

# CHAPTER 1

---

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

---

RUMES Bob<sup>1</sup> & BRABANT Robin<sup>2</sup>

Royal Belgian Institute of Natural Sciences (RBINS), Operational Directorate Natural Environment (OD Nature), Aquatic and Terrestrial Ecology (ATECO), Marine Ecology and Management (MARECO), Vautierstraat 29, 1000 Brussels, Belgium

<sup>1,2</sup> shared first authorship

Corresponding author: bob.rumes@naturalsciences.be

### Abstract

Offshore wind farms are expected to contribute significantly to the Belgian 2020 targets for renewable energy. By the end of 2018, an installed capacity of 1152 Megawatt (MW), consisting of 274 offshore wind turbines, will be operational in the Belgian part of the North Sea (BPNS). Four other projects are scheduled for the next few years after that. With 238 km<sup>2</sup> reserved for offshore wind farms in Belgium, 344 km<sup>2</sup> in the adjacent Dutch Borssele zone, and 122 km<sup>2</sup> in the French Dunkerque zone, cumulative ecological impacts are likely to form a major concern in the coming years. These anticipated 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 report provides an overview of the offshore renewable energy development in the BPNS.

### 1. Offshore renewable energy in Belgium

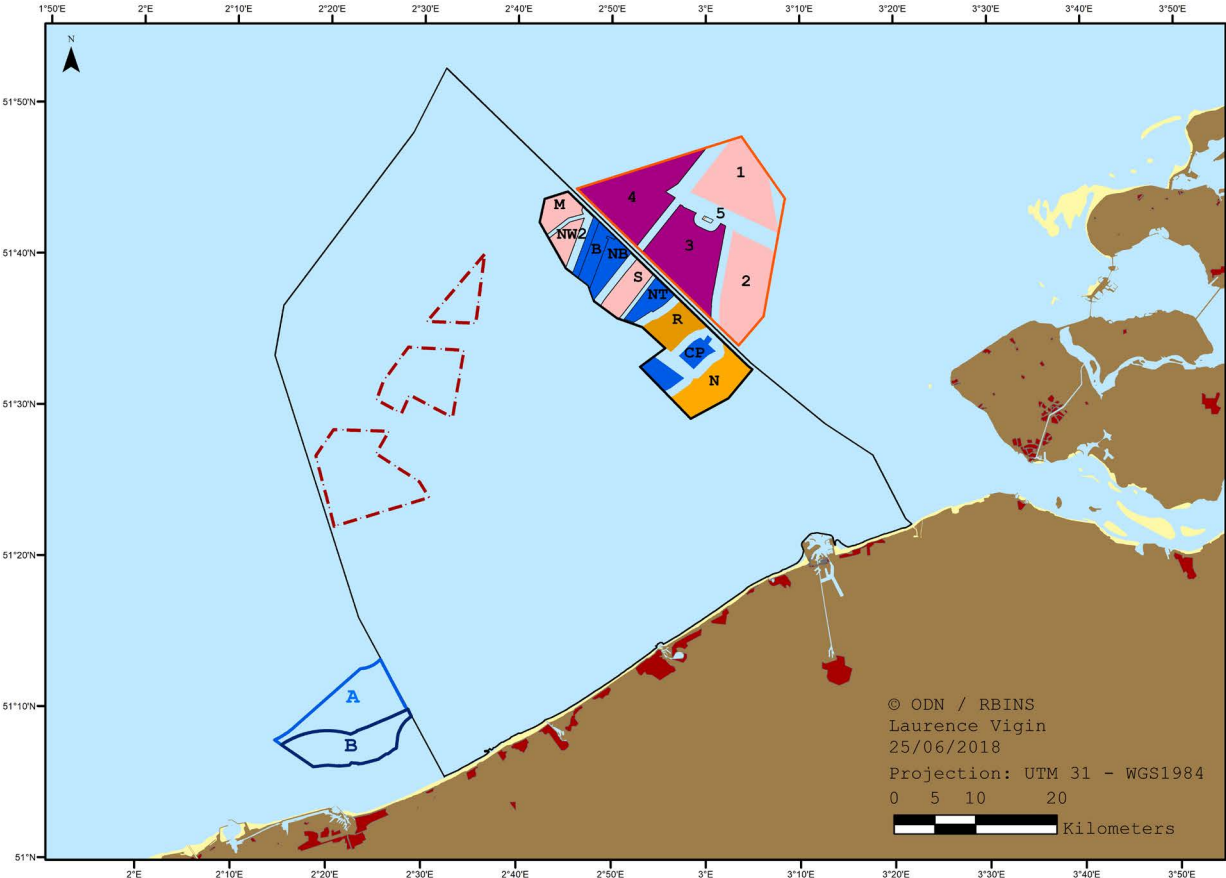
The European Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market imposes a target figure for the

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 BPNS are expected to make an important contribution to achieve that goal.

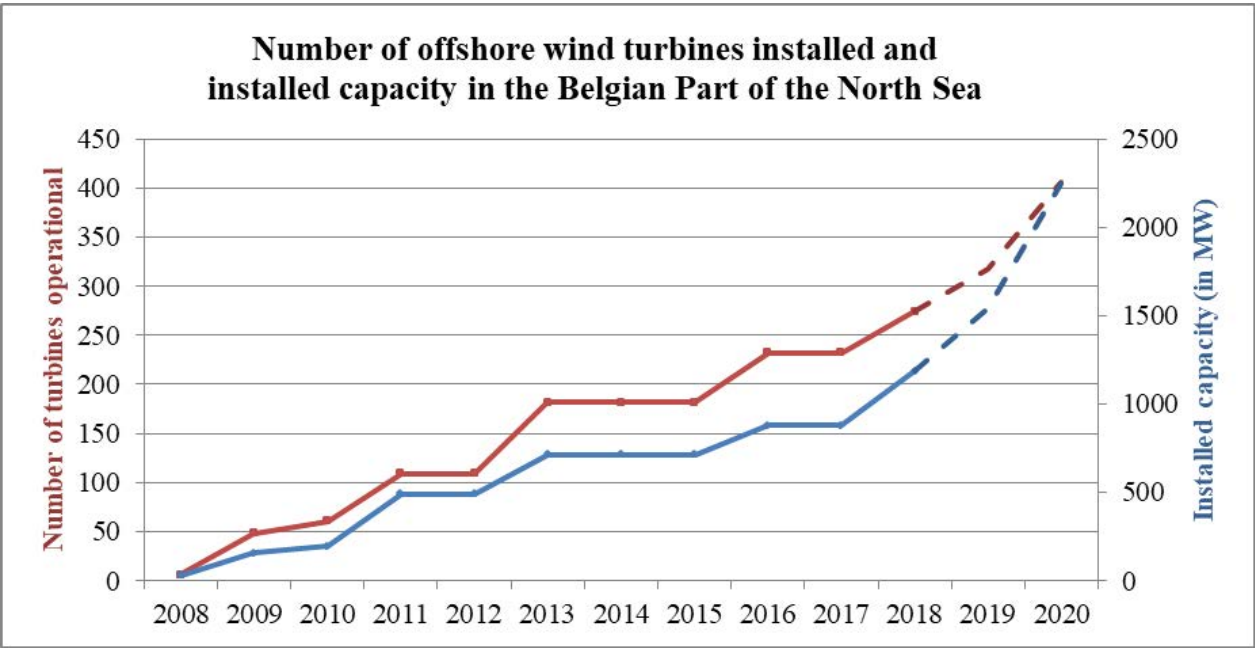
With the Royal Decree of 17 May 2004, a 264 km<sup>2</sup> area within the BPNS is reserved for the production of electricity from water, currents or wind. It is located between two major shipping routes: the north and south traffic separation schemes. In 2011, the zone was adjusted on its Northern and 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 km<sup>2</sup> (fig. 1).

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



**Figure 1.** Current and planned zones for renewable energy in and around the Belgian Part of the North Sea with indications of wind farms that are operational (blue), currently under construction (orange) or set to start construction in 2019 (pink) or 2020 (purple). The proposed sites for the Dunkerque offshore wind farm are indicated by A & B. Locations of the new renewable energy zone, as proposed in the draft of the marine spatial plan 2020-2026, are shown by the dashed lines.



**Figure 2.** Number of offshore wind turbines installed and installed capacity in the Belgian Part of the North Sea since 2008.

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.

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 & Mermaid (table 1). When all Belgian wind farms are built, there will be a little over 400 wind turbines in the Belgian part of the North Sea (fig. 2). The entire area with its 9 parks will have a capacity of 2250 MW and cover up to 10% of the total electricity needs of Belgium or nearly 50% of the electricity needs of all Belgian households.

The environmental permit includes a number of terms and conditions intended to minimize 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. Based on the results of the monitoring programme, and recent scientific insights or technical developments, permit conditions can be adjusted. As a result, in 2017, the Rentel project became the first project in Belgium to use noise mitigation (a big bubble curtain) during construction (hydraulic pile driving) to reduce the impact of underwater sound on marine mammals (fig. 3).



**Figure 3.** Big Bubble Curtain active during the construction of Rentel.

On 13 May 2017, the NEMOS project received an environmental permit for the construction and exploitation of a temporary research structure for wave energy conversion, at a distance of about 500 m 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 was scheduled to be dismantled and removed. However, on 19 January 2018, the POM West-Vlaanderen introduced a request for an environmental permit to continue the exploitation of this maritime innovation and development platform until 2033.

**Table 1.** Overview of wind farms in the Belgian part of the North Sea (situation on 20 May 2017)

Project		Number of turbines	Capacity (MW)	Total capacity (MW)	Concession obtained	Environmental permit obtained	Status
<b>C-Power</b>	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
<b>Belwind</b>	phase 1	55	3	171	YES	YES	Phase 1 operational since 2011
	Alstom Demo project	1	6		YES	YES	Demo turbine operational 2013
<b>Nobelwind</b>		50	3.3	165	YES	YES	Operational since 2017
<b>Northwind</b>		72	3	216	YES	YES	operational since 2014
<b>Rentel</b>		42	7.35	275	YES	YES	Construction started July 2017
<b>Norther</b>		44	8	320	YES	YES	Construction started July 2018
<b>Seastar</b>		30	8.4	252	YES	YES	Construction foreseen to start in 2019
<b>Mermaid</b>		28	8.4	235.2 + 5*	YES	YES	Construction foreseen to start in 2019
<b>Northwester 2</b>		23	9.5	218.5	YES	YES	Construction foreseen to start in 2019

\* including 5 MW of wave energy

## 2. Beyond 2020: the marine spatial plan 2020-2026

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. The current marine

spatial plan is valid for a period of six years and thus in 2020 a new plan will come into effect. This new plan will include a proposal for a new large area for renewable energy (fig. 1). Storage of energy and grid reinforcement continue to be major hindrances to the further integration of renewables into the electricity grid and locations are foreseen for a possible energy atoll and reinforcing the offshore electricity grid.

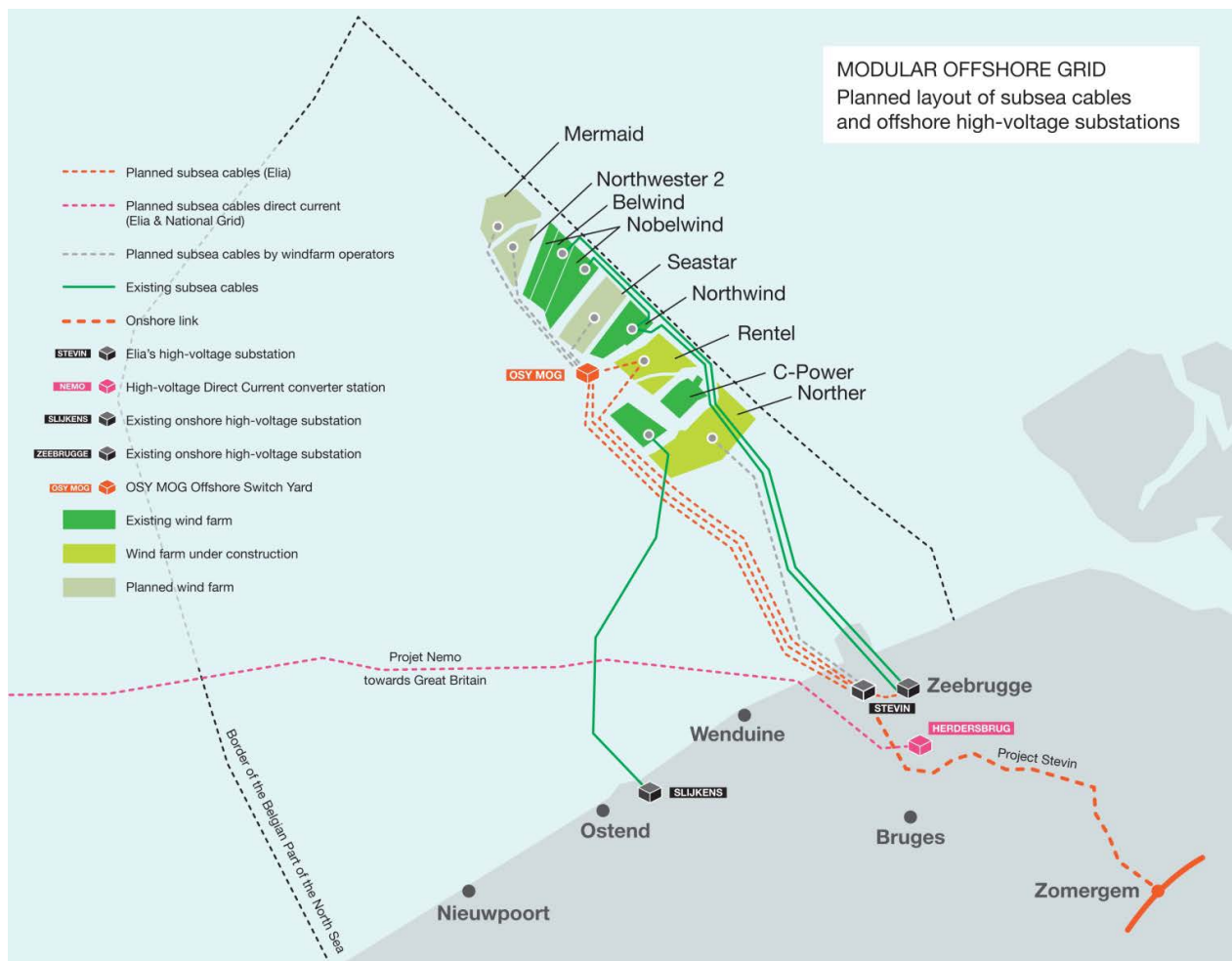
## 3. Grid reinforcement and the Modular Offshore Grid (MOG)

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. This project was completed in November 2017.

The currently 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 with the MOG expected to be operational by September 2019.



**Figure 4.** Design for the Modular Offshore Grid (MOG) (source: <http://www.elia.be>).