



ARAB REPUBLIC OF EGYPT
MINISTRY OF ELECTRICITY AND ENERGY
NEW AND RENEWABLE ENERGY AUTHORITY (NREA)



Environmental Impact Study
200 MW WIND FARM
At the GULF OF EL ZAYT



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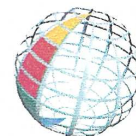
KfW-Entwicklungsbank

June 2008

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ABBREVIATIONS

EC	European Commission
EEAA	Egyptian Environmental Affairs Agency
EEHC	Egyptian Electricity Holding Company
EETC	Egyptian Electricity Transmission Company
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EMP	Environmental Management Plan
GoE	Government of Egypt
GPC	General Petroleum Company (or Corporation), Ministry of Petroleum
KfW	Kreditanstalt für Wiederaufbau
LC	Local currency (EGP)
MEE	Ministry of Electricity and Energy
MOP	Ministry of Oil and Petroleum
NREA	New and Renewable Energy Authority
WT	Wind Turbine

1. EXECUTIVE SUMMARY

1.1 Environmental criteria based selection of the 200 MW wind park area

A general frame study to identify areas suitable for wind power development had been carried out for the “NREA concession area”, of about 630 km², starting about 20 km in the south of Ras Gharib and reaching up to the Gulf of Zayt (about 60 km in the North of Hurghada). The zoning of the “NREA concession area” was result of a consultation between relevant competent authorities such as Ministry of Petrol, Ministry of Energy, Ministry of Defence and the Red Sea Governorate.

The following environmental surveys were carried out for the “NREA concession area”:

- Reconnaissance survey to assess the present landuse in the area
- A survey on the fauna (others than avifauna) and flora
- An autumn and spring monitoring of bird migration and bird habitat
- A geological survey

Based on that, an environmental study was prepared as a chapter of the overall feasibility study together with the annexed detailed studies. Because of the environmental assessment with regard to risks to migrating birds only a zone in the north of the “NREA area” was identified for a first phase wind power development.

The compiled documents were submitted by NREA to the EEAA, a copy of which is included in Annex 1, suggesting the utilisation of a northern zone for wind power. By letter of EEAA of March 2008 to NREA the global EIA report was approved by EEAA. Accordingly the construction of wind parks in the northern area (Zone 3) was approved. Moreover, NREA was requested to submit a scoped EIA for each wind park focussing on a list of information and impacts to be dealt with.

The cleared northern zone was further limited because of extensive petrol concession rights. Considering also the necessity of area for a parallel JBIC financed 220 MW wind park an area for the “European Wind Park (KfW, EC, EIB)” with 200 MW had to be selected in the Northwest of the “NREA concession area”, i.e. the area with lowest expected bird risk and with lack of significance of any other expected environmental impacts. Thus, for the 200 MW subject wind park an area was selected under consideration of environmental criteria already defined in the study of the greater area.

1.2 Environmental impact assessment of the 200 MW wind park area

1.2.1 Legal Requirements

Wind-generated electrical energy is renewable, produces no emissions and is generally considered being environmentally friendly. The legal basis for EIA is established by Law No. 4 of 1994, the Law on Protection of the Environment and it's Executive Regulations 1995 (Prime Ministers Decree 338, in which an EIA is required for all electricity project including renew-

able energies (see Annex 2 to the regulations). According to these Regulations the EEAA has the authority for approval of bases and procedures for the assessment of environmental impacts projects. Moreover, according to Article 10 of the regulations "The competent administrative body or the body that grants permits shall assess the environment impact of establishments that are requesting permits, according to the elements, designs, specifications and bases, which are issued by the EEAA in agreement with the competent administrative body.

The law and subsequent regulations did not give details on project clusters and corresponding EIA procedures. For that general guidelines for EIAs were issued by the Egyptian Environmental Affairs Agency (EEAA) in 1999. These guidelines available in Arabic only are called "Guidelines and Basics of Environmental Impacts Assessment, November 1999," and were issued by the Department of Environment of the EEAA. These guidelines classify projects in three groups, i.e. white list projects with minor environmental impact, grey list projects which may result in substantial environmental impacts and black list projects, for which a complete EIA is mandatory due to the magnitude of their potential impact. Wind power and associated power transmission line projects are considered to potentially result in substantial environmental impacts and, therefore, are classified as "grey list" projects. Earlier wind power projects (e.g. the recent Zafarana 120 MW) had been classified as grey list projects. Accordingly for Environmental Screening has to be carried out by filling in Form B. For matters with expected significant impacts the scope of additional investigations may be defined and studies would be carried out accordingly (e.g. ornithological study as carried out for the greater "NREA concession area").

Differing from the valid guidelines the Director of Energy Projects of EEAA informed during a meeting on May 26th, 2008 at the EEAA that the decision on classification of projects is with him and that he considers for the project the requirement of a full EIA including public consultation, as he considers the project to be environmentally critical. This was in spite of the approval letter of the EEAA to NREA of March 2008, in which the use of the northern area for wind power generation was approved in view of the results of the environmental impact assessment for the overall NREA area submitted by NREA and with special consideration of the results of the ornithological studies.

Thus, it seems that the environmental protection policy and the legal framework with regard to wind power development is not binding or precisely defined, and is rather depending on a day to day decision of EEAA with regard to the EIA requirements. In the absence of clearly defined requirements and procedures in Egypt, the environmental impact assessment for the overall area follows the recommendations of draft guidelines "Electricity Generating Facilities based on Wind Power" of December 2001, which were handed over by EEAA to the local Consultant in December 2001. However, the contents were amended by requirements of KfW communicated during a meeting in March 2008 (keeping internationally accepted standards, such as "Environmental, Health, and Safety Guidelines for Wind Energy" of IFC, World Bank Group and "European best Practice Guidelines for Wind Energy Development") and requirements listed in the EEAA letter of March 2008 to NREA.

There are no national laws and regulations on shadowing/flickering from wind turbines. According to German stipulations (Emission control law) the limit for affecting residencies by shadowing from wind turbine blades is 30 hours per year and/or 30 minutes per day. Moreover, there are neither local nor international standards on the calculation of noise propagation; instead German standards were applied.

As a signatory state the Government of Egypt has to meet environment protection obligations with regard to the

- Convention on Biological Diversity, (1994)
- Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention, 1979) and the
- Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA).

Accordingly, the criteria and conditions defined in these conventions were to be considered for the environmental impact assessment.

1.2.2 Summary of Results

The “European area” was selected by EIA criteria as established in the general EIA study for the greater “NREA area”. Therefore, except with regard to risks to the avi-fauna, the expected environmental impacts of wind power development in the “European area” are marginal. Nevertheless, for a more detailed environmental assessment of the “European area” more in depth surveys were carried out:

- Reconnaissance survey to assess the present land-use in the area (see Annex 3.1)
- A survey on the fauna (others than avifauna) and flora analogous to the earlier survey along representative transects

In the following an EIA summary is given:

- **Land characteristics and use:** All the area is consisting of desert ground (compacted gravel or rocky) and not ecologically sensitive. Very little deterioration is expected. According to information received the selected “European area” is free from oil concessions. However, as the Petroleum Company has the right to assign new oil concessions the availability of the area need to be verified before a signature of a loan agreement. Moreover, the reconnaissance of the area revealed petrol activities also outside the area, limiting the area in the east and requiring safe construction measures and safety distances for siting (pipelines).
- **Landscape character and existing views:** There is no special landscape or view existing in the desert plains and hills of the “European area” worth for being protected against the erection of wind power plants.
- **Flora and Fauna (without avi-fauna):** The field survey revealed that in this north-western part of the area there is almost a complete absence of flora and very limited expected fauna being of common nature. Accordingly, wind park utilisation in the area will have no impacts on the biodiversity and other environmental characteristics of the site. Not a single specie or animal recorded in the area or expected to occur in it, is included in the Red Lists, both internationally or nationally. Moreover, the nature of wind parks, which leaves the bulk of the wind park area untouched, is not critical to the rare existing fauna (not considering avifauna) in that area, if basic mitigation measures are kept.
- **Avifauna:** Although, this area is away from the main migration routes and does not show topographical bottlenecks, some smaller amounts of migrating birds were assessed to likely occur in that part of the greater area. Therefore, the wind park installation requires technical avoidance/mitigation measures at the plants and in the infrastructure itself as to the best practicable standard (painting of blades, no permanent

lights on the towers). Moreover, a careful post installation monitoring programme needs to be executed to assess, whether the impacts in a wind park will remain on acceptable level or whether additional measures will have to be carried out. Service facilities of NREA near to the Hurghada road would not cause negative effects on the birds. Electrical structures associated to the wind farm, such as the main substation and the 220 kV overhead line for interconnection with the main corridor are likely to have impacts on the avifauna, and, therefore, shall be constructed and protected according to the Guidelines “Protecting Birds from Power Lines” (see Annex 2)

- **Water quality:** A wind power utilisation in the area will not have not any **measurable** effects to the groundwater and surface water.
 - Only negligible volumes of water will be transported to the site by tanker trucks during construction (e.g. fresh water for curing concrete; saltwater for gravel road compaction). These small amounts of water would either be absorbed by works or evaporated. No water will reach surface or groundwater.
 - For operation of the wind park probably service buildings such as store, control and apartment buildings will be built outside the wind park, most probable at the main road Hurghada – Rhas Gharib and near the water pipeline Hurghada – Rhas Gharib. Considering 50 heads staying at these facilities at a realistic water consumption of 40 l/d about 2 m³ of water will be consumed per day. The resulting waste water shall undergo a two stage anaerobic treatment with reuse of effluents for limited irrigation and (very rare) regular sludge collection, drying and disposal). No water will reach surface or groundwater.
- **Air quality:** Small additional dust will occur locally during construction works and operation resulting from traffic on gravel roads. These isolated dust emissions cannot measurably contribute to increase of regional dust level.
- **Noise levels:** There is no settlement area in the surroundings of the “European area”. At the next settlements (Rhas Shukheir about 9 km away from the wind park borders) there would be no measurable noise level increase caused by the wind turbines or other equipment.
- **Antiquities or sites of historical & cultural importance:** None
- **Social and Economic Context:** There are no stakeholders affected by a wind park inside or in the greater surroundings, except the petrol business, which is anyhow involved throught the Ministry of Petrol and GPC. No people living in the surrounding of the “European area”, except people temporarily living in a petrol workers camp 9 km away from the borders of the wind park. Nevertheless, a public hearing as per the verbal request of the EEAA can be organised. But, for a.m. reasons this cannot involve really stakeholders. Wind park construction will create employment during both, the construction and the O&M phase. Personnel from the next villages or Bedouins are usually hired for simple work and security tasks. Wind energy utilisation will safe indigenous oil and gas, and thus contribute to economic sustainability in Egypt.
- **Infrastructure:**
 - **Waste** generated during the construction phase such as packing material, residual steel, lubricants, etc. shall be collected and adequately disposed off by the Contractor. Solid domestic waste originating during operation from a service building complex within the “European area” shall be collected and adequately disposed off.
 - **Water supply:** There is only very limited water demand from the Nile water pipeline during both, the construction and the operation phases (about 2

- m³/d), which will not affect the overall water supply in the region.
- **Domestic waste water** originating from the construction yard facilities or permanently constructed service buildings shall undergo two stage anaerobic treatment and be reused for irrigation of infiltrated to the sandy underground for natural post-treatment.
 - **Transport:** Wind power development at the “European wind park area” will not cause traffic bottlenecks in the greater area, neither during the construction phase nor during the O&M phase.
 - **Electricity:** The wind park internal grid shall be made by underground cables. Any wind park, which would be erected on the “European area”, shall be connected to a substation located outside the southern border to be built by EEHC/ETC (see Fig. 6.1). The 220 kV interconnections shall be built as OHTL according to accepted bird protection guidelines.
- Potential **occupational health and safety hazards** during the construction, operation, and decommissioning of wind power projects include risks from Working at heights. Health and safety risks shall be controlled at least as to the level defined in the IFC Environmental, Health and Safety Guidelines, Wind Energy, April 2007.

Alternatives: The “European wind park area” has been selected as the most environmentally compatible alternative out of a 20 times greater area. Thus, alternative studies were already carried out on macro level. Considering the increasing shortage in conventional energy and the need for the use of renewable energy wind power generation at high wind energy areas is the most economic solution. However, as areas with high wind power potential are very limited also in Egypt, there is no alternative to the site.

Environmental Management Plan: The EM plan is targeting to secure keeping health and safety as well as environmental standards during wind park construction. These tasks shall be under the Supervising Consultant. An independent reporting scheme on those matters should be defined and agreed for these tasks. During wind park operation a post construction monitoring shall be carried out to assess whether the impacts of a wind park on birds will be within acceptable limits as expected from the preceding ornithological study or whether additional mitigation measures have to be taken up to reduce impacts to acceptable level.

2 DESCRIPTION OF THE PROJECT AND LAYOUT

2.1 Objectives and scope

The "European area" shall be used for wind power generation in order to

- make use of the excellent wind power potential at the site, and in the same time
- to substitute oil and gas for electricity generation by CO₂ renewable wind energy.

The study shall analyse the feasibility of wind power development in the area. It rather considers typical layouts of wind parks than a definite planning. The definite wind park planning can be done only by the successful contractor after tendering. Only then the type of the wind turbine will be known. Accordingly, also the project implementation schedule shown in Figure 3 is an expected and not a final one.

The lifetime of wind power plants is 20 years. Wind Power would be developed in south-west to north-east rows at distances of about 1 km. A layout plan for the "European area" can be seen in chapter 2.3. Typical features of such a project are the wind turbine foundations of about 2 to 3 m depth and a surface of up to 15 x 15 m² in case of a large turbine (2 to 2.5 MW), the turbines itself with tubular tower diameters of up to 4.5 m at the footing and maximum blade tip heights of about 100m (it is proposed to limit the maximum tip height to 110 m to be in accordance with the ornithological study and still allow wind turbines up to 2.5 MW), the wind park internal grid through cable trenches, small transformer stations next to the wind turbines or inside the turbines and wind park internal earth roads of 5 m width. Directly adjacent to the project area, still in Zone 3, the cleared northern zone, a central MT/HT substation will be erected. Moreover, one service area of NREA shall be built somewhere outside the European wind park area consisting of a control building, storage buildings and housing facilities for staff. This service area will be constructed probably somewhere near to the main road Hurghada – Suez.

The assessment of environmental impacts caused by wind power development is targeting

- to determine any likely significant impact caused by wind power development in the area,
- to assess, whether such impacts can be mitigated or whether they require a restriction or a cancellation of wind power development,
- to define eventually necessary mitigation measures and environmental management (EM) requirements.
- to assess the effects of possibly required mitigation and EM measures with regard to the overall viability of wind power development in the area.

The scope of the project can be summarized as follows: Wind power development shall take place in the "European area" with about 36 km², whereby the western mountainous part shall be kept free from wind turbines. The area is shown on Figure 1. The area is located in a greater "NREA concession area", which was defined as a result of discussions held between different ministries and the Governorate and which was subject to a preceding environmental impact assessment. Accordingly, the defined area reflects already the requirements of the Ministry of Petrol and of the Ministry of Agriculture as well as the ornithological expert recommendations. However, with regard to the Ministry of Petrol, new petrol concessions may be given for the "European area". Therefore, when the decision on the project will be made, it

needs to be verified and guaranteed, that this area is kept free from petrol concessions, which could hamper a wind park implementation.

2.2 The “European (KfW - EC – EIB) area”

The location of the “European study area” can be seen from Fig. 1. It is located on the western bank of the Gulf of Suez, about 110 km in the North of Hurghada and 5 to 10 km to the West of the Hurghada – Suez Road. The distance to Cairo by road is about 400 km.

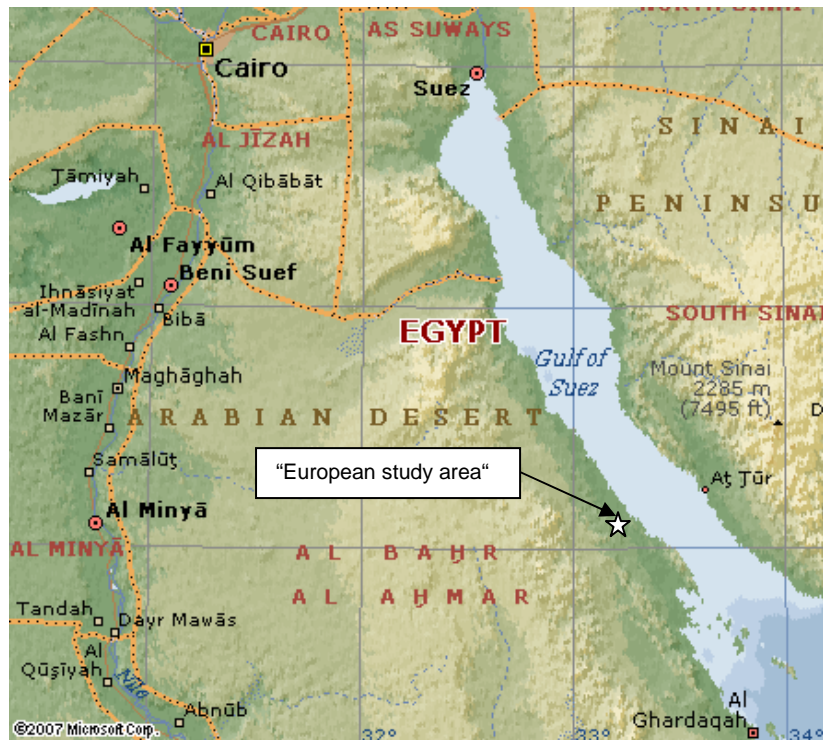


Fig. 1: Location of the “European study area”.

More details on the location can be seen from Figure 2. The area is about 10 km away from Ras Shukheir. It shall be directly adjacent to the “JBIC area” in the south. The 220 kV sub-station for both wind park areas will be located directly outside the “European area”. This substation shall also contain at least a wind park control room. The location for construction of a NREA service area is not yet decided. This location can be kept outside the wind parks and, therefore, is not relevant for the overall layout. Information on the topographical conditions can be seen from Fig. 3

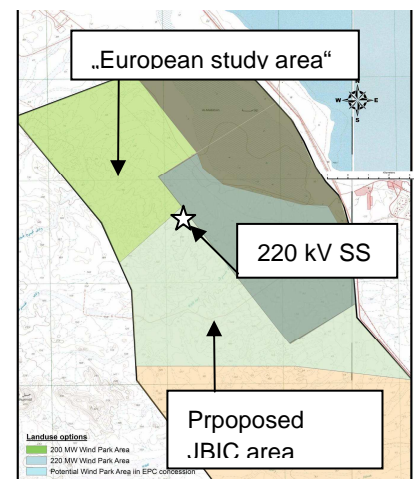


Fig. 2: The “European (former KfW) study area”

European 200 MW wind park area including potential expansion

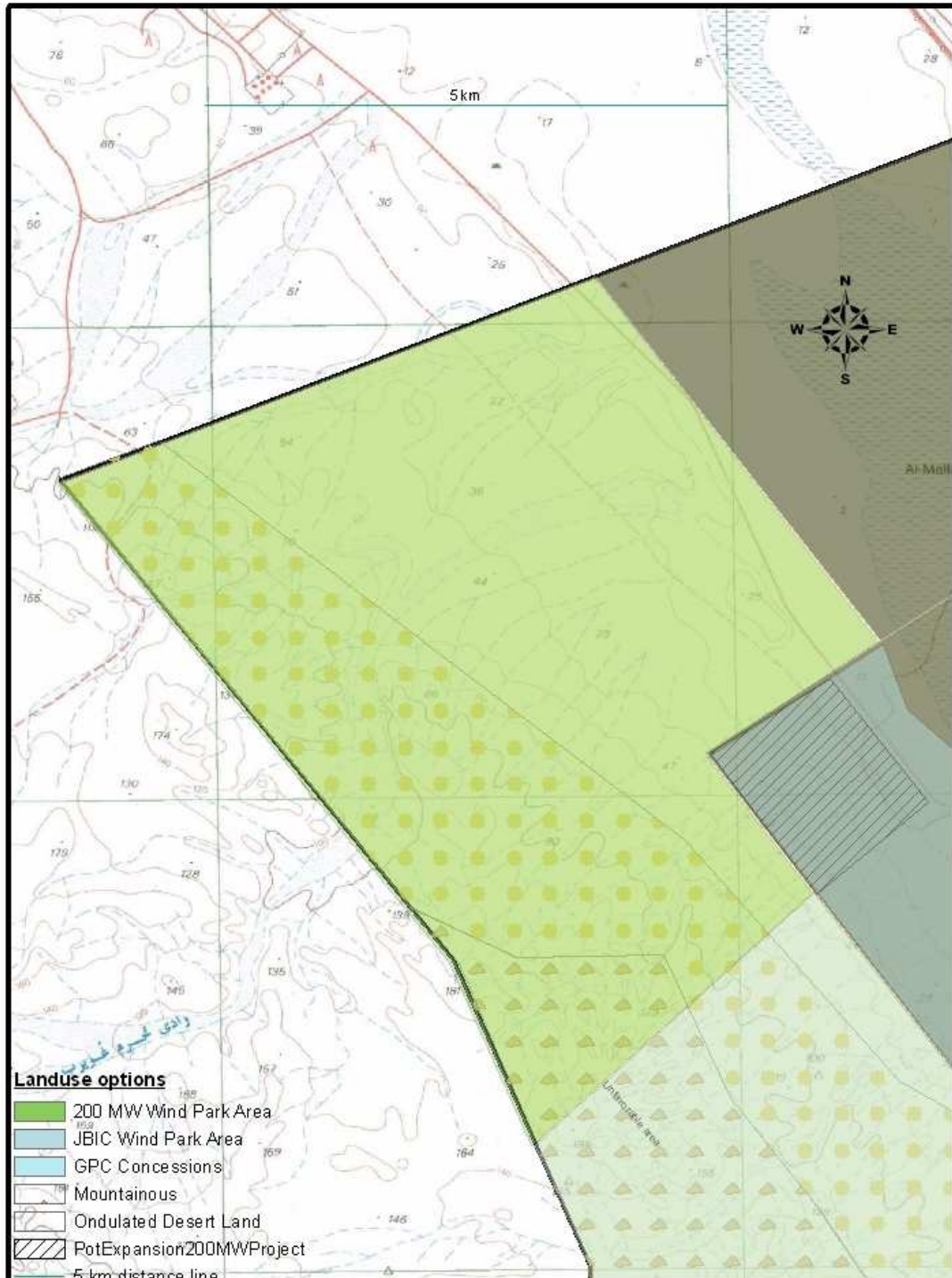


Fig. 3: European study area (before designated as “KfW area”)

The approximate border coordinates (Geographic projection WSG84) are given in Table 1. below.

"European area" (200 MW)	
Easting	Northing
33°06' 8.5"	28°09' 59"
33°08' 13.5"	28°07' 28.5"
33°08' 54.3"	28°06' 6.40"
33°11' 12.4"	28°08' 6.2"
33°10' 39.8"	28°08' 51.6"
33°10' 58.48"	28°09' 2.78"
33°09' 16.79"	28°11' 11.15"

Table 1 *Approximate border coordinates of the "European-area" in WSG84 including potential expansion area (see Fig. 3)*

2.3 The project - Layout of wind power development

The final design of wind power development in the "European area" would be known after detailed planning only, which would be carried out by the successful contractor after tendering. Thus, the detailed design will very much depend on the wind turbine type and capacity, which will be selected in a tender process. Therefore, potential environmental impacts have to be assessed for typical wind park layouts as shown in Fig. 4 at this stage. For the same reason also the project implementation schedule (see Fig. 5) must be considered as a typical one.

A wind park in the "European area" would typically be developed in rows perpendicular to the main wind direction with a distance between each row around of 1000 m, a distance between turbines in a row of about 200 to 300 m and a turbine height up to the upper blade tip of a maximum of 110 m. The size of foundations would be less than 15 x 15 m and a maximum of 3 m deep into the ground. Depending on the type of selected wind turbine transformer stations may be contained inside the wind turbine towers or a small transformer compact station might be placed next to each turbine. The housing of such compact station would be not more than 2 m x 6 m. Power cable trenches will be attached along the rows near to turbines, having a depth of about 1 to 1.5 m and a width of not more than 2.5 m. Inside the trenches plastic pipes with diameter of 5 cm for the control cables will be placed on top of the power cables. The power cables will be connected to a central substation with an area of about 350 m x 150 m (thereof about 200 x 150 m for the "European project") adjacent to the wind farm. Within the wind park earth roads of about 5 m width will be constructed, consisting of compacted desert gravel material. The compacted area will be enlarged next to each wind tur-

bine to a size of about 25 x 20 m for the erection of the wind turbines. The wind park design will exclude Wadis and steep mountainous areas. Due to both, the nature of the project and the hyper-arid climate, there is no need for surface drainage.

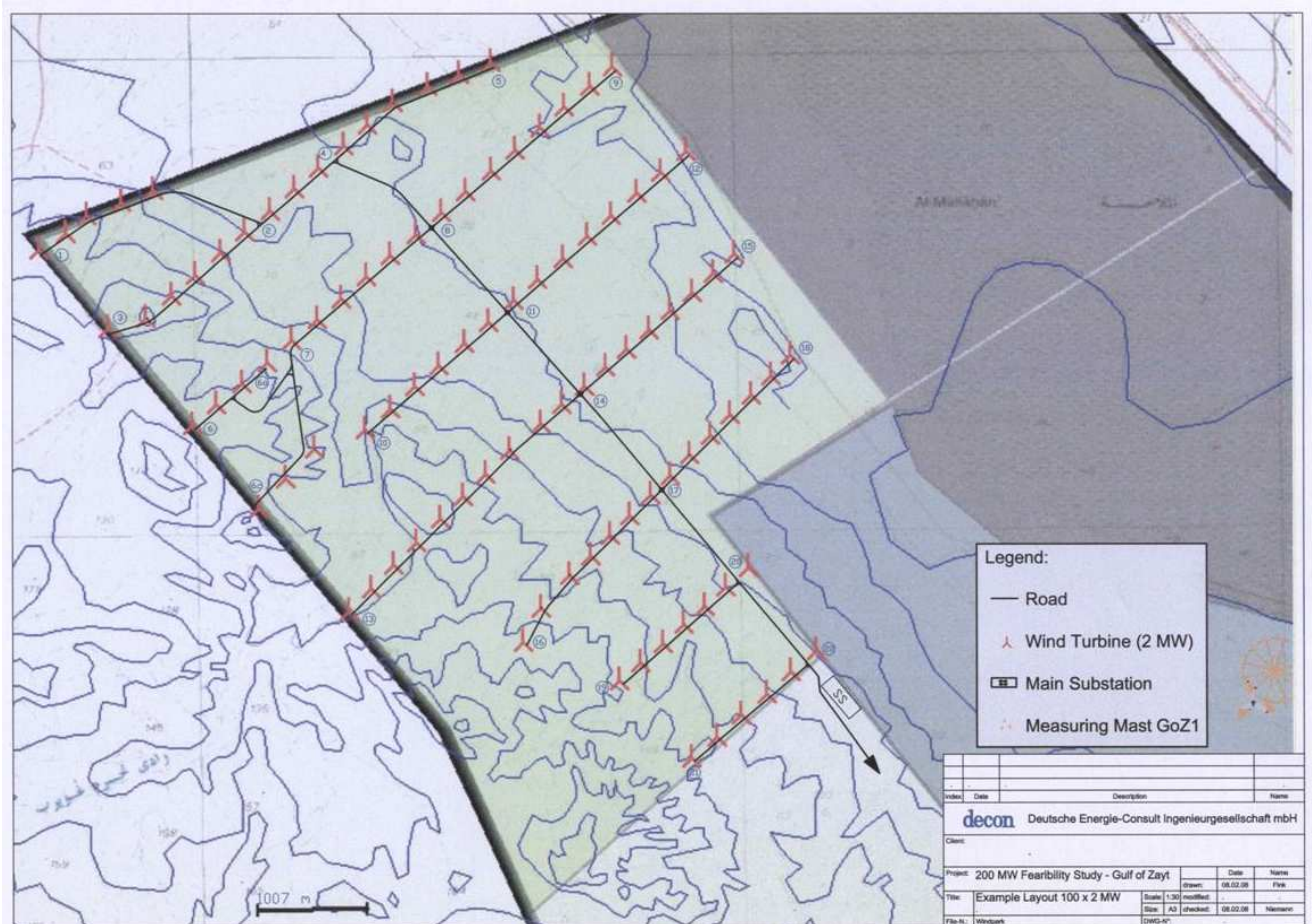


Fig. 4: Schematic layout of the wind park (100 x 2 MW)

In addition, outside the “European Area” service facilities of NREA especially for accommodation, maintenance and control would have to be built probably next to the main coastal road and the water pipeline along this road. Usually such service installations consist of an apartments building, a central facility (conference room, mosque, cantina), a storage premise (e.g. 30 x 20 m), an open storage area and a control and a small control and office building. Water will have to be taken from this pipeline. The number of persons living & working in the area in shifts to operate and maintain the wind park would be not more than 50, if caretaking of the European + other wind parks. Accordingly, the amount of domestic waste water generated would be less than 2 m³/d (considering an average per capita consumption of 40 l/d). These small amounts of waste water shall undergo a two stage anaerobic treatment followed by post-treatment of effluents percolated into sandy underground or reuse for irrigation. Sludge would have to be collected every 2 to 4 years (if treatment is properly designed), tried and buried.

Further installations associated to the wind farm would be a 22/220 kV substation and the 220 kV overhead-line interconnection to the main transmission line corridor. Although the

construction of both will be under control of the Electricity Holding Company (EEHC) provisions are made that these constructions shall be built according to general accepted bird protection guidelines. Thus, it is recommended to carry out the 220 kV switchgear as in-house GIS, what would imply almost complete bird protection at the substation.

2.4 Construction Phase: Site preparation and construction measures

Typical works to be carried out for wind power projects are limited to:

- Earth works: Excavation, backfilling and compaction works for road and platform construction as well as for foundation pits and trenches. Typical equipment used on the construction site are excavators, front-loaders, graders and compactors. No material will be taken from or to the area.
- Concrete works for foundations. As no water will be available at the site it is expected that ready mix concrete will be used.
- Wind turbine installation works using large mobile lifting capacities.
- Construction measures for a service area of NREA would be limited to typical house and storage building works.

The erection works of the wind turbines are usually carried out by the wind turbine supplier with a team of own technicians. Civil works will probably be carried out by local companies.

For Wind Park construction a temporary construction yard (for storage of materials and servicing of machinery) and a temporary office would be erected at a central place within the site. Such temporary facilities comprise of 4 to 6 rooms with simple sanitary facilities. Water supply would be via tankers. Electricity would be generated by a small mobile generator. Such office building would be for about 20 persons, who, however, spend much time at the construction sites. Proper non-hazardous solid waste management during the construction phase will be the responsibility of the contractor, who shall minimise origin of waste and collect the waste from the site and dispose it of in a regular way. Minor quantities of hazardous waste such as used oil and grease shall be collected and recycled, as it is usually done because of its value.

Construction measures of NREA would be supervised by NREA engineers. Moreover, usually international Consultants would be employed for assistance. This supervision includes the assurance of Contractor's proper waste management and the proper land reclamation at the end of construction measures. The works and the site personnel shall be supervised by a health and safety engineer, who shall be assigned by the Contractor.

Associated works outside the "European Area" would be

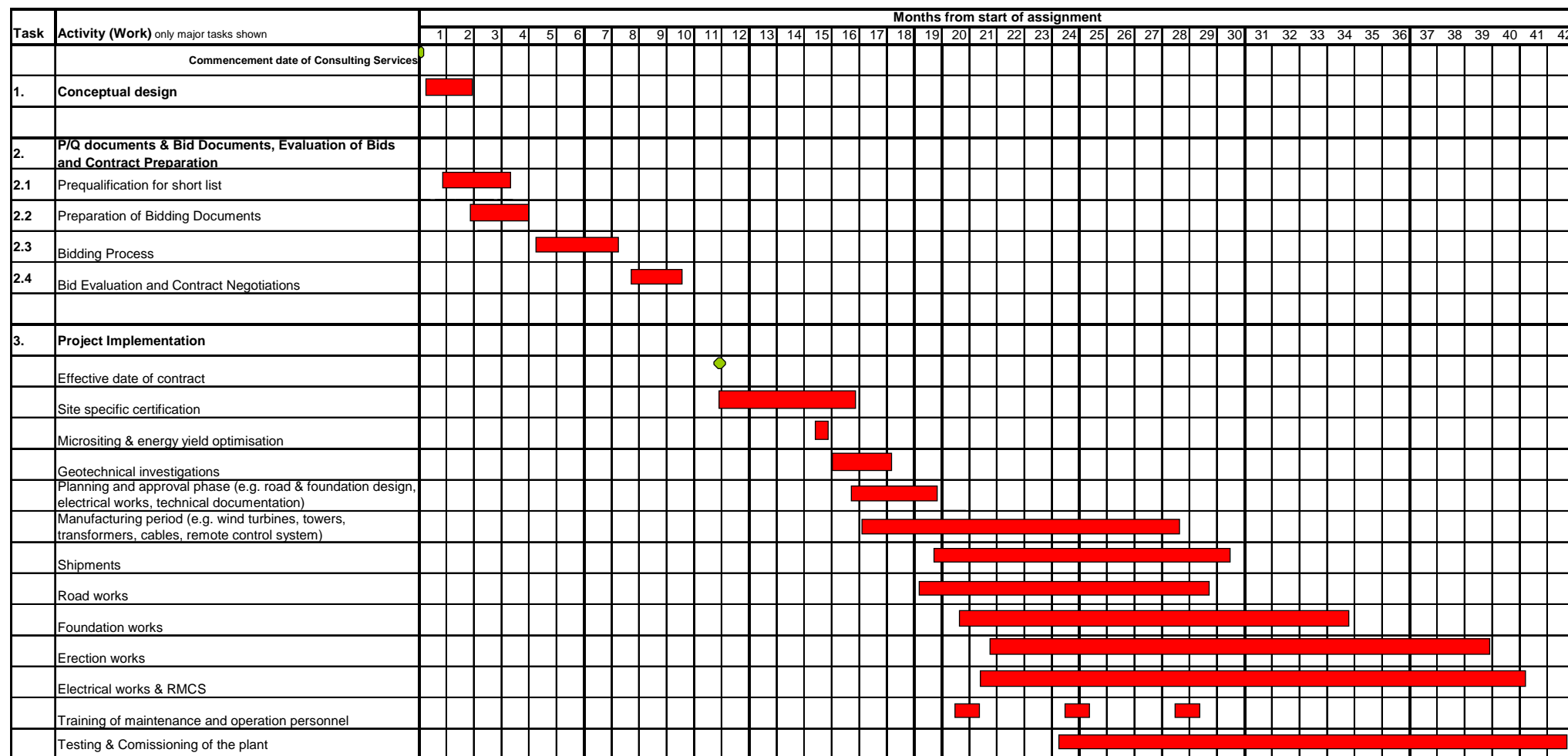
- NREA's service installations: structural civil (house building) works directly under control of NREA without Consultant
- 220 kV transmission line interconnection to be carried out under control of the EEHC/EETC: Structural steel constructions with small foundations including working activities at heights
- 22 kV/220 kV substation to be carried out under control of the EEHC/EETC: The works comprise steel structural, civil works for housing,

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foundations and trenches and electrical works at medium and high voltage level.

An exemplary project implementation schedule is enclosed below. The start of the project would be likely in 2009.

Project Implementation Schedule - Gulf of Zayt 200 MW



Legend:

Estimated time requirement

Targeted dates

Fig. 5: Project implementation schedule (optimistic scenario)

3 BACKGROUND INFORMATION

3.1 Legislative framework

Wind-generated electrical energy is renewable, produces no emissions and is generally considered being environmentally friendly. The legal basis for EIA is established by Law No. 4 of 1994, the Law on Protection of the Environment and its Executive Regulations 1995 (Prime Ministers Decree 338, in which an EIA is required for all electricity project including renewable energies (see Annex 2 to the regulations). According to these Regulations the EEAA has the authority for approval of bases and procedures for the assessment of environmental impacts projects. Moreover, according to Article 10 of the regulations "The competent administrative body or the body that grants permits shall assess the environment impact of establishments that are requesting permits, according to the elements, designs, specifications and bases, which are issued by the EEAA in agreement with the competent administrative body".

Of special relevance for a wind power project are the following annexes to the executive regulations of the environmental Law::

- Annex 2: Establishments subject to environmental impact assessment
- Annex 7: Permissible limits of sound intensity and safe exposure periods.

The law and subsequent regulations did not give details on project clusters and corresponding EIA procedures. For that general guidelines for EIAs were issued by the Egyptian Environmental Affairs Agency (EEAA) in 1999. These guidelines available in Arabic only are called "Guidelines and Basics of Environmental Impacts Assessment, November 1999," and were issued by the Department of Environment of the EEAA. These guidelines classify projects in three groups, i.e. white list projects with minor environmental impact, grey list projects which may result in substantial environmental impacts and black list projects, for which a complete EIA is mandatory due to the magnitude of their potential impact. Wind power and associated power transmission line projects are considered to potentially result in substantial environmental impacts and, therefore, are classified as "grey list" projects. Earlier wind power projects (e.g. the recent Zafarana 120 MW) had been classified as grey list projects. Accordingly for Environmental Screening has to be carried out by filling in Form B. For matters with expected significant impacts the scope of additional investigations may be defined and studies would be carried out accordingly (e.g. ornithological study as carried out for the greater "NREA concession area").

Differing from the valid guidelines the Director of Energy Projects of EEAA informed during a meeting on May 26th, 2008 at the EEAA that the decision on classification of projects is with him and that he considers for the project the requirement of a full EIA including public consultation, as he considers the project to be environmentally critical. This was in spite of the approval letter of the EEAA to NREA of March 2008 (see Annex 2), in which the use of the northern area for wind power generation was approved in view of the results of the environmental impact assessment for the overall NREA area submitted by NREA and with special consideration of the results of the ornithological studies.

Thus, it seems that the environmental protection policy and the legal framework with regard to wind power development is not binding or precisely defined, and is rather depending on a day to day decision of EEAA with regard to the EIA requirements. In the absence of clearly defined requirements and procedures in Egypt, the environmental impact assessment for the overall area follows the recommendations of draft guidelines "Electricity Generating Facilities based on Wind Power" of December 2001, which were handed over by EEAA to the local

Consultant in December 2001. However, the contents were amended by requirements of KfW communicated during a meeting in March 2008 (keeping internationally accepted standards, such as “Environmental, Health, and Safety Guidelines for Wind Energy” of IFC, World Bank Group and “European best Practice Guidelines for Wind Energy Development”) and requirements listed in the EEAA letter of March 2008 to NREA.

There are no national laws and regulations on shadowing/flickering from wind turbines. According to German stipulations (Emission control law) the limit for affecting residencies by shadowing from wind turbine blades is 30 hours per year and/or 30 minutes per day. Moreover, there are neither local nor international standards on the calculation of noise propagation; instead German standards were applied.

As a signatory state the Government of Egypt has to meet environment protection obligations with regard to the

- Convention on Biological Diversity, (1994)
- Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention, 1979) and the
- Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA).

Accordingly, the criteria and conditions defined in these conventions were to be considered for the environmental impact assessment.

3.2 Methodology

The environmental impact assessment for the “European wind park area” was carried out in a two step approach.

Step 1: Baseline investigations were carried out for the greater “NREA area” of about 630 km² with regard to any potential impacts caused by wind energy utilisation in this very homogeneous, non-populated desert area. These were with regard to competing uses, to flora & fauna and especially with regard to avi-fauna. In the latter case special emphasis was laid on migrating birds. In detail the following surveys were undertaken to determine the baseline situation:

- A reconnaissance survey to assess the present land-use in the area was carried out in July 2007.
- A survey on the fauna others than avifauna and flora was carried out by one fauna (Dr. Mohamad Basyoyani, Al Azhar University) and one flora (Prof. Dr. Kamal el Batanouny, Cairo University) specialist in July 2007. The results are compiled in the study, “EIA screening for the NREA wind farm area with special emphasis on flora and fauna (except avifauna)”, which is Annex 2.5.1 of the “EIA Survey and Assessment, Feasibility Study for a large wind farm at Gulf of Zayt, January 2008”, being enclosed as Annex 1 to this study. The focus was on habitat features, plant life, including identification of present species, their distribution and their assemblage in plant communities, the animal life by direct observation, tracks, burrows and scats and the possible impact of the project implementation on the recorded plant species and animal life. This study was already focussed in more detail to the northern part of the area suggested for a KfW wind park.
- An autumn and spring monitoring of bird migration and bird habitat in the overall area by a team of 6 ornithologists. The results are compiled in the studies
 - Ornithological Field Monitoring Report, (Annex 1, “EIA Survey and Assessment, Feasibility Study for a large wind farm at Gulf of Zayt, January 2008”)

- Ornithological Expert Opinion (Annex 1, “EIA Survey and Assessment, Feasibility Study for a large wind farm at Gulf of Zayt, January 2008”)
- Ornithological Assessment, Summary of Findings and Conclusions, (Annex 1, “EIA Survey and Assessment, Feasibility Study for a large wind farm at Gulf of Zayt, January 2008”)

Step 2:

The “European wind park area” was selected based on the environmental impact assessment of the overall area, as this area had been exclusively selected according to lowest expected environmental impacts, especially also with regard to birds. Thus this area selection already passed an environmental screening with regard to any sensitive impacts. Except residual risks for migrating birds (in that regard the northern area was already cleared by the EEAA) no other impact of wind power generation of potential significance was identified. To verify that a detailed reconnaissance on the “European area” (see chapter 3.2 and Annex 3) and on environmental patterns had been carried out in November 2007. Moreover, the flora and fauna (others than avifauna covered in the previous study) was reassessed for the representative transects by local specialists (Dr. Mohamad Basyoyani, Al Azhar University, fauna and Prof. Dr. Kamal el Batanouny, Cairo University, flora), based on the findings of the field studies of July 2007.

The assessment of the “European area” is further based on a desk study with regard to nationally or internationally designated nature conservation areas and protected /threatened/rare species of flora/fauna expected to be present in the area.

3.3 Consultation

Verbally a full environmental impact study including a public hearing was requested by EEAA. Such public consultation has to be carried out by NREA to make the EIA study complete. “The purpose of public consultation is to solicit views of groups or individuals, who may be affected by the project regarding their environmental concerns. Affected groups or people should identify the environmental issues they believe to be significant. Any significant issues, established during the public consultation, should be incorporated into the EIA Table. (World Bank)”.

Due to lack of residential areas and population inside and even at greater distances from the “European area”, there are no stakeholders in the region. A public consultation may be carried out in Cairo or, more difficult, in Ras Gharib more than 25 km away from the wind park area. A consultation with possibly governmental stakeholders, such as the Ministry of Energy, Ministry of Petrol, Ministry of Defense, the Red Sea Governorate and the General Petroleum Authority (GPC) was carried out prior to the definition of the NREA concession area and the results were summarised in the Agreement on the NREA concession area. In order to fulfil formal requirements of EEAA it is recommended to agree on formal requirements and participation groups with EEAA prior to any arrangement for public consultation.

3.4 Alternatives

The “European area” has been selected as the most environmentally compatible alternative out of a 20 times greater area. Thus, alternative studies to select the most environmentally compatible option were already carried out within the scope of the global study “Feasibility Study for a Large Wind Farm at the Gulf of El Zayt”.

In general wind power projects have to be developed at areas with good wind conditions. Previous wind measurements revealed that the greater area avails of unique high wind power potential. Therefore, there are no equivalent alternative areas for wind power development. Moreover, availability of areas with high wind power potential in Egypt is limited in general. The utilisation of solar power would be an alternative but at significantly higher cost.

Alternatively to power generation by renewable wind energy, conventional thermal power stations might be built. However, such would be likely to be fed by heavy fuel oil and to generate considerable amount of CO₂. This would also contribute to the exhaustion of oil and gas resources.

4. THE EXISTING ENVIRONMENT

4.1 Overview of existing environment

The “European area” is a desert area without any vegetation. The area is crossed by a major Wadi, the Wadi Khurm. However, due to the high wind speeds and the large sand transport/sedimentation potential, the wadi bed is not pronounced at its lower parts, i.e. near to the Sebkhah. The “European area” shows both, undulated land and gravel desert plains. Moreover, the western side, especially in the south-western corner, shows small mountains/hills up to 200 m height.

The ground surface of the desert plains and the undulated land, in most of the area, is covered with compact angular gravels and pebbles forming, what can be called desert armour. The level of the whole project area above sea level ranges from 0 m above sea level at the eastern side to hills and slightly elevated mountains rising to levels of 200 m in the west with rocky underground. In general, the mountainous areas would be kept free from wind power development because of difficult conditions for transport and erection.

Further characteristics of the area are:

- **Landuse:** There is very limited land-use within the greater area:
 - Two oil exploration and production concessions of the GPC are directly adjacent to the “European area” in the east. However, the activities also extend outside the concession coordinates to the “European area” itself and are blocking portions in the west. Although, a general agreement between the Ministry of Petrol (General Petroleum Authority) and NREA exists, the actual concession rights of the GPC have to be considered. On existing pipeline crossing inside the “European area” has to be secured according to safety standards set by the pipeline authority.
 - One salt depression zone (Sebkhah) is located in the West of the “European area” to the east of the main GPC road and pipeline systems. Although the western border of the depression is partly within the “European area”, the area shall not be used as it is within the reach of GPC activities.
- the area does not contain any **habitats** (natural or man made) for flora and fauna.
- **Infrastructure:** The project area has no infrastructure except a few desert tracks and gravel roads. The next housing facilities are at minimum distances of more than 5 km from the border of the area at Ras Shukheir, where housing and guesthouse facilities of petrol companies are located.
- The area does not contain any **historical sites** or **environmental protection areas, or is located inside or nearby a protected area.**

Moreover, the area or it’s direct neighbourhood is characterised by:

- Missing vegetation and very scarce fauna not considering avi-fauna; no rare or endangered species or plants; the area is near to a major migration route with endangered and protected birds. Some of migrating birds are expected to pass the area, which, however, does not show topographical bottlenecks and leaves space for bypassing.

- No surface water except small lakes within a salt depression (Sebkha) in the east of the “European area”.
- Air quality affected by dusts having their origin in the desert itself and caused by strong winds; in the far eastern part of the area, near to the GPC concession area, acidic emissions from flare gas burning is expected.
- Natural noise level high during frequent strong winds; no man made noise emissions in the area.
- Not any antiquities or other sites of historic and cultural significance in the overall area.
- Access to the area from the Suez- Hurghada road (a four lane road) via a reinforced earth road; there is not any bottleneck with regard to traffic/heavy transport capacity.
- Not any utility services in the area; transmission water pipeline (Nile water) is routed on the western side and in parallel to the Suez – Hurghada road, i.e. about 5 km away from the study area.

The area is characterised by average maximum temperatures ranging from 20 C° (January) to 33 °C (August) and average minimum temperatures ranging from 13°C (January) to 28 °C (August), an average annual precipitation of about 4 mm in the winter months, relative humidity in the order of 30 to 40 % and a zero cloudiness almost all through the year. Wind speeds can be derived from NREA’s own measuring stations. Extreme gust wind speeds at 50 m above ground are in the order of 35 m/s. The average wind speed at 50 m height is about 11 m/s. Rainfall is very sporadic in this hyper-arid area. It is variable from year to year and characterized by its irregularity both in time and space.

It is noteworthy that the natural conditions, especially the drastic dry and windy conditions, are very much limiting the biodiversity of the site:

- In exceptionally rainy years, runoff water is being collected in low parts, what may lead to the growth of some plants. However, these plants are subjected to long dry periods leading to their death.
- The high wind velocity in the site plays an important role in the severe erosion of the soil. The ground surface in the site is mainly covered by compact layer of pebbles and gravels. These represent desert armour, which prevents the permeation of rain water to the subsoil. The high wind velocity removes the seeds and other propagules. So, the chance for seeds to germinate and establish themselves is very poor.

4.2 Landscape character and existing views

The following photos allow a general impression on the landscape of the different parts of the “European Area”. The area is a desert area as typically met at the Gulf of Suez. There is no vegetation, no water and no existing views worth to be protected.



Fig. 6: Typical flat eastern landscape at the eastern part of the area



Fig. 7: Zone of hilly terrain in the middle to east part of the area



Fig. 8: Zone of mountainous terrain in the southwest of the area, which would require very high infrastructure cost and should be avoided from siting



Fig. 9: GPC pipelines, OHL and road outside the GPC concession blocking part of the European area

4.3 Flora and fauna (without avi-fauna)

The area encompasses different habitats. Each of these habitats has its own characteristic features. Consequently, the plant and animal lives are different in the various habitats, if existing at all.

Habitats:

The habitats identified at or near to the site are:

- **Sebkhas (Saline habitats): (*Al Mallaha*)**

This habitat usually occupies land below or slightly above sea level. The main saline area extends in the east of the “European area”. Although the area is just at the eastern border of the “European area”, it shall not be used for wind power implementation, as it is blocked by GPC activities.

- **Wadi Downstream**

- The “European area” is crossed by a few smaller and one big Wadi (Wadi Khurm), which are dewatering to the west, to the Sebkhah. They show pronounced wadi beds in the mountainous and hilly part of the area. In the low land plains the beds almost disappeared because of sedimentation effects caused by the high wind speeds and the large sand transport/ sedimentation potential. Usually the wadis have the potential to harbour some vegetation (about 2-5 % cover) with a sporadic growth of this vegetation in case of rare rainfall with plant communities dominated by *Ochradenus bacca-tus*, *Haloxylon salicornicum*, and *Zygophyllum coccineum*. However, during the reconnaissance the wadi beds in the “European area” were found to be free of vegetation.

- **Gravelly Desert Plains**

The eastern part of the project area is represented by flat, wind eroded gravelly and pebbly plains. These are completely devoid of plant cover. Only at some spots there are smaller hills originating from sand deposits. These singular spots may allow the growth of a very thin plant cover.

- **Hills & mountains**

Proceeding to the west in the project area, the land becomes hilly. These parts have no potential for any plant cover.

Flora:

Plant species observed in the greater area are very few in number and most of them are dead caused by the hyper-arid climate. All plants are common ones, not being red-listed. The “European area” itself does not show vegetation except very rare one at the border to the Sebkhah, i.e. the eastern border of the project area:

Trees:

Acacia raddiana can usually be found at wadi beds. However, the “European area is free of that.

Shrubs:

Tamarix* sp. (*T. passerinoides*).** ***Athl- Tartfa. This very common species occurs along the borders of the *Sebkhah* at the eastern border of the site, but outside the area suggested to be used for wind power installation.

***Nitraria retusa* (Forsk.) Asch. Ghakad - Ghrdak**. A halophytic plant that grows along the margins of the *sebkhah* at the eastern border of the site, but outside the area suggested to be used for wind power installation.

Undershrubs

Halopytes

Salsola longifolia Suweid. A halophytic plant with succulent leaves grows at salt affected habitats along the less saline habitats in the sebkha area in the east of the "European area".

Zygophyllum album L. Rotreit Abyadh. It is halophyte with succulent leaflets and petioles. The plant forms phytogenic mounds in saline habitats along the margins of the sebkha at the eastern border of the site, but outside the area suggested to be used for wind power installation.

Xerohpytes

Haloxylon salicornicum (Moq.) Bunge ex Boiss. Rimth. The plant occurs in rills and shallow drainage lines or on flat gravely plains. The plant forms phytogenic mounds by collecting the wind-drifted sand. The tail of the mounds points to the wind direction.

Zilla spinosa Pranl. Sillah. The plants recorded in the area were dead. It seems that in exceptionally rainy years, there is a chance for the growth of some individual. These desiccate due to lack of water supply and die.

Ochradenus baccatus: It has the potential to occur in the area. The plant is a common desert undershrub in the Eastern desert of Egypt.

Fauna – (without avifauna):

The fauna composition traced or expected at the project site can be classified into two main categories; namely: vertebrate and invertebrate animals.

- Invertebrates**

Six species were observed in the project area or in the near farm land in Wadi Dara. These are arthropods. Scorpionida (scorpion) is represented by only one species; the Yellow scorpion. Diptera and Hymenoptera are orders represented by two species in the project site. Only one species from order Coleoptera was found in the project site (Table 1).

Order	Family	Species
Coleoptera	Tenebrionidae	Tentyrina bohmi
Hymenoptera	Formicidae	Cataglyphus bicolor
		Monamorium subobacum
Diptera	Muscidae	Musca domestica
		Tabanus gratus
Scorpionida	Buthidae	Leiurus quinquestriatus
4	4	6

Table 4.2 Systematic list of arthropods traced or expected in the project area

Scorpions

The yellow scorpion was captured in the neighbouring area and is expected to occur in the European area as well. ***Leiurus quinquestriatus* (Hemprich and Ehrenberg, 1828)**, **Yellow scorpion**: The main characteristic feature is the blackish colour of last segment of the tail. One of the most dangerous scorpion species in the world and is common in Egypt.

Insects

Individuals of three different orders of insects were observed nearby the study area and are suspected to occur also inside the area. These include a small beetle: *Tenetyrina bohmi* (Coleoptera), a small ant: *Monamorium subobacum* and a large ant: *Cataglyphus bicolor* (Hymenoptera) and other two species belonging to order Diptera; namely House Fly: *Musca domestica* and Blue Fly: *Tabanus gratus*.

Vertebrates

The vertebrates in the site comprise reptiles and mammals. Both groups are expected to be represented by different species. Direct observation could not show the presence of these species. But other evidences were used as well as the previous records. The species record, either previous or present indirect observations shows that five reptiles and seven mammals are apt to occur in the site (Table 4.3). All species are of a status "low risk/least concern".

Order	Family	Species
Reptiles		
• Squamata	Agamidae	Agama agama spinosa
	Gekkonidae	Hemidactylus turcicus
		Tropioiclotus steudneri
	Lacertidae	Acanthodactylus boskianus
• Ophidia	Viperidae	Cerastes cerastes
Mammals		
• Lagomorpha	Leporidae	Lepus capensis
• Rodentia	Gerbillidae	Gerbillus gerbillus
		Meriones crassus
	Muridae	Mus musculus
		Acomys cahirinus
• Carnivora	Canidae	Vulpes vulpes
		Vulpes rueppelli

Table 4.3 Systematic list of terrestrial reptile and mammal species expected to occur in the project area

Mammalian Habitats

The traced mammal species in the project site can be found in different habitats. Table 4.4 shows the distribution of these species in the various habitats.

Species	Habitat types			Evidence	Previous record
	SB	GP	WD		
Lepus capensis	+++	++	++	Tracks	Osborn and Helmy (1980)
Gerbillus gerbillus	+++	+++	+++	Tracks	
Meriones crassus	+	-	-	Tracks	
Vulpes vulpes	+++	-	-	Tracks and scats	
Vulpes reuppelli	-	++	++	Tracks	

(-=absent; + = present up to three times; ++ = present up to five times; +++ = present more than five times) (SB= Sebkhah; GP=Gravelly plains, WD= Wadi downstreams)

Table 4.4 List of mammalian species expected to be found in the project area.

Threatened Species in the deserts of Egypt

The above-mentioned data and information show clearly that no species of both, reptiles and mammals in the Egyptian desert, is threatened globally (according IUCN categories) and nationally (according to their status in Egypt).

4.4 Birds - Avifauna

The “European Wind Park Area” is located more than 25 km in the North-East from the northern footings of the Gabal El Zayt, a coastal mountain range, which is an important step stone for birds migrating from and to Sinai and also an declared important bird area (IBA). The bird life in the “NREA area” of about 630 km² has been investigated with the focus on migrating birds. Results are based on one autumn and one spring observation. Regular observations were carried out from 26 different observation points equally distributed over the large area during one autumn and one spring migration period. The observation times were about 20 hours (autumn) and about 23 hours during spring at each observation site. Due to the time-wise small observation samples the assessment was made conservative. Detailed results are enclosed in the “EIA Survey and Assessment”, January 2008, enclosed as Annex 1.

Following the ornithological expert assessment and recommendations the “European area” was selected in the north-western part of the investigated greater area at the greatest distance from the main migration corridor. Thus, the selection of the area already reflects the outcome of the ornithological specialist studies for the greater area.

Habitats:

The “European area” can be classified into 2 categories:

- **Flat or slightly undulated gravel plains** in the east completely exposed to the wind mostly blowing from Northwest with wind speeds of more than 10 m/s near

the ground and not offering shelter for bird resting except within a few wadis or depressions.

- **Hilly or slightly mountainous** in the west reaching up to 200 m, which would offer some shelter for bird resting at the slopes opposite to wind direction.

Important features outside the “European area” are:

- The **red see mountains**, which at the latitude of the “European area” are about 15 km to the west from the “European area”. This range forms the western border of the Gulf of Suez, where the wind is accelerated because of the tunnel effect. The slopes of the hills are causing upwind effects. It was observed during spring, that larger numbers of birds of prey are moving along this mountain range towards Suez.
- In the west of the NREA area near to Ras Shukheir the **Sabkhet Ras Shukheir** is located. This contains several pools of hyper-saline water and large patches of salt-marsh. This area offers resting places for water birds. Limited numbers of flamingos, spoonbills and pelicans were observed.

Local Birds:

The harsh windy and hyper-arid climate and the desert bare of vegetation offers no attraction for birds. Almost all birds found in the area do not stay the whole year but appear there during migration. Very few local birds and birds species were observed, all of them classified in the IUCN red list to be of least concern. The chief group of local birds were the sandgrouse (*Pterocles senegallus*), brown-necked raven (*Corvus ruficollis*) and a few Bar-tailed desert larks (*Ammomanes cinereus*), hoopoe larks (*Alaemon alaudipes*) and pale crag martins (*Hirundo obscura*).

Migrating Birds:

With regard to migrating birds reference is made to the detailed reports enclosed as part of Annex 1. The “European area” is located in Zone III, which is farthest away from the main migration corridor. In this most northern zone there is no immediately recognisable topographical bottleneck. The terrain opens out and offers the birds more room to manoeuvre. Birds moving through here in general are heading in the direction of Suez. Although the frequency of birds passing here in Zone III is much less than in Zone I and Zone II the construction of wind power still requires awareness of potential bird risks

All bird species observed during systematic observations of the greater area are globally classified in the IUCN red list as “lower risk/least concern” except the Lesser Kestrel classified as vulnerable and the Pallid Harrier classified as near threatened. The Lesser Kestrel was observed within the first 200 m of the overall area 14 times during autumn and 19 times during spring. Figures for the nearly threatened Pallid Harrier were 73 (autumn) and 12 (spring). The spotted eagle was observed 1 time in the first 200 m and 8 times flying higher. This species is classified by IUCN as DD (Data Deficient) and might be threatened as well. All three species are contained in Appendix 1 of the Convention of Migratory Species (CMS), which is signed by Egypt. Although these endangered species were not observed in the Zone III (the northern zone) they may also occur in Zone III.

4.5 Water resources and waste water

The “European area” can be classified to be hyper-arid. It is crossed by some small and one major wadi, the Wadi Khurm. Due to the high wind speeds and the large sand transport/sedimentation potential, the wadi beds are not pronounced in the desert plains. In absence of reliable statistics, surface runoff reaching up to the “European area” is expected to be very seldom. Local people are talking about once in 10 or 20 years.

Open surface waters are met in the Sebkha area in the east and directly adjacent of the “European area”, where the surface is near to or even below the sea level. Accordingly, the lakes in that area receive their saline water by infiltration of seawater or, in very rare cases from rain runoff in the Wadi Jarf or the Wadi Khurm. Groundwater is expected in general at increasing depths towards the inland. Drinking water is available from a main Nile water pipeline passing in about 5 km distance in parallel to the Suez - Hurghada road outside the eastern border of the “European area”.

There are no human activities in the “European area” that use water or cause drainage.

4.6 Air quality

Due to the high wind speeds in the NREA area and the desert character of this area the level of dust or fine sand content in the air is frequently high. In the eastern part of the NREA area, near to the Sebkha, sulphate containing flare gases from EPC production wells cause acidic ambient air conditions in the surroundings.

4.7 Noise levels/shadowing/vibrations

The natural ambient noise level in the area is sometimes high because of noises caused by frequent strong winds. There are no settlements or residences in or near to the “European area”, which could be affected from noise pollution or shadowing effects from wind turbines.

4.8 Antiquities and other sites of historical and cultural importance

Not existing inside or adjacent to the “European area”.

4.9 Social and economic context

The next settlements are Ras Gharib about 30 km away, a tiny settlement at Wadi Dara village about 15 km to the south and a petrol workers camp about 10 km to the south-east of the “European area”. Most inhabitants are originating from the central or upper part of Egypt.

4.10 Existing transport infrastructure and traffic flows

The access to the area is from the Suez- Hurghada road, which is a four lane road. This road has very little traffic load compared to its capacity. It is fit to for heavy transports.

4.11 Existing utilities

There is not any water use or water distribution inside the “European area”. The same is valid for electricity. The next electricity supply system is the Ras Shukheir island grid. One private GPC island grid is extending from Ras Shukheir to the site, where a 10 kV branch of this grid is extending along the GPC internal road at the east of the “European area”, which in some parts even is on “European area” ground. A 220 kV overhead line between Hurghada – Zafarana was planned since long and the works are contracted. This line is also to supply Ras Gharib and is built independently from any wind power development at the “European area”.

5. PREDICTION OF IMPACTS AND EVALUATION OF SIGNIFICANT ENVIRONMENTAL AND SOCIAL EFFECTS

5.1 General

Expected or possible environmental impacts of wind energy projects in a desert area, as it is the case of the “European area”, are very much limited. This is valid for both, the construction and the operation phases. The limitation of environmental impacts is due to

- the fact that the area was already selected under the criteria of minimising environmental impacts,
- the nature of the area with a hyper arid climate shows no population, very limited or even no vegetation and wild life inside or near to the area that can be affected by the measure.
- the nature of a wind park project with very little specific land-use typically consisting of up to 3 m deep wind turbine foundations (in case of 2 MW wind turbines with foundation measures of about 15 m x 15 m and about 3 foundations per km² with a land requirement of about 0.1% of the area), underground cabling at distances of about 1 km, eventually small transformer foundations (use of about 0.005 % of the area), and 5 m wide gravel roads made from compacted desert gravel.
- a central substation would have to be built (about 200 m x 150 m for 200 MW wind power, equivalent to an area consumption of less than 0.1 %).
- one central building facility for wind park service, which would be located outside the “European area” probably somewhere next to the main road, and would be subject to separate approval.

Thus the utilisation of land by buildings is very limited

Local fauna and flora are very few in numbers and were common ones, not being red-listed. Also possible impacts caused by waste water and domestic waste generation during the construction phase and later on at the service buildings during the erection phase would be of very minor nature and could easily be mitigated.

As the location of the “European area” is not very far away from a main migration route the assessment of likely impacts on migrating birds caused by a future wind park during the operation phase was a key issue of EIA considerations for selecting the area.

5.2 Land take

Even if considering the desert gravel roads and platforms as land take of the wind-park project the overall use of the “European area “ by wind power and associated installations would be in the order of 1 % only. In the absence of ecologically sensitive habitats, attractive landscape, antiquities, agriculture, residents etc. the minor land take has not any impact.

5.3 Presumed environmental impacts caused by construction

There are not any significant environmental impacts expected resulting from the wind park construction phase. Minor impacts may originate from,

- littering of solid waste at the central construction yard or at the construction sites

- spread over the area,
- spills of oil and grease at the machinery park,
- deterioration of landscape due to not adequate backfilling or levelling after excavation.

They can easily be avoided by good housekeeping and strict supervision of construction measures.

The same is valid for associated constructions such as for the substation, the transmission line and NREA buildings, all being outside the "European wind park area".

5.3.1 Emissions

In the absence of sensitive receptors in the area emissions during construction, such as exhaust gases and/or noise from machinery have no significant impact. Spills of oil or lubricants are usually not a problem. Because of their value they are handled with care, or if used, collected for recycling.

5.3.2 Water supply, waste water and waste

Water supply is not relevant: For Wind Park construction a temporary construction yard (for storage of materials and servicing of machinery) and a temporary office would be erected at a central place. The office avails of simple sanitary facilities. Water supply would be via tankers from the central pipeline. Electricity would be generated by a small mobile generator. Such office building would be for about 20 persons, who, however, spend much time outside at the construction sites. The office will be equipped with simple sanitary facilities. Waste water quantities should be of an order of 1 m³/d. The domestic waste water would undergo anaerobic treatment in a septic tank and post-treatment by percolation into the sandy underground. There would be not any measurable harm to the environment resulting from this treatment.

Liquid waste is not relevant: Liquid waste such as used oil is not likely to have significant effects on the environment as these valuable products are usually carefully collected and send for recycling.

Solid waste is relevant: Waste such as packing materials (paper, plastics) originates from the individual turbine erection sites. Under the heavy wind conditions the waste is easily spread over the desert and transported over large distances.

5.3.3 Traffic and infrastructure

During the construction heavy transport will take place. The road system of the greater area does not show any bottleneck to the size and frequency of such transports. Thus there will no bottleneck, causing problems on the public roads and harm for passengers or regional population. Inside the desert area access roads will be built as compacted gravel roads to allow transport as needed.

5.3.4 Occupational health and safety risks

Potential occupational health and safety hazards during the construction of wind power projects include risks from

- Earth works and foundation constructions (minor nature),
- Working at heights (major risks),
- Electrical works (partly under control by external authority EEHC)

Health and safety risks shall be controlled at least as to the level defined in the IFC Environmental, Health and Safety Guidelines, Wind Energy, April 2007. For electrical works internationally acceptable Electrical Workers Safe-Work Regulations shall apply.

5.3.5 Economic impacts during construction

Wind park construction would have economic benefits for workers in Egypt usually mainly coming from upper Egypt but also from other regions:

- About 30 to 40 % of the investment volume would be produced locally.
- During construction local personnel would be employed for civil, electrical and installation works. The works would be carried out essentially by Egyptian companies.

Considering the unemployment rate in Egypt the demand for construction workers for wind park construction would not create labour bottlenecks in other areas.

5.3.6 Impacts on flora and fauna

No impacts with significant environmental effects during the construction:

- The very limited land-use of wind power projects allow avoiding even dispersed flora (e.g. acacia trees) during planning. In case of the "European wind park area" no vegetation was found except at the eastern border, at the salt marsh. However, this area shall be kept free from wind power development.
- Wadi habitats shall be avoided for risks from any flood, which may occur very seldom.
- Construction will be a moving process, always utilising very limited area of the wind park area at the same time, thus leaving huge areas untouched and much room for resting or retreat of the little common fauna expected in the area.

5.4 Presumed environmental impacts caused during operation

5.4.1 Dust emissions

No dust emissions will originate from a wind park during operation.

5.4.2 Gaseous emissions

No gaseous emissions will originate from a wind park during operation.

5.4.3 Liquid emissions, quantities, treatment and reuse

No liquid emissions will origin from the wind park itself during operation. Very small amounts of domestic waste water would origin from the sanitary facilities of

- the substation control room (3 persons à 30 l/d): 0.090 m³/d
- The service facilities including housing for NREA personnel outside the wind park area: (50 persons à 40 l/d): 2.0 m³/d

In both cases the domestic waste water will undergo 2 stage anaerobic treatment, as it is common and adequate practice in Egypt. Residual treated water will either be percolated to the ground or reused for limited watering of plants. There will not be any harm or measurable adverse impact resulting from liquid emissions.

5.4.4 Waste quantities and disposal

Waste from the wind park would consist of used consumables regularly to be exchanged, when servicing the machines, and smaller defective parts. These are non hazardous materials, most of them valuables and fit for recycling. Larger defective parts such as gear box or generator would anyhow be returned to the factory for repair or re-use of materials.

Hazardous used oil will be collected once per year or once in two years and send for recycling. The practice in other Egyptian wind park shows that this works without problems. The volume of used oils will depend on the type of wind turbine selected and on the service intervals requested by the selected contractor.

Domestic waste will be generated at the service facilities of NREA. The Zafarana experience shows that the domestic waste is small in quantities and mainly composed of biodegradable or burnable waste. The estimated volume not compacted is less than 50 persons x 2 to 3 l/d: 150 l/d. The standard method as applied in Zafarana or at remote housing facilities in the desert in Egypt would be that waste will be collected in bags and in bins, and disposed of on an environmentally safe waste disposal site (desert pits). To reduce the volume the waste is burnt. The residual waste will be covered by sand. The waste is inert and in absence of rain there is no harm for the subsurface. Considering the small amounts of domestic waste (about 60 m³ per year of non compacted waste equivalent to about 1 to 2 m³/a after incineration) this simple method is considered to be acceptable.

5.4.5 Noise and vibrations

Wind turbines working under regular conditions show very little vibration. This vibration is dampened by the foundation body and there is very little transmission into the underground, especially in case of a non rocky underground like in the European project area. Thus, vibration effects will not be measurable in the underground already nearby the wind turbines.

Noise propagation from the wind park was checked by a standard wind park modelling programme. The calculation was carried out using the noise calculation standard ISO 9613-2,

Germany and the 100 x 2 MW configuration and the Vestas V80, 60 m hub height. The results show that already at distances of 500 m away from the next wind turbine the noise level is reduced to less than 40 dB (A) and at distance of 100 m the noise level is reduced to less than 35 dB(A). According to Annex 7 of the Executive Regulations of the Environmental Law 35 dB(A) correspond to the highest class (hospitals during night). Thus, there is not any harm to any settlement or residence, as the next living area is about 9 km away from the wind park area. The calculation results are shown in Fig. 10.

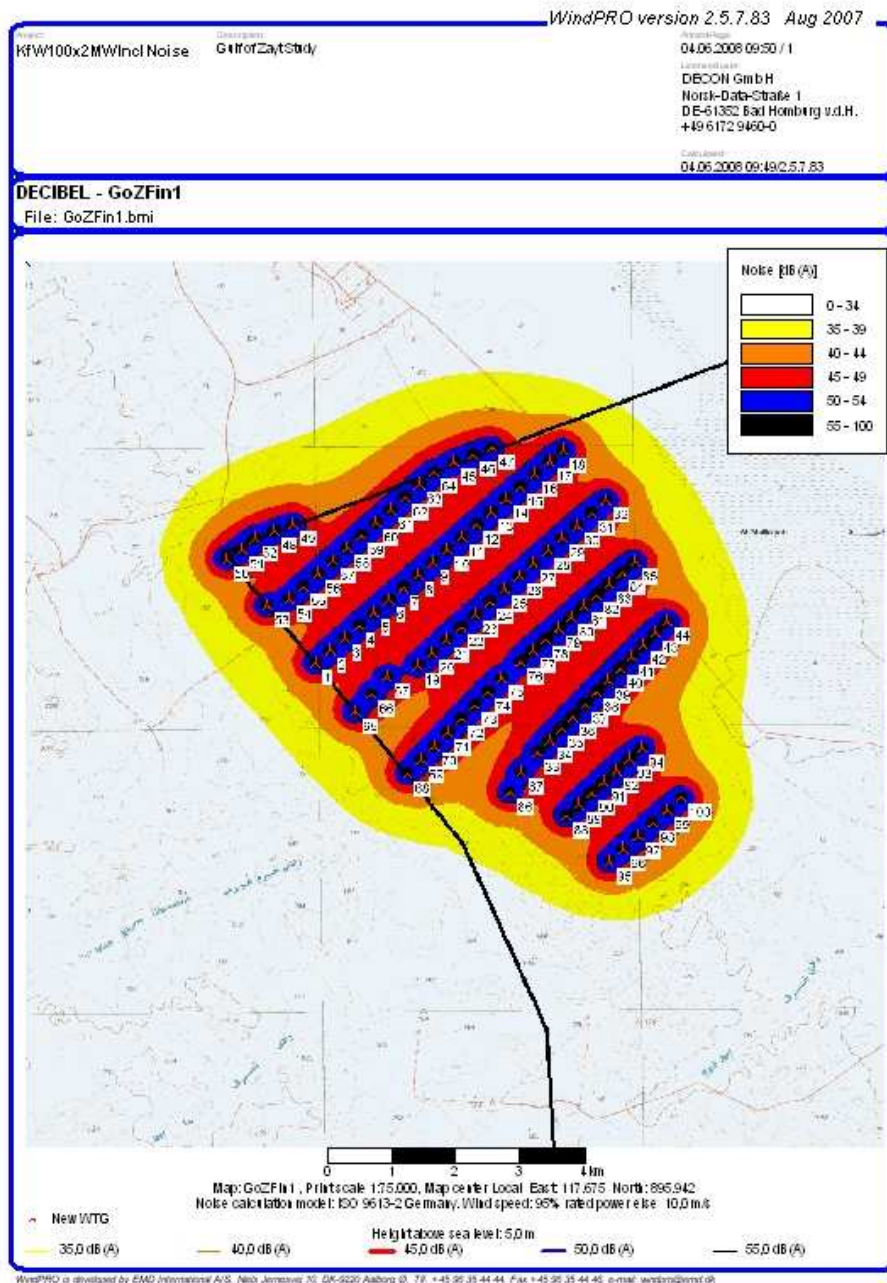


Fig. 10: Noise propagation calculation results

5.4.6 Light reflections and shadowing

The blade coating of modern turbines does usually absorb direct sun light and reflection is not a significant environmental impact. In case of the European Wind Park a special blade coating (red, bright white, red) shall apply to increase the visibility to the birds. Thus reflection characteristics would be increased. However, in any case, due to lack of receptors in the surrounding of the wind park that can be affected by reflection, there is no critical impact from that.

The critical impact of shadowing (flickering) as per acceptable standards is 30 hours per year and 30 minutes per day. This can be achieved only at places near to wind turbines, where the observed transition time of the sun through the rotor diameter can achieve such durations. As there are no residences or housing near to the turbines it is obvious that there is no impact from flickering beyond acceptable level.

5.4.7 Impacts on travel, utility services and other infrastructure

As the main roads in the overall region are very well dimensioned at low traffic frequency there are not any critical impacts on the traffic.

The facilities of NREA and of EETC (substation) will be supplied with water from the pipeline coming from the Nile via Hurghada. The expected amount of water consumption of 2 m³/d will not be critical for the supply of the region. As the area is supplied from a 220 kV transmission line there shall be no shortage in electricity.

5.4.8 Occupational health and safety and other risks

Potential occupational health and safety hazards during the operation and decommissioning of wind power projects include risks from

- Working at heights (major risks).
- Working on electrical systems.

The risks can be limited to acceptable standards if works are strictly carried out as to the stipulations defined in IFC Environmental, Health and Safety Guidelines, Wind Energy, April 2007 and according to internationally acceptable Electrical Workers Safe-Work Regulations.

5.4.9 Impacts on fauna and flora

As to the nature of wind power projects the use of the land is quite limited (less than 1 % of the land) leaving most of the area free from any interventions. The site surveys revealed that the European area is vast of flora and has very limited resident fauna being of common nature and mainly related to habitats. In addition these habitats anyhow will be avoided as the construction would be difficult or risky there. These are the salt marsh at the eastern border of the area and the Wadis. Thus the turbines will be installed away from such more sensitive areas. Thus the operation of the wind park will not have significant impacts on the flora and

resident fauna beyond acceptable limits. There are also no other activities in the area, which would contribute to increase impacts to non acceptable level.

The operation of the wind may have impacts on migrating birds. The preceding ornithological study including the European area assessed the occurrence of migrating birds at levels below 201 m, especially that one of soaring and gliding birds as these would be endangered because

- they have restricted flight agility and may be suffering from collisions with turbine blades,
- wind parks have barrier effects for many bird species as they tend to by-pass or over-fly wind park areas. This forces them to active flight at high energy consumption, which would cause loss of energy and increased likelihood for mortality on their migration routes.

Detailed reports are enclosed in Annex 1 to this report. Accordingly, the investigation area was split into three zones: The "European area" is located in Zone III, which is farthest away from the main migration corridor. In this most northern zone there is no immediately recognisable topographical bottleneck. The terrain opens out and offers the birds more room to manoeuvre. Birds moving through here in general are heading in the direction of Suez. Their frequency is much less than in Zone I and Zone II. Thus, even though the judgement was conservative, risks for birds in this Zone III were assessed to be on acceptable low level. However, technical avoidance/mitigation measures at the plants and in the infrastructure itself as to the best commercially practicable standard shall be implemented. Moreover, a careful post installation monitoring programme shall be executed to assess whether the impacts in a wind park would really be on acceptable level or whether additional measures will have to be carried out.

5.4.10 Economic Impacts

- Wind park operation will be carried out by local personnel. Accordingly, a significant number of electricians, mechanics, engineers and workers would be employed for O&M of the wind park.
- At steadily increasing oil prices, wind power utilisation, especially at a site with very high wind energy potential like the NREA area, is very competitive, if compared to international level of cost of energy. It saves indigenous gas and oil reserves, which alternatively could be exported at world market prices.

6 MITIGATION

6.1 Mitigation strategy

If not considering potential residual risks for birds there are only a few minor impacts expected from wind power projects in the “European area”. These can be easily avoided or mitigated by good design, workmanship practice, keeping health and safety standards as well as housekeeping and supervision.

The possible residual impacts on migrating birds shall be further reduced by

- limiting the max tip height of wind turbines to about 100 m (e.g. to 110 m) in order to limit the barrier effect.
- equipping wind turbines to the best commercially practicable standard available to make them more visible for soaring and gliding bird species.
- using stroboscopic navigation lights on top of the turbines instead of red lights.
- to establish a post construction monitoring programme for the wind park project and to take any correction measure, that might become necessary.

6.2 Mitigation measures

The minor environmental impacts that can be caused during the construction shall be mitigated as follows:

- The contractor shall be forced to good workmanship and housekeeping during construction by contractual stipulations and by supervising engineers in order to assure adequate disposal of solid waste and waste water, to avoid or to collect spillages of used oils, greases, diesel, etc.
- The contractor shall be forced not to leave the construction site unless the area was put into tidy conditions, excavations are backfilled, heaps of excavation material is levelled and waste is adequately disposed off.

Potential occupational health and safety hazards during the construction phase shall be controlled by

- Assignment of an health and safety engineer by the main contractor with full power for giving health and safety instructions.
- Strictly implementation of wind power manufacturers health and safety instructions concerning the erection, commissioning and maintenance of the wind turbines such as
 - Establishment of a health and safety plan for the construction site,
 - Provision of safety tools & equipment as to accepted standards by the Contractor,
 - Employment of personnel on the turbines only, which has passed a wind power safety training course,
 - Strictly avoidance of works during poor weather conditions (wind speeds beyond limits & lightning risk).
- Strict supervision of health and safety measures of the civil works companies, which may be employed via the main contractor or directly by NREA, especially with regard to wearing safety clothes, to equipment safety and a safe working environment.

- Strict supervision of keeping health and safety standards for working at electricity generation, transmission and distribution devices.

Minor impacts that can be caused during operation from service installations that will be built outside the wind park area shall be mitigated by

- Regular disposal of domestic waste.
- Regular disposal of hazardous wastes, especially recycling of used oils, which from time to time is generated during oil exchange at the wind turbines.
- Collection of domestic waste water, purification in a simply two stage anaerobic treatment plant and rinsing of treated water into desert gravel for natural post treatment or use for irrigation. Regular disposal of domestic sludge.

Impacts that can be caused to migrating birds in the already environmentally cleared northern zone (zone III) shall be further limited/mitigated by

- keeping the maximum tip height of 110 m in order to facilitate eventually necessary over-flying.
- targeting to keep distances between turbine rows at not less than 14 turbine diameters and perpendicular to that at 3.5 rotor diameters to facilitate wind park crossing of species, which do not avoid wind parks in general but tend to cross at lower heights,
- painting the blade edges stepwise by visible colours and equipping turbines with stroboscopic air traffic navigation lights instead of red lights.
- building the wind park internal grid by underground MT cables. If the use of overhead lines cannot be avoided (e.g. 220 kV OHL), such overhead lines have to be designed according to the guidelines "Protecting birds from power-lines, Nature and environment No. 140, Council of Europe Publishing". Analogous measures shall be applied at any substation to be built in that area.
- avoiding the Ras Shukheir Sebkha area as this area is judged to be environmentally more sensitive and as wind power development at this salt depression/salt lake area would be anyhow difficult/more costly.
- carrying out a very careful post construction monitoring focussing on flight behaviour at and near the wind park and on the determination of collision rates and mortality in the wind park and at the substation. The post monitoring may lead to further mitigation measures in order to identify any bird risks beyond acceptable level and to apply additional protection measures, wherever necessary.

6.3 Environmental management plan

The implementation of mitigation measures require actions during the bidding, planning, construction and post construction phase, which can be summarised in the following EMP.

Project activity	Environmental Concern	Mitigation Measures	Estimated Cost (EUR)
Bidding Process (NREA)	Health and Safety Risks	Make keeping standards as defined in the Environmental, Health and Safety Guidelines for Wind Energy, IFC,2007, a minimum obligation in the Tender Documents	No extra cost
		Make the assignment of a health and safety engineer during the construction process a condition	Included in investment cost estimate
		Make a health and safety plan for the construction site obligatory	Included in investment cost estimate
		Make provision of safety tools & equipment as per accepted standards by the Contractor a bidding condition	Included in investment cost estimate
	Impacts of the wind park on birds	Limit the maximum tip height of wind turbines to 110 m,	No cost
		Define the minimum distances between wind turbines to be not less than 3.5 x 14 rotor-diameters	No cost
		Requirement to paint blades stepwise by visible colours (e.g. red, bright white, red) and equipping turbines with stroboscopic navigation lights instead of red lights to minimum extent required	950,000 EUR
		Build internal grid as underground cable	This is the standard and considered in investment cost estimate
Bidding Process (EEHC)	Impacts of the wind park on birds	Make keeping guidelines "Protecting birds from power-lines, Nature and environment No. 140, Council of Europe Publishing" a condition for the design of of the 220 kV interconnection to the substation and introduce adequate bird protection measures at the substation.	For transmission line included in investment cost estimate; Substation 600,000 EUR
Planning process (NREA)	Health and safety risks	Check availability and adequacy of the health and safety plan	Included in Consulting Cost Estimate
	Impacts of the wind park on birds	Verify the detailed planning documents with regard to keeping above listed environmental protection conditions	Included in Consulting Cost Estimate
Planning process (EEHC)	Impacts of the wind park on birds	Check keeping guidelines for "Protecting birds from power-lines, Nature and environment No. 140, Council of Europe Publishing" in the detailed planning of the 220 kV interconnection overhead line	Included in Consulting Cost Estimate

Project activity	Environmental Concern	Mitigation Measures	Estimated Cost (EUR)
		and adequate bird protection measures at the substation	
Construction process	Health and safety risks	Check assignment of health and safety engineer of Contractor and his independency with regard to giving health and safety instructions	Included in Consulting Cost Estimate
		Check keeping the "Environmental, Health and Safety Guidelines for Wind Energy, IFC,2007" as a minimum condition	Included in Consulting Cost Estimate
		Check availability and proper utilisation of safety tools and equipment	Included in Consulting Cost Estimate
		Check hygienic conditions of temporary sanitary facilities	Included in Consulting Cost Estimate
		Assure stoppage of erection works during weather conditions beyond limits	Included in Cost Estimate, extended erection periods
	Pollution	Force contractor to good workmanship and housekeeping by supervising engineers in order to assure adequate disposal of solid waste and waste water, and to avoid or to collect spillages of used oils, greases, diesel, etc.	Included in investment and Consultant cost estimate
		Force the contractor to put the construction site into tidy conditions, excavations are backfilled, heaps of excavation material is levelled and waste is adequately disposed off.	Included in investment and Consultant cost estimate
Operation (NREA)	Health and safety risks	Assure that O& M at the wind turbines is carried out by personnel only that has passed a safety training course	Standard requirement to be observed by NREA
	Impacts of the wind park on birds	Carry out a post construction ornithological monitoring during peak migrating seasons in order to identify any bird risks beyond acceptable level and to apply additional protection measures, wherever necessary	350,000EUR
	Pollution	Assure proper management of domestic waste at service buildings (e.g. in cooperation with Ras Gharib waste management scheme) and of used grease and oils (recycling)	Standard requirement to be observed by NREA

6.4 Monitoring arrangements and actions

The purpose of environmental monitoring is to ensure that the designed mitigation measures are implemented on the ground and then whether they are effective over time. The latter is

especially relevant with regard to the bird protection aspects and the respective post construction monitoring.

The responsibility for monitoring the bidding, planning and the construction process lies with NREA. This supervision is supported by an international Consultant. Moreover, the financing institutes may make keeping the monitoring and a corresponding reporting a condition in the financing agreements. A corresponding budget is considered in the cost estimate for the Consultant. Moreover, environmental costs were considered, which is mainly related to the painting of blades, measures at the substation and the bird monitoring study. The keeping of health and safety standards shall be controlled by Contractor's qualified own health and safety engineer, who shall be acting in his field independent from eventual instructions of the Contractor.

The supervision of measures related to the main substation and the 220 kV interconnections would be out of control of NREA and should therefore be subject to a separate agreement between NREA and EEHC or part of a financing agreement.

The bird monitoring shall be carried out during a peak spring and autumn migrating season (2 months during spring and 2 months during autumn) during the operation phase. It shall be carried out by an independent ornithological expert team. The relevant cost is included in the environmental management plan. The monitoring may result into the following:

- a. Reconfirmation of expected results from the previous bird study, i.e. small residual amount of migrating birds being able to avoid the wind park area (over-flying or by-passing) without recognisable difficulties. No further action required.
- b. The impact on birds at the wind park or selected parts of the wind park would be beyond tolerable limits.

In case of b. adequate measures, such as creating corridors or temporary stoppage of turbines, may have be introduced.

Annexes