C-Power

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Author	HSE Manager	Jurgen Dumon	20/03/2017	
Review	Finance Manager	Johan Calliauw	20/03/2017	
Approval	Contract Manager	Dirk Magnus	20/03/2017	
Approval	Chief Executive Officer	Jaak Rutten	20/03/2017	

C-Power NV
Buskruitstraat 1
8400 Ostend - Belgium

Phone: +32 (0)59 79 79 80
Fax: +32 (0)59 79 79 88
www.c-power.be

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TABLE OF CONTENTS

1 GENERAL PROJECT INFORMATION

C-Power's wind farm is located on the Thornton Bank, approximately 30 km off the coast of Zeebrugge. The construction of the project was developed in three phases.

Phase 1 (2007-2009), the pilot phase, consisted of six 5M (5 megawatts) wind turbine generators (WTG) on gravity base foundations (GBF).
The 30 MW installed capacity has been fully operational since end of June 2009.

Phase 2 (2011-2012) consisted of:

- the construction of 49 jacket foundations (JF);
- the installation of 30 WTGs of 6,15MW: 24 WTGs in sub area B and 6 WTGs in sub area A, mutually connected with 33/36 kV infield cables;
- the laying and connection of infield cables;
- the crossing of the 33/36kV infield cables with the Interconnector gas pipeline and the Concerto South telecom cable;
- the construction and installation of the offshore transformer station (OTS);
- de-connection works of 150/170kV cable A from D1 and connection to transformer station and the connection of a 33kV infield cable between OTS and D1;
- the installation of 2 subsoil 150kV onshore connections between the 150 kV offshore cables and the high voltage station "Sas Slijkens";
- the laying of the second 150kV offshore export cable B.

Phase 3 (2012-2013) consisted of:

- the installation of 18 WTGs (6,15MW) and the necessary connections with the offshore transformer station

The figure below outlines the different phases of C-Power's project.

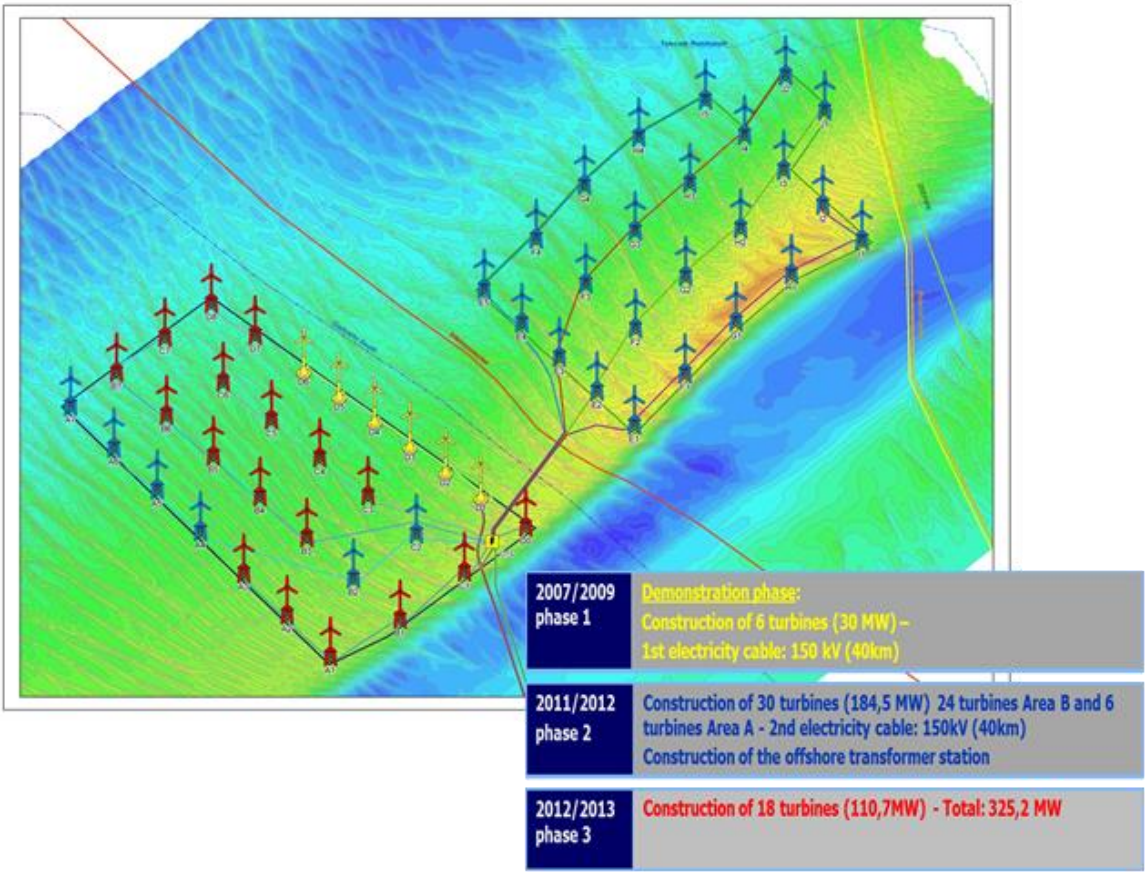


Figure 1: the different phases of C-Power's project

The complete project comprises 54 WTGs with a total rated power of 325 MW plus the supporting infrastructure. Full operation was accomplished by end of September 2013.

2 ACTIVITIES DURING 2016

2.1 MAJOR COMPONENT REPLACEMENTS

During 2016 some major components on the wind farm were exchanged. Following major component replacements were executed:

- February 2016 (DP2 SEP Neptune):
  - Generator exchange on I5
- June 2016 (DP2 Flintstone):
  - Cable OTS – D0 exchange
- August 2016 (DP2 SEP Thor):
  - Main bearing exchange on A2 & G4
  - Gearbox exchange on E2

2.2 GEARBOX OIL EXCHANGE

End October we trialed a new way for exchanging the gearbox oil. The procedure was made in close cooperation with Mr. J. Tavernier from FOD Leefmilieu. In this trial the new oil and used oil were contained in tanks which were located on a crew vessel, which was tied off on the gravity based foundation (in a blow off condition). This oil exchange was executed on three 5M turbines, i.e. D2, D3 and D6.
More details see annex 6: Oil exchange Oct 2016.

3 CONSTRUCTION & OPERATION PERMIT CONDITIONS

All permit obligations are integrated and implemented in the daily management of the activities offshore by C-Power and its contractors.

The annual institutionalized Follow-up Committees ("Begeleidingscomité") took place on 25/04/2016 and 16/01/2017.
During these Follow-up Committees, the progress of the project has been discussed as well as the compliance of the operation and maintenance activities with the permit conditions.

On top of this regular and official reporting to the authorities, C-Power informs the federal and nautical authorities on a frequent, voluntary and transparent basis, including a regular dialogue with the relevant authorities via e-mail (status reports, coordinates, maps, plans, intruders tracking, etc..), ad hoc meetings, telephone exchanges etc..

An overview of the main permit conditions is described below.

Drifting or sunken objects

A detailed track record of the drifted and sunken objects is kept in C-Power's logbook. No major events are to be reported.

Cables

No export cable surveys executed in 2016, since at the follow-up committee of 27 April 2015, all parties agreed that based on the results of the study made by C-Power the frequency of export cables survey can be decreased to one every three years. Next export cable survey is scheduled in 2017.

Monitoring

Retribution monitoring activities BMM
The invoice related to the mandatory monitoring activities in C-Power's concession area in 2016 amounted to 8.822,44 EUR and has been paid to BMM.

Meteorological parameters
Meteorological data (wind speed, wind direction, wave height, wave period, tide, pressure, temperature, visibility) measured in real time on C-Power's offshore transformer platform are available on "http://meteo.c-power.be". Next to that C-Power also engaged into a data exchange program with the 'Vlaamse Hydrografie' in order to have also meteorological data from Akkaert and Westhinder to support daily operations and safety.
C-Power exchanged on a regular basis (1x/month) the wind data from 4 turbines (B5, B6, C5, C6) with BMM in the framework of an underwater noise measurement campaign carried out by OD Natuur.

Risks & Safety

Internal emergency plan
Was initially released May 2014. During 2016 C-Power did review the complete procedure. Contact persons were reviewed. Except the change of some contact details no major changes have been made in the procedure.

Emergency exercises:
11/03/2016: Winching training 40th squadron on WTG
01/06/2016: Test FOD, new equipment for removing oil spills inside windfarm
21/06/2016: Medivac from WTG to Heli. MRCC cooperated in the drill. Presence 40th squadron was simulated.
07/07/2016: Medivac from OTS to Heli. MRCC cooperated in the drill. Presence 40th squadron was simulated.
29/08/2016: Medivac from WTG to Heli. MRCC cooperated in the drill. Presence 40th squadron was simulated.
31/08/2016: Environmental incident in cooperation with the FOD environment
During 2016: we executed 5 MOB trainings at sea.
For 2017: 2 ERP drills will be planned in cooperation with ISEC.

Harmful substances

Register updated when new substances present or existing substances are replaced by other.

Permit compliance procedures

An overview of permit conditions and a full copy of all permits have been integrated in all contracts with third parties operating offshore. All contractors are consequently fully informed on the mandatory permit conditions.
C-Power coordinates and supervises the permit conditions' compliance of the respective contractors.

During major component replacements, the planning of all construction related activities offshore has been communicated via a daily report sent to all relevant authorities by the Vessel Marine Coordinator. This included the contact details of C-Power's point of contact for the authorities, daily updates about offshore operations and changes in the planning.

All incident reports from contractors as well as from C-Power's staff are registered and kept on C-Power's internal server as the HSE register.

Wind Turbine data; Energy Production; Wind Turbine Availability: Confidential information

Data regarding energy production, availability and number of stop and maintenance hours can be found in Attachments 6.1 to 6.5. **These data are to be treated as confidential**.

4 ENVIRONMENTAL MONITORING ACTIVITIES

Bathymetric surveys

Bathymetric surveys of the gravity base foundations and of infield cables and jacket foundations in Areas A and B on the Thornton Bank have been executed in June 2016 in order to monitor the burial depth of the cables, the evolution of the morphology of the seabed around the foundations.

As for the scour depths at the jacket pin piles the survey charts show that the scour depth remains within the limits specified and furthermore show that the scour depth seems to have stabilized for the shallow water locations in Area A.

5 HEALTH, SAFETY AND ENVIRONMENT (HSE)

Main events and actions:

2016 was overall a good year for the HSE discipline for C-Power and its subcontractors. There were no LTIs and no environmental incidents.
It was also the second year of our SCHIC campaign (Safety Culture and Health Improvement Campaign), launched together with Senvion and CMI in order to improve safety culture and HSE performance in our daily operations. During this campaign we organized 2 safety days, the first in March, the second was held in October.

In September we organised a second survey to measure our Health and Safety level at the C-Power windfarm. We did a first survey in the summer of 2015. This result allowed us to have a good view on the level of HSE performance that was reached at the start of the SCHIC Campaign.
The results of the 2nd survey were promising. We could see a clear improvement in terms of procedures, HSE management, resources, Organisation and safety leadership.
Moreover, the improvement was visible for all 3 companies (C-Power, Senvion, CMI).

From this survey we defined 7 action points.

1. Common safety induction
2. Bottom-up approach
3. Develop roles and responsibilities
4. Reinforce existing taskforce on communication
5. Install common dashboard to communicate status of our safety objectives and actions
6. Golden rules in practice
7. Improve cooperation with subcontractors: same Health & Safety Standards

Nevertheless in 2016 we had 17 negative elements reported. In February 2016 we had a switching incident (leading to damage case) and during the year we had to deal with a few lifting and rigging incidents, however without major bodily injuries.

OHSAS18001

New certification for three years obtained 04/2016, next audit planned end March 2017.

Remote Monitoring system

C-Power has a 24-hour SCADA (Supervisory Control and Data Acquisition) surveillance system in operation. The SCADA system enables both the operational management of C-Power and Senvion to have a complete overview of all turbines.
On each wind turbine, 2 cameras are installed at the height of the boat landings. The camera images are sent through in real time to the operational center in Ostend and are stored for 24 hours. Also the Offshore transformer Station is equipped with 4 HD camera's covering the whole park.

6 ANNEXES

6.1 AVAILABILITY PER PHASE ON MONTHLY BASE

6.2 PRODUCTION – LOW WIND – STOPS – MAINTENANCE HOURS

6.3 PRODUCTION PER MONTH PER PHASE

6.4 PRODUCTION PER YEAR PER TURBINE

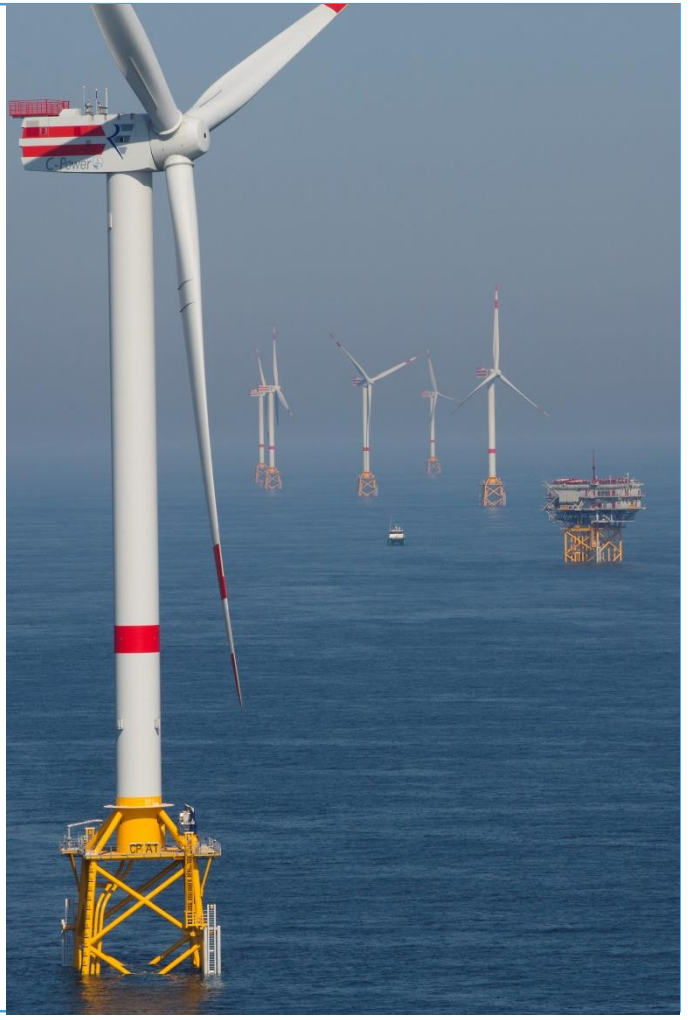
6.5 WIND SPEED AND WIND ROSE

6.6 OIL EXCHANGE OCT 2016

Offshore oliewissel

Oct 2016

C-Power



Inleiding

- Oliewissel uitgevoerd eind oktober 2016
- 3 turbines phase 1
  - D2 – 30/10/2016
  - D6 – 31/10/2016
  - D4 – 01/11/2016
- Nieuwe methode gebruikt, bunkeren van olie vanop een CTV naar de nacelle
- Eerste keer uitgevoerd door Senvion
- Eerste keer op een Belgisch windpark
- ISM FOD Leefmilieu (J. Tavenier)
- Testcase voor een seriële aanpak

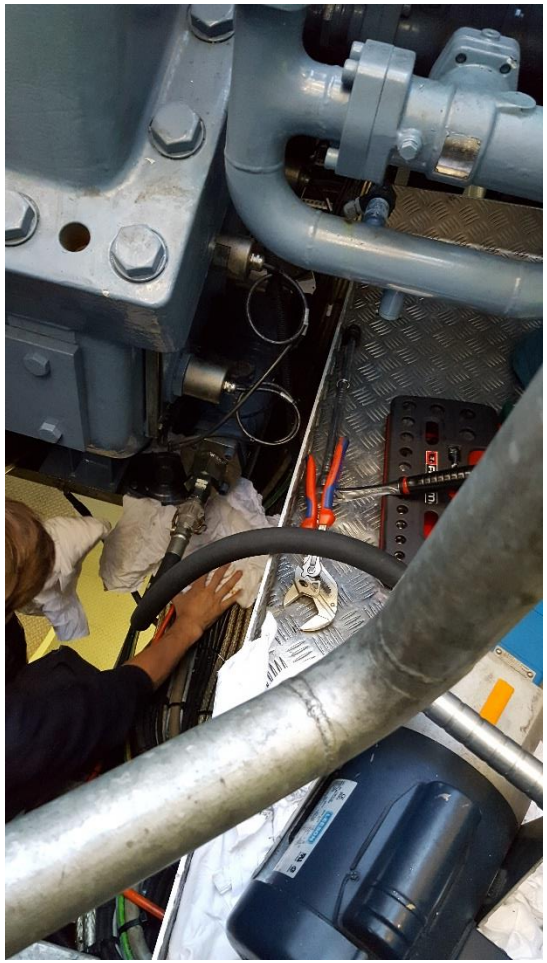
Uitrusting

- 20ft container
  - 2 tanks elk 1500l (verse en vuile olie)
  - Pomp installatie
  - Haspels met 2x180m leiding (vullen en ledigen)
  - Installatie om de olie voor te warmen (30°C)
- Genset voor elektrische voorzieningen van de container
- Spillkits en blusmiddelen
- Nodige koppelingen voor leidingen en gearbox

Werkwijze

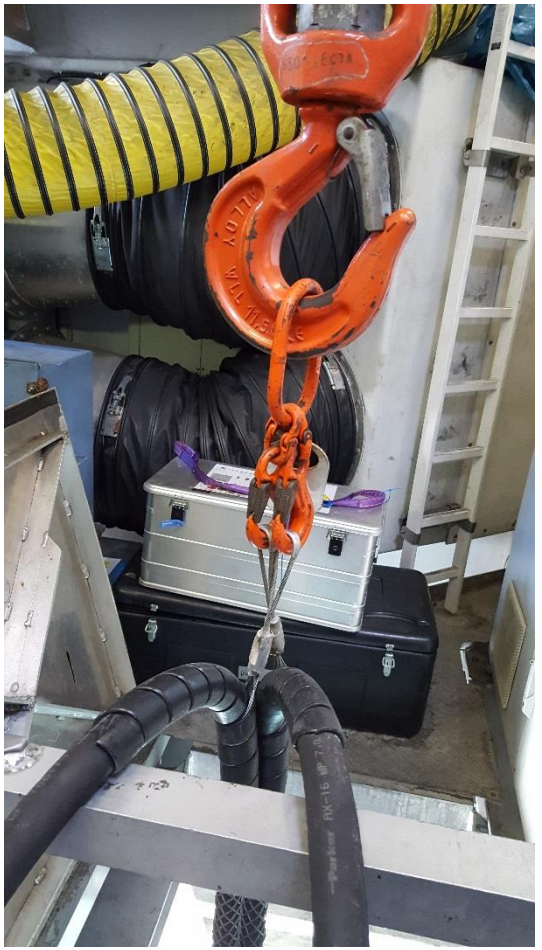
- <u>Wissel omvat 4 grote stappen</u>
    1. Voorbereiding en planning
    2. Preparatie lading CTV en transport
    3. Operatie zelf
        1. Ledigen gearbox
        2. Flushen gearbox
        3. Opvullen gearbox met verse olie
    4. Ledigen en vullen tanks voor de volgende WTG

Werkwijze



Koppeling gearbox

Debiet meter vulleiding



Bevestiging leidingen aan kraanhaak

Conclusie

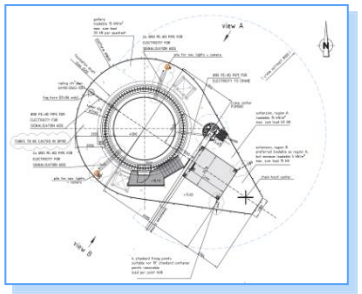
- **Beperkende Factoren**

Weersomstandigheden

- Windsnelheid <10m/s
- Golfhoogte <1m

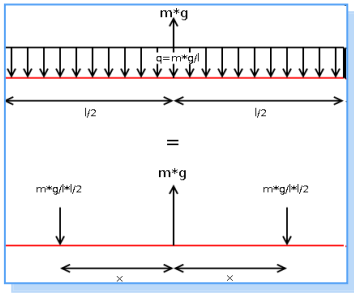
Stromingspatroon

- Schip ligt in blow-off toz structuur
- Om de 6h verandert de stroming



Gewicht

- Capaciteit van de CTV
- Beperkt tot lading voor een oliewissel.



Conclusie

- **Indien:**
  - Goede voorbereiding
  - Duidelijke afspraken met alle betrokken partijen
  - Rekening houden met de beperkende factoren

Is dit een goede economische en veilige manier van werken

- Feedback meeting is gebeurd (22/11/2016)
- Geen grote opmerkingen wel hier en daar kleine verbetering mogelijk voor een eventuele volgende campagne volgend jaar.
- Senvion bekijkt een andere methode voor de turbines op de jacket structuur.

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