Environmental Study and Assessment
BAIGALI-ECOLOGY LLC

# REPORT OF THE DETAILED ENVIRONMENTAL IMPACT ASSESSMENT FOR "SAINSHAND WIND PARK" PROJECT

ULAANBAATAR, 2015

Sainshand Salkhin Park LLC

# REPORT OF THE DETAILED ENVIRONMENTAL IMPACT ASSESSMENT FOR "SAINSHAND WIND PARK" PROJECT

**Project Executor:** **"SAINSHAND SALKHIN PARK" LLC**

**Report of the Assessment developed by:**
**"Baigali-Ecology" LLC**
**Director** **B.Ikhbayar**

**The Report is introduced to and accepted by:**
**"Sainshand Salkhin Park" LLC**
**Director** **R.Davaanyam**

**Ulaanbaatar**
**2015**

**TABLE OF CONTENTS**

## LIST OF TABLES

## LIST OF FIGURE

# INTRODUCTION

In 2014, there were produced 5476.7 million kWh electric energy and 7075.5 thousand Gcal thermal energy on the scale of the centralized energy system of Mongolia. Compared to the energy production of 2013, the production of electric energy increased by 6.7% (or by 344.4 million kWh) and the thermal energy – by 4.3% (or by 305.2 Gcal) respectively. In 2014, in total, the country used 6897.4 million kWh and of these, 76.5% were produced by the domestic thermal parks power plant 2.8% - by the renewable energy sources and 20.1% was supplied with the imported energy.

While in 2009, “Baigali-Ecology” LLC carried out the detailed environmental impact assessment /DEIA/ for the Sainshand wind park project, this time, in connection with the changes and amendments brought into the package of environmental laws and other relevant laws, regulations and legal documentations, the company accomplished the supplementary amendments and clarifications for the project’s DEIA.

“Sainshand Wind Park” LLC leased the land of 486.6 hectare area at a place called “Ulaantolgoin khundii” /valley/, located at the junction of the territories of Sainshand, Urgun and Altanshiree soums, Dornogobi province to build up a wind plant. The total capacity of the projected wind park is 54 MW and it is intended to improve the electricity supply of the central region system. Sainshand Wind Park LLC chose the wind turbines V110-2.0 with a capacity of 2.0 MW manufactured by the supplier “Vestas”, Denmark and is planning to install 27 turbines in total.

On October 14, 2014, the expert of the Ministry of Nature, Environment, Green Development and Tourism issued the conclusion A/105 to the General Environmental Impact Assessment /GEIA/ based on the provision 3.1.4, article 3 of the Mongolian Law on Environmental Impact Assessment and the provision 3.1.5 of the Regulations on Environmental Impact Assessment approved by the resolution 374 of the Mongolian Government from November 16, 2013. Then, based on the expert’s conclusion to the GEIA, the Environmental consultant “Baigali-Ecology” LLC has performed the Detailed Environmental Impact Assessment /DEIA/ for the Sainshand wind park project in accordance with the “Methodology on Environmental Impact Assessment” approved by the order A-11 of the Minister of Nature, Environment and Green Development from January 10, 2014.

The potential environmental impacts that might occur during the construction of the Sainshand wind park were thoroughly considered in the DEIA, necessary adverse impact mitigation and elimination measures were planned and the relevant Environmental Management Plan developed.

This report consists of 6 chapters and 27 subchapters and is documented with 52 tables and 18 figures.

“BAIGALI-ECOLOGY” LLC

# 1 BRIEF DESCRIPTION OF PROJECT

## 1.1 Brief introduction to Project

| | |
|---|---|
| ***Project name:*** | Construction and Operation of a Wind Park |
| ***Project number:*** | A/105 |
| ***Project executor:*** | "Sainshand Salkhin Park" LLC<br>State registration number: 9019077051<br>Register number: 528601 |
| ***Project executor's address:*** | Ulaanbaatar city, Sukhbaatar district, Central Tower, Room #408.<br>Tel: 976-11-325867, 325897 |
| ***Project implementation territory, project location*** | Junction of territories of Sainshand, Urgun and Altanshiree soums, Dornogobi aimag |

"Sainshand Salkhin Park" LLC leased an area of 486.6 hectare area at place called "Ulaantolgoin khundii", located at the junction of the territories of Sainshand, Urgun and Altanshiree soums, Dornogobi province to construct and operate a windplant. Ferrostaal as current main shareholder of Sainshand windpark, is planning to implement this project with equity and debt financing.

As a result of implementing the "Sainshand wind park" project, there would be built up wind park with 52 MW nominal capacity at the connection point to the grid. The project has a number of advantages to ensure the reliability of the regional electricity supply through renewable energy source, reduce the consumption of pure water by the conventional energy production industry, diminish the emission of NOx, sulphur, $CO_2$, etc. during energy production.

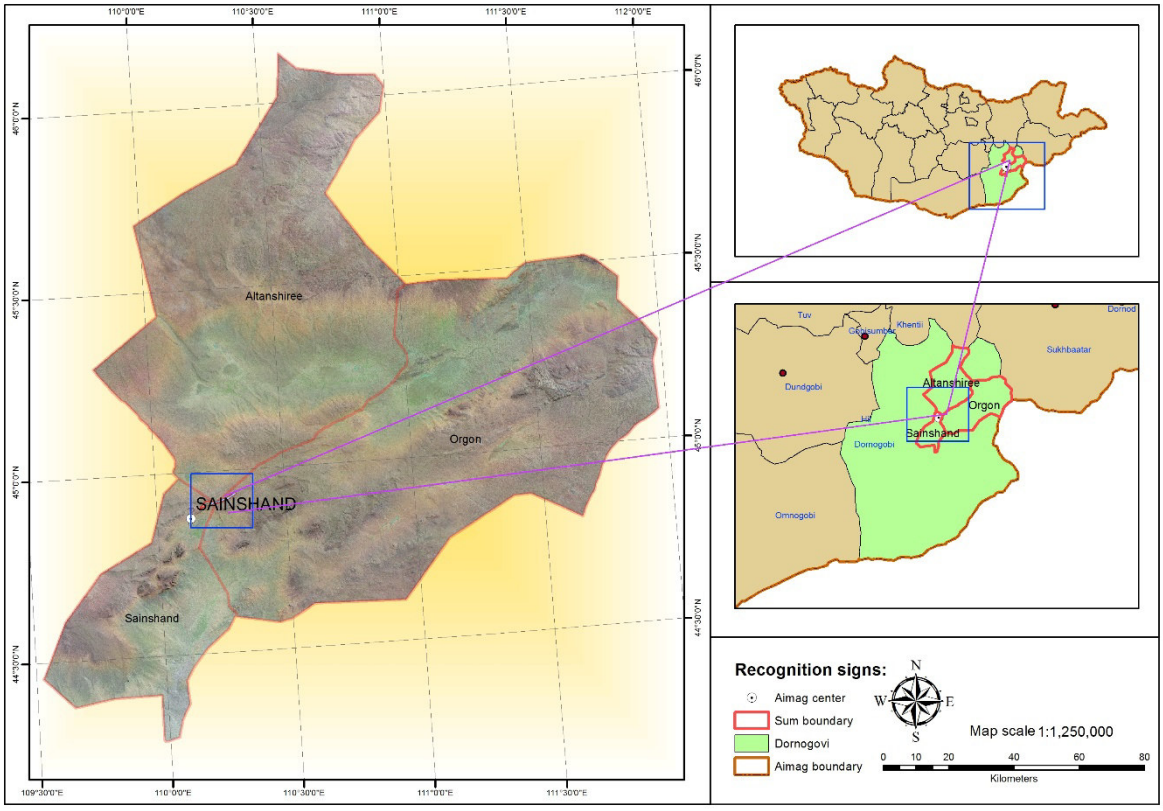
According to the relevant calculation, USD120.0 million would be supposedly required for implementing the project, and as it is planned the new wind park would annually supply to the grid 201.6 million kWh electric energy. The feed-in tariff is priced at USD0.095/kWh in accordance with the 11.1.1 of the Law on Renewable energy.

"Sainshand Salkhin Park" LLC decided to use V110 turbines with 2.0MW capacity manufactured by the Danish company "Vestas", which would not be only economically efficient but also the most suitable for the regional climatic conditions and energy production. It is planned to install 27 turbines in total.

It was calculated that the wind park, consisting of 27 Vestas wind turbines with a 2.0 MW capacity, would annually produce 233.5 thousand MWh energy and supply 201.6 thousand MWh to the grid. According to this calculation, the average production of each wind turbine would be 7,467 MWh.

## 1.2 Project locations

The Sainshand wind park project site is located at a place called “Ulaantolgoin khundii” elevated at the altitude of 1005 m, at 460 km southeastwards from Ulaanbaatar, at 232 km northwestwards from the Zamyn-Uud border point and at 15 km southeastwards from the center of Sainshand soum.




Source: Study of Environmental conditions, 2014

**Figure 1.1. Location of Project site**

The wind turbines would be installed in line from west to the east over the elevated flattish terrace (plateau) on the south of the Ulaantolgoin khundii and on the north of the Khetsuu tsav predominated with the low knolls and hillocks and dry swashes.

The place is connected to the Trans-Siberian railway which connects Mongolia and Eastern Asia with Europe. This railway reaches the Zamyn-Uud border station via Sainshand city and is further connected to the railway network of China.

## 1.3 Land ownership right, Land use planning

In the baseline report it is noted that in 2009, upon the directive #361 of the Sainshand soum’s Governor dated September 22, 2009, the project execution was granted the land use certificate for a 230.8 hectare area to build up and run a wind park in both the northern and southern sections of the horse-race finish ground of Sainshand soum, Dornogobi aimag, for the period of 15 years, and later in 2014, there were brought certain changes into some sections of above land.

The current area where the project is to be implemented is located at the junction of the territories of the three soums of Dornogobi aimag such as Sainshand, Urgun and Altanshiree, covering 486.6 hectare area that is permitted to be used for a period of 30 years, based on the relevant land use permits issued by the governors of the three soums. The area consists of:

- Based on the decision A/84 of Altanshiree soum's Governor dated July 03, 2014, the right to use the land of 58.637 hectare area (unit field No. 5407870) in the territory of the soum's 3rd bag for the period of 30 years was authenticated by the Land use certificate No. 342872 (please find the copy of the certificate attached).
- Based respectively on the decision A/94 dated July 08, 2014 and the decision A/99 dated July 25, 2014 of Urgun soum's Governor, there were issued the Land use certificates on the 96.276 hectare area (unit field No. 44030030) and the 256.57 hectare area (unit field No. 4403003071) within the surroundings of the Ulaantolgoin khundii in the territory of the soum, for the period of 30 years (please find the copy of the certificates attached).
- Based on the decision A/271 of Sainshand soum's Governor dated August 11, 2014, the right to use the land of 75.05 hectare area (unit field No. 101005797) for the period of 30 years was authenticated by the certificate No. 342871 (please find the copy of the certificate attached).

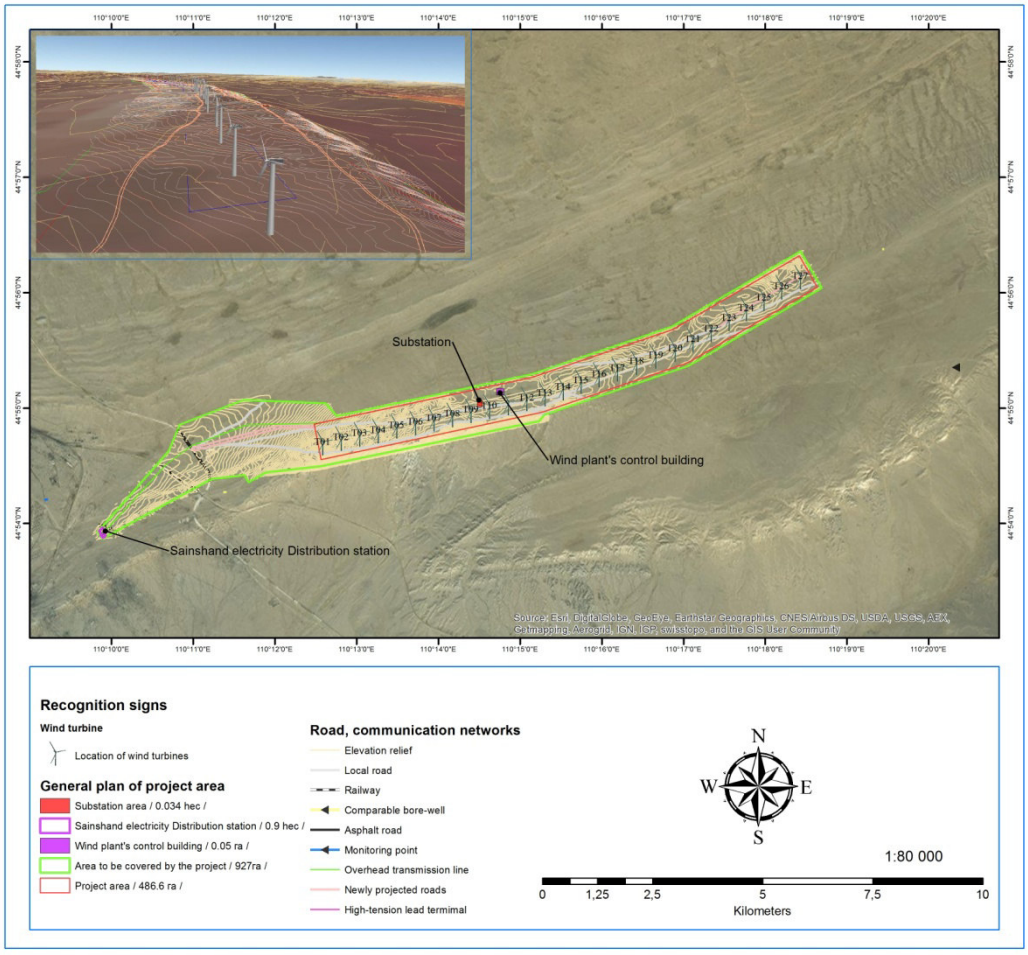



**Figure 1.2. Scheme of project's land use planning**

A low mountain terrace where the wind turbines are to be installed is called Baga Zavilaagiin ukhaa by the local people. Then, a valley lowering northwards from that terrace is called Ulaantolgoin khundii (valley), while, a broad dry-swash on the south of the Baga Zavilaagiin ukhaa is called Khetsuu tsav (broken country).

## 1.4 Project capacity

As a result of establishing the Sainshand wind park and producing clean energy adequate for providing the electricity demand of over 107.3 thousand households by using the wind force, the volume of $CO_2$ emitted by the energy production would be reduced approximately by 222.2 thousand tons, and the consumption of 1.97 million.$m^3$ clean water and 78416 tons of coal – saved annually. The project capacity is outlined in the table 1.1.

**Table 1.1 Approximate indexes of project capacity**

| No. | Index | Measuring unit | Quantity |
|---|---|---|---|
| 1 | Wind park, nominal capacity: | MW | 52 |
| 2 | Annual production of energy | MWh | 233,500 |
| | Of these: To be supplied to the grid | MWh | 201,600 |
| 3 | Number of wind turbines at the wind park | Piece | 27 |
| 4 | Wind turbine | Type | V110- 2.0 MW |
| 5 | Generator:<br>- Voltage<br>- Frequency | Type<br>V<br>Hertz | Asynchronous<br>690<br>50 |
| 6 | Annual production of energy per a turbine | MWh | 7,467 |
| 7 | Annual operational hours of a turbine | Hours | 3733 |
| 8 | Wind park's capacity factor | % | 42.6 |
| 9 | Wind park's operational period | Years | 26 |
| 10 | Year of wind park's operation at full capacity | Year | 2016 |
| 11 | Noise impact to be created by wind park:<br>- Wind turbine's tower, at the top<br>- Wind turbine's tower, at the base<br>- At 500 – 600 m distance from wind turbine<br>- At 750 – 850 m distance from wind turbine | Decibel<br>- - -<br>- - -<br>- - -<br>- - - | <br>100<br>63 – 68<br>35 – 40<br>30 – 35 |

Source: "Sainshand wind park" project

### 1.4.1 Technical specification and operational mode of wind

The capacity of Vestas V110 wind turbines is 2.0 MW. 27 turbines would be installed, resulting in an installed capacity of 54 MW of which only 52 MW would be feed in to the grid due to electrical loses and in accordance with the Special permission

The net weight of a turbine prior to packaging is 230.8 tons and its volume - 2400 m3. The weight of a nacelle, the heaviest component of the turbine is 80 tons and its dimension is 11.39 m * 3.5m * 3.73 m. Where as, the dimension of a blade, the longest component of the turbine is 54.0 m * 3.6 m and it weighs 8 tons.


**Figure 1.3. Vestas V110 wind turbine**

**Table 1.2. Wind turbine's technical specifications**

| Operational mode | | Indexes |
|---|---|---|
| Rated capacity | | 2000 kWт (50/60 Hz) |
| Cut-in wind speed | | 3 m/s |
| Rated wind speed | | 7.5 m/s |
| Cut-out wind speed | | 20 m/s |
| Wind class | | IEC IIIA |
| Operating temperature range: | Standard turbine: | - 20˚C … +40˚C |
| | Low temperature turbine: | -30˚C … +40˚C |
| **Sound power** | | |
| Sound power level (Mode 0, 13m/s at 10 m above ground /18.6m/s at hub height 95 m, air density 1.225 kg/m³) | | 107.3 dBA |
| **Rotor** | | |
| Rotor diameter | | 110 m |
| Swept area | | 9503 $m^2$ |
| Air brake | | Full blade feathering with 3 pitch cylinders |
| **Grid Connection** | | |
| Frequency | | 50/60 Hz |
| Generator type | | 4-pole (50 Hz)/6-pole (60 Hz) doubly fed generator, slip rings |
| **Gearbox** | | |
| Type | | Two helical stages and one planetary stage |
| **Tower** | | |
| Type | | Tubular steel tower |
| Hub height* | | 80 m and 95 m (60 Hz)<br>95 m and 125 m (50 Hz)<br>* Tower heights are preliminary and subject to change |
| **Nacelle dimensions** | | |
| Height for transport | | 4 m |
| Height installed (incl. CoolerTop®) | | 5.4 m |
| Length | | 10.4 m |

| | |
|---|---|
| Width | 3.5 m |
| **Hub dimensions** | |
| Max. transport height | 3.4 m |
| Max. transport width | 4 m |
| Max. transport length | 4.2 m |
| Max. weight per unit for transportation | 29.1 tons |
| **Blade dimensions** | |
| Length | 54 m |
| Max. chord | 3.6 m |
| Weight of unit blade | 8 tons |

Operational mode of wind turbine. In the normal mode, the wind turbine starts to operate at 3 m/sec. wind speed while the mode of its full load operation is 11.5 m/sec. The maximal wind speed at which the turbine would operate is 20 m/sec. As for the structure, the wind turbine represents the giant equipment- the turbine of 110 m diameter located at the 95m high tubular steel tower, having three blades each is 54 m in length. The turbine would operate normally in the temperature range between -20˚C and +40˚C and the minimal temperature at which the turbine operates is -30˚C.

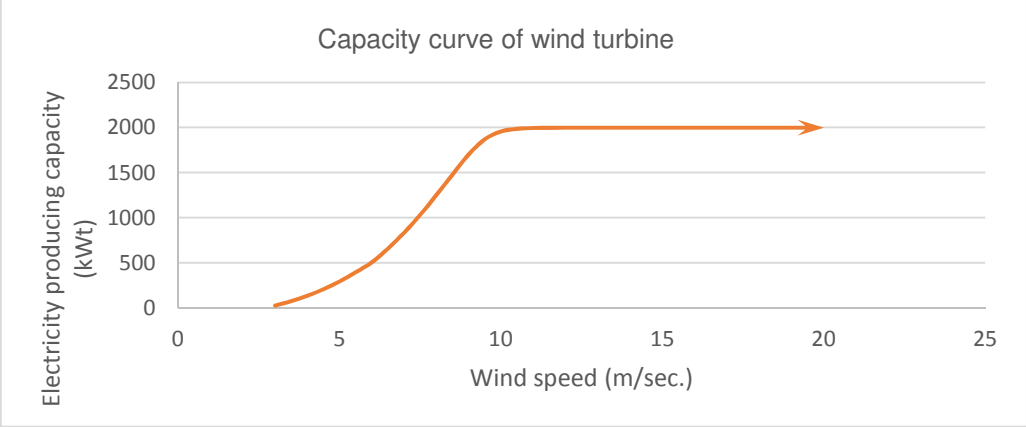



**Figure 1.4. Capacity curve of wind turbine**

As the wind speed increases from 3 m/sec. to 11 m/sec., the electricity-producing capacity of the wind turbine also increases. At the wind speed of 11.5 m/sec., the electricity-producing capacity reaches up to 2000 kilowatt and the turbine is operating at full power output.

## 1.5 Transportation of equipment

Transportation road. All components of the wind turbine would be transported from China on trucks. The wind turbine towers would be transported for over 660 km distance from Baotou city of China to Erlian border station. All other components would be transported for 830 km distance from Tianjin city to Erlian border station. Then the wind turbine components would be imported through the Zamyn-Uud border point and then, till Sainshand for 232 km distance on the asphalt road. Just before reaching Sainshand city, the trucks would leave the asphalt road to deliver the turbine components to the project site by the 4 km improved earth road.

### 1.5.1 Selection of transport vehicles, loading arrangement

The main equipment of the project such as the wind turbine blade, nacelle, hub and tower would be subject to transportation.

Transportation of blades.The total length of the blade is 54m, the width of its widest section is 3.6 m and it weighs 8 tons. The blades are made of special light material and are vulnerable to impact and scratch. They are transported on special trucks, in pairs being placed in opposed directions. The distance between two swivel mountings made of U-steel provided with a lashing that are used to fasten the blades is about 33m.

**Figure 1.5. Transportation and discharging of the wind turbine blades**

During the transportation, to prevent from bumping or other unforeseen risks, various type soft materials like old tires, etc. could be used as a damper to relieve chatter or vibration of the blades.

Transportation of nacelle. The dimension of the nacelle is 3.8m * 10.5 m * 3.9 m and its weight 80 tons, and concave trailer would be required in order to transport the nacelle. The maximal axle load permitted to be transported by the asphalt road is 10 tons. Since the nacelle is the heaviest equipment, the operations of its loading, transporting and unloading should be performed under the instructions of qualified engineers. Furthermore, in order to ensure the operational safety, a special lashing, damping and securing materials should be used.


**Figure 1.6. Transportation of wind turbine's nacelle**

Transportation of tower. The dimension of the base and single sections of the tower are:

| | | | | |
|---|---|---|---|---|
| Section 1: | 15.9m | x | 4.2/3.9m, | 70.4t |
| Section 2: | 22.9m | x | 3.9/3.4m, | 66.4t |
| Section 3: | 24.4m | x | 3.4/3.4m, | 46.8t |
| Section 4: | 30.0m | x | 3.4/2.3m, | 38.8t |

A concave trailer would be used in the transportation of the sections of the tower.

**Figure 1.7. Transportation of wind turbine's tower**

Transportation of hub. The dimensions of the hub's major part are 3.98 m 3.61 m *3.28 m and it weighs 22.7 tons. The low flat-bed trailer would be used in the transportation of the hub. During the transportation, a specific attention should be allotted to the protection of the ultra-wide section of the hub.


**Figure 1.8. Transportation of wind turbine's hub**

During transportation warning signs and supervision of security guards are required. In case of transporting during the night hours, it would be proper to use an intermittent light as a warning signal.

## 1.6 Erection and Construction

### 1.6.1 Installation of wind turbines

In total, there would be 27 wind turbines at 305-340m distance from each other installed. The length of underground interconnecting cable network trenches will be about 9 km and will have the dimensions depth: approx. 0.85 m, width: 0.75m. Further, roads of 8 km length and 4m width improved earth road will be constructed and used for erection, maintenance and operation of the wind turbines. The basic buildings and facilities consisting of the substations, administrative building, etc. of the wind park would cover 6695.0 $m^2$ in total.

**Table 1.3.Technical specifications of Vestas V110-2.0MW wind turbine**

| No. | Technical specification | Numerical value |
|---|---|---|
| 1 | Type of wind turbines | Vestas V110-2.0MW, Denmark |
| 2 | Capacity of wind turbines | 2.0 MW |
| 3 | Diameter of wind turbines | 110 m |
| 4 | Height of turbine's hub | 95 m |
| 5 | Diameter of foundation | 17.9 m |
| 6 | Height of foundation | 2.76 m |
| 7 | Number of turbines, distance between them | 27 turbines 305-340 m |
| 8 | Area to be covered with the underground electricity transmission lines connecting the turbines, length of the lines | Chosen as 9000. m* 0.75m = 6.750m$^2$ |

Foundation loads provided by Vestas are simulated according IEC61400-1 Edition 3 and summarized in the Table 1.4. Ultimate loads respond to bending moments, shear and direct forces measured in extreme wind conditions.

**Table 1.4.Maximum load of wind turbine foundation**

| Load case | Fr (kN) | Fz (kN) | Mr (kN•m) |
|---|---|---|---|
| Operation loads | 401 | 3175 | 36611 |
| Ultimate loads | 684 | 3159 | 64020 |

Once earthworks are finalized, the fertile soil would be equally distributed within the surrounding area of the foundation. Any operation handling liquid materials wouldn't be performed at the project site. Upon the completion of the project's geological survey, there might be made certain changes to the design of the foundations.

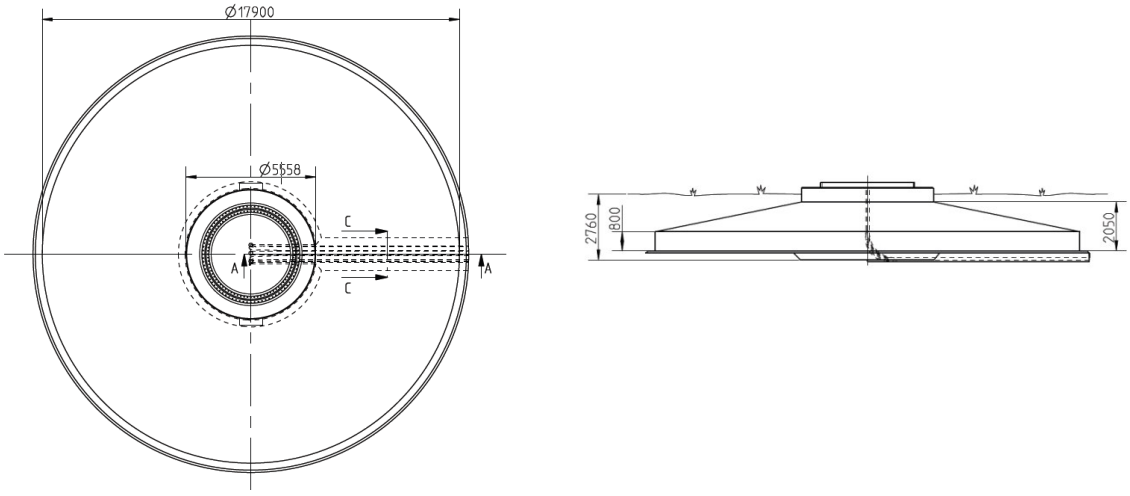



**Figure 1.9. Outline of wind turbine foundation**

The wind turbine tower and foundation would be connected and fixed to each other with anchor bolts.

**Table 1.5.Quantity of civil engineering work**

| Turbine foundation | Unit | Total |
|---|---|---|
| General civil engineering work | peace | 27 |
| Concrete and cement | $m^3$ | ≤15000 |
| Re-bar | ton | ≤1323 |
| Steel structure | ton | ≤21.6 |
| Concrete cushion | $m^3$ | ≤710 |
| Excavation | $m^3$ | ≤25785 |
| Backfill | $m^3$ | ≤8478 |

### 1.6.2 Construction of substation

Substation. The total area to be covered with the sub-station would be 6695.0 $m^2$ and all the equipment, electric instruments and external facilities would be placed in this area. The external facilities would include the main transformer, 110kV switchgears, 110kV, CT, PT and arrestors, lightning-conductors, lines for lighting, ground-wires and the outdoor type emergency diesel generator. The electrical building consists of 35kV switchgear room, operator room, and relay cubicle and battery room.

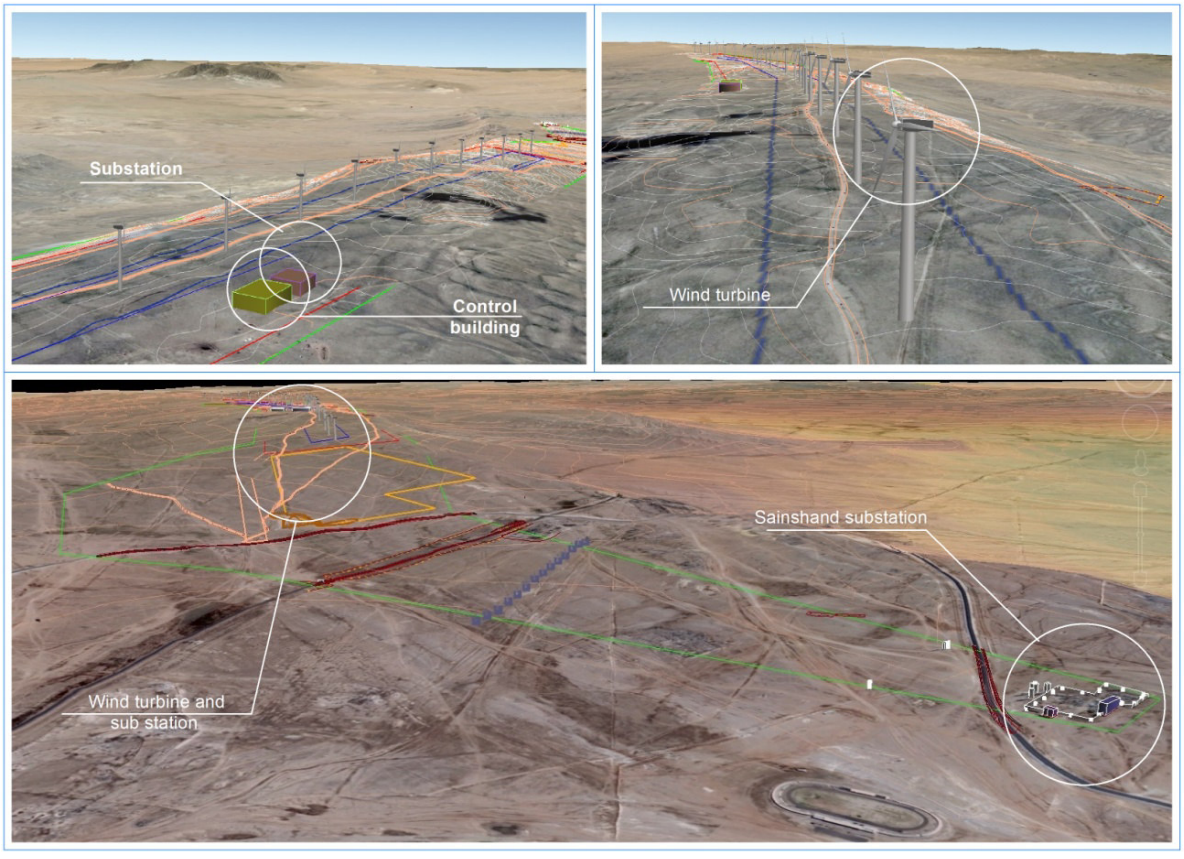



**Figure 1.10. General designing of windpark, in the three-dimensional view**

Administrative building /or Control building/. The administrative building is projected to be built up separately from the sub-station with an approximately distance of 10m. The substation would be surrounded with the fence and the total area of the substation building would be 342.3 $m^2$. Then, the administrative building would be one-storey building with the total area of 504.0 $m^2$, consisting of an office, meeting room, shift-workers room,

toilet,kitchen, bathroom, indoor storage, workshop and a garage will be arranged in the building.

### 1.6.3 **Project's internal roads**

The project's internal road to be built would be a 200 mm thick gravel road of 5.4 km total length. The internal roads will be designed for erection works and to provide access to the WTGs and the substation for purposes of operation, maintenance and repair during the design life of the wind farm. The bed of the internal improved gravel-covered road will be 5 m in width while the width of the road itself would be 4m. Also, the water drainage pipes are required to be installed at some sections.

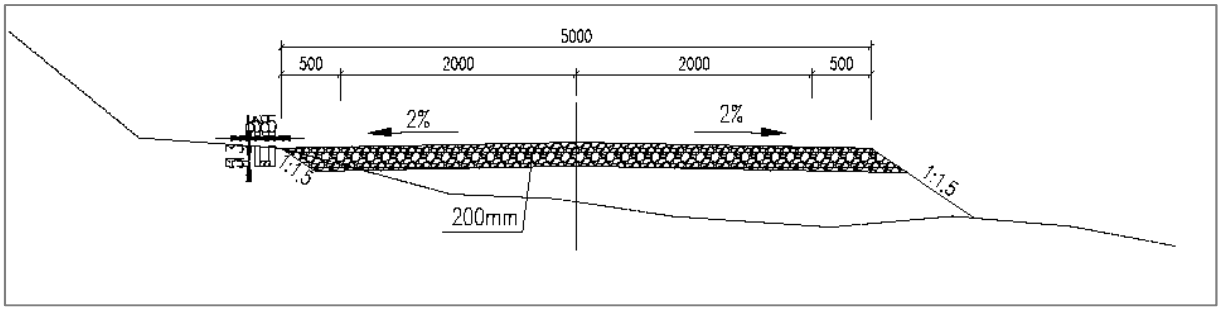



**Figure 1.11. Cross-section of the project internal road**

### 1.6.4 **Network connection and Energy production**

Electricity network connection and transmission: The electricity transmission cables would be positioned underground at the depth of 0.85 m and the mechanical protections would be made of metallic armouring and polyethylene material. Underground, medium voltage 35 kV cables would connect the turbines to each other in groups and to the substation. The cables would be laid in bedding sand and the trench will be backfilled with the original material and the surface will be reinstated with the previously excavated topsoil. Approximately 9 km of 35kV underground trenching will be required on-site to connect the turbines to the substation.

Wind park's 110/35 kV substation: The wind park substation is designed to collect all the power from the wind turbine-generators at medium voltage level of 35 kV. Then, step-up the voltage to high voltage level of 110kV. Two 110kV overhead line systems are connected to the existing Sainshand Substation and 2 transformers are installed.

35kV system: The 35kV switchgear receives the collector medium voltage cables of the wind turbine groups on a common bus bar. The outgoing connections are terminated to both step-up transformers 35/110kV.

110kV system: The 2 step-up transformers are fed by the 35kV outgoing feeders and transform the voltage to 110kV.The outdoor equipment like breakers and disconnectors as well as the protection equipment will be in line with the national and international standards and ensure the stable connection to the national grid. The 110 kV outdoor switchgear will be of "open" type and the circuit breakers will be SF6 gas insulated.

During the maintenance or unexpected emergency conditions, an additional electricity source would be required and therefore an emergency Diesel generator set would be installed within the substation's premises.

## 1.7 Project implementation

### 1.7.1 Energy production, operational safety of equipment

Lightning protection and earthing. The WTGs supplier provide the lightning protection system for the wind turbines. Each wind turbine tower should be equipped with the earthing connection according to the requirement of the wind turbine manufacturer. For the 110kV substation, a general grounding grid of galvanized flat steel or steel rod will be provided.

Lighting. The lighting system would consist of 3 subsystems. The electricity needed for general illumination would be provided by the low-voltage transformer. The standby diesel generator set serves the electricity source to be required for lighting during any failure or emergency. Whereas the electrical power needed for the Control Room Emergency Lighting would be supplied by the battery.

Cabling. The cabling is designated to connect various electrical equipment, transmit and distribute electric power required by these equipment, deliver several signals to the instruments for controlling, protection and measuring, and to maintain the normal operation of the wind park. The purpose of the cable connection is to transport electrical energy. The laying of cables of various voltage levels and different designations will be chosen in order to minimize the external damages as less as possible. The cables are usually laid in cable trenches, conduits and cable trays. The rated voltage of the cables will be equal to or higher than the rated voltage of the mains. The cables would be of aluminum type for the collector cables only. The remaining ones will be copper type

110 kV overhead transmission lines. The wind park would be connected to the Sainshand Substation through the two 110 kV overhead line systems. The LGJ185/30 type aluminum conductor steel reinforced (ACSR), insulators and the steel and concrete-steel towers (hybrid towers) would be used in the system. The stability of overhead line towers would be fully provided by reinforced concrete foundations.

### 1.7.2 Labor safety at the project's operational phase

Water supply and drainage system. It is planned to transport the potable and domestic consumption water for the workers of the site from Sainshand city. Then, complex facility consisting of storage tank unit would be established close to the substations. However, in case of necessity to dig a deep well, it would be required to get a relevant permit on digging and using the well from the local environmental protection department in the name of the project company.

The rain water will be drained outside the substation through gutter. Oil collecting pits would be also set for the transformers and diesel oil tank. The oil can be discharged into the considerably deep sewage pit in case of emergency.

The solid wastes and garbage would be occasionally transported to and removed at the soum's central garbage dump.

Fire-fighting. High capacity portable fire extinguishers would be provided at the sections of the wind park with major fire risks. With the assistance of a fire detection system,

the fire-fighting brigade would be informed promptly to take appropriate fire-fighting measures. Automatic and manual fire detection and alarm systems should be placed at the relevant locations. And the fire alarm control panel (FACP) is to be located in the Central Control Room. The boards clearly showing the location of the fire detectors activated. Escape routes should be indicated for safe leaving the buildings.

Considering the balance of fire risk and health of the staff, portable fire extinguishers instead of automatic gas fire extinguishing system would be placed in electrical rooms in the substation, such as switchgear room, relay room and control room, etc.

Air Conditioning. Air-cooling system or air conditioners designated to maintain indoor temperature at 20～24$^0$C would be installed in the control room and the relay room Explosion-proof exhaust will be provided for the battery room.

## 1.8 Project efficiency

Investment: The investment for the wind park with the rated capacity of 52 MW to be operated by Vestas turbines is calculated as USD 120 million. The percentage occupied by the wind turbines in the total investment of the project is estimated approximately 60.0%.

Sale of Electricity: At the meeting of the Regulators Council of the Energy Regulation Authority /today's Energy Regulation Committee/ held in September 2011, based on the provision 11.1.1 of the Mongolian Law of Renewable Energy, it was decided to purchase the energy to be supplied by the 52 MW rated capacity Sainshand wind park to the transmission grid for USD 0.095/kWh for the period of 26 years.

Equipment-related credit: It is planned that 70% of the total investment required for implementing the project would be procured through bank credits, while the remaining 30% would be covered through equity.

Project efficiency: "Sainshand Salkhin Park" LLC has chosen Vestas brand wind turbines manufactured in Denmark and China among the three potential alternatives like Siemens, Vestas and General Electric turbines taking into consideration a number of factors like the project efficiency, climatic conditions, location, etc. The investment and efficiency indexes dependent on the wind turbine are shown in the following table.

**Table 1.6. Wind turbine-dependent investment and efficiency indexes**

| No. | Index | Data |
|---|---|---|
| 1 | Rated Capacity, MW | 52 |
| 2 | Investment, million USD | 120 |
| 3 | Amount of Credit, million USD | 84.0 |
| 4 | Annual electricity output feed in to the grid, MWh | 201,605.0 |
| 5 | Capacity factor, % | 42.6 |
| 6 | Income tax percentage to be paid, % | 10 |

# 2 SCOPE OF PROJECT ACTIVITIES

## 2.1 Energy sector legal environment

### 2.1.1 Governmental energy policy

In Mongolia, the Governmental policy on energy sector is implemented through the fundamental legal documents including the "Energy Law" (2001), "Centralized Energy System" Program (2002), "National Program on Renewable Energy" (2005), "Renewable Energy Law" (2007), "National Development Policy of Mongolia based on Millennium Development Objective" (2008) and the "Concession Law". At the present, the development of the document "Governmental energy policy" is in the process, the draft document is being discussed through the site http://energy.gov.mn, and the relevant suggestions and proposals are being collected at the Office of Strategic Policy Planning under the Ministry of Energy.

Following strategic goals are reflected in the Governmental energy policy:

1. Within the framework of ensuring the labor safety and operational security:
    1) To ensure reliable energy supply and operational security;
    2) To promote regional mutually beneficial cooperation in the energy sector, and
    3) To improve workforce preparation system of the energy sector and strengthen its capacity.
2. Within the framework of enhancing the efficiency of the energy sector:
    1) To pursue policy on energy thrift and efficiency restoration;
    2) To operate the energy sector relying on the principle of competitive market through increasing the private sector participation in the sector, and
    3) To introduce innovative and advanced technology into the energy sector.
3. Within the framework of environmental conservation:
    1) To mitigate adverse environmental impacts and reduce the emission of greenhouse gas;
    2) To increase the production of renewable energy, and
    3) To promote new energy sources and environmentally-favorable technology.

Besides, the issues concerned with increasing of the investment made by all type private, governmental and international financial institutions in the energy sector, strengthening the renewable-energy support mechanism and applying the mechanism for promoting the renewable energy are duly reflected in the document.

### 2.1.2 Energy Law

The purpose of the Energy Law is to coordinate the relations connected with the production of energy by using relevant energy sources, its transmission, distribution, supply and dispatcher's regulation, as well as with the construction of energy facilities and the use of energy.

According to the law, any energy-producing economic entity or enterprise is required to acquire a special operational permit and consequently, the copy of the Special permit on

constructing energy facilities granted to the project executor is attached to the Report on the Detailed Environmental Impact assessment (DEIA). When the project executor completes the construction of the energy facilities and starts the production of energy, it would be required to get a special permit on energy production in accordance with the relevant provision of the law. The legally regulated relations that are required to be pursued in the course of project implementation are demonstrated as follows:

**Table 2.1. Project-related provisions and articles of the "Energy Law"**

| Legally regulated relations | Related provisions and articles of the law | Content of provisions and articles |
|---|---|---|
| Special permit on energy production | Provision 13.1 | The Special permit on energy production authorizes an entity to produce energy and connect the relevant energy source to the electricity transmission and distribution network. |
| Special permit on constructing energy facilities | Provision 20.1 | The Special permit on constructing energy facilities is granted to a financially-capable entity that makes a request to construct the relevant energy facility. |
| | Provision 20.2 | The special permit holder is obliged to hire an authorized professional company/entity for designing the energy facilities and performing their construction work. Consequently, the quality of the construction work must be checked up by the relevant authorized organization. |
| Obligations of special permit holder | Article 25 | The provisions regulating the relations connected with prohibiting the transference of the special permit holding right to others, keeping the financial book-keeping separately and its ratification by a relevant auditing company, adhering to the rules of the centralized electricity transmission/distribution network, and hiring a professional environmental consulting company for conducting a DEIA are reflected in this article. |
| Relations between supplier and consumer | Chapter 5 | This chapter regulates the relations connected with energy supply agreement, supplier and consumer rights and obligations, payment for energy consumption and fine-imposing for payment delay, suspension of energy supply or consumption, and the protective strip of energy supply lines and networks. |
| Relations between monitoring and responsibility | Chapter 6 | This chapter of the law regulates the relations connected with monitoring kept over the implementation of the law, dispute settlement, loss compensation and responsibilities to be charged to law-breakers. |

### 2.1.3 **Renewable Energy Law**

This law regulates the relations connected with the production and supply of energy with the use of different renewable energy sources and is applied to any entity that produces or supplies heat or energy within the territory of Mongolia by using various renewable energy sources. As it is stipulated in the law, the renewable energy-related laws and regulations consist of the Energy Law, Renewable Energy Law and other legal documentations that are issued in compatibility with the afore-mentioned two laws.

**Table 2.2. Project-related provisions and articles of the "Renewable Energy Law"**

| Legally regulated relations | Related provisions and articles of the law | Content of provisions and articles |
|---|---|---|
| Special permit on constructing a renewable energy source | Article 6 | The article stipulates that a legal party which builds up any type of energy facilities must acquire the special permit on constructing energy facilities specified in the article 20 of the Energy Law. |
| Special permit on renewable energy production | Articles 7 and 9 | According to these articles, the legal party that produces renewable energy is required to acquire the special permit on heat and electricity production specified in 13.1 of the Energy law. The provisions also describe the relations connected with acquiring the special permit. |
| Rights and obligations of special permit holder | Article 7 | According to the law, the special permit holder bears following obligations and enjoys following rights:<br>- To supply energy produced by a renewable energy source to the nearest connection point of transmission network;<br>- To be responsible for expenses on transmitting the electricity from the renewable energy source to the connection point of transmission network;<br>- To fulfill the demands made by the holder of special permit on making dispatcher arrangement;<br>- To be compensated from the Renewable Energy Fund the price difference of energy/ or electricity sold to the consumers of the area specified in the special permit. |
| Agreement on energy selling and purchasing | Article 10 | The article stipulates that the agreement on energy/electricity selling and purchasing between the producer and the transmitter should be established in compatibility to the template approved by the Energy Regulatory Agency and legally specifies the items that should be inevitably reflected in the agreement. |
| Price and tariff | Chapter 4 | In the chapter, it is specified that the price of 1 kW energy produced by wind-force energy source would be within the range between USD 0.08-0.095. It is also specified that the said tariff would be adhered at least for 10 years. |
| Dispute settlement | Article 14 | Any disagreement or dispute arisen between the holders of special permit on producing or transmitting renewable energy or between the special permit holders and the consumers shall be settled in accordance with the special rules specified in the Energy law. |

The manner of relation and operational coordination of the holder of the special permit on energy production with relevant governmental and monitoring institutions are clearly specified in the sector laws and regulations.

## 2.2 Environmental sector legal environment

### 2.2.1 Package of environmental laws

The package of environmental laws consists of 27 separate laws in total, and out of these, four laws are inevitably required to be considered within the framework of the wind park project. The project correlation of those laws that would play a prior role in coordinating the project activities and regulating the social relations to occur within the project framework from the point of environmental conservation is determined as follows:

**Table 2.3. Laws to be pursued in the project activities**

| № | Adopted law | Structure of law | Relations to be legally regulated |
|---|---|---|---|
| 1 | "Law on Environmental impact assessment" /Revised version/ | 5 chapters, 20 articles | Nature and environmental protection; prevention from the loss of environmental balance because of human activities; exploitation of natural resources with minimal adverse environmental impacts; assessment of environmental impacts to be resulted from region and sector-scale environmental policies, development programs and various type projects; issuance of conclusions and decisions regarding their implementation; and regulation of relations between the stakeholders. |
| | | Article 7<br><br>Article 9<br>Article 19<br>Article 20 | Impact assessment<br>- Conclusion of the General Environmental Impact Assessment /GEIA/<br>- Report of the Detailed Environmental Impact Assessment /DEIA/<br>Environmental protection management plan<br>Responsibilities to be charged to law-breakers<br>Loss compensation |
| | | Article 18 | Regulates the relations connected with ensuring the public participation in the DEIA. |
| 2 | "Law on Waste management" | Article 5<br><br>Article 24 | Reduction, classification, collection, transportation, storage, re-processing, re-use and export of wastes to be performed for the purpose to eliminate and prevent from the harmful effect of wastes on human health and environment; prohibition of waste's import and trans-boundary transportation. |
| 3 | "Law on soil protection and desert prevention" | Article 13 | Regulates the relations connected with preventing from soil decline, soil restoration and desert prevention. |
| 4 | "Law on Water pollution charge" | Article 10 | Regulates the relations connected with imposing a charge on water polluting to individuals and entities as well as with concentrating the charge into the budget. |

P.S.: * - Issues connected with the relations to occur in the course of project implementation are just compiled.

The major content of the package of environmental laws is not only to provide the local residents with the opportunity to protect their native or original environment but also arrange both positive and adverse impacts to be potentially imposed on the local society, economy and the livelihood of the local inhabitants by the development projects implemented within the relevant area and fix the limitations of the monetary responsibility to be charged against law breakers.

The package of environmental laws specifies that the holder of special permit on conducting production and service activities is obliged to hire a professional environmental consulting company for conducting the DEIA for one's own project, implement the adverse impact mitigation measures reflected in the assessment as well as the other measures specified in the relevant environmental management plan, provide a free entrance into the industrial site for any authorized person who is to carry out necessary inspections and check-ups, be responsible for implementing necessary environmental restoration measures, and procure the required environmental rehabilitation costs.

### 2.2.2 Scope of project's social relations

Fundamental legal arrangements on the social relations relevant to the project implementation would consider following items:

- The principle for ensuring the public participation in the DEIA and the relevant legal relations arrangements;
- The standards, norms and normative to be adhered in the energy production designated for protecting the social health and monitoring the operational security of electricity production;
- The limitations specified by other energy production-related social relations arrangements and standards.

Within the framework of its authority, the state administrative central organization in charge of environmental issues would make following demands for the project executor regarding the use of land:

**Table 2.4. Relations regulated by the Land Law**

| Scope | Law provision | Content |
|---|---|---|
| Elimination of land damage | Article 62 | The article stipulates that "An individual or entity that acquires a land into one's ownership while the damage caused to that land had been already identified shall compensate the damage on one's own expenses". |
| Issuance of quality certification | Article 58 | According to the "Land law", the owner or occupant of a land shall arrange the process of acquiring the state quality certification for own land on one's own expenses by hiring a professional organization that would regularly implement the quality certification procedures, and issue a relevant conclusion within the term specified in the relevant law. |

### 2.2.3 Public participation in the DEIA

As a result of the legal reform implemented in the environmental sector, the local residents were provided with the opportunity to be personally responsible for the conservation of the nature and environment within their territory, own and use the natural resources within the area, create new workplaces and derive benefit from additional income sources. Furthermore, there was established a proper mechanism for identifying a guilty party for any type environmental pollution or decline and the relevant governmental officials or the local authorities could become able to charge the polluters with responsibility.

**Table 2.5. Articles and provisions of the revised environmental laws related to governors**

| No. | Revised laws | Articles and provisions related to governors |
|---|---|---|
| 1 | "Law on introducing amendments into the Environmental protection law" | Article 1. Required chapters, articles, parts and provisions were added to the Environmental protection law:<br>15/31-8. To request a relevant governor and state environmental inspector to impose a compensation on and charge with responsibility the guilty party for damages caused to the environment |
| 2 | "Law on soil protection and desert prevention" | The provision 8.4, article 8 specifies the authority of all level governors including aimag, capital city, soum and district governors to be implemented on issues of soil protection and desert prevention. |
| 3 | "Air law"<br>/revised version/ | Article 8. Specifies the authority of the local self-governing organizations and local administrative organizations.<br>Article 15. Specifies the air quality improvement zone<br>Article 19. Describes the measures to be taken in the conditions where the level of air pollution and adverse physical impact are seriously increased. |
| 7 | "Waste management law" | Article 22. Specifies the monitoring to be kept over waste-related activities.<br>Article 23. Specifies the responsibilities to be charged against law-breakers. |

Also, the law identifies the environment-related obligations and responsibilities of all level civil representatives' meetings and governors and specifies that they would be charged with responsibility in case they don't fulfill the obligations accepted under the law. Consequently, in case any type environmental damage is revealed within the relevant territory during the four-year term of post-holding, the governor would be entitled to apply to the court with a claim, and if he/she doesn't act in above way in accordance with the law, then himself/herself would be charged with responsibility. On the other hand, an individual or NGO is also entitled to bring up to the court any individual or organization that has caused environmental pollution or damage.

## 2.3 Standards to be observed in the course of project implementation

### 2.3.1 Standard for protecting the surrounding environment

Here, we are including the environment protection-related standards to be adhered in the course of implementing the "Sainshand wind park" project along with their brief explanations. Following standards would be used for assessing and monitoring the results of the measures directed to mitigating the adverse environmental impacts caused by human factors.

**Table 2.6. Standards to be adhered in monitoring the conditions of surrounding environment**

| No. | Standard's | | | How to be observed in the planned project |
|---|---|---|---|---|
| | Generic term | Name | Scope | |
| 1 | MNS 4585:2007 | Air quality. General technical requirements | This standard applies to observing, assessing and monitoring the air quality in both the internal and external | It doesn't apply to the air within the preliminarily |

| No. | Standard's | | | How to be observed in the planned project |
|---|---|---|---|---|
| | Generic term | Name | Scope | |
| | | | ambiences of cities, settlements, dwelling apartments, office buildings, public entertainment and service places, civil buildings and facilities. | fixed industry-impact zone. |
| 2 | MNS 5885:2008 | Permissible level of polluting substances' content in ambient air. General technical requirements. | This standard applies to observing, assessing and monitoring the permissible norm of air-polluting substances in the external ambience. | During the operation |
| 3 | MNS 4585:2007 | Noise norm, General operational security requirements | This standard defines the noise classification, hygiene norms and general operational security requirements. | At the construction stage |
| 4 | MNS 4585:2007 | Electro-static field. Permissible level of tension at the workplace | This standard defines the permissible level of electro-static field tension generated at the workplace during the use of direct current high-voltage electric equipment and electrified insulation materials as well as the requirements made for protective devices and monitoring. | Around the sub-station<br><br>During the operation |
| 5 | MNS 4943:2011 | Water quality. Waste water. | This standard defines the maximal content of polluting substances in the waste water released to the open nature as well as the limitations of other relevant indexes.<br><br>The standard is applied for monitoring the requirements made for the waste water prior to releasing to the nature. | During the operation |
| 6 | MNS 3297:1991 | Soil. Standard indexes for assessing the soil hygiene in cities and settlements. | This standard defines the norms of hygiene indexes of the soils in the territories of cities, settlements, children's camp, spa and sanatorium, recreation zone, school and other children's organizations, water supply sources, industrial hygiene and protection zones, road and transportation areas, agricultural and forested areas, commercial and service organizations. | During the operation |
| 7 | MNS 3298:1991 | Soil. General requirements for taking test-designated samples | This standard defines the requirements made for assessing the pollution level and hygiene state of all type soils distributed in the territory of Mongolia as well as the requirements made for taking test-designated soil samples. | During the operation |
| 8 | MNS 5150:2002 | Labor safety and Industrial hygiene. Electric equipment' operational security. General requirements | This standard defines the general requirements for preventing from toxic and hazardous effects of electric current and electro-magnetic field on human body.<br><br>This standard is adhered when designing, manufacturing, testing, adjusting and assembling industrial and domestic electric equipment. | During the operation |

Besides, the post-construction rehabilitation should be performed in accordance with the following standards.

**Table 2.7. National standards to be pursued in the rehabilitation work**

| No. | Name of standard | Generic term |
|---|---|---|
| 1 | Environment. Stripping and storage of fertile soil layers during the earth-moving operations | MNS 5916 - 2008 |
| 2 | Environment. General technical requirements for vegetating damaged lands | MNS 5918 - 2008 |

### 2.3.2 Standards to be adhered in ensuring the hygiene and labor safety requirements

The project implementing entity is obliged to strictly observe the relevant hygiene and labor safety standards in its operation in order to ensure the project's operational security.

**Table 2.8. Standards to be adhered in ensuring the hygiene and labor safety requirements**

| No. | Name of standard | Generic term |
|---|---|---|
| 1 | Labor safety and operational security signs; color of warning signals | MNS 4643 - 1998 |
| 2 | Labor safety and Hygiene. Requirements made for the methodology for measuring the concentration of toxic substances in the ambient air of work zone | MNS 4991 - 2000 |
| 3 | Labor safety system. Fire safety. General requirements | MNS 4244 - 1994 |

### 2.3.3 Rules and procedures to be adhered in the project activities

In addition to above standards, the project executor is obliged to adhere to all-type labor safety and operational security rules and procedures approved upon the order of the energy sector minister.

**Table 2.9. Rules and procedures to be observed in the course of project implementation**

| No. | Name of rules/ procedures | Legal background | Date of approval |
|---|---|---|---|
| 1 | Procedures on lining and utilizing pits for domestic waste waters | Joint order #169/170 of Minister of Nature & Environment and Finance Minister | January 22, 1996 |
| 2 | Common procedures on organizing internal inspections and check-ups over the activities of entities and organizations | Resolution #311 of Mongolian Government | November 09, 2011 |
| 3 | Procedures on ensuring public participation in the DEIA | Order #A-03 of Minister of Nature, Environment and Green Development | January 06, 2014 |
| 4 | Procedures on monitoring the transactions made through the special account on environmental protection and restoration guarantee | Order #A-04 of Minister of Nature, Environment and Green Development | January 06, 2014 |
| 5 | Procedures on developing, revising, approving and reporting the Environmental management plan | Order #A-05 of Minister of Nature, Environment and Green Development | January 06, 2014 |
| 6 | Operational security rules to be adhered during the exploitation of electric facilities | Order #102 of Infrastructure Minister | August 22, 2014 |
| 7 | Fundamental rules on organizing labor safety and operational security trainings among energy workers. | | |

# 3 PROJECT'S POTENTIAL AND MAJOR ADVERSE IMPACTS, THEIR ASSESSMENT

## 3.1 Description of adverse environmental impacts conclusion

The conclusion A/105 to the General Environmental Impact Assessment /GEIA/ issued on October 14, 2014 by the expert of the Ministry of Nature, Environment, Green Development and Tourism based on the Report of the Socio-environmental conditions assessment performed for the Sainshand wind park project area was authenticated by the official letter 6/3886 of the chief expert from October 14, 2014.

In the conclusion to the GEIA, it was identified how the project's objective, scope, technology and activities coincide with the "Environmental protection law", "Law on Environmental impact assessment" and other relevant laws and regulations of Mongolia as well as with the Governmental policies and resolutions, the potential adverse environmental impacts that might be resulted from the project implementation were preliminarily identified and the circumstances of specific attention in which those adverse impacts may occur - reflected.

The major criteria reflected in the conclusion to the GEIA and the preliminarily identified adverse impacts are presented in the following table.

**Table 3.1. GEIA major criteria and potential adverse impacts**

| Criteria for identifying impacts* | Potential conditions for occurrence of adverse impacts** |
|---|---|
| *Criteria related to the project location* | |
| Susceptibility to human actions, natural and climatic changes | Susceptible to climatic changes, for instance:<br>- The locality is determined with considerable wind impact;<br>- There is a certain drought recurrence. |
| Either there exists any area planned to be used for long-term local development | The currently developed planning of the Sainshand Industrial Park area is located nearly at 3 km from the project site. |
| Possibility of occurrence of potential cumulative impacts | As for the space, the scope of impacts wouldn't expand further, however, in case of additional projects to be implemented in the surroundings of the wind park project, there might potentially emerge certain cumulative impacts. |
| *Issues considered in the preliminary EIA of the project* | |
| Air quality impacts:<br>- Either any polluting, toxic or hazardous material is emitted;<br>- Either any noise, vibration or heat impact occurs or any electro-magnetic radiation is produced. | following sources may adversely impact the air quality:<br>- Dust to be resulted from transportation during the construction phase.<br>- Emergence of minor electro-magnetic waves.<br>- Noise pollution. |
| Impacts on water environment:<br>- Probability of occurrence of surface or ground water deficiency;<br>- Either the fresh water reserve would be used;<br>- Probability of water pollution. | Adverse impacts on the water environment:<br>- Water will be required during both the construction and operational phases.<br>- Production of domestic wastewater; |
| Impacts on soil mantle:<br>- Probability of soil damage,<br>- Probability of soil pollution,<br>- Probability of soil decline and desertification. | Following adverse impacts would be imposed on the soil mantle:<br>- During the construction phase, the soil would be damaged by stripping, pulverized and declined under the impact of transportation;<br>- At the construction phase, the soil would be polluted during the exploitation, repair and maintenance of machineries and equipment as well as with |

| Criteria for identifying impacts* | Potential conditions for occurrence of adverse impacts** |
|---|---|
| | combustible and lubricating materials, solid and liquid domestic wastes. |
| Impacts on plant cover:<br>- Either plant-cover and woods are to be affected or not,<br>- Either rare or extremely-rare plants are to be affected or not. | Following adverse impacts might be imposed on the plant cover:<br>- As a result of soil-stripping, the plant cover would be destroyed to a minor considerable amount and certain area of land would completely lose the vegetation;<br>- The plant cover would get sparse and scanty at areas where the soil was pulverized;<br>- The growth environment of plants would be declined under the impact of dust to be resulted from the construction and transportation operations;<br>- Any rare or extremely-rare plant was not registered within the project area, and therefore, there would not occur any impact on plant species. |
| Impacts on wildlife:<br>- Probability of wildlife habitat decline;<br>- Either rare or extremely-rare animals are to be affected or not. | There exist following conditions that might adversely impact the wildlife:<br>- Animals inhabiting the project area might run away because of construction activities and;<br>- Adverse impacts on bird species should be thoroughly studied and identified during the operation of the wind park. |
| *Issues considered in the preliminary social impact assessment*: | |
| Impacts on local residents:<br>- Probability of violation of land ownership or use rights,<br>- Either any impact is imposed on the social conditions of local residents,<br>- Either there is any settlement that might be potentially affected;<br>- Probability of resettlement action necessity. | Following adverse impacts would be imposed on the inhabitants in the surroundings of the project area:<br>- Since the density of local herders and livestock in the vicinity of the project area is not so big, there would not occur any serious impact on the land use;<br>- While the project is not expected to adversely impact the social conditions of the local residents, the expected supply of energy fully coincides with their interest;<br>- The rededication of the land to a special license area restricts the summer pastures of the local herders during the construction phase;<br>- There is no residing household within the 1.5 km radius around the project implementation area throughout the calendar year.<br>- There would not occur any requirement for permanent resettlement. |
| Impacts on historical and cultural heritage:<br>- Either there is any historical or cultural value to be adversely affected by the project | None. |
| Impacts on human health:<br>- Either the project would adversely impact the local residents and inhabitants,<br>- Either the project would somewhat adversely impact the human health and life throughout all its stages. | Following adverse impacts would be imposed on human health:<br>- During the construction phase, the works of assembling, connecting and mounting would be performed at a maximum height of 100m (nacelle).<br>- Fire-risky conditions might occur inside the sub-station buildings and facilities. |

*- The criteria were identified within the framework of the General Environmental Impact Assessment (GEIA)

**- Conditions identified within the framework of the Detailed Environmental Impact Assessment(DEIA)

In the report of the environmental conditions assessment, the potential impacts of the project were identified as follows:

**Table 3.2. Project's environmental impacts**

| Environmental components | Construction phase | Operational phase |
|---|---|---|
| Land | During the construction phase, the land use planning would be changed and the area previously allotted as pastureland would be reduced. | The land would be used for the infrastructure purpose. Pastureland is reduced by the WTG and building foundations only. |
| Earth-bowel | The earth will be penetrated for excavation of wind turbines and buildings foundations. | Earth penetration during operation is not applicable. |
| Air | The dust resulted from the earth-moving and transportation operations would increase during the construction phase. | The project will not cause air pollution since it will not use coal. However, there would be produced electro-magnetic fields along the over-head line. |
| Water | Water would be used for a very short period during the construction phase, but this water would be supplied from an external source because the project implementation area doesn't have sufficient water reserve. | Water would be used for both the drinking and domestic consumption purposes. |
| Soil | The top soil would be stripped at partially-determined places during the construction phase, and thus, the soil at those places would be damaged. The soil in the surroundings of the project site would be affected under the bustle of humans and machineries during the construction phase, | Once in operation the wind park will not notably influence the soil anymore. |
| Plant-cover | The plant-cover would be completely destroyed at the places where the top soil is stripped.<br>The soil and plant cover would be pulverized during the construction phase under the impact of camping and transportation. | The space for growth of the plant cover would be restricted and reduced only by space taken up by wind turbines and buildings. |
| Fauna | The normal habitat of wild animals would be disturbed by the bustle and noise of humans and machineries. The nests and holes of some species of invertebrates, small birds, reptiles and rodents maybe destroyed. | The habitat and grazing area of wild animals would be directly affected.<br>Birds might be hit and killed by the blades of the wind turbines. Wild animals could potentially run away because of the noise produced by the wind turbines. |
| Historical and cultural heritage | There are no specific historical and cultural values to be affected by adverse impacts. | There are no specific historical and cultural values to be affected by adverse impacts./ not applicable |

Impacts to be imposed on the local socio-economy as a result of implementation of the wind park project are identified as follows:

**Table 3.3.Impacts to be potentially imposed by the project on the local socio-economy**

| Index | Construction phase | Operational phase |
|---|---|---|
| Employment | There would be a high demand of temporary workers at the construction phase. | There would be required a few permanent work places because the operator would be mainly responsible for the operation. Further a group of maintenance staff is required. |
| Market | The demand of supply would considerably increase and therefore, it would be possible to allot some portion of supply to local entities. These would include:<br>- Construction materials;<br>- Temporary dwellings, for example, rented gers;<br>- Food supply;<br>- Work clothes, supply of domestic needs;<br>- Fuel and diesel, spare parts. | The demand of supply would stabilize on a pre-construction level. |
| Tax and Budget | Following taxes would be paid to the local budget:<br>- VAT<br>- Population Income Tax (PIT)<br>Following environmental charges would be paid:<br>- Land use charge<br>- Water use charge | Following taxes would be paid to the local budget:<br>- VAT<br>- Population Income Tax (PIT)<br>- Enterprise/Organization's Income Tax (E/OIT)<br>Following environmental charges would be paid:<br>- Land use charge |

## 3.2 Scope of location-related impacts

As for the geographic location, the wind park project shall be implemented within the Dornogobi depression that is one of the relatively low-lying areas of Mongolia, belonging to the Dornogobi section, the Great Gobi region, the flat country with knolls and hills elevated at the altitude of 915-1005 m in average. The project implementation site is located at 15 km distance South east wards from Sainshand soum, Dornogobi aimag.

As it is reflected in the aimag's development program, in addition to the Sainshand Industrial Park, there would be built up a new settlement district and the Ecotown at the two other places. Besides, a certain area just on the south of the project site was also granted to one entity that made the request for land to build up a solar park relying on the private investment. So, when above planning and projects start to be implemented, there might happen a coincidence of adverse impacts of comprehensive activities which further might be converted into cumulative impacts by acquiring an integrated nature.

By the multiyear average, in the vicinity of Sainshand, the winter, spring, summer and the autumn continue respectively for 120, 50, 153 and 42 days. The winter is very cold while in the summer, it gets very hot and such a big difference in temperature exists not only between winters and summers but also between days and nights. Although, the project executors consider that the operation of the wind park would not create any adverse impact that would induce the uncomfortable climatic conditions of this region with the arid and rainless weather and climate, on the other hand, the extreme climatic conditions in which the

atmospheric temperature drops below -30$^0$C in winters and the wind speed exceeds over 20 m/sec. in springs may stop the rotation of the wind turbines.

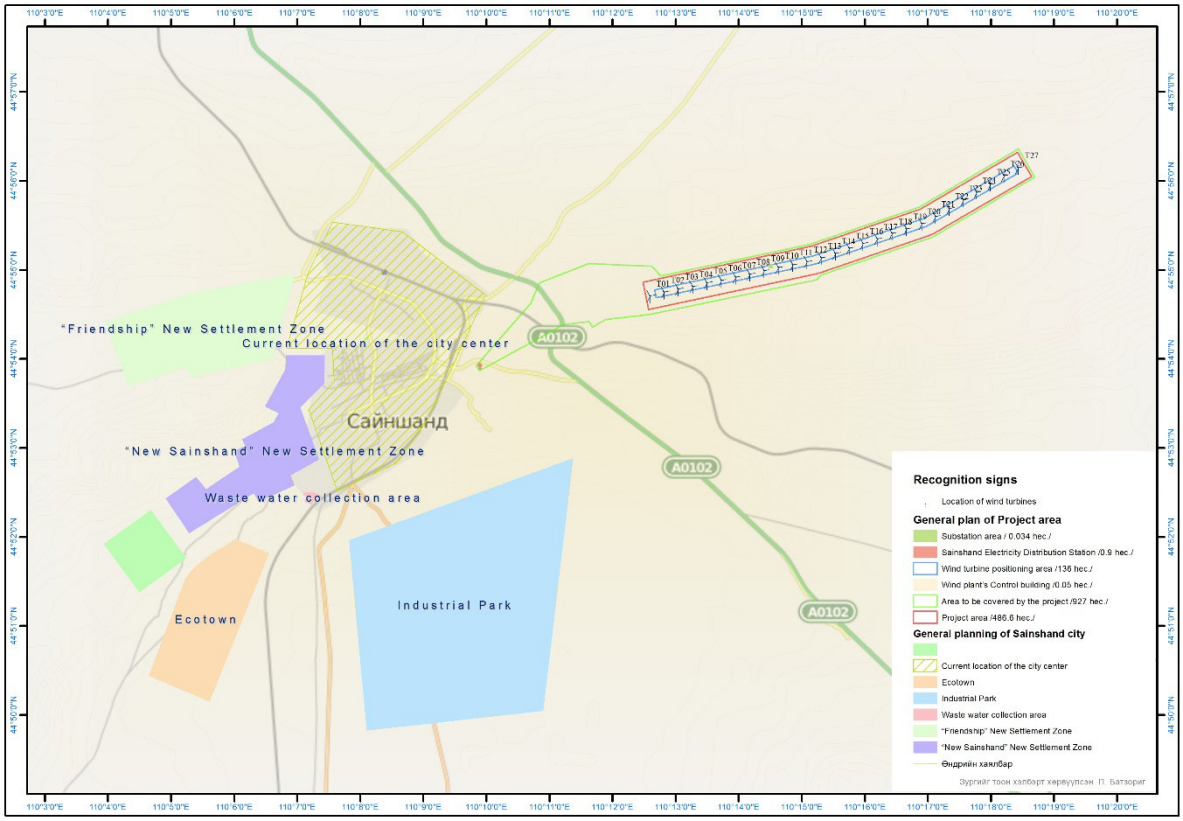



**Figure 3.1.Upbuilding projects reflected in the Master Plan on Dornogobi aimag development and their location**

In the surroundings of the project site, there is no area under the special state protection, while the locally protected place named “Zoogiinkhooloi” is located at 14 km southwestwards from the project site. However, this place is quite remote from the impact zone and therefore wouldn’t be affected by the project.

The project implementation area or the Ikh Zavilaagiinnuruu /ridge/ has previously been used as pastureland. However, because of insufficient water reserve, the local herders don’t permanently stay in this territory, but just use it seasonally while moving around and changing pastures. Indeed, there is only one herder’s household that has a permanent homestead at this place. If their winter camp-yard is located at the Southern slope of the Zavilaagiinnuruu, their well is built up within the dry-swash southwards from the ridge. Thus, the winter yard and the well are located at 500-1000 m from the project site and so, it might slightly contradict the land use right of that herder’s household.

If to summarize the project’s location-related impacts based on above described conditions and circumstances in the table 3.4, it is identified that there is no impact on legally protected areas, the impact on susceptibility of the project area has a self-regulatory nature, the impact on land use directly affects the pasture utilization, the implementation of the aimag development program has a possibility of self-regulation, and the cumulative impact has a direct form while the impact intensity is defined moderate.

**Table 3.4. Indexes of location-related project impacts**

| Adverse impacts | | Impact form | | | Rating of impact intensity | | |
|---|---|---|---|---|---|---|---|
| | | Direct | Indirect | Self-regulated | No impact or minor | Moderate | Strong |
| ***Impact on legally protected areas*** | | | | | | | |
| Locally-protected "Zoogiinkhooloi" is located at 14 km distance from the project site. | | | | x | x | | |
| ***Impact on susceptibility of the project area*** | | | | | | | |
| Impact to be resulted from unstable local winds | | | | x | | x | |
| Drought recurrence is quite frequent and so, the drought impact is considerable | | | | x | x | | |
| ***Impact on land use*** | | | | | | | |
| There are policies and plannings to be implemented by the aimag's development program within the area where the wind park is projected. | | | | x | x | | |
| Impact on pasture utilization | | x | | | | x | |
| ***Cumulative character of impacts*** | | | | | | | |
| The duration of the project is envisaged for 26 years | | x | | | x | | |
| The constructed facilities would be in permanent exploitation. | | x | | | | x | |
| **TOTAL** | **Number** | **3** | **0** | **4** | **4** | **3** | **0** |
| | **%** | **42.8** | **0.0** | **57.2** | **57.2** | **42.8** | **0.0** |

If to judge the project's location-related impact assessment by 7 indexes, 3 of those impacts have directly impacting nature while 4 impacts have self-regulatory tendency. As for the intensity rating, 57.2% of the location-related impacts are assessed as with no impact or minor impact, while the rest 42.8% have moderate intensity.

## 3.3 Major environmental impacts

The project impacts to be imposed on the environment were classified separately for the two phases of the project: the construction phase and the operational phase, and were assessed by rating of impact intensity.

### 3.3.1 Impacts on land and land surface, their assessment

The wind park turbines would be installed alongside the Zavilaagiinnuruu and the sub-station is planned to be built up on the north of the wind turbines' line. Within the framework of the project, there would be installed 27 turbines in total, while 67.2 thousand $m^2$/or 6.72 hectare area/ would be used and altered by the substation buildings and facilities as well as by the internal roads.

The project owner leases 486.6 hectare area in total to use for infrastructure purposes for the period of 30 years and that means the change by the same area would be made in

the combined /**general**/ land fund and the area of the land included in the “Road and network classification” would be increased by 486.6 hectares.

**Table 3.5. Area to be damaged by the project’s construction works**

| No. | Project’s construction works | Area to be damaged | |
|---|---|---|---|
| | | Area, $m^2$ | % |
| 1 | Area for installing 27 wind turbines | 6790.5 | 10.1 |
| 2 | Inter-turbines network | 6750 | 10 |
| 3 | Park internal road | 27,000.0 | 40.3 |
| 4 | Newly-projected road | 20,000.0 | 29.7 |
| 5 | Sub-station facilities | 342.0 | 0.5 |
| 6 | Administrative building | 504.0 | 0.7 |
| 7 | Other structures and facilities | 5,849.0 | 8.7 |
| **Total area** | | **67,235.5** | **100.0** |

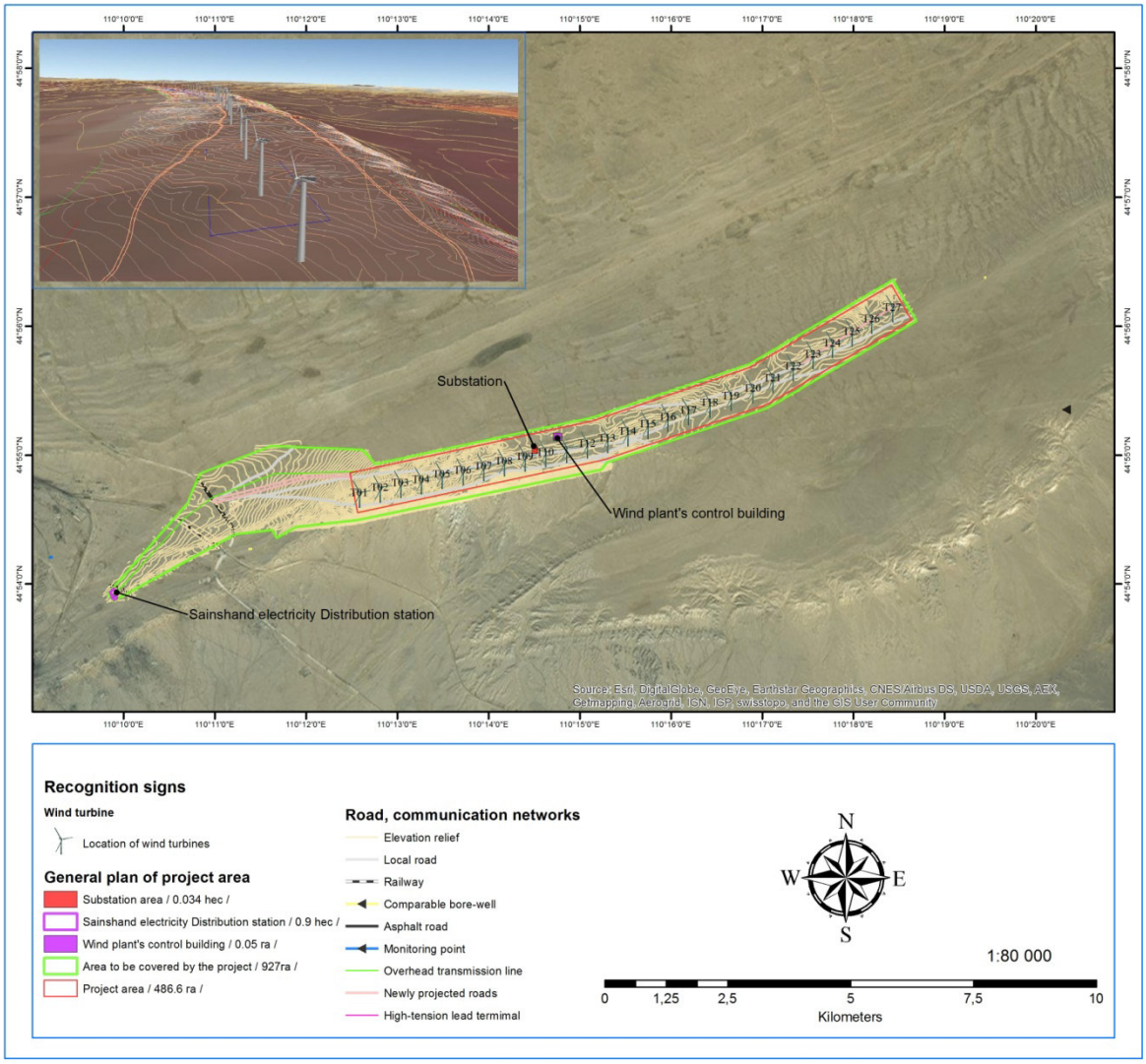



**Figure 3.2 Land use planning within the project area**

Since the wind park project will permanently use the land further for infrastructure and grid connecting/ feeding purposes, the impact on the land would continue throughout the life time of project implementation.

**Table 3.6.Intensity of impacts on the land**

| № | Impacts | Rating of impact intensity | | | |
|---|---|---|---|---|---|
| | | No impact or very little | Minor | Moderate | Strong |
| 1 | Impact on the combined /general/ land fund | | + | | |
| 2 | Impact on land use and ownership rights of others (during construction) | | x | | |
| 3 | Impact on pastureland use (during construction) | | x | | |
| 4 | Impact on further planning and development program of land use | | | + | |
| ***Conclusion*** | The total impacts to be imposed on the land by the project activity were assessed by 4 indices. Out of these, two were rated as without any impact, one minor and one - as moderate. Two of these potential impacts on the land are positive while the other two are negative.<br>Judging from this, the project impacts on the land would be regardless. Judging from the report of the project's environmental conditions assessment, the pasture land within the project implementation area is used by the local herders as a summer pasture and therefore, there exists a potential of arising land use conflict with the local herders households only during construction phase. The intensity of this impact is defined as minor. | | | | |

"x" – negative impact;"+" – positive impact

### 3.3.2 Impact on the bowels of the earth and its assessment

Basically, the project activities would be carried out over the ground if not to take into account infrequent penetrations down to the earth-bowel to be performed during the construction phase in connection with installation of wind turbines and erection of buildings and facilities. The penetration into the earth-bowel would be performed to dig out the basement holes and cable trenches for installing 27 wind turbines. The maximal depth would reach up to 3 m.

The earth-moving work would be performed at the area for constructing the buildings and facilities to ensure its levelness and the solids and rocks created as a result of earth-moving would be used in the environment restoration and road improvement works.

**Table 3.7. Assessment of impacts to be imposed on the land surface and the earth-bowel**

| № | Impact | Assessment of impact consequences | | | | |
|---|---|---|---|---|---|---|
| | | No impact or very little | Minor | Moderate | Strong | Hazardous /extremely dangerous |
| 1 | Impact on the earth-bowel from project designing | | x | | | |
| 2 | Impact on the earth-bowel to occur during the installation of wind turbines and the construction of other facilities | | | x | | |
| 3 | Impact to occur during the maintenance and leveling the project's internal roads | | x | | | |
| 4 | Impact on the earth-bowel formation that would cause the rock looseness and internal splits | | x | | | |
| ***Conclusion*** | Out of above impacts assessed by 4 indexes, three are rated as minor, while the remaining one is assessed as moderate.<br>Judging from the rating of impact intensity, the project doesn't influence on the geological formation, geomorphologic and tectonic conditions. Whereas, there might occur some slight impacts in the form of internal fracture while performing the engineering geological drillings and testing. The impacts like rock denseness, looseness and internal fracture which are rated as minor would occur during the construction of the wind park and its auxiliary buildings and facilities.<br>So, the project would impose insignificant adverse impact on the earth bowels. | | | | | |

### 3.3.3 **Air quality impacts, their assessment**

In the report of the baseline, it was noted that in the surroundings of Sainshand, the atmospheric pollution started to tend to exceed over the permissible level beginning from 2008. The major reason of the air pollution in this territory is determined with the content of sulfuric oxide and nitrogen dioxide produced by the thermal energy production and coal combustion. If so, the impacts to be imposed on the atmosphere by the current energy-production project relying on the use of wind force are determined as follows:

- **Dust during the transportation:** During the construction phase the transportation and installation of the wind turbine equipment and construction materials, there would emerge dust because of the traffic of heavy machineries and equipment.

- **Dust during assembly.** During the construction of the wind park, substation and administrative building, there would emerge dust as a result of the soil-stripping work and the unloading operation of sand and gravels to be used in the construction.

- **Physical pollution during the operation phase.** At the operational phase of the project, there would emerge certain minor electro-magnetic and noise pollutions. Certainly, there would be no electro-magnetic wave impact. The maximal level of noise to be produced by the rotation of the wind turbines would reach up to 107.5 dB.

**Table 3.8.Assessment of adverse impacts on air quality**

| № | Impacts | Assessment of impact consequences | | | | |
|---|---|---|---|---|---|---|
| | | No impact or very little | Minor | Moderate | Strong | Hazardous /extremely dangerous/ |
| 1 | Dust to rise during the project construction phase by soil-stripping and the traffic of heavy machineries. | | | x | | |
| 2 | Dust to rise from the project's access road, internal transportation road, and vehicles movement and traffic during the construction phase. | | | x | | |
| 3 | Soot and smoke released into the atmosphere from the diesel-operated heavy machineries (such as cranes, excavators, trucks and generators). | | x | | | |
| 4 | Dust to be created from loading or unloading construction materials, digging holes and creating stockpiles. | | x | | | |
| 5 | Noise impact to be produced at the operational phase by the rotation of the wind turbines. | | | x | | |
| 6 | Electro-magnetic wave impact to occur around the overhead transmission lines and the sub-station of the wind park. | | x | | | |
| ***Conclusion*** | Out of above impacts assessed by 6 indexes in total, one is rated as no or little impact, two are rated as minor, while the other three are assessed as moderate.<br><br>The dust would adversely impact on the health of the workers and local residents, while the dust arisen up to the atmosphere by the traffic of heavy vehicles may also reduce the visibility in the surroundings and serve the reason for road accidents. Besides, the dust would adversely impact on the soil and plant-cover in the vicinity by declining the soil fertility and plant growth capability.<br><br>So, the currently observed air quality standard of Mongolia MNS 4585:2007 should be strictly adhered during the project's construction phase. The major air quality adverse impacts are determined with the dust to be created during the construction and soil-stripping works as well as by the traffic of heavy machineries by the noise and electro-magnetic wave impacts to be produced at the project's operational phase. Thus, the project's air quality impacts are rated as moderate. Once the construction phase is completed, air impacts will cease to exist automatically.<br><br>Judging from this, the intensity of the impacts imposed by the project on the air quality could be identified "moderate". Once the construction phase is completed air impacts will cease to exist automatically. | | | | | |

### 3.3.4 Impacts on surface and underground waters, their assessment

As it was underlined in the report of project's environmental conditions assessment, the project implementation site is located outside the water catchment area in the territory. This additionally confirms that the project buildings and facilities would not be impacted by the surface flood-flows.

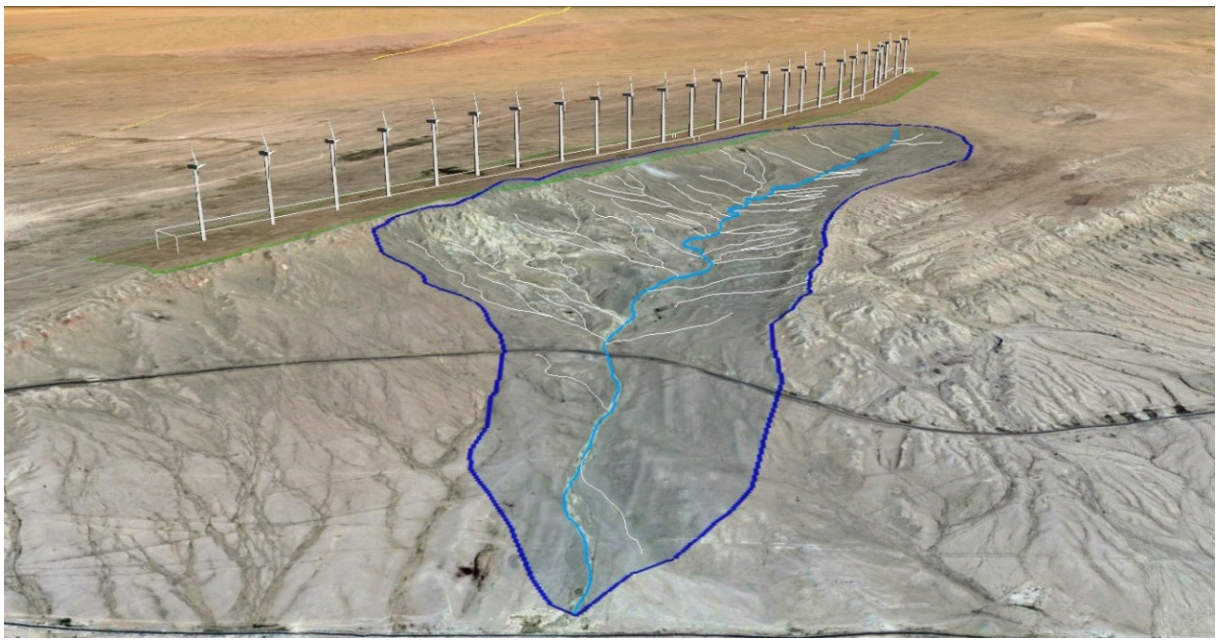


**Figure 3.3.Location of the Baga Zavilaagiin swash's water catchment area and the project site**

The industrial water consumption at the construction phase would continue shortly. At the operational phase, the wind park project would not use water for the industrial purpose, but just for the drinking and domestic consumption purpose.

There is no surface flow in the surroundings of the project site, but just there is a considerably big dry wadi consisting of a number of small swashes southwards from the flat ridge /plateau/ where the wind turbines are to be installed. In the rainy periods, there happens a flood-flow in above dry wadi. As for the underground water, the wells used by the local herders for both drinking and livestock-watering purposes are located at 1.5-2.0 km from the wind turbines.

**Table 3.9. Assessment of impacts to be imposed on surface and underground waters**

| № | Impacts | Assessment of impact consequences | | | | |
|---|---|---|---|---|---|---|
| | | No impact or very little | Minor | Moderate | Strong | Hazardous |
| 1 | A considerable amount of water would be used during the construction phase for suppressing the dust rising from the internal transportation roads as well as for the mixture to be used in the basement of the wind turbines. | | | x | | |
| 2 | Domestic waste waters produced by the workers' camp and the waste water from washing machineries and equipment released during the construction phase. | | x | | | |
| 3 | Infiltration of ground water and change of rainwater flood-flow direction resulting from soil-stripping work, road repair and maintenance, and the drawing of drainages performed during the construction phase. | x | | | | |
| 4 | Spillage and infiltration over or into the ground of materials that are toxic and hazardous for human health including combustible and lubricating materials, petroleum products, etc. pollution of underground water with above materials. | | x | | | |
| ***Conclusion*** | Out of the potential adverse impacts to be imposed on the quality and reserve of surface and underground waters during the operation of the wind park that were assessed by 4 indexes, one was rated as very little or no impact and another one - as moderate, while the rest two impacts were assessed as minor. This shows that the project would not impose any serious impact on the surface and underground waters.<br><br>Since the wind turbines installation area is located at the relatively elevated place, the waste liquids including accidentally spilt combustible and lubricating materials, waste waters released during the construction assembly works and the waste waters from washing and cleaning of construction equipment and machineries may infiltrate down into the ground, and then, might be transported downwards by rainwater flood-flows alongside the dry-swashes and pollute nearby wells and water points.<br><br>At the project's operational phase, the impacts on surface and underground waters would be minor. | | | | | |

### 3.3.5 Impacts on soil mantle

The gravelly thin brown soil is stabilized over the hilly surfaces within the area where the wind park is projected to be built up. The humus layer of this soil is thin and the soil mantle in whole is quite fragile, and consequently, its capacity for bearing the rehabilitation

measures is very weak. In such a condition, following reasons for impacting the soil mantle adversely in the course of project implementation were considered in the report:

1. Within the framework of the project's construction phase, the fertile layer of soil would be partially stripped and damaged.
2. The soil mantle would be pulverized by humans and vehicles bustling around the temporary camp of project workers during the construction phase.

   There would be created stockpiles of earth and sedimentary rocks during the earthworks related to the installation of wind turbines.
3. During the construction phase, the soil will be eroded by the traffic of heavy machineries and equipment.

**Table 3.10.Reasons for soil-mantle impacts, scope of impacts**

| № | Forms of impact | Reason of impact | Environmental component | Scope of impact |
|---|---|---|---|---|
| 1 | Big amount of loose earth and waste rocks would be created while digging the holes for installing the turbines. | Earth-moving work to be performed for installing the turbines. | Soil, vegetation and wild animals | Area where 27 turbines would be installed. |
| 2 | New earth roads would be created by the transportation of the wind turbines and other equipment. | Transportation of the turbines and equipment. | Soil and vegetation | The 5.4 km land strip to be covered by new transportation earth roads between the aimag center and the wind plant. |
| 3 | The soil mantle would temporarily be damaged by constructing underground electrical cables between the turbines. | Earth-moving work | Soil and vegetation | An area of over 8 km in length to be affected temporarily by laying electrical cables. |
| 4 | Dust would increase during the construction works. | Wind | Soil and vegetation | The surroundings of the project site. |

**Table 3.11 Intensity of impacts on the soil mantle**

| № | Impacts | Rating of impact intensity | | | | |
|---|---|---|---|---|---|---|
| | | No impact | Minor | Moderate | Strong | Hazardous |
| 1 | Under the impact of the project's construction works, 6.72 hectare area would lose the fertile soil layer and damaged. | | | | x | |
| 2 | During the construction phase, the surroundings of the project site would be pulverized and the quality of the fertile soil mantle - decline. | | | x | | |
| 3 | There would be created stockpiles of earth and sedimentary rocks during the earthworks related to the installation of wind turbines. | | x | | | |
| 4 | During the construction phase, the soil will be eroded by the traffic of heavy machineries and equipment. | | x | | | |

| | |
|---|---|
| ***Conclusion*** | When the impacts to be imposed by the project on the soil mantle were assessed by 4 indices, one was rated as strong and another one - as moderate, while the rest two impacts were assessed as minor. However, there would not emerge any destructive-level adverse impact on the soil mantle that may completely destroy and pollute the soil by making it infertile.<br><br>It is expected that the land would be mostly damaged in the course of building up the wind park. Almost the whole 6.72 hectare area where the wind turbines are to be installed, the inter-turbine underground networks constructed and the roads between the turbines will be affected. |

### 3.3.6 **Plant-cover impacts, their assessment**

During the construction phase, the plant cover would be destroyed by the considerable amount of soil-stripping and earth-moving works. The impact would be restricted to the area within which the soil is stripped.

As for the project area, it belongs to the territory where the fodder reserve per unit hectare is under 100 kg. So, the impact on the plant cover has the same reason as the impact on the soil mantle.

**Table 3.12. Intensity of impacts on plant-cover, their assessment**

| № | Impacts | Rating of adverse impacts' intensity | | | | |
|---|---|---|---|---|---|---|
| | | No impact | Minor | Moderate | Strong | Hazardous /Destructive/ |
| **1** | The plant cover would be destroyed to a considerable amount as a result of the construction and soil-stripping. | | | x | | |
| **2** | Damage of reproduction organ and loss of vitality of plants kept in the fertile soil stockpiles. | | | x | | |
| **3** | Decline of environmental growth because of dust produced by the transportation, exploitation of temporary roads. | | x | | | |
| **4** | The plant-cover would be pulverized around the temporary camp of project workers, substation and the parking area of transport vehicles. | | x | | | |
| ***Conclusion*** | In total, the project imposes 4 types of impacts on the plant cover and they were assessed by 4 indices. Out of these, the intensity of two impacts is rated as minor and the intensity of the rest two- as moderate. There would not emerge any destructive-level adverse impact on the plant cover that may completely demolish any plant species.<br><br>The direct impact on the plant cover to emerge during the construction phase would be temporary and so, it would be regulated through the environment restoration measures to be continuously implemented during the project's operational phase. | | | | | |

### 3.3.7 **Impacts on Fauna**

The identification of rare, extremely rare, endangered and vulnerable wildlife species distributed within the project area and factors like the susceptibility of their habitat, rehabilitation capability and conservation status have a major role in identifying the potential impacts on wildlife and their habitat.

The project area is not taken under the state or local special protection and is not inhabited by rare or extremely rare wildlife species. Species like Saker falcon, Cinereous vulture, etc. might be encountered during the periods of food and fodder abundance while some migratory bird species might pass over the area during their migration. Since the project area is not in a special protection zone, the assessment of the vertebrates which are mentioned above by the IUCN's regional assessment or which might be potentially included in this assessment are shown in the following table.

**Table 3.13.Susceptibility of vertebrates inhabiting the project site and its surroundings**

| Wildlife species | IUCN assessment, conservation status | Susceptibility |
|---|---|---|
| Mongolian gerbil (Meriones unguiculatus) | Regardless | Little |
| Red fox (Vulpes vulpes) | Possible to become rare on the regional scale | Medium |
| Dzeren (Procapra gutturosa) | Possible to become rare on the regional scale | Medium |
| Mongolianlark(Melanicorypha mongolica) | Regardless | Little |
| Hornedlark (Eremophila alpestris) | Regardless | Little |
| Raven (Corvus corax) | Regardless | Little |
| Great grey shrike (Lanius excubitor) | Regardless | Little |
| Pallas's sand grouse (Syrrhaptes paradoxus) | Regardless | Little |
| Upland buzzard **(**Buteo hemilasius**)** | Regardless | High |
| Saker falcon (Falco cherrug) | Susceptible | High |
| Cinereous vulture (Aegypuis monachus) | Regardless | High |
| Spotted gecko (Phrynocephalus versicolor) | Regardless | Little |

At the phase of energy production of the project, there would emerge some common risks for birds, e. to be hit by the blades of the turbines or collision with the transmission lines. The peace and tranquility of breeding birds that require a certain area for nesting might be disturbed during the construction phase.

**Table 3.14.Intensity of impacts on the fauna in the surroundings of the project site**

| № | Impacts | Rating of adverse impacts' intensity | | | | |
|---|---|---|---|---|---|---|
| | | No impact | Minor | Moderate | Strong | Destructive/ or Hazardous |
| 1 | During the construction phase, wild animals would run away because of the noise and traffic of the machineries and equipment and their habitat might be changed. | | | | x | |
| 2 | The habitat and reproduction conditions of the steppe rodents would be affected during construction. | | | x | | |
| 3 | The habitat and reproduction conditions of the locally acclimatized mammals would be affected. | | x | | | |
| 4 | Impact on the steppe region permanently-acclimatized birds | | | x | | |
| ***Conclusion*** | The potential impacts to be imposed by the project on the wildlife were assessed by 4 indexes, and out of these, one was rated as minor and another one - as moderate, while the rest two impacts were assessed as strong. Although, there would not emerge any destructive-level adverse impact on the wildlife, the wild animals would run away because of the permanent use of the land in the future and the continuous impact on the atmosphere, and consequently, their location would be impacted irreversibly.<br><br>If to assess the impacts on various wild animals encountered within the project area based on their susceptibility, the intensity of those impacts varies from "minor" to "strong", while in general, the impacts have a slightly adverse nature especially during the construction phase. | | | | | |

### 3.3.8 Impacts on historical and cultural heritage

In the report of the project's socio-environmental conditions assessment, it was noted that the relevant archeological survey was carried out at the places called Uzuur mountain's "Khetsuutsav" and "Bag Zavilaagiin" ridge that are located at the junction of the territories of Sainshand, Altanshiree and Urgun soums, Dornogobi aimag and in the result of the survey, there were revealed neither historical nor cultural heritage or archeological finding within the project area and its surroundings.

Thus, the project would not adversely impact any type historical or cultural heritage or archeological finding.

### 3.3.9 Impacts on specially protected areas

As it was noted in the baseline report, the site of the Sainshand wind park project is located at 8-9 km distance from the boundary of the locally protected area called "Zoogiinkhooloi" and consequently, the project would not impact any specially protected area. So, it is not required to assess such a type of impact.

## 3.4 Integration of project's environmental impacts

While integrating the intensity assessment of the environmental impacts of the Sainshand wind park project, the impact intensity was identified by 37 indices and of these, 2 indices were used for positive impacts, 7 indices were used for assessing the project's location-related impacts. So, the environmental impacts were assessed by 30 indices in total, and out of these, the intensity of impacts on each of the environmental components like the land; earth-bowel; surface and underground waters; soil mantle; plant-cover and the fauna was assessed respectively by 4 indices, while just the impacts on the air quality were assessed by 6 indices. If to have a look to the structure of the impacts, 20.2%of them adversely impact the air quality, while the adverse impacts imposed on each of other environmental components equally account for 13.3%. (see table 3.15)

**Table 3.15.Intensity of environmental impacts and their assessment**

| No. | Environmental components | Rating of adverse impacts' intensity | | | | | Assessment | |
|---|---|---|---|---|---|---|---|---|
| | | No impact | Minor | Moderate | Strong | Destructive/ or Hazardouas | Number | % |
| 1 | Impact on the land | | 3 | 1 | | | 4 | 13.3 |
| 2 | Impact on the bowels of the earth | | 3 | 1 | | | 4 | 13.3 |
| 3 | Air quality impact | | 3 | 3 | | | 6 | 20.2 |
| 4 | Impact on surface and underground waters | 1 | 2 | 1 | | | 4 | 13.3 |
| 5 | Impact on soil mantle | | 2 | 1 | 1 | | 4 | 13.3 |
| 6 | Impact on plant-cover | | 2 | 2 | | | 4 | 13.3 |
| 7 | Impact on fauna | | 1 | 2 | 1 | | 4 | 13.3 |
| **Total assessment of impacts intensity** | | **1** | **16** | **11** | **2** | | **30** | |
| | | 3.3 | 53.3 | 36.7 | 6.7 | | | **100.0** |

If to consider the project's environmental impacts from the point of view of intensity rating, out of the total 30 indices, one has no impact, while 16 indices have minor intensity, 11 are assessed as moderate and the rest 2 as strong. Of the total impacts, 56.6% have the intensity from "no impact" to "minor", while 36.7% and 6.7% account respectively for "moderate" and "strong". (see table 3.15)

Since it was impossible to identify by the intensity assessment the sequence of occurrence of adverse impacts to emerge at the project concrete stages, the Environmental Impact Assessment was performed by the method of Leopold matrix and then, compared to the method of intensity assessment.

The assessment of the environmental impacts to be resulted from each stage of the project's construction phase conducted by the Leopold matrix method fully covers the construction phase. The activities to be performed at the different stages are assessed by 12 indices and finally, the assessment results in 163 points in total (Table 3.16).

Judging from the comparison of the intensity assessment and the Leopold matrix assessment of environmental impacts, the project impacts on the air, soil and vegetation are expected to be relatively stronger compared to other environmental components, while the impacts on the fauna and water – to be relatively weaker.

**Table 3.16.Assessment of adverse impacts to emerge at the different stages**

| Operations to be performed at the construction phase | | Impact-affected components | | | | | | | Total number of impacts | % |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Land plot | Earth-bowel | Air | Underground water | Soil mantle | Plant cover | Fauna | | |
| 1 | Transportation of wind park equipment to the site | 1 | 0 | 5 | 1 | 1 | 3 | 1 | 12 | 7.4 |
| 2 | Unloading the wind turbine spare parts | 1 | 0 | 3 | 1 | 1 | 3 | 0 | 9 | 5.5 |
| | Installation of wind turbines | 4 | 5 | 1 | 3 | 5 | 4 | 2 | 24 | 14.7 |
| 4 | Assembly of the tower parts | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0.6 |
| 5 | Installation of wind turbine nacelle | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0.6 |
| 6 | Installation of wind turbine‘s hub | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0.6 |
| 7 | Installation of wind turbine blades | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0.6 |
| 8 | Digging of channels and trenches for installing the underground cables between the wind turbines | 3 | 3 | 2 | 1 | 4 | 4 | 2 | 19 | 11.7 |
| 9 | Construction of the wind park's internal roads network | 5 | 4 | 4 | 4 | 5 | 5 | 2 | 29 | 17.8 |
| 10 | Construction of infrastructure buildings and facilities | 4 | 3 | 3 | 3 | 4 | 3 | 1 | 21 | 12.9 |
| 11 | Construction of project's supply infrastructure buildings and facilities | 5 | 4 | 3 | 2 | 4 | 4 | 2 | 24 | 14.7 |
| 12 | Project's administrative buildings and facilities | 4 | 3 | 3 | 3 | 4 | 3 | 1 | 21 | 12.9 |
| **Total** | | **27** | **22** | **28** | **18** | **28** | **29** | **11** | **163** | **100** |
| **%** | | 16.5 | 13.5 | 17.2 | 11.1 | 17.2 | 17.8 | 6.7 | 100 | |

Of the total 163 points identified by the Leopold matrix method, the maximal points are allotted to the plant-cover (29) and the air quality (28) while minimal points account for the fauna (11). Whereas, 27; 22, and 18 points are allotted respectively to the land; entrails of the earth, and the water environment.

Judging from this, out of the adverse environmental impacts to emerge at the project construction phase, 30.0% are allotted to the land and the entrails of earth, while 45.5% and 24.5% account respectively for the habitats like air, water and soil, and the biological products like plant-cover and fauna.

When the intensity assessment method and the Leopold matrix method used for assessing the project's environmental impacts are compared in the matter of impact structure and the average values of the assessment results are considered, the impact on air quality accounts for the maximal portion (18.7%), while the impact on fauna – for the minimal portion (10.0%). Then, out of the average values, 28.3% account for the land and the entrails of the earth account; while 46.2% and 25.6% account respectively the habitats like air, soil and water and the biological products like plant-cover and fauna.

**Table 3.17.Compared indexes of the environmental impacts**

| No. | Environmental components | Assessment | | Average value of assess ments |
|---|---|---|---|---|
| | | Intensity method | Leopold Matrix method | |
| 1 | Impact on the land | 13.3 | 16.5 | 14.9 |
| 2 | Impact on the bowels of the earth | 13.3 | 13.5 | 13.4 |
| 3 | Air quality impact | 20.2 | 17.2 | 18.7 |
| 4 | Impact on water | 13.3 | 11.1 | 12.2 |
| 5 | Impact on soil mantle | 13.3 | 17.2 | 15.3 |
| 6 | Impact on plant-cover | 13.3 | 17.8 | 15.6 |
| 7 | Impact on fauna | 13.3 | 6.7 | 10.0 |

The specific feature of the Leopold matrix method consists in assessing adverse impacts to be potentially imposed on the environment by each technological stage, based on the assessment and conclusion of professional experts.

## 3.5 Project's socio-economic impacts

### 3.5.1 Project's socio-economic importance

The Sainshand wind park is directly dependent on the energy production and quality index of the centralized energy supply system.The project would be specifically important for ensuring the technical reliability of the Choir-Airag-Sainshand-ZamynUud's 110kV overhead electricity transmission line /OETL/, improving the electricity supply of the consumers of the aforementioned line and supplying energy tolarger consumers like the Sainshand Industrial Park, TsagaanSuvarga and OyuTolgoi mines.

### 3.5.2 Stakeholders and Public

In total, 45 citizens participated in the survey of the DEIA for the Sainshand wind park project conducted in 2014 and proposed their suggestions on behalf of the public. Out of them, the residents of Sainshand soum account for 64% while the residents from Altanshiree and Urgunsoum's account respectively for 20% and 16%.

Out of the participants in the survey, 78.0% possess the higher education while 4.0% and 11.0% have respectively the complete secondary education and the vocational secondary education. 7.0% of them didn't answer to the question regarding their education.

Judging from this, the survey could involve the representatives of the mass,who determine the local development policy being able by the educational level to assess and summarize the social importance of infrastructure project, its activities and the comprehensive impacts to be resulted from those activities.

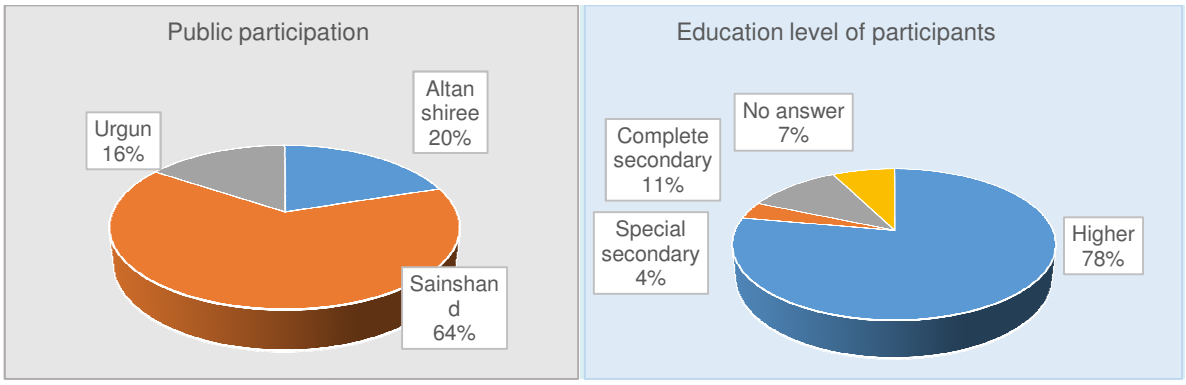



**Figure 3.4.Public participation index in the DEIA, 2014**

When the participants of the survey are assessed by age categories, the youth between 25-35 account for 56%, while the middle-aged people between 36-55 and the elders over 56 account respectively for 36.0%and 4.0%. Then, the rest 4.0% didn't answer to the question regarding their age.

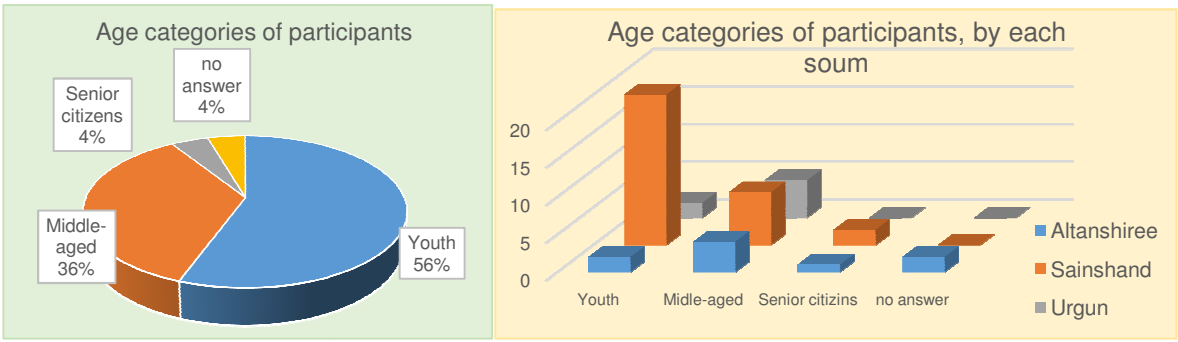



**Figure 3.5.Age categories of participants in the DEIA**

### 3.5.3 Residents in the vicinity of the project site

One local herders' households of Sainshandsoum permanently inhabits the wind park project site and uses the pastureland within the project area. Two households are temporarily located outside the project area while. So, it means the project's construction activities would

be performed within the summer-camping area of the two herders' households as indicated on the figure below.

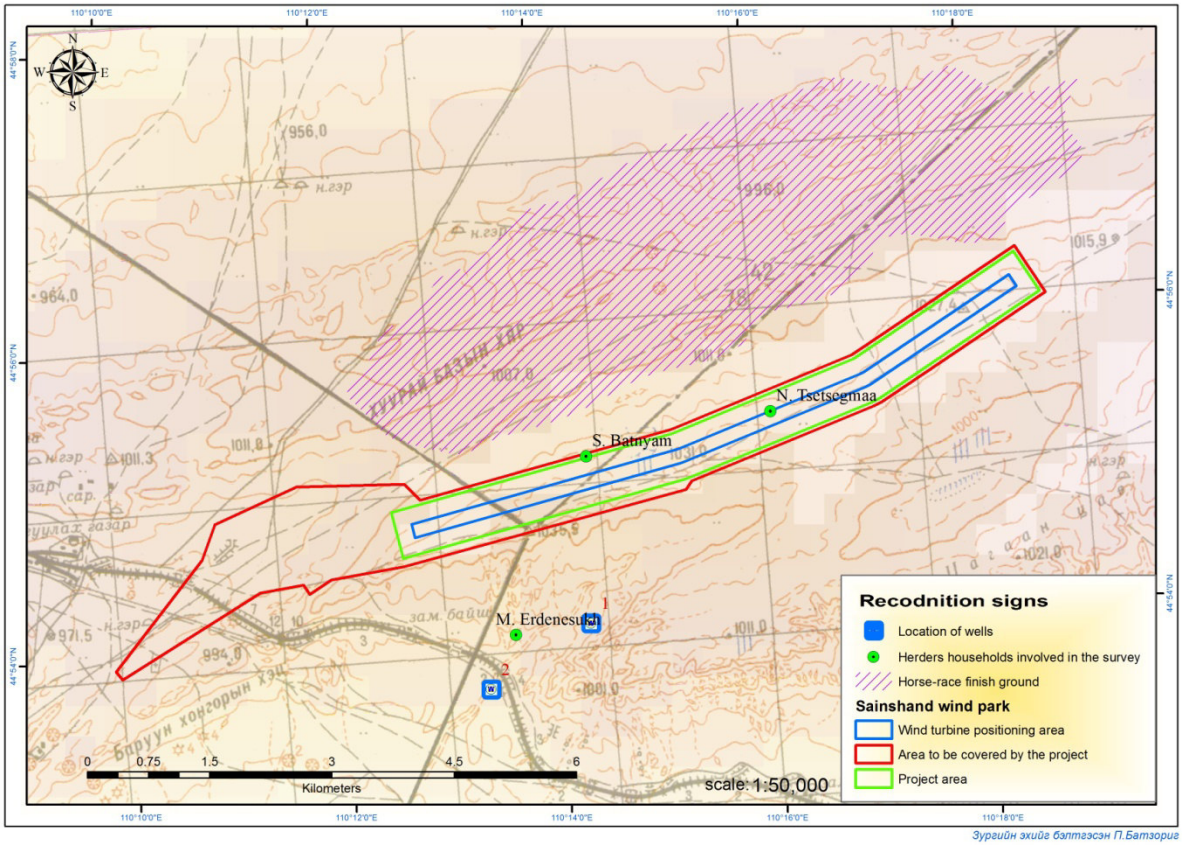



**Figure 3.6.Location of the summer camps and wells of the local herders in the project vicinity**

### 3.5.4 Suggestions of the residents for the implementation of the project

The meetings of the stakeholders taking a part in the project's DEIA were organized in the center of each of the three soums with the involvement of the local public representatives. The project-related suggestions and proposals of the participants were officially collected at the meetings.

**Table 3.18. Sorting the suggestions of the survey participants**

| Participants | Project-related suggestions/ or proposals |
|---|---|
| Residents | We would be very satisfied if we are provided with a reliable energy source, the electricity interruption is reduced and the price of electricity gets cheaper. |
| Government employees | The project executor should provide the concrete and correct information on the adverse environmental impacts of the project. Because of the lack of correct and true information, various conceptions and incorrect information are distributed among the local residents. |
| Governors | The project executor should commence the implementation of the project as quickly as possible. The proper attention should be allotted to the fact that |

| | |
|---|---|
| | the project is delayed because of the problems regarding the land ownership permit. If the project implementation starts soon, we would propose concrete suggestions on collaboration with the project executor regarding the correct and proper use of energy resource at the level of local development. |

*Source: Report of the Socio-environmental conditions assessment for the Sainshand wind park project, 2014*

Judging from the data and information reflected in the report of the Assessment of Environmental conditions, in general, the local residents appreciate this energy-supply project and pay a specific attention to a number of questions to be arisen in connection with the project implementation. The questions attracting the attention of the local residents should be considered in compatibility with the project's Feasibility study as follows:

**Table 3.19. Suggestions of the residents and Planning in the Feasibility study**

| Suggestions/ or proposals of the residents and citizens | Planning | Comments |
|---|---|---|
| - *On the issues related to the project products* | | |
| The new source of energy should be reliable and operate uninterruptedly | The designing of the project ensures the reliable operation of the sub-station, cable lines and the wind turbines. | There exist the regulations of legal relations compatible with the Energy Law, approved by the Sector Minister. |
| The new source of energy should be as cheap as possible | The energy/electricity would be supplied to the consumers by the current market price. | The maximal price limit of 1 kWh energy would be USD 0.095 as specified in the Renewable Energy Law. |
| - *On the issues related to the project activity* | | |
| Work places would be increased and the workforce would be supplied from the locality. | | The number of employees would be reduced at the operational phase of the wind park compared to the construction phase. |
| A new development policy would be formulated in compatibility with the energy supply. | There is an interest in joining the wind park to the larger consumers like Tsagaan Suvarga, OyuTolgoi, etc. | An issue of electricity consumption would be reflected in the aimag and local policies in the increased manner. |
| The date of project commencement should be brought closer. | The project is expected to be implemented within the fixed timeframe. | It is fully possible to implement the project by the planned date. |
| The extensive information on the project's environmental impacts should be provided. | The project would be socially responsible according to the relevant laws and regulations. | It is possible to operate by strictly observing the currently valid laws and regulations of Mongolia. |
| - *On the issues related to the environmental conservation* | | |
| Either the wind turbines' operation would increase the wind impact and turn the surroundings into desert | The rotation of the wind turbine blades doesn't result in desertification. | The wind park would not cause any desiccation. |
| Either the project would impact the utilization of the pasture and wells | There would emerge slight impacts on the pasture, wells and wildlife during the construction phase | The impacts on the local herders' households would be slowly reduced and then cease to exist during operation. |
| Either the project would | | The project has impact on living |

| Suggestions/ or proposals of the residents and citizens | Planning | Comments |
|---|---|---|
| impact the spread and acclimatization of wild animals. | | conditions of wild animals during the construction phase. |
| To study other potential environmental impact-resulting conditions and introduce them to the local residents. | Problems regarding operational safety, solid and liquid domestic wastes to emerge during the operation of the wind park are resolved in accordance with the applicable standards. | During operation, it would be possible to implement the measures specified in the environmental management plan in accordance with the relevant planning. |

### 3.5.5 **Assessment of social impacts**

If to judge from the major criteria of the preliminary assessment of the social impacts specified in the conclusion of the General Environmental Impact Assessment and the baseline report, the project activities would not cause any adverse social impact. Although the intensity of the impacts to be imposed on the inhabitants in the vicinity of the project site is very little, the project might impact temporarily somewhat adversely the status of utilization of dacha lands /or summer-camp lands/.

**Table 3.20. Impacts to be imposed by the project on the local socio-economy**

| Social impact indexes | Impact intensity | | | |
|---|---|---|---|---|
| | No impact | Minor | Moderate | Strong |
| ***Adverse impact on the residents*** | | | | |
| The summer pastures in the surroundings of the project site cannot be used by the local herders (During construction) | | | x | |
| There is no centrally-settled place within the impact zone of the project. | | x | | |
| ***Adverse impact on the human health*** | | | | |
| During the construction phase might be increased air pollution | | x | | |
| Surface active substances and the combustible and lubricating materials would be used in the project activities. | | | x | |
| It might be to ignore the HSE standard | | | x | |
| ***Impacts on the local socio-economy*** | | | | |
| Temporary workplaces would be created in the locality during the construction phase. | | | + | |
| The demand of materials possible to be locally supplied like the supply of foods, domestic needs, fuel and diesel, etc. | | | + | |
| The revenues including VAT, Personal Income Tax, and charges for using the land and water would be concentrated in the local budget. | | | + | |

The intensity of the project's socio-economic impacts varies between minor and moderate levels. The rating of impact intensity doesn't exceed over the moderate level because the construction phase of the project does not continue for a long period.

### 3.5.6 Analysis on the social impact assessment

As a result of making an analysis on the social impacts to emerge from the wind park project, it was identified that the local socio-economic conditions create a number of advantages for the implementation of the project. However, there also exist some specific minor weak points including the scanty water reserve.

**Table 3.21.Analysis on the project's social impacts/ SWOT-Analysis**

| Strengths | Weaknesses |
|---|---|
| - The project is located at 4 km from Sainshand and so, further it would be possible to enter to larger markets being connected to the centralized network. The demand at the domestic market is also increasing.<br>- Since any type toxic or hazardous chemical will not be used in the technological operations, the project would not adversely impact the human health.<br>- The product supply of the project could serve as an impetus for the local development.<br>- The Governmental policy support and appreciate the production of energy by using renewable energy resources. | - The harsh winter climate conditions might adversely impact the wind turbines.<br>- There is a lack of drinking and domestic consumption water. |
| **Opportunities** | **Threats** |
| - There is a possibility to prepare and supply the workforce locally to certain extend.<br>- The surroundings of the project site can be rehabilitated after the construction phase.<br>- Through the implementation of the proper organization and internal monitoring, it would be possible to reduce and eliminate the risks and prevent from the risks. | - Disregard of labour safety rules during construction and operation.<br>- The settlement of local herder's households and livestock is extremely sparse in the surroundings of the project site and the pastureland is used just by rotation. So, there might emerge a complication in removing the families temporarily. |

# 4 ADVERSE IMPACT MITIGATION AND ELIMINATION MEASURES

## 4.1. Measures for mitigating adverse environmental impacts

Following recommendations are provided on mitigation and elimination of adverse environmental impacts to be potentially caused by the construction and operation of the wind park project.

**Table 4.1. Measures for mitigating adverse environmental impacts**

| Adverse impacts | Impact mitigation measures |
|---|---|
| ***1. Mitigation of adverse impacts on land*** | |
| Impact on combined land fund | To settle the payment for the land used in accordance with the special license within the term specified in the relevant law;<br>To register the special license area /the project area/ which had been previously classified as pastureland in the combined land fund classification, in the infrastructure land classification. |
| Impact on pastureland use | To move any local herders household to camp outside the project area during the construction phase to temporarily free the summer campsites and pastures from the pastureland use. |
| Pulverization and damage of land surface | To restore the land around the substation and office building after the construction phase finishes, to reinstate previous landscape |
| Impact of environmental pollution caused by domestic wastes, waste water and use of latrine | To disinfect and decontaminate the latrines and waste liquid pits by the involvement of a designated professional company, to develop an engineering solution for discharging waste liquids.<br>To arrange a point for temporary storage of solid wastes to remove the accumulated solid wastes regularly in accordance with a fixed schedule;<br>To prevent from spreading out of and polluting the surroundings with wastes and garbage from the waste collection point, to strictly observe the relevant hygienic and sanitation rules. |
| ***2. Mitigation of adverse impacts on earth-bowel*** | |
| Earth-bowel damage, Stratigraphic alteration | Since all the wind turbines, buildings and facilities installed into or erected above ground would be maintained and used throughout the project operational phase, no impact mitigation measure indicated. |
| Earth-bowel pollution | To seal up the waste domestic water collection pit, to prevent from overflowing, spillage and infiltration into the ground;<br>Not to bury down into the ground the obsolete lubricating materials wastes containing surface active substances. |
| ***3. Mitigation of adverse impacts on air quality*** | |
| Dust to emerge during the excavation, preparation of concrete mixture and transportation of construction materials, equipment and waste earth rocks; especially during windy days. | The amount of dust in the air would increase during the construction phase and therefore, to make transport vehicles to follow the fixed route not only during the construction operations but also during the operation of the wind park. To cover the roads with gravels and regularize the dust-suppression watering. |

| Adverse impacts | Impact mitigation measures |
|---|---|
| Emission of soot and smoke into the atmosphere from transport vehicles, especially from diesel-operated heavy machineries. | To use transport vehicles that have passed through the annual technical inspection and that emit the toxic smoke or soot within the permissible standard, to regularize the inspection, repair and maintenance of transport vehicles. |
| Impact of dust pollution resulting from transportation activities. | To urge transport vehicles to travel by the determined routes during the construction phase, to water the earth roads regularly to prevent from dust, to close and rehabilitate the obsolete roads after the construction phase finishes. |
| Noise impacts to be created by machineries and equipment during the construction phase and by the rotation of wind turbines during the operational phase. | To measure regularly the level of noise at noise-producing sources during the construction phase;<br>To keep a proper monitoring in order to shorten the duration of noise;<br>The noise level of the wind turbines will be limited to 107dB. |
| Electro-magnetic wave impact to emerge alongside the overhead transmission lines and in the surroundings of the substations | The substation and equipment of the wind plant should be constructed or manufactured of materials which minimize the level of emission of electro-magnetic wave. |
| ***4. Mitigation of adverse impacts on surface and ground waters*** | |
| Use of water for dust-suppression and other purposes during the construction phase. | During the installation of the wind turbines and the construction of infrastructure buildings and facilities, it is necessary to avoid the use of the ground water reserve for dust-suppression purposes, to study the possibility of recycling waste water, and to use it by circulative in case if possibility. |
| Spillage and infiltration of combustible and lubricating materials into the soil, pollution of ground water. | To preliminarily determine the immediate measures to be taken in case of releasing combustible and lubricating materials, to implement relevant preventative measures from emergence of such a situation.<br>During operation combustibles and lubricants will be collected in separate pits and drained by a designated professional company. |
| Construction of new wells to utilize for water supply purpose. | In case of necessity of constructing a new well, at first, it is required to get an official permit from the local authorities and document the process. |
| ***5. Mitigation of adverse impacts on soil-mantle*** | |
| Soil erosion to emerge under the impact of earth stockpiles and excavations created by earth-moving operations during the construction of the wind park. | A big amount of excessive earth and soil would be created as a result of earth-moving works carried out during the construction of the wind park. A certain portion of this earth and soil would be used at the park's site and its facilities for backfilling, but the rest could be transported to another place to be used differently. For example; The soil dug out from the holes for installing the wind turbines should be used as a filling material in the basement of buildings and facilities. |
| Intensification of soil erosion and damage, fertility decline and desertification. | To minimize as much as possible the area where open excavations take place; e.g. digging out the holes for installing the turbines and excavating the foundation of buildings and facilities.<br>To free the turbine installation area of waste construction materials and properly enhance the surroundings; |

| Adverse impacts | Impact mitigation measures |
|---|---|
| | To use the fertile soils stripped off and store in a separate stockpile at the beginning of the construction operations in the rehabilitation of damaged areas, and in restoration and horticulture of the surroundings;<br>To locate the temporary camp of construction workers and a warehouse for materials in such a way as to urge transport vehicles to travel along the designated route to minimize the impacts causing the soil erosion and the area to be affected with soil erosion; |
| ***6. Mitigation of adverse impacts on vegetation and plant-cover*** | |
| Pulverization and compaction of vegetation in the course of wind turbine installation and construction of buildings and facilities, reduction of plant species in number or extinction of some species. | The soil would be stripped and the plant cover - destroyed within certain area in order to construct the park buildings and facilities, and so, it is required to allot a due attention in order not to use excessive area and protect the surroundings from pulverization;<br>To arrange the exploitation and parking of the transport vehicles used in the construction work in accordance with the relevant requirements to protect the surrounding environment from pollution;<br>At the end of construction phase reinstatement and landscaping works will take place restoring the original conditions.<br>Roads width and hardstands dimensions will be reduced for operation purposes. |
| ***7. Mitigation of adverse impacts on fauna*** | |
| Disturbance of birds habitat at the places where the wind turbines are installed, fleeing of birds. | To conduct a study on birds' nests in spring not to allow birds to nestle too close to the wind turbine towers; therefore in fall revealed nests can be translocated to a safer distance.<br>To locate a bird-scarer at the turbines in order to prevent them from being hit by the blades;<br>To conduct the registration of birds (monitoring) within the project area and its vicinity every year.<br>To clean the wind park area and its surroundings of carrions of domestic and wild animals by removing or burying. |

## 4.2. Mitigation of adverse impacts on historical and cultural heritage

The wind park project wouldn't have any impact on historical and cultural monuments. However, in case of revealing any historical and cultural monument, or archeological and paleontological finding during the project operation, the industrial and construction works should be temporarily ceased, the relevant professional institution should be notified and the necessary study of the findings conducted.

### 4.3. Impact on specially protected area

Since the project operation would not adversely affect any specially protected area, it is not required to implement any adverse impact mitigation measure.

### 4.4. Mitigation of adverse socio-economic impacts

Following measures would be implemented in order to mitigate the project's adverse impacts on the local socio-economy:

- To protect the workers during construction and operation phase international HSE-standards will warrant maximum safety.
- To notify in advance the local herders not to use temporarily the summer pastures around the "Ikh Zavilaagiin" ridge during the construction phase of the project;
- To negotiate with the herders households and establish an agreement with them on freeing the pastures during the construction work, especially during the period of installing the wind turbines, and to reimburse them a single-time compensation for causing changes and alterations in their pastures and summer-camp sites;
- Establishment of new workplaces and associated services.

## 5 ASSESSMENT AND MANAGEMENT OF PROJECT RISKS

### 5.1 Assessment of potential hazard and risks

The Sainshand wind park project doesn't use any chemicals during construction or operation. However, there might emerge any unforeseen hazard or risk during the construction and operation of the project in connection with unpredicted natural disasters or failure of technological operations.

#### 5.1.1 Hazards and risks to be potentially resulted from natural disasters

Natural disaster-related risks could be resulting from natural phenomena like earthquake, flooding, winds and storms, thunder and lightning, fire, spread of contagious diseases, etc.

Earthquake. Earthquake is one of the most hazardous forms of natural disaster that results in enormous socio-economic loss and damage. That's why, mankind has spent hundreds of years and great efforts for studying and finding out ways and methods for predicting an occurrence of any earthquake and preventing from its hazards and consequences. However, still the hazard and damage to be potentially caused by earthquake couldn't be reduced yet. The project implementation area is included in the Richter-Scale seismic zone of 5-6 points and therefore, because of earthquake, there might happen a disruption or catastrophe like distortion or breakage of lines and networks, occurrence of cracks in buildings, facilities and equipment, collapse of turbine, etc. So, it is required to carry out a thorough calculation in order to construct foundations of the wind turbines as strong as they could bear the earthquake action.

Wind and storm. The project implementation area is quite windy in any season of year. Especially, in the spring months, the wind speed repeatedly exceeds over 20-24 m/sec. If on the scale of the whole territory of Dorngobi aimag, annually, the dust storms are observed in average for 16.4-68.2 days, in the vicinity of Sainshand, especially in the springs, strong winds happen for 5-10 days, while dust and snow storms are observed respectively for 20-30 days and 10.7-11.8 days. The wind blows mostly from the west and northwest. So, above conditions should be taken into thorough consideration and dust-prevention measures – planned in an elaborated manner during the transportation and construction operations. In addition, it is necessary to operate by ensuring the technical and occupational safety that should be adhered in the conditions where the wind speed might impact the operational procedure of the wind turbines.

Thunder and lightning. In summers, especially in the rainy July and August, the thunders and lightning are repeatedly observed. Consequently, a proper earthing system is to be installed and connected to other metal components of the wind park to minimize the impact of thunder and lightning, which may result in a fire. Also, it is required to equip the wind turbines, electrical transmission line and other equipment with lightning conductors. As for the surroundings of Sainshand city, during the summers, thunder and lightning are observed annually for 15.3 days. That's why proper measures for protecting men and nature should be implemented.

Flooding: Since the project site is located at the relatively elevated plateau, it would not be affected by the risk of flooding that is observed a few times in many years in this territory.

Fire. The fire risky conditions are usually resulted from the violation of storage and use procedures of combustible and volatile materials, incorrectly mounted electric connections, over-loading of electricity, use of damaged cables or inattentive and irresponsible attitude of workers to their job. Especially, as the wind park produces the energy, the operators of the station should strictly observe the operational safety regulations of electric equipment in their operation. Furthermore, the operators should be regularly warned about fire risks, the relevant warning sheets - prepared and located at the required places, and the primary fire-fighting tools should be kept ready under hands. A fire detection system will be installed as well as firefighting equipment as per local regulations.

### 5.1.2 **Hazards and risks to be potentially resulted from technological failure**

At both the construction and operational phases of the wind park, various types of accidents and risks may potentially happen. However, as it was proved by practice, most of those accidents result from negligent and incautious operation of workers themselves. This matter is directly connected with all types of activities including the construction of industrial buildings and engineering facilities, assembly and installation of equipment, handling equipment, etc. In other words, it means that various hazards and risks may potentially happen resulting in operational interruption, incapacitating or life loss of humans because of irresponsible attitude of workers and engineering manpower to do their job, especially because of violation of operational procedure in the course of energy production or because of weakening the monitoring kept over the operation of equipment. So, specific attention should be allotted to this matter at both phases of the project.

In case of emergence of any risk or hazard, at first it is required to identify the time of accident, its location, type, impacts on human health and environment, and the scope of those impacts, and then based on above findings, the required man force and monetary capital should be determined to implement necessary measures for eliminating the hazard consequences as soon as possible. After eliminating the consequences of the accident, it would be required to conduct a relevant study and keep monitoring.

## 5.2 Risk analysis matrix

Risks are assessed by 5 levels of rating according to the criteria of consequence and probability assessments. If in the consequence assessment, the risk-affected objects are classified as risk-affected population and risk-affected assets, and the indexes like consequence mitigation and consequence elimination solutions are taken into consideration, in the probability assessment, the percentage occupied by the risks are defined by 5 levels of rating and based on those ratings, the risks are identified approximately. Further, there are produced the matrix by integrating the probability and consequence assessments. The results of the risk assessment are then identified by synthesizing per technological facilities as well as per potential accidents or hazardous phenomena.

As for the risk assessment of Sainshand wind park, the probability of impacting the human health, environmental components and the project operation is rated as minor for the risks to be resulted from potential hazards related to various type natural disasters or from potential accidents related to failure in technological operation. The recurrence, probability and intensity of potential risks that might be caused to the human health and safety, and the environment are shown in the following tables.

**Table 5.1. Recurrence and intensity of potential risks for human health**

| Recurrence of cases | | Risk intensity | | | | |
|---|---|---|---|---|---|---|
| **Recurrence/ year** | **Definition of recurrence** | **A insignificant** | **B minor** | **C moderate** | **D strong** | **E hazardous** |
| > 1 | Multiple times | | | | | |
| 1/10 - 1 | Not a single time | | 1 | 2, 3, 8.3 | | |
| 1/100 - 1/10 | Single time | 4,8.2 | 7.1,7.2,8.4 | 5,6 | | |
| 1/1000- 1/100 | Little probability | | 8.1 | | | |
| Comments: | | | | | | |
| | Very little risk | | | | | |
| | Bearable risk | | | | | |
| | It is required to implement risk mitigation recommendations | | | | | |
| | It is necessary to implement a risk mitigation measures | | | | | |

Judging from above table, out of the risks that might impact the human health, the accidents and failures which may potentially happen in the course of equipment loading and discharging during the project construction phase; fire risks which might occur because of failure of electricity/energy supply operational safety are rated as moderate. So, it is required to implement the relevant risk mitigation recommendations.

The recurrence, probability and intensity of potential risks that might be caused to the environmental components in the course of project implementation are shown in the table 5.2.

**Table 5.2. Recurrence and intensity of potential environmental risks**

| Recurrence of cases | | Risk intensity | | | | |
|---|---|---|---|---|---|---|
| **Recurrence/year** | **Definition of recurrence** | **A insignificant** | **B minor** | **C moderate** | **D strong** | **E hazardous** |
| > 1 | Multiple times | | | | | |
| 1/10 - 1 | Not a single a time | | 1,2,3 | 8.3 | | |
| 1/100 - 1/10 | Single time | 5 | 7.1,7.2,8.2 | 4,6,8.4 | | |
| 1/1000- 1/100 | Little probability | | 8.1 | | | |
| Comments: | | | | | | |
| | Very little risk | | | | | |
| | Bearable risk | | | | | |
| | It is required to implement risk mitigation recommendations | | | | | |
| | It is necessary to implement risk mitigation measures | | | | | |

Judging from above table, for the environmental components, the fire risks which might happen because of failure of electricity/energy supply operational safety, accidents which might result from natural force-majeur like thunder, lightning, dust or snow-storms, etc. are rated as moderate. The recurrence, probability and extent of potential risks that might be encountered by the project operation are shown in the table 5.3.

**Table 5.3.Recurrence and intensity of risks to be potentially encountered by the project activity**

| Recurrence of cases | | Risk intensity | | | | |
|---|---|---|---|---|---|---|
| **Recurrence/year** | **Definition of recurrence** | **A insignificant** | **B minor** | **C moderate** | **D strong** | **E hazardous** |
| > 1 | Multiple times | | | | | |
| 1/10 - 1 | Not a single time | | 1 | 2,3 | 8.3 | |
| 1/100 - 1/10 | Single time | | 5, 7.1,7.2, 8.2 | 4,6 | 8.4 | |
| 1/1000- 1/100 | Little probability | | 8.1 | | | |
| Comments: | | | | | | |
| | Very little risk | | | | | |
| | Bearable risk | | | | | |
| | It is required to implement risk mitigation recommendations | | | | | |
| | It is necessary to implement risk mitigation measures | | | | | |

Judging from above table, the risks to be resulted from potential hazards and accidents that might happen during transportation, fire risks that might emerge because of failure of operational safety of energy facilities, and the risks that might be caused by natural force-majeure like thunder and lightning, dust and snow-storm, etc. are rated as strong. So, it is necessary to implement risk mitigation measures according to the relevant recommendations.

The risks that might emerge during the construction phase of the project and the risks related to fire and labor safety are assessed as moderate.

All other types of risks that might be potentially imposed on the human health and safety, environmental conditions and the project activity in the course of project operation are preliminarily identified for each of the sources and shown in the table 5.4.

**Table 5.4. Assessment of accident and hazard risks for the Sainshand wind park project**

| No. | Activity/Case | Reason for negative consequences | Potential harm or consequence | Rating | Measures for preventing from risks, risk mitigation measures | Recurrence/ year | Human health and safety | Ecological safety | Project activity |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Transportation of wind turbines and associated equipment, Erecting of buildings and facilities during the construction phase | Dust to arise during the soil-stripping and construction operations; Dust to arise during the movement and traffic of heavy machineries | Restriction of visibility; Pollution of air for breathing of local residents and project workers. | Minor | To moisten by spraying water for the dust suppression purpose along the transportation roads as well as during the construction works. | 1/5 | | | |
| 2 | Assembly of wind park building, Loading and discharging of equipment | The wind turbine dimension is very big, and consequently, there exists a potential of operational safety failure of heavy machineries and hoisting equipment | Injury of project workers | Moderate | To provide with specially designated equipment, to strictly observe the safety operational rules for transporting, loading and unloading activities. | 1/5 | | | |
| 3 | Failure and accident during transportation | Failure or accident might be caused by driver's irresponsibility, slippery roads, sudden appearance of wild animals on the road, incompleteness of transport vehicles, violation of traffic rules, etc. | Humans, livestock and wild animals might be hit, injured or killed by transport vehicles. Risks to emerge during the transportation because of slippery, breakage of equipment | Minor | To provide primary medical assistance in case of being injured because of violation of the traffic safety regulations; to coordinate the loss or damage caused by the accident according to the relevant insurance procedures; in case of hitting an animal or livestock, the relevant compensation should be paid. | 1/5 | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | strengthening, etc. | | To provide vehicles fit for the intended purpose. | | | | |
| 4 | Damage or breakage of equipment | Violation of industry safe operational and labor safety rules and procedures. | Temporary interruption of operation because of breakdown of equipment. | Minor | To train workers soundly in handling of equipment, to keep the spare arts of equipment ready under hands, to regularize the repair and maintenance of equipment. | 1/10 | | | |
| 5 | Electricity supply operational safety | The electricity distribution equipment is not adjusted correctly or ground connection is not provided. | Disruption of normal safe working conditions because of potential fire risks and electrical shock | Moderate | To provide components with earthing connection or electrical isolation; sufficiently protective fusing is to be established. | 1/10 | | | |
| 6 | Fire and blaze | Fire risk might happen at the places where the combustible and volatile materials are kept because of breach of fire safety rules, negligent and incautious operation of workers. | Burn, air and soil pollution | Moderate | All necessary measures for protecting from fire risks should be taken; fire detection and fire fighting is to be foreseen for the whole site.<br>The fire-signaling device and the board showing the safety exits should be located at all work sites. | 1/10 | | | |
| 7.1 | Labor safety and operational security | Violation of labor safety rules, irresponsible attitude at work place, unpredicted circumstances at the work place.<br>Actions caused by negligent and incautious activities of workers. | Technological failure in the course of operation, breakdown of transporting equipment, damage to human health. | Minor | Safety instructions for working in electrical rooms and the substation are to be provided. Staff is to be trained accordingly. | 1/10 | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 7.2 | | Accident resulting from the mistakes related to psychological state of workers. | Be in temporary hesitation, unintentional repetition of accustomed actions, incorrect understanding of equipment reading, mixing of objects while acting, unintentional switching of different systems, be indifferent to false information and warnings. | Minor | To examine the workers on a regular basis in order to prevent from potential risks and accidents to be potentially resulted from the workers' unintentional and incautious actions and psychological state. | 1/15 | | | |
| 8.1 | Natural force-majeure circumstances | <u>Earthquake</u><br>The project site is included in the seismic zone of 5-6 points. | Loss of human life, damage of wind turbine foundation, collapse of buildings and facilities, emergence of cracks and splits on the roads and squares, interruption of electricity, damage to equipment. | Minor | The seismic rating of buildings and facilities should be at first identified and the preliminarily preventative measures – taken. The tension-bearing capacity of the foundation should be also at first defined to construct it sufficiently strong to resist to the relevant earthquake. The relevant civil engineering standards should be considered in designing the buildings, facilities and the foundation. | 1/100 | | | |
| 8.2 | | <u>Flooding</u><br>Flooding happens usually when a big amount of precipitation falls down for a very short time. | Loss of human life, damage and destruction of infrastructure. | Minor | To change the direction of surface flows; to warn the population regularly about any expected flooding to protect human lives and the infrastructure. | 1/10 | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 8.3 | | Thunder and lightning<br>Thunder and lightning might happen repeatedly in the rainy seasons, during the cloudbursts and heavy rains. | Outbreak of fire caused by lightning at the turbine that could result in huge economic loss. | Moderate | The ground connection should be designed and executed by professional electrical engineering company to ensure the reliability of the protection functionality. | 1/5 | | | |
| 8.4 | | Wind and storm<br>Dust and snow storms, sudden drop in temperature. | Temporary stop of the wind turbines because of rotation mode disruption | Moderate | To design the measures to be implemented in case of extremely severe natural phenomena, to be ready to implement them in case of necessity. To take proper measures required for monitoring the dust. | 1/10 | | | |
| Note: 1/10-1/5 Probable to be repeated not single time, 1/100-1/10 very little probability. | | | | | | | | | |

## 5.3 Measures for mitigating and eliminating risk harms and consequences

### 5.3.1 Prevention from risks to be potentially resulted from natural disasters

As for the wind park, during strong dust and wind storms, it is required to take necessary measures for preventing risks that might result from excessive wind speed, loss of operational mode, and damage of equipment; keep a regular control over the weather and climate forecasting, install proper lightning conductors and grounding systems, and monitor permanently the operation of above devices during the rainy seasons. Especially, the hub of wind turbines has a relatively higher potential for being affected with a lightning. So, the fire risks should be limited effectively by the following, amongst others:

- ✓ Use of metallic covers thoroughly installed, ensuring electrical connectivity;
- ✓ Early fire detection with automatic fire detection/alarm systems;
- ✓ Frequent as well as professional maintenance, and
- ✓ Automatic switch-off of the turbines and complete disconnection from the power supply system in the case of fire risks being identified.

### 5.3.2 Prevention from risks to be potentially resulted from technological failure

At the construction phase of the project, an unforeseen risk or accident may potentially happen in the course of the transportation and installation of the wind turbines. So, it is required to operate cautiously in the course of the transportation and installation of the turbines, keep a proper control over the strengthening of the loads and the completeness of the transport vehicles, heavy machinery and cranes, and instruct the workers regularly on the labor safety and safe operational rules and the primary-level measures to be taken in case of any accident and risk.

### 5.3.3 Basic requirements for labor safety

- ✓ The operation and operational sequence of machineries and equipment should be in compliance with the general safe operational requirements;
- ✓ To ensure the fire safety, it is required to strictly adhere to the internal fire safety regulations, keep the fire-fighting tools and equipment ready under hands, and train the workers in handling properly with those equipment;
- ✓ It is prohibited to use in the equipment any new substance or material which hasn't been tested and approved in accordance with the relevant fire safety and hygiene requirements or hasn't been produced in accordance with the relevant requirements;
- ✓ To ensure completeness and integrity of the buildings and facilities, technological equipment, electricity and measuring and inspection tools, work-clothes, and protective tools and instruments; to keep a permanent monitoring over their operation and use;

To ensure the labor safety and normal working conditions of the workers, the risk reduction measures should be implemented by the project owner "Sainshand Salkhin Park" LLC. Sainshand Salkhin Park LLC should preferably employ an independent 3rd party called „Owner's Engineer" to supervise the foreseen measures to be taken during the courses of engineering and all site activities.

## GENERAL CONCLUSION

Following conclusions are made based on the results of the detailed Environmental Impact Assessment (DEIA) performed for the Sainshand wind park project to be implemented by "Sainshand Salkhin Park LLC" at the junction of the territories of Sainshand, Urgun and Altanshiree soums, Dornogobi aimag, as well as on the relevant recommendations on adverse impact mitigation and elimination measures:

1. "Sainshand Wind Park LLC" was granted the exploitation license on the land of 486.6 hectare area at the place called "Ulaantolgoin khundii" (valley), located at the junction of the territories of Sainshand, Urgun and Altanshiree soums, Dornogobi province to construct and operate a wind park. It is planned to finance the project via equity and loan capital.

2. "Sainshand Salkhin Park LLC" decided to use V110 turbines with 2.0 MW capacity manufactured by the Danish company "Vestas", which would not only be economically efficient for the construction of the wind park but also the most suitable choice for the regional extreme climatic conditions and energy production. It is planned to install 27 turbines in total.

3. In the normal mode, the wind turbine starts to operate at 3 m/sec. wind speed while the mode of its stable operation is 11.5 m/sec. The maximum wind speed at which the turbine would operate is 20 m/sec. As for the structure, the wind turbine represents the giant equipment- the rotor of 110 m diameter located at the 95m high tubular steel tower, having three blades each is 54 m in length. The turbine would operate normally in the temperature range between -20˚C-40˚C and the minimal temperature at which the turbine would operate is -30˚C.

4. All components of the wind turbine would be transported from China on trucks. The wind turbine towers would be transported for over 660 km distance from Baotou city of China to Erlian border station. All other components would be transported for 830 km distance from Tianjin city to Erlian border station. Then, the wind turbine components would be imported through the Zamyn-Uud border point and then, transported till Sainshand for 232 km distance by the existing asphalt road. Just before reaching Sainshand city, the trucks would leave the asphalt road to deliver the turbine components to the project site by the 4 km improved earth road.

5. It was calculated that an investment of USD 120.0 million is required for the implementation of the project, the wind park would annually deliver 201.6 million kWh energy.

6. In the course of the construction of the wind park, there would be modified in total 6.72 hectare land. The dust would increase in connection with earth-moving and soil-stripping works, and the traffic of heavy machineries, but it would be just a temporary impact on air quality. Besides, as a result of soil-stripping work, there would emerge certain adverse impacts like the temporary destruction of plant-cover, increase of noise and sound, etc. So, it is required to implement the recommendations on adverse impact mitigation measures reflected in this report; and to restore the project site upon the completion of the construction phase.

7. As it was preliminarily planned, the amount of 56,757.3 thousand tug is projected to be spent on the environmental protection measures for the period of first 5 years, the amount of 3,400.0 thousand tug is projected for implementing the environmental monitoring program.

8. The new package of environmental laws adopted in 2012 and the recommendations on adverse impact mitigation and elimination measures reflected in the report should be strictly adhered to, not only by the project owner but also by the local governors and the managing staffs of the soums' administration in their activities, based on the professional consultation provided by the entity/or company carrying out the DEIA.

9. We suggest to implement the Sainshand wind park considering that the recommendations on mitigating and eliminating the project's adverse environmental impacts and the measures reflected in the Environmental Management Plan are strictly adhered and timely implemented in comprehensive manner.

10. The project owner would be responsible for implementing the recommendations on the measures for mitigating and eliminating adverse environmental impacts reflected in the report as well as for the costs to be required for implementing those measures.

11. Every 5 years period, the required amendments should be introduced into this report. Besides, necessary amendments and clarifications must be introduced on every occasion when any change or alteration is made in the project's technology, capacity and land use agreement. Also, every two years, it is required to present the report to the relevant environmental auditing.

12. In the course of project operation, the measures implemented within the relevant year by the project owner towards the environmental conservation, rehabilitation and adverse impact mitigation should be summarized along with their results and presented to the local residents. Then, each year in December, above-mentioned report associated with the suggestions and proposals of the local residents and the conclusions made by the local administration, office in charge environmental issues and the local environmental inspectors should be delivered to the state administrative central organization in charge of environmental issues.

# 6 ENVIRONMENTAL MANAGEMENT PLAN

## 6.1 Purpose and scope of Environmental management plan

### 6.1.1 Purpose and scope of the plan

The main purpose of the Environmental Management Plan (EMP) of the Sainshand wind park project is to consider within the framework of the project implementation all the adverse environmental impact mitigation and elimination measures to be implemented at both the project construction and operational phases, budget the relevant expenses in the practicable way, and provide the project owner with an opportunity to fulfill its social and environmental responsibility by observing and adhering strictly to this plan.

In order to ensure/satisfy the essential purpose of the EMP, following objectives directed towards raising the social responsibility of the project owner within the extent of its financial capacity should be implemented:

1. To bring the quality and results of implementing the measures reflected in the Environmental Management Plan up to the level of the proper environmental restoration requirements;
2. To monitor the implementation of the EMP not only from the part of the project owner but also of the local residents in order to reach actual interdependent outcomes;
3. To have the project owner ready for any third-party auditing as a result of implementing the EMP in the proper manner.

### 6.1.2 Scope of the plan

Within the scope of the project operation, the EMP would cover following environmental and social welfare issues and design the measures to be necessarily implemented. These include:

- To design the measures intended for mitigating adverse impacts to potentially emerge within the framework of project implementation and calculate relevant expenses;
- To design environmental restoration and nature conservation works and calculate relevant expenses;
- To arrange the sequence and schedule of the temporary resettlement activities and calculate relevant expenses;
- To determine the policies for protecting human health and environment in risky and hazardous conditions;
- To develop the Environmental Monitoring Program, indicating the ways of its implementation and calculate relevant expenses, and
- To publicize the information on environmental restoration measures implemented by the company.

The mitigation measures would be implemented within the framework of the relevant management policy. In order to regulate or systematize its activities, the project owner should develop the internal rules and the labor safety instructions of the organization in accordance with the relevant laws currently observed in Mongolia and should strictly adhere to them in its operation.

There is a legal regulation according to which the project owner bears the responsibility for compensation for any type environmental damage resulting from the negligence of required impact mitigation measures.

### 6.1.3 Term for implementing the plan, budget

The EMP would be accomplished within the lifetime of the project. The plan would be implemented in the following manner:

1. At the construction phase of the project. The project owner would pay major attention to preventing environmental pollution and ensuring labor safety. The relevant norms and standards for mitigating the intensity of all type adverse impacts to be potentially resulting from the project would be strictly observed by the project owner at this phase.
2. At the operational phase of the project. After finishing the construction phase, the project owner starts the energy production. Simultaneously, the company will commence the implementation of the post-construction environment restoration measures. A permanent monitoring would be kept over the implementation of the activities intended to protect the environment and human health in order to protect the surrounding environment and ensure the normal operation of the wind turbines.

As it was calculated, the amount of 56,757.3 thousand tugrig in total would be required for implementing the Environmental Management Plan.

**Table 6.1. Total amount required for implementing the measures reflected in the EMP**

| No. | Package of measures to be implemented within the framework of the EMP | Total expenses calculated, thsnd tug. | Percentage in the total amount |
|---|---|---|---|
| **1. Package of works to be implemented within the framework of the Environmental protection plan** | | | |
| 1.1 | Adverse impact mitiation measures | 10,690.0 | 19 |
| 1.2 | Environmental restoration measures | 26,580.0 | 47 |
| 1.3 | Resettlement actions and relevant compensation | 9,318.7 | 16 |
| 1.4 | Plan for preventing from risks and hazards | 3,150.0 | 6 |
| 1.5 | Arranging the waste management | 1,100.0 | 2 |
| 1.6 | EMP, Repoting on its implementation to the stakeholders, discussion of the plan among the stakeholders | 2,518.6 | 4 |
| | **Sub-total** | **53,357.3** | 94.0 |
| **2. Works to be implemented within the framework of the Environmental Monitoring Program** | | | |
| 2.1 | Environmental monitoring program | 3,400.0 | 6.0 |
| **Total expenditure** | | **56,757.3** | **100.0** |

## 6.2 Environmental protection plan

### 6.2.1 Plan on adverse impact mitigation measures

In designing the adverse impact mitigation measures, the measures that are required to be necessarily implemented have been considered by each of the environmental

components. Judging from the report of the detailed environmental impact assessment, the intensity of the adverse environmental impacts to emerge potentially within the framework of the project varies from “minor” to “moderate” and there would not emerge any hazardous or destructive intensity impact. Since the impacts are usually related to the specific feature of the project as well as to the environmental conditions and geographical location of the project implementation area, the impacts are possible to be mitigated and eliminated further through the relevant impact reduction and elimination measures.

**Table 6.2. Planning of adverse impact mitigation measures**

| Prevention from adverse impacts | Expected results | Total expenditure, thsnd.tug | Responsible body | Standards and methodologies to be adhered |
|---|---|---|---|---|
| **1. AIR QUALITY** | | | | |
| The dust in the air would be increased during the construction work in connection with the disturbance of the soil-mantle and so, proper dust-suppression measures like moistening by water-spraying, etc. should be implemented. | The dust to emerge during the construction would be reduced. | 3200 | Project owner | The "Air Law" and "Air Pollution Law" of Mongolia,<br><br>MNS 0017-2-3-16:1998 (in the settled sections)<br><br>MNS 4585:2008 Air quality. General technical requirements.<br><br>The Fire safety law:<br>Provisions 16-1, 2; provisions 18-1,2; 19-1,2; provisions 20-1,2, and provisions 21-1,2,3 |
| During the construction phase, dust would be increased by the traffic of transport vehicles and so, proper dust-suppression measures like moistening by water-spraying, etc. should be implemented. | The dust arising from the roads would be reduced. | | | |
| For the purpose to reduce the smoke and soot to be emitted by transport vehicles, the repair and maintenance of machineries should be carried out regularly, in accordance with the fixed schedule. | The amount of smoke and soot emitted by transport vehicles to the air would be reduced. | Operational expenditures | | |
| During the construction phase, proper noise-stifling measures should be taken for equipment producing excessive noise or sound | The noise produced within the construction site would be reduced to a certain extent. | - | Project owner | Noise restrictions in different working environments, 2007.04.30<br>MNS 4585:2007 |
| **2. LAND SURFACE AND ENTRAILS OF THE EARTH** | | | | |
| The area affected and damaged during the installation of the wind turbines should be cleaned after finishing the construction and then, proper land surface rehabilitation work should be implemented. | The areas around the land turbines would be cleaned and restored. | Reflected in 6.2.2 | Project owner | The Land Law: Provisions 50-1.1,1.2 and 55-2, 3,4,5;<br><br>"The Environmental protection law": Provision 25-2;<br><br>"The Law on the Entrails of the Earth": |
| Monitor the construction work in order not to affect and damage a land that is not | Pulverization of land surface and decline of fertile soil by travelling of | - | All workers | |

| Prevention from adverse impacts | Expected results | Total expenditure, thsnd.tug | Responsible body | Standards and methodologies to be adhered |
|---|---|---|---|---|
| reflected in the project design. | transport vehicles over healthy areas with no designated roads, would be reduced. | | | Provisions 41-1, 2, 3, 4; |
| Substation area will be surrounded with protective fences in order to ensure the safety of humans, livestock and wild animals. | The land use and organization would be improved. | Should be reflected in the construction plan | Project owner | |
| **3. SOIL-MANTLE** | | | | |
| The stripped off fertile soil would be covered with enamel-paper to protect from wind-blow. | The reserve of fertile soil to be used in the reinstatement would be stored. | 250.0 | Project owner | The Land Law: Article 50, Provision 50.1.1. |
| During the construction phase, to remove any waste containing petroleum-products in an environmentally-favorable way, and a polluted soil should be cleaned off on every occasion. | The pollution of soil by combustible and lubricating materials would be reduced. | Should be reflected in the construction plan | | |
| After the construction work finishes, the surrounding area should be reinstated, shaped and covered with the original soil layer. | The surrounding area would be protected. | Should be reflected in the construction plan | | |
| The permanently used road should be improved and the parking area (150 $m^2$) should be covered with asphalt. | The soil would be prevented from pollution. | Reflected in 6.2.2 | | |
| **4. SURFACE AND GROUND WATERS** | | | | |
| A location of a new well and its water reserve should be first identified and then, an exploitation permit should be requested from the relevant local organization. | The laws and regulations would be observed. | - | Project owner | It is required to satisfy the Mongolian standard MNS 4943-2011 and the World Bank's criteria. |
| A pit for collecting domestic waste water should be properly sealed to prevent from infiltration into the ground or a tank with a | The entrails of the earth would be prevented from pollution. | 5,000.0 | | The Water law and the Law on water pollution charge; |

| Prevention from adverse impacts | Expected results | Total expenditure, thsnd.tug | Responsible body | Standards and methodologies to be adhered |
|---|---|---|---|---|
| certain capacity should be installed underground and used for above purpose. | | | | "Water environment quality indexes" MNS 4586:1998. "Protection of Underground water from Pollution" MNS 3342:1982. |
| The collected waste liquid should be transported and supplied to the Sainshand water treatment facility in accordance with a fixed schedule. | | 240.0 | | |
| **5. PLANT-COVER** | | | | |
| The scanty vegetation underneath the transmission lines should be left untouched. | The reserve for further soil rehabilitation work would be created. | - | | MNS 5918:2008 "Vegetating the damaged lands; General technical requirements" |
| The surrounding area should be enhanced by building a green belt upon the completion of the construction phase. | The surrounding environment would be protected. | Reflected in 6.2.2 | | |
| **6. FAUNA** | | | | |
| Transmission line will be equipped with bird-scarers. | Probability of being killed by crashing against the electricity transmission lines would be reduced. | - | Administrative and management department | "The Law on Fauna" Provision 6.1.7: Wild animals should be prevented from being affected and killed in the course of industrial and economic activities. |
| To participate in local wildlife protection activities and support environmental researches and studies, which are related to the wind park project. | The habitat of wild animals would be restored and the relevant studies supported. | 2,000.0 | Project owner | |
| **7. SOCIO-ECONOMY** | | | | |
| To deliver the notice on necessity of freeing the project area temporarily to certain herders' households. | Adverse impacts on the herders' households would be reduced. | - | Project owner | |
| To provide the herders' households freeing the pastures with a relevant compensation. | | Reflected in 6.2.3 | | |
| **Total amount of expenditure on adverse impact mitigation measures** | | **10,690.0** | | |

### 6.2.2 Plan on environmental restoration measures

**Environmental restoration measures.** Within the framework of the construction of the wind park, there would be installed 27 wind turbines, and the 6.72 hectare area would be damaged in the course of installation of the turbines. Upon the completion of the construction operations, the damaged land in the surroundings would be restored by enhancing the conditions of the surrounding area and building up a green belt within its boundary. The intentionally built up green belt would cover at least 2.5 thousand $m^2$ area and would be under the routine care and maintenance. The area of the green belt is calculated so, that an area of 35 $m^2$ is allotted per one worker.

**Table 6.3. Plan on environmental restoration measures**

| No. | Works to be performed | Term of performing | Expected results |
|---|---|---|---|
| 1 | The area surrounding the foundation of the turbine would be backfilled, shaped and covered with original soil layers. | In the course of turbine installation | The damaged land would be cleaned and restored. |
| 2 | When finishing the construction works, to dismantle the equipment and prepare them for transportation. | After the project construction phase | |
| 3 | To dismantle the temporary dwellings of workers and the parked equipment, clean out the wastes and garbage. | | |
| 4 | To build up a green belt around the buildings and facilities. | | The biological rehabilitation measures would be implemented. |
| 5 | To take regular care of the built up green belt. | Every year | |

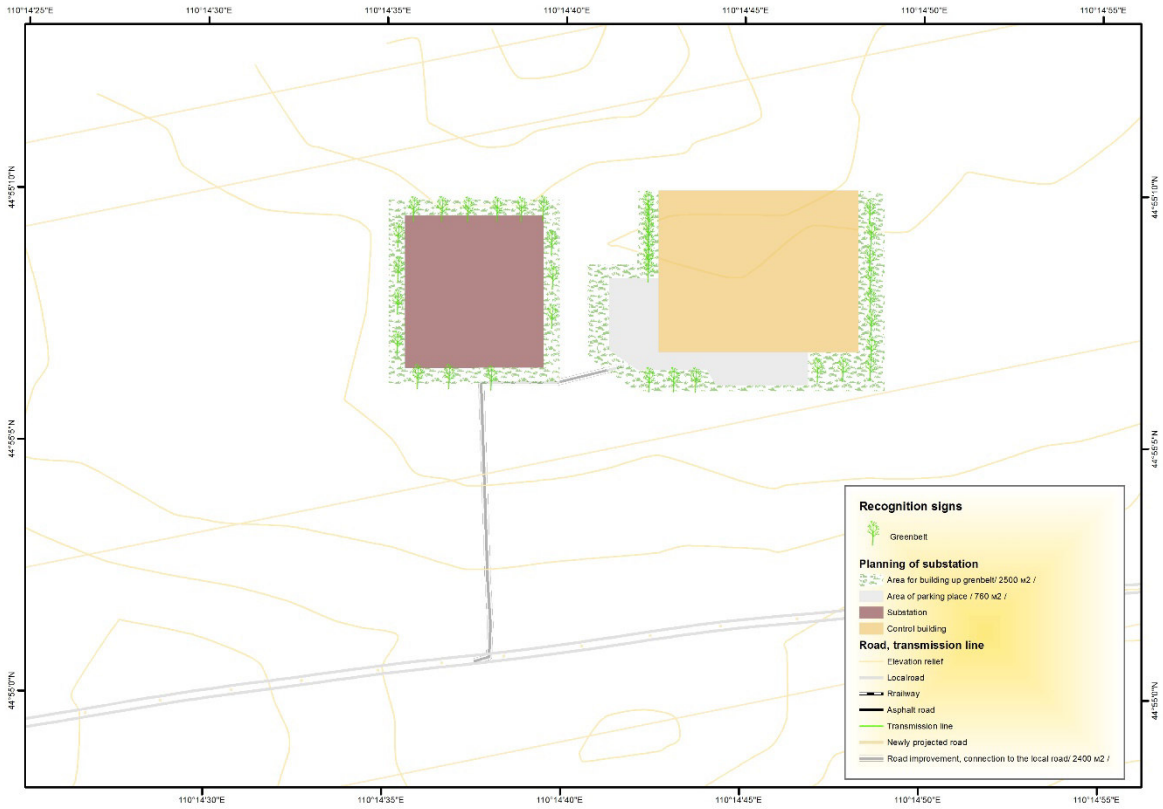



**Figure 6.1. Post-construction environment restoration plan**

**Budget for restoration measures.** An amount of 26.6 million tugrig in total would be required for the complete restoration of the land damaged under the impact of the project activities, and out of this amount, 32.9% would be spent on constructing an open auto-parking area in front of the administrative building /or control building/, while 31.9%; 13.5%, and 21.6% would be spent respectively on back-filling, leveling, shaping and covering the damaged area with the fertile soils; connecting the local road to the wind park road, and building and enhancing the green belt.

**Table 6.4. Calculation of restoration cost**

| Works to be carried out | Measuring unit | Volume of work | Total expenses | |
|---|---|---|---|---|
| | | | thsnd.tug. | % |
| Back-filling, leveling and shaping the damaged land by covering with the fertile soil | $m^2$ | 5660 | 8,490.0 | 31.9 |
| Road restoration, connection of the wind park road to the local asphalt road | $m^2$ | 2400 | 3,600.0 | 13.5 |
| Construction of an auto-parking area | $m^2$ | 760 | 8,740.0 | 32.9 |
| Building up a green belt | $m^2$ | 2500 | 2,000.0 | 7.5 |
| Reguar maintenance of the green belt | $m^2$ | 2500 | 3,750.0 | 14.1 |
| **Environmental restoration expenses, thsnd.tug.** | | | **26 580.0** | **100.0** |

### 6.2.3 Plan on resettlement and relevant compensation

The three herders households from Sainshand soum permanently move and camp around the project implementation site, and use the pastureland in the surroundings as the summer pastures. If one of these households is located outside the project area, the second one is – at its boundary and the third household is located within the wind turbine installation field. So, prior to commencing the construction of the project, it would be required to completely free the project site.

Since there is no permanently exploited immovable estate within the project area, it would be required to free the land just from the use of pasture. In order to accomplish this work, the herders households using the summer pastures should be preliminarily notified on the necessity not to allow their livestock into the project area during the construction, relevant negotiations should be made with them and based on those negotiations, an agreement on mutual understanding should be established with them.

Out of the three herders households registered as the pasture-occupant within the project area, one household permanently occupies and moves around the project site, while the two others use the pastures just in the summers. So, the duration of pastureland use during the project's construction phase is calculated by 730 days for the household of M.Erdenemunkh who use the pastures within the project area around the four seasons of the year, while this period is fixed as 360 days for the two other households, namely for the households of Ch.Delgersaikhan and S.Batnyam. In the calculation, the daily pay for livestock breeding is determined based on the minimum wage rate.

**Table 6.5. Amount of compensation for freeing summer pastures**

| Head of impact-affected household | Number of famly members | Duration of pasture-freeing, days | Daily pay for livestock breeding, person/day | Compensation for pasture-freeing, thousand.tug. |
|---|---|---|---|---|
| Ch.Delgersaikhan | 3 | 360 | 6,426.7 | 2,313.6 |
| M.Erdenemunkh | 3 | 730 | 6,426.7 | 4,691.5 |
| S.Batnyam | 4 | 360 | 6,426.7 | 2,313.6 |
| **Total amount of compensation for pasture-freeing** | | | | **9,318.7** |

Under the agreement, the herders would be temporarily obliged not to allow their livestock to get into and graze within the project area especially during the installation of the wind turbines while the project owner would provide a single time compensation for the herders for freeing temporarily the pastures. Thus, the compensations would be granted to the three concretely-identified households permanently moving around the project area and using the pastures within its impact zone. In total, the amount of the compensations to be provided to them would make up 9.3 million tugrig.

### 6.2.4 Plan on measures for protecting historical and cultural heritages

Through the impact assessment, it was identified that there were neither historical and cultural heritage or monuments nor archeological and paleontological findings in the vicinity of the project implementation area, and so, it would not be required to budget any expense on measures for protecting such heritage and findings.

### 6.2.5 Management plan for preventing from risks

**Prevention management.** Most of potential risks that might emerge during the operation of the project are likely to be related to the technological operations, and therefore, it would be required to thoroughly consider any possible risk or hazard, regularize the internal monitoring, keep ready under hands a sufficient reserve of the materials and rescue equipment necessary for implementing the emergency measures immediately in case of any accident or risk, provide the workers with the labor safety and operational security instructions and involve them regularly in the relevant trainings. Furthermore, some kind of unpredicted risks or emergency (for instance, fire at the top of turbines, etc.) might be resulted from unforeseen natural disasters including thunder, lightning, etc. So, the lightning protection system of the turbines should be installed correctly and thoroughly inspected at regular time intervals.

**Budget for preventing from risks.** According to the relevant calculation, the amount of 3,150.0 thousand tugrig would be required for providing the conditions necessary for preventing from potential risks and hazards that might emerge during the project operation. This amount should be procured from the beginning of the construction phase of the project.

**Table 6.6. Expenses on risk prevention and protection measures**

| No. | Measures to be implemented | Term | Expense, thsnd.tug. |
|---|---|---|---|
| 1 | To conduct a thorough check-up over the completeness and integrity of fastening tools and equipment during the transportation | Beginning from the construction phase | Operational expenditures |
| | To perform the strengthening and assembling works in strict accordance with the relevant standards during the installation of the wind turbines and erecting other buildings and facilities. | | |
| 2 | To provide the workers with all necessary work clothes and labor safety tools or equipment. | Beginning from the project operation phase | 1,250.0 |
| 3 | To keep ready under hands the first aid medical instruments, medicines and preparations to be required in case of potential accident or risk. | Beginning from the construction phase | 500.0 |
| 4 | To organize the labor safety and safe operational trainings regularly among the workers. | During the operation phase | 800.0 |
| 5 | To organize the training on fire-protection measures and provide the workers with the instructions on how to act in case of fire emergency in order to render primary medical aid for others as well as for themselves. | | |
| 6 | To prevent from fire risks, to keep ready under hands a set of fire-fighting tools to be required in case of fire. | Beginning from the construction phase | 600.0 |
| **Total expenses on measures for preventing from potential risks, thousand tugrig** | | | **3 150.0** |

### 6.2.6 Waste Management Plan

The majority of the waste management related issues is identified in the section on adverse impact mitigation measures of the present DEIA. The domestic solid and liquid

wastes would not be buried underground, but are planned to be regularly removed at the preliminarily-fixed time intervals.

**Table 6.7. Amount of wastes to be created from project activities, Classification of wastes**

| | Type of waste | Code | Hazard rating | Measuring unit | Exp. amount to be created within 5 years |
|---|---|---|---|---|---|
| Domestic | Food remnants | Т 03 99 | | thsnd.tons | 11.8 |
| | Domestic waste water | | | thsnd.tons | 3,773.7 |
| | Solid domestic wastes | | | thsnd.tons | 47.4 |
| | Other domestic wastes | С 01 99 | minor | thsnd.tons | 7.1 |
| Industrial | Hydraulic oil wastes | М 01 | minor | - | - |
| | Waste packaging materials | О 01 | minor | - | - |
| | Waste concrete, bricks, polishing plates and ceramics | П 01 | moderate | - | -- |
| | Other construction wastes | П 08 | strong | - | - |
| | Obsolete machineries, wastes to emerge as a result of their repair or disassembling. | Ө 01 | minor | - | - |
| **Total solid wastes (thsnd.tons)** | | | | | |
| **Total liquid wastes (thsnd.m$^3$)** | | | | | **3,773.7** |

In total, the amount of 1,100.0 thousand tugrig would be required for temporary storage, removal and demolishment of the construction and domestic wastes to emerge during the construction of the wind park as well as for cleaning up the polluted area.

**Table 6.8. Expenses on waste management-related measures**

| Works to be performed | Expense to be required, thsnd.tug. | Laws, standards and methodologies to be adhered |
|---|---|---|
| During the construction phase, solid wastes would be first temporarily stored in a specially-designed sealed vessel and then, removed to the rubbish dump approved by the relevant hygiene and sanitation inspection organization. | 600.0 | "Waste law";<br>"Hygiene law": provisions 7-4, 5; 55-1;<br>"Law on domestic and industrial wastes": provisions 10-1, 2, 3; article 11, and provision 12-2;<br>MNS 5344:2011. "General requirements for transportation of domestic wastes" |
| During the construction phase, necessary disinfection or decontamination measures would be taken at the workers latrines and waste water pits. | 500.0 | |
| **Expense on waste removal, thousand tug.** | **1,100.0** | |

### 6.2.7 **Management and organizational plan**

In the structure of operational arrangement of the wind park project, the works intended to ensure the labor safety and protect the health of workers should be included in the job responsibility of the established managing staffs including the engineers, foremen of operational units, etc. As a result of including these issues in the organizational structure, it would not be necessary to budget additional expenses.

### 6.2.8 Reporting and discussion among the stakeholders and other interested parties

**Reporting and discussion among stakeholders and interested parties**. Since the Sainshand wind park project is going to be implemented in Sainshand soum of Dornogobi aimag, the local authorities and residents of the soum would be the major stakeholders and parties interested in the report and project-related information. So, the project information to be delivered to them should be prepared, presented and discussed in a form that meets their interests.

**Expense on presentation and discussion of the EMP among the local residents.**

The presentation and discussion of the report on the implementation of the project's Environmental Management Plan would be organized once a year and the amount of 2,518.6 thousand tugrig would be required for organizing 4 meetings among the stakeholders and interested parties. The first year discussion of the report would be organized within the framework of the Detailed Environmental Impact Assessment and so, the meetings to be held among the stakeholders and interested parties are planned for the following 4 years.

**Table 6.9. Expenses on the presentation and discussion of the report on the implementation of the Environmental Management Plan**

| No. | Works to be performed | Measuring unit | Quantity | Unit expense, tug. | Total expense, thsnd.tug. |
|---|---|---|---|---|---|
| 1 | Reporting the performance of the EMP | how many times | 4 | 100,000.0 | 400.0 |
| 2 | Spreading the information about meeting, including the date | how many times | 4 | 15,000.0 | 60.0 |
| 3 | Organizing of the meeting | how many times | 4 | 250,000.0 | 1,000.0 |
| 4 | Per diem for participants in the meeting | person/day | 12 | 40,000.0 | 480.0 |
| 5 | Diesel | L | 200 | 1,960.0 | 392.0 |
| 6 | Other expense | % | 8 | | 186.6 |
| **Total expenses on the report presentation and discussion works, thousand.tug.** | | | | | **2,518.6** |

## 6.3 Environmental monitoring program

In the course of the wind park project implementation, the environmental monitoring efforts would be implemented according to the terms and methodology reflected in this program. The environmental monitoring program would be directed towards enhancing the outcomes of adverse impact prevention and nature conservation measures and consequently, a thorough study of environmental monitoring indexes of the relevant year would be of specific importance for further refining the environmental protection management plan.

In accordance with the Mongolian "Environmental protection law", "Law on Environmental impact assessment" and other relevant laws and regulations, "Sainshand Salkhin Park" LLC would be responsible for covering the expenses on environmental monitoring works that would be implemented by the accredited laboratories in accordance with the approved methodologies.

### 6.3.1 Indexes for conducting the monitoring

**Air quality.** During the construction phase of the project, it would be required to keep a permanent control over the dust to arise within the project site and its vicinities as well as over the content of the air polluting substances emitted from transport vehicles.

**Water pollution.** In the course of the project construction phase, it is required to keep a proper control in order to prevent soil and water pollution with domestic wastes, waste waters, combustible and lubricating materials. Thus, in order to thoroughly identify the extent of soil and water pollution caused by above impacts, it would be required to locate correctly the temporary waste collection points and keep a permanent monitoring over their exploitation.

**Soil damage and pollution.** The "Standards on fertile soil stripping and storage" MNS 5916:2008 would be observed in order to ensure that the thickness of stripped fertile topsoil and its storage conditions meet the relevant standard requirements. Within the framework of the project operation, the soil in the surrounding area of the warehouse for storing fuel, diesel and spare parts might be polluted and therefore, the permanent control should be kept over this area in order not to expand the spread of pollution. In addition, a proper attention should be allotted in order to prevent from pollution of the soil by domestic wastes as well as from emergence of surface flows.

**Environmental restoration of surroundings.** The green belt to be built upon the completion of the project construction phase should meet the concrete criteria. For instance, the standard MNS5917:2008 should be adhered in shaping a damaged land by the technical method and the standard MNS 5918:2008 - in vegetating works.

### 6.3.2 Monitoring program

In the course of the project operation, "Sainshand Salkhin Park" LLC would implement the Environmental Monitoring Program for the purpose to identify on every occasion, mitigate and eliminate any type of adverse environmental impact that might be potentially resulted from the project operation. The amount of 3,400.0 thousand tugrig would be required for implementing the monitoring program. Out of the total amount required for implementing the monitoring program, 29.4% are allotted to the human health protection measures, while the rest 70.6% - to the monitoring works directed towards mitigating the adverse impacts.

**Table 6.10. Environmental Monitoring Program**

| Criteria for conducting the monitoring | Location of monitoring points | Term and frequency | Expense, thsnd.tug. | Standards, methods and methodologies to be adhered |
|---|---|---|---|---|
| **1. AIR QAULITY** | | | | |
| **Monitoring over the dust in the air:**<br>Total amount of dust $PM_{2.5}$, $PM_{10}$<br>Downfall of dust<br><br>**Dotted-source of pollution:**<br>$SO_2$, $NO_x$ | 1. To take a sample from 2 dust-producing sources and analyze;<br>2. To observe the dust-producing sections of the roads and work sites, to monitor the dust-suppression measures implemented at those sections. | Twice a year<br><br>Regularly in the course of project implementation | 500.0 | MNS 4585-98. Atmosphere quality index. General requirements.<br>MNS 12.055-91. Identification of dust amount at workplace. |
| 1 **LAND SURFACE** | | | | |
| **Damage of land surface:**<br>To fix monitoring points to measure the damaged sections within the project area. | To make the measurements and recording at each damaged section within the project area; | In the course of project construction phase | 600.0 | To conduct field measurements and observations, to synthesize the data acquired through above methods by inserting them into the relevant geographic data fund. |
| **3. SOIL MANTLE** | | | | |
| Storage of the fertile soil layers, height and inclination of the fertile soil stockpiles. | Stockpiles of fertile soils. | Twice a year<br>(in summer & fall) | 600.0 | The Hygiene Law: article 7, provisions 7.4 and 7.5.<br><br>Sampling would be performed in accordance with:<br>MNS:3297:1991<br>MNS 3473:1983, and<br>MNS 4288:1995 |
| Study of soils' chemical and chemical properties conducted on the basis of the complete soil profiles. | Location of soil-sampling points within the project area. | Twice a year<br>(in spring & fall) | | |
| Study and measurement of soil erosion, damage and surface alteration. | Eroded and damaged areas the surface appearance of which was altered under the impact of the project activities. | Twice a year<br>(in spring & fall) | | |

| | | | | |
|---|---|---|---|---|
| **4. PLANT-COVER** | | | | |
| Number of plant species, vegetation coverage, absolute and average height of plants (cm), growth (center/hectare). | Within the area involved in the green belt. | Once a year during the project implementation (between July 20 and August 20, or during the blossom of plant mass) | 1,000.0 | The geo botanical recording and notes of the plant-cover field study. |
| Measures for controlling the formation of plant-covers and increasing the vegetation coverage. | | Once a year | 200.0 | The geo botanical recording and notes of the plant-cover field study. |
| **5. HUMAN HEALTH MONITORING** | | | | |
| Involvement of the workers in the regular medical examination, monitoring over the observation of the labor safety and safe operational rules and regulations. | Monitoring at the workplace, Implementation of the Internal rules | Once a year | 500.0 | Workplace environment and hygiene requirements. MNS 4990:2000 |
| **Total expenses to be required for implementing the Environmental monitoring program, thsnd.tug.** | | | **3,400.0** | |

## 6.4 Operational budget for implementing the relevant year's plan

An amount of 10.6 million tugrig would be required for implementing the environmental conservation measures for the first year of project implementation and this expenditure would be wholly related to the construction phase. Out of the total expenditure on implementing the Environmental Management Plan for the first year, the compensation for temporarily relocating the herders accounts for 87.9%.

As for the first year of project implementation, the construction works would continue throughout the whole period while the time for implementing the measures for mitigating adverse environmental impacts and restoring the environment would not yet have started.

**Table 6.11. Total expense on environmental protection measures for the first year of project implementation**

| No. | Works to be performed | Calculated expenditure | |
|---|---|---|---|
| | | thsnd.tug. | % |
| 1 | Implementation of the Environmental Monitoring Program | 680.0 | 6.4 |
| 2 | Restoration of the surrounding environment | - | - |
| 3 | Discussion of the report | - | |
| 4 | Implementation of waste management | 220.0 | 2.1 |
| 5 | Protection and prevention from risks and hazards | 380.0 | 3.6 |
| 6 | Compensation for land-freeing | 9,318.7 | 87.9 |
| | Adverse impact mitigation measures | - | - |
| **Environmental protection expense for the first year, thsnd.tug.** | | **10,598.7** | **100.0** |

Judging from above table, for the first year of project implementation, the project owner would be required to procure the amount of 10.6 million tugrig for mitigating the adverse environmental impacts.

## REFERENCE MATERIALS


1. Norms and rules for computing the hydrographic indexes BNbD 2.01.14-86.
2. Meteorological data from the Office of Hydrology, Meteorology and Environment ecology, 2003-2013
3. Report on the Environmental impact assessment, “Baigali- Ecology” LLC, 2009
4. Mehtodology on Environmental impact assessment, 2014
5. R.Mijiddorj, Sh.Bayasgalan, Ts.Naranchuluun, and B.Altantsetseg. Methodological questions of Environmental assessment. UB, 2002
6. National Atlas of Mongolia, 2009
7. V.I. Grubov. Reference on the tubular plants of Mongolia, 1971
8. G.Davaa. Surface waters of Mongolia, Ulaanbaatar, 1999
9. N.Batsukh. Hydrogeology. Ulaanbaatar, 2012
10. N.Batsukh. Field hydrogeology. Ulaanbaatar, 2008
11. A.G. Bannikov. Mammals of Mongolian People’s Republic. Publishing house under the Academy of Sciences, USSR. Moscow. 1954
12. Environmental and Social impact assessment for the Salkhit Uul wind park, Mongolia. Prepared by Black & Veatch for Newcom group. 2008.
13. Physical geography of Mongolia, Edited by: Academician Sh.Tsegmid. Ulaanbaatar,1969
14. S.S Korjuev. Geomorphological map of Mongolia. Scale 1:3 000 000. National Atlas of Mongolia. Moscow-Ulaanbaatar, 1990
15. P.Khukhuu. Geophysico-hydrogeological conditions of the Sainshand hydrogeological basin. Ulaanbaatar, 2008
16. Geology of Mongolian People’s Republic. Volume I. Stratigraphy, 1973
17. Geology of Mongolian People’s Republic. Volume II. Tectonics, 1977
18. G.Badarch. Tectonics map of Mongolia. Scale: 1:3 000 000. National Atlas of Mongolia, Moscow-Ulaanbaatar, 1990
19. I.Baljinnyam. Map of Seismic regional sub-divisions. Scale: 1:6000000. National Atlas of Mongolia, Moscow-Ulaanbaatar, 1990
20. Perlee, Ser-Odjav, 1957 - Kh. Perlee and N.Ser-Odjav. Traces of ancient humans found in Dornogobi aimag //Science & Technology. No.5/6, Ulaanbaatar.
21. Klyashtorny, 1980 – S.G. Klyashtorny. Epigraphic works in Mongolia // Archeological findings of 1979. Moscow.
22. Ser-Odjav, 1982 - N. Ser-Odjav. Report on travelling to Dornogobi aimag for checking the authenticity of information. Manuscript Fund, Archeological Institute under the Mongolian Academy of Sciences /MAS/, Ulaanbaatar.
23. Erdenebat, 2001 - U.Erdenebat. Meaning of Mongolian cave archeological study. // Studia Museologica. Tomus I (IV), Fasc.3, Ulaanbaatar, 18-24.
24. Socio-economic compilation of Dorongobi aimag, Dec. 2012.