

# CHAPTER 1

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

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### Abstract

Eight offshore wind farms are operational in the Belgian part of the North Sea (BPNS), totaling an installed capacity of 2.26 Gigawatt (GW) and consisting of 399 offshore wind turbines. They produce an average of 8 TWh annually, accounting for  $\sim 1/3^{\text{rd}}$  of gross electricity production from renewable energy sources in Belgium (FPS Economy, 2022). An additional zone for offshore renewable energy has been designated in the marine spatial plan 2020-2026 and is anticipating an installed capacity ranging between 3.15 and 3.5 GW. As “Blue Growth” matures to a sustainable blue economy, it has been tasked with ensuring the environmental sustainability of the natural capital of the oceans and seas (EU, 2021).

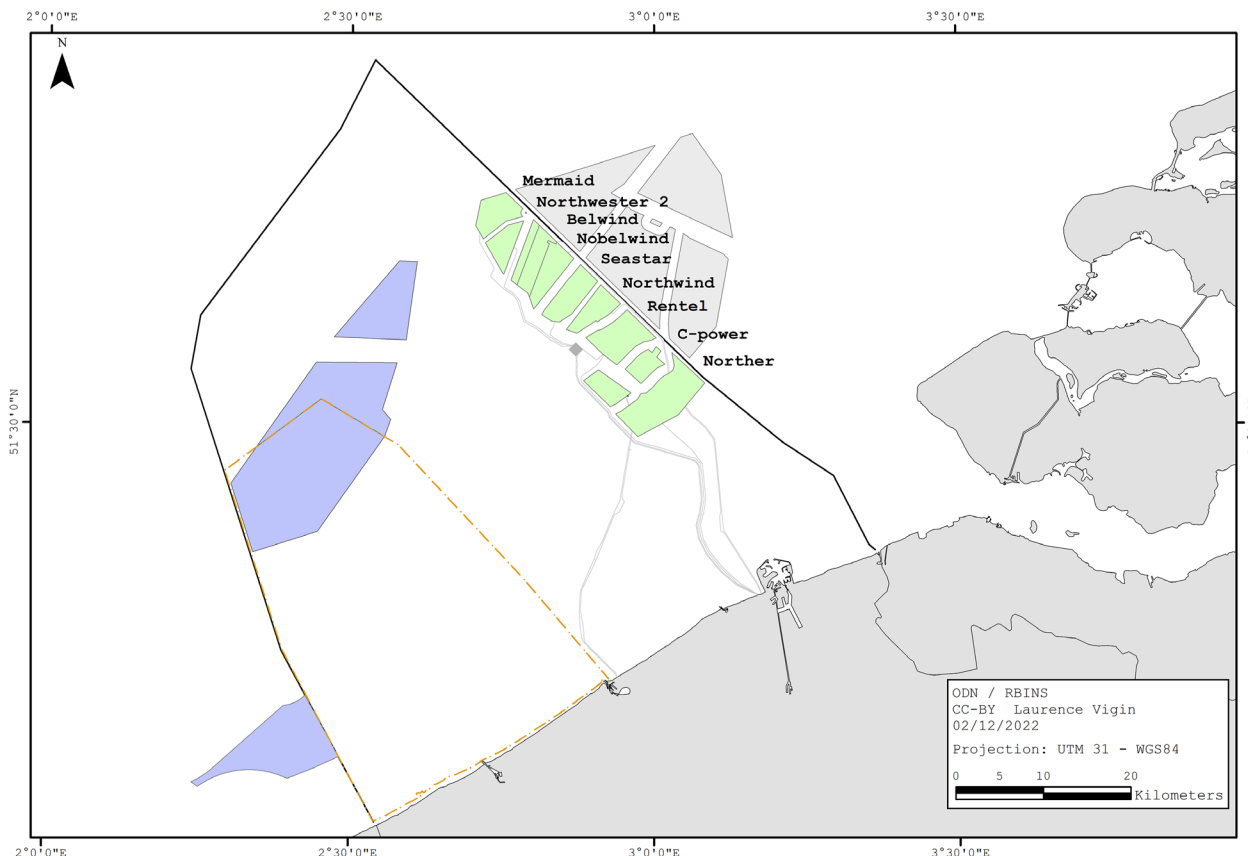
With 523 km<sup>2</sup> reserved for operational and planned offshore wind farms in Belgium, 344 km<sup>2</sup> in the adjacent Dutch Borssele zone, and 122 km<sup>2</sup> in the French Dunkerque zone, cumulative ecological impacts continue to be a major concern. These anticipated impacts, both positive and negative, triggered an environmental monitoring program focusing on various aspects of the marine ecosystem components, but also on the human appreciation of offshore wind farms. This

introductory chapter provides an overview of the status of offshore renewable energy development in the BPNS.

### 1. Offshore wind energy development in Belgium

With the Royal Decree of 17 May 2004, a 264 km<sup>2</sup> area within the BPNS was 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). A second area of 285 km<sup>2</sup> is reserved in the revised marine spatial plan that came in force on March 20<sup>th</sup>, 2020.

The European Directive 2009/28/EC on the promotion of the use of energy produced from renewable sources, 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



**Figure 1.** Current and planned zones for renewable energy in and around the Belgian Part of the North Sea. Operational wind farms in Belgian waters are shown in green. Operational wind farms in the Dutch Borssele area are in grey. The blue areas in the NW of the Belgian part of the North Sea are the Princess Elisabeth zone, an area for renewable energy development as delineated in the revised marine spatial plan 2020-2026. Also in blue is the proposed Dunkerque offshore wind farm in French waters. The orange dashed line is the Belgian Natura 2000 area ‘Vlaamse banken’.

consumption, which had to be achieved by the end of 2020. Offshore wind farms in the BPNS make an important contribution to that goal.

On 31 December 2019, Belgium submitted a National Energy and Climate Plan to the European Commission which envisions a target figure of 17.5% for the contribution of the production of electricity from renewable energy sources by 2030. This plan includes 4 GW of operational offshore wind energy by 2030 (Belgische Overheid, 2019).

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.

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

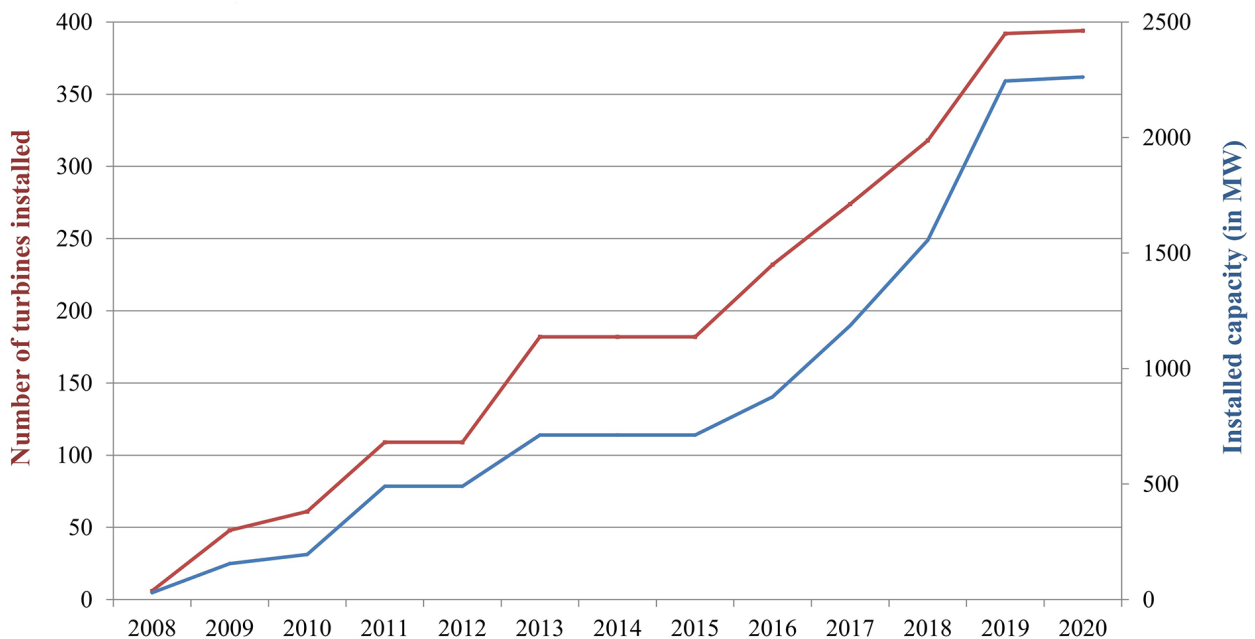
future project to the Minister responsible for the marine environment. MUMM's advice includes an environmental impact assessment, based on the EIS. The Minister then grants or denies the environmental permit in a duly motivated decree.

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 and Fig. 1). On July 20<sup>th</sup> 2018, the merger between the Seastar and Mermaid projects was finalized and the resulting merged project was named Seamade NV. 399 wind turbines are operational in the Belgian part of the North Sea (Fig. 2). The entire first area has a capacity of 2262 MW and can cover up to 10 % of the total electricity needs of Belgium or nearly 50 % of the electricity needs of all Belgian households. The capacity density of the first wind energy zone, defined as the ratio of the wind energy zone rated capacity to its ground area, is at 9.5 MW/km<sup>2</sup> among the highest in Europe. Over the last decade, turbine size, rotor diameter and installed capacity per turbine has gradually increased (Table 1) with extra-large monopiles (i.e.,

with a diameter larger than 7 m) becoming the dominant foundation type in our (shallow) waters (Fig. 3).

The environmental permit includes a number of terms and conditions intended to mitigate and/or minimize the impact of the project on the marine ecosystem. Furthermore, as required by law, the permit imposes an environmental 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.

On 20 March 2020, the second marine spatial plan for the BPNS (Royal Decree of May 22<sup>nd</sup>, 2019, establishing the marine spatial planning for the period 2020 to 2026 in the Belgian sea-areas) came into force. This 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) for the period 2020-2026. Management actions, indicators and targets addressing marine protected areas and the management of human uses including commercial fishing,

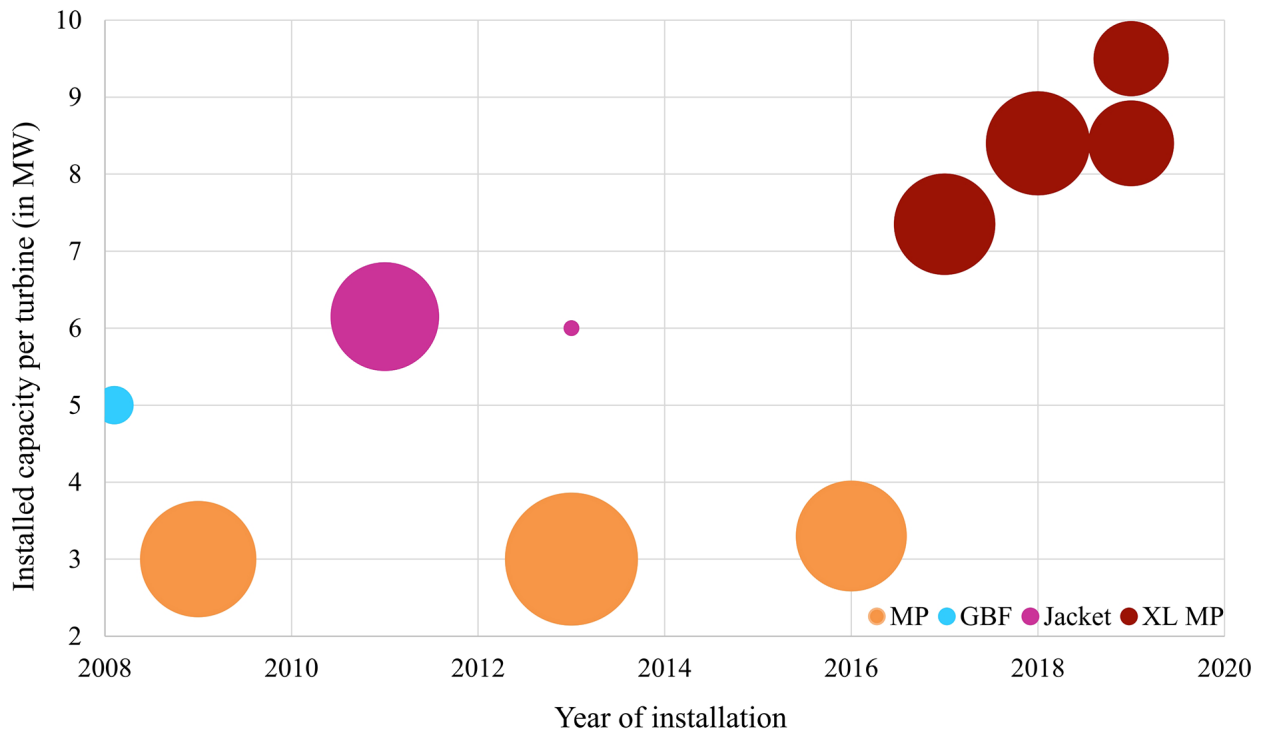


**Figure 2.** Number of offshore wind turbines installed and installed capacity in the Belgian Part of the North Sea since 2008.

**Table 1.** Overview of operational wind farms in the Belgian part of the North Sea.

Project	Number of turbines	Capacity (MW)	Foundation type	Rotor diameter (m)	Hub height (m LAT*)	Total capacity (MW)	Operational since
Norther	44	8.4	monopile	164	107	370	2019
C-Power	phase 1	5	gravity based	126	94	325	2009
	phases 2 & 3	6.2	jacket	126	94		2013
Rentel	42	7.4	monopile	154	106	309	2019
Northwind	72	3	monopile	90	72	216	2014
SeaMade	58	8.4	monopile	167	109	487	2020
Belwind	phase 1	3.1	monopile	90	72	171	2011
	Alstom Demo project	6	jacket	150	100		2013
Nobelwind	50	3.3	monopile	90	72	165	2017
Northwester 2	23	9.5	monopile	164	106	219	2020

\*lowest astronomical tide



**Figure 3.** Overview of the timing, individual capacity and foundation type of offshore wind turbines installed in the Belgian Part of the North Sea since 2008. The size of the bubbles is proportional to the number of turbines installed per project of phase (Table 1). MP: monopile foundation, GBF: Gravity based foundation, Jacket: Jacket foundation, XL MP: monopile foundations exceeding approximately 7 m in diameter.

offshore aquaculture, offshore renewable energy, shipping, dredging, sand and gravel extraction, pipelines and cables, military activities, tourism and recreation, and scientific research are included. In this revision of the marine spatial plan, the Belgian federal government has delineated a second zone for renewable energy of 285 km<sup>2</sup> located at 35-40 km offshore (Fig. 1). This second zone would be suitable for an additional 3.15-3.5 GW of installed capacity. 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 reinforcing the offshore electricity grid.

This second Belgian zone for marine renewable energy is partly located inside the designated Natura 2000 area ‘Vlaamse banken’. A targeted research programme was designed in order to determine whether and how renewable energy development is compatible with the conservation objectives for this Natura 2000 area. This programme commenced in 2019 and is expected to last four years.

## References

- Belgische Overheid, 2019. Nationale Klimaatcommissie, Belgisch geïntegreerd Nationaal Energie en Klimaatplan (NEKP, 2021-2030), Afdeling A: Nationaal plan.
- EU, 2021. Communication from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions on a new approach for a sustainable blue economy in the EU Transforming the EU’s Blue Economy for a Sustainable Future, COM/2021/240 final.
- FPS Economy, 2022. ENERGY - Key Data - Edition February 2022. 39 pp.

