

# Agenda

technical options & requirements interface OWF – TenneT  
Arnhem, 27 November 2015

1. Opening / welcome
2. Introduction
3. Context
4. HV/MV connection interface OWF – TenneT Alan Croes
  - Physical interface point
  - Voltage level
  - Operation of bays
  - Data links
  - Protection
  - kWh meter
  - SCADA
  - Capacity, guaranteed or overplanting
5. Requirements from RfG code (TenneT document SOC 11-175) Bart van Hulst
  - Voltage and frequency support
  - Fault ride through
  - Compensation requirements
  - ...
6. A.O.B.
7. Wrap up

# Context

Approach from TenneT in development of the concept has been:

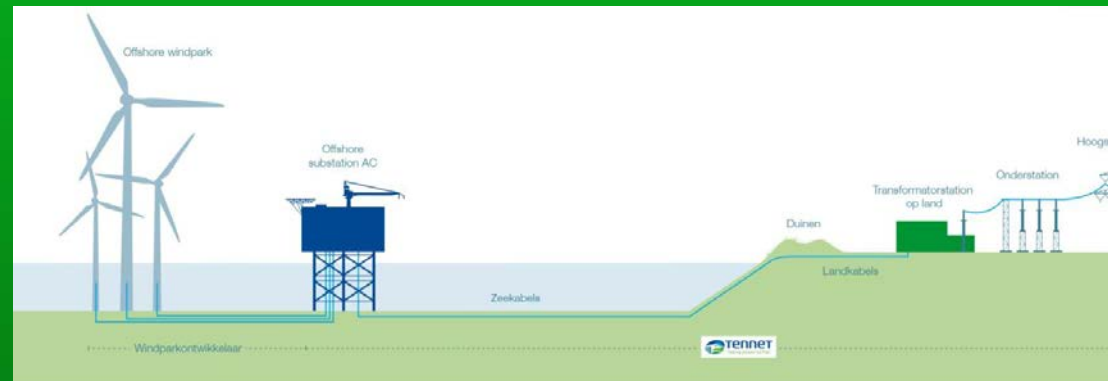
Bill: Wind op Zee

Bill: STROOM

EU / ACER / ENTSO-E

ACM

TenneT  
concept



# HV/MV connection interface OWF – TenneT 1/3

- Physical interface point
- Voltage level
- Protection
- kWh meter

All medium voltage inner array cables will be connected to the TenneT platform up to 700 MW (2 “kavels”)

- proposed MV level: 66kV
- interface: take away the necessity for a platform for the OWF, “full service approach”
  - => ownership interface at cable sealing end
  - => protection by TenneT based on overcurrent settings delivered by OWF
  - => kWh meter by TenneT according to requirements of Measurement code

¿ how much J-tubes are needed ?



# HV/MV connection interface OWF – TenneT 2/3

- Operation of bays
- Data links
- SCADA

- connection platform – shore will be a 3-phase 220kV cable with fibers for data transmission available for OWF
  - => connect on TenneT-MUX on platform and “retrieve” at HV-substation TenneT
  - => no “intelligence” with computers needed on platform
  - => therefore no SCADA equipment expected from OWF on platform
- operation of connection MV-bays will be provided by TenneT control centre on request of OWF
  - => visibility of park by OWF should be arranged by OWF at last windturbine before the platform
  - => redirection of output on the MV busbar during maintenance or failure will be handled by TenneT



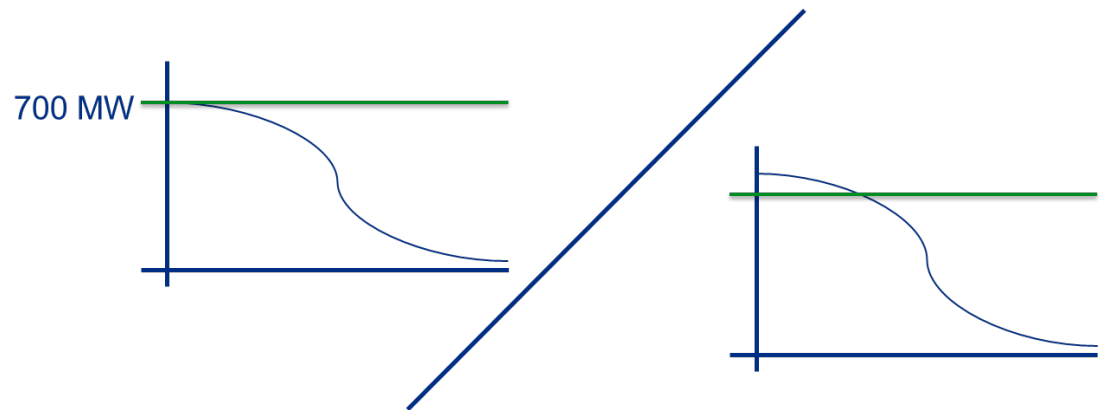
# HV/MV connection interface OWF – TenneT 3/3

- Capacity, guaranteed or overplanting

- TenneT has no preference on this option

=> if overplanting, maximum output control should be organized

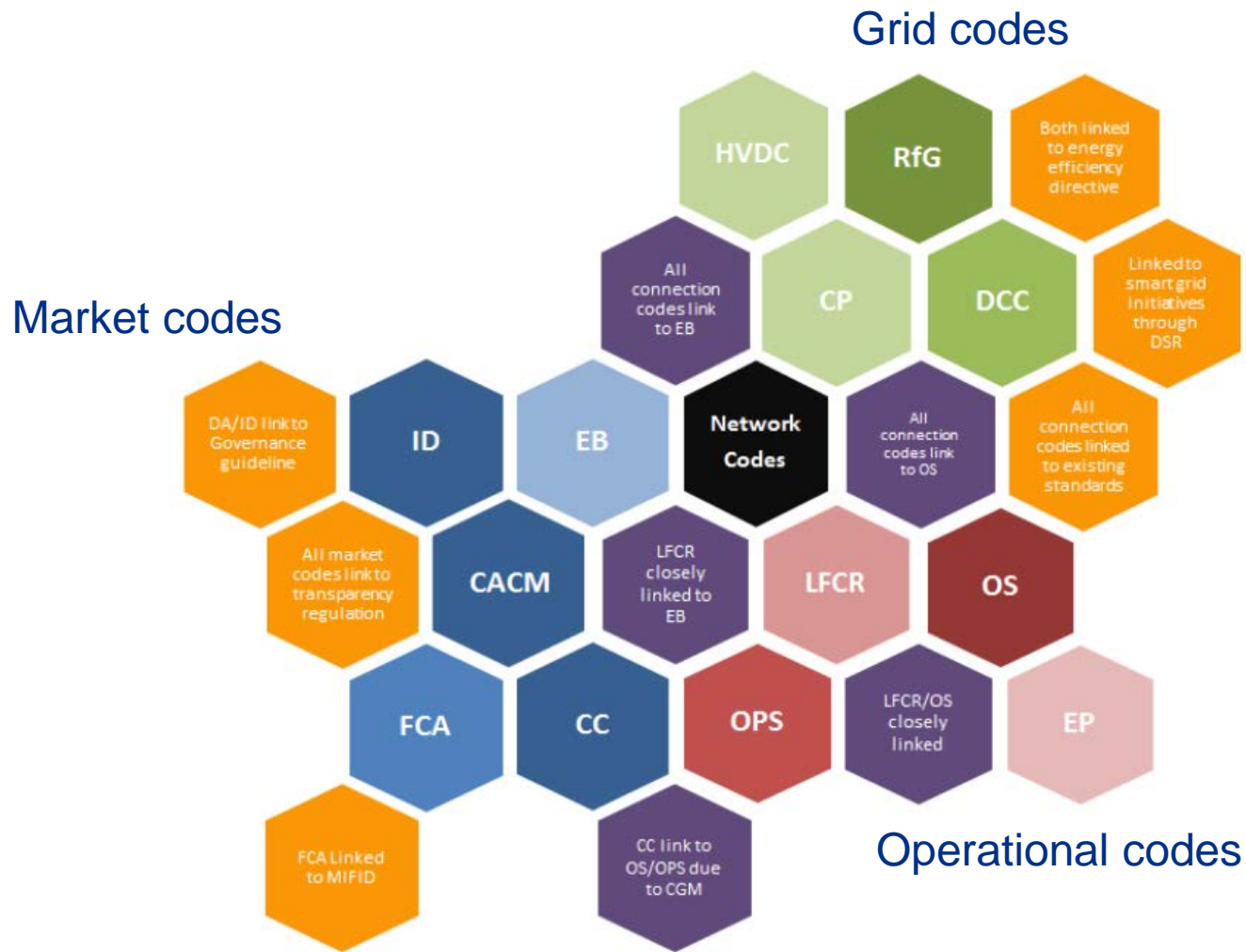
=> decision on choice needed given cable design parameters



# European network codes

- The European Commission, together with many stakeholders, have established that greater effort is needed to create a secure, competitive and low carbon European energy sector and a pan-European Internal Energy Market. Network codes are intended as a tool to reach this objective by complementing existing national rules to tackle cross-border issues in a systematic manner
- Consequences:
  - More cross border transport of energy
  - Maintaining the balance and system security of supply will require more effort, to facilitate the market
  - More cooperation between TSO and DSO (TenneT and Tennet Offshore)
- Requirement for Generators

# Netcodes ENTSO-E



# Planning RfG

- Network code version ready for comitology expected this year
- Dutch translation of RfG currently under construction, expected early 2015
- Q1/Q2 2015 cross border meetings national authorities will commence
- Expected voting by EC mid 2015 expected. Then code will be in force
  
- Then 3 year for implementation → national definition of the non-exhaustive requirements



# Wind farm connection requirements - TenneT

- New grid code applicable for all new initiatives
- Some requirements are non-exhaustive, can be further detailed at national level
- New network code for Offshore Netherlands shall be developed
- Provisionally the non exhaustive requirements currently are defined in the document “SOC 11-175”

# Wind farm connection requirements - TenneT

- Basic requirements: Voltage and frequency envelope

## **Frequency**

Requirements regarding frequency envelope are shown in Table 1.

**Table 1**

<b>Synchronous Area</b>	<b>Frequency Range</b>	<b>Time period for operation</b>
Continental Europe	47.5 Hz – 48.5 Hz	30 minutes
	48.5 Hz – 49.0 Hz	30 minutes
	49.0 Hz – 51.0 Hz	Unlimited
	51.0 Hz – 51.5 Hz	30 minutes

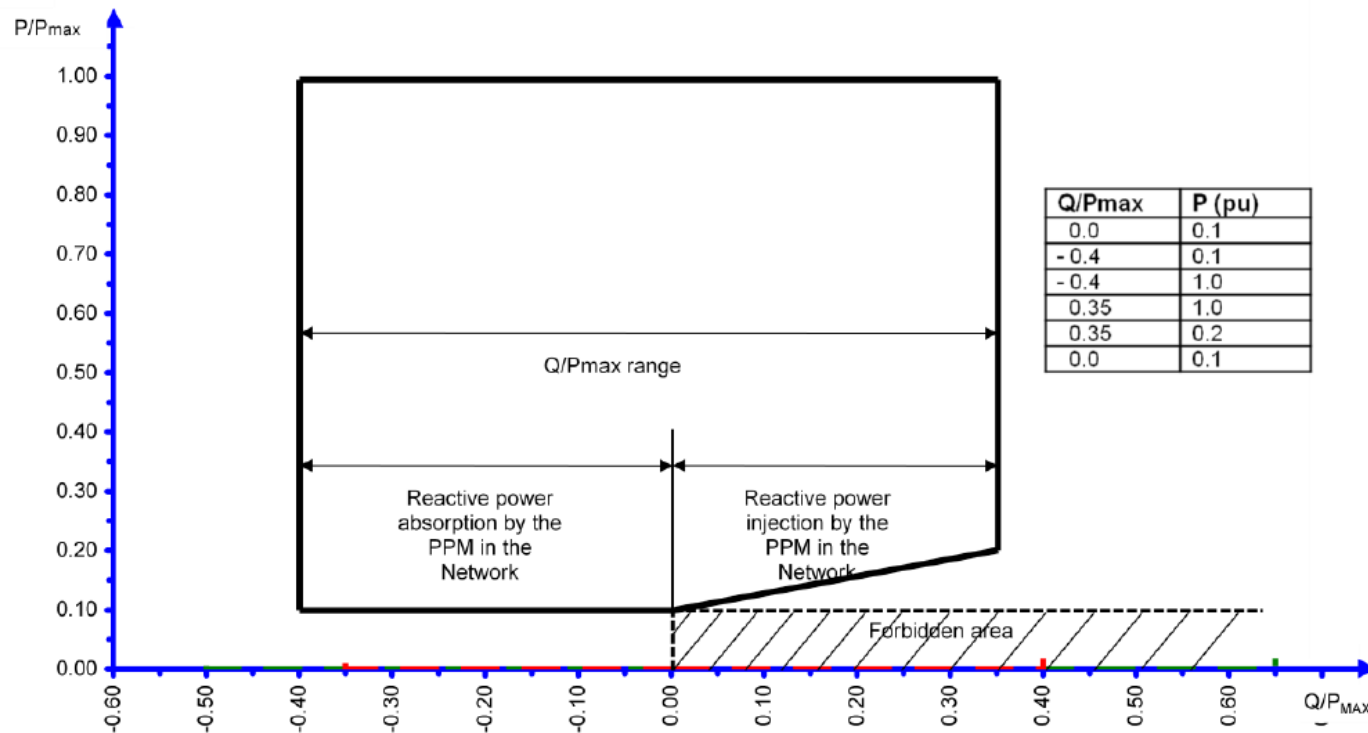
## Wind farm connection requirements - TenneT

**Table 2**

<b>Synchronous Area</b>	<b>Voltage Range</b>	<b>Time period for operation</b>
Continental Europe	0.80 pu – 0.85 pu	30 minutes
	0.85 pu – 0.90 pu	60 minutes
	0.90 pu – 1.10 pu	Unlimited
	1.10 pu – 1.15 pu	60 minutes

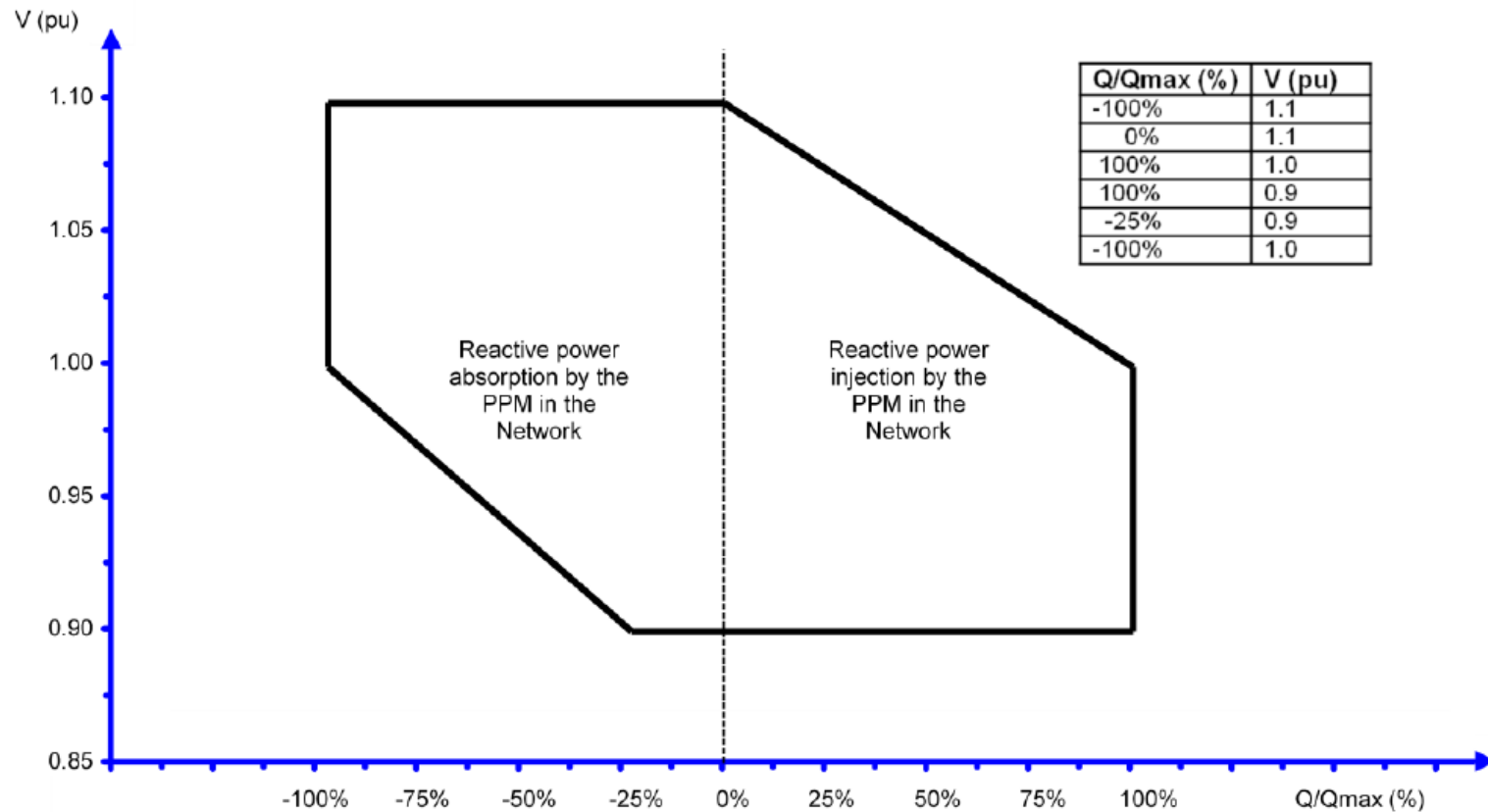
# Wind farm connection requirements - TenneT

- Reactive power capability → P – Q/Pmax profile



# Wind farm connection requirements - TenneT

Reactive power capability → V – Q/Qmax profile



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Alan Croes

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5. Requirements from RfG code (TenneT document SOC 11-175)

Bart van Hulst

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