
OFFSHORE WIND
FUEL FOR A NEW OFFSHORE INDUSTRY
INPUT FROM ENERGY TRANSITION OUTLOOK 2017
Ditlev Engel
DNV GL - Energy

Industry consolidation

DNV

GL Group

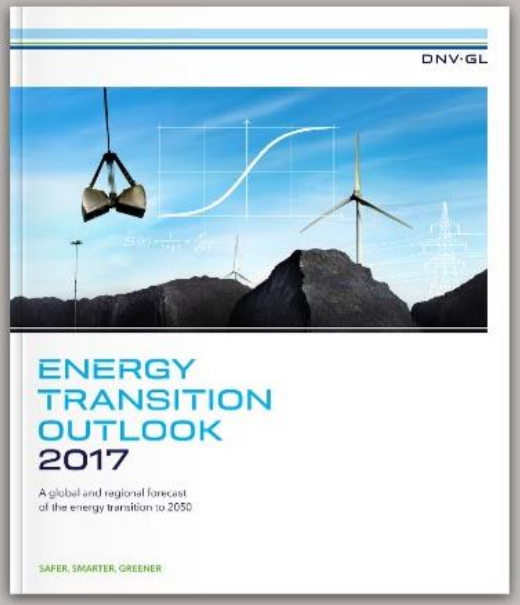
KEMA

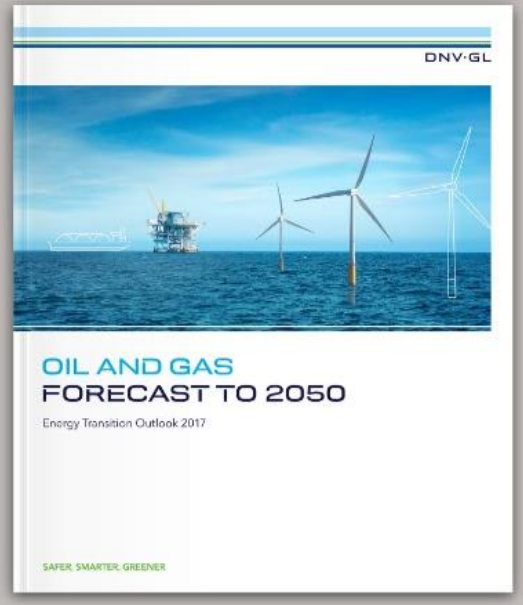
NOBLE DENTON

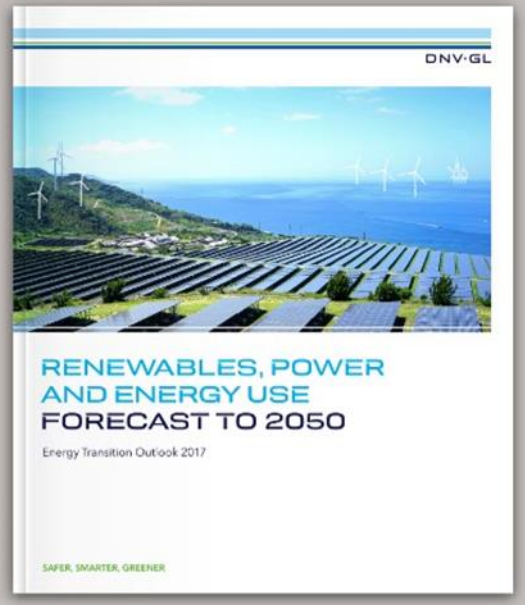
GARRAD HASSAN

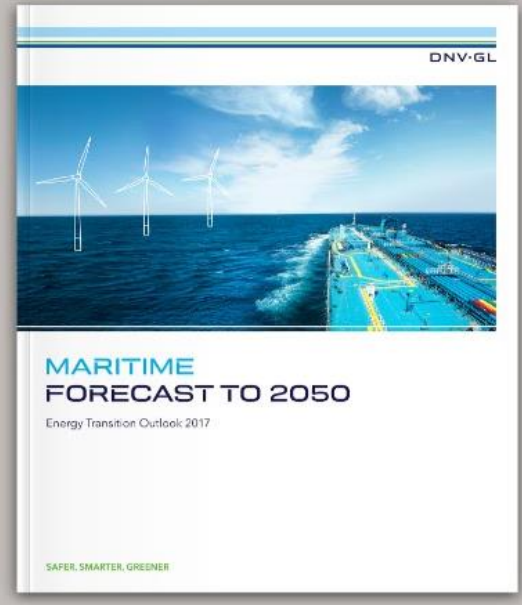
ADVANTICA

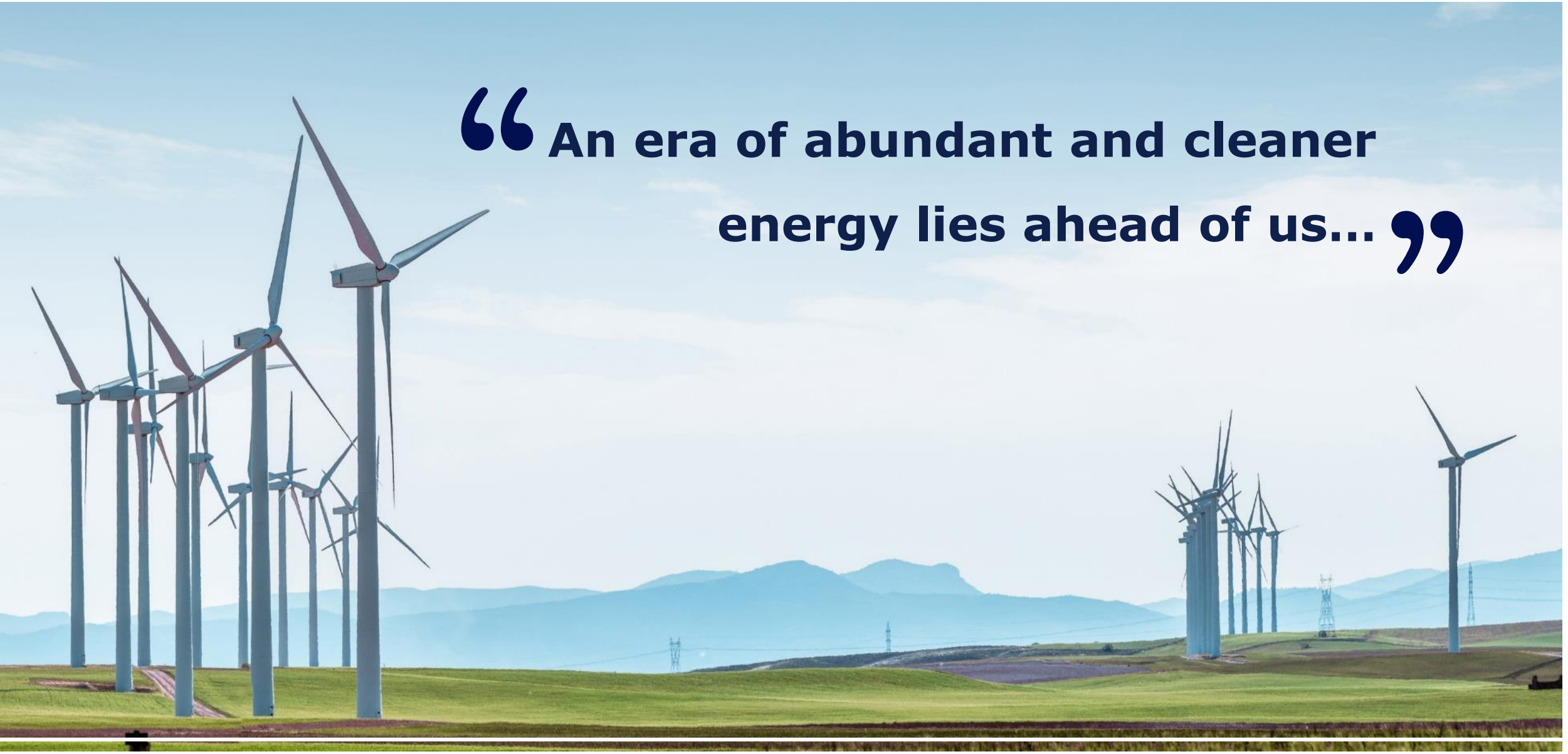
DNV GL's Energy Transition Outlook 2017

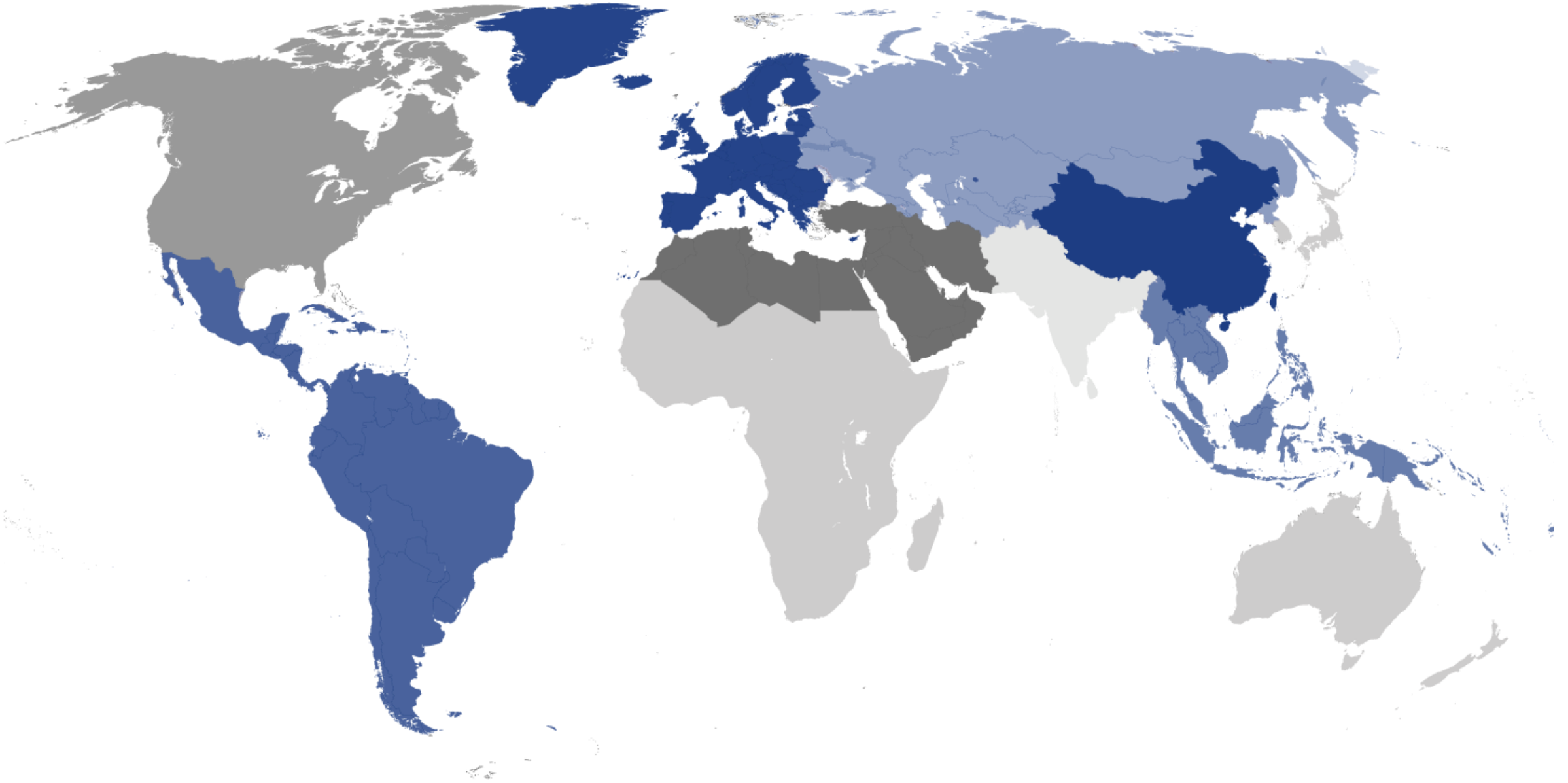


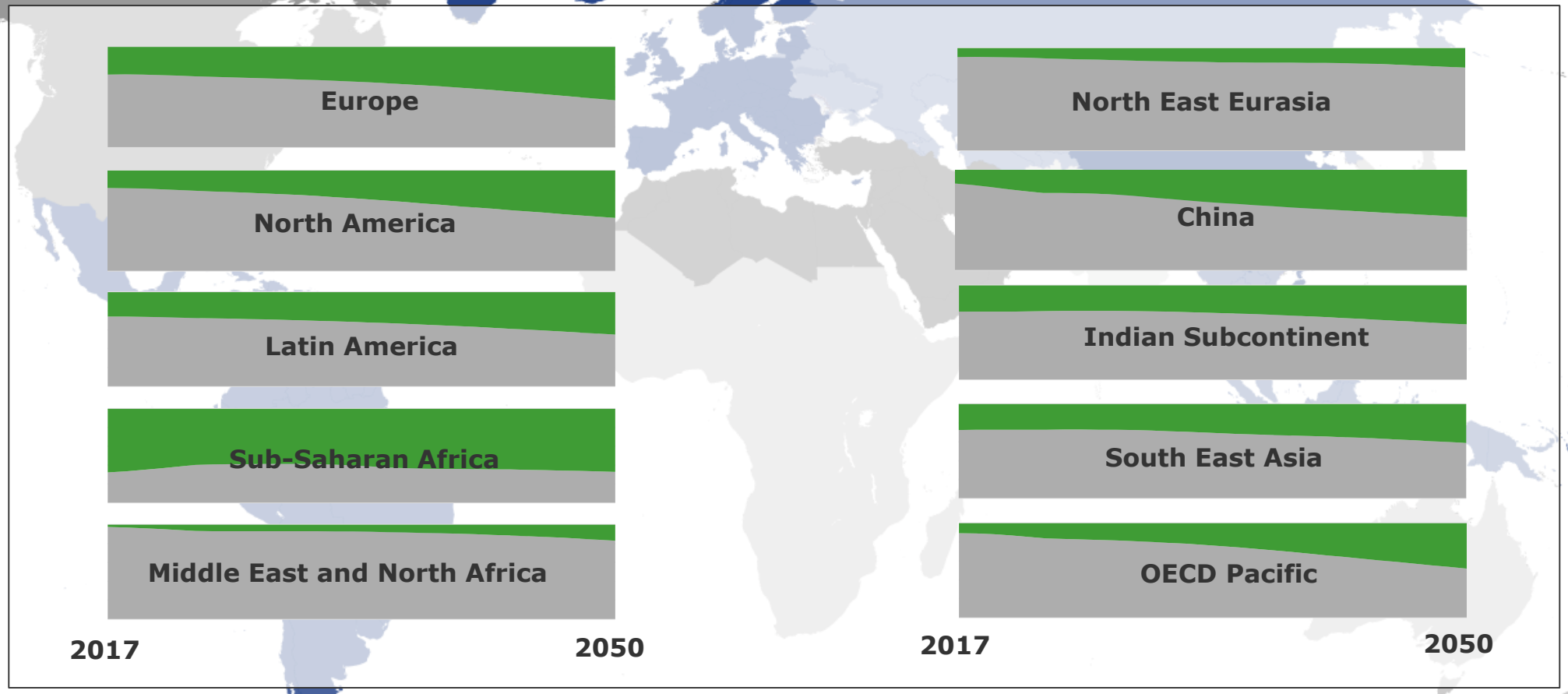




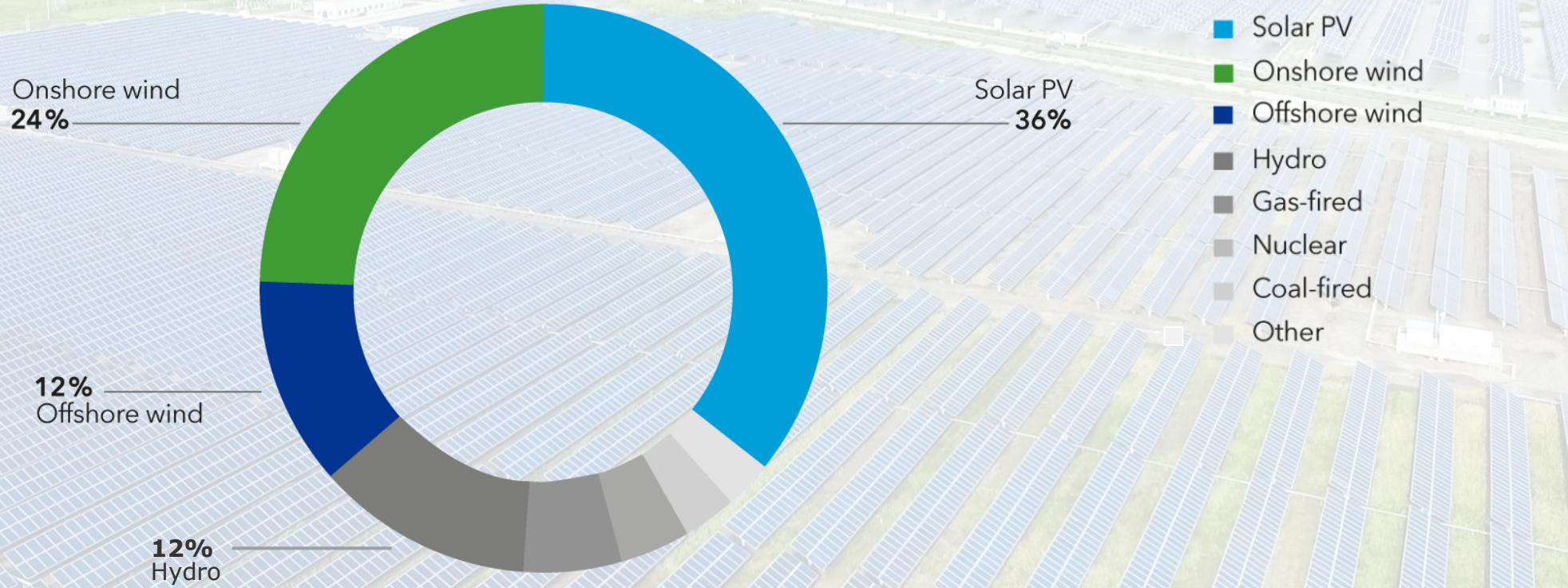




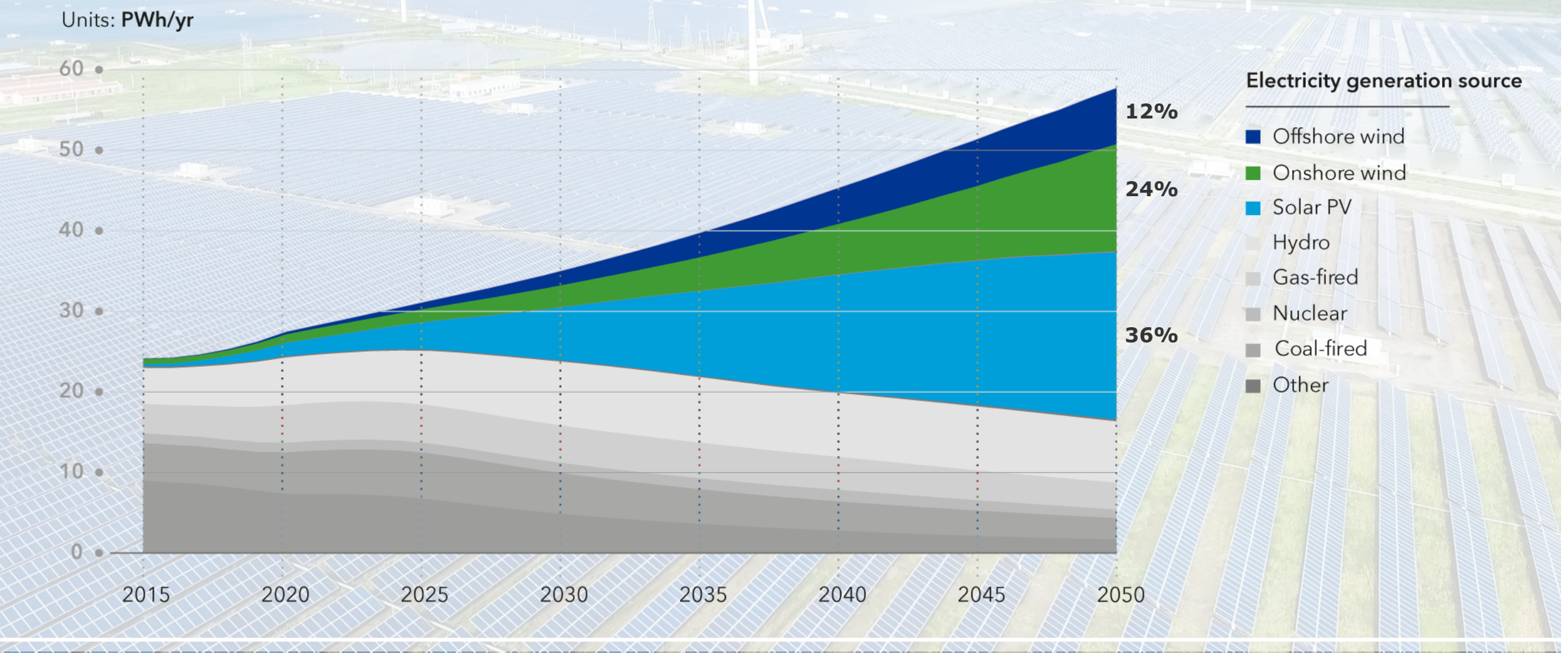



Europe
North America
Latin America
Sub-Saharan Africa
Middle East and North Africa
2017
2050
North East Eurasia
China
Indian Subcontinent
South East Asia
OECD Pacific
2017
2050
Non-fossil
Fossil

Global electricity production in 2050

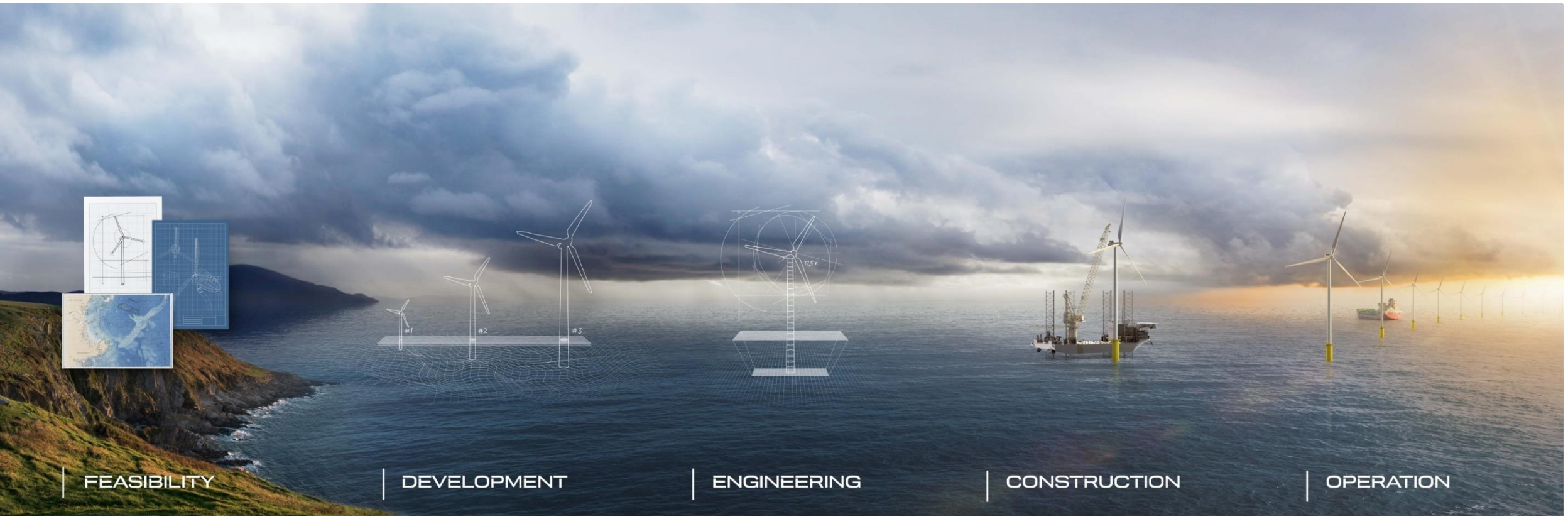


Growth of Solar PV and wind by 2050

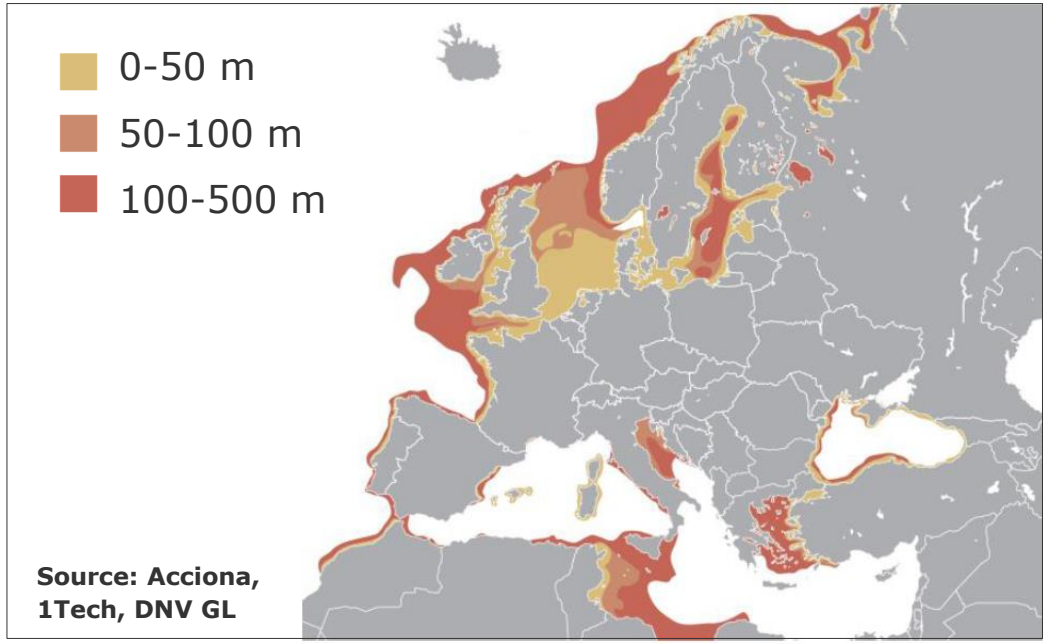



Rapid growth
Cost no longer significant constraint
Continued technology developments
Intelligent management of turbines
Learnings from analysis and experience

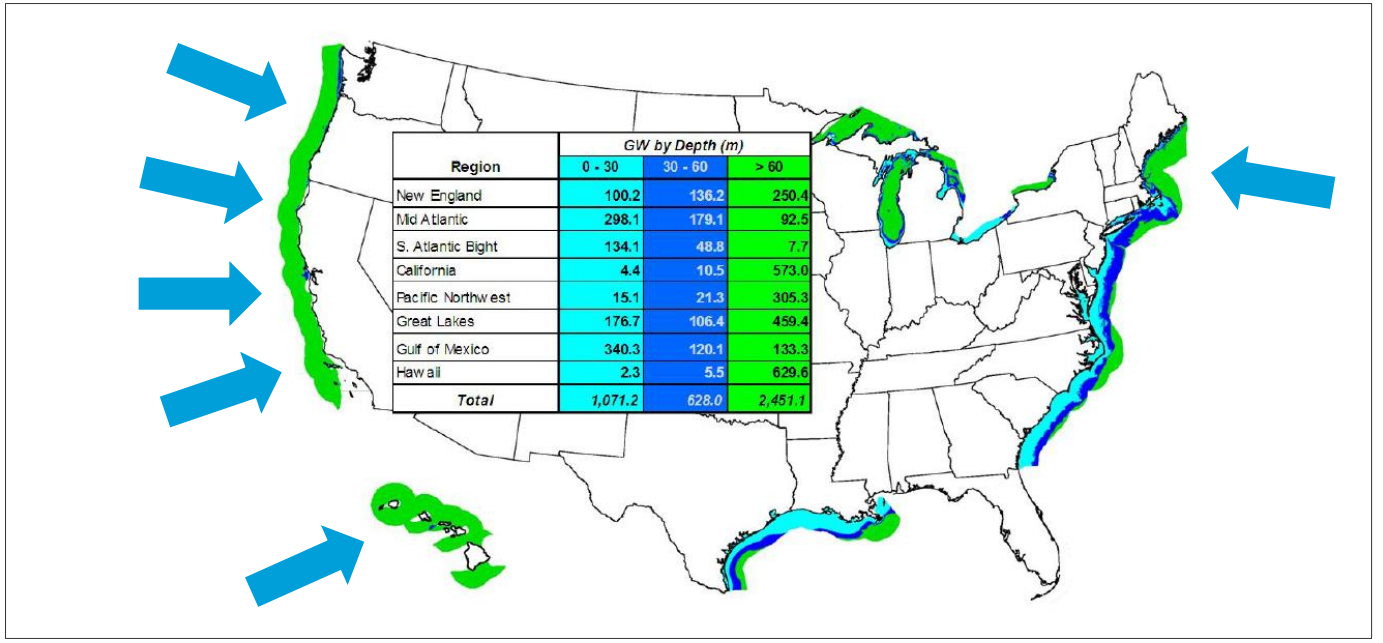
Today, we are at the start of tomorrow's industry



The area for offshore wind with fixed foundations is limited



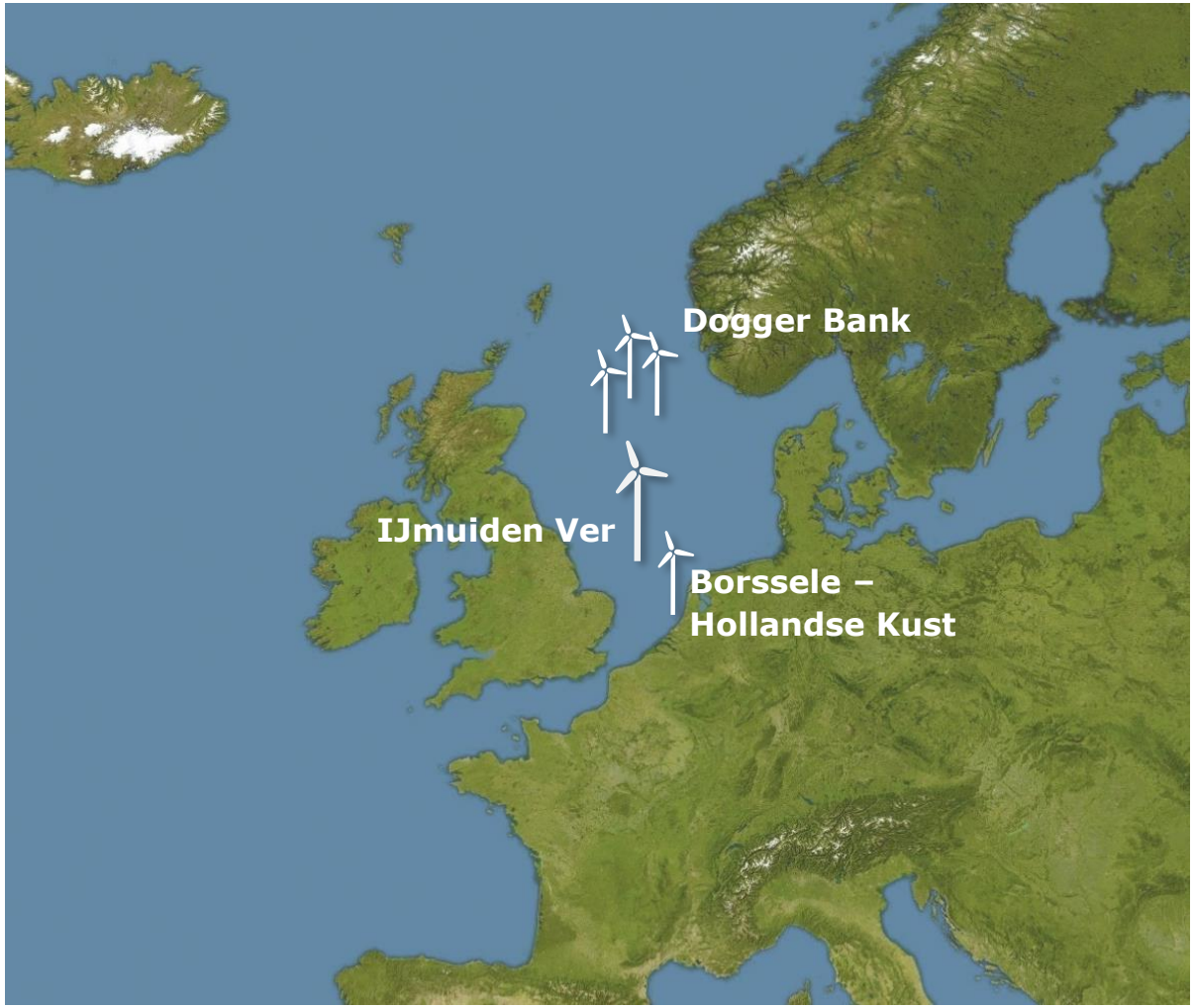
Source: Acciona, 1Tech, DNV GL



Region	GW by Depth (m)		
	0 - 30	30 - 60	> 60
New England	100.2	136.2	250.4
Mid Atlantic	298.1	179.1	92.5
S. Atlantic Bight	134.1	48.8	7.7
California	4.4	10.5	573.0
Pacific Northwest	15.1	21.3	305.3
Great Lakes	176.7	106.4	459.4
Gulf of Mexico	340.3	120.1	133.3
Hawaii	2.3	5.5	629.6
Total	*1,071.2*	*628.0*	*2,451.1*

Country/Region	Share of offshore wind resource in deep water locations (>60m depth)	Potential floating wind capacity
Europe	80%	4,000 GW
USA	60%	2,450 GW
Japan	80%	500 GW

North Sea Wind on the Drawing Board



TODAY

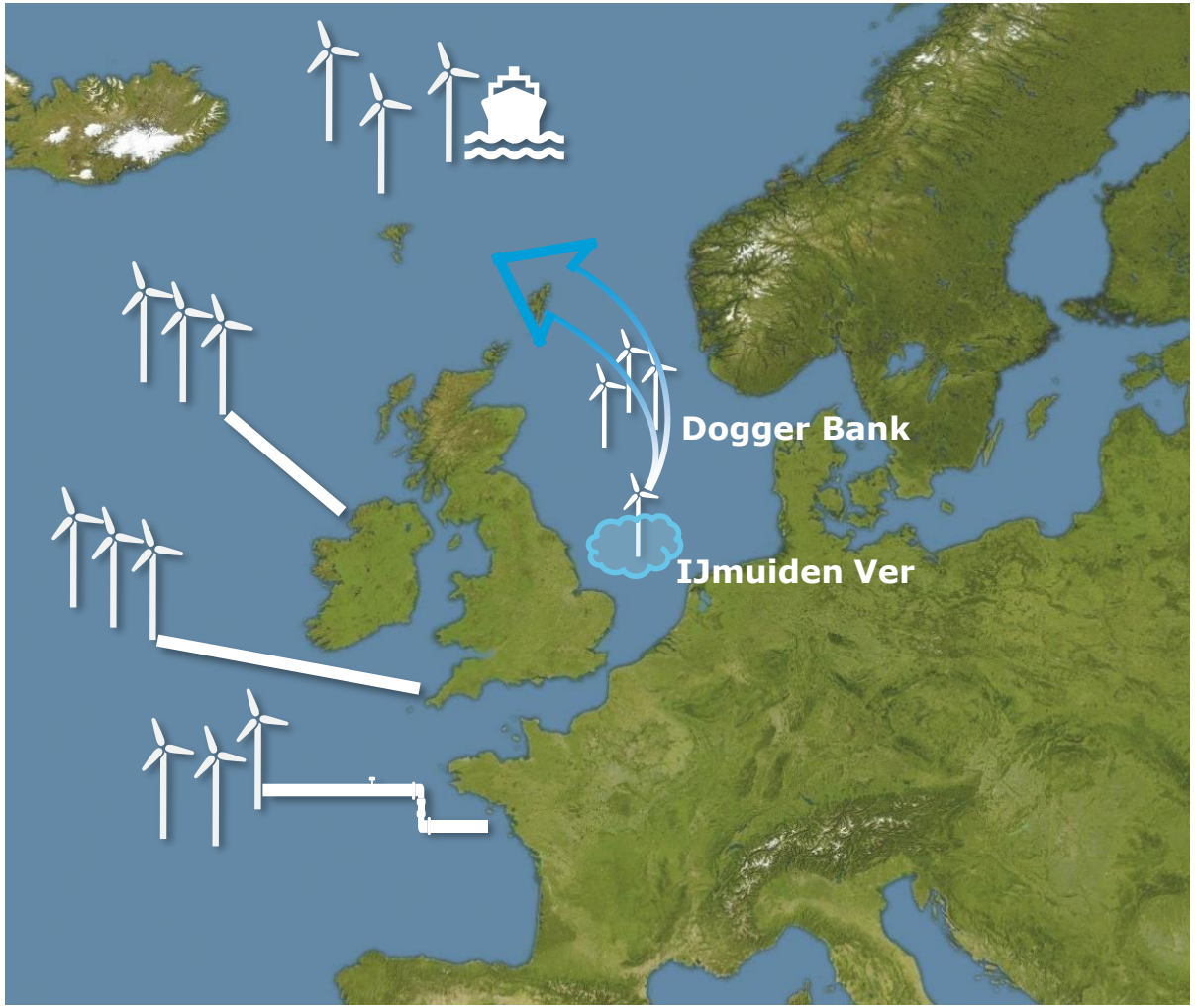
Standardisation key for Borssele and HKZ

AC grid connections

TOMORROW

Conventional electrical connections to shore will no longer suffice

Shift of offshore wind to ocean space



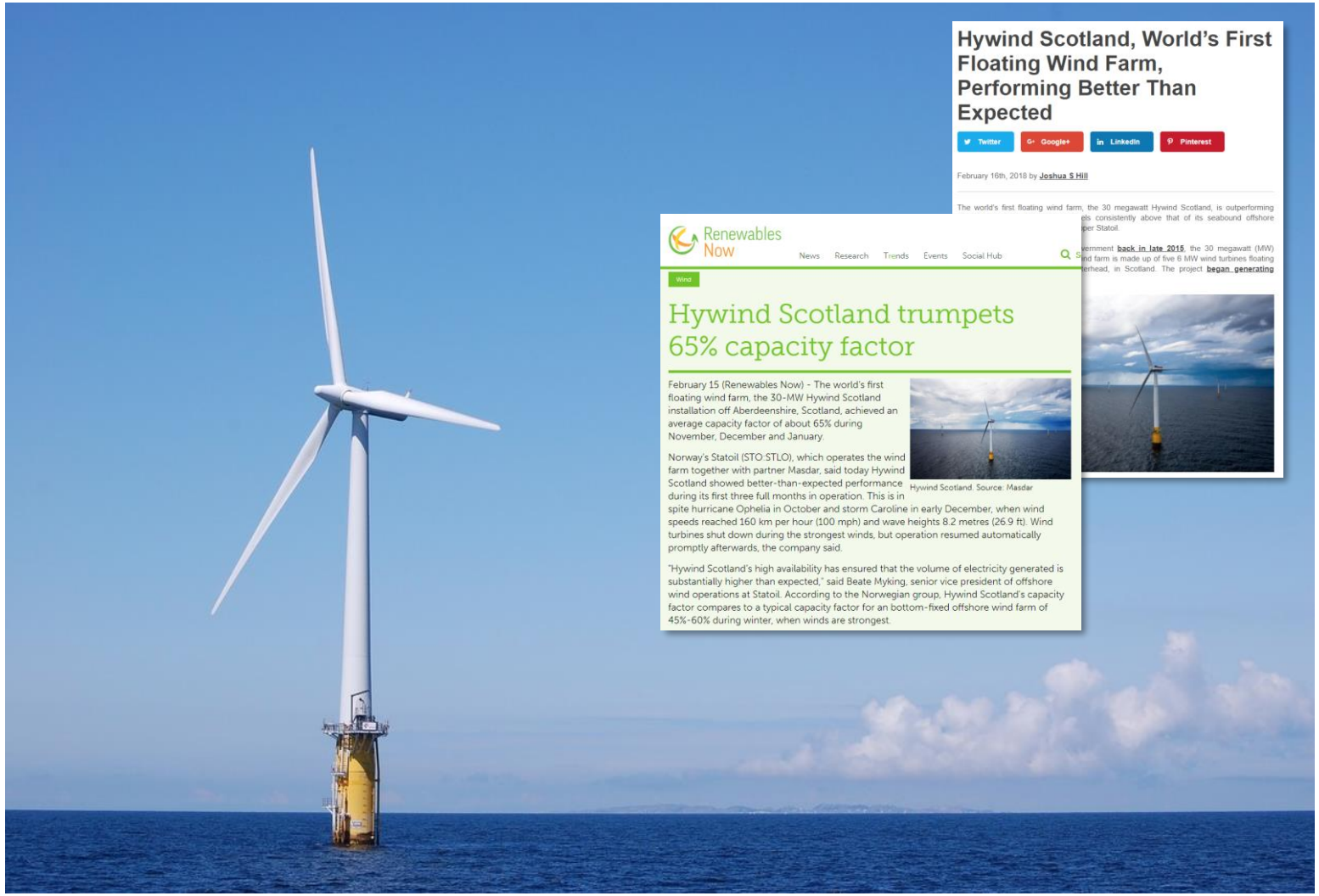
TODAY

The industry focusses on cost reductions and standardization of the civil structures as fixed foundations.

TOMORROW

Floating wind will allow for scale at global level. This changes the nature of offshore works.

DNV GL & Floating Wind



Industry rules and standards

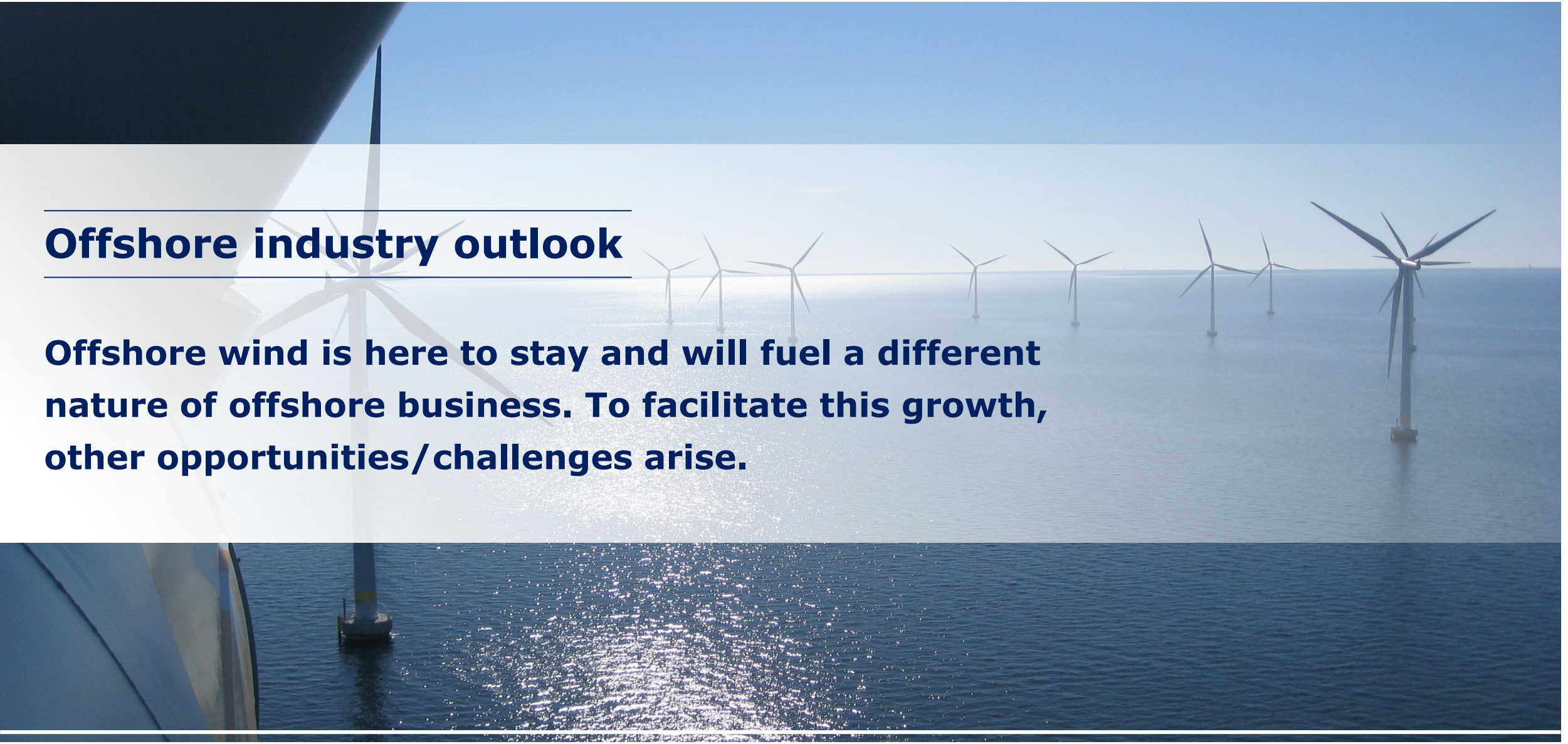
Concept design support

Floating wind market studies & technical due diligence

Verification & independent analysis of several floaters and wind farms

BLADED software: 20 different floating wind projects in last 10 y.

DNV·GL

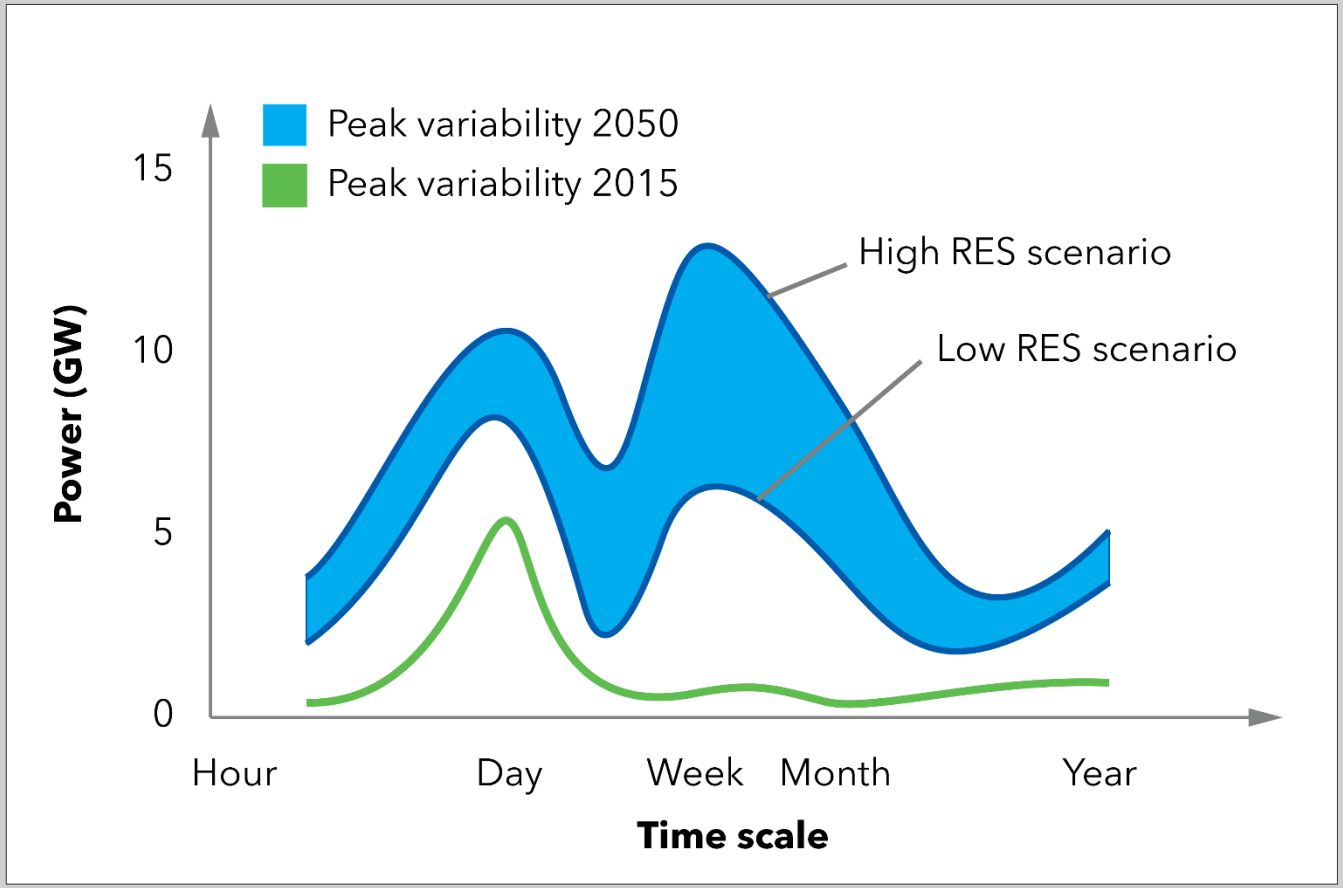


Offshore industry outlook

Offshore wind is here to stay and will fuel a different nature of offshore business. To facilitate this growth, other opportunities/challenges arise.

Source: TenneT

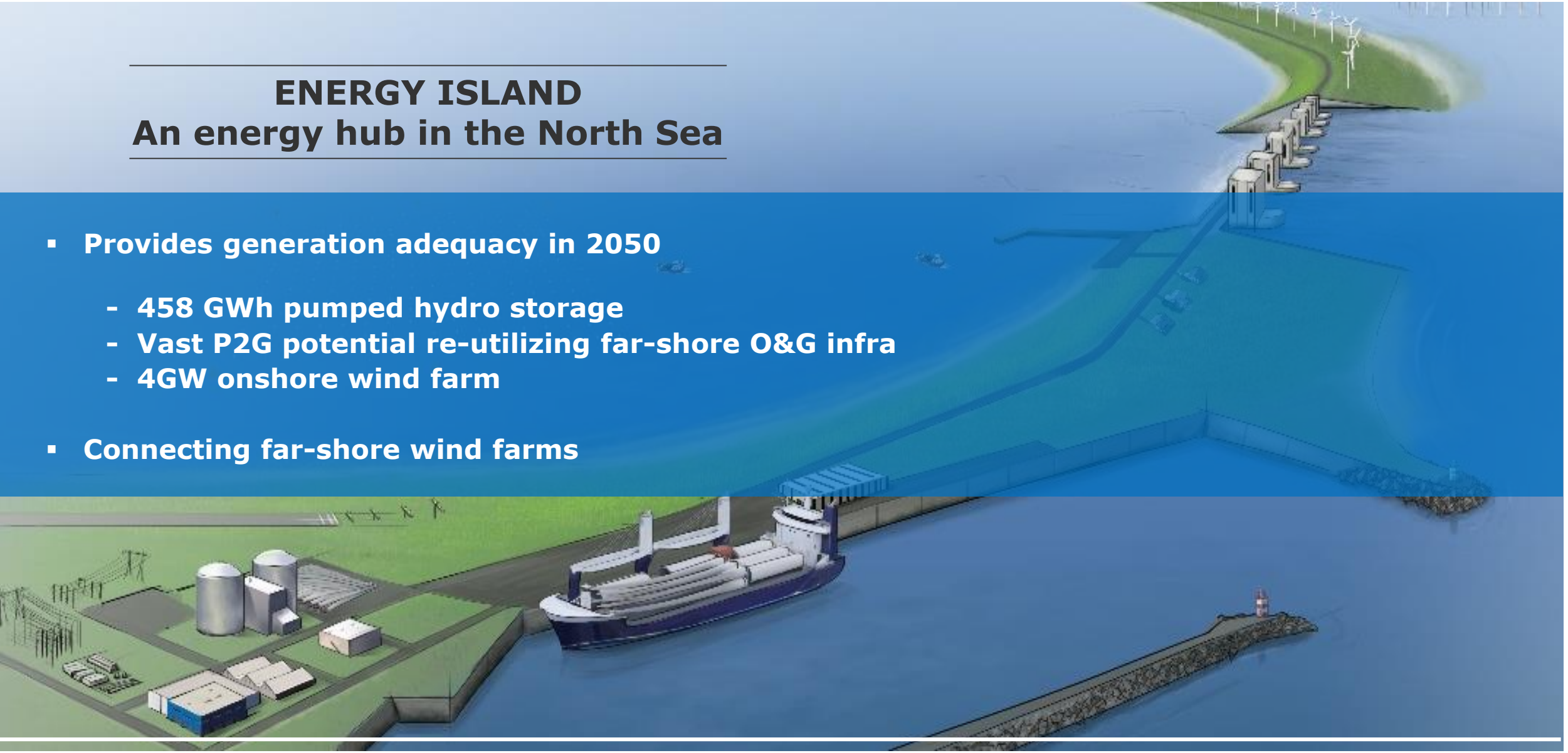
Meanwhile; a Variability Challenge is to be solved…



Example for The Netherlands, based on e-highways 2050

ENERGY ISLAND
An energy hub in the North Sea

- **Provides generation adequacy in 2050**
  - **458 GWh pumped hydro storage**
  - **Vast P2G potential re-utilizing far-shore O&G infra**
  - **4GW onshore wind farm**
- **Connecting far-shore wind farms**



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