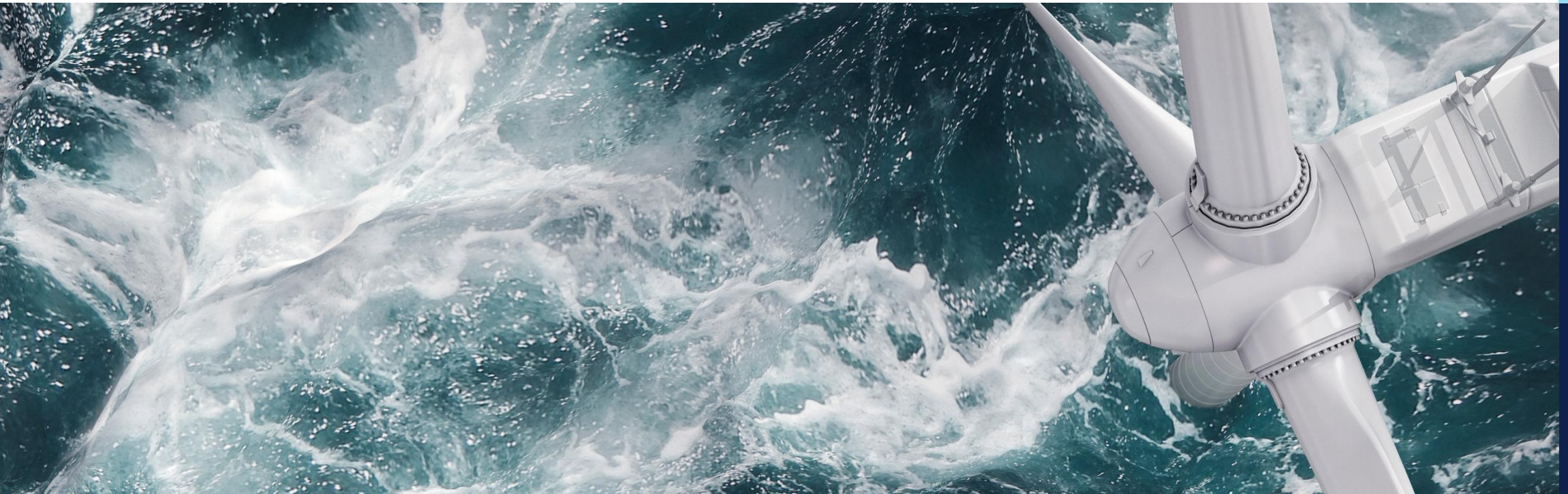
WHEN TRUST MATTERS

Interoperability across HVDC grid – could project certification contribute to enable “plug and play”?

UiO & GP Ocean Grid project

Sille Grjotheim
Country Manager Renewables Certification Norway

19 March 2024



Agenda

1. Intro DNV
2. Creating international recognised standards through research and Joint industry projects (JIPs)
3. Schemes developed to help the industry reduce risks in a transparent and structured way:
   - Project certification
   - Grid Code Compliance
   - Grid readiness verification

Could adjustments of these schemes combined with a JIP to develop early recommended practices bring the industry quicker to “plug and play”?
Even before we see the results from the InterOpera program.

160 years of building trust

Since 1864, we have been guided by our purpose of:

Safeguarding life, property, and the environment

Our vision is to be:

A trusted voice to tackle global transformations

DNV

A global assurance and risk management company

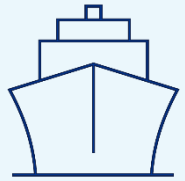
~15,000
employees

100,000+
customers

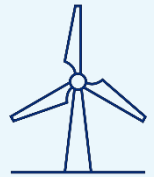
100+
countries

5%+
of revenue to R&D

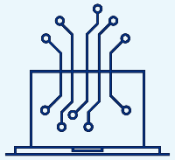
Ship and offshore classification and advisory



Energy advisory, certification, verification, inspection and monitoring



Software, cyber security, platforms and digital solutions

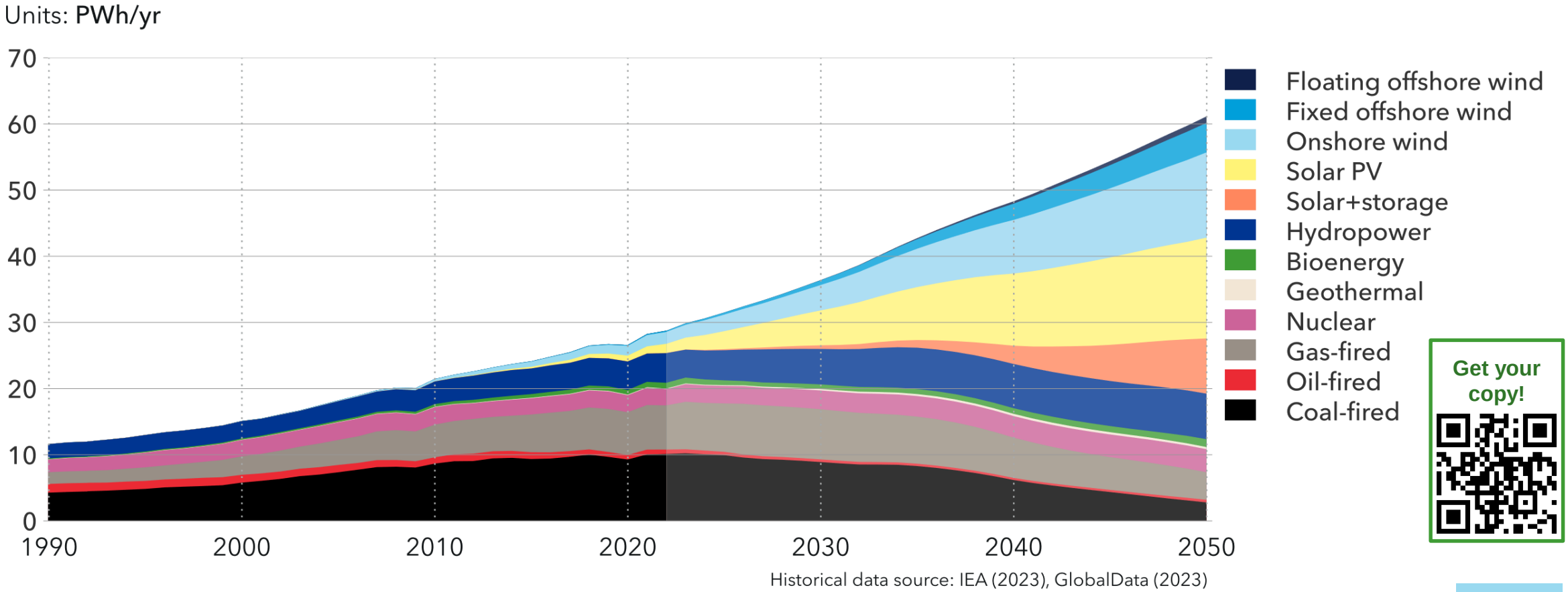


Management system certification, supply chain and product assurance

DNV

15% of electricity will come from offshore wind in 2050 (2% from floating wind)

World grid-connected electricity generation by power station type

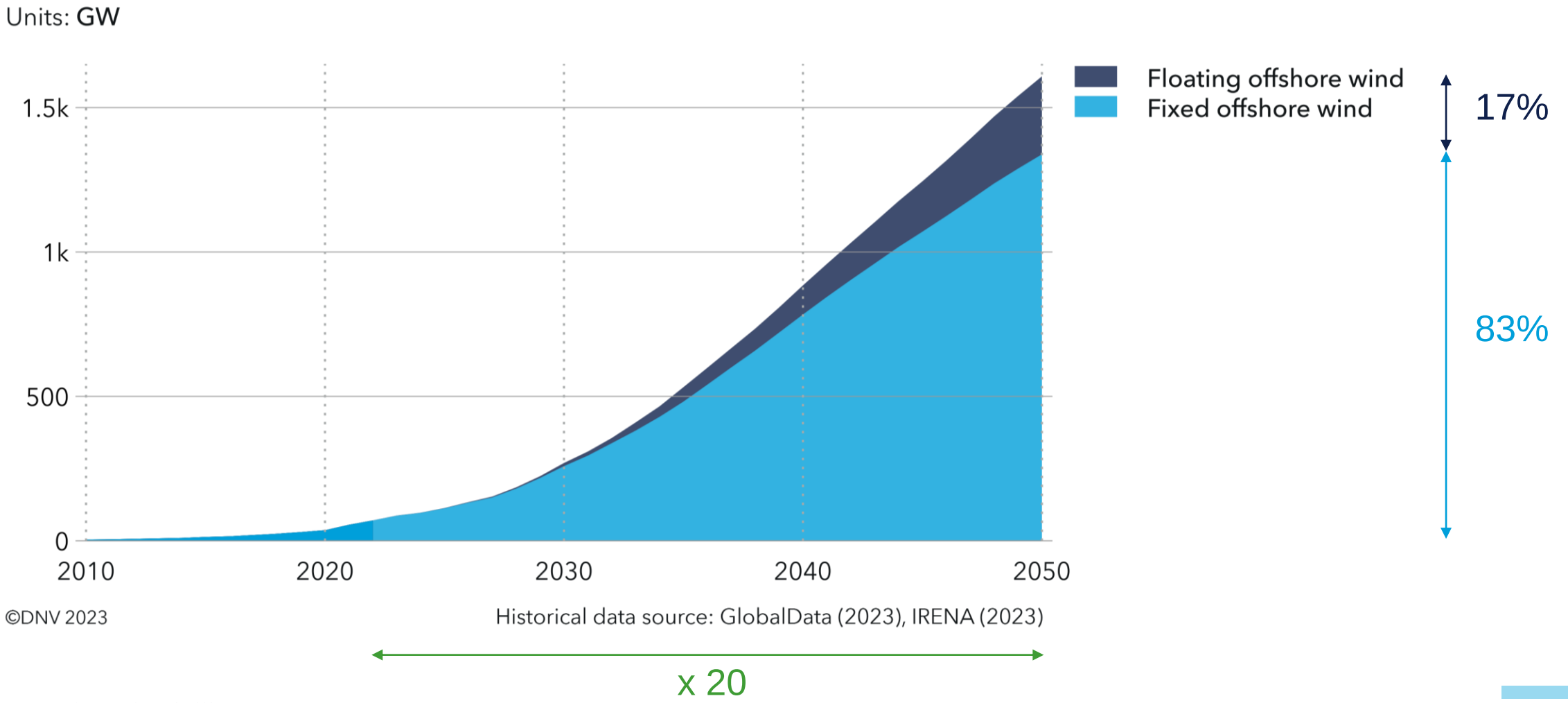


Historical data source: IEA (2023), GlobalData (2023)

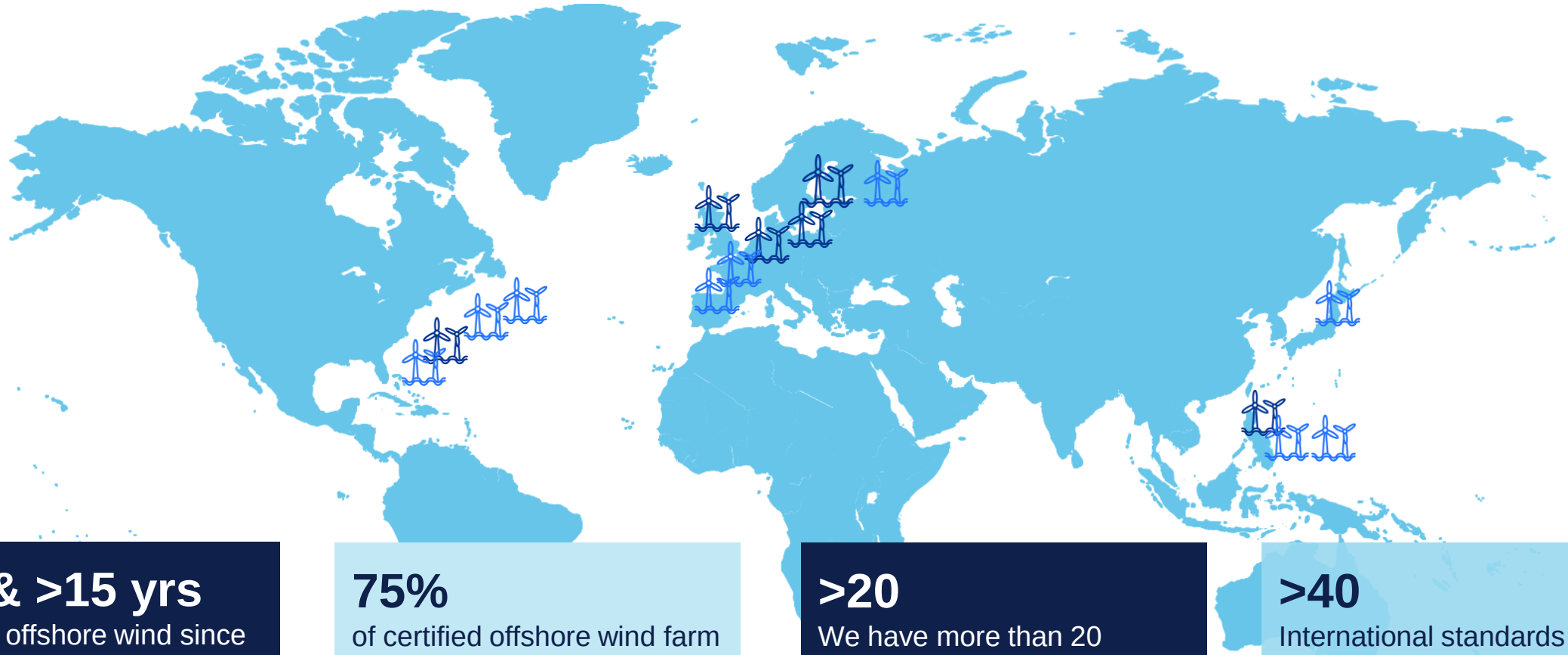
Get your copy!

DNV's ETO 2023 https://eto.dnv.com/2023

Global installed offshore wind capacity



New projects will benefit from lesson’s learned worldwide



>35 & >15 yrs
Active in offshore wind since the beginning both bottom fixed (35 yrs) & floating (15 yrs)

75%
of certified offshore wind farm utilized our project certification services to manage risks

>20
We have more than 20 research and innovation projects running ensuring today’s standards are ready for tomorrow’s challenges

>40
International standards and recommended practices used globally to design, construct and operate offshore wind plants

+500 experts working full time on offshore wind world-wide, around **5000** energy experts

2. Creating international recognised standards through research and Joint industry projects (JIPs)

Developed floating offshore wind service documents

Selected reference projects

Hywind demo selected reviews (2008)

2009:
DNV Guideline

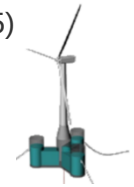
Pelastar FEED (2013)

2011-2013:
JIP: Development of
DNV-OS-J103 Technical requirements

VolturnUS – concept (2014)

aerodyn SCD nezzy – concept (2014)

ACS - concept (2014-2015)



2016-2019:
JIP: Development of
DNVGL-RP-0286 Coupled analysis

WindFloat Atlantic certification (2015- 2018)

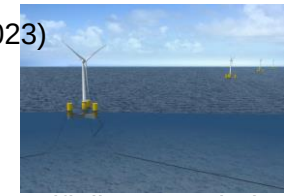
Hywind Scotland verification (2015-2017)

Nautilus – concept (2017)

2018:
DNVGL-SE-0422 Certification procedure
DNVGL-ST-0119 Technical requirements
DNVGL-RP-0286 Guidance analysis (2019)

Hywind Tampen selected reviews (2018-2023)

Groix & Belle-Ile wind farm Project Cert. (2019-2022)



Odfjell Oceanwind FOWU AiP/Basic design approval ongoing

2020-2023:
DNV-RU-OU-0512 Classification
- First issue Oct 2020
- Second issue July 2021
- Third revision issued July 2023 covering also substations

DNV-ST-0119 June 2021
- Third revision
- Update initiated fall 2023

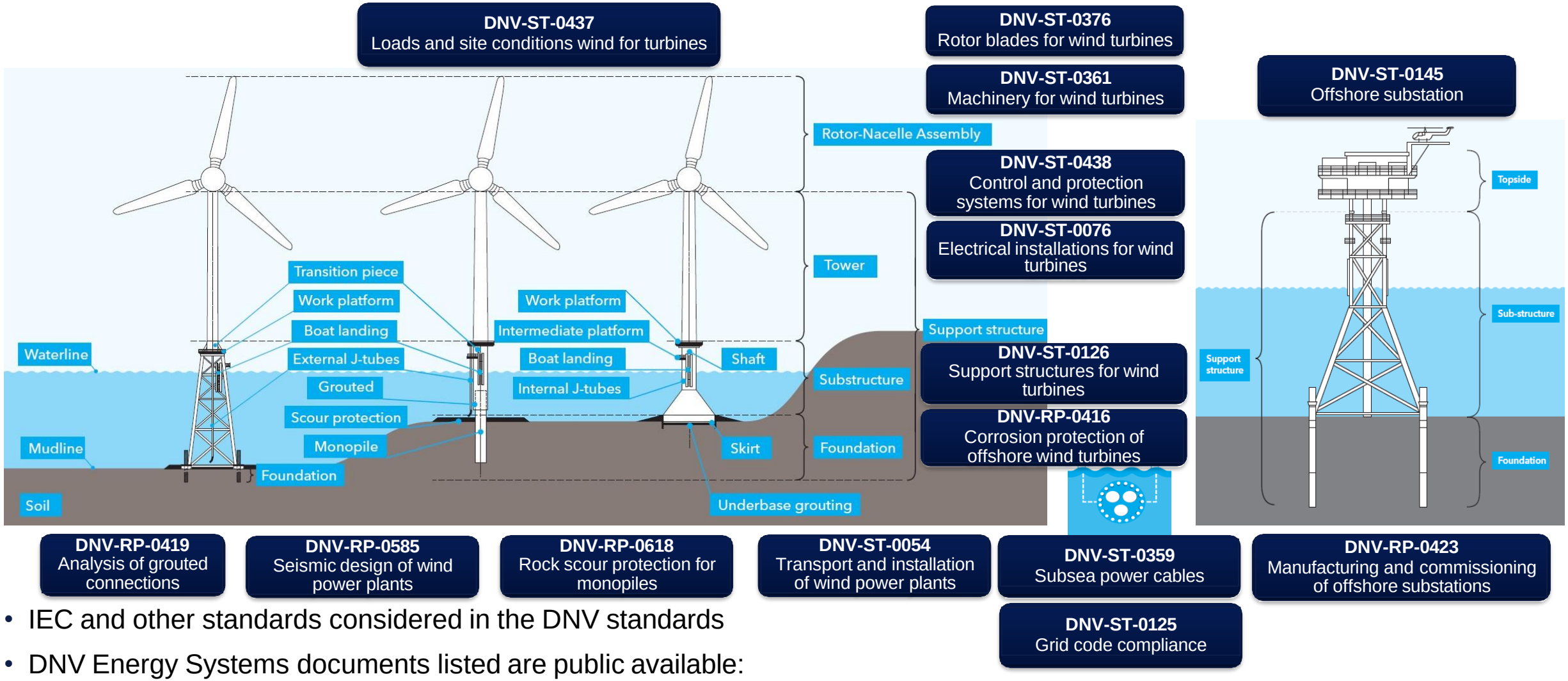
DNV-SE-0422
- Second revision to be issued fall 2023

INNWIND.EU 2012 - 2017

LIFES50+ 2015 - 2019

FLAGSHIP 2020 - 2023

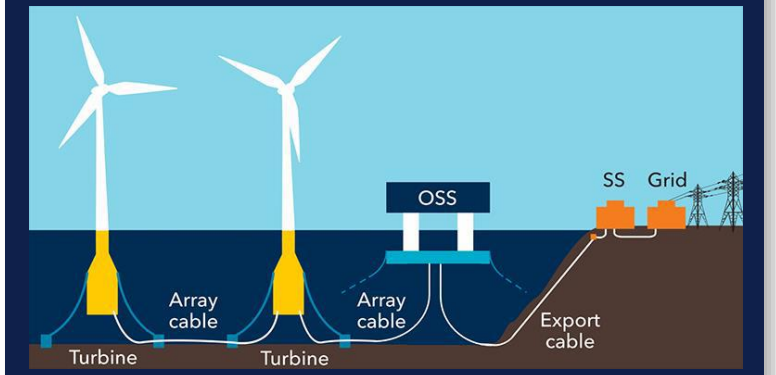
DNV standards for bottom fixed power plants



- IEC and other standards considered in the DNV standards
- DNV Energy Systems documents listed are public available: https://www.dnv.com/rules-standards/

DNV initiated Joint Industry Projects (JIPs)

Floating substations



Design of floating substations are currently being discussed using experience from O&G and bottom fixed substations.
This JIP aims at aligning best practice and closing the gaps in available substation standards enabling scaling of floating offshore wind. Key topics will be substation power components and high voltage dynamic cables.

Mooring and cables

Mooring and cable equipment is a key cost driver within floating wind.
This JIP aims to establish an appropriate safety level for floating wind which balances cost and reliability.
Dynamic simulations and probabilistic analysis will be used to advice on re-calibrated safety factors and design recipes for mooring design.

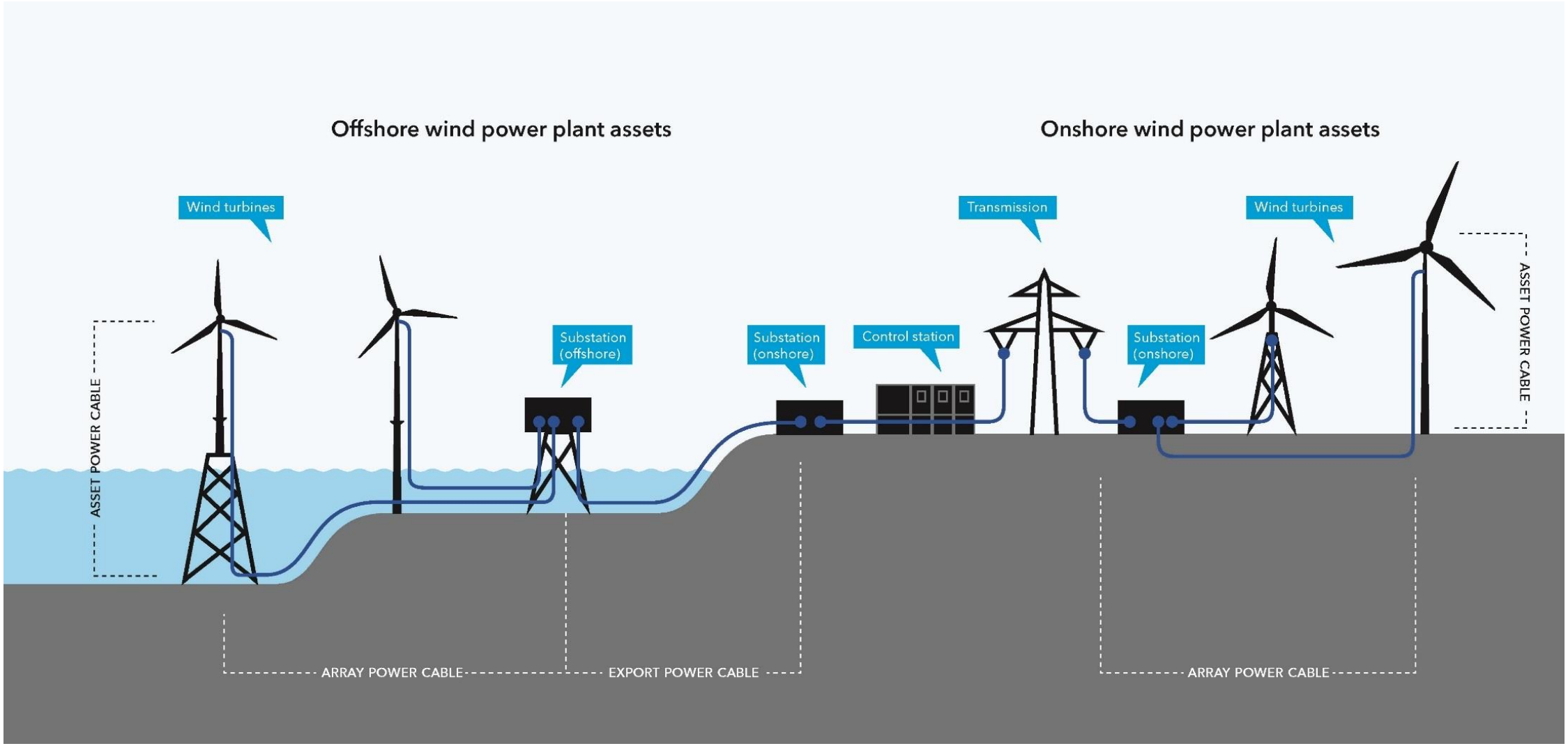
Concrete floating structures

Concrete is used for floating offshore wind floaters and is expected to be important also in future installations. Requirements in current standards are based on experience from O&G and bottom-fixed structures.
This JIP aims to further refine, optimize and align the requirements for floating offshore wind needs.

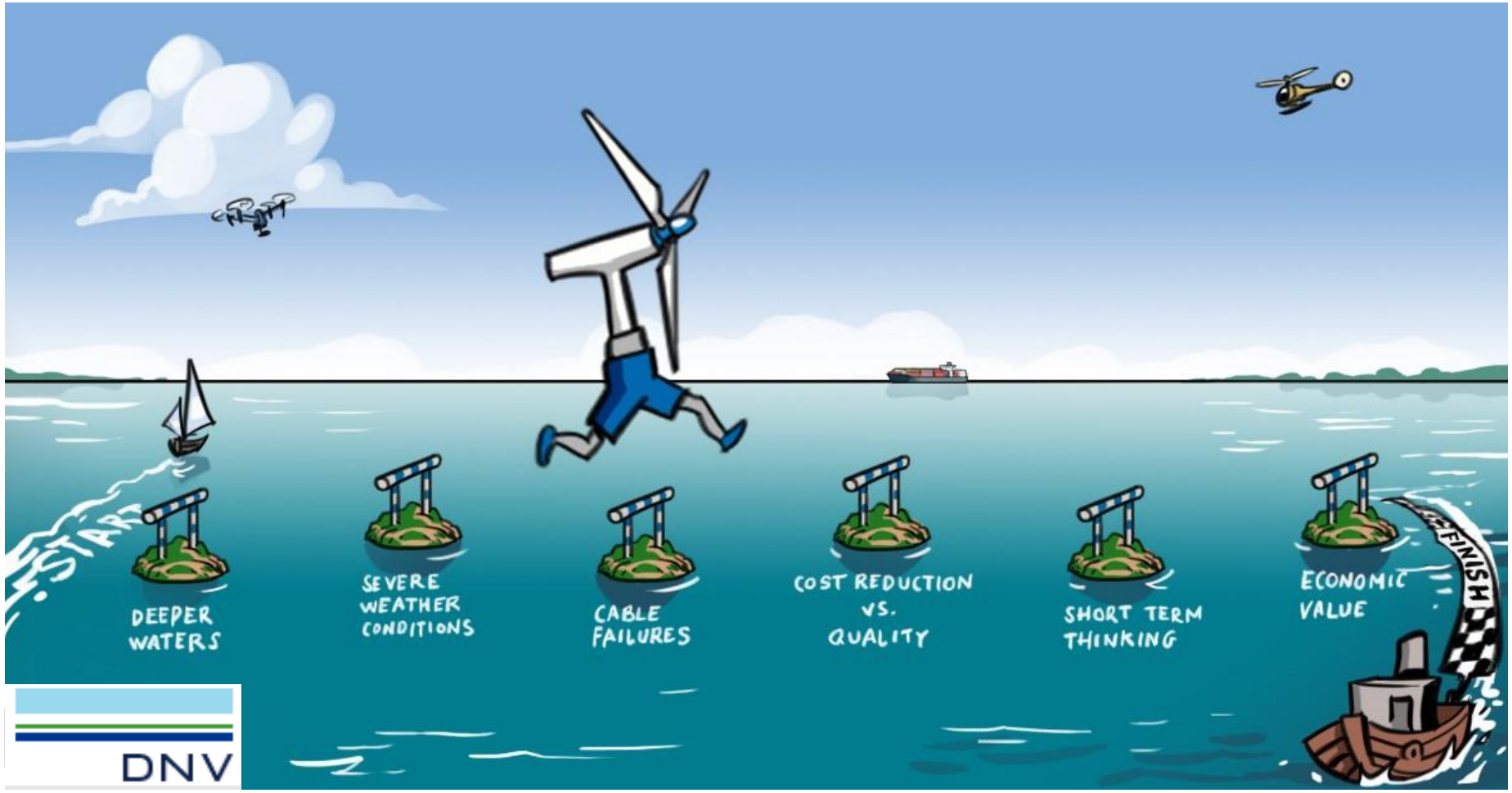
3. Schemes developed to help the industry reduce risks in a transparent and structured way:

- Project certification - PC
- Grid Code Compliance - GCC
- Grid readiness verification

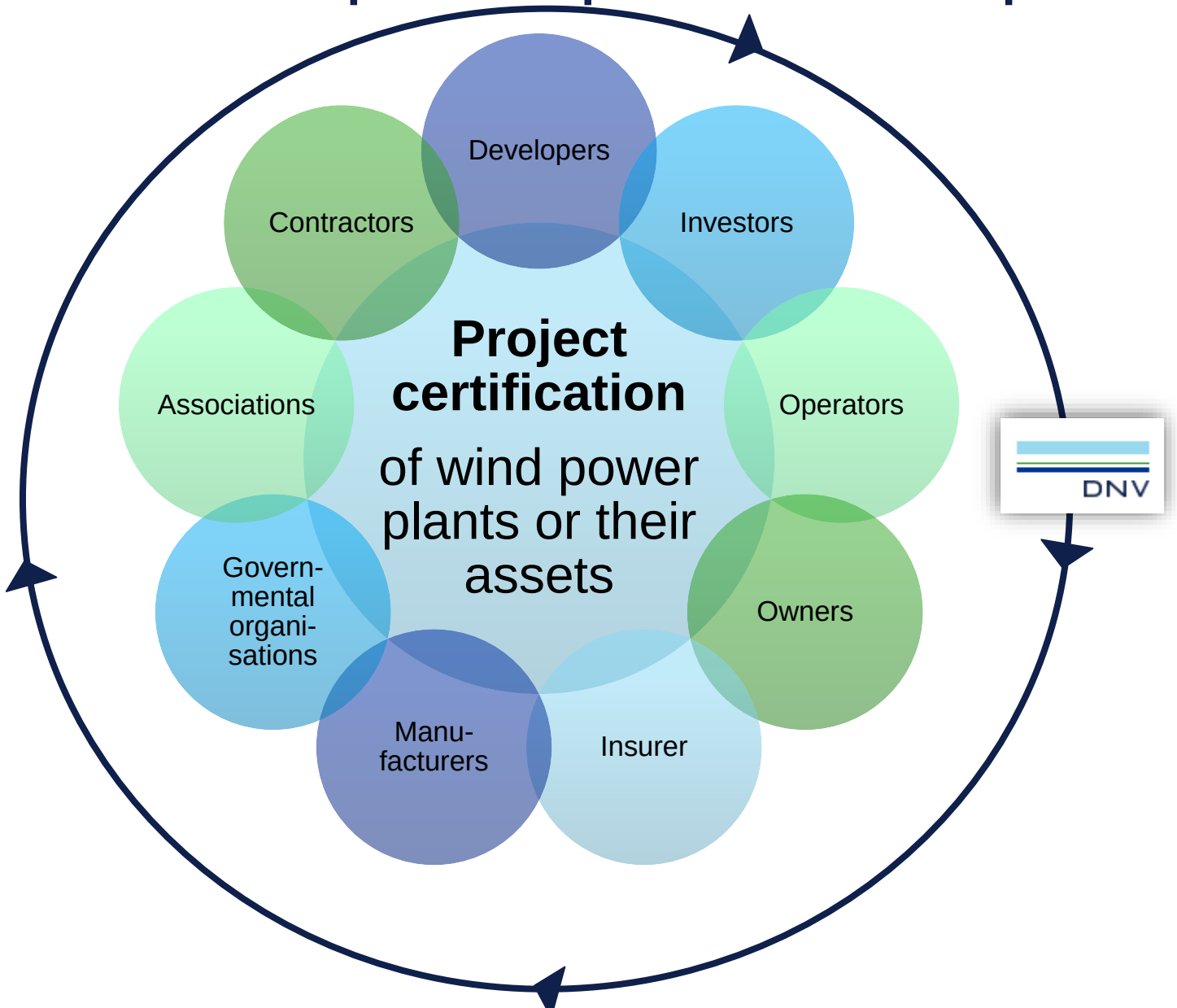
Typical wind power plant assets



Offshore wind challenges – interoperability is only one of them!



Stakeholders in wind power plant development



DNV

Renewables Certification in brief

+300 employees around the world

CNAS

DAkkS Deutsche Akkreditierungsstelle

IECRE

3 Main service lines

Project Certification of renewable power plants

Type Certification of wind turbines and generators

Component Certification of wind turbines components

Active in developing guidelines for wind turbines and related assets, structures and components

DNV

Type Certification

- A wind turbine **type**
  - evaluated for compliance with applicable regulations and assumed conditions (e.g. generic wind turbine class)
- Validation for selected design parameters and conditions
- Manufacturing process and type testing on a sample
- Industry practice

VS.

Project Certification

- Power plant including type certified wind turbines
  - evaluated for compliance with applicable regulations and **site-specific** conditions
- designed for a specific location and layout
- manufactured for a specific project
- installed and commissioned under site-specific circumstances

Project Certification, PC options for a wind power plant

3rd party conformity assessment services for wind power plant assets and lifecycle:

- The phases in green are mandatory for a Project Certificate, however, each phase can obtain Statement of Compliance
- The scope of work is divided in phases e.g. one scope for “Concept” phase, one for “Design basis” phase…”

Concept | Design basis | Basic design | Design | Manufacturing & Surveillance | Transport & installation | Commissioning; operation & maintenance manuals | In-service | Lifetime extension

WIND TURBINES

- Rotor-nacelle assembly
- Support structure
  - tower
  - substructure
  - foundation/station keeping
- Mechanical, electrical and safety systems

OFFSHORE SUBSTATIONS

- Transformer station/convert platform
  - topside
  - structure
  - electrical equipment and safety
- Support structure
  - substructure
  - foundation/station keeping

POWER CABLES

- Asset power cable
- Array power cable
- Export power cable
- Installation, termination, accessories

The conformity assessment mechanism developed over decades and described in DNV-SE-0190 *Project certification of wind power plants* supports offshore wind stakeholder in realising reliable power plants for the next decades.

Providing offshore wind certification experience to:

- **Project developer**
- **Owner**
- **Network operator**

skyborn, sse Renewables, Ørsted, CIP Copenhagen Infrastructure Partners, EDF renewables, TenneT, amprion, EnBW, edp renewables, VATTENFALL, RWE, Shell, IBERDROLA RENEWABLES, equinor, enel, Dominion Energy

Wind turbine manufacturer

SIEMENS Gamesa RENEWABLE ENERGY, GOLDWIND, GE Renewable Energy, Vestas, ENVISION, HZ windpower, 上海电气 SHANGHAI ELECTRIC

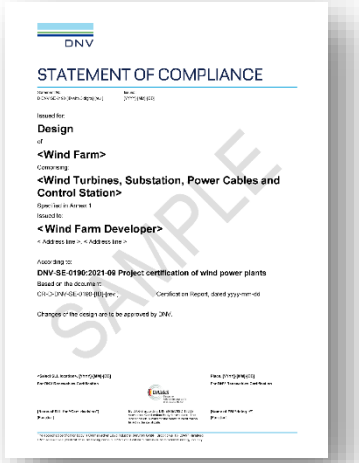
Component manufacturer

winergy, SINOMA, LM WIND POWER, EUROS, ABB, tpi COMPOSITES, Romax TECHNOLOGY, Nexans, SINOI A CNBM-COMPANY

>75%

of certified offshore wind farm utilized our project certification services to manage risks

[Valid certifications (dnv.com)]


DNV

STATEMENT OF COMPLIANCE

Issued for:
Design
of
<Wind Farm>
Comprising:
<Wind Turbines, Substation, Power Cables and Control Station>
Specified in Annex 1
Issued to:
<Wind Farm Developer>
< Address line >, < Address line >

Assessed to:
DNV-SE-0190:2021-09 Project certification of wind power plants
Based on the documents:
DNV-SE-0190-(01)-[rev]_____ Certificate Report, dated yyyy-mm-dd

Changes of the design are to be approved by DNV.

SAMPLE


DNV

PROJECT CERTIFICATE

Issued for:
<Wind Power Plant>
Comprising:
<Wind Turbines, Substation, Power Cables and Control Station>
Specified in Annex 1
Issued to:
<Wind Power Plant Developer>
< Address line >, < Address line >

According to:
DNV-SE-0190:2021-09 Project certification of wind power plants

This project certificate is based on the documents per Annex 2. The project certificate remains valid if maintenance of the project certificate is successfully carried out per Annex 2.

Changes of the certified wind power plant assets are to be approved by DNV.

SAMPLE

Sharing knowledge and lessons learned with authorities worldwide to further support the industry's success

Authorities

	Area	Name
	Australia	OIR
	Belgium	SPFE
	Denmark	DEA
	Germany	BSH
	Japan	METI
	Norway	OSA
	Poland	Min. of Infrastruc.
	South Korea	KEA
	Taiwan	BSMI
	The Netherlands	RWS
	USA	BOEM

What we recommend

improve **efficiency and transparency**

an **holistic scheme** helps to achieve a **safe and reliable power production**

apply a **practical** approach with **stepwise approvals** and **flexible** split into phases and assets depending on project **individual needs**

new regulations require a transition period for all the stakeholders

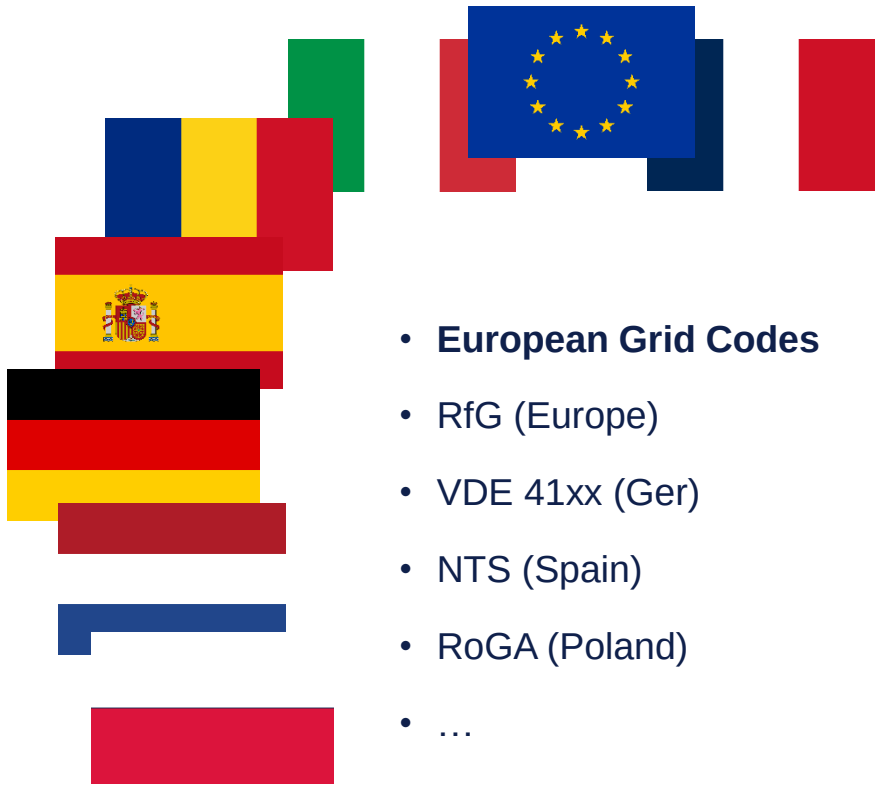
Regulatory requirements – Where is 3rd party assurance (project certification) required?

Light blue: Floating is high on the agenda!

Symbol	Definition
✓	requirement by laws/acts/orders
✓	indirect requirement e.g. by investors, insurance
✓	requirements under development
	no requirement yet

*Some requirements and recommendations in different locations, e.g. Scotland (floaters) and Irland (OSS and cables), UK moorings

Markets where Grid Code Compliance (GCC) is on the agenda



- **European Grid Codes**
- RfG (Europe)
- VDE 41xx (Ger)
- NTS (Spain)
- RoGA (Poland)
- …

- **Certification Scheme**
- **DNV-SE-0124** (international)
- FGW TG8 (Germany)
- NTS (Spain)
- …

- **Measurement and validation Rules**
- **DNV-ST-0125**
- FGW TG3
- IEC 61400-21
- …

FGW TG4

IEC 61400-27

…

- **Pan European Grid Codes**
- CEA (India)
- G99 (UK)
- Creg (Colombia)
- …

We are able to certify according to every grid code *BUT codes should be harmonised and aligned!*

Grid readiness verification

CLIENTS
TSOs, contractors, wind farm developers, O&G operators

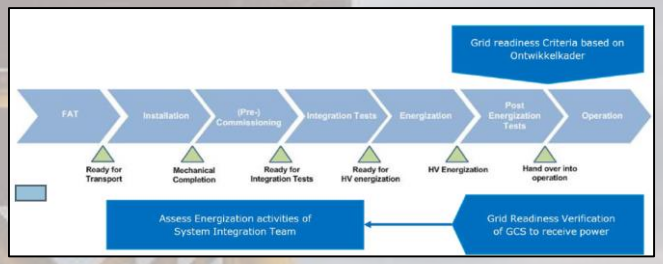
OUR SERVICES
Grid readiness verification process to verify that at the end of post energization the operational requirements have been met in particular with relevant

- Grid codes
- IEC standards
- DNV standards in particular DNV-ST-0145 – offshore substations
- CIGRE technical brochures in particular TB483 – Guidelines for the design and construction of AC offshore substations for wind power plants
- Project specific requirements deducted and developed from development framework criteria

VALUE FOR THE CLIENT
Independent verification document to show to stakeholders (OWF operators, authorities) that complete set of development, realisation and validation steps have been undertaken, necessary to ensure that the offshore grid meets the development framework criteria.

DIFFERENTIATORS

- DNV experience & methodology
- Senior T&D expertise for technical assessment
- Impartial, independent and not tied to any particular solutions or manufacturers



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What do you think?

Could adjustments of these schemes combined with a JIP to develop early recommended practices bring the industry quicker to “plug and play”? Even before we see the results from the InterOpera program.

Thank you

Sille Grjotheim

Country manager Renewables Certification Norway

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