

SUPPORTING THE DEVELOPMENT OF A NORTH SEA OFFSHORE POWERHOUSE

CASE STUDY: NORTH SEA WIND POWER HUB PROJECT

*TU Delft Power Web Institute
Monthly Lunch Lecture
9 May 2019*

Confidential and Proprietary



STAY TUNED, SAFETY FIRST!

For your safety as well as our own we would like to draw your attention to the following safety measures.

In case of an emergency, the following instructions also apply:

- Follow the escape route as indicated.
- Use the stairs instead of the lift.
- Go the assembly point.
- Follow the instructions of the in-company emergency worker who is present at that moment.



ABOUT ME



Huygen van Steen

Working on the North Sea energy transition

Utrecht Area, Netherlands



**university of
 groningen**



Sub Project Lead North Sea Wind Power Hub (secondment)

TenneT

Apr 2018 – Present · 1 yr 2 mos

Arnhem

www.northseawindpowerhub.eu



Managing Consultant

Navigant

Mar 2017 – Present · 2 yrs 3 mos

Utrecht Area, Netherlands



Ecofys

4 yrs 11 mos



Senior Consultant

Mar 2014 – Feb 2017 · 3 yrs

Utrecht Area, Netherlands



Consultant

Apr 2012 – Feb 2014 · 1 yr 11 mos

Utrecht Area, Netherlands

PROGRAM OF TODAY

1. Introduction Navigant

- Build – Manage - Protect

2. How Navigant supports clients to navigate the energy transition

- From climate science to program and project implementation

3. North Sea Wind Power Hub

- Climate Change and impact on North Sea Offshore Wind
- International coordination
- Approach
- Concept
- Analyses
- Benefits
- Stakeholder engagement



ABOUT NAVIGANT

ABOUT NAVIGANT

Ecofys has become Navigant

- Brand transition completed on 01-01-2019



NAVIGANT

*"We work side-by-side with our clients to create clear and compelling insights that turn problems into opportunities, and pinpoint the best ways to **build, manage, and protect** the value of their business"*

NAVIGANT AT A GLANCE



NAVIGANT'S SUCCESS DRAWS FROM EXPERIENCED PROFESSIONAL ADVISORS WORLDWIDE

AMERICAS

Atlanta
Chicago
Colorado
New York
San Francisco
Southern California
Toronto
Washington, DC

EUROPE

Berlin
Brussels
Cologne
London
Utrecht

MIDDLE EAST

Dubai
Abu Dhabi

ASIA

Hong Kong
Singapore
Trivandrum, India

CLIENTS IN 43 COUNTRIES ON 6 CONTINENTS

4,300+ engagements from 60 offices in 2016

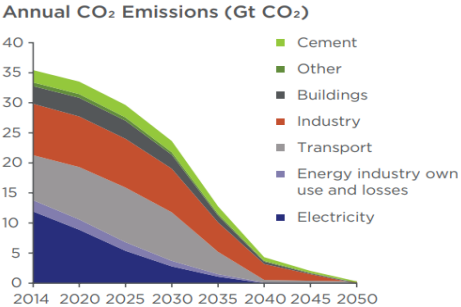

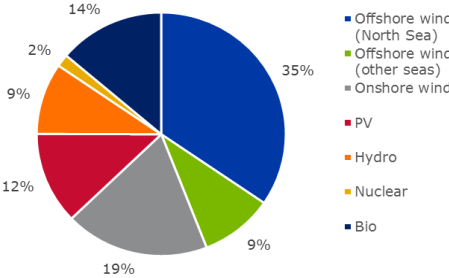
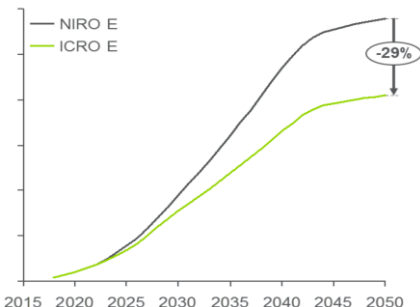

5,500+ employees





HOW NAVIGANT HELPS CLIENTS NAVIGATE THE ENERGY TRANSITION

NAVIGANT SOLUTIONS - EXAMPLES

THOUGHT LEADERSHIP	CLIMATE SCIENCE	SCENARIO DEVELOPMENT	STRATEGY & ECONOMICS	IMPLEMENTATION SUPPORT
Examples				
<p>Energy Transition Within 1.5 °C Approach to a 100% Decarbonization of the Global Energy System by 2050</p>  <p>Report available from: www.navigant.com</p>	<p>Science Based Targets Helping large clients set concrete emission reduction targets.</p>  <p>Information available from: www.navigant.com</p>	<p>Translate COP21 Study 2045 outlook and implications for offshore wind in the North Seas</p>  <p>Report available from: www.northseawindpowerhub.eu</p>	<p>Urgency & Benefits International coordinated roll-out vs. a national incremental roll-out of offshore wind</p>  <p>Report is confidential</p>	<p>PMO support supporting TenneT with the project management activities of the consortium</p>  <p>Information available from: www.northseawindpowerhub.eu</p>



THE NORTH SEA WIND POWER HUB PROJECT

Disclaimer:
this presentation is by Navigant with permission
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share publicly available information

<https://www.youtube.com/watch?v=x7dR39HctbY>

Source: www.northseawindpowerhub.eu

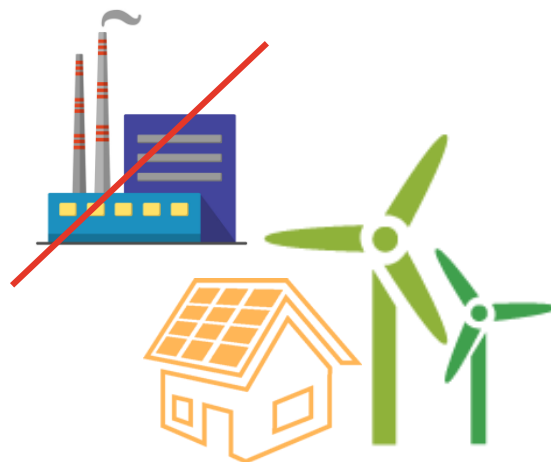
THE ENERGY TRANSITION AND NORTH SEA OFFSHORE WIND

The Paris agreement implies a radical change in the electricity generation mix for North Sea countries



PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21•CMP11

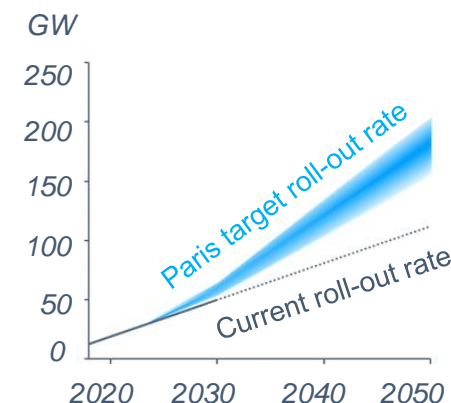
1.5 °C scenario: drastically decrease our GHG emissions



Energy system has to change with much more non-dispatchable renewable sources



Including an estimated 180 GW of offshore wind and 50-80 GW of interconnectors⁽¹⁾



And requiring an accelerated and steady deployment based on cross border spatial planning

¹ Translate COP21: 2045 outlook and implications for offshore wind in the North Seas (Ecofys 2017)

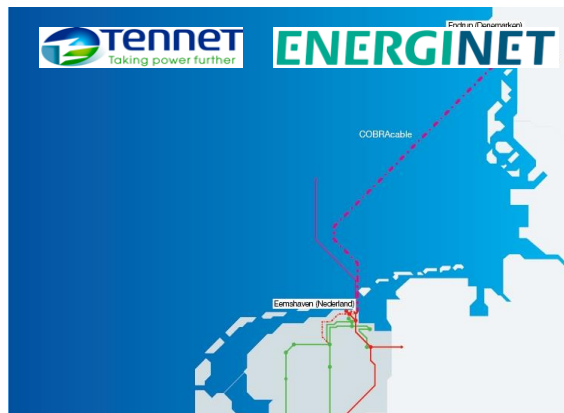
GRAND VISION AND THE NORTH SEA WIND POWER HUB

Developing 180 GW of offshore wind power in the North Sea, to be supplied to European markets, using a modular “hub and spoke” concept



North Sea Wind Power Hub Consortium

TenneT Netherlands, TenneT Germany, Energinet, Gasunie and Port of Rotterdam joined forces to develop a large scale European energy system for offshore wind in the North Sea.



International Cooperation



Future Role of Gas



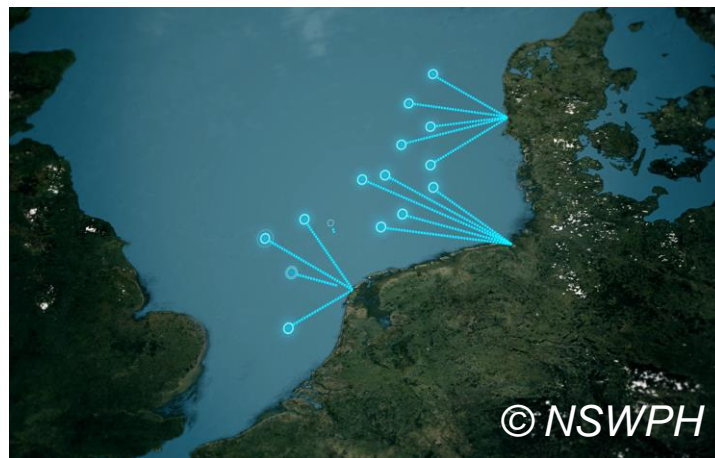
Land Reclamation

INTERNATIONAL COORDINATED ROLL-OUT

Business as usual

Internationally coordinated

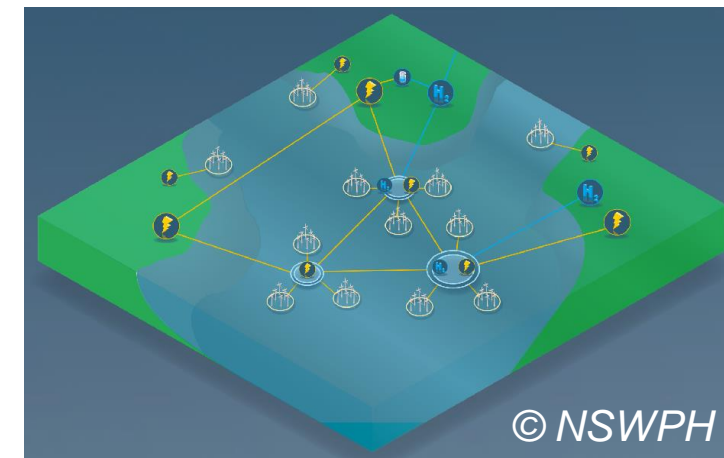
Optimised system



National Incremental Roll-Out (NIRO)



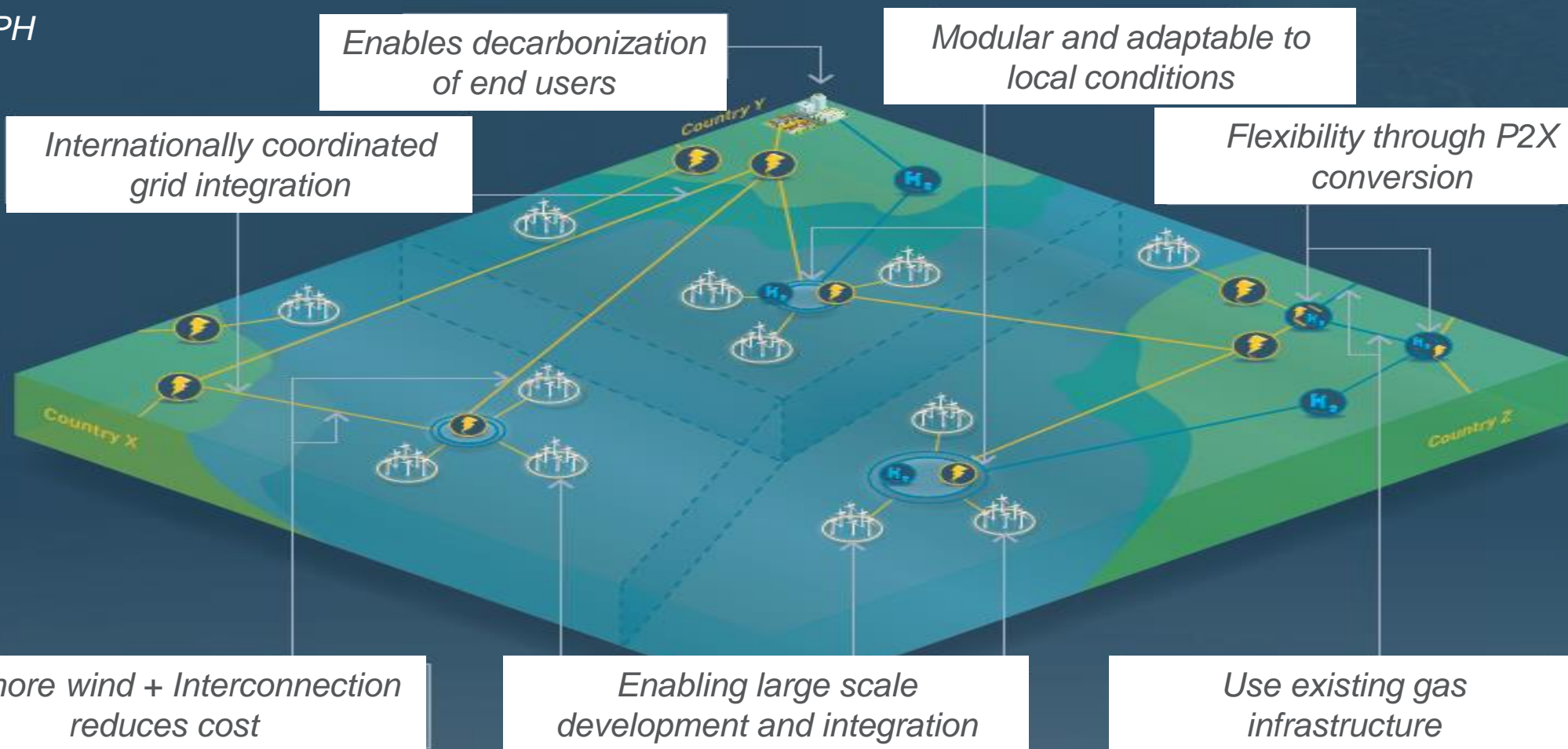
International Coordinated Roll-Out (ICRO)



Hub and Spoke Vision

THE NSWPH OFFERS A UNIQUE CONCEPT

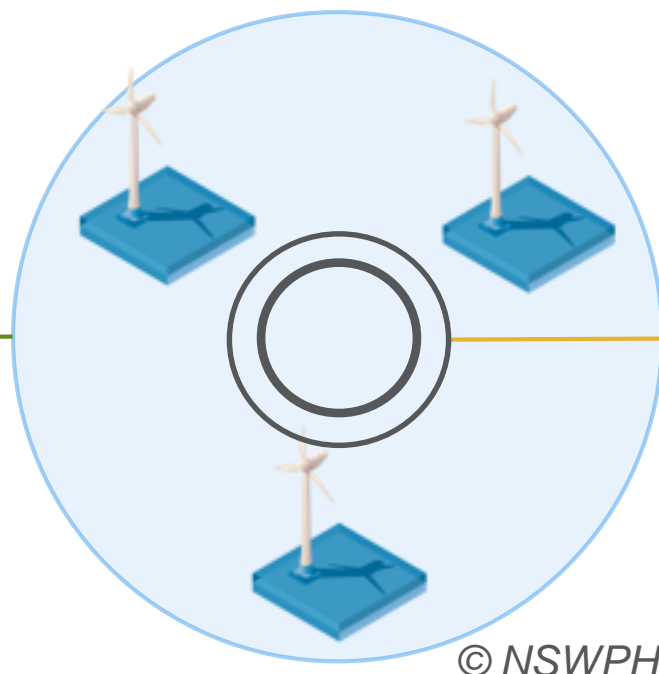
© NSWPH



NSWPH TWO LEG APPROACH

Leg 1 North Sea International Coordinated Roll Out

- Development and operation of the integrated (E and Gas) infrastructure
- In close cooperation with stakeholders
- Ensure security of supply
- Lowest societal cost
- Achieve Paris goals

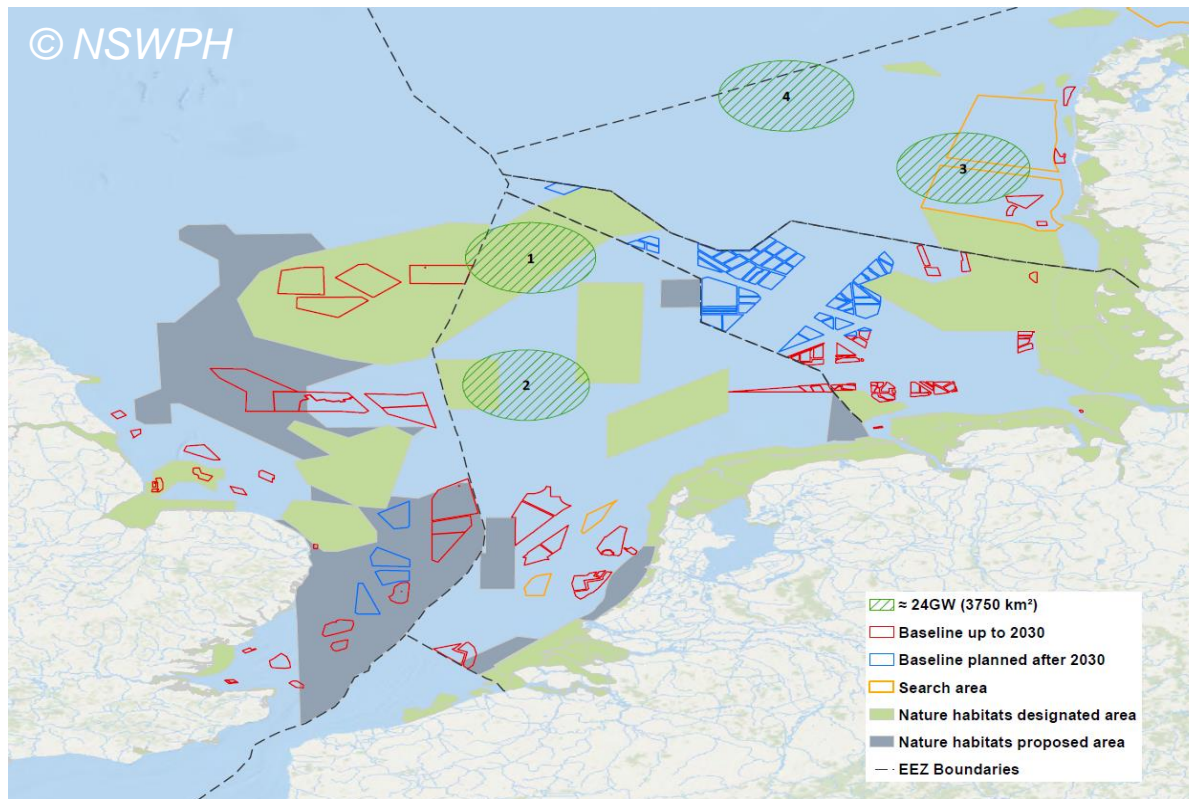


Leg 2 Towards the First Modular Hub & Spoke project

- Assess technical feasibility
- Potential environmental impacts,
- Cost saving potential
- Requirements for adaptation of the market design and regulatory framework.

CONSORTIUM HAS BROADENED ITS INVESTIGATIONS BEYOND DOGGER BANK

Several locations have been evaluated in addition to the initial Dogger Bank location to evaluate the main techno-economic driver dependence on location.

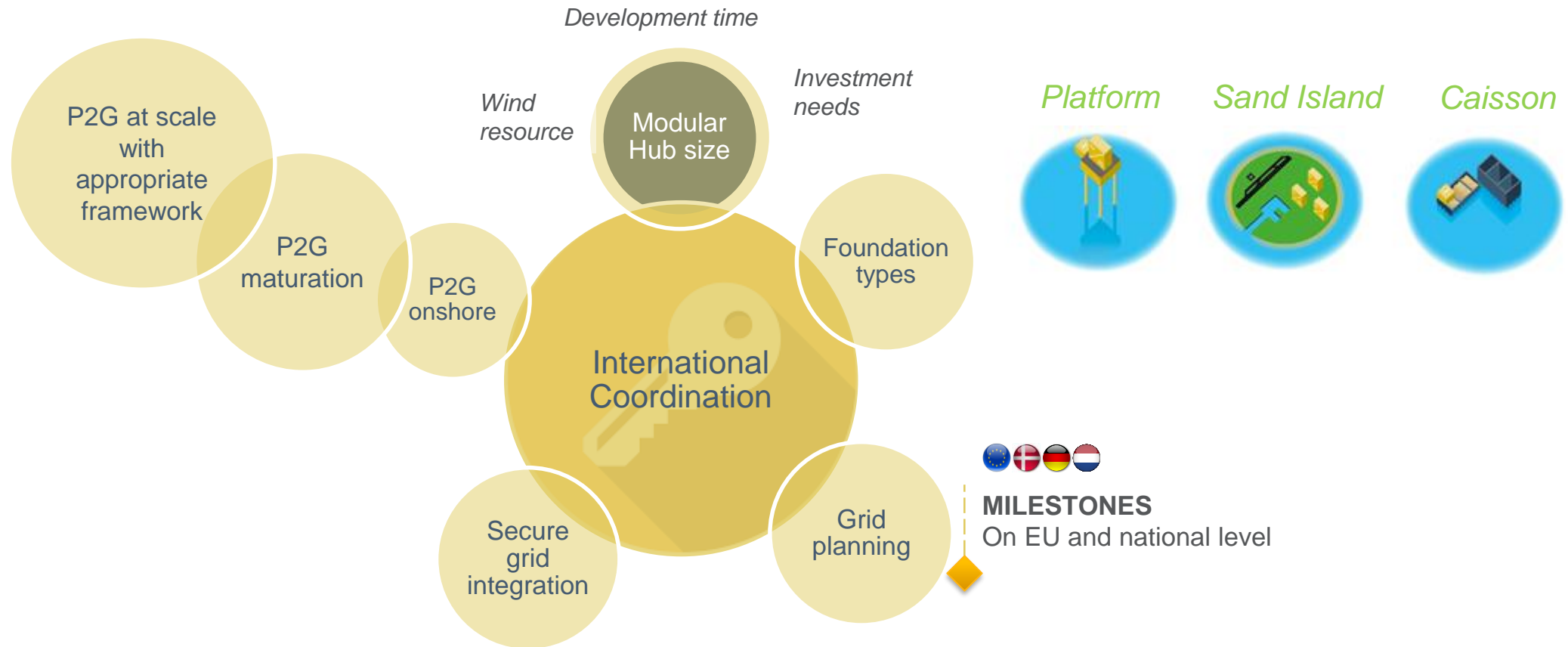


Broadened investigative space:

- Increased number of test locations to four
- Technical, Economical, baseline Environmental and Market and Regulatory analyses
- Alternative design options include sand filled island, caissons, platform and floating structure
- Significant attention to onshore grid integration and future security of supply issues, including the possible role of P2X in this respect

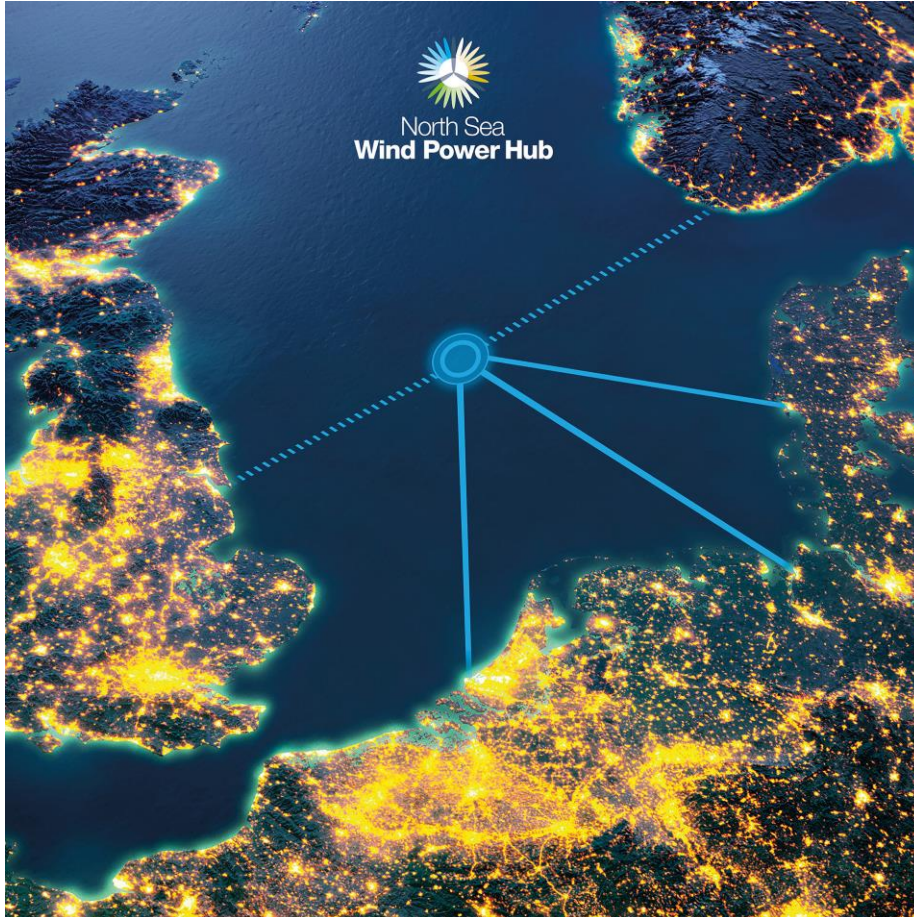
Disclaimer: These test locations do not indicate any preferred location selection

Key results from the assessment phase will allow the consortium to narrow down on the options



MAIN BENEFITS ...

The Hub and Spoke concept brings forward numerous benefits for society.



Increases the security of realising the Paris Agreement in a timely and cost effective manner



Each 12 GW hub project could provides 16 million households with clean energy and reduces CO2 by an additional 2% for entire Europe compared to a radial scenario



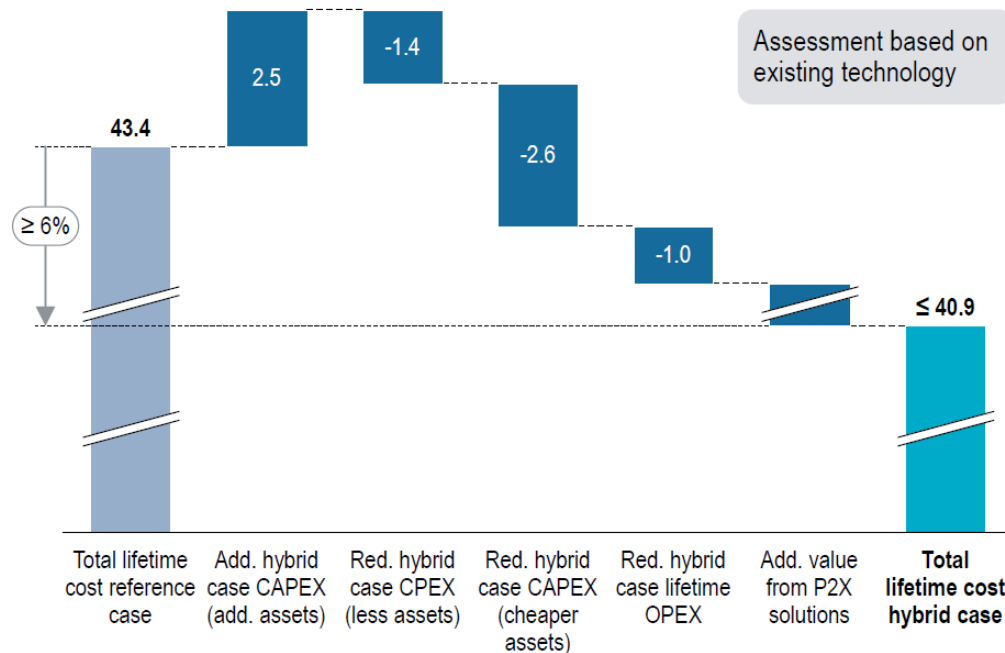
Power2X provides flexibility to the energy system, balancing supply and demand to maintain security of supply



30% cumulative cost reduction on the electrical infrastructure for an international coordinated roll-out compared to a national radial roll-out.

EXTERNAL VALIDATION OF COST REDUCTION HUB & SPOKE CONCEPT

Significant lifetime benefits [EUR bn]¹⁾



1) Results are subject to barriers; currently no deal-breakers (8% discount factor) assumed

Source: Roland Berger

Source:

<https://northseawindpowerhub.eu/wp-content/uploads/2018/11/Presentation-Roland-Berger.pdf>

EC 'North Seas Offshore Energy Clusters Study' by Roland Berger

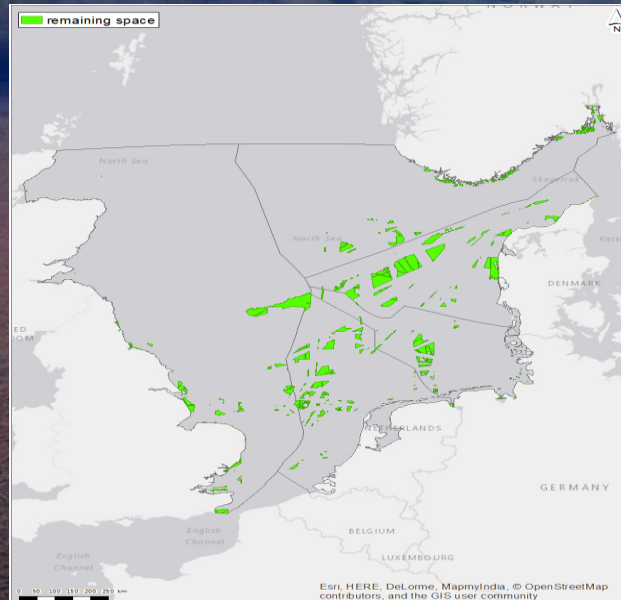
- Validation of lifetime (cost) benefits
- Identification of project specific barriers
- Draft action plan for implementation

Chart notes:

- Add. assets include artificial island and on-island HVAC equipment
- Red. assets include elimination of add. IC assets and cheaper on-island equipment
- Red. OPEX from usage of island as maintenance hub

THE NORTH SEA IS INTENSELY USED

- 430,000 km^2 of Southern North Sea
- 220,000 km^2 with <55m water depth
- 180 GW = ~ 20,000 – 30,000 km^2



- Known appointed OWF areas ~ 47 to 84 GW capacity
- Exclusionary approach leaves small, scattered space for OWFs
- Remaining space is ~14,000 km^2 (or 15-25 GW)



ECO
SYSTEM



EXISTING
WIND FIELDS



COMPLEX
SHIPPING
LANES



PIPES
AND CABLES



HELICOPTER
FLIGHT SAFETY
ZONES

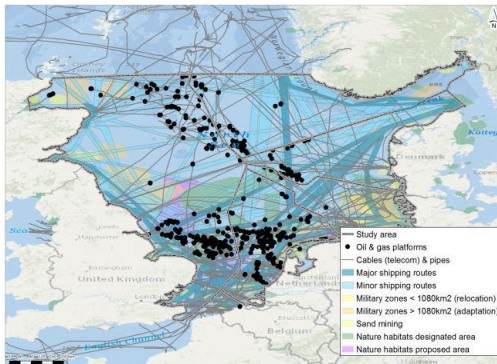


MILITARY
AREAS



OIL AND GAS
PLATFORMS

CONSORTIUM HAS INTENSIFIED STAKEHOLDER ENGAGEMENT



Discuss the vision with key stakeholders

- Emphasize the requirement for cross-border cooperation and co-utilization
- Jointly work towards timely achieving the COP21 goals (avoiding roll-out delays)

Feed the spatial planning debate

- Active outreach to important stakeholders. Transparent and open discussions with Governments, Industry and NGO's. Clearly stating what the consortium is doing.
- Seeking joint understanding to work towards urgent regional spatial planning. Provide insight into spatial planning debate: Techno-Economic / security of supply

Consult influential wind industry players

- To seek input from Industry on issues like: (i) Market arrangements, (ii) Interconnector accessibility and (iii) Key success factors.
- Support for joint publishing Industry Report

TAKE HOME MESSAGE

Urgent action is essential to timely shape the boundary conditions that are required to meet the long term climate goals



Specify renewable targets, grid planning and spatial planning well beyond 2030



Reconsider market and regulatory rules to allow for anticipatory investments long term system optimisation



Facilitate industry to be ready and properly incentivised, to develop and operate in a dynamic and flexible system



Develop onshore grid integration and flexibility options to ensure security of supply for all consumers.

HOW NAVIGANT HAS SUPPORTED THE NSWPH PROJECT

- Scenario development studies
 - Translate COP21
 - Combined EH2
- Economic analysis
 - LCOE analyses
 - Cost comparison NIRO vs ICRO
- Implementation support
 - Project management support
 - Concept paper development
- Ad-hoc support
 - Strategic support
 - Framework agreement with TenneT

CONTACTS

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See you on 16th May at the:

