



## **WIND POWER PLANTS MOUNT VLAŠIĆ PLATEAU**



**Ministry of Economy of Central Bosnia Canton**  
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## 1. INTRODUCTION

The use of renewable energy sources for electricity generation is of particular interest, since it is the most convenient and the best form to use. An option to increase the use of hydro energy construction of large hydropower plants is very limited simply because all major rivers are already used or their use is not profitable due to economic, environmental or other reasons. That is why the attention of investors and others turned to wind and solar energy as a form in which the conversion efficiency and developed technologies provide the most favorable conditions. As a result of this orientation, there has been intensive development of wind power, according to the level, which is only comparable with the progress in the computer industry.

In Bosnia and Herzegovina there are no detailed data on the characteristics of the wind, however, empirical estimates from meteorologists, local residents and field by seeing and measuring and testing of wind the last few years by the concessionaire, is determined by a larger number of micro-locations on the plateau of Mount Vlastic, which proved to justify the investment in this sector.



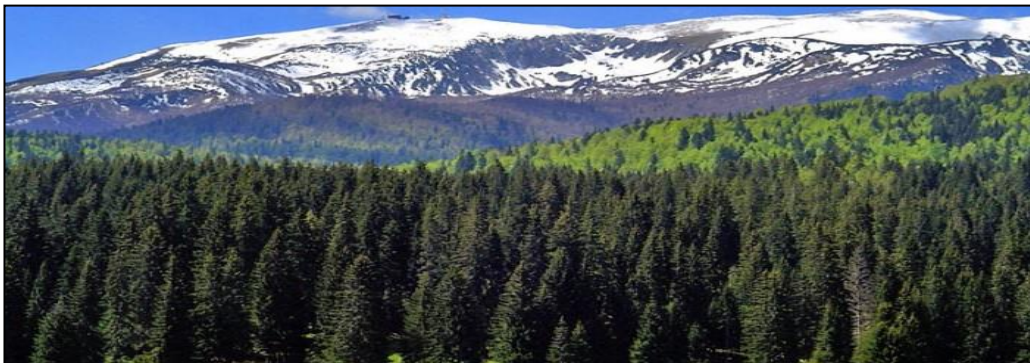
## 2. LOCATIONS

Bosnia and Herzegovina includes three major geographic areas: the pannonian area in the north, the mountainous area in central part and the coastal region which is in the south. The biggest area is mountainous area, and almost in the center of this area Mountain Vlastic and the town of Travnik is located, Travnik is the administrative center of Central Bosnia Canton.

Travnik is centrally placed in relation to the borders of Bosnia and Herzegovina, average distance from the regional centers of Banja Luka, Mostar, Tuzla and Sarajevo is about 100 kilometers away. Such transit connections are provided by the natural layout of the river valleys, basins and mountain ranges, the easiest natural plan contributed to the construction of the roads and directions of development in this part of BiH.

Distance from Travnik to the Sava river valley in the north by traveling along the river Vrbas to Bosanska Gradiska is the same as the distance to the Bosanski Brod traveling along the Bosna valley, it is about 200 km and the same distance is to the coastal areas in the south to the city of Split.

The general geographical location of Travnik is at 44 degrees 14 minutes on the north latitude and 17 degrees 40 minutes on the east longitude, Travnik is located in the middle of the northern zone, while its regional geographic location is in the central part of the mountain Dinara range and it indicates a transitional character of the continental climate.



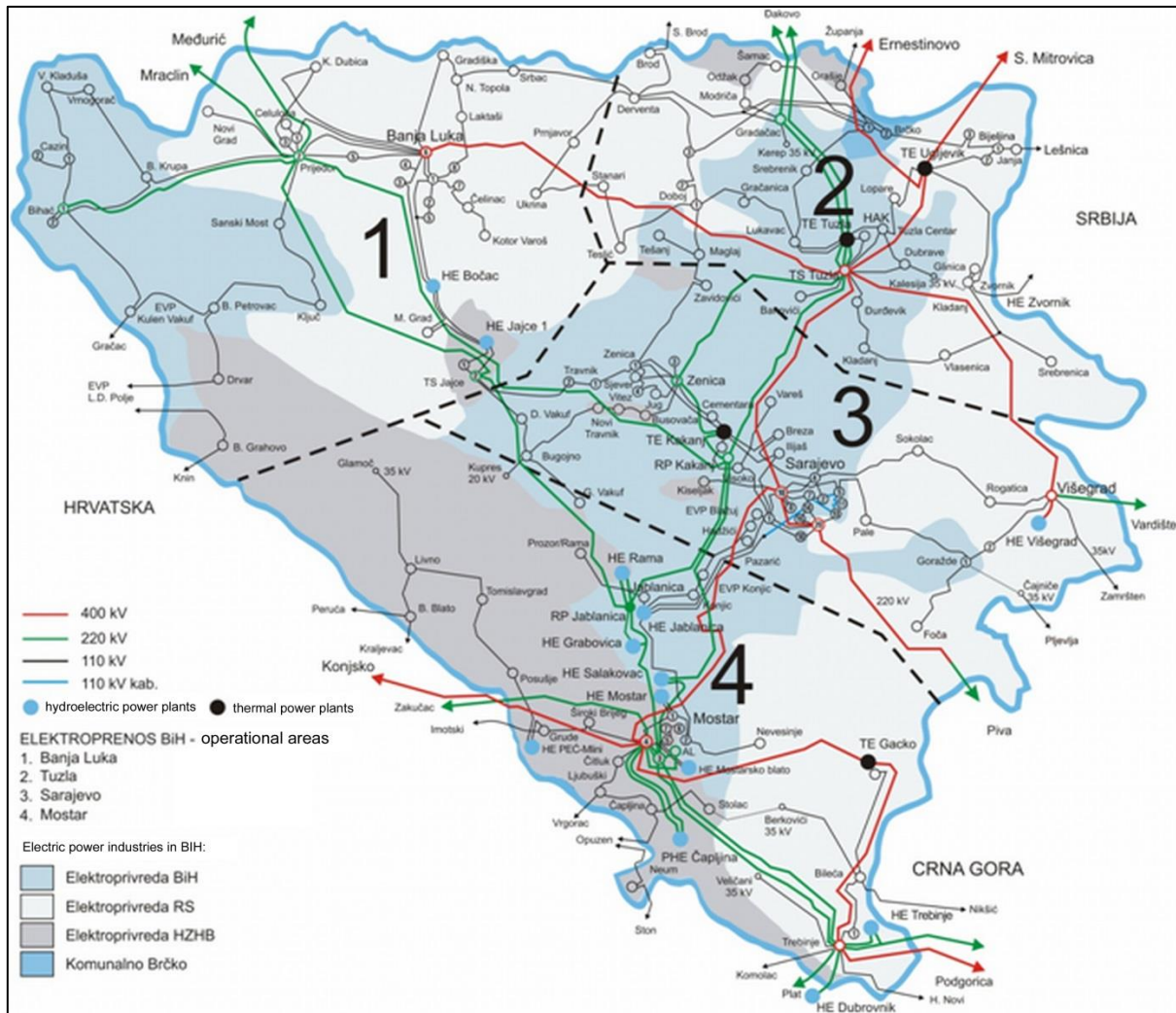
### **3. REQUIERMENTS FOR INCLUSION IN POWER SYSTEM**

In the electricity market in Bosnia and Herzegovina three power companies are present , they include production, distribution, supply and trade. The Act established Independent System Operator (ISO) and the single power transmission company (Transmission). These two companies are regulated by the State Electricity Regulatory Commission (SERC). Due to the specific composition of Bosnia and Herzegovina, there are Entity Regulatory Commission for Electricity and Regulatory Commission for Electricity in Federation of Bosnia and Herzegovina (FERC) and Regulatory Commission for Electricity of Republika Srpska (RERS).

In the Federation of BiH Law on Electricity in the Federation and the Law on use of renewable energy sources and efficient cogeneration define and regulate the power system, the development of the electricity market and the institutions responsible for the market, the general conditions of electricity supply, planning and maintenance of the power system.

The Concessions Law defines the manner and conditions under which a legal person may obtain a concession for the use of natural resources.

Connecting wind farms at the Vlastic site can be performed on an existing transmission line of 110 kV from Jajce to Travnik. Connection includes the construction of connecting substations through which the wind power would join to the main grid. Wind turbines would be connected by underground line, while from substations to the connection to the 110 kV distribution line would be built above-ground lines.



source: <http://www.derk.ba/ba/ees-bih/karta-ees>

## 4. EQUIPMENT TRANSPORTATION

Location includes all infrastructural elements that ensure the technical conditions for construction of wind farms. Transportation equipment from Western European countries is possible in many ways, but it is certainly the most cost effective transport equipment by boat to the port of Ploče in Croatia. From the port of the goods transported existing roads to the site of wind farms.

From the port the goods would be transported via existing roads to the site of wind farms. There are several roads that could be used to get equipment to the desired location; most suitable travel direction should be select, taking in consideration the distance, but also in terms of road conditions, given that it is transport equipment which requires the use of heavy trucks. Reaching the micro locations for the installation of each wind turbine there are rural roads that had to be partially reconstructed, and in some areas they would have to build new roads in order to provide the necessary infrastructure for the delivery of equipment to the site.

Transport by ship, the existing path to micro locations and the network of rural roads on the micro-location provides low-cost transportation and installation of equipment, which has a significant impact on the economics of the project, because the experience of European countries shows that the category of costs has a significant share in the total investment cost of implementation project construction of wind power plants. According to equipment manufacturers maritime transport is the best channel for conveying heavy and scale equipment (wind turbine blades, segments of the stairs, mechanical room ...). Equipment manufacturers have specialized vessels for such transportation, and it is technically feasible. Details of transport and determining the amount of transport costs should be done through a special feasibility study transport equipment for wind power plants.



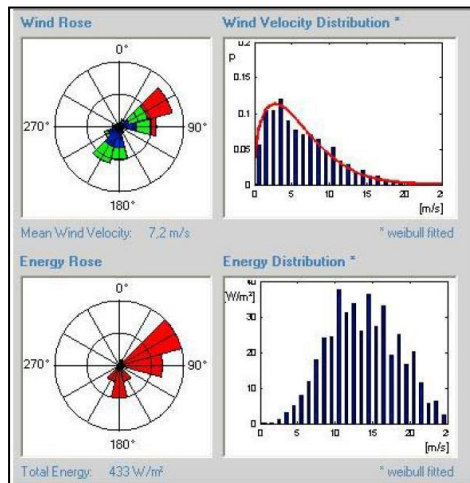
## 5. WIND POTENTIAL

At the site of Vlasic following concession have been concluded:

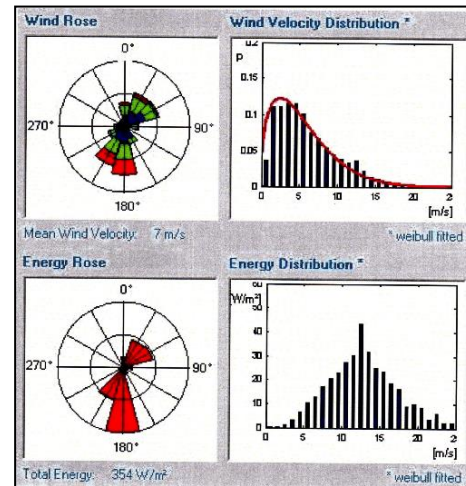
Concessionaire	Installed power
<b>Elektroprivreda BiH</b>	up to 50 MW
<b>Eberkon doo Travnik</b>	up to 50 MW
<b>TLG doo Travnik</b>	up to 100 MW
<b>Lahor doo Travnik</b>	up to 50 MW
<b>Eskimo S2 doo Travnik</b>	up to 200 MW

After the tests of wind, concessionaires are in the process of gathering authorizations for the construction of wind farms and seeking investors for the project.

### *Wind rose and distribution rates in the diagram*

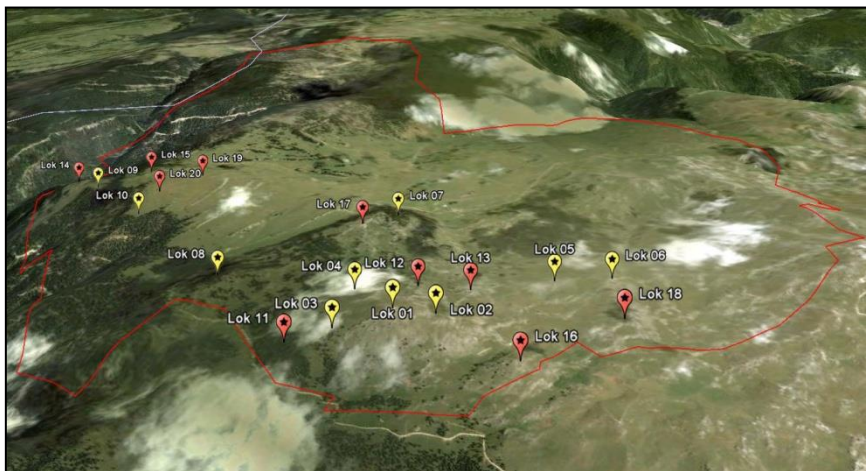


*Location Galica – Vlašić*



*Location Vitovlje malo - Dobretići*





*Mikrolocations wind turbines Vlašić and Galica*



## 6. FINANCE COSTS

Currency	€ (EUR)		WIND POWER VITOVLJE MALO – DOBRETIĆI VESTAS V112					
The lifespan of a wind turbine	20							
Discount rate	7%							
Profit tax	10%							
<b>Power of Wind power plant</b>		<b>value</b>		<b>INVESTMENT</b>		<b>TERMS OF PAYMENT</b>		
<b>Total installed power</b>	MW	48		Investment volume Mio.€		64,8		
<b>The estimated number of hours</b>	h/a	3730	42,6% NCF	Time use				
<b>Efficiency</b>	%	86	4186 kJ/KWh	Date of the trial run	date	1.2017.		
<b>Total operating expenses</b>		Value	Increase	Usage time after probe	year	20		
<b>Staff costs</b>	Mio/€/a	0,102	1,0%	Time write-off of equipment	godina	25		
<b>Insurance costs</b>	Mio/€/a	0,369		FINANCING				
<b>Fixed maintenance costs</b>	Mio/€/a	2	2,0%	The share of foreign capital 1		80%	-16 10%	
<b>Concession fee 2%</b>	Mio/€/a	0,2	2,0%	The cost of foreign capital		4%	-6 20%	
<b>Costs TS 110 i transmission line</b>	Mio/€/a	0,35		Start loan repayment	date	1.2018.	-2 20%	
<b>The cost of road construction</b>	€/MWh	0,25	1,0%	Repayment period	year	15	-1 10%	
<b>Wind</b>	€/GJ			The share of foreign capital 2			1 10%	
<b>The funds for the compensation of the environment</b>	€/MWh	0,025	2,0%	The cost of foreign capital			13 30%	
<b>Operating income</b>		Vrijednost	Increase	Start loan repayment	date			
<b>Fixed income</b>	Mio/€/a			Repayment period	year			
<b>Special revenue D</b>	Mio/€/a			CALCUATION OF OWN CAPITAL				
<b>Special revenue E</b>	Mio/€/a			The share of own capital		20%		
<b>Special revenue F</b>	Mio/€/a			Interest				
<b>The average selling price of electricity</b>	€/MWh	53,23		Period of allocation of own capital	year	15	Total 100%	

Display of costs and funding models for selected wind turbines VESTAS V112

## 7. CONCLUSION

There are technical possibilities for the construction of wind farms both in terms of wind and the aspect of the existing infrastructure capabilities necessary to build and operate wind farms. There are real economic interests for the construction of such plants, and the investment in the wind farm is fully justified. Implementation of the project would have a very positive social effect.

Engaging local businesses during wind farm construction. A continuous source of income for local governments on the basis of concession rights. Employment in maintenance and administration of wind farms. The possibility of using space for wind farms and other complementary purposes. The incentive and example for the creation of a positive entrepreneurial spirit.



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