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Strategic Environmental and Social Assessment of Solar Energy Projects in the East Nile Region (Arab Republic of Egypt)

Non-Technical Summary (NTS) of the Final Draft SESA Solar Report




May 2018

New and Renewable Energy Authority (NREA)
Ministry of Electricity and Renewable Energy

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Strategic Environmental and Social Assessment of Solar Energy Projects in the East Nile Region (Arab Republic of Egypt)

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1 Objective and Scope

1.1 Objectives and Scope of the overall SESA Process

The Government of Egypt (GoE) has identified three large areas suitable for development of Renewable Energy (RE) farms for both wind and solar energy projects in Egypt. Among these, an area of 2,200 km^2 with a usable area of 1,725 km^2 (425 km^2 were excluded due to military height limitations, see section 0.2) located to the east of the Nile River across three Governorates Beni Suef, El Minya and Assiut has been identified based on existing data on solar and wind potential and existing land-use (the "Project Area"; see section 0.2). To ensure a strategic level assessment of potential environmental and social issues associated with the development of such projects and to inform the decision-making process for project development two Strategic Environmental and Social Assessments (SESAs) have been conducted. A SESA is a systematic decision-support process that helps to ensure that environmental, social and other sustainability aspects are considered effectively in policy, plan and programme making. The SESA process for the Project Area has the following objectives:

- To provide a reliable source of environmental and social data for the Project Area to inform RE development plans, environmental permitting and project financing.
- To identify eventually existing zones of technical or social constraints for RE development within the Project Area.
- To identify and assess potential environmental and social impacts associated with RE project development and operation in the Project Area and define mitigation and management measures to address these potential impacts, including recommendations on arrangement of plots for individual wind or solar power projects.
- To identify areas in the Project Area, which are suitable for RE development based on the outcome of the environmental and social impact assessments.
- To engage with stakeholders, including members of the public on the planned development of RE projects in the Project Area.
- To develop a Geographic Information System ("GIS") database, which will be used to inform future RE projects.
- To determine the spatial distribution of wind and solar power potential of the area.
- To identify and outline best possible areas for wind power and solar power development considering technical, environmental and social RE power potential aspects.
- To identify eventually existing further requirements (data procurement/measurements, studies, administrative) for RE development on the identified areas.

In addition, during the course of the SESA, the Consultant provided training to the staff of the New and Renewable Energy Authority (NREA) on SESA, Environmental and Social Impact Assessment (ESIA) and GIS.

1.2 Objectives and Approach of the SESA Solar Report

This subject report, the SESA Solar Report, focuses on the social and environmental assessment to define the suitability for solar PV power development within the greater East Solar-1, East Solar-2 and East Solar-3 subareas identified by NREA considering technical, social or environmental constraints.

Considering the environmental, social and technical attributes and the significance of predicted impacts the study identifies

- areas that are favourable for solar power development;
- areas that are less favourable, but can be developed with restrictions; and
- areas in which solar power development is precluded.

The results, which are also entered into a GIS database, are mapped by overlaying the hard criteria and predicted impacts. Thus, within the SESA Solar Report, areas are classified from the point of view of social and environmental criteria as well as of the physical-technical constraints. A further differentiation within the subareas of equal technical, environmental and social suitability (favourable or less favourable) took place according to the spatial solar radiation distribution, which, however, is not part of this report and is dealt with in the separate Final Recommendation Report.

This SESA Solar Report is analogous to a regional ESIA study for the East Solar-1, East Solar-2 and East Solar-3 subareas. It shall facilitate the later environmental permitting for the intended 50 MW solar power plots of private investors.

2 The Project Area

The East Nile Area originally refers to an area of 2,200 km² with a usable area of 1,725 km² and is mainly located in the Governorates of El Minya. Smaller portions are extending to the Assiut Governorate in the south and to the Beni Suef Governorate in the north (see Map NTS 2–1). With the modification in 2016 three subareas with a total of 425 km² were excluded from further RE developments due to military height limitations ("zero height", see Map NTS 2–1) leading to two subareas for wind power development (East Wind-1 and East Wind-2) and three subareas for solar power (photovoltaic - PV) development (East Solar-1, East Solar-2 and East Solar-3) defined by NREA. This report comprises the SESA Solar Report for the East Solar-1, East Solar-2 and East Solar-3 subareas.

The Project Area is located in the Eastern Desert consisting of a rolling sandy highland that rises abruptly from the Nile Valley and merges some 80 to 137 km east of the Nile into the Red Sea Mountains.

East Solar-1
The East Solar 1 subarea is the largest (416 km²) and the most southern of the three solar subareas. The East Solar-1 subarea has an extension of 28 km from north to south and lateral lengths of about 18 km (west to east) in the north and 11 km in the south.

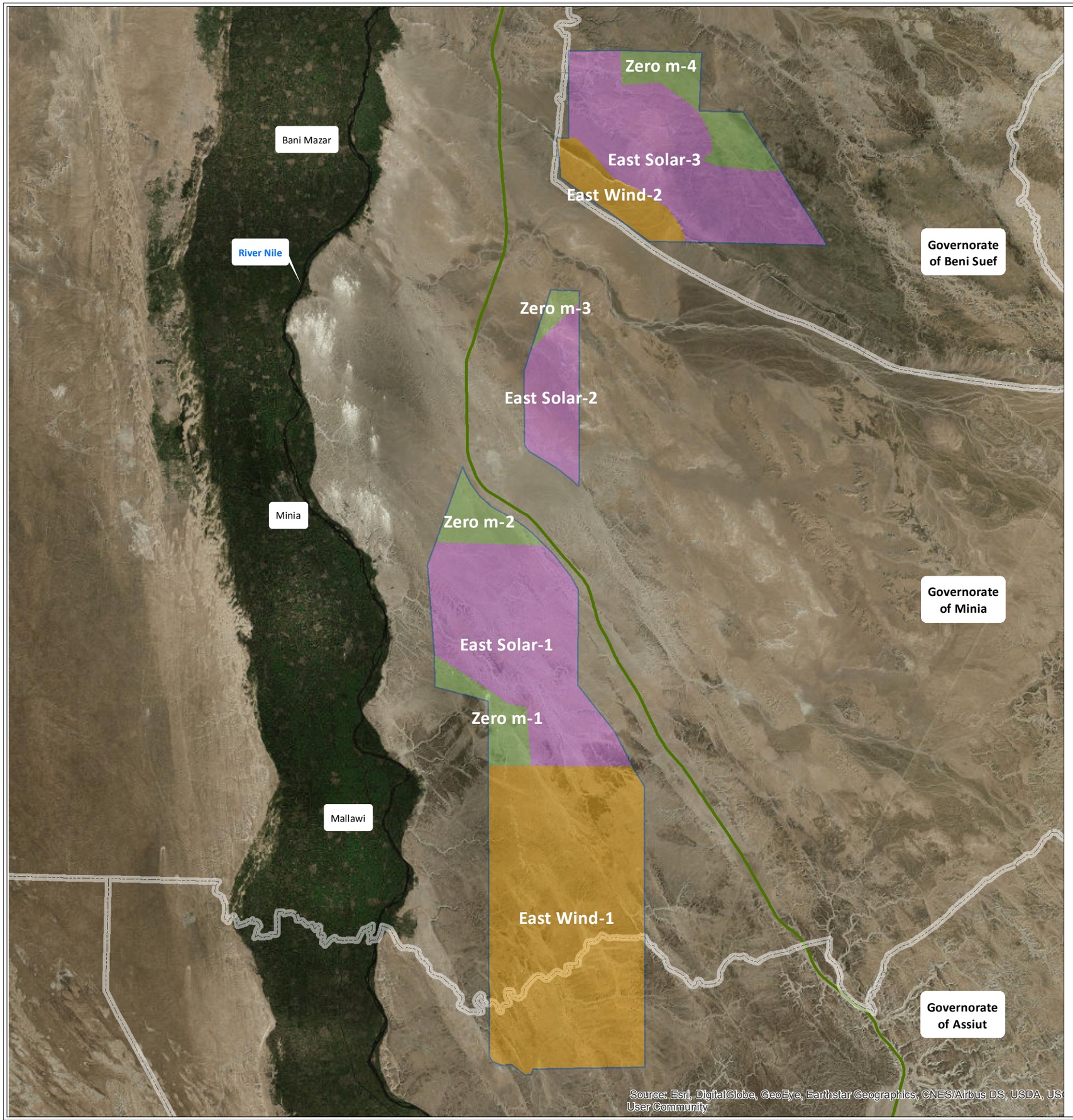
The area belongs to the El Minya Governorate. The most western part is located about 5 km away from the Nile Valley. It starts about 10 km south of the East Solar-3 subarea and is directly connected to the East Wind-1 subarea further to the south.

East Solar-2
The East Solar-2 subarea amounts to 179 km² and is located in the East of El Minya governorate. It starts about 15 km south of the East Solar-3 subarea. The area is crossed in the south by the new Highway from El Minya to Ras Ghareb.

East Solar-3
The northern border of the most northern East Solar-3 subarea of 363 km² is located in the south of Cairo at about 160 km linear distance and at 60 km linear distance to Beni Suef. It is located northeast of the Cliff, the south-eastern part is even at the Cliff's edge, which extends to about 70 km to the east in parallel to the old Ras Ghareb road. The majority of the area consists of complex terrain with deep valleys and Wadis.

In the SESA Solar Report, the following terminations are used to distinguish between different areas:

- Project Area: whole area useable for RE developments (1,725 km²)
- Subareas: East Solar-1 or East Solar-2 or East Solar-3 subarea
- Zones: favourable, less favourable and preclusive zones as defined under section 5 and 6



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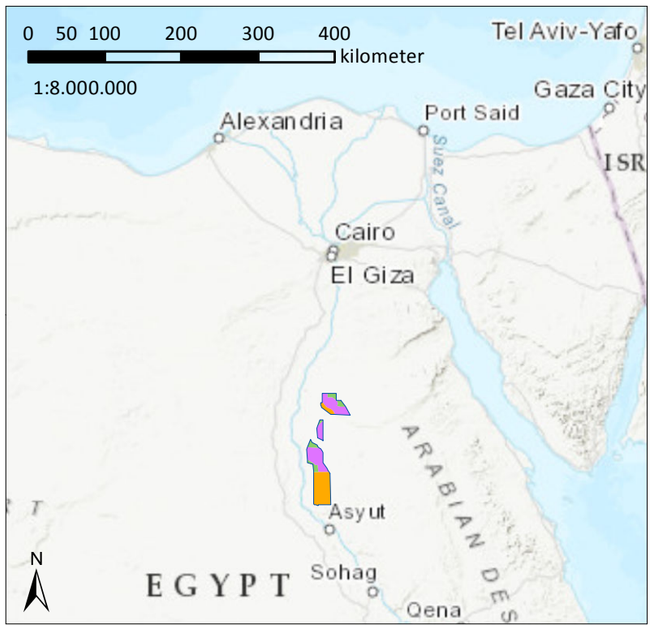
Strategic Environmental and Social Assessment of Renewable Energy Projects in the East Nile Region (Arab Republic of Egypt)
SESA Solar Report

client:
New and Renewable Energy Authority (NREA),
Ministry of Electricity and Renewable Energy

Map NTS 2-1:
Overview on the location and the extent of the Project Area and of different subareas based upon already prescribed height restrictions for RE developments

Bordering of project area and subareas

- project area
- subarea not useable for RE developments (due to height restrictions "Zero")
- subarea usable for PV solar power projects (due to height restrictions "5 m")
- subarea usable for wind power projects (due to height restrictions "150 m")
- borders between governorates
- Cairo – Asswan Highway



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3 Legislative Framework and International Environmental and Social Standards

The SESA Solar has considered the Egyptian legal and regulatory framework (e.g. Guidelines developed by the Egyptian Environmental Affairs Agency (EEAA)), EBRD Performance Requirements and the Equator Principles. While compliance with Egyptian legal and regulatory requirements is obligatory, the SESA has adopted the strictest requirements, Egyptian or international – whichever is stricter. Thus, the conditions for later international project financing shall be fulfilled.

4 Description of a Typical Solar Power Project

Typical features of a solar photovoltaic (PV) plant are:

- Ground mounted PV plants are built ideally on flat terrain or slightly sloped (south-facing slope for terrain located in northern hemisphere (in which the project area is located), north-facing in the case of the southern hemisphere).
- PV modules are fixed to mounting structures distributed on rows (according to the planned layout) all over the suitable land. Mutual row-to-row distance depends on the module technology and site characteristics.
- Depending on the soil features, mounting structures are generally fixed into the ground through steel poles.
- PV modules are connected in series to make a string and then are combined in parallel in DC string combiner boxes through fuses, which protects the modules in case of over current or reverse flow. From DC combine boxes, strings are then connected to the inverters. Common PV plant configuration is to divide the PV filed in several independent subfields “solar arrays”. Every subfield will have inverter, MV transformers and MV switchgear.
- DC-AC Inverters for conversion of the DC electricity from the PV arrays (through LV cables) to AC electricity are located in each block.
- AC is further fed to the transformer before being evacuated through the transmission lines from the PV plant to the nearest substation. These lines can be either underground or overhead.
- Internal roads of about 5 m in width, which allow lorries transporting PV modules reducing the mechanical loads, are a mandatory condition.
- External access roads from the existing road network.
- Central service buildings such as a possibly control room, spare part stores, workshop and worker facilities for service personnel.

Initially, about 90 % of the PV area will be touched due to site levelling works, mounting structure foundation installation, as well as intensive transportation activities. Once the PV plant is operational, the PV modules will cover more than 65 % to 75 % of the PV plant area. However, the ground beyond the PV modules will not be impacted directly during the operation phase (see also section 6.5 of the Non-Technical Summary).

4.1 Construction Works

Construction works for a typical PV plant project consist of civil, mechanical and electrical works.

Major elements of civil works are ground levelling, foundation works for PV mounting structures, construction of concrete foundations for auxiliary buildings (e.g. service buildings, control room, substation, inverters), drainage works, excavation and backfilling of cable trenches and roads.

Major elements of mechanical works are installation and assembly of PV mounting structures and fence on the site. The mounting structures can be fixed tilted or tracking (monoaxial or biaxial) depending on the planned technical solution.

Major elements of electrical works are consists in installation of PV modules, inverters, transformers and cabling.

4.2 Operation and Maintenance Works

Operation and maintenance (O&M) activities comprise the regular control/operation of the PV plant as well as troubleshooting, repair and scheduled maintenance. Considering that PV plant operation can be done by remote control, relevant activities for a 50 MW PV plant are usually limited and do not require permanent presence of personnel at the site. Nevertheless, O&M personnel should be available within 24 hours for troubleshooting (e.g. change of fuses, replacement of sensors, restarting of inverters, opened protection) to avoid loss of generation.

One of the most important activities of maintenance is module cleaning by using water or air. It is a simple but important task, which can produce significant and immediate benefits in terms of production.

For the O&M a standard set of spare parts is stored near to site to reduce delay and loss of generation. Accordingly, a storage building needs to be maintained not too far away from the site.

4.3 Decommissioning Works

The design lifetime of a PV plant is generally 25 years. However, this time can be extended up to 40 years depending on the PV plant status. Decommissioning is the process for removing a PV plant with their foundation and the electrical infrastructure and restore the land to its original state.

Decommissioning means a large potential for recycling and recovery of valuable components and metals and thus corresponds to commercial interest.

5 Methodology and Approach

5.1 Stakeholder Engagement and Public Consultation

The SESA approach to stakeholder engagement and disclosure is captured in the Stakeholder Engagement Plan (SEP), which is attached to the Scoping Report (see Annex A1). The SEP is seen as a living document which will be implemented, and was and will be updated during SESA development, SESA disclosure and during RE project development in the Project Area, if necessary. In the SEP, the SESA stakeholders are identified, the various stages when stakeholders, including the public, are engaged and how, during and after the SESA process and the type of information to be disclosed.

As the first step in stakeholder engagement and information disclosure, the draft Scoping Report was issued, following submission to NREA on 27 June 2016, and circulated to various key stakeholders, including those in the three Governorates together with an invitation for the scoping meeting, held on 12 July 2016 at NREA offices in Cairo. The draft and final Scoping Report, which considered the comments from the stakeholders received during the scoping meeting, have been disclosed on the homepages of NREA and EBRD accordingly.

During various site reconnaissance missions of the Consultant's experts, people who have been accidentally encountered in the Project Area have been addressed and project information flyers in Arabic have been distributed (see Annex C). The results of all interviews were documented on interview forms (see Annex D). A summary of the received feedback can be found in section Annex 5.3.1.7 of the SESA Solar Report.

Furthermore, key stakeholders such as the regional Governorate of El Minya were visit on 4 October 2016 and 31 October 2016. In addition, Governorates were informed and asked to raise comments via fax, email or mail by NREA.

The scope of the SESA Solar and SESA Wind has been defined at an early stage in the SESA process through a scoping study (results were documented in a separate report, submitted in October 2016 as mentioned above). The scoping determined which impacts are likely to be significant and become the main focus of the SESA. Scoping also identified data availability and data gaps. The scoping process determined the appropriate spatial and temporal scopes for the assessment and suggests suitable survey methodologies.

The draft SESA Solar Report as well as the SESA Wind Report will be disclosed to stakeholders and to the public and will be discussed during a public hearing, following the local procedures and EBRD's Environmental and Social Policy. Consequently, the draft SESA Reports will be disclosed on the homepages of EBRD and NREA plus direct notification to registered stakeholders, including public notification of report availability. For private sector projects, EBRD's Environmental and Social Policy requires a minimum of disclosure period of 60 and 120 days respectively for public sector projects. Given the fact that the SESA is the first assessment for later private financed projects, it has been accepted by EBRD to apply the minimum disclosure period of 60 days.

The public consultation process aims to minimise potential negative environmental and social impacts, strengthen social acceptance of the project, informing the relevant parties that the envi-

ronmental and social impacts will be minimised to levels that are low as reasonably practical and achieve the balance between legitimate requirements for development and environmental protection.

The public hearing should take place after the SESAs have been available for an appropriate period of time. After the public hearing, the stakeholders are afforded at least a month to provide comments. The final version of the SESA Reports will be prepared based on these relevant comments and remarks received during this process and will be disclosed again. In addition, the Final Recommendations Report will be disclosed, following the same guideline.

5.2 Baseline Studies on Existing Physical, Biological and Social Environment

Baseline data on the physical, biological and social environment of the Project Area was investigated by:

- Desk top studies, i.e. by a review of existing literature, an investigation on data officially available by the Egyptian Environmental Affairs Agency (EEAA) and on existing data available on the World Wide Web and on available satellite images,
- Approach of the administration of the Governorates for inquiry of data and information,
- Interviews with local people, and
- Several special field investigations inside and next to the Project Area between spring 2016 and spring 2017.

The focus of the investigation of the physical environment was on climate, geomorphology, hydrological conditions and water resources. To describe the biological environment of the Project Area baseline data on protected areas, habitats, flora and fauna was collected. The focus of the investigation of the social environment was on general and administrative issues, on existing infrastructure such as paved access roads and power grid, current land-use on and sociological conditions.

5.3 Technical and Land-Use Criteria for Classification of Area as preclusive of less favourable

Based on the gathered information the East Solar-1, East Solar-2 and East Solar-3 subareas were screened with regards to constraints due to competing land-use and technical constraints, which impede solar power development or make it more difficult. This leads to areas defined to be preclusive, i.e. not usable for solar energy developments or to be less favourable. In this context, the relevant criteria were: accessibility/remoteness, geomorphology and competing land-use (e.g. farming).

5.4 Basic Approach for the Impact Assessment

An impact is defined where project activity-receptor interactions occur. According to ISO14001:2004 an impact is defined as: “Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation`s environmental aspects (activities, products or services)”.

Once the impacts, either adverse or beneficial, are fully understood, it is necessary to judge the significance of each impact and to determine whether it is acceptable, requires mitigation or is unacceptable. Within the assessment process, impacts are ranked according to their “significance” which is a function of “event magnitude” and “receptor sensitivity”. Determining event magnitude requires the identification and quantification (as far as practical) of the sources of potential environmental and social effects from routine and non-routine project activities. Event magnitudes are classified according to the extent, frequency, duration and the intensity of an event as low, medium or high. Receptor sensitivity requires an understanding of the physical, biological and social environment. Criteria for the assessment of receptor sensitivity (low, medium, high) are for instance: area of influence, percentage of resource affected, persistence of effects, sensitivity of resources. Impact significance is obtained by superimposition of event magnitude and receptor sensitivity with an overall classification in four attributes: negligible, minor, moderate or major.

6 Existing Environment

6.1 Physical Environment

The Project Area and its surrounding area are characterised by a hyper-arid desert climate with high temperature differences between night and day of more than 15 °C. The average maxima vary between 19 °C (winter) and 37 °C (summer). The monthly means vary between 12 °C and 29 °C at the nearest met stations. Precipitation was measured sporadically (1 or 2 mm) during winter months only. However, that does not mean that uncommonly convective heavy rains of high intensities may occurred at rare intervals, such as in October 2016.

The underground of the Project Area is formed in the Eocene. It consist of thick marine limestone with chert and minor clay beds. It is overlain by layers of gravel and sand of limited depth in general varying from few centimetres to 1 or 2 metres at Wadi beds and hangs.

The East Solar-1, East Solar-2 and East Solar-3 subareas extend on desert ground well away from any village or other settlements. They are connected with few economic activities only.

Most of the East Solar-3 subarea has a complex relief with deep falls into Wadis. This is different in the East Solar-1 and East Solar-2 subareas, which are quite uniform, consisting mostly of slightly undulated land except for some cuts by major Wadis at some spots of the East Solar-1 subarea. The landscape does not contain any special features. All Wadis have a moderate slope and sandy underground. The Wadi beds were free from erosion marks (e.g. accumulation of stones) that indicate any major water flow that may have occurred at rare frequency.

Figure NTS 6-1: Limestone Stratification at WP 60_4 in the north of the East Solar-2 subarea (left) and pocketed weathered Limestone at WP 42_3 (East Solar-3)

In general, the areas show good foundation conditions. Soft soils or migrating sand dunes are not observed in the three East Solar subareas. However, due to the marine limestone underground the subsurface may contain caves.

An evaluation of the physical environment with regards to technical and land-use aspects according to the defined criteria leads to the following conclusions:

East Solar-1 subarea (see Map NTS 8–1)

- No preclusive zone was identified due to accessibility.
- No preclusive zone was identified due to geomorphology.
- Preclusive zones were identified with regards to land-use:
    - farming areas in the northwest along the El Minya - Assiut Road, inside the northwestern part of the area;
    - gravel mining and screening plants in the southeast.

East Solar-2 subarea (see Map NTS 8–2)

- No preclusive zone was identified due to accessibility. This is under the assumption that the new highway El Minya to Ras Ghareb crossing the East Solar-2 subarea can be opened for access to the site.
- No preclusive zone was identified due to geomorphology.
- No preclusive zone was identified due to land-use.

East Solar-3 subarea (see Map NTS 8–3)

- A preclusive zone was identified on the cliff in the southeast of the subarea due to unstable foundation conditions.
- No preclusive zone was identified due to land-use, but it is expected that Bedouins have a claim on the land and agreements would have to be sought by individual investors.
- The accessibility of the subarea is classified as less favourable due to long distances to the existing highway and associated additional costs for road construction due to less favourable geomorphic conditions.

6.2 Biological Environment

East Solar-1 subarea

The investigation reveals that there exists no legally protected site / area, no national park or important bird area and no internationally recognised area of biodiversity value in or near to the East Solar-1 subarea.

Due to the extreme aridity of the Eastern Desert the gravely and pebbly plains, the elevated areas and small hills within the East Solar-1 subarea do not serve as a suitable habitat for plants. Hence, large parts of the subarea have a very low to no importance as a habitat for plants and animals.

No Wadi within the East Solar-1 subarea was found to have a very high or high importance as a habitat for plants and animals. Wadi Ibadah and Wadi al-Birshawi provide appropriate living conditions for single plant and animal species, and thus, differ remarkably from the vast desert habitats dominating the East Solar-1 subarea. The aforementioned Wadi is important for plants and animals (see Map NTS 8–1). The importance of all other Wadis as a habitat for plants and animals was assessed to be low or very low.

As caves form particular structures in the desert offering important habitats for animals, caves in the East Solar-1 subarea, which can be particularly found at slopes, are important as a habitat for plants and animals.

Large parts of the East Solar-1 subarea are completely without vegetation. Plants can only be found in the Wadis. Even there, the vegetation is neither rich in species, nor dense in populations. All species recorded in the Wadis of the East Solar-1 subarea are considered to be of "Least Concern" in the IUCN Red List of Threatened Species. Hence, besides Wadi Ibadah and Wadi al-Birshawi, the East Solar-1 subarea is not important for plants.

Wadi Ibadah and Wadi al-Birshawi form suitable habitats for single animal species from different groups (mammals, birds, reptiles, insects, spiders). However, the obtained results of the investigation clearly show that the local fauna is poor in species and density is low. The species recorded in the East Solar-1 subarea are quite widespread and can be found in several desert habitats in Egypt. None of the recorded species is known to be endangered or threatened. Consequently, the East Solar-1 subarea is not an important habitat for animals.

As Wadi Ibadah and Wadi al-Birshawi comprise patches of vegetation which form a stopover habitat (mainly for a single day) for passerines during migration, it might be occasionally used by a low number of birds as a roosting site. All other parts of the East Solar-1 subarea have no significant importance as a roosting habitat for birds.

One can clearly derive from the results revealed in the East Wind subareas that the East Solar-1, which is located between the East Wind-1 and the East Wind-2 subarea, is not of particular importance for migrating birds – neither in spring nor in autumn.

To conclude, no preclusive zone was identified in the East Solar-1 subarea for solar PV plant developments with regards to the biological environment.

East Solar-2 subarea

There is no legally protected site / area, no national park or important bird area and no internationally recognised area of biodiversity value within the East Solar-2 subarea or its surrounding area.

The East Solar-2 subarea is very flat and homogenous comprising gravely and pebbly plains. No large Wadi exists in the subarea, and thus, it is nearly completely free of vegetation. Only two small vegetated spots have been found in the subarea. The recorded plant species are considered to be of "Least Concern" in the IUCN Red List of Threatened Species. To conclude, the East Solar-2 subarea is not an important habitat for plants.

Accordingly, the local fauna was found to be extremely poor in species and density was extremely low, too. None of the recorded species is known to be endangered or threatened. As there are no

cliffs or slopes, caves are extremely unlikely to occur. Hence, the East Solar-2 subarea is not an important habitat for animals.

To conclude, no preclusive zone was identified in the East Solar-2 subarea for solar PV plant developments with regards to the biological environment.

East Solar-3 subarea

There is no legally protected site / area, no national park or important bird area and no internationally recognised area of biodiversity value within the East Solar-3 subarea or its surrounding area. The "Wadi Sannur Cave", a rare geologic feature in Egypt, which is of interest for paleoclimatological records (EEAA 2015), is located at minimum distances of about 8 km northeast to the East Solar-3 subarea.

Due to the extreme aridity of the Eastern Desert, the gravely and pebbly plains, the elevated areas and small hills within the East Solar-3 subarea do not serve as a suitable habitat for plants. Hence, large parts of the subarea have a very low to no importance as a habitat for plants and animals.

No Wadi within the East Solar-3 subarea was found to have a very high or high importance as a habitat for plants and animals. Wadi ash-Shaykh complex provide appropriate living conditions for single plant and animal species, and thus, differ remarkably from the vast desert habitats dominating the East Solar-3 subarea. The aforementioned Wadi complex is important for plants and animals (see Map NTS 8–3). The importance of all other parts of the subarea as a habitat for plants and animals was assessed to be low or very low.

As caves form particular structures in the desert offering important habitats for animals, caves in the East Solar-3 subarea, which can be particularly found in the canyon-like Wadi ash-Shaykh in the northwest of the subarea and at slopes, are important as a habitat for plants and animals.

Large parts of the East Solar-3 subarea are completely without vegetation. Plants can only be found in Wadis. Even there, the vegetation is neither rich in species, nor dense in populations. All species recorded in the East Solar-3 subarea are considered to be of "Least Concern" in the IUCN Red List of Threatened Species. Hence, besides the Wadi ash-Shaykh complex the East Solar-3 subarea is not important for plants.

The Wadi ash-Shaykh complex offers suitable habitats for single animal species from different groups (mammals, birds, reptiles, insects, spiders). However, the obtained results of the investigation clearly show that the local fauna is poor in species and density is low. The species recorded in the East Solar-3 subarea are quite widespread and can be found in several desert habitats in Egypt. None of the recorded species is known to be endangered or threatened. Consequently, the East Solar-3 subarea is not an important habitat for animals.

As the Wadi ash-Shaykh complex comprises patches of vegetation which form a stopover habitat (mainly for a single day) for passerines during migration, it might be occasionally used by a low number of birds as a roosting site. All other parts of the East Solar-3 subarea have no significant importance as a roosting habitat for birds.

From the results obtained for the East Wind subareas it can be deduced that the East Solar-3 subarea, which is located north of the East Wind-2 subarea, is not of particular importance for migrating birds – neither in spring nor in autumn.

To conclude, no preclusive zone was identified in the East Solar-3 subarea for solar PV plant developments with regards to the biological environment.

6.3 Social and Economic Environment

The Project Area is located in the Governorates of Beni Suef and El Minya. Population is mainly located in the Nile Valley, whereas the Project Area indicates no permanent settlements.

General characteristics

- Land-use

  The region consists of a vibrant mining industry. Many mines exist at desert areas near to El Minya but outside the Project Area. The white bricks extracted from the mines are used for construction. Mining is a very labour intensive industry and hosts a substantial number of workers at the areas. It is less likely that there will be an impact on mining activities since most mines are not permanent and almost no brick mines are located inside East Solar subareas. From discussion with mine owners, the potential to find good sources of extracting materials in the subareas selected for the project is very low.

- Cultural heritages

  No cultural heritage sites are located in or in the zone of influence of the East Solar-1, East Solar-2 and East Solar-3 subareas.

- Roads and traffic

  The Project Area is crossed by the El Minya - Assiut National Road and near to the Cairo - Aswan Highway. The road networks also connect the Project Area with the Red Sea ports (Ras Ghareb port and Safaga port) via the new Ras Ghareb - El Minya Highway. That allows project equipment to be transported from harbour to the East Solar-1, East Solar-2 and East Solar-3 subareas.

- Bedouin community near the Project Area

  Although no Bedouin camp was identified during the site reconnaissance, the Consultant learned from discussions with the authorities and local Bedouin, many Bedouin are already impacted and influenced by other projects. Those impacts have modified their original structure and the consequence of that is that they have constructed settlements, meaning they are not nomads anymore and they are not performing activities such as roaming for resources within the area.

- Stakeholder interviews

  In order to learn about general views and attitudes of local authorities and population towards the proposed project, meetings and discussion were conducted with the regional Governorates as described under section 4.2 of the SESA Solar Report and interviews were held with people encountered in the field. The overall knowledge about the project and its impacts was generally very limited in detail.

  The following beneficial impacts of the proposed solar plant project were mentioned by the local authorities / population:

  - Job opportunity for local people:
    One of the advantages of big projects like proposed RE developments are the potential job opportunities for semi-skilled and unskilled workers. The proposed project will open job opportunities for the local people, especially during the construction phase. On top of that, local people get an opportunity to acquire new knowledge and skills that will benefit them.

- Land-use:
  The planning shall not interfere with the existing cultural heritages and shall also consider possessed land though customer land rights. Regarding the mining activities, there is low probability of negative impact since most mines are not permanent and nearly no mines are in the vicinity of the East Solar project. From discussion with mine owners, the potential to find good source of extracting materials into the areas selected for the East Solar subareas is very low.

- Cooperation with local Governorates:
  Officials on the local Governorate level feel excluded since they were not included in selection of the area. The presidential decree means they have no potential for future urban expansion in Eastern Desert.

East-Solar-1 subarea

- Land-use
  During the site reconnaissance in October 2016, it was noted that on the El Minya - Assuit National Road land reclamation activities in the East Solar-1 subarea are ongoing.

  Farmers which were interviewed indicated that the land reclamation activities in all the region of the project are coordinated by one family. They are responsible for dividing the plots and supporting the encroachment process until the person becomes officially the land owner. These identified plots were considered as preclusive areas.

- Roads and traffic
  The area is located more than 7 km away from the Nile Valley, but has good accessibility via well dimensioned asphalt or even crossing the area (El Minya - Assiut National Road) from El Minya (northwest), the Nile Valley (west) and from the East Wind-1 subarea (south). Furthermore, a connecting road between the El Minya - Assiut National Road and the Cairo – Aswan Highway (south) is crossing the East Solar-1 subarea.

No preclusive zones regarding accessibility were identified for the East Solar-1 subarea.

East-Solar-2 subarea

- Land-use
  No land reclamation activity was noted in this subarea.

- Roads and traffic
  The area is located more than 27 km away from the Nile Valley, but can be accessed from the El Minya - Assiut National Road and from the new Highway connecting El Minya and Ras Ghareb.

East-Solar-3 subarea

- Land-use
  No land reclamation activity was noted in this subarea.

- Roads and traffic
  The area is located more than 22 km away from the Nile Valley, but could be accessed through Cairo - Aswan Highway and a new to be built access road of minimum 11 km (linear distance).

7 Prediction of Impacts

7.1 Physical Environment

The expected impacts can be summarised as follows:

Air quality

During the construction phase, some emissions of exhaust gases of machinery and dust at individual construction places (road construction and excavation sites) may occur. During the operation phase, only occasional service visits will take place.

Thus, minor significance of impacts on the ambient air quality is assumed during the construction phase and is respectively negligible during the operation phase.

Water resources and wastewater

Water will have to be transported from the sources (wells) inside and next to the Nile Valley. These water sources / wells are fed by the River Nile having an average discharge of about 2,000 m^3/s. Water supply will mainly be required for the construction phase, i.e. for concrete making, for anti-dust spraying and for sanitary purposes. Minor amounts of biodegradable low toxicity domestic (residential) wastewater from the sanitary facilities of the temporary construction yard offices will be treated by a two stage septic tank and percolation into the sandy subsurface for post-treatment. Wastewater will not get into contact with groundwater.

During the operation phase, from time to time, very little amount of water will be required for cleaning. The water consumption impact significance is assessed to be minor for the construction phase. During the other phases, the impact significance is negligible.

The impact significance is assessed to be minor during the construction phase. During the operation phase, the impact significance is negligible.

Domestic and Hazardous Waste

Considerable amounts of solid waste will be generated by solar PV plant construction projects. The waste essentially consists of packing material (paper, plastics, wood) for transport of the equipment components. The waste will occur mostly at the installation of the PV modules, the electrical infrastructure and in the construction yard. The waste can easily be spread by wind over the desert and transported over large distances.

The only possible source for hazardous waste caused during construction is spilt oil and grease originating from construction equipment (e.g. lorries, excavators, craned) and from handling and commissioning of deliveries (e.g. transformers). Both, the littering of waste and the spillage of hazards can easily be avoided by proper workmanship and strong supervision. Little domestic waste will be generated by personnel at the service facilities, if any, and the power substations. The experience with previous renewable energy projects in Egypt (e.g. Zafarana wind farm) shows that the domestic waste is small in quantities and mainly composed of biodegradable or burnable waste.

During the operating phase, waste generation is limited to the used consumables, when servicing the solar PV plant, and smaller defective parts. These are non-hazardous materials, most of them

valuables and fit for recycling. Larger defective parts such as inverters, or PV modules would anyhow be returned to the factory for repair or re-use of materials.

Noise and reflection

As potential human receptors, working personnel on the farms or mining areas in the East Solar-1 subarea was identified. For these receptors, standards for commercial or industrial properties apply. Relevant applicable ambient noise level standards are 70/70 dB (day/night time) according to IFC EHS Guidelines and 65/ 55 dB according to the Egyptian Law 4/1994, executive regulations, Annex 7. The more strict Egyptian standards are considered.

Human receptors in the neighbourhood of PV plants, such as workers or farmers, are not permanently living at the working place. Moreover, the working places are at least 300 m distant to the PV plant and thus the noise levels at receptors' place will be much lower than the limit of 65 dB during daytime during the construction phase. Accordingly, the receptor sensitivity is evaluated to be low during the construction phase. This applies also for the other phases, when no noise emission will take place. For the workers employed at the PV plants accepted occupational H&S standards will apply.

Considering that modern and efficient solar panels with high absorption capacity will be applied, the reflection of sunlight is marginal only. Therefore, the impact significance of reflection on human receptors will obviously be negligible.

Archaeological, historical and cultural heritage

The site investigation revealed that all the three East Solar subareas are free from archaeological, historical and cultural heritages. Moreover, this applies also for the surroundings, i.e. for distances from the border of more than 5 km. Accordingly, it is obvious that impact significance is negligible and no subject to detailed evaluation.

Land-use

The net area coverage rate of land-use/land-take for solar PV power development (roads, platforms, foundations, auxiliary installations) is about 70 % to 90 % during the construction and operation phase. These percentages will be lower in subareas containing Wadis (because of lower solar PV energy resources, the risk of occasional Wadi runoff, and stability of the Wadi bed and Wadi banks/hangs). Accordingly, the event magnitude is judged to be medium for all phases.

The land-use/land-take impact is evaluated against the different nature of the ground. As the soil (receptor) is of low value (non-vegetated desert sand or rocks) with a high resilience (little affected by construction measures only) the receptor sensitivity is evaluated to be low for all phases.

Because of a medium event magnitude and the low receptor sensitivity, the impact significance of land-use/land-take is evaluated to be minor for both, the construction and the operation phase.

Traffic and utility services and other infrastructure

The traffic load caused by solar power development can be estimated for the construction phase considering the safe assumption of parallel work on three solar PV farms as well as parallel delivery of PV and auxiliary equipment over a period of three months. Except for the power transformers of substations (e.g. one 125 MVA Transformer for two 50 MW plots) no heavy haulage transport is required.

Accordingly, the average expected additional traffic load per working day caused by solar farm development during the construction phase is about 45 large lorry transports and 25 transports by smaller vehicles including minibuses, pick-ups or small lorries. Distributed over a working day (10 hours), this corresponds to an additional traffic load of 4.5 lorries per hour and 2.5 smaller vehicles per hour.

For the East Solar-1 subarea, this may be compared to the current traffic load on the El Minya - Assiut Road, which is the most frequented road in the area. A rapid assessment revealed a number of 45 small vehicles (personal cars, minibuses, pick-ups) and 40 lorries per hour in one direction on this road. Assuming that all additional peak traffic loads will apply for the same road stretch, the current traffic load will be increased by about 10 %, resulting to a total traffic load of about 50 small vehicles and 45 lorries per hour and per direction. In case of East Solar-2 it may be compared with the very low traffic load compared to the capacity of the new El Minya - Ras Ghareb Highway. Even when considering the extra traffic load during the construction phase, the overall traffic on the asphalt roads in the area is still low. Moreover, the roads are well dimensioned and by far have not reached their capacity. During the operation phase, the additional traffic load is negligible.

Low event magnitude and low receptor sensitivity signify a negligible impact significance of traffic caused during all phases.

Run-off / flash flood risk

The region is hyper-arid with very minor precipitation during winter times. However, occasionally rains of high intensity can occur.

If such torrential rains fall on areas with mountainous character (i.e. larger hangs with of good gradients, narrow Wadis with high slopes) the resulting runoff can accumulate and develop to become dangerous flash floods.

Desktop studies and field inspection at the East Solar-1, East Solar-2 and East Solar-3 subareas revealed that the Wadis are not prone to such floods. Cross sections are wide, sloping is shallow and hills only exist with heights of 50 m only above Wadi beds. Moreover, the Wadis do not show large stones or rocks at the low areas of the Wadi beds.

Accordingly, no special risk from flash floods in the Wadis is expected in the East Solar-1, East Solar-2 and East Solar-3 subareas. In addition, as solar PV plants typically required flat surface for installation of the panels, installation in Wadi beds is considered not feasible from a technical point of view, thus minimising this risk in addition.

Seismicity Risks

Possible elevated earthquake risks due to geological fault lines were presumed during scoping. The strength of earthquakes at an exceedance probability of 10 % in 50 years is discussed in section 5.1.1 of the SESA Solar Report. The strength for the areas is low to moderate, corresponding to a peak ground acceleration of 0.8 to 1.0 m/s². Risks can be well-controlled by applying adequate earthquake codes as part of construction norms.

7.2 Biological Environment

The following assessment of likely impacts caused by multiple solar PV developments is valid for all subareas (East Solar-1, East Solar-2 and East Solar-3). Where impacts have to be assessed differently, this is explicitly mentioned in the text.

In the absence of any legally protected site or internationally recognised area of biodiversity value within or adjacent to the three East Solar subareas, construction and operation of multiple solar PV power projects in the three subareas will not affect any protected area.

Construction

Construction of multiple solar PV power projects in the East Solar subareas might lead to:

- Loss of habitats for plants and animals and direct damage of plants

  During construction of multiple solar PV plants, removal and partial destruction of the top soil surface and some deeper soil layers will occur. Consequently, installation of foundations of PV modules and auxiliaries, permanent access roads, trails for power lines, storage positions for heavy machines or other technical installations might directly impact (destroy) habitats for plants and animals and (damage) plants. Due to the extent of the affected area of a PV plant, event magnitude is assessed as high.

  Receptor sensitivity can be regarded as low, because large parts of the East Solar subareas are completely without vegetation. Plants can only be found in the Wadis. Even there, the vegetation is neither rich in species, nor dense in populations. Animal species recorded in the subareas are quite widespread and can be found in several desert habitats in Egypt. The local fauna of the three subareas is poor in species and density is low. Moreover, none of the recorded species is known to be endangered or threatened. Furthermore, one can clearly derive from the results revealed in the East Wind subareas that the East Solar subareas are not of particular importance for migrating birds – neither in spring nor in autumn. Suitable habitats for single animal species from different groups (mammals, birds, reptiles, insects, spiders) can only be found in Wadi Ibadah and Wadi al-Birshawi (East Solar-1 subarea) and in the Wadi ash-Shaykh complex (East Solar-3 subarea). Hence, besides Wadi Ibadah and Wadi al-Birshawi and the Wadi ash-Shaykh complex, the three subareas do not serve as an important habitat for animals.

  To conclude, the effects caused by loss of habitats for plants and animals or direct damage of plants will lead to moderate impacts.

  Siting of PV modules shall avoid vegetated areas and particular structures like caves or crevices. No PV panel shall be installed next to or inside Wadi Ibadah and Wadi al-Birshawi and the Wadi ash-Shaykh complex. Construction measures in these Wadis shall be limited to single crossing by gravel roads and by cable trenches carried out at less sensitive spots. In doing so, effects caused by construction of multiple solar PV plants can be reduced and the residual impacts are assessed as minor.

  The important Wadis have to be assessed as less favourable for solar PV power projects (see Map NTS 8–1 and Map NTS 8–3).

- Disturbance by human activities with heavy machines, traffic, noise and dust emission

  Animals might be affected by disturbance during the construction phase. However, disturbance effects are restricted to a rather small area. Moreover, constructional work is limited to a rather short period of time. Thus, animals can find alternative habitats for the time of constructional works. In addition, animals can reoccupy all areas after the construction phase.

  Animal species recorded in the East Solar subareas are quite widespread and can be found in several desert habitats in Egypt. The local fauna of the subarea is poor in species and density is low. Hence, the impact on animals caused by disturbance during construction is negligible.

- Compaction of soil due to land-use

  Compaction of soil might lead to damage of local seed banks and a reduction of the suitability for plant growth. However, the potential for plant growth in this hyper-arid area is very limited and the subareas comprise no threatened species or plant communities of conservational concern. The impact due to the construction of multiple solar PV plants is assessed as moderate (high event magnitude and low receptor sensitivity). If construction works will avoid vegetated areas (in particular the important Wadis) and particular structures like caves or crevices, residual impacts can even be assessed as minor.

- Dust emissions

  Dust emissions will be limited to a very small area and limited to rather brief periods. Only negligible impacts on habitats or flora are expected due to dust emissions (medium event magnitude and low receptor sensitivity).

- Waste

  Waste resulting from constructional work will cause no significant impact on habitats, flora or fauna. However, it might pollute larger areas when drifted away by strong winds. Moreover, it will probably attract certain animals, however, especially feral species (dogs, cats, rodents, etc.). This might affect indigenous species. Thus, waste should be removed immediately from the site and should be stored at or near the site in appropriate ways.

- New species of urban and rural environments

  New species of urban and rural environments can be imported into the area together with construction materials and containers. This should be avoided as much as possible, because new species often affect indigenous species.

To conclude, the residual impacts on habitats, flora and fauna caused by the construction of multiple solar PV power projects within the East Solar subareas are negligible to minor.

<u>Operation and maintenance</u>

In general (i.e. disregarding the existence/absence of sensitive receptors), operation and maintenance of multiple solar PV plants within the East Solar subareas might cause different effects:

- Modification of habitat suitability / quality due to changed abiotic habitat factors

- Disturbance of animals or indirect loss of habitat by visual effects (silhouette effects, dazzling effects)
- Disturbance of animals by light emissions (reflections)
- Attraction, irritation or disorientation of animals by artificial light emissions
- Disturbance by human activities related with maintenance of solar farms
- Barrier effects / habitat loss
- Collision risk for flying animals (bats, birds, insects)

In any case, receptor sensitivity can be regarded as low, because large parts of the East Solar subareas are completely without vegetation. Plants can only be found in the Wadis. Even there, the vegetation is neither rich in species, nor dense in populations. Animal species recorded in the East Solar subareas are quite widespread and can be found in several desert habitats in Egypt. None of the recorded species is known to be endangered or threatened. Suitable habitats for single animal species from different groups (mammals, birds, reptiles, insects, spiders) can only be found in Wadi Ibadah and Wadi al-Birshawi (East Solar-1 subarea) and in the Wadi ash-Shaykh complex (East Solar-3 subarea). Hence, besides Wadi Ibadah and Wadi al-Birshawi and the Wadi ash-Shaykh complex the three subareas do not offer important habitats for animals.

To conclude, operation and maintenance of multiple solar PV plants within the subareas will cause negligible to minor residual impacts on habitats, plants and animals. There are no other activities in the subareas that might contribute to increased impacts to significant levels. During periods of maintenance of PV plants, human activities will be restricted to the already existing roads and storage positions. Furthermore, it is assumed that an appropriate procedure will be applied and that the required amount of water will be minimised when cleaning solar PV panels.

7.3 Social and Economic Environment

Workforce and jobs

With regards to job creation, the project will result in direct and indirect jobs. For each 50 MW project (a possibility of maximum 2 to 3 projects in parallel), the following numbers are assumed: unskilled workers 100 persons plus 20 skilled workers for project management and supervision tasks (duration 4-5 months).

If 2 or 3 projects start at the same time, this would require 250 to 400 workers. The local communities (El Minya and Beni Suef) could theoretically provide a proportion of this temporary labour force dependent on skills needed.

The project will permit to create some jobs (a limited number) and will be a source of income for those who will operate PV plants and work on permanent basis. Based on rough calculation for the direct jobs to be provided during operation, it will involve/engage about 5 to 10 people per PV plant for O&M and guarding. The permanent staff are likely to live locally.

Workers might be adversely impacted if fundamental principles and rights are not respected. Labour and working conditions defined in EBRD PR2 and IFC PS2 shall be maintained. This is also relevant for lodging in temporary facilities at the site.

Supply chain

The project will also result in positive opportunities for local companies that can work in importing/manufacturing of some components due to the need of the supply chain.

Vehicle drivers will benefit from the project through the provision of transportation to those who work in the project. As well, some of them might be contracted to transfer the workers to the Project Area.

Community members from the region and surrounding villages will benefit from some increase of the economic activities in order to serve the needs of the project developers and workers. Hotel, shops, restaurants will also see their turnover increase.

The project might result in development of the surrounding areas. Most future PV plants will require additional paved roads and enhanced basic infrastructure inside the selected zone.

Skilled and unskilled workers will get acquainted with modern technologies of wind and / or solar power, which will create more job opportunities for them in the future as other development will take place in Egypt for RE. Similar as for the workers, Labour and working conditions defined in EBRD PR 2 and IFC PS 2 shall be maintained.

New source of energy

The most important and positive impact is that the development of RE projects will result in a renewable source of electricity that will enrich the National Electricity Grid by:

- contributing to addressing a national energy shortage,
- reducing the use of fossil fuels in electricity generation, and
- displacing carbon-intensive sources of electricity.

Enhancement of the community

Some enhancement of the services and utilities in the areas due to the project implementation can be expected. Moreover, the project will offset emissions from thermal installations and thus contribute to the improvement of air quality, particularly by reducing the CO_2 emissions.

Economic benefits and investment

The project will result in economic benefits through the long-term improvement of power supply.

Typically, the following positive impacts are expected from the development of PV plants:

- Development of a solar power economy (development of related industries, development of commercial activities and management of such equipment).
- Provision of renewable source of energy will result in a reduction of subsidy allocated for the non-renewable fuel. As well, the new source of energy is considered clean energy.
- Additional tax income in case the projects will be implemented as IPP projects.

Bedouin community

The solar plant development areas are located in the desert, an area traditionally used, and traversed, by Bedouins. During SESA fieldwork, few Bedouins were encountered but nevertheless the development of solar projects will change the character of the Project area to a degree which may impact upon Bedouins. Furthermore, the influx of labour may also pose an impact to Bedouin communities, if present. Individual projects should seek engage with Bedouins about project developments, afford project benefits and opportunities to Bedouins and put in place measures to avoid influx related impacts.

To avoid the potential negative impacts associated with labour influx (including but not limited to issues such as discrimination, people trafficking, forced and child labour, community health impacts through worker influx, and avoidance of community tensions) a coordinated and comprehensive policy for developers at the East Solar-1, East Solar-2 and East Solar-3 subareas should be developed. This impact is considered minor because the subareas are far from the villages at East Nile banks.

Impacts related to temporary inconvenience

Considering that the selected solar plant areas are in far distance to any community, no measurable inconvenience for local communities will arise.

Occupational Health and Safety

Major health and safety risks result from working on electrical systems and working with tools and machinery. Investors will be contractually required to keep the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines) as a minimum standard. Besides keeping the general guidelines regarding environmental, occupational health and safety and community health and safety aspects of special relevance are the sector guidelines: IFC's general Environmental Health and Safety Guidelines and the Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution as well as EBRD's PR 4.

Moreover, future investors will be required to employ through their Contractors an H&S engineer/supervisor being fully authorised to sanction any wrongdoing. An H&S management plan will be established at the start of construction activities subject to approval of supervising authority NREA. Important elements are safety training (for workers, machine drivers), emergency measures in case of accidents and a reporting system.

With the implementation of such measures, residual health and safety impacts are expected to be minor.

8 Mitigation Measures

8.1 General Management and Mitigation - Best Practice

After having thoroughly assessed the impacts, the so-called mitigation hierarchy shall be applied as the general mitigation strategy. The first step in this process comprises measures to avoid environmental or social impacts of a plan/project, by changes in the project design or in project activities. If it is not possible to avoid an impact, additional measures should be implemented to minimise the identified effect. The remaining impacts have to be rectified, e.g. by restoration of habitats to their original state or by relocation of affected species or habitats. The last option in the mitigation hierarchy is to compensate for or to offset any residual, unavoidable loss or damage. Such biodiversity offsets generally take place in a different area and aim for securing a "no net loss" outcome.

The mitigation strategy shall be accompanied by a thorough risk management covering post-construction monitoring and adaptive management.

The following management and mitigation measures can be regarded as a best practice standard that shall be applied in all East Solar subareas under any condition and during any project phase (construction, operation, maintenance and decommission):

- All activities must be restricted to the boundaries of the construction areas, storage positions and access roads / tracks. Any use of the surroundings must be strictly avoided.
- Supplying or changing oil, lubricant or hydrocarbon to vehicles shall be done in gas stations and not on site. Strict control must be applied by a site supervisor. Contingency measures and plans for spill removal must always be ready on site.
- Waste has to be removed immediately and has to be safely stored at the site so that drifting is avoided.
- Awareness programmes to personnel shall be carried out. Behaviour and attitude of involved personnel during field activities shall be controlled by a site supervisor.
- Potential occupational health and safety hazards during the construction phase shall be controlled by appropriate measures.
- The contractor shall provide effective protection for land and vegetation resources at all times and shall be held responsible for any subsequent damage.
- The contractor shall be forced to good workmanship and housekeeping during construction by contractual stipulations and by assignment of supervising engineers in order to assure adequate disposal of solid waste and wastewater, to avoid or to collect spillages of used oils, greases, etc.
- The contractor shall be forced not to leave the construction site unless the area has been put into a tidy condition, excavations are backfilled, heaps of excavation material are levelled and waste is adequately disposed of.
- Ban killing, hurting and unnecessary disturbing (incl. relocation) of any wildlife elements in the Project Area.

8.2 Physical environment

8.2.1 Land-use/Land-take

Areas of current land-use or under development are designated to be preclusive for solar power development. This is to avoid social conflicts. The impact significance of land-take of the remaining portions (solar power plots) on land owned by the Government is minor. Compensation or offtake measures are not required as solar projects shall only be developed on land that is not subject to any claims. During the preparation of the ESIA for each individual project, a detailed review will be needed to assess whether there are areas in addition to the areas of economic activities already precluded for solar PV power development.

8.2.2 Landscape Character and Visual Impact

Considering the vast character of the landscape and little presence of human receptors at some spots only inside or near to the area and the large distances of development projects to the next villages or settlements, no specific mitigation measures are required during planning and permitting process.

8.2.3 Water resources and wastewater

To protect water resources and to keep the withdrawal of water from wells (feed by resources from the River Nile) at a moderate level during periods of high water demand (casting of foundations during the construction phase), equalisation water tanks shall be installed at all East Solar subareas, at the wells and at the concrete batching plant. The volume of the water tank at the batching plant shall at least correspond with the water demand for the part of the PV plant that requires the larger volume of uninterrupted concrete pouring, which depends on the specific design of the PV plant. The volume of the water tank at the source shall correspond to the volume of the biggest tanker lorry used during the construction phase.

Domestic wastewater treatment from the sanitary installations at the site during construction shall be collected and treated in a simple two-stage anaerobic treatment plant with rinsing of treated water into desert gravel for natural post-treatment. Sludge from domestic wastewater treatment shall be disposed regularly to keep the treatment plant well-functioning.

8.2.4 Domestic and hazardous waste

The contractor shall be forced to carry out good workmanship and housekeeping during construction by contractual stipulations and by assignment of supervising engineers in order to assure adequate disposal or recycling of waste. This shall be carried out to the extent that potential packing material waste shall be returned to the delivery lorries.

To mitigate negative impacts during the construction phase, residual non-hazardous waste shall be collected and safely stored at the site so that drifting by wind is avoided. The recyclable or usable fraction (e.g. metals, reuse of wood) shall be separated and carried to the recovered substance cycle. The residual fraction of biodegradable or burnable waste will be collected in bags and in bins and disposed at designated waste treatment sites and landfills. In case of the absence of such sites, the waste shall be disposed at an environmentally safe waste disposal site (desert pits). To reduce volume, the waste is burnt and 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 m^3 per year and a 50 MW plot of non-compacted waste equivalent to about 2 m^3/a after incineration), this simple method is considered to be acceptable.

Spillage or dispersion of hazardous waste, such as spilt oil and grease originating from construction equipment or transformers, into the soils at the site shall be avoided by carefully handling and collecting in containers and subsequent recycling.

8.2.5 Air Quality

The impacts on the ambient air quality during the construction phase are caused by dust development at the working sites of machinery during road and foundation excavation works and shall be mitigated under occupational health and safety aspects.

Mitigation measures are:

- the spraying of water,
- workers to be assigned at the upwind side (the side of the dune facing the wind direction) from machinery; and
- the wearing of protective masks.

8.2.6 Noise

Mitigation of noise impacts on sites of economic activities within or next to the solar PV plant areas, where workers are employed or even reside for periods of time, shall be through keeping siting distances of at least 200 m to any existing economic activity in the area. This applies for the construction.

8.2.7 Archaeological, historical and cultural heritage

In the absence of archaeological, historical and cultural heritage inside or next to the project areas and having evaluated the impact significance on traffic to be negligible, no mitigation measures are required for these subjects.

8.2.8 Mitigation of impact on traffic

The effects of additional traffic load on the regional roads evaluated to be of minor significance during the construction phase shall be further reduced by shifting of heavy haulage transports to low traffic hours (such as late evening or night time hours).

Further investors shall make sure that the employed drivers of construction machinery (such as lorries and loaders) have received sensitisation/training on safety utilisation of their machines in order to minimise accidents risks. Heavy haulage transports shall be convoyed by safety cars.

8.3 Biological environment

Construction and decommission phase

No significant impacts caused by construction/decommission activities requiring particular mitigation measures have been identified in the process of the assessment. Nevertheless applying general measures to avoid or, at least, minimise any impact on habitats, flora and fauna during construction and decommissioning is crucial. This covers:

- Restrict all activities to the boundaries of the construction areas, storage positions and access roads/tracks. Any use of the surroundings must be strictly avoided.
- Comply with the regulations defined in Article 28 of the Egyptian Law no. 4/1994 for the Protection of the Environment amended by Law 9/2009, i.e. mainly a ban of:
  - hunting, killing, catching birds and wild animals or marine living organisms,
  - cutting or damaging protected plant species,
  - collecting, possessing, transporting, or offering to sell kinds of fauna and flora fossils or changing their features, and
  - trading in all endangered living organisms of fauna and flora species.
- Large Wadis, which hold sparse vegetation, form specific elements in the desert and can be used as a habitat for certain animals and temporarily as foraging or hunting sites for local birds. Hence, important Wadis have to be assessed as less favourable for PV plant developments (see Map NTS 8–1 and Map NTS 8–3). An appropriate mitigation measure is to avoid construction works in these Wadis as much as possible.
- Avoid installing wire fences and steel cables that might pose a collision risk for birds. If wire fences or steel cables are required, these structures can be marked, if appropriate, to increase their perceptibility and to reduce the risk of collision for birds.
- Avoid lighting of PV plants to minimise attraction, irritation or disorientation of animals. If lighting is absolutely required, the minimum number of lights of lowest effective intensity shall be used. LED-lights or other light sources with wavelengths of more than 550 mm are known to have only limited effects on insects, and thus, shall be preferred.
- Build the grid within a solar PV power project and the grid between different PV projects by underground MT cables. If the use of overhead lines cannot be avoided, such overhead lines should be designed according to available guidelines (e.g. BirdLife International 2015) in order to avoid the risk of electrocution of large birds.

Except from considering and applying the aforementioned measures, no further management and mitigation is required with regards to habitats, flora and fauna, because no residual significant adverse impacts are expected by construction/decommission of multiple solar PV plants and associated infrastructure in the Project Area.

Operation and maintenance phase

In order to protect habitats, flora and fauna in the three subareas, in particular species protected by Egyptian legislation (e.g. Rüppell's Sand Fox), the regulations defined in Article 28 of the Egyptian Law no. 4/1994 amended by Law no. 9/2009 have to be followed and best practice procedures and general mitigation measures during operation and maintenance have to be applied.

When cleaning solar PV panels an appropriate procedure shall be applied and the required amount of water shall be minimised in order to save resources and to minimise the impact on the biological environment.

Beyond that, no additional management and mitigation is required with regards to habitats, flora and fauna. No residual significant adverse impacts are expected by operation/maintenance of multiple solar PV plants and associated infrastructure in the Project Area.

Need for Post-Construction Monitoring / Risk Management

The gathered baseline data clearly shows that the East Solar subareas do not serve as an important habitat for plants. Animal species recorded in the East Solar subareas are quite widespread and can be found in several desert habitats in Egypt. The local fauna of the subarea is poor in species and density is low. Moreover, none of the recorded species is known to be endangered or threatened. Consequently, the East Solar subareas are not an important habitat for animals.

Hence, there is no need for additional baseline studies on flora and fauna in the three subareas (neither before nor during nor after construction of PV plants).

8.4 Social environment

Management of impacts related to health and safety

Potential impacts on workers and community health and safety during construction of a project are those associated with any construction project involving earthmoving, use of large equipment, transportation of overweight and oversized materials, and construction and installation of industrial facilities. Additionally, health and safety issues include working in trenches or electrical works.

Mitigation measures:

- Investors will be contractually required to force contractors to keep the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines) as a minimum standard. Besides keeping to the general guidelines regarding environmental, occupational health and safety and community health and safety aspects, of special relevance are the sector guidelines: IFC's Environmental Health and Safety Guidelines and the Environmental, Health, and the Safety Guidelines for Electric Power Transmission and Distribution as well as EBRD'S PR 4.

- In accordance with the Labour laws related to occupational health and safety No. 12 of year 2003, workers shall be oriented about health and safety procedures.

- The contractor and subcontractors shall assign a health and safety supervisor fully authorised to sanction any non-observance of H&S procedures.

- The contractor shall establish a health and safety plan prior to the start of construction works. He shall make health and safety facilities (i.e. firefighting equipment, a surgery room for first aid treatment, first aid materials, protective tools, etc.) available in the project site and shall have equipment for emergency evacuation to the next hospital standby at the site.

- As mentioned before, all personnel shall undergo an initial safety training specifically tailored to the individual work tasks.

Mitigation of impacts on the Bedouin community

Bedouins are a special ethnic group with own special culture, who traditionally consider the desert to be Bedouin land, even though the economic value of such ground, as in the subject Project Area, might be minor. The interests of Bedouin groups need to be considered when developing and implementing solar PV power projects.

This was an issue of concern for various stakeholders living in the villages in the Nile Valley or on new farms at the boundaries of the Project Area as found out by the Consultant during the fieldwork. The fact that they have their own unique culture that distinguishes them should be respected and appreciated. The following are key relevant recommendations:

Mitigation Measures:

- Bedouins should be consulted during the planning for the individual projects to ensure that any proposed development plan does not conflict with their reasonable interests. Participatory consultation tools should be employed during project execution and operation.

- Affording potential benefits such as job opportunities should be considered.

- The absence of information and statistics is a real challenge. There is a need to start by developing a database that includes information about the Bedouins community. This is essential for monitoring benefits from the project and to ensure that Bedouins are not excluded.

Labour influx and labour and working conditions

Mitigation measures:

- Minimising the number of workers from outside the Governorates close to the Project Area is highly recommended. The contractor should be advised to employ construction labour from the nearest villages in the Nile Valley. The incentives to contractors for such a measure include reducing the need for accommodation and transportation for workers.
- Community leaders could take part in the process of employment in terms of informing their local community about job opportunities. This will fall under the responsibility of the Social Development Officer.
- Fundamental principles and rights of workers need to be respected in line with EBRD PR2 and IFC PS2 and with special reference to national labour and employment laws.
- The temporary accommodation facilities at the site need to be appropriate for its location and be clean, safe and, at minimum, meet the basic needs of workers as per IFC and EBRD Workers' accommodation: processes and standards[1].
- Involve stakeholders and the public, implement consequential information disclosure, establish a grievance process and redress mechanism by NREA.

Mirror effect

Unlike Concentrated Solar Power (CSP) plants, mirror effects caused by the modules of a modern PV Plant are negligible. Thus, no special protection measures are required.

8.5 Special Mitigation Features in the individual East Solar Subareas

East Solar-1 subarea

Areas in the East Solar-1 subarea currently used or being under development for economic activities have to be considered to be preclusive. In addition, special features were identified that require specific mitigation: The important Wadi Ibadah and Wadi al-Birshawi has to be assessed as less favourable for solar PV plants , and thus, construction works in this Wadi complex shall be avoided as much as possible (see Map NTS 8–1).

East Solar-2 subarea

Besides general mitigation measures to be applied to all solar PV plants, no special features in the East Solar-2 subareas were identified that require specific mitigation (see Map NTS 8–2).

East Solar-3 subarea

Besides general mitigation measures to be applied to all solar PV plants, special features in the East Solar-3 subarea were identified that require specific mitigation: the important Wadi ash-Shaykh complex has to be assessed as less favourable for solar PV power developments, and thus, construction works in this Wadi complex shall be avoided as much as possible (see Map NTS 8–3).

[1] http://www.ebrd.com/downloads/about/history/workers.pdf

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Strategic Environmental and Social Assessment of Renewable Energy Projects in the East Nile Region (Arab Republic of Egypt)
SESA Solar Report

client:
New and Renewable Energy Authority (NREA),
Ministry of Electricity and Renewable Energy

Map NTS 8-1:
Restrictions for solar power developments in the East Solar-1 subarea

Bordering of East Solar-1 subarea

East Solar-1 subarea

Roads

road

Zones preclusive for PV solar power development

due to economic activities (farming)

due to economic activities (mining)

Zones unfavourable for PV solar power development

due to geomorphology

wadi of importance

0 10.000 Meter

1:150.000

N

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Map NTS 8-2:
Restrictions for solar power developments
in the East Solar-2 subarea

Bordering of East Solar-2 subarea

East Solar-2 subarea

Roads

road

No restrictions exists for PV solar power development in the East Solar-2 subarea!

0 10.000 Meter

1:150.000

N

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Map NTS 8-3:
Restrictions for solar power developments
in the East Solar-3 subarea

Bordering of East Solar-3 subarea

East Solar-3 subarea

Roads

road

Zones preclusive for PV solar power development

due to geomorphology

Zones unfavourable for PV solar power development

due to geomorphology

due to accessibility

wadi of importance

0 10.000 Meter

1:150.000

N

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

9 Environmental and Social Management and Monitoring Plan

It is understood that NREA will launch tenders for the selection of private investors for the individual 50 MW solar PV plant plots and will supervise the investors during the lifetime of the projects. It is essential that mitigation measures, i.e. the ESMP, become part of the tender documents and in the subsequent contract with investors. Moreover, thorough consideration/implementation of all requirements and measures needs to be supervised during planning, construction, operation and dismantling of each 50 MW solar PV plant. As part of this supervisory task NREA will also be the address and in charge of following up any grievance during the lifetime of each project.

The implementation of mitigation measures require actions during the bidding, planning, construction and post-construction phase for each individual solar PV plant that would be erected in the accepted area. This can be summarised in the following Environmental and Social Management Plan (ESMP). These actions will apply to all solar PV developments in the Project Area and where necessary will be supplemented with specific measures during individual project impact assessment and permission.

Table NTS 9-1: Environmental and Social Management Plan

Project activity	Environmental Concern	Requirement (Legislative, EBRD PR, Best Practice)	Environmental and Social Management
All Phases	Grievance	EBRD PR1 and PR 10, Best Practice	Introduce a grievance mechanism that applies through life cycle of the solar PV power development to be managed by the Egyptian Authority in charge.
Bidding and Planning Phase	Health and safety risks	EBRD PR1 and PR4, Voluntary and Best Practice	Make keeping standards as defined in the General IFC Environmental, Health and Safety Guidelines of April 2007 a minimum obligation in the Tender Documents for each individual plot.
			Make the assignment of a fully authorised health and safety engineer during the construction phase obligatory in the Tender Documents.
			Make a health and safety plan for each construction site obligatory in the Tender Documents.
			Make provision of safety tools & equipment as per accepted standards by the Contractor a bidding condition in the Tender Documents.
	Keeping mitigation measures	EBRD PR 1, Best Practice	Make keeping mitigation measures defined for the construction, operation and decommissioning phase in this study obligatory to investors as a minimum, when tendering the 50 MW plots.
	Impact on habitats, flora and fauna	EBRD PR 6, Best Practice	Avoid installing wire fences and steel cables or, if absolutely required, mark them in order to make them more perceivable. Avoid or minimise lighting of solar PV plants.

Project activity	Environmental Concern	Requirement (Legislative, EBRD PR, Best Practice)	Environmental and Social Management
			Avoid construction works in important Wadis systems. Avoid impacting on particular structures (like caves or crevices) that might form a suitable habitat for animals (to be considered in project-specific ESIAs).
		EBRD PR 6, Best Practice	Build the grid within a solar PV power project and the grid between different projects by underground cables. If the use of overhead lines cannot be avoided, such overhead lines should be designed according to available guidelines (e.g. BirdLife International 2015) in order to avoid the risk of electrocution of large birds.
Construction phase	Health and safety risks	EBRD PR4, EP3, Best Practice	Make Keeping the Equator Principle "EP3 - Applicable Environmental and Social Standards "as well as the IFC and EBRD Performance Standards (PS) respectively Performance Requirements (PR) as a minimum condition.
		EBRD PR4, Best Practice	Contractor and Subcontractor shall assign a health and safety engineer/supervisor fully authorised in giving health and safety instructions
		EBRD PR4, Best Practice	Establish an H&S plan prior to start of any construction measure.
		EBRD PR4, Best Practice	Make safety tools and equipment available and train in their proper utilisation.
		EBRD PR4, Best Practice	Construct and make available temporary hygienic sanitary facilities at the construction site.
		EBRD PR4, Best Practice	Assure stoppage of erection works during weather conditions beyond safety limits (e.g. sandstorms).
	Protection of water resources	EBRD PR3, Best Practice	Install water tanks to protect wells from over-utilisation: One tank at the batching plant with a minimum volume corresponding to the water demand for foundation pouring of one day. One tank at the water supply well with a minimum volume equal to the largest tank lorry. Minimise water consumption.
	Traffic	EBRD PR4, Best Practice	Carry out heavy haulage transports during hours of low traffic load (late evening or night times) and safeguard them with convoy cars.
	Pollution	EBRD PR3, Best Practice	Assure good workmanship and housekeeping supervised by skilled staff to assure minimise wastewater and solid waste generation and to assure adequate disposal of domestic, hazardous waste and wastewater
	Non-hazardous waste disposal	EBRD PR3, Best Practice	Collect and safely store, separate recyclable fraction, bury biodegradable fraction, ash and residual waste on an environmentally safe waste disposal site (treatment sites and landfills). If this is not practicable, desert pits with final soil coverage of at least 1.5 m).

Project activity	Environmental Concern	Requirement (Legislative, EBRD PR, Best Practice)	Environmental and Social Management
	Hazardous waste disposal	EBRD PR3, Best Practice	Avoid spillage of oil, diesel or grease into the soils, collect used oils or greases and bring it for recycling.
	Domestic wastewater treatment	EBRD PR3, Best Practice	Construct simple two-stage anaerobic treatment plant with rinsing of treated water into desert gravel for post-treatment at the sanitary facilities of each construction yard.
		EBRD PR3, Best Practice	At the end of construction works: Require the contractor to put the construction site into a tidy condition, excavations are to be backfilled, heaps of excavation material are to be levelled and waste is to be properly disposed of
	Impact on habitats, flora and fauna	EBRD PR 6, Best Practice	Restrict all activities to the boundaries of the construction areas, storage positions and access roads/tracks. Any use of the surroundings must be strictly avoided.
		EBRD PR 6, Best Practice	Avoid importing new species of urban and rural environments into the area (e.g. together with construction materials and containers).
		National Legislation	Comply with the regulations defined in Article 28 of the Egyptian Law no. 4/1994 for the Protection of the Environment amended by Law no. 9/2009.
	Labour and working conditions	EBRD PR 7, Best Practice	Employ as much construction labour as possible from near the areas where construction works will take place, i.e. from the nearest villages to the Nile Valley.
		EBRD PR 2 and PR 7, IFC PR2, Best Practice	Comply with the fundamental principles and rights of workers and accommodation standards fulfilling the requirements of EBRD (PR2) and IFC (PS2) and of the national labour and employment laws.
		EBRD PR 7, Best Practice	Any temporary accommodation facilities at the site need to be appropriate for its location and be clean, safe and, at a minimum, meet the basic needs of workers.
Operation and maintenance phase	Health and safety risks	EBRD PR4, Best Practice	Assure that O&M at the solar PV plant is only carried out by personnel who have passed a special safety training course.
	Cultural Heritages	EBRD PR 8, IFC PS 8, national Legislation	Develop a chance find procedure for use during construction. Train workers, contractors and sub-contractors in the implementation of the chance find procedure
Decommissioning	Land-use and landscape	EBRD PR 6, Best Practice	Remove solar PV installations at the end of the lifetime and bring the landscape into a tidy condition (levelling of heaps, backfilling of excavations)