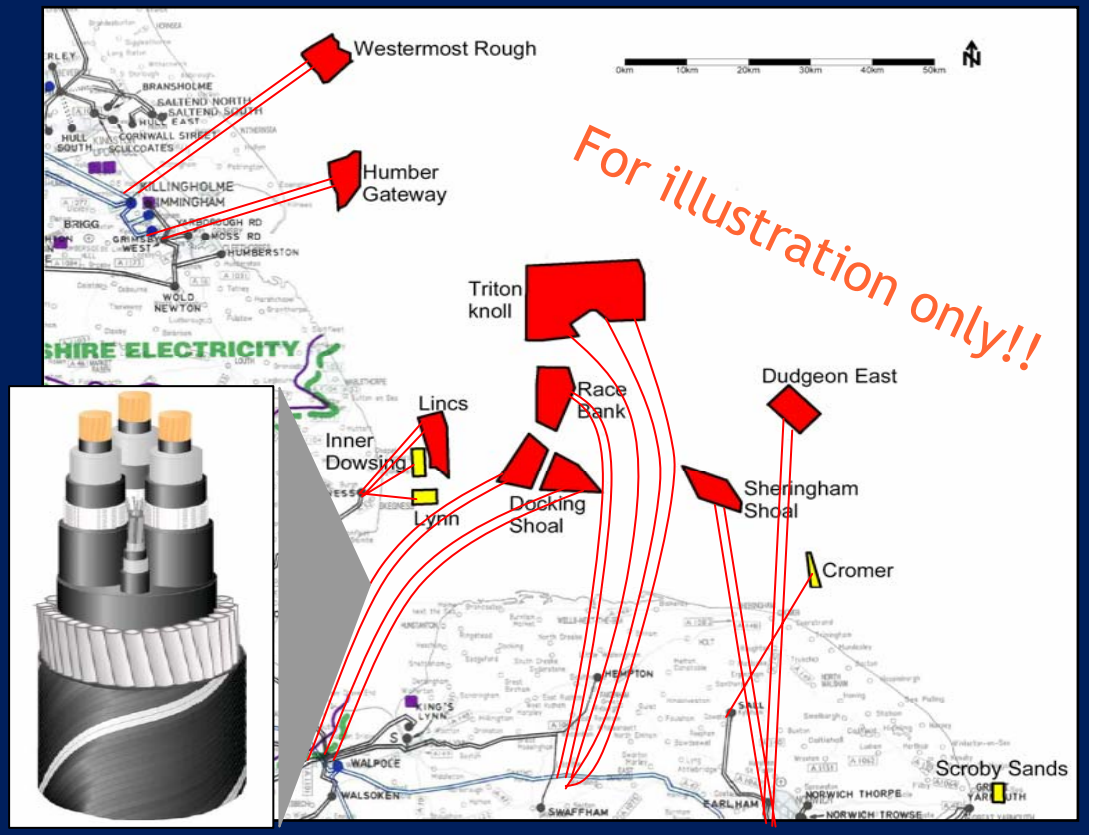
Several 100 MW offshore wind generation has to be connected to the onshore network.

Conventional approach: individual connections

- 132…245 kV AC, 3 core cables

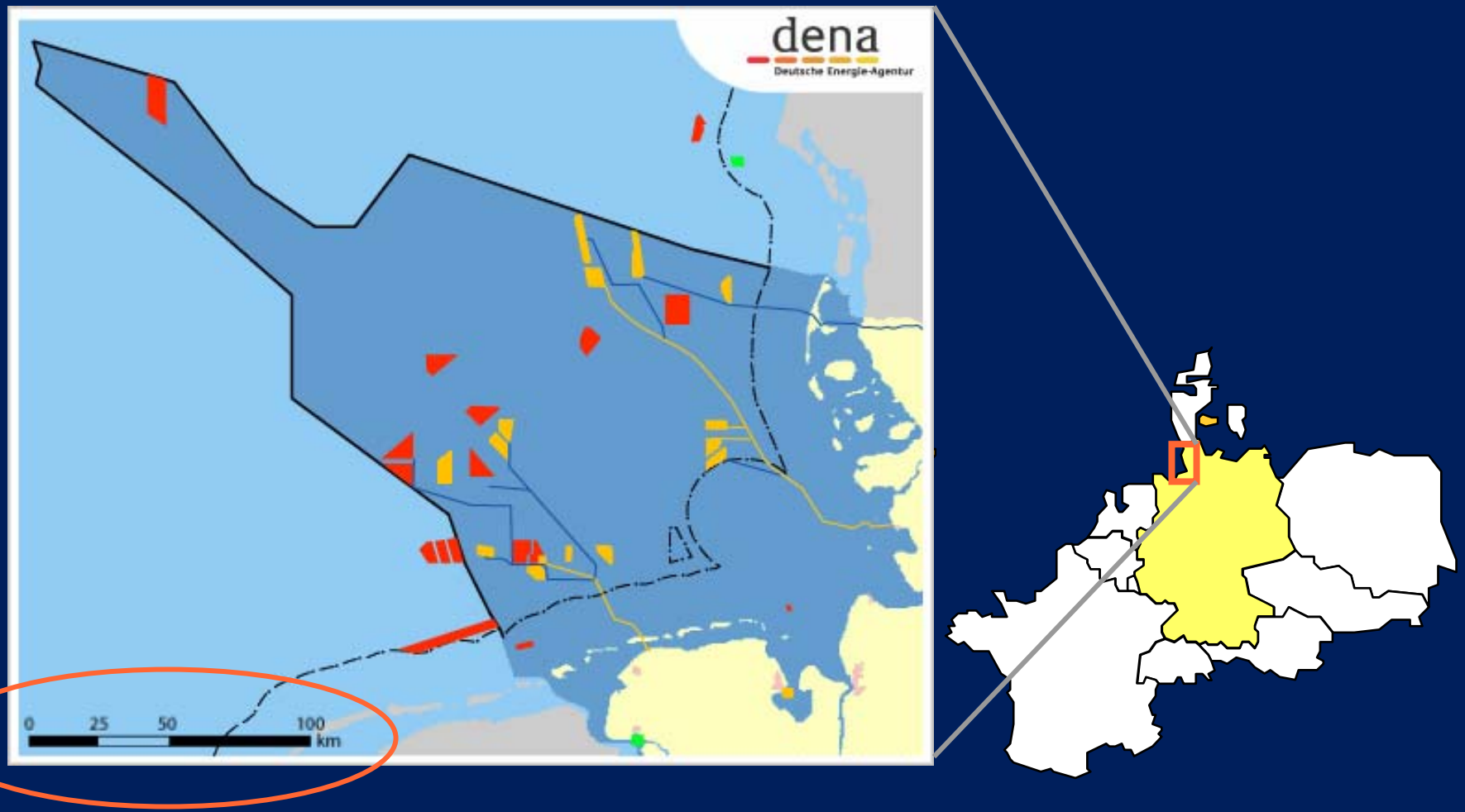
→ Numerous offshore transmission connections

→ Costly, numerous permits, fragmented planning



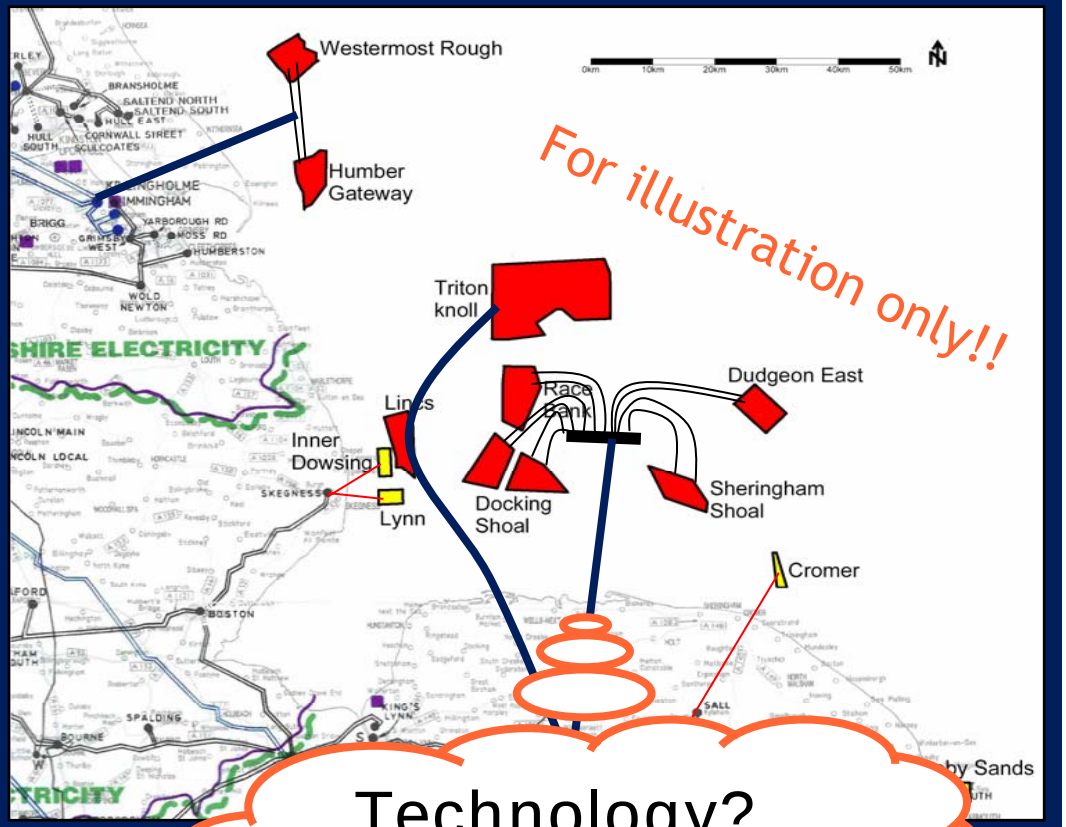
Source: ABB

Higher distances of German offshore farms increases the challenge.



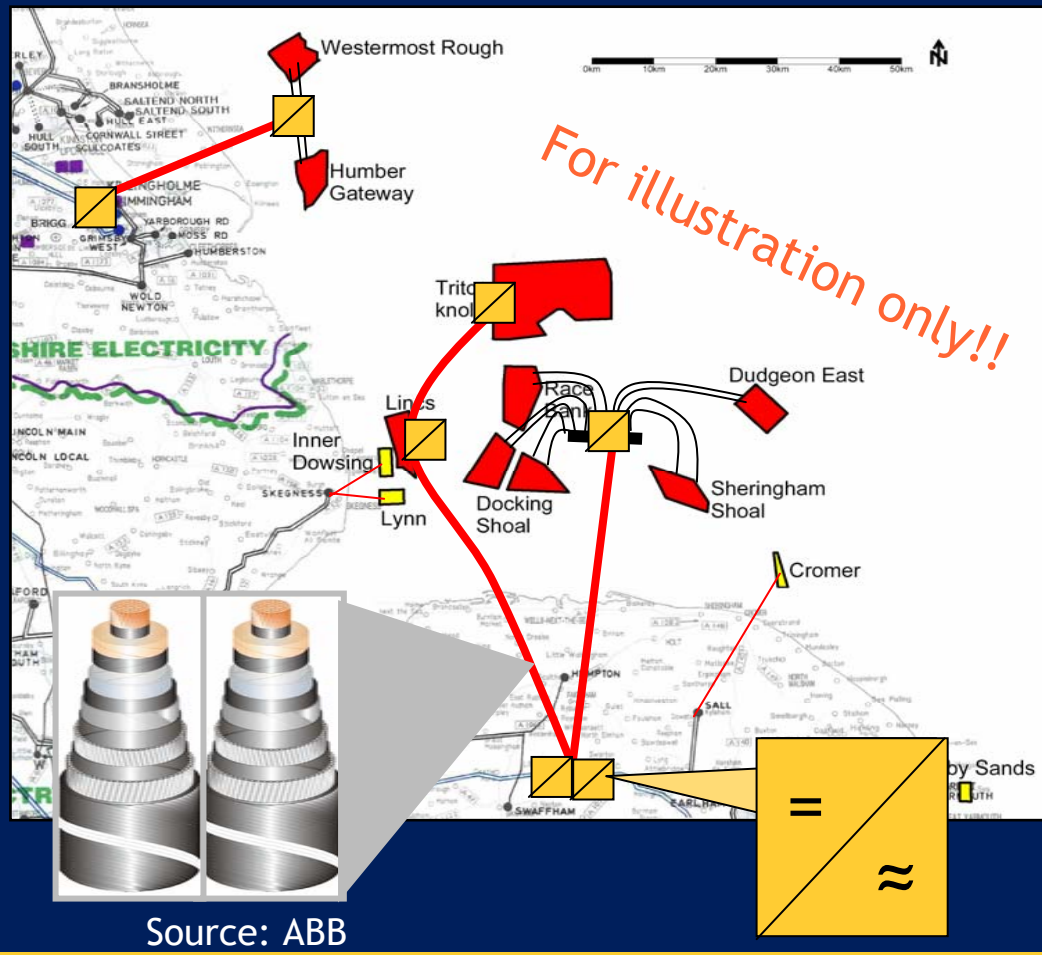
Collective offshore connections are a second option.

- Collection of connections on one platform
- Transmitting electricity onshore using few high-capacity cables



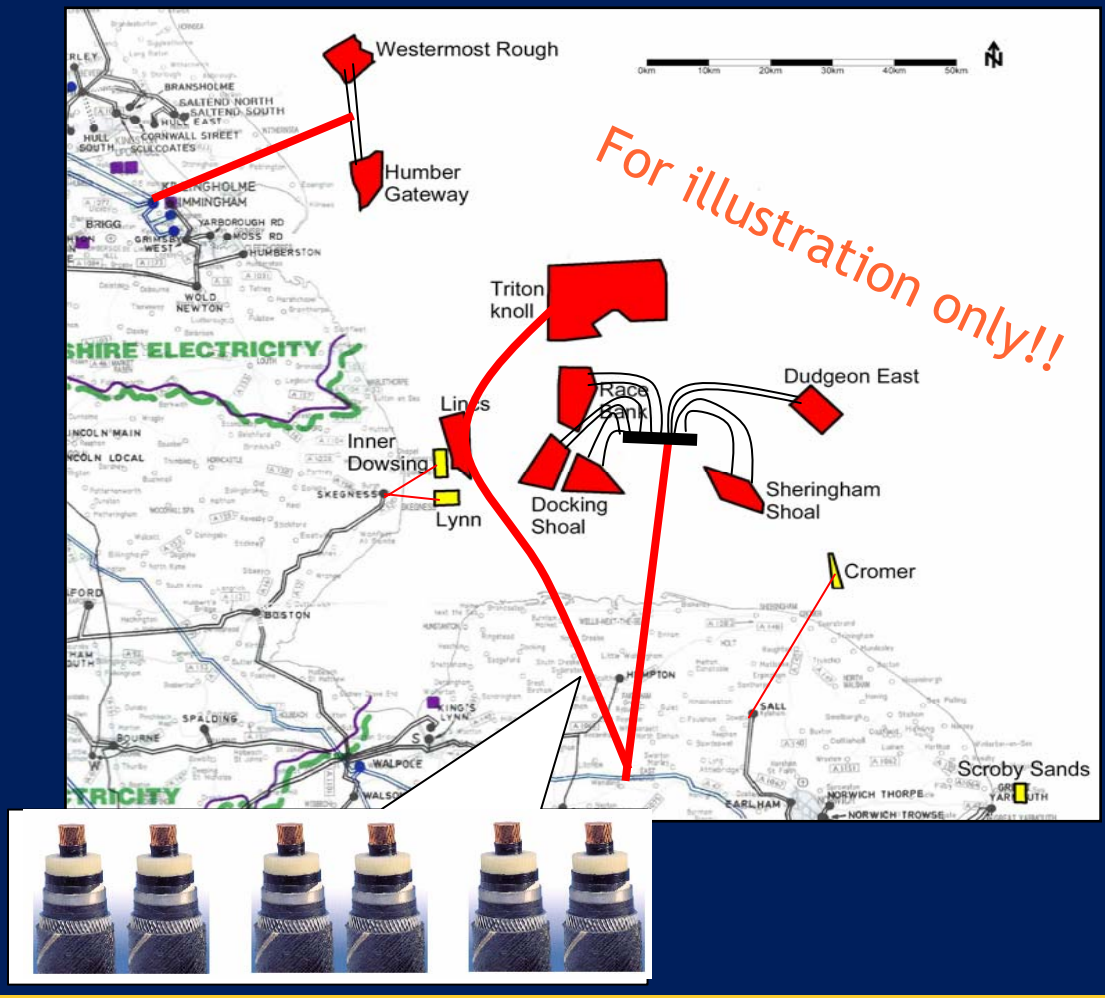
HVDC connections are foreseen by E.ON for the German North Sea.

- DC concepts
  - Bipolar up to 1000 MW (@450 kV / 2100 mm²)
  - Substantial technology step (risk) and costs (offshore converter stations)
  - Flexibility with respect to further extensions?



A new bipolar concept concept is currently developed.

- Bipolar AC transmission
  - Six single core cables
  - Up to 245 kV / 2000 mm² / 1300 MVA
  - (semi-) conventional technology



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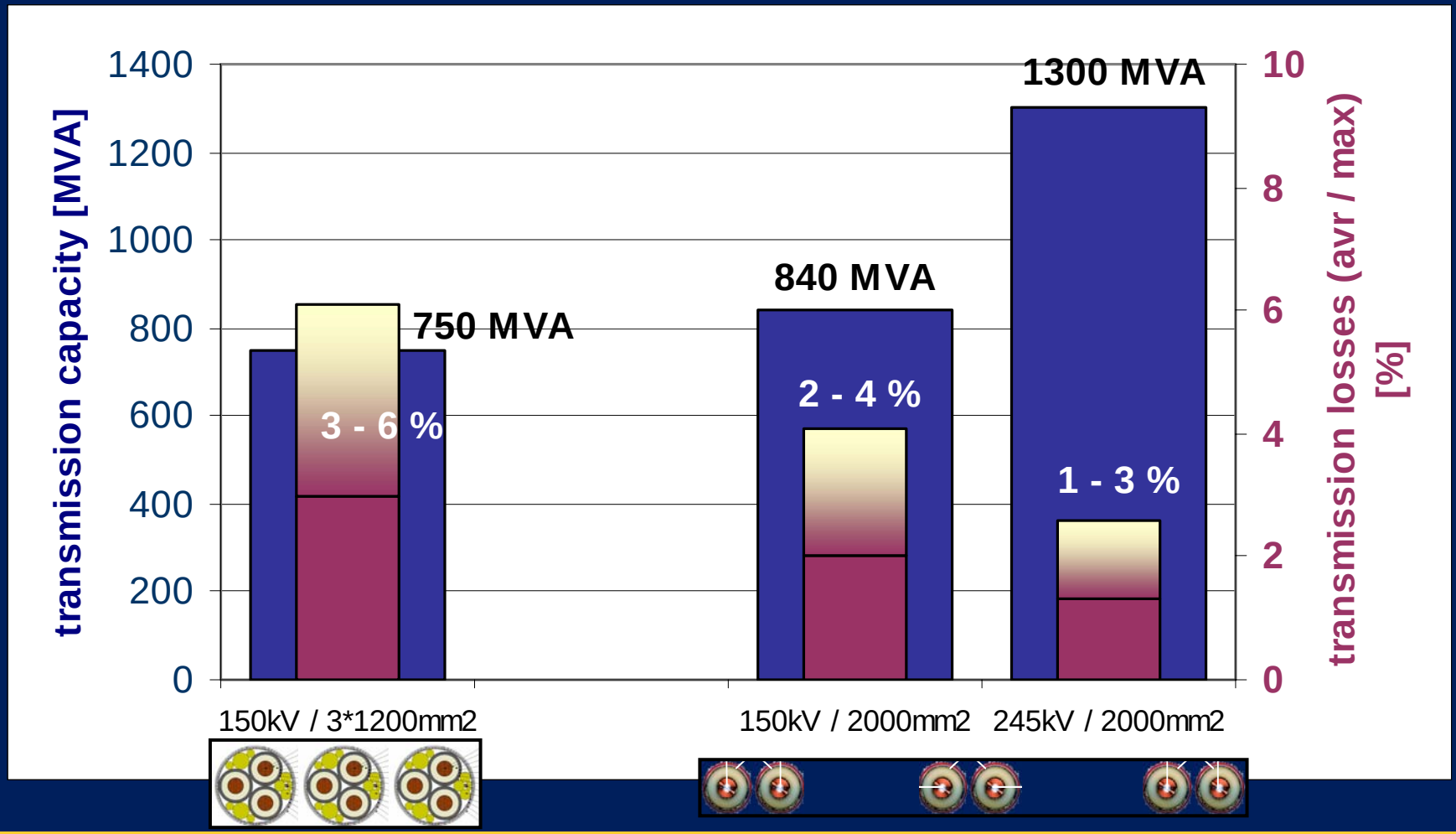
The AC bipolar concept promises higher capacities and a reduction of losses.



Comparing technological and environmental aspects…

	Individual connections	Collective connections
Technology	Proven technology	Different options, some innovation required
Onshore connection	Several connection points possible	Strong connection points required
Permission procedure	More difficult, many cables, individual procedure	Easier, only few cables
Required space in critical shorezone	Cables to be laid with water distance (20-50m)	Just one cable trench

Comparing economic and regulatory aspects…

	Individual connections	Collective connections
Investment lumpiness	Incremental investments in connection	Collective, mostly lump-sum Investment
Operational cost	Individual cables have higher losses	Substantial reduction of losses possible
Dealing with project insecurity	Lower risks	Risk of over- or underinvestment
Regulation	Can be responsibility of project developers	Difficult to arrange collective agreements by individuals --> Regulated Network Owner

Regulating Offshore transmission faces a number of challenges.

Challenges of Offshore Transmission Regulation

- Offshore projects face numerous project risks that influence construction timing
- Offshore wind developers have the incentive to overstate the development status of their projects
- Overdimensioning of collective transmission lines leads to unnecessary project cost and risks
- Underdimensioning: Non-existing network connections are a showstopper for offshore-development
- Regulation may influence choice of technology. Should the regulator prescribe the risk aversion of the Offshore-TSO/Offshore Transmission Owner?

Solutions are currently emerging along the offshore project developments

- **Solutions Germany**
  - E.g. E.ON Netz established procedural rules and requires developers to present proof for orders of equipment
  - Bremen Wind Energy Institut is conducting a capacity assessment of resources required for offshore wind construction
- **Development United Kingdom**
  - Regulation of Offshore transmission regulation is currently within a consultation process and expected to be effective not until October 2009
  - Offshore Transmission Owners (OFTO) would be selected by competitive tender and awarded a transmission licence
  - In the meantime developers are designing and constructing individual connections

The countries with substantial offshore developments have diverse regulatory approaches.

Responsible parties for offshore transmission

Belgium	Germany	Netherlands	United Kingdom
Project developers, indiv. connections	Transmission System Operator, collective connections	Project developers, mostly individual connections	Planned: Licensed Offshore Transmission companies, currently indiv. connections

Summary and conclusions

- Collective offshore connections have many advantages compared to the conventional solution of individual connections
- On the other hand, regulatory challenges increase
- High expectations related to the contribution of offshore wind-energy to CO_2-savings leads to time pressure
- Currently, offshore-windfarms and regulatory solutions evolve in parallel processes
- Further research is required both on technological designs and regulatory best-practise approaches for offshore transmission.

Thank you for your attention!

Dr. Christian Nabe
Ecofys Germany GmbH
Stralauer Platz 34
D – 10243 Berlin
Tel. +49 (0)30 2977 3579 12
c.nabe@ecofys.de
www.ecofys.de