

PROMOTiON

PROgress on Meshed HVDC Offshore Transmission Networks

About myself

- Niek de Groot
- Economic Adviser DC Interconnectors at TenneT TSO
- PROMOTioN Project WP1 Workpackage lead
- Dutch
- Background in Engineering

Email: Niek.de.Groot@TenneT.eu





CONTENT

- What?
- Why?
- How?
- Who?
- What brings us here today





What?

Objectives

- Identify **technical requirements** and investigate possible **topologies** for **meshed HVDC offshore grids**
- Develop **protection schemes** and **components** for HVDC grids
- Establish components' **interoperability and initiate standardisation**
- **Demonstrate cost-effective** offshore HVDC equipment
- Develop recommendations for a coherent EU and national **regulatory framework** for HVDC offshore grids
- Develop **recommendations for financing mechanisms** for offshore grid infrastructure deployment
- Develop a **deployment plan** for HVDC grid implementation

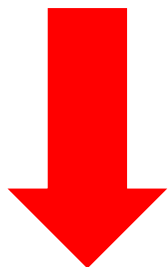




Why?

European Commission energy strategy

By 2030.....



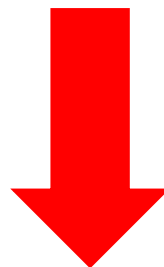
40%

cut in greenhouse
gas emissions
compared to
1990 levels



27%

share of
renewable energy
consumption



27%

energy savings
compared with
the business-as-
usual scenario

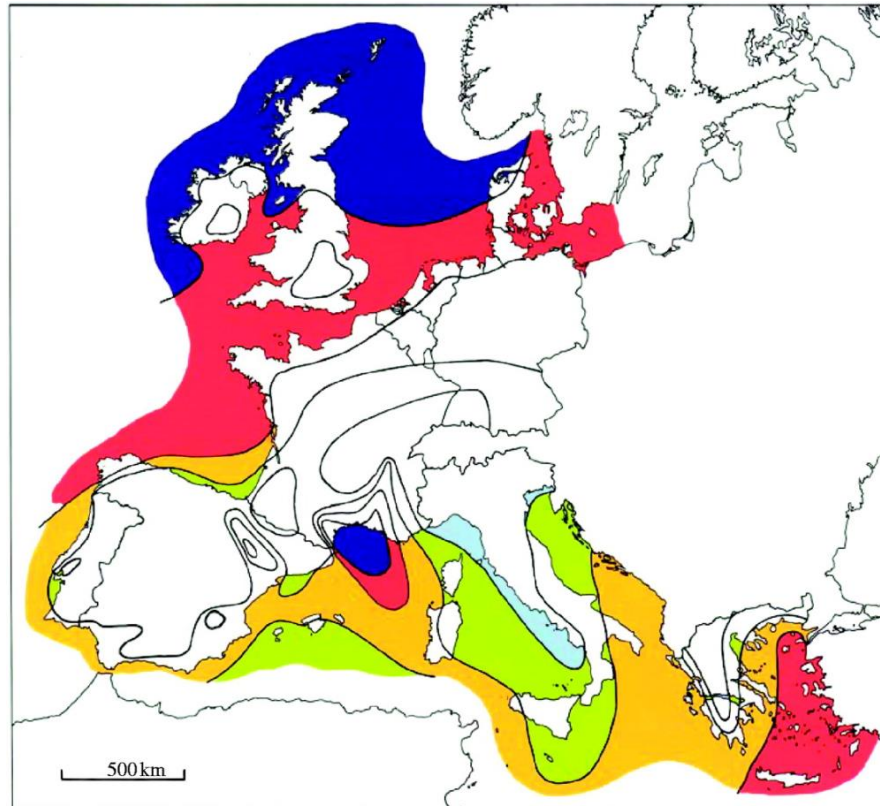


15%

electricity
interconnection
target



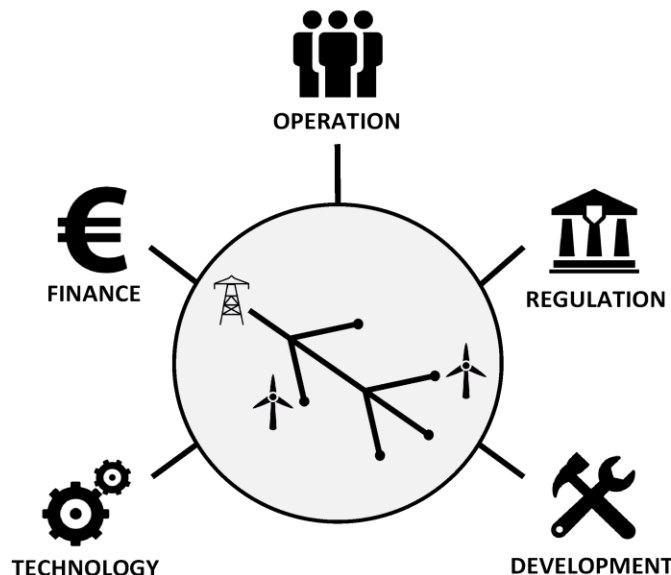
European offshore wind energy resources



wind resources over open sea (more than 10km offshore) for five standard heights										
	10m		25m		50m		100m		200m	
	ms ⁻¹	W m ⁻²	ms ⁻¹	W m ⁻²	ms ⁻¹	W m ⁻²	ms ⁻¹	W m ⁻²	ms ⁻¹	W m ⁻²
	>8.0	>600	>8.5	>700	>9.0	>800	>10.0	>1100	>11.0	>1500
	7.0–8.0	350–600	7.5–8.5	450–700	8.0–9.0	600–800	8.5–10.0	650–1100	9.5–11.0	900–1500
	6.0–7.0	250–300	6.5–7.5	300–450	7.0–8.0	400–600	7.5–8.5	450–650	8.0–9.5	600–900
	4.5–6.0	100–250	5.0–6.5	150–300	5.5–7.0	200–400	6.0–7.5	250–450	6.5–8.0	300–600
	<4.5	<100	<5.0	<150	<5.5	<200	<6.0	<250	<6.5	<300

Challenges for deployment of meshed offshore HVDC grid

- Cost effective and reliable converter technology
- Grid protection systems
- Financial framework for infrastructure development
- Regulation for deployment and operation
- Agreement between manufacturers, developers and operators of the grid



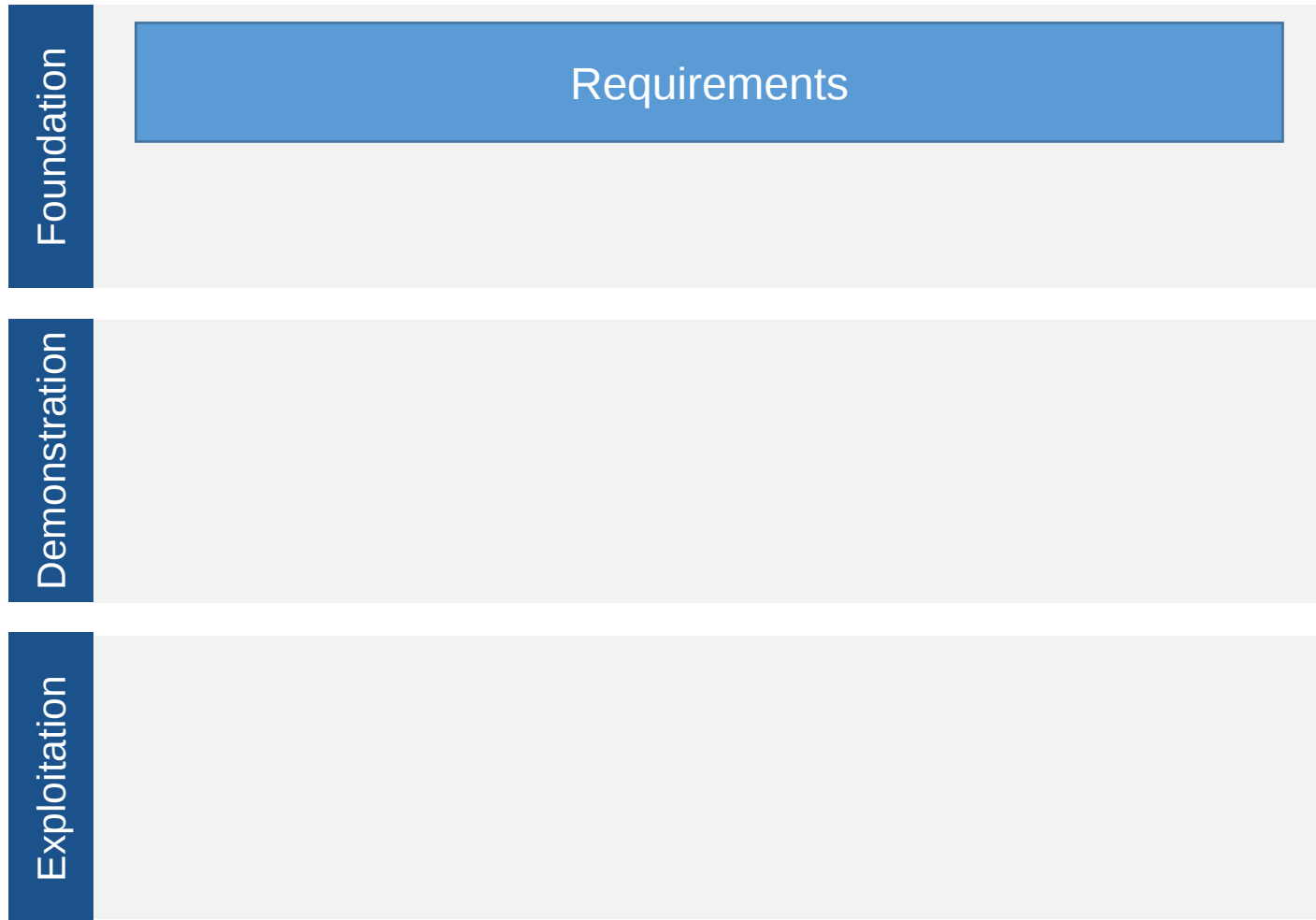


HOW?

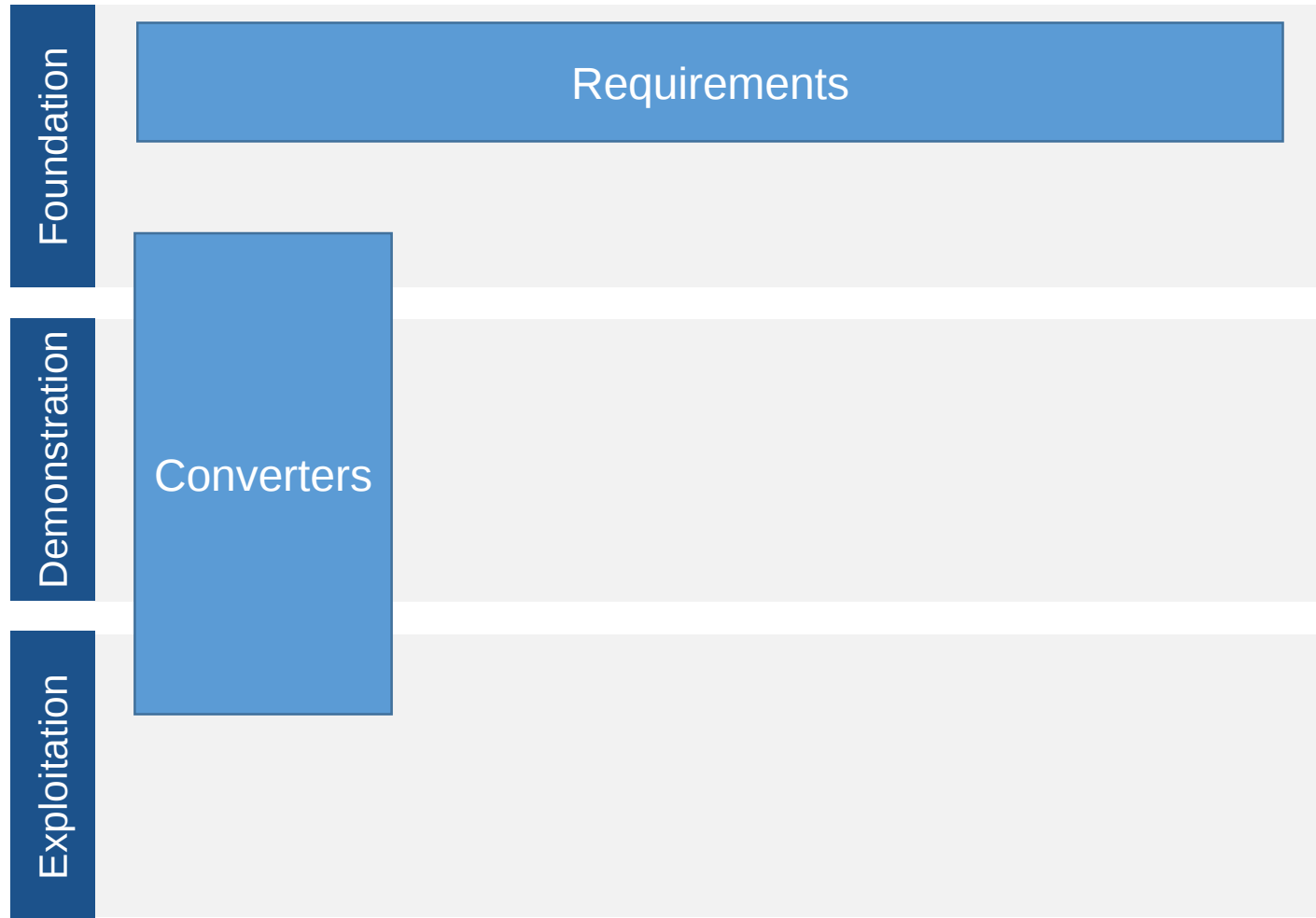
Project Structure



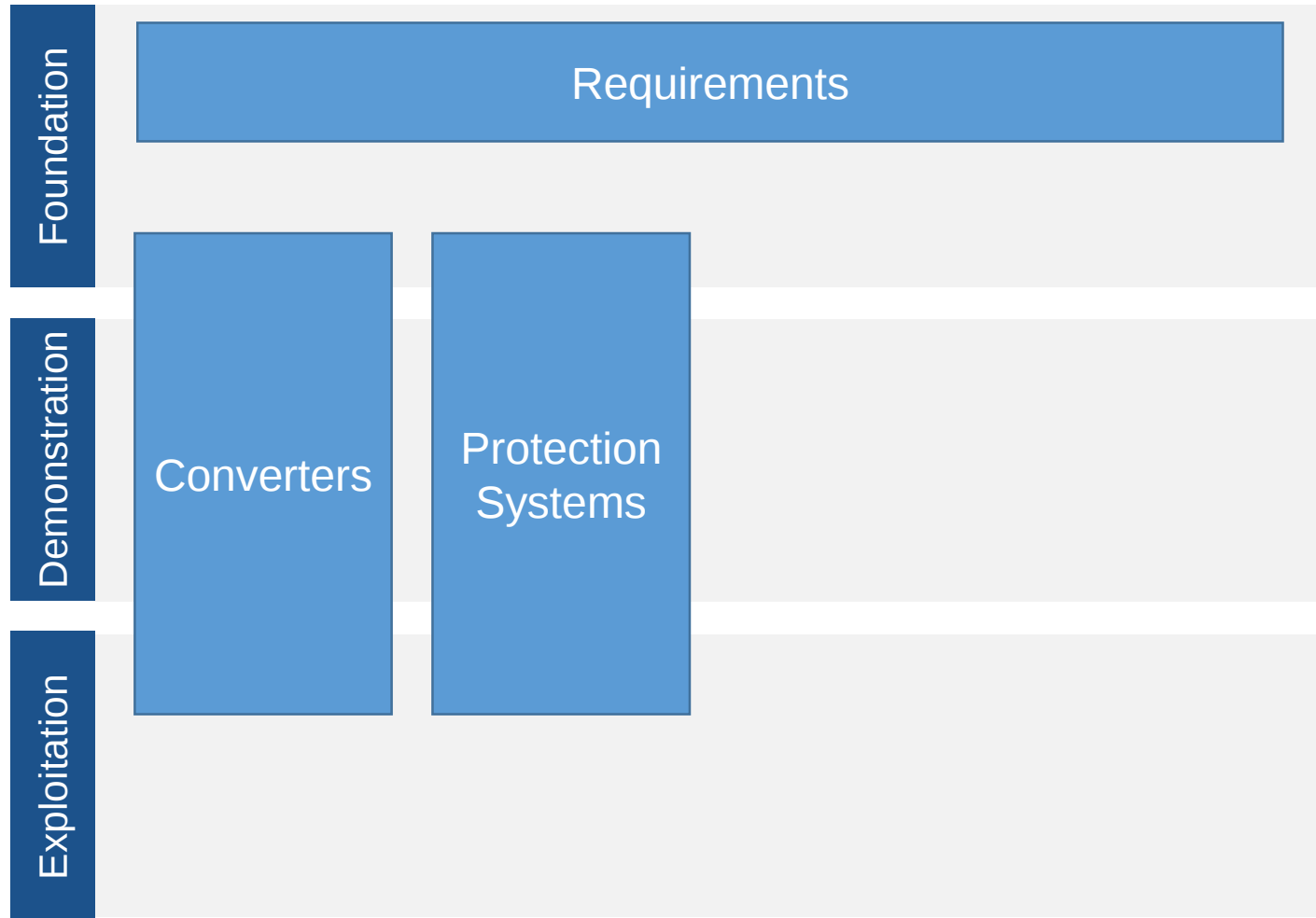
Project Structure - Requirements



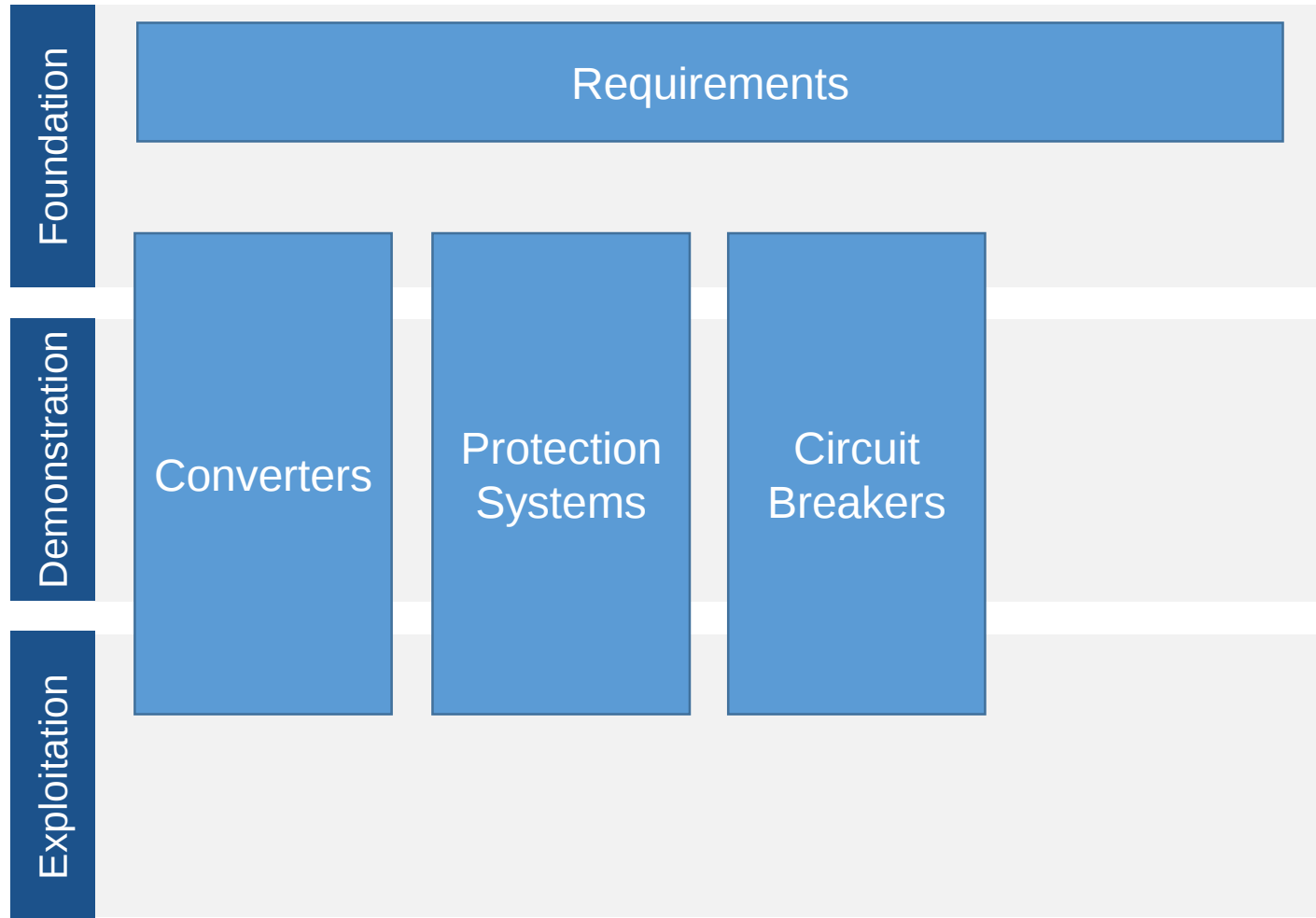
Project Structure - Converters



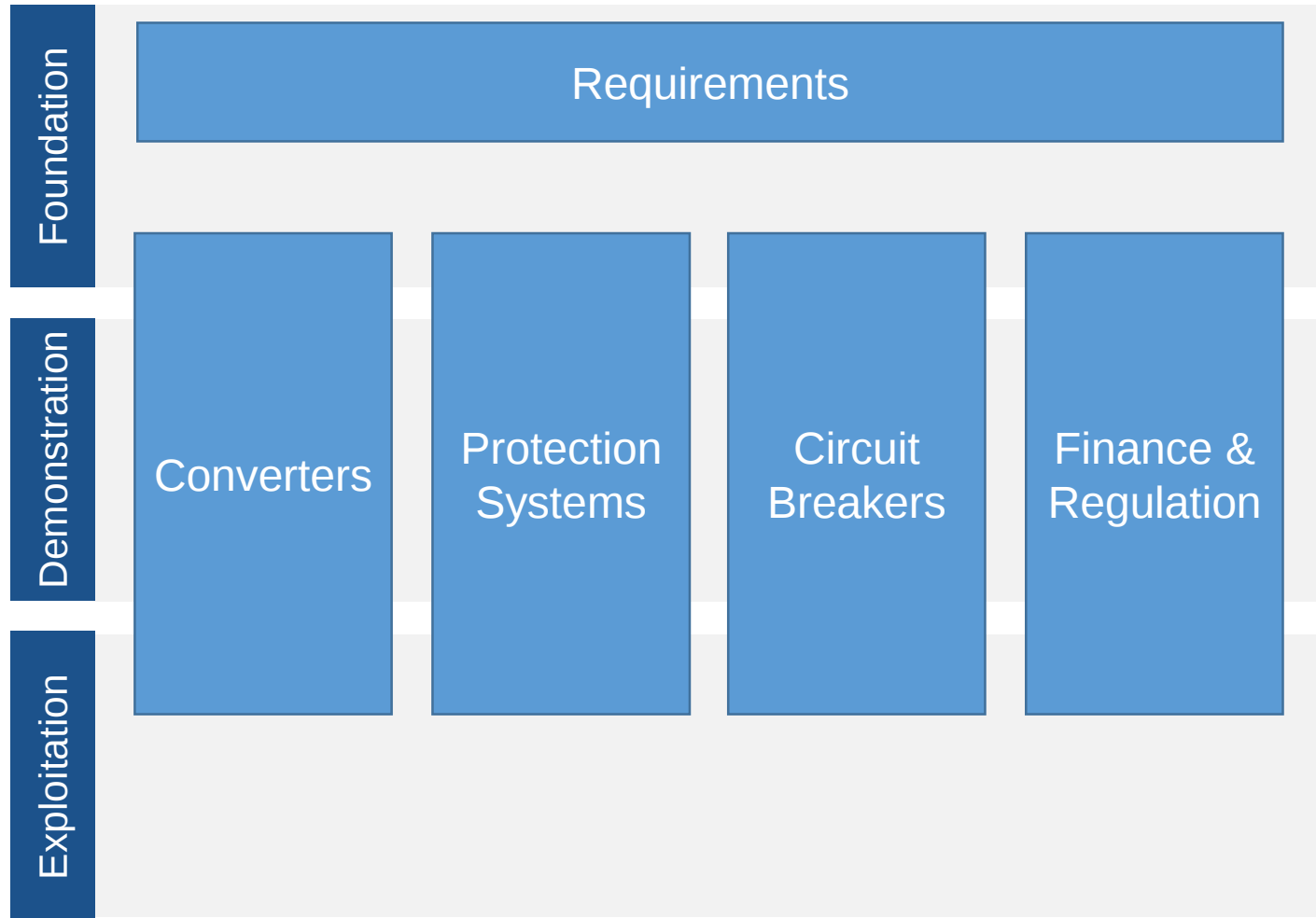
Project Structure – Protection Systems



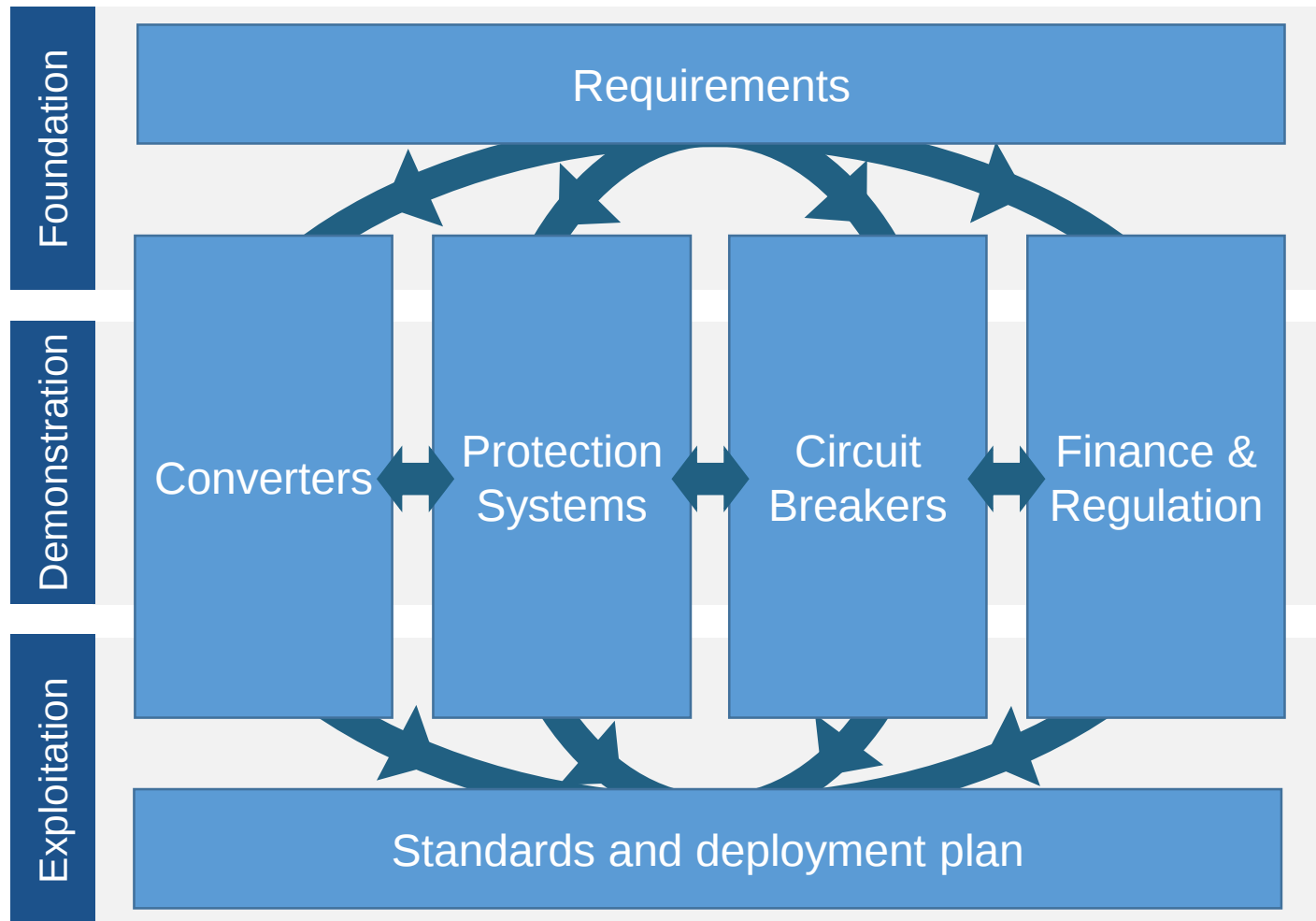
Project Structure – Circuit Breakers



Project Structure – Finance & Regulation

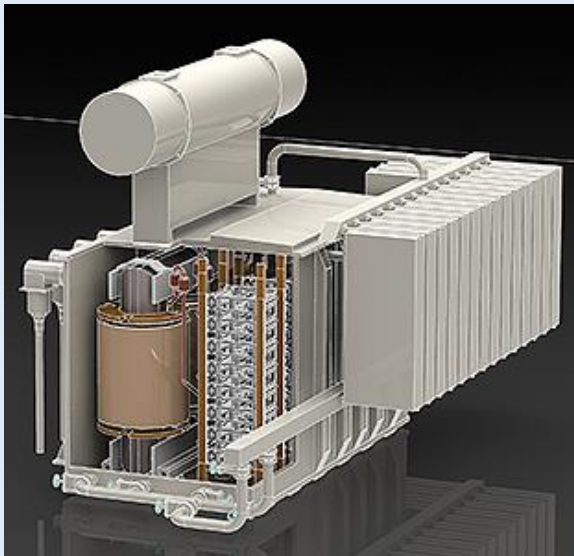


Project Structure – Standards & Deployment plan



Large scale demonstrators

Diode Rectifier



Wind park in Denmark

HVDC Grid Protection



The National HVDC centre

HVDC Circuit Breaker testing

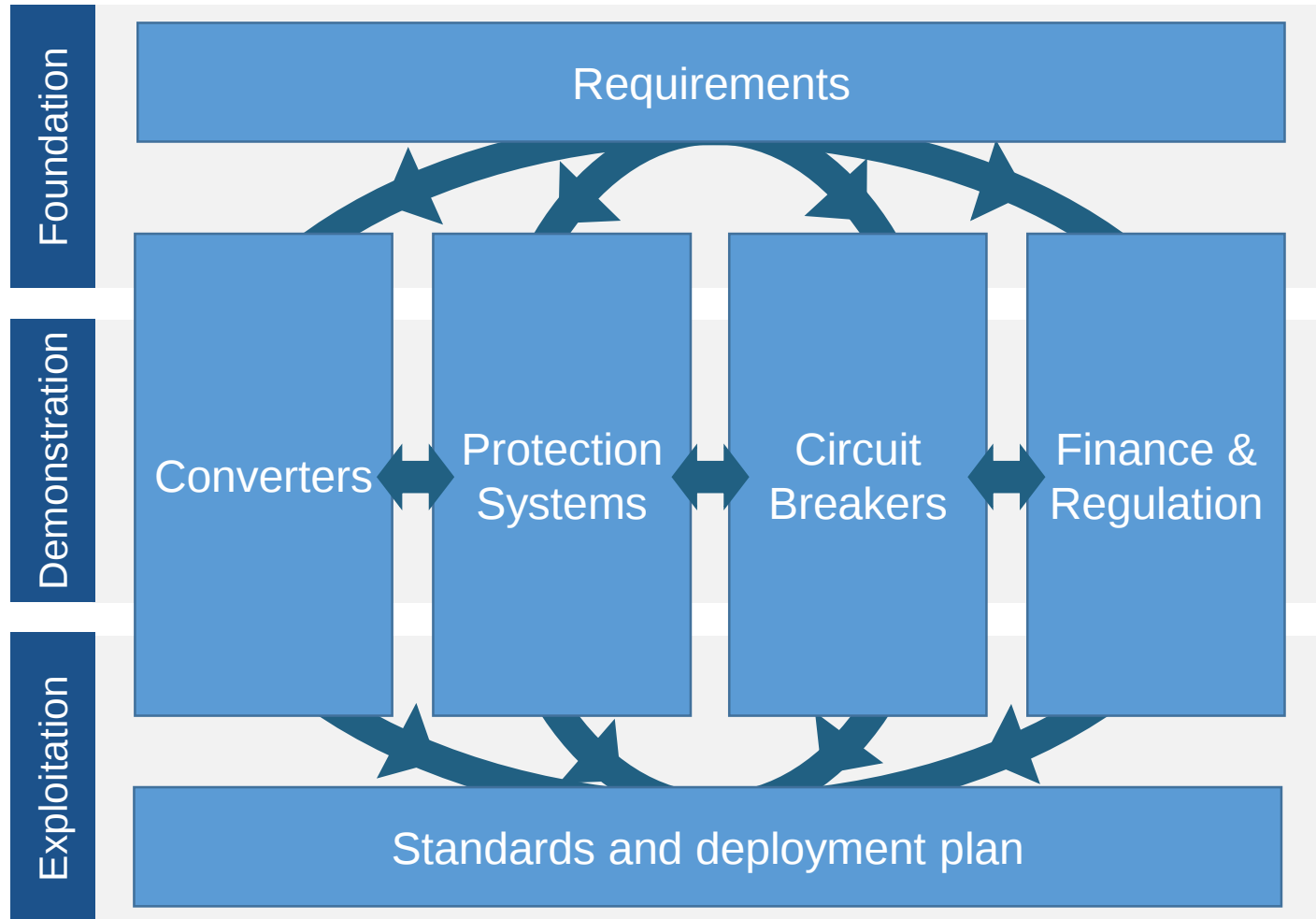


KEMA laboratories



What brings us here today

Project Structure



WorkPackage 1 – Requirements for meshed offshore grids

Task 1.1

- Requirements, Reference scenarios and Fundamental topologies

Task 1.2

- Collect knowledge from literature

Task 1.3

- **Collect knowledge from projects**

Task 1.4

- Design Initial roadmap

Task 1.5

- Review requirements Task 1.

Goals of today

- Collecting existing knowledge regarding HVDC grids, offshore grids and meshed grids
- Increasing awareness of the PROMOTioN project
- Disseminating data collected from the questionnaire
- creating link between PROMOTioN and other H2020 Projects

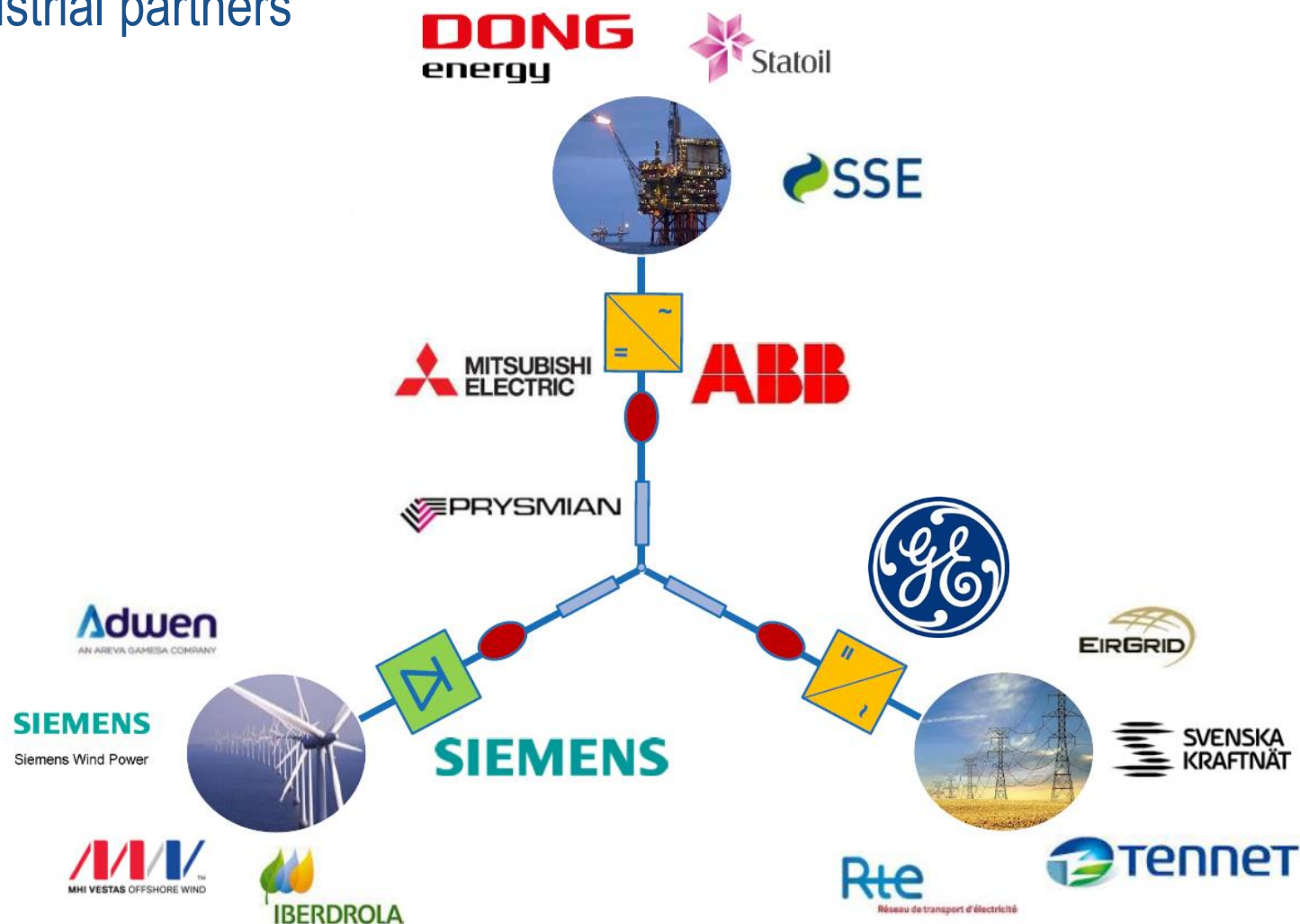




Who?

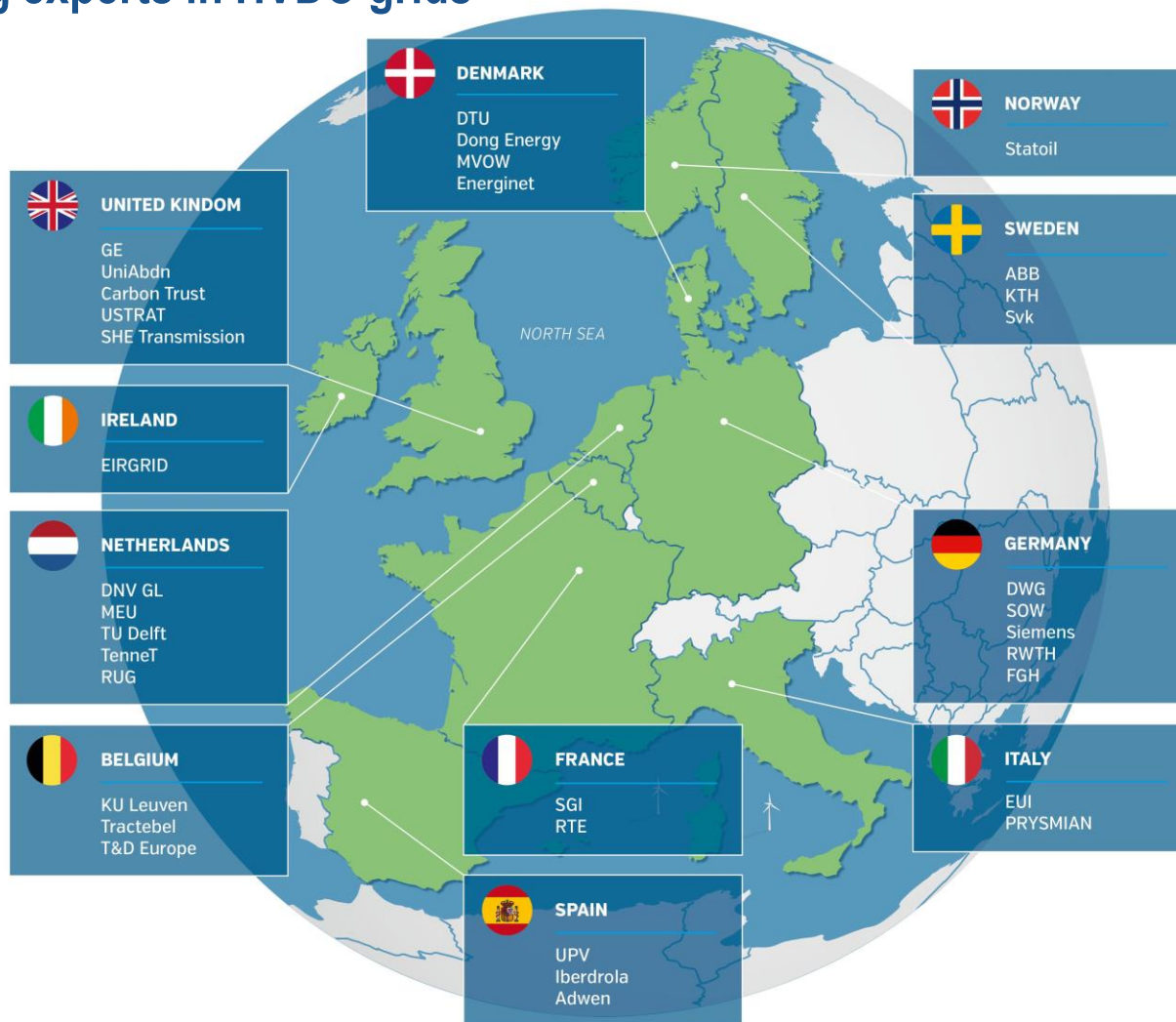
Offshore Energy Value Chain

industrial partners



European Partners

34 leading experts in HVDC grids





**BEYOND THE INBOX.
GET UPDATED WITH OUR NEWSLETTER!**

Signup for newsletter

www.promotion-offshore.net/newsletter



Thank you!

Any questions?



© PROMOTioN – Progress on Meshed HVDC Offshore Transmission Networks

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 691714.

APPENDIX

DISCLAIMER & PARTNERS

COPYRIGHT

PROMOTioN – Progress on Meshed HVDC Offshore Transmission Networks

MAIL info@promotion-offshore.net WEB www.promotion-offshore.net

The opinions in this presentation are those of the author and do not commit in any way the European Commission

PROJECT COORDINATOR

DNV GL, Kema Nederland BV
Utrechtseweg 310, 6812 AR Arnhem, The Netherlands
Tel +31 26 3 56 9111
Web www.dnvgl.com/energy

CONTACT

Cornelis Plet
DNV GL Energy
cornelis.plet@dnvgl.com
promotion@dnvgl.com
+31 26 356 2370

PARTNERS

Kema Nederland BV, ABB AB, KU Leuven, KTH Royal Institute of Technology, EirGrid plc, SuperGrid Institute, Deutsche WindGuard GmbH, Mitsubishi Electric Europe B.V., Affärsverket Svenska kraftnät, Alstom Grid UK Ltd (Trading as GE Grid Solutions), University of Aberdeen, Réseau de Transport d'Électricité, Technische Universiteit Delft, Statoil ASA, TenneT TSO B.V., German OFFSHORE WIND ENERGY Foundation, Siemens AG, Danmarks Tekniske Universitet, Rheinisch-Westfälische Technische Hochschule Aachen, Universitat Politècnica de València, Forschungsgemeinschaft für Elektrische Anlagen und Stromwirtschaft e.V., Dong Energy Wind Power A/S, The Carbon Trust, Tractebel Engineering S.A., European University Institute, Iberdrola Renovables Energía, S.A., European Association of the Electricity Transmission & Distribution Equipment and Services Industry, University of Strathclyde, ADWEN Offshore, S.L., Prysmian, Rijksuniversiteit Groningen, MHI Vestas Offshore Wind AS, Energinet.dk, Scottish Hydro Electric Transmission plc



Backup slides



© PROMOTion – Progress on Meshed HVDC Offshore Transmission Networks

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 691714.

Political Context

Political Declaration on energy cooperation between the North Seas Countries

- Aim: Create good conditions for offshore wind energy to ensure sustainable, secure and affordable energy supply in the North Seas Countries

Regional cooperation in the energy Union – MEP manifesto

- Increase of regional cooperation as a way to realize the full potential of the Northern Seas energy system
- Large scale deployment of offshore wind farms and completion of a meshed electricity grid

Projects of common interest

- Help deliver Europe's energy and climate objectives and form key building blocks of the EU energy union.



ENTSO-E vision 2030 for the North Sea

