Summary of selection for environment impact assessment Production of electrical energy using alternative regenerating wind energy sources – PLLC "Aušrinis" park of up to 6 wind turbines at Biržai District Municipality, Parovėjos Eldership, Padvariečiai, Leitiškiai, Jasiškiai village

During PBA (Planned economic activity) it is planned to construct up to 6 wind turbines, the nominal capacity of each is up to 7,2 MW. The height of wind turbine tower planned to be constructed is up to 167 m; rotor diameter - up to 172 m; the total height of wind turbine to be constructed is up to 252 m.

Wind turbines are delivered to the construction place, unloaded and installed with the help of a specific crane. During construction process, considering the weight of wind turbines and safety requirements, the steel rods and special-purpose concrete for foundation are used. Having formed the foundation the towers of wind turbines, rotor and blades, produced at special-purpose wind turbine manufacturing factory, are installed in the order of priority. For the access to the WPP it is foreseen to use local roads which will be strengthened and renovated.

In order to decrease visual pollution of landscape, the electrical energy generated by wind turbines will be connected to the electrical networks at the connection point specified by the operator in the connection conditions by underground electric power cables. Underground electric cables will be laid through state land and private land plots.

Model*	**GE 6.0-164**	**Nordex N163/5.X -5,700**	**Siemens Gamesa SG 5.8-170**	**Vestas V172-7,2**	**Summarized wind turbine physical and technical parameters**
Rated power, MW	6,0	5,7	6,6	7,2	**up to 8,0**
Tower (mast) height, m	167	164	165	166	**up to 167 (for sound)**
Rotor diameter, m	164	163	170	172	**up to 172 (for shadow)**
Total height of WT, m	249	245,5	250	252	**up to 252**
Preliminary production of one WT electricity per year	22–25 mln./kW				

The table provides the alternatives of four wind turbine models with similar technical data, so that the PBA initiator would have opportunity to choose the most suitable option at a later stage of the design works.

During the Planned economic activity the waste production is not foreseen. Small amount of metal and mixed construction waste may be produced during installation – construction of wind turbines. These wastes will be grouped into special containers and in accordance with the agreements with waste managers will be transported for the further management. Wastes will be managed in accordance with the new revision of *"Waste Management Requirements" (Žin., 2011, No. 57-2721; with all most recent changes)* approved by the order of the Minister of Energy of the Republic of Lithuania No. D1-368 dated 3 May 2011.

For the operation of wind turbines the water is not foreseen to be used, no sewage water will be discharged. In the planned territory, surface (rain) sewage water will be discharged from the formed surfaces. The amount of surface sewage water will be marginal; the pollution sources during operation are not foreseen. Surface water from the roads will be discharged through surface water slopes to the reconstructed drainage collectors. In the planned territory of wind

turbines the equipment of existing recreation system is planned to be reconstructed or restore those damaged during construction according to the developed solutions of the recreation system project part.

During Planned economic activity the pollutants produced by those vehicles arriving at site may be emitted to the environment air. However, the estimated number of vehicle arriving at site per day may be equal 0-2.

During operation of wind turbines the smell is not developed.

Performing planned economic activity the following physical pollution will be resulted: noise, shadowing, infrasound and low-frequency sound, electromagnetic emission.

When feathering the blades of the rotor of wind turbine makes aerodynamic noise the volume of which depends on the rotation speed and the shape of wind generator wings, and features. The limit values for noise in residential and public buildings and their surroundings in Lithuania are determined by the Lithuanian hygiene norm *HN 33:2011 "Noise limit values for residential and public buildings and their surroundings" (Žin., 2011, No. 75-3638)*, therefore when planning economic therefore when planning economic activities it must be ensured that the permissible rates are not exceeded.

Wind turbines, as well as other high structures at the sunny weather, project shadow on the nearby objects. Beside, living nearby wind turbines the light flashing effect caused by rotating wings may occur. Selection of appropriate area and use of quality equipment may solve this problem. When planning economic activity the wideness and direction of the shadow projected by wind turbines was calculated, and turbines are distributed in such a manner that they would not residential surrounding. In accordance with the simulation results, considering average sun shine duration, and arrangement of local homesteads it is apparent that the shadow of planned park towers will not exceed the recommended permitted limit of 30 h/year at the territory of residential homesteads.

Evaluating the infra sound produced by wind turbines the difficulties to separate it from the level of existing infra sound made by wind itself or other sources arise. Also in Lithuanian Republic there are no established methods for forecasting (simulating) the expansion of infra sound and low frequency sound. On the basis of published data about infra sound and low frequency sound emitted by wind turbines it may be concluded that that at a 100 m distance the level of sound mentioned decreases up to an insensible for a human. The distance to the nearest residential house is maintained at 719 m, so no significant impact on human health is expected.

Electrical fields are usually formed in the area of high voltage of electric transmission lines. According to the similar wind turbine technical data the EMF power flow frequency (SLV) of operating at full capacity generator is equal to 24 μW/cm2. This frequency is measured at 1 m distance from generator. Since the generator is in the body at 164-169 m above the ground the power of electromagnetic field, varying according to the cubic dependence of the distance, will not impact the environment because it will not exceed the level permitted – will not reach 0.5 kV/m *(HN 104:2011 "Human protection against electromagnetic fields caused by overhead power lines")*.

Forecasted levels of noise are established by calculations, in accordance with preliminary calculations, do not exceed *HN 33:2011* limit values of noise level at night (22-07 o'clock), i.e. Forecasted levels of noise are established by calculations, in accordance with preliminary calculations, do not exceed *HN 33:2011* limit values of noise level at night (22-07 o'clock), i.e. **45 dB(A),** in the nearby homesteads. In order avoid possible noise impact caused by WT to those people living nearby, from the nearest wind turbine to the territory of residential homesteads at least 45 dB(A) sound level (until the night time (22-07 o'clock)) corresponding distance shall be maintained.

When planning economic activity, the calculation of physical pollution (noise and shadow) were performed, and wind turbine park shall be arranged in such a manner that the limit values in the residential area would not be exceeded. The nearest homestead from the planned wind turbines is at 719 m distance. Having evaluated noise dissipation and shadowing calculations in accordance with published literature, having performed analysis of electromagnetic emission and infra sound, and low frequency sound level the following was determined: planned wind turbines will not negatively impact public health in the nearest residential area. Having performed calculations of noise dissipation it was established that the excess of noise level in the nearest residential area is not foreseen.

For the period of planned economic activity the biological pollution is not foreseen.

The worth case scenarios which can happen during operation of wind turbine and may impact environment and residents around are the accidents related to the damages of mechanical structures which may cause tower falling or blade drop-over, falling of tower top part together with blades and rotor, and similar mechanical accidents which may impede normal working and living conditions of residents around. Mechanical falling of wind turbine tower may be caused by natural and anthropogenic factors. Such meteorological factors as hurricanes, tornado and heavy shower are considered as natural factors. Blade accident may be caused by severe icing if, calculating blade constructional resistance, the possible increase of blade weigh in case they are covered with ice, was not considered. Mechanical deformation of wind turbine towers, their falling and blade drop-over would cause negative implications and would be dangerous just near these towers only. Heavy structures shall not be thrown by wind, so the area of potential impact is determined only by the height of the structures. In this case the zone of potential impact – up to 1.5 times of total wind turbine height, i.e. up to 252 x 1.5 = 375 meters, as the height of planned to constructed wind turbines shall not be higher than 252 meters. Since the nearest built-up area is 719 meters far from WT, WT towers are far enough from the nearest built-up territory, so the deformation of wind turbine tower, which could cause natural and anthropogenic factors, will not impact existing structures.

Construction stages:

- finish of design development works (arrangement of land plots and reconstruction designs, technical and detail plans, etc.);
- selection of construction site (construction of roads and foundation);
- installation and connection of wind turbines.

Whether during construction or completion of construction, agricultural work and other necessary types of economic activity will not be disrupted at the project territory and other surrounding territories.

The area for planned economic activity (PEA) was selected having evaluated alternative areas to perform envisaged economic activity. Nature conditions (relief, prevailing wind direction, landscape) and existing infrastructure (possibility to connect to the electrical networks and existing road network) were evaluated; a possible situation of economic activity in respect of urbanised (residential), protected areas and those areas of historical, cultural or archaeological values was considered. The area has been selected as conforming to the envisaged economic activity.

The current initial target purpose of land plots – agriculture. The area is not built-up, meadowlands prevail and land plots are cultivated.

Land plots are reformed by developing designs of land plot formation and conversion. Plots will be portioned and leased by parts (0.20 ha for each wind turbine); the main target destination is changed to the land of “Other” purpose (Areas of communication and engineering services maintenance objects) if required by applicable legislation.

Following the Biržai District Regulations on Land use and protection of General Plan, Recreation, Tourism, Development of Nature and Cultural Heritage, Natural Frame, Forest and NATURA 2000 Territory Arrangement, Territorial Engineering Infrastructure and Communication Drawings, the Planned Economic Activity (PEA) do not contradict the general plan solutions since at the territory of planned economic activity there are no objects of cultural heritage, protected areas, forests, recreational areas, urbanized territories.

In accordance with the map approved by the Commander of the Lithuanian Armed Forces, the area the construction of wind turbines is planned at falls into areas where wind turbine sites are approved provided that the producer of energy from renewable sources signs an agreement with the Lithuanian Armed Forces for the reimbursement of part of the investment and other costs for the performance of national security functions.

According to the data of the Register of Earth Interior (REI) at the territory of the planned economic activity there are no key sources of mineral products. The nearest source of mineral products is at about 12,2 km. The nearest existing drinking fresh water source is at about 600 m distance from PEA. Industrial and mineral water sources at the nearest territory are not available.

Following the Geological Information System GEOLIS, at the territory of planned economic activity no geological processes and events happen. The nearest recorded geological events – a landslide - is 0.5 km east of the PEA.

The nearest to the PEA geotopes being found – outcrop "Velniapilis uola" - 1.5 km northwest of PEA.

The nearest protected areas of NATURA 2000 PAST and BAST are not limited to PAE. The nearest protected and NATURA 2000 areas are Biržų giria, PAST and BAST located 3.5 km to the east from the PAE site, Ąžuolynas forest, BAST - 3.7 km to the south, the surroundings of Drąseikiai village, BAST - 5.5 km and Gipsokarsto lakes and their surrounding lakes. There are no important bodies of water in the area of the planned wind farm, only a few small rivers. The nearest river is Apaščia, which is about 943 m from the PAE. It is envisaged that none of the wind turbines will be in the protection areas of impounded surface water and protected strand lines. It is foreseen that underground electrical cables, the wind turbines will be connected to the electrical network with, in several points will cross rivers or channels. In these points underground electrical cables will be laid by the method of directional drilling, leaving at least 3 meters above the bed of impounded surface water, following the procedure set by legal acts. On the planned territory there are no protected values or their fragments, as well as historical values and immovable cultural values evaluating in relation to the assessment of the monumental aspect.

During planned economic activity the environment will not be impacted significantly. However, it would be possible to highlight several alternatives of technical, technological and environment impact minimising measures. The following compensating and environment impact minimising measures are:

Number	**Environmental component**	**Meansure**	**Implementation phase**
1.	Water	In the planned plots of land, WT will be located outside the coastal protection belts of surface water bodies. In order to reduce the potential environmental impact of laying cables through water bodies, the cable line will be laid through rivers, it is that the stream bed will not be damaged by open pit mining.	Planning stage
		During the installation of WT, if necessary, reclamation facilities will be moved without damaging their system.	

		During the installation of WT, if necessary, reclamation facilities will be moved without damaging their system.	Construction works
2.	The soil	WT installation, transformer substation construction, cable laying and the fertile soil layer excavated during the construction of access roads will be stored in the designated place.	Construction works
		After the completion of the installation of the WT park, the work area will be cleaned, the excavated remaining soil will be evenly distributed in the territory, the fertile soil layer will be spread in the park territory and planted.	Construction works
3.	Landscape	Routes of WT connection cable lines are selected so that no cutting of forest or other vegetation is carried out.	Planning stage
		The construction sites of WT towers and the routes of internal access roads were selected by preserving the field forests, groups of plantations and individual trees growing in the territory.	Planning stage
		The preserved, harvested fertile soil layer is used for the restoration of damaged land areas.	Construction works
4.	Public health	Construction works will be carried out only with technically sound mechanisms, the noise level of which will not exceed STR 2.01.08:2003 "Management of noise emitted by equipment used in outdoor conditions" (approved by the Ministry of the Interior of the Republic of Lithuania in 2003 June 30 by order no. 325) of the sound power levels allowed by outdoor equipment. Installation works of the WT park are expected to be carried out only on working days during the day.	Construction works
5.	Socio-economic environment	The existing field roads, which will be used for the installation and servicing of the WT, will be strengthened as needed: they will be graded, the existing pits will be leveled, and the gravel cover will be renewed. Roads of local importance are periodically maintained. Measures are planned to reduce the dustiness of gravel roads: local road maintenance, road surface irrigation.	Construction works/ exploitation
6.	Biodiversity: birds and bats	It is planned to prepare and coordinate a monitoring program for birds and bats to assess the impact of the WT Park on migrating, nesting birds and breeding and migrating bats. The monitoring of dying birds and bats will be carried out after the start of WT activities in order to determine the significance of the potential effects of specific WT and to propose the most effective measures to avoid, reduce or compensate for the effects. The program must cover at least one year before the construction or start of operation of the WT and three years after the start of the WT operation. Subsequently, monitoring studies are repeated every 5 years. Mitigation measures for birds and bats: – If negative impacts on bats are detected during monitoring, in order to reduce possible deaths of migrating bats, increasing the minimum wind speed for the start of WT operation (which is 3.5 m/s in most WT models) to 5.5-6 m/s during the bat migration period, applying this measure from sunset to sunrise. The application of the measure must be specified after monitoring. – Bird detection equipment - radar/spec. installation of the detector in the affected WT: special equipment is installed to stop the operation of the wind farm if an approaching bird is detected in the rotor rotation area	Planning stage Stages of planning and execution of activities

		(identified remotely). The technical parameters of the tool will be selected during the technical design stage. WT, in which it is appropriate to install this measure, must be determined during monitoring one year before the start of operation. – Contribute to the preservation of rare and sensitive bird species by means of remote telemetry. To install 2-4 telemetry devices (transmitters) and monitor the movement of sensitive species for birds (birds of prey) nesting in the surrounding environment sensitive to the effects of WT, the territories are used on the site before construction and after VE construction works. In this way, to gather knowledge about the possible management of emerging conflicts due to WT activity and to apply the accumulated knowledge in practice by reducing the impact on sensitive WT effects to bird species by determining the VE stopping period, dangerous flight heights and searching for other effective means of avoiding collisions with WT; – Alteration of nutritional habitats near WT, making them less attractive to sensitive VE species of birds or bats, and restoration of natural habitats in cultivated fields away from WT, making them attractive to birds of prey. The implementation of this measure would be possible only if the WT owner had rights to the use of these land plots. Application of other compensatory measures contributing to the restoration of the conservation of species sensitive to the impact of WT. The measures will be selected during monitoring of birds and bats.	

The nearest living environment from PEA (on the territory of Latvia) is 1.54 km in the north direction. According to the results of the simulation, under the most unfavorable conditions, shading and noise have no effect on the residential environment in the territory of the Republic of Latvia.

Evaluating at a distance of 5 km from the PEA there are two protected trees growing on the territory of Latvia, species habitats, forests, lakes and meadows fall.