Report 2021

Belgium

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The federal government began planning the first Belgian offshore wind farm in the North Sea in 2003, and in 2004 created a 156-km² area in the Belgian Exclusive Economic Zone (EEZ) in international waters for wind farms.

The first wind turbines were installed in this area in 2009. By the end of 2020, 399 offshore wind turbines are operational—producing around 7 TWh/yr.

In 2021, Belgium had the sixth-highest offshore wind capacity in the world and was pushing for additional development. However, Belgium has limited territorial waters, and offshore wind must compete with numerous other uses and respect environmental constraints.

Construction works are expected to remain at a standstill for a few years while awaiting the official tender procedure for new developments in the more western Princess Elisabeth Zone, where space is already allocated for doubling wind capacity at sea to 4.5GW.

Development beyond the second offshore wind zone will be difficult, and Belgium is exploring the option of interconnection with or develop-

Table 1. Key national statistics 2021: Belgium

Total (net) installed wind power capacity	4.7 GW
Total offshore capacity	2,262 GW
New wind power capacity installed	0.57 GW
Decommissioned capacity (in 2021)	/ GW
Total electrical energy output from wind	11, 94TWh
Wind-generated electricity as percent of national electricity demand	14,3%
Average national capacity factor	34,9% (est. By avg capacity)
Target	
National wind energy R&D budget	

ing new offshore wind capacity in the waters of other countries.

In February 2021, Belgium and Denmark signed a memorandum of understanding for developing an electricity interconnector from an energy island Denmark plans to build in the North Sea. The interconnector could connect Belgium to large offshore wind farms off the Danish coast. Power from the wind farms would be transmitted to both countries.

Highlight(s)

- Belgium has the sixth highest offshore wind capacity in the world.
- A second offshore zone is under development (the Princess Elisabeth zone) in order to double the wind capacity at sea to 4.5 GW.
- Belgium and Denmark signed a MoU for the development of a hybrid interconnector between both countries.
- By the end 2021, the total land-based installed capacity in Belgium had reached 2476,1 MW.

Market Development

Targets and Policy

In general, Belgium's renewable energy policy is aligned with the EU 2020 targets. Belgium's land-based and offshore wind energy developments are essential for both Belgian and European targets for energy development from renewable sources. For 2020, Belgium had a binding national target for renewable energy equal to 13% of the final gross consumption of energy (Figure 1).

By the end of 2021, the total land-based installed capacity in Belgium had reached 2476,1 MW.

In 2021, the 399 wind turbines, spread over 9 offshore zones, produced approximately 6.77 TWh. This corresponds to the annual electricity demand of almost 2 million households or 8% of the total electricity demand in Belgium.

Regarding offshore wind power, the transmission system operator (TSO), Elia, is obligated to buy green certificates from generators at a minimum price set by federal legislation. This system was established in 2002 and amended in 2014 and 2016. Purchase agreements must be approved by the regulator, CREG. Purchase obligations apply for a period of 22 years but may not exceed the depreciation period.

Belgium introduced changes to the formula for the levelized cost of wind energy (LCOE) to address the risk of overcompensation. On 27 October 2017, the federal government decided on the LCOE for the remaining parks: Mermaid, Northwester 2, and Seastar. These three parks are built at an LCOE of 79 EUR/MWh (94.8 USD MWh). The support period is fixed at 16 years, potentially extendable for one year in case of low-wind conditions.

Progress and Operational Details

Offshore wind-generated electricity first began in 2009 and progressed rapidly to a total of 2,262 MW in 2020, which is comparable to the capacity of the two largest nuclear reactors (Doel 4 and Tihange 3) combined.

Land-based wind capacity remained low until 2004 when the installed

capacity and production doubled yearly from 96 MW in 2004 to 2476,1 MW in 2021.

Matters Affecting Growth and Work to Remove Barriers

Work to remove barriers to new wind energy projects continues. Such barriers include spatial planning limitations (i.e., military, aeronautical, or traffic-related restrictions) and lengthy permitting procedures. The federal administration has created a 'one-stop-shop' aimed at simplifying and speeding up the license procedures.

Lengthy legal procedures also affect the sector. For example, cases where local communities appealed against the construction of wind energy facilities, have taken years to resolve. Such legal cases could potentially be avoided by involving the local communities more closely at the project planning stage and by offering them the opportunity to take part in investments through cooperatives.

The main issue affecting the growth of wind is the number of judicial appeals filed at the State Council, which has severely hindered the development of land-based wind farms both in the Flemish and Wallonia regions. Belgium has limited space for wind energy compared to many other countries.

R,D&D Activities

National R,D&D Priorities and Budget

Several key technologies that Belgium wants to invest in for the future have been put forward via the Steering Group of the SET-Plan.

With some research projects like GREDOR or SmartWater in the Walloon Region, Belgium is developing services that will ease the future integration of a larger share of wind energy by modernising the electric grid and offering capacity for clearly tailored storage.

The Flemish Region supports RD&D in offshore and land-based wind via several projects. In 2021, the cluster IBN Offshore Energy project (embedded in OWI-Lab, the Belgian RD&I expertise collaboration in onshore and offshore wind and set-up in 2017) had initiated, set-up, and executed multiple RD&I projects in the field of offshore wind power.

The IBN-Offshore Energy (http://offshoreenergycluster.be/) is a network of Flemish companies innovating in the field of offshore energy (offshore wind, floating wind, wave & tidal). The activities of the IBN Offshore Energy are oriented toward facilitating innovation in this area; the mission of the support team is to support the process from the back of the envelope idea towards a project plan for an innovative product or service ready to be executed.

The projects that have been set-up focus on 6 key topics in which industry-driven R&D is set up:

1. (Smart) structures and foundations (incl. new materials, structural integrity topics, etc...).
2. Innovative electro-mechanical equipment and connections (incl. new drivetrains, electrical power conversion, etc...
3. The usage of robots (UAVs; drones; cobots, etc...).
4. Offshore energy in the grid (incl. storage, ancillary services, power quality, etc...).
5. Installation of offshore energy.
6. Emerging offshore energy technologies (floating wind turbines, wave and tidal energy, etc...).

National Research Initiatives and Results

Results achieved by OWI-lab:

- Successful demonstration of structural health monitoring solutions for monitoring dynamic parameters, e.g., frequencies and damping, of offshore foundations and solutions for monitoring load/lifetime parameters, e.g., bending moments, equivalent damage loads, damages, of offshore foundations.
- Successful use of optical fibres for subsoil strain measurements and back analysis of soil response curves of monopile foundations within the Nobelwind project.
- Successful validation of virtual sensing strategies on monopile foundations within the Nobelwind project.
- Successful windfarm wide load assessment using AI and machine learning algorithms demonstrated on C-power jacket foundations.
- New 4G/5G IOT sensor set-ups and AI techniques set-up in Belgian offshore wind farms as part of the ICON Supersized 4.0 project.

Test Facilities and Demonstration Projects

- Ongoing tests on the Belgium windfarms, Northwestern, and Norther for the validation of advanced structural health monitoring strategies using IOT sensors and optical fibres in the framework of the DBC ICON Supersized project.
- Ongoing measurement campaigns for improving the soil-structure interaction models/digital twins within the Northwester 2 and Rentel windfarms in the framework of the ETF project Windsoil and DBC SBO Soiltwin project.
- New large icing spray test array installed in Sirris/OWI-Lab large climatic test chamber as part of EU H2O2 Newskin project.
- New humidity testing feature in Sirris/OWI-Lab large climatic test chamber.

New projects

- H2020 platoon: digitizing the energy sector.
- EU DOCC-OFF project Digitalization of Critical Components in OFFshore wind turbines.

Collaborative Research

International collaboration is considered essential to accelerate the needed investments in research and development of renewable energy, such as wind. To that end, the Federal Public Service of Economy became a member of the IEA Wind Technology Collaboration Program in 2015.

Belgium is active in several tasks of IEA Wind TCP (11, 31, 27, 41, 34, 46, 48 and 50).

Impact of Wind Energy

Economic Benefits

The wind energy sector creates excellent economic opportunities. Being active in this industry has also created opportunities for export. In addition to wind farm constructions, there is a need to build grid infrastructure, grid connections, and connections with neighbouring countries.

The impact on employment is substantial, and jobs are created in the design, construction, maintenance, and replacement of wind farms, in addition to the permanent workforce, often in areas with few job opportunities. The offshore wind industry supports about 16,000 jobs in Belgium, including export activities, construction and operations, and maintenance. More specifically, the offshore wind industry will continue to provide significant direct and indirect contributions to the energy sector, which has about 50,000 direct jobs today.

Environmental Impact

In addition to adding sustainable energy capacity, offshore wind energy developments also increase biodiversity, specifically organisms such as sea corals and plants. Offshore wind turbine foundations form artificial reefs, where mussels and other sea life grow. The foundations also contribute to the growing fish population, providing many opportunities to further develop the marine culture in the Belgian North Sea.

Next Term

Belgium is preparing for the tender for the second offshore zone, which is planned to be launched in 2023.