# LEONA WIND POWER PROJECT

# REPUBLIC OF SENEGAL

# Environmental and Social Impact Assessment

## Executive Summary

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## Introduction

This Environmental and Social Impact Assessment (ESIA) is for the proposed Leona Wind Power Project (hereafter the 'Project') in the Republic of Senegal and has been prepared by Dar Al-Handasah Consultants (Shair and Partners – DAHC), on the instruction of the Leona Wind SURL (hereafter the 'Project Company'). This ESIA has been prepared as part of the Environmental Impact Assessment (EIA) process stipulated under Senegalese Law 01/2001 and internationally recognised guidance and standards as adopted by the World Bank and International Finance Corporation (IFC). It is intended to identify, predict, evaluate and mitigate the biophysical, social and other relevant significant effects of the project, prior to major decisions being taken and commitments made in respect of the implementation of the project.

## Project Description

*Need for the Project*

The Republic of Senegal has seen a significant increase in demand for electricity over recent years. This increase in demand, coupled with an aging and limited electricity generation infrastructure, has led to increasing power outages and other supply problems. The Senegalese electrical generation base is currently reliant upon a combination of oil, diesel and gas powered stations (380 Mega Watts (MW)), and the import of hydroelectric power from the Manantali dam in Mali (60MW).

In response to the growing demand, the aging infrastructure and the high cost of oil-based generation, the Senegalese Government has taken the decision to encourage the development of renewable energy sources. Through Public Private Partnership (PPP) investment, the Project Company are proposing to develop an onshore wind farm with an installed capacity of up to 50MW. The final decision on the size of the project will depend on the condition of the distribution network run by SENELEC and its capacity to absorb wind generated electricity.

*Overview of the Project*

The proposed Project comprises three main components:

- Wind farm, including:
  - Wind turbines and their foundations and turbine assembly platforms;
  - Internal access roads; and
  - Local transmission grid.
- Local Substation; and

- Overhead Transmission Line.

In order to cover the possible range of turbines in terms of numbers and heights (36 to 50MW total installed capacity from wind turbines of 2 MW to 3 MW each) and to reflect the potential impacts of these, two separate wind farm scenarios were selected by the Project Company to be evaluated by the ESIA:

- Scenario 1: a wind farm consisting of 12 Vestas V112 – 3.0 MW turbines, with a combined installed capacity of 36MW per year.
- Scenario 2: a wind farm consisting of 25 Gamesa G97 – 2.0 MW turbines with a combined installed capacity of 50MW per year.

It is normal for the final layout of the wind farm components, including the specific location of the individual wind turbines, to be established using an iterative process at the detailed design and planning phase and after the appointment of the Engineering, Procurement and Construction (EPC) Contractor on a competitive tender basis. For the purposes of this ESIA, the two proposed scenarios provide a maximum and minimum range of possible impacts from a physical, environmental and social perspective over the entire project area. These two scenarios make it possible to avoid, limit and/or mitigate potential environmental and social impacts arising as a result of the project in accordance with Senegalese law and international standards.

Figures A and B below show the two evaluated configurations:

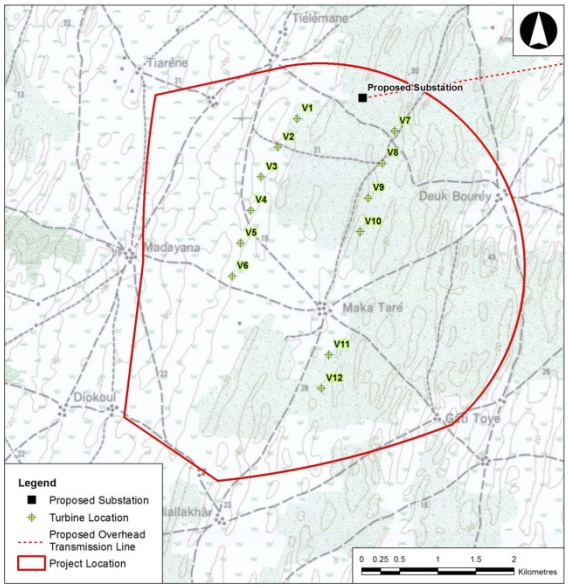


**Figure A: Scenario 1 Layout**

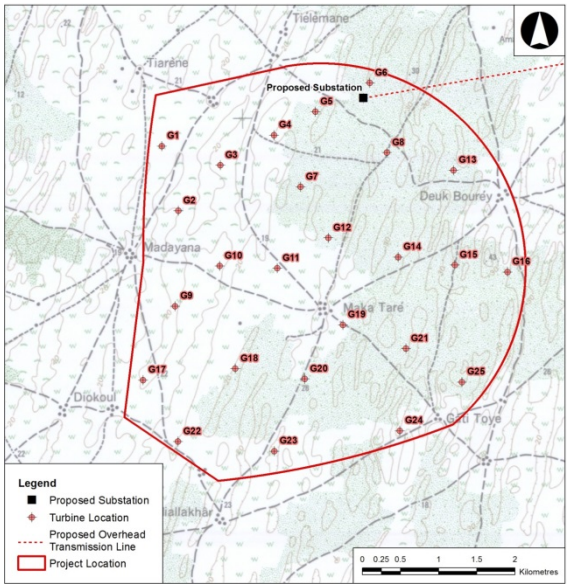


**Figure B: Scenario 2 Layout**

The primary parcel of land to be utilised by the Project (hereafter the 'Study Area') is located approximately 200km north of Dakar, and approximately 26km south-east of St Louis. The Study Area falls within the following administrative units:

- Province of Louga:
    - Communauté Rurale (CR) of Leona;
    - CR of Potou; and
    - CR of Sakal
- Province of St Louis:
    - CR of NDiebene Gandjol; and
    - CR of Gandon.

The wind farm is delimited by the villages of Ndiallakhar, Diokoul, Madayana, Tiarene Peulh, Tiarene Sarr Tielemane, Deuk Bourey, Gati Toye 2. A further village, Make Tare, is situated at the centre of the Study Area. The site was chosen from a study of five pre-selected sites based on a number of factors, including wind patterns, connection to the national electricity network, logistics, and a number of other site characteristics, e.g. topography.

**Regulatory Framework**

ESIAs in Senegal are governed by the Environmental Code and its associated decrees. The principal components of the key National legislation are outlined in:

- The constitution of 22 January 2001 Under Article 8 which includes the right of each individual to have a clean environment; and
- Law 01/2001 of 15 January 2001 which contains the Environmental Code, and Decree Number 282/2001 of 12 April 2001 which relates to the application of the Environmental Code.

The 'Direction of Environment and Classified Establishments (DEEC)', tied to the Ministry of Environment and Protection of Nature, is responsible for the implementation of environmental policy in Senegal and the approval and monitoring of environmental assessments with the support of the Technical Committee (TC). The TC is a regional body established under the principles of devolution and decentralisation of Government administration. For this project, the regional division 'DEEC Louga' is involved.

Other institutions and services are also affected by the construction of the wind farm Leona. These include, but are not limited to:

- Local authorities (Regional Council of Louga, Rural Communities of Leona, Gandon and Sakal);
- Regional Technical Services from Land Use Planning Department;

- Civil Protection , Rural Development, Livestock , Water and Forest, Support for Local Development , Hydraulics, Territorial Administration , Property management, etc.
- Civil Society; and
- National Electricity Board of Senegal (SENELEC)

*Applicable International Standards*

International standards that have been applied include:

- 2012 IFC's Performance Standards (PS), in particular:
    - PS1 - Assessment and Management of Environmental and Social Risks Impacts;
    - PS2 - Labour and Working Conditions;
    - PS3 - Resource efficiency and pollution abatement;
    - PS4 - Community Health, Safety and Security;
    - PS5 - Land Acquisition and Involuntary Resettlement;
    - PS6 - Biodiversity Conservation and Sustainable Natural Resource Management; and
    - PS8 - Indigenous Peoples
- The Operational Policies (OP) of the World Bank:
    - Operational Policy 4.01- Environmental Assessment;
    - Operational Policy 4.04- Natural Habitats; and
    - Operational Policy 4.12- Involuntary Resettlement
- The Equator Principles

In addition, the guidelines of the World Bank Group (General Environmental, Health and Safety) will also apply:

- General Environmental, Health and Safety
- Sector guidelines for:
    - Wind Energy
    - Electricity power transmission and distribution

IFC categorises projects to determine the level of environmental and social assessment that will be required. The proposed Project is most likely to fall under Category B. That is a project "with potential limited adverse social or environmental impacts that are few in number, site-specific, largely reversible, and readily addressed through mitigation measures".

**Existing Environmental and Social Conditions**

*Climate*

Senegal lies in the semiarid region of the Sahel and has two distinct seasons, the dry season and the wet season. The dry season typically occurs between November and May, and the wet season between June and October. The prevailing wind direction is North-North Westerly, with wind speeds in proximity to the Site recorded at an average wind speed of 6.4m/s at 60m height.

*Topography and Land Form*

The Site is located in an area of low relief and is characterised by a series of NE-SW trending sand dunes with ridge and trough features.

The dunes are fairly uniform in nature, with crests typically between 25 to 30 metres high and have a relatively narrow (approximately 100m to 200m) undulating plateau. They are separated by low wide interdunal zones (referred to as the interdunal depressions) with flat bottoms. The maximum elevation across the Study Area is approximately 60m asl.

*Soil*

The soil type at the site is 'Dior' which is very nutrient poor and results in low crop yields. It is a ferruginous soil with 92% sand and approximately 0.4% organic matter and is extremely poor in water-holding capacity (moisture content 0.08cm3). It is suitable for rainfed crops such as groundnuts, millet and niébé which are widely grown at the Site. Dior soil has a weak structure, a very thin organic layer (if present at all) and generally supports a weak canopy cover. It is therefore highly vulnerable to both gully and eolian erosion. Gully erosion is apparent at a number of locations on the dune slopes. These areas will be avoided during the micro-siting of the individual wind turbines.

*Water Resources and Hydrogeology*

Surface water flow and flooding is considered extremely unlikely. There are no permanent surface water features within the Project Location or immediate surrounds. In dune areas the sandy soils drain rapidly and permit no accumulation of surface water. Some ponding does occur after rain events in some inter-dunal depressions where soils may have a higher

clay fraction and water tables may be relatively high. Similarly, the surface drainage network is only weakly defined with little evidence of water channelling outside of the gullies on the high risk dune slopes.

Groundwater is used by potentially affected communities as a source of both potable and non-potable water. Non potable uses include; irrigation, animal watering, construction etc. The Project team inspected a number of wells in January 2012 when the average depth of the water table was approximately 10m below ground level. According to the communities these were fairly typical levels for the start of the dry season. Discussions with the St Louis Hydrology Department confirm there is no evidence that the Study Area experiences serious groundwater quality or reliability problems at present although there is some suggestion that saline intrusion is an issue nearer the coast.

*Ecology*

The natural vegetation in this part of the ecosystem is a grassland steppe comprising a mosaic structure in which woodlands and thickets alternate with denuded areas and grassland, with interspersed temporary ponds (during the rainy season). Overall, the site is heavily anthropized. The communities practice shifting cultivation with short fallow periods of 2 to 3 years. Agricultural yields are low in this part of the region, which in some areas is degraded. The largest concentration of trees and shrubs is located in and around the villages.

The bird surveys undertaken identified a total of 136 species within the Study Area: 103 resident species, 8 regional migrants and 27 Palearctic migrants. Palearctic migrant species were not observed during the surveys or reported in discussions with community leaders in concentrations representative of the major migratory route. In addition, two bat species have also been observed in the Study Area. No other wildlife of conservation value was observed in the Study Area or identified during the public consultations.

*Noise and Air Quality*

There are very sources of emissions that could affect air quality in the Study Area. Existing emission sources are insignificant in scale to be of cause for concern. The three main existing sources of emissions are: dust storms, field burning (not widely practiced by residents) and the use of firewood in small-scale processes such as cooking. There are very few emissions generated from mobile sources (vehicles). Internal roads handle fewer than 10 vehicles per day, and the nearest main road is 10 km from the Study Area.

Background noise in the Study Area is taken to be equivalent to a quiet rural area, in the order of 35 dBA or less. The Project Location is entirely rural in nature; there is little

vehicular traffic within the Study Area (anticipated at <10 vpd on all tracks) only isolated use of equipment and individual construction sites. Even aircraft noise is very rare and restricted to aircraft passing high overhead.

*Socio-Economic Context*

A detailed socio-economic survey was conducted for all households in the Study Area. The survey, conducted in October 2012, found that there are 203 households and a population of approximately 1848 (based on the 201 households surveyed) in the Study Area. The gender distribution across the Study Area is equal (50/50 male / female).

Land use in the Study Area is dominated by agriculture and pastoralism with almost half of the local population practicing these two activities. The water supply is provided from traditional wells and a water tower located in the village of NDiallakhar. Malaria and diarrhoea are the main diseases reported alongside other health problems such as rheumatism, skin diseases and eye infections. No cases of HIV / AIDS have been reported in the Study Area.

Each village has a "village chief" who is accountable to government administration and services. The various roles that the village chief performs include the allocation of common resources to villagers, the collection of tax, the collective management of natural resources and mediation and resolution of any conflicts that arise between villagers. The village chief is often supported in this latter function by other senior figures in the village administration. The chief is consulted by the Rural Community of Leona on any matter that may affect the village.

**Impact Assessment**

The assessment of environmental and social impacts is presented in Chapter 7 of the main report. It is based on a cross analysis of predictable interactions between sources of impact from the Project and sensitivities identified in the natural and human environment. Each source of potential impact was assessed taking into account the duration, scope and intensity of the impact and the associated probability or frequency. For each impact, a distinction was made between the construction and operation phases. The mitigation measures to be implemented to reduce project impacts to acceptable levels have also been presented. The residual impacts after implementation of the various recommended measures are also evaluated.

The ESIA for the Project is based on the initial turbine layout scenarios and covers the Site Area from a physical, ecological and social perspective. It is normal for a wind farm project

to determine the final layout of the wind farm components using an iterative process at the detailed design and planning phase and after the appointment of the EPC Contractor.

As such a key outcome of the design and planning phase will be a detailed and Site Layout Plan that will be developed based on the final choice of turbines, geotechnical constraints and the measures and recommendations coming from the ESIA (taking into account any updates as required). This Plan will site all the project components including final turbine positions, access roads, local transmission grid, substation, OTL, laydown area(s), work areas (including cement/ concrete batching), material storage areas, worker accommodation, offices, and borrow pits.

**Summary of Impacts**

Tables 1 and 2 present a summary of expected environmental and social impacts during the construction and operations and maintenance phases. The residual impacts after mitigation measures have been implemented, are shown in the final column of the tables. The full register of mitigation measures are presented in the environmental and social management plan (ESMP) in Chapter 9 of report.

**Table 1: Summary of environmental and social impacts during the Construction Phase**

| Activity / Source | Potential Impact | Consequence | Impact Significance | Mitigation / Enhancement Reference | Residual Significance |
|---|---|---|---|---|---|
| **Geology and Soil** | | | | | |
| Use of heavy vehicles and construction equipment. | Soil compaction | Localised compacted soils, leading to soil structure damage and soil that cannot be utilised for agriculture unless remediated.<br>Compacted soils may elevate the risk of erosion through increasing surface runoff. | Local, medium-term impact of **minor adverse** significance. | Measure include:<br>• Site Layout Plan taking into account sensitive areas;<br>• Vehicle/ equipment movements to be restricted to designated areas;<br>• Rehabilitate disturbed areas as soon as practicable after completion of works;<br>• Implement Waste Management and | **Negligible** |
| The installation of access roads, turbine assembly platforms, construction compound areas and the substation.<br>Use of heavy vehicles and plant. | Soil erosion | Gully erosion is prevalent along a number of ridges to the east of the Site.<br>Further adverse effects will accelerate the rate of erosion causing potential loss of more agricultural lands and affect the productive base of the community. | Local, permanent impact of **moderate adverse** significance. | | **Negligible** |

| Activity / Source | Potential Impact | Consequence | Impact Significance | Mitigation / Enhancement Reference | Residual Significance |
|---|---|---|---|---|---|
| Accidental spillages of contaminants and poor construction site housekeeping and storage.<br>Maintenance and cleaning of equipment and plant. | Soil contamination | It is expected that the volume of contaminants involved in any spill event will be low.<br>However, any localised contamination of soil will reduce agricultural productivity. | Local, long-term impact of **minor adverse** significance. | Hazardous Materials Management Plans;<br>• Spill response measures as per the Emergency Response Plan. | **Negligible** |
| **Water Resources and Hydrogeology** | | | | | |
| Accidental spillages of contaminants and poor construction site housekeeping and storage. | Groundwater contamination | Contamination of groundwater, including changes to turbidity; discolouration; and elevation of pH.<br>Local communities are highly reliant on groundwater for drinking and non-potable uses and if contamination were to occur on an extended basis this could lead to reduced agricultural productivity, and have health implications through the direct ingestion of contaminants.<br>Although the soils are well drained; the consequences of accidental spillages will be limited due to the presence of hardstanding areas reducing the infiltration of contaminants to the ground. | Local, long-term impact of **minor adverse** significance. | Measures include:<br>• Site Layout Plan taking into account sensitive areas;<br>• Implement Waste Management and Hazardous Materials Management Plans;<br>• Spill response measures as per the Emergency Response Plan.<br>• Plant, equipment or project vehicles | **Negligible** |
| Materials processing and vehicle washing | Groundwater contamination | | Local, long-term impact of **minor adverse** significance. | | **Negligible** |
| Construction workers and construction accommodation and welfare facilities. | Groundwater contamination | | Local, long-term impact of **minor adverse** significance. | | **Negligible** |

| Activity / Source | Potential Impact | Consequence | Impact Significance | Mitigation / Enhancement Reference | Residual Significance |
|---|---|---|---|---|---|
| Installation of access roads, hardstanding, impermeable areas and gradients. | Groundwater contamination | Changes to Site drainage patterns and increase in infiltration rates, potentially resulting in localised impacts on shallow groundwater. | Local, short-term impact of **minor adverse** significance | operated or serviced and materials processed designated sites only.<br>• Provision of adequate services (e.g. drinking water and sanitation) and wastewater generated is to be safely disposed of by approved companies. | **Negligible** |
| Construction activities such as excavation and HGV movement. | Construction noise | Wind turbines sites will be at least 500m away. Noise impacts will be greatest to construction site operators.<br>There will also be some noise impacts to receptors during the construction of the access roads. | Short-term, local impact of **minor adverse** significance | Measures include:<br>• Site Layout Plan;<br>• Agreed, daytime work hours;<br>• Staged construction to minimise interruptions to stakeholders ;<br>• Use of appropriate Personal Protective Equipment (PPE);<br>• Regular maintenance of construction | **Negligible** |
| Construction activities such as excavation and HGV movement. | Construction vibration | Locations for batching plants, construction areas, etc., have not yet been identified; however, these are likely to be at located at least 500 m away from the nearest receptors. The movement of HGVs will be of low intensity intermittent and temporary. | Short-term, local impact of **minor adverse** significance | | **Negligible** |

| Activity / Source | Potential Impact | Consequence | Impact Significance | Mitigation / Enhancement Reference | Residual Significance |
|---|---|---|---|---|---|
| | | | | machinery and vehicles;<br>• Vehicles and equipment should not be left idle for excessive periods;<br>• Speed limits enforced; and<br>• Implementation of grievance mechanism. | |
| **Air Emissions** | | | | | |
| Construction activities; site clearance, movement of vehicles, storage of spoil, movement of spoil. | Generation of dust | Possible health effects for those exposed to elevated dust levels for an extended period – typically the work force.<br>Nuisance effects for those outside of the 100-200m radius are not expected due to the 500 metre exclusion zone around each turbine.<br>There is potential for localised damage to crops and flora exposed to high dust levels. | Local, short-term impact of **minor adverse** significance. | Measures include:<br>• Use designated roads only;<br>• Speed limits enforced;<br>• Transported materials should be covered by sheeting;<br>• Stockpiles will be sheeted or sprayed with water whenever required; | **Negligible** |

| Activity / Source | Potential Impact | Consequence | Impact Significance | Mitigation / Enhancement Reference | Residual Significance |
|---|---|---|---|---|---|
| | | | | • Control of stockpile height, and basal; and<br>• Damping down surfaces with water whenever required. | |
| **Ecology – Habitats, Flora and Fauna** | | | | | |
| Clearance of vegetation from site | Loss of vegetation and habitats | The site is modified by human activities. Little or no trace of the original habitat remains. However, all the remaining trees, bushes, and shrubs play an important role in the provision of shade and markers/ boundaries and provide habitats for birds and as such are considered of local conservation importance. | Local, long-term impact of **minor adverse** significance | • Measures include:<br>• Site layout Plan<br>• Clearance of vegetation is confined to delimited areas;<br>• Offset/ compensate for the loss of trees, bushes or shrubs; | **Negligible** |
| Use of construction plant and vehicles, | Construction noise | Loud and intermittent noise may startle or cause stress to fauna. | Local, temporary, | | **Negligible** |

| Activity / Source | Potential Impact | Consequence | Impact Significance | Mitigation / Enhancement Reference | Residual Significance |
|---|---|---|---|---|---|
| and construction activities. | | Noises may induce changes to breeding and feeding behaviour and may result in the displacement of species. | impact of **minor adverse** significance. | • Limit noise levels (as above);<br>• Set up and maintain a register of avifauna encountered;<br>• Carry out site specific visual inspection to determine the existence of vertebrates, nesting sites, and other fauna elements before any clearance and excavation works; any fauna elements found will identified, logged and relocated using appropriate means;<br>• Enforcement of speed measures;<br>• Adequate disposal of food and other waste; and | |
| Direct collision of species with construction vehicles and plant.<br>Fauna may be attracted into working areas. | Direct injury or death of species. | Fauna will not be familiar with the new temporary structures which may result in collision with vehicles or the construction plants. Additionally, there is a risk of animals becoming trapped in excavations or fences as fauna may be drawn into construction areas in search of food dropped by construction workers. There is an overall risk of population decline. | Local, long-term impact of **minor adverse** significance. | | **Negligible** |
| Hunting of species by construction workers. | Injury or death of species. | Population decline. | Local, long-term impact of **minor adverse** significance. | | **Negligible** |

| Activity / Source | Potential Impact | Consequence | Impact Significance | Mitigation / Enhancement Reference | Residual Significance |
|---|---|---|---|---|---|
| | | | | • Project Code of Conduct.<br>• <br>• | |
| • Social Impacts | | | | | |
| Project land requirements | Economic displacement – loss of income | The total area of land permanently required for the Project components is a small percentage of the site area, is not contiguous, and avoids sensitive areas; households will be able to continue farming and grazing activities without materially affecting their livelihood. | Local, long-term adverse impact of **minor adverse** significance. | • Measures include:<br>• Site Layout Plan taking into account sensitive areas;<br>• Implement the LACP; and<br>• Implement the Stakeholder Engagement Plan | **Negligible** to **moderate positive** |
| Mobilisation of Construction workforce. | Influx of construction workers (up to 200) and opportunistic job-seekers into the area. | Population increase within the site area; changes in gender balance, age profile, and ethnic structures; and increase in social tension.<br><br>As the construction work is of a technical nature and the communities are small, scattered but close knit, the likelihood of job-seekers from outside the area is small. | Local, short-term, **minor adverse** significance. | • Implement the LACP;<br>• Wherever possible, prioritise local employment;<br>• Implement a transparent recruitment process;<br>• Implement training programmes to | **Negligible** |

| Activity / Source | Potential Impact | Consequence | Impact Significance | Mitigation / Enhancement Reference | Residual Significance |
|---|---|---|---|---|---|
| | Increased employment opportunities | Due to the technical nature of the work and the availability of skills in the area, most workers will be sourced from outside the area, region, or even Senegal. However there maybe some limited opportunities for the take up of local labour and local procurement. | Local, regional, short-term impact of **minor positive** significance. | develop local workforce capacity;<br>• Implementation of Construction and Labour Camp Management Plans;<br>• Implement the grievance mechanism;<br>• Project Code of Conduct;<br>• Implement the EHS Plan;<br>• Implement the Turbine Transportation and Local Traffic Management Plans; and<br>• Implement the Stakeholder Engagement Plan; | **Negligible** to **moderate positive** |
| Influx of construction workers and job-seekers | Increase in STDs. | Social interaction with construction workers from outside the area may lead to a spread of STDs; however prevalence rates are low and community is conservative in nature. | Local, long-term adverse impact of **minor adverse** significance | | **Negligible** |
| | Pressure on health services | Health services in the area are poor; however, workforce will be provided access to separate health facilities and an influx of job seekers is not expected. | Local, short-term adverse impact of **minor adverse** significance | | **Negligible** |
| Construction related activities | Increase in safety risks associated with accidents | Community is not exposed to such construction projects – an increase in traffic and other hazardous activities may increase the risk of accidents. | Local, long-term adverse impact of **moderate adverse** significance | | **Negligible** |
| Implementation of the LACP, construction activities and presence of workforce | Potential for conflict/ disputes between the construction work force and the community | Conflicts may occur with respect to inappropriate use of resources, asset damage, or inappropriate behaviour. | Local, long-term adverse impact of **minor adverse** significance | | **Negligible** |

| Activity / Source | Potential Impact | Consequence | Impact Significance | Mitigation / Enhancement Reference | Residual Significance |
|---|---|---|---|---|---|
| | | | | | |
| **Transportation** | | | | | |
| Delivery of the wind turbine modules from Dakar to the Project site. | Increased road congestion and safety risk | Road congestion caused by the slow movement of transport carriages and the size of the materials being transported.<br>Road congestion may result in impatience of surrounding road users thereby increasing the risk of road traffic accidents. | Local temporary impact of **moderate adverse** significance. | Implement the Turbine Transportation and Local Traffic Management Plans. | **Minor adverse** |
| Delivery of the wind turbine modules, and construction traffic movement within the vicinity of the project. | Vehicle and pedestrian collisions. | Local populations will not be accustomed to wind turbines and the vehicles transporting them and therefore may be unaware of the risks they pose. As a result there is a risk of death and injury. | Local, short-term impacts of **Moderate adverse** significance. | | **Minor adverse** |
| | Severance of pedestrian and vehicular routes utilised by local people. | Due to the size of the transport carriages local road networks will be blocked in certain areas during the transportation of the turbines. However, this will be very short term in nature and will result in minor inconvenience to local people. | Local, short-term impacts of **minor adverse** significance. | | **Negligible** |

**Table 2: Summary of environmental and social impacts during the operation and maintenance phase**

| Activity / Source | Impact | Consequence | Impact Significance | Mitigation / Enhancement Reference | Residual Significance |
|---|---|---|---|---|---|
| **Noise** | | | | | |
| Operation of the wind turbine | Noise impacts | Nuisance night-time noise experienced potentially affecting villagers sleep patterns and causing stress. | Long-term, local impact of **moderate adverse** significance | This impact will be addressed in the siting of the wind turbines; however a grievance based Noise Management Plan will also be implemented. | **Minor adverse** |
| **Visual Impacts** | | | | | |
| Presence of the wind turbine in the landscape | Visual impact of the turbines | The presence of the turbines may result in a perceptible change in the existing view, and may affect the overall quality and character of the view. However, overtime, the presence of the turbines will become an accepted part of the landscape in the area with people getting used to their presence. | Local, long-term impact of **Minor Adverse** significance | Mitigation measures may include:<br>• All turbines should be the same height, colour and shape;<br>• The turbines are recommended to have to have tubular towers;<br>• Use of appropriate (e.g. matt, neutral) colour the turbines so as to fit into the background. | **Negligible** |
| **Shadow Flicker** | | | | | |

| Activity / Source | Impact | Consequence | Impact Significance | Mitigation/ Enhancement Reference | Residual Significance |
|---|---|---|---|---|---|
| Operation of the wind turbine | Shadow flicker impacts | This will result in some receptors receiving short periods of shadow flicker throughout the year which will cause a nuisance to villagers who live and regularly use these areas. | Local, long-term adverse impact of **minor adverse** significance. | This impact will be addressed in the siting of the wind turbines; however a grievance based Shadow Flicker Management Plan will be implemented. | **Negligible** |
| **Ecology - Birds and Bats** | | | | | |
| Operation of the wind turbine | Collision and/or barotrauma (bats) leading to death or injury | Population decline | Ranges from **negligible** to local long-term impacts of **moderate adverse significance**. . | • Develop and implement the Ecology Management Plan including regular monitoring/ data collection of bat and birds (injured, carcasses, nesting birds, etc.).<br>• The search area should cover a radius of 50m from all turbine locations.<br>• Visibility enhancement such as balls, bird deterrents, or diverters could be attached to the OTL. | **Negligible to minor adverse** |
| Risk of collision with a transmission cable. | Death or injury | Population decline | | | |
| Increased disturbance during maintenance. New features within the landscape. | Displacement/ abandonment of species from the area. | Population decline/ displacement. | | | |
| **Social Impacts** | | | | | |

| Activity / Source | Impact | Consequence | Impact Significance | Mitigation/ Enhancement Reference | Residual Significance |
|---|---|---|---|---|---|
| Operation and maintenance activities. | Generation of employment and economic opportunities. | Most of the activities during the operations and maintenance phase require a technically skilled work force. However there may be some limited opportunities for the take up of local labour. | Local, regional, short-term impact of **minor positive** significance. | • Implement the LACP;<br>• Wherever possible, prioritise local employment;<br>• Implement a transparent recruitment process;<br>• Implement training programmes to develop local workforce capacity;<br>• Project Code of Conduct; and<br>• Implement the grievance mechanism;<br>• Implement the Stakeholder Engagement Plan; | **Minor positive** |
| Implementation of Project Agreements/ obligations. | Improving living standards | • Livelihood restoration, improvement and diversification;<br>• Investment in infrastructure development;<br>• Reduction in land degradation, re-vegetation of degraded lands. | Local, long-term, **moderate positive** significance. | | **Moderate positive** |
| | Conflicts/ disputes | Community expectations of the Project are high; conflicts between the Project and the Communities and loss of goodwill towards the Project if the Project Agreements/ obligations are not fulfilled. | Local, long-term adverse impact of **minor adverse** significance | | **Negligible** |
| | | Inequitable distribution of project benefits between communities; breakdown of the current generally harmonious relationships between the villages/ communities and loss of goodwill towards the Project | Local, long-term adverse impact of **minor adverse** significance | | **Negligible** |
| Operation of the Project | Generation of Electricity. | Will result in<br>• Reduction in electricity rationing;<br>• Create conditions to attract direct foreign investment to Senegal;<br>• Increased productivity and lower costs; and | National, long-term, **major positive** significance. | N/A | **Major positive** |

| Activity / Source | Impact | Consequence | Impact Significance | Mitigation / Enhancement Reference | Residual Significance |
|---|---|---|---|---|---|
| | | • Facilitate rural electrification. | | | |

**Hazard Risk Assessment**

The Hazard Risk Assessment was carried out in accordance with the methodology guide published by DEEC, and with a view to compliance with Senegalese regulations. The implementation of preventive measures in response to identified hazards for the wind farm reduces risks to acceptable levels in respect to conditions on the ground (especially the micro-siting of turbines in relation to the nearest dwellings).

The implementation of a 500m exclusion zone in accordance with international best practice, means that people are outside the identified risk zone associated with wind farms developments.

**Implementation Schedule**

It is expected that the engineering, procurement and construction (EPC) contractor will be appointed in last quarter of 2016 and close out of the financial statement by the end of the first quarter of 2017. The design, planning and manufacturing of the turbines will start shortly thereafter and is expected to last at least nine months. Consequently, the construction phase is expected to begin in the first quarter of 2018 and will last 12-18 months. Based on this indicative calendar, the project will be operational by the third quarter of 2019.

The peak workforce employed by the Project for construction will be approximately 200 people, mainly through the EPC contractor. Due to the highly technical nature of the work, it is expected that up to 20 people will be employed from the local or regional workforce. During the operational phase, it is expected that up to 10 people will be employed on a permanent basis from the local or regional workforce with maintenance experts used on a periodic basis.

**Environmental and Social Management Plan**

The Environmental and Social Management Plan (ESMP) was prepared at the end of the ESIA process in compliance with the law N ° 2001-01 of 15 January 2001 pertaining to the Environmental Code.

The aim of the ESMP is to provide a framework for environmental and social management of the Project, by translating the mitigation measures specified in the ESIA into a concrete action plan for the Project. Thus, the ESMP presents the following information:

- A Mitigation Plan that includes mitigation measures to be executed by the Project for each phase of its implementation, with a view to compliance with Senegalese

law, international standards and best practices; the plan also specifies actions and follow-up procedures and associated responsibilities.

- A comprehensive monitoring plan.
- A Capacity building and Communication Plan.
- An implementation plan for the ESMP.

The ESMP provides a framework for tracking or auditing the compliance of the project in compliance with the reference standards and best practices. It makes specific reference to the roles and responsibilities for each aspect of the Project subject to mitigation measures and describes the organization of those responsible for environmental and social management of mitigation actions and monitoring during the construction and operation phases.

**Stakeholder Consultation**

Stakeholder consultations were undertaken throughout the ESIA and the minutes of meetings are attached to the Stakeholder Engagement Plan (SEP) (Annex L of the ESIA). The consultation process for the ESIA culminated in a public hearing chaired by DEEC and in the presence of interested and affected parties. The official account of the hearing concluded:

"Ultimately, it was decided to approve the ESIA report for the Leona wind power project subject to the integration of the main observations made by the stakeholders. The primary recommendation is the electrification of all the villages in the community of Leona that are affected by the project by including this as an item in the terms of the contract between the Promoter and SENELEC".

The ESIA report takes into account the outcomes of all consultations to date, including the meeting of the Technical Committee 24 September 2013 and the public hearing referred to above.

**Contact for further information about the project**

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