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Wind Power Plant Podveležje

Non-Technical Executive Summary

PROJECT BACKGROUND AND OBJECTIVES

The utility “JP Elektroprivreda Bosne i Hercegovine d.d. Sarajevo” (EP BiH) is building the Wind Farm Podveležje with a capacity up to 48 MW (hereafter “the Wind Farm” or “the Project”). The Project is located near the city of Mostar and is financed by the German development bank KfW (in German *Kreditanstalt für Wiederaufbau*). JP Elektroprivreda Bosne i Hercegovine d.d. Sarajevo will be the operator of the power plant and JP Elektroprivreda Bosne i Hercegovine d.d. Sarajevo, with an approximate ratio 80/20 percent respectively.

The Construction Contractor for building and improvement of the wind farm internal roads (Lot 3) is Consortium comprising HP INVESTING d.o.o. Mostar, AMITEA d.o.o. Mostar and IZGRADNJA TOJAGA d.o.o. Mostar. For the installation of 110/30kV substation and 30kV cable collector system (Lot 2), the contract was awarded to the company ABB d.o.o. Zagreb. The Construction Contractor for installation of wind turbines (Lot 1) is not known at this time, as the tendering process is currently in progress.

Through the construction of the Podveležje Wind Farm, the Project represents a development opportunity and an overall chance not only to increase the electricity production, but also to serve as a driving force of economic development in this region. The Podveležje Wind Farm Project represents a significant strategic benefit to this region, it aims to provide up to 48 MW of reliable and “clean” electrical energy to the national grid.

A preliminary environmental assessment was developed for the project in 2008, and the first environmental approval for the Project was obtained at that time, and the renewed national environmental approval was obtained in 2013.

PROJECT DESCRIPTION

The Podveležje WF is planned as a line of series of operational plateaus, including the design, procurement, manufacture, transport, storage, installation, test runs and commissioning of 15 Wind Turbine Generators, complete with rotors, nacelles and towers, access roads, including all internal cabling and wiring, step-up transformer module, the connection to the existing electricity grid, protection, control and measuring equipment. Currently it is foreseen that 15 wind turbines will be installed with a capacity of 3.0 MW to 3.2 MW each and a maximum capacity of 48MW.

For the Project itself has been divided into 3 components/lots:

- § Lot 1: Engineering, procurement, supply and construction of the 15 (fifteen) Wind Energy Converters of the 3MW platform, with the same rated unit power (in range



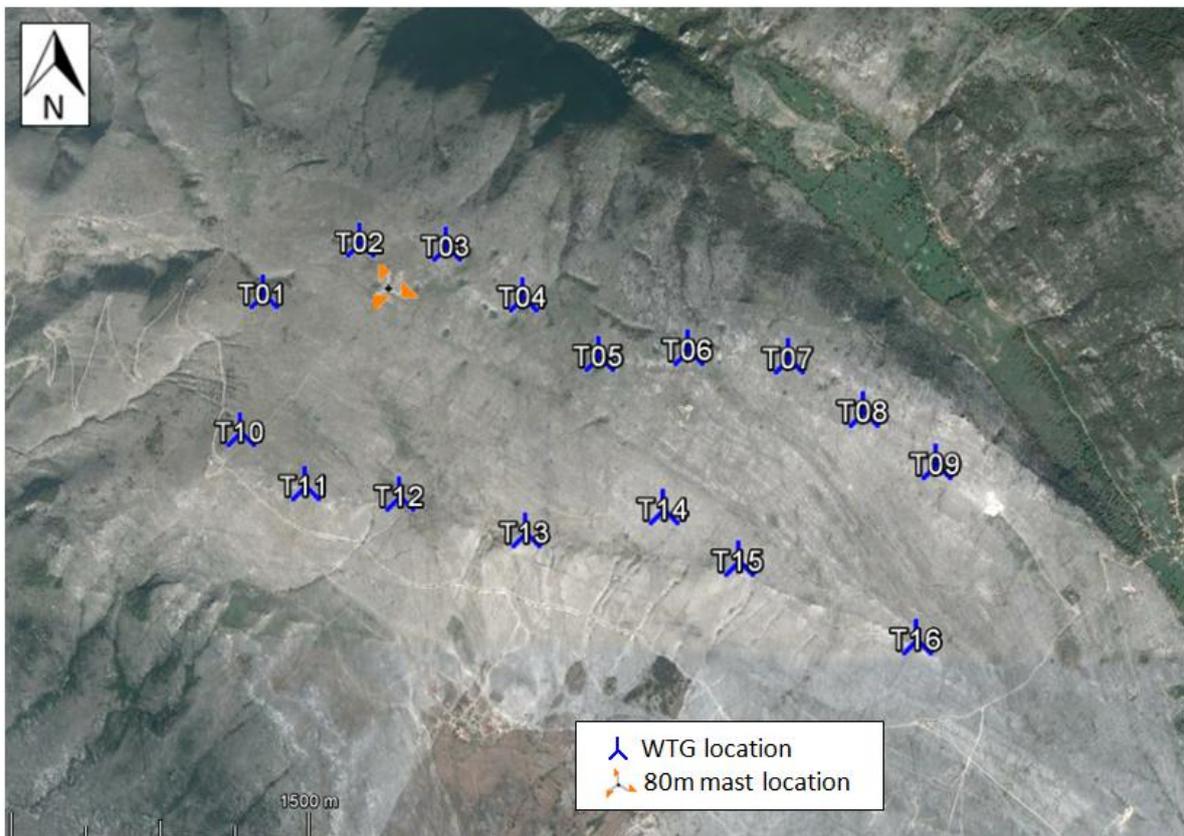
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3,0MW – 3,2 MW), including their foundations and all relevant civil works, electrical works, and WEC control system, including a 5 to 15 year operation and maintenance contract.

- § Lot 2: Engineering, procurement, supply and construction of a 30/110 kV substation, the 30kV power cabling, fiber optical cabling and earthing network between WECs and Substation, including all relevant civil works, electrical works and Substation control system.
- § Lot 3: Construction of the wind farm internal roads and crane platforms.

The overhead line for electrical connection of the Wind Farm to the National Grid will be in the responsibility of the Transmission Company Elektroprijenos BiH a.d. Banja Luka.

According to the latest time schedule, commissioning of the Wind Park is planned for summer 2019.



**Optimized location of the Wind Turbines.
(Wind Turbine T13 will not be build)**

The existing access roads to the Podveležje plateau will be used for the transport of the major equipment, construction materials and the machinery, also for the purposes of installation and



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maintenance of the wind turbines during operation phase. The need for road improvement measures was assessed and implemented as necessary.

Bosnia and Herzegovina Mine Action Centre (BH MAC) issued letter in June 2014 with confirmation that the Project site, in accordance with Employer's request, is outside of any defined suspicious areas and that **risk of mines is not expected**.

PERMITTING STATUS

The following relevant consents and permits have been issued by authorities up to date:

- § Final Urban planning consent issued by the Herzegovina-Neretva Canton;
- § General building permit: approval for construction of complex structure for wind farm Podveležje issued by the Herzegovina Neretva Canton;
- § Final Environmental permit issued by the Federation of Bosnia and Herzegovina;
- § Building Permit for internal access roads and crane platforms issued by the Herzegovina Neretva Canton;
- § Building Permit for Substation 110/30 kV/kV issued by the Herzegovina Neretva Canton.
- § Energy Permit for Podveležje Wind Farm issued by the Federal Ministry for Energy, Mining and Industry.

DESCRIPTION OF THE ENVIRONMENTAL CONDITIONS

Physical Environment

The proposed location of the wind farm on the Podveležje plateau is about 10 km east from Mostar town, and in the center of the Herzegovina-Neretva Canton of FBiH. The city of Mostar is located on the river Neretva, 125 km south from Sarajevo, the capital city of Bosnia and Herzegovina. Mostar's surrounding is composed of rocky hills and mountains which are sharply rising from the Neretva valley.

The Podveležje plateau, as part of Herzegovina's outer Dinaride is characterized by carbonate composition. In this area 6 larger settlements are located: Dobroč, Gornje Gnojnice, Podvelež, Banjdol, Kružanj and Kokorina, together they form an ethnographic complex.

The Podveležje plateau is basically built from Paleocene and karst sediments, as well as from fragmentary Neocene sediments and quaternary creations. The karst limestone is more suitable from the point of engineering and morphological characteristics for the construction of residential buildings. From the geological and geomorphological aspect, the Podveležje plateau belongs to typically karst terrains.

Sub-surface waters are the main source of potable water supply in the Federation of Bosnia and Herzegovina. Through the entire Podveležje plateau there are no streams which carry water during the whole year. The biggest water wells are in the Podveležje area - in the community of Bare - there is Jelovčev well (always filled with water) and the well called Vrbovica.



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Mediterranean climate prevails near the sea, and because the country is also dominated by mountains and hilly terrain in the west-central area the climate becomes continental, with cold winters and hot summers all the way to the northern plains. In the winter months cold winds are typically blowing from the north and north-east with snow and frost.

Biological environment

Since 1954 until now there are 16 strict protected nature reserves, 9 nature reserves with management status, 2 national parks, 5 special reserves, 10 reserves of natural areas and 110 natural monuments in the territory of Bosnia and Herzegovina.

Two nature parks are formed in 1995: Hutovo blato and Blidinje. The nature park Hutovo blato is located 30 km south from the Podveležje plateau. It is legally protected from uncontrolled human impacts, and it is known as a significant habitat for different flora and fauna species. Here 253 different bird species are recorded. This area is considered to be very important for breeding, eating and resting of migratory birds on their way to Asia and Africa and back.

The specific and scarce vegetation on the Podveležje plateau is controlled by **natural conditions** (height, climate, geology- and morphology of the terrain, scarce fertile soil, hydrographic features, water shortages and soil dispersion because of high wind intensity), and by anthropogenic activities. Three vegetation belts can be distinguished in the Podveležje plateau. The lowest zone is inhabited by the following animals: snakes (*Vipera berus*), lizards, rabbits (Leporidae), wildfowls (*Gallus gallus*), mountain partridges (*Alectoris graeca*), quails (Phasianidae).

The bat and bird baseline survey was performed once a month during a 12 months period in the WF area (about 6 km²) and in one comparable reference site ("Lisac") with the same range of habitats (both alpine pastures) and topography, similar mix of species, at least half size of the WF area (i.e. 3 km²) and close to the WF (8 km East), but far enough to not be impacted by the WF. However, with different altitude (from 800 m to 1250 m) which implies a slightly different bird species composition and lower bat activity level.

85 species of birds were recorded in WF area (63 in the reference site "Lisac"), of which 22 recorded species are particularly sensitive to wind farms (acc. to Council of Europe). Most of recorded species have the threat status of least concern (LC) in Bosnia-Herzegovina (BiH). The Skylarks (*Alauda arvensis*) are in great abundance, dominating the whole project area; some other species that prefer open habitat like Woodlark (*Lullula arborea*); Wheatear (*Oenanthe oenanthe*) occurred during the survey.

15 raptors species were recorded. It must be noted that Eagles represent one of the most threatened bird species in BiH and Europe in general; hence special emphasis to protection/ mitigation measures should be given for Golden Eagle and Short-toed Eagle. For Harrods, the project area is part of their migration corridor.

14 bat species were recorded (out of 29 species confirmed in BiH) and 3 general groups were documented in acoustic survey.



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Human Environment

The region of Podveležje has generally a relatively small population density. According to the last population census from 1991, around 3.200 residents in 579 households organized in the local community of Podveležje live on the Podveležje plateau.

To the local community of Podveležje belong 16.116 hectares of land (13% of the Mostar land area).

Postwar population density is less. It is estimated that the whole Podveležje plateau is settled by 1050 people who are located in 13 villages. The main occupation of the residents is agriculture, apropos livestock, which is still done in the traditional way.

There are six villages next to the Wind Farm: Dobrč, Usamljena kuća - Okolište, Gnojnice Gornje, Gornje Opine, Okolište and Šipovac.

Distance between the Wind Park and the local villages

Village	Distance to the Wind Park
Dobrč	765 m
Usamljena kuća - Okolište	978 m
Gnojnice Gornje	2.139 m
Gornje Opine	888 m
Okolište	1.091 m
Šipovac	2.238 m

National Monuments

According to the General Framework Agreement in BiH, Annex 8 - Commission for the preservation of national monuments, there are 41 national registered monuments.

Within the area of the Wind Park a few fortifications exist but no further information with respect to their status is currently available. It is known that they have a certain cultural value.

ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES

Impacts during construction

The construction of the wind park, the associated infrastructure and workers camps will cause short-term and local **gaseous and particulate air emissions**.

Initially these will be associated to the clearing of the site areas and with any type of earthworks required. The trucks used to transport and haul away materials, as well as other construction equipment's movements will also be a source of short-term air emissions in the project area. The construction of the above ground facilities will in addition imply excavations, concreting, backfilling, etc. All these activities are potentially generators of local air emissions, especially of dust.



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Noise emissions will be associated to the clearing of the site and to the required earthworks for the construction of the wind turbine areas and the access roads. The trucks used to transport and haul away materials, as well as excavations, concreting, backfilling and usage of any machinery are potentially noisy.

No residential area will be directly affected by construction noise.

The **fauna** present in an area where construction activities take place is subject to the following impacts:

1. Direct killing and injuring due to removal of the vegetation and the soil, movements and works of heavy vehicles and machinery;
2. Disturbance due to noise and vibrations;
3. Optical disturbances (movement of workers and construction vehicles, light pollution at night);
4. Destruction of habitats and nests due to cutting of trees and bushes, circulation of heavy vehicles and machinery, and soil clearance;
5. Injuries or direct killing due to falls into open trenches;

The existence and level of significance of impacts on the fauna from the wind park does not vary significantly because the area is very homogenous.

The impacts on **flora** and vegetation occurring during the construction phase are mostly limited to the lost of vegetation area because of earthworks, the construction of access roads and the platforms.

The project location is characterized by natural karst systems and low-growing plants. The construction of access roads, foundation, cable corridors will cause a slight **visual degradation** which means degradation of the surface cover.

The evaluation of **socio-economic impacts**. No data have been collected for a socio-economic survey. Therefore, the following impact description is based on reasonable assumptions and do not allow impacts to be fully quantified or their importance to be assessed or ranked numerically in all cases. In such situations, the determination and classification of the impacts is based on professional judgment of the likelihood and consequence of the impact.

During construction of a new Wind Park there could be new opportunities for business for the local population, although the construction of the Wind Park will be a short-term **employment opportunity** (maximum 2 years). The experience based on similar projects financed by International Financing Institutions shows that local population can be involved in construction works as both skilled and unskilled workforce. At the same time, these workers will have the opportunity to strengthen their capacity by handling new technologies and respecting new management methods.



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The construction workers will obtain most of their food and fulfill other necessities from the surrounding area. This will create a potential market for the local agricultural producers and other small businesses like local shops.

Therefore, the construction of the Wind Park could have a positive impact on a local scale.

Within the area of the Wind Park a **few fortifications** exist. No further information with respect to their status is currently available. It is known that they have a certain cultural value. Therefore, specific measures will be considered to secure them against any impacts resulting from the construction activities.

The same is applicable for future cultural/archaeological/religious findings to be observed during earthworks required for the access roads, earth cables and for the foundations of the wind turbines and the cranes.

The only potentially toxic or hazardous materials expected at the construction site area are relatively small amounts of lubricating oils and hydraulic and insulating fluids. Therefore, contamination of surface or ground water or soil contamination is highly unlikely. However, any oil shall be stored in appropriate containers or drums. Handling hazardous substances safely involves a series of rules such as having a register of hazardous substances used at site including product labels and Material Safety Data Sheets (MSDS), establishing procedures and be trained in implementing them, safe handling using appropriate PPE, storing materials properly in ventilated, dry, cool areas, and disposing hazardous substance following disposal procedures in observance of regulations.

The Contractor shall be responsible for ensuring that waste management is undertaken in conformity with the Construction Waste Management Plan according to the Country Laws.

All disturbed/cleared areas will be rehabilitated as soon as construction in that area has been completed as part of the construction contract. Stockpiled topsoil from the cleared areas shall be spread over the disturbed areas after construction in each area has been completed and rehabilitated with indigenous vegetation. Excess sub-soil will be carted away to an authorized location.

Impacts during operation

In the absence of ambient air quality data based on recently undertaken air quality measurement, it is expected that the **air quality** in the region where the wind park is located is impacted in a minor amount only. However, the operation of the wind turbines will not have any effects on the environmental situation of the air quality at site and in the region.

During operation of the wind turbines **noises** are generated by air flow around the blades (aerodynamic noise) and due to movement of the gears (mechanical noise).

Sound emerged during normal operation of the wind turbines is a result of high frequency vibrations coming from numerous mechanical parts mounted inside of the wind turbine.



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Normally noise coming from a wind farm located in a rural area will be louder than the noise coming from a wind farm located in an industrial zone. If the wind turbines are not located on a proper distance from human residential areas, the noise emission during operation could pose disturbance to the local population and to the animals.

A preliminary noise assessment was undertaken by the utility “JP Elektroprivreda Bosne i Hercegovine d.d. Sarajevo” in June 2013, considering the wind park configuration and layout applicable at that time. The results shown below should provide an indication of the potential impacts resulting from noise on the environment. Additional baseline noise level measurements and the noise level analysis at the most affected sensitive area (Okolište (single house) and Dobrč) will be conducted. Based on these baseline noise measurements, the most recent wind farm layout and an up-to-date site map, noise level analysis will be made.

Calculated noise level

Receptor point	Distance from the closest turbine	Calculated noise levels dB (A)
Gornje Opine	888	42,6
Okolište	1.091	39,1
Šipovac	2.238	31,3
Gornje Gnojnice	2.139	39,1
Dobrč	765	43,0
Usamljena kuća - Okolište	978	40,2

The Contractor is requested to perform the noise assessment based on the finally chosen wind turbines and to consider suitable mitigation measures to reduce the expected and calculated impacts to an acceptable level in case of exceeding the applicable standards.

Almost all sensitive bird species are at risk from possible collision mortality and most of them at danger of disturbance. Some will be affected by barrier effect in case more wind farms are built in the vicinity. Indirect effects will be potentially visible in the operation phase. It can be concluded that the whole project area is a sensitive location for migration birds and nesting place of several vulnerable and endangered raptor species.

To mitigate impacts on birds, following mitigation and monitoring measures are recommended:

- Installation of radar SCADA (Supervisory Control and Data Acquisition) system, capable of activating mitigation measures (e.g. shut down of turbines) during conditions of high bird mortality risk or in presence of sensitive raptor species, and other systems such as lighting and acoustic deterrence.
- Increasing visibility of rotor blades: red color painting of peaks of blades and lighting for night protection.
- Installing transmission cables underground.
- Grouping turbines to avoid alignment perpendicular to main flight paths and to provide corridors between clusters.



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- Sitting turbines close together to minimize development of footprint (subject to technical constraints).
- Monitoring of bird populations on bird activities and mortality surveys during the first two years of operation. Employing an on-site ecologist during maintenance period.

Of the 14 **bat** species recorded, 1 is considered at medium risk and six species are considered to be at high risk of collision with wind turbines. During seasonal migrations higher bat fatality of other species can also be expected.

To mitigate impacts on bats, following mitigation and monitoring measures are recommended:

- Since most bat fatalities occur by low wind speed, these can be significantly lowered by increasing the cut-in speed (CiS), i.e the wind speed at which turbines will generate usable power: adjusting of CiS at 6 m/s between one hour before sunset and one hour after sunrise, from May 1st until October 31st if temperature is above 10 °C.
- Prevent turbines from freewheeling or spinning at low rpms when wind speed is lower than the CiS. This can be achieved by raising the start-up speed (SuS) or by using blade feathering.
- Use of multifactorial based model to predict bat activity level in correlation to wind speed
- Wind turbines should be maintained in a way that they don't attract insects. Lighting shall be used only when necessary (because of safety reasons) in form of red blinking lights.
- Two years monitoring of bat populations on activities and mortality surveys from February to November.

Because of its vertical dimensions and rotating blades, wind turbines are conspicuous and regarding that, they represent a whole new dominant element of space. The Wind Park Podveležje will not be visible from Mostar due to sharply elevated slopes of Podvelež. According to that no **visual degradation** of space from this perspective will appear. The closest villages are located in the valleys, and only from a few houses the wind farm can be slightly noticeable.

Wind turbines are tall objects, with a relatively small volume, although they can block the sunlight and create shadows. While operating they can cause some unpleasant **shadow flickering** which can be noticed from the distance of 10 rotor radius (ca. 600m).

A special sort of unpleasant flickering can be caused by the rotating shadows coming from the blades. This effect can be seen only from the neighboring buildings (through the windows) which are situated in the zone of moving shadows.

A shadow flickering assessment was undertaken by the utility "JP Elektroprivreda Bosne i Hercegovine d.d. Sarajevo" in June 2013, considering the wind park configuration and layout applicable at that time. The results of the shadow flickering are described in the following table. It should be noted that the layout of the Wind Park changed between 2013 and today because the supplier of the wind turbines was not known at the time the shadow flicker assessment was done. An up-to-date analysis on shadow flickering based on the actual layout and the offered wind turbine with the highest shadow flicker impact will be conducted upon selection of a Construction Contractor and the contract award.



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The results as shown below should provide an indication of the potential impacts resulting from the shadow flickering effect.

Effects coming from shadowing (indicative data only)

Receptor point	A	B	C	D	E	F
	Gornje Opine	Dobrč	Okolište	Najbliža kuća - Okolište	Gronje Gnojnice	Šipovac
Distance from the closest WT	888	765	1.091	978	2.139	2.238
Shadow-hours/year	00:00	55:14	29:12	14:42	00:00	00:00
Number of shadow days	0	178	124	56	0	0
Maximum shadow-hours/day	00 min	36 min	22 min	24 min	00 min	00 min

The calculation results show that three of the six examined emission points (A, E, F) are not under the impact of shadow flickering. Theoretically, the maximum impact for emission points (B, C, D) is calculated 55:14 hours per year. Considering that the sky is about 25% covered with clouds during the day, whole year through, and considering that the wind turbines are rotating 80% of the time, it can be expected that the maximum of shadow flickering will be minimized by around 35%.

Shadow flickering during the year (indicative data only)

Receptor point		Distance from the nearest WT	Theoretical maximum of shadow flickering hours/year	Real time of shadow flickering
B	Dobrč	765	55:14	36 hours
C	Okolište	1.091	29:12	19 hours
D	Usamljena kuća - Okolište	978	14:42	9 hours

The Contractor is requested to perform the shadow flicker assessment based on the finally chosen wind turbines and their layout and to consider suitable mitigation measures to reduce the expected and calculated impacts to an acceptable level according to the applicable standards.

Based on the limited quantities of fluids contained in the wind turbine generators and the leak detection and containment systems, the potential for an **accidental spill** from malfunction is



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extremely limited. Furthermore, any accidental gear oil or other fluid leaks from the wind turbines will be contained inside the turbine towers which are sealed around the base. Replacement fluids must be stored indoors in appropriate containers. All operation staff must be trained in appropriate handling and spill prevention techniques to avoid any accidental spills.

There will not be any on-site **wastewater** disposal. The turbines and the associated wind farm components do not generate wastewater.

During operation, **no solid waste** will be produced.

Transformers at the substation should be provided with **firewalls** along with an **extinguishing system** with the appropriate extinguishing agent. For the outdoor power transformer, a foam extinguisher system is appropriate. The fire extinguishing system prevents the spread of fire to other equipment in case of a transformer fire. The corresponding training for personnel and firefighting procedures should be enforced, as well as personal protective gear including helmets, gloves and tools must be available at the substation.

The substation is enclosed by a fence for **security** reasons. Other security measures that can be implemented are warning signage, locking the gate, and no spaces beneath the fence (washout) that allow underneath access to people.

PUBLIC CONSULTATION

Vjetroenergetika d.o.o. in accordance with the Environmental Protection Law held in February 2008 a **public consultation**. The purpose of the public consultation session was to present the Preliminary Environmental Assessment of Wind farm Podvelezje.

The consultation ("javna rasprava") was organised by the Federal Ministry of Environment and Tourism. Interested participants, NGOs together with the representatives of the local communities and canton were present in public consultation. All received comments on the preliminary EIA were considered by the Expert Committee and addressed in the final preliminary EIA. The result of the public consultation is a part of the environmental permit application.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

The purpose of the ESMP is to ensure that the social and environmental impacts, risks and liabilities identified through „The Documentation with the Application for the Environmental Permit” are effectively managed during the construction, operation and closure of the project. The results of the “Baseline Survey of Birds and Bats at the Wind Farm Podveležje Project Area” (Oikon Ltd., 2015) have also been considered. The ESMP is a stand-alone document, and specifies the mitigation and management measures to which the Employer and Contractor are committed and shows how the project will mobilize organizational capacity and resources to implement these measures. The ESMP also shows how mitigation and management measures must be scheduled.



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The Contractor is obliged to prepare the Elaborate on environmental protection according to the Decrees on development of building site, compulsory documentation at building site and participants/parties in building (Official Gazette of FB&H, No. 48/09, 75/09, 93/12). This means that the Contractor has to develop the final version of the ESMP considering all necessary management actions during the construction phase. The present initial ESMP provides the overall framework based on the environmental permit and on the results of the “Baseline Survey of Birds and Bats at the Wind Farm Podveležje Project Area” (Oikon Ltd., 2015).

The Contractor has to add the site-specific management measures based on his construction and implementation activities and should revisit the Birds and Bats survey recommendation section for deepening his understanding on this topic.

The mitigation measures from the ESMP are included in the Environmental and Social Impacts and Mitigation Measures section.