

STAKEHOLDER CONSULTATION PROCESS OFFSHORE GRID NL

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QUALITY CONTROL

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(Please note that the below is not a literal transcription of the comments made, but rather represents the overall tone and context of the discussion)

0. Welcome

Rob van der Hage opens the meeting and welcomes all attendees.

1. T16 Physical coordinates

The coordinates of platform Borssele Alpha have been notified in RD including a reference to the position paper which will soon be online. The position paper details the reasoning behind the location of the platform. During the meeting the question was raised if the coordinates can, additional to the RD system, also be provided in the UTM system. This has been adjusted in the position paper [ONL 15-360_T16_physical coordinates_PP_v1].

2. T2 Number of bays

[Discussion]

Summary of concerns based on feedback during the Expert Meeting

- Concern on the responsibility to decide which string is faulty in the case of less than 6 bays
- In the case of less than 6 bays; concern on switching time after failures to return the healthy cable. In the opinion of the OWF this will take longer than estimates by TenneT, and therefore the cost impact due to losses of MWh is higher
- Consensus on providing 6 66kV bays to connect the OWF. This is sufficient for 90% of the designs and preferred by all OWF. Connection possibility to connect 2x2 infield cables and 4x1 infield cable = 8 cables (because of 8 j-tubes) will remain per OWF

Feedback from the meeting attendees

Will there be transformers for each cable? T: yes

This construction is business as usual for Medium voltage. Is TenneT sure this can also be applied to High voltage? We believe these cable current transformers are not sufficient for HV. T: this has already been applied to HV and is possible/common practise.

In the case of 2 strings attached to 1 bay; there is a concern on the responsibility to decide which string is faulty. The OWF prefers TenneT to take this responsibility. TenneT states that it is the responsibility of the OWF. The problem is on OWF side and we have to rely on the detection in order to determine the faulty cable.

Is it the intention of TenneT to install a 'fast event recorder' on the 66kV side? T: Not per bay other than the

fast event recorder as part of the protection/bay units.

If you have two strings connected to one bay and there is one faulty string; there will also be a short circuit from the other string. T: Full converters cannot inject currents higher than 1,1 In. DFIG can inject higher currents; they can be detected by applying directional overcurrent relays.

This design takes away some of the advantages of a ring connection and therefore makes it less flexible.

90% of the layouts require 6 strings. Would it therefore be possible to make available 6 bays? All OWF agree on this.

Is 66 kV switch gear available on the market? T: yes it is and this will be mentioned in the updated position paper.

3. T6 Protection

[Notification]

Please clarify that the WTG/OWF protection system is operated and owned by TenneT? T: confirmed.

Furthermore no comments.

4. T8 SCADA, communication interface and data links

[Notification]

Please clarify the possibilities to install a 4G network to support communication within the OWF.

In which topic is space on the platform e.g. for LiDAR, SODAR, wind and wave measurement arranged? Prepare discussion for next meeting if measurements can be shared (in order to avoid 2 or 3 redundant installations).

Furthermore no comments.

5. T4 Access to platform

[Discussion]

Summary of concerns based on feedback during the Expert Meeting

- The assumptions in the study deviate from one party – these assumptions will be looked into and will be used to run the calculations again in order to determine any major difference
- Other parties confirm they would not install a heli-deck and access by CTV is business as usual

Feedback from the meeting attendees

The assumptions in the study show a mismatch with our experience. Based on German experience: Numbers of Ampelmann (2 meters) are optimistic while numbers for helicopter deck (25 m/s) are pessimistic. Maintenance days are too optimistic. Offshore installations require more maintenance. OWF will send additional information via the website.

Other parties confirm they would not install a heli-deck and access by CTV is business as usual.

We assume that TenneT staff will be available during the installation phase. T: confirmed.

Could we have more information on the design of J-tubes and possibilities of pulling. E.g. will there be shared or individual wings. T: We suggest to provide an information session on basic design of the platform in September and October.

6. T9 Metering

[Notification]

Please clarify if the metering is done onshore or offshore? T: offshore.

Furthermore no comments.

7. T12 Redundancy/availability

[Discussion]

Summary of concerns based on feedback during the Expert Meeting

- There is a consensus on the presented option 2

Feedback from the meeting attendees

The underlying calculations are not clear. T: The underlying assumptions and information is confidential and cannot be published; the NPV calculations result in the lowest LCOE.

OWF: we confirm these results and conclusions. If we would do these calculations we would come to the

same results.

There is a consensus on the presented option 2.

8. Planning legal consultation

[Notification]

Feedback from the meeting attendees

Attendees appreciate that these expert meetings will be the place for TenneT to consult the model agreements in the months after summer and in English.

With respect to the technical requirements, which follow another legal path, there are some concerns:

- These should be established by the ACM at some point in time, since ACM has indicated not to see a formal role to start the process of establishing these technical requirements before STROOM enters into force, this is considered a serious risk for the tender. OWFs need to know the technical requirements to adhere to for their tender bid.*
- The time path for ACM to establish the technical requirements in the Codes is unknown at this stage and that causes uncertainty for OWFs.*
- The technical requirements and the model agreements are strongly related with regards to the requirements that TenneT and the OWFs have to comply with towards each other and should be seen integral package.*

NWEA offers to fulfil a role in the consultation process.

OWFs appreciated the clear overview.

9. T7 Reactive power compensation

[Discussion]

Summary of concerns based on feedback during the Expert Meeting

- Consensus on the proposed position with the additional note that if the WTG cannot compensate the reactive power at zero load. T: This can be done by optimising the system as a whole,

Feedback from the meeting attendees

Do we understand correctly that TenneT will provide a setpoint to us (OWF) that we have to adhere to? T: yes correctly.

Are you sure wind turbine manufacturers can provide wind turbines which can compensate? T: yes we are – in the case you'll find an example that cannot compensate we will adjust the configuration and the OWF will have to stay within a -0,1 – 0,1 pu bandwidth.

Wind turbine manufacturers have been involved in the RfG discussion and know what to expect in the future. If they cannot provide a wind turbine which can compensate they will have a disadvantage towards the rest of the market. We (OWF) are convinced they will make sure they provide such facilities to the wind turbines.

10. P1 Planning

[Discussion]

Summary of concerns based on feedback during the Expert Meeting

- In case we look at a two-season installation of the OWF this planning is good; but in case of a one-season installation scheme this planning is too tight
- Works of OWF and TenneT could conflict
- Will the progress on limiting the identified uncertainties be communicated

Feedback from the meeting attendees

Would it be possible to adhere to an earlier date for installation of onshore and offshore equipment?

There will be a potential problem with regards to installation on the platform. Could be 3 parties at the same time which is undesirable.

This planning is fine in case of a two-season building period. In case piling restrictions are lifted this planning is too late. T: would 1st of August be better with regards to a one-season planning? OWF: yes.

We will have to know these dates and also the piling restrictions before we hand in the bid. Otherwise we cannot make a binding offer. This is crucial for our planning and business case.

We would recommend do to all testing of the topside onshore. During our works we have done all that we could do onshore. After that it took us only two weeks to install and commission the topside offshore.

T: how much time does it take to commission all WTG? Up to 2 months of installation and in the worst case 2 years after installation. However; this will not affect the TenneT planning.

Cable pull-in works will conflict with TenneT works. A planning for mutual works offshore should be made..

Could you tell us more about your identified uncertainties and moreover if you will communicate the progress on limiting these uncertainties?

Adjust in position paper: grid connection commissioned and fully tested without WTG. Export cable should be export cables.

11. O2 Stranded asset mitigation

[Discussion]

Summary of concerns based on feedback during the Expert Meeting

- Concern by part of the attendees that the risk assessment is insufficient
- Consensus by part of the attendees that the risk of both cables failing at the same time period is acceptable
- Consensus by part of the attendees that this position (no back up generation) is common practise and acceptable in the case of two export cables

Feedback from the meeting attendees

Which CAPEX is taken into account in these calculations? T: the capex which is needed to enforce the platform in order to make back up generation possible (tons of steel).

Which capacity did you take into account? ~9 kVA for both farms.

A generator in each WTG will be far more expensive than one back up on the platform.

Centralised solution is common practice due to higher accessibility.

A good risk assessment should be done which includes the probability of double cable failure. This is a small probability but a very high cost. T: could you indicate which probability is acceptable and which probability you use in your models? OWF: No

Could you share the risk assessment?

Could you make an analysis of bringing back the LCoE to zero and then determine cable failure rate. With goal seek you should be able to see if the change of occurrence is acceptable or not. T: but what would you consider acceptable?

The following is common practise:

- one export cable + one diesel generator at WTG of centralised on platform
- two export cables: never any diesel generator(s)

Have you included the connection between Alpha and Beta in your calculations? T: no and therefore in practise the probability will be even lower.

We accept the risk since we see the probability of failure of both cables at the same time period as extremely low.

12. Closure

13. List of attendees

Company	Name
DELTA	Jan Maas
TenneT	Daniel Markus
TenneT	Bart van Hulst
TenneT	Thomas Donders
Vattenfall	Volker Mahlmann
RWE	Jörn Runge
DNV-GL	Hans Cleijne
Engie/GDF-Suez	Eric Dekinderen
Engie/GDF Suez	Bob Meijer
NWEA	Dolf Elsevier van Griethuysen
DONG	Ole Holmstrøm
TenneT	Rob van der Hage
Eneco	Jos Jacobs
Parkwind	Dirk Vandercammen
TenneT	Marien Ruppert
TenneT	Frank Wester
Ecofys/TenneT	Anna Ritzen
Vattenfall/NUON	Martin Ars
Shell	Paul Donnellan
De Brauw Blackstone Westbroek	Arjan Kleinhout
TenneT	Saskia Jaarsma