

STAKEHOLDER CONSULTATION PROCESS OFFSHORE GRID NL

Type: Position paper
 Work Stream: Interface Management
 Topic: I02 – Offshore testing and commissioning with OWF
 Filename: ONL TTB-05582
 Version: V3.0
 Pages: 6 pages

QUALITY CONTROL

Prepared: AMO
 Reviewed: AMO / NLO-OD / BLIX
 Approved: Consultation Board
 Release: BLIX

Table of Contents

1. BACKGROUND MATERIAL.....2

2. SCOPE AND CONSIDERATIONS.....2

3. OFFSHORE TESTING AND COMMISSIONING WITH OWF3

 3.1 INTRODUCTION 3

 3.2 SCHEDULE EARLY CABLE PULL-IN 3

 3.3 ALTERNATIVE SCHEDULE..... 4

4. POSITION OF TENNET6

1. Background Material

LITERATURE USED:

- IJmuiden Ver planning

2. Scope and Considerations

For the roadmap offshore wind 2030 (routekaart windenergie op zee 2030) TenneT is tasked with the connection of several offshore wind farms up to 2030. The wind farm zones 'Hollandse kust West' and 'Ten Noorden van de Waddeneilanden' will be connected with TenneT's previously established and consulted standardized 700 MW grid connection concept. Due to its size and distance to shore, a new grid connection concept has been established for the wind farm zone IJmuiden Ver. The figure below shows a schematic cross-section of this new grid connection concept. Wind turbines are connected through 66 kV "inter-array" cables (in orange) to an offshore (HVDC) converter station. Using 2 GW high voltage (525 kV) export cables (in green) the electricity is transported to shore. TenneT will be responsible for the offshore grid, from the onshore substation up to and including, the offshore substation. TenneT intends to create a new standard HVDC grid connection concept for both connections to IJmuiden Ver and potential future far shore wind farms.

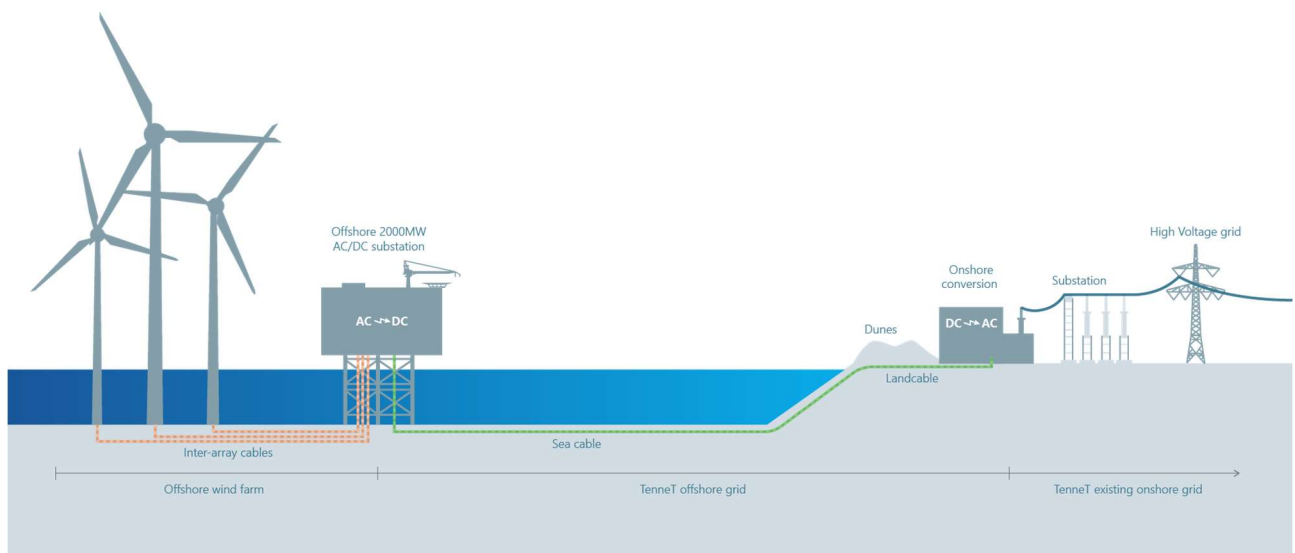


Figure 1 - HVDC grid connection concept

This paper describes how TenneT, as the offshore grid connection owner, proposes to deal with commissioning.

3. Offshore testing and Commissioning with OWF

3.1 Introduction

Prior to the consultation process a high-over planning schedule for both IJmuiden Ver alpha and beta has been agreed with the Ministry of EAC. This planning was based on the following key assumptions: Contract award in Q1 2023 following the irrevocable permit of IJmuiden Ver;

- Construction period of approximately 4,5 years for the grid connection system (GCS);
- The construction period is followed by a 6 months period to jointly commission the GCS with the offshore wind farms (OWFs).
 - Period includes energisation of the wind farms and terminal operations testing;
 - Low and high power tests of the GCS;
 - Trial operations (ideally with 100% of the connected wind farm capacity to understand the impact of the grid connection system on harmonics).

In accordance with the schedule that has been agreed with the Ministry of EAC, the IJmuiden Ver alpha platform is ready for commissioning in Q3 2027 and the IJmuiden Ver beta platform is ready for commissioning in Q1 2029. For the IJmuiden Ver alpha platform this would imply that the wind farm can only start its commissioning activities such as cable pull-in, terminations and WTG installation and commissioning in September 2027.

As TenneT recognises this is not the preferred time window, TenneT proposes different schedules that would allow OWFs to pull in their cable during the good weather season.

3.2 Schedule early cable pull-in

This schedule is based on providing the wind farms with the possibility to start early cable pull-in simultaneously with TenneT's platform commissioning (not shared testing and commissioning).

However, this schedule has the following disadvantages for the OWF:

- It is not possible to directly energise each string that is connected to the platform which has substantial risk for the technical integrity of the OWF;
- It is not possible to provide transport capacity to each string that is connected (this has severe consequences for OWF economics due to the impact of discounting).

Also, the OWF developers have indicated that their ideal cable pull-in period starts in March / April to ensure the good weather season can be used.

TenneT could seek other technical solutions to energise OWFs, however, given the fact that the 2 GW HVDC platform is not commissioned at the time when energisation is first required, these solutions are likely to be technically complex and very costly.

Furthermore, there are possibilities to perform no power tests at the very end of the platform commissioning

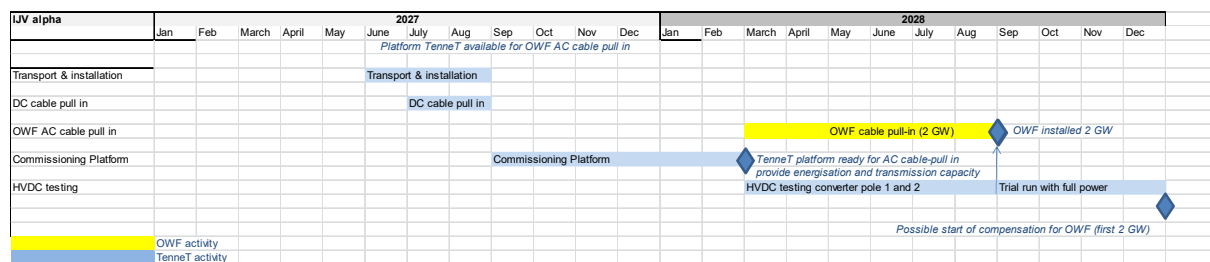
period, which could shorten but not eliminate the time without transport capacity for the OWFs. The wind farms could also start cable pull-in in September, however, this is not ideal from a weather window perspective.

Based on the arguments above TenneT is of the opinion that the preferences of the wind farm developers cannot be properly met in this schedule. TenneT has investigated the feasibility of an alternative scenario, with the results as presented in the following section.

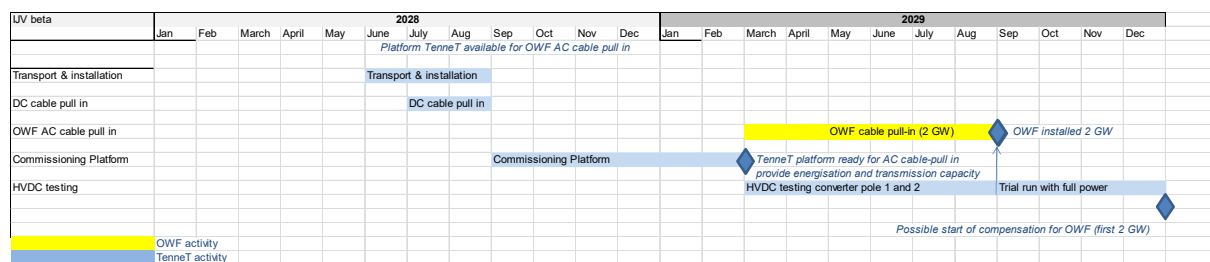
3.3 Alternative schedule

In the alternative schedule the two offshore seasons that are required to commission 2 GW offshore wind farms are separated between:

- First year of offshore activities, in which TenneT performs sail out, DC cable pull-in and the platform commissioning; During the commissioning of the platform the OWF developers may start with early cable pull-in, however, at this time there is no transport possibility, nor is it possible to energise the OWF. Furthermore, SHE limitations may apply with respect to simultaneous operations.
- Second year of offshore activities, in which the OWFs connect to the TenneT system (2 x 1 GW) and the HVDC system tests are performed including a trial run.



Graph 1.1 Commissioning Schedule IJmuiden Ver alpha



Graph 1.2 Commissioning Schedule IJmuiden Ver beta

The benefits of this schedule are as follows:

- The activities of for the GSC and the OWFs are separated as much as possible;
- The wind farm developers can start cable pull-in at the start of the good weather season (2 x 1 GW);
- The OWFs can be directly energised due to the fact that the platform commissioning is completed prior to OWF cable-pull in;

- The wind farms can have direct access to the transport capacity due to the fact that the schedule allows to perform all no power converter tests prior to start of the OWF cable pull-in.

The schedule can be applied to all tenders (in the year of the tender the OWF commissioning period can be mentioned, which will be 2028 for IJmuiden Ver alpha and 2029 for IJmuiden Ver beta). Alignment on the schedule will bring benefits to the offshore wind farm developers and TenneT as it provides clarity on roles and responsibilities.

4. Position of TenneT

The offshore wind farm developers and TenneT agree the following definitions to ensure efficient commissioning of the HVDC system:

- Guaranteed date when TenneT is ready for OWF AC cable pull-in: As of this date TenneT can energize / commission the OWF (for all 66 kV AC bays) and offer transmission capacity;
- OWF AC cable pull-in and termination finalized: Guaranteed date by the OWF developer when their cable pull-in and termination is finalized (2 x 1 GW), thus when the wind farm can provide full power for final HVDC testing. If the OWF is not fully commissioned, this leads to additional costs and delays in the schedule.
- Testing period: The testing period will start when the platform is ready for OWF cable pull-in.
 - The wind farm has access to transmission capacity, however, from TenneT's perspective the transportation performance is not yet guaranteed (compensation scheme not applicable);
 - OWF developer and TenneT will bilaterally agree on a detailed schedule to allow HVDC testing throughout this period.
- Closing of trial operations: First possible moment to start compensation.

The schedule as indicated in the graph 1.1 will be the proposed basis for the future development of the compensation scheme for HVDC systems ("schadevergoedingsregeling" as determined by the Ministry of Economic Affairs and Climate). Any penalties that may apply need to be proportional.

TenneT and the OWF developers may optimise the schedule further after signing ATO/REA, when agreement between both parties can be reached on the optimisation of the schedule. When the wind farm cannot proceed scheduled activities due to limitations of TenneT, then this should be taken into account while evaluating if the OWF has complied with its milestones.

Therefore it is possible to discuss in more detail the period necessary for 2 x 1 GW cable pull and the start of the trial run.
