

STAKE HOLDER CONSULTATION PROCESS OFFSHORE GRID NL

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QUALITY CONTROL

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1. Background material

Literature used:

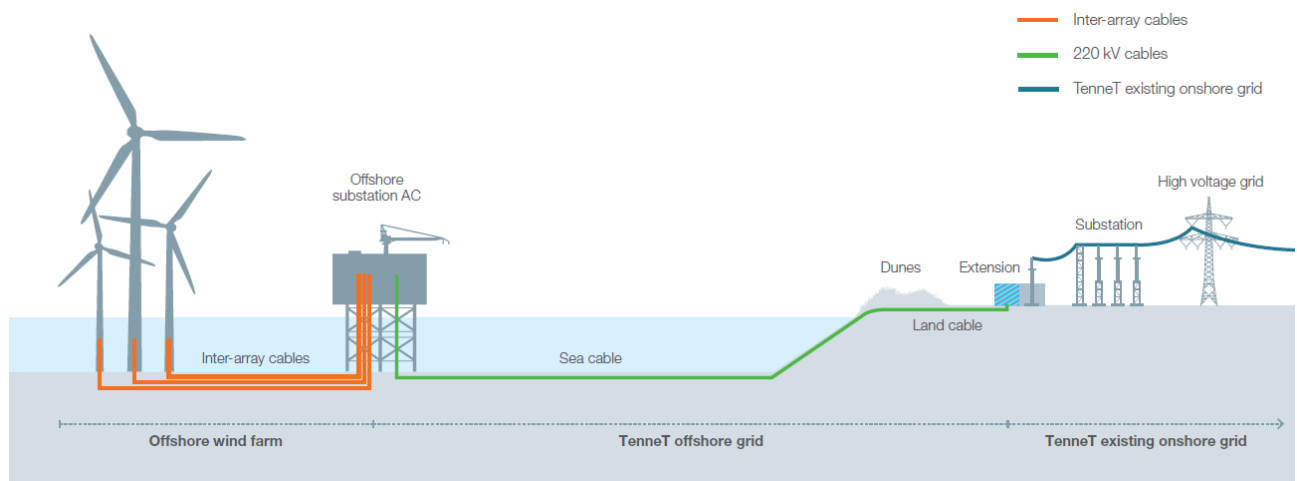
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2. Scope and considerations

The Figure below shows a schematic cross section of the connection of an offshore wind farm to the onshore electricity grid. Wind turbines are connected through “inter-array” cables (in orange) to the offshore Connection Point (CP)¹ at the offshore substation, from which electricity is transported to shore. TenneT is responsible for the grid connection up to, and including, the offshore substation and will take care for the supply and installation.

The wind park, including the wind turbines and the array cables, up to the offshore CP at the switchgear installation on the offshore substation of TenneT, is to be supplied and installed by the wind park owner (WPO²).

TenneT intends to standardise the offshore transmission grid as much as possible for all five wind areas to be realised in the coming years in line with the Energy Agreement.



Schematic of the offshore electrical grid. Source: TenneT

¹ The connection point (CP) between the offshore power park module (PPM) and TenneT is specified [TenneT position paper ONL 15-061 T.3 Point of Common Coupling] at the cable termination of the inter-array cables and the switchgear installation on the platform.

² Wind park owner: owner of the Power Park Module (TenneT, position paper ONL 15-079 T.5 Operation of Bays)

This position paper describes the interface between the wind park owners (WPO) (one WPO per offshore platform up to a maximum of three³) and TenneT. Although this paper focusses on installation activities, also the detailed design phase, fabrication and testing / commissioning phase are covered.

In this position paper the interfaces will be listed and generally described. Only on major interface items roles will be defined. The further detailing of the interfaces including detailed interface matrices will be made in later phases in mutual agreement between TenneT and the connecting WPO.

The following main technical interfaces have been identified:

1. 66 kV cable route starting at the entry of the platform safety zone (500m) up to the 66 kV switchgear
2. 66 kV switchgear at the offshore platform
3. Telecommunication and fibre optic infrastructure
4. WPO equipment located on TenneT infrastructure (offshore and onshore)

Above technical interfaces are described in further detail in paragraph 2.3 to 2.6 covering the following project phases: design, fabrication, installation, testing and commissioning. Operation and maintenance phases will be covered in a separate position paper [ONL-TTB 3040 Position Paper T14 OM interface management_v1]. Organisational interfaces (planning, coordination, safety, document control, etc) applicable to these phases will be described briefly in paragraph 2.2.

2.1 General interface management methode

Per main interfaces defined above, sub interfaces will be listed in below paragraphs. For each sub interface a functional role will be assigned to TenneT and to the WPO. The definitions of the functional roles are described in Annex A. In general one of the parties (mainly TenneT) will have the responsible (R) and accountable (A) role whereas the other party (WPO) will have either a supportive (S), consulting (C) or informative (I) role. The responsible / accountable party may transfer the 'responsible' part of the interface (execution) to a third party (contractor). In a later phase, more detailed interface matrices will be made.

2.2 Organisational interfaces

For the main technical interfaces also organisational interfaces have to be managed in each of the project phases. With regards to TenneT infrastructure (offshore platform and onshore substation) including manufacturing locations, TenneT will be responsible (R) for these organisational interfaces. Some important organisational interfaces are briefly described below.

General coordination

Interface meetings shall be held on a regular basis between all involved parties (TenneT, WPO and involved contractors). Amount, subjects, duration, location, agenda etc. of these meetings shall be agreed upon in a

³ There are two 350MW concession area's per platform which could be acquired by a single WPO or by two WPO with a possibility to have one additional small innovation wind park which could introduce a third WPO on a specific platform.

later phase.

Planning

During all project phases, TenneT will be responsible for the overall planning of the grid connection. The current version of this planning can be found in a separate position paper [ONL 15-344 P1_Planning_PP_v1].

Coordination during offshore works

TenneT will be responsible (R) and accountable (A) for the offshore platform and therefore for planning, coordination and safety rules, where WPO will be supportive (S).

To manage planning, coordination and safety properly, TenneT will provide work permits for offshore works within the safety zone (500m) of the offshore platform and for all works on the platform. The WPO will support TenneT with this coordination by correct and on-time application for work permits and by participating in all planning and progress meetings to be scheduled for this purpose.

TenneT will define the method for (emergency) communication within the project site (platform safety zone and the platform itself).

Further agreements between TenneT and WPO on marine coordination and coordination of works on the platform shall be made in a later phase.

Document control

Exchange of documents and formal communication between the parties shall be through a single document management system. For all interface items where TenneT will have the responsible / accountable role, TenneT will select this system.

2.3 66 kV cable route from platform safety zone up to the 66 kV switchgear

In the table below, high level interfaces for the 66 kV cable route from entry of the platform safety zone (500m) up to the 66 kV switchgear are listed with for each interface the role of the two main stakeholders.

Table 2-1. High level interfaces on 66 kV cable route from platform safety zone up to the 66 kV switchgear

Interface	TenneT	WPO
Design: Cable field layout in the direct vicinity of the platform (<500m)	A ⁴	R
Design: Cable approach from burial to J-tube including cable scour protection and cable protection system	C	R / A
Design: Scour protection of the jacket (if applicable)	R / A	C
Design: J-tube with a bell mouth	R / A	C
Design: Cable hang-offs	C	R / A

⁴ The cable field layout shall be approved by TenneT. In case of conflicting interest within the 500m zone TenneT will be leading and decide.

Interface	TenneT	WPO
Design: Cable route from hang-off to 66 kV switchgear	R / A	C
Design: Cable pull-in methodology (basic design/philosophy)	R / A	C
Design: Cable pull-in method (detailed design)	C	R / A
Construction & installation of the platform	R / A	I
Procurement of HV Cable trays	R / A	I
Procurement of Cable specific items (clamps, cable termination, etc.)	-	R / A
Installation: 66kV Cable pull-in and routing works	S	R / A
Installation: 66kV Cable termination and connection works	S	R / A
Cable testing	C	R / A
Energising of cable	R	A ⁵

Design

Design of the cable pulling methodology (basic design/philosophy) will take into account the following factors:

- Dimensioning and load restrictions (e.g. J-tubes)
- Locations for winches,
- Temporary storage area + facilities (scaffolding) on the cable deck in case the cables are stored before the topside is installed on top;
- Working area on the cable deck for cable works;

Cable route design will be based on pull-in of the 66 kV cables and routing them up to the 66 kV switchgear without joints or junction boxes on the cable deck.

Based on the generic cable pulling methodology the WPO has to make a detailed design for the cable pulling and installation method. With respect to the J-Tubes, they have a fixed position on Jacket which is determined in the basic design. The angle of the J-tube may however be (slightly) adapted as long as there are no conflicts with neighbouring cables or J-tubes. TenneT has to be consulted in this design process and has to approve the method.

Procurement for items of the 66kV Cable route

TenneT will procure, after detailed design by the WPO, the cable trays for the main cable route. All components which are cable specific (e.g.; clamps, wall penetrations etc) will be procured by the WPO.

Installation of 66 kV Cables

WPO is responsible for installation of cable protection (if applicable), the actual cable pull-in, cable storage (if any), J-Tube pigging, cable routing, cable fastening and termination works making use of equipment such as pulling winch, hang-offs, pull-in wire etc. TenneT will support these WPO activities with regards to the platform structure itself.

⁵ Accountable here means: the WPO will give clearance to TenneT to energise the cable.

Onshore, the WPO will get the possibility to install pull-in equipment on the platform.

Testing and commissioning

WPO will be responsible for (after installation) testing of the 66 kV cables, including HV tests, phase checks, sheath testing and OTDR tests on optical fibres.

For commissioning of the 66 kV cables, TenneT will be responsible for the energising of the cable and TenneT will do the actual switching operation, after clearance is given by the WPO. Reference is made to position paper ONL 15-079-T5_Operation of Bays_PP_v1.

For the testing and commissioning phase agreements shall be made between TenneT and the WPO including agreements on installation responsibility (nominated person⁶) and LOTO (Lock-out, Tag-out) principles.

2.4 66 kV switchgear (feeder bays for WPO strings)

In the table below, high level interfaces for the 66 kV switchgear (feeder bays for WPO strings) are listed with for each interface the role of the two main stakeholders.

Table 2-2. High level interfaces on 66 kV switchgear (feeder bays for WPO strings)

Interface	TenneT	WPO
Design: 66kV GIS	R/A	I
Design: switchgear control	R/A	I
Design: protection of string feeder bays	R/A	C
Installation of switchgear on platform (+ P&C cabinets)	R/A	-

Design / installation onto the platform

TenneT intends to include the following cable termination in the 66 kV switchgear (only GIS part) which is designed according to IEC 62271-209:

Pfisterer HV-CONNEX, Size 4

The WPO shall align the accessories and (type) testing of its 66 kV cables on these specifications.

See position paper ONL 15-060-T2_ J tubes_ bays_PP_v3.1 for additional information on 66 kV GIS design.

Aspects on which the WPO will be consulted during the design phase of the 66 kV switchgear protection system are:

- Type of protection relay(s) for the string feeder bays;

⁶ Nominated person: the person responsible for the electrical safety of an electrical system. In Dutch: "installatie verantwoordelijke".

- Protection relay settings for the string feeder bays;

See position paper ONL 15-080-T6_Protection_PP_v2 for more information on protection of the 66 kV switchgear on the offshore platform.

Testing and commissioning

For testing and commissioning of the 66 kV system, see paragraph 2.3.

2.5 Telecommunication and fibre optic infrastructure

In the table below, high level interfaces for the telecommunication and fibre optic infrastructure (for use of the WPO) are listed with for each interface the role of the two main stakeholders.

Table 2-3. High level interfaces on the telecommunication and fibre optic infrastructure (for use of the WPO)

Interface	TenneT	WPO
Design & installation: Fibre optic infrastructure of the grid connection system	R / A	C
Design & installation: routing and termination of inter-array FO cable in splice box	C	R / A
Design & installation: Interface to other equipment of TenneT	R / A	I

Fibre optic infrastructure design and installation

In the design phase, TenneT will take the lead in the fibre optic infrastructure design and TenneT will define requirements, location of patch panels and fibre optic cabling within the platform. WPO shall provide all necessary design input including number and specification of fibre optic cables from WPO inter-array strings. Special attention shall be given to the location of the first splice boxes where fibre optic cables from WPO inter-array strings will be terminated and connected to fibre optic platform cables.

During the design phase, agreements shall be made on interface management of the installation phase (checks by WPO) and testing phase (see also paragraph 2.6).

For the scope and design of the telecommunication and fibre optic equipment for use of the WPO, reference is made to position paper ONL 15-185-T8_SCADA communication interface and data links_PP_v2.

Interface to other equipment of TenneT

Some data acquisition equipment on the platform owned and operated by TenneT will be made available to the WPO. Reference is made to position topic " T18_Shared Services ".

2.6 WPO equipment located on TenneT infrastructure (offshore and onshore)

Reference is made to position paper ONL 15-185-T8_SCADA communication interface and data links_PP_v2 where WPO systems are listed for the WPO rooms located on the land station and on the platform which are taken into account by TenneT.

Also auxiliary services for the WPO rooms and estimated room sizes are listed and described in that position paper.

In general the WPO can freely design the equipment to be installed in the WPO rooms as long as general requirements and boundary conditions applicable to these rooms are followed (weight / size limits, climate conditions, power supply etc). If equipment is to be placed outside of the WPO room (including connection from this equipment to the WPO room), WPO shall inform TenneT on these requirements in the early design stage and agreements on this equipment shall be made between TenneT and the WPO⁷.

With regards to installation of equipment in the WPO rooms, TenneT will preferably finish installation activities for auxiliary services before WPO will start installation of its equipment. Agreements shall be made on starting date and (ultimate) date of completion of the WPO installation works.

WPO room on land station

In the table below, high level interfaces for the WPO equipment in the WPO room on the land station are listed with for each interface the role of the two main stakeholders.

Table 2-4. High level interfaces on the WPO equipment in the WPO room on the land station

Interface	TenneT	WPO
Design: TenneT auxiliary services for the WPO room	R/A	C / I
Design: WPO equipment inside WPO room	I	R / A
Construction: TenneT auxiliary services for the WPO room	R/A	I
Construction: installation of WPO equipment in the WPO room	S	R / A

WPO room on platform

In the table below, high level interfaces for the WPO equipment in the WPO room on the platform are listed with for each interface the role of the two main stakeholders.

Table 2-5. High level interfaces on the WPO equipment in the WPO room on the platform

Interface	TenneT	WPO
Design: TenneT auxiliary services for the WPO room	R/A	C / I
Design: WPO equipment inside WPO room	I	R / A
Construction: TenneT auxiliary services for the WPO room	R/A	C / I
Construction: installation of WPO equipment in the WPO room	S	R / A
Construction: installation of WPO equipment on other locations	S	R / A

⁷ For the WPO room on the platform, WPO will be provided a) space to place sensors outside and b) access to shared services data. See position paper "ONL 15-185-T8_SCADA, communication interface and data links_PP_v2" and position topic "T18_Shared Services "

All permanent WPO equipment for the WPO room on the platform shall be installed when the platform still is at the yard, i.e. before load out. Configuration / programming works, interface tests and inspections by WPO shall be done at the construction yard as far as possible. The construction yard may be located outside of Europe.

If installation works need to be planned after offshore installation of the topside, WPO shall inform TenneT as early as possible.

Commissioning

The WPO will be responsible and accountable for all testing and commissioning activities related to the WPO equipment on TenneT's infrastructure. TenneT will support WPO during testing and commissioning with regards to the services provided by TenneT (66 kV GIS switching actions, auxiliary services to WPO rooms, shared data acquisition systems, optical fibres).

TenneT aims to have finished the testing and commissioning phase of the grid connection system before the start of the WPO testing and commissioning activities.

3. Position TenneT

Above considerations lead TenneT to the following position:

TenneT intends to manage interfaces by involving all stake holders as early in the project as possible and to define clear roles for each interface.

In this position paper the major technical interface categories have been identified and briefly described. Further details of these interfaces shall be determined in mutual agreement between the WPO and TenneT in a later phase.

4. Topic consultation

The expert meeting of November 9th, 2015 gives TenneT the opportunity to inform the developers on their position regarding "Installation interface management".

5. Annex A - Functional roles in interface management (RASCI)

Functional Role:

R	The party who is responsible for the interface and is responsible for the execution. The responsible must report to the accountable. Each activity should have a minimal number of "R"s.
A	The party who is accountable and qualified for the correct and thorough completion of the interface and must give an approval before an action item or solution can be effective.
S	The party who supports the responsible party to achieve the result of the work execution
C	The party who is consulting the other involved parties regarding the implementation or must be pre consulted. This is two-way communication. This person will (also) give direction to the result, he / she will be consulted prior to decisions or actions.
I	The party who needs to be informed about the decisions, on the progress, achievements etc. This is one way communication. Limited number - the necessary ones.