

# POTENTIAL FOR COST OPTIMIZATION THROUGH JOINT EUROPEAN OFFSHORE GRID STANDARDS

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OFFSHORE GRID DEVELOPMENT

DFBEW / OFATE CONFERENCE  
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# EUROPEAN CLIMATE GOALS FOR 2050 REQUIRE SUSTAINABLE CONCEPTS TODAY.



## CO<sub>2</sub>-neutral

climate neutrality in the EU by 2050

## ~ 300 GW

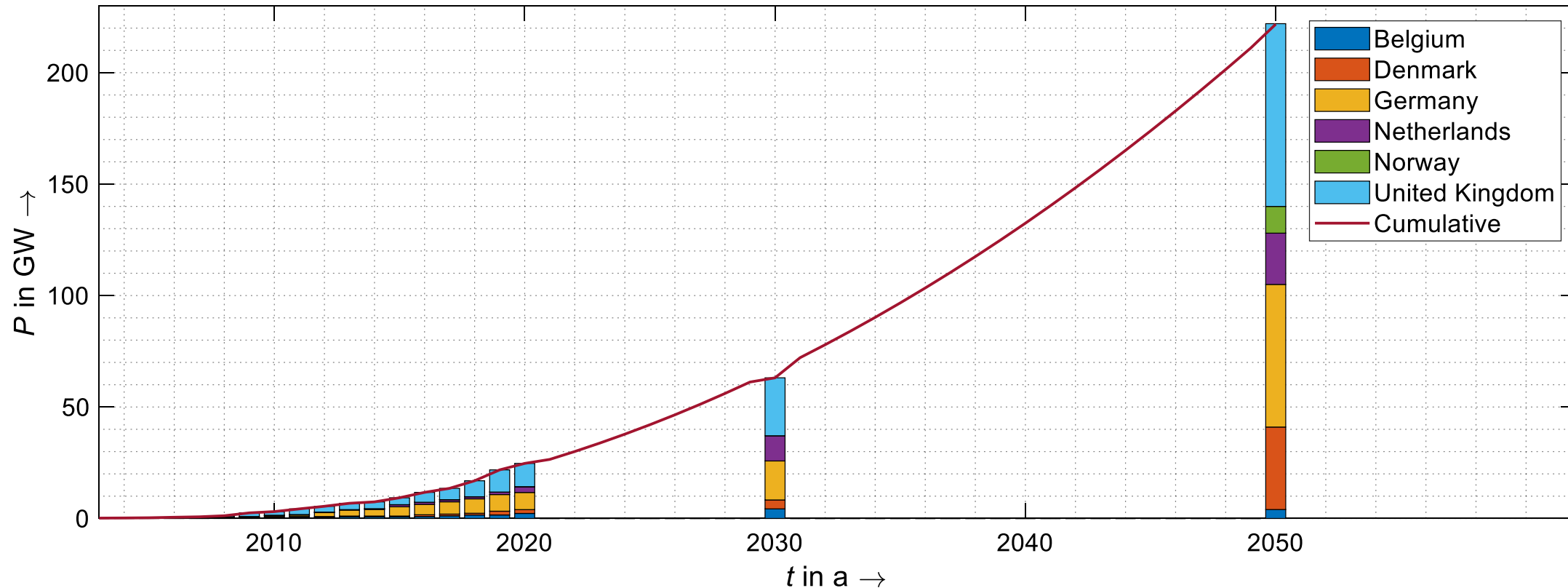
offshore wind power capacity by 2050  
to reach the climate goal of the Paris agreement

## 10 years

needed on average  
to build a new power connection

# ONE CHALLENGE IS THE INTEGRATION OF OFFSHORE WIND INTO THE EU ENERGY SYSTEM.

Development of the installed offshore wind capacity in the North Sea

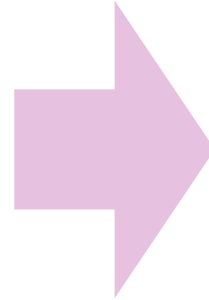


Source of data: <https://windeurope.org/>, accessed on 3 September 2021

# WE NEED TO ESTABLISH NEW PHILOSOPHIES OF SYSTEM PLANNING AND OPERATION.

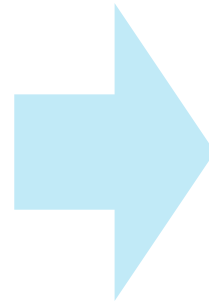
## Challenges for system design

- **Connection:** Offshore power must be connected to the energy system.
- **Transport:** Offshore power must be transported to the place of demand.



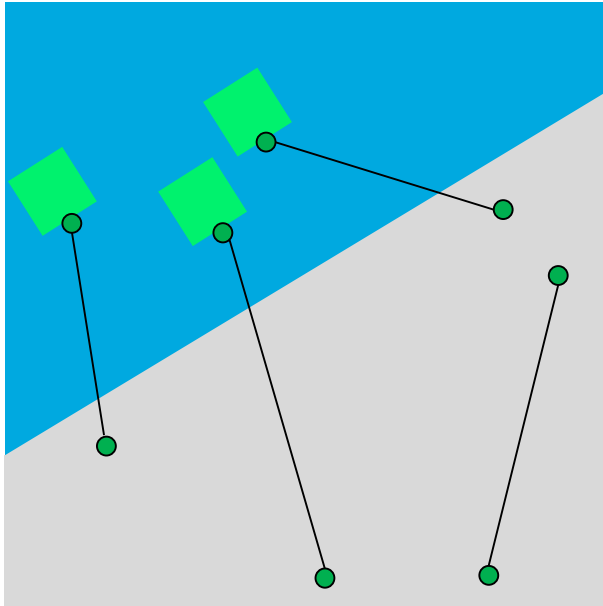
## Approaches for system design

- Connection and transport of offshore power require **grid expansion on land and at sea.**
- Concepts based on a **one system view.**



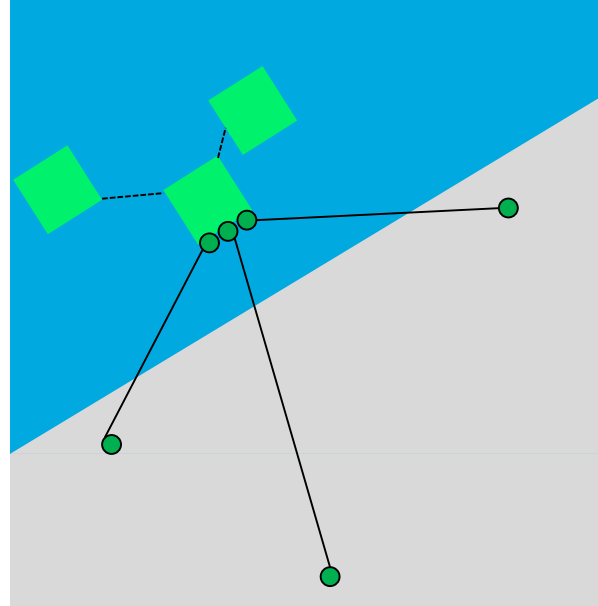
# INNOVATIVE TECHNOLOGY CONCEPTS MUST BE DEVELOPED AND STANDARDIZED...

## Point-to-Point



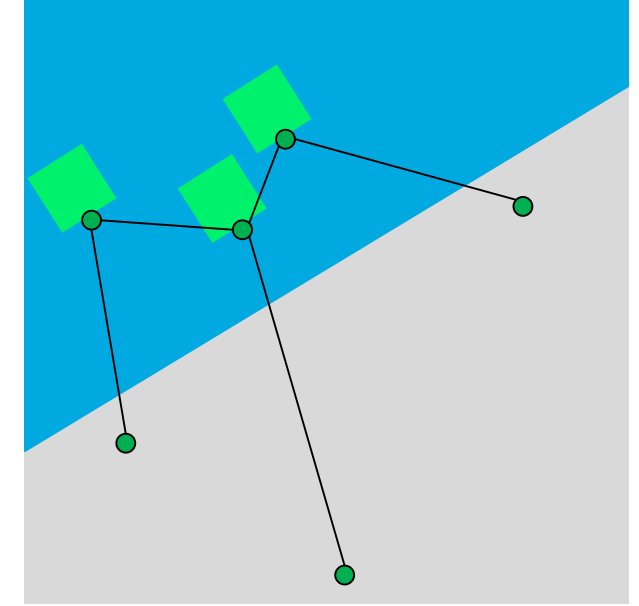
HVDC systems are built as independent point-to-point connections and are combined with onshore HVDC corridors (state of the art approach).

## AC-Hub



Nearby wind parks are bundled on the AC side and connected to various onshore connection points using separate point-to-point HVDC connections.

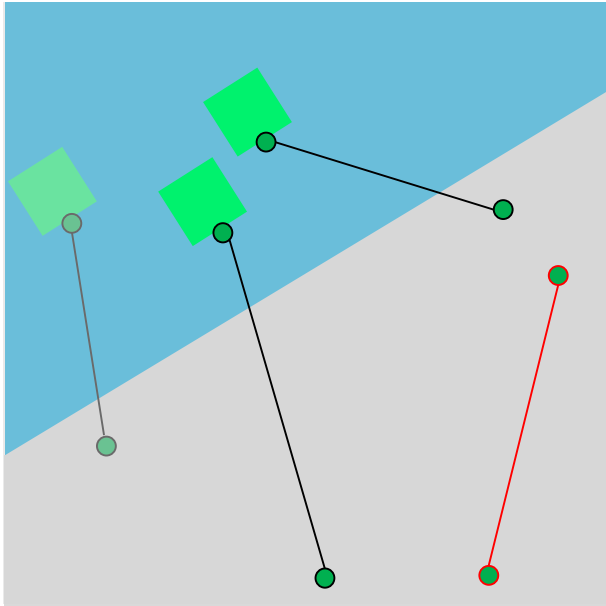
## Multi Terminal DC



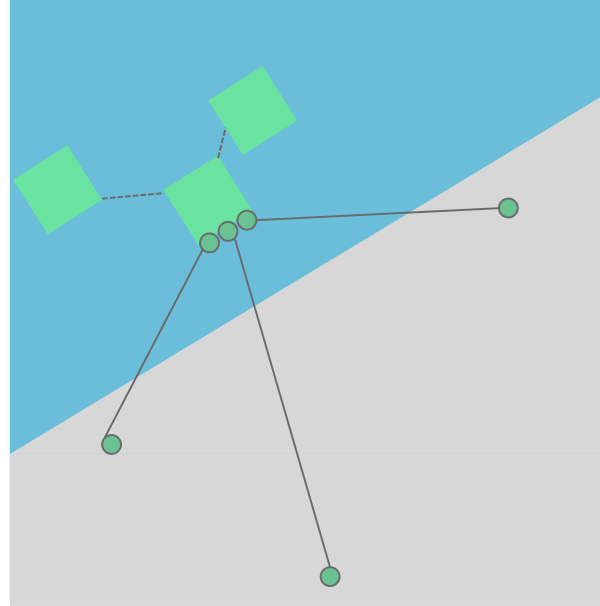
Nearby wind parks are connected on the DC side and connected to various onshore connection points using separate point-to-point HVDC connections.

# INNOVATIVE TECHNOLOGY CONCEPTS MUST BE DEVELOPED AND STANDARDIZED...

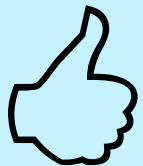
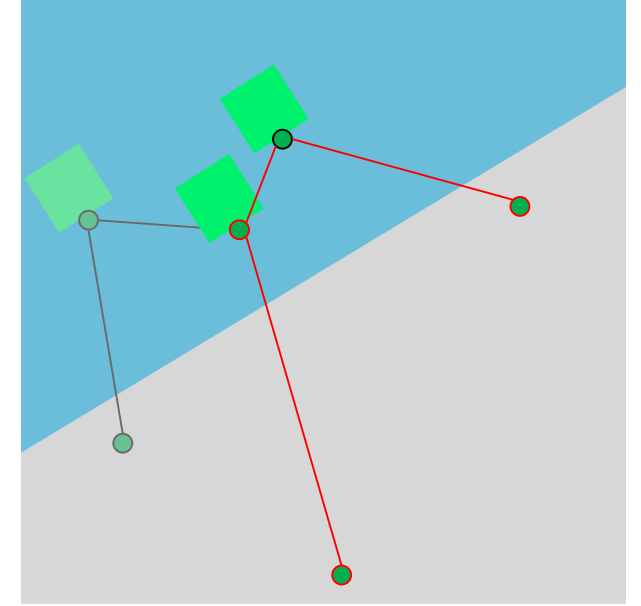
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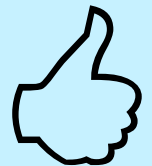
AC-Hub



Multi Terminal DC

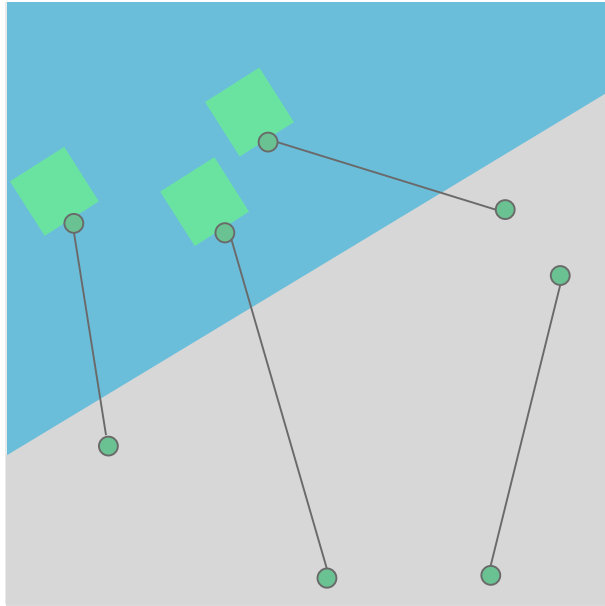


Cost efficiency in network planning and avoidance of penalties through redundancy of the connection systems.

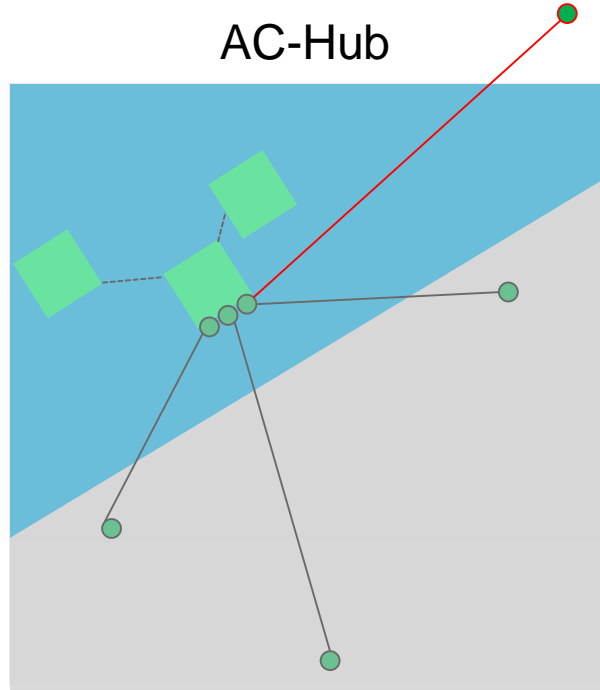


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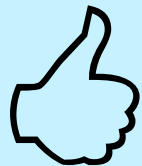
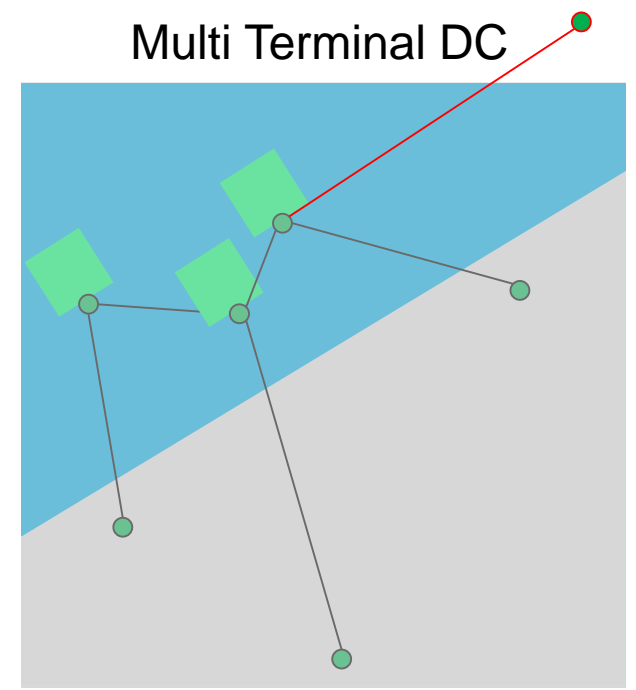
Point-to-Point



AC-Hub



Multi Terminal DC

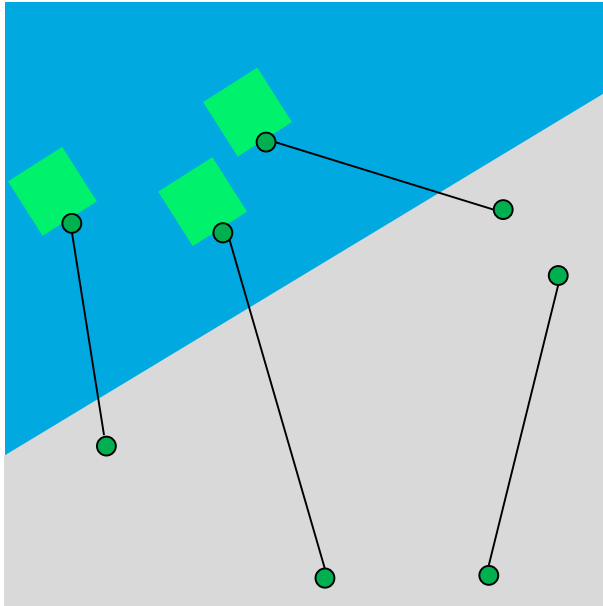


Social economic welfare gains in the involved market areas as a result of new international offshore interconnector capacities.

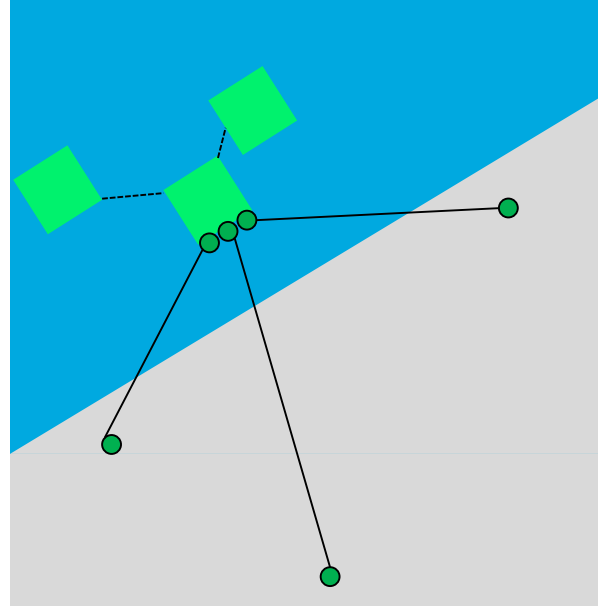


# ...AND NEW OFFSHORE SYSTEMS SHOULD BE DESIGNED OFFSHORE GRID READY.

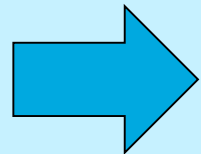
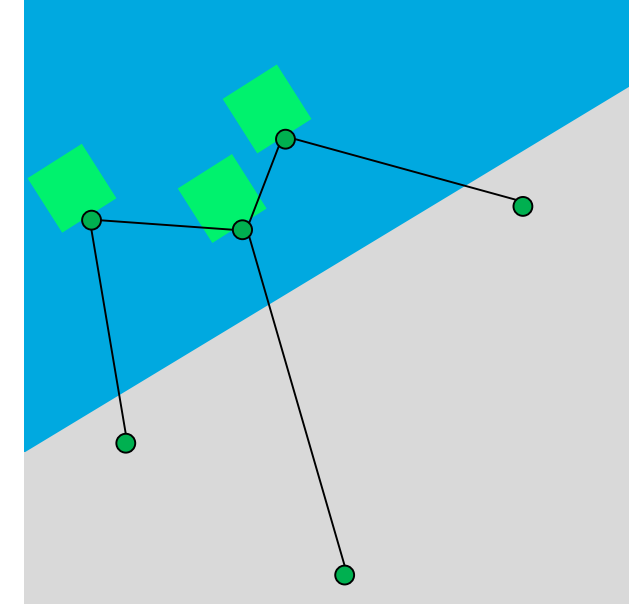
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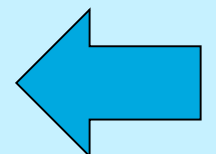
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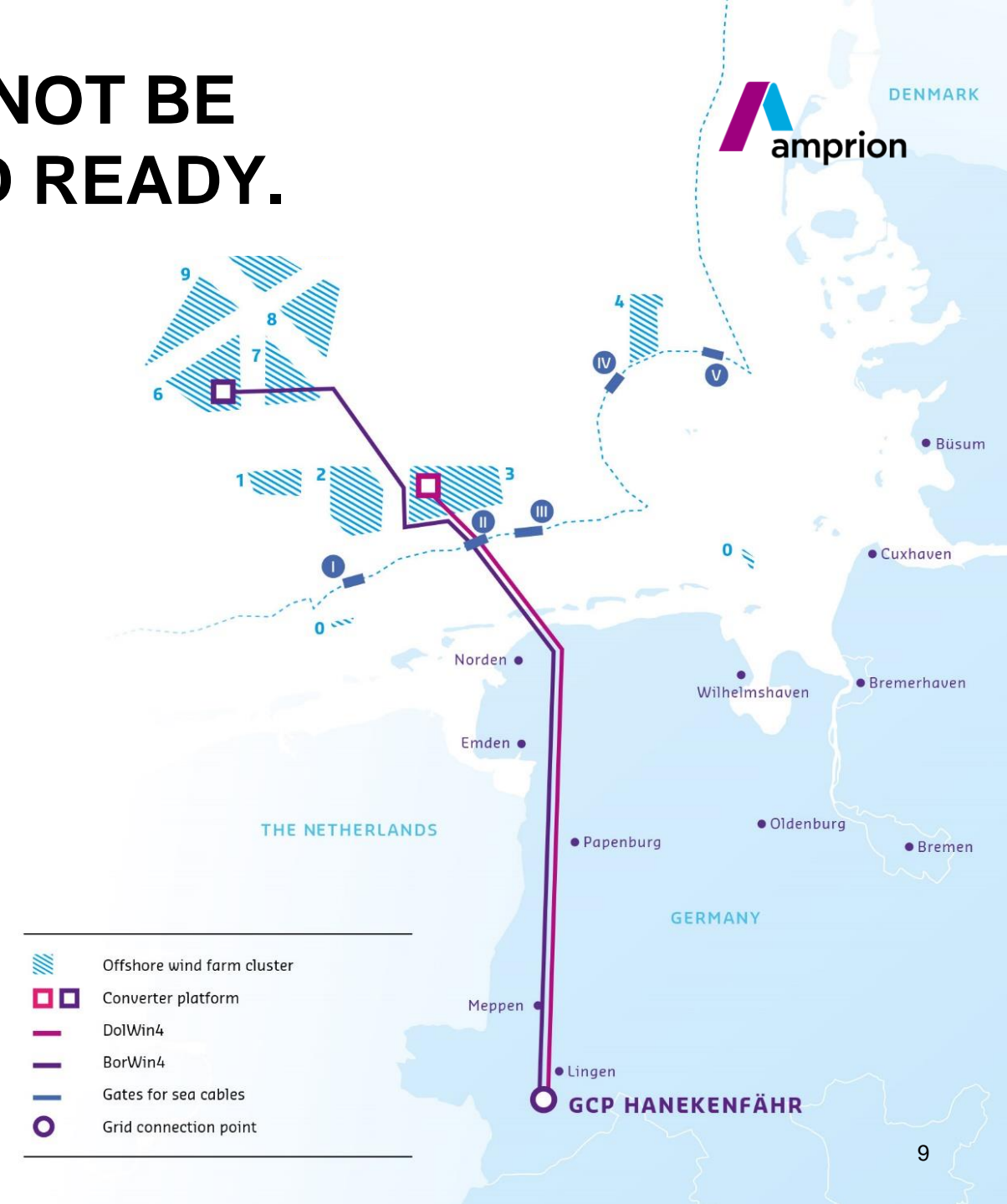


The upgrade option (offshore grid readiness) of offshore connection platforms enables the cost-benefit ratio of future grid expansion measures to be optimized.



# OUR ONGOING PROJECTS CANNOT BE IMPLEMENTED OFFSHORE GRID READY.

	DoIWin4	BorWin4
Grid Connection Point	Hanekenfähr (NI)	Hanekenfähr (NI)
Commissioning	2028	2029
Length	approx. 220 km <i>50 km offshore 150-170 km onshore</i>	approx. 300 km <i>130 km offshore 150-170 km onshore</i>
Rated Power	900 MW	900 MW
Technology	Symmetrical Monopole 320 kV DC Cable	Symmetrical Monopole 320 kV DC Cable



# BUT SUBSEQUENT SYSTEMS WILL BE DESIGNED OFFSHORE GRID READY.



	LanWin1 (NOR-12-1)	LanWin3 (NOR-11-1)	
Grid Connection Point	Wehrendorf (NI)	Westerkappeln (NW)	
Commissioning	2030+ (Forecast 2031)	2030+ (Forecast 2033)	<b>BorWin4 (NOR-6-3)</b>
Length	approx. 390 km <i>230 km offshore 150-170 km onshore</i>	approx. 390 km <i>230 km offshore 150-170 km onshore</i>	approx. 300 km <i>130 km offshore 170 km onshore</i>
Rated Power	2000 MW	2000 MW	900 MW
Technology	Bipole (with DMR) 525 kV DC Cable	Bipole (with DMR) 525 kV DC Cable	Symmetrical Monopole 320 kV DC Cable

Basis: Confirmation of **Grid Development Plan 2030**



# BUT SUBSEQUENT SYSTEMS WILL BE DESIGNED OFFSHORE GRID READY.

	NOR-13-1 (LanWin5)	NOR-x-2 (Zone 4 and 5)	NOR-x-4 (Zone 4 and 5)
Grid Connection Point	Search area: Zensenbusch	Rommerskirchen	Oberzier
Commissioning	2030+ (Forecast 2035)	2035+ (Forecast 2037)	2035+ (Forecast 2039)
Length	approx. 490 km	approx. 650 km	approx. 675 km
Rated Power	2000 MW	2000 MW	2000 MW
Technology	Bipole (with DMR) 525 kV DC Cable	Bipole (with DMR) 525 kV DC Cable	Bipole (with DMR) 525 kV DC Cable

\*According to the Grid Development Plan 2035 for  $P_{offshore} > 20$  GW

\*\*These grid connection systems are not yet finally confirmed

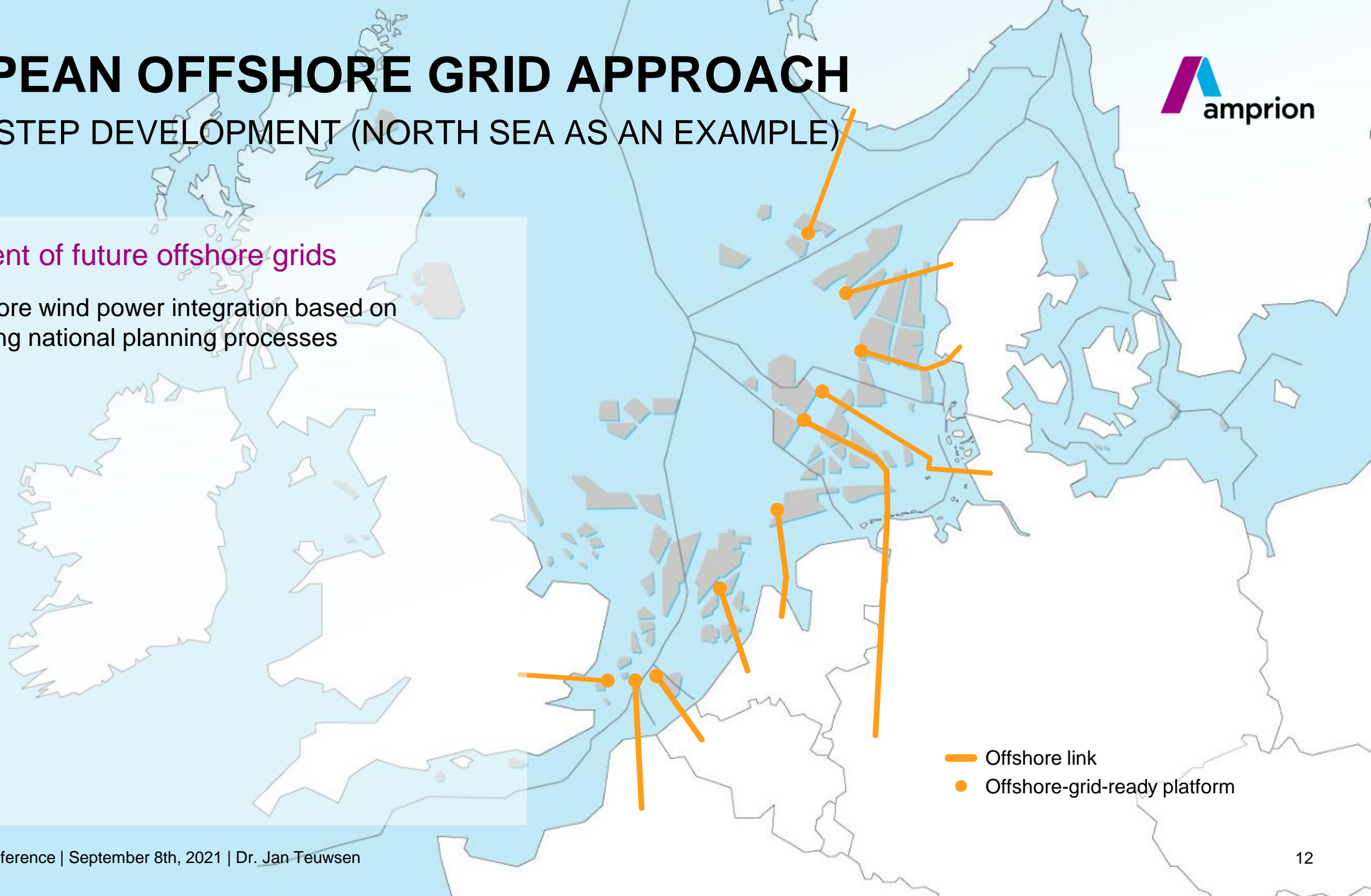


# EUROPEAN OFFSHORE GRID APPROACH

## STEP-BY-STEP DEVELOPMENT (NORTH SEA AS AN EXAMPLE)

### Development of future offshore grids

- 1) Offshore wind power integration based on existing national planning processes



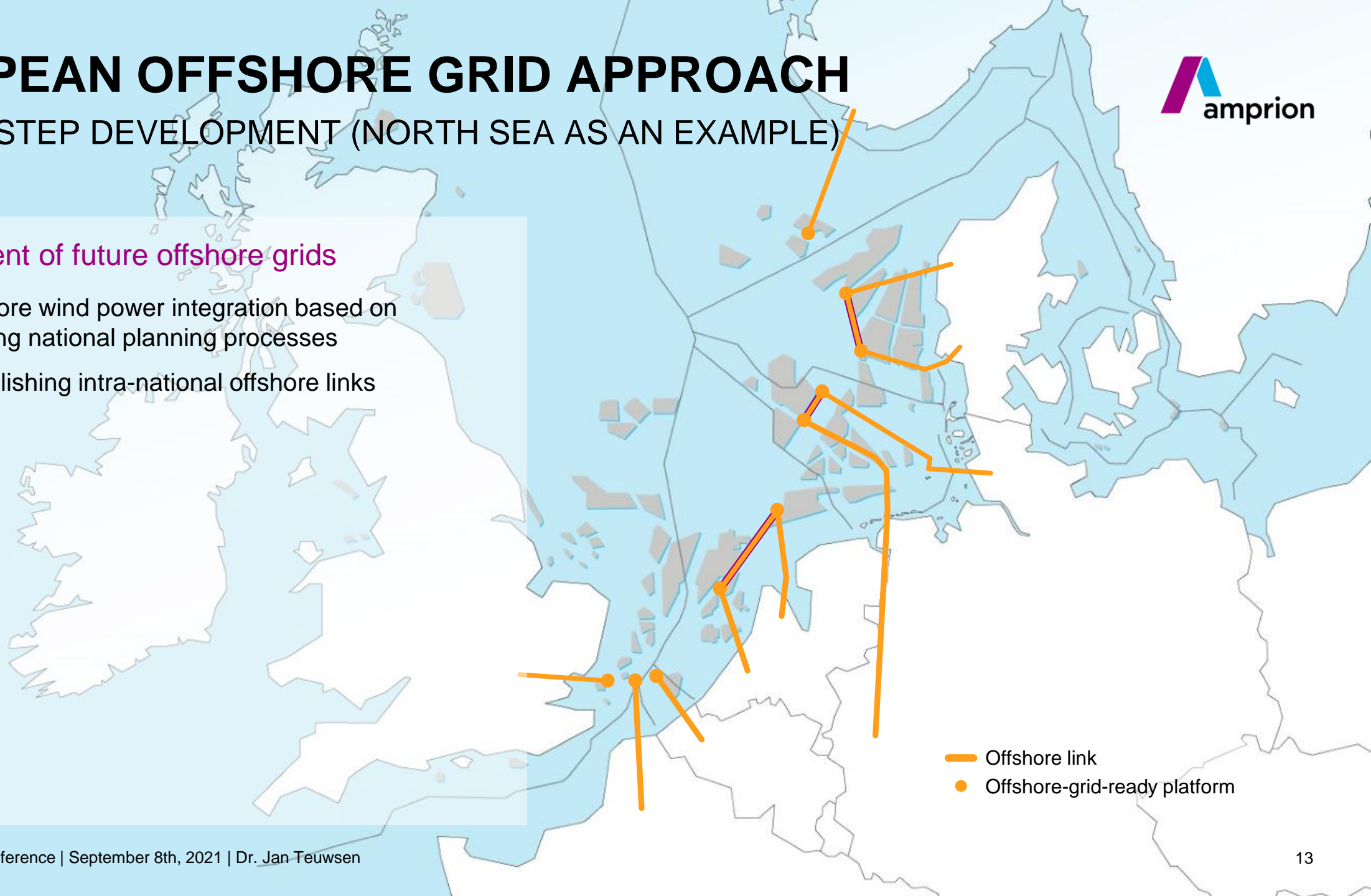
- Offshore link
- Offshore-grid-ready platform

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- 1) Offshore wind power integration based on existing national planning processes
- 2) Establishing intra-national offshore links

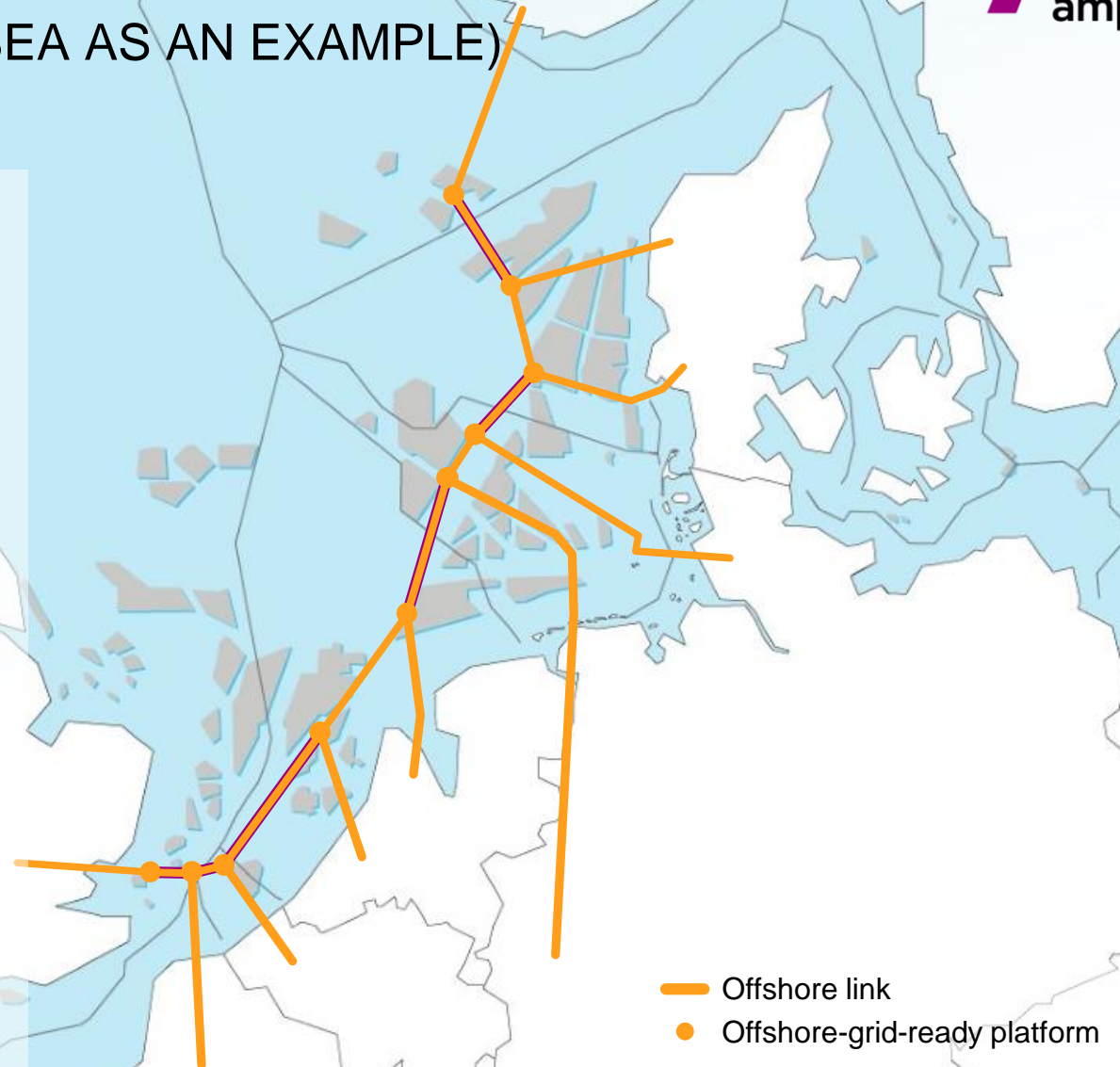
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- 2) Establishing intra-national offshore links
- 3) Establishing international links to create an interlinked offshore grid



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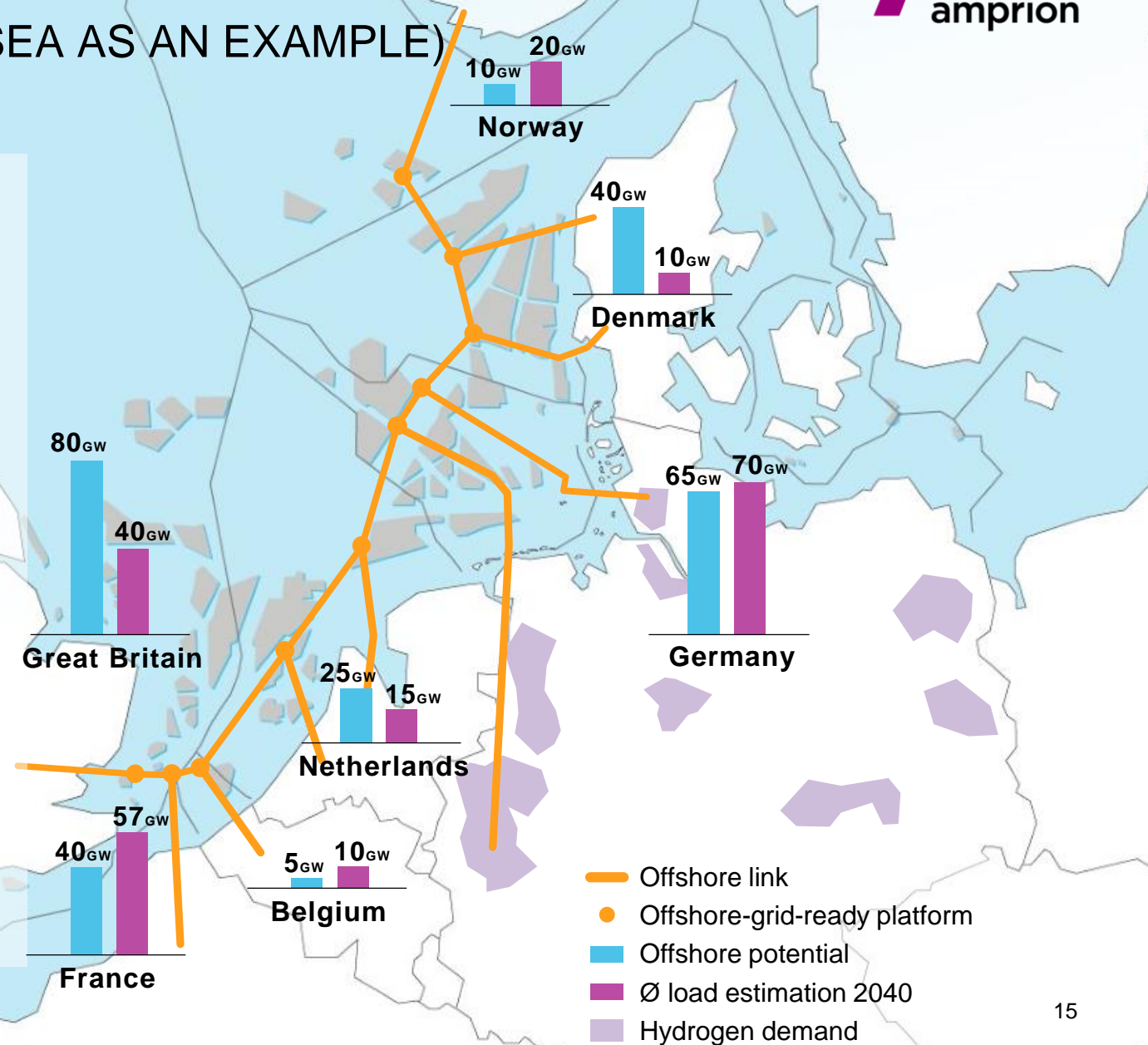
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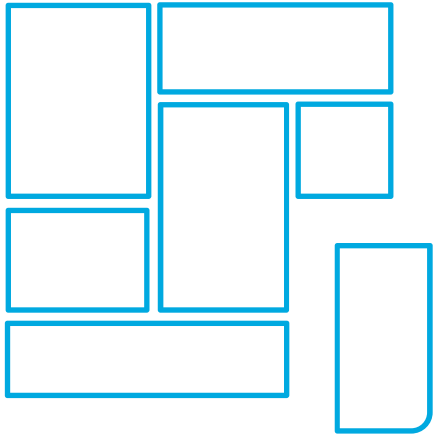
### Main advantages of the approach

- **Step-by-step development** with an open approach
- **Coordinated** on- and offshore grid development with a **'one system view'**
- Consistent consideration of **sector coupling**
- **Optimised utilisation** of wind capacities



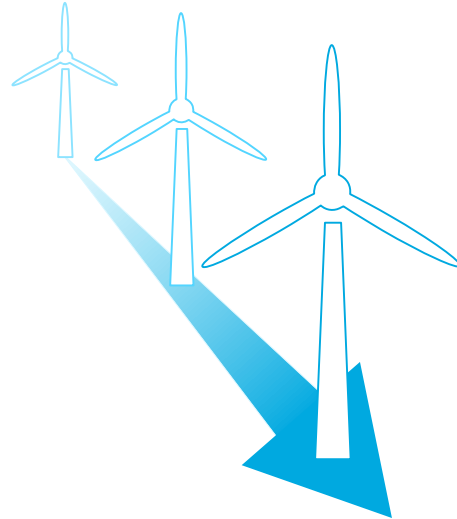
# KEY PRINCIPLES OF THIS APPROACH

## MOVING FROM CONCEPTS TO IMPLEMENTATION



### MODULAR EXTENSION

System composition can be expanded step by step based on existing planning processes.



### ROBUST PROGRESS

National offshore goals are never at risk due to fallback options during the grid development process.



### ONE SYSTEM VIEW

Combining system-orientated optimisation with interface standardisation.



### JOINT APPROACH

Autonomous implementation by international partners with close cooperation, e.g. with respect to technical standards.

# EUROBAR-INITIATIVE IS LAUNCHED.

AN ACCELERATOR FOR A MODULAR OFFSHORE-DEVELOPMENT



Eurobar is an initiative of European TSO aiming at the efficient integration of offshore wind energy from a ‘one system view’.

## Memorandum of Understanding:

- „**Becoming Offshore Grid Ready**“ – Propelling the development of a joint European offshore grid standard by collecting and sharing knowledge
- “**Joint development based on a bottom-up approach**” – designing a modular and flexible approach, using established national and international planning processes thus securing national and European offshore goals
- „**Open European Collaboration**“ – Open Initiative for all interested offshore TSOs from all coasts of all seas and remaining open for participation of additional TSOs at any time

<https://eurobar.org/>

**THANK YOU FOR YOUR ATTENTION.**

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