AquaVentus

October 2021
Maritime Hydrogen
and Marine Energy

AquaVentus

Green hydrogen from the North Sea

This is AquaVentus!

Board

Jörg Singer
Mayor Island of Heligoland

Fabian Ziegler
Deutsche Shell Holding GmbH

Sven Utermöhlen
RWE Renewables GmbH

Christoph von dem Bussche
GASCADE Gastransport GmbH

Martin Gerhardt
Siemens Gamesa Renewable Energy A/S

Kay Martens
Versorgungsbetriebe Helgoland

As of today **72 members** along the value chain

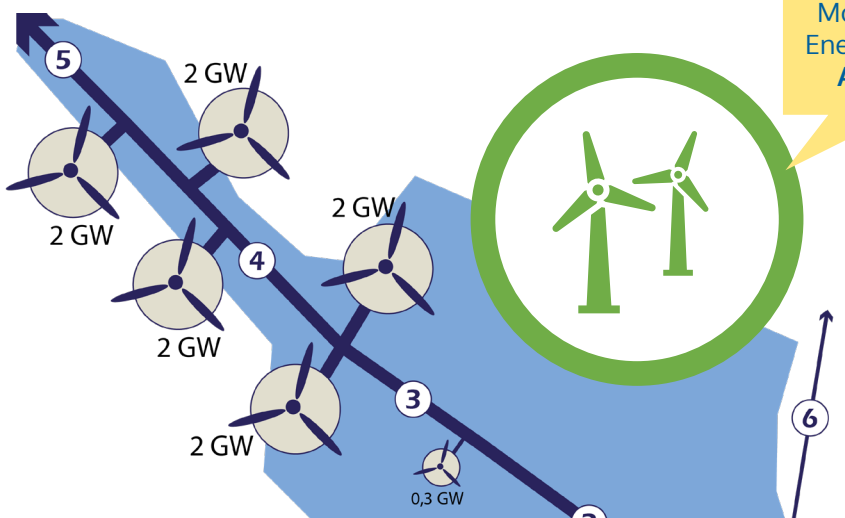
Members

EnBW, e.on, Vattenfall, RWE, Siemens Energy, Shell, Linde, gasunie, Ørsted, AVIA, Hanse Werk, DFKI, Boskalis Hirdes, Hitachi ABB, IKEM, equinor, Siemens Gamesa, Fraunhofer IFAM, hydrogenious LOHC Technologies, GASCADE, HHLA, Helgoland, hynamic, Northland Power, Stiftung Offshore Windenergie, Mabanaft, Vestas, DNV, Carneade, subsea 7, MCDERMOTT, virya energy, Weidmüller, AG EMS, Nordische Immobilien Verwaltung GmbH, Wirtschaftsförderung, buckstay, Park Wind, valloure, German LNG Terminal, OWT Offshore Wind Technologies, KONGSTEIN, WindMW, entec, ViRiDi, J-POWER, BO Enterprises, Brunsbüttel Ports, Chatham Partners, REUTHER, RHENUS CUXPORT, HC Hageman, OVERDICK, HLF Consulting Engineers, ROSEN, Versorgungsbetriebe Helgoland GmbH, VBH, H2 Industrie, GORG, C/H2 Cuxhaven Hydrogen Maritime Hydrogen, EE.SH, Van Oord, ROWE, Stablegrid Engineers GmbH

What does AquaVentus stand for?

- Germany and Europe are **serious** about hydrogen!
- Germany will create at least **5 GW** of production capacity by 2030!
- Germany and Europe become **world market leader in** hydrogen!
- **Offshore wind** plays an important role in this!

What is our Contribution?



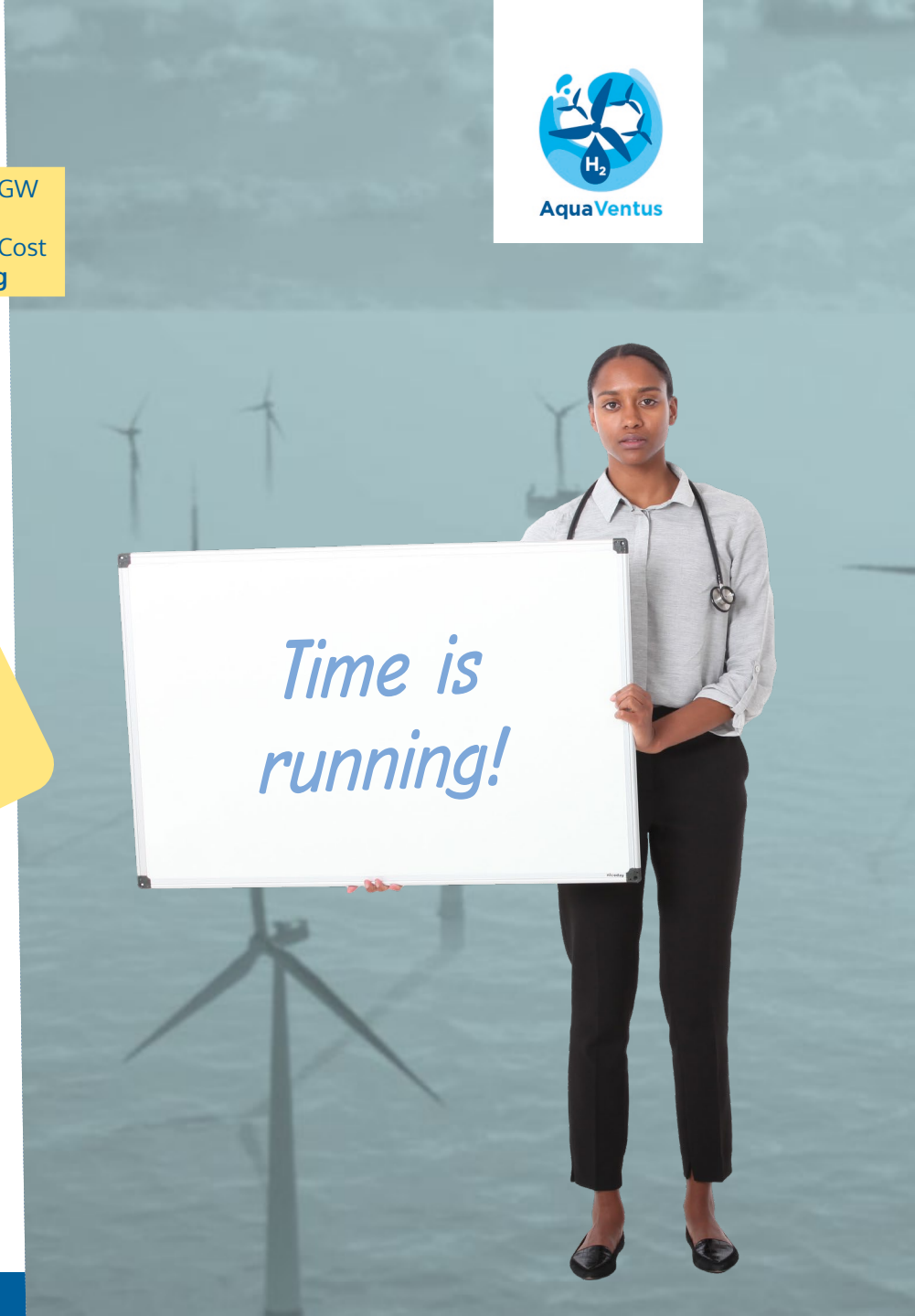
More Renewable Energy is needed = **Additionality**

Avoiding 5x 2 GW HVDC Grid Connections = Cost **Cost Saving**

10 GW
1 Mio. t/y*

In parallel to conventional grid expansion = **Acceleration**

Sparing cable routes= **Simplification**



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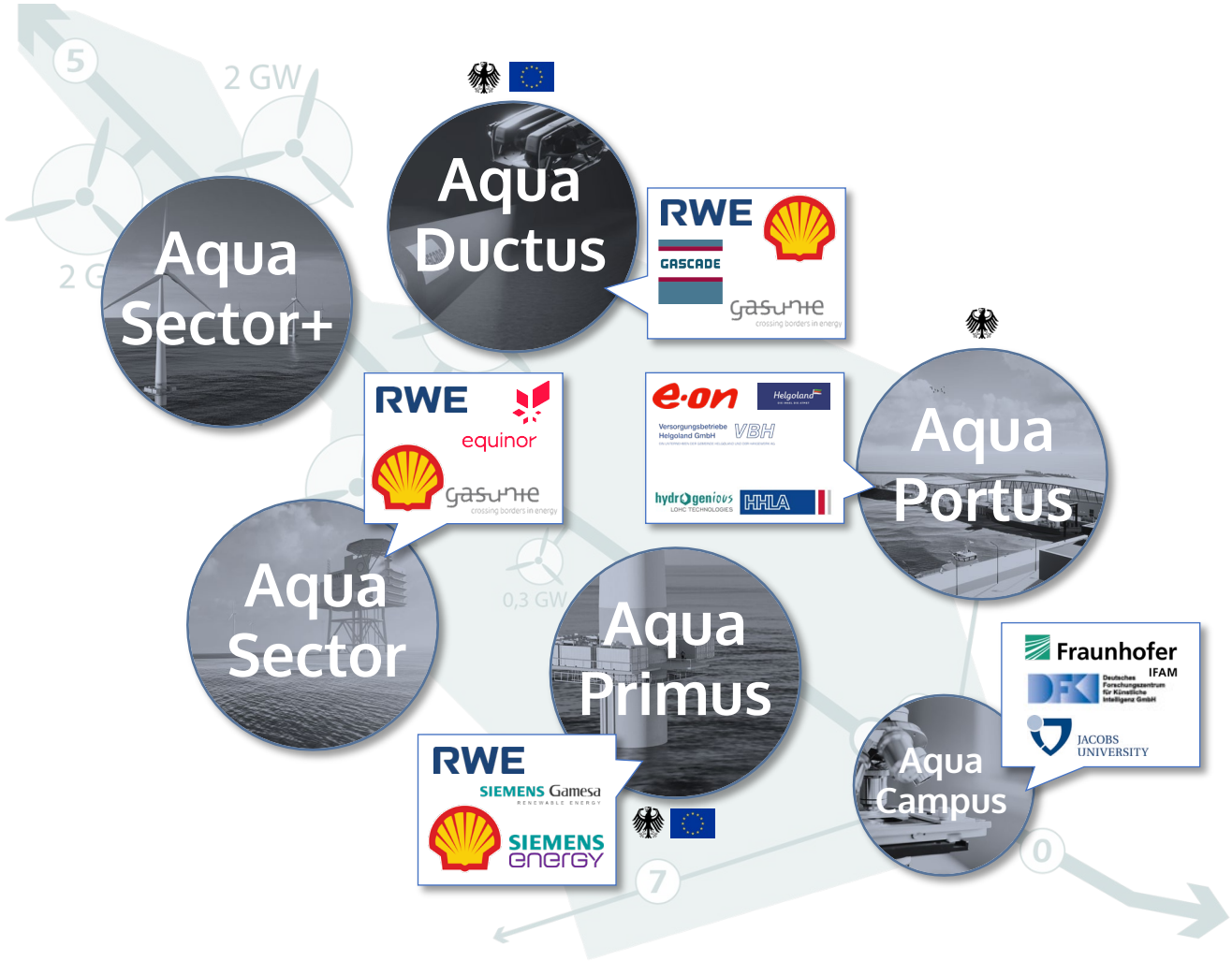
The Project Family



AquaNavis

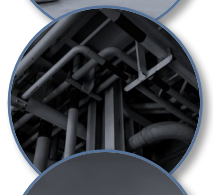
AquaLogis

AquaConsens

Leitprojekt TransHyDE

Bundesministerium für Bildung und Forschung

Leitprojekt H_2Mare



AquaGlobus

Bundesministerium für Wirtschaft und Energie

IPCEI

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First movers need Funding

740 Mio. €

Bundesministerium für Bildung und Forschung

8 Mrd. €

Bundesministerium für Wirtschaft und Energie

Wasserstoff Leitprojekte

Leitprojekt TransHyDE

Transport, Infrastructure, Stoarge, System Analysis

cruh21 enabling energy innovation

AquaDuctus AquaPrimus AquaPortus

Leitprojekt H_2Giga

OEM Electrolysis Technology

More than 240 companies

Leitprojekt H_2Mare

Hydrogen Production Offshore (+ derivatives)

cruh21 enabling energy innovation

AquaPrimus

IPCEI

Important Projects of Common European Interest

Large scale cross-country infrastructure

62 Projects

AquaDuctus AquaPrimus

AquaVentus

AquaPrimus 2023

First prototype in Mukran

- Strong **consortium** composed of more than 50 internationally leading companies, organisations and research institutions
- Construction of a first **prototype**
- No own turbine, but supply with green power via own **solar farm** on site
- **Easy access** via quay edge, optimisation of configuration
- One year **trial operation** parallel to further development
- Afterwards **regular operation** as part of the HyStarter measures on site as TYPE B

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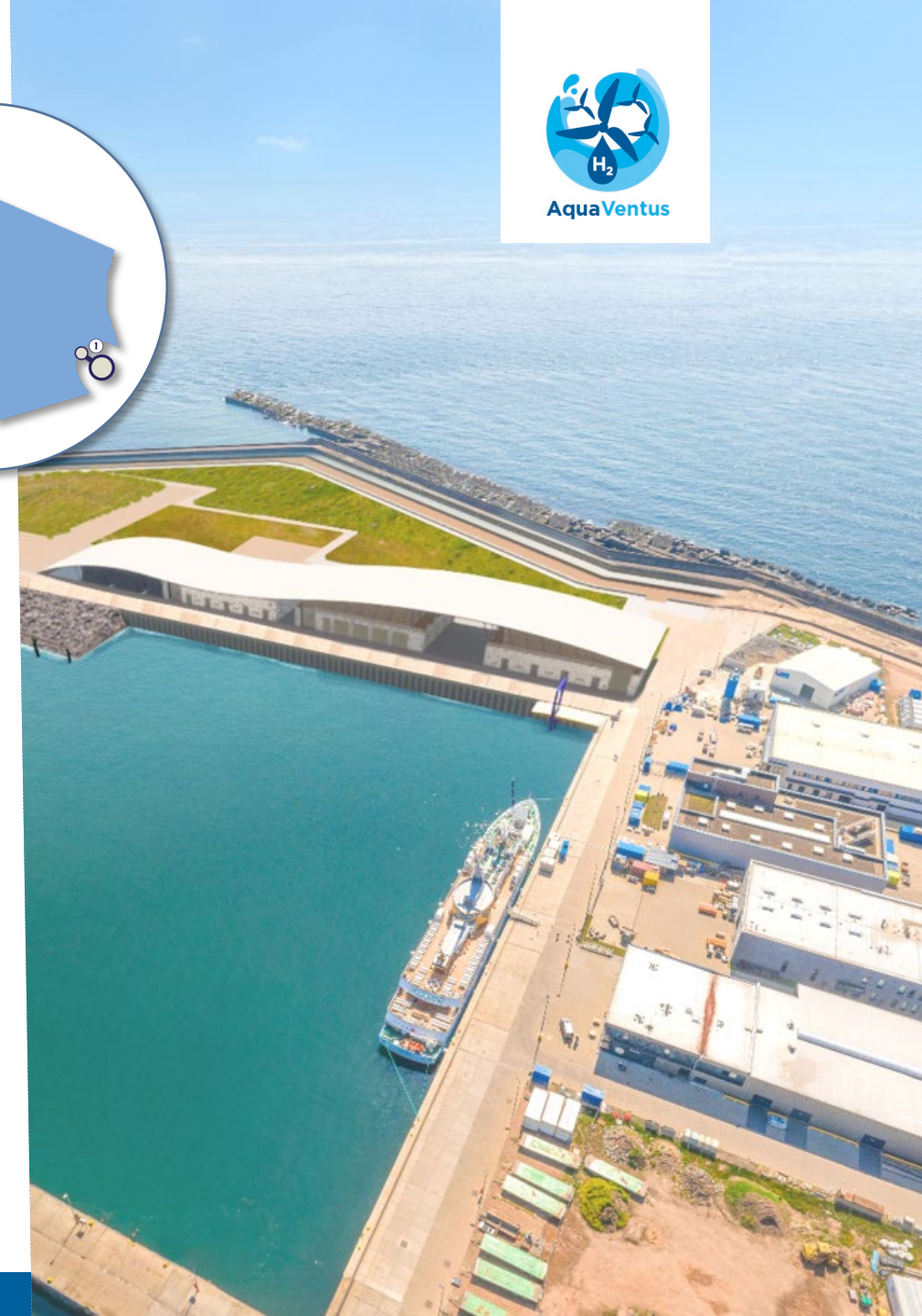
AquaPortus 2024
Preparation of Heligoland's South Harbour

- Establishment of a **LOHC infrastructure** to receive and process the AquaPrimus production volume
- Conversion of the island heat supply from heating oil to climate-neutral LOHC **waste heat** as *by-product*
- Preparation of first H_2 **mobility solutions,** e.g. dune ferry, CTVs



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AquaPrimus 2025

Two offshore pilot plants

- Construction of the first two pilot plants in the **coastal sea** off Heligoland
- Connection of the 2 x 14 MW via **pipeline** via Heligoland test field to the South Harbour
- One year **trial operation** in preparation for series production
- Commercial **regular operation** for the decarbonisation of Heligoland

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AquaPortus 2026

Heligoland goes green

- Further expansion of the hydrogen **infrastructure** on Heligoland
- Conversion of the N-1 **emergency power supply** to fuel cells incl. system services
- **Temporary storage** of necessary H2 buffer quantities offshore
- **Dismantling** of the existing fossil infrastructure (diesel generators, lattice mast chimney and tanks)

AquaSector 2028
The new AlphaVentus

- **Award of project rights** to SEN-1 by the BSH following a qualitative tender by mid-2022 at the latest
- The consortium awarded the contract will build the world's first large-scale **offshore hydrogen farm** (290 MW)
- Up to 25,000 t of green hydrogen will be piped to Heligoland via the second AquaDuctus **pipeline segment**
- In case of successful pilot, **large scale application** of a decentralised solution would be possible

*To be effective in climate policy, we must start **now**!*

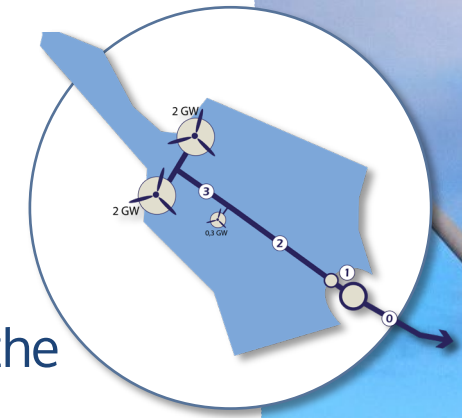
AquaPortus 2029
The North Sea hydrogen hub

- Heligoland becomes the central **hydrogen hub** in the North Sea
- Future H2- or LOHC-powered **ships** bunker on the island
- The ships calling at Heligoland are **carbon-neutral**
- Via Heligoland, the North Sea coastal region is supplied with **surplus quantities** from AquaPrimus and AquaSector by feeder*

*Especially where there is no prospect of a medium- to long-term connection to a hydrogen network!

AquaDuctus 2030
Step by step

- The dedicated **hydrogen pipeline** extends into the “Entenschnabel” (Duck's Bill)
- At the same time, it is connected **onshore** to supply the greater Hamburg/Brunsbüttel area
- The first gigawatt of generation capacity is contracted and under construction
- Up to **100,000** tons of inexpensive green hydrogen are **available** for the economy and mobility



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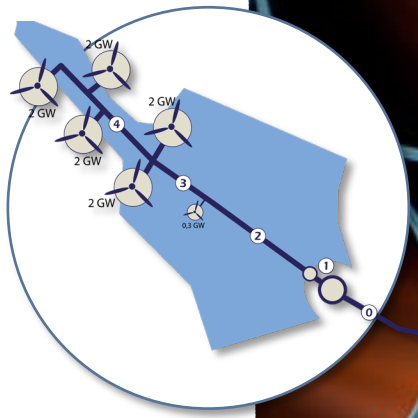
AquaDuctus 2035
It's going to be big!



- In the following years, a significant **generation capacity** of 10 GW will be created offshore
- The central pipeline provides the project developers with a reliable, **non-discriminatory** and low-cost means of transporting hydrogen to shore
- The replacement of five HVDC connections offers significant economic benefits, protects the natural habitat of the Wadden Sea and relieves the transmission system operators of the burden of conventional grid expansion

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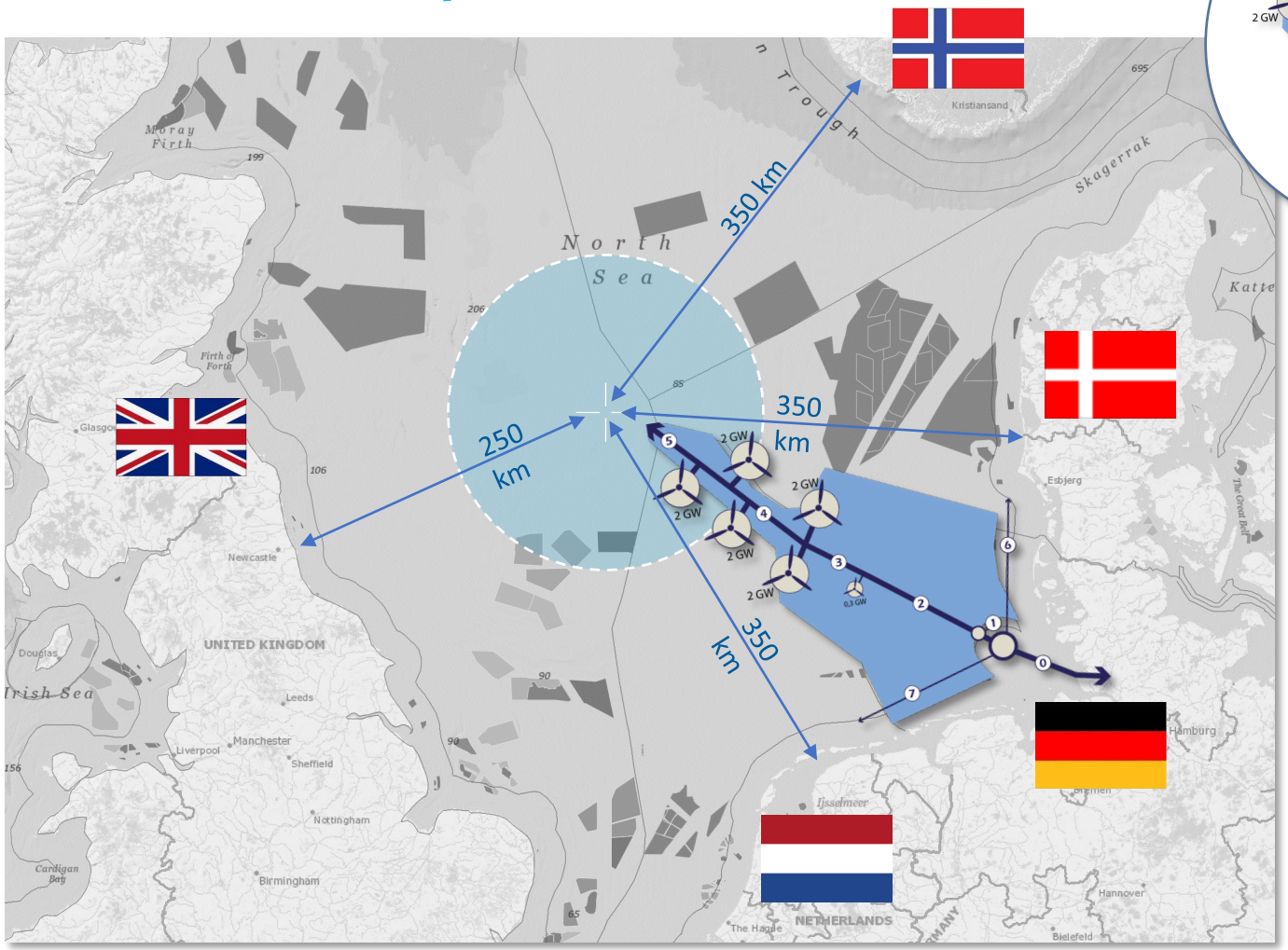
AquaVentus 2035+
Think European!



Quelle: 4cOffshore

Thank you for your attention!

www.aquaventus.org