

## **Annexes to Connection and Transmission Agreement**

<b>Annex 0</b>	<b>Definitions used in Annexes</b>
<b>Annex 1</b>	<b>Details of Connected Party</b>
<b>Annex 2</b>	<b>Description and technical specifications of the Connection, including drawings</b>
<b>Annex 3</b>	<b>Technical terms and conditions for the Platform</b>
<b>Annex 4</b>	<b>Technical requirements applicable for the connection of offshore power park modules</b>
<b>Annex 5</b>	<b>Compliance Activities; applicable testing requirements</b>
<b>Annex 6</b>	<b>Operational arrangements and exchange of information</b>
<b>Annex 7</b>	<b>Tariff sheet</b>

## Annex 0 Definitions used in Annexes

The English terms used in the Annexes are referring to the following Dutch definitions, defined in article 1 of the General Terms and Conditions to the Realisation Agreement and the Connection- and Transmission Agreement.

English Term	Definitie	
<b>Annex</b>	<b>Bijlage</b>	Een bijlage bij een van de Overeenkomsten, zoals van tijd tot tijd gewijzigd.
<b>Agreements</b>	<b>Overeenkomsten</b>	De Realisatieovereenkomst en de Aansluit- en Transportovereenkomst.
<b>Realisation Agreement</b>	<b>Realisatieovereenkomst</b>	De tussen TenneT en Aangeslotene gesloten realisatieovereenkomst en de bijlagen daarbij, zoals van tijd tot tijd gewijzigd.
<b>Connected Party</b>	<b>Aangeslotene</b>	De aangeslotene zoals omschreven in de Overeenkomsten. Aangeslotene wordt geacht Offshore Power Park Module (Offshore PPM) te zijn zoals bedoeld in RfG.
<b>Connection</b>	<b>Aansluiting</b>	Het geheel van kabels en apparatuur op het Platform dat de Installatie verbindt met het Net op zee. De Aansluiting, zoals nader omschreven in Bijlage 2 bij de Realisatieovereenkomst en Bijlage 2 bij de Aansluit- en Transportovereenkomst, maakt deel uit van het Net op zee. De 66 kV kabels van Aangeslotene maken geen deel uit van de Aansluiting.
<b>Platform</b>	<b>Platform</b>	Het offshore onderstation van TenneT, het platform waarop de Aansluiting aanwezig is of wordt aangebracht.
<b>Offshore Power Park Modules</b>	<b>Offshore Power Park Module / Offshore PPM</b>	Een Offshore PPM of elektriciteitsproductie-eenheid als bedoeld in RfG, zoals verder gespecificeerd in Bijlage 4 bij de Realisatieovereenkomst en Bijlage 4 bij de Aansluit- en Transmissieovereenkomst.
<b>Connection</b>	<b>Aansluiting</b>	Het geheel van kabels en apparatuur op het Platform dat de Installatie verbindt met het Net op zee. De Aansluiting, zoals nader omschreven in Bijlage 2 bij de Realisatieovereenkomst en Bijlage 2 bij de Aansluit- en Transportovereenkomst, maakt deel uit van het Net op zee. De 66 kV kabels van Aangeslotene maken geen deel uit van de Aansluiting.
<b>Connection Point</b>	<b>Overdrachtspunt</b>	Een fysiek punt dat de interface vormt tussen enerzijds de Aansluiting en anderzijds de Installatie,

		zoals omschreven in Bijlage 2 bij de Realisatieovereenkomst en in Bijlage 2 bij de Aansluit- en Transportovereenkomst.
<b>Primary Connection Point</b>	<b>Primair Overdrachtspunt</b>	Elk primair Overdrachtspunt zoals omschreven in Bijlage 2 bij de Realisatieovereenkomst en Bijlage 2 bij de Aansluit- en Transportovereenkomst.
<b>Secondary Connection Point</b>	<b>Secundair Overdrachtspunt</b>	Elk secundair Overdrachtspunt zoals omschreven in Bijlage 2 bij de Realisatieovereenkomst en Bijlage 2 bij de Aansluit- en Transportovereenkomst.
<b>Tertiary Connection Point</b>	<b>Tertiair Overdrachtspunt</b>	Elk tertiair Overdrachtspunt zoals omschreven in Bijlage 2 bij de Realisatieovereenkomst en Bijlage 2 bij de Aansluit- en Transportovereenkomst.
<b>Acknowledged Metering Responsible Party</b>	<b>Erkende Meetverantwoordelijke</b>	Een erkende meetverantwoordelijke partij of een erkend meetbedrijf zoals bedoeld in de Meetcode Elektriciteit.
<b>Metering Code</b>	<b>Codes</b>	De door de ACM vastgestelde codes overeenkomstig de Wet, zoals van tijd tot tijd gewijzigd, inclusief: <ul style="list-style-type: none"> <li>• de technische codes zoals bedoeld in artikel 31, eerste lid van de Wet, dat wil zeggen de Netcode Elektriciteit, de Systeemcode Elektriciteit, de Meetcode Elektriciteit en de Begrippencode Elektriciteit;</li> <li>• de Tarieencode Elektriciteit zoals bedoeld in artikel 36 van de Wet; en</li> <li>• de Informatiecode Elektriciteit en gas zoals bedoeld in artikel 54, eerste lid van de Wet.</li> </ul>
<b>Onshore Substation</b>	<b>Onshore Onderstation</b>	Het onshore onderstation dat wordt beheerd door TenneT en waaraan de exportkabels van het Platform worden verbonden.
<b>RfG</b>	<b>Requirements for Generators (RfG)</b>	De EU Verordening tot vaststelling van een netwerkcode betreffende eisen voor aansluiting van elektriciteitsproducenten op het net ( <i>Requirements for Generators</i> ), die op offshore-power park modules van toepassing is.
<b>The Parties</b>	<b>Partij of Partijen</b>	Een partij of de partijen bij een van de Overeenkomsten, zijnde TenneT en/of Aangeslotene.
<b>TenneT</b>	<b>TenneT</b>	TenneT TSO B.V.
<b>Feed-in Transmission Capacity</b>	<b>Transportvermogen Invoeden</b>	Het contractueel overeengekomen op de Aansluiting beschikbaar gestelde transportvermogen zoals bedoeld in artikel 3.1.1 van de Netcode Elektriciteit dat Aangeslotene mag invoeden op het Net op zee, zoals gespecificeerd in Bijlage 1 bij de Aansluit- en Transportovereenkomst.
<b>Energisation Operational Notification</b>	<b>EON</b>	Een 'Energisation Operational Notification' of inschakel-bedrijfsvoeringsnotificatie afgegeven door TenneT, als bedoeld in RfG.

<b>(EON)</b>		
<b>First Interim Operational Notification (ION1)</b>	<b>Refer to: ION</b>	Een 'Interim Operational Notification' of voorlopige bedrijfsvoeringsnotificatie afgegeven door TenneT, als bedoeld in RfG. De ION wordt onderscheiden in ION1 (af te geven door TenneT voor ingebruikname van de eerste turbine) en ION2 (af te geven door TenneT na het bereiken van 60 MW geïnstalleerd productievermogen), zoals beschreven in Bijlage 5 bij de Aansluit- en Transportovereenkomst.
<b>Second Interim Operational Notification (ION2)</b>	<b>Refer to: ION</b>	Een 'Interim Operational Notification' of voorlopige bedrijfsvoeringsnotificatie afgegeven door TenneT, als bedoeld in RfG. De ION wordt onderscheiden in ION1 (af te geven door TenneT voor ingebruikname van de eerste turbine) en ION2 (af te geven door TenneT na het bereiken van 60 MW geïnstalleerd productievermogen), zoals beschreven in Bijlage 5 bij de Aansluit- en Transportovereenkomst.
<b>Final Operational Notification (FON)</b>	<b>FON</b>	Een 'Final Operational Notification' of definitieve bedrijfsvoeringsnotificatie afgegeven door TenneT, als bedoeld in RfG.
<b>Connection and Transmission Agreement</b>	<b>Aansluit- en Transportovereenkomst</b>	De tussen TenneT en Aangeslotene afgesloten Aansluit- en Transportovereenkomst voor een Net op zee en de Bijlagen daarbij, zoals van tijd tot tijd gewijzigd.
<b>Contracted Transmission Capacity</b>	<b>Gecontracteerd Transportvermogen</b>	De gecontracteerde afname van transportvermogen zoals bedoeld in artikel 3.7.4 van de Tarievencode Elektriciteit, waarvan de waarde is gespecificeerd in Bijlage 1 bij de Aansluit- en Transportovereenkomst.
<b>Overplanting Capacity</b>	<b>Overplantingscapaciteit</b>	Het transportvermogen dat meer bedraagt dan het Transportvermogen Invoeden.
<b>Tariff sheet</b>	<b>Tarievenblad</b>	Het tarievenblad waarop ter informatie door Aangeslotene aan TenneT verschuldigde gereguleerde tarieven en gereguleerde vergoedingen staan vermeld.
<b>Working day</b>	<b>Werkdag</b>	Een werkdag zoals bedoeld in de Begrippencode Elektriciteit.
<b>WTG</b>	<b>WTG</b>	<i>Wind Turbine Generator</i> of windturbine.

## Annex 1      Details of Connected Party

### General details

EAN code of connection	_____
EAN code(s) of power line(s)	_____
Connected Party	_____
Correspondence address + contact person	Refer to separate document: "Contact list TenneT-Connected Party"
Chamber of Commerce registration number	_____
Commencement date	DD-MM-YYYY
Invoice address	_____
Order number / reference for invoicing purposes	_____

### Transmission details

Feed-in Transmission Capacity	two times 350 MW
Capacity including overplanting	two times 380 MW
Initially contracted Transmission Capacity (offtake)	< 5 MW
Transmission tariff category (consumption)	not applicable
kW <sub>max</sub> category of operating time	not applicable

### Details of metering device

Location of metering device	In Connected Party's Room at the Platform
Voltage level of metering device	66 kV
Details metering	(kWh and kVArh; both for offtake and feed-in)
Owner of metering device	_____
Correction factor for cable losses	not applicable
Correction factor for transformer losses	not applicable
Programme-responsible party	_____
Party with metering responsibility	_____
Electricity supplier:	_____
Installation responsible:	_____

## Annex 2 Description and technical specifications of the Connection, including drawings

### Connection details

Substation (name and coordinates)	Platform Hollandse Kust Noord: 587410 E, 5839436 N (in ETRS_1989_UTM_Zone_31N)
Connection capacity	Two times 350 MW
Capacity according to permit for exploiting the Installation	Two times ... MW (maximum 380 MW)
Physically connected voltage level	66 kV

### Description of the Connection

Minimum four (4), maximum eight (8) 66 kV strings, connected to maximum six (6) bays, with bay names as stated below:

Object-ID	Object description	Voltage level	Comment by Connected Party
HKN	Platform Hollandse Kust Noord	220/66 kV	n/a
AFA1x	t.b.d. (site x)	66 kV	
AFA2x	t.b.d. (site y)	66 kV	
AFA3x	t.b.d. (site x)	66 kV	
AFA4x	t.b.d. (site y)	66 kV	
	t.b.d.	66 kV	

### Description of the Connection Points

Primary Connection Point	The Primary Connection Point between the Installation (Offshore Power Park Module) and TenneT is specified at the 66kV cable termination of the 66kV inter-array cables in the 66kV switchgear installation on the Platform.
Secondary Connection Point(s)	The Secondary Connection Point(s) are defined at the terminals of the interface cabinet and it concerns all communication and control related interfaces.
Tertiary Connection Point(s)	The Tertiary Connection Points concern all spatial boundaries at the Platform and onshore, where ownership and management transfer to the Parties.

**Explanation of Secondary Connection Points**

Current transformer and voltage transformer measurements

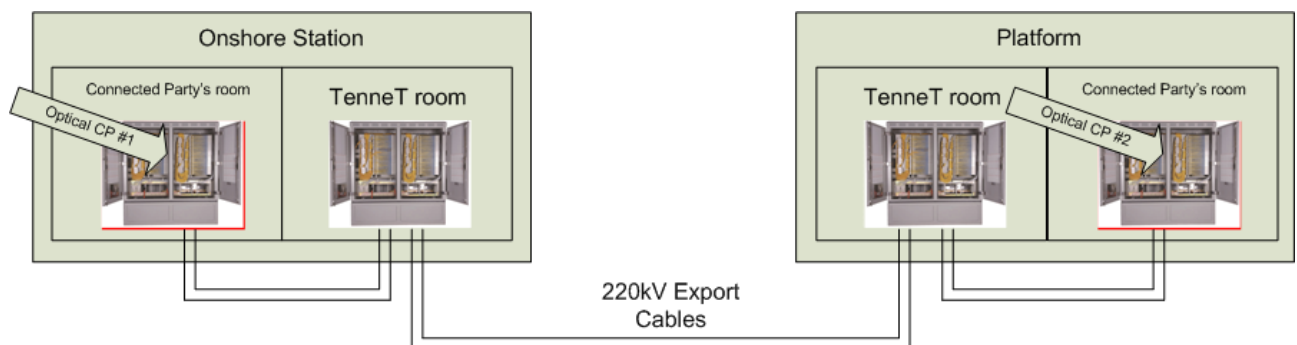
The current and voltage measurements shall be provided by TenneT at the terminals of the interface cabinet located in the Connected Party's room on the platform. The interface cabinet is property of TenneT. From the terminals of the interface cabinet onward, the Connected Party is responsible for connecting these measurements to its equipment, including the measurements for the accountable metering equipment of the Acknowledged Metering Responsible Party. The metering equipment shall be according to the Metering Code.

Explanation of fibre optic cable Connection Points (Optical CP) as Secondary Connection Points

TenneT shall install two 220kV export cables from the Onshore Substation to the Platform (offshore). Fibre optic cables will be included in these cables. All of these fibre optic cables will end in a fibre optic patch panel which will be installed into a fibre optic patch cabinet in TenneT rooms, both on the Onshore Substation as well as on the Platform. From the TenneT room designated fibre optic cables will be installed and connected to a second patch panel which will be installed into a fibre optic patch cabinet in the designated room for the Connected Party ("Connected Party's room" in the figure below). The optic fibres designated to be used by the Connected Party will be 1:1 patched in the TenneT rooms and thereby create a "dark fibre" path from the Connected Party's room onshore to the Connected Party's room offshore (on the Platform).

TenneT shall install the patch cabinet and panel in the Connected Party's room offshore. The patch panel (in the patch cabinet) placed in the Connected Party's room will be the Optical CP, meaning that the patch cable itself that will be plugged into the patch panel of the equipment shall be provided and installed by the Connected Party. Any other communication equipment or cables required by the Connected Party inside the Connected Party's room shall be provided and installed by the Connected Party.

The above design is depicted in the figure below:

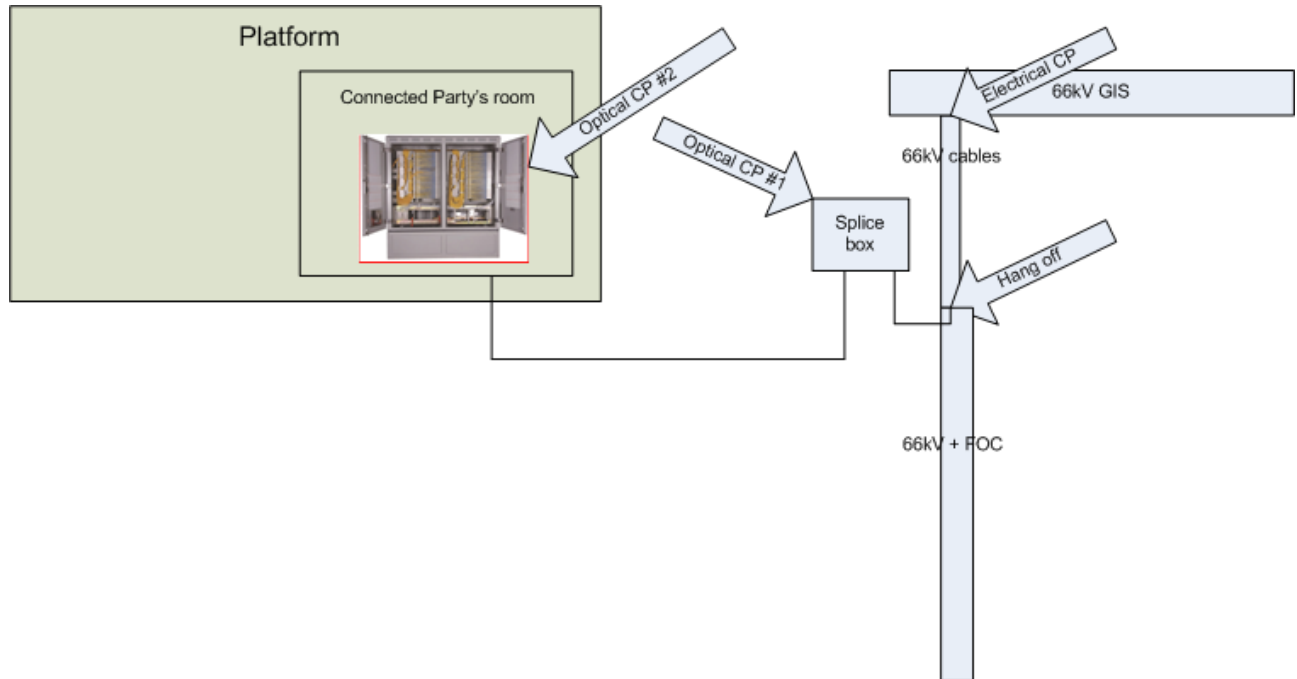


<b>Optical Connection Point #1 (onshore)</b>			
<b>Optical Connection Point #2 (offshore)</b>			
<b>Equipment</b>	<b>Installed and provided by</b>	<b>Spliced by</b>	<b>Patched by</b>
Patch panel and patch cabinet in Connected Party's room	TenneT	--	Connected Party
Optical cables from TenneT's room to Connected Party's room (TenneT patch cabinet)	TenneT	TenneT	--
Optical cables from Connected Party's room (TenneT patch panel) to Connected Party's equipment	Connected Party	Connected Party	--

At the cable hang off on the cable deck (or such other location as may be agreed upon between TenneT and the Connected Party), an optical cable splice box shall be installed by TenneT for each 66 kV cable.

From this splice box a Fibre Optic Cable (FOC) as specified by the Connected Party shall be provided and installed by TenneT towards the fibre optic patch cabinet placed in the Connected Party's room. The fibre optic cores of the FOC will end in a fibre optic patch panel (19" rack) inside the patch cabinet. The patch cabinet is owned by TenneT. The fibre optic patch panel shall be provided and installed by the Connected Party which shall also terminate the FOC in the patch panel. The other side of the FOC will end in the splice box on the cable deck, where the optical fibres shall be spliced by the Connected Party.





Optical Connection Point #1 (cable deck) Optical Connection Point #2 (Connected Party's room)			
Equipment	Installed and provided by	Spliced by	Patched by
Splice box on cable deck	TenneT	--	--
Patch cabinet in Connected Party's room	TenneT	--	--
Patch panel in Connected Party's room	Connected Party	--	Connected Party
Optical cables from splice box to Connected Party's room (TenneT cabinet panel)	TenneT	Connected Party	--
Optical cables from Connected Party's room (TenneT patch panel) to Connected Party's equipment	Connected Party	Connected Party	--

Also the relevant Tertiary Connection Point (e.g. power supply) is defined at the interface panel in the Connected Party's room.

**Single line diagram and other drawings and/or photographs, including but not limited to the connection- and metering point(s), bay codes.**

The following single line diagrams and other drawings and/or photographs, including but not limited to the connection- and metering point(s), bay codes, are added to this Annex 2:

*A2.1 HV Single Line Diagram (general) (ONL-TTB-04301, v07 dated 16 September 2019)*

*A2.2 Offshore Grid Connection Scheme (general) (ONL-AMO-00003, v01 dated 15 November 2019, sheet 1 to 4)*

*A2.3 Layout offshore WPO Control Room (ONL-TTB-00216, dated 14 February 2019)*

## Annex 3 Technical terms and conditions for the Platform

### 1. General system specifications

Nominal frequency:	50 Hz
Nominal voltage:	66 kV +/- 10%
Maximum system voltage:	72,5 kV
Impedance earthed grid with	
• Short circuit withstand capability of 66 kV GIS:	31,5 kA
• Maximum contribution from power transformer:	16 kA
• Single phase short circuit current:	Maximum 8 kA (maximum 0,6 s)
• Earth fault factor (c):	approximately 1,4 (according to IEC $1 < c < 1,73$ )
Operating voltage:	66 kV +/- 1%

### 2. Number of J-tubes and bays

The Platform will accommodate up to two times 8 (eight) J-tubes (inner diameter 450 mm) for use by the Connected Party. Each connection of a J-tube will be facilitated with a Primary Connection Point. Six 66 kV bays will be available per Power Park Module of 350 MW (i.e. the Installation of the Connected Party and any other Power Park Module connected to the Platform). This results in four bays "one string – one bay" and two bays "two strings – one bay". In the case of "two strings – one bay", this will be done with two separate cable disconnectors.

• Minimum number of 66 kV cables per Power Park Module (350 MW):	4
• Maximum number of 66 kV cables per Power Park Module (350 MW)	8
• Maximum number of 66 kV GIS bays available per Power Park Module (350 MW)	6
• Maximum current (I) per 66 kV GIS bay:	1250 A
• Minimum power (P) per 66 kV GIS bay:	45 MW

TenneT will define the final layout of the 66 kV switchgear installation and cable routing on the Platform in order to ensure a balanced distribution of power per switchgear section. It shall be possible to group all 66kV cables of the Connected Party into two times two sections. The maximum active power (P) for each section shall be less than 210 MW.

### 3. Secondary Connection Point

- The Secondary Connection Point is defined and explained in Annex 2;
- A metering system is to be provided by the Acknowledged Metering Responsible Party under responsibility of the Connected Party;

- Besides a metering system, TenneT will install Power Quality Monitoring equipment to measure and verify that the energy supplied is in accordance with RfG requirements;
- A patch panel in the Connected Party's room will be provided by TenneT facilitating the fibre optic cable interface which is explained in detail in Annex 2;
- An interface cabinet for secondary equipment in the Connected Party's room will be provided by TenneT in order to facilitate the other Secondary Connection Points, including a telecom interface (other than fibre optics) and other shared services (such as a weather station, CCTV, etc.).
- Connected Party shall ensure that TenneT is not disadvantaged by the use of the fibre optics made available by TenneT and / or the patch panel and / or patch cabinet (room number: *t.b.d.*). This means, among other things, that the Connected Party will not perform or have performed on its behalf any acts that:
  - Allow third parties to use the fibre optics made available by TenneT in any way by subletting or otherwise;
  - Create adjustments in any way at or to the demarcation point of the fiber optic;
  - Attempting or actually carrying out (repair) work on the glass fibers, cable, patches or other equipment involved in this or in any way, or taking measurements, without prior notice to TenneT and prior written permission for this;
- Connected Party reports regular work on the patch panel and / or patch cabinet to the telecommunications department of TenneT in advance. This notification must be made during working days on +31 (0) 26 373 1616 and via e-mail to [Telematicadesk@tennet.eu](mailto:Telematicadesk@tennet.eu). In the event that urgent work has to be carried out by Connected Party to the patch panel and / or patch cabinet, Connected Party will inform the telecom department of TenneT as soon as possible after the work has started.
- If TenneT has to perform regular work involving the fibre optics made available to Connected Party, TenneT will first consult with Connected Party for a suitable moment. In the event of unforeseen work and in the event of a malfunction, TenneT will inform Connected Party as soon as possible after the work has started.
- Contrary to the liability regime in the main body of this Agreement, TenneT is not liable for any damage suffered by Connected Party as a result of the unavailability of the glass fibres or patch panel / patch cabinet made available by TenneT, unless in case of intent or gross negligence.

#### 4. Tertiary Connection Points

- The tertiary Connection Points are defined in Annex 2.
- The interface cabinet for secondary equipment in the Connected Party's room shall also facilitate a power supply comprising two times uninterrupted 400 V<sub>AC</sub> (16 A) and two times 110 V<sub>DC</sub> (6 A).

## 5. Operation of bays

TenneT will standardise the operation of bays for the Platform. TenneT (National Control Centre, NCC) shall make the standardised procedure for operation of bays available for the Connected Party and other Offshore PPMs. The switchgear installation with connections to the Installation or (the) other Offshore PPM(s) connected to the Platform is fully operated by TenneT (owner of the switchgear). According to this procedure TenneT will contact the person responsible for the Installation of the Connected Party (refer to separate document: "Contact list TenneT-Connected Party") for all operation activities.

## 6. Protection

TenneT will standardise the protection equipment of the 66 kV cables situated on the Platform. TenneT will own, operate and maintain the protection system. TenneT will align on details of the protection system with the Connected Party and the other Offshore PPM(s) connected to the Platform.

The following guidelines will apply to the protection system of the 66 kV cables on the Platform:

- TenneT's protection system will be based on a primary protection by a protection relay (Definite Time Overcurrent Relay, ANSI Code 50) in the outgoing feeder bays; the protection system and its settings will be aligned with the Connected Party and the other Offshore PPM(s) connected to the Platform;
- It is up to the Connected Party to decide whether this sole protection relay with upstream back-up, without redundancy, is sufficient for the protection of its assets. TenneT is not liable for any direct or indirect damages arising out of this decision of the Connected Party.
- The TenneT protection panel of each 66 kV cable allows for additional protection relays of the Connected Party, if desired. In such a case TenneT facilitates one slot of 12 U (HE) for 19" racks and the Parties shall review the complete protection design. The additional protection system, if added by the Connected Party, will be owned and maintained by the Connected Party;
- In case two 66 kV cables are connected to one 66 kV bay, TenneT cannot distinct which of the two 66 kV cables is healthy or faulty if the protection trips. The Connected Party may install additional equipment to distinguish between the healthy and faulty 66kV cables;
- Underneath the Gas Insulated Switchgear (GIS) cable termination box there will be enough space left for the Connected Party to install equipment to distinct the healthy 66 kV cable from the faulty 66 kV cable (e.g. current transformers or short circuit indicators). For practical reasons this equipment will be installed after cable termination (e.g. use of *split core* current transformers);
- If the Connected Party desires an "emergency button" for tripping a particular 66 kV cable, TenneT facilitates such by connecting the *tripping contacts* through TenneT's bay unit (IED) to the *tripping coil*;
- *Fault ride through capability* for any fault in the Offshore Transmission System (on 66 kV switchgear, in other 66 kV cables and in the *step-up* transformer and the Offshore Transmission System for electricity) shall be respected; reference is made to Annex 4;

- The 66 kV system that is part of the Offshore Transmission System is impedance earthed by an earthing transformer; the protection system shall be aligned with this earthing method by providing earth fault current protection ( $I_{0>}$ ).
- Upon reasonable request by Connected Party, TenneT will consider to make relevant data from the disturbance recorders available.

## 7. Reactive power compensation

Regarding the reactive power capabilities of the Connected Party to absorb or inject reactive power on demand of TenneT, reference is made to the Netcode, article 3.34.

$P_{\max}$  (1,0 pu) equals the Transportvermogen Invoeden; reference is made to Annex 1 (Feed-in Transmission Capacity).

During operation the Connected Party shall absorb or inject reactive power at the Primary Connection Point on demand of TenneT between -0,1 pu and +0,1 pu, with a minimum of 100 MW installed active power at the Primary Connection Point, without any right of financial compensation.

If the reactive power capabilities of a specific WTG cannot comply at very low active power (below 0,1 pu), then TenneT will adjust the component set-up (reactors, capacitors) accordingly.

The provisions in this Agreement do not preclude participation of the Connected Party in a reactive power market, notwithstanding the obligation of Connected Party to comply with the standard in this paragraph.

### Reactive power controller

TenneT will draw up the requirements and is responsible for the design and operation of the onshore reactive power controller to control the voltage onshore.

The reactive power controller of the Offshore PPM must have the ability to be an integral part of the onshore voltage controller and reactive power control.

## 8. SCADA, communication interface and data links

TenneT shall make available to the Connected Party:

- at the Platform: a room designated for the Connected Party ("Connected Party's room") of  $\sim 20\text{m}^2$  to install cabinets owned by the Connected Party. Following services are supplied by TenneT: CT/VT connections, Heating, Ventilation, Air Conditioning (HVAC); a redundant and uninterruptable power supply, fire detection and extinguishing;
- At the Onshore Substation: a room of  $\sim 48\text{m}^2$  ( $\sim 6\text{m} \times 8\text{m}$ ) with following services supplied by TenneT: Heating, Ventilation, Air Conditioning (HVAC); a redundant and uninterruptable power supply, fire detection (no fire extinguishing);
- A patch cabinet at the Platform in the Connected Party's room, for the optical fibres of all 66 kV cables. The amount is to be agreed upon by TenneT and the Connected Party. The patch cabinet capacity will be

sufficient for 24 optical fibres per cable as a maximum. If, during the design phase, this maximum of 24 optical fibres per cable does not prove to be sufficient and additional fibres can be fitted in (e.g. in patch cabinet, splice box, fibre cable routing, etc.), upon request of Connected Party TenneT will consider to allow for more than 24 optical fibres per cable;

- The principle of the amount of CT/VT connections is depicted in single line diagrams. The following connections will be provided by TenneT to the Connected Party:
  - 1 (one) CT for a protection relay;
  - 2 (two) CT's for the Acknowledged Metering Responsible Party's measurement system;
  - 1 (one) CT for wind farm power plant control;
  - 1 (one) VT winding connection for the above;
  - 1 (one) VT winding connection for the Acknowledged Metering Responsible Party's measurement system.
- In case Connected Party requires additional CT's in the 66 kV bays appointed to Connected Party (e.g. for protection purposes), Connected Party should arrange for split ringcore CT's itself. TenneT will reserve space for these split ringcore CT's.  
In case Connected Party requires additional CT's in other bays that are not appointed to Connected Party (e.g. 66 kV transformer bays), Connected Party may submit this request for discussion in the PWG. TenneT will assess the feasibility to approve of such request, which shall not be denied on unreasonable grounds.
- Optical fibre pairs in both 220 kV export cables, which will be made available in the (one) patch cabinet in the Connected Party's room both at the Platform and in the Onshore Substation respectively. For each Connected Party, each 220 kV export cable will contain a maximum amount of 24 optical fibres. Therefore, in total each Connected Party will have 48 optical fibres at its disposal.
- Only in case of a firm and significant delay in realisation of such communication through the 220 kV export cable fibres TenneT will install a wireless communication interface (emergency facility) between the Platform and the Onshore Substation.

Technical details regarding data exchange between TenneT and the Connected Party shall be imposed by TenneT as follows:

- the data exchange (set-point signals, measurements, switching positions) shall be technically based on the protocol IEC 61850 and TenneT's implementation thereof;
- for the data exchange between the reactive power controllers of TenneT and the OWF (e.g. MVAR setpoints) a faster communication channel (a direct interface with OWF power plant controller) is needed to avoid instabilities of the MVAR regulation;
- the data exchange shall be physically located on the Onshore Substation.

## 9. Shared (maritime) information systems

TenneT aims to share (maritime) information systems on the Platform with the Connected Party and third parties where possible, in order to save on space, weight and power consumption. Rijkswaterstaat CIV ("RWS") will organise and maintain these shared systems. TenneT has a role as assessor of technical feasibility of the systems on the Platform. Any costs related to these systems will be settled between RWS

and the Connected Party. The shared (maritime) information systems for the Platform are summarized in the table below.

	System	Description	Third party involved
1	LiDAR	LiDAR and Long Range LiDAR: Light Detection And Ranging: wind measurement	KNMI
2	Meteo	Weather station: cloud height sensor, visibility sensor, wind sensor, atmospheric pressure sensor, air temperature & humidity sensor.	KNMI
3	Hydro	Water temperature sensor, wave height sensor, current measurement buoy	RWS
4	AIS transceiver	Navigation: Automatic Identification System for vessels.	RWS
5	AtoN	Navigation	RWS
6	Nautical radar	Monitoring safety zone around the Platform.  Optional: Nautical monitoring can be expanded in order to support monitoring and enforcement of the decision on " <i>Doorvaart en medegebruik van windparken op zee</i> ".	RWS
7	Bird & Bat detection	Monitoring of bird and bat migration.	RWS
8	VHF FM	Radio communication system, two Marine Channels and DSC (Digital Selective Calling).	RWS
9	Communication	Mobile telecommunication	TenneT
10	AGRS (netpos)	Differential GPS	RWS
11	LoRA	Communication	RWS
12	WiFi	Communication	TenneT
13	CCTV	High End and Normal CCTV	RWS

## 10. Individual information systems

Additional to the shared information systems listed above, Connected Party may propose to install individual systems on the Platform for the purpose of individual use. TenneT will not unreasonably decline such a proposal. Amongst other considerations, the proposal may not compromise the basic principles of the shared information systems or compromise the realisation and operation of the Platform with respect to planning or technical and safety aspects. If the proposal is approved, TenneT will make available the provisions required



for installation.

Connected Party will install its own systems on the Platform as laid down in the table below. Connected Party will be the owner of the individual information systems and responsible for the correct functioning and maintenance of these systems.

	System	Description
1	t.b.d.	

## 11. Curtailment Principles for Overplanting Capacity

Curtailment can be applied in the cases that (i) during the use of the Overplanting Capacity the 220 kV export cables reach their maximum allowable temperature limits or (ii) TenneT deems this necessary to maintain system security (onshore or offshore).

With respect to maximum allowable temperature limits (i), TenneT in general identifies three levels in the 220 kV export cable load management process, in order to ensure that the 220 kV export cable conductor temperature never reaches 90° Celsius:

1. Alignment of the Connected Party's generation forecasts to dynamic cable loading capabilities;
2. Actual curtailment of the power output of the Connected Party;
3. Actual curtailment of the power output of the Connected Party by TenneT.

### 1. Alignment of the Connected Party's generation forecasts to dynamic cable loading capabilities

The Connected Party is responsible for alignment of its forecasts to possible curtailment of the Installation or the other offshore PPM's output due to the temperature limit of the export cables (only if the Connected Party's output is higher than the Feed-in Transmission Capacity). To facilitate this alignment process, TenneT will provide:

- a. calculation results based on the best estimate of the soil condition for the 220 kV export cables, final design of the cable system and the voltage level of the system (updated to the as-built situation);
- b. the actual cable conductor temperature measurements (data format and frequency to be defined between TenneT, the Connected Party and the other Offshore PPM(s)).

### 2. Actual curtailment of the power output of the Connected Party

If the cable conductor temperature reaches the first threshold value, the Connected Party receives a warning signal "temperature High" from TenneT. The Connected Party shall then start preparing for curtailment of the Connected Party's output.

If the cable conductor temperature reaches the second threshold value, the Connected Party will receive a warning signal "temperature High-High" from TenneT. The Connected Party shall then immediately start curtailing the Connected Party's output down to the Feed-In Transmission Capacity.

3. Actual curtailment of the power output of the Connected Party by TenneT

If the cable conductor temperature reaches the maximum allowed temperature of 90° Celsius, TenneT may curtail below the Feed-In Transmission Capacity by switching off 66 kV cables of the Connected Party.

Finally, Connected Party acknowledges it cannot claim any rights under this Connection and Transmission Agreement in respect of the Overplanting Capacity or curtailment of any Overplanting Capacity (regardless whether this is related to maximum allowable temperature limits or to maintain system security).

## Annex 4      Technical requirements applicable for the connection of offshore power park modules

### 1. Introduction

This annex is based on the Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators ('RfG'). RfG, the Act, and relevant clauses of the current Electricity Grid Code (Netcode Elektriciteit) and the Electricity System Code (Systeemcode Elektriciteit) apply accordingly, unless indicated otherwise in this Annex.

### 2. Applicability

With respect to RfG, the Connected Party is considered an Offshore PPM, which results in the applicability of:

- Chapter 4 of title II: "Requirements for offshore power park modules",
- Chapter 4 of title IV: "Compliance testing for offshore power park modules", and
- Chapter 7 of title IV: "Compliance simulations for offshore power park modules".

RfG specifies the general required capabilities of Offshore PPM. Proceedings regarding compliance testing and compliance simulations related to the RfG requirements will be part of the Connection and Transmission Agreement (Annex 5: Compliance Activities; applicable testing requirements).

### 3. Explanatory Notes to RfG

#### Article 2: Definitions

Definition 1. The Offshore Network is connected to the synchronous area of Continental Europe.

#### Article 2: Definitions

Definition 2. The nominal voltage of the Connection Point is 66 kV.

#### 4. Explanatory Notes to the Netcode elektriciteit

##### Article 3.33 sub 5: Voltage stability – fast fault current injection

The typical response times are depicted in Figura a, for illustrative purposes.

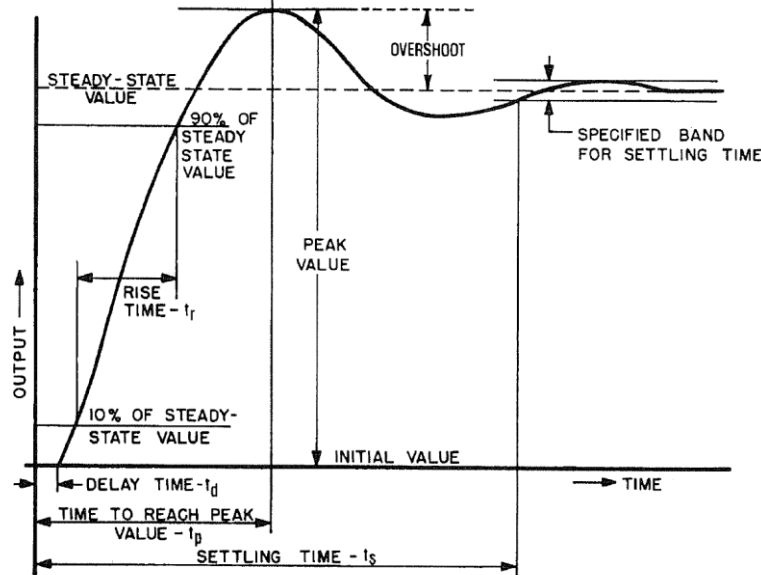


Figure a: Typical transient response of a feedback control system to a step change in input

##### Article 3.34 sub 6: System restoration

Black start capability is not required from Offshore PPMs connected to the Offshore Network (*net op zee*).

#### 5. Harmonic emission limits

Reference is made to Netcode, article 3.34 sub 7.

The Connected Party is responsible for the fulfilment of the requirements with respect to the total harmonic distortion and the emission limits. TenneT shall specify the maximum allowed harmonic distortion at the 66 kV Primary Connection Point.

The Connected Party is responsible for taking necessary measures in order to fulfil the requirements with respect to the harmonic distortion, at its own cost.

TenneT shall define the planning levels of the harmonic emission limits at 66 kV level, which shall be further allocated to the individual Offshore PPMs based on the capacity according to the Wind Farm Permit and the equivalent permit of the other Offshore PPM. All Offshore PPMs shall plan for and take measures to fulfil the requirements, and be accountable for the fulfilment of its requirements at its own costs.

1. The Connected Party and other Offshore PPM shall not exceed the harmonic emission limits as specified by TenneT

Since, without detailed information of the Offshore Transmission System, it is not possible yet to define concrete and complete requirements with respect to the harmonic emission limits, the following approach on the definition of these requirements will be followed:

- a. TenneT specifies the maximum contribution of the individual harmonic voltages to the THD at the Connection Point (conformity will be assessed per transformer secondary winding on each 66 kV busbar section). TenneT will provide the frequency sweeps of the harmonic grid impedance at the 380 kV onshore connection to the national grid together with all impedances of the (offshore) grid between 380 kV onshore connection and the 66 kV offshore connection point of the Connected Party. These frequency sweeps can be used for the harmonic study. For initial calculations by Connected Party, TenneT has provided two memoranda:
  - “Harmonic impedance loci at EHV-grid connection point for the offshore areas HKN and HKW-alpha” dated 29 November 2019,
  - “Harmonic impedance loci at 66 kV connection point, location Hollandse Kust Noord and Hollandse Kust West-alpha” dated 14 December 2019.
- b. The Connected Party shall deliver their wind farm grid specifications and the contribution of the individual harmonic voltages at the Connection Point (conformity will be assessed per transformer secondary winding on each 66 kV busbar section) as a percentage of the rated voltage at the busbar section (66 kV) (95% and 99,9% percentile values). The Connected Party shall prove through calculation that its Installation complies with the requirements, summation is allowed per part. The Connected Party shall consult TenneT if compliance cannot be achieved without the installation of filter equipment. As part of this consultation the Connected Party shall specify the root loci for which compliance can be achieved without filters. In case a special situation requires additional investigation to assess the compliance, TenneT and Connected Party will align the exchange of additionally required information for this purpose.
- c. An independent third party, to be assigned by TenneT, will perform an overall harmonic study to verify that the planning levels at the Platform are not exceeded. This study will investigate the harmonic behaviour of the grid including all connected Offshore PPMs to the Platform (including the Connected Party). All parties shall make the necessary information for these studies available and share it with the independent third party without restrictions, although based on a non-disclosure agreement. The study is part of the conformity test procedure.
- d. After realisation of the Connection, as part of the compliance activities, the harmonic voltage levels at the Connection Point (per transformer secondary winding on each 66 kV busbar section) will be measured. Compliance shall be assessed by comparison of measured voltages against the planning levels. Additionally, not part of compliance assessment though, the measured voltages will be compared to the agreed design values calculated by the Connected Party. This comparison will be discussed between

TenneT and Connected Party in order to understand any deviations between measured voltages and agreed design values and gain a further understanding of the potential impact of such deviations.

## 2. Regarding the responsibility for maintaining power quality

- TenneT is responsible for undoing, at the onshore connection of the Platform to the onshore transmission system, the impact of the total Offshore Transmission System (export cabling and 66 kV cables) to the onshore transmission system for electricity with respect to the harmonic amplification;
- The design criteria for the Connected Party and the other Offshore PPM shall be based on the compliancy and planning levels of the THD at the 66 kV busbar.

## 3. Harmonic emission limits

The harmonic emission level  $E_{U_{hi}}$  is defined per harmonic order and per installation directly supplying the 66 kV busbar. The following remarks are made:

- 1) the size of each installation (string) is a PPM design parameter and preliminary based at 64 MVA (exact parameter is depending upon grid design of the Connected Party);
- 2) under normal operating conditions, each PPM is individually connected to a single export cable to the onshore grid connection. The system is designed to facilitate all PPMs connected to one Platform even during an outage, although under limited conditions. The harmonic emission limits are defined for the latter case.

The harmonic emission limits presented in table 1 are based on a PPM layout with six strings of connected turbines, each string has 64 MVA of installed power. In case the design of the PPM deviates from this starting point (but still same installed power ' $S_i$ ' per string), the values of  $E_{U_{hi}}$  shall be adjusted according to the formula:

$$E_{U_{hi}, new} = E_{U_{hi}, table 1} * 6 * (S_{i, new} / S_{t, new}).$$

The harmonic emission limits in table 1 are also based on only connecting the six strings of 64 MVA installed power without connecting also another consumer to the Platform. In case of another consumer connected to the Platform, the values of  $E_{U_{hi}}$  shall be adjusted according to the formula:

$$E_{U_{hi}, new} = E_{U_{hi}, table 1} * S_{OWP} / (S_{OWP} + S_{consumer}).$$

**table 1: Harmonic emission limits ( $E_{Un}$ ) for each individual PPM connected to the 66 kV busbar offshore**  
 $S_i$  = installed power of customer installation per string  
 $S_t$  = total power of the installation

Un = 66 kV				$S_t$ (MVA) = 64 Un = 66 kV, emission limit per CP with $S_i$						
	Measurements in a week	h	Planning level $L_{66kV}$ (%)	Measurements in a week	h	$S_i$ 'N-0' (MVA)	$S_t$ (MVA)	$\alpha$	$E_{Un}$ (%)	
THD ≤	95%		3	THD ≤	95%	64	384		0,250	
Even harmonics	95%	2	1,40	Even harmonics	95%	2	64	384	1,0	0,117
Mutiple of 3	95%	3	2,00	Mutiple of 3	95%	3	64	384	1,0	0,167
Even harmonics	95%	4	0,80	Even harmonics	95%	4	64	384	1,0	0,067
Not mutiple of 3	95%	5	2,00	Not mutiple of 3	95%	5	64	384	1,0	0,167
Even harmonics	95%	6	0,40	Even harmonics	95%	6	64	384	1,0	0,033
Not mutiple of 3	95%	7	2,00	Not mutiple of 3	95%	7	64	384	1,0	0,167
Even harmonics	95%	8	0,40	Even harmonics	95%	8	64	384	1,0	0,033
Mutiple of 3	95%	9	1,00	Mutiple of 3	95%	9	64	384	1,0	0,083
Even harmonics	95%	10	0,35	Even harmonics	95%	10	64	384	1,0	0,029
Not mutiple of 3	95%	11	1,50	Not mutiple of 3	95%	11	64	384	1,0	0,125
Even harmonics	95%	12	0,32	Even harmonics	95%	12	64	384	1,0	0,027
Not mutiple of 3	95%	13	1,50	Not mutiple of 3	95%	13	64	384	1,0	0,125
Even harmonics	95%	14	0,30	Even harmonics	95%	14	64	384	1,0	0,025
Mutiple of 3	95%	15	0,30	Mutiple of 3	95%	15	64	384	1,0	0,025
Even harmonics	95%	16	0,28	Even harmonics	95%	16	64	384	1,0	0,023
Not mutiple of 3	95%	17	1,20	Not mutiple of 3	95%	17	64	384	1,0	0,100
Even harmonics	95%	18	0,27	Even harmonics	95%	18	64	384	1,0	0,022
Not mutiple of 3	95%	19	1,07	Not mutiple of 3	95%	19	64	384	1,0	0,089
Even harmonics	95%	20	0,26	Even harmonics	95%	20	64	384	1,0	0,021
Mutiple of 3	95%	21	0,20	Mutiple of 3	95%	21	64	384	1,0	0,017
Even harmonics	95%	22	0,25	Even harmonics	95%	22	64	384	1,0	0,021
Not mutiple of 3	95%	23	0,89	Not mutiple of 3	95%	23	64	384	1,0	0,074
Even harmonics	95%	24	0,24	Even harmonics	95%	24	64	384	1,0	0,020
Not mutiple of 3	95%	25	0,82	Not mutiple of 3	95%	25	64	384	1,0	0,068
Even harmonics	95%	26	0,23	Even harmonics	95%	26	64	384	1,0	0,019
Mutiple of 3	95%	27	0,20	Mutiple of 3	95%	27	64	384	1,0	0,017
Even harmonics	95%	28	0,23	Even harmonics	95%	28	64	384	1,0	0,019
Not mutiple of 3	95%	29	0,70	Not mutiple of 3	95%	29	64	384	1,0	0,059
Even harmonics	95%	30	0,22	Even harmonics	95%	30	64	384	1,0	0,019
Not mutiple of 3	95%	31	0,66	Not mutiple of 3	95%	31	64	384	1,0	0,055
Even harmonics	95%	32	0,22	Even harmonics	95%	32	64	384	1,0	0,018
Mutiple of 3	95%	33	0,20	Mutiple of 3	95%	33	64	384	1,0	0,017
Even harmonics	95%	34	0,22	Even harmonics	95%	34	64	384	1,0	0,018
Not mutiple of 3	95%	35	0,58	Not mutiple of 3	95%	35	64	384	1,0	0,049
Even harmonics	95%	36	0,21	Even harmonics	95%	36	64	384	1,0	0,018
Not mutiple of 3	95%	37	0,55	Not mutiple of 3	95%	37	64	384	1,0	0,046
Even harmonics	95%	38	0,21	Even harmonics	95%	38	64	384	1,0	0,018
Mutiple of 3	95%	39	0,20	Mutiple of 3	95%	39	64	384	1,0	0,017
Even harmonics	95%	40	0,21	Even harmonics	95%	40	64	384	1,0	0,017

## Annex 5 Compliance Activities; applicable testing requirements

### 1. Scope

The document “RfG compliance verification”, available on the site of “Netbeheer Nederland” (<https://www.netbeheernederland.nl/dossiers/regulering-20/documenten>), applies to Connected Party.

### 2. Introduction

The commissioning will be divided into two main consecutive activities: (1) Site Acceptance Test, Hot Commissioning (SAT) activities, and (2) compliance testing activities.

#### 1. Site Acceptance Test, Hot-Commissioning (SAT) activities:

- Responsibility of the Connected Party and the Connected Party shall mitigate any risk that the energisation of its Installation jeopardises the Transmission System.
- SAT program of the Connected Party shall be approved by, and scheduled in cooperation with TenneT.

#### 2. Compliance testing activities:

- As described in RfG, chapter 4 of Title IV "Compliance testing for offshore power park modules" apply, and
- Are further detailed in the document “RfG compliance verification”, with the additions as noted below.

### 3. Notifications

The operational notification procedure, RfG, Title III, chapter 1, is applicable. The procedure is further detailed below:

- 3.1 Energisation Operational Notification (EON);
- 3.2 First Interim Operational Notification (ION1);
- 3.3 Second Interim Operational Notification (ION2);
- 3.4 Final Operational Notification (FON).

#### 3.1 Energisation Operational Notification (EON)

An Energisation Operational Notification (EON) issued by TenneT is needed before energizing the Connection, the wind farm grid and the wind farm auxiliaries (Offshore PPM).

#### Procedure:

- The Connected Party shall submit an itemised statement of compliance to TenneT for issuing an



EON.

- This statement of compliance shall contain the following documents and reports:
  1. A signed CTA;
  2. A protection and control settings document, approved by TenneT;
  3. A signal exchange list;
  4. An overall testing and commissioning plan, including, but not limited to:
    - Planning of personnel support at the platform
    - Planning of personnel support at the National Control Centre of TenneT
    - Contact details of the authorised responsible commissioning manager
    - Planning of reactive power generation or consumption per energised string
    - Confirmation that Power Quality measurements can and will be performed during the commissioning;
  5. A report proving the harmonic compliancy, approved by TenneT;
  6. A report proving compliance with insulation coordination requirements, approved by TenneT.

Planning:

- The Connected Party shall have an EON at least one (1) month before the energisation of the first string.
- Within maximum four (4) weeks after receiving the statement of compliance of the Connected Party, TenneT will respond. If the assessment of the application is positive, an EON will be granted by return.
- A period of minimum ten (10) months shall be scheduled for review, discussion and approval by TenneT of the report regarding the harmonic compliancy.

**3.2 First Interim Operational Notification (ION1)**

A first Interim Operational Notification (ION1) issued by TenneT is needed before taking the first WTG in operation for power generation.

Procedure:

- The Connected Party shall submit an itemised statement of compliance to TenneT for issuing an ION1.
- This application shall contain the following documents and reports:
  1. An EON or an application for an EON;
  2. Technical data of the turbines (according to IEC 61400-21, annex A);
  3. Technical data of the wind farm including, but not limited to, array cable specifications, turbine transformer specifications;
  4. Report of studies demonstrating the expected steady-state and dynamic performance;
  5. Simulation models, as specified by point (c) of Article 15(6) of the RfG.

Planning:

- Connected Party shall have an ION1 at least one (1) month before the taking the first WTG in operation.
- Within maximum four (4) weeks after receiving the statement of compliance of the Connected Party, TenneT will respond. If the assessment of the statement of compliance is positive and an EON is already granted, an ION1 will be granted by return.

**3.3 Second Interim Operational Notification (ION2)**

A second Interim Operational Notification (ION2) issued by TenneT is needed after reaching 60 MW installed and commissioned WTG capacity.

Procedure:

- The Connected Party shall submit an itemised statement of compliance to TenneT for issuing an ION2.
- This statement of compliance shall contain the following documents and reports:
  1. An ION1;
  2. Interim Power Quality measurements;
  3. Interim voltage control test.

Planning:

- The Connected Party shall have an ION2 no later than two (2) months after reaching 60 MW installed and commissioned WTG capacity.
- Within maximum four (4) weeks after receiving the application of the Connected Party, TenneT will respond. If the assessment of the statement of compliance is positive, an ION2 will be granted by return.

**3.4 Final Operational Notification (FON)**

A Final Operational Notification (FON) issued by TenneT is needed after reaching full capacity installed and commissioned.

Procedure:

- The Connected Party shall submit an itemised statement of compliance to TenneT for issuing a FON.
- This statement of compliance shall contain the following documents and reports:
  1. An ION2;
  2. Update of applicable technical data, simulation models and studies including the use of actual measured values during testing.
  3. Final report on Power Quality measurements;
  4. Final report on on-site tests.

Planning:

- The Connected Party shall have a FON no later than four (4) months after reaching full installed and

commissioned WTG capacity.

- Within maximum four (4) weeks after receiving the statement of compliance of the Connected Party, TenneT will respond. If the assessment of the application is positive, a FON will be granted by return.

#### **4. Additional provisions**

In order to remain system stability TenneT is entitled to:

- refuse to energise the Connection in case an EON cannot be granted;
- order to stop power generation by the Offshore PPM (refuse feed-in) in case an ION2 cannot be granted ultimately four (4) months after reaching installed and commissioned WTG capacity of 60 MW;
- order to stop power generation by the Offshore PPM (refuse feed-in) in case a FON cannot be granted ultimately four (4) months after reaching full installed and commissioned WTG capacity.

TenneT will not issue a refusal as mentioned here on unreasonable grounds.

#### **5. Further detailed commissioning planning**

Because the Offshore PPM Installation will consist of several physical cable connections, which might be commissioned separately, a further detailed commissioning planning shall be agreed upon by the Parties. The SAT and commissioning could then be done per 66 kV cable with connected WTGs, where the requirements will be assessed proportionally in respect with the technical capabilities per connected 66 kV cable.

It is acknowledged by the Parties that necessary information for compliance testing activities shall be made available and shared without restrictions.

#### **6. Applicable testing requirements**

The document "RfG compliance verification", should be read as follows:

Section 4.2.20 Power Quality

$PLTi \leq 0,25$

$PSTi \leq 0,35$

Section 4.2.21 Isolation coordination

Transient voltages may never exceed the BIL of 325 kV.

## Annex 6      Operational arrangements and exchange of information

### 1. Scope

This Annex describes the operational arrangements agreed between Connected Party and TenneT. It is generally noted that in this Annex the Parties capture data in good cooperation. This will take place in the bilateral consultations after the tender and prior to concluding the Agreement. The following details are specified:

- a. The contact persons of the two Parties
- b. The content of the operational arrangements
- c. The procedure for resolving failures, and
- d. The exchange of information

### 2. Contact details

#### 2.1 Contact details for operational matters

##### **Operations**

Operations at Connected Party will be performed by<sup>1</sup>:

Organisation: \_\_\_\_\_  
Location: \_\_\_\_\_  
Person responsible: \_\_\_\_\_  
Telephone: \_\_\_\_\_  
Fax: \_\_\_\_\_  
E-mail: \_\_\_\_\_

Operations at TenneT will be performed by:

Organisation: National Control Centre (NCC)  
Location: Arnhem  
Person responsible: \_\_\_\_\_  
Telephone: +31 26 373 12 41  
Fax: +31 26 445 26 97  
E-mail: NCC\_NL@tennet.eu

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<sup>1</sup> If the Connected Party outsources operational management to a third party, this third party will act as the contact person on behalf of the Connected Party.

## 2.2 Contact details for planning the availability of the TenneT transmission system

### *Planned Unavailability*

On working days, Connected Party's contact person for matters concerning Planned Unavailability within the meaning of Article 4.2.2.2 of the Grid Code will be:

Organisation: \_\_\_\_\_  
Location: \_\_\_\_\_  
Person responsible: \_\_\_\_\_  
Telephone: \_\_\_\_\_  
Fax: \_\_\_\_\_  
E-mail: \_\_\_\_\_

On working days, TenneT's operational support department can be reached in the following ways:

Organisation: TenneT's operational support department (planned unavailability group)  
Telephone: +31 26 373 17 61  
Fax: +31 26 373 24 53  
E-mail: groepvnb@tennet.eu

## 2.3 Changes to contact details

The Connected Party shall ensure that changes to contact details are notified to TenneT by:

Organisation: \_\_\_\_\_  
Location: \_\_\_\_\_  
Person responsible: \_\_\_\_\_  
Telephone: \_\_\_\_\_  
Fax: \_\_\_\_\_  
E-mail: \_\_\_\_\_  
Correspondence address: \_\_\_\_\_

The TenneT Customer Relationship Manager will be responsible for changing the contact details:

Organisation: Customers & Markets  
Location: Arnhem  
Person responsible: \_\_\_\_\_  
Telephone: \_\_\_\_\_  
E-mail: \_\_\_\_\_  
Correspondence address: **TenneT TSO B.V.** Customers & Markets  
Postbus 718  
NL-6800 AS Arnhem

### **3. Content of arrangements**

#### **3.1 Access to the Platform**

A Crew Transfer Vessel (CTV) or Offshore Service Vessel with a Walk to Work (W2W) solution are the standard access method. The Platform will be equipped with a helicopter hoisting platform. In case of emergency response and if allowed by authorities, helicopter hoisting will be used.

All persons requesting access to the Platform minimally need to be qualified for accessing high voltage premises as well as standard marine certification (offshore safety directive).

A shelter on the cable deck with all required equipment for emergency stay is required by native standards and will be accessible without any restrictions.

A general day crew room with necessary basic facilities - including emergency accommodation - will be accessible to all parties on the Platform.

As a design principle, equipment owned by TenneT or the Connected Parties will be installed in separate rooms, having separate entrance doors. Under normal circumstances a room will only be accessible to the owner of the equipment inside this room. At the Platform, one room will be designated for use by the Connected Party ("Connected Party's room").

In case the Connected Party requires access to the Platform, accompaniment by (a) TenneT representative(s) is required. TenneT and the Connected Party shall make operational agreements regarding response time of accompanying staff.

#### **3.2 Installation Interface Management**

TenneT will manage interfaces by involving the selected Connected Party as early in the project as possible and to define clear roles for major interfaces. The following main technical interfaces have been identified:

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

Each technical interface and the associated sub interfaces are defined in the next paragraphs. For each sub interface a functional role is assigned to TenneT and to the Connected Party. One of the parties (mainly TenneT) will have the responsible (R) and accountable (A) role whereas the other party (Connected Party) will have either a supportive (S), consulting (C) or informative (I) role. The responsible Party may transfer the 'responsible' part of the interface (execution) to a third party (contractor). Further details of these interfaces shall be determined in mutual agreement between the Connected Party and TenneT.

### 3.2.1. 66 kV cable route from platform safety zone (500 m) 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 (500 m) up to the 66 kV switchgear are listed with for each interface the role of the two main stakeholders.

#### High level interfaces on 66 kV cable route from platform safety zone up to the 66 kV switchgear

Interface	TenneT	CP
Design: Cable field layout in the direct vicinity of the platform (< 500 m)	A <sup>2</sup>	R
Design: Scour protection of the Jacket (if applicable) TenneT will design and provide a scour protection which stabilises the seabed around the Platform and which is suitable for cable routing and pull-in and inform CP on the details of the scour protection.	R / A	I
Design: 66 kV cable approach from burial to J-tube. CP shall design the installation of the cable over the platform scour protection, the cable protection system, fixation of the cables on the scour protection and the protection of the cable on and near the scour protection edge.	C	R / A
Design: J-tube with a bell mouth	R / A	C
Design: 66 kV cable hang-offs	C	R / A
Design: 66 kV cable route from hang-off to 66 kV switchgear	R / A	C
Design: 66 kV cable pull-in methodology (basic design/philosophy)	R / A	C
Design: 66 kV 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 (terminals, 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 <sup>3</sup>

#### Design

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

- Dimensioning and load restrictions (e.g. J-tubes);
- Locations for winches;

<sup>2</sup> The 66 kV cable field layout shall be approved by TenneT.

<sup>3</sup> Accountable here means: the Connected Party will give clearance to TenneT to energise the cable.

- 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;
- Pull-in and routing of cables up to the 66 kV switchgear without joints or junction boxes on the cable deck.

Based on the generic cable pulling methodology<sup>4</sup>, the Connected Party shall consult TenneT on detailed design for the cable pulling and installation method of 66 kV cables. With respect to the J-tubes, they have a fixed position on the 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. TenneT will organise regular design meetings with the Connected Parties to the Platform.

#### Procurement for items of the 66kV Cable route

TenneT will, after a detailed design has been submitted by the Connected Party, procure the cable trays for the main cable route. All components that are cable specific (such as cable supports to and from the main cable route and the cable terminations) will be procured by the Connected Party.

#### Installation of 66 kV Cables

The Connected Party is responsible for installation of cable protection (if applicable), the actual cable pull-in, cable storage (if any), J-Tube pigging, cable fastening and termination works making use of equipment such as pulling winch, hang-offs, pull-in wire or messenger wire, etc.

TenneT will facilitate these activities of the Connected Party with regards to the Platform structure itself. The Connected Party will get the possibility to install pull-in equipment on the Platform while it is under construction onshore.

Before installation and after installation of the 66 kV cables on the Platform by the Connected Party and at such other moments as the Parties may agree on, joint inspections will be held to assess and log possible damages caused by one Party to property of the other Party.

#### Testing and commissioning of 66 kV cables

After installation, the Connected Party shall be responsible for testing of the 66 kV cables, including HV tests, phase checks, sheath testing and optical time-domain reflectometer (OTDR) tests on optical fibres.

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<sup>4</sup> Generic cable pulling methodology as described in the document "Standard 700 MW AC Offshore Substation Cable Pulling Methodology" of December 2019, outlining the general methodology regarding the pulling of HV sea cables on the standard 700MW AC offshore substation. This methodology will be the basis for the detailed cable pulling methods which will be established by the various cable contractors in close cooperation with the platform contractor during the detailed design phase of the project.



For commissioning of the 66 kV cables, TenneT will be responsible for energising of the 66 kV cables and TenneT will execute actual switching operation after clearance is given by the Connected Party. For the testing and commissioning phase agreements shall be made between TenneT and the Connected Party including agreements on installation responsibility (nominated person<sup>5</sup>) and LOTO (Lock-out, Tag-out) principles.

Depending on the testing equipment needed, the equipment may be placed in vicinity of the Gas Insulated Switchgear (GIS) equipment or on the top deck of the Platform. The Connected Party may need HV cables, cable terminations and/or test bushings to connect the test equipment to the 66 kV cable bay.

### 3.2.2. 66 kV switchgear (feeder bays for 66 kV cables of the Connected Party)

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

#### High level interfaces on 66 kV switchgear (feeder bays for 66 kV cables of the Connected Party)

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

#### Design / installation on to the platform

TenneT will 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 Connected Party shall align the accessories and (type) testing of its 66 kV cables on these specifications. Aspects on which the Connected Party will be consulted during the design phase of the 66 kV switchgear protection system are:

- Type of protection relay(s) for the 66 kV feeder bays;
- Protection relay settings for the 66 kV feeder bays.

#### Testing and commissioning

For testing and commissioning of the 66 kV cables is referred to Annex 5 to the Connection and Transmission Agreement.

<sup>5</sup> Nominated person: the person responsible for the electrical safety of an electrical system. In Dutch: "installatieverantwoordelijke".

### 3.2.3. Telecommunication and fibre optic infrastructure

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

#### High level interfaces on the telecommunication and fibre optic infrastructure (for use of the Connected Party)

Interface	TenneT	CP
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 define requirements, location of patch panels and fibre optic cabling within the Platform.

The Connected Party shall provide all necessary design data, including number and specification of fibre optic cables from 66 kV cables of the Connected Party. Special attention shall be given to the location of the first splice boxes where fibre optic cables from 66 KV cables of the Connected Party will be terminated and connected to the fibre optic cables of the Platform.

An exact description of the telecommunication interface is included in Annex 2.

During the design phase, agreements shall be made on interface management of the installation phase (checks by the Connected Party) and testing phase.

### 3.2.4. Connected Party's equipment located on TenneT infrastructure (offshore and onshore)

The Connected Party can freely design the equipment to be installed in the designated rooms as long as general requirements and boundary conditions applicable to these rooms are followed (weight / size limits, climate conditions, power supply etc.).

In the case equipment of the Connected Party is to be placed outside of the Connected Party's room (including connection from this equipment to the Connected Party's room), the Connected Party shall inform TenneT on these requirements in the early design stage and agreements on this equipment shall be made between TenneT and the Connected Party.

With regards to installation of equipment in the designated rooms, agreements shall be made on starting date and (ultimate) date of completion of the Connected Party's installation works.

Designated room for the Connected Party in Onshore Substation

In the table below, high level interfaces for the equipment of the Connected Party in the designated room in the Onshore Substation are listed with for each interface the role of the two main stakeholders.

High level interfaces on the Connected Party's equipment in the designated room on the Onshore Substation

Interface	TenneT	Connected Party
Design: TenneT auxiliary services for the designated room	R/A	C / I
Design: Connected Party's equipment inside designated room	I	R / A
Construction: TenneT auxiliary services for the designated room	R/A	I
Construction: installation of Connected Party's equipment in the designated room	S	R / A

Connected Party's room at the Platform

In the table below, high level interfaces for the equipment of the Connected Party in the Connected Party's room on the Platform are listed with for each interface the role of the two main stakeholders.

High level interfaces on the Connected Party's equipment in the Connected Party's room on the Platform

Interface	TenneT	CP
Design: TenneT auxiliary services for the designated room	R/A	C / I
Design: Connected Party's equipment inside designated room	I	R / A
Construction: TenneT auxiliary services for the designated room	R/A	C / I
Construction: installation of Connected Party's equipment in the designated room	S	R / A
Construction: installation of Connected Party's equipment on other locations	S	R / A

All permanent equipment of the Connected Party for the Connected Party's room on the Platform must be installed when the Platform is in the construction yard, i.e. before load out. Configuration / programming works, interface tests and inspections by the Connected Party shall be done in 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*, the Connected Party shall inform TenneT as soon as possible.

Commissioning

The Connected Party shall be responsible and accountable for all testing and commissioning activities related

to the Connected Party's equipment on TenneT's infrastructure.

TenneT will support the Connected Party during testing and commissioning with regards to the services provided by TenneT (66 kV GIS switching actions, auxiliary services to designated rooms, shared data acquisition systems, optical fibres).

### **3.2.5. Coordination during offshore works**

TenneT will be responsible (R) and accountable (A) for the Platform and therefore for planning, coordination and safety rules, where the Connected Party will be supportive (S). To manage planning, coordination and safety properly, TenneT will be responsible for providing work permits for offshore works within the safety zone (500 m) of the Platform and for all works on the Platform.

The Connected Party will support TenneT with this coordination by correct and on-time application for work permits and by participating in all planning, interface 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 the Connected Party on marine coordination and coordination of works on the Platform shall be made in a later phase.

### **3.2.6. Document management**

Exchange of documents and formal communication between the Parties shall be through the document management system "Think Project!".

## **3.3 Operations & Maintenance (O&M) interface**

The major O&M interface categories are described below. Further details of these interfaces will be worked out in cooperation with the parties connected to the Platform (during the construction phase).

### Identified operational interfaces

- Logistics/transport to the Platform
- Logistics/transport from the Platform
- Work permitting process
- Installation responsibility / Work responsibility / designated persons
- Access to the Platform for the SCADA controls system
- Communications regarding activities around the Platform
- Switching activities by TenneT on behalf of the Connected Party

- Operations of grid connection including fibre optic communication infrastructure
- Power interruptions due to failures on the Platform or in the 66kV Connection

Identified maintenance interfaces:

- Maintenance of the 220 kV equipment
- Maintenance 66 kV inter-array cables Connected Party and 66 kV equipment TenneT (including protection control)
- Maintenance equipment Connected Party on the Platform
- Maintenance combined equipment on the Platform
- Metering activities (calibrations)

**3.4 Switching procedures**

Supplemental to relevant (international) standards and guidelines, a specific switching procedure may be in place that the Parties must follow to assure safety, continuity, etc. If this situation occurs, it is detailed in the table below.

Switching procedure (brief description)	Annex
XX	4.1
XX	4.2
XX	4.3
XX	4.4

Part of the procedures will be the fault location for isolating the Connected Party 66 kV cables is the Connected Party's responsibility. TenneT will execute the incorporated switching activity upon notification by the Connected Party.

Arrangements for tag out and lock out will be made in mutual agreement to place locks at the bays in relation to isolation and earthing of the 66 kV cables in order to assure that safe working can be executed in accordance with the relevant (international) standards and guidelines.

**3.5 Operational data exchange**

All digital or oral operational instructions given by TenneT shall be interpreted as a request from TenneT to the Connected Party. The Connected Party is fully responsible for executing the request within save margins of their equipment. TenneT is not responsible for executing commands which lead to unacceptable operational conditions and can harm any equipment of Connected Party.

### 3.6 Reactive power control, frequency control and reactive power capabilities

The tables in this paragraph 3.6 are included as examples. No later than 6 months before energizing of the Connection the parameters and settings will be agreed upon and recorded in the sections below of this Annex 6 of the CTA applying the agreed procedure for changes and updates via the Project Working Group (referring to the Realization Agreement, article 6.5). The format and/or content of these tables may change in that respect.

#### 3.6.1 Parameter settings reactive power controllers and frequency controller

No later than 6 months before energizing of the connection the parameter settings of the reactive power controller will be agreed upon and recorded in Annex 6 of the CTA.

The table below will contain the current parameters setting for the reactive power controller:

Parameter settings Reactive Power Controller (2016-x-y)	Value	Status
<b>General Settings</b>		
Reactive Power Control Mode		
Voltage Droop (%)		
<b>Control Speed of Reactive Power Controller</b>		
Delay time (s) - <i>for information only</i>		
$t_1$ : Time to reach 90% of steady state value (s)		
$t_2$ : Time required to settle at the steady state value (s)		
Maximum Voltage overshoot (%)		
Steady state reactive tolerance (%)		
<b>Steady State Reactive Power Exchange at the PCC</b>		
Tbd		
Tbd		
<b>Disturbance operation</b>		
Tbd		

The table below will contain the current parameters setting for the 'fast acting reactive current injection' (Annex 4, paragraph 3, note 6).

Parameter fast acting reactive current injection (2016-x-y)	Value	Status
<b>Droop setting</b>		
Additional reactive current Droop		

The table below will contain the current parameters setting for the 'Active Power Frequency Response in case of Overfrequency' (RfG, Article 10 sub 2, limited frequency sensitive mode — overfrequency).

Parameters Active Power Frequency Response in case of Overfrequency (2016-x-y)	Value	Status
<b>General Settings</b>		
Overfrequency threshold		
Frequency Droop (%)		
<b>Control Speed of Frequency Controller</b>		
Response time		

### 3.6.2 Adaptation of reactive power capabilities

In case the installation is not 100% functional and thereby not fully compliant with the requirements regarding reactive power capability, agreements can be made to allow connecting to the installation on the platform under 'emergency conditions'.

## 4. Resolution of failures

For the purposes of this Annex, a failure is defined as an unscheduled interruption or restriction of electricity transmission, including but not confined to a voltage management disruption (such as voltage dips and transients).

In case of an event that requires involvement of TenneT, e.g. reporting of accidents and of SHE-related incidents, please notify TenneT Marine Operations Centre ("MOC") by phone. The contact details of the MOC are as follows and also included in the separate document: "Contact list TenneT-Connected Party".

The Marine Operation Centre is 24 hours per day, seven days per week, available via:

- Telephone: +49 5132 89 2400 and
- e-mail: [TennetOffshore.MOC@tennet.eu](mailto:TennetOffshore.MOC@tennet.eu).

TenneT Marine Operations Centre is the central office for TenneT marine related topics including accident- and incident registration. and will get in touch with the relevant persons within the TenneT organisation. TenneT Marine Operations Centre is also the central point of contact for authorities and third parties.

### 4.1 Duty to provide information on failures

As soon as a failure occurs, the Parties shall inform each other as comprehensively and as quickly as possible to allow them to act effectively. The information provided must in any event include the volume of switched-off capacity and the estimated resolution time of the failure.

Subsequently, the Parties shall on request provide each other with information from which the (probable) cause of the problem can be determined, and shall state the actions taken to resolve the failure as well as the measures that will be taken to prevent a recurrence.

## 4.2 Major incidents and protection and restoration plan

TenneT shall coordinate the response to a major incident affecting the security of supply. For this purpose, TenneT may execute a switch-off. The Connected Party must then take care that the requested amount of power is shut down in accordance with instruction of TenneT. This instruction will be provided from TenneT's National Control Centre by telephone to the contact listed in 2.1. At its request, TenneT will confirm the instruction in writing provided by telephone to the Connected Party.

The Connected Party may request TenneT to switch off all or part of the Connection if it is affected by a major incident. This must be done to control the incident or to prevent damage to the managed Installation, the Connection, or the Transmission System. TenneT shall respond to such request unless it cannot reasonably be expected to do so.

## 4.3 Crisis centre

In the event of a major incident, the Connected Party may opt to have a crisis centre handle communications. The Connected Party shall indicate when the crisis centre is to take over handling communications. The details of the Connected Party's crisis centre are stated below.

### ***Connected Party's crisis team***

The Connected Party has designated a crisis team to handle major incidents. The contact details of this team are as follows and also included in the separate document: "Contact list TenneT-Connected Party".

Organisation:	_____
Location:	_____
Person responsible:	_____
Telephone:	_____
Fax:	_____
E-mail:	_____

## 5. Exchange of information

The Parties shall provide each other with the information that by reasonable standards may be relevant to the operation of the Offshore Transmission System (including the Connection and the Platform) and the onshore transmission system and the operation of the Installation of the Connected Party.



## Annex 7 Tariff sheet

### General note:

Following the annual regulatory tariff decision by the Dutch regulator ACM, TenneT will send the Connected Party a so-called 'tariff letter' which includes:

- Tariff sheet ('Tarievenblad');
- Explanatory notes to the fees and tariffs of TenneT, and
- Explanatory notes on the tariff decision.

For consultation purposes only, please find below an example of a tariff sheet (in Dutch only).



BIJLAGE TARIEVENBLAD 2015  
BIJLAGE BEHORENDE BIJ Aansluit- en Transportovereenkomst

Versie: december 2014

Geldig vanaf: 1-1-2015

Naam klant: OWF C.V.

Gegevens aansluiting		Factuurgegevens klant	
Naam aansluiting	Offshore Platform X	Facturatienaam	OWF C.V.
Adres aansluiting		T.a.v.	T.a.v. Crediteurenadministratie
		Factuuradres	Postbus .....
			Postcode ..... Woonplaats .....
		Debiteurennummer	TE.....
Tariefscategorie	EHS (220 kV - 380 kV)	Uw betalingskenmerk	
Bedrijfstijd	Groter dan 600 uur	EAN-code	.....
		Volumecorrectiefactor	0 %

Tarieven*	Hoeveelheid**	Tarief per eenheid	Bedrag per jaar	Bedrag per maand***
<b>Transportdienst</b>				
kW-gecont. 220-380 kV (> 600u)	3500	€	€	€
kW-max <u>mgd</u> 220-380 kV (> 600u)	.....	€	€	€
Vastrecht transportdienst 220-380 kV	2	€	€	€
<b>Meetdienst</b>				
Meterhuur	1	€	€	€
Meetdienst	1	€	€	€

\*) Deze kolom geeft ter indicatie een volledige weergave van de tarieven voor aangesloten op het Extra Hoogspanningsnet. Dit wil niet zeggen dat de hier genoemde aansluit-, transport- en meettarieven ook zullen gelden voor aangesloten op een transmissiesysteem op zee, hiervoor zijn vooralsnog geen tariefstructuren voorzien.

\*\*\*) De hoeveelheid voor kW-max wordt op basis van meetwaarden vastgesteld.

\*\*\*\*) Het maandbedrag is i.v.m. afrondingsverschillen indicatief weergegeven.

*Wij verzoeken u dit tarievenblad zorgvuldig te bewaren bij uw aansluit- en transportovereenkomst en de bijhorende toelichting door te lezen.*