ENVIRONMENTAL IMPACT ASSESSMENT
REPORT ON
INVESTMENT PROPOSAL
(non-technical summary)

for Wind Power Plant Complex in the region of Mount Murgash on the territory of the Villages of Zhelyava, Eleshnitsa and Churek

Investor: Ecosource Energy EOOD

1. General Information:

The platforms encompass 44 plots at the total area of 174 258 m^2, located on the territory of three villages, as follows: - 13 estates with a total area of 51 825 m^2 on the territory of the Village of Zhelyava, the region of Kremikovtsi, Metropolitan Municipality (MM), Sofia City District; - 12 estates with a total area of 47 968 m^2 and 5 estates with a total area of 21 286 on the territory of the Village of Eleshnitsa; - 15 estates with a total area of 53 174 on the territory of the Village of Churek, Elin Pelin Municipality, Sofia District. The property of the Investor Ecosource Energy EOOD, acquired through a purchase and sale, under numbers and together with the respective areas allocated under territories, has the following title documents, mentioned hereinafter:

Title deed for the sale of real estates No. 105, Vol. IV, reg. No. 3058, File No. 466 dd. No. 2701, file No. 91 of 17.10.2005 for the following real estates, located on the territory of the Village of Zhelyava, the *Shiroki Preslap* area, Classification of Administrative Territorial and Territorial Units 29204, the Kremikovtsi Region, Sofia City District, namely: - No. 001031 with an area of 3 244 m^2; - No. 001032 with an area of 2 798 m^2; - No. 001033 with an area of 4 228 m^2; - No. 001034 with an area of 4 000 m^2; - No. 001035 with an area of 4 000 m^2; - No. 001036 with an area of 4 000 m^2; - No. 001037 with an area of 4 000 m^2; - No. 001038 with an area of 4 000 m^2; No. 001050 with an area of 4 403 m^2; - No. 001051 with an area of 4 233 m^2; - No 002005 with an area of 4 000 m^2; - No. 005005 with an area of 4 766 m^2; - No. 005006 with an area of 4 153 m^2.

Title Deed for the sale of real estates No.59, Vol. IV, reg. 28.10.2005 for the following real estates located on the territory of the Village of Eleshnitsa Murgash Area Code under the Classification of Administrative Territorial and Territorial Units 34120, Elin Pelin Municipality, Sofia District, namely: – No. 024041 with an area of 2 446 M^2; - No. 024042 with an area of 4 169 $м^2$; - No. 024043 with an area of 4 000 $м^2$; - No. 024044 with an area of 4 000 $м^2$; - No. 024045 with an area of 4 000 $м^2$; - No. 024059 with an area of 4 521 $м^2$; - No. 024060 with an area of 4 000 $м^2$; - No. 024061 with an area of 4 000 $м^2$; - No. 024062 with an area of 4 639 $м^2$; - No. 024063with an area of 4 000 M^2; - No. 024044 with an area of 4 000 $м^2$; - No. 024065 with an area of 4 193 m^2.

Contract for the sale of a real estate, private municipal property, by and between the Elin Pelin Municipality and *Ecosource Energy EOOD* dd. 12.06.2006 for real estate No. 024003 with an area of 85 425 m^2, located on the territory of the Village of Eleshnitsa, the *Bulini Ravnishta* area, Code under the Classification of Administrative Territorial and Territorial Units 34120, Elin Pelin Municipality, Sofia District, with the following estates resulting from partition thereof, and namely: - No. 024083 with an area of 4 000 m^2. Contract for the sale of a real estate, private municipal property, by and between the Elin Pelin Municipality and *Ekosource Energy EOOD* dd. 29.12.2005 for real estate No. 024087 with an area of 339 413 m^2 (339 413 m^2 according to sketch), located on the territory of the Village of Eleshnitsa, the *Bulini Ravnishta* Area, Code under the Classification of Administrative Territorial and Territorial Units 34120, Elin Pelin Municipality, Sofia District, with the following estates resulting from partition thereof, and namely: - No. 024088 with an area of 4 012 m^2; - No. 024090 with an area of 4 441 m^2; - No. 024091 with an area of 4 551 m^2; - No. 024092 with an area of 4 282 m^2.

Title deed for the sale of real estates No. 59, Vol. IV, reg. No. 3058, File No. 466 dd. 28.10.2005 for the following real estates located on the territory of the Village of Churek, Murgash Area and Jotsova Livada Area, Code under the Classification of Administrative

Territorial and Territorial Units 87760, Elin Pelin Municipality, Sofia District, and namely: - No. 544018 with an area of 4 378 m^2; - No. 544019 with an area of 1 749 m^2; - No. 547042 with an area of 4 659 m^2; - No. 547043with an area of 3 977 m^2; - No. 547050 with an area of 1 574 m^2; - No. 547051 with an area of 3 499 m^2; - No. 547052 with an area of 4 001 m^2; - No. 547053 with an area of 3 786 m^2; - No. 547061 with an area of 2 978 m^2; - No. 547062 with an area of 2 803 m^2; - No. 547063 with an area of 3 720 m^2; - No. 547064 with an area of 4 000 m^2; - No. 547065 with an area of 4 000 m^2; - No. 547066 with an area of 4 050 m^2; - No. 548002 with an area of 4 000 m^2.

1.4. Location: map or scheme and a description of the region.

The terrain for the construction of a Wind Power Station Complex comprises 44 independent platforms with an average area of about 4 decares1 (from 1.5 to 4.8 decares) in a rough terrain with altitude from 1 400 to 1 670 m in the region of Mount Murgash, each platform is equipped with a wind turbine of 2.3 MW (or 1 MW). The platforms encompass 44 plots at the total area of 174 258 m^2, located on the territory of three villages, as follows: - 13 estates with a total area of 51 825 m^2 in the Village of Zhelyava, the region of Kremikovtsi, Metropolitan Municipality, Sofia City District; - 12 estates with a total area of 47 968 m^2 and 5 estates with a total area of 21 286 m^2 in the Village of Eleshnitsa as well as 15 estates with a total area of 53 174 m^2 in the Village of Churek, Elin Pelin Municipality, Sofia District.

The region constitutes high mountain common pastures with agricultural land of IX category whose designation must be changed prior to implementation of the investment proposal. Wind generators must be distanced at least 500 m away from the territory of the closest settlement. The Murgash Mountain Hostel (altitude of 1400 m) located southwest of the mountain itself (altitude of 1 687 m) is in immediate proximity. Such hostel is a massive building with a capacity of 60 beds with outdoor lavatories and bathrooms. The hostel is approximately 14 km away from the Town of Buhovo and is connected with it by a macadam road. The Vitinya Throat is located in immediate proximity, as the exit settlements with tourist paths and the time to reach the hostel on foot are the following: the Town of Buhovo (4 hours away), the Village of Zhelyava (3.5 hours away); - the Village of Churek (4.5 hours away); - the area of Zherkovo (4 hours away); - the Village of Vrachesh (6 hours away).

The investment proposal is related to execution of town planning procedures that require drawing up of a number of Detailed Development Plans – Building Plans (DD-BP) for the different territories which are to be approved by the respective Municipal Expert Council on the Structure of the Territory (MECST) with the municipalities mentioned.

The Draft DD-BP for the territory of the Village of Zhelyava, the region of Kremikovtsi – development procedure application No. GR-94-V-314/05 for landed estate (LE) Nos. 001031, 001032,001033, 001034, 001035, 001036, 001037, 001038, 001050, 001051, 002005, 005005, 005006, code under the Classification of Administrative Territorial and Territorial Units: 20204, Zhelyava Area– Shiroki Preslap has been considered at a sitting of the specialized MECTD with the MM in execution of order No. RD-09-09-32/30.09.2005 of the Mayor of MM. A resolution has been adopted for the reasoned proposal to be coordinated with the Ministry of Regional Development and Public Works, the Regional Inspectorate on Environment and Water, the Ministry of economy and energy, and the Ministry of Agriculture and Forestry, and then a permission for DDP (report No. ES-G-136/15.11.2005) to be issued.

1- 1 000 m^2

The Draft DDP /BP/ drawn up for the territory of the Village of Eleshnitsa, Elin Pelin Municipality – a development procedure under application with Ref. No. UT2-20-132/23.11.05 for the following real estates - Nos. 024041, 024042, 024043, 024044, 024045, 024059, 024060, 024061, 024062, 024063, 024064, 024065 – has been considered at a sitting of the Territory Structure Municipal Expert Council appointed by order No. 1164/23.11.05 by the mayor of Elin Pelin Municipality. A resolution has been taken for adoption of the Draft DDP /BP/ upon coordination thereof with *ViK*, the Regional Inspectorate for Public Health Protection, *Elektrorazpredelenie*, the Regional Fire and Accident Safety Service, the Regional Inspectorate on Environment and Water and for submission of such Draft DDP /BP/ with the purpose of approval of a platform for design under the procedure of the Agricultural Land Protection Act and the Execute Regulation of ALP (Resolution No. 21 from Report No. 7/01.12.2005). A Draft DDP /BP/ has also been drawn up for the following estates on the territory of the Village of Eleshnitsa, Elin Pelin Municipality – Nos. 024083, 024088, 024090, 024091, 024092.

The Draft DDP /BP/ drawn up for the territory of the Village of Churek, Elin Pelin Municipality – development procedure under Application Ref. No. UT2-20-133/23.11.05 for the following real estates - Nos. 544018, 544019, 547042, 547043, 547050, 547051, 547052, 547053, 547061, 547062, 547063, 547064, 547065, 547066, 548002 - has been considered at a sitting of the Municipal Expert Council on Territory Development, appointed by order No. 1164/23.11.05 by the mayor of Elin Pelin Municipality. A resolution has been taken for adoption of the Draft DDP /BP/ upon coordination thereof with *Vodosnabdyavane i Kanalizatsiya*, the Regional Inspectorate for Public Health Protection, *Elektrorazpredelenie*, the Regional Fire and Accident Safety Service, the Regional Inspectorate on Environment and Water and for submission of such Draft DDP /BP/ with the purpose of approval of a platform for design under the procedure of the Agricultural Land Protection Act (ALP) and the Execute Regulation of ALP (Resolution No. 20 from Report No. 7/01.12.2005).

2. Annotation to the Investment Project:

It has been planned that 44 wind turbines will be constructed; each one of such turbines will be equipped with three screws/blades and the turbine axis height will be up to 65 m (but it may vary from 56 to 66 m depending on the relief) and the blade length will be up to 37 m (but such length may be reduced to 27 m), and each one of such turbines will require approximately 1.4 decares of free erecting area around its foundation. Foundations themselves are with comparatively small surface depending on the pad surface and they may vary from a simple foundation that is a cylinder from reinforced concrete with a diameter of 19.1 m and depth of 2.6 m, to a circle of piers with a diameter of 12.5 m with attached cylinder from reinforced concrete with a diameter of 13.25 m. Laying, enforcement type and the choice of foundation are determined by the turbine height chosen and the geological features of the space chair. Laying the foundations of the turbine towers requires erecting area of approximately 400 m^2 around them. The difference in surfaces of one and the same model will depend on the option for using different foundations depending on the space chair. The very tower supporting wind turbines consists of 2 (3) sections, with a length of 20-22 m each and a diameter of approximately Ø4 m at the foundation decreasing to Ø3 m at the top.

The erection has been planned to be completed with two autocranes with cantilever range of about 20 – 25 (30) m. Since the erection of the rotor is most problematic, the positioning of the cranes has been conformed with the installation of the screws/blades to the hub on the ground and later lifting up the entire rotor unit. The average area required as space

for installation of screws/blades to the hub on the ground and its lifting is approximately 1 400 m^2 and such area is allocated as follows: - total storage area for screws – 500 m^2; storage area for segments/sections from the tower - 300 m^2; storage area for the hub/nacelle – 30 m^2; - working area around the foundation – 450 m^2, area for the main crane – 200 m^2; - area for the auxiliary crane – 50 m^2. The platforms on which the two cranes shall be erected with a total area of 250 m^2 must be leveled, and the maximum slope must be up to 3-4%, - the storage platforms for the segments of the tower, the components of the nacelle and the screws with a total area of 830 m^2 allow a greater longitudinal slope of up to 10% and leveling them on all platforms is not required. The cleared erection area should not have any durable vegetation but it is not mandatory that it should be a bare terrain.

Wind turbine platforms will be connected to each other by a road with a width of 3.5 – 4.2 m and a curve with a radius from 30 to 100 m, whose easement will be used for laying the cable network. Road routes are in compliance with the existing track remnants of the dirt roads along the mountain ridge and around it. A road with a length of 13.6 km and a width from 3.5 to 4.2 m will be constructed on such tracks; such road will be a bed of 20 cm sand foundation with 5-10 cm concrete scrap or rubble. Interior platforms near the foundation and the roads are required for ensuring access for the necessary transport for installation, repair and maintenance of turbines.

*Social impact (employment of manpower, social necessity, social benefits).*The region of Mount Murgash is in many cases representative of wind power (good wind indices, relief, density of population, vegetation, geological conditions, etc.). The region is distinguished by constant air currents throughout the year, wind speed and direction, at a comparatively low altitude, good access for transport and availability of power supply network.

After the ratification of the Kyoto Protocol, this country has undertaken the obligation to reduce its emissions for the 2008-2012 period by 8 % in comparison with the year 1988 accepted as basic under the framework convention. The solution of the existing ecological problems relating to the production of power is natural production of power from renewable energy sources. Energy generated by wind is renewable and reduces the use of fossil fuels. It is not related to emission of CO_2, sulphur oxides, dust or any other air pollutants. Upon substitution of 1 kWh of electricity with coal, with the same quantity of wind electricity the following emissions are prevented: about 1 kg of CO_2, about 100 gm of ash and gypsum, 2 mg of sulphur dioxide and 3 mg of nitrogen oxides (when using high caloric imported coals. Greenhouse gasses generated in the production process of wind generators are compensated for by the reduction of the harmful emissions from their electricity production for only 3 – 5 months of operation. By this index, windpower engineering ranks definitely first among the rest of the power plants for the so-called “clean electricity”. Throughout its economic life, a wind turbine of an average size saves more than 3 300 tons of electricity producing coal, prevents emission of more than 7 000 tons of CO2 equivalent into the atmosphere and avoids hundreds of tons of ash.

The potential of the solar energy having fallen on the surface of the earth (between 1 and 3 % of it is transformed into wind energy) is 5 times greater than the present consumption of energy in the world. Its production is cheap and is not associated with storaging harmful substances, generation of waste or other hidden side effects (like the nuclear power engineering, for instance). The construction of wind plants on farm land does not cause destruction of the soil layer (save for the bases of the foundations) or the termination of the production of agricultural products. The restoration of the condition of the environment after

the termination of the operation of wind plants is related solely with dismantling and removal of the foundations.

The purpose of this investment proposal is the production of renewable electricity, and the purchase by NEK (the National Electric Company) of the entire power produced has been legally secured. The location of both terrain and facilities on the platform around the mountain of Murgash is suitable for implementation of such type of projects.

In 2005 Bulgaria is holding one of the last positions in Europe regarding electricity production from renewable energy sources (RES). Only 0.5% of electricity produced in Bulgaria is from such energy sources, including wind, solar energy and geothermal sources. Electricity production in Bulgaria is primarily based on fossil fuel, nuclear energy and hydraulic power capacity employment. Under the National Program for Renewable Energy Sources RES (2004-2015) of the Ministry of Energy and Energy Resources as well as the commitments made this country is to achieve electricity production from RES at the amount of 11% of electricity produced in Bulgaria by 2010 (pursuant to the Treaty of Accession of the Republic of Bulgaria to the European Commission). The Common Energy Strategy of the European Community aims at: - guaranteeing security of deliveries by means of diversification of energy types and delivery origin; -ensuring better competition environment, and last but not least - achieving sustainable development of the energy branch by means of increasing the share of RES. Imposition of a common strategy has become a necessity due to: - the increasing energy dependence of the EU; - the constantly rising petrol prices (per saltum sometimes); - significant changes in the environment; - significant rise in energy prices in the EU.

The implementation of the investment project will have a positive impact in relation to the social and economic conditions during the operation of the wind plant. It can be specified and expressed as follows: considerable capital investments, finding expression in the construction of the plant itself; meeting the increasing demand of electricity on the market and in compliance with the country's requirements and commitments; prevention of emissions of harmful substances and reduction of emissions of greenhouse gasses; transition to sustainable development of the energy field by increasing the share of WS; reduction of the country's dependence on foreign suppliers outside the EU; creation of an alternative to nuclear power through electricity production by WP; creation of local engineering infrastructure; creation of part time jobs; provision of part time employment to a 10 – 15 person construction and design personnel from a Bulgarian construction company; creation of permanent jobs by providing employment for 3 – 5 persons of servicing personnel (security and maintenance).

The realisation of profit from wind power is related also with the respective amendments to the legal conditions: 1. The purchase price of 1 kWh of electricity is sufficiently high and will continue to go up (law provides that the purchase price cannot be less than 80% of the retail price for domestic purposes); 2. For each kWh produced by a renewable energy source, a green certificate will be granted which will be sold regardless of the fact whom the windpower is supplied to (the profit from the contemplated green certificates is equal to the revenues form their price); 3. Legal obligation of NEC to purchase preferentially 100% of the produced wind electricity (at a purchase price of about 2 times higher than the price of electricity from WPP's); 4. All investments in windpower engineering, save for the lands, are depreciated with tax acknowledged annual quotas of 15 to 50%; 5. Wind generator plants do not need numerous operating personnel and have no expenditures on

fuel (presently, the taxes in this country are comparatively low, compared with the European ones, but they will inevitably be going up).

3. Analysis of the existing situation, prognosis and evaluation of the estimated impacts on the environment components which are expected to be affected by the implementation of the investment project.

Wind energy does not cause pollution of the air, water and soil. The impact of the so-called Wind Power Plants Complex on the environment involves: clearing the durable high-stem vegetation around the foundation; breaking up the soil layer during the construction and excavations works and the laying down of the foundations; additional packing of the soil layer by the transport vehicles during the erection of the generators; noise loading up in the vicinity, visual impact and shadowing (the so-called flickering shadow of the range; impact on bird and the fauna, possible magnetic interference with the radars of the Sofia Airport; break down in the telecommunication systems at the summit; mechanical impact upon emission of ice pieces.

The region of Mount Murgash is in many aspects representative of wind power (good wind indices, relief, density of population, vegetation, geological conditions, etc.). The region is distinguished by constant air currents throughout the year, in terms of wind speed and direction, its is typical as one of the windiest locations in this country with an average of about 3 % „tranquil weather" and wind below 1 m/s. At the same time the region is comparatively near to the Kremikovtsi industrial zone, at relatively low latitude with a comparatively good transport access and developed power supply network.

3.1. Atmospheric Air

The region is distinguished by the typical of continental climate distribution of precipitations (summer maximum and winter minimum) intensified by the orographic impact of the mountains with a latitude of more 1 000 m. The winter in the region is cold, with frequent fogs and very strong "pulsing" winds. The number of the days with average yearly negative temperatures in January is almost 100. Winter precipitations are not very high but the snow cover overlaps during the precipitation periods reaching the maximum about the middle of February through the end of March. Spring is cool and sets in late with average day-and-night temperatures above 10^{O}C only about the end of May, with large cloudiness, frequent fogs and abundant spring precipitations. The summer is cool and rainy and only during intensive breaks the maximum temperature rises above 20^{O}C. The autumn is warmer and drier than the spring, the number of foggy days is smaller, and there are frequent clear and warm days.

The transformation of wind energy does not cause air pollution. The solution of the existing ecological problems relating to the production of power is natural production of power from renewable energy sources. Energy generated by wind is renewable and reduces the use of fossil fuels. It is not related to emission of CO_2, sulphur oxides, dust or any other air contaminants. Upon substitution of 1 kWh of electricity with coal, with the same quantity of wind electricity the following emissions are prevented: about 1 kg of CO_2, about 100 gr of ash and gypsum, 2 mg of sulphur dioxide and 3 mg of nitrogen oxides (when using high caloric imported coals. Greenhouse gasses generated in the production process of wind generators are compensated for by the reduction of the harmful emissions from their electricity production for only 3 – 5 months of operation. By this index, windpower engineering ranks definitely first among the rest of the power plants for the so called "clean electricity". Throughout its economic life, a wind turbine of an average size saves more than 3 300 tons of electricity

producing coal, prevents emission of more than 7 000 tons of CO_2 equivalent into the atmosphere and avoids hundreds of tons of ash.

3.2. Ground and Underground Waters

Following the performance of the appropriate survey of the Basin Directorate "Danube Region" (letter outgoing No. 3858/24.01.2007) it has been established that: „In the region of Mount Murgash, where the construction of a wind power plat is under way, no permissions have been granted for use or taking water from water sites and no SPZ under Regulation No. 3/16.10.2000 have been established. At such stage of the procedure of evaluation of the investment proposal, BDDR[2], has expressed a positive opinion.

"Vodosnabdyavane i Kanalizatsiya" EOOD - Sofia ("Water and sewerage') has coordinated the investment proposal in the region of Mount Murgash, since no existing water pipelines, water supply facilities, water sources and SPZ's managed by "Vodosnabdyavane i Kanalizatsiya" EOOD - Sofia are affected (letter incoming No. 3/26.01.2007).

No amendments to the regime of the water flows and the underground waters are expected, since the project does not provide for use of water sites upon correction of water flows, construction of dams or of other hydrotechnical facilities, upon extraction of aggregates from river beds, etc.

The implementation and the operation of the site will not affect the quantity regime or the qualities of the underground waters, the general condition of the water ecosystems and the processes of self-cleaning in normal and dry years.

3.3. Waste

The waste which will be generated during the construction of the site shall be waste from the construction and excavations works: Code 20.02.02 – soil and stones – the performed types of excavations works for each turbine (depending on the foundation) will amount to the following: in case of solid foundation (without piers) with an area of 290 m^2 or a maximum capacity of about 750 m^3; - in the case of a foundation on piers – 140 m^2 or about 360 m^3. The difference in the areas using one and the same model is due to the possibility for using various foundations, depending on the space chair: - simple foundation, reinforced concrete cylinder with a diameter of 19.1 m and a depth of 2.6 m or a circle of piers with a diameter of 12.55 m with a reinforced concrete cylinder with a diameter of 13.25 m fixed to them. The necessary levelling up of each platform for achieving the prescribed maximum slope of the terrain (necessary for positioning the autocranes during performance of the erection) will be on the average for each platform on an area of about 250 m^2, however, no extraction outside the platform shall be provided for in this case, since the excavated earth masses from the higher part will be used for filling in into the lower zone of the platform.

In addition, it will be necessary to remove soil relating to the construction of the beds for the road connections among the platforms for the turbines. The road routes are in compliance with existing track remnants on dirt roads along the mountain ridge and around it. The construction of a 13.6 km long and 3.5 to 4.2 m road is planned which will be a bed of 20 cm sand base with 5-10 cm concrete fracture or ballast. The extracted humus level between the tracks (as far as it exists) from an area of about 48 decares, which actually is the projection of the remnants of existing roads along the ridge areas, can be used upon recultivation of the platforms. The estimated quantity of extracted earth masses to form the roadbeds will be about 10 - 15 000 m^3, part of them will probably be used over again during the filling in works.

[2] Basin Directorate "Danube Region"

The technological process of transmission of electricity does not involve the emission of other hazardous substances or waste except the transformer oil which shall be delivered periodically (once in two or three years) to be recycled or shall be treated on the spot.

3.5. Harmful Physical Factors:

Every operating mechanical system generates sound waves from the vibrations of its separate mechanisms and units during their movement, friction, bumping, etc. This is why, noise is inevitable during the operation of wind generators too. However, besides the mechanical noise, they produce also aerodynamic one, due to the rotation, the vibration, the friction a the other kinds of interactions of the rotor blades with the air flow passing around them. Such noise depends mainly on the rotor speed and on the methods of its aerodynamic operation.

The initially erected wind turbines in the 80-ties were very noisy and caused the withdrawal of the wind parks several kilometres away from residential buildings. The reduction of the aerodynamic noise is a problem which the manufacturers have already coped with by reducing the thickness of the back part of the blades (with profile of airplane ones), they have change the material and their construction and have also ensured their active direction against the wind. This provides for avoiding the so-called "wind shadow" and the abrupt changes of the speed of the turbine, and hence, the impulse noises and vibrations. At the same time, the manufacturers have also soundproofed the reduction gear box as a result of which turbines can be erected near residential districts as well.

Contemporary megawatt turbines (for instance, a 2-3 MW turbine), at 95% of their nominal capacity, rotate at a relatively slow speed (10-30 revolutions per minute) and generate noise with intensity of about 100-103 dBA. Such noise levels at a distance of about 250-350 m go as low as 40 dBA, and at a distance of up to 450-550 m, as low as 35 dBA (see Fig 7 of i.3.5.3). The lower capacity turbines of 1-1.5 MW are less noisy and in relation to them, the specified distances are much smaller.

Other hazardous cases are the cases of icing of the blades and changing the profile at low temperatures and high humidity as well. Under such conditions, ice could accumulate in layers on the wind turbine blade ends. Ice pieces disconnect from the rotating turbine blades and float at great distances beyond the rotor disk plane and could cause damages and harms. The safety zone behind the installation has a distance of retreat equal to the height of the axis plus the turbine diameter. It is dangerous to stay within the zone with a radius of 35 m around the turbine foundation in seasons with positive temperatures because of the air turbine mechanical impact, and in cases of icing – at about 120 m beyond the plane of the rotating of the blade because of floating ice pieces.

Wind turbines are electric generators which are sources of electromagnetic radiation and can cause unterference with signals and communications of such kind. There is a risk that the signals of the Meteorological Station on the mount, whose channels are (probably radio relay) may be interrupted or jammed

The region of the mount is located at a distance of about 30 km from the Sofia Airport and some of the flight routes/corridors probably pass also above/near it. The wind generators in a wind park can cause interference in the radar systems and under certain conditions cause disturbances in the radar installations and the communications of the Sofia Airport. The rotating blades generate electromagnetic interferences which depend on the location, the relief, the type of the turbines, the size, the shape and the construction material of the blades. It is planned to avoid metal alloys as material for the blades and to construct them of *fibreglass*

(epoxy resinpolyester-bound glass fibres composites) with integrated lightning protection. The wind turbines of that kind are with optimized geometry of the blades which allows for reduction of the noise emissions and electromagnetic radiation.

Transformation from low voltage to average voltage of 33 kV sis provided for and the wind turbines will be connected serially with a cable routing The 33 kV distribution line will be the electric power line about 20 km long and will pass along a route which will be specified The operation of electricity transmission facilities with an average voltage of 33 кV does not involve pronounced electromagnetic impact on the environment. For instance, at the electric power line 20 кV (nearest to the case of 33 кV) there is no excess of the maximum allowed levels of the physical factors

3.6. Ground and soils

Each turbine requires a solid foundation and a cleared area of about 1 400 m^2 around the foundation. The foundations themselves may vary, depending on their pad surface, from a regular foundation (with a diameter of 19.1 m and depth 2.6 m) with an area of от 290 $м^2$ to a foundation (with a diameter of 13.25 m), fixed to a circle of piers with an area of 140 m^2 around them тях. The laying of the foundations on the turbine piers requires an erection area of about 480 m^2 around them (a rectangular with dimensions 24 x 20 m). The difference in the surfaces of one and the same model will depend on the possibility for using different foundations depending on the space chair.

It is planned the erection to be effected with two auto cranes with cantilever range of about 20 – 25 (30) m. The average area necessary for assembling the screws/blades to the head on the ground and later lifting up of the whole rotor unit is about 1 400 m^2, distributed as follows: - total storage area for screws - 500 m^2; storage area for segments / sections from the tower - 300 m^2; storage area for the hub/nacelle – 30 m^2; - working area around the foundation – 450 m^2, area of the main crane – 200 m^2; - area of the auxiliary crane – 50 m^2. The platforms on which the two cranes shall be erected with a total area of 250 m^2 must be levelled, and the maximum slope shall be up to 3-4%, - the storage platforms for the segments of the tower, the components of the nacelle and the screws with a total area of 830 m^2 allow a greater longitudinal slope of up to 10% and levelling them on all platforms is not required. The cleared erection area should not have any durable vegetation but it is not mandatory that it should be a bare terrain. Recultivation of the levelled areas and grassing around the facilities has to be effected after erecting them, as well as taking of antierosion measures (stopping the erosion from the wind and the turbulent currents).

Wind turbine platforms will be connected to each other by a road with a width of 3.5 – 4.2 m and a curve with a radius from 30 to 100 m, the easement thereof will be used for laying the cable network. Interior platforms near the foundation and the road are required for ensuring access for the necessary transport for installation, repair and maintenance of turbines.

3.8. Flora and Fauna, Protected Nature Territories

The impact on vegetation might be conditionally divided into two phases: *During construction works* The entire grass vegetation will be removed upon basing the piers for the rotors, i.e. under the spot for the foundation with an area of 290 (140) m^2 and under the roadbed of the routing of the road connections (where it exists). The vegetation between the levelled platforms for the autocranes with an area of 250 m^2 that will as well be removed during the erection, may be recovered thereafter. The grass vegetation will be trodden all over the cleared (erection) area of 1,400 m^2. *Simultaneously with the construction works* forestation

with local species is necessary – (low bushy vegetation, if necessary grass as well) around the foundations, as well as provision of anti-erosion measures. The grass species have great self-recovery ability and extra measures are not needed, such as secondary lying down in grass. Excluding the very foundations and the roadbeds, the remaining area will not be irrevocably damaged. *During operation* No impact on the existing vegetation in the forested territories under the mountain ridge is expected. The operation of the site will not have a negative impact on the vegetation in the neighbouring terrains under such conditions.

The wind power station platform is located out of the European migratory passages and the region has no particular significance for the migration and wintering of the separate bird species. The terrain is part of a territory that by its biocenotic value might be classified as biocenosis under anthropogenic influence of high level of tolerance of floral and fauna elements. The partial urbanization of the territory (presence of mountain hostels, forestry enterprise buildings, shelters, meteorological stations, tourist paths) has stimulated the growth of a variety of synantropic bird species and has helped their spread up in the mountains.

Impact of the noise from the rotation of the blades on birds. During rotation the blades emit specific noise due to the mechanical influences and streamline surmounting the air resistance. Due to the great height at which the blades are located and the lack of surface absorption it is expected that the noise will dispread over a significantly larger distance than measurements and calculated noise zones on the earth surface show. On the other hand such noise has varying parameters that are the function of the wind strength and direction. It could be expected that in comparatively quiet weather the birds will perceive that noise by night at great distance and since they do not recognize it, they will react inadequately. Wind turbines from that type have optimized geometry of the blades that allows reducing noise emissions and electromagnetic impacts.

The turbine blades have been provided for peripheral speed of 25-78 m/sec, developed at rotation of 8-25 revolutions per minute. In spite of the comparatively slow motion, there is a risk of birds hitting the wind power station blades. The risk will depend on the wind speed and the visibility. In case of fog, low clouds and bad visibility birds fly lower, at the height of the wind power station masts. In such conditions the probability impacts is greater even if the blades do not rotate.

Impact of the reflection of the rotating blades during the daytime. In sunny weather the rotating blades will produce strong reflections or “flickering shadow” that the birds will see at great distance. In all cases they will perceive this as danger and will perplex the flight of the birds. The avoidance of the “flickering shadow” is not a problem if the distance between the generators is increased to 10 times the rotor diameter.

Impact of the magnetic field changes in the region of the electric power stations. The magnetic field changes owing to the work of the electric power station would result in confusion and disorientation of some of the birds. Such information could be found out in a number of specialized ornithological magazines, discussing this problem, but in that case it is provided for the blades to be constructed of glass-fibre-resin materials (epoxy resin-bound composites) without metals or alloys that strongly reduces electromagnetic disturbances.

The electric poles of high voltage (33 κV) that will be constructed for transmitting the produced electricity behind the transformer are a real danger for birds. These devices are enticing perches for many species and under conditions for creation of electric arc (wet weather, etc.) there is a risk birds to get killed. Appropriate designing of the top part of the pylons and provision for appropriate constructions might reduce the risk to a minimum.

The impact of wind power stations on fauna might be sought chiefly in relation to migrating birds. They could not strongly affect local fauna to an extent that could be considered dangerous and limiting the distribution and reserves. This is so, because local species get accustomed to the specific features of the station devices with respect to the noise, as well as to all other impacts. And since it cannot be expected that the rotating blades will strike and kill lots of birds (particularly in good daytime visibility), the other impacts on migrating birds that will be analysed, are practically without influence on local ornitofauna.
In contrast to aircraft engines at airports, birds cannot cause problems or be themselves dangerous to wind turbines, however precautions may be taken for reducing such effect. Experience shows that for many bird species and their habitats correct designing and localization of wind generators is related to minimum impact. The chief impact is the risk of "hitting" the bird with the blades, thus causing injuring or death. Probability for such an event depends on the flight characteristics of the given species and the related to the season behaviour of the birds. It is expected that most birds in flight will take precautions to avoid the moving obstacle, although various species act in different ways to avoid it. Researches on birds, affected by wind turbines, show that their number is considerably smaller than birds, killed by other human activities – traffic, hunting, high-voltage lines as well as the negative impact of intensive use of fossil fuels. Researches show that migrating birds are wiser, wiser than we knew until recently, and are capable of successfully avoiding wind turbines.

The region that is an object of the investment proposal does not fall within the borders of a protected territory. The nearest potentially protected dwelling area is „Etropole – Bailovo" with zip code BG0001043."

3.9. Landscape

The terrain falls within broken ground of 1,400 to 1,670 m above the sea level in the Mount Murgash region. The construction of 44 wind turbines is provided for, each of which needs approximately 1,400 decares cleared erection area around its foundation. The rotors will have three blades that will be lifted up at about 65-70 m above the earth surface as a result of which the wind park will be visible from kilometres. The visual impact of the simultaneous work of 44 identical wind turbines might as well cause negative sensation of far too strong human intervention in this high-mountain open country.
The rotors will be lifted up at about 65-70 m above the earth surface and the wind park will be visible from kilometres.

The perception of the wind park will be sensed as: - dominating the landscape silhouette – up to about 2 km; - comparatively dominating silhouette – from 2 to 5 km; - visible peculiarity only in clear weather as a part of wider landscape – from 5 to 15 km; - a visible peculiarity only in very clear weather, as a minor element of the landscape - from 15 to 30 km. According to the approved visibility as a function of the distance, a part of the wind park will be also visible from Sofia in clear weather. However, the wind generators will be a dominating the landscape factor only in the region of the mountain ridge. Provision for anti-erosion measures, upper layer recultivation as well as self-grassing of the affected terrains will mitigate the change of the landscape and the artificial introduction of such a landscape dominant.

4. Health and Hygiene Environmental Aspects

The planned to be erected turbines Leitwind (LTW 70/77) and Win Wind (WWD-1 and WWD-3) must meet the requirements for safe use according to the International Electro-

technical Commission – IEC 16400. The wind generators shall be positioned at a distance of no less than 500 m away from the territory of the nearest settlement, according to Art 141, para 1 of Regulation No. 14 of June 15, 2005 on technical rules and normative for designing, construction and use of the sites for production, transformation, transfer and distribution of electricity, SG 53/2005, promulgated 28.06.2005 of the Ministry of Regional Development and Public Works and the Ministry of Environment and Water.

Due to the remoteness from settlements, no change in the health status of population is expected upon operation of such sites. The risk of accidents is chiefly due to increasing the speed of wind turbines in strong wind or occurrence of power failures in the transmission network. The turbines are with a horizontal axis and three blades made fibreglass (epoxy resin-bound glass fibres composites) with integrated lightning protection and potentials for peripheral speed of 22-80 m/s, developed upon rotation at 6-23 revolutions per minute The design wind speed at which turbines operate at total output is over 12 m/sec, but they can also operate in the range from 2.5 m/sec to 25 m/sec.

Other hazardous cases are also the cases of icing of the blades and changing the profile at low temperatures and high humidity-l. The facilities stop operating in case of emergencies or are redirected at an angle against the direction of the wind and shall be set into operation or redirected against the current after a detailed control on the condition of the separate components. Ice pieces break loose from the rotating turbine blades and float at great distances beyond the rotor disk plane and could cause damages and harms. The safety zone behind the installation has a distance of retreat equal to the height of the axis plus the turbine diameter. It is dangerous to stay within the zone with a radius of 35 m around the turbine foundation in seasons with positive temperatures because of the air turbine mechanical impact, and in cases of icing – at about 120 m beyond the plane of the rotating of the blade because of floating ice pieces.

In cases of emergency, the installations stop functioning or are redirected at an angle against the direction of the wind and in the case of determined icing of the blades, operational strategy for their stopping could be undertaken. Commissioning or resumption of their operational state by redirecting them against the draught is performed following a thorough control over the condition of the separate parts.

Transformation from low to average voltage of 33 kV is envisaged, and the wind turbines will be connected serially with a cable routing. At O.H.L. 20 kV (in this case 33 kV) the top admissible levels of the physical factors are not exceeded. Passing of such electric power lines through towns and villages is permitted under the operating legislation. The air distribution lines do not have negative impact on the visible aesthetic natural environment.

7. Measures for reducing the negative consequences

The practical measures involve, as follows: - change of the turbine blades colour and their marking with risk signalling colour combinations; - use of pylons and rotor axes without apparent possibility for nesting, driving birds in the breeding period; - assembly of screening umbrellas on the pylons of air lines; - lack of refuse, carrion or whatever foodstuffs in the station region that could attract birds; - radar or carrying out appropriate watch of sufficient scope to alarm the turbine operators for approaching bird flights; - possibility of comparatively fast stopping the blades in case of risk of entry of birds in the windpark region. The driving of birds that successfully adjust to various devices in open country is carried out by any means

but guaranteeing lack of foodstuffs and permanent vegetation in the region is particularly important.

10. Conclusion

The impact of the Wind Power Plant Complex on the environment involves the following: - clearing the permanent high-stem vegetation around the foundation; - disrupting the soil layer during building-excavation works and founding; - extra compression of soil layer by vehicles during assembly of generators; - noise loading in the region; - visual impact and overshadowing (the so-called "flickering shadow") of the ridge; - impact on bird and animal world; - possible electromagnetic interference with the Sofia Airport radars; - disturbance of the summit telecommunication systems; - mechanical impact in case of throwing out ice pieces.

Impact on the atmospheric air quality

The project implementation and electric power production will not cause pollution or generation of harmful emissions, since wind generated power is renewable and saves use of fossil fuels. It does not cause emission of CO_2, sulphur oxides, dust or any other air pollutants. Upon substitution of 1 kWh of electricity with coal, with the same quantity of wind electricity, the following emissions are prevented: about 1 kg of CO_2, about 100 gr of ash and gypsum, 2 mg of sulphur dioxide and 3 mg of nitrogen oxides (when using high caloric imported coal. Greenhouse gases generated in the production process of wind generators are compensated for by the reduction of the harmful emissions from their electricity production for only 3 – 5 months of operation. By this index, windpower engineering ranks definitely first among the rest of the power plants for the so-called "clean electricity". Throughout its economic life, a wind turbine of an average size saves more than 3 300 tons of electricity producing coal, prevents emission of more than 7 000 tons of CO^2 equivalent into the atmosphere and avoids hundreds of tons of ash.

Impact on surface and underground waters

In the region of Mount Murgash, no permits have been issued for use or water drawing from water sources and established SPZ's under Ordinance No. 3/16.10.2000 near facilities, no existing water mains, water-supply facilities, water-supply sources or SPZs are affected. No changes in water currents or underground waters regime is expected, since the project does not stipulate use of water sources upon correction of water flows, construction of dams or other hydrotechnical facilities and corresponding extraction of aggregates from riverbeds, etc. The project implementation and operation will not affect either the quantity regime or underground waters qualities, the water ecosystems general status or the self-cleaning processes during normal or dry years.

Generated Waste

The technological process of windpower production and electric transmission is not related to harmful stuffs or waste emissions, safe for the transformer oil that is delivered regularly (once each 2-3 years) for recycling or is treated on the spot.

Noise Load

The noise isolines territory distribution prognosis is given in the Murgash Windgenerating Park noise map. The equivalent levels of noise over 65 dBA are only in zones, almost overlapping the land surface projection of the rotating blades. The zones of

noise level over 55 dBA are 44 ellipses, corresponding to a circumference with a radius of about 73 m. The zones of noise level between 50 and 55 dBA represent several differently shaped areas around the generators with borders outlying at a distance of 73-79 m against and 145-158 m in the direction of the wind. The zone of noise level between 45 and 50 dBA covers a total area around the generators (depending also on the relief) with a border, outlying at a distance of 122-131 m against and 245-261 m in the direction of the wind. The zone of noise level between 40 and 45 dBA represents a total strip of land around the generators, outlying at a distance of 200-210 m against and 400-420 m in the direction of the wind.

Electromagnetic Fields

There is a risk that the signals of the Meteorological station telecommunication facilities at the summit, whose channels (very likely radio-relay ones) cross the wind generators platforms, be interrupted or jammed. The wind generators may cause interference with the Sofia Airport radar systems, and under certain conditions they may cause disturbances to the radar installations and communications of the Sofia Airport. The provided for transformation from low to medium voltage of 33 kV, power cable and transmission station are not related to significant electromagnetic impact on the environment.

Ground and Soils

Each turbine needs a solid foundation, varying from a common foundation with an area of 290 м^2 to a foundation, attached to a circle of piers, with an area of 140 м^2. Laying the foundations of the turbine towers requires erecting area of approximately 480 m^2 around them. The average area, needed for assembling the blades to the hub on the ground followed by lifting the entire rotor unit shall be about 1,400 m^2 and the platforms, where the two cranes should be erected on an area of a total of 250 m^2, must be levelled at a maximum slope of up to 3-4%.

Wind turbine platforms will be connected to each other by a road with a width of 3.5–4.2 m and a curve with a radius from 30 to 100 m, the easement thereof will be used for laying the cable network. The taken away humus level between the wheel-tracks (as far as it exists) of an area of about 48 decares that is the projection of the tracks of existing roads along the ridge parts, could be used for recultivation.

Flora and Fauna

The examined terrain does not fall into the limits of a protected nature territory or of a potentially protected site, which fact has been confirmed by letter AAPIM-10490/16.01.2007 of MEW. The Ministry of Environment and Water reference in writing of MEW has been made following a Decision for providing access to public information No. 7/16.01.2007. In the reference in writing, the investor has been informed that: “Mount Murgash does not fall into potentially protected areas. The nearest potentially protected dwelling area is „Etropole – Bailovo” with zip code BG0001043.” No presence of rare or endangered of extinction vegetation species, included in the LBD, has been found.

No impact on the existing vegetation in the afforested territories below the ridge is expected. The terrain of the ridge itself is part of a territory that by its biocenotic value might be classified as biocenosis under anthropogenic influence of high level of tolerance of floral and fauna species (IX category agricultural land – pastures and village territories).

The impact of wind power stations on the fauna might be related chiefly to migrating birds, however, the windpower station is located out of the European migratory passages and the region has no particular significance for the migration and wintering of the separate bird species. The researches show that migrating birds are wiser than we knew until recently and are capable of successfully avoiding wind turbines and available proofs suggest that correctly located wind plants do not present considerable risk for the birds. The wind generators could not have great impact on the local fauna that could be considered dangerous and limiting the distribution and the reserves. This is so, because local species get accustomed to the specific features of the station devices with respect to the noise, as well as to all other impacts. And since it cannot be expected that the rotating blades will strike and kill lots of birds (particularly in good daytime visibility), the other impacts on migrating birds that will be analysed, are practically without influence on local ornithofauna.

Disruption to Landscape

The visual impact of the simultaneous work of 44 identical wind turbines may also cause negative sensation of far too strong human intervention in such high-mountain open country. The perception of the wind park will be sensed as: - dominating the landscape silhouette – up to about 2 km; - comparatively dominating silhouette – from 2 to 5 km; - visible peculiarity only in clear weather as a part of wider landscape – from 5 to 15 km; - perceivable peculiarity only in very clear weather, as a minor element of the landscape - from 15 to 30 km. According to the approved visibility as a function of the distance, a part of the wind park will be as also visible from Sofia in clear weather. However the wind generators will be a factor dominating the landscape only in the region of the ridge.

Impact on Human Health

Due to the wind park remoteness from built-up areas, no change in the state of the health of the population is to be expected during its operation. The risk of accidents is chiefly due to increasing the revolutions of wind turbines in strong wind or occurrence of power failures in the transmission network. Turbines have an in-process inspection of the turbine axis deviation direction which allows the axis to be directed in the case of comparatively small changes and shifted in the case of stormy winds. Three independent grips of the different blades, brake gear for stormy winds and rotor locking in case of need have been provided for.

The Wind Power Plant Complex in the region of Mount Murgash on the territory of the villages of Zhelyava, Eleshnitsa and Churek meets the ecological and the respective other normative requirements of the Republic of Bulgaria for designing such sort of projects. Provided during the project implementation the recommended measures for protection and recovery of the environment are fulfilled, the necessary construction and operation normative requirements are observed, as well as the requirements of the wind generators manufacturers, the impact on the environment will be local and limited with respect to the examined physical factors and landscape, in view of which we propose to the Honourable Expert Council to RIEW Sofia to grant an affirmative conclusion on the report for EA and to permit the project implementation upon conformity with the recommendations for reducing the impact made in the report.

Manager of the Team of Licensed EIA Experts: ……

/ Dr. Eng. Valentin V. Kamburov /