



Annual work report 2015

Offshore wind energy power plant

Belwind



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1 Introduction

The Belwind offshore wind farm is located on the Belgian Continental Shelf, within the Belgian Exclusive Economic zone. The distance from the wind farm to the nearest point at the shore (Zeebrugge) is approximately 46 km (Figure 1).

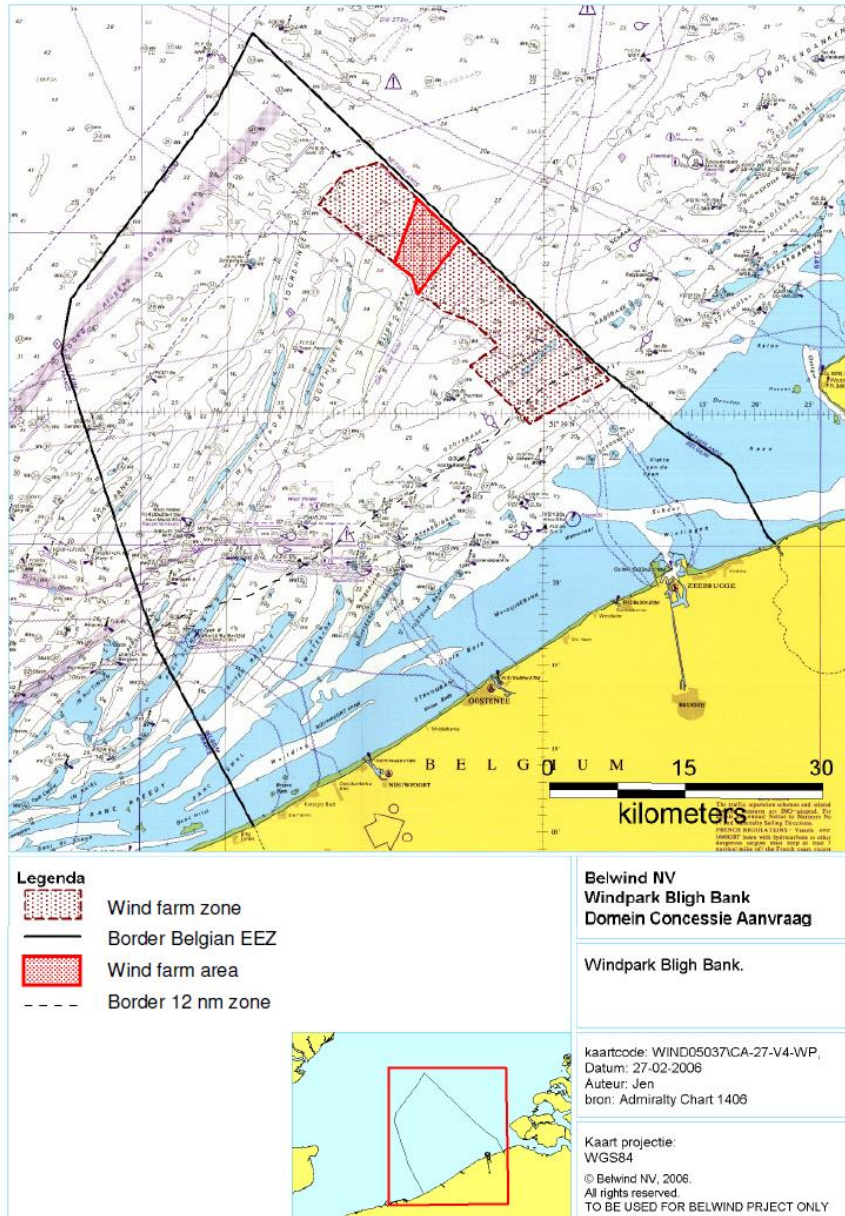


Figure 1: Location offshore wind farm Belwind

2 Project overview

According to 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, the wind farm will be constructed in phases.

The pilot phase, Belwind 1 or Belwind phase 1, consists of 55 wind turbines of 3 MW each (Vestas V90) and an offshore high voltage station (OHVS). Via a local grid (33 kV) the wind turbines are connected to the OHVS. The energy is transported to land by a 150 kV submarine cable. Phase 1 is erected and fully operational since January 2011.



Figure 2: Locations of the wind turbines and the grid connection phase 1

The development of Phase 2, Belwind 2 or Belwind phase 2, has in 2014 been started. For the development a new company was erected named Nobelwind in which funds was found for the pre-development.

Nobelwind will consist of 165MW, with its own OHVS and submarine power cable. A preference of WTG is made by 50 WTG of 3.3MW V112.

The works for Nobelwind have been started in 2013:

- Installation of the export cable (grid connection)
- The detail engineering has been started-up in 2013

The full development of Nobelwind was performed during 2014 and several survey works have been performed. It is the plan to start of the construction works end 2015 earliest.

The Belwind Demo project received its cable installation in 2014 during the summer. Once the cable was connected the commissioning of the Haliade 150 Turbine got on its way. The WTG already produces 6MW but due to some technical challenges that need to be overcome the commissioning will need to be extended and is predicted to be finalized in 2015.

3 Construction works on the Belwind concession

In 2015 there were no construction works in Belwind.

3.1 Environmental research activities

Also in 2015 the MUMM coordinate all the foreseen standard monitoring activities in the field. So was there a continuation of the bird assessments, the fish assessments by line fishing and trawl net fishing as were there further research activities on the substrate on the foundations and the seabed. Together with the scientist some dedicated programs were also started-up in 2015.

3.1.1 Fish telemetry installation

At WTG C05 & B05 a fish telemetry device wasn't installed at the back of the left boat landing support. This device came lose and was lost probably due to wave impact. The devices have been recovered by divers and are now deployed on the bottom within the wind farm by means of an acoustic release system.

3.1.2 Scientific diving

In coordination between the scientific diving parties and Belwind It was agreed to work out a dedicated diving methodology that shall be used for all scientific diving activities. This methodology shall be tailored to the needs and risks of scientific diving while safeguarding that all processes are standardized in place to assure that these activities are performed in the safest manner possible. During 2015 a member of the O&M team followed the Scientific Diving Course in order to better understand the used practices during research diving activities. This person will work with the QHSSE-team towards a general scientific diving procedures.

3.1.3 Bat Monitoring

On request of the MUMM, Belwind facilitated the installation of a bat monitoring equipment on the BW1 OHVS. From June till end October the system was installed on the cable deck level. The system was resupplied of energy by a solar panel and the 3G network of the windfarm was used to allow data communication directly between the system and the researcher's data capturing. Early result analysis shows that some bat activity was measured during darkness.

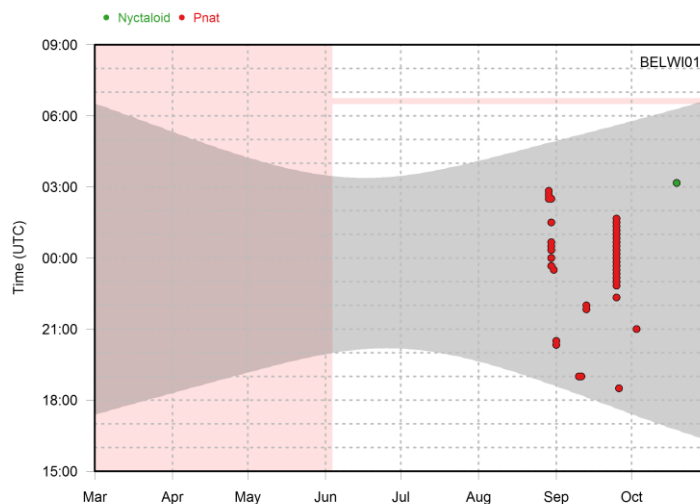


Figure 3: Bat presence near BW1 OHVS

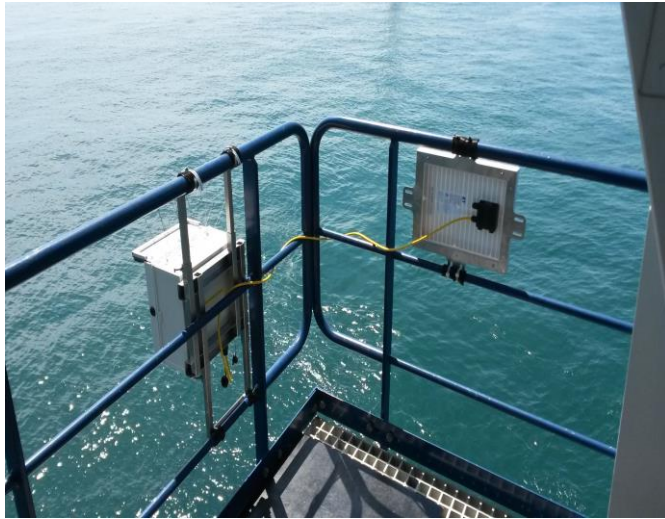


Figure 4: Installation of Recorder system on BW1 OHVS Cable deck

4 Wind farm annual operations information

4.1 Availability of the electrical installation.

In 2015, the main electrical infrastructure was 99,8% available due to planned maintenance shut downs on the OHVS for 33kV maintenance controls and on the booster station for 150kV insulator cleaning .

4.2 Production

4.2.1 Performance of the wind farm

Output and Capacity factor

The year 2015 was in terms of production the highest since the beginning of Belwind. The availability was kept high and the wind resource was more or less in line with the forecasted values.

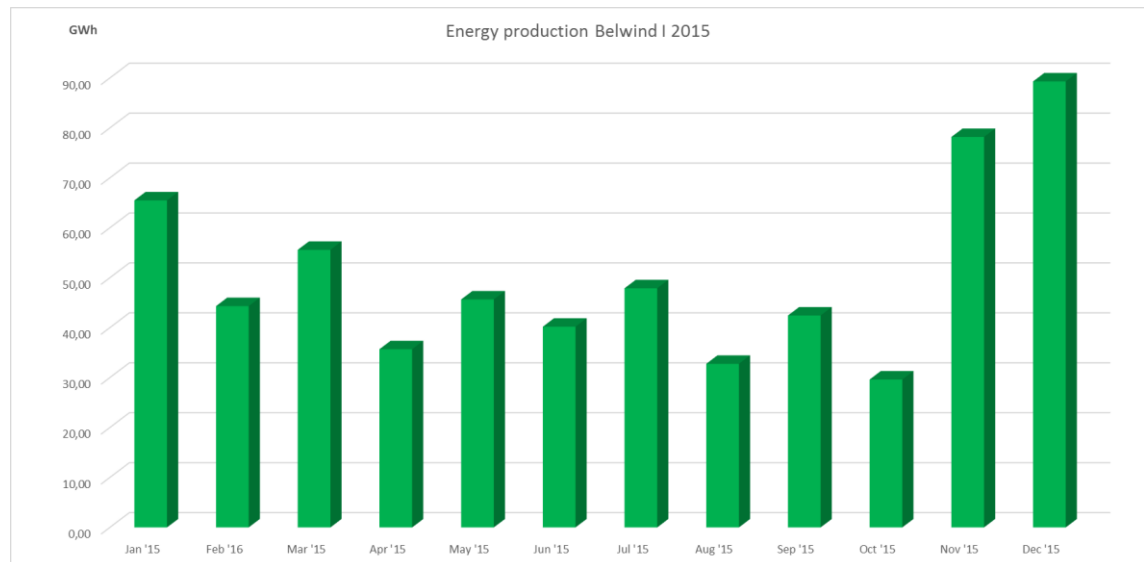


Figure 5: Monthly production 2015

4.2.2 Wind analyses

The global average wind speed in 2015 was slightly below the expected wind resource. The measured value in January, July, November and December was significantly higher than the estimated speed by the assessment studies, February, August and especially October were very low wind months.

4.2.3 Wind rose & energetic wind rose

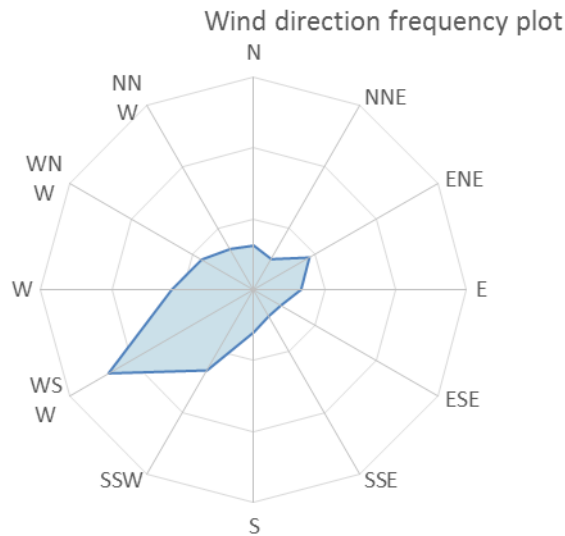


Figure 6: Energetic wind rose

The displayed wind rose is a graphical representation of the wind speed and direction measured all over the wind park.

For all wind speed categories, the wind directions SW and NNE-NEE prevail.

4.3 Maintenance

4.3.1 Planned Maintenance

MVOW, the service contractor for the BELWIND1 **WTG's**, performed the following planned maintenance and inspections in 2015:

- Annual service: yearly an annual service is done on all the turbines. The annual service takes three full days per turbine. Every component is carefully inspected and made sure it will operate correctly for the next year.
- Statutory inspections: on regular intervals, the service elevator (3 months), the Acta crane on the transition piece (1year) and the hook on points (1 year) are inspected and certified by a 3th party [AIB-Vincotte].
- MVOW HV inspections: every year, all the HV equipment on the turbines (transformer and switchgears) is inspected by MVOW.
- Vincotte HV inspections: every year, MVOW skilled technicians and a third party [AIV-Vincotte] inspect and certifies the HV installation. The switchgear in the turbines is inspected with ultra-sonic equipment.
- Blade inspections: All blades from all WTG's were inspected by the use of drones. The outcome of the inspections were rather positive and only small blade repairs need to be planned.

The maintenance contract of the **electrical installation** with Seahopper - a joint-venture between Fabricom and CG holding – was stopped end 2014 as a result of the two partners stopping their

collaboration. A new maintenance contract to run the maintenance on the critical high voltage equipment of Belwind 1 was agreed. This new collaboration with CG Holding took effect the 1st January 2015.

Booster station:

CG Holding and Parkwind performed all planned maintenance.

Offshore High Voltage Station:

CG Holding and Parkwind performed all planned maintenance.

On the **foundations**, the following tasks have been performed in 2015 as part of the routine maintenance:

- Topside inspections;
- Inspection of cathodic protection;
- Survey of cables and scour protection;
- Internal and external NDT-inspections of welds, bearings and boat landing studs;
- Underwater inspection of outer submerged foundation.

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 the appendix 1 of the authorization for the construction and a license for the operation of a wind farm.

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.	<ol style="list-style-type: none"> 1. Since the development of the second phase of the Bligh Bank project (Nobelwind) and the design of the shared grid connection Nobelwind and Northwind, it was decided by Belwind (for financial and technical reasons) to transfer a part of the ownership of the domain concession to a new company, namely Nobelwind NV. Therefore the construction and operation licence has to be partially transferred to Nobelwind NV. The modalities of this transfer to Nobelwind have been confirmed by a Ministerial Decree of October 7th 2015. 2. The validity of the construction and operation licence of Belwind has been extended till January 22th 2038.
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.	No floating of sunken objects has been established.
14	During construction, all foundations and structures already finished must have a temporary warning light (at the highest point) for shipping and aviation traffic.	
15	The holder must set up the necessary safety systems to assure the signalling of the wind farm and structures at all times.	Since 8 February 2011 all navigation and aviation signalisation is fully operational
16	All WTGs 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 round and in the wind farm	On 22 January 2011 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 Belwind, Vestas and Seahopper execute internal emergency exercises.
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.	No activity in 2015.

Condition Number	Condition Summary	Current Status
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.	Certificates of Origin supplied for all scour protection materials have been transmitted to the MUMM.
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 has been performed in 2015.
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.
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	<p>A logbook must be kept in which the following is specified for each turbine:</p> <ul style="list-style-type: none"> ➤ 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.

Table 1: Permit conditions overview

6 Operations Management

6.1 Health Safety and Environment

6.1.1 Proactive safety initiatives

In 2015 some proactive safety initiatives, to avoid unwanted events from happening, were initiated:

The exploitation procedure was finalized and introduced. The goal of this exploitation procedure is to avoid unwanted events when working with electricity. The procedure describes the correct work methods including the lock-out-tag-out procedure, the BA4/BA5 acknowledgement, etc.

The implementation of a full near miss and hazard observation reporting system. Personnel is encouraged to report all unwanted events. The unwanted events are logged by the QHSSE department, followed –up and the statistics are reported and discussed during the monthly meetings. The first steps were taken to design an online reporting tool to facilitate the notification, reporting and follow-up of events.

Existing work procedures were updated and new work procedures were implemented. Some examples are the confined work procedure, transfer procedure, training procedure, unwanted event reporting procedure, hazardous goods procedure, etc.

A full risk assessment was executed for the OHVS of Belwind. Risk were identified, evaluated and measures were proposed and implemented.

6.1.2 Emergency exercises

In 2015 some emergency exercises were organized for Belwind:

- A fire with personnel on board the CTV exercise with MVOW;
- A CTV emergency evacuation to another vessel exercise with MVOW;
- An injured person exercise - Belsar (Heli rescue)
- An evacuation from the cable deck of the BWD OHVS
- A man overboard exercise
- Exercise with rescue from the hub by MVOW

6.2 O&M office Parkwind

O&M team offices are located in the harbor of Ostend.
Esplanadestraat 10B
8400 Oostende

7 Conclusion and outlook

2015 was the most productive year since Belwind was built in terms of Energy. There were no significant downtimes for unexpected maintenance activities. Where unplanned downtime occurred it was managed to keep this to a minimal.

The planned maintenance activities got slightly delayed due to the other activities but low wind in October made it possible to catch up and finish in a descend time frame.

We are happy to report that no big QHSSE incidents have to be recorded and that all tasks as mentioned under the operational permits are well managed. We foresee a further rolling out of the HSSE master plan in 2015 supported by the Parkwind HSSE team.

Belwind –captured under the bigger Parkwind organization- will keep striving for innovation in terms of maintenance procedures, preventive actions, O&M inspection tools, etc. as it has been doing in the past. This smarter maintenance shall allow Belwind to enlarge its maintenance scope without running the risk of needing a larger OPEX budget. Next to the standard maintenance we do foresee some issues to start showing after 5 years in operation which might need some more dedicated attention but with the strong team we are confident that any concerning progress can be tackled adequately and preferably in a proactive matter.