

# Grid design for Offshore Wind

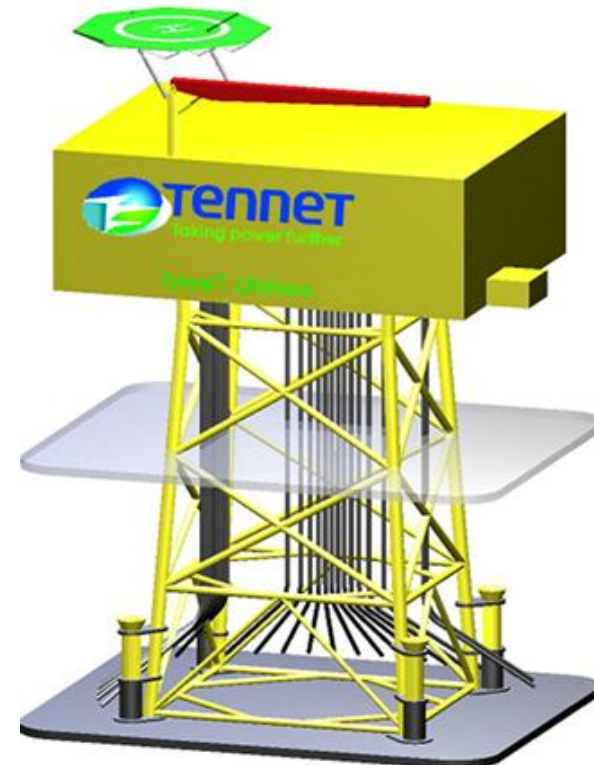
## Future proof and optimised grid development

Den Haag, 15 September 2014



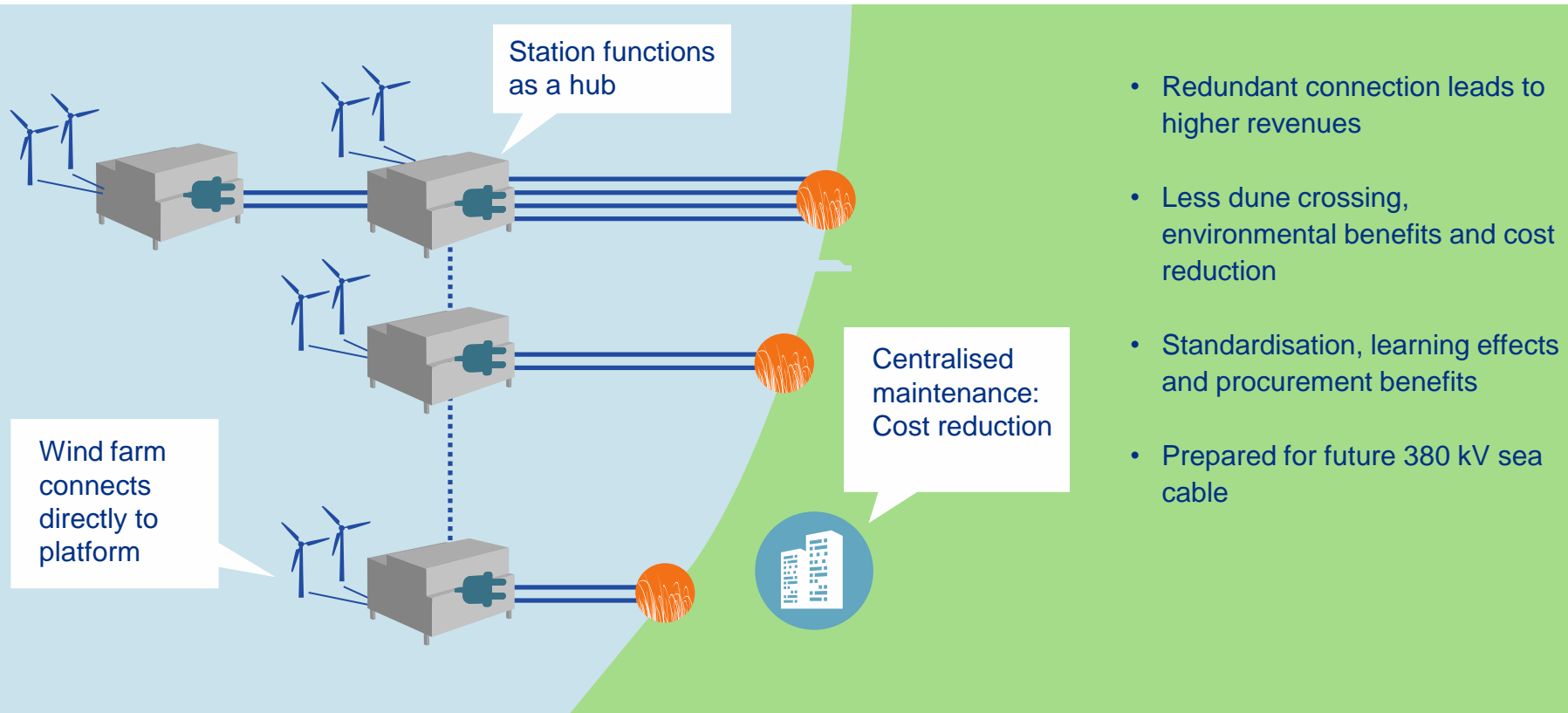
# Grid development at sea via innovative standardised platform

- A 600-700 MW platform is used as standard, to create benefits of scale with a scalable and stepping stone platform.
- Timing of preparation and realisation in sync with OWF, avoiding 'stranded assets'.
- Connecting wind turbines directly to MV on the platform implies no need for an OWF platform investment.
- By compensating Mvar at sea, even locations further offshore (e.g. IJmuiden Ver) could be connected via AC.
- As soon as 380kV subsea cable is available, this can be applied and reduce the amount of required cables.
- Redundancy and flexibility can be realised cheaper compared to the individual connection, resulting in higher production volumes.



# 3450 MW Offshore wind in the Netherlands: structured

Centralised infrastructure and grid optimisation offer major benefits



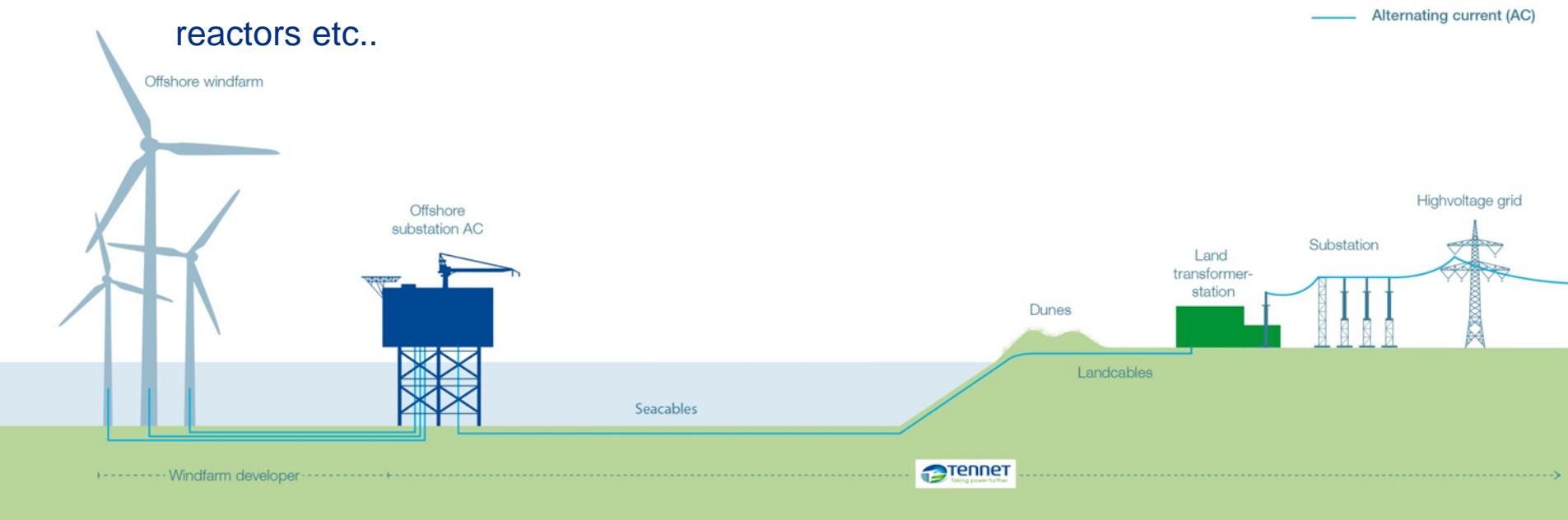
*\*Fictitious locations.*

# RCR-procedure TenneT

## Scope of Work

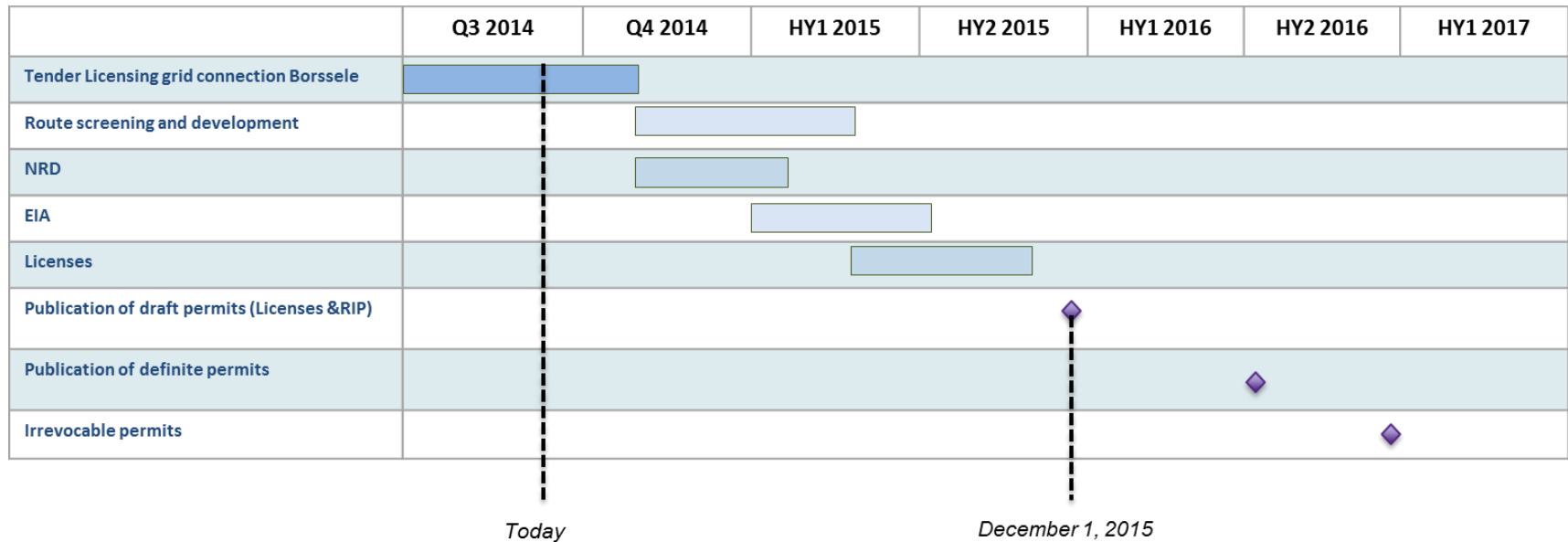
- 2 offshore platforms (AC from probably 66 kV to 220 kV);
- 4 offshore 220 kV AC offshore cable systems (3 phases per cable, one cable per system). Two systems for each platform;
- 4 onshore 220 kV AC land cable systems (1 phase per cable – three cables per system);
- Expansion of 380kV substation Borssele (onshore) with 220/380 kV, transformers, reactors etc..

Offshore wind connection in The Netherlands – schematic



# RCR procedure TenneT

## Time-line

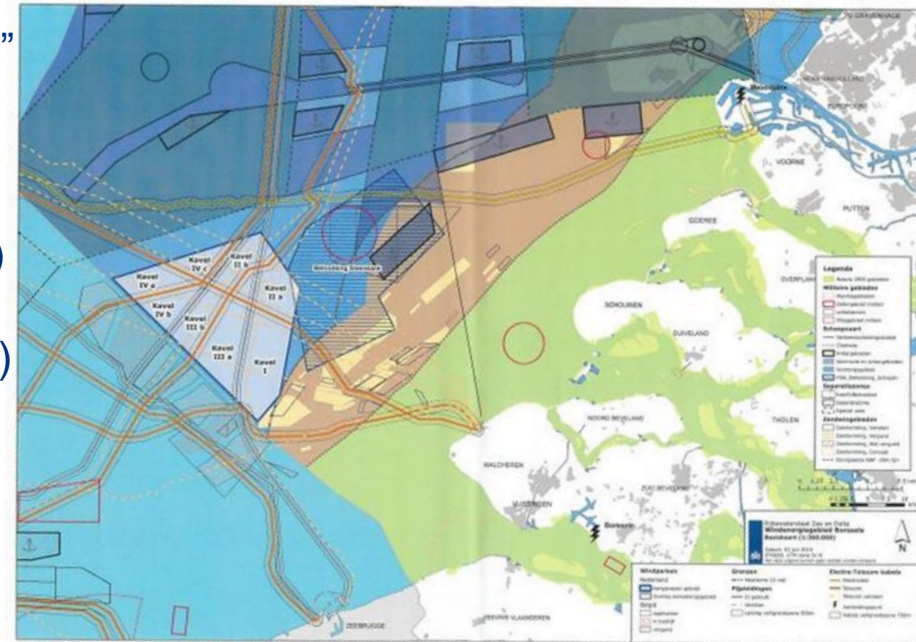


- Party contracted for EIA and Licensing: November 2014
- Publish NRD: Early 2015
- Draft permits: < December 2015 (licenses and RIP)
- Definite permits: June 2016
- Irrevocable permits: December 2016

# Workshop: Locations of the platforms



- Platform locations inside or outside “Kavel” (wind area Borssele)
- Distance between platforms (vs. reliability)
- Cable corridors (a.o. in sand mining areas)
- Redunancy
- Helicopter deck (approach route)



# Workshop: Inter array cabling 33 kV vs 66 kV



- 33 kV offshore cable is commercial available, 66 kV is expected to be commercial available as of 2017
- TenneT supports and boosts the development 66 kV to become the new offshore standard → reduction of costs
- Application of 66 kV cabling increases the span of the platform
- 66 kV decreases grid losses
- 66 kV has the advantage of more installed power per string → less strings are needed
- MS 33/66 kV owned by TenneT?

TenneT is Europe's first cross-border grid operator for electricity. With approximately 20,000 kilometres of (Extra) High Voltage lines and 36 million end users in the Netherlands and Germany we rank among the top five grid operators in Europe. Our focus is to develop a north-west European energy market and to integrate renewable energy.

**Taking power further**

[www.tennet.eu](http://www.tennet.eu)

