Annual work report 2014

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).

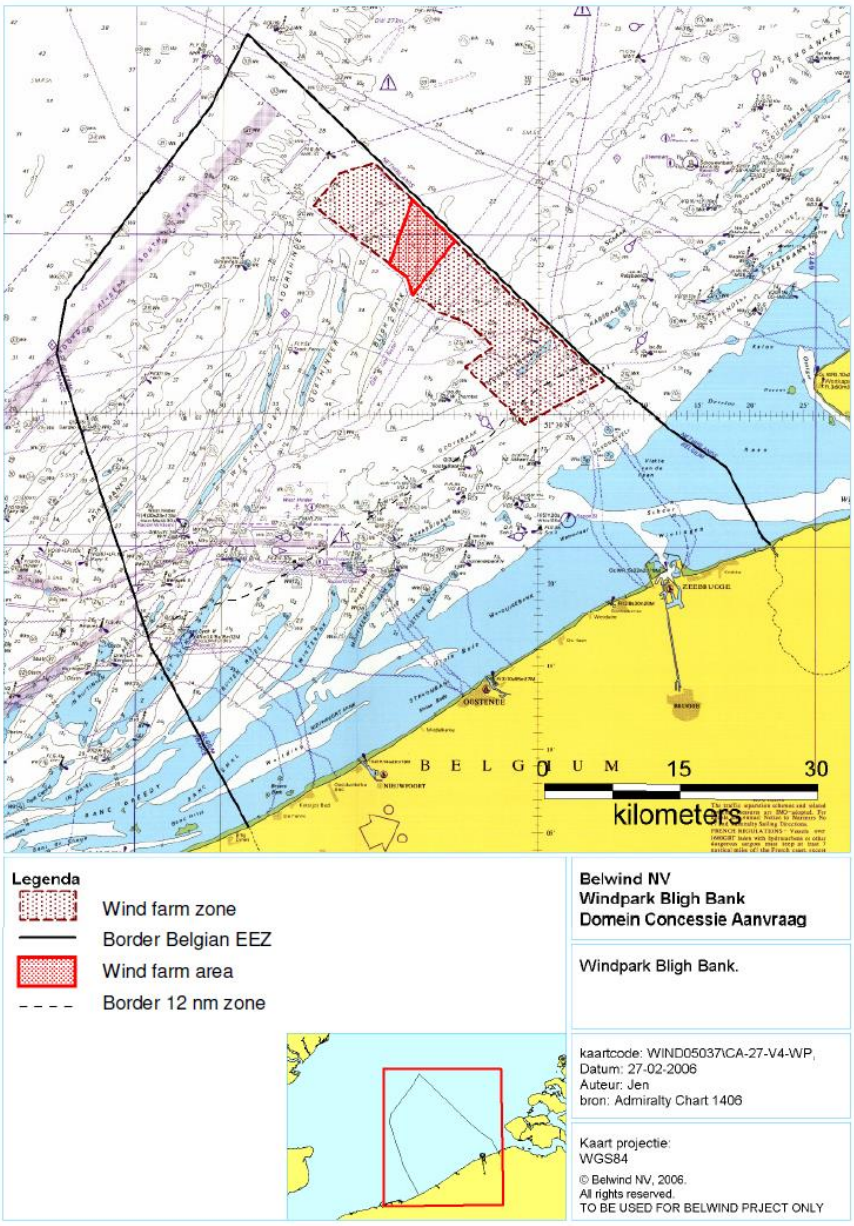

Figure 1: Location offshore wind farm Belwind

2 Project overview

According 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 d 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 2014 there were 2 types of construction activities on the Belwind concession.

3.1 Belwind DEMO project

Photo 1: Alstom Haliade wind turbine

3.1.1 Description of the construction method and wind turbine

The Haliade150 is a direct driven turbine with 150m blade diameter. The Turbine was transported in Bunny-ear configuration and was installed on the jacket foundation. The turbine has in 2014 been connected per 33kV infield cable to the BELWIND1 OHVS via where the power will be transferred to 150kV and brought to shore together with the power of all 55 V90 turbines on Belwind phase 1.

3.1.2 Overview timing of the activity

Installation cable

The installation vessel Simon Stevin was on site 04/07 to 01/08 to prepare the crossings, perform the pull in and lay the 33kV cable and to jet and rock dump the cable.
The cable installation was finalized 11/08/2014 by soaking the infield cable connection under tension.

Energize Transformer

The Alstom Haliade 250 WTG was first energized on 14/08/2014 from which date the hot commissioning could start. As the Haliade is a demo turbine an extensive number of procedures was trialed and a great number of extra sensors and monitoring systems installed.

First production

19/09/2014 the turbine produced its first energy towards the grid and started a careful ramp-up program under which all systems were extensively tested.

First 6 MW

On 13/10/2014 the turbine reached 6MW production for the first time.

3.2 Surveys activities Nobelwind

Geophysical and Geotechnical campaigns have been started up in the second half of 2014. The Markab has performed TPT and boreholes on 61 locations.
The Geo Ocean executed a new mapping of the Nobelwind area to assure up to date survey data is available to the project and the contractors.

3.3 Environmental research activities

Also in 2014 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 2014.

3.3.1 Fish telemetry installation

At WTG C05 & B05 a fish telemetry device has been installed at the back of the left boatlanding support. The fish telemetry sensors have been installed by “Vlaams Instituut voor de Zee (VLIZ). ”The purpose of this research is to analyze the behavior of various types of fish. For example: the period of time various species stay at the Belwind concession and where they go afterwards. This gives VLIZ valuable information about the influence from Belwind to different types of fish and how they adapt to the new environment.

3.3.2 Marven measurements

Together with the scientific institutes and with support of the MUMM a campaign was performed in which the influence of the cables on the environment was further studied. Both offshore in the windfarm as well as at the beach where the export cables pass EMV measurements were executed. Production data was logged especially for this campaign and shared to allow interpretation of the results.

3.3.3 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. We all hope to see this project further finalized in 2015 to create a new known and approved standard in the industry.

4 Wind farm annual operations information

4.1 Availability of the electrical installation.

In 2014, 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 .

- On the OHVS, a scheduled intervention on the 33kV Bus-bar of the L string that required a half shutdown of 4 hours was performed on September 2nd**.**
- On the booster station at Zeebrugge a scheduled intervention on the 150kV main transformer that required a full shutdown for 5 hours was performed on November 5th.

4.2 Production

4.2.1 Performance of the wind farm

Output and Capacity factor

The year 2014 was in accordance with the expectations. The availability was kept high and the wind resource was more or less in line with the forecasted values according to two different yield assessment studies.

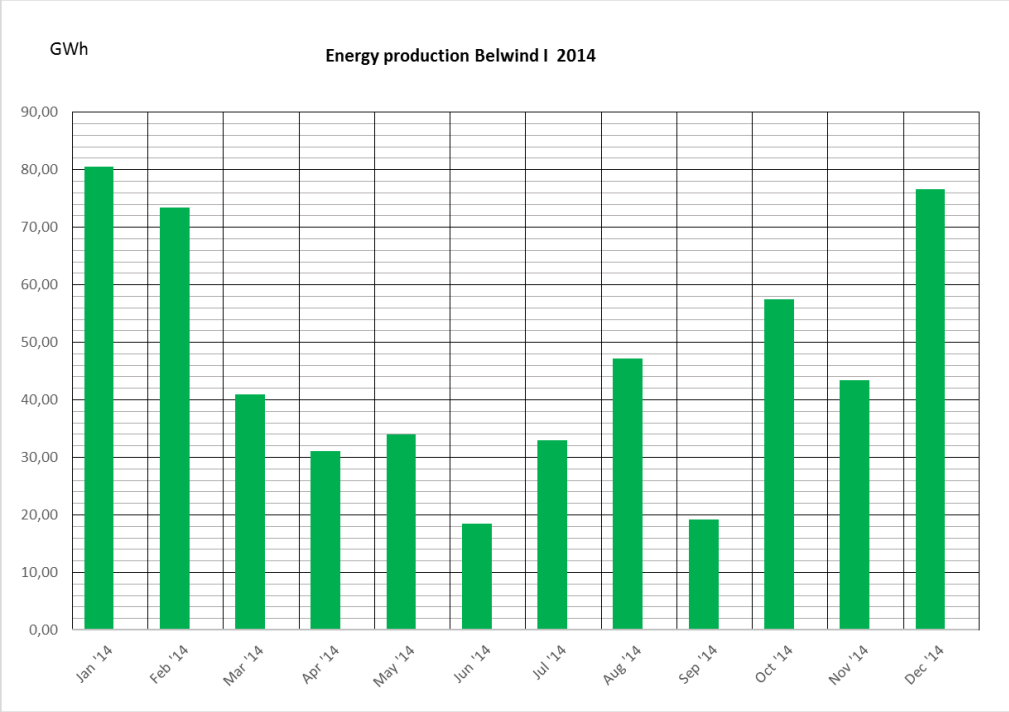

Figure 3: Monthly production 2014

4.2.2 Wind analyses

The global average wind speed in 2014 was slightly below the expected wind resource. For the third year in a row, the measured value in January, February, October and December was significantly higher than the estimated speed by the assessment studies.

4.2.3 Wind rose & energetic wind rose

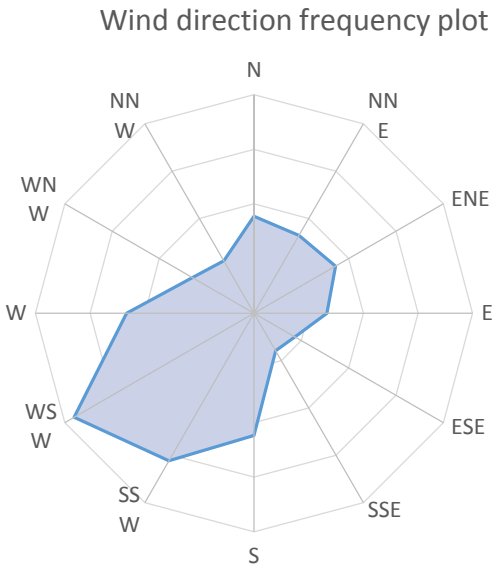

Figure 4: Energetic wind rose

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 2014:

- 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 executed.

On the Belwind **Booster station** in Zeebrugge, Sea hopper together with Belwind performed all planned maintenance.

On the Belwind **Offshore High Voltage Station**, Sea hopper performed together with Belwind all planned maintenance.

On the **foundations**, the following tasks have been done as part of the routine maintenance:

- Topside inspections;
- inspection of cathodic protection;
- survey of cables and scour protection;
- Underwater inspection of outer submerged foundation: visual inspection.

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.	1. Belwind submitted a modification for the installation of 1 wind turbine Alstom Haliade 6 MW. The minister responsible for the marine environment accorded this modification. 2. Belwind submitted for an extension of the construction period with 5 years (normally 5 years).
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.	For the installation of the inter array cable of the Belwind demo project, the composition of the mattresses has been approved by the board
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.

Condition Number	Condition Summary	Current Status
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	For the installation of the foundation of the Belwind demo turbine, the board was informed that the hammering activity was finished on the 13/2.
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	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.

Table 1: Permit conditions overview

6 Operations Management

In April 2014 the O&M team for the Belwind phase 1 project has moved to the new offices in the harbor of Ostend (on the REBO site):

Esplanadestraat 10B
8400 Oostende

Since then several improvements projects have been implemented in the offices and on the quay side with the biggest impact being the improvement of the key-side area buy the purchase of new cranes by Parkwind.

7 Conclusion and outlook

2014 was a productive year, both in terms of Energy and in terms of availability. 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 all ran on schedule and some even ended quite a bit earlier than planned due to a good focus on the less windy periods and allowing production during the heavier sea state conditions in which works harder to execute. Also on the electrical substations the maintenance was picked-up early by Parkwind stepping in and taking over the management of several activities. The ending of the maintenance contract with Seahopper was managed in a good matter. The maintenance on the substations was standard and organized in a good matter. We have evaluated though that in 2015 we should enlarge the programs were possible to investigate some of the deteriorating results.

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 upgraded 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.