Application for superficies licence for encumbering public water body with wind power plant

Hereby we submit an application for a superficies licence for the establishment of a wind power plant in the territorial sea of the western coast of Saaremaa. The application has been drawn based on the requirements provided for in the Water Act (§ 22) and Electricity Market Act (§ 92 1 lg 2).

General information

Saare Wind Energy OÜ (hereinafter also as SWE OÜ) is planning the development of an offshore wind farm in the territorial sea of the western coast of Saaremaa. The location of the offshore wind farm is generally in the preferred region for the establishment of wind farms set out in the national spatial plan of Estonia 2030+. The existing nature reserves, fairways, sufficient distance from the coast etc have also been taken into account. The depth of the sea in that area is approximately 20-35 metres. General overview of the planned offshore wind farm has been given on figure 1 in annex 1.

The planned capacity of the wind farm is 600 MW and according to the initial production calculations (confidential in details) the total production volume is approximately 2.8 TWh per year.

In the presently drawn up solution the plan is to use 100 Siemens SWT-6.0-154 (http://www.energy.siemens.com/hq/en/renewable-energy/wind-power/platforms/d6-platform/) wind turbines, each with the power of 6 MW.

1 Amendments to the Water Act as of 1.07.2015 entered into force after submission of the application for superficies licence and therefore the proceeding of the superficies licence has been transferred to Technical Regulatory Authority and some of the aspects of requirements for the superficies licence application have changed. This update includes the necessary corrections.

2 Hereinafter in this application the planned wind power plant encumbering a public water body has also been referred to as an offshore wind farm.
The developer has entered into a cooperation contract with Siemens Wind Power A/S (Denmark) but due to the confidentiality agreement the specific content of the agreement cannot be disclosed in the present document.

Connection with the Estonian transmission network takes place according to the technical requirements issued by Elering AS to SWE OÜ in Lihula – Sindi – Kilingi-Nõmme area either in Sindi or Lihula substation. A solution including the submarine power cable and mainland electricity transmission system shall be erected from the offshore wind farm to the connection point, which shall be specified and supplemented with additional works separately from this application for superficies licence (including spatial plans on mainland).

In terms of connection of the offshore wind farm, cooperation possibilities with a potential additional electricity connection between Estonia and Latvia shall be analysed.

Taking into account the time spent on official procedures (incl procedure of the superficies licence and the EIA being part thereof with studies), the construction period and launch phase, the forecast time of commissioning of the wind power plant and connection with network is 2022.

The cost of the planned wind power plant (including the connection fees and erection of submarine power cables) according to the calculations made within the business plan is in the scale of 1.7 billion euros. It is a large-scale investment object and its development includes the involvement of additional capital and the organisation’s growth in stages according to the development stages of the project.

According to the financial calculations the investments cannot only be covered with equity and loans, therefore the development of the offshore wind farm project also accounts for participation in the flexible mechanisms of Kyoto protocol of the UN climate convention, joint implementation and emission trading and possibility of selling the emission reduction units as a result of the project. Depending on the developments of quota trade the sale of millions of quotas on the international market provides a significant addition for investments.

According to the Electricity Market Act (§ 92) a superficies licence to build a wind power plant on a public water body may only be granted to an electricity undertaking within the meaning of the Electricity Market Act or to an undertaking which belongs to the same group with an electricity undertaking within the meaning of section 2(3) of the Competition Act. SWE OÜ is presently an electricity undertaking (producer and seller) producing electricity with solar panels in Jüri, Harju County and selling it to other companies. The share capital of SWE OÜ is more than the 31 950 € required by law.

By the time of issue of the superficies licence for the developed project (i.e the requirement of the Electricity Market Act) SWE OÜ shall be transformed into a company corresponding to the scale of the project through the involvement of additional energy companies, cooperation partners and investors.

In this stage many experts of the field and professionals have been engaged, e.g Hendrikson & Ko OÜ who has big experiences in the area of environment management and sea planning in Estonia has also participated as a consultant in the preparation of this application.

According to the calculations of the business plan, the wind farm is not economically profitable if the developed project did not participate in Kyoto flexible mechanisms and it would not be possible to sell the emission reduction units at the international greenhouse gases emissions trading.

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3 EIA – environmental impact assessment
The project does not put a price pressure on Estonian electricity consumers through the increase of renewable energy fee because the annual total amount of the fee is limited.

**Purpose of use of the structure**

Above all, erection of an offshore wind farm is an important step in the gradual transfer to renewable energy sources in the production of electricity. Taking into account the objectives established by the EU for 2030, the emission of greenhouse gases must be decreased by 40% compared to the 1990s, production of electricity with renewable sources must be taken to 27% and in a longer-run reach a carbon-free economy, the planned wind farm contributes significantly to the achievement of the objectives. Considering the annual electricity production of 2 800 GWh the emission of nearly 2.5 million tons of CO2 in the atmosphere is avoided. The planned electricity production would make 21% of Estonia’s annual electricity production for 2014 (13 274 GWh).

The purpose of using the offshore wind farm is the production of electricity and transfer thereof to the transmission network. The work of the wind power plant is planned as continuous work during the entire operation period (2 x 20-25 years) and the production volume thereof mainly depends on the offshore wind speed and the service quality of wind turbines.

**Maximum height and depth of the structure and other significant technical data**

The offshore wind farm is composed of wind turbines, power cables connected therefrom to the offshore substation, offshore substation and electricity transmission system to the mainland connection point (transmission network’s substation).

**Wind turbines.** According to the present solution the plan is to use Siemens SWT-6.0-154 (http://www.energy.siemens.com/hq/en/renewable-energy/wind-power/platforms/d6-platform/) wind turbines.

Some of the most important technical data of the wind turbines are as follows:

- **power** 6 MW;
- **rotor’s diameter** 154 m;
- **height of the tower to be specified but approx.** 102 m;
- **suitable wind speed for production of electricity** 3-25 m/s;
- **weight of gondola and blades** 360 tons.

Therefore the maximum height of the structures from ground is 180 metres from sea level.
In general, one of the three principal foundation types shown on the following drawing are used for the positioning of wind turbines (Diagram 1), of which the first and second one are most common.

Above all, the specific type of wind turbine foundation depends on the seabed geology. In case of hard sediments (basement rocks, limestone etc), ramming a pile foundation in the ground may not be possible. In case of soft sediments (soft clay, sea mud etc) the concrete foundation may sink into sediments with decreased controllability (slanted). The depth of dredging a pile into the ground depends on the geological situation and may be up to 15-20 metres in seabed sediments.

Taking into account the potential ice conditions of the Baltic Sea, the solution used in the offshore wind farm according to the present prerequisites is the gravity foundation. Gravity foundation is positioned on seabed without dredging. It may be necessary to remove soft sediments to the depth of up to few metres (mud etc) and to level the seabed (including rocks). Therefore the depth of gravity foundation is up to 3 metres in seabed sediments.

The depth of installing the wind turbines is 20-35 metres. Therefore if the pile foundation or tripod foundation with piles is used, the depth of the structure from the surface to the bottom of the sea is 20-35 metres and additionally up to 20 metres in seabed sediments. The maximum total depth of the structure measured from the surface of the sea is up to 55 metres.

In case of the gravity foundation the relevant maximum depth is 38 metres from the surface of the sea (up to 35 metres water layer + 3 metres substratum).

The surface area of each foundation is up to 500 m².

According to the present knowledge the seabed is mainly sandy and rocky.
In addition to the wind turbines, a substation shall also be established in the offshore wind farm and an internal submarine power cable system shall be erected from the wind turbines to the substation. A power cable is guided from every wind turbine for the transmission of produced electricity. These cables shall be aggregated/joined and directed to the offshore substation of the wind farm. In the so-called electricity “collection” system of wind farm, the voltage applied is up to 33 kilovolts (kV). These cables are installed in the seabed or buried relatively shallow in the seabed surface (up to 1 metre deep).

**Offshore substation.** The substation established in the offshore wind farm is a platform based on an analogous foundation as the wind turbines and on which the substation is located where the electricity produced in wind turbines and collected with the internal cables of the wind farm is raised to a higher voltage (presumably 110-150 kV) and the transmission system begins here (offshore cable + mainland cables or overhead lines) up to the connection point located on mainland substation (e.g Sindi).

A solution including the submarine power cable from the wind farm to the connection point and the mainland transmission system shall be established and which shall be specified and supplemented with additional works separate from this superficies licence application (including mainland spatial plans).
Electricity transmission on mainland shall be solved with other relevant plans and projects and these are not part of the present application.
Submarine power cable has been planned from the offshore wind farm in the direction of Saaremaa but the exact location thereof shall be specified in the subsequent process based on the mainland solution, conditions to be specified in the sea (incl. EIA) and other circumstances.

In terms of the connection of the offshore wind park, cooperation possibilities regarding a potential additional electricity connection between Estonia and Latvia shall be analysed.

Presently, the initial conceptual solution of the transmission system has been drawn as well as the spatial location thereof, see figure 2 in annex 1. In terms of the connection of the offshore wind park, cooperation possibilities regarding a potential additional electricity connection between Estonia and Latvia shall be analysed, however this solution has not been added to this document in detail.

Upon installation of the transmission system it has been considered that it would be safe and could be implemented technically, takes into account nature protection restrictions (passes through protected areas and the valuable parts thereof as little as possible), socioeconomic interests (e.g. fisheries, land use) and would be economically expedient.

The length of the transmission system from the substation located in the offshore wind farm to the transmission network’s transmission line is 186 kilometres (see figure 2). The mainland part thereof is 33 kilometres long and the part in sea i.e submarine power cable is 153 kilometres long.

Regardless of the large transmission capacity (600 MW) the diameter of the submarine power cable is in the scale of a couple dozen centimetres (we assume up to 30 cm). Therefore the area of seabed directly used by submarine power cable is 45 900 square metres.
The submarine power cable is installed with the help of specific cable installation ships. The cable can also be ploughed into seabed with a plough-like device which firstly opens a furrow in the seabed, installs the cable and the same device also closes the furrow thereafter. It is also possible to create a dredge in the seabed, install the cable from another ship and cover the cable with the seabed surface as the third work operation. The specific work technology shall be chosen taking into account the circumstances of the final utility line and the technical capacity of cable installation companies.

Upon installing the cable the width of the work corridor extends from a couple of metres up to a couple dozen metres. In this stage the assumed width of the work corridor is approximately 30 metres. In this case the construction area of the submarine power cable is 4 590 000 square metres i.e. 4.6 km².

According to Regulation No 19 by the Minister of Economic Affairs and Communications of 2007 Extent of protected zone of an electrical installation and operating procedure in protected zone, the protected zone of a water power cable is 100 metres on both sides of the cable i.e a corridor with the width of ca 200 metres. Therefore, the area of the protected zone is 30.6 million square metres i.e 30.6 km².
The area under construction of the water power cable depends on the choice of technology specified in the subsequent development of the project, the specific choice of the utility line and the opinion of the decision-maker on how the area under construction is specified (cable width, width of the construction works corridor or width of protected zone).
Coordinates of the encumbered area of public water body and size of the encumbered area in square metres and the number of structures on the encumbered area and area under construction of the structure

The offshore wind farm is planned at the distance of 10-27 km from the western coast of Saaremaa. The maximum area encumbered with the offshore wind park superficies licence is 154.4 million m² (154.4 km²) and the coordinates of most important extreme points are:

1) 21°28,646´ E 58° 9,466´ N
2) 21°46,115´ E 58°11,080´ N
3) 21°53,362´ E 58° 6,386´ N
4) 21°30,178´ E 58° 5,669´ N

100 wind turbines are planned in the offshore wind farm. The specific location thereof shall be determined in the subsequent course of superficies licence procedure taking into account the conditions of different participants in proceeding and conditions specified in the course of environmental impact assessment and technical-economic circumstances also specified in the subsequent process.

In the optimal solution of the offshore wind farm the wind turbines with the planned size are located at the distance of approx. 800-1100 metres from each other. Therefore the sea territory encompassed by 100 wind turbines together with the area between turbines is in the scale of 100 km² (100 million m²).

The foundation of each wind turbine is in the scale of up to 500 m². Therefore the seabed area of 100 wind turbines is approx. 50 000 m². If we consider the projection of the maximum reach
(diameter 154 m) of the wind generator’s blades/rotor on ground/sea as the construction area, the area of one wind turbine is approx. 19 000 m² and the area of 100 wind turbines is 1 900 000 m² i.e. 1.9 km².

One 1 substation shall be erected in the offshore wind farm which is a platform based on an analogous foundation as the wind turbine and the area of such structure is in the scale of 500 m².

The length of the electricity transmission system from the substation of the wind farm to the transmission network’s transmission line is 186 km, -of which 153 km- is submarine power cable. The area of seabed directly used by the submarine power cable is 45 900 m². -Taking into account also the corridor of construction works among the area under construction and encumbered area (width up to 30 metres) the area is 4 590 000 m² (4.6 km²) and if we also account for the protected zone for the submarine power cable among the area under construction and encumbered area (width 200 metres), the area is 30.6 million m² (30.6 km²).

Depending on the spatial solution to be specified in the further development of the project and choice of technology, the decision-maker’s opinion on how the area under construction is exactly defined, the maximum area of public water body to be encumbered (offshore wind farm together with substation and internal cables of the wind farm ca 100 km² + submarine power cable in maximum interpretation ca 30.6 km²) is approximately 130 million square metres i.e. 130 km².

Description of studies conducted before the issue of a superficies licence

Environmental impact assessment (EIA) needs to be conducted within the superficies licence procedure. EIA also includes environmental studies for specifying the existing situation. EIA shall be conducted according to the relevant law (Environmental Impact Assessment and Environmental Management System Act) which sets out the procedure as well as the theme of substantive assessment.

The specific need of studies conducted within EIA shall be established in the EIA programme phase but taking into account the former analogous situations, the most labour-intensive are the studies of wild birds and marine biota (seabed, fish fauna, marine mammals).

Additional works need to be performed in terms of a specific technical solution (design, specific modification and installation of the wind turbine etc) (these are also of assistance in the EIA). Before the issue of a superficies licence, studies are conducted regarding all themes and accounting for the needs of the specific stage, but in some cases even more detailed, specific and substantial studies/analyses are made after the issue of a superficies licence. Necessary studies:

- Detailed study of bathymetry
- Geotechnical study of seabed
- Detailed study of wind conditions, waves and ice conditions (incl also 1 year measuring)
- Organisation concept of logistics and works during construction

Duration applied for in the superficies licence

SWE OÜ applies for a superficies licence for 50 years.
Potential output of the wind power plant and approval of the transmission network operator on the technical requirements for connection with the transmission network

The output of the offshore wind farm is 600 MW.

Connection with the Estonian transmission network takes place according to the technical requirements issued by Elering AS to SWE OÜ (letter 05.02.2015 No 2-7/2015/1-2, see Annex 2) either in Sindi or Lihula substation.

A solution including the submarine power cable from the wind farm to the connection point and the mainland transmission system shall be established and which shall be specified and supplemented with additional works separate from this superficies licence application (including mainland spatial plans).

Taking into account the time of preparation (including applying for a superficies licence), construction period and commissioning phase, the forecast time of connection of the wind power plant with the network is 2022.

Veiko Väli                     Valery Makushin
Member of the management board /digitally signed/ Member of the management board /digitally signed/

Annexes:
1. Figures 1 and 2 with the location area of planned wind power plant.
2. Elering AS technical requirements for connection in Lihula or Sindi substation.
3. Environmental and spatial plan expert opinion, Hendrikson&Ko (not included to this document).
Annex 1.
Figure 1. Location and general data of the offshore wind farm.
Figure 2. Conceptual solution of the electricity transmission line.
Annex 2. Elering AS technical requirements for connection in Lihula or Sindi substation


Lo Valery Makushin

Käesolevad tehnilised tingimused on mõttidesuvar ning koostatud arvestades nende väljastamise ajal Elering AS poolt sõlmitud liitumislepingud ning Eleringi poolt esitatud liitumislepingu pakkumis. Tehniliste tingimuste koostamisel aluseks võeti asjakohade muutunusel pärast arvestama, et Eleringil on öösist vastavalt muuta ka tehnilisi tingimusi.


Liitumine Kilingi-Nõmme alaajamas ei ole tuuleelektrijaama ühendamine võimalik maa-ala kitsenduste tõttu.

Liitumine Lihula alaajamas

Aastaks 2020 valmis Harku – Lihula – Sindi 330 kV ohuüli, mis on üle 50 MW tootmisvõimsuse liitumise eeldus Lihula alaajamas. 600 MW tuuleelektrijaama liitumiseks tuleb rajada Lihula alaajama kahe latsiülemingeta ja nelja lahtriga 330 kV jaotsa koos juhtimisvööndiga, reelkeaiuse ja omatarbesüsteemidega. Eeldatav liitumistasu on ligikaudu 4 650 000 €.

Tuleb tähele panna, et liituja lahtri on arvestatud kui simpleks-lahtriga (ühe võimsusülitiga, ühendatud uhele alaajama labile), mis on kuuluvad, kuid väärtuslikud. Soovi korral võib liituda ka duopleks-lahtrites (kahe võimsusülitiga, ühendatud nõlvale alaajama labile), mis on kalliimad, kuid suurema töökindlusega. Duopleks-lahtrites liitumise korral oleks liitumistasu ligikaudu 5 500 000 €.

Liitumine Sindi alaajamas

Eeldused orienteeruvad liitu misjasuul jaoks mahus liitujate kanda. Täpne liitu misja selgub liitumispakkumise valjastamisel, mille Elering edastab 90 päeva jooksul alates liitu misja korr eksi liitu misja allikusest ning menetlustas liitu misja laakumisest.


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