

KfW Entwicklungsbank

**Preliminary Assessment of Environmental Impact of Mesihovina Wind Farm
Construction Project in the District of Tomislavgrad – owner EP HZHB**

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1 NON-TECHNICAL SUMMARY

1.1 Introduction

Elektroprivreda Hrvatske zajednice Herceg-Bosne (EP HZHB) is the electric power company covering the Federation of Bosnia and Hercegovina. EP HZHB's present production of electric energy is based wholly on the exploitation of water energy sources. The production capacity of existing hydro-electric plant is only sufficient to cover a third of the demand for electric energy in EP HZHB's supply area. EP HZHB is endeavouring to expand and change its production capacity, whilst maintaining its successful environmental record, by exploring with the help of international consultants the possibilities of wind power exploitation. Out of ten locations investigated, three have been chosen for more detailed measurements and the construction of a wind farm. The three locations are: Borova Glava, Midena-Brišnik and Jastrebinika.

This document contains the Preliminary Assessment of the Environmental Impact of the Mesihovina Wind Farm Construction Project at the Midena-Brišnik location.

1.2 Legal basis

Relevant legislation requires that an environmental impact assessment, a public consultation process and the making available of documents for public inspection form a component part of the project approval procedure in FBH. An environmental impact assessment is carried out within the framework of the procedure for obtaining building permission, as provided in the Environmental Protection Act [*Zakon o zaštiti okoliša*] (*Službene novine* [official gazette] FBH no. 33/03) and consists of two stages: a preliminary environmental impact assessment and the preparation of a complete environmental impact study.

Pursuant to the Federal "Regulations for Plant and Machinery Requiring Mandatory Environmental Impact Assessment and Plant and Machinery Requiring Mandatory Environmental Permit for Construction and Commissioning" [*Pravilnikom o pogonima i postrojenjima za koje je obavezna procjena utjecaja na okoliš i pogonima i postrojenjima koji mogu biti izgrađeni i pušteni u rad samo ako imaju okolišnu dozvolu*], plant for the exploitation of wind power for the production of energy (windmills) with a production capacity of 2 MW or 4 converters are not classified as high-risk environmental activities. It is incumbent upon the competent agency (the Federal Ministry of the Environment and Tourism) to decide whether, further to the preliminary environmental impact assessment, a complete environmental study is required.

1.3 Location of project

Construction of the proposed project is planned in the district of Tomislavgrad. The wind park consists of three main rows stretching from the south-east to the north-west, following the highest points of a ridge. 22 turbines of around 2 MW are proposed, with a total power of 44 MW. The location of the project shown on a topographical map 1:2500 is presented as figure 1.1.

Position of wind turbines in Mesihovina wind farm

Figure 1.1 Location of project

1.4 Technical specifications

1.4.1 Plant

The wind park will consist of the following components:

- Wind turbines of around 2 MW. The turbine supplier has not yet been chosen, but appropriate wind turbine models of well-known manufacturers will be chosen.
- Towers, upon which the wind turbines will be installed, with suitable earth construction, electric installations, etc.
- Transformers (low and medium tension) installed inside the tower of each turbine in order to raise the produced low tension to medium tension.
- Underground cables for conducting electric energy, connecting the wind farms with the control building.
- A control building to contain the electric system for monitoring and control of the wind farms, and other apparatus.
- A connection from the wind park to the electricity grid, via above-ground lines leaving the control building.

The wind turbine models considered have a rotor diameter of 80 to 90 metres, with a body height of around 80 metres. The maximum height of the top of the propeller is thus around 125 metres.

1.4.2 Installation of wind turbines

The towers, turbines and accompanying plant will be transported to the location by special lorries able to carry extreme loads. The towers will be transported in parts and assembled on the site with the help of a crane. Each wind turbine will need a total of 8-9 lorries and a minimum road width of 5 metres to allow the lorry to manoeuvre.

An approximate surface area of 15x15x2.5 m will be excavated in order to lay the foundation for each wind turbine. This will allow full earth encapsulation of the foundation. A so-called plateau (flat area) will be made at the installation site of each wind turbine. The purpose of the plateau is to facilitate assembly by ensuring sufficient space for fitting of the tower, generators and propellers. The space is also useful for movement of the lorries and crane. The surface area of the plateau will be approximately 50x50 m in diameter for each assembly location.

The parts of the wind turbines and accompanying plant will be transported by special lorries to the assembly location. A purpose-built crane, able to lift heavy loads, will be used to lift the parts and will facilitate installation of the wind turbines on their sites (see Figure 3.11). A trench will be dug along the internal road linking the wind turbines in the wind park to contain medium tension cables and other electric connections. This trench is typically 80 cm wide and 1 m deep.

The building to contain the control and measuring instruments, the switchboard for medium tension, the remote monitoring and control system, telecommunications and other equipment will take up an area of around 120 m².

1.4.3 Energy production

The production of electric energy, on the basis of the proposed turbine type, wind farm type, spatial arrangement of the turbines and wind assessment carried out, is assessed at **128,527 GWh**.

1.5 Description of environment

1.5.1 Flora and fauna

The Mesihovina wind farm is situated immediately below Duvanjsko Polje in a region of the Grabovica mountain range. This area falls within the sub-mediterranean landscape, i.e. the sub-mediterranean rocky ground ecosystem.

A layer of dense thickets at the location contains hazel (*Corylus avellana*). The layer of thickets also sporadically contains the following species: spindle (*Evonymus europeae*), wild rose (*Rosa arvensis*), and hawthorn

(*Crataegus monogyna*). Herbaceous plants present here are hellebore (*Helleborus multifidus*), horse-tail (*Equisteum* sp.), plantain (*Plantago holosteum*), milfoil (*Achillea millefolium*), lady's bedstraw (*Galium verum*), clustered bellflower (*Campanula glomerata*), fens ruby (*Euphorbia cyparissias*) and others. Endemic species have not been noted at this location.

Concerning animals this is the habitat of quails, partridges, wild ducks, rabbits, foxes, some deer, and, rarely, wild boars and bears. The quails inhabit Duvanjsko Polje but migrate to the north and fly very low. Migration is in the direction north-south and includes the planned location. The chosen location is on the migratory path of quails, ducks and other birds. This area is the permanent habitat of rabbits, foxes and wolves.

1.5.2 Geology and morphology

The location for construction of the wind park is in south-western Bosnia, a mountainous region made up of karst valleys: the Glamoč, Livanj i Duvanjska valleys. Mesihovina is part of the Dinara mountain, in which can be distinguished anticline, syncline groups of flexure and individual flexure. The Midena mountain range represents the south-eastern part of the Dinara tectonic unit. Mesihovina includes the hilly areas of the Midena mountain range, made of upper thick layered cretaceous limestone with chondrodont. The layers are 30-50 cm deep.

Hydro-geologically the karst is permeable, with fractured rocks and porous permeability. The dolomites are a partial hydro-geological barrier which, depending on their position in relation to the geological pole, may play a role as supporting layered barriers.

The ground represents a firm and hard base for works and a suitable foundation for the work. The firmness of the limestone varies from 80 to 110 MPa. The dynamic quality is well balanced and dolomites can be distinguished where the significant variability of those parameters is directly related to the degree of grusification of the rocks.

1.5.3 Stability and seismic hazard of terrain

The area in which wind exploitation is intended can be classified as stable terrain with stable precipitation under natural and artificial conditions. This kind of terrain is suitable for excavation, carving out and lateral cutting with special limitations.

According to the available results of investigation into earthquakes, the area studied falls, according to the regional position of Bosnia and Hercegovina, within an area with possible earthquakes from 3° to 7° on the Mercalli scale. However, information for the areas of Livno, Duvno and Kupres indicate there have been earthquakes of 9° on the Mercalli scale (1906). Attention must be paid to the seismic hazard in the region when building.

1.5.4 Hydrology

The studied terrain of Mesihovina consists of various rocks with terrain of high to medium and low water permeability, and terrain which is partly or even completely impermeable.

No source of water was found in the location of the future wind parks.

1.5.5 Climate

Mesihovina has a mild continental climate with temperature differences and oscillations and a very strong wind from the south (cold north-easterly gales and southerly sirocco). Snow falls only occasionally and stays on the ground for an average of five days per year.

1.5.6 Cultural heritage

There are no buildings of cultural heritage at the location intended for construction of the wind park. Approximately 150m from the nearest turbine there is a medieval Slavic fortified settlement and approximately 450m a site where ancient Roman coins have been found.

1.5.7 Use of land - settlements

The land planned to be used for construction of the wind park is registered in the district land registries as forestry land. Some settlements are situated in the vicinity of the proposed locations, of which most are several kilometres distant, while the nearest settlement is situated at a distance of 500m.

1.5.8 Infrastructure

Further to the information obtained and the field visit it can be concluded that there is no infrastructure on the site of construction of the wind parks. Access roads will have to be rebuilt to allow access for large lorries.

1.5.9 Areas with special protected status

The area strictly intended for construction of the wind parks contains no protected areas.

1.6 Assessment of impact and mitigating steps

The following paragraphs present environmental and social impacts related to the construction and operation of the wind farm.

1.6.1 Flora and fauna

Impacts on the flora and vegetation in the construction and working stage of wind farms are manifested in a reduction of the natural habitat and the diversity of that habitat and thus the diversity of plant species. However, an analysis has shown that such impacts are not to be expected.

As regards fauna, impacts are only related to temporary displacement caused by the presence of workers and machinery, as well as noise, vibrations and detonations, exhaust gases and dust from the construction works. Such impacts are by their nature reversible, i.e. the animals will return to inhabit the location upon completion of the works.

The operation of a wind farm generally has a negligible effect on flora and fauna, with the exception of bird and bat populations. Concerning the impact on birds, information exists on birds killed by collision with the turbine blades, however such collisions are statistically very rare and the number of birds killed in that way is far less than the number of birds killed by other human activities such as illegal hunting or collisions with high-voltage electricity conductors. Despite this the owner of the project will carry out an extensive monitoring program in order to record and assess collisions which may occur during the operation of the wind farm. The analysis will permit the identification of specific locations significant for birds which may be the subject of future construction of wind farms.

1.6.2 Air quality

A consequence of the earth works will be the emission of dust, in particular during the site cleaning and excavation stages, and as a consequence of the presence and movement of machinery at the location in question. Similar impacts will also arise during construction of the access roads. Insignificant atmospheric pollution may also be caused by exhaust gases from vehicles moving to and from the works sites. In any case such impacts are of a local character and with limited effect, such that they do not have significant consequences for air quality in the area.

Care will be taken to apply good construction practice in order to reduce the emission of dust, in particular sprinkling the earth with water during the summer works and covering lorries during the transport of dug material. The emission of exhaust gases will be controlled by the use of proper vehicles and machinery.

1.6.3 Landscape

Computer modelling was carried out in order to assess the visual impacts of the wind turbines on the nearest settlements. The wind turbines will be partly visible from the settlements of Gornji Brišnik, Donji Brišnik, Čebara, Mrkodol, Bukovica, Borčani, and Crvenice. The model showed that the impacts on the local population will not be significant.

1.6.4 Shadow flickering

Wind turbines are tall objects with relatively small volume, but they may nevertheless block light, i.e. create shadow in their vicinity. Flickering may be very unpleasant to man, and is visible at distances of 500 -700m from the wind turbine. Shadow and flickering do not however impact on land cultivation or animal husbandry.

Computer modelling was carried out in order to assess the real impacts of flickering and shadow on the nearest settlements. The results show that the nearest settlement is situated over 500m from the Mesihovina wind farm and that flickering and shadow will not have a negative effect on the local population and local transport on the M15 road.

1.6.5 Noise

The operation of a wind turbine creates sound due to the flow of air around the blades and the column (aerodynamic noise) and sound from movement of the mechanism (mechanical noise). Modern wind turbines are extremely quiet and as a rule the noise of a large modern wind turbine is completely obscured by the noise of the wind at a distance of 200 metres.

Computer modelling was carried out in order to assess the real impacts of noise on the nearest settlements. The results showed that the noise level in the nearest settlements will be under 35 dB(A) except for the settlements of Čurčića and Gornji Brišnik where the sound level may reach 44 dB(A), which is still below the permitted limit of 50 dB(A). It can be concluded that noise will not have negative impacts on the local population and environment.

In the construction stage, there will be a relative increase in the present sound level as a consequence of the construction works and the movement of vehicles. The effect of the noise will in general be of a temporary nature and fully reversible upon completion of the works. Certain steps will also be undertaken to further decrease the noise level:

- the movement of heavy vehicles will be planned in cooperation with the local traffic police, in particular as regards passage through certain settlements;
- the movement of heavy vehicles near schools, hospitals or other sensitive areas will be avoided completely;
- works causing noise on the construction site near settlements will be suspended during hours foreseen for rest.

1.6.6 Cultural heritage

In addition to the fact that the proposed construction locations are not in an archaeological excavation zone, contact has been made with the competent agencies in order to ensure that the works will not have an impact on the cultural heritage of the wider region. As a minimum the presence of an archaeologist able to intervene in the event of ancient finds at the construction location will be ensured on the site.

1.7 Alternatives

The proposed project is the result of the detailed analysis of a range of alternatives based on environmental, technical and economic criteria:

- the choice of wind energy exploitation as a contribution to the production of electric energy in the area is a clear result of environmental sustainability

as it exploits renewable sources of energy and avoids the use of fossil fuels;

- concerning the choice of location, the proposed location was chosen from several alternative locations analysed in the preparation stage of the feasibility study by international consultants. The investigations included measuring wind power using 10m masts over one year. The remaining criteria (in addition to wind power) were:
 - impacts on the environment, in particular regarding impacts on protected areas;
 - the landscape, with a view to reducing to a minimum necessary interventions and thereby their environmental impacts;
 - access to the locations, with a view to reducing to a minimum necessary infrastructure works and thereby their impacts on the environment and the community;
 - the proximity and capacity of the electricity grid;
- concerning the size of turbines, wind turbines of around 2 MW were chosen as they represent the current trend in the wind farm industry. Their quality is proven as is the fact that they achieve economically viable results with lower electric energy production costs than smaller machines. From the environmental standpoint they require fewer turbines for the same quantity of produced energy and therefore have less visual and environmental impacts as a result of construction works.

1.8 Conclusion

The proposed project comprises the construction of the Mesihovina wind farm with an installed capacity of 44 MW at a location in the district of Tomislavgrad. The project is particularly significant as it allows the investor, JP EP HZHB, to better satisfy the electric energy supply requirements of the area it services, without excess reliance on importation. The chosen location is registered in the district registers as a forestry land area – even though vegetation is limited – far from protected areas or areas of special ecological interest. Therefore very limited impacts on the natural environment can be expected. The visual impacts, and impacts arising as a result of shadow flickering and the emission of noise have been assessed using computer models and taking account of the proximity of neighbouring settlements. In all cases such impacts have been assessed as negligible. Further to the above, you are kindly requested to **take a favourable view on our application for a preliminary assessment of environmental impact.**