Institute for Strategic Studies and Prognoses

KRNOVO WIND FARM

Pilot case analysis

Project co-financed by the EU (ERDF, IPA)

1. Introduction

The ability to meet its own electrical energy needs plays a significant role in the development process of each country. In order to reduce the use of fossil fuels, reduce the level of pollution and energy imports, many countries are entering into implementation and development programs in the field of renewable energy sources. Combustion of fossil fuels is released into the atmosphere of large amounts of carbon dioxide (CO2) and other gases with a greenhouse effect that lead to global warming. It is believed that reducing the level (CO2) is a key precondition for reducing the harmful effects of global warming.

Renewable energy sources are limited due to different types of constraints, such as: site complexity and topography, accessibility of the site and road networks, the presence of nature parks, railways, electricity networks, restrictions on urban settlements and the environment.

An analysis of the potential of renewable energy sources shows that they can play an important role in the energy balance we are trying to achieve. However, as stated in the analysis of the assessment of the potential of renewable energy sources in Montenegro, there are a number of obstacles that prevent the widespread use of renewable energy sources: very low prices of traditional energy and fuel, insufficient investors interested in investing in the mentioned technologies, lack of comprehensive legal basics in order to promote the use of renewable energy sources and insufficient information to the public who are not familiar with the possibilities of using renewable energy sources.[1]

2. Legislative framework

The legislative framework regarding this area is regulated by the *Law on Energy* (LoE) [2]and the *Law on Energy Efficiency* (LoEE)[3].

In the Law on Energy adopted in 2010 it is established that the conditions for performing energy activity and the manner of their activities for the purpose of quality and safe supply of end customers with energy; public services and other activities in the field of energy of interest to Montenegro; the way of organizing and functioning of the electricity and gas

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[1] Assessment of Potential Renewable Energy Sources in the Republic of Montenegro (2007), Ministry of Environmental Protection, Land and Sea of the Republic of Italy, Italy, pp. 2-3

[2] Law on Energy ("Official Gazette of Montenegro", No. 28/10 of 14.05.2010, 40/11 of 08.08.2011, 42/11 of 15.08.2011, 06/13 of 31.01.2013, 10/15 of 10.03.2015)

[3] Law on Energy Efficiency ("Official Gazette of Montenegro", No. 29/10)

market; manner and conditions of using renewable energy sources and cogeneration; energy efficiency in the energy production, transmission and distribution sector. [4]

According to the Law on Energy, Article 5 paragraph 38 defines renewable energy sources as energy sources that are renewed in whole or in part, in particular the energy of watercourses, wind, non-accumulated solar energy, biofuel, biomass, biogas, geothermal, hydrothermal and aero thermal energy, tide and shocks, gas from landfills, gas from the wastewater treatment plant. While it is specified in Article 82, paragraph 1 of this law, it is stated that energy facilities for the production of energy from renewable sources (more precisely wind farms) can only be built after preliminary measurements and research of the potential of renewable energy sources have been carried out.

Law on Energy Efficiency adopted in 2010, which determines the way of efficient use of energy, measures for improving energy efficiency. This law does not apply to the energy efficiency of the power generation, transmission and distribution plant. In this law, energy efficiency is defined as the ratio between energy consumption and output in services, goods or energy.

Law on Ratification of the Treaty establishing the Energy Community[5](EncT), adopted by Montenegro in 2006 and based on the decisions of the Council of Ministers of the Energy Community since the date of signing EnCT to date, the obligations of Montenegro from the Acquis Communautaire are as follows:

1. Electricity:

• Directive 2003/54 / EC of the European Parliament and of the Council (26 June 2003) on common rules for the internal market in electricity;

• Directive 2005/89 / EC (18 January 2006) on measures to ensure the security of electricity supply and investment in infrastructure;

• Regulation (EC) 1228/2003 (June 26, 2003) on the conditions for access to the network for cross-border electricity exchange;

2.Gas:

• Directive 2003/55 / EC (June 26, 2003) on common rules for the internal market for natural gas;

• Directive 2004/67 / EC (26 April 2004) on measures to ensure the security of natural gas supply;

[4] This law does not apply the energy efficiency in final energy consumption.
[5]Law on Ratification of the Agreement on the Establishment of the Energy Community "Official Gazette of the Republic of Montenegro, No. 66/2006.

• Regulation (EC) 1775/2005 (September 28, 2005) on the conditions for access to the natural gas transmission network.

3. Environment:

• Directive of the European Parliament and of the Council of 13 December 2011 on the assessment of the impact of certain public and private projects on the environment;

• Directive 2003/35 / EC (May 26, 2003) on public participation in the preparation of specific plans and programs relating to the environment;

• Directive 1999/32 / EC (26 April 1999) on the reduction of sulfur content in certain liquid fuels, supplementing Directive 93/12 / EEC;

• Directive 2001/80 / EC (23 October 2001) on the limitation of emissions of certain pollutants into air from large furnaces;

• Article 4 (2) of Directive 79/409 / EEC (2 April 1979) on the protection of wild birds.

• Directive 92/43 / EZZ (21 May 1992) on the protection of natural habitats and wild fauna and flora.

4. Competitiveness:

• Articles 81, 82 and 87 of Annex III of the EnCT.

5. Renewable energy sources:

• Directive 2003/30 / EC (8 May 2003) on the promotion of the use of biofuels or other renewable fuels for transport.

• Directive 2009/28 / EC (23 April 2009) on the promotion of the use of energy from renewable energy sources.

6. Energy efficiency:

• Directive 2006/32 / EC (5 April 2006) on efficient end-use of energy and energy services and Directive 2012/27 / EU (October 25, 2012) on energy efficiency;

• Directive 2010/30 / EU (May 19, 2010) on labeling and standardized information on energy consumption and other resources for products that affect energy consumption and implementation regulations for particular product groups;

• Directive 2010/31 / EU (May 19, 2010) on the energy performance of buildings abolishing Directive 2002/91 / EC;

7. Directive 2009/119 / EC on Minimum Oil and Oil Derivatives

8. Directive 2008/92 / EC on the transparency of electricity and gas prices charged to industrial end-users and the Regulation on Energy Statistics.

Montenegro ratified the *Kyoto Protocol* to the United Nations Framework Convention on Climate Change (UNFCCC) by law.

2.1. Institutional - Organizational Framework

Institutions that make up the organization sector of the energy sector of Montenegro are:[6]

• Ministry of Economy in charge of energy, according to the ZoE, especially for the energy policy and strategy of the state, as well as preparation of laws and by-laws in that sector. The Ministry of Economy for the Energy Sector covers three sectors: Energy Sector, Energy Efficiency Sector and Sector for Mining and Geological Research.

• The Energy Regulatory Agency (RAE) was established by the Parliament of the Republic of Montenegro on January 22, 2004 as an independent, functionally independent and non-profit organization, for the purpose of regulating the energy sector of Montenegro.

• Elektroprivreda Crne Gore (EPCG AD) is the holder of three licenses for: (i) production, (ii) distribution of electricity and distribution system operators and (iii) electricity supply. EPCG AD currently has the status of public electricity supplier in Montenegro. The ownership structure is: State - 57.0%, A2A (Italy) - 41.7%, minority shareholders - 1.2%.[7]

• ZETA ENERGY DOO Danilovgrad RAE has issued a license for the production of electricity. The ownership structure is: EPCG - 51% and NTE (Norway) - 49%.

• The Montenegrin Electricity Transmission System (CGES AD) was separated from the EPCG AD in 2009 and has two licenses: for the transmission system operator and the transmission of electricity. The ownership structure is: State - 55,0%, the Italian transmission system operator (TERNA) - 22, 1%, other legal and natural persons - 22.9%.

• The Montenegrin Electricity Market Operator (COTEE d.o.o.) started operating in 2011 on the basis of the decision of the Government of Montenegro to separate this energy activity from CGES AD. COTEE d.o.o. which is 100% state-owned. COTEE d.o.o. has a license for an electricity market operator.

• Coal mine AD Pljevlja (RUP) is in mixed ownership, and its ownership structure is: A2A - 39.5%, State - 31.1%, other legal entities and natural persons - 29.3%.

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[6]Energy Development Strategy of Montenegro until 2030 (2014), Ministry of Economy, Podgorica, Montenegro, pp. 2-3.

[7] Process of activation of put option is in progress.

In the oil and gas sector, where oil derivatives and liquefied petroleum gas are fully imported by Montenegro, the main energy entities are:

1. Jugopetrol AD Kotor - joint stock company for exploration, exploitation and trade of oil and petroleum products.

2. Montenegro Bonus d.o.o. Cetinje - a state-owned company dealing with wholesale of petroleum products, trade and electricity supply. In addition, Montenegro Bonus d.o.o has been nominated for a gas transmission operator, and the Government of Montenegro is in charge of the development of a part of the IAP gas pipeline through Montenegro.

• The Statistical Office of Montenegro (MONSTAT) has a very important role in the energy sector of Montenegro because it represents the official producer of energy statistics. MONSTAT is responsible for producing energy balances, while the responsible Ministry is responsible for the development of planned energy balances.

2.2. Regulation related to Krnovo wind farm

In addition to the above, the following legal documents refers to the Krnovo wind farm itself. Respective documents comprehend the following:

• Regulation on the tariff system for determining the incentive price of electricity from renewable energy sources and high efficiency cogeneration ("Official Gazette of Montenegro" No. 52/11 and 28/14)

• Regulation on wind farms ("Official Gazette of Montenegro", number 67/09)

• Rulebook on methodology for calculating the purchase price of electricity from wind farms ("Official Gazette of Montenegro" No. 27/10)

• Decree on the manner of acquiring the status and exercising the rights of privileged producers of electricity ("Official Gazette of Montenegro", No. 37/11 and 28/14)

• Decree on compensation for stimulating production of electricity from renewable energy sources and cogeneration ("Official Gazette of Montenegro", No. 8/14)

• Contract for land lease and construction of wind farm at Krnovo locality closed 05.08.2010. - Direct contract closed 06.07.2015.

• Contract for defining the conditions for concluding a contract for purchase of electricity from the wind farm Krnovo completed 17.11.2014.

Regarding the strategies that have been adopted in this area, it is important to highlight the *Energy Development Strategy of Montenegro by 2030 - the White Book.*[8]From June 2012, the

[8]Energy Development Strategy of Montenegro until 2030 (2014), Ministry of Economy, Podgorica, Montenegro

result of a project funded by the European Union (Specific Contract No. 2011/262840). It was developed by Exergia as a member of the COWI consortium.

3. Wind potential and environment description

Montenegro has significant potential for the use of wind energy in individual parts of the territory and most of the territory of Montenegro wind speed is less than 5 meters per second. However, the estimated values increase from 5 to 7 m / s, moving towards the coast, reaching values from 7 to 8 m / to certain areas along the coast. It is also an interesting area around Niksic with an average wind speed in the range of 5.5 to 6.5 meters in seconds. Typical values of the actual energy potential of the wind are 100 ÷ 300 W / m2, while in the most winding regions, on the slopes and peaks of mountain wreaths, the actual energy potential of the wind reaches values of over 400 W / m2. In the coastal area and around Niksic there is a well-developed network of transmission lines and roads, it is exactly these areas represent the most interesting locations for exploiting the energy potential of the wind:

- Coastal belt: the highest wind speeds in the country were measured in the area of Rumija, taking into account technical, economic and environmental limitations. Another interesting area is the hills in the hinterland of Petrovac (this area is located near the main roads and 220 kV networks). Other suitable locations could be in the mountain zones of Herceg Novi and Orahovac. In all these areas, the mean wind speed is over 6 m/s
- Area around Niksic: this area is characterized by an average wind speed in the range of 5.5 to 6.5 m / s. In addition, the existing road and electricity network infrastructure is one of the reasons for choosing this site for the wind farm at Krnovo.

In the assessment studies of the potential of renewable energy sources in the Republic of Montenegro, Montenegro has issued four licenses to measure the wind potential without exclusive right to the site. Two companies who recived the permission were submitted to the competent ministry of energy in 2009.measurement, analysis and potential technical solutions.

Based on the results of measurements, according to the relevant Ministry of Spatial Planning and the Environment and the Opinion of the Transmission System Operator, in December 2009 a public tender was announced for two specific locations.[9]

Two locations for wind farms, for which contracts for land lease and the construction of wind farms have been signed, are the Mozura, the predicted power of 46 MW and the

[9]Assessment of Potential Renewable Energy Sources in the Republic of Montenegro (2007), Ministry of Environmental Protection, Land and Sea of the Republic of Italy, Italy, pp. 2-3

annual production of 105.8 GWh and the Krnovo installed power of 72 MW and the annual production of 215 GWh. Except these locations, until 2020 and later, several more wind farms were added, without precisely determined locations, with the potential to reach the amount of 348 GWh (151 MW) and by 2030years 436 GWh (190 MW).

4. Krnovo Wind farm

Wind power is the fastest growing worldwide power generation technology and is the cheapest technology for electricity generation from renewable sources available today in the market. It is planned that the costs will continue to decline and that the wind energy from 2020 will be the cheapest electricity source in the world.

The hill is a grassy plateau, surrounded by branches of the Vojnik Mountain, which descends to the Nikšić Field. It is located in the territory of three municipalities: Niksic, Savnik and Pluzine. The project includes 26 wind farms, two overhead transmission lines (Krnovo-Brezna and Brezna-Klicevo), two new substations (Krnovo and Brezna) and buildings for wind turbine management. The construction began in May 2015, and the works were completed in October 2016. Installed wind power is 72 MW, and the planned annual output is 200 to 230 GWh. Windmills are located at an altitude of 1500 m above sea level, while wind generators are at a relative height of 85 m.

Near the location on the wind farm there are houses and other facilities used as huts. The nearest village is Grozd (2.3 km), while the closest town is Savnik (6.5 km). The transit line passes through several villages. Six houses are up to 200m from the corridor, and the closest is only 88m away. The minimum allowed distance from the transmission line corridor is 60m.

The agreement on land lease and the construction of a wind farm at the Krnovo Montenegro site was concluded in 2010 with the consortium "MHIIVICOM Consulting GmbH" whose members are Mitsubishi Heavy Industries from Japan and Ivica Consulting GmbH from Austria. After that, there is a change in the structure of Annex, signed by the contractual parties in 2012, instead of Mitsubishi Heavy Industries, the French company "Akuo Energy" joined the consortium as the new leader of the consortium. In 2018 Masdar of Abu Dhabi signed an agreement with French firm Akuo Energy on the purchase of 49% of Krnovo wind power plants. The basic elements of the Lease Agreement are[10]:

• The amount of rent for state-owned land submitted as part of the offer was 0.10 € / m2 (according to the public advertisement the minimum amount of rent for state land is 0.05 €

[10]Ministry of Economy (2015), "Krnovo Project", Montenegro.

/ m2) and is paid from the date of the spatial planning documentation containing the construction project wind farms at Krnovo.

• The area of state-owned land was initially 183.322 m2, with obligatory land survey after completion of the construction of the wind farm and before commissioning, but it cannot be less than the area defined by the Contract. The contract subsequently specified the state-owned land, which is leased in the amount of 219,097 m2, on the basis of which the amount of the rent was determined;

• The land is leased for a period of 20 years that starts to run on the day of issuing spatial planning documents; it was subsequently established by the annex that it started to run from the issuance of innovated urban-technical conditions, i.e. dated 10 May 2013;

• At the time of signing the contract, it was determined that the total installed power of the wind farm would be up to 50MW, with the possibility of increasing the installed capacity for another 22MW by signing the Annex of the Contract in the case that AD Prenos issued a positive opinion confirming the possibility of increasing and connecting the wind power plant with total installed power up to 72MW electroenergy system;

- The state of Montenegro undertakes that the purchase price of electricity generated in the wind farm will be guaranteed and fixed for the first 12 years of operation, and will not be less than 95,99 € / MWh;

The project is worth 140 million euros and for financing it is provided from the credit from the European Bank for Reconstruction and Development, the German development bank KfW IPEX-Bank and the French development financial institution Proparko.

Possible negative impacts are: damage to roads during construction works and wind turbine transport, possible negative impact of wind turbines on birds and blind mice, and noise production during the operation of wind farms. Despite these negative effects, the project has great importance for the economy and sustainable development of Montenegro.

The largest wind farm in the region will significantly contribute to the achievement of Montenegro's energy targets set by 2020, which obliges 33% of total consumption to be from renewable energy sources. Krnovo Green Energy acquired the status of a privileged producer at the beginning of November last year, which enabled it to provide an incentive price for the sale of produced electricity of at least 95.99 € per megawatt. The guaranteed price represents the way of stimulating production from renewable energy sources. The price of energy for supplying distribution customers amounts to 36.97 € / MWh. The difference between this price and the incentive price is provided by collecting funds from all end customers in a proportionate proportion depending on their consumption, which is a common practice in the EU countries. Each supplier of electricity shall be obliged to deliver the invoice to the customer and shall indicate the amount of the fee as a special item.

The amount of state aid is determined as follows: the difference between the guaranteed price and the current energy supply price multiplied by the produced amount of electricity. The difference is 59,02 € / MWh multiplied by 215 mwh with the planned average value of annual production and amounts to 12,689,300 €. Krnovo represents 8% of the installed capacity for electricity production, while 6% of the total electricity production.

Table 1: Basic information about Krnovo wind farm

Value of the project: 140 milion €
Project Implementers: Ivicom Consulting (Austria) - founded Krnovo Green Energy, a loan user established for the purpose of building and future use of the wind farm, Akuo Energy (France) - a sponsor, developer and operator. 2018 Mazdar bought 49% of the actions.
Installed power: 72 MW
Turbines: General Electric manufacturer, 2,8 MW
Annual reduction of CO2 emissions: 78 768 tons
Land lease: 20 years with the possibility of extension up to a maximum of 5 years
Beginning of works: May 2015 - while it is 2017. In the beginning of the year he started his trial work
Altitude: 1500 meters
Average wind speed: 5.5 to 6.5 meters per second
Windmill generator: at a height of 85 meters, weighing 83.5 tons
Production: estimated at 200 GWh per year (200-230 GWh), which is sufficient for 50 000 households (45 863).

Source: Akuoenergy

5. Environmental impact assessment

5.1. Environmental analysis

Wind power plants, as well as other sources of electricity, have the ability to change the natural environment in which they are located. In relation to fossil fuels, the impact of wind energy on the environment is much lower. Wind farms have one of the smallest global warming potentials per unit of electricity they generate.

Although significantly smaller, their environmental impact is not negligible. They affect natural heritage in several ways: air pollution, habitat change, impact on flora and fauna.

5.1.1. Air pollution

Wind farms emit different amounts of pollution when they are connected to the power grid and when they are isolated from the power grid. When isolated from the electricity network, almost negligible quantities of CO_2, CO, SO_2, NO_2, Hg and radioactive waste are produced when operating.

Different meta-analyzes have led to the conclusion that the medium potential of global warming for wind energy is 11-12 g CO_2 / kWh. When power plants are connected to the power grid, there is a significant increase in the amount of CO_2 emitted per unit of electrical energy.

As far as particulate air pollution is concerned, wind farms emit more particulate matter than electric stations using fossil fuels. A large part of the particle pollution occurs during the construction of wind farms. They also emit more heavy metals and particulate matter from nuclear stations.

5.1.2. Habitat changes

The most frequent habitats on which wind farms are located are peat bogs, steppes, natural meadows and forests as well as sandy dunes systems. Habitat change is mainly reflected in the reduction or loss of biodiversity. Potential impacts on habitats are the following:

- Direct habitat loss as a result of infrastructure construction (foundations of turbines, auxiliary facilities, roads, quarries). The wind farm on Krnov consists of 26 wind turbine generators, new substations, 3.8km of reconstructed roads and 13km of new roads (mainly upgrading existing macadam roads);

- Degradation of habitats due to changes in habitat hydrology that can change the flows and levels of both surface and ground waters that are critical in peat bogs;
- Fragmentation of habitats that includes 5 occurrences: reduction of total area of habitat, reduction of the interior, isolation of one fragment of habitat from other parts of the habitat, tearing of one larger area on the habitat at several smaller ones, reduction of the average size of each part of the habitat;
- Degradation and loss of habitats outside the area of development (especially wetland habitats) that may arise from pollution, accumulation or erosion from the development area.

The land on which wind farms are located can still be used for cattle breeding.

5.1.3. Impact on the flora

One of the examples of the effects of the construction of wind farms on the flora are forest fragments or forest fragments that result from the fragmentation of forest land.

The edge effect changes the conditions of the outer parts of the forest fragments where we can no longer see the true habitat of the interior of the forest. The influence of forest fragmentation on flora depends on the size of the fragment of the forest as well as its degree of isolation, that is, its distance from the nearest similar fragment. Fragments that are smaller and more isolated are losing species faster and they go through the degradation process of the ecosystem.

Every forest in the interior has its own microclimate (different temperature, humidity, more shade, etc.) than the climate from the outside of the forest. Forest fragmentation exposes plants located in the lower layer of forest with completely different conditions from those to which they are accustomed and most often it leads to the loss of such species from the bare areas.

By draining the habitat as well as by changing surface flows and water levels, there is a shift between plants that grow on soil that is saturated with water and those occupying dry habitats.

5.1.4. Impact on the fauna

Birds

The influence of wind energy on birds can be direct and indirect, but it is certainly very complex. It depends on the bird species, season and location of the wind farm, and it can be temporary or permanent.

Significant potential impacts of wind farms are as follows:

- Disturbing the birds during construction, which may lead to temporary or permanent displacement of birds from the site of development and the environment;
- Collision mortality;
- The obstacle to bird movement (depends on the type of bird and / or season)
- Immediate loss or degradation of the habitat, especially in wetlands.

The most endangered are birds of prey because they glide on thermal spas. These are pillars of warm air rising, which occurs when the air mass moves from lower altitudes over geographical obstacles to higher altitudes. When they glide, predators often get hurt because they come in the same plane with sharp edges of rotating blades moving over 300km / h.

Another reason why the predators are most often hurt is their sight. Without expecting such an obstacle in front of them, they concentrate on the ground for a prey, and their sight range is 60°.

Preliminary research on the influence of the wind farm was carried out at Krnovo, and within these research, ornithological monitoring was carried out. These studies are especially related to the occurrence and use of the wind farm area by species that have the potential to collide with wind turbine generators.

The research was carried out in the following periods: April-June 2015 (spring), July-October 2015 (autumn), November 2015-February 2016 (winter), to get as reliable data as possible.

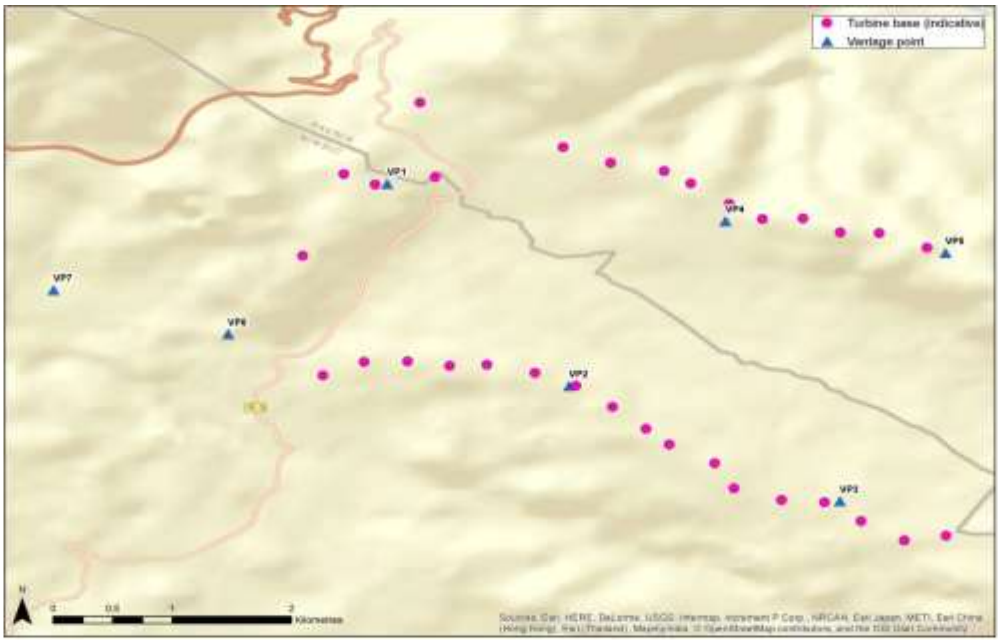
In this project, Vantage point (VP) methodology of research was used. Spring migrations were monitored in periods of:

- 8-15 April 2015.
- 4-6 and 25-28 May 2015.
- 6-9 and 28-30 June 2015.

In order to ensure that the activity of birds is recorded in all parts of the wind farm, a total of 5 VP examinations were carried out at the site of the project (VP1-VP5) and 2 VPs were in the control area (VP6 and VP7).

A total of 36 hours of research were conducted on each VP, which comes at 12 hours a month for each point. The studies lasted from 1 to 3 hours.

Map 1: VP locations



Source: Centre for bird protection (CZIP)

During the survey, the details of all target species were recorded if they were noticed in 2km from the VP site. Target species include all birds of valuable conservation due to the risk of collision with wind knifes, in particular predators and aquatic birds. The recorded data included: type, sex (where possible), number and duration of the flight height at intervals of 15 seconds. 5 different intervals of height were used:> 50m, 50-100m, 100-150m, 150-200m,> 200m. In addition, the location and direction of the target species flight are recorded on the field map of the target area.

In addition to the target species, data on secondary species that are at a lower risk of collision with turbines was recorded.

Table 2: Primary and secondary target species

Species	European Red List	Target	Secondary Target	Resident/Migratory
Accipiter gentilis	No		✓	Resident
Accipiter nisus	No		✓	Resident
Aquila chrysaetos	No		✓	Resident
Buteo buteo	No		✓	Resident
Buteo rufinus	No		✓	Migratory
Circaetus gallicus	No		✓	Migratory
Circus aeruginosus	No		✓	Migratory
Circus macrourus	Near threatened	✓		Migratory
Circus pygargus	No		✓	Migratory
Corvus cornix	No		✓	Resident
Falco subbuteo	No		✓	Migratory
Falco tinnunculus	No		✓	Resident
Falco vespertinus	Near threatened	✓		Migratory
Grus grus	No			Migratory
Pernis apivorus	No		✓	Migratory

Source: CZIP

Out of the 15-species recorded, 13 were predators, of which two species are considered near threatened in Europe. There was no significant difference in the representation of birds between the site of the project (VP1-VP5) and the control post (VP6-VP7).

Generally speaking, the variation in the number of observations between VPs is mainly due to the difference in the number of *Buteo buteo* observations between two groups of turbines, one group in the north (VP4, VP5 and to a lesser extent VP1) and one group in the south (VP2 and VP3).

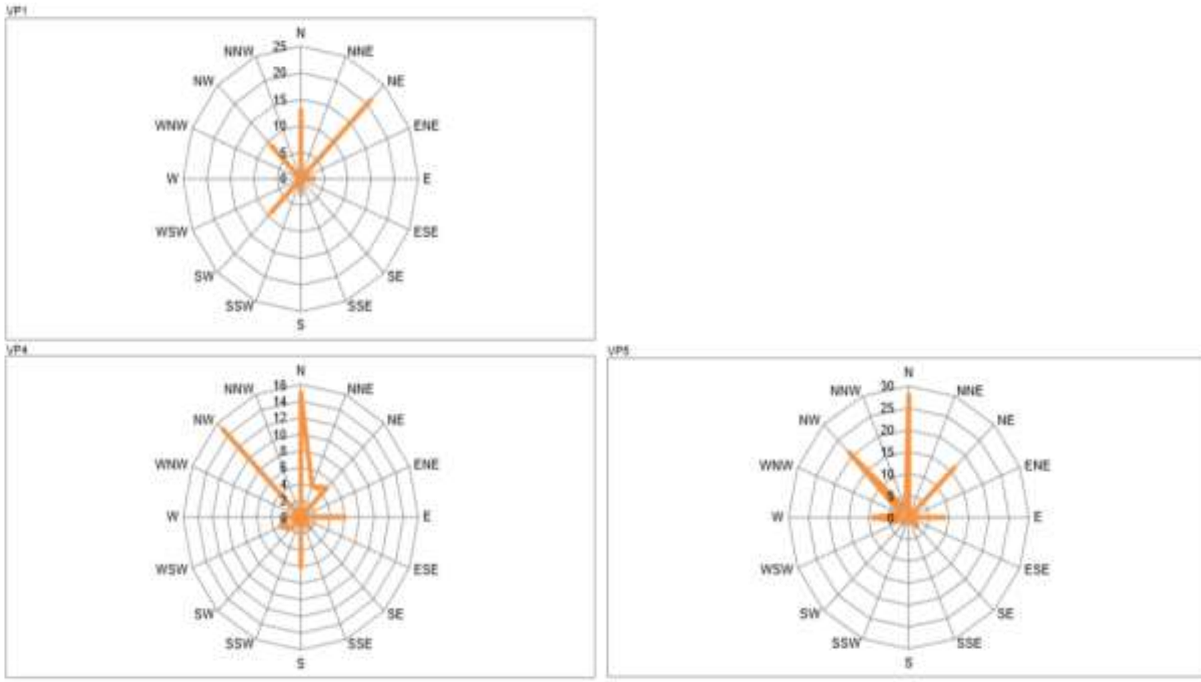
Table 3: Frequency of species and cumulative representation by VP

Species	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7
Accipiter gentilis	1,1	0,0	0,0	0,0	0,0	0,0	1,1
Accipiter nisus	0,0	1,1	0,0	0,0	0,0	1,1	2,2
Aquila chrysaetos	1,1	0,0	0,0	4,4	5,7	0,0	1,1
Buteo buteo	15,22	7,9	10,13	20,30	19,34	11,20	12,12
Buteo rufinus	0,0	0,0	0,0	0,0	1,1	0,0	0,0
Circaetus gallicus	4,5	8,8	2,2	1,1	0,0	4,4	2,2
Circus aeruginosus	2,2	0,0	0,0	0,0	0,0	0,0	0,0
Circus macrourus	1,1	0,0	0,0	0,0	0,0	0,0	0,0
Circus pygargus	7,9	2,2	0,0	4,5	0,0	3,3	0,0
Corvus corax	1,3	0,0	2,4	0,0	4,30	2,12	1,3
Falco subbuteo	0,0	1,1	0,0	0,0	0,0	0,0	0,0
Falco tinnunculus	17,22	15,18	11,13	12,19	17,22	16,20	14,15
Falco vespertinus	0,0	0,0	0,0	1,4	0,0	0,0	0,0
Grus grus	0,0	0,0	0,0	0,0	1,7	0,0	0,0
Pernis apivorus	0,0	0,0	0,0	0,0	0,0	2,2	5,5

* Target species in bold type.

Source: CZIP

Graph 1: Flight direction (northern turbine)



Source: CZIP

Graph 2: Flight direction (southern turbine)

Source: CZIP

For migratory species, there is an indication of the mild passage of species vulnerable to collisions with wind farms, especially predatory birds. The only primary target species that are considered transient migrants are rarely recorded (*Circus macrourus* and *Falco vespertinus*). Secondary target species recorded rarely and in a small number include: *Circus aeruginosus*, *Circus pygargus* and *Buteo rufinus*.

The number of species and representation in the northern part of the project area is higher compared to the southern part of the project area. Considering the relatively small number of birds, the impact on migratory birds during the spring is not significant.

VP research on *autumn migrations* has been carried out during the following dates and covers key periods for migration autumn:

- 1-5 July 2015.
- 15-21 August 2015.
- 12-16 September 2015.
- 9-12 and 23-25 October 2015.

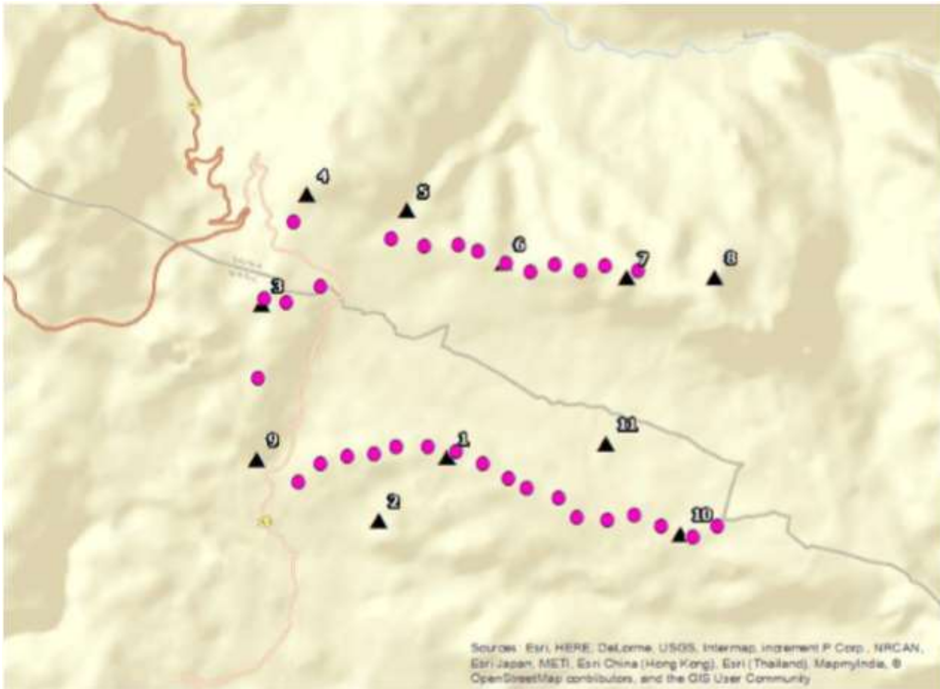
The report on autumn migration includes the occurrence and distribution of nesting birds (May-June 2015) (quail (*Coturnix coturnix*)) and species of owls (October-November 2015).

A total of 48 hours was spent in research for each VP, which means 12 hours a month for each VP.

Owl studies were performed by nocturnal playback surveys at 11 locations through the project area on October 10 and November 14, 2015.

One species of owl, a tawny owl (*Strix aluco*), was confirmed on the spot while the other, the Eurasian eagle owl (*Bubo bubo*), is probably present, although no evidence was found for her presence. In October, the occurrence of individual male specimens of the tawny owl were recorded at points 2, 4, 5 and 9. The possible sound of the Eurasian eagle owl was recorded shortly and in the distance of point 10. In November, one forest owl was recorded at point 2.

Map 2: Locations for owl surveys (triangles) and indicative turbine locations (circles)



Source: CZIP

As far as VP research is concerned, out of the 11 species recorded 10 were predators, one species (*Circus cyaneus*) is considered to be near threatened in Europe. Within the project area, most species were observed at VP1 and the least at VP3.

Table 4: Primary and secondary target species

Species	European Red List	Target	Secondary Target	Resident/Migratory
Accipiter gentilis	Least Concern		✓	Resident
Accipiter nisus	Least Concern		✓	Resident
Aquila chrysaetos	Least Concern		✓	Resident
Buteo buteo	Least Concern		✓	Resident
Circus aeruginosus	Least Concern		✓	Migratory
Circus cyaneus	Near-threatened	✓	✓	Migratory
Circus pygargus	Least Concern		✓	Migratory
Corvus corax	Least Concern		✓	Resident
Falco subbuteo	Least Concern		✓	Migratory
Falco tinnunculus	Least Concern		✓	Resident
Pernis apivorus	Least Concern		✓	Migratory

Source: CZIP

VPs can be divided into two groups based on the number of observations and representation on each VP. The difference in the number of sightings *Aquila chrysaetos* and *Circus aeruginosus* separated two groups of turbines, one in the north (VP4 and VP5), and one group in the south (VP1, VP2 and VP3). Most of the *Aquila chrysaetos* observations were at VP4 and VP5, and most observations of *Circus aeruginosus* were at VP1, VP2 and VP3.

Table 5: Frequency of species observation and cumulative representation according to VP

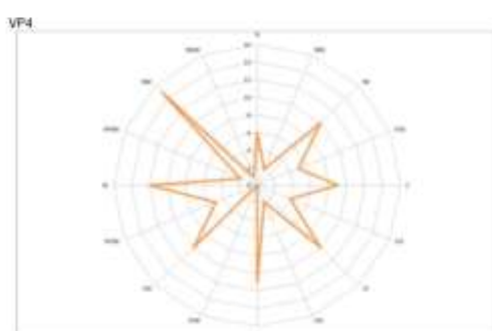
Species	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7
Accipiter gentilis	0,0	0,0	0,0	3,3	0,0	3,3	2,2
Accipiter nisus	0,0	0,0	0,0	0,0	3,10	1,5	0,0
Aquila chrysaetos	0,0	1,1	0,0	1,1	0,0	1,1	2,2
Buteo buteo	42,57	38,51	27,33	35,46	42,53	27,31	21,21
Circus aeruginosus	17,17	15,15	7,7	8,8	3,3	7,7	4,4
Circus cyaneus	**1,1**	**2,3**	**1,1**	**1,1**	**0,0**	**0,0**	**0,0**
Circus pygargus	6,6	9,9	5,5	6,6	3,3	2,2	0,0
Corvus cornix	0,0	2,2	1,1	5,5	7,7	2,2	0,0
Falco subbuteo	1,1	0,0	1,1	1,1	0,0	0,0	0,0
Falco tinnunculus	51,71	43,50	34,41	50,66	45,56	40,45	28,35
Pernis apivorus	0,0	0,0	0,0	0,0	1,1	4,4	10,12

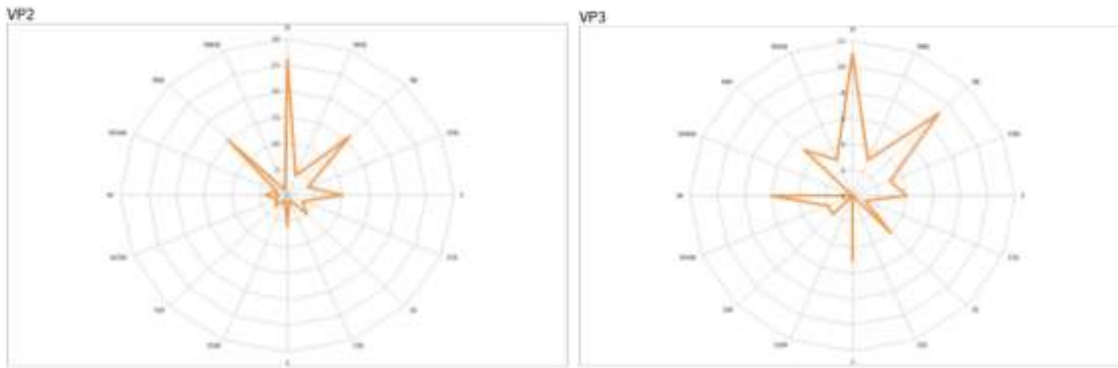
* Target species in bold type.

Source: CZIP

The dominant flight directions that have been observed highlight the domination for the northern routes of both the northern and southern turbine groups. The western directions of the flight are noticed at VP4, and east at VP1 and VP5.

Graph 3: Flight directions recorded at VPs





Source: CZIP

The CRM (Collision Risk Model) for the north and south turbines shows a relatively low annual turbine collision rate when adjusted to avoid collisions. The highest crash rates are found in the two most commonly encountered species *Buteo Buteo* and *Falco tinnunculus*. The cumulative crash rate for both sets is, on average, 3 per year.

Table 6: Estimated annual risk of collision (northern turbines)

Species	Avoiding action				
	None	90%	95%	98%	99%
Buteo buteo	90.70	9.07	4.53	1.81	0.91
Falco tinnunculus	39.70	3.97	1.98	0.79	0.40
Circus aeruginosus	4.40	0.44	0.22	0.09	0.04
Circus pygargus	2.14	0.21	0.11	0.04	0.02
Aquila chrysaetos	7.48	0.75	0.37	0.15	0.07
Corvus corax	27.17	2.72	1.36	0.54	0.27
Pernis apivorus	0.62	0.06	0.03	0.01	0.01
Falco vespertinus	2.35	0.24	0.12	0.05	0.02
Circaetus gallicus	0.31	0.03	0.02	0.01	0.00

Source: CZIP

Table 7: Estimated annual risk of collision (southern turbines)

Species	Avoiding action				
	None	90%	95%	98%	99%
Buteo buteo	63.21	6.32	3.16	1.26	0.63
Falco tinnunculus	13.63	1.36	0.68	0.27	0.14
Falco subbuteo	0.36	0.04	0.02	0.01	0.00
Circus pygargus	0.40	0.04	0.02	0.01	0.00
Circus aeruginosus	0.10	0.01	0.00	0.00	0.00

Source: CZIP

In addition to VP research, a transect surveys were also undertaken to establish some basic knowledge about the breeding bird community in the project area. The study was conducted on 3 transects in May and June 2015. Each transect was walked and birds were recorded that were 100m from the observers.

Map 3: Transect locations and indicative turbine locations (circles)

Source: CZIP

A total of 26 potential breeding bird species were recorded during the transect survey. In the research, no breeding predators were recorded. However, based on the data obtained during the VP of the spring research, it was noted that 7 species of raptors hold the territory within or around the project area.

Table 8: Astimated number of breeding predators

Species	European Red List	National Population Estimate (pairs) [1% threshold]*	Estimated number of breeding pairs
Accipiter gentilis	Least Concern	100-200 [1-2]	1-2
Accipiter nisus	Least Concern	200-300 [2-3]	1-2
Aquila chrysaetos	Least Concern	30-50 [1]	1 (in the wider Krnovo area)
Buteo buteo	Least Concern	400-600 [4-6]	4-6
Circaetus gallicus	Least Concern	40-60 [1]	1 (in the wider Krnovo area)
Falco tinnunculus	Least Concern	400-600 [4-6]	4-6
Pernis apivorus	Least Concern	150-200 [2]	1-2

* From BirdLife International, 2015

Source: CZIP

Winter VP research was conducted in periods:

- 13-15 November 2015.
- 11-13 December 2015.
- 3-6 January 2016.
- 5-7 February 2016.

At least 20 hours of research has been carried out at every VP.

Table 9: Primary and secondary target species

Species	European Red List	Target	Secondary Target	Resident/Migratory
Accipiter gentilis	Least Concern		✓	Resident
Accipiter nisus	Least Concern		✓	Resident
Aquila chrysaetos	Least Concern		✓	Resident
Buteo buteo	Least Concern		✓	Resident
Buteo lagopus	Least Concern		✓	Migratory
Circus cyaneus	Near Threatened	✓	✓	Migratory
Falco tinnunculus	Least Concern		✓	Resident

Source: CZIP

Of the 7 species recorded, all are predators, and one (*Circus cyaneus*) has a near threatened status in Europe.

Within the project area, the largest number of birds was recorded at VP4 and the least at VP3.

Table 10: Frequency of species observation and cumulative representation per VP

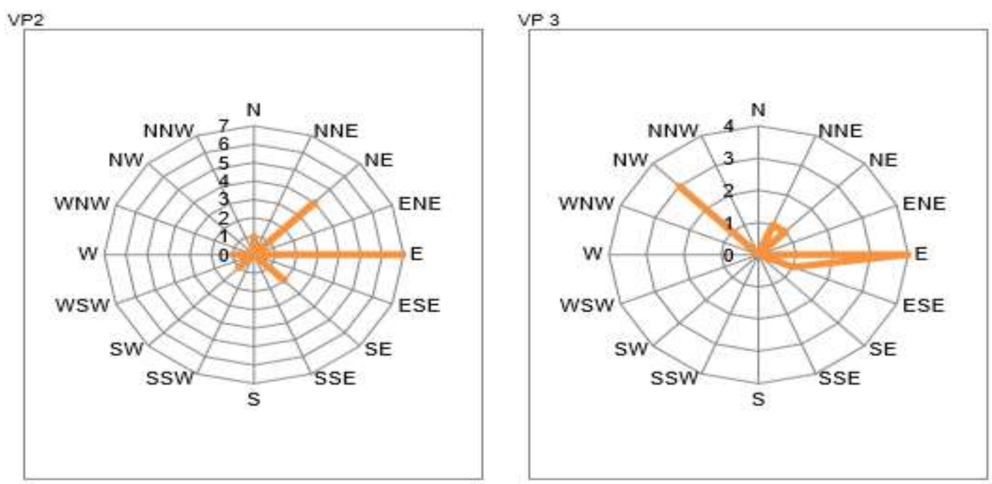
Species	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7
Accipiter gentilis	0,0	0,0	0,0	1,1	0,0	0,0	1,1
Accipiter nisus	0,0	0,0	0,0	1,1	0,0	1,1	2,2
Aquila chrysaetos	0,0	0,0	0,0	3,3	1,1	0,0	0,0
Buteo buteo	10,10	12,12	7,7	10,10	12,12	6,6	3,3
Species	**VP 1**	**VP 2**	**VP 3**	**VP 4**	**VP 5**	**VP 6**	**VP 7**
Buteo lagopus	0,0	0,0	1,1	1,1	0,0	0,0	0,0
Circus cyaneus	**2,2**	**2,2**	**1,1**	**1,1**	**0,0**	**0,0**	**0,0**
Falco tinnunculus	1,1	2,2	1,1	0,0	0,0	1,1	0,0

* Target species in bold type.

Source: CZIP

The dominant flight direction over the northern series of turbines is north-south, and across the southern series of turbines is east-west.

Graph 4: Flight direction (southern VPs)



Source: CZIP

The differences in the number of observations *Aquila chrysaetos* and *Circus cyaneus* separated two groups of turbines. Most recorded *Aquila chrysaetos* were at VP4 and VP5 (the northern group), and most *Circus cyaneus* were around VP1, VP2 and VP3 (the southern group).

For all species the collision risk it is low except for, for example, *Buteo buteo* where there is risk of one collision for every 5.8 years and one collision for every 5 years for *Falco tinnunculus.*

Table 11: Annual risk of collision (northern series of turbines)

Species	Avoiding action			
	None	0.9	0.95	0.99
Buteo buteo	8.65	0.87	0.43	**0.09**
Falco tinnunculus	3.63	0.36	**0.18**	0.04
Corvus cornax	2.05	0.21	0.10	**0.02**
Aquila chrysaetos	0.46	0.05	0.02	**0.005**
Circus aeruginosus	0.25	0.02	0.01	**0.002**
Falco vespertinus	0.18	0.02	0.01	**0.002**
Circus pygargus	0.16	0.02	0.01	**0.002**
Buteo lagopus	0.10	0.01	0.01	**0.001**
Pernis apivorus	0.05	0.005	0.002	**0.0005**
Circaetus gallicus	0.02	0.002	0.001	**0.0002**

Source: CZIP

Table 12: Annual risk of collision (southern series of turbines)

Species	Avoiding action			
	None	0.9	0.95	0.99
Buteo buteo	0.41	0.39	0.08	**0.08**
Falco tinnunculus	0.11	0.11	**0.02**	0.02
Circus aeruginosus	0.004	0.004	0.001	**0.001**
Circus pygargus	0.01	0.01	0.001	**0.001**
Buteo lagopus	0.003	0.003	0.001	**0.001**
Falco subbuteo	0.002	0.002	0.0005	**0.0005**

Source: CZIP

The final report states that, considering the data from April 2015 to February 2016, the impact of the collision is not significant and mitigation will not be necessary. It is recommended to carry out monitoring after the construction in the years 1, 2, 3, 5, 10 and 15 of the active operation of the turbine. This would allow confirmation of the foreseen impact on any effect.

Bats

For bats, as for the birds, there is a high risk of collision with parts of wind farms (turbines, towers, power lines) during the flight. In addition, there is a danger for them when they pass through the low air pressure field that surrounds the turbine tips (causing lung bleeding).

In 2013, a study in America showed that more than 600,000 bats were killed in clashes with parts of wind farms in the previous year.

It has also been shown that deaths of bats would be reduced by 73% if the turbines were switched off during low wind, when bats are most active. Placing microwave transmitters on wind turbine towers could reduce the number of bat collisions.

Bats represent a very important link in the food chain. They feed on insects and so they help farmers.

Due to the fact that bats are long-lived organisms, their reproduction is slow, they need a longer time to recover from the loss of individuals, and if large losses occur each year, then the question is whether the populations of bats will be able to they recover.

5.2. Social analysis

Wind power plants on Krnovo are the first such large investment in the energy sector in Montenegro since 1980. The construction of 26 wind generators together with 2 transmission lines and 2 substations has begun at 2015 after the 6 years of preparation. The whole investment project was worth 140 million of EUR.

Based on the similar experience from the countries that has implemented wind power plants this huge investment project has its positive and negative impacts. The main question is whether the project is profitable or not – or that the positive impacts are much bigger than negative. Except the positive impact on CO2 reduction it might have positive impact on socio-economic conditions in Montenegro so that all negative impacts (change in natural landscape and so on) can be mitigated. When it comes to positive impact this investment has brought opportunities for new employment and businesses for local citizens of these less developed area. „Krnovo Green Energy" company has been established and during the construction as well as operational phase a lot of new jobs has been opened for highly skilled and less skilled workforce.

When it comes to positive impact first of all these investments has brought foreign direct investments. The project on Krnovo is realized by the Austrian company Ivica Consulting and the French company AkuoEnergi. Agent for construction was a newly founded company Krnovo Green Energy, investors, along with the EBRD, and the German Development Bank (KfV) and France Investment company for promotion of economic cooperation, Proparco.

Table 13: Krnovo wind energy project

Location	Krnovo
Municipalities	Niksic, Savnik and Pluzine
Investor	Austrian Ivicom Consulting and French Akuo energy
EBRD loan	48,5 million of EUR
Financed by	EBRD, KFW, French investment company for promotion of economic cooperation (Proparco)
Company	Krnovo Green Enegry
Percentage of total energy production in MNE	6%
Facilities	26 wind generators, 2 transmission lines and 2 substations
Total amount of investment	140 million EUR
Construction period	18 months
Annual production	200-230 GWh

It can be anticipated that employment opportunities can be available for skilled personnel such as engineers, technician as well as semi-skilled and low skilled personnel such as drivers' equipment operators, construction laborers and so on.

On local level, it can also create opportunities for local industry which can be materialized through accommodation, catering, transport and security. So this project can be booster of income for local economy especially for three municipalities in which area the project was realized: Savnik, Niksic i Pluzine. These three less developed local communities on the North can benefit from tourism development. Instead of farming, since the construction of the wind mills can lead to loss of productive land, locals can focus on tourism.

Besides employment and business opportunities Krnovo wind energy project can help improve local infrastructure. In order to enable the conditions for access to each windmill, as well as to ensure the movement of vehicles in the part of the access roads to the substations and the Wind Farm maintenance building, the roads has to be built, which include:

- Access road to the complex of the Wind Farm and the substation Brezna.
- Access road within the complex, between the Wind Farm, substation and the Wind Farm maintenance building.
-

The access road to the substation (400)/110/35 KV Brezna takes place through Nikšić-Plužine, turns and passes through Gornja and DonjaBrezna. Existing roads has been used during the construction of the first phase TS (400)/110/35 KV Brezna. The negative impact of this is that the construction of the access roads has led to cutting the trees and changing the local biodiversity.

When it comes to negative impact on local communities wind power projects might have considerable environmental and social impacts during construction, since that includes site preparation, construction of access roads, tower foundation, erection of towers and transmission lines and the movement of vehicles. However, these impacts are usually temporary and localized. However, the positive side of the theKrnovo project is that wind farm is located on less populated location so that the only negative impact is the impact on forest and the impact on beautiful landscape of mountain Krnovo.

On national level, by completing their construction, they will contribute achieving a national target of 33% of the share of renewable sources in final consumption. This mean significant decrease in CO_2 emission but also generally speaking increase in energy supply safety in Montenegro.

For the first 12 years of operation, as stated in the contract, the purchase price of electricity generated in the wind farm is guaranteed and it cannot be less than 95.99 EUR per megawatt hour (MVh). Currently the wind farms supplies 45000 of households.

The construction of wind farms can attract new fresh FDI. At the beginning of 2018 Energy companyMasdar, with its headquarters in Abu Dhabi, signed a contract with French company Akuo Energy, which plans to invest in the Krnovo wind farm.

An agreement signed by two companies' leaders during a conference on sustainable energy in Abu Dhabi predicted that the Arabian company will acquire a 49% stake in the wind farm near Niksic, which currently has a power of 72 MW and is managed by a French company.

5.3. Spatial analysis

Wind Farm area includes wind turbines (windmills) with the infrastructure of the complex and substations TS 33/110 KV Krnovo, and the building for the maintenance of a Wind Farm.

When it comes to negative spatial impacts of the construction of windmills farm it can include:

- Land degradation and change in the use of the land,
- Construction of the acess roads which couses loss of local biodiversity, felling the trees, air pollution, noise and etc.

Wind power projects can result in the temporary but also permanent disturbances to land. The permanent disturbances are caused due to construction of wind turbine pads, access roads, substations, service buildings and other infrastructure. Temporary disturbances are caused by construction of access roads, storage of equipment, and lay-down or storage facilities. However, if the wind turbine is sited in a forested area, additional land is needed; thus, the impact on land is higher in a forest compared to the plains.

While some of the people like how wind turbines look, some of them don`t. Windturbines leave a smaller footprint on land compared to the majority of other energy sources (including solar, nuclear and coal). The problem is mitigated if the wind turbines are built outsideurban areas. The negative impact on the landscape itself can have an intersection in the area where the windmills are built. Also, windmills construction can also contribute to landscape degradation and soil pollution by releasing oil and wind power plants and substations.

The extent of impact of wind power projects in a hilly terrain, on forests, wildlife and water resources is much higher compared to that in plain areas. Since Krnovo is in the mountainous area activities such as road construction, erection of transmission lines for grid connection, and cutting and felling trees can lead to slope destabilization such as creation of landslides and negative impact on local biodiversity.

In addition, when it comes to spatial impact of the construction of the windfarms the construction itself influenced the change in property-legal relations, so many land owners were forced to redeem their lands as well as nomads who raise livestock in the katun to get out of the area.

So in order to prevent all these negative impact on the landscape of Krnovo, some of the protection measures has to be implemented.

Measures to protect the population from long-term exposure to electric and magnetic fields must be part of the project planning process, including the appropriate positioning of the transmission lines in relation to the populated areas and the education of the buffer zone.

The reduction of forests and forest land in the zone of direct impact of the transmission line route must be compensated for forestry and forestry work on forest land and bare lands.

In places where the route of the transmission line passes through the forest area (in the field covered by the scarlet and low plant), it is necessary to make an appropriate forest average. Also, it is necessary to arrange the terrain by separating the logs and cutting the mass from the location of the route, or by depositing, to prevent the eventual fire.

Special attention should be paid to crossing the route of the transmission line and the underground cable with existing transmission lines, roads, infrastructure facilities, and other significant existing and projected facilities.

On the part of the route passing through national parks and sensitive areas it is necessary to apply all known methods and procedures that will minimize the impact of the transmission line on the natural ambient. („fit into the ambience,, by applying appropriate coatings for poles, shape and height of the poles, reducing the number of access roads, running two transmission lines on common poles etc.).

The obligation of the investor is to provide: reconstruction and landscape management of the complex and preservation of the existing high vegetation.

Transport of poles, electromagnetic equipment, tools and other necessary materials are planned to be carried out with the appropriate means of transportation to the construction site - pavements on the route of the transmission line or cable trenches.

It is necessary to keep in mind that existing and abandoned access roads are used as much as possible, also as far as possible, devastating existing arable land.

After the construction of the transmission line, it is necessary to arrange the route, remove the material and a redundant excavation at the locations planned for the deposit of such material, repair the damaged roads, dismantle the construction site and arrange the surrounding terrain. The terrain that was occupied during construction should be brought into the condition that was encountered before construction.

5.4. Other impacts

5.4.1. *Demographic analysis*

Krnovo is a mountainous area at the northeast of municipality Niksic, which together with mountain Lukavica makes a highland know as Montenegrin Tibet. It is located at about 1500 meters above the sea level. In the past this area was famous by a numerous katunas and sheep pastures, but today, those katunas are abandoned and only a few livestocks and mountain cycling lovers are visitors of this beautiful landscape.

When it comes to construction of the wind turbines in this area, noise with high and low frequency could be a problem for some people that live in the proximity of wind turbines.

Because of that building wind turbines in urban environments should be avoided. Also, from the other countries experience it is known that wind turbines can have negative impact on the human psyche from constant observation of the work of the generator.

Therefore, the construction of wind farms in this less populated area should not have a negative impact on the immigration etc. Even more, these contractions could bring some economic benefit for the locals and their local communities through new employment opportunities, through building of the new roads and new infrastructure facilities.

However, the operation of any energy conversion system, on a useful scale, is a security risk. Wind turbines do not consume fuel or produce pollution during a normal working cycle, but they still have a risk associated with their construction and operation.

There have been a lot of deaths during the construction, operation and maintenance of wind farms, including workers and passers-by, and other injuries and deaths that have occurred since the establishment of wind farms. Most worker crashes occurred during the fall or interception in machines during maintenance inside the turbine housing. Failure on the blades and falling ice also caused the number of deaths and injuries. Passengers' deaths include parachute swinging in a turbine and small-vessel collisions with a turbine. Other deaths are attributed to transport vehicles, including motorcyclists who were disturbed by the flickering of wind turbines along the freeways.

When the turbines release the brakes, they can rotate freely until a breakdown or a fire occurs. Free rotating blades can also hit the tower. Turbine blades can spontaneously schedule as a result of a manufacturing error. A common problem is lightning, causing damage to the rotor blades and fires. When a turbine throws pieces of blades or ice, they can fly hundreds of meters in the distance. Although no passerby was killed due to a fault on the turbine, there were falls in their vicinity, and injuries caused by the fall of the ice.

Large pieces of debris, up to several tons, fell into inhabited areas, residential properties, roads, damaging cars and homes.

5.4.2. Educational impacts

In order to create a better environment for functioning of the electricity distribution system in Montenegro a lot educational campaigns have to be conducted. There's a big educational gap in our society even among highly skilled engineers and other personnel about renewable energy sources especially when it comes to wind sources and wind plants.

Despite the positive environmental and social impacts, constructions of wind mills could bring opportunities for skills development and on-site trainings.

Our electric power distribution system is conducting campaigns and training for their employees in order to overcome this gap. Besides these campaigns the whole civil society has to be the part of that since it is very important issue and since the decrease of carbon footprints should be on the top of the priorities in our country. Where it is possible trainings and skills development programs for locals should be started even before the construction of the wind mills initiation. These measures have to be developed in order to avoid conflicts among locals and constructors. Also, related to the risk and accidents fire-fighting trainings also have to be conducted.

At the beginning of the 2018 an educational campaign has been organized by CEDIS. CEDIS employees have learned a lot about how wind farms work and their management system, how the parts of the windmills was delivered to a given location, as well as specially trained personnel working at those heights for the needs of the wind farm.

5.4.3. Social cohesion and human development

Wind power as a renewable energy source needs to be explained and communicated in an open way to the civil society. This is important in order to understand how to stimulate a constructive dialogue about the effects of construction of the wind farms on local and national level. The construction of wind farm affects changes in the landscape and use of local resources and sometimes leads to uncertainty, anxiety and stress of locals. Therefore, a constructive dialogue is important.

Open public debatescan be one of the methods. These public debates can be used when mapping people's opinions and interests and these should be integrated in the planning process which will lead to a greater social cohesion. There is a necessity for more analyses in order to describe and consider people´s interest and feeling about a change in their living environments especially when it comes to landowners. There are also other factors that can explain wind power opposition.

Because of the lack of the public debates social cohesion was missing in the operational phase and the small-scale conflicts have escalated between landowners and representatives of Krnovo Green Energy Company. Namely, the landowners have protested before the construction of wind power has started because their property rights have not yet been resolved on the right way. The constructors has obtained a license to start the work, but the locals were complained that the property lawsuit was not fully implemented since their fee was not paid and that price of 50 cent per meter square is far below the prices that they should receive in accordance with the Law on Expropriation.

In order to avoid these kinds of conflicts, the constructive debates are needed so that national consensus could be achieved and in order to reduce the anxiety of the local citizens due to the usurpation of their land.

6. Economic analysis

6.1 Renewable Energy Sector regional overview

The Western Balkan countries (Albania, Bosnia and Herzegovina, Kosovo, Macedonia, Montenegro and Serbia – WB6) must comply with specific EU regulations, since they are aspiring to join the European Union. Among other pressing issues, these regulations are trying to fix the energy sector as well.

It has been assessed by different independent institutions, lastly by the International Renewable Energy Agency (IRENA), that WB6 countries have significant renewable energy potential. Nevertheless, reports of the Energy Community Secretariat indicate that they are being very slow and hesitant in removing non-cost barriers to attract investments in renewable energy projects , and that they are remaining dependent on the conventional way of energy generation which caused compliance gaps in all three energy sectors: electricity, heating and cooling and transport.

Hydropower represents the backbone of some of the electricity systems in the region. In Albania, the power system runs almost exclusively on hydropower whereas in Montenegro hydro represents more than half of electricity produced in the country. Serbia is the third amongst the countries of the Western Balkans with hydropower electricity production. Besides hydropower sources, RES in general are not utilized and the incentives and regulations for their full exploitation are still lagging behind significantly. Countries of the region are expected to diversify their energy supplies and technologies towards deploying more renewables.

Countries of the Western Balkans have made commitments towards 2020 targets of energy from renewable sources in gross final energy consumption. The highest committed percentage comes from BiH with 40%, followed by Albania with 38%, Montenegro 33%, Serbia 27%, Kosovo 25% and the lowest from Macedonia with 21%.

It is crucial to understand that RES exploited most is the hydropower sector; its share in the RES scheme of the WB6 countries is around 95%. The region’s average percentage towards reaching these targets is around 70%.

Table 14: RES target fulfillments: Albania, BiH and Kosovo (data from 2015)

RES 2020	**Albania (38%)**		**BiH (40%)**		**Kosovo (25%)**	
RES	Target (MW)	Reached (2015)	Target (MW)	Reached (2015)	Target (MW)	Reached (2015)
Hydro	2324	1797	2700	2150	240	71.94
Wind	30	0	33	0.3	150	1.35
Solar	50	0	16.2	8.2	10	0.15
Biomass	5	0	35.7	1	14	0
Other						
Total	2409	1797	2784.9	2159.5	414	73.44
% reached	74.60%		77.54%		17.74%	

Source: Balkan Green Foundation

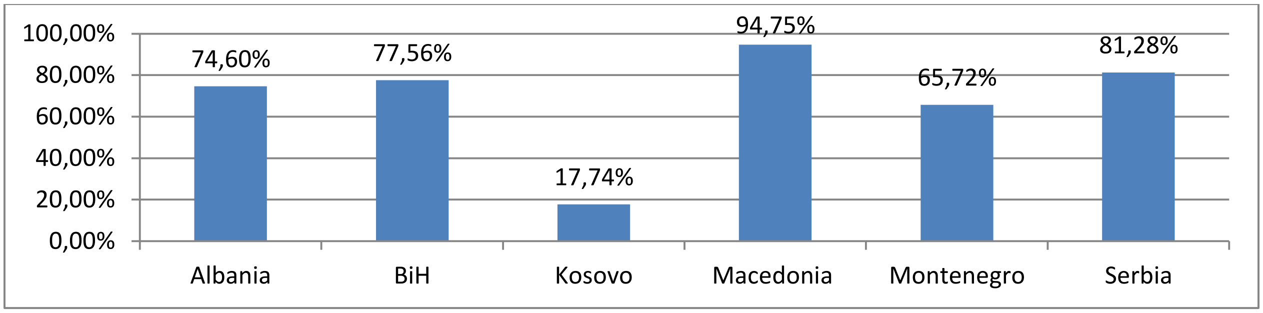
Table 14: RES target fulfillments: Macedonia, Montenegro and Serbia (data from 2015)

RES 2020	**Macedonia (21%)**		**Montenegro (33%)**		**Serbia (27%)**	
RES	Target (MW)	Reached (2015)	Target (MW)	Reached (2015)	Target (MW)	Reached (2017)
Hydro	709	699	826	668	3276	2898
Wind	50	36.8	151.2	0	500	0.5
Solar	25.4	16.7	10	0	10	10.8
Biomass	14	3.99	29.3	0	130	4.9
Other					14	129.9
Total	798.4	756.49	1016.5	668	3930	3044.1
% reached	94.75%		65.72%		81.28%	

Source: Balkan Green Foundation

Implementing objectives and reaching the targets remains a challenge. Kosovo has made the lowest progress towards achieving its goals, by reaching only 17.74% of its target, whilst Macedonia reached almost 95% of its 2020 target. Second best in reaching its target is Serbia which has reached 81.28% followed by BiH which has reached 77.54%, Montenegro 65.72% and Albania 74.60%.

Graph 4: reached %



Source: Balkan green foundation

A successful trend of generating capacities from small HPPs has been realized in Bosnia and Herzegovina, Montenegro, and Macedonia. The average Feed-in tariff from the respective supporting schemes in the WB6 stands around 75 EUR/MWh.

Table 16: Feed-in tariffs for RES

Country	**Albania**	**BiH**	**Kosovo**	**Macedonia**	**Montenegro**	**Serbia**
RES	Feed-in EUR/Mwh	Feed-in EUR/Mwh	Feed-in EUR/Mwh	Feed-in EUR/Mwh	Feed-in EUR/Mwh	Feed-in EUR/Mwh
Hydro	55.3	93.75	67.47	59.16	86.15	86.33
Wind	0	104.84	85	89	95.99	92
Solar	0	205.74	136.4	140	120	173.56
Biomas	0	196.4	71.3	160.5	122.55	113.24
Total	55.3	600.73	360.17	448.66	424.8	465.13

Source: Balkan green foundation

Concrete steps should be made in exploitation of this source, since wind is an abundant resource in the region. The Feed-in tariff average for the WB6 countries stands just below 80 EUR/MWh.

Private involvement in the energy sector is becoming increasingly important as public funding diminishes. International financial institutions and facilities, such as the EBRD and EIB, play a pivotal role in providing technical assistance programs to project developers in designing bankable projects, in lending facilities for renewable energy and energy efficiency financing and especially in encouraging joint facilities, pooling grants from different donors and sources, in which the international bank plays a role of guarantor. In addition, the Energy Community Secretariat is making strides in fostering inter-regional cooperation in terms of policymaking, energy market design, awareness raising and capacity building to improve the overall regulatory environment to attract foreign direct investment. The road to increasing investment flows in renewable energy projects in the Western Balkans is full of obstacles, but current trends suggest that these challenges will be overcome and integrate more with Europe.

6.2. Energy sector impact

The electricity market in Montenegro has been officially opened since 01.01.2009. by the adoption of the Rules for the establishment and operation of the electricity market by the Energy Regulatory Agency. In accordance with the Decision on the electricity market model in Montenegro, the electricity market in Montenegro consists of the wholesale and retail markets. The important role of the Montenegrin Electricity Market Operator (COTEE) defined by the Law on Energy and the Market Rules is the implementation of activities to encourage the production of electricity from renewable energy sources and high efficiency cogeneration. The use of renewable energy sources for the production of electricity is encouraged in order to achieve the national goal of the share of renewable energy sources in the total final energy consumption from 33% by 2020.

Currently, in Montenegro, not including the Krnovo wind farm, there are six electricity producers out of which five producers have the status of a privileged buyer just like the wind farm on Krnovo. All currently privileged buyers are from the small hydropower sector with a total of 12 small hydropower plants with a total installed power of 22.1 MW. The largest electricity producer in Montenegro is Montenegrin Electric Enterprise (EPCG) with the power of the electricity system based on the consumption of two hydro power plants: "Perućica" and "Piva" as well as the thermal power plant "Pljevlja". The total installed production capacities of the power plants are 874 MW, of which 649 MW or 74.3% are owned by hydropower plants, while the thermal power plants are 225 MW or 25.7%. Hydroelectric power plant "Perućica" is the oldest hydropower plant in Montenegro, which was put into operation in 1960. Its installed capacity is 307 MW, and possible annual production is around 1300 GWh. With the hydroelectric power plant "Piva", the total installed capacity is 360 MW.

The production achieved in 2017 at the level of Montenegro according to the EPCG data was 2241,2 GWh, from which the Perućica hydroelectric power plant produced 561 GWh (25% of the total amount), Hydroelectric power plant "Piva" 360 GWh (16% of the total amount), and the thermal power plant "Pljevlja" 1265 GWh (56.4% of the total amount), while small hydropower plants together produced a total of 54.2 GWh of energy, representing 2.4% of the total amount. Under such conditions, Montenegro is one of the leaders in the region and in Europe, since only 2017, 43.4% of the total electricity production is production from renewable energy sources, more precisely, production from hydroelectric power plants.

The average planned annual production of wind power plants on Krnovo is 215 GWh. As such, Krnovo wind farm will have a major impact on the electricity sector in Montenegro, especially the renewable energy sector. Although it planned to produce annual production smaller than the two largest hydroelectric power plants in Montenegro "Perućica" and "Piva", the potential wind turbine production on Krnovo is almost four times higher than the total production of small hydropower plants in 2017. Taking the assumption that the wind farm at Krnovo produced the planned annual production in 2017, then the share of the wind farm in the total final electricity production in Montenegro would amount to 11.4%. Together with small hydropower plants as well as two large hydroelectric power plants, the Krnovo wind farm will significantly contribute to the energy sector in Montenegro and greatly increase the percentage of production and consumption of electricity from clean forms of energy, i.e., renewable energy sources. Montenegro is already one of the leaders in the field of renewable energy in Europe, however with the wind power project at Krnovo, this share will further increase, which exceeds the national target of Montenegro of 33% of renewable energy sources in total final consumption.

The total production of electricity by the privileged producers in 2017 was 84.4 GWh, which is more than the total production of the eligible producers for the period 2014-2016, which amounted to only 55.4 GWh. The wind farm on Krnovo also had a great contribution. In the first month of work, in November 2017, the Krnovo wind farm produced 14.2 GWh, representing 80% of electricity generation in November by privileged producers. In December, Krnovo wind power produced 23.8 GWh, which in total for the year 2017 is production of 37.9 GWh. Although it only worked two months, 44.9% of the total electricity from the privileged producers was produced from the Krnovo wind farm.

Wind power on Krnovo will have a significant impact on the energy sector in Montenegro, especially in the sector of renewable energy sources. With an installed capacity of 72 MW, it is the biggest privileged producer in Montenegro without competition. The rapid start of production in November 2017 led to the month being recorded as the month of most produced electricity from renewable sources. As a privileged producer with the largest amount of production capacity, it will also affect the overall energy sector. The total production of Krnovo wind farm in a year will be enough to supply 45,864 households. According to the investors estimates, Krnovo wind farm represents 8% of the total installed capacity in Montenegro and will produce 6% of the total electricity production. Krnovo also represents the first investment in the energy sector since 1980, which is of such proportions. Krnovo is also the first investment in the region that is supported by the European Bank for Reconstruction and Development, as well as the first investment in a fully privately-owned region. The Krnovo project can serve as a model for future similar investments in Montenegro and the region and can represent a "lighthouse" for commercial banks to enter into projects and help finance and develop the production of electricity from renewable sources.

Table 17: Electricity production in 2017

Producers	GWh
Hydroelectric power plant „Perućica“ EPCG	**561**
Hydroelectric power plant „Piva“ EPCG	**360**
Thermal power plant „Pljevlja“ EPCG	**1265**
Privileged producers	
Kronor	**13.882**
Hydropower	**26.502**
Synergy	**2.479**
Igma-Energy	**3.628**
Krnovo Green Energy	**37.981**

Source: COTEE and EPCG

6.3. Microeconomic impact

6.3.1. Energy prices impact

The State of Montenegro has undertaken the purchase price of electricity produced at the Krnovo wind farm to be guaranteed and fixed for the first 12 years of operation, in the amount not to be less than 95.99 € / MWh. The said guaranteed price was based on the Rulebook on methodology for calculation of the purchase price of electricity from wind farms, which was adopted by the Ministry of Economy on the basis of the Decree on wind farms. In accordance with it, a purchase price of 95,99 € / MWh was determined, depending on the specific investment costs, which guaranteed and guaranteed a 12-year repurchase period as the period necessary for the refund of funds invested in the construction of an electricity facility such as are wind farms at the said incentive price. Pursuant to the Decree on Fees for the Promotion of Electricity Generation from Renewable Energy Sources and Co-Generation, the manner of determining the amount of the fee for stimulating the production of electricity from renewable energy sources and cogeneration and allocating the funds collected from compensation, as well as the closer method of calculating the proportional share of the electricity supplier and a qualifying buyer - self-suffers in the purchase of electricity from privileged producers. In this way, encouraging production from renewable energy sources involves the provision of cash, which represents the difference between the price of energy for supply, in accordance with the supply contract and the incentive price determined on the basis of the Tariff System Regulation. The price of energy for supplying distribution customers is currently regulated and determined by the Decision on determining the price of electricity from domestic sources for delivery according to regulated tariffs adopted by the Energy Regulatory Agency and amounts to 36.9744 € / MWh. The difference in cash between the said price and the incentive price, pursuant to the Decree on Fees for the Promotion of Electricity Generation from Renewable Energy Sources and Co-Generation, is provided by collecting funds from all end customers in a proportionate proportion depending on their consumption, which is also common practice in EU countries . Funds from the collected fee are on the supplier's account and each electricity supplier is obliged to indicate the amount of the fee on the account that delivers to the customer for the delivered electricity as a special item. Due to the encouragement of production from renewable energy sources, from the beginning of 2017, electricity bills were increased by 5 to 8%. At the beginning of 2014, production incentives were two to three cents on an average electricity bill of 35 euros, to increase each year. In 2016 it increased at the beginning of the year to about 25 cents per average bill, to double in June to about 50 cents per average bill, which in fact represents an incentive fee of 0.129 eurocenti per kilowatt-hour Kvh. Due to the completion of work at Krnovo wind farm and the beginning of work and electricity production, in 2017, the fee increased by 3.5 times from 0.129 eurocenti per kilowatt-hour to 0.473 eurocent per kilowatt-hour and on the average account of incentive charges is around 2 euros, which is between five and eight percent of the total electricity bill.

Table 18: Compensation for stimulating production of electricity from renewable sources.

Period	c€/kWh
01.01.2014-31.01.2015.	0.00652
01.02.2015-31.12.2015.	0.046239
01.01.2016-03.06.2016.	0.058715
04.06.2016-31.12.2016.	0.129
01.01.2017-	0.47316

Source: COTEE

The higher the consumption of the higher the fee and the difference in relation to the current account. In this way, due to the incentive price of electricity from renewable energy sources, an additional financial burden has been imposed on citizens, who pay far higher fees for renewable energy sources than was the case in previous years. Although the low purchasing power of the population, it is additionally burdened with higher fees that increase electricity bills in proportion to the amount of consumption. The Ministry of Economy announced in 2017 that there will be no increase in electricity bills, although the fees for the stimulation of renewable energy sources have increased three and a half times, due to a decrease in the price of active energy. However, in 2018, the price of active energy for households and small customers will increase by at least 3.6% due to the increase in prices on the international market as well as the increased value added tax. In addition to the increased fees for the production of wind power plants at Krnovo, electricity bills will grow, which will affect the reduction in purchasing power and the income of citizens.

In addition to the guaranteed purchase price of electricity from the wind farm on Krnovo, in the first 12 years of operation, wind farms are not obliged to pay systematic and auxiliary services. After the expiration of that period, the electricity produced in the wind farm will be bought at the market price, and the systematic and auxiliary services will be paid to the transmission system operator.

In addition to the fees paid by the citizens of Montenegro through the electricity bill, the amount of state aid has been determined. The amount of aid is determined by first determining the difference between the guaranteed and the current market price of energy for supply, which will then be multiplied by the produced amount of electricity, which had planned the mean value of the annual production of 215 GWh, and consequently the total annual level of compensation amounts to 12.6 million. In case of a change in the price of electricity on the market, there is a possibility of changing the mentioned calculation. When making a decision on the guaranteed price of electricity produced by Krnovo wind farm, which the electricity company is obligated to purchase, the market price of energy for the supply was 36.9744 € / MWh. The difference between the market price and the guaranteed price of electricity is 59,02 € / MWh.

The guarantee of the price of electricity from renewable sources is favorable to the investor and it is brought into a favorable market position in relation to competitors, ie, producers of electricity from standard sources. This investor acquires an economic advantage that allows him to determine the guaranteed price for the produced electricity, which could potentially distort the competition in the electricity generation market. Also, the guaranteed prices guarantee security and certainty and thus contribute to reducing investment risk and financial costs. It is important to note that the policy of guaranteed prices also leads to the development of the market for renewable energy sources, giving an incentive to maximize the production of renewable energy sources.

The guaranteed fixed price of electricity purchase from the wind farm at Krnovo in the amount of 95,99 € / MWh in the period of 12 years is explained as a necessary condition for the refund of funds invested in the construction of the wind farm on Krnovo. The planned average annual production of the Krnovo wind farm is 215 GWh. For a period of 12 years, according to the pre-determined, guaranteed price and planned average production during the year, the next calculation. At a price of 95,99 € / MWh, in the period of 12 years and the annual production of 215 GWh, as well as the obligation of the electricity utility of Montenegro to buy up all the electricity produced in the wind farm, the wind farm's income on Krnovo will amount to EUR 247.6 million. Considering that the total investment cost for the construction of the wind farm was about 140 million euros, there is a figure of 107.6 million euros, which represents a significant difference from the total investments. For comparison, if the average annual production in the 12-year period was sold at a market price of 36.9744 € / MWh, the wind farm's revenues would amount to € 95.4 million, which is not enough to cover the investment costs amounting to around € 140 million.

In the countries of the region, the guaranteed prices for the purchase of electricity from wind farms are similar to those in Montenegro. In Croatia, the guaranteed price is 95.2 € / MWh, while in Serbia this price is 92 € / MWh. In Germany, the guaranteed prices range from 46 € / MWh to 83 € / MWh depending on the length of the purchase period.

6.3.2. Income generation effects

Income generation effect mostly relates to payments to local residents for leasing their land and compensation to the local community by the project owner. These compensations (which are mainly financial) facilitate the acceptance of investment projects by the local community, which is an element that favors its sustainability. For this type of effect, you need to identify the following:

1. Did financial transfers exist from the investment company to the community? Were there any investments or aid to the local community?

2. Did the owners of the country come from the construction of a wind farm?

While wind farms are mainly owned by an energy company or electricity supplier, the land on which the facilities are located is often leased by private landowners. Practice in the world has shown that the owners of these lands have great benefits and financial compensation based on land lease.

Namely, before the construction of the wind farm on Krnovo, the majority of the land on the location of the project was privately owned. Therefore, the state of Montenegro has committed to expropriation of land in accordance with the Law on Expropriation. Contract between the state of Montenegro and the investor, the investor is guaranteed the right to use, lease or ownership of the land by direct contract with the owners of private property or the right to use after the expropriation. The State of Montenegro has expropriated land in a private property with a total area of 600 thousand square meters. The original plan encompassed over 300,000 euros, dedicated to the expropriation of land, of which only 72,000 landowners agreed to the offered price (approximately 144 square meters of total 600 = Total land that is privately owned is a property of about a hundred owners land paid for the sale of their land Most of the 100 owners were not satisfied with the originally set price of 50 cents per square meter offered by the state. Therefore, in court proceedings initiated by dissatisfied land owners, a court expert determined a new price which was about 2 euros per square meter square on which the owners agree.

In addition, the state provided state-owned land to the investor of the project as part of the offer. The amount of rent for state-owned land was 10 cents per square meter (according to the public advertisement, the minimum amount of rent for state land is 5 cents per square meter). The land is leased for a period of 20 years that starts to run on the date of issuance of innovated urban-technical conditions in 2013, and the state-owned land that is leased is 219 097 square meters, on the basis of which the amount of rent which amounts to a total of 21,909 euros annually. The state of Montenegro will receive nearly half a million euros in 20 years from this lease.

Investor for the Krnovo wind farm project, Akuo Energy, together with Ivicom Consulting, has paid over 600,000 euros to real estate owners in the Krnovo area, through fair compensation for land expropriation. In addition, the local population, and not only the owners of the land, have significant benefits from the implementation of the project.

In addition to the land allowance, which besides the state is being collected by the local self-government, the investors have invested a great deal in improving the quality of life in these areas. Through the implementation of the project, investors invested heavily in the construction of road and electricity infrastructure. Also, it is important to mention the ecological benefit of the citizens of Montenegro, which is reflected in the reduction of CO_2 emissions in the amount of 78 768 tons per year, which is equivalent to the removal of 11 000 cars from the roads.

6.4. Macroeconomic impact

6.4.1. Impact to GDP

Introduction

Further analysis aims to assess the impact of total investments in wind farm Krnovo. The main task is to assess the overall effects of these investments (direct and indirect effects) both during construction period and operation and maintanance period. For the purpose of this analysis, the following inputs were used:

- Macroeconomic model developed by ISSP

The ISSP team created an econometric model for the purpose of analyzing and quantifying the impact of both investment and other variables and their changes on GDP.

The model is based on time series made up of 71 quarter data, starting from the first quarter of 2000 to the third quarter of 2017. The official data produced by the Statistical Office of Montenegro was collected and used to create the aforementioned model.

The model specification was estimated using the OLS method. Estimation of coefficients was made using statistical programs Eviews and SPSS.

The model was used to calculate the investment multiplier that measures the increase in gross domestic product under the influence of a unit increase in investments. Economic theory – Keynesian model suggest that the unit investment increase leads to an above-unit increase in national income, and hence is the measure of the relationship between income changes and the change in the level of investment that has led to a change in the level of income and it is called an investment multiplier.

Based on the ISSP macroeconomic model that relies on quarterly data for the value of foreign direct investment as well as GDP, the value of investment multiplier is calculated. It should be noted that, first of all, quarterly data is converted into annual data for foreign direct investment and GDP in time range from 2000 to 2016 in order to obtain the value of the investment multiplier annually. Regression for these two significant variables has been initiated, respecting all regression axioms, satisfying all the criteria of statistical significance and obtaining the investment multiplier value of 1.149.

$$GDP = 2462.902 + 1.149*FDI$$

In other words, the increase in foreign direct investment by 1 € leads to an increase in gross domestic product by 1.149 €.

Planned investments on the wind farm project on Krnovo

This analysis is based on planned investments for Krnovo wind farm, which according to the data of the European Bank for Reconstruction and Development are estimated at 139 million €. The wind farm project on Krnovo was financed by the European Bank for Reconstruction and Development in the amount of 48.5 million €, the German Development Bank KfW IPEX Bank also in the amount of 48.5 million € and the French development financial institution Proparco in the amount of 17 million €. The total loan amount is 114 million €. We assume that the rest of the investments of 25 million € are financed by the equity of the project's investor, the French company Akuo energy.

According to the IRENA – International Renewable Energy Agency, the total capital cost for the construction of a wind farm in the world is between 1700 $ and 2450 $ per kW. Putting in the ratio of the total investment of the wind farm on Krnovo, with it's total installed power of 72 MW, we get that the total capital cost of the wind power plant on Krnovo is 1930 $ or 1544 € per kW.

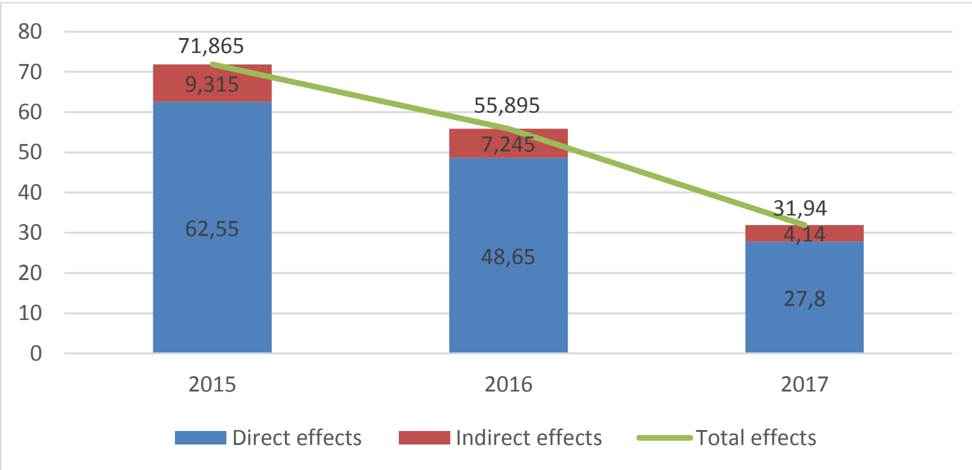
The effects of wind power investments on Krnovo

The total effects of capital investments on the Krnovo wind farm project were calculated using the acquired value of the investment multiplier (1.149) multiplied by the total investment during the construction period. In this way, we can distinguish the direct and indirect effects of capital investments of the wind power plant on Krnovo.

The direct effects of investments in the wind farm during the construction period from May 2015 to May 2017 (two years) amounted to 139 million €. In addition, using an investment multiplier, we can calculate the indirect effects of the investment for the observed period amounting to 20.7 million €. This gives the total effects of investments (direct and indirect) in the amount of 159.7 million € for the observed period. In other words, the overall effects of capital investments for the Krnovo wind farm are at the level of 4% of the total nominal GDP in 2016. The multiplier effect will primarily be reflected in the increase in the activity of the construction and transport sector, as well as through the revenues received by land owners that need to be expropriated to realize the project. All these activities are also taxable and, based on that, in the process of building a wind farm, there has been a rise in budget revenues.

Assuming that most capital investments took place in the first year of construction (the purchase and transport of wind turbines require more than 60% of the total capital costs according to data obtained from the Agency for Renewable Energy Sources), we estimate that in 2015 45% of investments were made, in 2016 35% and in 2017 20%. In the graph below, there is a rough assumption of direct and indirect investments throughout the construction period.

Graph 5: Effects of investments on Krnovo wind farm (in million of €)



Source: ISSP calculations

During the years of construction period, direct and indirect capital investments calculated as a percentage of nominal GDP are at the level of 2% in 2015, 1.4% in 2016 and 0.6% in 2017.

It is important to note that these are only calculations, that is, the amount of direct and indirect effects of capital investments on Montenegro's GDP, which shows that the total effects of wind power investments on Krnovo in the amount of 159.7 million € represent an additional value arising from the economic theory of the investment multipliers in the amount of 20.7 million €. With this calculation, it is important to point out that without the aforementioned capital investments in the wind power plant on Krnovo, the GDP of Montenegro in the period from 2015 to 2017 would be lower in the average amount of 1.3% per year.

6.4.2. Employment, earnings and economic impact

Methodology

The impact of investment on employment and economy is typically categorized into three groups: direct impacts, indirect impacts, and induced influences. For renewable energy projects, the direct impact of investment on employment and economy relates to jobs and economic activity associated with the design, development, management, construction and maintenance of production capacities. Direct impact includes jobs, revenues and economic outputs of contractors, construction workers, truck drivers and other professionals engaged in the design, installation and maintenance of the system, and also direct impact involves management and support staff. Indirect jobs and economic activity are all activities and activities that are related to the production and supply of equipment, materials and services for production facilities, as well as suppliers that provide raw materials and services to these manufacturers. For example, for wind farms this includes jobs in production facilities wind generators and other production facilities that produce building materials, constructions and electrical components for the wind farm system. Also, indirect impact includes bankers who finance contractors, bookkeepers and other suppliers that provide the necessary materials. Induced jobs and economic activities include jobs and economic activities that occur as a result of spending of individuals who are directly or indirectly employed in projects, which can include jobs in local shops and restaurants, boutiques, schools and hospitals. A more detailed example, a worker who is engaged in building a wind farm is spending his income on buying food, restaurants or in order to pay for accommodation. This analysis focuses on the assessment of direct and indirect jobs and the accompanying economic activity. However, the applied approach in the continuation of this work also assesses the induced jobs and economic activities so that the induced influence is added.

This analysis uses the "The Jobs and Economic Development Impact" model, JEDI model, developed by the National Renewable Energy Laboratory for the needs of the United States Department of Energy to assess the impact of investment in a wind farm on employment and economic activity. Specifically, the analysis uses the JEDI-Wind model for assessing the impact of investments in the wind farm on Krnovo on gross national employment and the economy of Montenegro.

The JEDI-Wind model is a flexible input-output modeling tool designed to assess the economic impact of costs, i.e. investment in the process of building and maintaining the production capacity of the wind farm. Like the other input-output models, the JEDI model presents the whole economy as a system of interactions or connections between the sub-sectors of a country's economy. Within the model, the relationship between the subsector is presented with a multiplier that determines that certain costs, during the construction or maintenance of a wind farm, affect the employment, income and output of all other sectors in the economy.

At the basic level, the model uses relevant information about a specific project as input, including data such as: total investment cost, total installed capacity, operating and maintenance costs, location, and more. Based on these inputs, the JEDI model estimates the impact of these investments on gross employment, earnings and economic activity. Also, JEDI model estimates all three types of impacts (direct, indirect and induced) separately. The sum of all three types of impacts is the overall effects on employment and the economy resulting from the costs of investments in the construction and maintenance of a wind farm.

It is very important to note that this model is designed for the United States and used by their Department of Energy and the National Laboratory for Renewable Energy, therefore multipliers as well as the assumptions that are included and used to estimate the given outputs based on the inputs are designed to present a realistic picture of the economy and systems of the United States economy. This model is not adapted to other countries closer to the economies of Europe for instance; therefore, in the model, some parameters have been changed in order to get closer to the real state of affairs of Montenegrin economy (eg, the assumption of the amount of daily wages for workers is adjusted to Montenegrin economy wages, based on the data on the average salary taken from the Statistical Office of Montenegro). In addition to adapting certain parameters to the real state of affairs in Montenegro, approximate values and assumptions of the researchers were used for a part of the inputs because there is lack of information about the construction costs and the planned maintenance costs because of the confidentiality of the investors' data. At the end, based on the researchers guess, multipliers used are the ones for the state of Vermont because Vermont's population is the most similiar to population of Montenegro and therefore that would present better picture than for example multipliers of California state which has 39 million people.

The minimum inputs required to run the analysis using the JEDI-Wind model consists of data related to production capacity (MW), location, year of construction and installed system costs ($ / kW). JEDI offers default values for more detailed costs, financial parameters, operating and maintenance costs, and other assumptions if the model user does not specify. The data used for the input series was taken from government documents and official data from the websites of Akuo Energy and Ivicom Consulting Company.

Results

Construction period

In this section, the estimated gross effects of employment, wages and economic activities arising from the construction and maintenance of the wind farm on Krnovo were presented. Jobs are defined as full-time for 40 hours a week for one year. One job represents a full-time work hour for one person for one year. Three jobs can represent one employed person for three years or three employees for one year.

Earnings represent total payment costs, including wages, compensations and benefits paid to workers.

Economic activity is the sum of all activities (value of production in all industrial sectors) resulting from investments in wind energy production.

Employment during construction is considered a short-term type of employment. Such employment occurs only during the duration of the construction period of the wind farm. For wind farms, it is characteristic that the number of employees during the construction period is far greater than the number of employees during the period of operation and maintenance. Wind farm on Krnovo had a greater effect on short-term employment in the period of construction, than it will have in the period of operation and maintenance, in that period the effect of wind power plant on Krnovo on the total employment in Montenegro will be very low.

During the construction phase of Krnovo wind farm, installations and services related to the construction of a wind farm, the estimation of the JEDI model shows that in that period of construction there were 258 directly linked jobs. Out of the indirect effects during the construction period, 173 jobs were generated in the supply chain, while the project of this size generated about 69 induced jobs. All together (direct, indirect and induced) effects of employment during the construction period of the wind farm were 500 new jobs. Total employee salaries during the construction period were estimated at 2.57 million €, earnings in the indirect effects of the supply chain amounted to 6.71 million € and the induced effects were estimated at 2.63 million €, which totaled amounts to 11.91 million € earnings through direct, indirect or induced effects during the construction period. The total economic activity generated from the construction period amounted to 32.6 million €, while the total added value of the construction phase of the wind farm on Krnovo amounted to an additional 15.8 million €.

Graph 6: Estimates of gross employment, wages and economic activity during the period of construction of the Krnovo wind farm (in millions of €)

Impact	Jobs	Earnings	Output	Value Added
Direct	258	2.57€	2.91€	2.68€
Indirect	173	6.71€	21.98€	8.72€
Induced	69	2.65€	7.71€	4.39€
Total	**500**	**11.91€**	**32.60€**	**15.80€**

Source: JEDI Wind model calculations

The graphic above shows the overall picture of the economic effects of the mentioned investment in Krnovo wind farm during the period of construction, from 2015 to 2017. Jobs during the construction process include direct employees who include construction workers, operators, electricians, engineers, transport workers and other workers involved in construction. Indirect jobs represent jobs in production facilities that produce turbines, towers, and other components, as well as jobs in industries supplying materials and services to manufacturing companies and construction companies that build the project.

Operation and maintanance period

Jobs, earnings and economic activities related to the period of operation and maintenance of wind power plants are comprised of the influence of purchasing equipment, materials and services necessary for maintenance of installed systems. Employment as well as economic impact during the period of operation and maintenance is expected to be maintained throughout the lifetime of the system (20-30 years).

The annual period of operation and maintenance of the Krnovo wind farm is estimated to continue to support about 26 jobs per year for the maintenance of the wind farm's work itself. In addition, the annual generated jobs in the supply chain will be 5 employees per year, and 6 induced jobs. The average estimated annual earnings of direct employees in the wind farm will be 220 000 € annually, which represents an average salary of about 700 € per employee per month, while the total annual impact of earnings is estimated at 680 000 €. Total economic activity generated over a year was estimated at 2.35 million €, and added value is estimated at 1.71 million € for one year.

Graph 7: Estimates of gross employment, wages and economic activity during the period of operation and maintenance of the Krnovo wind farm (in millions of €)

Impact	Jobs	Earnings	Output	Value Added
Direct	26	0.22€	0.22€	0.22€
Indirect	5	0.24€	1.47€	1.11€
Induced	6	0.23€	0.67€	0.38€
Total	**37**	**0.68€**	**2.35€**	**1.71€**

Source: JEDI Wind model calculations

Similar to the construction phase, onsite jobs directly support the service and maintenance of systems (as well as associated management and administration) while indirect jobs are jobs related to the purchase of equipment and materials, as well as the services necessary to keep the systems operating.

Conclusion

This section summarizes all direct effects of the construction, operation and maintenance of the wind farm on Krnovo. During the construction process, Krnovo wind farm generated about 252 direct jobs for a period of two years as the construction lasted. In addition, through assessments of the JEDI model, it was established that in the period of maintenance and operation, 26 jobs will be directly connected to the needs of the wind power plant per year. During the period of construction, 2.57 million € was allocated for the salaries of employees, while that figure for the period of operation and maintenance is at the level of 0.22 million € per year, that is, over a period of 20 years (duration of the concession) for the needs of earnings of employees directly linked 4.4 million € will be allocated for the operation of the wind farm. The total added value, according to the estimates of JEDI model, amounts to 15.8 million € for the period of construction, while for the period of maintenance this amount is 1.71 million €, which in the total concession period amounts to 34.2 million €.

In the areas of employment, wages and economic activity, wind power plants have a characteristic high impact of investments in the period of construction and significantly less impact in the period of operation. This is due to the fact that wind power plants are a capital-intensive projects that requires a lot of workforce during the construction process. For the purpose of operating and maintaining a wind farm, a large number of manpower is not necessary and therefore the overall employment, wages and economic activity during regular work is significantly lower than during construction. Although the number of employees and earnings is reduced during the period of work, these jobs and economic activities are expected to last throughout the entire lifetime of the project.

This JEDI analysis estimates gross employment, wages and economic activity of the wind farm project on Krnovo. Furthermore, the results presented in this analysis are not intended to be precise forecasts and projections of the national economy and the impact on the employment of this project, but are more intended for a approximate assessment of the overall effects of investments. This analysis represents only a preliminary analysis of the overall effects of investments on Krnovo and additional and deeper analyses would be needed to examine the net effects of investments. While the results presented provide a reasonable framework assessment of the effects of wind power plant investments on Krnovo, the same results are sensitive to changes in assumptions. Lastly, it is important to note again that the JEDI model takes multipliers and is based on the economies of United States, so it is just a generalized overview of the impact of this type of investment in the US that can be slightly closer to the economy of Montenegro by changing some parameters.

6.5. Specific economic impacts

6.5.1. Impact on tourism

For some people, wind turbines are symbols of sustainable development and valued for producing clean energy. Perhaps this attitude can give wind turbines some recognition for being part of modern heritage. Windmills, the predecessors of modern wind turbines, were also contested when introduced to the European landscape around the 12th century. In countries like Holland, windmills today are a visual part of the nation’s heritage.

However, wind turbines are unlikely to be a major tourism draw in their own right, especially since they are now increasingly part of the cultivated landscape in many countries. In some cases worldwide there are guided tours to see the offshore wind farms.

A Scottish report reviewing a number of studies evaluating the impact of wind farms on tourism suggests limited overall negative impacts. However, tourists generally prefer wind energy projects to be located away from accommodation areas, historic sites, scenic areas and viewpoints, and places of natural beauty. The proportion of visitors who flatly oppose wind turbines near tourism attractions appears to be a minority, according to some reports. For example, a broad national survey in France showed 22% of the population thought wind turbines affected tourism negatively, while the rest were positive or neutral.

While preference studies show broadly similar patterns, very few quantitative studies published to date have established empirical links between wind farms and the net economic impact on tourism. On the example of Montenegro and the wind farm on Krnovo, it is still early to quantify the impact of the wind farm itself on tourism. The famous tourist website booking.com has already listed wind farm on Krnovo as an attraction for visiting in Montenegro. However, given that Montenegro's tourism is largely based on summer tourism in coastal cities or winter-recreational tourism in the north of Montenegro while green eco-tourism continues to be low, the impact of the wind farm Krnovo on tourism is not expected to be very significant.

7. Global best practices

Planning and policy content

Early spatial planning and mapping and implementation of mitigation measures are undertaken in order to increase social acceptance and improve the integration of wind farms into their environment. Community involvement is quite important when it comes to identifying most suitable zones and places for wind energy development. This kind of mapping can cover everything from micrositing to large zones and should take cumulative impacts into account.

Wind turbine installation and operation cause impacts and there are processes that are aimed at minimizing said impacts. Those processes must be based on a a clear mitigation hierarchy spanning from avoidance of negative effects to reducing any unavoidable impacts.

Spanish Wind Atlas - SP The Spanish Wind Atlas was developed by the Institute for Energy Diversification and Saving and is used by the Spanish Public Administrations for wind farm planning and other wind-related studies. Furthermore, it is also used to provide the stakeholders and the general public with a tool that enables them to identify and asses the already existing wind resource in any scope of a surface of the national territory.

The performance and functionality of Geographical Information Systems has been displayed by including complementary information of interest: maritime zoning, cartographic and topographic, environmental figures, etc. The interface includes intuitive navigation devices to make browsing easier for the user as well.

Project initiation – communication and scoping

Communication among project developers, local communities and other economic actors is of utmost importance to the balanced and coordinated integration of wind farms within local natural and economic environments and to secure a positive dialogue between all parties concerned.

A few other factors that can contribute to improved acceptance of wind energy projects are positive communication and the dissemination of factual information through social media networks and newsletters, on websites, in school curricula or during specific local events. Promoting the features of a wind farm that are attractive to tourists (e.g. visitor centre development) is another way of contributing to the optimisation of social acceptance.

A good example is the *planning phase of the Hitra project (Norway),* where an open dialogue with the municipality and all other local stakeholders was included at the beginning of the project. Comments and recommendations were encouraged to reduce the potential for conflicts. The local newspapers were supplied with up-to-date information about the project. Dialogue with groups opposed to development was also established, so that they could contribute to changing local attitudes and opinions towards the project.

Environmental impact assessment

Some of the relevant general recommendations include:

- Clear and high quality Environmental Impact Assessment (EIA) standards
- Evaluating cumulative impacts
- Taking carbon emissions into consideration
- Compatibility of wind farms with other human activities
- Careful siting and pre-construction assessment with respect to human activities to minimise impacts
- Evading, minimising and controlling noise impacts
- Considering socio-economic impact assessments
- Include socio-economic criterions while granting the permits
- Evaluating the visual impacts of the wind farm
- Integrating wind turbines in the landscape

The UK Department of Energy & Climate Change's (DECC) Overarching National Policy Statement for Energy (2011) provides strong guidance and states that where a project is "likely to have socio-economic impacts at local or regional levels, the applicant should undertake and include in their application an assessment of these impacts as part of the Environmental Statement".

It explains that socio-economic assessments should consider all relevant socio-economic impacts such as the impact on tourism and cumulative effects, the creation of jobs and training opportunities, the provision of local services and infrastructure.

Consultation and communication

Important general recommendations include:

- Promoting the touristic features of the wind farm
- Creating and maintaining up-to-date and complete websites, social media networks and newsletters about the project and its environmental and economic impacts and benefits to the locality
- Avoiding labelling stakeholders that show concerns as NIMBYists
- Raising awareness and communicating with factual information
- Providing detailed information on local benefits

- Organizing events around wind energy

- Communicating positively on local initiatives
- Opening the participation in wind energy projects to local financing and equitable profit sharing
- Facilitating the implementation of conditions enabling an equitable distribution of benefits
- Using the profits from wind energy as a leverage for developing other renewable energy projects
- Finding the right balance to secure both community involvement and efficient wind farm development
- Using appealing ways to disseminate a broad positive communication on wind energy

Consenting authorities should always communicate their own strategic goals clearly and consistently, and implement a set of transparent and consistent rules as a framework for the consenting process. They should also aim to facilitate the implementation of conditions that would enable an equitable distribution of benefits.

Whitelee Wind farm Visitor Centre – UK The 322MW Whitelee Wind farm in Scotland, one of the largest onshore wind farms located in Europe and only 20km from the centre of Glasgow (a city of nearly 600,000 people) provides an excellent opportunity to allow a significant number of people to experience modern, large scale wind energy generation first hand.

A visitor centre was built and included as part of the project. Whitelee has proved enourmosly successful in terms of visitor numbers with over 90km of trails, an exhibition hall including bespoke interactive facilities, a classroom and an electric powered bus.

Effectiveness:

- Nearly 100,000 people visited in 2010 alone, including several hundred school classes. Education and interpretation is provided by staff from the Glasgow Science Centre, an educational charity that operates a major science centre.
- Public feedback is over 90% positive and "chat" on various blogs is also overwhelmingly supportive.
- As its reputation grows, an increasing number of official government delegations from across the world are coming to Whitelee. Already, visitors from France, China, Mongolia and Thailand have come to learn more.
- Equally importantly, the local community is using Whitelee as a resource. The local primary school in Eaglesham used the wind farm as a case study for a web based video which explores local attitudes to the wind farm.

Mitigation and monitoring

General recommendations include adopting a Mitigation Hierarchy, where mitigation attempts, in the following order, to:

1. preventing negative effects through relevant dimensional planning and targeted location (e.g. micrositing) approaches

2. minimising unavoidable impacts through technical mitigation (e.g. radars) or flexible operating practices

3. repairing any residual effects and restoring negatively affected areas

4. any residual adverse effects should be addressed by compensation or offsetting measures. For example, creating alternative attractive habitats for vulnerable species nearby an affected area has shown promising results. The efficiency of this implementation process must be overseen by a relevant public authority

Negative impacts on biodiversity can be avoided through micrositing. Small adjustments to the siting of individual turbines may have a large impact on the incidence of, e.g. bird strikes (Ferrer et al 201215). Many large birds, for example, use 'hangwind' areas where air rises over a ridge, to gain height. Avoiding the immediate area of such hangwind sites by micrositing, even by a few tens of metres, as proposed for *the Hitra wind farm extension in Norway*, may reduce considerably the degree to which flight paths of these species and wind turbines overlap.

Once clear and high quality Environmental Impact Assessment standards have been set out, monitoring of the impacts of wind farms on the environment must be undertaken in order to develop a common understanding of the real impacts of wind farms. It is important to collate existing information on how flora and fauna will respond to environmental changes over the years to come. If managed rigorously and appropriately, monitoring will facilitate the avoidance or reduction of negative impacts on biodiversity for future wind farms. If monitoring activities are not carried out properly or at all, this could cause significant and lasting damage to the environment.

The Andalusia Environmental Ministry have developed *a protocol for monitoring programs on bird mortality in wind farms in the province of Cadiz (Spain).* Important results have been obtained of both mortality and success of the corrective measures. The protocol includes tracking tabs for recording incidents on wildlife at wind farms.

8. Financing Renewable Energy Projects – an overview

The shift to renewable energy from fossil fuels is continuing. Fossil fuels present limited resource. Therefore, numerous of the world's energy companies are shifting their focus to renewable energy sources. While renewable energy investments have seen steady growth over the last decade, a more rapid scaling-up is necessary in developing countries to meet climate and sustainable development goals.

Renewable energy projects, especially in developing countries, face multiple challenges from the institutional, policy and regulatory level to the market and project level which can hinder the development and uptake of renewable energy. The latter include lack of market transparency, lack of financing and experience in project development, and lack of relevant information on regulations, markets and resource availability. This has led to a lack of bank funding eligible projects, making it difficult for investors to identify attractive projects, and therefore reducing available capital for those that are ready to be financed.

A variety of public or private financing instruments currently exists within European countries to support renewable energy. The choice of instruments depends on the stage of development of the technologies or projects. Most RES financing instruments fall under three main categories:

- Energy Market instruments (Feed-in Tariffs, Premium, Renewable obligations, Tenders, Fiscal incentives).
- Equity Finance Mechanisms (Venture Capital, Equity, R&D Grants, Capital/Project Grants, Contingent Grants).
- Debt Finance Mechanisms (Mezzanine Debt, Senior Debt, Guarantees).

For the development of capacity for the use of large-scale renewable energy sources, it is necessary to invest from the private sector since the most governments are unable or unwilling to cover the costs of building an infrastructure for the production, transmission and distribution of energy. Historically, private funders were not particularly willing to invest in projects of using renewable energy sources, because they were considered very risky.

There are several reasons why private investors are traditionally considered projects of using renewable energy sources at risk. First of all the use of renewable energy is a relatively new thing and it is still not considered a "mature" technology.

Second, given the large initial capital costs of building infrastructure for the use of energy from renewable sources, investors need to be convinced that the electricity produced will find a buyer ready to pay the appropriate price. Perhaps the business models of guaranteed price by the state serve as mode to convince the investors.

Thirdly, it is necessary for private investors to be sure that policies and regulations governing the activity of renewable energy production are stable and that it is unlikely to change in the short or medium term.

Private financing is possible in several different forms. The main are the founding capital equity and loans. The equity is a direct investment in a project or a company that develops a project related to the use of renewable energy sources with the expectations that investment will be completely repaid. Loans are offered in several ways. The simplest of them is a structured loan from a financial institution. Alternatively, a company may try to come up with funds through bonds that represent securities for which the issuer guarantees to holder to pay on the specified day in the future the full value of the bond plus the related interest. In recent years, as a reaction to demand, special "green" bonds have emerged that are intended for investment in projects related to the use of renewable energy sources.

Only public funding will never be enough to ensure that the use of renewable energy sources develops in a massive amount that is necessary to significantly reduce the reliance on fossil fuels. However, if used properly, public funds can encourage private investment to a significant extent.

There are several key sources of public finance:

- Fiscal assistance: governments, through an annual state budget approved by parliament, may decide to directly finance projects related to the use of renewable energy sources.
- Loans: where it's difficult to get private investments at a price that makes a project viable, the government can provide credit for the development of the use of renewable energy sources.
- Loan guarantees: Instead of directly lending money to an investor, the government can conclude a contract by which it acts as a guarantor for a loan approved by a financial institution, such as a bank.
- Tax incentives: if the government is committed to the development of the use of renewable energy sources, then it may be interested to use its tax laws to waive certain taxes on parts of the equipment and services used to develop the necessary infrastructure.

The significant role of the Montenegro Electricity Market Operator (COTEE) consists in the implementation of activities to encourage the production of electricity from renewable energy sources. The use of renewable energy sources is encouraged in order to achieve the national goal, i.e. the share of renewable energy sources in total final energy consumption. The encouragement of electricity generation by privileged producers is reflected in the guaranteed price and guaranteed the entire purchase of electricity. The law stipulates that the entire electricity from facilities having the status of a *privileged producer* is purchased by the Market Operator and paid to each producer at the appropriate incentive price. Upon gaining the status of a privileged producer, a privileged producer concludes a contract with the Market Operator on the purchase of electricity produced from renewable sources at an incentive price. This Agreement shall remain in force for 12 years from the date of issue.

In this way, Montenegro is encouraging investors in investing in renewable energy sources in country, giving them the status of a privileged producer and with clearly defined legal regulations guaranteeing them an incentive price and buying up the entire production. With this system, the risk of investors is reduced and a general guarantee of cost-effectiveness of the investment is given.

Green Bonds

Numerous support schemes and financing instruments have been established over the years to support the development of RES technologies and projects. The assessment of the appropriateness of each instrument or approach requires to focus on the ability of each instrument to cover the financing needs of specific technologies or projects with various degrees of maturity, and to increase attractiveness for private sector investors.

One of innovative and successful financing instrument in the market are so called Green bonds.

Green bonds, a type of financial instrument issued to fund environmentally-friendly projects such as renewable energy installations or low-carbon construction, have been around for the better part of a decade, pioneered by the European Investment Bank (EIB) and the World Bank.

Green bonds can mobilize resources from domestic and international capital markets for climate change adaptation, renewables and other environment-friendly projects. They are no different from conventional bonds, their only unique characteristic being the specification that the proceeds be invested in projects that generate environmental benefits. In its simplest form, a bond issuer will raise a fixed amount of capital, repaying the capital (principal) and accrued interest (coupon) over a set period of time. The issuer will need to generate sufficient cash flows to repay interest and capital. The main investors are located in Europe, followed by Japan and the Americas.

In Europe, institutional investors (such as pension funds and insurance companies) and, in the United States, investors with strong environmental focus were the first green bond investors. Since then, green bond issuers have tapped into a broader group of investors including asset managers, companies, foundations, and religious organizations.

In 2017, 163 billion $ worth of green bonds were issued, an increase of almost 70 percent over 2016 figures.

In general, green bonds accelerate the renewable revolution by reducing the capital cost for these projects, allowing renewable energy to become competitive without government subsidies. For example, a Moroccan green bond issued in 2016 helped fund part of Noor PV 1, the world's largest concentrated solar plant, while Italian utility Enel issued a green bond to offer a record low bid for an 850 MW wind project in the country. French energy giant EDF raised one of the first corporate green bonds to build wind and solar farms, while Fiji is using the proceeds of its sovereign green bond to achieve its target of 100 percent renewable energy by 2030.

The green bond market's rapid expansion should be seen as good news in the fight against climate change and the transition towards a low-carbon future. Investors' enthusiasm for ethically conscious finance will encourage numerous industries to become greener and will provide countries around the world with a key tool in fulfilling their responsibilities under the Paris Agreement.

Green bonds are an excellent way to secure large amounts of capital to support environmental investments that may not otherwise be available, or that may be uneconomic using more expensive capital. Green bonds are well suited for large-scale sustainability projects such as wind and solar development, which often require capital investment ahead of revenues, and which generate modest revenue over a longer investment horizon.

The first entity to issue such bonds was the World Bank, which began the practice in 2008 and has since issued over 3.5 billion $ in debt designated for issues related to climate change.

Early in the year 2014, Unilever issued 250 million British pounds in Green bonds in conjunction with Morgan Stanley. In a few hours, investor proposals reached 750 million pounds. Nearly a hundred investors were finally selected, mainly private fund managers, pension funds and insurance companies. With this Green Bond, Unilever was able to successfully finance projects to improve energy efficiency and save more water in its global production network

Cape Town in South Africa also raised a Green Bond of 1 billion Rand in July 2017. Similar to Unilever success story investors offer roughly 4.3 billion Rand for this Green Bond. The purpose of this Green Bond was to finance water treatment projects, rehabilitation and protection of coastal areas

With Green Bonds Projects World Bank so far has 13 completed projects in renewable energy and energy efficiency which led to 67,460 GWh in annual energy savings, 5,980 GWh annual energy produced from renewable resources and 1,470 MW renewable capacity from solar, wind, and hydro technologies

Green crowdfunding

There is growing interest in crowdfunding as an alternative way to support projects focused on renewables. Through crowdfunding, sponsors of green energy projects are able to involve local communities in the ownership and financing, raising awareness about sustainability. In crowdfunding, pledgers are typically motivated by both financial objectives (i.e. making money) but also by intrinsic objectives (i.e. helping reduce carbon emissions and pollution).

Green crowdfunding portals appeared in the 2000s in the US, UK and Nordic countries, where there is widespread sensitivity to environmental topics. The expectations are that they will now rise in developing countries like China (and in the Far East), in Africa and South America where large-scale projects are now being implemented in the hydroelectricity sector, in photovoltaics and wind turbines. But in the future investments will also be in small-scale projects which can also be financed through crowdfunding.

In developing countries energy is lacking in many regions, especially rural villages. Green crowdfunding can make the difference and bring energy in order to increase wellbeing and stimulate entrepreneurship.

With the ability to post a project with all its details to the web and its global reach, the opportunity to tap into the minds and investment wealth of large numbers of people is increasing. This is particularly true for smaller scale projects that are outside the scope of the traditional larger investment institutions or investment banks.

The earliest crowdfunded renewables project is Windcentrale, which was launched in the Netherlands in 2010 to enable investors to acquire wind turbines and thereby support the development of renewables in that country.

To date, Windcentrale has raised more than 16.5 million € in total, potentially positioning it among the energy crowdfunding frontrunners. The company raised 230,000 € in half an hour on one project and 1.3 million € in 13 hours on another.

Another example of a renewable energy company exploiting the emerging blockchain technology is the South African-based Sun Exchange, which crowdfunds solar photovoltaic projects for commercial and industrial operators on a blockchain-based platform.

The British groups have been the most active so far. Abundance, for instance, raised 17.7 million £ across 17 projects, returning 1.47 million £ to investors. Three other ongoing projects are being financed with more than 800,000 £ so far. The platform is also part of the European project CrowdFundRES, which aims to unleash the potential of crowdfunding for financing renewable energy projects.

The majority of crowdfunding platforms are dedicated to company projects but a growing number are taking a more general approach in providing a posting space for project developers with varying levels of sophistication and varying requirements and restrictions.

Among these are Oneplanetcrowd in the Netherlands, BetterVest/GreenCrowding in Germany, Lumo in France and Abundance in the United Kingdom.

The European Union has also recognized the value of crowdfunding in advancing renewables and through the Horizon 2020 programme is supporting the CrowdfundRES project.

The three-year project which kicked off in February 2015 was conceived to bring together project developers, investors and crowdfunding platforms with the main objective of "unleashing the potential of crowdfunding" to accelerate renewables development.

The sums raised by Green Bonds are often several tens of millions of dollars or more and are mainly intended for institutional investors (pension funds, investment funds, etc.). Crowdfunding, on the other hand, primarily appeals to individuals for projects that are generally human-sized and which rarely exceed a million dollars.

With these examples, it can be seen that these financial mechanisms are increasingly important levers to develop energy transition projects, whereas until now the biggest obstacle to develop these projects was the great difficulty in obtaining loans and financing by traditional banks.

So, things are taking place in order to give a growing place to the companies of change which are working for the transition from fossil fuels to green technologies. The business world is evolving faster than one thinks towards a renewable energy economy.

9. Conclusions

The following chapter summarized the most important conclusion arisen from the pilot case analysis. Importance of the conclusions is in direct correlation with the importance of the respective energy investment in the RES i.e. wind energy context.

- The legislative framework regarding energy area is regulated by two main laws: the *Law on Energy* (LoE) and the *Law on Energy Efficiency* (LoEE). Maininstitutions that make up the organization of the energy sector of Montenegro areMinistry of Economy, The Energy Regulatory Agency (RAE) and ElektroprivredaCrne Gore (EPCG AD).
- Montenegro has significant potential for the use of wind energy in individual parts of the territory and most of the territory of Montenegro wind speed is less than 5 meters per second. However, the estimated values increase from 5 to 7 m / s, moving towards the coast, reaching values from 7 to 8 m / to certain areas along the coast. It is also an interesting area around Niksić with an average wind speed in the range of 5.5 to 6.5 meters in seconds.
- The hill is a grassy plateau, surrounded by branches of the Vojnik Mountain, which descends to the Nikšić Field. It is located in the territory of three municipalities: Niksić, Šavnik and Plužine. The project includes 26 wind farms, two overhead transmission lines (Krnovo-Brezna and Brezna-Klicevo)The construction began in May 2015, and the works were completed in October 2016. Installed wind power is 72 MW, and the planned annual output is 200 to 230 GWh. Windmills are located at an altitude of 1500 m above sea level, while wind generators are at a relative height of 85 m.
- The state of Montenegro undertakes that the purchase price of electricity generated in the wind farm will be guaranteed and fixed for the first 12 years of operation, and will not be less than 95,99 € / MWh.
- Value of the project: 140 million €Project Implementers: Ivicom Consulting (Austria) - founded Krnovo Green Energy, a loan user established for the purpose of building and future use of the wind farm, Akuo Energy (France) - a sponsor, developer and operator. 2018 Masdar bought 49% of the actions.
- Krnovo represents 8% of the installed capacity for electricity production, while 6% of the total electricity production.

- Based on the similar experience from the countries that has implemented wind power plants this huge investment project has its positive and negative impacts. When it comes to positive impact this investment has brought opportunities for new employment and businesses for local citizens of this less developed area. The positive side of the the Krnovo project is that wind farm is located on less populated location so that the only negative impact is the impact on forest and the impact on beautiful landscape of mountain Krnovo.
- Wind power projects can result in the temporary but also permanent disturbances to land – landscape degradation and soil pollution. In order to prevent all these negative impact on the landscape of Krnovo, some of the protection measures have to be implemented.
- The construction of wind farms in this less populated area should not have a negative impact on the immigration etc. Even more, these contractions could bring some economic benefit for the locals and their local communities through new employment opportunities, through building of the new roads and new infrastructure facilities.
- Despite the positive environmental and social impacts, constructions of wind mills could bring opportunities for skills development and on-site trainings.
- In order to avoid conflicts of landowners and constructors, the productive debates are needed so that national consensus could be achieved and in order to reduce the anxiety of the local citizens due to the usurpation of their land.
- Apart from the fact that wind energy is one of the energy sources that has the least environmental impacts, unless the necessary measures are taken, this impact is not negligible. Preliminary research shows that the impact of the wind farm at Krnovo on the environment for now is very small, but further research and precautionary measures should be implemented to maintain this negative impact at a low level.
- The biggest danger wind farms present for birds, but also bats. Due to the large number of different species of birds and their various habits (moving, nesting, etc.), work should be done to find the best solution that will not hurt any particular species.
- For wind farms to be as successful as possible, there are a number of things to pay attention to during all stages of planning, construction and upcoming work. The most important thing is to keep regular communication between all involved in the wind farm project.
- For every entrepreneur, the easing circumstance would be the existence of an official document that determines the steps which should be followed to make the wind farm project more successful. Such a document should be full of useful tips that can be applied anywhere in the world.

- Countries of the Western Balkans have made commitments towards 2020 targets of energy from renewable sources in gross final energy consumption. These countries have significant renewable energy potential but there are many obstacles and barriers that needs to be removed in order to achieve full potentials. Nevertheless, countries of the Western Balkans are working on achieving its energy goals and current trend suggests that these challenges will be overcome.
- The average planned annual production of wind power plants on Krnovo is 215 GWh. Projections estimate that wind park on Krnovo will represent 8% of the total installed capacity and 6% of the total energy produced.
- In first two months of work, wind park Krnovo produced 37.9 GWh which represents 44.9% of the total energy production from privileged producers in 2017.
- Wind park on Krnovo is the biggest privileged producer in Montenegro. Krnovo will significantly contribute to the energy sector in Montenegro and greatly increase the percentage of production and consumption of energy from renewable sources.
- The purchase price of electricity produced from Krnovo wind farm is guaranteed for the first 12 years in the amount of no less than 95.99 €/MWh.
- These incentives to renewable energy projects via guaranteed prices are funded from energy consumers (citizens). Citizens of Montenegro pay higher electricity bills because of the necessary compensation for stimulating production from renewable sources. In period from 2014 to 2017, these fees have increased from 0.00652 c€/kWh to 0.47316 c€/kWh which represents an increase by 7150%. In this way, additional financial burden has been imposed on citizens.
- Guaranteed prices of electricity production from Krnovo wind farm are explained as necessary condition for the refund of funds invested in the construction phase. With guaranteed price and planned average production during one year, revenue of wind park Krnovo in first 12 years will amount 247.6 million € which is 107.6 million € higher than total investment costs in construction phase.
- Krnovo wind farm is first fully privately-owned company in this region. Profit is distributed to owners of wind power plant: Akyo Energy, Ivicom Consulting and also Masdar. Investors have paid fair compensation for land expropriation to real estate owners upon which land power plant Krnovo is constructed.
- The direct investments in the wind farm amounted to 139 million €, in addition to that, additional value of those investments amounted to 20.7 million € in the phase of construction. These effects are at the level of 4% of the nominal GDP in 2016.
- Direct and indirect effects during construction were primarily reflected in the increase in the activity of the construction and transport sector. Besides that, benefits also had land owners through expropriation and Government of Montenegro through taxes and land leases which increased the budget revenues.

- Without capital investments in wind farm on Krnovo, GDP of Montenegro in period from 2015 to 2017 would be lower in the approximate amount of 1.3% per year.
- Krnovo project generated 252 direct jobs during construction phase and is estimated to generate around 26 jobs per year that are directly involved with operation and maintenance phase.
- According to JEDI model, every year while operating, Krnovo wind farm will produce added value of 1.71 million € through direct, indirect and induced effects.
- Krnovo wind farm won’t have a major influence on tourism sector, however wind farm will attract tourists with interests in eco-tourism and renewable energy projects.
- The Krnovo project can serve as a model for future similar investments in Montenegro and the region and can represent a "lighthouse" for commercial banks to enter into projects and help finance and develop the production of electricity from renewable sources.
- Krnovo wind farm represents a successful indicator and the beginning of the development of renewable clean sources of energy that will lead Montenegro towards a bright ecological future.

10. Literature

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