Annual work report 2018

Offshore wind energy power plant

Nobelwind

Subject	Author	Reviewer	Approver	Date
Draft report	O&M	CSU/DVA	KVE	02/05/2019
Final report	O&M	CSU/DVA	KVE	10/05/2019

PUBLIC VERSION

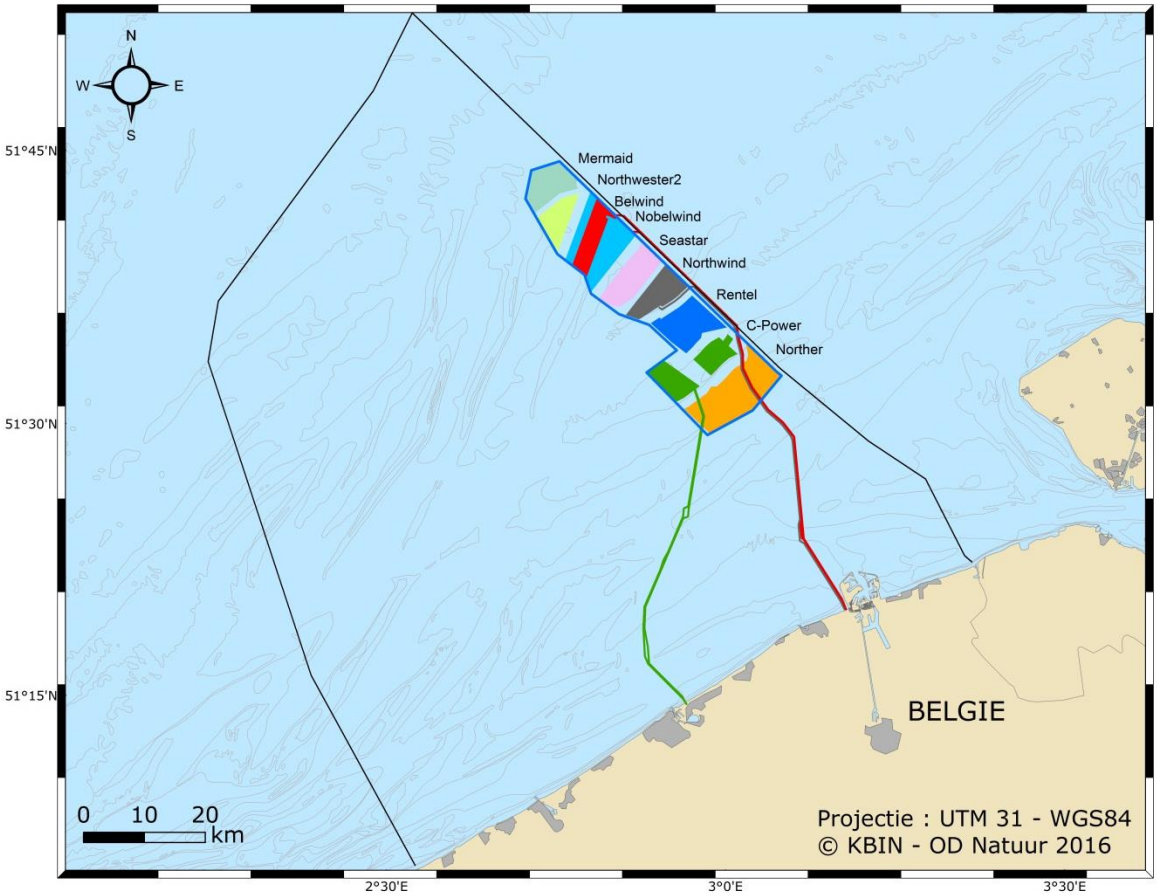
Table of Contents

1. Introduction

The Nobelwind offshore wind farm is located on the Bligh Bank, part of the Belgian Continental Shelf within the Belgian Exclusive Economic zone. The distance from the wind farm to the nearest point at shore (Zeebrugge) is approximately 47 km. Other wind farm data can be found in Table 1.

Table 1: Wind Farm data

Quantity	50	#
Power wind turbine	3.3	MW
Wind farm power	165	MW
Offshore HV stations	1	#
Wind farm area	20	Km²
Minimum seabed level depth, approx.	26	m LAT
Maximum seabed level depth, approx.	38	m LAT
Distance to the coast, approx.	47	km

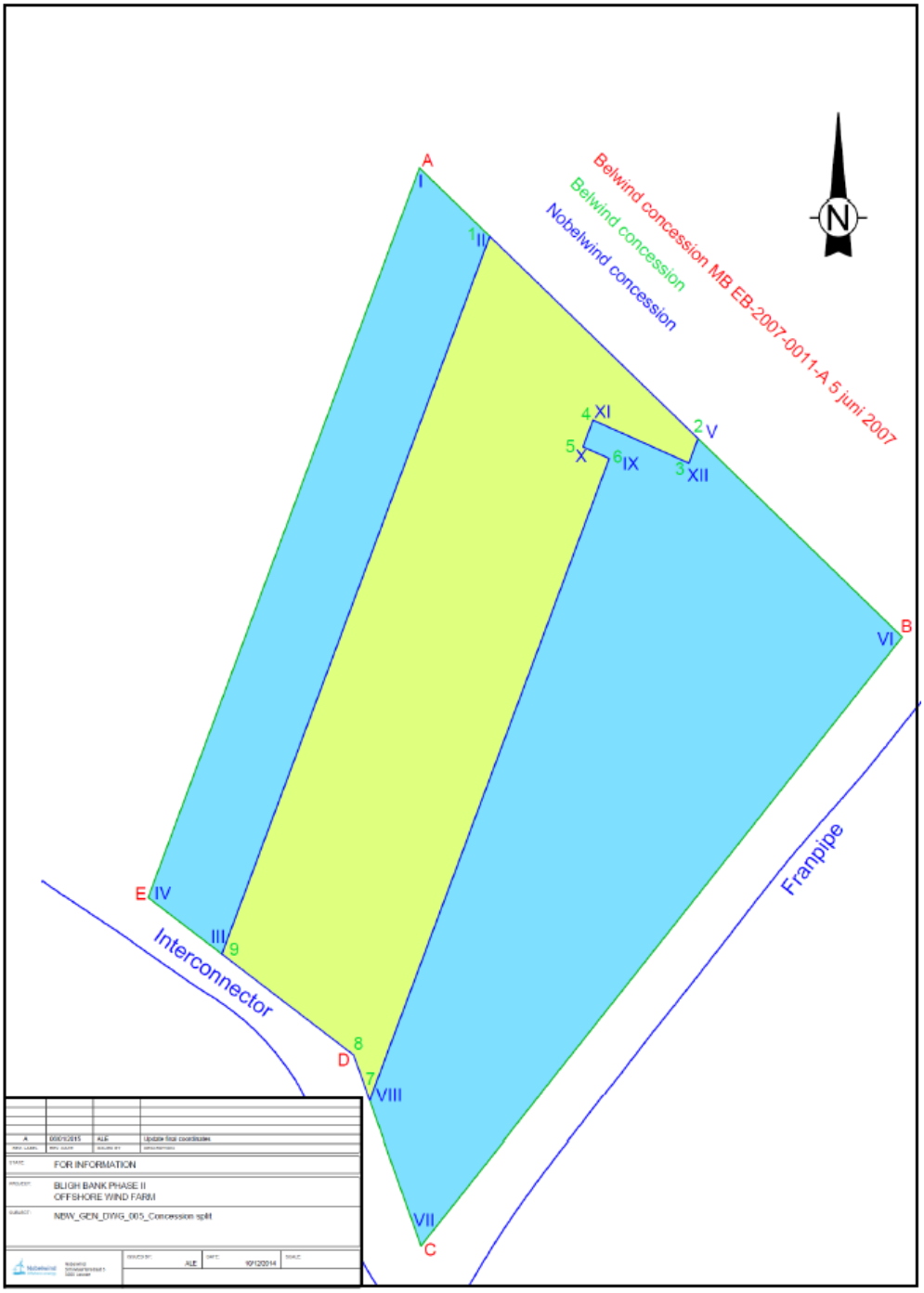


Location offshore wind farm Nobelwind

PUBLIC VERSION

2. Project overview

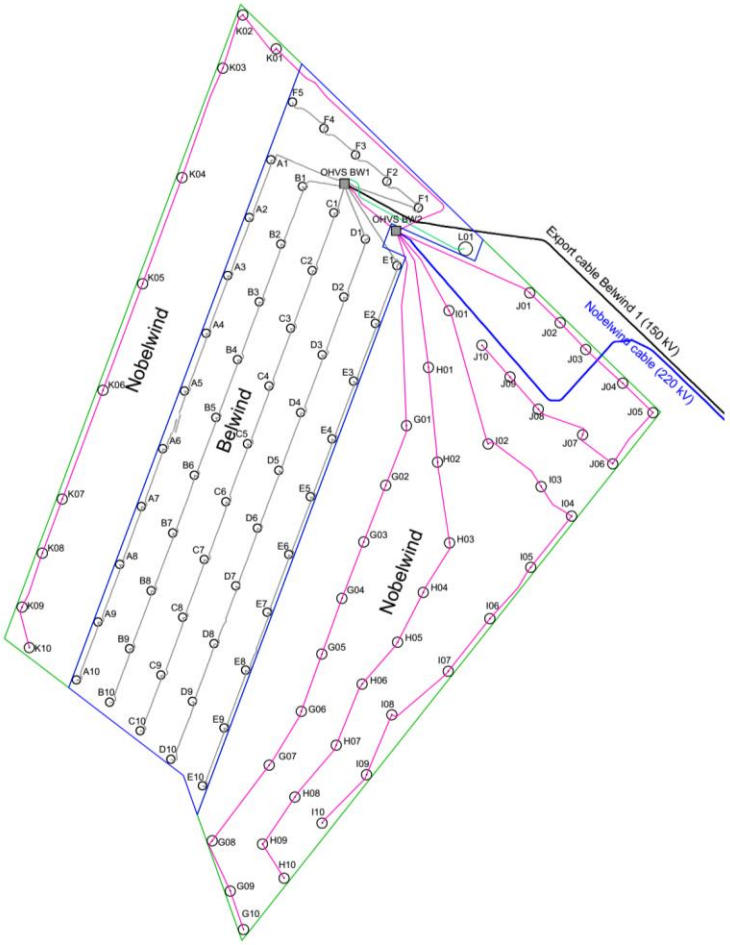
The Bligh Bank offshore wind park zone is the initially Belwind concession zone, which has been split up into two separate concessions namely the Belwind and Nobelwind concession. In line with the Royal Decrees of 20 December 2000 (Domain concession), 12 March 2002 (Sea-cable permit) and 07 September 2003 (Marine environmental permit), the partial split of these initial permits has been applied for by Belwind and Nobelwind. Nobelwind obtained in 2015 the necessary authorization for its realization.



Domain concessions Belwind and Nobelwind

PUBLIC VERSION

Nobelwind consists of 50 WTG's, type Vestas V112 3.3 MW, total of 165 MW and one Offshore High Voltage Station (OHVS). Via a local grid (33kV) the wind turbines are connected to this OHVS. Further, a 220kV interconnector cable connects this OHVS with the Northwind OHVS. Energy is transported to land via the existing 220kV export cable, installed during the construction of the Northwind project, but the cable owner is now Cableco CVBA. Construction started in 2016. The first energy has been produced since January 2017 and Nobelwind in full production as of May 2017.



Locations of the Nobelwind and Belwind wind turbines and the grid connection

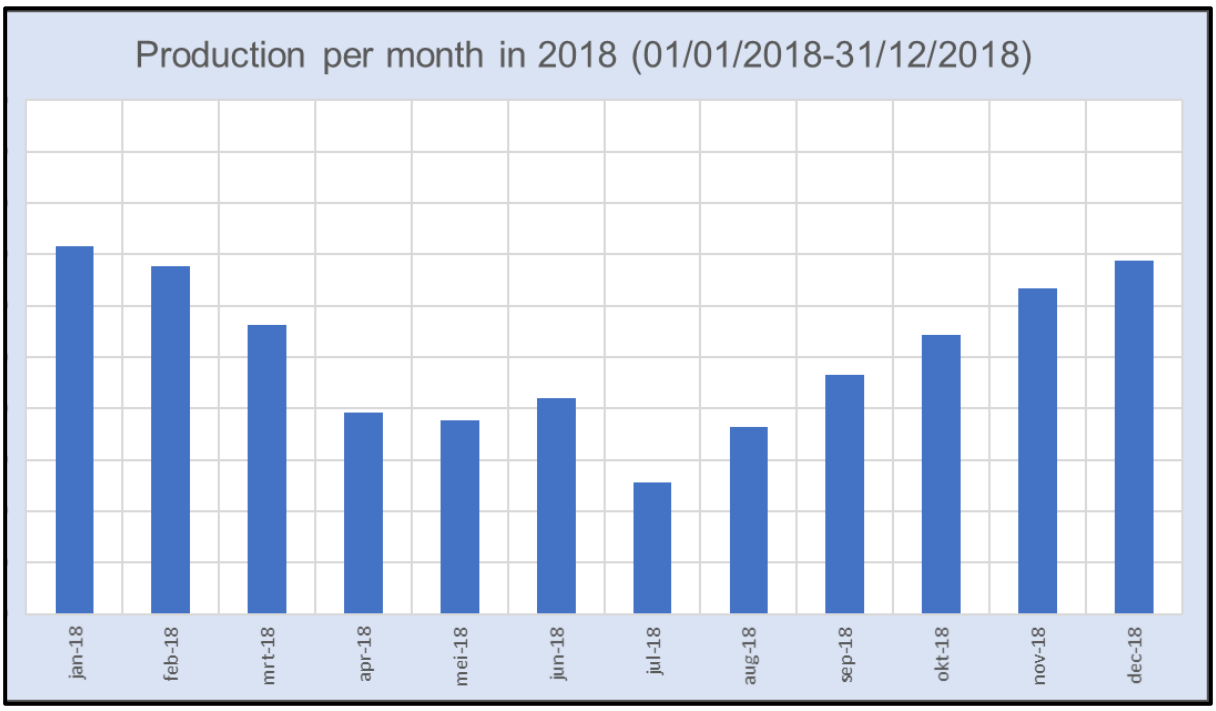
PUBLIC VERSION

3. Wind farm annual operations information

Below figures cover the 50 MVOW V112 turbines.

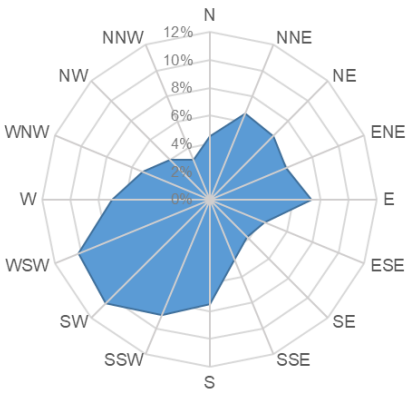
3.1. Production

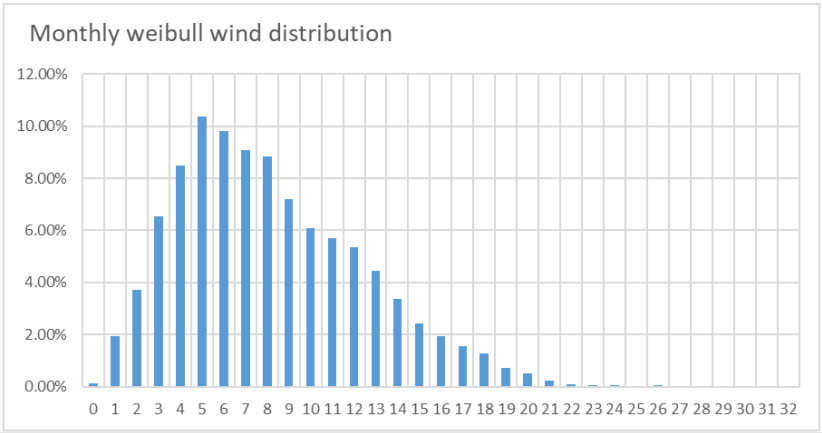
3.1.1. Performance of the wind farm



Monthly production V112 2018

3.1.2. Wind rose & energetic wind rose





Wind graphs 2018

The displayed wind rose is a graphical representation of the wind speed and direction measured all over the wind park. The wind speed is calculated as an average from all turbines. For all wind speed categories, the wind direction WSW prevails.

3.2. Planned maintenance

MVOW, the service contractor for the Nobelwind **WTG's**, performed the following planned maintenance and inspections in 2018:

- 2-Yearly Service: 25/50 WTG's completed;
- Yearly Statutory inspections: 50/50 WTG's completed;
- HV inspections: all WTGs have been inspected.

On the **electrical installation**, the following tasks have been performed for 2018 as part of the routine maintenance:

- Yearly mandatory statutory inspections of high voltage installation: this inspection was carried out by supplier according to legal criteria and no major observations were made;
- Yearly mandatory statutory inspections of all lifting equipment by supplier: all secondary equipment, cables, chains, slings, hooks and the cranes mechanisms are inspected to see if any aging or damage has occurred to the equipment. An exception has been obtained from Vinçotte to go from a 3-monthly inspection to a yearly inspection as all lifting equipment is rarely used;
- Yearly maintenance of all lifting equipment by Parkwind: the maintenance focuses on visual inspection, cleaning and functional testing of low voltage systems and components;
- Yearly inspection and maintenance of the fire detection system by supplier: this maintenance campaign focuses on testing of the fire detection equipment and fire control cabinet functions;
- Yearly inspection and maintenance of the firefighting by supplier: this maintenance campaign focuses on the firefighting equipment, e.g. pressure on the firefighting gas and portable fire bottles and test of the release valves and activation push buttons;
- Yearly inspection of First Aid kits;
- 3-monthly maintenances to all SCADA systems and IT infrastructure by Parkwind and supplier: during the SCADA and IT maintenance all equipment is tested and some performance and connectivity tests are performed;
- Yearly maintenance of HVAC installation by supplier: check of filters, functional tests of all valves & sensors, inspection of coolers and cleaning of the heat exchange condensers is performed;
- Yearly inspection of diesel fuel system by Parkwind: general inspection of the diesel generator, pumps and valves are focused during this yearly maintenance. Also, the diesel tank and its leak detection is checked;
- Generator maintenance and load test have been done on a 6-monthly basis to ensure the correct working;
- Yearly inspection of life saving equipment (life jackets and immersion suits) by supplier;
- Yearly inspection life raft by supplier;
- Regularly high and medium voltage equipment checks by Parkwind
- Small preventive maintenance has been done (e.g.: changing defect light bulbs, …);
- Preventive paint repairs have been performed to avoid excessive corrosion;
- Onshore: Yearly HVAC maintenance has been performed by supplier.

Most of the critical maintenance where performed during the planned outage for the Cableco Stevin works. During this outage the coupling cable 33kV between BW and NBW was energized to keep all turbines online so MVOW could continue to perform works on the turbines

In 2018 Parkwind also closed all open punches from the project in collaboration with Bladt/Semco.

On the **foundations**, the following tasks have been performed in 2018 as part of the routine maintenance:

- Inspection, maintenance and recertification of the fall arrest systems: the complete fall arrest system is inspected and recertified by qualified technicians. If any system is non-compliant it gets replaced as soon as possible;
- Cathodic protection: the cathodic protection needs to prevent/limit the corrosion on the primary and secondary submerged steel. The protection level is continuously monitored through the ICCP scada system. The status of the system determines whether offshore interventions are required to control, repair or check the system.
- Survey of inter-array cables: this multibeam survey takes a snapshot of the sea bottom condition and the results are used to determine the depth of burial of the cable assets;
- Survey scour protection: This multibeam survey measures the level of scour protection compared to the level during as-built, design and earlier years;
- ROV inspection of outer submerged foundation to evaluate the marine growth and presence of ropes, fishing nets, rocks or other debris;
- Smart foundation monitoring: the WTG's K05, G08 and G10 are equipped with several sensors in order to monitor the grout, loads, and vibrations.
- MP-TP bolted connection: the bolted connection needs to be checked to assure the bolts are tightened to the correct tension, the flange is air-tight, and the bolts are not corroding.

4. Environmental Research

The MUMM coordinated all the foreseen standard environmental monitoring activities in the field. In collaboration with scientific organizations, some dedicated programs were also started-up in 2017 and further executed by the MUMM whereby Nobelwind cooperates where relevant (e.g. fish track sampling).

5. Permit conditions

In compliance with the authorization for the construction and a license for the operation of a wind farm on the Bligh Bank in the Belgian sea areas article, we give an overview of the environmental permit conditions as mentioned in Schedule 1 of the authorization for the construction and a license for the operation of a wind farm (see Table 2).

Table 2: Permit conditions overview

Condition Number	Condition Summary	Current Status
2	Each planned modification must be reported to the Board and will be included in the annual work report.	No modifications to be reported in 2018.
4	The holder undertakes to find and recover all floating or sunken objects used for its activities which, for any reason, have ended up in the sea during the construction, operation or dismantling stages.	All dropped objects related to Nobelwind offshore activities (#4) are recorded in the online reporting tool, the SOS system, and notified to the Board.
14	During construction, all foundations and structures already finished must have a temporary warning light (at the highest point) for shipping and aviation traffic.	No new foundations installed in 2018.
15	The holder must set up the necessary safety systems to assure the signalling of the wind farm and structures at all times.	Since 14 July 2017 all navigation and aviation signalisation are fully operational and monitored.
16	All WTG's must be numbered individually at the base of the mast and at the top of the nacelle.	The foundation and the WTGs have been numbered in accordance with the requirements of this condition.
17	All WTGs and transformers must be provided with collection receptacles to prevent liquids from being released in the environment.	The design of the WTG is such that in case of leakage in the nacelle, all fluids are collected in the central part of the nacelle. From here, collection receptacles are installed under the oil pumps and hydraulic systems as standard.
20	During the operation stage, the availability must be facilitated of a specially equipped intervention vessel (or combination of vessels) for assignments concerning the prevention of shipping traffic accidents and cleaning up sea pollution around and in the wind farm	An agreement was signed with Federal authority responsible for the marine environment.
21	Once or twice a year, the holder must take part in simulated nautical accidents, emergency towing exercises and pollution combating exercises.	On a regular base Nobelwind MVOW execute internal emergency exercises (see 8.2.3 of this report).

Condition Number	Condition Summary	Current Status
24	Before laying protective mattresses or other artificial erosion protection on the seabed, the holder must verify and certify that all components chosen can be used without any danger of leaching into the marine environment. The composition of the erosion protection must be presented to the Board for approval. The use of monoliths and slag is hereby prohibited.	For the support of the IA (Inter Array) cable K03-K01, the approval from the MUMM has been obtained in March 2017 regarding the components of the bags.
29.1	The construction materials and rip-rap must be made of natural materials and must not contain any waste materials or a secondary raw material… the use of slag is prohibited.	No new construction material to be approved in 2018.
31.2	Pile driving activity between 1 January and 30 April will be subject to additional, special monitoring in the amount of EUR 50,000 at most, which is not included in the estimated budget and is completely at the expense of the holder	No piling activities have been performed in 2018.
33.1	The lighting of the turbines for the benefit of shipping and aviation traffic must comply with the conditions set by the competent authorities.	Lights are installed according to the Navigational Aids Plan and have been fully operational in the O&M reporting period. Since Nobelwind is built around Belwind, the Navigational Aids Plan of Belwind has been changed into a Navigational Aids Plan of the Bligh Bank, considering the whole zone of Belwind and Nobelwind as one zone.
33.2	Foghorns, which come into operation automatically in the event of a meteorological visibility of less than 2 sea miles, must be placed on the corner turbines.	Fog horns are installed according to the Navigational Aids plan and have been fully operational in the O&M reporting period.
34	The holder must maintain the farm on a regular basis.	All installations are maintained on a regular basis.
48	A logbook must be kept in which the following is specified for each turbine: ➢ Date, time and all relevant data of incidents that occur which have an impact of the environment, stating the measures taken; and ➢ The recording of hazardous waste materials, the date of removal of the relevant batch of waste, the quantity and the name of the carrier and the recognised waste processor must also be recorded.	We confirm that logbooks have been kept for all turbines since start-up of the first WTG and this has continued during operation.

PUBLIC VERSION

6. Operations Management

6.1. Health Safety and environment

6.1.1. Unwanted events over the reporting period

One unwanted event (LTI) happened during the reporting period.

6.1.2. Proactive safety initiatives

In 2018 some proactive safety initiatives, to avoid unwanted events from happening, were initiated:

To stimulate the reporting of near misses, hazard observations and opportunities for improvement in the online 'SOS' reporting system, a KPI was set for all O&M personnel of at least one notification per offshore day. This KPI stimulated the reporting and use of the SOS system, making sure people are more familiar with the system and ensuring a process of continuous improvement. The KPI had a big impact on the amount of reported event.

Offshore workplace inspections, on both the OHVS and turbines, were executed by the External Service for Prevention and Protection at Work. All remarks were logged into an action list with Responsibles assigned. In this framework Legionella testing was performed.

The Employer Requirements for HSSE Assurance for Contractors were finalized. These HSSE Employer Requirements provide a clear overview of the requirements Contractors are expected to meet regarding training, Work Vessel Coordination, Emergency Response, risk assessments, method statements, management of change, environmental requirements regarding hazardous substances, waste, … The HSSE Employer requirements were also translated in a HSSE Questionnaire for Contractors which is to be used to compare Contractors during tender phase.

The HSSE Inductions were updated conform new and revised safety procedures. The first steps were taken to transform the current inductions, in PowerPoint format, to an online induction system coupled to the SOS system for follow up of training certificates.

Several Risk Assessments were created or reviewed, such as:

- Risk Assessment First Aid
- Risk Assessment Confined spaces
- Risk Assessment Environmental strain / influence
- Risk Assessment Security
- Risk Assessment Night Work
- Risk Assessment Helicopter operations

Existing work procedures were updated and new procedures were implemented. Some examples include:

- Work Vessel Coordination procedure
- Working with drones
- Organization of Safety Exercises
- SF6 procedure
- Alcohol and drug procedure (under final revision)
- Exploitation procedure
- Night Work

6.1.3. *Emergency exercises*

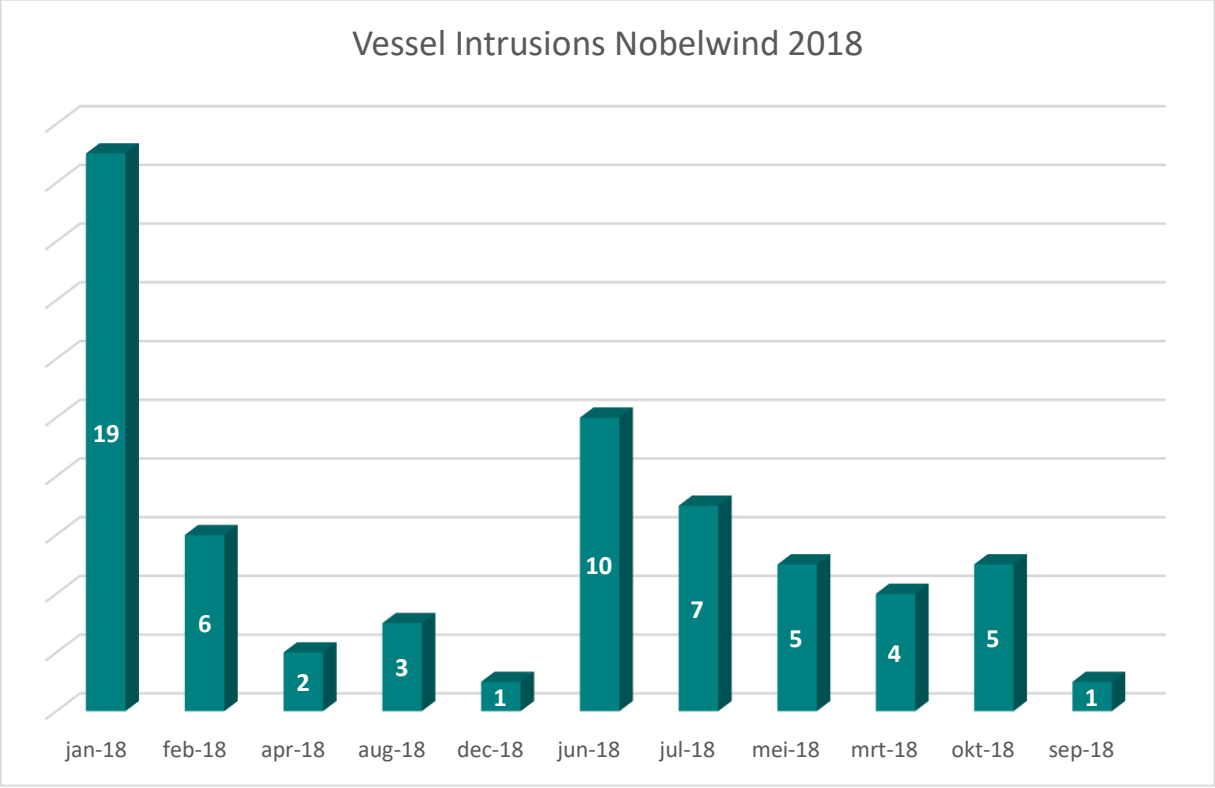
Overview emergency exercises 2018	
WTG	04/07/2018: Contractor - Unconscious casualty in basement TP
	04/07/2018: Contractor - Unconscious casualty in basement TP
	15/10/2018: Contractor - Evacuation from elevator to ladder
	16/10/2018: Contractor - Evacuation from elevator to ladder
	17/10/2018: Contractor - Evacuation from elevator to ladder
	17/10/2018: Contractor – Ladder rescue
	21/11/2018: Contractor – Fire evacuation from nacelle
	22/11/2018: Contractor – BlighSar
	23/11/2018: Contractor – Shoulder fracture in HUB
Vessels	23/11/2018: Contractor – Reanimation on Esvagt Mercator
	All year around: Contractors – MOB on all vessels
	All year around: Contractors – Fire drills on all vessels
OHVS	27/09/2018: Parkwind : Evacuation of victim with broken leg after falling down the stairs

6.1.4. *Emergency actions (TIER2)*

Two TIER 2 situations, that need external assistance, were reported in 2018:

6.1.5. *Intrusions*

In 2018 we had 63 intrusions reported on the Nobelwind concession:



PUBLIC VERSION

6.2. Vessel & accessibility

For maintenance on the turbines the Esvagt Supporter (in December 2017 replaced by the Esvagt Mercator) is used as hotel/mother ship. Small crew transfer crafts, FRC's, are being used for transfer of personal, tools and equipment on the wind turbines, as well as for maintenance on the OHVS and the foundations, for delivery of parts and equipment to the wind farm and for carrying out surveys and measurement campaigns.

6.3. O&M office Parkwind

O&M team offices are located in the harbor of Ostend:

Esplanadestraat 10B
8400 Oostende

8. Conclusion and outlook

Nobelwind was fully commissioned since mid-May 2017. On average, 2018 has been a low wind year and significantly below the expected wind resource.

The maintenance routine on all aspects (WTG, civil and electrical) was carried out. With the correct lessons learned implemented in both scheduled and unscheduled tasks, it is expected that in 2019 the maintenance routine can continue without any major surprises to overcome.