CHAPTER 1

OFFSHORE RENEWABLE ENERGY DEVELOPMENT IN THE BELGIAN PART OF THE NORTH SEA

RUMES Bob[1] & BRABANT Robin[2]

Royal Belgian Institute of Natural Sciences (RBINS), Operational Directorate Natural Environment (OD Nature), Aquatic and Terrestrial Ecology (ATECO), Marine Ecology and Management Section (MARECO), Gulledelle 100, 1200 Brussels, Belgium.

[1,2] shared first authorship

Abstract

Offshore wind farms are expected to contribute significantly to the Belgian 2020 targets for renewable energy. As of 2016, an installed capacity of 870 Megawatt (MW), consisting of 232 offshore wind turbines, is operational in the Belgian part of the North Sea. In 2017 and 2018, an additional capacity of respectively 275 and 320 MW will be added (fig. 1), with three other projects scheduled for the next few years after that. With 238 km² reserved for offshore wind farms in Belgium and 344 km² in the adjacent Dutch Borssele, cumulative ecological impacts may however be expected. These impacts both positive and negative, triggered an environmental monitoring programme focusing on various aspects of the marine ecosystem components, but also on the human appreciation of offshore wind farms. This chapter provides an overview of the offshore renewable energy development in the Belgian part of the North Sea.

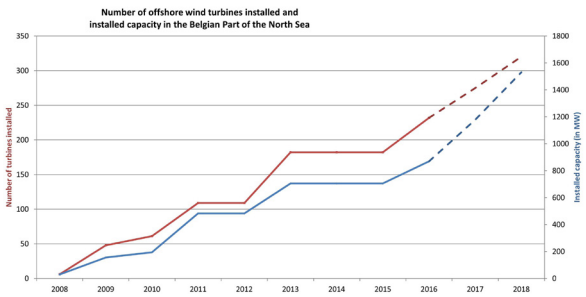

Figure 1. Number of offshore wind turbines installed and installed capacity in the Belgian part of the North Sea since 2008.

1. Offshore renewable energy in Belgium

The European Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market imposes a target figure for the contribution of the production of electricity from renewable energy sources upon each Member State. For Belgium, this target figure is 13% of the total energy consumption, which must be achieved by 2020. Offshore wind farms in the Belgian part of the North Sea (BPNS) are expected to make an important contribution to achieve that goal.

With the Royal Decree of 17 May 2004, a 264 km² area within the BPNS is reserved for the production of electricity from water, currents or wind. It is located between two major shipping routes: the north and south traffic separation schemes. In 2011, the zone was adjusted on its Northern and Southern

side in order to ensure safe shipping traffic in the vicinity of the wind farms. After this adjustment, the total surface of the area amounted to 238 km² (fig. 3).

Prior to installing a renewable energy project, a developer must obtain (1) a domain concession and (2) an environmental permit. Without an environmental permit, a project developer is not allowed to build and exploit a wind farm, even if a domain concession was granted.

In order to stimulate the development of wave energy in Belgium, the Mermaid project obtained its domain concession license only on condition that a certain amount of energy would be generated from waves as well as from wind.

When a project developer applies for an environmental permit an administrative procedure, mandatory by law, starts. This procedure has several steps, including a public consultation during which the public and other stakeholders can express any comments or objections based on the environmental impact study (EIS) that is set up by the project developer. Later on during the permit procedure, the Management Unit of the North Sea Mathematical Models (MUMM), a Scientific Service of the Operational Directorate Natural Environment (OD Nature) of the Royal Belgian Institute of Natural Sciences, gives advice on the acceptability of expected environmental impacts of the future project to the Minister responsible for the marine environment. MUMM's advice includes an environmental impact assessment, based on the EIS. The Minister then grants or denies the environmental permit in a duly motivated decree.

The environmental permit includes a number of terms and conditions intended to minimise and/or mitigate the impact of the project on the marine ecosystem. Furthermore, as required by law, the permit imposes a monitoring programme to assess the effects of the project on the marine environment.

Table 1. Overview of wind farms in the Belgian part of the North Sea (situation on 20 October 2016)

Project		Number of turbines	Capacity (MW)	Total capacity (MW)	Concession obtained	Environmental permit obtained	Status
C-Power	Phase 1	6	5	325	YES	YES	Phase 1 operational since 2009
	Phase 2 & 3	48	6.15		YES	YES	Phase 2 and 3 operational since 2013
Belwind	Phase 1	55	3	171	YES	YES	Phase 1 operational since 2011
	Alstom Demo project	1	6		YES	YES	Demo Turbine operational since 2013
Nobelwind		50	3.3	165	YES	YES	Operational since 2017
Northwind		72	3	216	YES	YES	Operational since 2014
Norther		44	8	320	YES	YES	Construction foreseen to start in 2018
Rentel		42	7.35	275	YES	YES	Construction started in July 2017
Seastar		41	4-10	246*	YES	YES	Construction foreseen to start in 2019
Mermaid		27-41*	4-10	232-266 + 5**	YES	YES	Construction foreseen to start in 2019
Northwester II		22-32*	3-10	217-224	YES	YES	Construction foreseen to start in 2019

*number of turbines and/or total capacity still to be decided; **including 5 MW of wave energy.

At present, nine projects were granted a domain concession and an environmental permit (from south to north: Norther, C-Power, Rentel, Northwind, Seastar, Nobelwind, Belwind, Northwester II and Mermaid; table 1). When all Belgian wind farms are built, there will be just under 500 wind turbines in the Belgian part of the North Sea. The entire area with its nine parks will have a capacity of 2200 MW and cover up to 10% of the total electricity needs of Belgium or nearly 50% of the electricity needs of all Belgian households.

On 13 March 2017, NEMOS received an environmental permit for the construction and exploitation of a temporary research structure for wave energy conversion, at a distance of about 500 meters north of the eastern harbour wall in Ostend. A monitoring programme focusing on underwater sound and the impact on soft substrate benthos was imposed. After an operational test phase that ends in 2020, the installation will be dismantled and removed.

2. Marine spatial plan and aquaculture

On 20 March 2014, Belgium approved a new marine spatial plan for the BPNS by Royal Decree. The new plan lays out principles, goals, objectives, a long-term vision and spatial policy choices for the management of the Belgian territorial sea and the Exclusive Economic Zone (EEZ). Management actions, indicators and targets addressing marine protected areas and the management of human uses including commercial fishing, offshore aquaculture, offshore renewable energy, shipping, dredging, sand and gravel extraction, pipelines and cables, military activities, tourism and recreation, and scientific research are included (fig. 3). The current marine spatial plan is valid for a period of six years and thus in 2020 a new plan will be formulated. This will allow the government to take into account new developments in the field of marine renewable energy.

In the current marine spatial plan, two zones are dedicated to sustainable aquaculture. These are both situated within the operational Belwind and C-Power windfarms. In December 2015, the Aquavalue project formulated a roadmap for integrated aquaculture for Flanders and defined on a technical and economical level four possible pilots for integrated aquaculture in Belgium. These included two pilots in the wind farms: one involves bivalve and sea weed aquaculture, and the other the herding of conditioned sea bass. On 22 May 2017, the resultant *Edulis*-project deployed a mussel longline in the C-Power windfarm in order to test the practical viability of mussel longline aquaculture in the wind farms (fig. 2)

Figure 2. Project Edulis mussel longline in C-power windfarm (Nancy Nevejan, UGent).

3. Grid reinforcement and a “plug at sea”

The first three offshore wind farms were connected to the electricity grid by a limited strengthening of the existing high-voltage grid. For the next six projects to be built, a comprehensive network upgrade is necessary. To meet this necessity, Elia launched the Stevin project which includes a new power station near the port of Zeebrugge and a high voltage network from Zeebrugge to Zomergem. It is expected to be ready in 2018.

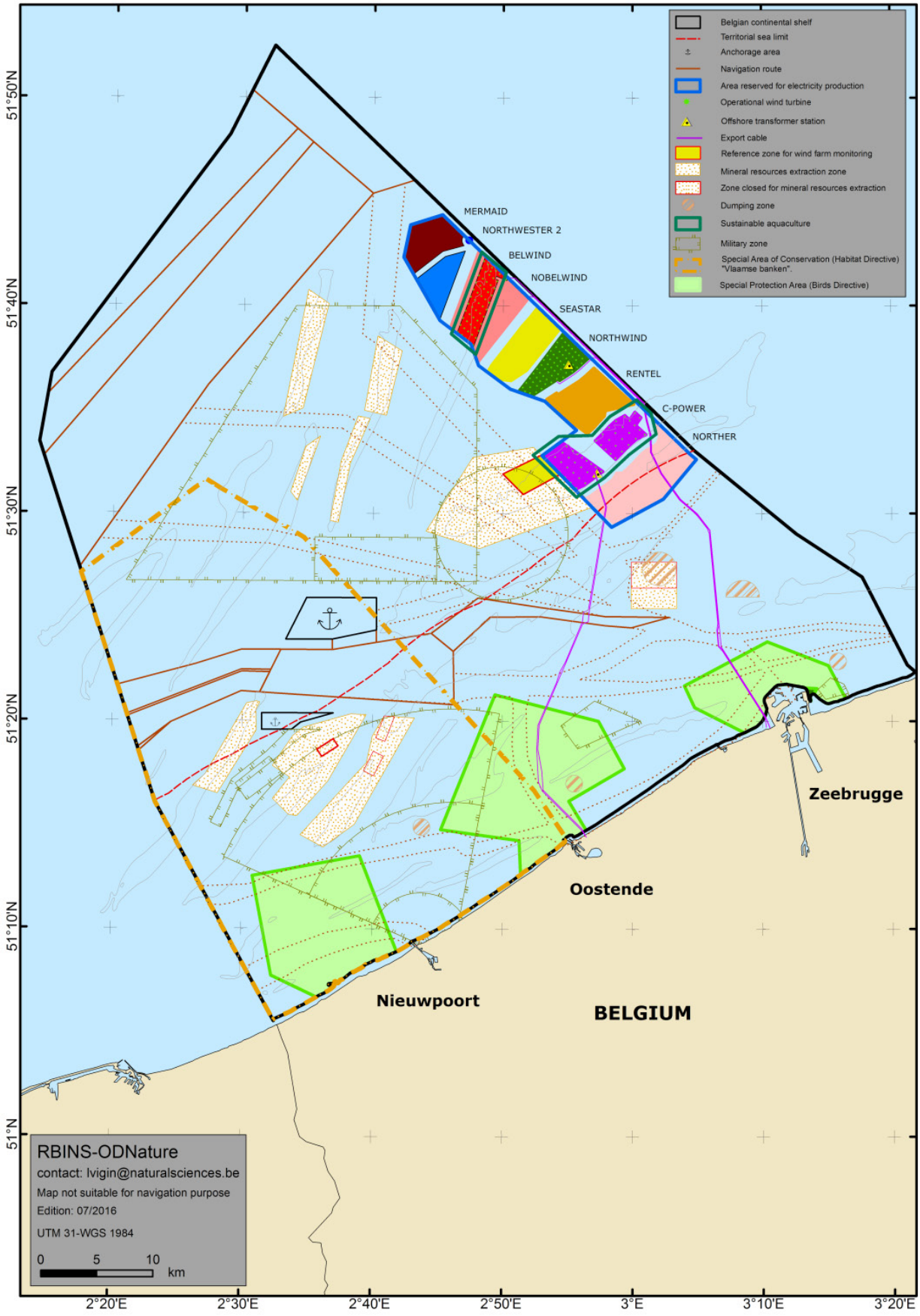

Figure 3. Marine spatial plan of the Belgian part of the North Sea.

The three operational wind farms each ensure the export of their electricity to the onshore grid. Several proposals have been formulated to develop a shared connection, a so-called "plug-at-sea", which would allow the remaining projects to share an export connection and would allow for integration in an as yet to be developed international offshore grid. In its current iteration, the Modular Offshore Grid (MOG), consisting of a single Offshore Switch Yard (OSY) located near the Rentel concession and four export- and/or interconnection cables, would connect four of the remaining wind farms to the grid (fig. 4). Construction of the MOG is expected to start at the end of 2018.

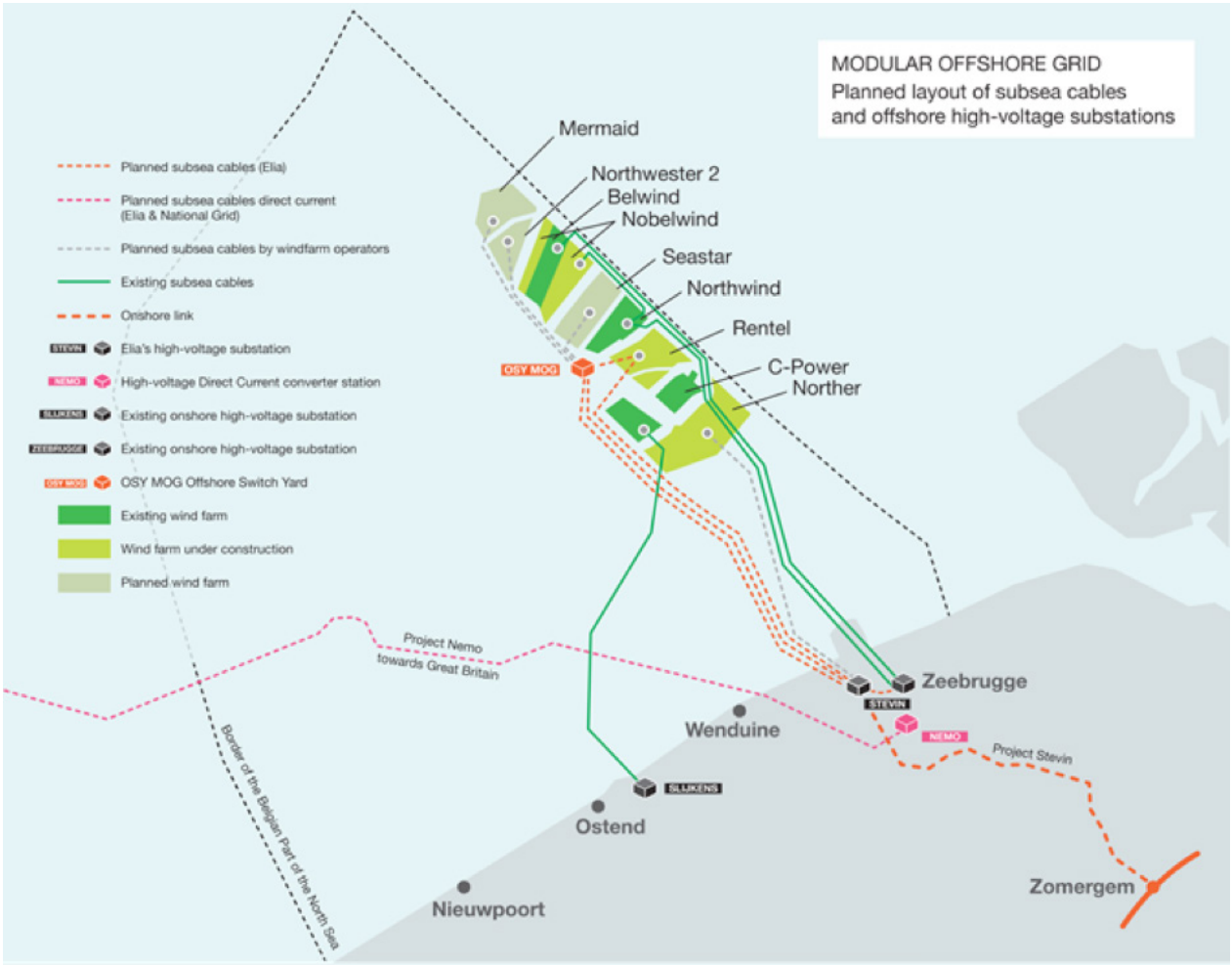

Figure 4. Design for the Modular Offshore Grid (MOG) (Source: http://www.elia.be).