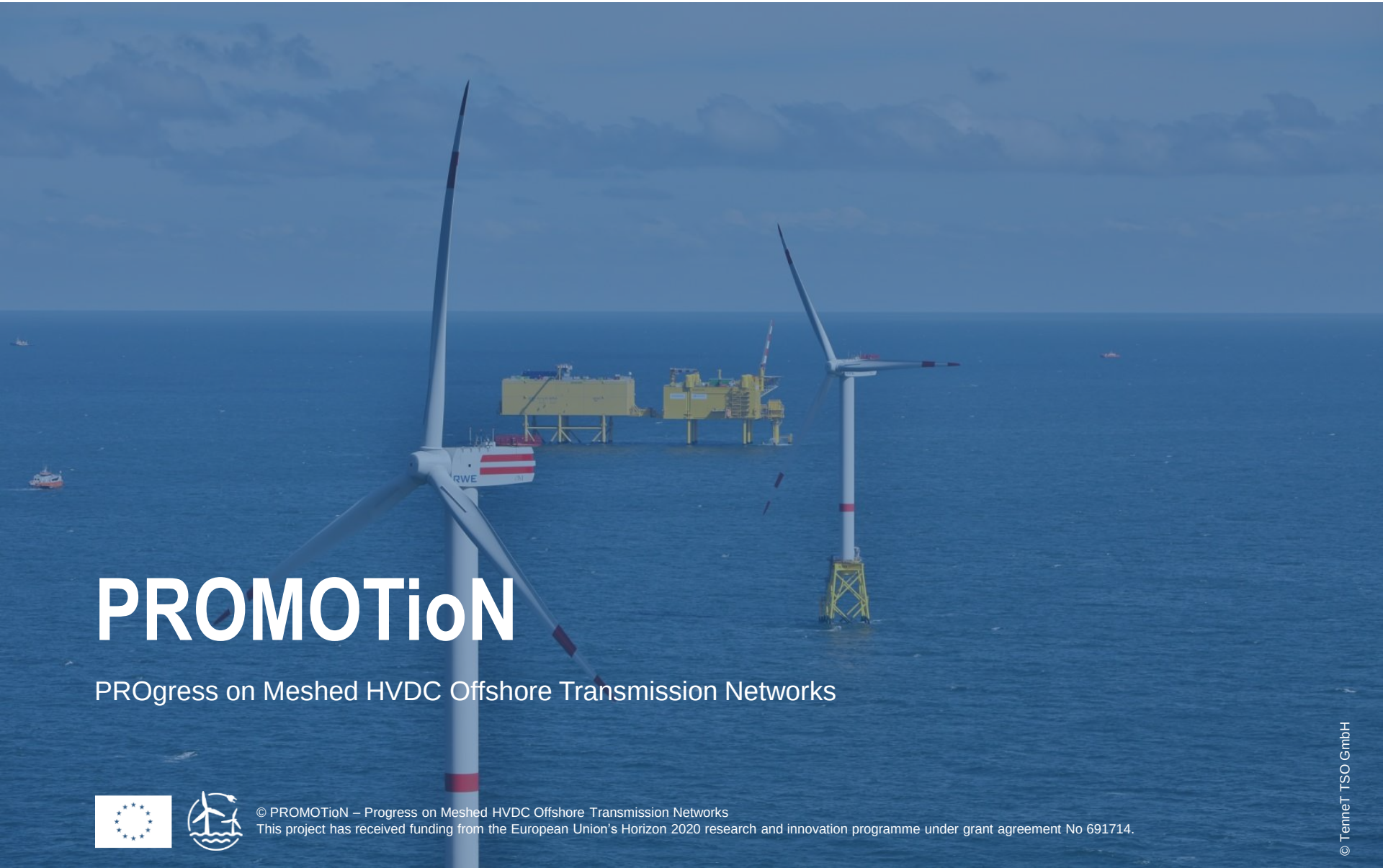
PROMOTioN
PROGRESS ON MESHED HVDC OFFSHORE TRANSMISSION NETWORKS



PROMOTioN

PROgress on Meshed HVDC Offshore Transmission Networks

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The Project

The Facts

- EU funding programme **Horizon2020**
- Project duration: **4 years** (01/2016 – 12/2019)
- **34 partners** from **11 countries**
- Project coordinator: **DNV GL**
- Largest **funded research project** of the EU within ‚Energy' sector
- Total budget approx. **51 mio. Euro**

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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

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The Background

European Commission energy strategy

By 2030…..

40%
cut in greenhouse gas emissions compared to 1990 levels

27%
share of renewable energy consumption

30%
energy savings compared with the business-as-usual scenario

15%
electricity interconnection target

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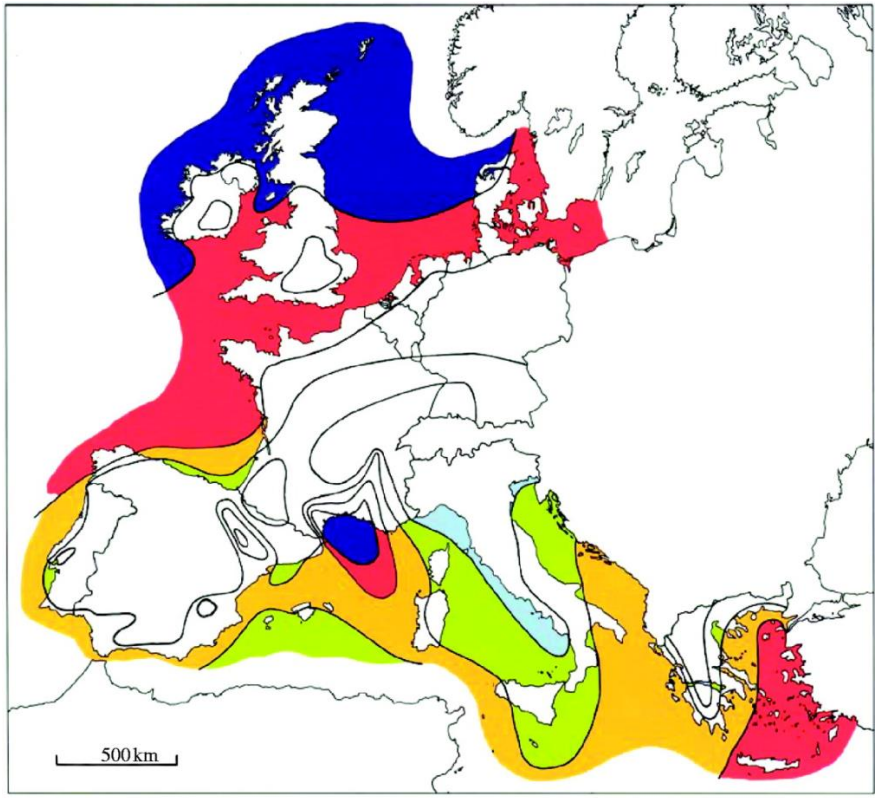
European offshore wind energy resources



wind resources over open sea (more than 10 km offshore) for five standard heights

	10m		25m		50m		100m		200m	
	$m s^{-1}$	$W m^{-2}$	$m s^{-1}$	$W m^{-2}$	$m s^{-1}$	$W m^{-2}$	$m s^{-1}$	$W m^{-2}$	$m s^{-1}$	$W m^{-2}$
	>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

Source: Petersen, E. L. (1993). Wind resources part I: The European wind climatology. In A. D. Garrad, W. Palz, & S. Scheller (Eds.), 1993 European Community wind energy conference. Proceedings. (pp. 663-668). Bedford: H.S. Stephens and Associates.

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Political context [I]

MEP Manifesto for regional cooperation (January 2016)

- Signed by **20 Members** of the European Parliament from **9 Member states**
- Builds upon existing structures (NSCOGI)
- **Promotes the** large scale development of offshore windenergy and the **implementation of a meshed offshore grid** in a 7-stage-action plan

*"We believe that the progressive, large-scale, deployment of offshore wind farms and emerging marine renewables, along with the completion of **a meshed electricity grid**, **should be the backbone** of Northern Seas regional cooperation."*

(Regional cooperation in the Energy Union – Northern Seas as the power house of North-Western Europe; A Manifesto by 20 Members of the European Parliament – January 2016)

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Political context [II]

Political declaration for cooperation within the energy sector from 6 June 2016

Objective: Countries bordering the North Seas want to **improve the conditions for offshore wind energy** and achieve a secure and cost-efficient energy supply

‚Northern Seas Energy Cooperation‘

1. Maritime spatial planning
2. **Development and regulation of offshore grids** and other offshore infrastructure
3. Support framework and finance for offshore wind projects
4. Standards, technical rules and regulation of the offshore wind sector

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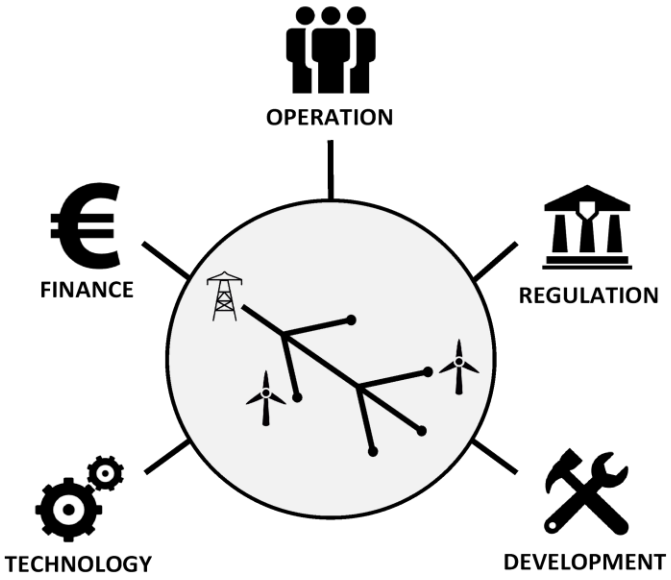
Challenges for deployment of meshed offshore HVDC grid

- 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



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The Structure

Project Structure

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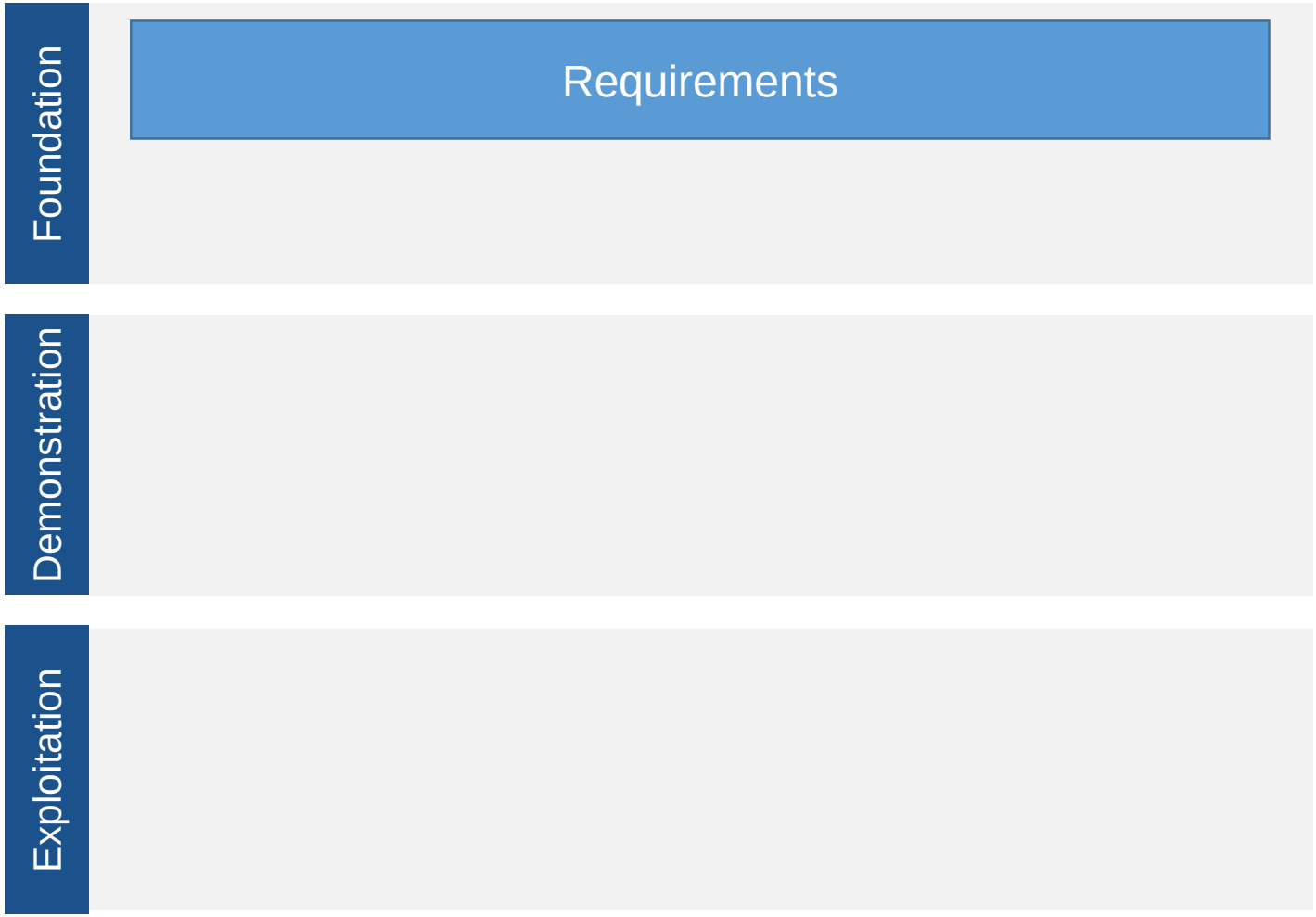
Project Structure - Requirements



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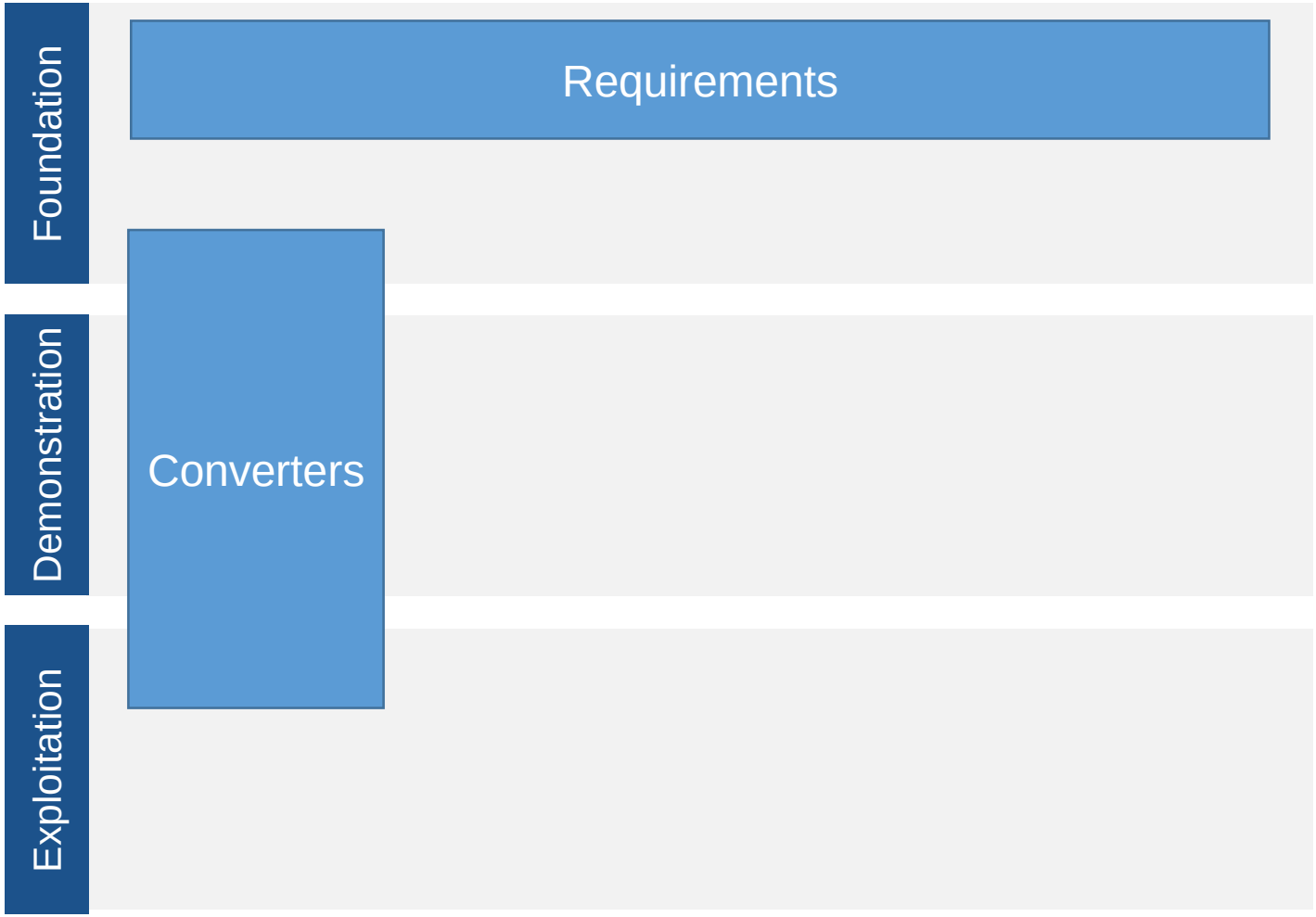
Project Structure - Converters



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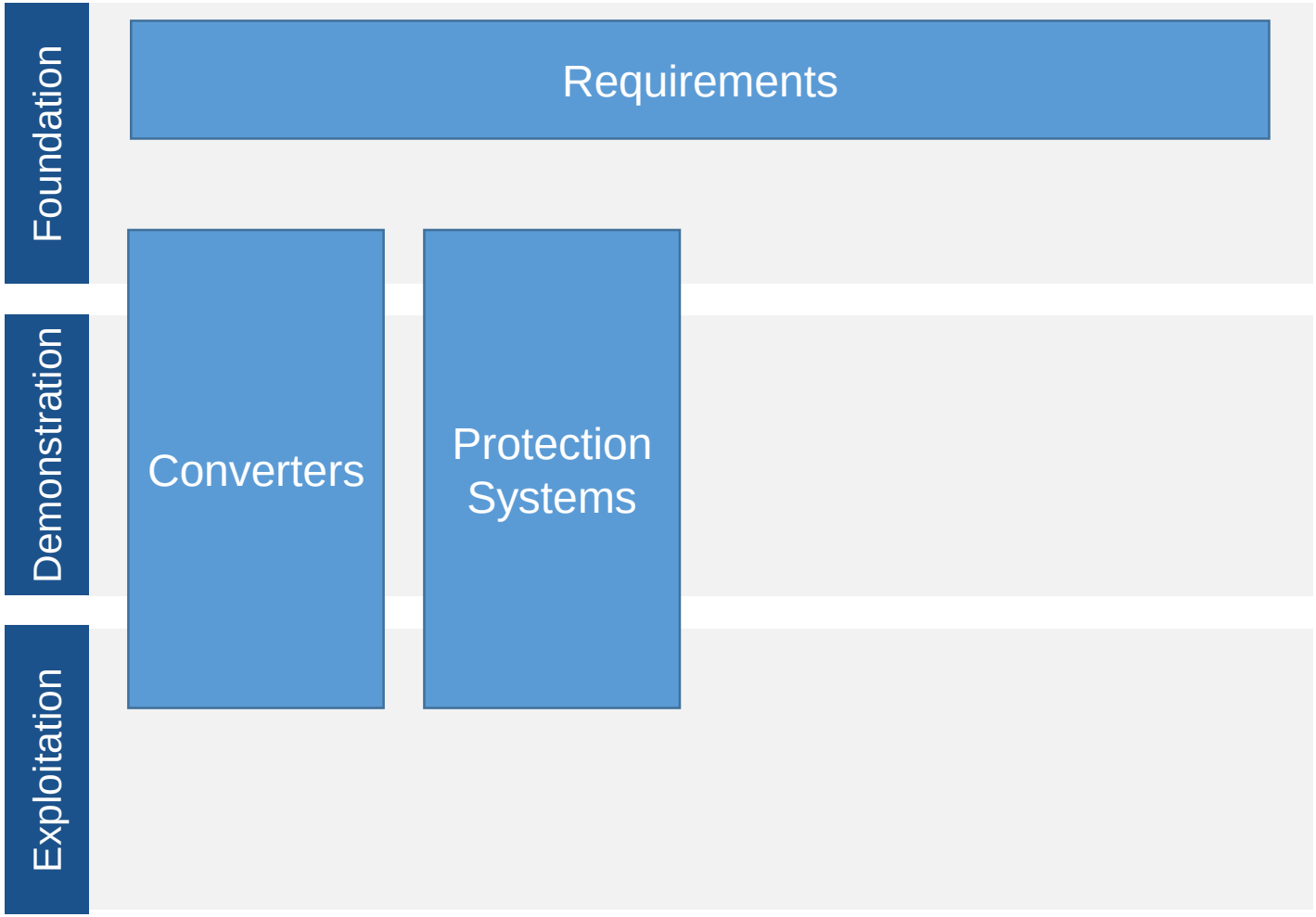
Project Structure – Protection Systems



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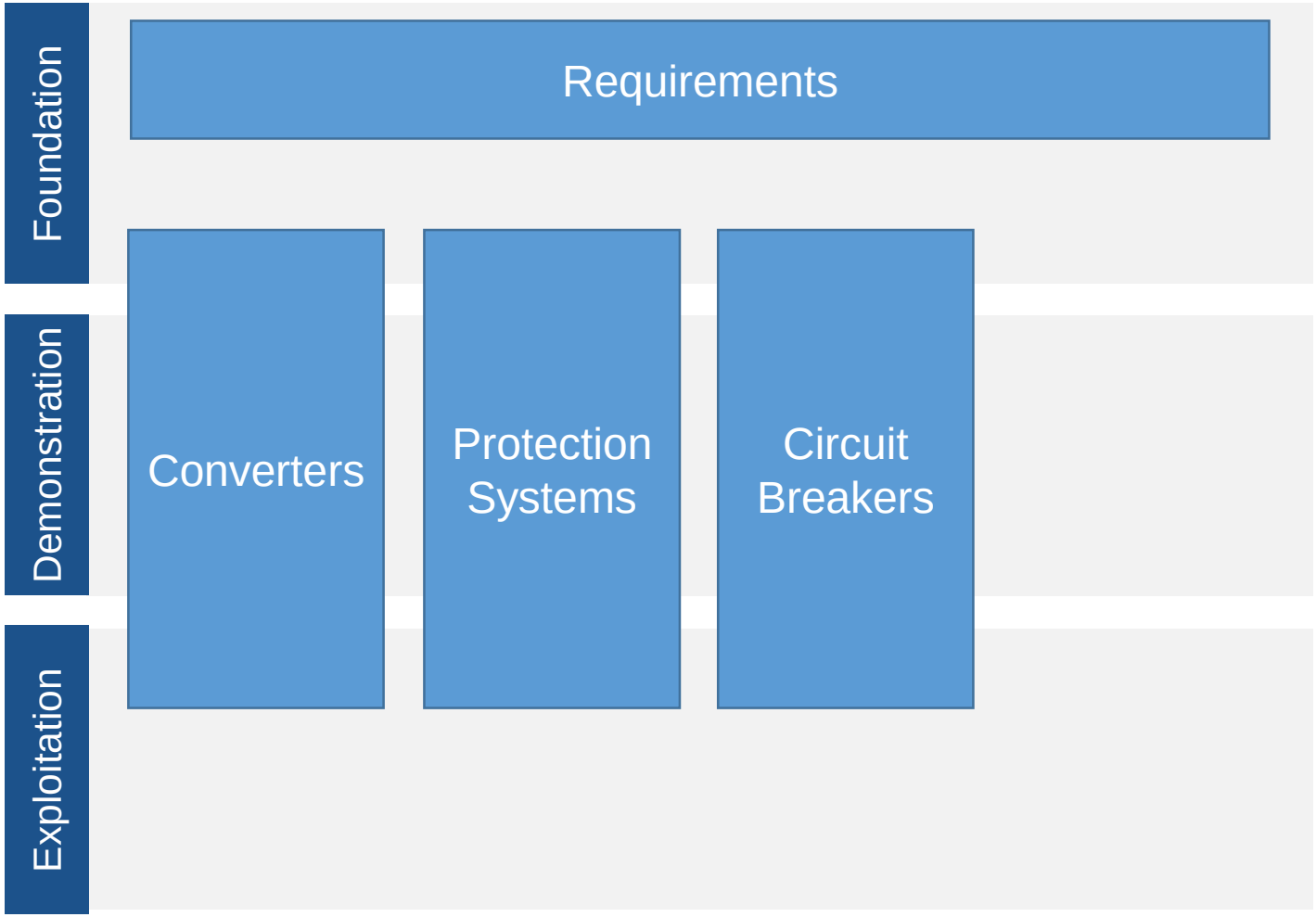
Project Structure – Circuit Breakers



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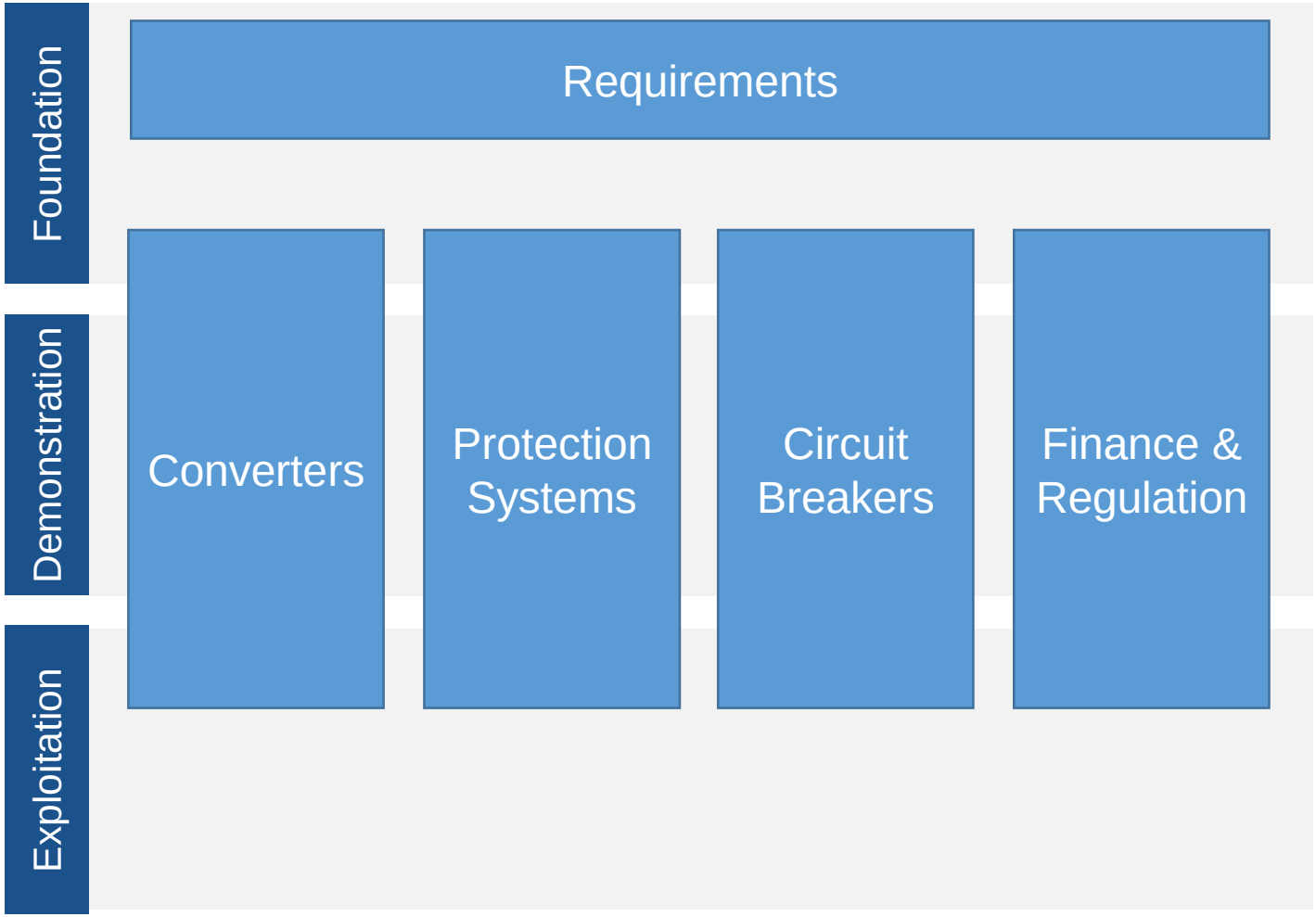
Project Structure – Finance & Regulation



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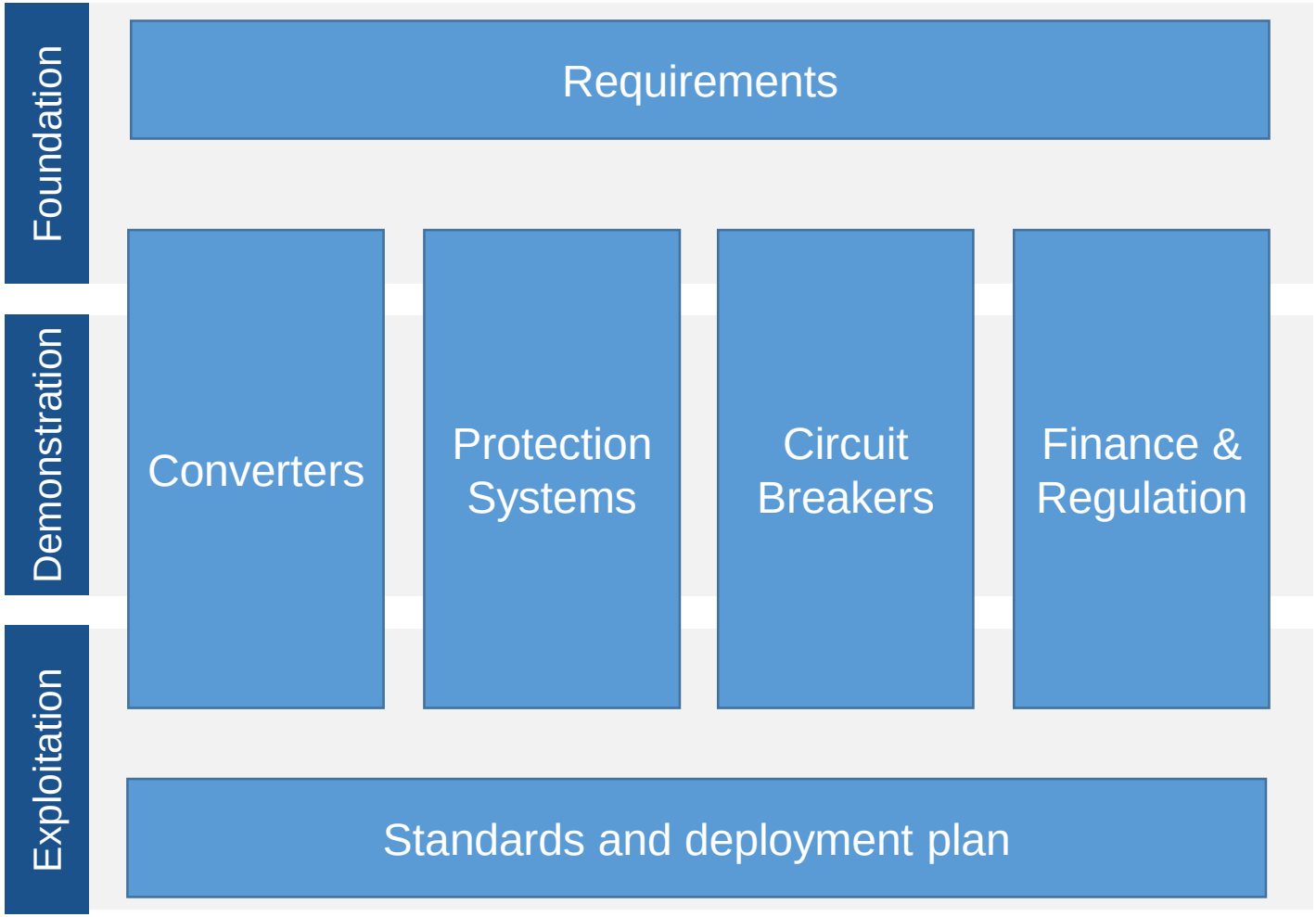
Project Structure – Standards & Deployment plan



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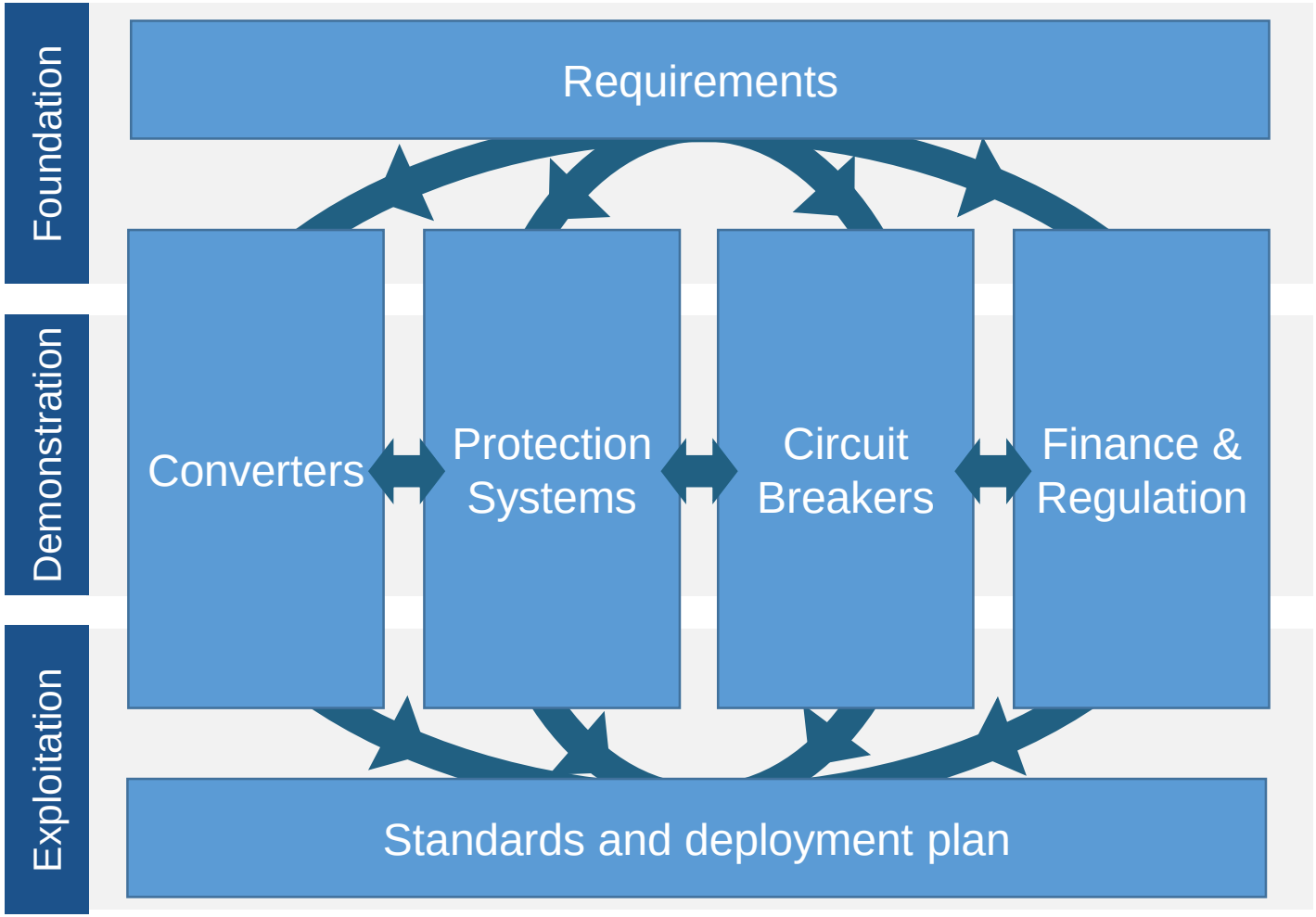
Project Structure – Coordination & dissemination



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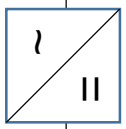
Who?

PROMOTioN – Integrated Plaza, Hannover Fair, 24 April 2017



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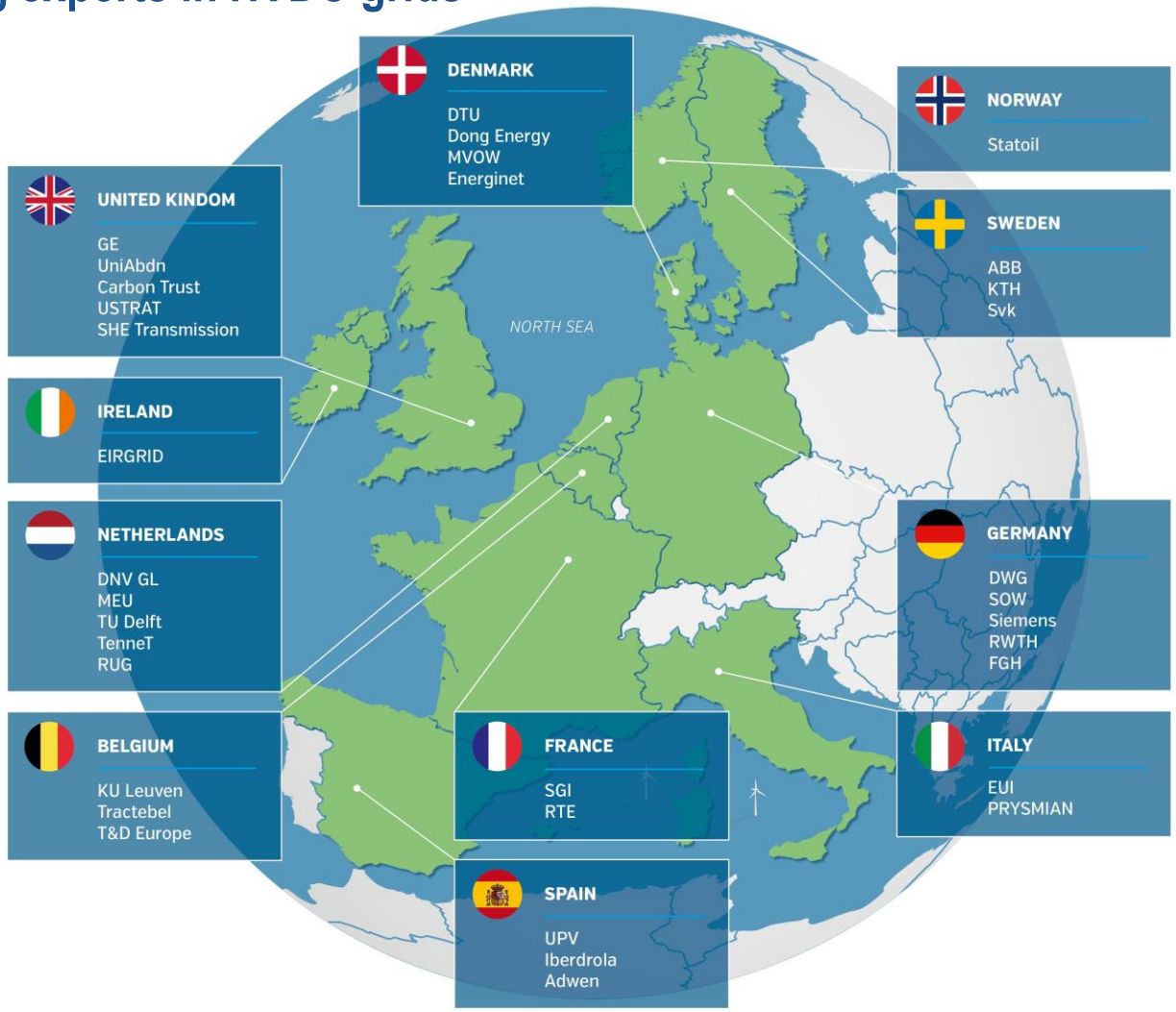
European Partners

34 leading experts in HVDC grids



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Current project developments

- **Publication** on **regulatory** and **technical topics** until June 2017, amongst others:
  - Deliverable „**Draft Roadmap for meshed HVDC offshore grids**“
  - Deliverables on **Financing and Regulation** (legal, economic and financial barriers)
  - HVDC circuit breaker **test circuits** and **protection schemes**
- PROMOTioN @ **Offshore Wind Energy London 2017**
  - **7 June 2017, ICC Capital Suite, Room 16 – ExCel**

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Thank you for your attention!

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APPENDIX

DISCLAIMER & PARTNERS

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