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
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

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
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

Ecofys has become Navigant
- Brand transition completed on 01-01-2019

“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

2018 REVENUES: $743 MILLION

WORKED ON 2,600+ CLIENT ENGAGEMENTS IN 2018

THREE KEY BUSINESS SEGMENTS
FINANCIAL SERVICES ADVISORY AND COMPLIANCE • HEALTHCARE • ENERGY

PEOPLE
5,950 EMPLOYEES
1,400 EXPERT HUMAN CAPITAL
3,300 BUSINESS PROCESS PROFESSIONALS

SIGNIFICANT CLIENTS RELATIONSHIPS*
5+ YEARS =67%
92% of our largest 100 clients were repeat customers in 2018

AWARDS AND ACCOLADES
=9 CONSECUTIVE PERFECT SCORES ON THE 2019 VAULT AWARDS
BEST CONSULTING FIRM FOR:
#10 Energy Consulting
#12 Healthcare Consulting
#20 Financial Consulting

HUMAN RIGHTS CAMPAIGN FOUNDATION’S CORPORATE EQUALITY INDEX (CEI)

AMERICA’S BEST EMPLOYERS 2017 & 2016 TOP 250 MID-SIZE FIRMS - FORBES

CORPORATE SOCIAL RESPONSIBILITY
4,700+ Hours of volunteer time and donations to 215+ non-profits
700+ Employee Resource Group members expanding cultural awareness
200+ Sponsored internal and external CSR events annually

OUR CLIENTS
HEALTHCARE 8 out of the top 10 hospital systems (by Member Hospital Beds)*
LIFE SCIENCES 36 of the top 50 pharmaceutical companies**
ENERGY 50 of the world’s largest electric and gas utilities
FINANCIAL SERVICES 8 Out of 10 of the largest U.S. banks

*Revenues over $500K in 2018

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NAVIGANT’S SUCCESS DRAWS FROM EXPERIENCED PROFESSIONAL ADVISORS WORLDWIDE

CLIENTS IN 43 COUNTRIES ON 6 CONTINENTS
4,300+ engagements from 60 offices in 2016
5,500+ employees

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

**EUROPE**
- Berlin
- Brussels
- Cologne
- London
- Utrecht

**MIDDLE EAST**
- Dubai
- Abu Dabi

**ASIA**
- Hong Kong
- Singapore
- Trivandrum, India
HOW NAVIGANT HELPS CLIENTS NAVIGATE THE ENERGY TRANSITION
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**Examples**

**Energy Transition Within 1.5°C**
Approach to a 100% Decarbonization of the Global Energy System by 2050

**Science Based Targets**
Helping large clients set concrete emission reduction targets.

**Translate COP21 Study**
2045 outlook and implications for offshore wind in the North Seas

**Urgency & Benefits**
International coordinated roll-out vs. a national incremental roll-out of offshore wind

**PMO support**
Supporting TenneT with the project management activities of the consortium

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**Report available from:**
www.navigant.com

**Information available from:**
www.navigant.com

**Report available from:**
www.northseawindpowerhub.eu

**Report is confidential**

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**Annual CO₂ Emissions (Gt CO₂)**

**Science Based Targets**

**Driving Ambitious Corporate Climate Action**

**North Sea Wind Power Hub**
THE NORTH SEA WIND POWER HUB PROJECT

Disclaimer: this presentation is by Navigant with permission from the NSPWH consortium. Navigant can only share publicly available information.
https://www.youtube.com/watch?v=x7dR39HctbY

Source: www.northseawindpowerhub.eu
The Paris agreement implies a radical change in the electricity generation mix for North Sea countries.

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

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\(^1\) **Translate COP21**: 2045 outlook and implications for offshore wind in the North Seas (Ecofys 2017)
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 COORDINATED ROLL-OUT

Business as usual

Internationally coordinated

Optimised system

National Incremental Roll-Out (NIRO)

International Coordinated Roll-Out (ICRO)

Hub and Spoke Vision

© NSWPH

© NSWPH

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THE NSWPH OFFERS A UNIQUE CONCEPT

- Internationally coordinated grid integration
- Enables decarbonization of end users
- Modular and adaptable to local conditions
- Flexibility through P2X conversion
- Offshore wind + Interconnection reduces cost
- Enabling large scale development and integration
- Use existing gas infrastructure
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.
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
Key results from the assessment phase will allow the consortium to narrow down on the options for P2G at scale with appropriate framework, P2G maturation and P2G onshore. The findings will also help in determining the modular hub size, wind resource, investment needs, foundation types, grid planning, secure grid integration, development time, and platform selection. On EU and national level, the milestones include development time, investment needs, and platform selection.
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 provide 16 million households with clean energy and reduce 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.
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

Source:
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)
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
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

HUYGEN VAN STEEN
Managing Consultant
+31 (0)6 1589 7842
Huygen.van.steen@Navigant.com

CHRISTEL PETERSEN
HR Business Partner
+31 (0)6 1438 3312
christel.petersen@navigant.com

See you on 16th May at the:

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navigant.com