



Non-Technical Summary for the New Damanhour Power Plant

June 2015

List of Abbreviations and Acronyms

| Abbreviation | Description |
|---------------------|--|
| ACC | Air-Cooled Condenser |
| AfDB | The African Development Bank |
| AQL | Air Quality Limit |
| BAT | Best Available Technique |
| CBOs | Community Based Organisations |
| CCGT | Combined Cycle Gas Turbine |
| CSOs | Civil Society Organisations |
| CTG | Combustion Gas Turbine |
| DPP | Damanhour Power Plant |
| EBRD | The European Bank for Reconstruction and Development |
| EEAA | The Egyptian Environmental Affairs Agency |
| EETC | The Egyptian Electricity Transmission Company |
| EHCE | The Egyptian Holding Company for Electricity |
| EHS | Environment, Health and Safety |
| EIA | Environmental Impact Assessment |
| EIB | The European Investment Bank |
| EMP | Environmental Management Plan |
| EMS | Environmental Management System |
| EPE | European Principles for the Environment |
| ESIA | Environmental and Social Impact Assessment |
| ESMP | Environmental and Social Management Plan |
| ERs | Executive Regulations |
| EU | The European Union |
| GASCO | The Egyptian Natural Gas Company |
| GRM | Grievance and Redress Mechanism |
| IFIs | International Financial Institutions |
| IUCN | The International Union for Conservation of Nature |

| | |
|--------------|---|
| NDPP | The New Damanhour Power Plant |
| NGOs | Non-Governmental Organizations |
| NTS | Non-Technical Summary |
| OSs | Operational Safeguards |
| PIC | Public Information Centre |
| PM | Particulate Matter |
| PMU | Project Management Unit |
| PPE | Personal Protective Equipment |
| PRs | Performance Requirements |
| RMCs | Regional Member Countries |
| SEP | Stakeholder Engagement Plan |
| UNECE | The United Nations Economic Commission for Europe |
| WDEPC | West Delta Electricity Production Company |

1. INTRODUCTION

The West Delta Electricity Production Company (WDEPC) is proposing to construct and operate a new combined cycle power plant (New Damanhour Power Plant - NDPP) in Zawyat Ghazal, Damanhour-El Beheira Governorate. WDEPC is an Egyptian joint-stock company, part of the Egyptian Electricity Holding Company (EEHC). It provides electricity to the El-Beihera, Alexandria and Matrouh Governorates.

The objective of the New Damanhour Power Plant (NDPP) is to address current shortfalls in the electricity supply in the Alexandria Region and Egypt as a whole. Currently Egypt has an installed generating capacity 26,000 MW, which is approximately 8,000-10,000 MW below capacity required to ensure secure supply. Demand is increasing by approximately 6% p.a., leading to increasing shortages. These shortages have a negative impact on households and communities, and particularly on the development of the commercial and industrial sectors. The proposed NDPP will provide additional supply and reduce the current shortage of installed capacity by approximately 15-20%.

The proposed plant is to be located on vacant land which is part of an existing power plant with old units which use either gas or oil as fuel. Three 65MWe units which have been in service for more than 40 years and are at the end of their service life will be decommissioned in 2015 and are to be demolished. The new power plant will be gas fired and will consist of two units with a generating capacity of 900MWe each, thus together providing a total new capacity of 1800 MWe. The new units will use state-of-the-art combined cycle gas turbine technology, which is highly efficient (57.7% thermal efficiency) and has comparatively low emissions.

The project will meet national environmental and social legislative requirements, which includes an Environmental and Social Impact Assessment (ESIA) with full public participation. Three International Financial Institutions (IFIs) are considering providing funding; these are the European Bank for Reconstruction and Development (EBRD); the European Investment Bank (EIB) and the African Development Bank (AfDB). Consequently, the environmental, social and health and safety requirements of these three IFIs, as set out in their environmental and social policies and standards, have to be met by the project. Both EBRD and EIB policies require compliance with European Union (EU) Directives and technical standards such as Best Available Techniques (BAT).

An Environmental and Social Impact Assessment (ESIA) of NDPP has been prepared in compliance with Egyptian impact assessment laws and standards. This includes a detailed 'Environmental and Social Management and Monitoring Plan (ESMP)' which identifies the actions that must be taken to avoid, reduce, or control potential environmental and social impacts during project construction and operation. It also includes a 'Stakeholder Engagement Plan' (SEP) which identifies the key stakeholders; describes how and where the Company will provide information to stakeholders and communicate with them and to take their views into account; and includes a grievance procedure.

This Non-Technical Summary presents the results and conclusions of the NDPP ESIA study and its public consultation process. It describes the current situation and potential future impacts of the proposed project on the community and on the environment, and the actions the Company will take to reduce or mitigate any negative impact. This Summary also includes a section on three associated projects linked to NDPP and necessary for its operation. These three projects will have separate ESIA's carried out in 2015.

2. LOCATION AND PROJECT DESCRIPTION

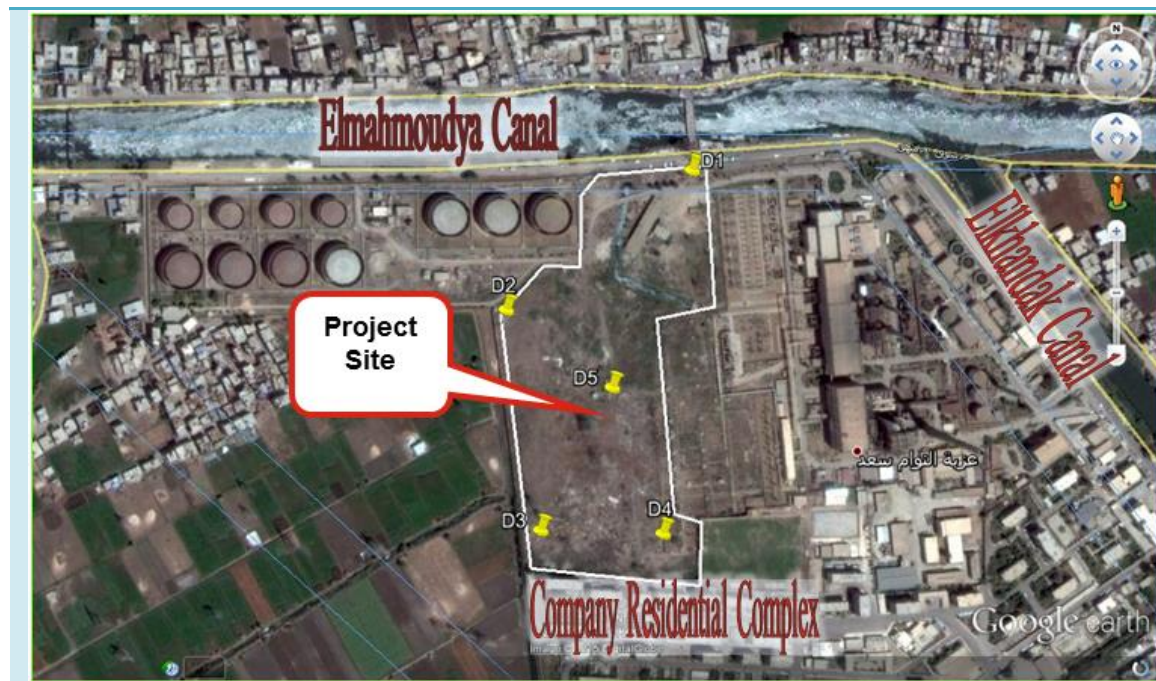
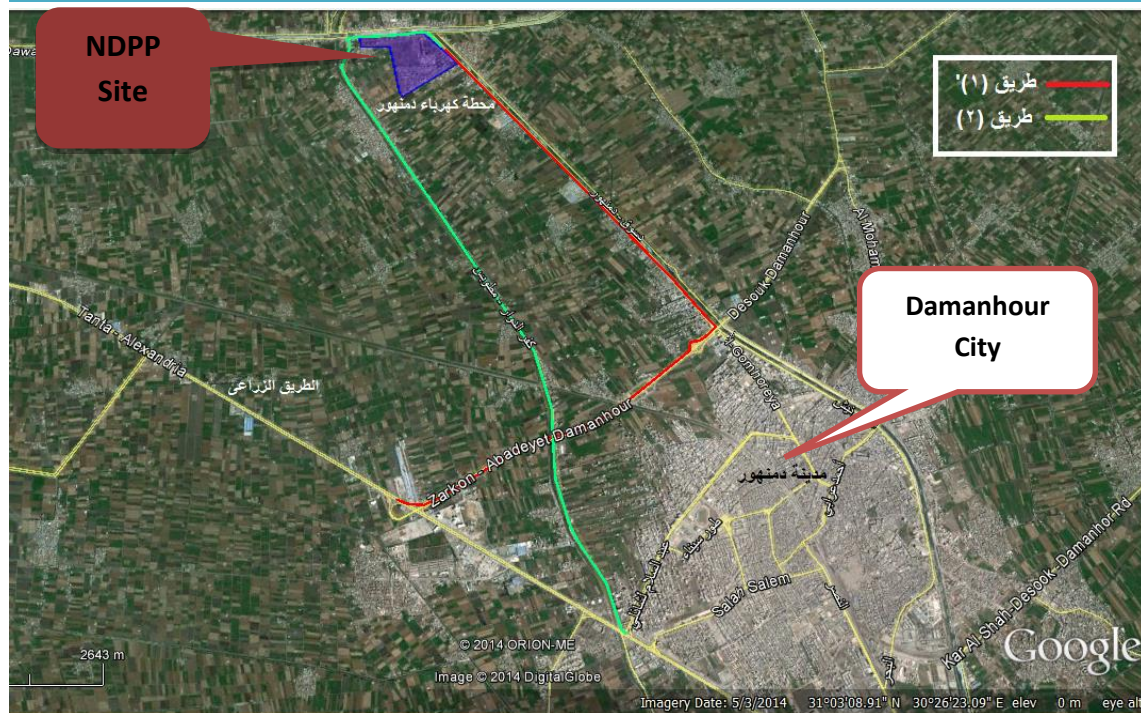
2.1 Location

The new power station will be built on vacant land which is part of the existing Damanhour Power Plant, in the Zaweyat Ghazal suburb of the town of Damanhour. Figures 1-1 and 1-2 shows the location of the power station in the Nile Delta region and its distance (4.5 km) to the city of Damanhour.

Figure 1-3 provides a view of the site with its existing structures (e.g. powerhouse; fuel oil tanks; switchyard etc.) and shows the vacant plot for the new power station. The El-Mahmoudya canal and the Elbahr road are to the north of the site; a power station staff housing area is to the south of it; the El Khandak canal borders the east of the project site, and agricultural land and Garboua village are to the west of the site.



Figure 1-1: Location of Damanhour power station in the Nile Delta



Figures 1-2 (top) and 1-3: Location of the project site in relation to the city of Damanhour and local residential areas

2.2 The Existing Power Station

The existing power station as shown in Figure 1-3 consists of

- 3x65 MWe heavy fuel oil fired plants (commissioned between 1968 and 1969; to be decommissioned in 2015, and subsequently to be demolished);
- one 300 MWe gas fired plant (commissioned in 1991),
- one 50 MWe Combined Cycle Gas Turbine
- 4 gas turbines (25 MWe each, commissioned between 1985 and 1995)
- plus a cluster of administrative buildings.

The total land area of the Damanhour site, including all existing generating plants and supporting structures plus the site reserved for the new plant extends to approximately 412,000 m². Of that, the area of the new Damanhour CCGT generating units, supporting structures, administrative buildings) is 90,000 m². Three tanks close to the designated NDPP site will be demolished to provide additional space.

The following photo (Figure 1-4) shows the existing power station in the background, with the vacant site for the new power station in the foreground. The stack height is 85 and 138 metres respectively, which makes the power station the visually dominant feature in this landscape.



Figure 1-4: View of the main units. The 3x65 MWe units are on the left, the 300 MWe unit is on the right (stack height 138 metres). The 3x65 MWe units are to be decommissioned and demolished as part of the project.

2.3 The New Damanhour Power Plant

NDPP will consist of two identical combined cycle gas turbine units of 900 MWe/each, giving the station a total power generating capacity of 1800 MWe. Using combined cycle technology increases generating efficiency significantly, in this case to approximately 56%. Figure 1-5 provides a schematic of a combined cycle gas turbine unit (CCGT).

Combined Cycle Gas Turbines are a highly efficient energy generation technology that combines a gas-fired turbine with a steam turbine. In the case of Damanhour, each of the two units consists of 2 gas turbines which a capacity of 300 MWe each, i.e. a total of 600 MWe. The heat of the exhaust flue gases is then recovered through 2 heat recovery steam generators. This is then utilized to drive one steam turbine of 300 MWe capacity in each of the two units, thus giving each unit a total capacity of 900 MWe.

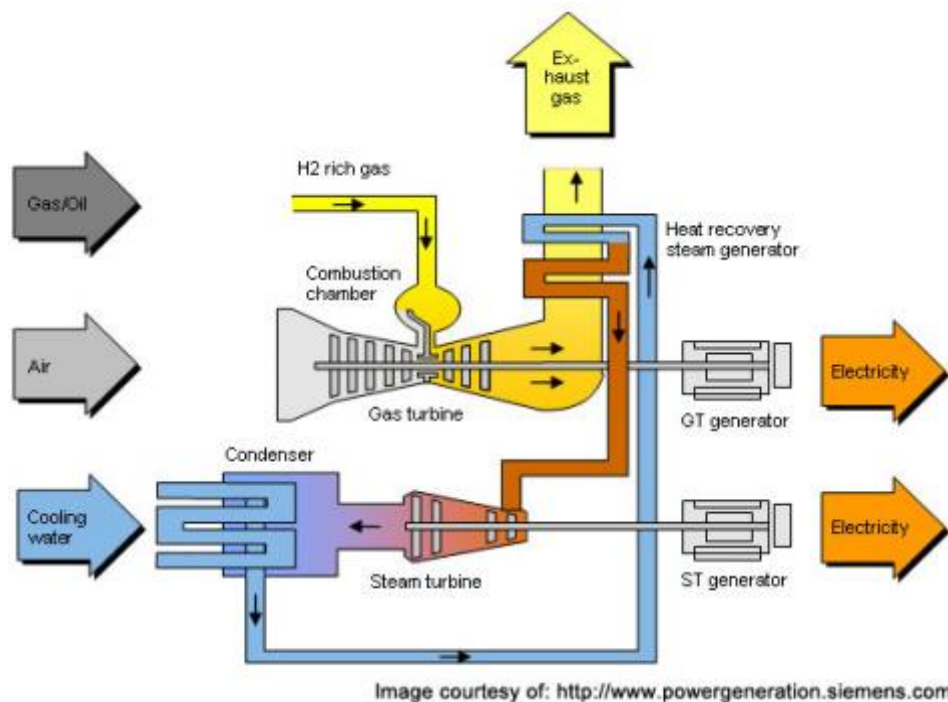


Figure 1-5: Diagram of a Combined Cycle Gas Turbine. Please note that Damanhour will be air-cooled, hence it will not require cooling water

It is planned that NDPP will at first operate in single cycle mode (2x600 MWe; gas turbines only), scheduled for 2018. Full operation of the combined cycle plant (2x900 MWe; combined gas and steam turbines) is scheduled for 2019.

The units will use natural gas as fuel; fuel oil in will be used in emergencies only (shortage of gas supply). NDPP will use an Air-Cooling Condenser (ACC) to condensate the steam. The condensate then goes into a closed cycle back to steam generation; this system will use very little water for makeup of the steam cycle.

The following map (Figure1-6) shows the layout of the station with its main components. The four gas turbines are at the bottom of the map. The air cooling system is located in the two blocks at the top, near the canal.

| Stack Emissions | Predicted Emission (Natural Gas) | AQL | EU | Predicted Emission (Light Fuel Oil) | AQL | EU |
|--------------------------------------|-------------------------------------|-----|-----|--|------|-------|
| CO (mg/m ³) | 20 | 100 | 100 | 20 | 250 | (100) |
| NOx (mg/m ³) | 40 | 500 | 50 | 70 | 500 | (50) |
| SO ₂ (mg/m ³) | 0.5 | 150 | | 650 | 1300 | 150 |
| PM (mg/m ³) | 3 | 50 | | 5 | 100 | 10 |

Figure 1-7: Predicted emissions for NDPP compared with Egyptian and EU emission limits

2.4 Associated Facilities

There are three separate projects linked to the NDPP project. These include a 14.5 km high voltage transmission line connecting the new plant to the grid, and a 4 km gas supply pipeline. These two projects are required to operate the plant and are therefore deemed directly associated facilities. A second 60 km grid connection is also being planned to ensure a stable connection of the new station to the national electricity grid once NDPP is fully operational. However this line is not deemed as a directly associated. These projects are the responsibility of, respectively, the national gas supply company (GASCO) and the national electricity grid operator (EETC).

These projects are not formally part of the NDPP project and are not included in the NDPP ESIA. Their environmental and social impact will be assessed separately in ESIAs for each project. These ESIAs will be prepared in compliance with Egyptian EIA law and environmental and social policies of the IFIs providing funding (notably the World Bank and EIB); under EU law the EIA Directive applies. EBRD Performance Standards applicable to such projects include PR 1: Environmental and Social Appraisal and Management; PR 4: Community Health, Safety and Security; PR 5: Land Acquisition, Involuntary Resettlement and Economic Displacement and PR 10: Information Disclosure and Stakeholder Engagement. These ESIAs and resettlement/livelihood restoration plans will be commissioned in mid 2015 and are scheduled to be completed by the end of 2015.

The routing of all three projects will follow existing infrastructure corridors (HV lines and an existing gas supply pipeline) as far as possible, to avoid or reduce any additional impact on the environment and people living and working in the area affected. The routing tries to avoid settlements.

The following provides summary information on these three projects, inclusive of a preliminary assessment of their environmental and social impact, and maps of the currently envisaged routing.

Associated Project: 14.5 km Grid Connection

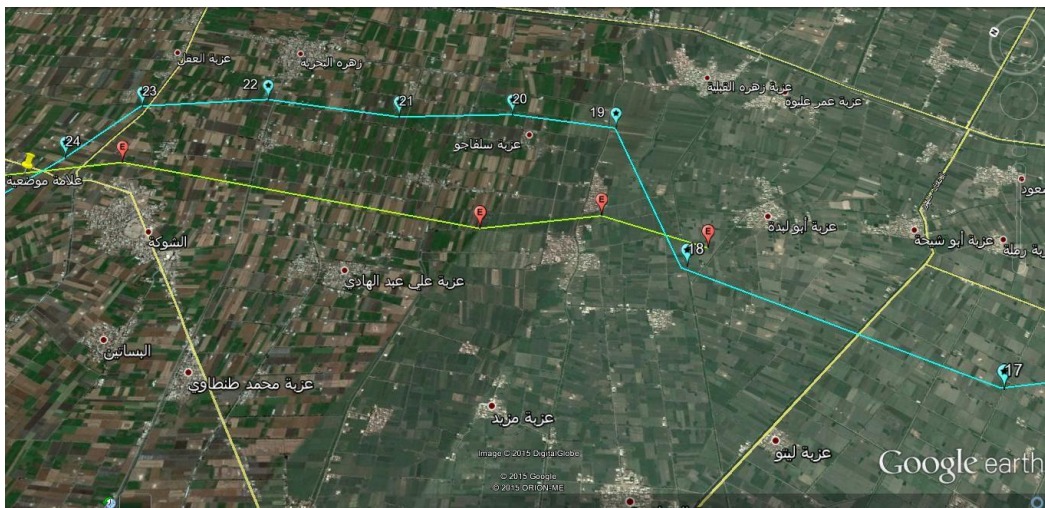
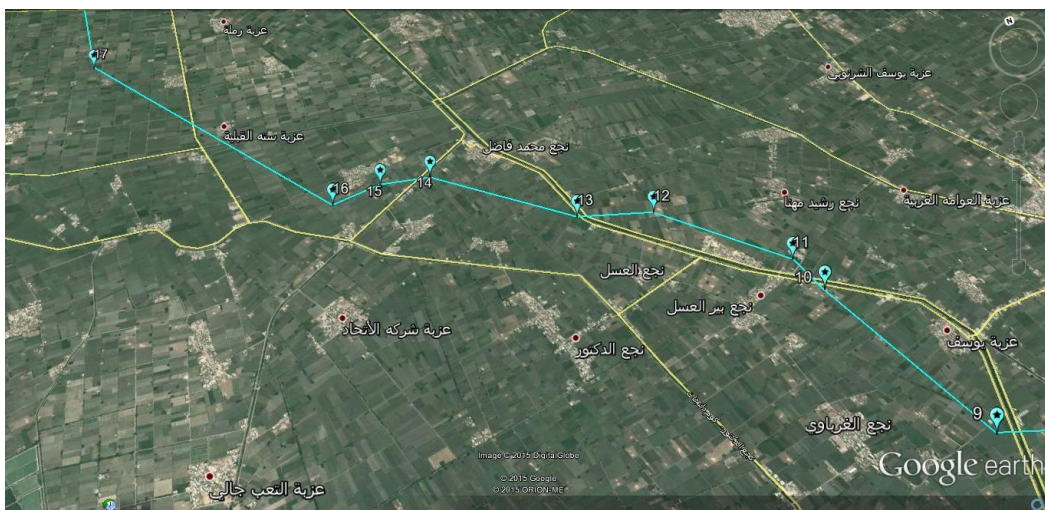
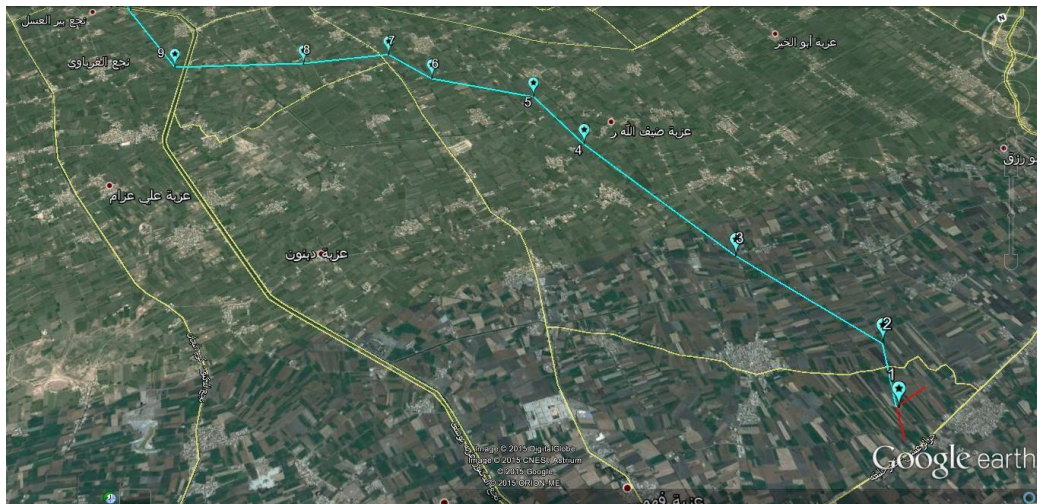
- **Company/Entity Responsible:** Egyptian Electricity Transmission Company (EETC). This project is part of the Egyptian Power Transmission Project (EPTP) jointly funded by EIB, AFD, KfW and the EU.
- **Description:** 500kVm OHTL In/Out connection from one circuit of the existing 500kV Kafr El-Zayat line. Total length of line is 14.5 km; approximately 45 pylons (max.). There is no requirement for a substation; there will be no permanent structures other than pylons.
- **Routing:** Largely to follow an existing HV line in its corridor; later across agricultural land, skirting settlements.
- **Environmental Impact:** As this is agricultural land no loss of valuable habitat or any significant impact on biodiversity is to be expected.
- **Social Impact:** There will be very limited permanent loss of agricultural land (for pylon foundations) and loss of income due to construction impact on crops. The OHTL Right of Way (RoW; 25 meters either side from the center line) needs to be clear of trees and any structures but can be used for growing traditional crops. Within the RoW a number of activities would be prohibited, including mining and any construction. To limit any negative impact, temporary access roads and storage areas for equipment will need to be restricted to a minimum; the same applies to a site office and any camp for labourers.

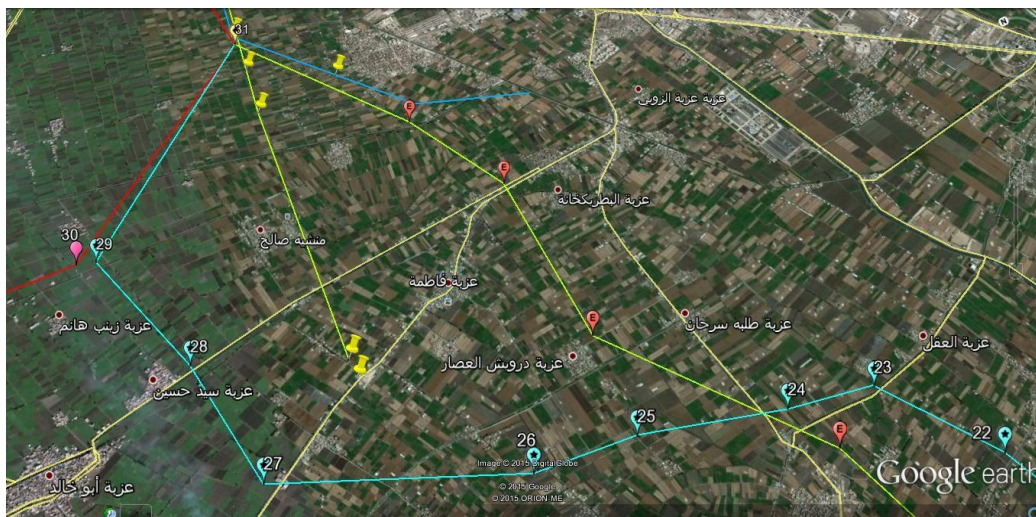
The following photos (Figures 1-8 and 1-9) show the proposed route near the power station (note the proximity of residential properties) and across agricultural land.



Figures 1-8 and 1-9: 14.5 km HV line route near Damanhour power station

The four maps (Figures 1-10 to 1-13) show the proposed route across agricultural land, avoiding settlements where possible. The markings and numbers indicate likely pylon locations.





Figures 1-10 to 1-13; proposed route of the 14.5 km HV grid connection (markings and numbers indicate pylons)

Associated Project: 4 km Gas Supply Pipeline

The short gas supply pipeline is an essential element of the project. The gas will be provided from the main gas substation located close to Damanhour. The proximity of this supply point was a consideration for the site selection.

The Project is subject to separate permitting and design systems, but has been reviewed as part of the current assessment to identify key risks (if any) and to ensure that the project is structured to comply with National Legislation and the Lenders requirements. An ESIA of this project is scheduled to be completed in 2015.

Given below is a summary of the key impacts

- **Company/Entity Responsible:** GASCO. This is part of a package of 8 short gas supply pipelines (between 0.4 and 17 km) to be constructed under a World Bank loan.
- **Description:** 24 inch diameter pipeline for gas transport; no pressure reduction stations (other than on the Damanhour Power Station Site).
- **Routing:** The new one is located in parallel to an existing gas pipeline. In places close to new housing. See photos below for routing and affected areas.
- **Environmental Impact:** As this is either residential or agricultural land no loss of valuable habitat or any significant impact on biodiversity is to be expected.
- **Social Impact:** This is a short route which skirts residential areas where possible but will in places come very close to residential buildings. It is likely that many of these residential houses were built illegally. There will be no permanent loss of land but a corridor of 3 metres either side of the pipeline has to remain free of any building. There will be loss of income due to construction impact on crops where the pipeline crosses agricultural land and gardens.

The following photos (Figures 1-14 and 1-15) show the proposed route close to the power station and across a canal (note the proximity of residential properties). The following map (Figure 1-16) shows that the routing is chosen to avoid housing areas as much as possible.



Figures 1-14 and 1-15: Route of new gas supply pipeline between residential buildings and crossing a canal (see Figure 1-16 for the location of the canal)

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محطة شعبان

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New PRS

Elzbat an Nawwam Sad

Kafr Al Dawar - Matbas

Damanhour Kafr El-Dawar

Image © 2014 DigitalGlobe
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Imagery Dates: Apr 10, 2013 - Oct 22, 2013 31°05'05.95" N 30°26'00.98" E elev 3 m Eye alt 1.39 km

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Future Project: 60 km Grid Connection

As part of strengthening the grid systems and to increase security of supply, a further 60 km 500 kV double-circuit line is planned to connect NDPP with the national grid substation at Abu-El-Matameer. This will be constructed in the future and is subject to separate financing and permitting; it will not be part of the current financing arrangements with the international Lenders. Given below is a summary of this line.

- **Company/Entity Responsible:** Egyptian Electricity Transmission Company (EETC)
- **Description:** 500kVm double-circuit, from new Damanhour PP to Abu-El-Matameer.
- Total length of line 60 km; the precise number and size of pylons is not yet available. The line will be connected to an existing substation which is to be upgraded; there is no requirement for permanent structures other than pylons.
- **Routing:** This line will follow the route of a previously planned (but not built) 220kV line. The old route will be reviewed and amended if necessary. As far as possible this new line will be built within an HV line corridor
- **Environmental Impact:** As this is agricultural land no loss of valuable habitat or any significant impact on biodiversity is to be expected.
- **Social Impact:** The line will in places be close to residential areas (e.g. where it connects to Damanhour power station). There will be very limited permanent loss of agricultural land (for pylon foundations) and loss of income due to construction impact on crops. The OHTL Right of Way (RoW; 25 meters either side from the center line) needs to be clear of trees and any structures but can be used for growing traditional crops. Within the RoW a number of activities would be prohibited, including mining and any construction. To limit any negative impact, temporary access roads and storage areas for equipment will need to be restricted to a minimum; the same applies to a site office and any camp for labourers.

3. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

The project is committed to the national legislation in terms of environmental protection, labour rights, health and safety procedures and other related laws mentioned listed in this Chapter. The preparation of the ESIA and ESMP is one of the requirements of EEAA and Environmental Law No .4 of Year 1994 and its amendments.

The key national laws which apply are

Egyptian legislation related to environmental aspects:

- The Egyptian environmental law No. 4 of year 1994 amended with law No. 9 of 2009, and its executive amendment no. 338 of 1995 modified by ministerial decrees no. 1741 of 2005, no. 1095 of 2011 and no. 964 of 2015.
- The Egyptian Environmental Affairs Agency (EEAA) Guidelines of Principles and Procedures for Environmental Impact Assessment.
- Law No. 48 of year 1982 on the Nile River, waterways and its executive amendment.

- Law No 63 of year 1974 for Electricity Sector institutions.
- Law No. 18 of 1998 on certain provisions for the electricity distribution companies, power plants and transmission grid.
- Law No. 102 of 1983 regarding the nature reserves, and its complementary decrees in preservation of rare and endangered wild animals.
- The decree of the Minister of Construction and Urban Development and Housing, Utilities No. 9 of 1989 amending the Ministerial Decree No. 649 for the year 1962 on the liquid waste disposal.
- The Presidential Decree with Law no. 142 of 2014 modifying some provisions of Traffic Law no. 66 of 1973.

Egyptian legislation related to the Socio-economic environment:

- The Egyptian Labour Law No. 12 of year 2003.
- Egyptian Constitution 2013 that has passed through popular referendum in January 2014
- Law No. 10 of year 1990 on property expropriation for public benefit and other laws governing expropriation
- Law No. 117 of year 1983 concerning the protection of monuments is applicable
- The Procurement Law No.89/1998
- Laws and regulations related to archaeology (Law No. 119 of year 2008 and Law No. 117 of year 1983)

The aforementioned laws on land acquisition do not directly apply to the project and the scope of work of this ESIA. However, they apply to the associated transmission lines project which, according to the EEAA guidelines, requires a full EIA which will be carried out separately for each project.

The preparation of the ESIA for the NDPP (i.e. this ESIA) and an associated Environmental and Social Management Plan is the responsibility of West Delta Electricity Production Company. The Egyptian Electricity Holding Company will seek project approval from EEAA; this permitting process involves active public participation at the scoping and draft ESIA stage and also requires separate permits from various ministries.

As both EBRD and EIB policies require compliance with EU Directives the following key Directives apply to this project:

- **Directive 2011/92/EU** of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment. This was amended by **Directive 2014/52/EU**.
- **Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control)** plus associated BAT/Brefs.
- **Directive 2008/50/EC on ambient air quality and cleaner air for Europe**
- **Directive 92/43/EEC** aims to contribute towards ensuring biodiversity through the conservation of natural habitats and of wild fauna and flora.
- **Directive 2009/147/EC** relates to the conservation of all species of naturally occurring birds.

In addition, International Conventions need to be considered either because Egypt is a signatory, or because the IFIs require compliance. These include:

- The UNECE Convention on **Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters** (Aarhus Convention).
- The **Stockholm Convention on Persistent Organic Pollutants**
- The **African Convention on the Conservation of Nature and Natural Resources** (Algeria 1968).
- The **Convention on Biological Diversity** (Rio de Janeiro, Brazil, 1992). International Union for Conservation of Nature reports (IUCN).

4. PROJECT ALTERNATIVES

Project alternatives assessed were assessed for their feasibility, likely impact and suitability. These include the 'no project' option; site alternatives; fuel alternatives; and technology alternatives.

No Project Option: In the first option (no project at all) power shortages would increase, as would the stability of the electricity supply system would in the region. This option would have a negative impact on residents and local business and is therefore considered to be unacceptable.

Site alternatives: The proposed site offers a number of clear advantages over any potential alternative in the region. The site is an unused part of a property of West Delta for Electricity Production Company (WDEPC) which avoids any costs associated with the purchase of a new site (land costs; potential property disputes; potential resettlement costs). As part of an existing and well managed power station it already has much of the required infrastructure for a new station (e.g. access roads; grid connection; water supply; buildings available for administration and staff; staff housing and amenities etc.). Additionally, well trained workers with long technical experience will become available once the old units are decommissioned. This makes the proposed site almost uniquely suitable. Because of these considerable advantages no other sites were investigated.

Fuel alternatives: Fuel alternatives would be other fossil fuels, notably oil as already used at the existing Damanhour power station. The fuel selected for the new CCGT is natural gas, which is readily available, does not imply high transport costs, and is by far the cleanest fossil fuel available. Combined with advanced combustion technology (combined cycle) and low NOx burners, emissions of gaseous pollutants are considerably below those from oil or coal fired power stations. Additionally, there are no emissions of particulate matter (dust).

Technology alternatives: Regarding gas fired power stations the technology chosen (combined cycle) is state-of-the-art, highly efficient (thermal efficiency 59%), and fully meets the requirements of EU Best emissions and technology directives (Industrial Emissions Directive;

Best Available Techniques for Large Combustion Plants). Renewables (wind-power and photo-voltaics) would not meet the requirement for a stable base-load supply (uninterrupted supply potentially 24/7) necessary to meet existing and projected increased demand. However, Egypt is planning to increase its renewable energy capacity (wind power and photo voltaic) substantially over the next decades.

5. THE CURRENT ENVIRONMENTAL AND SOCIAL SITUATION

Site characteristics and Visual Impact

Damanhour is located in the flat Nile Delta region, without any natural elevations. The land use in the vicinity of the power plant is almost entirely agricultural, with scattered low-rise residential areas (villages) and a number of commercial services buildings. Damanhour power plant with its stacks (the tallest of which is 138 metres high) is the most dominant structure as shown in the maps and photos in the project description.

The power station site inclusive of the vacant land for the NDPP is an industrial site surrounded by residential areas and agricultural land. There is no any area of cultural and historical importance nearby

Soil and Groundwater

The site is located on the Nile flood plain between the Rosetta Nile branch and the southern areas adjacent to El-Mahmoudia canal. It consists of the Nile mud and is considered one of the most productive agricultural areas. The site falls within the 1-meter contour line above sea level.

Flora, Fauna and Biodiversity

Field surveys show that the ecosystem of the proposed power plant site is essentially a derelict industrial site with poor in diversity and biological structure. No significant habitats or species were found in the surveyed area, i.e. the actual power station site and its immediate vicinity. There are no protected areas in the vicinity of the project area. No rare or threatened species were found or are recorded in this area.

Aquatic Environment

The existing power station has a direct water based cooling system for its condenser cooling. Approximately 35 cbm per second of water are taken from the El-Mahmoudia canal, pass the condensers, and are then directly discharged back into the canal. The thermal loading of the cooling water is approximately 5°C.

A range of common aquatic plant species were recorded in the canal bank ecosystem adjacent to the site. The total number of algal species in the canal was about 80 species, plus 48 species of zooplankton in canals and ditches of this region. A total of 29 species of benthic organisms in the El-Mahmoudia Canal was recorded. These field aquatic surveys have shown that the ecosystem in front of the proposed power plant is poor in diversity and structure. No significant species were encountered in the surveyed area and its immediate vicinity.

Climate and Air Quality

The area (Zawyet Ghazal, Damanhour, El Beheria Governorate) is semi-arid. It is characterized by short winter and long summer (from May to September). The winter is cold, rainy and windy. The summer is warm with clear sky, high solar radiation and no rainfall. Minimum temperatures occur during January and February (7.6 C°). Maximum temperatures occur during the period of July – August, with the highest temperature of 32.1 C° (for 2014) recorded in July. The annual mean temperature in 2014 was 19.4 C°.

There are no permanent air quality monitoring stations in the region and data on ambient air quality are scarce. The main major sources of air pollution in the Damanhour area are the power plant and local traffic. Measurements were carried out outside the plant boundaries by the Air Pollution Lab Team of Alexandria University on Sunday May 10th 2015. These measurements included carbon monoxide, nitrogen dioxide, sulphur dioxide, total suspended particulates (TSP) and respirable dust (PM₁₀) and were made at six locations to the south, southeast and south-west of the project site, representing ambient air quality downwind of the power plant. The monitoring locations are shown on the map below (Figure 1-17). Measurement results are summarized in the table below (Figure 1-18).



Figure 1-17: Ambient air quality monitoring points downwind of the power station

| Site/ Parameter | SO ₂ (µg/m ³) | NO _x (µg/m ³) | CO (mg/m ³) | TSP (µg/m ³) | PM ₁₀ (µg/m ³) |
|--|---|--------------------------------------|---|--------------------------|---------------------------------------|
| SE1 | 12 | 20 | 0.88 | 168 | 68 |
| SE2 | 11 | 18 | 0.79 | 166 | 59 |
| S1 | 9 | 18 | 0.67 | 153 | 73 |
| S2 | 8 | 18 | 0.55 | 148 | 68 |
| SW1 | 10 | 19 | 0.75 | 138 | 65 |
| SW2 | 8 | 18 | 0.71 | 127 | 63 |
| AQL (Egyptian Environmental Law) | 300 | 300 | 30 | 230 | 150 |
| Air Quality Standard (EU Standard) Commission(EC) | 350 µg/m³-1hr 125 µg/m³-24hr | 200 µg/m³-1hr | 10 mg/m³ maximum daily 8-hr mean | - | 50 µg/m³-24hr |

Figure 1-18: Results of measurements made 10 May 2015

These measurements show that the baseline ambient air quality at the time of measurement was significantly below the permissible limits at all six locations.

The existing Damanhour Power Station is by far the largest single-source emitter of air pollutants in the region. At present the following quantities of key pollutants are emitted (Figure 1-19).

| Units | Units 1, 2 , 3 (for each unit) | Units 1-3 combined | 300 MW Unit |
|-----------------------------------|-----------------------------------|-----------------------|-------------|
| Load in MWe | 47 | 141 | 300 |
| Type of fuel | Fuel oil | Fuel oil | Fuel oil |
| Total annual emissions | | | |
| SO2 annual total, million tons | 0.024 | 0.072 | 0.017 |
| NOx annual total, million tons | 0.009 | 0.027 | 0.075 |
| CO2 annual total, million tons | 38.1 | 114.4 | 222.4 |
| Relative emissions | | | |
| SO2 (g/kWh) | 0.006 | | 0.006 |
| NOx (g/kWh) | 0.002 | | 0.0028 |
| CO2 (kg/kWh) | 1.4 | | 1.4 |

Figure 1-19: Typical Emissions from the existing Damanhour Power Station units

Noise

Similarly to ambient air quality, there is no noise monitoring network and no noise measurements from the vicinity of the power station. To address this gap, measurements were carried out in the period from December 2014 to January 2015, both during daytime and night-time. The sites where measurements were taken are shown in the following Figure 1-20; the measured noise levels are presented in Figure 1-21. These monitoring sites are representative of receptors (mainly residential areas) in the immediate vicinity of the power station, i.e. an area most directly affected by noise emissions. Some residential areas, most notably the apartments for power station staff, are immediately adjacent to the power station (see Figure 1- 22).



Figure 1.20: Noise measurement locations

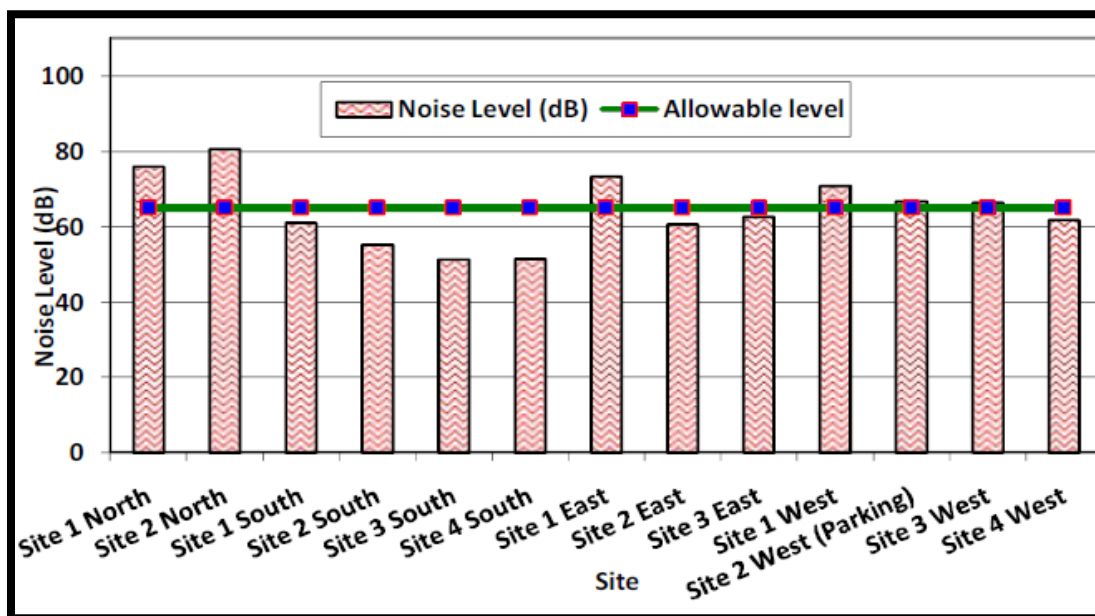


Figure 1.21: Daytime noise measurements taken in January 2015



Figure 1-22: Residential buildings for power station staff, adjacent to the power station

A similar pattern exists for night-time, where the allowable noise limit of 55dB is on average slightly exceeded at locations 1 and 2 North and 1 East.

In summary it was found that

- The levels of noise inside the new Damanhour station are lower than the maximum allowable level (85 dB).
- During daytime (from 10 am to 7 pm) some measuring sites outside the new Damanhour station show higher levels of noise than the maximum allowable level (65 dB during daytime).
- During night-time (from 10 pm to 7 am) some sites outside the Damanhour station show levels of noise higher than maximum allowable level (55 dB during night-time).

Traffic

Figure 1-2 shows the major roads in the Damanhour area and in the immediate vicinity of the power station. There is a network of major roads connecting the area to major ports which are important for transport of heavy goods such as equipment for the NDPP. These roads are generally dual carriage and in good order. Regional and local roads are often crowded and narrow.

Natural and other Hazards

Egypt is a country of low to moderate seismic hazards, with earthquakes occurring in the northern parts of the country. Damanhour is classified as in zone 2 according to earth quake risk (5 being the highest).

The project site does not contain any of the narrow wadies which collect rainwater and may cause flash floods.

Operational hazards include fire and explosion risk associated with the gas supply and with oil storage. The power station has trained staff for fire fighting and emergency response, and the municipal fire brigade station is close by.

Solid and Hazardous Wastes

Solid waste on site consists of redundant equipment, packaging, and domestic solid waste. The power station does not generate hazardous wastes other than oil residues from machinery and in surface run-off water; these oil residues are collected and disposed off via a licensed contractor. The same applies to used transformer oil.

Socioeconomic Conditions of the project areas

Damanhour Power Plant is located in El-Behira Governorate in Damanhour Markaz. The NDPP is located in Zawyet Ghazal village, which is part of Damanhour Markaz. The new plant is an extension of an existing power plant. The populated area of Damanhour Markaz comprises 396.11 km² and is administratively divided into 7 rural local units which consist of 50 villages and 458 hamlets.

The total population of El Behira Governorate is 4.737 million people with annual natural increase of 1.7%. El Behira population represent 6.53% of the total Egyptian population. The Markaz's population reached 798.39 thousand persons according to the 2006 National census. The total population of Zawyet Ghazal village including all its sub-villages is 8868 individuals according to the 2006 National Census. Males represent 51.3% of the total population. They reside the residential areas surrounding the NDPP. The population density ratio increased from 0.64 thousand persons/km² in 2002 to 0.67 thousand persons/km² in 2006.

Age distribution of the project areas reflected that 31.7% of the total population are below 10 years old, whereas those of the age category 15-less than 45 years represent almost half of the population. Comparing those figures with the national age distribution, a slight difference was noted with diversion less than 0.3.

The percentage of the people aged 15 years or more within the labour force of Zawyet Ghazal village is approximately 42.9%, whilst those aged 15 years or more outside the labour force account for about 57.1%. Females comprise only about 9% of the people within the labour force. This is mainly because of the rural nature of the village where females at work are not socially accepted.

The National Census data and the Egyptian Human Development Report 2010 revealed that people within labour force are those 15+. The unemployment rate in Zawyet Ghazal village is about 13.2% amongst this group. The unemployment rate shows substantial differences between males and females within the labour force. About 69% of the females at the age of 15-65 are unemployed. This could be attributed to two main factors, namely the limited job opportunities suitable for women and constraints facing female work due to norms and traditions. Unemployed persons around the current power plant are demanding permanent jobs. This demand needs to be handled carefully during project implementation. Comparing the unemployment percentage to the national rate, it is obvious that unemployment in Zawyet Ghazal is higher than the national level which is 8.9%. The distribution of the El Behera Governorate population by occupation revealed that 46.8% work as farmers, while 10% work as skilled labourers¹. Additionally, 8.0% work as labourers in factories. Professionals and legislators represent about 11.0%. The majority of the population of Zawyet Ghazal are working as farmers and skilled labourers. The data revealed that there is a high potential for hiring community people as unskilled labourers. Regarding skilled workers and professionals these are more likely to be recruited from outside the village.

The Household Income, Expenditure and Consumption Survey 2013 reported that the households needs 1620 EGP per month to satisfy their basic needs. The poverty line is estimated at 327 per capita per month. Within the El Behira Governorate about 23% of the population are living below that poverty line. A survey conducted by the ESIA team in 2015 (118 households in the project area) showed that households with family income between 500 and 1,000 EGP form the largest income group of the entire group of interviewees. This showed that the majority of the sample households surveyed were below the poverty line; this class comprises about 26% of households. About 23% of the surveyed households had a family income above 3,000 EGP/month. Most of the families in the high-income group live in the employee residential compound of the power station. The middle-income groups jointly comprise the highest percentage of households. Families with a monthly income below 500 EGP account for only 2.5%. Among the community, the residents of electricity colony are seen as better off in terms of salary and general economic conditions. This is an incentive for community people to seek work at NDPP.

All households in the project areas have access to electricity. The sample surveyed reported two major problems associated with the electricity supply. The first problem reported is the cost of electricity which has increased due to changes in the electricity tariff in 2014. 27% of surveyed households reported that the electricity bill increased during last year. The second problem is repeated power cuts; this was mentioned by approximately 34% of the surveyed households. The survey revealed that households are expecting that NDPP and other similar projects will resolve this problem.

All interviewed households stated that their houses have a connection to the public drinking water supply network. The households in the employees' residential compound are supplied with drinking water from a treatment plant within the premises of the colony.

¹ National Census, 2006, CAPMAS

All household included in the ESIA survey have access to the public sanitary sewage network. They also have toilet facilities inside their buildings. However, all households in the sub-villages of Zawyet Ghazal, El-Nawam Sa'ad and Garboa'a are connected to a local domestic network, which was built by the people in the area. These domestic networks are equipped with pumping stations for disposal of the sanitary sewage they collect. The households in the employees' residential compound are connected to a sanitary sewage collection network constructed to serve the colony.

All households in the employees' residential compound have a natural gas supply. The gas supply installation and the gas consumption costs are not the responsibility of the households. The interviewed households from the compound mentioned that this is a free service provided by the power plant. The households in the employees' residential compound expressed no problem related to energy supply.

Gas cylinders are the main source of energy for cooking and other domestic uses such as water heating for all interviewed households in the three sub-villages.

6. THE LIKELY IMPACT OF THE NEW DAMANPOUR POWER PLANT

6.1 During the Site Preparation and Construction Phase

This section describes the impacts which might occur during the construction of NDPP. This is then summarized in an impact rating matrix.

Impact on Soil and Ground water

Ground works and demolition of three large oil tanks involve the risk of soil and groundwater contamination. These works will be carefully controlled, contractors will be trained and supervised, and an emergency taskforce will be in place to address any spillages.

Impact on Flora, Fauna and Biodiversity

Site clearance and construction will cause some disturbance and will destroy a large part of the existing flora and fauna. However, as this a derelict industrial site with poor flora and fauna and no species of particular biodiversity value this impact can be considered marginal and acceptable. This can be mitigated by selective replanting after completion of construction.

Impact on Surface Water Quality

Impacts on groundwater can occur when digging deep foundations for the NDPP. There is a risk of groundwater contamination if oils and other contaminants are accidentally discharged. This risk will be minimized by contractor training and supervision. Oil containment and cleaning equipment will be available on site, as will be trained specialists.

Impact on Air Quality

There will be increased vehicle emissions and emissions from stationary construction equipment. All equipment and cars and lorries will meet current Egyptian requirements. Impacts on air quality also include dust from construction works. Where possible this will be reduced (damping down with water; barriers etc.). Contractors will be instructed and supervised.

Noise Impact

The power station is surrounded by residential buildings, most of which were built after construction of the power plant. These housing areas are exposed to noise emissions from the current power station operation and will be receptors for any new noise emissions during construction works. Increased noise emissions are possible from vehicles and stationary equipment (machinery). All equipment and cars and lorries will be required meet current Egyptian legal limits. As a mitigation measure equipment will be required to limit noise to no more than 85-dB equivalent noise level at one-meter distance. In addition, contractors will be required to reduce the noise so that at the boundaries levels are kept at less than 65 dB (day-time) and 55 dB (night-time). Noisy activities will be restricted to daytime. Noise barriers will be provided where necessary and possible.

Traffic Impact

Demolition and building works will cause some temporary increase in traffic. This includes heavy lorries and transport of additional staff. Drivers will be required to use the most suitable access roads as identified in the traffic study. Drivers will be instructed in safe driving and controlled, to minimize any nuisance and dangers to residents.

Solid and Hazardous Waste

Safe disposal of demolition waste and excavated soil is a key issue. All wastes will be disposed off via licensed contractors and in compliance with legal requirements. This will be controlled by WDEPC.

Socio- Economic Impact

Project construction will add temporary job opportunities for technical and non-technical workers. West WDEPC states as a condition with the contractor that 90% of the labour must be of the Egyptian nationality. Project construction provides about 1500-2000 temporary job vacancies along the construction period. Total estimated direct job opportunities amount to 350 jobs. As most of the surrounding area residents are of semi-skilled labourers and low skilled ones, they will have the first priority to be employed. With regard to high skilled and engineers, they will not be recruited from the project surrounding areas.

As the contractors provide workers with shelter in the area and give them a kind of allowance for food and water, it is anticipated that income of the areas adjacent to the project will be slightly increased through purchasing food products and water. Most of contractors prefer to purchase construction materials from the project area in order to reduce transportation cost. The supplies might be provided by the local companies in the proximity areas or from El Beheira

Governorate. The construction phase will increase the demand on different consumables such as food and drinks by the workers. This is expected to increase business demand on different service providers, especially food sellers.

Potentially negative impacts: The project will not result in any land acquisition as it will be implemented inside the current power station. However, associated projects (two overhead transmission lines and the gas supply pipeline) might potentially require some permanent land acquisition. A resettlement action plan/livelihood restoration plan will be prepared. Similarly, some residents may have concerns about living under high-voltage transmission lines, which could lead to increased stress levels and subsequent health effects.

Impact Summary

The following matrix (Figure 1-23) provides a rating of these mentioned impacts.

| Component | Issue | Importance/ Extent (On-site/ Local/ Regional) | Permanence (Temporary/ Permanent) | Overall Significance (Major/ Neutral), Minor/ (Negative/ Positive) |
|-------------------------------|--|---|---|---|
| Air Quality | Particulates (dust) and gaseous emissions (impact on local population) | Local | Temporary | Minor, Negative |
| Water Quality | Discharges (liquids; soil) | Local | N/A | Neutral |
| Soil Quality | No impact | N/A | N/A | Neutral |
| Noise | Machinery, trucks | Local | Temporary | Minor, Negative |
| Hazardous Wastes | Demolition of fuel tanks; site clearance. | On-site and regional (waste dump) | Temporary | Neutral |
| Traffic | 5% traffic-increase. | Local, Regional | Temporary | Minor, negative |
| Flora and Fauna; Biodiversity | Destruction of habitat on site | Local | N/A | Neutral |
| Job opportunities | 1500-2000 direct jobs. | Local | Temporary | Major, positive |
| Services | Off-site services (transportation, fast food... etc.) | Local | Temporary | Minor, positive |

Figure 1-23: Impact Rating Matrix (NDPP construction)

6.2 During Power Station Operation

Visual and Landscape Impact

The Damanhour power station will remain the dominating structure in this flat landscape, largely because of the tall chimney stack (138 metres) of the existing 300 MWe unit; the stacks for the new units will not exceed 85 metres.

Impact on Soil and Groundwater

Normal operation of the NDPP will not affect soil and groundwater. The risk of accidental spillages from fuel oil will be mitigated with appropriate equipment, working practices and control of installations.

Impact on Surface Water Quality

The NDPP does not impact on the El-Mahmoudia canal because it uses air cooling compared with the direct water cooling used for the 3x65 MW units and all other units on site. This avoidance of a wet cooling system will benefit the canal because thermal discharges will be lower.

Impact on Flora, Fauna and Biodiversity

NDPP operation will have no direct negative impact on local flora and fauna. The new station will be landscaped where possible.

Impact on Air Quality

NDPP is a state-of-the-art gas fired power station which uses the least polluting fossil fuel available. It will be equipped with active control of NO_x which is the major air pollutant. Sulphur dioxide will normally (gas firing) not be emitted in any appreciable quantity but can occur if fuel oil has to be used (which is predicted not to exceed one week per year). Similarly, there will be no dust emissions because of using gas.

Likely dispersion of emissions from the power plant and resulting ambient pollution levels were modelled by the Air Pollution Laboratory of Alexandria University for typical meteorological conditions characteristic for all four seasons. The pollution load from the NDPP on the area in the vicinity of the plant is low and will not significantly add to current (low) pollution levels. The highest projected concentrations of carbon monoxide and nitrogen dioxide > 0.01 and 0.01 mg/m³ respectively for each one of the two combined cycle modules.

The two modules together would add comparatively low pollution loads to the baseline air quality; the additional load would be 0.06 - 0.6% of the Air Quality Limit (AQL) for carbon monoxide and 6.6 - 66% of the AQL for nitrogen dioxide. These predicted ranges of increase depend on meteorological conditions. Projected total annual emissions for carbon dioxide (the most important Greenhouse Gas) are, at 774 million tons, higher than these from the old plant (222 million tons for the 300 MWe unit; 114 million tons for the three 65 MWe units combined). This is because of significantly higher electricity generation and associated fuel use.

Relative emissions at 1.1 kg per kilowatt hour (kWh) are lower due to higher efficiency of the new plant when compared to the 1.4 kg/kWh for the old oil fired units. The following dispersion maps (Figures 1-24 a-d) show the modelled dispersion for NO_x under typical seasonal meteorological conditions.

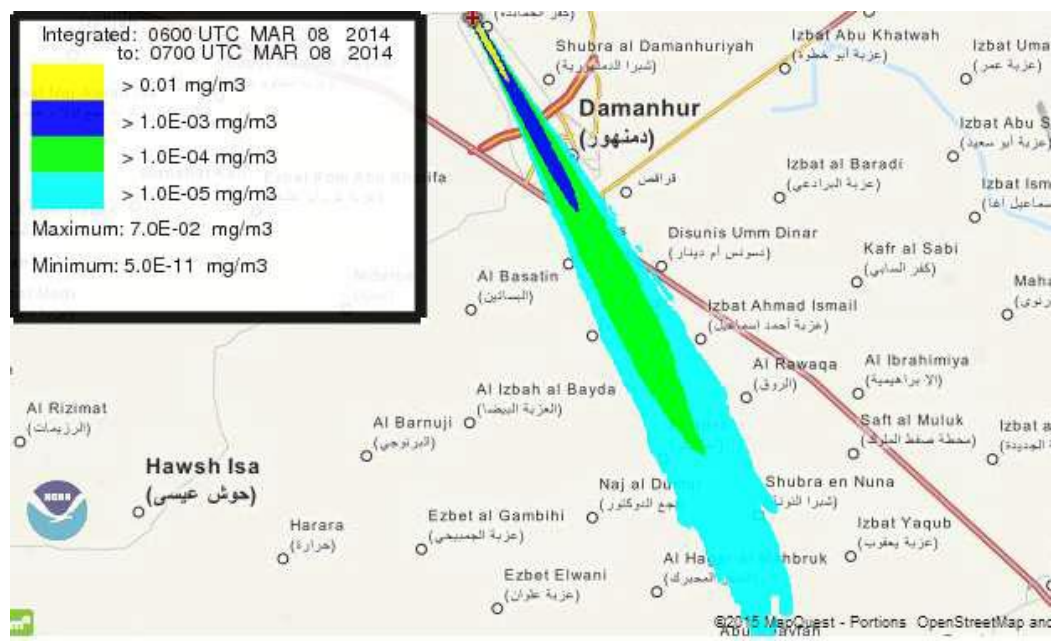


Figure 1-24a: Dispersion of Nitrogen Dioxide emission from NDPP for typical meteorological conditions in winter

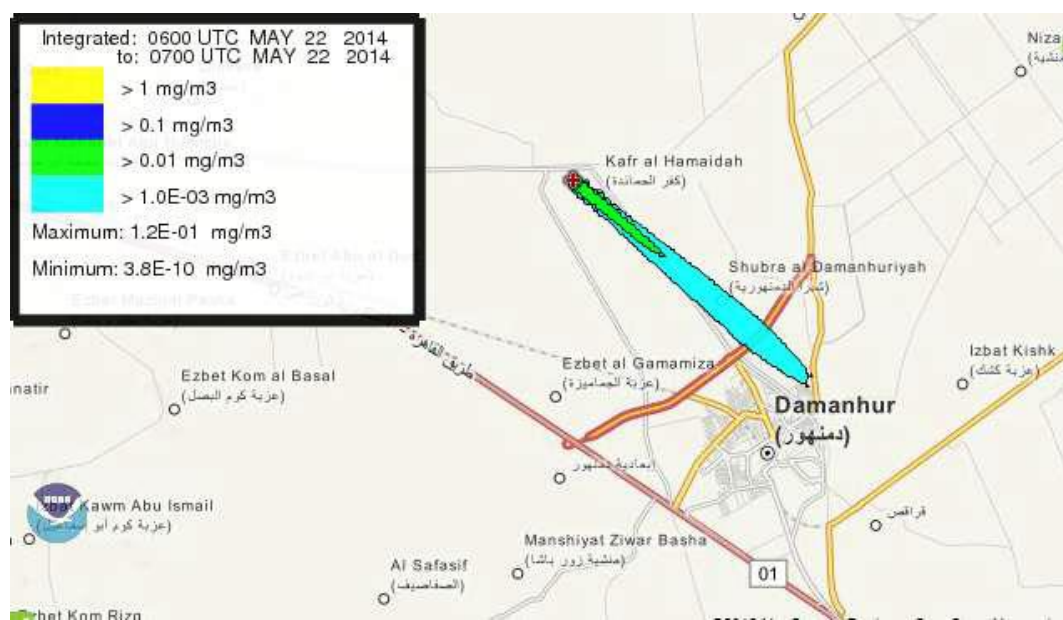


Figure 1-24b: Dispersion of Nitrogen Dioxide emission from NDPP for typical meteorological conditions in spring



Figure 1-24c: Dispersion of Nitrogen Dioxide emission from NDPP for typical meteorological conditions in summer

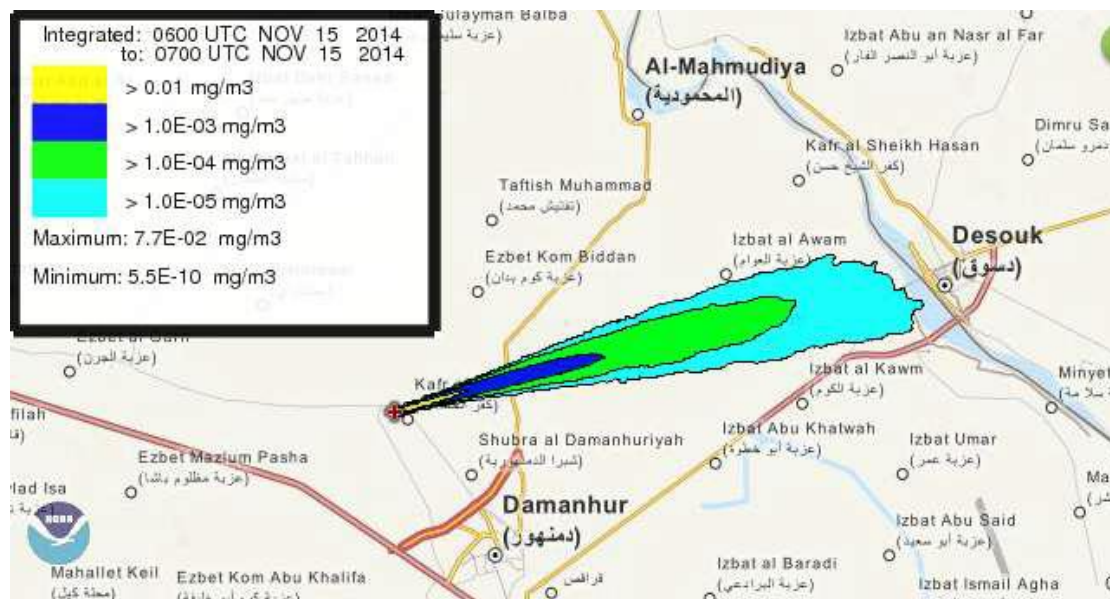


Figure 1-24d: Dispersion of Nitrogen Dioxide emission from NDPP for typical meteorological conditions in autumn

Noise Impact

Noise levels at the boundary of the power station are unlikely to exceed legal limits. All equipment will meet national noise limits and appropriate working practices will be applied. If required, noise barriers will be provided.

Traffic Impact

The traffic study carried out predicts an increase in traffic growth of approximately 5% due to transportation of staff and services. This is not considered a significant burden.

Solid and Hazardous Waste Impact

Solid and hazardous waste generation during after completion of site construction, i.e. during normal NDPP operation will be very limited. West Delta for Electricity Production Company (WDEPC) will continue to use licensed contractors for the safe disposal of hazardous waste; these contractors will be checked regularly for valid licenses. Municipal solid waste will be disposed of via the municipal waste collection services. Redundant equipment will either be recycled or disposed off, in both cases via licensed and controlled contractors.

Socio-Economic Impacts

Direct impacts would include the creation of new jobs for operation and maintenance workers and the associated income and taxes paid to the state. The precise total number of newly employed personnel is not yet known.

An indirect positive impact is the increased stability of the electricity supply which is a requirement for many commercial activities relying on the use of machinery. Based on the current situation of the electricity cut off, students struggle to study during the night time, particularly, during the final exams; educational web services come to a halt.

A more secure supply of electricity will also enhance living conditions through enabling the community people to use their appliances. The residents will benefit from appropriate lighting, ventilation, refrigerating, and use of entertainment appliances.

Impact Summary

The following matrix (Figure 1-25) provides a rating of the fore-mentioned impacts during operation of NDPP.

| Component | Issue | Importance/ Extent (On-site/ Local/ Regional) | Permanence (Temporary/ Permanent) | Overall (Major/ Neutral), Positive) | Significance Minor/ (Negative/ Positive) |
|-----------------------|---|---|---|--|---|
| Air Quality | NOx and CO2 from NDPP; older units also SO2 and particulates (dust) | Local/regional | Permanent | Major, positive (reduction in SO2 and dust) | |
| GHG Effect | Increase in overall emissions | Global | Permanent | Major, negative (Minor, positive, if related to relative emissions per kWh) | |
| Surface Water Quality | ACC reduces thermal discharges | Local | Permanent | Major, positive | |
| Soil Quality | No impact | | | Neutral | |
| Noise | Noise from NDPP | Local | Permanent | Neutral | |

| Component | Issue | Importance/ Extent (On-site/ Local/ Regional) | Permanence (Temporary/ Permanent) | Overall Significance (Major/ Neutral), Minor/ (Negative/ Positive) |
|-------------------|---|---|---|---|
| Traffic | 5% increase in traffic | Local | Permanent | Minor, negative |
| Biodiversity | Destruction of habitat on site | Local | | Neutral |
| Aquatic Ecosystem | Less thermal discharges, impact on flora and fauna | Local | Permanent | Minor, positive |
| Job opportunities | About 300-350 direct job opportunities (plus indirect jobs) | Local, regional | Permanent | Major, positive |
| Essential needs | Electricity dependent services (e.g. water supply) | Regional | Permanent | Minor, positive |
| Services | Electricity-based communal services improve | Regional | Permanent | Minor, positive |
| Public health | Reduced air emissions should result in improved public health | Local | Permanent | Minor, positive |
| Land price | Availability of a secure electricity supply increases land value | Regional | | Minor, positive |
| Community welfare | Overall community living conditions | Regional | | Minor, positive |
| Investments | Area more attractive to investors due to more reliable electricity supply | Regional | | Minor, positive |

Figure 1-25: Impact Rating Matrix (NDPP Operation)

7. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

A comprehensive Environmental and Social Management Plan (ESMP) has been developed for the Project and is part of the ESIA report. It is a commitment by the company and a condition of the financing banks which require regular reports and which will carry out performance monitoring. The plan will be subject to review by the Lenders as well as the Company's EHS staff and an appointed Owners Engineer.

The plant will be designed to comply with the requirements of national and EU legislation, which includes the parameters set out in the Annex V of the European Union Industrial Emission Directive. To monitor compliance, a continuous emission monitoring systems will be installed for NOx.

The Plan relates to both the construction and the operation phase and includes

- Implementation of formal environmental and health and safety management systems (based on international standards such as ISO 14001 and OHSAS 18001); certification within 2 years;
- A Health and Safety Officer in site during construction
- A Community Liaison Officer during construction and operation of NDPP
- Regular environmental and social performance audits
- Training and supervision of staff
- Training and supervision of all contractors during construction and operation
- An Response Team to address emergencies during construction
- Improved air emission monitoring during operation (continuous monitoring) to ensure legal compliance and to maintain low emission levels
- Better control of nuisances such as dust and noise
- Design of plant to take into account Best Available Techniques (BAT) in relation to noise and air emissions
- Control of solid and hazardous waste disposal
- Monitoring of environmental and social due diligence compliance of associated projects (transmission lines and gas supply)
- Setting up a permanent Community Advisory Panel
- Implementation of a grievance procedure

To ensure that the mitigation measures as well as the monitoring plan detailed in the ESMP are successfully implemented, the WDEPC will set up a Community Advisory Panel comprising members who represent the local community of Zawyet Ghazal. The panel will be mandated to meet on a regular basis, and will receive copies of internal and external communications relating to community issues.

8. CONCLUSIONS

The New Damanhour Power Plant will significantly help Egypt to reduce its shortage in electricity generating capacity and will also help to stabilize the current distribution system. This will be done in a state-of-the-art facility, using the cleanest fossil fuel available, with appropriate controls of emissions.

The ESIA study concluded that the project in its various stages from construction and pre-construction activities to full operation will have many positive social and economic impacts, particularly the encouragement of investments, achievement of the development plans of the country, and direct and indirect job opportunities.

Environmental impacts during construction and operation of NDPP are limited. During the construction phase minor, local nuisances such as increased traffic, noise from machinery and dust from excavation may occur. An environmental and social management and monitoring plan has been prepared to limit and control any such impact. During operation of NDPP gaseous

pollutants will be emitted, but at levels well within legal limits. Furthermore, emissions of sulphur dioxide and dust will be significantly reduced as the most polluting old oil-fired 65 MWe units will be demolished and replaced with NDPP, which has a significantly higher efficiency, uses much cleaner fuel, and is equipped with pollution control technology. Other environmental impacts such as local noise are likely to be reduced due to modern technology in compliance with national and international noise limits.

The local community has been involved in the planning and permitting process through active public consultations and will be kept informed and involved via a Community Advisory Panel.