Export markets assessment for the Dutch offshore wind industry

ESTONIA, LATVIA AND LITHUANIA

Commissioned by The Ministry of Foreign Affairs of the Netherlands

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BLIX

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Export opportunities within five years for the Dutch offshore wind industry in the Baltic States

Ambitious renewable targets

- Ambitious short-term targets, mainly in Estonia and Lithuania.
- Only specific offshore wind energy target in Lithuania (700 MW by 2030), Estonia expects NECP with offshore roadmap in 2022.

Emerging offshore wind markets

- Export market value potential of 10-18 bn€* (3-5 GW) in the project pipeline until 2030 for Estonia and 4 bn€* (1 GW) for Lithuania.
- Latvia prioritizes onshore wind development until 2030.

Offshore grid is biggest challenge

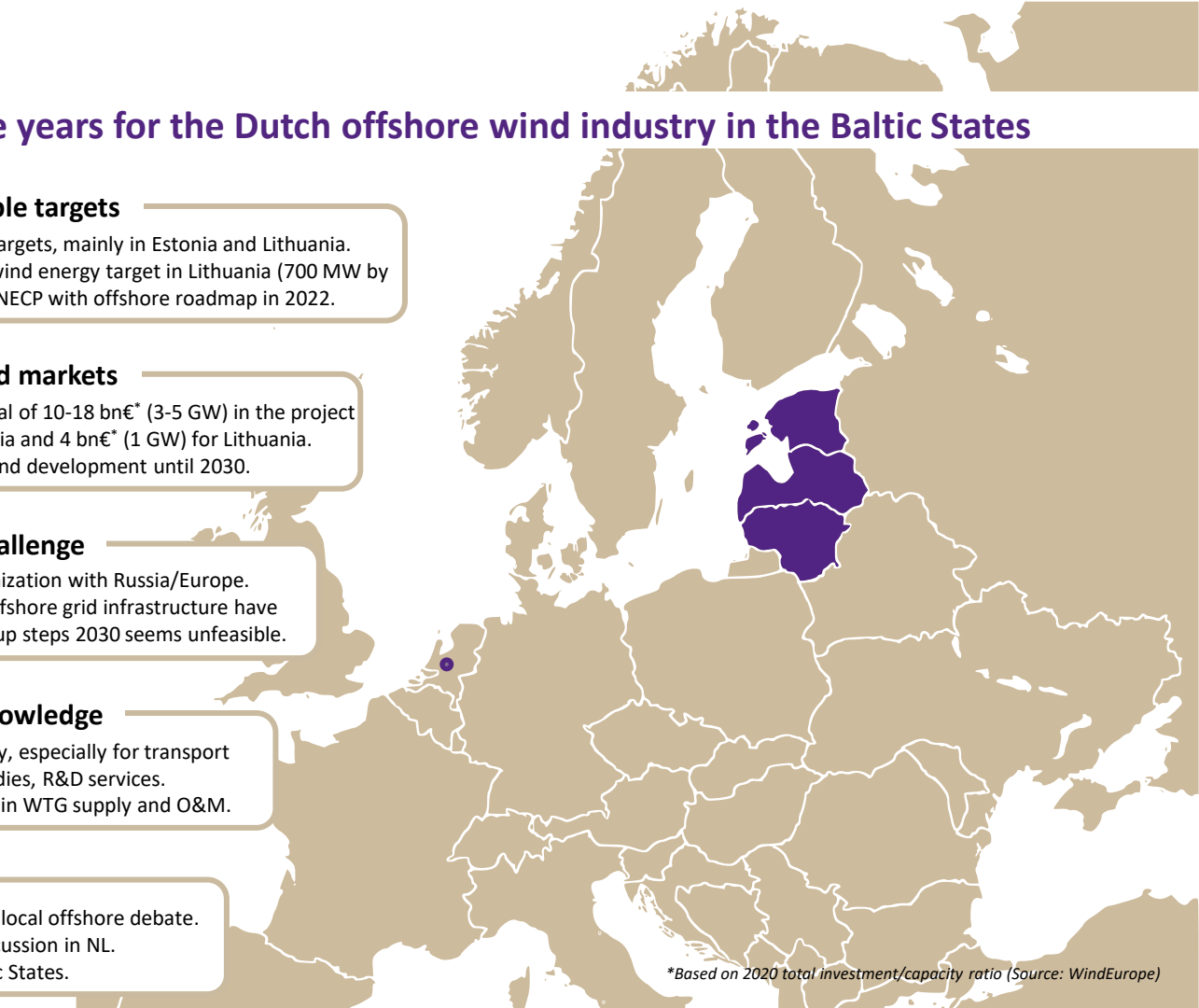
- TSOs prioritize grid (de)synchronization with Russia/Europe.
- First regional initiatives for an offshore grid infrastructure have been taken, but without follow-up steps 2030 seems unfeasible.

Limited local experience & knowledge

- Great opportunities for Dutch industry, especially for transport and installation, foundations, site studies, R&D services.
- Strong DE/GE competition, especially in WTG supply and O&M.

Plan of approach

- Engagement of the Dutch Embassies in the local offshore debate.
- Promotion of the Baltic States offshore discussion in NL.
- Promotion of Dutch companies in the Baltic States.



*Based on 2020 total investment/capacity ratio (Source: WindEurope)

Study objective and approach

Study objective

Background

In September 2020, eight EU countries linked to the Baltic Sea (Poland, Germany, Denmark, Sweden, Finland, Lithuania, Estonia and Latvia) signed a joint declaration with the European Commission to accelerate the development of new offshore wind energy projects in the region. Offshore wind energy not only contributes to achieving climate and energy targets for these countries, but also supports the economic growth of Central and Eastern Europe in a broader sense. The Baltic Sea has great potential for offshore wind energy with no less than 93 GW in 2050, compared to 2.2 GW today.

Due to the current absence of operational offshore wind energy projects in the Baltic States (Estonia, Latvia and Lithuania) and the limited local knowledge regarding offshore wind development, it is expected that players in the offshore wind industry from other European Union countries will play an important role in the realization of future projects in these countries.

Study purpose

The Regional Business Development Nordic - Baltic Team from the Ministry of Foreign Affairs of the Netherlands and its embassies in the Baltic States see export opportunities here for the Dutch offshore wind energy sector. Therefore, BLIX Consultancy was requested to conduct a market research on the offshore wind energy sector in the Baltic States.

Part of the market study is:

- Assessment of the current and future offshore wind industry in each of these countries.
- Mapping the opportunities and threats for Dutch companies.
- A comparison of the export opportunities for Dutch players in the offshore wind sector with the competition from Denmark and Germany.
- Advice on a strategic approach to this new market for the Dutch government.

Target group

This study is intended for the Dutch companies which are active in the offshore wind energy sector and are seeking opportunities for future projects in the Baltic States.

Figure 1: Focus area for this market research *(Source: BLIX)*

Approach

Research questions

In this market study, the following research questions are addressed:

- What is the current situation of offshore wind industry by country and what are the ambitions?
- What are the present policies related to offshore wind and what are the plans for future policies?
- Who are the main stakeholders, decision makers and relevant organizations?
- What does the project pipeline look like and which information is available over the projects, tenders and timelines?
- Which local value and supply chain players are already active in these countries or are expected to become active in the near future?
- What elements of the wind value chain in each potential export market are Dutch companies most capable of playing a major role? And what is the expected competition from Denmark and Germany?
- What are the recommendations for a plan of approach for the Dutch government into the new developing market in these countries?

Sources

For this market research a large number of recent sources are used to assure correct and up to date information:

- Literature study of policy documents, offshore wind energy news websites, study reports, presentations, company websites;
- Participation in webinars on the development of offshore wind energy in the Baltic States;
- Interviews with relevant stakeholders such as wind energy associations and government representatives from Estonia, Latvia and Lithuania, international market players active in the offshore wind energy industry in the Baltic States.

Presentation of results

The results of the study are presented in three parts:

PART 1	Analysis and assessment of the offshore wind market in Estonia, Latvia and Lithuania
PART 2	Local value and supply chain analysis and assessment of the competitive landscape for Dutch offshore wind industry companies
PART 3	Advice on the strategic market approach for the Dutch government ("plan of approach")

PART 1: offshore wind market assessment

PART 1: offshore wind market assessment

Baltic States

Baltic Sea region

Introduction

The Baltic Sea has a total area of 397,978 km² and borders the nine countries Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Sweden and Russia. The Baltic Sea can be divided into the sub-regions of the Gulf of Finland, the Gulf of Bothnia, the Gulf of Riga, Baltic Proper, the Danish Straits and the Kattegat. The estimated sea areas of the Baltic States and their relative area to the whole Baltic Sea area (Figure 2) are:

- Estonia: 36,500 km² (9.2%)
- Latvia: 28,500 km² (7.2%)
- Lithuania: 6,400 km² (1.6%)

The relatively shallow water body (average depth 54 m) and the high average wind speeds make the Baltic Sea a suitable area for offshore wind energy projects. The Baltic Sea is also used by other sectors such as fishing, shipping and mineral extraction. The fragile Baltic Sea ecosystem, which is also under pressure from climate change, is home to several saline and coastal ecosystems and contains breeding and wintering areas for seabirds and breeding and nursery habitats of many fish species such as herring and sprat. The development of offshore wind projects must therefore compete with various stakeholders and sectors in the Baltic Sea.

Maritime spatial plan

The EU countries bordering the Baltic Sea are currently in the final stages of developing or updating their Maritime Spatial Plans (MSPs) in accordance with the "EU Directive on MSP" from 2014. These MSPs are expected to be adopted in the first quarter of 2021. The objective of the "EU Directive on MSP" is to create a standard for authorities to analyze and efficiently balance the interest from different sectors for the sea area, but also to coordinate the activities in the marine areas and therefore minimize the effects on the ecology. The existence of spatial plans are also expected to encourage investments, increase cross-border cooperation and protect the environment. Offshore wind energy development areas are also among the most important topics that are being addressed in these plans. The MSPs create a formal basis for the allocation of sea areas for offshore wind farms and transmission systems, under a range of country-specific legal requirements, such as minimum distance to shore or minimum depth requirements.

One challenge that applies to all Baltic States in allocating offshore wind development areas is the existence of NATO radar systems on which the countries depend, but which cover much of the land and sea area. Helsinki Commission (HELCOM) and Visions and Strategies Around the Baltic Sea (VASAB) are the two main cooperation parties that established the joint Baltic Sea MSP Working Group which guides dialogues on recent and future MSP related developments in the region.

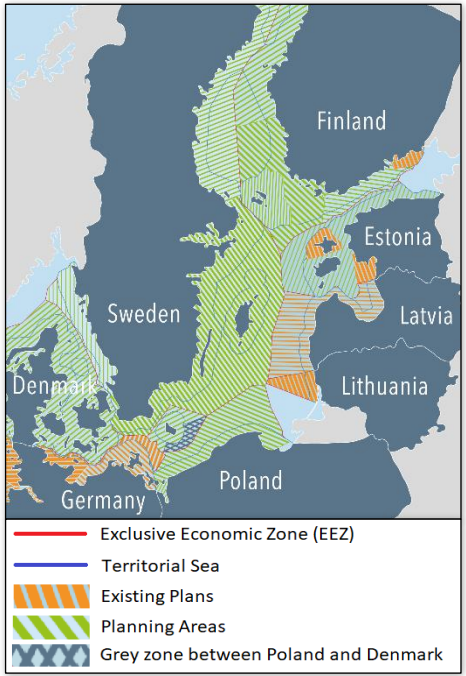


Figure 2: Baltic Sea Exclusive Economic Zone borders
(Source: European Maritime Spatial Plan Platform)

Offshore wind energy policy

The eight EU Member States bordering the Baltic Sea signed the "Baltic Sea Offshore Wind Joint Declaration of Intent" with the European Commission in September 2020, considering the EUs climate-neutral 2050 target from the Paris Agreement. In this declaration, all members agree on the high potential of offshore wind power in the region as stated in the report of the Baltic Energy Market Interconnection Plan (BEMIP) and they consent that a cooperative regional approach is the best way to achieve this potential.

Sources: 1. European Maritime Spatial Plan Platform (2021)
2. Towards a meshed offshore grid in the Baltic Sea – Baltic InteGrid (2019)
3. Developments offshore wind in the Baltic Sea – WindEurope (2021)
4. Baltic Sea Offshore Wind Joint Declaration Of Intent (2020)

Baltic Sea region

Offshore wind in the Baltic Sea

The Baltic Sea has favorable sea conditions for offshore wind development, such as shallow waters, low wave heights and weak tides, resulting in relatively low Levelized Cost of Energy (LCoE) values for offshore wind energy. Therefore, many projects are expected to be realized in the region in the recent future. While the current installed capacity in the Baltic Sea is only 2.2 GW, it is projected to be up to 9.5 GW by 2030 and up to 35 GW by 2050. In the "Study on Baltic Offshore Wind Energy Cooperation under BEMIP" a total of 93.5 GW potential capacity for the future has been identified (Figure 3). To achieve the maximum potential of offshore wind energy in the Baltic Sea region, the following four topics need to be addressed by the Member States: 1) enable a stable growth strategy to make investments feasible, 2) adapt national energy and climate plans with clear goals and timelines, 3) regional cooperation for project optimization and 4) exploitation of available EU funds.

Country	Potential capacity
Denmark	19.5 GW
Estonia	7.0 GW
Finland	8.0 GW
Germany	8.0 GW
Latvia	14.5 GW
Lithuania	4.5 GW
Poland	12.0 GW
Sweden	20.0 GW
Total	93.5 GW

Figure 3: Offshore potential in BEMIP countries *(Source: BEMIP)*

Offshore wind infrastructure in the Baltic Sea

The integration of the Baltic States' electricity networks into the EU energy system has been identified as one of the strategic priorities of the EU's energy policy to promote the establishment of a secure and reliable European electricity system. The resulting EU-initiated grid reinforcements and modernization/development of the onshore transmission network by the Estonian, Latvian and Lithuanian TSOs help to enable the development of offshore wind energy.

In recent years various initiatives have been taken to promote offshore grid infrastructure in the Baltic Sea. The "Baltic InteGrid" project (2016 - 2019) created a professional network and an environment for the relevant stakeholders (TSOs, policymakers, offshore wind industry, national authorities, academia) to optimize the transnational coordination of offshore wind energy infrastructure, and to provide insights into the preconditions for developing a regional meshed network. In addition, in December 2020 the TSOs of all eight EU-Member States surrounding the Baltic Sea signed the "Baltic Offshore Grid Initiative" with the aim of developing further cooperation on planning principles for the offshore energy grid in the Baltic Sea (also in line with the ENTSO-E Ten-Year Network Development Plan) and conduct studies that support the vision for the grid in the region. Estonia and Latvia aim with a joint offshore project to provide by 2030 the first pillar of an offshore grid connection hub.

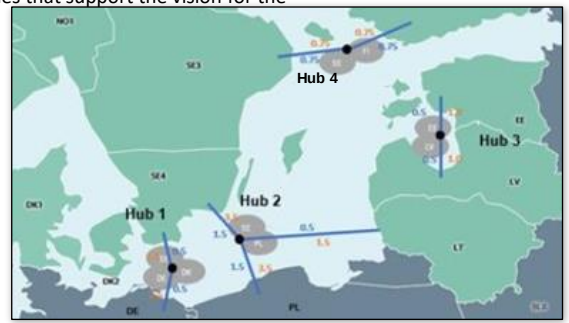


Figure 4: Four offshore hubs proposed in BEMIP *(Source: BEMIP)*

Cross-border regional cooperation

The Baltic States are members of several cross-border regional cooperation initiatives to stimulate the offshore wind energy development:

- BEMIP – The objective of the Plan is to achieve an open and integrated electricity and gas market between the Baltic Sea countries
- HELCOM – International organization governing the Convention on the Protection of the Marine Environment of the Baltic Sea area
- VASAB – Intergovernmental multilateral co-operation of the Baltic Sea Region in spatial planning and development
- Baltic Sea Offshore Wind Joint Declaration of Intent – A declaration to accelerate offshore wind project development in the Baltic Sea.
- Baltic InteGrid – Integrated Baltic Offshore Wind Electricity Grid Development Project
- Baltic Offshore Grid Initiative – A signed MoU between the eight TSOs of the Baltic Sea region with the aim to develop common planning principles and perform studies that support the common vision for the offshore grid

In addition, Estonia and Latvia are working on a joint 700 to 1000 MW offshore wind farm project with an expected auction in 2026.

Sources: 1. Study in Baltic offshore wind energy cooperation under BEMIP countries (2019)
2. Towards a meshed offshore grid in the Baltic Sea – Baltic InteGrid (2019)
3. Boosting offshore wind energy in the Baltic Sea – WindEurope (2019)
4. Developments offshore wind in the Baltic Sea – WindEurope (2021)
5. https://www.offshorewind.biz/2020/12/29/baltic-sea-tsos-agree-to-cooperate/

PART 1: offshore wind market assessment

Estonia

Policy and regulatory environment

Policy plans

Estonia currently has no specific targets for offshore wind energy in its policies and strategies. The "National Development Plan of the Energy Sector until 2030" from 2017 sets targets for the use of fuel-free sources (solar, wind and hydropower) as a share of final energy consumption (50%) and electricity consumption (more than 10%) by 2030. The "General Principles of Climate Policy until 2050" is a resolution of the Parliament, also from 2017, aimed at a gradual increase in the use of renewable energy sources in all sectors of final consumption. This resolution also doesn't mention explicit targets for offshore wind energy. It is expected that the share of wind energy in the generation of electricity will only increase strongly after the existing generation technologies are decommissioned, so probably after 2030.

However, the coalition agreement for the new government that is established in 2021, declares high ambitions on renewable energy projects, especially offshore wind projects. It states that the EU funds will be used to develop a joint offshore wind farm with Latvia, new maritime planning will be completed, and offshore wind development areas will be clearly defined in it. The government will also support the further improvements of both onshore grid infrastructure and the cross-country network plans on Baltic Sea, in order to enable offshore wind energy projects.

On the basis of this coalition agreement, the government is currently preparing a new "National Energy and Climate Plan", which is expected to be submitted in 2022. The NECP will most likely also include a roadmap for the rollout of offshore wind energy in Estonia. Also, the plan contains many constraints for onshore wind development, such as defense constraints, which open up more opportunities for offshore wind development.

Offshore grid infrastructure plans

AS Elering is the state-owned national TSO responsible for the development of the grid infrastructure. Current grid infrastructure discussions are focussed on disconnecting Estonia from the Russian grid and connecting the electricity system with the European electricity grid in the period 2025 – 2030 by strengthening interconnection with the Nordic and European markets, for example via offshore wind farms. However, there are no concrete plans yet; AS Elering is one of the main initiators of the cross-border offshore grid infrastructure works as studied in the "Baltic Sea InteGrid" project and pursued by the "Baltic Offshore Grid Initiative".

The EU has started onshore grid reinforcements for a DC connection with Poland to further connect Estonia to the EU by 2025. This is also beneficial for the rollout of a large amount of offshore wind capacity, as most of the energy will need to be transported to neighboring countries.

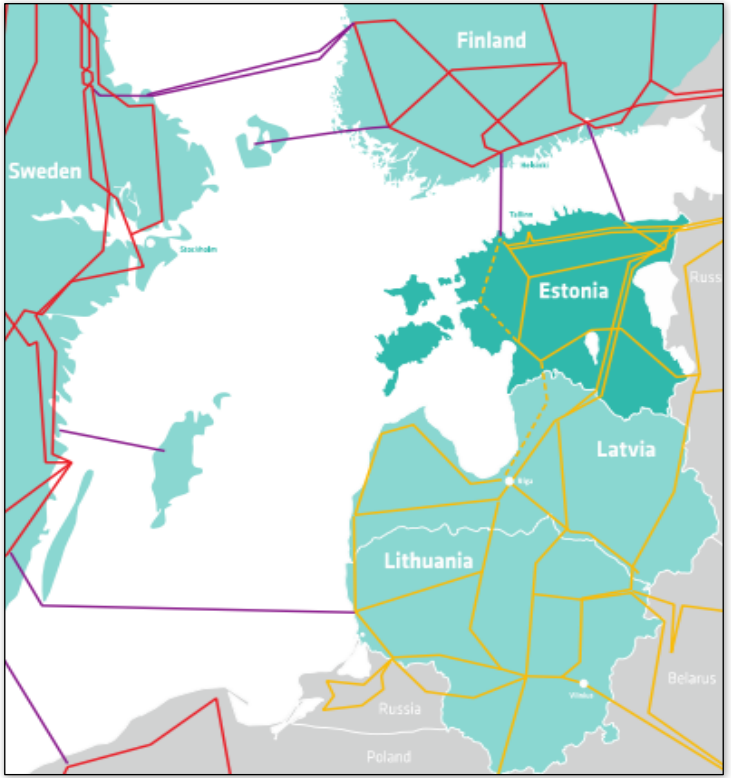


Figure 5: Map of current grid in Estonia and between neighboring countries *(Source: AS Elering)*

Sources: 1. https://fbx.ee/news/baltic-news/coalition-agreement-center-reform-government-2021-2023-news/
2. Interview with Ministry of Economic Affairs and Communications, Estonia (2021)
3. Study in Baltic offshore wind energy cooperation under BEMIP countries (2019)
4. AS Elering website

Policy and regulatory environment

Maritime spatial plan

Estonia does not yet have an adopted national maritime spatial plan (MSP) but they are in the final stages of developing one (called "Estonia 2030+") which is foreseen to be ready by Q3 2021. This MSP, based on the Planning Act from 2015, includes detailed planning for all the sea areas of Estonia. New offshore wind energy development areas are also identified, see Figure 6. The wind energy development areas of the new MSP near Saarema Island are relatively far from the onshore grid but benefit from the advantageous wind climate, while the new areas in the Gulf of Riga have a lesser wind climate and possible ice formation but are closer to the grid connection.

Since 2012, two regional pilot plans have also been developed, covering the Estonian waters around Hiiu Island and Pärnu Bay. These MSPs are based on the "Order of the Government" from 2012 and contain several wind energy development areas near Hiiu and in the Gulf of Riga. All aspects of these MSPs are legally binding, although they are not covered by the new Planning Act, with the exception that in the Hiiu MSP offshore wind energy has been abolished by the National Court of Estonia in 2018.

Most of the projects started before 2015 are related to spatial planning constraints related to defense locations and NATO radar systems used by the Ministry of Defense. This can impose restrictions on the project developer such as a limitation of the turbine size or even a ban on wind turbines. This is expected to be avoided for future projects covered by the new MSP.

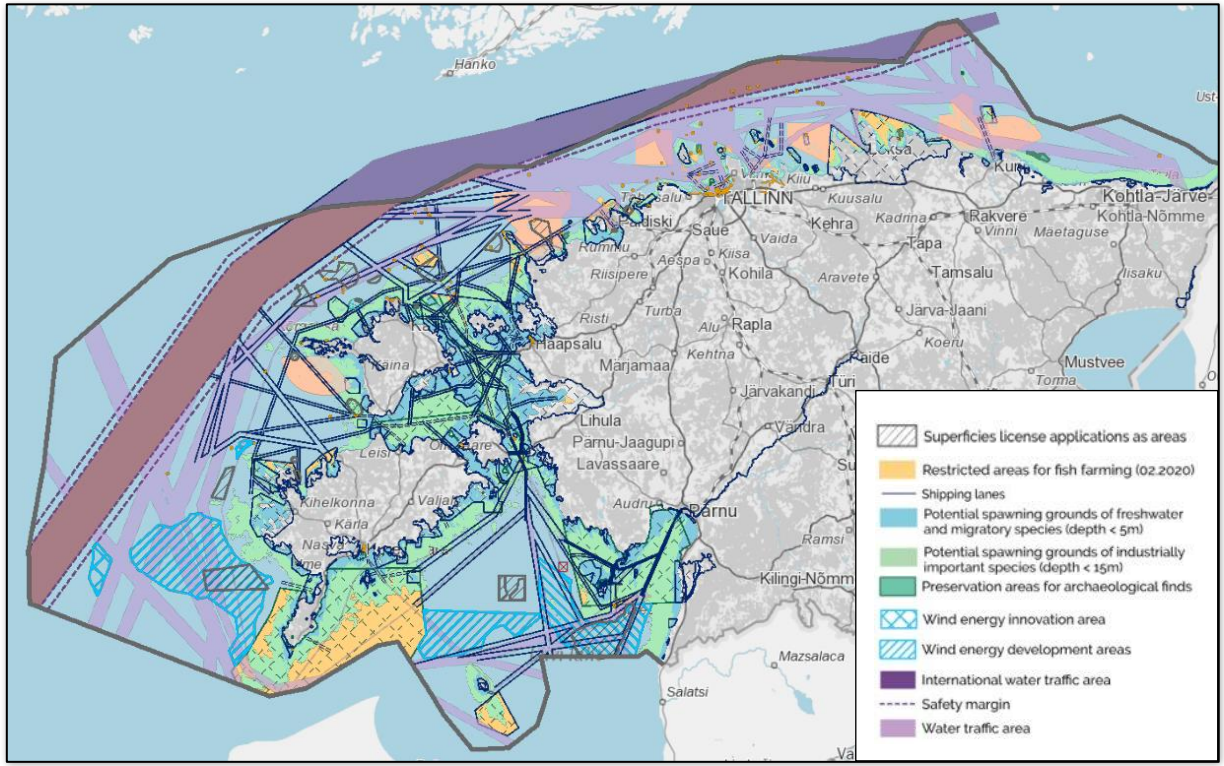


Figure 6: Map of Estonia sea areas for various purposes *(Source: Estonian MSP - http://mereala.hendrikson.ee/kaardirakendus-en.html)*

Sources: 1. Study in Baltic offshore wind energy cooperation under BEMIP countries (2019)
2. Estonian Maritime Spatial Plan draft – the Ministry of Finance, Estonia (2019)
3. European Maritime Spatial Plan Platform (2021)
4. Interview with Estonia Wind Energy Association (2021)
5. http://mereala.hendrikson.ee/kaardirakendus-en.html

Policy and regulatory environment

Support schemes

In 2018, the Electricity Market Act was amended in Estonia, introducing new support mechanisms for sustainable energy. This system works with technology-neutral tenders for the purchase of sustainable electricity generation in which wind, solar, geothermal, hydropower, biogas and biomass projects can participate. The winner of the tender will receive a compensation for the renewable electricity produced with a sliding premium on top of the electricity market price for a period of 12 years. The currently planned tenders for the purchase of electricity generated by large-scale renewable producers are 450 GWh in 2021 and 650 GWh in 2023.

Relevant authorities and stakeholders

The competent authority for the planning and permitting of offshore wind farms in Estonia is centralized under the stakeholders as shown in the table below:

Stakeholder	Role/responsibility
Ministry of Economic Affairs & Communication	The Consumer Protection and Technical Regulatory Authority (CPTRA) manages the state consent process
Ministry of Finance	Manages the process of spatial planning
Ministry of Environment	Responsible for the Strategic Environmental Assessments (SEA)
AS Elering (TSO of Estonia)	Issues connection permits

Permitting procedure

An offshore wind developer must comply with the following main regulatory requirements during the permit procedure:

1. State consent. A state consent is given by the Consumer Protection and Technical Regulatory Authority (CPTRA) which is operating in the administrative area of the Ministry of Economic Affairs & Communication. In case there are other interested parties then a tender for state consent shall be organized. A state consent is valid for 3 years and can be prolonged for 2 more years, during which time the construction of the offshore wind farm must start.
2. Permit for the special use of water & Environmental Impact Assessment (EIA). The permit is issued by the Minister of Environment under the Water Act. This law is the main legislation affecting the planning of offshore wind farms in Estonia by regulating the use and protection of water and the relationships between landowners and water users. An EIA is obligatory for offshore wind farm development under the Environmental Impact Assessment and Environmental Management System Act.
3. Construction permit. This permit is issued on the basis of the Building Act by the Ministry of Economic Affairs & Communications. The current version of the Building Act is old, but an update is expected soon on this regulation.
4. Permit for use of the construction and generate electricity (under the Building Act and the Electricity Market Act). The Electricity Market Act enacts the authorisation to use a site in an area of public water and generate electricity. Hereto, the owner of an offshore wind farm must pay an annual charge.

Sources: 1. Study in Baltic offshore wind energy cooperation under BEMIP countries (2019)
2. https://www.offshorewind.biz/2013/02/20/poland-lithuania-estonia-potentials-of-offshore-wind-energy-in-the-baltic-sea-2/

- Conditions supporting offshore wind development
- Medium barriers for offshore wind development
- High barriers for offshore wind development

Assessment of the policy and regulatory environment

Policy/regulation		Reasoning
National Development Plan of the Energy Sector until 2030 (2017)		• No specific offshore wind targets are included in the Plan. • Ambitious 2030 renewable target of 50% share of final energy consumption (including joint projects with other Member States). • More than 10% share of the final electricity consumption should in 2030 come from fuel-free sources solar, wind and hydropower.
General Principles of Climate Policy until 2050 (2017)		• The General Principles of Climate Policy until 2050 is a resolution of the Parliament from 2017 which aims at a gradual increase in the use of renewable energy sources in all sectors of final consumption. • No explicit offshore wind energy targets are mentioned.
National Energy and Climate Plan (expected in 2022)		• A new National Energy & Climate Plan is currently being prepared by the new government and expected to be submitted in 2022. • The coalition agreement declared high renewable ambitions for this plan and will mostlikely include a roadmap for offshore wind energy. • The plan is expected to be more ambitious than the ones for other Baltic States, especially for offshore wind energy development.
Maritime spatial plan		• A new nation-wide MSP is expected to be ready in the third quarter of 2022, which includes several offshore wind development areas. • Some of the current projects initiated within the existing two regional MSPs are experiencing spatial plan issues, but this is expected to be avoided for future projects covered by the new MSP.
Infrastructure developments		• Several ideas for offshore grid connections (including interconnections) are on the table, but concrete initiatives have not yet been taken. • Another obstacle is the financing of this offshore grid. • Grid reinforcement of the onshore grid are expected to be required in the future to enable large amounts of offshore wind energy. The EU has already taken some initiatives as part of the grid synchronization with the Baltic states.
Support schemes		• Currently there is no specific support scheme for offshore wind, but there is one for 12 years in competition with onshore, solar energy, hydropower, geothermal energy, biogas and biomass. • So far only tenders for 2021 - 2023 for the purchase of small amounts of renewable electricity generation are planned.
Permitting procedure		• Getting the permit for the special use of water is the most challenging step of the permitting procedure, because an EIA must be done. Once received, this permit is valid for a period of 50 years. • The permitting procedures for the construction permit and permit to generate electricity are relatively simple. • The state consent is valid for 3 years (can be prolonged for 2 more years) during this time the building must start.

Offshore wind project pipeline

The table below provides an overview of the offshore wind projects currently under development in Estonia, see also Figure 7.
The projects for which the permit procedure started before 2015 fall under the old legislation. However, these projects are restricted by the wind farm specifications from their original application and if the developers would like to update their plans with current technologies, a new permit application is required under the new MSP. Moreover, the development locations of most of these projects (Hiiumaa, Neugrund Reef, Kihnu Island) often coincide with nature conservation zones and defence zones. The projects of Eesti Energia and Saare Wind Energy/Van Oord expect to complete the EIA process within the next two years and operate before 2030.

Some developers have already applied for the development of offshore wind farms in the designated wind farm areas under the new MSP. However, these applications will not be assessed until adoption of the MSP, then applications from competitors are also expected.

Project name, Area	Status	Comment	Capacity	Operation date	Owners
Hiiumaa	State consent (2006), permitting on hold	The Hiiu offshore wind area was abolished by the Supreme Court in 2018	1100 MW	On hold	Enefit Green, Roheline Elekter
Liivi Bay (Gulf of Riga)	State consent (2009), awaiting EIA	Expected to complete EIA process in next two years	1000 MW	Before 2030	Eesti Energia
Neugrund Reef	State consent (2010), awaiting EIA	Permit being granted is unlikely since the area is near to defense sites	380 MW	unknown	Neugrund OU
Kihnu Island (Gulf of Riga)	State consent (2013), awaiting EIA	Permitting possible but only with strict tip height restrictions	380 MW	unknown	Tuuletraal OÜ
Saarema	State consent (2015), awaiting EIA	Expected to complete EIA process in next two years	1 GW	Before 2030	Saare Wind Energy, Van Oord
"Elwind" – Liivi Bay (Gulf of Riga)	Concept (2020)	Auction in 2026	700-1000 MW	Before 2030	EST/LAT government
Liivi Laht and Sorve	Applied (2020)	Competitors can (and mostlikely will) apply after new MSP	780 MW	unknown	Utilitas
SW1–SW10 - West of Hiiumaa and Saarema	Applied (2020)	Competitors can (and mostlikely will) apply after new MSP	1644 MW	unknown	Sunly OÜ

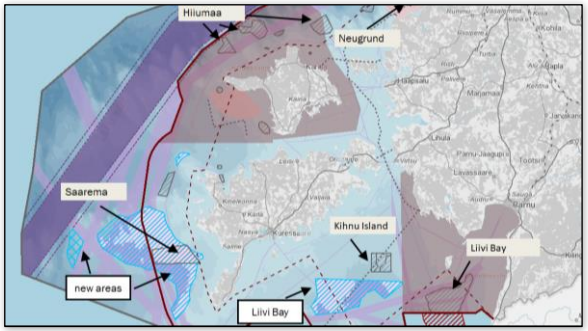


Figure 7: Planned offshore wind projects *(Source: Webinar)*

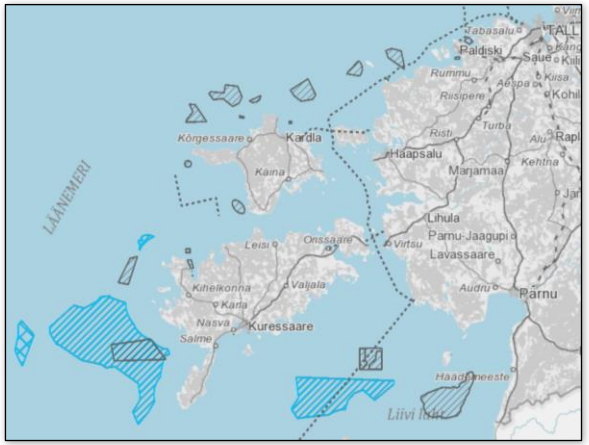


Figure 8: Offshore wind development areas of the new MSP *(Source: EST MSP)*

Sources: 1. Study in Baltic offshore wind energy cooperation under BEMIP countries (2019)
2. Interview with Ministry of Economic Affairs and Communications, Estonia (2021)
3. http://mereala.hendrikson.ee/kaardirakendus-en.html
4. Webinar – Offshore wind – Baltic Sea & Estonia (2020)

PART 1: offshore wind market assessment

Latvia

Policy and regulatory environment

Policy plans

In 2010, the document "Latvia 2030 - Sustainable Development Strategy of Latvia until 2030" was published on behalf of the Ministry of Regional Development and Local Government. "Latvia 2030" is the main long-term policy planning tool and every other strategic planning and development document in Latvia has been and will be prepared in accordance with the priorities and lines of action of "Latvia 2030". This strategic paper states that half of Latvia's total final energy consumption by 2030 will come from renewable energy sources, with wind power plants, mainly onshore, accounting for up to 15% of the total electricity production.

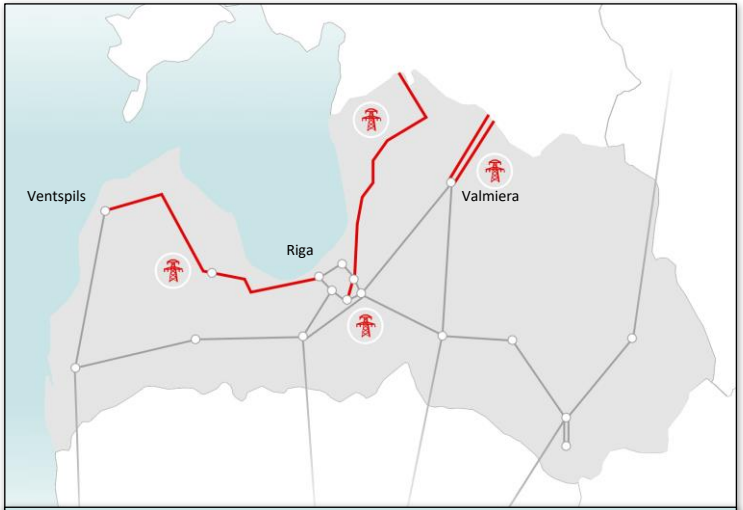
"Latvia's National Energy and Climate Plan 2021 – 2030" (NECP) from 2020 lays down the basic principles, goals and action lines for the long-term planning of energy and climate policy. In the NECP 800 MW of wind energy capacity is foreseen until 2030, but for economic reasons the aim is to use all onshore wind potential first, and offshore wind capacity is expected to be hardly or not necessary at all to reach the renewable targets until 2030.

Latvian wind energy stakeholders hope that the funding from the Recovery and Resilience Fund will be used by the Latvian state to support the wind energy sector (offshore and onshore), for example with support for (offshore) grid infrastructure development, port development, etc. This could provide a significant boost to the wind energy sector in Latvia.

Offshore grid infrastructure plans

Augstsprieguma tīkls (AST) is the national state-owned TSO of Latvia responsible for the operation and development of the grid infrastructure. Current AST priority projects include rebuilding the existing two interconnectors between Latvia and Estonia, extension with a third connection between these two countries, grid synchronization with Europe, including through EU-initiated grid reinforcements with Poland, and modernization and development of the onshore transmission network. The latest development is the finalization of the 330 kV Kurzeme ring connecting Ventspils to Riga, completed in 2019. This grid connection makes the grid more stable and supports the potential capacity of offshore wind farms in Western Latvia.

AST is also one of the TSOs that has signed the "Baltic Offshore Grid Initiative", but no short-term actions are expected from them for the development of an offshore grid infrastructure.



	The Kurzeme ring	Transmission Line Riga CHP-2 - Riga HPP	Latvia - Estonia third interconnection	Transmission Line Valmiera (LV) – Tartu (EE)	Transmission Line Valmiera (LV) – Tsirguliina (EE)
Completion of the project	2019	2020	2021	2023	2024
Costs	127 milion EUR	14,58 milion EUR	84 milion EUR	23 milion EUR	22 milion EUR
EU co-financing	55 milion EUR	7,29 milion EUR	62%	75%	75%
Line length	207 km	13 km	176 km	49 km	49 km

Figure 9: Map and details of grid infrastructure development plans in Latvia *(Source: AST)*

Sources: 1. Study in Baltic offshore wind energy cooperation under BEMIP countries (2019)
2. Interview with Latvia Wind Energy Association (2021)
3. https://www.offshorewind.biz/2020/12/29/baltic-sea-tsos-agree-to-cooperate/

Policy and regulatory environment

Maritime spatial plan

In accordance with the EU Directive on MSP , the Latvian Government adopted in May 2019, the "Maritime Spatial Plan for Internal Waters, Territorial Waters and Exclusive Economic Zone of the Republic of Latvia“ ("MSP 2030"). The Maritime Spatial Plan 2030 which is the first long-term national marine use document, includes the priorities of use of the sea areas of Latvia. With this plan an efficient and sustainable use of marine space and reconciling the interests of different sectors were aimed.

The MSP comprises five research areas for the development of offshore wind farms, each of which can site at least one wind farm up to 800 MW. The potential electricity cable corridors are also defined in the MSP to ensure the connectivity of these wind farms with the onshore electricity grid and with the interconnections with neighboring countries.

However, despite this plan, various problems are foreseen for the specified offshore wind energy research areas, as the interaction with nature zones and radars of Ministry of Defence and NATO are not fully addressed. For example, when a site is selected by a developer in the wind farm research area E4, it is necessary to coordinate with the Ministry of Defense, as the designated area is located in the operational protection zone around military maritime surveillance equipment.

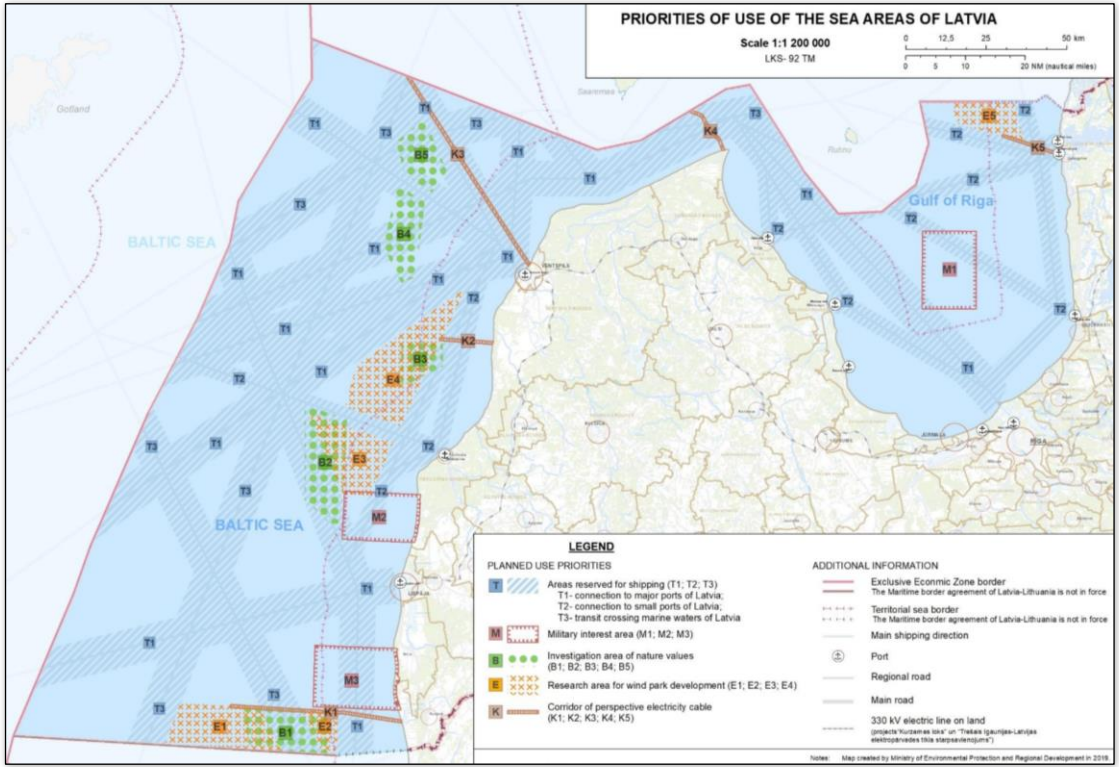


Figure 10: Map of priorities of Latvian sea areas including research areas for offshore wind park development *(Source: European MSP Platform)*

Sources: 1. Webinar – Wind energy for Latvia's future (2020)
2. Maritime Spatial Plan 2030, Latvia (2019)
3. European Maritime Spatial Plan Platform (2021)
4. Interview with Latvia Wind Energy Association (2021)

Policy and regulatory environment

Support schemes

Currently there is no support mechanism for offshore wind projects in Latvia and it is not expected any time soon since the priority is given making full use of the onshore wind energy potential.

Relevant authorities and stakeholders

The competent authority for the planning and permitting of offshore wind farms in Latvia is centralized under the stakeholders as shown in the table below.

Stakeholder	Role/responsibility
Ministry of Economics	Responsible for area determination, tendering and licensing
Ministry of Environmental Protection and Regional Development	Manages the process of spatial planning
State Construction Control Bureau	Responsible for the construction process and its legality
Augstsprieguma tīkls (AST, TSO of Latvia)	Issues connection permits

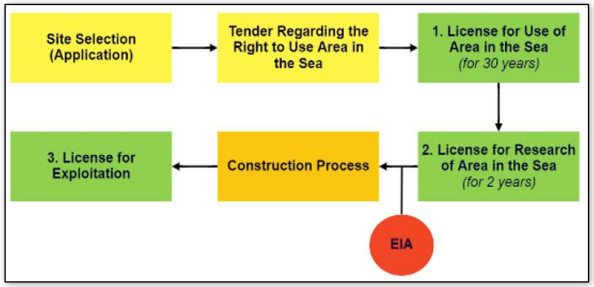


Figure 11: The licensing procedure for offshore wind park exploitation in Latvia *(Source: Ministry of Economics, 2021)*

Permitting procedure

The Marine Spatial Planning is prepared with the legislative basis of the "Spatial Development Planning Law" which is in effect since December 2011. Permitting and licensing procedures are handled according to the "Marine Environment Protection and Management Law". Under this law, the Cabinet of Ministers are responsible for the regulation of procedures for offshore wind project development area determination, tendering and licensing. In practice, this responsibility is delegated to the Ministry of Economics.

The first step for a developer in the licensing procedure, see also Figure 11, is to apply for a site which must be selected in the areas for offshore wind farm development as defined by the MSP. After the application has been accepted by the Ministry and the Cabinet Order regarding determination of the area in the has been approved, the Ministry announces the tender regarding the right to use area in the sea. The criteria for the winner are defined by the tender commission (based on Regulation No. 631). The winner of the tender receives the following licenses issued by the Ministry:

1. License for Use of Area in the Sea. This license for use of area in the sea is valid for 30 years.
2. License for Research of Area in the Sea. The license for research of area is necessary to perform an obligatory Environmental Impact Assessment (EIA) and is valid for 2 years.
3. License for Exploitation. This license is issued after the constructed wind farm is approved by the State Construction Control Bureau, expiry date is the same as for license for use of area in the sea.

While the existing regulation provides for the right to apply for the necessary licenses, the Ministry is aware that investors are exposed to a serious risk from the beginning of project development, when it is necessary to choose and invest in an offshore area, which they may not obtain as a result of the ensuing tender. Therefore, the Ministry is considering possible solutions for improving the situation.

Sources: 1. Webinar – Wind energy for Latvia's future (2020)
2. Maritime Spatial Plan 2030, Latvia (2019)
3. Study in Baltic offshore wind energy cooperation under BEMIP countries (2019)
4. Procedures and Licenses for Offshore Wind Parks in Latvia (2021)

Assessment of the policy and regulatory environment

- Conditions supporting offshore wind development
- Medium barriers for offshore wind development
- High barriers for offshore wind development

Policy/regulation		Reasoning
Sustainable Development Strategy of Latvia until 2030 (2010)		• Hierarchically, this is the highest national level long-term planning document. It lists the most important tasks of the state and society in order to achieve balanced and sustainable development; half of Latvia's total final energy consumption by 2030 will come from renewable energy sources, with wind power plants, mainly onshore, accounting for up to 15% of total electricity production. • No specific strategy for offshore wind energy is mentioned.
Latvia's National Energy and Climate Plan 2021–2030 (2020)		• According to the NECP 800 MW of wind energy capacity is foreseen until 2030. • However, it is expected that the vast majority of this capacity will be provided by onshore wind projects, as this is economically more attractive and thus the aim is to use all onshore wind potential first.
The Maritime Spatial Plan for Internal Waters, Territorial Waters a nd Exclusive Economic Zone of the Republic of Latvia (2019)		• In May 2019 the first long-term national MSP was adopted by the Latvian Government, which includes five research areas for the development of offshore wind park up to 800 MW each. • The areas for potential electricity cable corridors to connect these wind farms are also defined. • However, the interaction with nature zones and radars is not sufficiently addressed in the MSP.
Infrastructure developments		• The EU has started initiatives to connect Latvia further with the EU before 2025 via DC connections with Poland. Therefore, the onshore grid infrastructure is expected to be ready for an increase in onshore wind capacity and even a first offshore wind project. • AST is also one of the TSOs that has signed the "Baltic Offshore Grid Initiative", but no short-term initiative are expected from them, since Estonia priorities onshore wind development.
Support schemes		• Currently there is no support mechanism for offshore wind projects and it is not expected in the near future since the policy focusses on the cheaper renewable alternatives, specifically onshore wind.
Permitting procedure		• Permitting procedures for offshore wind energy projects are clear in Latvia. • The current permitting procedures forces investors to take significant risks at the very beginning of project development without any certainty about obtaining the selected wind farm area. The Ministry is aware of the situation and considering possible solutions.

Offshore wind project pipeline

The foreseen 800 MW of wind energy capacity for Latvia in their National Energy and Climate Plan does not include offshore wind specific plans. Due to the economically better position of onshore wind projects and the sufficient available land areas, it is expected that most of this capacity will be provided by onshore wind projects. Despite the fact that five offshore research areas are described in the MSP, no further developments are expected in the near future.

In September Estonia and Latvia signed an MoU for a joint offshore wind project to be developed within the Estonian Exclusive Economic Zone. This project would also form the basis for a future offshore infrastructure hub. The capacity of 1000 MW is considered by Latvia to be sufficient to meet expectations for offshore wind development in their country. However, Latvia has not taken any follow-up action so far, although Estonia appears to be doing something.

The first offshore wind project that was under development in Latvia, the "Baltic Wind Park" (200 MW), was put on hold in 2016 due to a moratorium on additional renewables capacity. The current status of this project is unknown.

Project name/Area	Status	Comment	Capacity	Operation date	Owners
"Baltic Wind Park"	On hold (2016)	-	200 MW	unknown	Baltic Wind Park
"Elwind" – Liivi Bay Estonia (Gulf of Riga)	Concept (2020)	EEZ Estonia, auction in 2026	700 - 1000 MW	Before 2030	EST/LAT state
Energy Research Area E1	Concept	-	-	After 2030	-
Energy Research Area E2	Concept	-	-	After 2030	-
Energy Research Area E3	Concept	-	-	After 2030	-
Energy Research Area E4	Concept	-	-	After 2030	-
Energy Research Area E5	Concept	-	-	After 2030	-

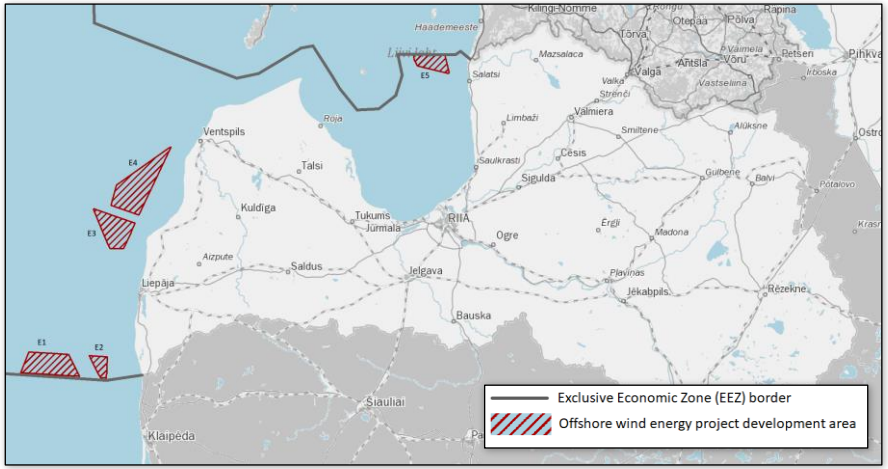


Figure 12: Latvian MSP offshore wind energy project development areas
(Source: http://mereala.hendrikson.ee/kaardirakendus-en.html)

Sources: 1. Webinar – Wind energy for Latvia's future (2020)
2. European Maritime Spatial Plan Platform (2021)
3. Interview with Latvia Wind Energy Association (2021)

PART 1: offshore wind market assessment

Lithuania

Policy and regulatory environment

Policy plans

The (former) Lithuanian government prepared in 2018 the "National Energy Independence Strategy" which defines Lithuania's long-term goals for renewable energy. The targets of this strategy for Lithuania's final electricity consumption sourced from renewables is 30% by 2020, 45% by 2030 and 80% by 2050. It is expected that wind power (mostly onshore) will cover more than half of the renewable energy sources for electricity generation in 2030 and 2050.

In the "National Energy and Climate Action Plan of the Republic of Lithuania for 2021-2030" from 2019, 700 MW of installed offshore wind capacity is predicted by 2030. To achieve this, a Government Resolution was adopted in June 2020 to build and start operation of the first 700 MW offshore wind park by 2030 with a tender planned for 2023.

Recently, the programme of the new 18th government of Lithuania was approved, indicating that steps will be taken to ensure that 30% of the electricity consumed in the country is produced by using renewable energy sources by 2025 (and respectively 50% by 2030).

Offshore grid infrastructure plans

Litgrid AB is the state-owned TSO of Lithuania, responsible for the development and operation of the national grid infrastructure. Similar to the TSOs of other Baltic States, Litgrid is currently focusing on the works of desynchronisation from the Russian power grid and synchronisation with the European power grid. In order to manage that, an increase of transmission capacity on the Harmony Link (Lithuania – Poland) with an additional 500 MW converter and internal grid upgrades are required. As it is expected to have an increase in local renewable electricity generation and to enable offshore wind energy, Litgrid also plans to expand/upgrade the existing grid. In the installed capacity projection list of Litgrid for 2030, offshore wind energy is taken into account with a capacity of 700 MW.

The parliament will discuss this spring the strategy of grid developments for offshore wind projects where they see two options: including the offshore grid into the project scope of the developer or giving this duty to Litgrid. While international developers prefer to have the grid under their scope, local companies prefer offshore grid infrastructure works to be done by Litgrid. Litgrid as responsible party has two major advantages: financially because they can apply for green deals / funds from the EU and in terms of regulation because it will be easier for them to get land use approval for the onshore cable. Litgrid recently started organizational preparatory works for the 700 MW grid connection project.

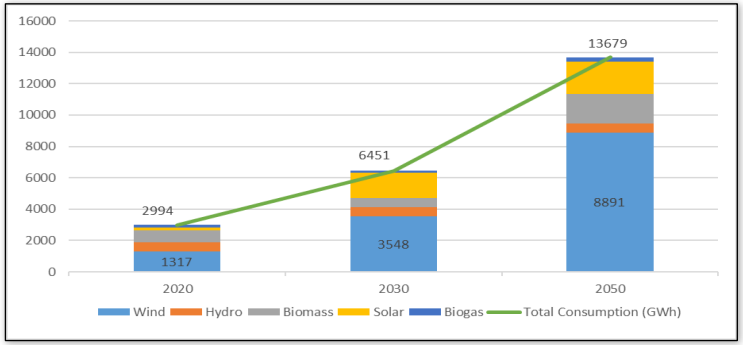


Figure 13: Forecasted RES-generated electricity *(Source: BLIX)*

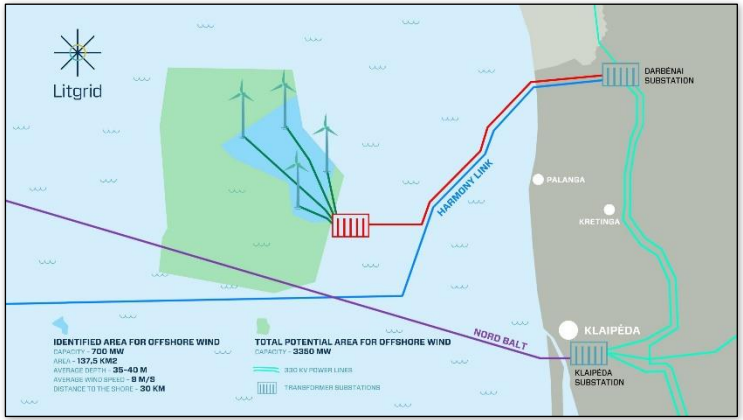


Figure 14: Current and expected offshore grid infrastructure *(Source: Litgrid)*

Sources: 1. Webinar – Offshore development in Lithuania (2020)
2. Study in Baltic offshore wind energy cooperation under BEMIP countries (2019)
3. Resolution No XIV-72 on the Programme of the Eighteenth Government of the Republic of Lithuania (2020)
4. Interviews with Ministry of Energy, Lithuania and Lithuania Wind Energy Association (2021)

Policy and regulatory environment

Maritime spatial plan

The currently available maritime spatial plan called the "Comprehensive Plan of the Republic of Lithuania" (and its section on "Maritime Areas") was adopted in 2015 and expired in 2020. A new MSP under the same name is under preparation on behalf of the Ministry of Environment and in accordance with the EU MSP Directive. The strategic section of the MSP called the "Concept of Comprehensive Plan of the territory of the Republic of Lithuania (CPRL)" was approved by the Lithuanian Parliament in June 2020. Currently, the Plan is in the finalization phase, preparing for submission to the Government. The suitable areas for offshore wind energy are expected to remain the same in the new plan.

In the former plan, there are three suitable areas for offshore wind development within the borders of the Exclusive Economic Zone of Lithuania. One of these areas is close to shore and within the territorial sea area, making it a 'red zone' in terms of radar interaction. The other two areas are marked as 'yellow zone', meaning they also interact with radars, but with additional radar support equipment it is possible to develop offshore wind energy projects in these areas. Since one of these two suitable areas is relatively far from the shore, only one area is currently being considered for the development of offshore wind projects.

In advance of the expected offshore wind permit auction in 2023, the detailed plan of the considered suitable sea area will be prepared and exact site coordinates will be available. The Lithuanian Energy Agency is taking the lead for the preparation of the detailed maritime plan for the project area.

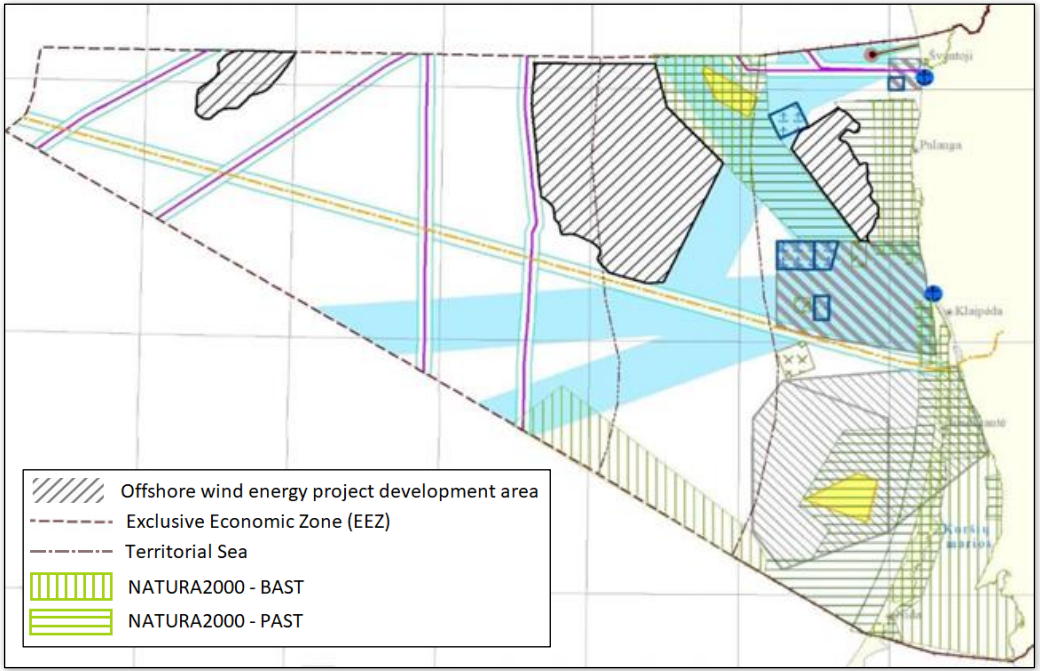


Figure 15: Map of Lithuanian sea area with determined offshore wind energy development areas
(Source: Webinar – Offshore development in Lithuania)

Sources: 1. Webinar – Offshore development in Lithuania (2020)
2. Study in Baltic offshore wind energy cooperation under BEMIP countries (2019)
3. European Maritime Spatial Plan Platform (2021)
4. Interviews with Ministry of Energy, Lithuania and Lithuania Wind Energy Association (2021)

Policy and regulatory environment

Support schemes

There is currently no support scheme specifically for offshore wind development in Lithuania. Instead, there is a general support scheme, regulated by the "Law on Renewable Energy" from 2011, for all electricity generation projects with renewable energy sources. However, there is a plan for an amendment of the "Law on Renewable Energy" under consideration in the Lithuanian Parliament from October 2020, to provide a support model specifically for offshore wind projects with a two-sided CfD model for 15 years.

Relevant authorities and stakeholders

The main stakeholders and authorities are shown in the table below.

Stakeholder	Role/responsibility
Ministry of Energy	Coordinates and assigns parties to prepare the EIA, wind and geotechnical studies.
Ministry of Environment	Authorizing of the MSP, sets the environmental requirements for the development permit and EIA, grants construction permit.
National Energy Regulatory Council	Assessment and granting of the development permit.
Litgrid AB (TSO of Lithuania)	Responsible for the onshore grid and possibly also for the future offshore grid.

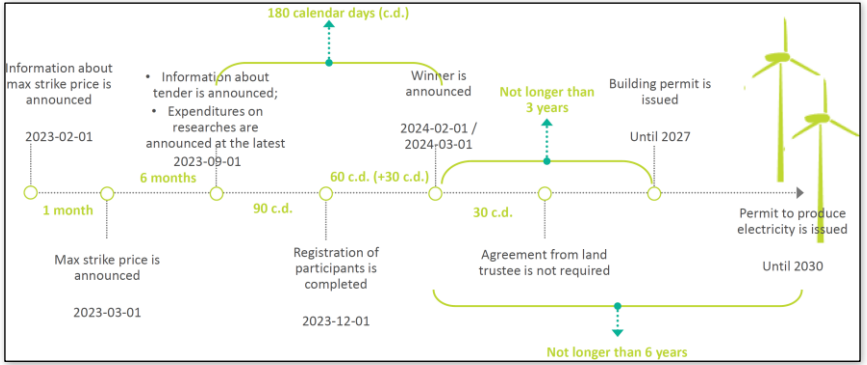


Figure 16: Timeline of the expected tender for offshore wind project *(Source: Ministry of Energy, Lithuania)*

Permitting procedure

Even though legislative ground for offshore wind development was laid in May 2011 and the Government criteria for the first offshore wind tender by January 2013, there was no legislation that allowed developers to perform seabed surveys and technically this prevented any development works for offshore wind projects until now.

Figure 16 presents the timeline of the first 700 MW offshore wind tender in Lithuania. Before the expected auction, the Ministry of Energy ensures the preparation of technical studies such as: the Strategic Environmental Assessment (SEA) (recently commissioned to UAB Ardynas), the Environmental Impact Assessment (EIA) (soon to be procured), detailed maritime plan for the area, wind energy studies and seabed surveys. After all of these necessary studies are prepared, all the interested developers need to follow the following permitting steps to develop their project for the specified area:

1. Development Permit, developers will bid in the auction for the right of the Development Permit for a period of 41 years, including a CfD subsidy contract for a period of 15 years (currently under discussion by the Parliament).
2. Construction Permit, the developer needs to apply with their own offshore wind farm design for a construction permit from The State Territory Planning and Construction Inspectorate under the Ministry of Environment.

Sources: 1. Webinar – Offshore development in Lithuania (2020)
2. Study in Baltic offshore wind energy cooperation under BEMIP countries (2019)
3. RES support schemes for off-shore wind, Ministry of Energy, Lithuania (2020)
4. Interviews with Ministry of Energy, Lithuania and Lithuania Wind Energy Association (2021)
5. https://www.offshorewind.biz/2013/02/20/poland-lithuania-estonia-potentials-of-offshore-wind-energy-in-the-baltic-sea-2/

- Conditions supporting offshore wind development
- Medium barriers for offshore wind development
- High barriers for offshore wind development

Assessment of the policy and regulatory environment

Policy/regulation		Reasoning
National Energy Independence Strategy (2018)		• Lithuania's long-term plan for localisation of energy sources, mostly by increasing the usage of renewable energy sources. • The expected share of renewable energy sources in total consumed electricity by 2030 is 45% of which 53% consists of wind energy. Most of this is expected to be generated by onshore wind farms.
National Energy and Climate Action Plan of the Republic of Lithuania for 2021-2030 (2019)		• According to this plan, which is based on the "National Energy Independence Strategy", there will be an offshore wind farm in operation by 2030 with a total capacity of 700 MW.
Programme of the 18th government of Lithuania (2021)		• The recently approved programme of the in 2020 installed 18th government of Lithuania indicates that steps will be taken to ensure that in 2025 30% of the electricity consumed is produced by renewable energy sources (and 50% by 2030).
Maritime Spatial Plan		• The former comprehensive plan was adopted in 2015 and expired in 2020, a new plan is currently being finalized. • This new Plan includes 2 less suitable smaller areas (<1 GW) and a large offshore wind development area (~3.4 GW), which is also (partly) the destination for the first offshore wind project with a planned auction in 2023. • The Ministry of Energy will ensure that the detailed plan of the area is available prior to this auction.
Infrastructure developments		• Litgrid currently gives priority to grid desynchronization with Russia and synchronization with the rest of Europe. • In the installed capacity projection list of Litgrid for 2030, 700 MW offshore wind capacity is taken into account and the first efforts for offshore grid expansion have started already. • The Parliament will discuss this spring whether the offshore grid connection will be included in the project scope of the developer or if it will be the responsibility of Litgrid. The latter is expected.
Support schemes		• There is currently no offshore wind energy specific support scheme. • There is a proposal for an amendment of the "Law on Renewable Energy" being discussed by the Lithuanian Parliament from October 2020 concerning an offshore specific support mechanism. • The suggested model is a double-sided contract for difference for 15 years.
Permitting procedure		• The permitting procedure for offshore wind projects in Lithuania are clear and straightforward, although never tested. • The development permit is valid for a period of 41 years. • The Ministry of Energy will ensure that the necessary site studies on the offshore wind farm area are ready for interested developers prior to the 2023 auction. This prevents long waiting terms for individual permitting applications.

Offshore wind project pipeline

Currently, Lithuania has only one offshore wind project in the pipeline for development. The permit and subsidy for this project with a capacity of 700 MW will be auctioned by the government in 2023. The specific coordinates of this project will lie in an area from the new MSP with a possible capacity of up to 3.4 GW. The detailed plan of the project area is expected to be available to the developers before the auction in 2023.

Project/Area	Status	Comment	Capacity	Operation date	Owners
Lithuanian Tender 1	State consent (2020), site studies commissioned by government	Auction planned for 2023	700 MW	2030	-

State	Main information	Timeline
Government's decision on capacity and location	700 MW and set location	Adopted – June 2020 Comes in effect – February 2023
Draft laws	Support model and connection to onshore grid	Adoption in Parliament – end of 2020, Comes in effect – January 2021
Studies and other actions	Spacial planning, environmental impact assessment, wind speed measurements, sea bottom survey	2020–2023
Grid development		2020–2027
Tender		September 2023
Offshore wind farms construction		2024-2029
Transmission networks completed		January 2027
Start of electricity production		2029-2030

Figure 17: Timeline for the first Lithuanian offshore wind project
(Source: RES support schemes for off-shore wind, Ministry of Energy, Lithuania)

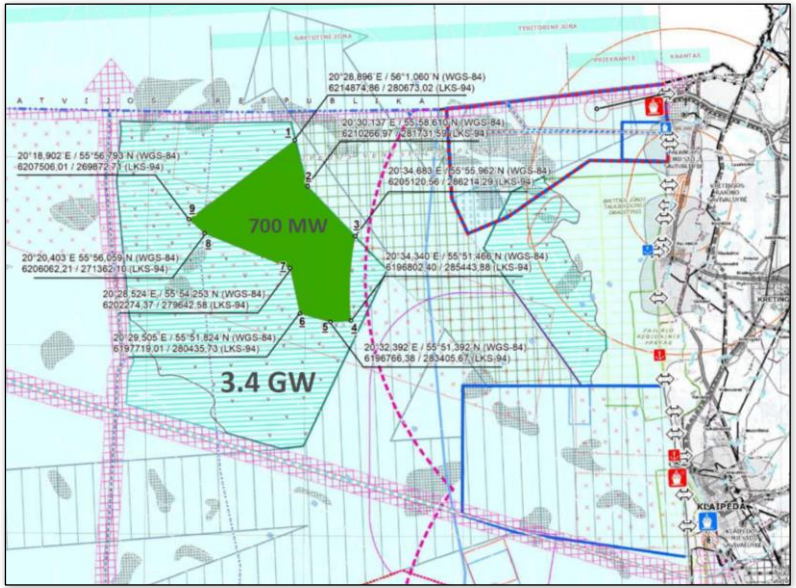


Figure 18: Proposed area for the first Lithuanian offshore wind project
(Source: RES support schemes for off-shore wind, Ministry of Energy, Lithuania)

Sources: 1. Webinar – Offshore development in Lithuania (2020)
2. RES support schemes for off-shore wind, Ministry of Energy, Lithuania (2020)

PART 2: value chain assessment

PART 2: Value chain assessment

Europe

European offshore value and supply chain outlook

Offshore wind developments

At the end of 2020, there were 162 operational offshore wind farms worldwide (116 in Europe) with a total capacity of 32.5 GW (25 GW in Europe). In 2020, a record capacity of 5.2 GW of offshore wind power was commissioned (2.9 GW in Europe) and a total of 9.9 GW of capacity is currently under construction (4.7 MW in Europe).

Despite the global Covid-19 pandemic, the offshore wind industry was able to grow in 2020. As the Levelized Cost of Energy is expected to decrease for offshore wind projects and with further technological developments (larger turbine size, advanced floating foundation types, etc.), an even stronger growth of offshore wind energy projects is expected for the future.

Wind turbine manufacturers

There are several wind turbine manufacturers active in the offshore wind energy industry, with the share of the two largest companies amounting to no less than 92% of all offshore wind turbines operating in Europe by 2020. Siemens Gamesa leads with a 68% share, which equates to a total installed capacity of 16.9 GW in 2020. The second largest supplier is Vestas with a 23.9% share and a total capacity of installed turbines until the end of 2020 of 5.7 GW. GE Renewable Energy has a significantly smaller market share of 1.4%. GE Renewable Energy did not connect any turbines in 2020, but did receive the largest wind turbine order for their Haliade-X 13 MW turbine, with installation expected to begin in 2022.

Wind turbines from Siemens Gamesa and Vestas will be the strongest candidates for upcoming projects in the region, due to their position in the industry, but also due to their proximity to production facilities in the region and easy access to the Baltic Sea from Germany and Denmark. GE could also potentially invest in gaining a market share in the offshore wind projects in the Baltic Sea area because of the already existing production facilities in the region.

Other parts of value and supply chain

As Europe is the leading region in offshore wind energy, it is able to host the most advanced solutions for the entire value and supply chain. Many European companies who have gained experience in different parts of this sector and had the opportunity to offer their solutions around the world are also taking initiatives for the projects planned to be developed in the Baltic Sea to expand their markets.

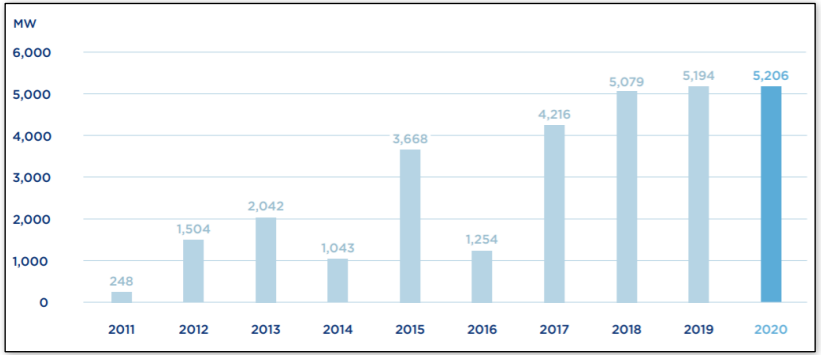


Figure 19: Annually added global offshore wind capacity
(Source: Global Offshore Wind Report 2020, WFO)

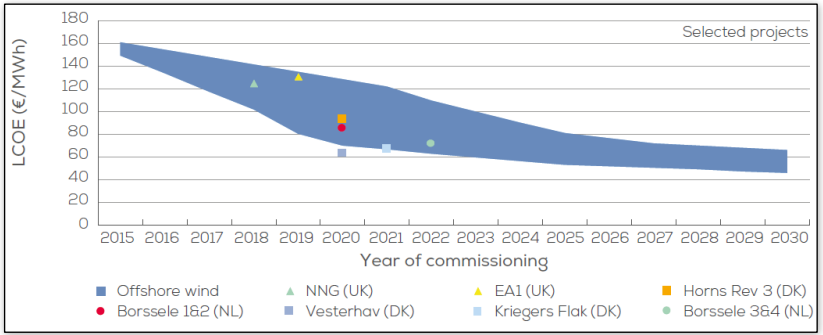


Figure 20: Offshore wind LCOE trajectory from 2015 to 2030, including estimated LCOE
(Source: BVG Associates - WindEurope)

Sources: 1. Global Offshore Wind Report 2020, WFO (2021)
2. Offshore Wind in Europe, Key trends and statistics 2020, WindEurope (2021)
3. Unleashing Europe's offshore wind potential, BVG Associates – WindEurope (2017)

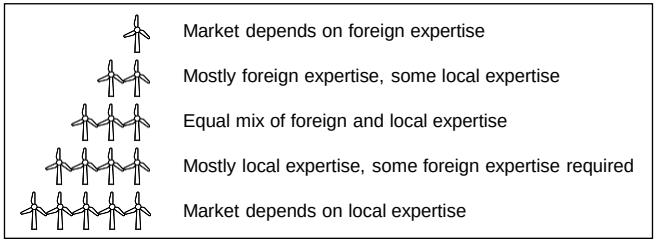
PART 2: Value chain assessment

Baltic States

Value chain analysis: Local offshore wind market players

A market analysis of the value chain and supply chain of the current local offshore wind industry in Estonia, Latvia and Lithuania has been carried out. The current market state and active local businesses for various value chain services and parts of the supply chain are shown in the table below and in the following slides. The market dependence on foreign or local expertise is assessed for each service and indicated in the last column.

There are already some large local companies active in the international offshore wind industry (such as TFKable) and some large international players with a subsidiary or production location in the Baltic States (such as BLRT Grupp). There is an equal mix of necessary foreign and local expertise for the foundation, cabling and supporting infrastructure supply chain, but for all other services and components, the lack of knowledge and experience indicates a substantial potential for international participation in the large-scale offshore wind rollout in the Baltic States.



Service	Current market state	Active local companies	Level of expertise
Project development	The Estonian offshore wind market has almost 4 GW in the pipeline up to 2030, with most of this capacity being developed by Estonian commercial or state-owned energy companies, such as Eesti Energia and Enefit Green. There is also an international party involved in the development of these parks, Van Oord, which is of great added value due to the lack of knowledge and experience among the local developers. The Latvian offshore wind market only has a joint project with Estonia ("Elwind") in the pipeline up to 2030, which will be auctioned in 2026. The Lithuanian offshore wind market has one wind farm site of 700 MW in the pipeline up to 2030, which will be tendered in 2023. Ignitis Group (LT) recently entered into a partnership with Ocean Winds in the development of offshore wind farm projects to gain experience, which will be used to develop offshore wind energy in Lithuania. Together with Ocean Winds, Ignitis Group aims to participate in the first auction for offshore wind farms in 2023. E Energy Invest (LT), who teamed up with GE in 2020 for the development of an onshore wind park, has also already shown interest in participating in this tender.	• Enefit Green (EE, LV, LT) • Eesti Energia (EE) • Neugrund (EE) • Tuuletraal OÜ (EE) • Saare Wind Energy (EE) • Utilitas (EE) • Sunly OÜ (EE) • Ignitis Group (LT) • E Energija (LT)	
Technical project design	The technical project design mostly lies with the local project developers and international technical contracting firms like COWI, Ramboll, etc.	n/a	

Sources: 1. Study in Baltic offshore wind energy cooperation under BEMIP countries (2019)
2. https://windeurope.org/about-wind/campaigns/local-impact-global-leadership/#map
3. Interviews with Estonia, Latvia and Lithuania Wind Energy Associations (2021)

Value chain analysis: Local offshore wind market players

Service	Current market state	Active local companies	Level of expertise
Consulting, permitting and due diligence	There are only a few specialised local consulting companies that are active in the Baltic offshore wind market, such as SWECO and Bureau Veritas. Because of the upcoming offshore wind energy market in the Baltic States, small and large international companies are expanding their services to the area by offering consulting, permitting and due diligence services.	• Bureau Veritas (LV) • SWECO (LT)	
Site studies	Site studies are carried commissioned by the developers and carried out by international specialised companies, such as Fugro, Horizon, Geoquip, G-tec, etc. Garant Diving (LT), subsidiary of Garant Group, is active in offshore wind and has conducted several scientific studies for international offshore wind farm development projects.	• Garant Diving (LT)	
Transport and installation	There are a few local electrical installation companies in Estonia, Latvia and Lithuania. Inikti (LT) started their first activities in the wind energy market in 2005 and has now a large portfolio of wind projects they have been involved in all over Europe with mainly installation and dismantling works, but also development and maintenance. Inikti has the ambition to become active in the offshore wind industry in the Baltic States. For the offshore installation of the wind farm (turbines, foundations, etc.) these countries still rely on international offshore installation providers, such as Subsea 7, Boskalis, Heerema, DEME, Van Oord, Jan de Nul.	• Empower AS (EE, LV) • ECC Latvija (LV) • Inikti (LT)	
Operation & maintenance	The operation and maintenance of offshore wind farms is expected to be performed mainly by the turbine manufacturers. The Baltic States have a number of companies that provide O&M services for onshore wind farms and may also be able to provide these services to offshore wind farms in the future. For example, Empower4WindIKZ, subsidiary of Empower AS, offers all kind of wind turbine maintenance services, IKZ Baltic Fibre Technology Group (LV) performs blade maintenance and repair services and Aerones (LV) offers robotic-technology based blade services such as inspection, cleaning and small repair. Gridinta (LT) is already active in the offshore wind industry and offers blade and tower maintenance, inspection and repair services.	• Empower4Wind (EE) • IKZ Baltic Fibre Technology Group (LV) • Aerones (LV) • Gridinta (LT)	
Technology R&D projects	The known technological R&D institutes in the Baltic States that specialize in offshore wind energy are the Tallinn University of Technology (EE)y, Tartu University (EE), and Klaipeda University (LT).	• Tartu University (EE) • Tallinn University of Technology (EE) • Klaipeda University (LT)	

Sources: 1. Study in Baltic offshore wind energy cooperation under BEMIP countries (2019)
2. https://windeurope.org/about-wind/campaigns/local-impact-global-leadership/#map
3. Interviews with Estonia, Latvia and Lithuania Wind Energy Associations (2021)

Supply chain analysis: Local offshore wind market players

Service	Current market state	Local companies active in the offshore wind market	Level of expertise
Wind turbine	There are manufacturing sites of ABB in Estonia, Latvia and Lithuania for the production of ABB wind generators, converters and electric drives. The small Estonian wind turbine manufacturer Eleon is currently developing their first offshore wind turbine generator with a rated power of 10 MW. Large, international companies such as Siemens (G), Vestas (D) and GE (USA) have manufacturing facilities in surrounding countries connected to the Baltic Sea so that creates an opportunity for these companies to supply the Baltic offshore wind market with blades, nacelles, towers, etc.	• Eleon (EE) • ABB (EE, LV, LT) • Diab (LT)	
Foundations	Several subsidiaries of BLRT Grupp are located in Lithuania and offer a full range of services from conceptual design to turn-key solutions and the fabrication of steel structures for the renewables sector. Estonia houses Marketex, part of the internationally renowned BLRT Grupp (G), which delivers turnkey installations for the wind industry. Also, international players like EEW group (G) and the Polish St3 Offshore (P) and GSG Towers (P) with manufacturing locations of different types of foundation structures in countries with direct access to the Baltic Sea can easily supply the future Baltic offshore wind market.	• BLRT Grupp (LT) • Marketex Offshore Constructions – BLRT Grupp (EE) • Nordecon Betoon (EE)	
Cabling	The third largest electrical cable manufacturer in Europe, TFKable manufactures high and medium voltage conduits and cables and controlling/optical cables for offshore wind industry in Kaunas Lithuania. The Prysmian Group, which is one of the world leaders in submarine connections for offshore wind farms, has a manufacturing site in Estonia. Prysmian provides inter-array cables and export cables (HVAC and HVDC). Other large international cabling companies, such as the German NKT Group GmbH and Norwegian Nexans S.A., are located with their production centers in surrounding countries with direct access to the Baltic Sea.	• TFKable (LT) • Prysmian Group (EE)	

Sources: 1. Study in Baltic offshore wind energy cooperation under BEMIP countries (2019)
2. https://windeurope.org/about-wind/campaigns/local-impact-global-leadership/#map
3. Interviews with Estonia, Latvia and Lithuania Wind Energy Associations (2021)
4. Supply Chain Analysis of the Offshore Wind Energy Transmission Industry, Overview for the Baltic Sea Region, Baltic InteGrid (2018)

Supply chain analysis: Local offshore wind market players

Service	Current market state	Local companies active in the offshore wind market	Level of expertise
Substation	There are no local companies active in this area of the supply chain. The globally largest transformer manufacturer, ABB, has a headquarter in Latvia and production sites in Finland and Sweden with access to the Baltic Sea. Siemens is also already active in the conventional Latvian energy market and in the Estonian energy market with grid connection projects for Elering TSO and can supply components for the distribution and transmission of offshore wind energy from the German production sites.	• ABB (EE, LV, LT)	
Supportive infrastructure (vessels etc.)	In Estonia there are three large industrial vessel providers, all of them expanding their range of vessels for servicing the growing offshore wind energy industry. Marketex (BLRT Grupp) from Estonia recently built four new 19.5 metres long high capacity and flexible Wind farm Support Vessels (WSV). The transportation vessel portfolio of Baltic Workboats mainly includes medium sized crew transfer vessels and small workboats and pilot vessels. The icebreakers of TS Shipping OÜ are able to serve as offshore support vessel and offer accommodation, subsea construction and walk-to-work. Lithuanian Western Baltija Shipbuilding, part of the BLRT Grupp, produces a wide variety of ships and hulls for different types of ships such as installation ships. They also manufacture additional equipment structures for the offshore wind industry. For example, they constructed the transformer platform for the Bard Offshore Wind Farm.	• Marketex (BLRT Grupp) (EE) • Baltic Workboats (EE) • TS Shipping OÜ (EE) • Western Baltija Shipbuilding (BLRT Grupp) (LT) • KLASCO (LT)	

Sources: 1. Study in Baltic offshore wind energy cooperation under BEMIP countries (2019)
2. https://windeurope.org/about-wind/campaigns/local-impact-global-leadership/#map
3. Interviews with Estonia, Latvia and Lithuania Wind Energy Associations (2021)
4. Supply Chain Analysis of the Offshore Wind Energy Transmission Industry, Overview for the Baltic Sea Region, Baltic InteGrid (2018)

Port analysis

- Many of the Estonian, Latvian and Lithuanian seaports have the capacity to become hubs for offshore wind farm maintenance as these operations do not require specialized port infrastructure and a nearby port is preferred.
- Currently, there are no ports in the Baltic States that are ready for offshore wind installation and construction support. A new port infrastructure is required to accommodate the large vessels used in the installation and maintenance of major wind farm components.
- Based on an evaluation of Baltic Sea ports carried out by Baltic InteGrid to determine their suitability as potential future hubs for activities related to the construction, installation and operation & maintenance of offshore wind facilities, 14 opportunity ports were selected from a list of 306 Baltic Sea ports. These ports included Muuga (EE), Riga (LV), Liepaja (LV) and Klaipėda (LT). The ports were assessed based on water depth, the ability to accommodate vessels used in the offshore wind transmission market, proximity to current and future offshore wind projects, accessibility, availability, and synergies with existing supply chains.
- Also, the Latvian ports of Riga, Liepaja and Ventspils ports have already done some research on optimizing their infrastructure and announced their willingness to make investments to become key port service providers for future offshore wind energy projects in the Baltic Sea. In fact, the port of Klaipėda in Lithuania has already invested in the port infrastructure to ensure the safe handling of ships up to 300 meters in length, and also the Paldiski South Harbour – Port of Talinn in Estonia is, according to sources, able of being the base port for assembly and construction work of offshore wind projects.
- However, the entire Baltic Sea region already has a large capacity of port infrastructure (mainly in Denmark and Germany) to meet a growth in demand for the manufacture and installation of the main elements of an offshore wind farm. The main obstacles to the development of the necessary port infrastructure in Estonia, Latvia and Lithuania are competition from within and outside the region, relatively low local demand and competition for space and quays from the port areas themselves. On the other hand, significant savings in labor costs in this region present a distinct advantage.
- German ports are thanks to their advanced port infrastructures and their strong connections to continental European industries most suited and most likely to develop into (or remain) hubs to service the Baltic offshore wind sector. Ports in Estonia, Latvia and Lithuania will have to compete against the experience and track record of German ports once their own offshore wind projects are ready to be developed.

Figure 21: Baltic States ports with the potential and/or interest to service the offshore wind industry *(Source: BLIX)*

Sources: 1. Towards a meshed offshore grid in the Baltic Sea, Baltic InteGrid (2019)
2. Interviews with Estonia, Latvia and Lithuania Wind Energy Associations (2021)
3. Wind in our Sails 2011, European Wind Energy Association (2011)

PART 2: Value chain assessment

Benchmark of Dutch, Danish and German market players

Opportunities for foreign players in the offshore value chain

The opportunities for foreign players in the offshore value and supply chain in the Baltic States have been assessed based on the demand and opportunities for a specific service or product supply and the available local, Dutch, Danish and German expertise. The resulting market entry opportunities of Dutch players in the offshore wind energy market of Estonia, Latvia and Lithuania are shown in the table below and in the following slides.

- Immediate opportunities for market entry by Dutch players
- Some, or delayed opportunities for market entry by Dutch companies
- Limited or no opportunities due to sufficient expertise or competition

Service	Market entry	Demand / opportunity in Baltic States	Opportunities for Dutch companies	Expected competition from Denmark and Germany
Project development		There are offshore wind projects in the pipeline with almost 5 GW of capacity and local developers have already shown interest in the development of these projects. It is expected that most of these parties will team up with international players because of their lack of necessary know-how and experience with offshore wind projects.	Dutch companies like Shell and Eneco may become active in the offshore wind development industry in the Baltic States, although the competition is expected to be strong. Van Oord is already involved as co-developer of one of the Estonian projects.	There are multiple offshore wind developer companies from Denmark and Germany already active in the Baltic Sea offshore wind business such as Ørsted, RWE and EnBW with a strong competitive position to expand their business to the Baltic States.
Technical project design		There are currently no local companies that are able to perform works in this area, so this offers many opportunities for foreign companies.	Despite the lack of local market players in the Baltic States, the opportunities for the Dutch companies that offer concept and detailed design services (e.g. Deltares) or specialised electrical and structural design services (KCI, IV-Groep) are small given the international competition.	Technical project design is in Denmark and Germany done by project developers and various specialised companies like COWI, Ramboll and JBO. These companies provide end-to-end solutions. Their competitive position is expected to be high.
Consulting, permitting and due diligence		Besides the local offices of a few international companies like Bureau Veritas from the USA and SWECO from Sweden, there are no local companies that can offer end-to-end consultancy services for offshore wind projects. Therefore, there are opportunities for international players.	As a country with various offshore wind projects operational and under development, the Netherlands host numerous consultancy companies for offshore wind energy (e.g. Arcadis, Royal Haskoning DHV, BLIX Consultancy, Pondera, IX wind) that are already internationally active and see opportunities to expand their business to the Baltic States.	For the consulting, permitting and due diligence services strong competition is expected from large offshore wind specialised consultancies like COWI and Searenergy from Germany and K2 Management, Ramboll and Niras from Denmark.

Opportunities for foreign players in the offshore value chain

Service	Market entry	Demand / opportunity in Baltic States	Opportunities for Dutch companies	Expected competition from Denmark and Germany
Site studies		Other than Garant Diving which is based in Lithuania and active in general different offshore sectors, there are no local companies active for offshore site study services. The Baltic States are expeced to rely on international expertise for these services.	Dutch companies offering wind resource assessments, geotechnical campaigns, geotechnical desk studies and other site studies (such as Boskalis subsidiary Horizon and smaller companies like Pondera) have great opportunites due to the lack of local expertise.	Some competition is expected in this service area from companies such as the Danish Frands-Haahr and DEWI from Germany for wind studies.
Transport and installation		There are a few local electrical installation companies in the Baltic States. For the offshore installation of the wind farm (turbines, foundations, etc.) these countries will rely on international offshore installation providers from UK, BE, NL, DK.	The large internationally operating Dutch companies such as Van Oord, Boskalis Westminster, Heerema Marine Contractors, Jumbo Maritime and Biglift/Spliethoff have a strong competitive position due to their local presence in the transport and installation market of the Baltic Sea, the lack of local players in these countries and limited competition from Denmark and Germany.	Only little competition is expected from Denmark and Germany given that these countries also rely on transport and installation services from Dutch, UK or Belgian companies. Cadeler from Denmark and SAL from Germany are active in the offshore wind energy business, but not as main contractor in the Baltic Sea.
Operation & maintenance		The O&M of offshore wind farms is generally performed by the (foreign) turbine manufacturers. The Baltic States have a number of local companies that provide these services for onshore wind farms and may also be able to provide these services to offshore wind farms in the future.	The O&M contracts are expected to be rewarded to the wind turbine suppliers, supplemented by some services from local or neighbouring specialized parties. There are therefore only limited or no opportunities for Dutch companies. In subsea maintenance there may be some opportunities for Dutch specialized companies.	It is likely that the wind turbine manufacturers from Denmark and Germany will also contract the O&M services for their products. Companies such as Ziton, Maersk supply, DBB and Deutsche Wind Technik may be able to provide additional services.
Technology R&D projects		The R&D projects for offshore wind in the Baltic States are currently being carried out by the universities. Since the offshore wind market is still at the forefront of development, there is probably a great demand for collaboration opportunities with international knowledge institutes and research programmes.	Innovation and research in the Dutch offshore wind industry is supported and initiated by the government through the Top Sector Energy at Sea (TKI Wind op Zee) and commercial initiatives such as GROW, and carried out by various knowledge institutes, like TNO-ECN. Cooperation from the Baltic States with these institutes will probably be desirable.	Denmark and German have some internationally renowned research institutes like the Danish DTU, and IKEM and Fraunhofer from Germany, that will compete with the Dutch institutes.

Opportunities for foreign players in the offshore supply chain

Service	Market entry	Demand / opportunity in Baltic States	Opportunities for Dutch companies	Expected competition from Denmark and Germany
Wind turbine		There are manufacturing sites of ABB in all three Baltic States but given strong competitive position of the Danish and German wind turbine suppliers international competition is expected.	Despite the lack of local market players, there are no Dutch opportunities as there are no Dutch offshore wind turbine manufacturers.	Siemens from Germany and Vestas from Denmark are expected to play a dominant role in the Baltic wind turbine supply chain, as they do all over the world.
Foundations		The opportunities for international manufacturers of offshore wind turbine foundations seems limited with internationally renowned BLRT Grupp manufacturing sites in Estonia and Lithuania.	The opportunities for the internationally operating Dutch companies such as SIF Offshore Foundations seem promising, but will face strong competition from local players and companies from countries directly connected to the Baltic Sea.	There are both Danish and German companies active in the Baltic Sea offshore wind industry, able to compete with Dutch companies, e.g. EEW, Steelwind, Bladt.
Cabling		With the presence of production locations of major cable suppliers such as TFKable and Prysmian Group in the Baltic States, the demand for services from parties from abroad is expected to be limited.	Dutch companies like TKF may be able to provide cabling for offshore wind farm development in the Baltic States, but strong competition from the local companies and Denmark and Germany is expected.	Denmark and especially Germany are strong competitors who also have direct access to the Baltic Sea; NKT Group is the main supplier of export cables and cabling for wind farms in Europe.
Substation		There are no local companies active in this area of the supply chain so there are large opportunities for international substation producers.	There are great opportunities for the Dutch manufacturing companies of offshore substations, such as Heerema Fabrication Group and HSM, as they can face competition from Denmark and Germany.	Competition is expected from the Danish companies Bladt and Semco, and no competition from large German companies.
Supportive infrastructure (vessels etc.)		In the Baltic States there are a number of large industrial vessel providers (such as two subsidiaries of BLRT Grupp), all of them expanding their range of vessels for servicing the growing offshore wind energy industry. There is however always room for strong international competition.	The Dutch offshore shipping industry is strong with some of the largest internationally operating companies in the world such as Damen Shipyards Gorinchem, Royal IHC, Huisman, etc. They could supply installation ships to the Baltic states.	Competition from Denmark and Germany is limited due to the withdrawal of major players like Nordseewerke, NordicYards and Weserwind. Existing shipyards are active in different segments (e.g. Blohm&Voss, Thyssenkrup). For equipment German companies like Liebherr and Acteon are very active in offshore wind.

PART 3: SWOT analysis and plan of approach

PART 3: SWOT analysis and plan of approach

SWOT analysis

SWOT analysis of Dutch offshore expertise in the offshore wind development market of the Baltic States

Strengths

- Dutch offshore wind industry is mature with broad experience throughout the value chain, especially strong in offshore Installation and transport, including Dutch port and logistics specialists, site studies, R&D, O&M.
- Strong Dutch supply chain in offshore substations, foundations and supporting infrastructure.
- Good position of some large Dutch players such as Van Oord as co-developer in Estonia.
- Good representation of the Dutch industry through the Dutch government and the Netherlands Wind Energy Association (NWEA).

Weaknesses

- The Netherlands does not have direct access to the Baltic Sea, Denmark and Germany do, so the opportunities for the Dutch construction ports are also limited.
- There are no Dutch manufacturing sites of major components in the Baltic States.
- O&M is normally in the hands of the wind turbine providers (usually Danish or German) and local parties.
- There are only a few large Dutch offshore developers and investors who are active internationally.

Opportunities

- Emerging market with offshore wind development areas allocated in the new MSPs and 4-6 GW in the project pipeline through 2030. First project tender is expected in 2023.
- Lithuania has a target of 700 MW offshore wind energy by 2030 in its National Energy and Climate Plan. Estonia expects an ambitious NECP in 2022 (including a roadmap for offshore wind). These concrete goals and timelines enable a stable investment climate.
- The Baltic Sea has favourable sea conditions for offshore wind development, resulting in relatively low LCoE values and lower risks for developers.
- The overall offshore wind potential in the Baltic Sea and the Baltic States' consent to regional cooperation (also for the development of an offshore grid) increase investment opportunities.
- Limited local knowledge and experience across the entire value chain of offshore wind development offers opportunities to international players.
- There are no trade barriers and regulations are shaped by the same EU law.
- EU initiatives to synchronize the Baltic States with the rest of the European grid through onshore grid reinforcements also enhance the development of offshore wind energy.
- The operating permit for an offshore wind farm is valid in Estonia and Lithuania for 50 resp. 41 years, which leaves room for delays or for a long operational lifetime of the wind farm.
- Lithuania expects a 15-year cfd-based scheme in the near future.

Threats

- Latvia does not have a specific target and timeline for offshore wind energy in its NECP.
- The development of offshore grid infrastructure is one of the greatest challenges in enabling offshore wind energy in the Baltic states this decade. Despite various cooperation initiatives, in general the TSOs of the Baltic States are currently prioritizing grid (de)synchronization with Russia/the rest of Europe, and other regional TSOs are less willing to act now.
- There is a not-in-my-backyard mentality, also because of the visual impact. This is especially true in the south of Estonian waters where the sea belongs to Estonia and the air to Latvia.
- The reliance on NATO radar in the Baltic States is causing wind turbine height restrictions and this issue is not fully resolved for allocated wind development areas in new MSPs.
- The willingness to act now or later, especially in Latvia as they prioritize onshore wind.
- The Baltic states have less money available for large investments, they rely on EU measures, investment banks, etc.
- Competition is expected from the local market players, which are already active or have the ambition to become active in the offshore wind industry.
- Fierce competition from Denmark and Germany, especially in project development, technical project design and in the wind turbine and cabling supply chain.
- Currently there are no specific support scheme for offshore wind energy in the Baltic States.

PART 3: SWOT analysis and plan of approach

Plan of approach (recommendations)

Recommendations for a plan of approach

Active engagement of the Dutch Embassies in the Baltic States offshore debate

- Offer bilateral policy support/ best practice sharing to the relevant Baltic States Ministries of Climate, Ministries of Maritime Affairs and regional authorities and TSOs, both for the domestic market and regional cooperation, and especially building on the North Sea Grid initiative.
- Run a series of events dedicated to offshore wind developments in the Baltic States with Estonian, Latvian, Lithuanian and Dutch experts, with a focus on Dutch small and medium-sized companies.

Promotion of the Baltic States offshore discussion in the Netherlands

- Organize trade missions & policy debates for policy/regulation/regional development practice sharing.
- Organize Baltic States-focus events with support of NWEA, Baltic States Wind Energy Associations and the Baltic States Embassies to discuss offshore wind developments in the Baltic States at key Dutch wind events.
- Invite the various Baltic developers (such as the Estonian Eesti Energia and Saare Wind Energy) to dedicated study tours and business mixers in the Netherlands.
- Promotion of the Baltic developers and Baltic TSOs efforts in project developments in the Netherlands (support in finding partners, investors, financers, contractors and consultants), depending on their needs.

Promotion of Dutch companies in the Baltic States

- Engage with the three Baltic States wind energy associations, promoting offshore wind to assure:
  - Presence of a Dutch Pavilion in key offshore/wind and energy-related Baltic States conferences, including Tier 2 & 3 (SME) suppliers.
  - Matchmaking one on one / supply chain meetings in cooperation with networks such as Northern Netherlands Offshore Wind (NNOW) and AYOP with local Baltic States networks.
  - Dutch companies speaking at key offshore events in the Baltic States & Roadshows in the Baltic States with a presentation of the Netherlands sector.
  - Organize site visits to Dutch offshore sites and harbors for a variety of Baltic States stakeholders: regional-and state authorities, the three Baltic States TSOs, local developers and other stakeholders.

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About BLIX Consultancy

BLIX is an independent consultancy company in onshore and offshore wind energy with offices in the Netherlands, Taiwan and South Korea. It is our mission to accelerate the energy transition with enthusiastic and excellent teams in order to lower the cost of wind energy and optimise revenues. Our consultants have been involved in the offshore wind energy sector since the start of the industry and worked in different phases of wind projects in several countries in Europe, the USA and Asia.
Services of BLIX include interim-management, project and strategic advice in all phases of a wind energy project: feasibility, development, engineering and contracting, construction, and operation, maintenance, repowering and decommissioning.

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