

# Tennet

ONL TTB-03070

Stakeholder engagement and  
Consultation Process OWFs

Expert Meeting, 21.10.2015, Arnhem

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# Stay tuned. Safety first!



Voor uw en onze veiligheid vragen we uw aandacht voor de volgende veiligheidsmaatregelen.

In geval van een ontruiming van het pand:

- Volg de vluchtroute zoals aangegeven.
- Gebruik de trap in plaats van de lift.
- Ga naar het verzamelpunt.
- Volg de aanwijzingen van de bedrijfshulpverlener. Deze is geval van een ontruiming aanwezig.





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# Welcome

# Agenda (21.10.2015)



| WHEN        | WHAT  | TYPE OF SESSION |
|-------------|---|-----------------|
| 09:00-09:15 | Welcome<br>Agenda for today   |                 |
| 09:15-10:00 | T.13 Installation interface management [D]  | Discussion      |
| 10:00-10:15 | T.2 Number of bays [N]<br>T.11 Overplanting [N]<br>T.12 Redundancy & Availability [N] | Notification    |
| 10:15-10:30 | <i>Coffee</i>   |                 |
| 10:30-11.15 | T.14 O&M interface management [D]   | Discussion      |
| 11.15-12.00 | T.18 - Shared data acquisition systems [D]  | Discussion      |
| 12.00-13.00 | <i>Lunch</i>  |                 |
| 13.00-13:45 | T.17 Compliance testing [D]   | Discussion      |
| 13.45-14.30 | T.15 Harmonic emission limits [D]   | Discussion      |
| 14.30-14.45 | <i>Coffee</i>   |                 |
| 14.45-15.30 | P.1 Planning [D]  | Discussion      |
| 15.30-17.00 | Technical Annex to Agreements [D]   | Discussion      |
| 17.00-17.10 | Closure   |                 |



# **T.13 Installation interface management**

## *Discussion*



## T.13 Installation interface management

### Input

- TenneT position paper: ONL TTB-03024 T13\_Installation interface management\_PP\_v2

### Main considerations

- Main technical interfaces:
  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)
- Roles in interface matrix:  
responsible (R) | accountable (A) | supportive (S) | consulting (C) | informative (I)



## T.13 Installation interface management

### Main considerations (continued)

- Coordination during offshore works

TenneT will provide work permits for offshore works within the safety zone (500m) of the offshore platform and for all works on the platform. 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 management

Exchange of documents and formal communication between the parties shall be through a single document management system. TenneT will select this system.



## T.13 Installation interface management

### Main considerations (continued)

#### New additions: procurement and installation

- TenneT will procure, after detailed design by the WPO, the cable trays for the main cable route.
- All components which are cable specific (eg; clamps, wall penetrations etc) will be procured by the WPO.
- WPO is responsible for installation of cable protection (if applicable), the actual cable pull-in, cable storage (if any), cable routing, cable fastening and termination works.
- Any equipment required for these activities, e.g. pull-in winch, swivels, pull-in wire, tools, etc. are the responsibility of the WPO. TenneT will support these WPO activities.
- The J-Tubes will be checked for internal damages (pigging) onshore by TenneT. The WPO will be invited to witness.
- Any offshore pigging is the responsibility of the WPO.
- The WPO will get the possibility to install equipment on the platform onshore.





## T.13 Installation interface management

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

- Interface matrix

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



## T.13 Installation interface management

### 66 kV switchgear (feeder bays for WPO strings)

- Interface matrix

| 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    | -   |

### Telecommunication and fibre optic infrastructure

- Interface matrix

| 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     |



## T.13 Installation interface management

### WPO room on land station

- Interface matrix

| 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

- Interface matrix

| 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 |



## T.13 Installation interface management

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### **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.



# Questions & concerns



# Small changes to Position Papers

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## **T.2 Number of J-tubes/bays**

Design of the J-tube mentions an inner diameter of 450mm instead of 400mm.

## **T.12 Redudancy/availability**

TenneT has decided not to update the single line diagram ("Option 2"). As it is currently not known how offshore wind farms are allocated per section or per transformer, TenneT decided leave this open, and have final decision when winners are known.



## T.11 Overplanting

The following items have been added;

1. Additional calculations on dynamic loading of the export cables
2. Export cable load management
  1. Alignment of the wind park owner's (WPO) generation forecasts to dynamic cable loading capabilities. TenneT will provide:
    - a) calculation results as described above (updated on the as-built situation)
    - b) the actual cable conductor temperature measurements (data format and frequency to be defined in a later stage)
  2. Actual curtailment of the power output of the wind park by the WPO;
  3. Actual curtailment of the power output of the wind park by TenneT.



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**Coffee break**





# **T.14 O&M interface management**

## *Discussion*



# T.14 O&M interface management

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## Input

- TenneT position paper: ONL-TTB-3040 T14\_OM interface management\_PP\_v2

## Main considerations

- Roles in interface matrix:  
responsible (R) | accountable (A) | supportive (S) | consulting (C) | informative (I)



## T.14 O&M interface management

### Main considerations (continued)

- Main operational interfaces:
  1. Logistics/transport to platform
  2. Logistics/transport to platform
  3. Work permitting process
  4. Installation responsibility / Work responsibility / designated person
  5. Access to the platform for the SCADA controls system
  6. Communications regarding activities around platform
  7. Switching activities by TenneT for WPO
  8. Operations of grid connection
  9. Power interruptions due to failures on the platform or in the 66kV grid



## T.14 O&M interface management

### Main considerations (continued)

- Main maintenance interfaces:
  1. Maintenance on 220kV equipment
  2. Maintenance 66kV inter-array + 66kV equipment TenneT (incl protection control)
  3. Maintenance combined equipment on the platform
  4. Metering activities (calibrations)
- TenneT has the opinion that the O&M interfaces should be worked out in close cooperation with the connected parties. Therefore TenneT will do this in close cooperation with the connected parties for Borssele Alfa, which will be known mid 2016. The Borssele Alfa connection should be operational in 2019. The adopted processes, protocols and standards should give clarity on the roles at the interfaces for customer connections will be applicable for the other four platforms.



## T.14 O&M interface management

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### **Position**

In this position paper, the major O&M interface categories have been identified and briefly described. Further details of these interfaces will be worked out in cooperation with the connected parties of the Borssele Alpha platform (during the construction phase) and will be applicable for the other four platforms.



# Questions & concerns



# T.18 Shared data acquisition systems

## *Discussion*



## T.18 Shared data acquisition systems

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**There are two options for the measurement systems:**

- a) Only one system per function where data of measurement systems may be shared between the stakeholders
- b) Each stakeholders installs its own system

TenneT intends to make available the data of as many measurement systems as possible / required.

For the external measurement systems (weather and ships) TenneT intends to appoint RWS as a coordinator and supplier.





## T.18 Shared data acquisition systems

TenneT foresees following measurement systems to be installed on the platforms:

| System                                | Responsible for system          | Shared?        |
|---------------------------------------|---------------------------------|----------------|
| AWOS                                  | RWS                             | Yes            |
| AIS                                   | RWS                             | T.b.d.         |
| Visibility measurements               | RWS                             | Yes            |
| SWH (Wave Heights)                    | RWS                             | Yes            |
| CCTV                                  | TenneT                          | Yes            |
| LIDAR                                 | TenneT + WPO's                  | No             |
| DTS (Distributed temperature sensing) | TenneT (EXC), WPO (IAC)         | Possible (EXC) |
| Accountable metering (kWh / kVar)     | Independent metering firm       | No             |
| Metering (Park control)               | WPO                             | No             |
| Power quality metering                | TenneT                          | Yes            |
| VT's and CT's for metering            | TenneT (within 66kV switchgear) | Yes            |
| Bird / Bat radar                      | RWS                             | Yes            |
| Ship Radar                            | N/A (will not be available)     | N/A            |



## T.18 Shared data acquisition systems

### Position

With respect to data acquisition on the offshore platform, TenneT aims to share systems with WPO's where possible in order to save on space, weight and power consumption.

The following systems will be shared:

- Various meteo systems (AWOS, Visibility, SWH)
- AIS (if legally possible)
- CCTV
- Power quality metering

For these shared systems, communication interface(s) will be required to be able to share the data.

For the systems which are not shared, TenneT will make available all provisions required for installation and operation of these systems including mounting facilities, auxiliary services and telecommunication systems.



# Questions & concerns



# Lunch



# **T.17 Compliance testing**

## *Discussion*



# T.17 Compliance testing

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## Input

- TenneT position paper: ONL-TTB-03069 T17\_Compliance testing\_PP\_V1

## Main considerations

The commissioning can be divided into two main consecutive activities:

- the Site Acceptance Test (SAT) activities (followed by)
- the compliance testing activities.



## T.17 Compliance testing

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### **Main considerations**

The SAT program of the OWF shall be approved by TenneT and scheduled in cooperation with TenneT.

The compliance tests are described in the (draft) RfG, chapter 4 of Title IV "Compliance testing for offshore power park modules", and has been further detailed in the TenneT document "Compliance activities" with reference SO-SOC 13-141, version 3.0 January 2014.

These two documents, with the additions (as mentioned in the position paper) to the document SO-SOC 13-141, are applicable for the compliance activities.



## T.17 Compliance testing

### Position

With respect to the SAT activities of the Offshore PPM connection to the TenneT platform, the OWF shall submit their SAT program to TenneT for approval.

Furthermore, it is the responsibility of each connected OWF party that its Offshore PPM has the required capabilities according to the TenneT requirements.

TenneT requires the OWF to perform all compliance activities. The planning of all activities shall be agreed with TenneT.

Once all compliance tests of the entire connection are performed successfully, the OWF realisation phase is considered to be finalised.





# Questions & concerns



# **T.15 Harmonic emission limits**

## *Discussion*



# T.15 Harmonic emission limits

## Input

- TenneT position paper: ONL TTB-3041 T15\_Harmonic emission limits\_v2

## Main considerations

- To ensure a proper operation of the PPM and the TenneT offshore and onshore grid, attention shall be paid to the following topics:
  1. The offshore PPM shall not exceed the harmonic emission limits as specified by TenneT
  2. The connection of the TenneT offshore grid, including the offshore installation of the PPMs, to the onshore grid shall have no impact on the harmonic amplification.



## T.15 Harmonic emission limits

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### Main considerations: harmonic emission limit

- The connected parties shall respect the defined acceptable Total Harmonic Distortion level at their 66 kV grid connection. All connected parties shall in principle take measures to fulfil the requirements.
- At this stage it is not possible, without detailed information of the grid, to define concrete and complete requirements with respect to the harmonic emission limits.
- A three step approach is defined in ONL\_TTB-3041\_T15\_Harmonic\_emission\_limits\_PP\_v2



## **Main considerations: harmonic amplification**

- TenneT will take the responsibility to undo the impact, at the onshore connection to the grid, of the total offshore grid (export cabling and inter array cabling) to the onshore grid with respect to the harmonic amplification.
- Compliancy and planning levels of the THD at the 66 kV busbar shall also be a design criterion for the PPM of the OWFs.
- The OWF shall take care of the withstandability of their equipment against any amplification of background harmonics due to their inter array grid.



## T.15 Harmonic emission limits

### Position

- Connected party is responsible for fulfilling the requirements with respect to the harmonic distortion.
- TenneT will specify the maximum allowed harmonic distortion (for instance by specifying the maximum emission level of individual harmonic currents) at the 66 kV level and the maximum allowed impact on the onshore grid.
- If more than one OWF is connected to one single 66 kV bus bar, the emission planning level will be distributed proportional to the rated power of each connected party.
- The necessary measures to be taken by the OWF to fulfil the requirements with respect to the harmonic distortion, are the responsibility of the OWF.
- TenneT will take the responsibility to investigate and specify the needed measures to make sure that at the onshore connection point there is no harmonic amplification caused by the offshore installation of TenneT and the installation of all connected OWFs.



# Questions & concerns



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**Coffee break**





# **P.1 Planning**

## *Discussion*



## Input

- TenneT position paper: ONL 15-344-P1\_Planning\_PP\_v2

## Main considerations

- TenneT will have the grid connection for Borssele Alpha ready 31 August 2019. TenneT and the OWF will as soon as practicable jointly prepare a planning. TenneT has the intention to investigate and agree on an optimal planning for the realisation phase ahead of 31-8-2019 for both the activities of TenneT and the OWFs.
- TenneT will not anticipate on a possible later start date of the operation phase, according to the agreement that the last possible start of the subsidy payment is 5 years after the subsidy tender decision.
- A tight cooperation with the OWF-developers will be pursued to mitigate and anticipate possible delays or accelerations.



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# Technical Annexes

## *Discussion*



## Annex sections deviating from position papers

- The following position papers are similar to the content of the legal annexes.

| Position paper                                    | Annex number | Annex (sub-)topic                             |
|---|--------------|---|
| T2: J-tubes - bays                                | 2            | J-tubes                                       |
| T3: Point of common coupling                      | 2            | Primary connection point                      |
| T4: Access to platform                            | 6            | Access to platform                            |
| T8: SCADA, communication interface and data links | 3            | SCADA, communication interface and data links |



# Updates from position papers in legal annexes

- The content of the following position papers (PP) has been updated in the legal annexes.

| PP          | Annex | Main difference  | Explanation   |
|-------------|-------|--|---|
| T3: PCC     | 2     | Annex provides definition sec. & tert. connection point.                         | Discussed   |
| T4, T7, T15 | 4     | RfG code references and amendments   | Informed through presentations                                    |
| T7: RPC     | 3     | Full reactive power cap. of PPM  | Further clarification   |
| T8: SCADA   | 2     | Optic fibre cable routing/patching and splicing                                  | Refers to option 3a in PP (best solution), technical result of PP |
| T9: Met.    | 2, 3  | Transition of ownership  | Technical result of PP  |
| T14: OM IM  | 6     | Switching  | Standard procedure  |
| -           | 3     | Shared services, flexible trans. cap., harm. emission limits and transient study | Under consultation  |
| -           | 6     | Control work, failure identification, (major) failure response,                  | Standard procedure  |
| -           | 7     | Insurance  | Under consultation  |
| -           | 8     | Tariff letter  | Standard procedure  |



## T.13 Installation interface management

### Main content of Annex

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.

Body of the text will be the following interface matrices(from ONL TTB-03024 T13\_Installation interface management\_PP\_v2):

- 66 kV cable route from platform safety zone up to the 66 kV switchgear
- 66 kV switchgear (feeder bays for WPO strings)
- Telecommunication and fibre optic infrastructure
- WPO room on land station
- WPO room on platform

Procurement and installation of 66 kV route as defined in ONL TTB-03024 T13\_Installation interface management\_PP\_v2

Further details of these interfaces shall be determined in mutual agreement between the WPO and TenneT in a later phase.



## T.13 Installation interface management

- Coordination during offshore works

TenneT will provide work permits for offshore works within the safety zone (500m) of the offshore platform and for all works on the platform. 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 management

Exchange of documents and formal communication between the parties shall be through a single document management system. TenneT will select this system.



## T.14 O&M interface management

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### **Main content of Annex**

The major O&M interface categories will be described (also see below).

Further details of these interfaces will be worked out in cooperation with the connected parties of the Borssele Alpha platform (during the construction phase) and will be applicable for the other four platforms.

### **Identified O&M interfaces**

1. Logistics/transport to platform
2. Logistics/transport to platform
3. Work permitting process
4. Installation responsibility / Work responsibility / designated person
5. Access to the platform for the SCADA controls system

Continued on next slide





## T.14 O&M interface management

6. Communications regarding activities around platform
7. Switching activities by TenneT for WPO
8. Operations of grid connection
9. Power interruptions due to failures on the platform or in the 66kV grid

### **Identified maintenance interfaces:**

1. Maintenance on 220kV equipment
2. Maintenance 66kV inter-array + 66kV equipment TenneT (incl protection control)
3. Maintenance combined equipment on the platform
4. Metering activities (calibrations)



## T.15 Harmonic emission limits

### Main content of Annex

1. The offshore PPM shall not exceed the harmonic emission limits as specified by TenneT
  - At this stage it is not possible, without detailed information of the grid, to define concrete and complete requirements with respect to the harmonic emission limits
  - Approach with three steps (ONL TTB-3041 T15\_Harmonic emission limits\_PP\_v2) will be entered in Annex
2. The connection of the TenneT offshore grid, including the offshore installation of the PPMs, to the onshore grid shall have no impact on the harmonic amplification
  - TenneT will take the responsibility to undo the impact, at the onshore connection to the grid, of the total offshore grid (export cabling and inter array cabling) to the onshore grid with respect to the harmonic amplification
  - The compliancy and planning levels of the THD at the 66 kV busbar shall be a design criterion for the PPM of the OWFs



# T.17 Compliance testing

## Main content of Annex

### 1. Site Acceptance Test (SAT) activities (followed by)

- Responsibility of the OWFs and OWFs shall mitigate any risk that the energisation of their installation jeopardises the TenneT offshore grid
- SAT program of the OWF shall be approved by, and scheduled in cooperation with, TenneT

### 2. Compliance testing activities

- As described in the (draft) RfG, chapter 4 of Title IV "Compliance testing for offshore power park modules"
  - Further detailed in the TenneT document "Compliance activities" with reference SO-SOC 13-141, version 3.0 January 2014 with additions as noted in ONL-TTB-03069
- T17\_Compliance testing\_PP\_V1



## T.18 Shared data acquisition systems

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### Main content of Annex

The following systems will be shared:

- Various meteo systems (AWOS, Visibility, SWH)
- AIS (if legally possible)
- CCTV
- Power quality metering

For these shared systems, communication interface(s) will be required to be able to share the data.

For the systems which are not shared, TenneT will make available all provisions required for installation and operation of these systems including mounting facilities, auxiliary services and telecommunication systems.



# Closure

# Thank you

