



**AFRICAN DEVELOPMENT BANK GROUP**

**PROJECT : South Helwan 3x650 MW Supercritical Thermal Power Plant**

**COUNTRY : EGYPT**

**SUMMARY OF THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT**

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Preparation Team	Team Leader:	Mr. E. Negash, Chief Power Engineer, ONEC.2
	Team Members:	Mr. N. Kulemeka, Chief Socio-economist, ONEC.3 Mr. D.T. Lekoetje, Senior Public Utilities Economist, ONEC.2 Ms. S. Fourati, Senior Environment Officer, ONEC.3 Mr. Z. Bellot, Investment Officer, ONEC.2 Ms. S. Alissoutin, Financial Analyst, ONEC.2, Mr. K. El-Askari, Infrastructure Specialist, EGFO Mr. A. Algindy, Procurment Officer, EGFO
	Sector Director:	MS. H. Cheikhrouhou, Director, ONEC
	Regional Director:	Mr. J. Kolster, Director, ORNA
	Sector Manager:	Mr. E. Negash, OIC, ONEC.2
Peer Reviewers		Mr. Y. Ahmad, Country Program Officer, ORNA Mr. M. Assefaw, Principal Financial Analyst, OWAS.2 Mr. T. Bah, Senior Power Engineer, ONEC.2 Ms. M. Mourni, Chief Water & Sanitation Engineer, OWAS.

# ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

## SUMMARY

Project title : **South Helwan 3x650 MW Supercritical Thermal Power Plant**  
Country : **EGYPT**  
Project reference : **P-EG-FAA-018**

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### 1. INTRODUCTION

In accordance with the construction of the new thermal plant in South Helwan, an environmental and social assessment of the project was carried out. This executive summary provides the main conclusions of this environmental and social assessment and the main actions to undertake as per the Environmental and Social Management Plan of this project.

The environmental and social assessment was reviewed according to the policies and procedures of the African Development Bank and the operational policies of the World Bank.

### 2. PROJECT DESCRIPTION AND JUSTIFICATION

#### 2.1. PROJECT DESCRIPTION

Upper Egypt Electricity Production Company (UEEPC), a company incorporated in Egypt and affiliated to the Egyptian Electricity Holding Company (EEHC) proposes to construct and operate a new thermal power plant at a selected site south of ex-Helwan Governorate, which is along the Nile River and about 10km south of the village of Kureimat in the Dayr El-Maymoun area. The site is within an existing piece of land allocated to the Upper Egypt Electricity Production Company (UEEPC) by Presidential Decree No. 43 of 2010 issued on 14 February 2010 for the development of the power plant. The overall proposed site area is approximately 378,000 m<sup>2</sup>.

The proposed power plant will consist of three supercritical thermal steam units, with a nominal electricity generating capacity of 650 megawatts (MWe) each, which will be known as South Helwan Power Plant. The overall generating capacity of the power plant will be 1950MWe. The power plant will utilize natural gas as its primary fuel, and also have the capability to operate using mazout (heavy fuel oil) to provide security of electricity supply in the event that gas supplies are unavailable for any reason. In addition, emergency generators, for the plant safe shut down, operating on sollar oil (light fuel oil) will also be provided on-site to drive key items of equipment within the power plant in the event of a power supply failure, and sollar oil will also be able to be used, if required, to operate the auxiliary boiler during start-up.

The power plant will incorporate a direct (once through) cooling system using water abstracted from the River Nile. The abstracted water will also be used, following pre-treatment demineralization, to provide process water make-up in the boiler system. Nile water will be used as non-contact cooling water and for process water following demineralization. Nile water will be pumped through an intake pipeline buried under the bankline whilst heated cooling water will be returned to the Nile via a discharge pipeline. Potable water supplies will be drawn from the same water supply system of the power plant. The South Helwan site is located within a bare sandy area of uncultivated land. It is entirely situated on approximately more than 37 hectare rectangle- shaped piece of land located in a rural/desert area approximately 10 km south of the village of Kureimat, in the Helwan Governorate on the east bank of the Nile River.

**Landsat Image of the Wider El-Kureimat and Atfieh Area  
Showing the Proposed Site of the Helwan South Power Plant**



The site of the new Helwan South 1950 MWe power plant facility is an area of about 276,000 m<sup>2</sup> within the existed allocated site. The site locus is approximately 100 km south of Cairo and 23 km north of Beni-sueif. Two physiographic zones occupy this area: a floodplain adjacent to the Nile, and a rocky desert plateau east of the floodplain. The site of the existing land is 450 meters wide and has an average length of 800 meters; in all the site encompasses 378,000 square meters.

On the north side of the site is the Kureimat Power Complex (2x600 MWe+ 2x750 MWe), at around 7.5 km and the Kureimat village (about 10 km) and the Helwan South irrigation pumping station (about 9 km). The site is about 700 m south of the Dayr al-maymoun village. On both of the south and the east sides of the site is a wide-extended desert land. On the east side, and across the power plant site is a two-lane road running parallel to the Nile river. On the western side of the site is an agricultural stripland parallel to the Nile River where the power plant's cooling water intake and discharge structures will be located. The nearest town of importance is Es-saff, Markaz Es-saff, about 38 km along the road in the north direction. Towns of importance in the wide vicinity of the power plant site are Atfieh, Giza, Helwan, Imbaba, 15th of May, Beni-Suweif and El-Wasta.

The site entirely consists of approximately flat land, which is owned by the Upper Egypt Electricity Production Company (UEEPC). The power plant is intended to be operational by the end of the year 2014/2015. The power output from the proposed plant will be sold to the Egyptian Electricity Transmission Company (EETC).

## **2.2. LAND ACQUISITION AND RESETTLEMENT**

The project site is located within a bare sandy/desert area of uncultivated land of approximately 37 hectares. The site is about 7.5 km south of the village of Kureimat where the Kureimat power complex is located. The site of the existing land is 450 meters wide with an average length of 800 meters encompassing 378,000 square meters. Most of the land for the proposed project is public land. The Power Company has already obtained a Government Decree to occupy and use the land for the purposes of the proposed power plant. The available land is adequate for the new power station and that all efforts have been made to avoid potential conflicts and tension over resources with the local residents especially those of Dayr al-Maymoun village which is approximately 700 meters from the project site.

No additional land will be required outside the acquired perimeter for workers' camp. Most of the workforce will reside in their homes from within the surrounding towns and villages and commute to work; the campsite at El Kureimat will accommodate some workers; most senior staff will reside in near-by city of Beni-Suweif; leaving a small number of people who will be expected to reside within the South Helwan campsite itself. Adequate services will be provided at the campsite such as health, water and sanitation facilities to ensure that the project does not exert pressure on existing facilities for communities around the project area.

## **2.3. PROJECT JUSTIFICATION**

The EEHC has an objective to provide a secure, reliable electricity generation and distribution system for Egypt. The South Helwan on the Nile River site has the minimal additional infrastructure requirements. A workers colony is not required during construction as the power plant will use the local workforce from Helwan Governorate and the surrounding towns and villages.

Also, the power plant site will bring socio-economic benefits to the wider Helwan Region, through employment opportunities, supply contracts and the effects of project expenditure within the local economy. In addition, the power plant will be constructed and operated on a land originally allocated for power generation activity, thus it will not include any land take.

### 3. STATUTORY, LEGAL AND ADMINISTRATIVE FRAMEWORK

#### 3.1 LEGISLATIVE FRAMEWORK

Egyptian Law 4/1994 and its executive regulations set the overall framework for environmental protection in Egypt. According to this law, an environmental Social impact assessment (ESIA) should be prepared with the application for the license of a project.

**Table 1: Related Egyptian Environmental Laws**

<b>Environmental Issues</b>	<b>Laws</b>
<b>Noise</b>	Article 42 of Law 4, and article 44 of its executive regulations on maximum allowable limits for sound intensity. These noise regulations are under revision by EEAA currently.
<b>Air Quality</b>	Article 40 of Law 4 (articles 42 and 36) of its executive regulations maximum allowable limits for the concentration of pollutants. The Government of Egypt has established air pollution and water pollution limits applicable to the Power Plant projects. These regulations are also under revision by EEAA.
<b>Waste Water</b>	Law No. 93/1962 on standards for the discharge wastewater to the sewerage network and its Ministerial Decree 44/ 2000.
<b>Hazardous Material</b>	Article 32 of Law 4 on handling of hazardous materials.
<b>Waste Management</b>	Law No. 38/1967 amended by Law No. 31/1976, and Law 4 on public cleanliness and collection and disposal of solid Waste.

#### 3.2 INSTITUTIONAL FRAMEWORK

The Egyptian Environmental Affairs Agency (EEAA) was established, as a result of this Policy the Environmental Affairs Law (Law No. 4 /1994), to be the competent national authority in environment management.

Upper Egypt Electricity Production Company (UEEPC), a company incorporated in Egypt and affiliated to the Egyptian Electricity Holding Company (EEHC) will supervise all activities related to the Environmental and Social Management Plans (EMP), and carry out supervision of the implementation of the mitigation measures.

#### 3.3 POLICIES AND PROCEDURES OF THE DONORS

The ESIA was carried out and reviewed according to the national requirements and the policies and procedures of the African Development Bank and the World Bank.

The AfDB' policies applied for this project are:

- Environment policy
- Environmental and Social Assessment Procedures for public sector
- Gender Policy
- Cooperation with civil Society Organisations policy

- Involuntary resettlement policy

## **4. DESCRIPTION OF THE PROJECT ENVIRONMENT**

### **4.1 BIOPHYSICAL ENVIRONMENT**

Two physiographic zones occupy this area: a floodplain adjacent to the Nile, and a rocky desert plateau east of the floodplain. On the north side of the site is the Kureimat Power Complex (2x600 MWe+ 2x750 MWe), at around 7.5 km and the Kureimat village (about 10 km) and the Helwan South irrigation pumping station (about 9 km). On both of the south and the east sides of the site is a wide-extended desert land. On the east side and across the power plant site is a two-lane road running parallel to the Nile River. On the western side of the site is an agricultural stripland parallel to the Nile River where the power plant's cooling water intake and discharge structures will be located.

The Helwan South site is located on the western edge of the North Galala Plateau, a desert environment ranging in elevation from 330 to 1,275 meters above sea level. Wadis drain into the Nile River from the west slope of the plateau. The development of the site did not affect the drainage in adjacent areas. The river bank in this reach of the Nile (El- Wasta to Beni-sueif) is generally steep, consisting of small floodplain areas on the east bank; however, more extensive agricultural lands occur on the west bank. Flat desert lands above the east bank extend some 35 km inland to the Galala Plateau ridge. This area is not irrigated, but sporadic grazing occurs throughout the plateau.

The power plant site is located immediately above a river floodplain and just upstream and downstream of Helwan South Island, away from the cultivated area. Small oases occur about 1 km south of the site, and immediately to the north of the site. These oases are located on wadis at their confluences with the Nile flood-plain. The oases and adjacent floodplain are used to grow a variety of fruit, vegetable, and forage crops and to graze livestock. The natural growth of palm trees and shrubs, combined with fig trees and other cultivated woody plants, provides habitat for a variety of songbirds and some shorebirds.

Natural stream bank vegetation forms a narrow border to the river and consists of *Scirpus*, *Juncus*, *Phragmites*, *Typha*, and other emergent species. Snails are abundant along the shoreline, as are nematodes and other bottom worms in shallow water. The shoreline also shows evidence of high siltation and periphytic growth. The shoreline is already stabilized as a part of the existing project. The elevation is on average not changed in the cultivated area but all areas are of uniform elevation.

Above the floodplain the topography of the site consists of an abrupt slope followed by a flat plateau some 300 meters to the east. The elevation difference from the Nile at summer flow levels to this plateau is approximately 20 meters. The site's eastern most boundary extends along the main north-south highway and includes a major wadi. The flow through this wadi during storm periods would be blocked east of the highway's elevated road bed. Vegetation cover types within the site boundaries and in surrounding areas consist of three categories: emergent marsh wetlands adjacent to the Nile River, cultivated areas on the historical river floodplain, and barren desert on the eastern plateau.

The project area lies within the hyperarid climatic province of Egypt characterized by a mild winter and hot summer.

There are no significant habitats within the project's area of influence. The primary wildlife species observed onsite during the November 2010 field reconnaissance were birds. Within the wetlands, the cattle egret (*Bubulcus ibis*), moorhen (*Gallinula chloropus*), common swallow (*Hirundo Rustics*), and

graceful warbler (*Prinia gracilis*) were commonly observed in the *Scirpus – Juncus* marshes. Most of the avian activity, however, was centered in the agricultural areas. Swallows were observed foraging the fields. Cattle egrets, spur-winged plovers (*Hoploterus spinosus*), crested larks (*Galerida cristata*), and Senegal stone curlews (*Burhinus senegalensis*) foraged on the ground in the fields. Palm doves (*Streptopelia senegalensis*) were commonly observed foraging on the ground as well as resting in the trees. No birds were observed in the desert on the site. In addition, the field surveys have indicated that non-of the floral and faunal communities and/or species are of conservation value (rare or threatened). Meanwhile, no natural protectorates exist near the vicinity of the proposed site.

No archaeological resources are known in this zone. During February 1991 and before the construction of the existing Kureimat power plant, Kathryn A. Bard and Ricardo J. Elia of the Office of Public Archaeology, Boston University have conducted Preliminary Archaeological Assessment for the Kureiamt, Egypt Feasibility study. Also, the local archaeological authorities have surveyed the whole area around the site and they all proved that no historical resources exist.

Two water sources are available near the site, i.e. the Nile River and the underplaying aquifer. The quality of both surface water and groundwater in the Helwan South reach of the Nile is generally good. Only in localized sectors where there are concentrated sources of contaminants, such as irrigation drainage return waters, would water quality degradation be expected to occur.

The groundwater basin, which lies both beneath and closely adjacent to the Nile Valley from Cairo to Aswan, includes an area of about 2 million feddans. Water storage in this linear basin has been estimated at approximately 27 billion m<sup>3</sup>. However, because the hydrologic balance of the Nile Valley alluvial aquifer is directly connected with Nile surface flows, production from the aquifer is nominally the same as withdrawing water from the river. In essence, the valley aquifer is a transmission medium for river surface resources.

## **4.2 SOCIO-ECONOMIC CONTEXT**

The site is about 700 m south of the Dayr al-Maymoun village. The nearest town of importance is Es-saff, Markaz Es-saff, about 38 km along the road in the north direction. Towns of importance in the wide vicinity of the power plant site are Atfieh, Helwan, Giza, Imbaba, 15th of May, Beni-sueif and El-Wasta. The Helwan South site is within the Atfieh local governing unit, with the city of El-Saff as the governing center of the district. No villages or individual residences are located on the site. Agricultural workers who farm the floodplain live in nearby villages. Kureimat village is located some 10 km to the north of the site. The site is located within a totally rural landscape with some small scattered residential communities.

Agricultural crops have been cultivated on the higher floodplain and at the mouth of several small wadis at the project site between the 23 m and 28 m elevations. At least two different crops are planted annually on the lower areas, and in August, corn and peanuts are the predominant crops. Winter wheat is to be planted after the corn is harvested. Orchard and perennial crops included grapes, melons, guava, lemon, Indian fig (*Opuntia ficusindica*) and castor bean. Generally, the project area is an agricultural-desert landscape. The project site has neither human settlements nor agricultural activities occurring.

There is a typical rural housing with many small villages. The nearest village to the site is at about 1 km. No housing, except the existing plant's colony, occurs in the immediate vicinity of the site which is totally surrounded by desert, agricultural and farm lands. No industry, other than the existing Kureimat power complex, is present near the site.

The proposed site lies within the administrative boundary of the Helwan Governorate, which is recently formed as a distinct Governorate, separated mainly from Cairo and Giza Governorates, where most of its Kisms / Marakez / Districts/ Cities were basically affiliated to Cairo and Giza Governorates. The Governorate of the Helwan has prepared an Urgent Development Plan (UDP) for land-use management and planning, in which it sets out its policy to control development in the South Helwan region up to 2017 and beyond.

## **5. ALTERNATIVE SOLUTIONS**

### **5.1 ALTERNATIVE TECHNOLOGIES AND FUELS**

The technological alternatives are constrained by:

- Importing electricity: Egypt is interconnected to Libya and Jordan and is exporting electricity to both countries.
- Renewable energy: Renewable energy is not competitive
- Rehabilitation of existing power plants is not enough to cope with the growing demand for electricity.
- Strengthening of Transmission and distribution capacity alone will not replace the need for the generation capacity.

Consistent with the generation expansion plan, the EEHC has stipulated that the South Helwan should be gas/oil-fired supercritical steam units of a net 3x650 MWe generating capacity. The reasons for the selection of this technology (Steam Cycle) are

- Operational flexibility,
- Steam Cycle (SC) turbine has bigger inertia and is therefore more stable to network disturbances
- Unforeseen risk of new technology
- Fuel flexibility: SC plants use mazout as a back-up fuel, easily available domestically, while Combined Cycle (CC) plants use imported diesel oil.
- In Egypt only 30% of CC plants are manufactured locally, in comparison to about 40-45% of SC plants manufactured locally. Therefore, the use of SC technology creates more local employment and requires less foreign exchange.

Furthermore, natural gas has been selected as the main fuel for the power plant. Compared to other fossil fuel generating technologies, gas fired steam generators have a relatively low emissions of carbon dioxide (CO<sub>2</sub>), moderate emission levels of nitrogen oxides (NO<sub>x</sub>) and the lowest emission levels (almost traces) of sulfur dioxide (SO<sub>2</sub>) and particulates.

### **5.2 'NO PROJECT' OPTION**

The no action alternative will result in the demand for electricity exceeding supply, with an increasing deficit as demand increases in future years. A lack of a secure and reliable electricity generation and supply system has significant social and economic implications, since it will

- constrain existing and future economic development and investment through lack of energy resources to meet industrial demand;

- restrict socio-economic development through lack of electricity supply, or poor reliability and shortages in electricity supply for domestic users, community and other public facilities and public services;
- inhibit provision of social services, including public health and poverty eradication

As a result, the "no action" option is not a viable or acceptable alternative to the proposed project

## 6. POTENTIAL IMPACTS AND MITIGATION MEASURES

During operation, the **key** releases into the environment from the power plant will comprise the following:

- Exhaust gases, will be emitted into the atmosphere, normally from the Boilers' stack as a result of fuel combustion. Emissions from the combustion of natural gas are carbon dioxide (CO<sub>2</sub>), water vapor, carbon monoxide (CO) and nitrogen oxides (NO<sub>x</sub>). Sulfur dioxide (SO<sub>2</sub>) and particulates, which are typically associated with coal and oil combustion, will only be produced in trace quantities during natural gas firing. In emergencies when heavy fuel oil (mazout) is used instead of gas, SO<sub>2</sub> and particulates will however be key emissions from the power plant.
- Heated cooling water will be discharged into the River Nile via the cooling water discharge structure at a temperature of no more than 8°C at the point of discharge. Process waste water will be treated and discharged into the discharge system, which includes two pathways: one to the circulating water discharge system (CWDS) and the other to the plantation irrigation network. Any oil and residual solids will be removed before discharge and the pH of discharged water maintained at between 6 and 9.
- Chlorine will be added to the cooling water system to control bacterial and algal growth on various surfaces and in the cooling water intake. The cooling water discharge will contain residual quantities of chlorine at concentrations below the World Bank standard for free chlorine of 0.2 mg/l.
- Small volumes of solid wastes will be segregated, collected and disposed of by licensed waste disposal contractors.

The power plant incorporates a range of measures to eliminate or reduce operational releases within its design and layout, such as low NO<sub>x</sub> burners in the boilers, oil interceptors fitted to the site drainage system and effluent treatment facilities to treat wastewater prior to discharge. As a result, the power plant is designed to meet high environmental standards and comply with the emission limits of the Arab Republic of Egypt and the World Bank.

### **Air Quality**

Construction activities will result in locally high levels of dust. This may affect nearest receptors or sensitive environments which lie in the immediate boundaries of the power plant. Existing concentrations of airborne dust are already high in this rural area. Potential impacts from dust emissions on site will be significantly reduced by careful management and the implementation of mitigation measures to reduce dust generation.

The power plant will burn natural gas as its primary fuel. As a result, the principle pollutant during normal operation will be NO<sub>x</sub>. During emergency operation (and for not more than 2% of operating time), the burning of light fuel oil will result in emissions of particulate matter and SO<sub>2</sub> along with trace amounts of other pollutants. Emissions from the plant will meet Egyptian and World Bank Guidelines.

In order to analyze the potential impacts of the plant's emissions during normal operation (firing gas) on ambient air quality in the project area, dispersion modelling has been undertaken.

The assessment indicates that the highest concentrations for each of the averaging periods under consideration (hourly, daily, yearly) are found to the north-north-west, south and south- south-west of the site, respectively. The maximum hourly average value of NO<sub>x</sub> is 367.3 µg/m<sup>3</sup>, the maximum 24-Hours average is 126.7 µg/m<sup>3</sup> and the maximum annual average is 37.3µg/m<sup>3</sup>. The ambient existing levels of pollutants are dominating the wider area of the Helwan South site. Combined effects from the proposed Helwan South power project and the surrounding sources for nitrogen oxides (NO<sub>x</sub>) have been obtained using the background NO<sub>x</sub> measurements recorded for the Helwan South area via the NRC. The maximum total combined 24-hour impact level (138.79µg/m<sup>3</sup>, including the background level) is under the Egyptian 24-hour limit of 150 µg/m<sup>3</sup>. The maximum 24-hour impact level of the Helwan South power project is 126.7 µg/m<sup>3</sup> (excluding the background level). The maximum combined 1-hour impact level, including the highest value during 2008, is 397.52 µg/m<sup>3</sup>.

### **Aquatic Environment**

Cooling water and process water for power plant operation will be drawn from the Nile River via an intake structure. The quantity of the cooling water that will be returned back to the Nile River is about 69 m<sup>3</sup>/sec. Process water that will be abstracted from the Nile River is about 0.07% of this quantity. Potable water will be supplied to the power plant via the power plant water supply system. Cooling water will be returned to the Nile River via a discharge structure whilst waste process water will be disposed of after treatment via discharge system, which includes two pathways: plantation irrigation network and Circulating Water Discharge System (CWDS). Sanitary waste water will be disposed of after treatment via plantation irrigation network and the residual sludge will be transported by trucks to the sewer treatment plant of El-Saff town. No ground water or other surface water will be used during power plant construction an operation. The Contractors will be responsible for relevant water/toilet facilities during construction and the need to provide appropriate services will be specified in their contracts. The key potential impacts of the power plant on the aquatic environment will therefore be impacts to the aquatic flora and fauna during power plant construction and operation.

The aquatic environment surrounding the project site is characterized by generally fair water quality. The aquatic flora is characterized by poor biodiversity and no sensitive ecosystems. No commercial fishing occurs in the vicinity of the project, but very limited fishing activity near El-Kureimat power complex site, around 7.5km downstream the South Helwan project site.

During construction of the power plant dredging and construction of the intake and discharge structures could lead to potential impacts on physical aquagraphy, water quality and removal of, or disturbance to, aquatic habitats, flora and fauna. Given that the area of impact is much localised, losses are in many cases temporary and field survey data available do not indicate significant or sensitive habitats, the impacts of power plant construction on the aquatic environment are not considered to be significant. In addition, good site management and engineering practices during construction will ensure that any residual impacts are reduced to a minimum.

Power plant operation will result in a heated plume of waste cooling water being discharged into the Nile River. Process water will be disposed of to the discharge system. All discharges of process water will be treated prior to discharge to ensure that the Egyptian and World Bank waste water quality guidelines are met. Treatment includes neutralization, oil separation, flocculation and filtration.

The returned cooling water will be released at a temperature of no more than 8°C at the point of discharge. Thermal modelling of the discharge plume shows that, at max. operational conditions, the point at which the plume has decreased in temperature to 3°C above ambient, lies at approximately within 100 m from the point of discharge. The mixing zone has been defined by the HRI/MWRI to be 150 m from the point of discharge. The area affected by the highest temperature increases and therefore where aquatic ecology is likely to be most affected, is localized and the aquatic habitats in this area have been found to already be relatively impoverished. Outside this area, more marginal increases in the Nile River water temperature are likely to create new or improved habitats for flora and fauna.

Physical aquagraphy, Helwan South Nile River bank line access, fishing and navigation are not predicted to be significantly affected by the presence of the intake and discharge structures

### **Noise Impacts**

The construction of the Helwan South power plant is expected to generate a maximum noise level of 55 dB(A) during the day at the fence of the power plant and 50 dB(A) at night. These worst-case construction noise levels are both within Egyptian and World Bank guidelines, and for most of the construction periods, the noise levels will be lower than these values. There are no residential receptors within 100 m of the plant. Construction traffic on local roads will also generate additional noise, however noise levels on local roads predicted for peak construction activity (during 2012-2013) is expected to be only 0.3dB(A) above ambient levels. The potential noise emissions from the South Helwan plant during operation have been modelled to provide noise contours in the area around the site. The predicted operational noise levels at the site boundary and at all receptors are below the Egyptian and World Bank guidelines during daytime and night-time.

### **Flora and Fauna**

No areas protected for their conservation value are located on, or in the vicinity of, the project area. The proposed site itself and the surrounding land is desert and agricultural vegetated with much of the area having been dominated by common cultivars. Given that the potential impacts of construction and operation on power plant area likely to be localized and good site management practices will be implemented, no significant effects are predicted.

### **Land Use, Landscape and Visual Impacts**

The land use at the project site is agricultural land. There is no loss of this land to the power plant development, as this land is offered for sale by its owner, either, for other purposes or for a power generation activity, therefore there is not significant land use impacts due to the Helwan South power project.

Visual impacts of the power plant from the residential areas to the northwest and southeast are also not expected to be significant given the long distance of their locations from the site and orientation of the facilities. The potential landscape and visual impacts of the project are therefore expected to be properly accommodated.

### **Soils, Geology and Hydrology**

Due to the characteristics of the soils and geology of the site, in particular the lack of any sensitive features, and the mitigation measures proposed as part of the construction and operation of the power plant, no significant impacts are predicted to occur. In addition, preliminary land surface investigations confirmed the site as being uncontaminated.

### **Traffic**

The assessment of traffic and transport covers the changes in traffic conditions in terms of delay and congestion during construction and operation. The greatest potential for traffic impacts to occur arises during a short period at peak construction. There is some potential for increased congestion on the main roads to the power plant. However, the impacts will only occur during the peak construction phase and during peak hours. The overall impact is therefore predicted to be insignificant. Mitigation measures will be put in place to reduce the potential for impacts to arise.

### **Socio-economic and Cultural Effects**

It is anticipated that the power plant will provide a net positive socio-economic impact through the provision of employment opportunities and attraction of economic investment into the area. In addition, the use of local labor (95% during construction), will maximize these positive impacts through the development of the local skill base and will also generate increased demand for local services, materials and products. The project design has considered enhancing the project benefits through its social corporate responsibilities program. Resulting from the community requests that local population, both men and women, be considered for employment opportunities, the Power Company shall ensure that the construction companies recruit local people willing and able to participate in the implementation of the project. In addition, the project has undertaken to construct local clinic and a basic school for the communities of the project area in liaison with the Ministries of Health and Education, respectively. Provision of these social amenities will be implemented under the civil works contracts. Furthermore, social and recreational facilities for the staff of the Power Company shall be accessible by the local people upon request, including access to potable water within the project premises. The clinic and school will be constructed at the current site of El Kureimat and not at South Helwan since staff of South Helwan will reside at El Kureimat during operation. These facilities will follow the national environmental regulations and the general ESMP for Kureimat Complex in terms of environmental management.

### **Impacts on Fishing Activities**

Scientific research has shown that certain species of the fish grow considerably faster in warmer water. Experience from more than 10 other power plants located on the banklines of both of the River Nile and its branches that have operated in Egypt for a number of years indicates that the overall impacts on fisheries of slightly warmer water actually are positive, and consultations with the fishermen indicate that the catches in these areas have increased rather than decreased. Since this is part-time, small-scale fisheries no statistics are available, but after many years the warmer water around the various points of discharge, is clearly perceived by the fishermen to have positive effects. In line with this recognition, discussions have already been initiated between the EEHC and the General Authority for Fishery Development with a view to jointly take advantage of this, e.g. establishing a fry collection station near the edge of the mixing zone.

## **Archaeology, Historic and Cultural Heritage**

No available information was found which identified any archaeological, historic or cultural remains on the site or in the surrounding area. Consequently, no impact is predicted to occur on any known archaeological, historic or cultural resources. UEEPC have incorporated mitigation measures into the construction program to ensure that any potential finds of significance are recorded and are accorded the required protection in consultation with Supreme Council for Antiquities.

## **Solid and Hazardous Waste Management**

The management of wastes during construction and operation of the power plant will include mitigation measures to collect and store waste on-site, record all consignments of solid or contaminated waste for disposal and periodically audit waste contractors and disposal sites to ensure that disposal is undertaken in a safe and environmentally acceptable manner according to the rules set by Law 4/1994 and the Law 9/2009 and the Governorate of Helwan.

Private sector contractor will be assigned via general bidding process and the contract will include detailed environmental procedures, according to Law 4/1994 and the Law 9/2009 and Governorate of Helwan regulations, for disposing debris materials. The contract covers all fees required. During construction and operation, all wastes including debris waste, general waste, packaging waste, commercial wastes, raw-water pre- treatment sludge, tank sludge and interceptor sludge will be disposed of by licensed waste contractors according to the rules set by Law 4/1994 and the Law 9/2009 and the Governorate of Helwan.

## **Associated Infrastructure**

Transmission lines which will evacuate power generated by the Helwan South power plant will add connecting transmission lines to the Egyptian network. Some limited distance (on 500 kV) transmission lines will connect the power plant to existing substations following new routes.

The power plant will be connected through the following:

- Construct 500 kV O.H.T.L double circuit South Helwan Power Plant 500/ Minya East 500(proposed) with length of about 200 km.
- Construct 500 kV O.H.T.L double circuit South Helwan Power Plant 500/ Bader 500 (under construction) with length of about 150 km.

The proposed transmission routes of 500 kV TLs with their transmission towers would be footed mostly (at least 95%) on dry, unproductive, uninhabited, state owned land. The land required for each tower footing is expected to be maximum 20x20 meters.

The final information related to the location of the associated infrastructure (i.e., transmission lines and substations) is to be determined by EEHC/EETC/ UEEPC.

Also, a new gas pipeline route will have to be identified from Dahshour to Atfieh within the gas network in collaboration with EGAS/ GASCo.

Gas connection will be implemented, where gas pipelines will be buried underground along the identified route. A separate ESIA for the Gas Pipeline Project has already been implemented by GASCo.

However, since the transmission lines and gas pipelines are likely to require some land acquisition (and possibly resettlement), a Resettlement Policy Framework (RPF) is prepared separately, as part of this ESIA work for the TLs and another RPF is prepared separately by GASCo for the gas pipeline.

## **Climate Change**

Natural gas has been selected as the main fuel for the power plant. Compared to other fossil fuel generating technologies, gas fired steam generators have a relatively low emissions of carbon dioxide (CO<sub>2</sub>), moderate emission levels of nitrogen oxides (NO<sub>x</sub>) and the lowest emission levels (almost traces) of sulfur dioxide (SO<sub>2</sub>) and particulates. The efficiency of the proposed steam power plant is 42-45% with natural gas, with associated CO<sub>2</sub> emissions of about 520 g/kWh. Emissions of carbon dioxide are estimated to be up to 6,750 kilotonnes per year (expressed as CO<sub>2</sub>). This assumes that the plant operates for the whole year and consumes around 180 tonnes of gas per hour. The emissions of CO<sub>2</sub> from fuel burning in Egypt amounted to around 160,000 kilotonnes in 2000 (Ref: EEAA: Egypt's Second National Communication). Fuel combustion will account for most of Egypt's CO<sub>2</sub> emissions from all sources.

Natural gas fuel also has the significant benefit over fuel oil of being able to be delivered by an existing pipeline, whereas oil requires delivery to the power plant by road, rail and/or sea. The use of a pipeline avoids the potentially significant environmental impacts of road, rail or seaborne traffic and fuel unloading operations at a power plant.

Supercritical power plants are highly efficient plants with best available pollution control technology, reducing existing pollution levels by burning less fuel per megawatt-hour produced and capturing the vast majority of the pollutants. This technology increases the kWh produced with fewer emissions.

**Environmental and Social Management Plan (ESMP)** includes mitigation measures, design of monitoring programs where appropriate, and specification of management measures (including institutional responsibility and training requirements). Mitigation measures introduced into the design and construction phase of the power plant will be carried forward into the operational phase by the UEEPC Company. Many of the mitigation measures have already been integrated into the design of the power plant in order to minimize any operational impacts on the environment. Mitigation measures such as low NO<sub>x</sub> burners, noise silencers and water discharge controls are for example integral to the design of the power plant.

The total implementation cost of the environmental and Social Management Plan is about US\$ 1.848 million, which amounts to about 0.35% of the total project cost.

## **7. ENVIRONMENTAL RISK MANAGEMENT**

### **Occupational Health and Safety**

With the provision of a high standard of health and safety management on site, construction and operation of the power plant in accordance with good industry practice, the occupational health and safety risks associated with construction and operation of the power plant will be minimized and are not significant.

### **Natural Disaster Risks**

An assessment of the risks to the power plant from seismic activity has concluded that given the engineering measures incorporated into the design of the power plant, the potential environmental impacts of a seismic event during power plant operation are not anticipated to be significant. Furthermore the power plant will be designed to conform to the Uniform Building Code Zone 2 seismic criteria, according to US regulations for earthquake. These design criteria are therefore considered sufficient to withstand the level of seismic activity experienced in the area. The risks of flooding during power plant construction and operation were also examined. However, site drainage will be constructed to minimize any risks of contaminated water reaching the surroundings and to properly drain the site, no significant flood risk impacts are anticipated.

### **Major Accident Hazards**

Given the wider land surrounding the Helwan South power plant and the measures incorporated into the design of the plant to minimize the risk from fire and explosion, the plant is not anticipated to pose a potential risk of any significance to any third party facilities.

A Quantitative Risk Assessment (QRA) study for the proposed expansion of Helwan South Power Station was prepared. The risks in all directions outside the facility do not reach any residential areas. The agriculture land is not expected to have a continuous population and the road to the East is a low traffic road. Therefore, the QRA results suggest that the risk to the nearby populations would be well within the proposed risk criteria and hence would be acceptable.

The risks to the workers were shown to be As Low As Reasonably Practicable (ALARP). Significant fire hazards will also exist inside the facility.

Other recommendations are:

- The emphasis on risk reduction should be on preventative measures, i.e. to minimize the potential for leaks to occur. This would chiefly be achieved through appropriate design (to recognized standards) and through effective inspection, testing and maintenance plans / procedures.
- Rapid isolation of significant leaks will not eliminate the risks but will help to minimize the hazards and, particularly, the ignition probability (by limiting the total mass of flammable vapor released). For isolation to be effective, first requires detection to occur and hence best practice fire and gas detection systems, with associated shutdown systems and procedures, will be important mitigation measures..

## **8. MONITORING PROGRAMME**

### **Stack Emissions**

Stack emissions will be monitored continuously during plant operation at a representative point in the stack. Operational monitoring of stack emissions shall comprise monitoring the levels of Oxides of Nitrogen; Sulfur Dioxide; Carbon Monoxide; and Total Suspended Particles and PM10. The automatic monitoring system used will be linked in the controlling room to an alarm system to warn when emission limits for each pollutant are being approached Concentrations will be recorded as hourly rolling averages and reports on stack emissions monitoring will compare recorded emissions against predicted levels and Egyptian and WB guidelines. Reports will be submitted to the EEAA, the African Development Bank and any other concerned authority on an annual basis (or as required).

The provision of three continuous monitors (or three: one at the site, one upwind and the third downwind) will provide the basis for “validating” the predictions made in the ESIA. The monitors will

also include a weather station providing data on air temperature, wind speed, wind direction and mixing heights on a continuous basis. These monitors shall, also, be connected electronically, if possible, to the EEAA ambient monitoring system.

### **Aquatic Environment**

Monitoring of impacts of the power plant on the aquatic environment will include monitoring of the quality of the discharge water, Nile River bankline and benthic sediments, ambient water quality and the impact on aquatic flora and fauna. The survey will include the area affected by the thermal plume (i.e. 75-150 m from the discharge point).

### **Wastes**

Wastes generated on site and collected for disposal by skilled firms will be referenced, weighed and recorded. Environmental audits will be undertaken which will assess the quality and suitability of on- and off-site waste management procedures.

## **9. PUBLIC CONSULTATION AND THE PUBLICATION OF INFORMATION**

In order to ensure that the views and interests of all project stakeholders are taken into accounts, public consultation has been carried out. This consultation has been undertaken as part of the Environmental Impact Assessment process. The objectives of consultation and disclosure are to ensure that all stakeholders and interested parties, are fully informed of the proposed project, have the opportunity to voice their concerns and that any issues resulting from this process are addressed in the EIA and incorporated into the design and implementation of the project.

The adopted methodology for the public consultation was based on:

- discussions with local stakeholders and interested parties during preparation of the environmental documents for local permitting requirements;
- discussions with local stakeholders during scoping and preparation of this ESIA-Report, including the organization of a Public Scoping Meeting on 24 November 2010, in the Helwan Governorate;
- the organization of a Public Consultation Meeting on 16 March 2011, in the Kureimat Power Plant site, and
- on-going consultation through an “open-door” policy during construction and operation of the power plant.

A public Consultation Process is implemented by which UEEPC/HPP will consult and involve stakeholders in the planning, development, construction and operation of the power plant. As a category 1 project, this executive summary is disclosed on the African Development Bank’s website 120 days before board approval.

## **10. COMPLEMENTARY INITIATIVES**

The Bank is studying the opportunity to finance technical assistance to EEHC in Health, Environmental and Social Management, training, etc. The project design will therefore include Environmental Training for staff employed at the plant and other from the Upper Egypt Power Company. On the job training will be given to the staff employed for the EMU in the day-to-day monitoring activities; monitoring the stack emissions; collection and analysis of air quality data; monitoring the water effluents; collection and analysis of water

quality information; use of monitoring equipment, operation and maintenance; industrial hygiene; occupational health and safety; and emergency and contingency procedures.

## **11. CONCLUSIONS**

An Environmental and Social Impact Assessment has been carried out for the project in May 2011.

An Environmental and Social Management Plan constitutes the framework for the planning and execution of activities during its construction and operation phases. It is compliant with Egypt's legal and regulatory requirements, and those of AfDB, as well as the international standards.

## **12. REFERENCES AND CONTACTS**

### **REFERENCES**

The documents reviewed by the African Development Bank include :

- The environmental and social impact assessment for the South Helwan Power Plant and its annexes, prepared by Engineering Consultants Group (ECG), may 2011
- Quantitative Risk Assessment Study, prepared by Eco Con Serv, may 2011
- Resettlement policy Framework for Helwan South / Badr and Helwan South / El-Minya East 500 kV Electrical Interconnection

### **CONTACTS:**

#### **EGYPTIAN ELECTRICITY HOLDING COMPANY**

Chairman of the Egypt Electricity Holding Company  
Chairman of Upper Egypt Power Company  
Counselor for Environmental Management and Studies Sector  
**Ministry of Electricity and Energy Building**  
4<sup>th</sup> Floor, Ramsees Street  
Nasr City, P.O. Box 11517  
Cairo, Egypt.  
Tel. +20 2-2401-2361, Fax. +20 2-2261-6512  
Website: [www.egelec.com](http://www.egelec.com)

#### **AFRICAN DEVELOPMENT BANK**

Engedasew NEGASH, Chief Power Engineer, Department of Energy, Environment and Climate Change (ONEC), African Development Bank, BP 323 - 1002 Tunis Belvedere, Tunisia  
Tel: (216) 71 10 3931, Email: [e.negash@afdb.org](mailto:e.negash@afdb.org)

Awatef SIALA FOURATI, Senior Environment Officer, Environment and Climate Change Division (ONEC.3), Department of Energy, Environment and Climate Change (ONEC), African Development Bank, BP 323 - 1002 Tunis Belvedere, Tunisia Tel: (216) 71 103854, Email: [s.fourati@afdb.org](mailto:s.fourati@afdb.org)

Noel KULEMEKA, Chief Socio-economist, Environment and Climate Change Division (ONEC.3), Department of Energy, Environment and Climate Change (ONEC), African Development Bank, BP 323 - 1002 Tunis Belvedere, Tunisia  
Tel: (216) 71 102336, Email: [n.kulemeka@afdb.org](mailto:n.kulemeka@afdb.org)