【欧州】【海事】

Maritime Issues – Renewable energy including offshore wind power generation: Baltic Energy Market Interconnection Plan (BEMIP) high-level group adopts work programme for Baltic Sea offshore wind development

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【概要：Summary】

Offshore renewable energy covers several energy sources and various technologies. However, based on the European Green Deal (COM (2019) 640 final) with its climate neutrality goal in 2050 and the commitments under the 2015 Paris Agreement, the development of offshore wind is becoming a crucial tool for the EU meet its climate targets. Offshore wind power is developed and deployed in the EU's North Sea, Baltic Sea, the Mediterranean and Black Seas, the Atlantic Ocean and the outermost regions and overseas territories to achieve the ambitious objectives of the decarbonisation of the EU's energy market. However, the construction of offshore wind farms and grid infrastructure will have to be decisively accelerated in quantity, size, and power capacity at all maritime locations suitable for offshore windfarms in the EU.

Regarding the potential of offshore wind power generation in the Baltic Sea, a study on the Baltic Sea offshore wind energy cooperation under the Baltic energy market interconnection plan (BEMIP) initiative considers a possible expansion in the Baltic Sea Area, which could exceed a total capacity of 93GW. Therefore, the signing of the "Baltic Sea Offshore Wind Joint Declaration of Intent" underlines the Baltic Sea countries' willingness to accelerate the development of offshore wind energy in the region. The BEMIP High-level Group intends to operationalise the Baltic Sea Offshore Wind Declaration. Accordingly, it drafted a work programme for offshore wind development in the Baltic Sea on 28 October 2021. This work programme for offshore wind development not only aims at kick-starting the implementation of the Baltic Sea Offshore Wind Joint Declaration of Intent, but it also confirms the commitment to coordinate efforts for a synchronization of the Baltics' grid with the continental European network. The aim is to develop an offshore grid that facilitates the increased deployment of offshore wind generation capacities in the Baltic Sea until 2050.

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1. Background of the EU's offshore wind energy exploitation plans

In its European Green Deal (COM (2019) 640 final), the EU sets its target of achieving net-zero GHG emissions by 2050, and it also intends to fulfil its commitments under the 2015 Paris Agreement. Therefore, the EU will have to significantly

increase utilisation of renewable energies for its energy production. In this context, the onshore and offshore wind energy production for power generation is considered being one of the key renewable energy sources. Wind energy as source for power generation is mentioned in the European Green Deal as one of the key elements to achieve the carbon neutrality target in 2050. According to the European Commission's European Green Deal, besides onshore wind parks "…increasing offshore wind production will be essential, building on regional cooperation between Member States" (COM (2019) 640 final). The offshore wind power generation has gained attention as in contrast to onshore wind parks, the offshore wind power generation benefits from the utilisation of the stronger and steadier winds at sea and suffers less space restrictions, compared to onshore wind parks. According to the EU Blue Economy Report 2021, offshore wind energy is currently the only commercial deployment of a marine renewable energy with wide-scale adoption. Other promising ocean technologies, including wave energy, tidal energy, salinity gradient energy and ocean thermal energy conversion (OTEC), are still at the research and development stage and not yet commercially available (European Commission 2021f).

As the EU Blue Economy Report 2021 points out, Europe is by far the world leader in offshore wind energy (European Commission 2021f). Starting with the first offshore wind farm (Vindeby) in Denmark in 1991 and only a small number of demonstration plants in the early 2000s, in 2018, the EU has become the world leader in offshore wind energy, with a total of installed offshore wind power generation capacity of 22.1 GW from 5,047 grid-connected wind turbines across 12 countries (European Commission 2021f). In 2019, 502 new offshore wind turbines were connected to the grid across 10 projects. In 2020, 2.4 GW of new capacity were added to the grid (European Commission 2021f). The main EU producers of offshore wind energy are Germany, the Netherlands, Belgium, and Denmark.

Regarding the offshore wind energy production, but also regarding the other forms of offshore renewable energies, the European Commission sees a massive potential in Europe's five sea basins, outermost regions, and overseas territories also in future (European Commission 2021a).

The North Sea has a high and widespread natural potential for more offshore wind farms, thanks to shallow waters and localised potential for wave and tidal energy. Therefore, the North Sea is currently the leading region for deployed capacity and expertise in offshore wind (COM/2020/741 final). Furthermore, also the Baltic Sea has a high natural potential for offshore wind energy exploitation. The EU's Atlantic Ocean as well as the Black Sea offer a good natural potential for both, offshore bottom-fixed and floating wind energy turbines, while the Mediterranean Sea shows potential for floating offshore wind energy (COM/2020/741 final). Moreover, the EU islands have large potential in marine energies and can play an important role in the EU's offshore energy development. They also provide attractive testing and demonstration grounds for innovative offshore electricity generation technologies. Finally, also many European outermost regions and overseas countries and territories have a good potential for offshore renewable energy (COM/2020/741 final). Floating offshore wind farms seem to have become a viable option for EU countries and regions with water depths of 50-1,000m. The first multi-turbine floating project was Hywind Scotland with a capacity of 30 MW, commissioned in 2017 by Equinor, followed by the Floatgen project in France and the WindFloat Atlantic in Portugal. With a total installed capacity of 45 MW in 2019, Europe's floating wind fleet could open-up greater opportunities to harvest the most resourceful wind energy sites in Europe (European Commission 2021e). By 2024, 150 MW of floating

offshore wind turbines are expected to be commissioned. (COM/2020/741 final).

By using the technology of floating offshore wind power generation platforms, more sites in the Atlantic Ocean, the Mediterranean Sea and potentially the Black Sea will become suitable for the installation of wind farms. To fully exploit the potential of offshore wind, the EU is committed to further support the development of offshore wind power generation for the regions with deeper water of 60m depth and more by developing floating substructures or integrated floating wind energy systems. The utilisation of floating offshore wind farms could allow an expansion of the utilisation of up to 80% of offshore wind resources in deep water areas (European Commission 2021e).

The transition to floating offshore wind technology will not only open new markets for the construction of floating offshore wind sites, representing a considerable market opportunity for EU companies. It will also accelerate the construction of vessels for the support of their installation and operation. In total, about 6.6 GW of floating offshore wind energy is expected to be integrated in the grid by 2030, with significant capacities also in third countries in Asia, like South Korea and Japan, besides the European markets in France, Norway, Italy, Greece, and Spain (European Commission 2021f).

Accordingly, the objective of the EU's renewable energy policy is to rapidly scale up both, offshore renewable energy of different types and the wind energy sites with bottom-fixed and floating turbine technology (European Commission 2021a). Since the EU's offshore wind sites expansion has already led to a significant fall in costs and bid prices for offshore wind energy projects, it will also support the acceleration of the development of a green hydrogen production and market (European Commission 2021a).

2. The EU's strategy to develop offshore wind and ocean renewables energy

To take full advantage of its potential regarding the offshore renewable energy production, the European Commission published a dedicated EU strategy on offshore renewable energy in 2020. Starting from the currently installed offshore wind capacity of 12 GW, the strategy entitled "An EU Strategy to harness the potential of offshore renewable energy for a climate neutral future" (COM/2020/741 final), sets the target for achieving 300 GW of offshore wind capacity and 40 GW of ocean renewables such as wave, tidal and floating solar by 2050 and a mid-term target of an installed capacity of at least 60 GW of offshore wind and at least 1 GW of ocean energy by 2030 (European Commission 2021a). Getting to 300 GW of offshore wind and to 40 GW of ocean energy installed capacity by 2050 means multiplying the capacity for offshore renewable energy by nearly 30 times by 2050. The investment needed to do so is estimated at up to EUR 800 billion COM/2020/741 final).

The strategy sees offshore renewable energy as one of the most promising routes to increase future power generation, and to reach Europe's decarbonisation objectives while meeting the expected rise in electricity demand. The term "offshore renewable energy technology" includes several clean energy technologies. The Offshore Strategy intends to make offshore renewable energy a core component of Europe's energy system by 2050. Large commercial floating wind energy projects are being announced in some Member States and ocean energy is reaching a level of maturity that makes them attractive to future applications.

The strategy on offshore renewable energy presents a general enabling framework, addressing barriers and challenges, common to all offshore technologies and sea basins, but it also sets out specific policy solutions adapted to the different state of development of technologies

and regional contexts. Every sea basin in Europe is different and has different potentials due to each specific geological conditions and the specific stage of offshore renewable energy development. Therefore, different technologies suit different sea basins. Regional cooperation has recently been stepped up in some sea basins, with the North Seas Energy Cooperation (NSEC) providing the most advanced example and reference point for other Member States willing to tap the full potential of offshore renewable energy.

The work ongoing in the Baltic Energy Market Interconnection Plan (BEMIP) or the high-level group for south-west Europe on interconnections and the Central and South-Eastern Europe Energy Connectivity (CESEC) is important to mention in this context (COM/2020/741 final).

Europe's offshore wind industry benefits from having a first-mover advantage in bottom-fixed wind turbines with a strong home market, where 93% of the European installed offshore capacity in 2019 was produced in Europe (COM/2020/741 final). The EU-27 offshore wind market represents 42% (12 GW) of the global market in terms of cumulative installed capacity, followed by the UK (9.7 GW) and China (6.8 GW). EU renewable energy industries are also strong in the emerging technology of floating offshore wind. Multiple floating designs exist and/or are being developed, none of which prevail at this stage. The EU industry is also the global leader for developing ocean energy technologies, mainly wave and tidal. EU companies hold 66% of patents in tidal and 44% of patents in wave energy, and 70% of the global ocean energy capacity has been developed by EU-27 based companies (COM/2020/741 final). However, ocean technologies could make a significant contribution to Europe's energy system and industry as from 2030. Currently, a significant reduction in cost would be needed for tidal and wave energy technologies to reach their potential in the energy mix. A crucial but feasible step to reach commercial size by 2030 would be implementing the existing pipeline of 100 MW pilot-farms projects by 2025 (COM/2020/741 final). Other technologies are still at the early stages of development but could be promising for the future: algal biofuels (biodiesel, biogas, and bioethanol), ocean thermal energy conversion (OTEC) and floating photovoltaic installations (already deployed in landlocked waters but mainly at the research and demonstration stage at sea, with only 17 kW being installed).

This Strategy sets out the scaling-up of offshore renewable energy and its use as an EU priority. Offshore renewable energy potential is present, in different forms, in all European oceans and sea basins, including islands and outermost regions. Its development would have positive industrial, economic, and social impacts spread across the EU and its regions. Achieving the scale up proposed by this strategy will require the collaboration of all parties concerned, including Member States, regions, EU citizens, social partners, NGOs, and all sea users (COM/2020/741 final).

Regarding infrastructure development, increasing offshore renewable energy generation requires adequate infrastructure to make the most efficient use of the generated electricity. To ensure the scale up of offshore renewable energy in the most cost-effective manner, the infrastructure development and planning must go beyond national borders and take place at regional level, and more specifically at sea-basin level. This can result in hybrid projects combining offshore renewable energy generation and its transmission in a cross-border setting, which would allow significant cost savings. A further step in the development of the European energy infrastructure will be an offshore meshed grid. This would be similar to the onshore interlinked transmission grid system, where electricity can flow in many directions and would allow for a fully integrated, cost-effective

deployment of offshore renewable energy (COM/2020/741 final).

The Offshore Renewable Energy Strategy sets the highest deployment ambition for offshore wind turbines, both fixed-bottom and floating, where commercial activity is well advanced. In these sectors, Europe has already gained technological, scientific, and industrial experience and strong capacity exists across the supply chain, from manufacturing to installation (European Commission 2020).

3. The Baltic Sea's wind potential and the "Baltic Energy Market Interconnection Plan" (BEMIP)

In the next decades, the construction of offshore wind farms will have to be decisively accelerated, in quantity, size and power capacity. The European Commission expects that about 450 GW of offshore wind power generation will be needed by 2050 to achieve the carbon neutrality target. This would require Europe to build 7 GW of new capacity each year by 2030 and to further increase the annual increase in new capacity to 18 GW by 2050. Therefore, the EU is committed to further support the construction of offshore wind farms and to accelerate the offshore wind power generation. In Europe, currently the North Sea accounts for 77% of all cumulative offshore wind capacity. The Baltic Sea accounts for 2 GW of installed offshore wind capacity, with Denmark having installed 872 MW, Finland 68 MW, Germany 1,074 MW and Sweden 192 MW.

The Baltic energy market interconnection plan (BEMIP) is considering the creation of an initiative to support the development of offshore wind power in the Baltic Sea. It aims at building an open and integrated regional electricity and gas market between EU Member States in the Baltic Sea region. The BEMIP initiative's members are Denmark, Germany, Estonia, Latvia, Lithuania, Poland, Finland, Sweden, and Norway, which participates as an observer. As part of the BEMIP implementation, several cross-border and domestic infrastructure projects of common interest have been completed in the Baltic Sea area for improving the integration with the Nordic electricity market.

The electricity infrastructure projects, such as Estlink, Nordbalt and the LitPol Link, connecting the three Baltic States with Finland, Sweden, and Poland respectively, significantly improved the Baltic countries' integration in the EU energy market (European Commission 2019). However, the Baltic Sea's capacity could be significantly increased, according to the "Study on Baltic Offshore wind energy cooperation under BEMIP" (European Commission 2019). The study analyses the opportunities for and obstacles to the development of offshore wind power in the Baltic Sea Area, as well as the possible benefits from and obstacles to regional cooperation and coordination of offshore wind power (European Commission 2019).

The potential number of offshore wind farm blocks with a capacity of 500MW that could be placed in the Baltic Sea has been estimated based on wind conditions, water depth, and spatial and environmental planning constraints. Based on this process, the total offshore wind farm capacity identified exceeds 93GW in the Baltic Sea, with national totals of between 4.5GW in Lithuania and 20GW in Sweden (European Commission 2019). The total net output implied for the gross potential capacity identified is 325 TWh/year (European Commission 2019). Especially in the southern part of the Baltic Sea, there are most suitable sites for offshore wind power generation.

The cooperation on offshore wind power projects as cross-border renewable energy (RES) projects is expected to generate substantial economic benefits through the achievement of renewable energy targets at lower cost. In addition, benefits can be realised by integrating the cooperation on offshore wind power in regional grid planning. The development of advanced

offshore hubs, which connect wind power to two or more Member States, could also be beneficial. The study concludes that the Baltic Sea area clearly shows the availability of sites suitable for large-scale offshore wind farm deployment projects achieving around 93 GW by 2050, up from today's 2.2 GW.

According to the study, there are basically two scenarios possible. Considering a scenario with a minimum result, reflecting a continuation of current expectations and trends, the 2.5 GW offshore wind power installed in the Baltic Sea Area in 2020 would increase to 6.5 GW in 2030 and 17 GW in 2050. Instead, a more ambitious scenario would double the results of the low scenario, with 12.7 GW in 2030 and 32.1 GW in 2050 (European Commission 2019). However, this is still far off the 93 GW for large-scale offshore wind farm deployment projects in the Baltic Sea area, which could theoretically be achieved by 2050.

On 30 September 2020, at the occasion of the Offshore Wind Conference, hosted by the Polish Wind Energy Association (PSEW), in Szczecin, Poland, the representatives of the High-Level Group on the Baltic Energy Market Interconnection Plan (BEMIP) of eight Baltic Sea Area bordering countries including Poland, Germany, Denmark, Sweden, Finland, Lithuania, Estonia, Latvia of Member States and the European Commission signed the Baltic Sea Offshore Wind Joint Declaration of Intent (European Commission 2021g). This Declaration follows on the cooperation work on offshore wind that has been conducted within the BEMIP Renewable Energy Working Group since 2016. This identified offshore wind power as a significant component for economic development and energy transition contributing to renewable energy targets and facilitating carbon neutrality by 2050. The cooperation started by the States envisions commonly planned wind production areas that would enable to maximize the potential of wind as an energy source (European Commission 2020b). The European Commission signed the joint declaration with the aim to accelerate the set-up of new offshore wind capacities in the Baltic Sea and to promote the development of offshore wind energy in this region (European Commission 2020b). The declaration underlines the need to scale up offshore wind energy capacity in the EU by 2050 (European Commission 2020c). The signatory states will aim to work towards increased offshore wind electricity supplies and better transmission infrastructure across the Baltic Sea, considering the need to ensure a sustainable, competitive, and secure supply of electricity to consumers. The Member States intend to further contribute to political, economic, and technological integration in the Baltic Sea Region through increased regional cooperation on offshore wind development. The joint declaration underlines that a significant increase in offshore energy can be most efficiently achieved through a cooperative, regional approach (European Commission 2020b).

The BEMIP High-level Group was intended to operationalise the Baltic Sea Offshore Wind Declaration and to draft a work programme for offshore wind development in the Baltic Sea in 2021 (European Commission 2020b). The draft work programme for offshore wind development in the Baltic Sea is expected to consider each Baltic Sea Region's country's National Energy and Climate Plans and the EU policy regarding renewable energy, including questions of hybrid offshore wind projects, smart grids, energy system integration and digitalization (European Commission 2020b).

4. The new Baltic Sea region offshore development work and energy market interconnection plan

The primary objective of the Baltic energy market interconnection plan (BEMIP) initiative is to achieve an open and integrated regional electricity and gas market between the EU Member States in the Baltic Sea region.

On 28 October 2021, the BEMIP high-level group adopted a new work programme for offshore wind development in the Baltic Sea region. The work programme was agreed at a meeting of senior officials from the eight EU Member States in the Baltic region. The programme confirms the commitment to coordinate on the development of the offshore grid. This work-program aims to kick-start the implementation of the Baltic Sea Offshore Wind Joint Declaration of Intent. Given the rapid developments in the field of offshore renewable energy, ongoing project development, and policy developments, this work program will be reviewed in 2024 (European Commission 2021g). Other areas of cooperation include maritime spatial planning, focusing on offshore wind development, cooperation on enabling appropriate financing, and the acceleration of specific Baltic offshore projects. Dedicated working groups on infrastructure, markets, gas and electricity, security of supply, synchronisation, renewables, and energy efficiency prepare specific measures, projects, and studies necessary for achieving the initiative's objectives and targets (European Commission 2021h). The work program is considered being an integral element of a new BEMIP Action Plan, which was established in May 2021, within the BEMIP High-Level Group.

Moreover, to address challenges and achieve synergies at regional level, the BEMIP Action Plan incorporated projects and processes implementing the EU's Strategy for the Baltic Sea Region (EUSBSR) in the area of energy. Work within the BEMIP Offshore Wind Working Group should also consider to making use of and explore synergies with the EUSBSR (European Commission 2021g). BEMIP members agree that regional cooperation for the development of the offshore wind potential in the Baltic Sea should concentrate in the area where such cooperation brings the most added value without doubling work conducted in other fora or at EU level. Therefore, the BEMIP Offshore Wind Working-Group should establish regular strong cooperation and work together with the North Seas Energy Cooperation (NSEC). Developments therein should be disseminated and discussed (European Commission 2021g). The BEMIP Renewable Energy Working Group should also establish strong cooperation with the HELCOM-VASAB working group on maritime spatial planning (BEMIP 2021).

Furthermore, since the three Baltic States' electricity grid still operates synchronously with the Russian and Belarusian systems, a BEMIP working group steers the work to achieve, by 2025, the synchronisation of the Baltics' grid with the continental European network. Several cross-border and domestic infrastructure projects, such as Estlink, Nordbalt and the LitPol Link, connecting the three Baltic States with Finland, Sweden and Poland significantly improved the Baltic countries' security of supply and their integration in the EU energy market and the Nordic electricity market, as part of the BEMIP implementation (BEMIP 2021). However, further efforts are needed in the region to complete synchronisation of the three Baltic States with European networks.

The BEMIP Offshore Wind work program records a political intent alone. It does not establish any new legal commitments and does not replace or modify any existing legal obligations with regards to the BEMIP Member States. Given the rapid developments in the field of offshore renewable energy, ongoing project development, and policy developments, this work-program will be reviewed in 2024 (BEMIP 2021).

Regarding Maritime Spatial Planning focusing on offshore wind development, which is co-chaired by Poland, the action includes a cooperation on better coordination of maritime spatial planning and environmental assessments to be able to utilise the offshore wind energy potential of the Baltic Sea to enable cooperation and coordination between relevant authorities in all BEMIP members

and with the transmission system operators (TSOs), in view of the current and future maritime spatial plans for the Baltic Sea.

Regarding the Cooperation on enabling appropriate financing (co-chaired by Estonia), the possibilities and conditions for subsidy free and market based offshore wind development in the Baltic Sea should be enhanced. To take full advantage of their potential, cross-border cooperation models between national support schemes to facilitate long-term investments in joint and hybrid offshore wind energy projects need to be discussed. The Member States should also share best practices on the accelerated development of offshore wind energy from more advanced and experienced Members States to less advanced (BEMIP 2021).

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