

TenneT

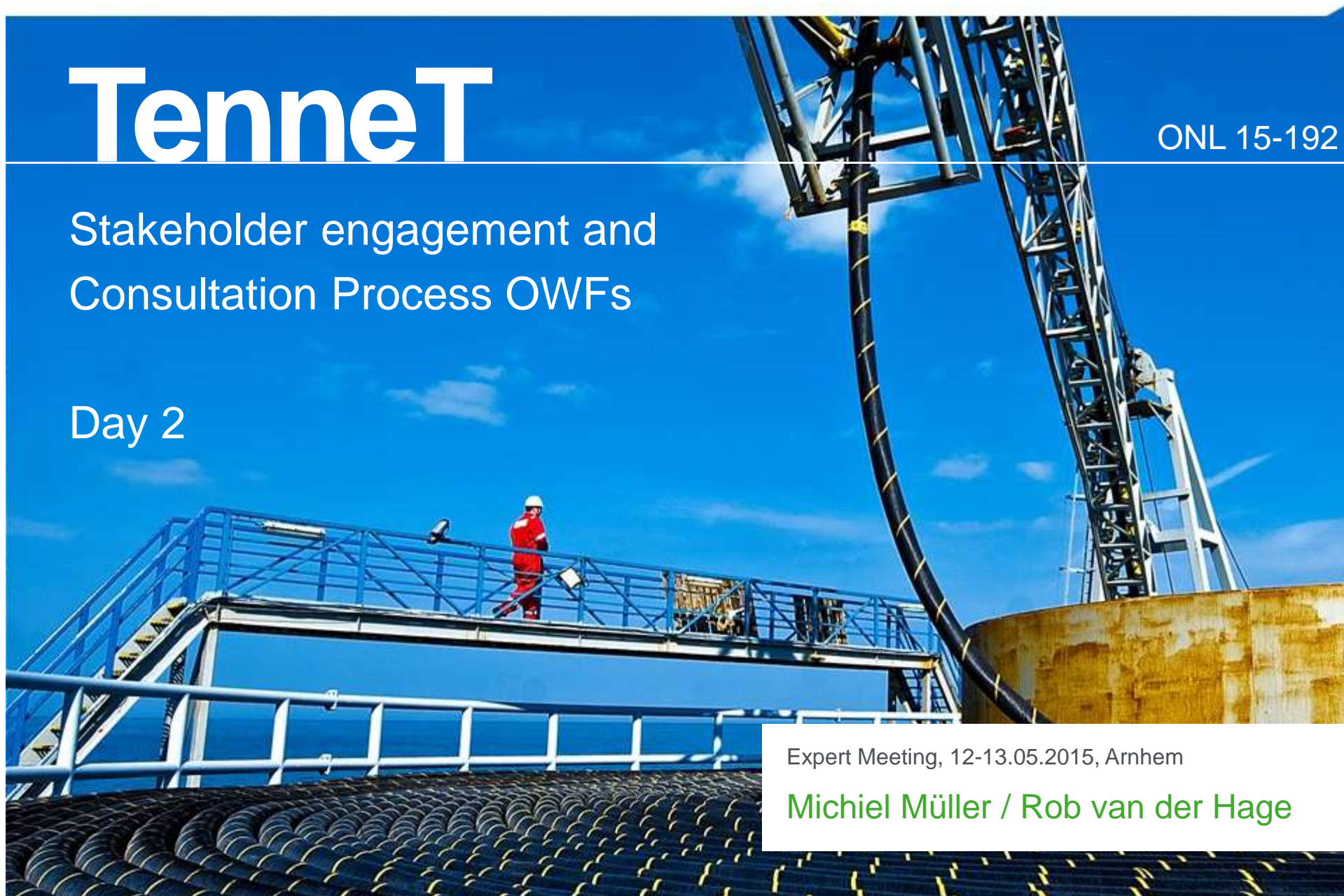
ONL 15-192

Stakeholder engagement and
Consultation Process OWFs

Day 2

Expert Meeting, 12-13.05.2015, Arnhem

Michiel Müller / Rob van der Hage





Stay tuned. Safety first!

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

In geval van een ontruiming van het pand:

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





Welcome



Agenda (12.05.2015)

WHEN	WHAT	TYPE OF SESSION
09:00-09.15	Welcome Agenda for today	Introduction
09:15-12.30	Dedicated legal session (Realsiation and Connection Agreement)	Discussion
12.30-13.30	Lunch	
13.30	Closure	



Agenda (13.05.2015)

WHEN	WHAT	TYPE OF SESSION
09:30-09.40	Welcome Agenda for today	Introduction
09:40-10.30	T.8 SCADA, communication interface and data links	Discussion
10.30-11.15	T.6 Protection	Discussion
11.15-11.30	Coffee break	
11.30-12.00	P.1 Planning	Discussion
12.00-12.15	T.15 Harmonics & transients study	Information
12.15-13.15	Lunch	
13.15-13.30	T.1 Voltage level	Notification
13.30-14.30	T.4 Access to platform	Discussion
14.30-14.45	Coffee break	
14.45-15.00	T.11 Overplanting	Notification
15.00-15.30	T.9 Metering	Discussion
15.30-15.45	L.2 Initial Investment Plan	Information
15.45-15.55	T.5 Operation of Bays	Notification
15.55-16.00	Closure	



Announcement

Planning of up-coming Expert Meetings

- June/July: 2-3 July (thu/fri)
- September: 16-17 September (wed/thu)
- October: 14-15 October (wed/thu)



Planning consultation topics

		nov	dec	jan	feb	mar	apr	may	jun	sep	oct	nov		
T.1	Voltage level	Yellow	Yellow	Yellow	Yellow	Green	Green	Blue	Grey	Grey	Grey	Grey	Yellow	I. Inform
T.2	# of J tubes / bays	Yellow	Yellow	Yellow	Yellow	Green	Green	Light Green	Green	Blue	Grey	Grey	Green	D. Discuss
T.3	Point of Common Coupling	Yellow	Yellow	Yellow	Yellow	Green	Blue	Grey	Grey	Grey	Grey	Grey	Light Green	WIP
T.4	Access to platform	Grey	Grey	Grey	Grey	Grey	Yellow	Green	Green	Blue	Grey	Grey	Blue	N. Notify
T.5	Operation of Bays	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Blue	Grey	Grey	Grey	Grey	Grey	Closed
T.6	Protection	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Green	Blue	Grey	Grey	Grey	Grey	
T.7	Reactive power compensation	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Grey	Green	Blue	Grey	Grey	Grey	
T.8	SCADA/Metering/Data links	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Blue	Grey	Grey	Grey	Grey	
T.9	Metering	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Blue	Grey	Grey	Grey	Grey	
T.11	Overplanting	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Blue	Grey	Grey	Grey	Grey	Grey	
T.12	Redundancy / availability	Grey	Grey	Grey	Grey	Grey	Yellow	Yellow	Green	Blue	Grey	Grey	Grey	
T.13	Installation interface management	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Green	Green	Blue	Blue	
T.14	O&M interface management	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Green	Green	Blue	Blue	
T.15	Harmonics and transient study	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Yellow	Green	Green	Blue	Blue	
T.16	Physical coordinates	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Green	Green	Green	
T.17	Compliance testing	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Yellow	Green	Blue	Blue	
P.1	Planning	Grey	Grey	Grey	Grey	Green	Green	Green	Green	Green	Blue	Grey	Grey	
L.1	Connection Agreement	Grey	Grey	Grey	Grey	Yellow	Green	Green	Green	Green	Green	Blue	Blue	
L.2	Initial Investment Plan	Grey	Grey	Grey	Grey	Grey	Grey	Yellow	Yellow	Yellow	Blue	Grey	Grey	
O.1	Innovation	Grey	Grey	Grey	Grey	Grey	Blue	Grey	Grey	Grey	Grey	Grey	Grey	
O.2	Stranded asset mitigation	Grey	Grey	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Green	Blue	Grey	Grey	



T.8 SCADA, communication interface and data links

Discussion



T.8 SCADA, communication interface and data links

Input

- Questionnaire as sent out to wind turbine generator suppliers



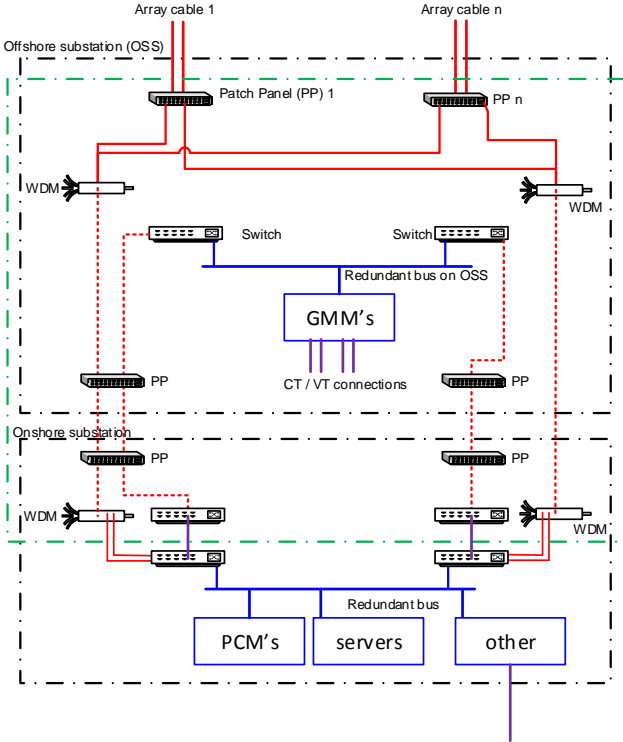
T.8 SCADA, communication interface and data links

Main considerations

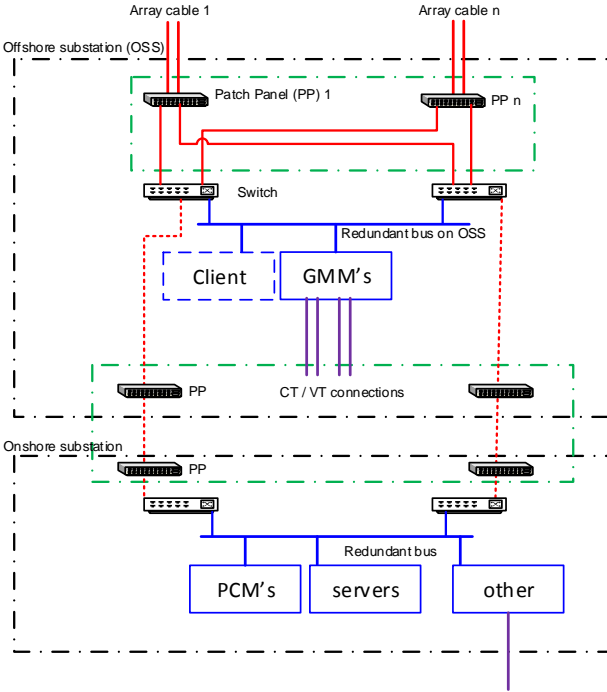
- TenneT identifies three different general communication principles:
 1. Passive (all fibres are patched through one-on-one from array cables to export cables).
 2. Multiplexing (fibres of array cables are patched to (at least two) multiplexing devices).
 3. Switches (all fibres from array cables are patched to switches, where various redundant configuration are possible).
- PPM SCADA equipment installed on the offshore substation can also be roughly divided into three principles where each consecutive option requires more equipment offshore:
 - a) Grid metering modules (GMM) only (devices on which CT/VT outputs are connected and which convert the CT/VT signals to any data format / output to be agreed upon).
 - b) Power control modules (PCM) with separate or integrated GMMs possibly including one client system.
 - c) PCM's, GMM's and also PPM SCADA equipment like servers, clients, master control modules.



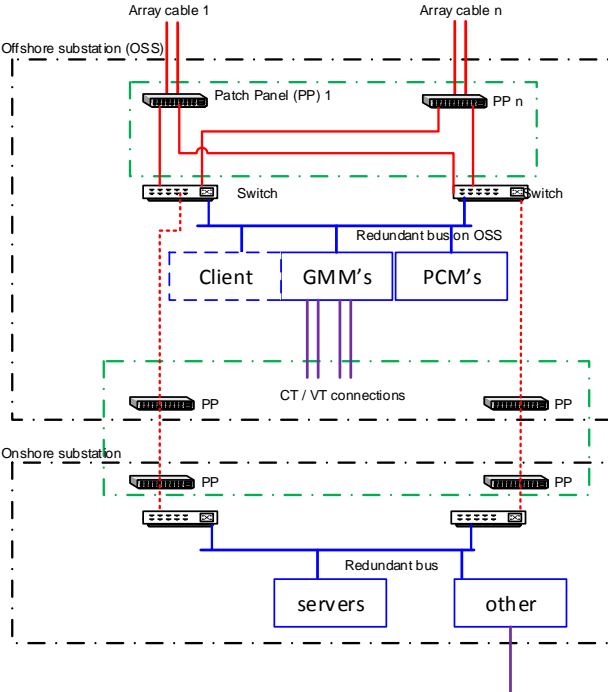
T.8 SCADA, communication interface and data links



Option 2 - a



Option 3 - a



Option 3 - b



T.8 SCADA, communication interface and data links

Conclusion from WTG supplier feedback

- Option a) (GMM's only) will lead to the lowest amount of PPM SCADA and communication equipment on the offshore platform;
- Although option 2 (multiplexing) is technically feasible, there is only a minor benefit (no WPO SCADA and communication equipment on the offshore platform) which does not weigh up to the higher complexity, higher risks and uncertainties and lower flexibility of option 2 compared to option 3 (switches).



T.8 SCADA, communication interface and data links

Position

For the PPM SCADA and communication system (owned by the WPO), TenneT intends to make available on the five offshore platforms to be realised by TenneT up to 2023:

- A telecommunication room for each WPO to install his cabinets for switches and GMM's (max 4 cabinets, as defined above) including sufficient CT/VT connections and a redundant and uninterruptable power supply;
- Sufficient patch panels to connect the fibres of all array cable strings (maximum amount to be determined, but at least 6 fibres per string);
- Sufficient optical fibre pairs in both export cables to connect the main switches to the onshore communication interface point.



Questions & concerns



T.6 Protection

Discussion



T.6 Protection

Input

- ONL 15-080-T6_Protection_PP_v1
- Expert Meeting 14-15 April 2015
- Feedback received from website



T.6 Protection

Main considerations

- **Consensus.** There is a general consensus that TenneT can take responsibility of the protection equipment on the platform, The OWF will take care of the protection equipment in the string. Settings of both protection equipment should be tuned to each other.
- **Concern.** There is a general concern of a risk that standardisation of the protection system by TenneT does not leave enough flexibility for the wind farm owners to use their own protection philosophy for an important asset. If this cannot be realised on the platform, it has to be done at the turbine side, which would drive up total cost.



T.6 Protection

Follow-up

- TenneT does not intend to decide on the full protection scheme of the inter array strings, but only focusses on the relays on the platform.
- Extra requirements of the connected PPM, impedance or distance protection, will be taken into account with space for one extra relay in the standard cabinets on the platform. In close alignment with the connected parties, TenneT will fill in the final protection scheme and equipment.



T.6 Protection

Position

TenneT intends to standardise the protection equipment on the platform of the offshore PPM inter-array cable strings to the TenneT offshore transformer platform by implementing a standard protection system, owned, operated and maintained by TenneT for all five platforms to be realised by TenneT up to 2023.



Coffee break



P.1 Planning

Consultation

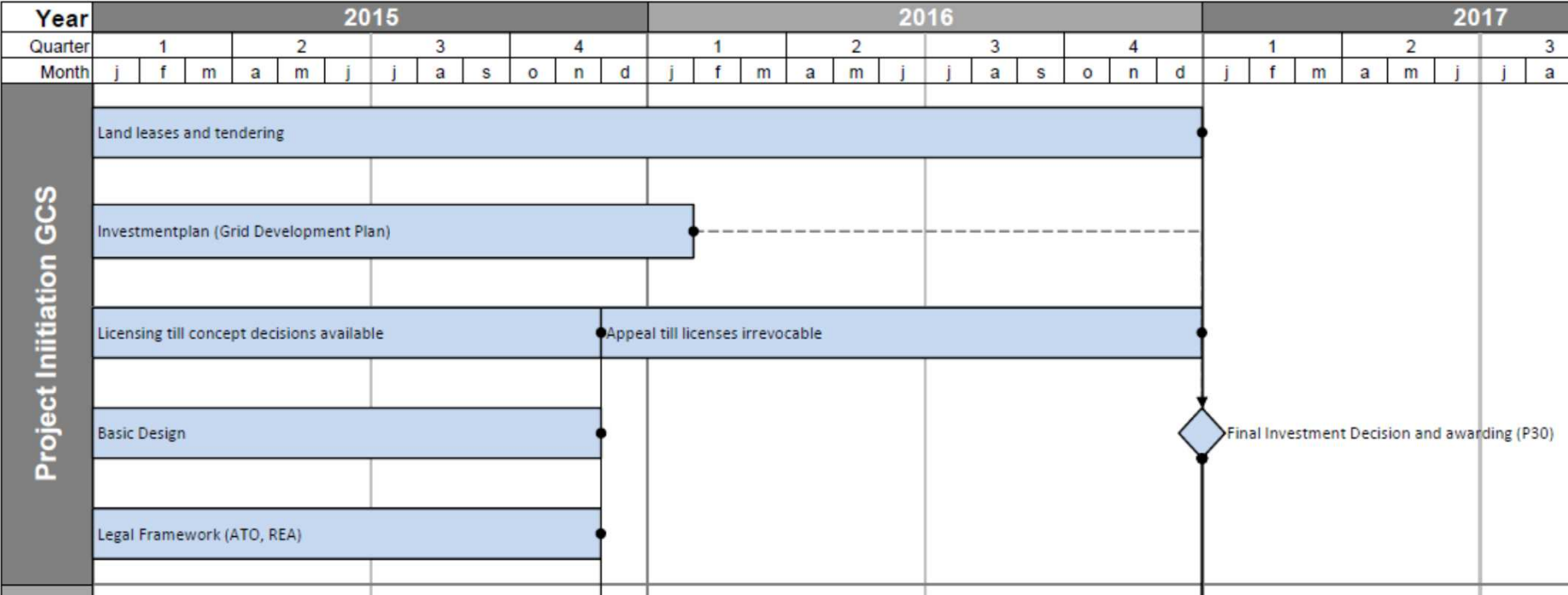
- Developer's comfort with TenneT realisation planning
- Earliest timeline for "first turbine"
- Planning and requirements for start-up of wind farm
- Specifying planning interface in realisation



Position paper on planning that defines platform availability date.

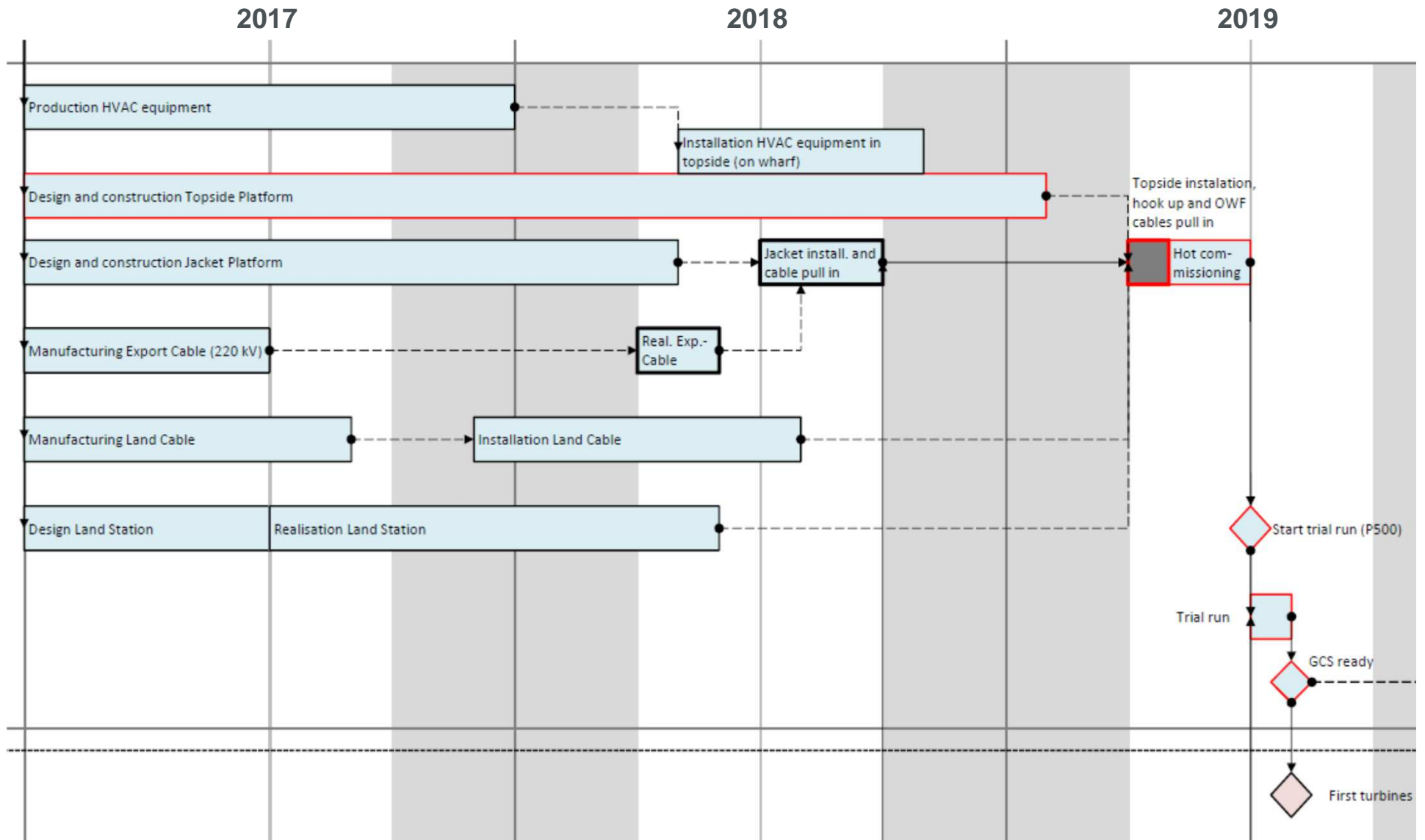


P.1 Planning





P.1 Planning





T.15 Harmonics & transients study

Information



T.15 Harmonics & transients study

Introduction

TenneT must be compliant with the requirements of the Electricity law and Grid code

Based on the defined capacity per 66 kV bay TenneT will specify:

- Emission limits based on OWF requested transport capacity
- Harmonic amplification limit
- Root loci of the grid at 66 kV level at N-0 condition

(expected November 2015)

OWF will calculate their emission levels. Requirements:

- Emissions shall be below emissions limits
- Amplification limit is not exceeded



T.15 Harmonics & transients study

Process

Compliance test is based on calculations and a measurement period

Calculations:

- If calculated emissions are below specified levels → accepted
- If calculated emission exceeds the limits, OWF shall take measures; new calculated emissions are below specified levels –OK

Compliance measurements:

- According to compliance test program
- Measured values of harmonics should be below compatibility levels;
- Amplification factor shall be < 1



T.15 Harmonics & transients study

Planning

TenneT currently prepares document:

Harmonic emissions limits for connected parties

available September 2015



Break & lunch



T.1 Voltage level

Notification



T.1 Voltage level

Summary of feedback

Consensus. There is a general consensus that the application of 66 kV as the medium voltage level for the infield cables is technically feasible, both with respect to the electrical equipment and with respect to the potential impact on turbine structure, foundation and cable installation.

Consensus. The indicated expected cable length reductions (in going from 33 to 66 kV) are confirmed by the attendees of the Expert Meeting. It is also confirmed by the attendees that by far the majority of developers considers only layouts where the maximum number of turbines is attached to every string.

Consensus. Cost impact ranges provide a good overview of potential cost impact, in terms of cost savings (cable length reduction) and cost increases (equipment). By including an overall worst and best case, additional uncertainties in the market with respect to the new technology is considered to be covered sufficiently.



T.1 Voltage level

Summary of feedback

Consensus. There is a general consensus supporting the conclusion of the position paper that it can be expected that a competitive market will be available for the supply of 66 kV cables, in time (at tender open by end 2015) and with the appropriate guarantees and certificates.

Consensus. There is a general consensus supporting the conclusion of the position paper that it can be expected that a competitive market will be available for the turbines at 66 kV level, in time (at tender open by end 2015) and with the appropriate guarantees and certificates.

Mixed opinion. Some parties express some concern that the range of capacities of turbines that will be available at 66 kV may be limited especially on the lower side of the spectrum. This concern is not shared by all. In addition it is recognised that hard facts with respect to this topic are nearly impossible to get out of the market, as turbine suppliers consider this vital to the negotiation position. In addition indications are that the smallest capacities of turbines will not be permitted within the permitting constraints for the site..



T.1 Voltage level

Notification

TenneT's position on 'T1 Voltage Level':

- TenneT intends to standardise the connection voltage level of the inter-array systems to the TenneT offshore transformer platform at 66 kV for all five platforms to be realised by TenneT up to 2023.

has been presented for final decision making by the appropriate body and will not come back in the stakeholder consultation process.



T.4 Access to Platform

Discussion



T.4 Access to Platform

Input

- ONL 15-184-T4_Access to platform_PP_v1
- Expert Meeting 14-15 April 2015
- Feedback received from website



T.4 Access to Platform

Main considerations

Following feasible ways of access have been identified by TenneT for WPO's representative(s) (as well as TenneT's subcontractors):

1. **Accompanied only:** Access of WPO's representative(s) to the platform only when accompanied by (a) TenneT representative(s).
2. **Partly independent access:** The WPO's representative(s) is/are allowed to independently access the platform for the room(s) with WPO owned equipment without accompaniment by a TenneT representative, but under the safety and operational regulations and requirements, as (to be) determined by TenneT.

From a safety point of view, TenneT considers both options as equals since for both options the same safety and operational regulations and requirements will be applicable.



T.4 Access to Platform

Position

TenneT is inclined towards standardising the offshore platform providing a helicopter hoist facility on the platform, but no helicopter landing platform. This due the short distances to shore, the reliability of the system (>98%, for power to the platform even more), the expected amount of maintenance and the usability of heli-transport for maintenance and emergency purposes (for materials a boat is needed).

TenneT is inclined towards allowing access for WPO's representative(s) to the offshore platform without accompaniment. However, only specific rooms (WPO equipment room(s) and general room) will be accessible. If WPO's representative(s) needs to access other areas (e.g. switchgear rooms where inter array cables are connected), accompaniment by (a) TenneT representative(s) is required.

Above positions are applicable to all five platforms to be realised by TenneT up to 2023.



Questions & concerns



Coffee break



T.11 Overplanting

Notification



T.11 Overplanting

Summary of feedback

- **Consensus.** There is a general consensus that every party will consider whether or not overplanting / dynamic loading will be incorporated in the design of the wind farm. For this the parties require clear boundary conditions provided by TenneT, as well as any information available on cable design and soil conditions to evaluate dynamic loading possibilities.



T.11 Overplanting

Notification

TenneT's position on 'T11 Overplanting':

- TenneT intends allowing the PPMs to transmit 10% above their rated power (350MW), which is 35MW extra, with the requirement for PPM's to curtail their produced power, in case the 220 kV export cables reach their maximum allowable temperature limits . Details on curtailment of the PPMs will be addressed to in the 'Customer Connection Agreements (ATO)'.

has been presented for final decision making by the appropriate body and will not come back in the stakeholder consultation process.



T.9 Metering

Discussion



T.9 Metering

Input

- Electricity Metering Code (Meetcode Elektriciteit) per 1 January 2015
- Electricity Grid Code (Netcode Elektriciteit) per 26 March 2014
- ONL 15-185-T9_Metering_PP_v1
- Expert Meeting 14-15 April 2015
- Feedback received from website



T.9 Metering

Main considerations

- In Position Paper T.3 Point of Common Coupling , the position on the connection point between the offshore PPM and TenneT is described, specified at the cable termination of the inter array cables (owned by the PPM) and the switchgear installation on the platform (owned by TenneT).
- Regarding the Electricity Metering Code, accountable metering equipment should be installed at the connection points between the system operator and the connected party.
- According to the Grid Code and the Metering Code, the installation and maintenance of the metering equipment is the responsibility of the connected party, to be carried out by an independent certified metering company.
- Regarding the installation, commissioning and maintenance of the metering equipment, two solutions for operation of the switchgear bays can be defined:
 1. The installation, commissioning and maintenance of the accountable metering equipment is organised by the different PPMs.
 2. TenneT takes care of the installation, commissioning and maintenance of the accountable metering equipment.



T.9 Metering

Position

TenneT intends to centralise the organisation of the accountable metering requirements via one certified party, contracted by TenneT, responsible for the installation, commissioning and maintenance of the metering equipment. The responsibilities of the PPMs as connected party will be dealt with in the connection agreement.



Questions & concerns



L.2 Initial Investment Plan

Information



L.2 Initial Investment Plan

Content

1. Why do we prepare an Initial Offshore Investment Plan?
2. What will be the content of the IOIP?
3. When will the IOIP be consulted and published?.



L.2 Initial Investment Plan

Why - Initial Offshore Investment Plan

- Experience in Germany, NetzEntwicklungsplan
 - Realistic planning
 - Supply chain
 - Stranded assets
- Obligation TenneT to The Ministry of Economic Affairs requires IOIP from TenneT
 - Required by law STROOM
 - Based on Scenario EA
 - Check ACM warrants need and necessity



L.2 Initial Investment Plan

Why - Initial Offshore Investment Plan

- Objectives of the IOIP:
 - ❑ Provide all OWFs with (reconfirmation of) information on TenneT's technical concept, technical requirements
 - ❑ Gain approval regarding need and necessity of proposed investments from the Ministry and ACM
- TenneT benefits from IOIP:
 - ❑ After approval, TenneT can safely prepare offshore investments
 - ❑ With this formal, public document, TenneT proves itself as a reliable and transparent partner for OWFs



L.2 Initial Investment Plan

What - Provisions in (draft) law regarding content of scenario

STROOM, draft law Article 5.6: investment plan offshore transmission system

1. The Minister will determine a scenario regarding the offshore wind energy development.
Content of this scenario:
 1. Location OWF
 2. Expected start of operation OWF
 3. Expected lifetime of OWF
 4. Maximum capacity of OWF
 5. Electrical connection concept
 6. Expected start of operation of offshore transmission system
 7. Future developments of offshore wind energy
2. The Minister can adjust the scenario
3. The offshore transmission system operator shall prepare an investment plan based on the scenario.



L.2 Initial Investment Plan

What - Provisions in (draft) law regarding content of scenario

Proposed content IOIP by TenneT:

- Overview of activities since date of signing Energieakkoord
- Expected expansions for the offshore grid will be based on the scenario by the Ministry of Economic Affairs
- Description of generic technical concept of the offshore grid connection system
- Status update per area Borssele, Hollandse Kust Zuid and Noord
- Legal framework regarding offshore code and model connection agreements
- Investment plan – confidential appendix with financial details



L.2 Initial Investment Plan

When - Timeline

Proposed content IOIP by TenneT:

- Informal publication scenario by MinEA: July 2015
- Preparation IOIP by TenneT: until October 2015
- Consultation draft IOIP by TenneT during 4 weeks: October 2015
- Implementation of consultation results by TenneT: until January 2016
- STROOM enters into force as of 1 January 2016
- Formal publication scenario by MinEA: January 2016
- Submission of IOIP to ACM and MinEA by TenneT: 1 February 2016
- Assessment by ACM and MinEA, estimated duration 12 weeks: 1 May 2016
- Potentially, implementation of ACM or MinEA views
- Final publication of IOIP by TenneT: sometime between May and August 2016



T.5 Operation of Bays

Notification



T.5 Operation of Bays

Summary of feedback

- **Concern.** The TenneT proposal requires 24/7 quick response and access to the control centre. Can this be guaranteed? Will TenneT provide performance guarantees? Is there a dedicated operator available for specific actions (e.g. testing, commissioning)?
- **Concern.** Are emergency buttons and required switch signals available to the wind farm operator?
- **Consensus.** There is a general consensus that if above concerns are taken away, the proposed solution of TenneT is acceptable



T.5 Operation of Bays

Notification

TenneT's position on 'T.5 Operation of Bays':

- TenneT intends to standardise the operation of bay's for the offshore platform, similar to the current practice for the operation of switchgear onshore for the connected parties, where the switchgear installation with connections to the offshore PPM is fully operated by TenneT, as the owner of the switchgear.

is ready for final decision making by the appropriate body and will not come back in the stakeholder consultation process.



T.2 # of J-tubes and bays

Notification



T.2 # of J-tubes and bays

Summary of feedback

- **Consensus.** There is a general consensus that for the majority of wind farm owners the proposed number of J-tubes provides sufficient connection flexibility.
- **Concern.** There is a general concern with respect to the suggested configuration where in specific cases two strings would be combined on a single bay. The wind farm owners request more information and discussion on this topic.



T.2 # of J-tubes and bays

Notification

TenneT's position on "T.2 Number of J tubes and bays", **only with respect to the number of J tubes:**

- TenneT states that in case of 66 kV inter-array cables (based on conservative 64 MW per cable) a standard platform shall be equipped with 18 J-tubes for the inter array system:
 - 2x 8 J-tubes for offshore PPM
 - 1 J-tube installed for possible test purposes
 - 1 J-tube installed for the connection to the neighbouring platform.

has been presented for final decision making by the appropriate body and will not come back in the stakeholder consultation process.

The topic "T.2 Number of J tubes and bays" is put on the agenda for the next Expert Meeting of July 2015, for a final consultation discussion **only with respect to the number of bays.**



Closure

Thank you

