Environmental and Social Impact Assessment of the New Damanhour Power Plant

(1800 MW)

Damanhour City, Egypt

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1 INTRODUCTION

1.1 Preamble

The West Delta Electricity Production Company (WDEPC) is proposing to construct and operate a new combined cycle power plant (CCGT) in Zawyat Ghazal, Damanhour- El Beheira Governorate. WDEPC is an Egyptian joint-stock company, part of the Egyptian Holding Company for Electricity (EHCE). It provides electricity to the Elbeihera, 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 MWe 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 the site of an existing, mainly gas fired power plant. Old and inefficient units of this power station will be demolished and are to be replaced with two state-of-the-art 900MWe gas fired electricity generating units with the highest possible efficiency and low pollutant emissions. These two units will replace three 65MWe units which have been in service for more than 40 years and are at the end of their service life.

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) in addition to the Arab Fund for Economic and Social Development. 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 requirements include compliance with European Union (EU) Directives and technical standards.

An Environmental and Social Impact Assessment (ESIA) has been prepared to meet these national and IFI requirements. 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' 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 ESIA does not include projects associated with the power station development, and necessary for the operation of the new power station. These are a 14.5 km high voltage transmission line connecting the new plant to the grid and a 4 km gas supply pipeline. 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 the new station is fully operational. These three associated projects are the responsibility of, respectively, the national gas supply company (GASCO) and the national electricity grid operator (EETC), and are subject to separate due diligence in accordance with national law and the requirements of supporting IFIs, notably the World Bank, EIB and KfW. All applicable national and international laws and policies such as the Egyptian Environmental Law and the environmental and social policies of the African Development Bank (ADB), the European Bank for Development and Reconstruction (EBRD) and the European Investment Bank (EIB) are presented in this ESIA.

1.2 The New Power Station

The New Damanhour Power Station will consist of 1800 MWe with two identical combined cycle units of 900MWe/each. 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, giving each unit a total capacity of 900MWe. It is planned that NDPP will at first operate with a single cycle of 2x600 MWe (Gas turbines only), to commence in 2018. Full operation of the then combined cycle plant of 2x900 MW 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 does not use water for condenser cooling as the existing units on site. Rather it 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.

1.3 Project 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. Figure 1a shows the location of the power station in the Nile Delta region.

Figure 11-1: location of the power station in the Nile Delta region

The following Figure shows the proximity of the power station to the City of Damanhour.

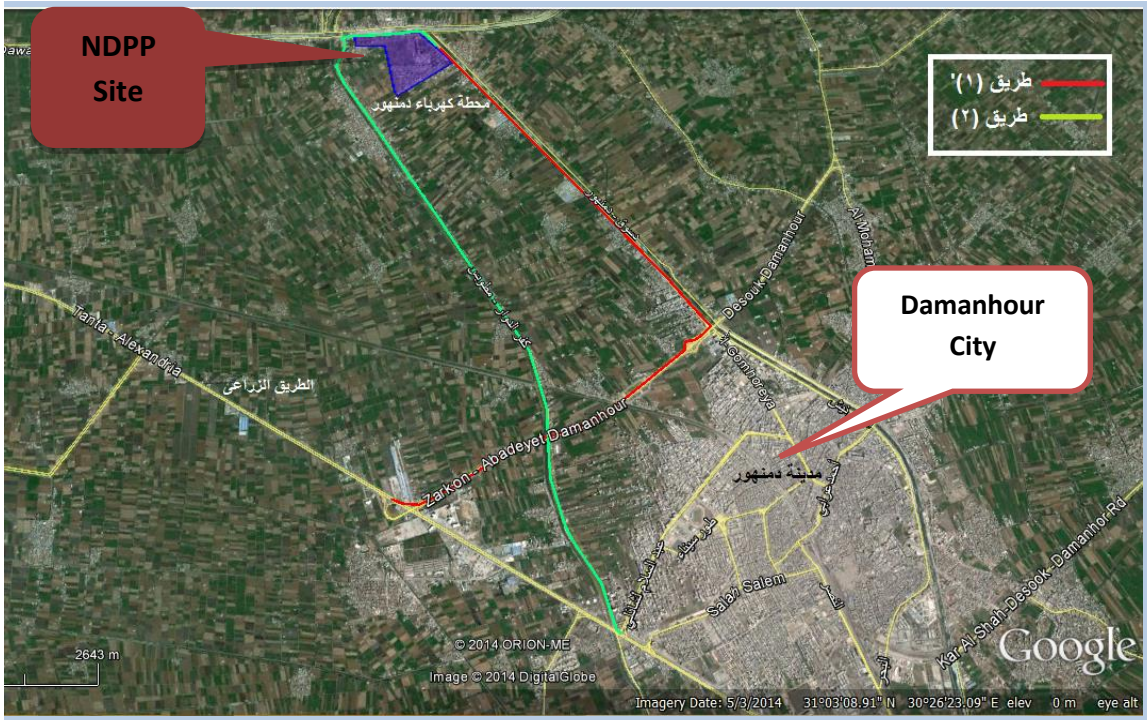


Figure 12-2: The proximity of the power station to the City of Damanhour.

The power station site is located 4.5 km to the northwest of the city of Damanhour.
The existing power station site encompasses a total area of consists of approximately 412,000 m^2. This includes 240,000 m^2 for the new Damanhour CCGT generating units inclusive of all supporting structures and administrative buildings. The existing power station consists of the following older generating units:

- 3x65 MWe heavy fuel oil fired plants;
- one 300 MWe gas fired plant;
- one 158 MW Combined Cycle Gas Turbine which consists of 4 gas turbines (25 MW each) and one steam unit (58 MW).

1.4 This Environmental and Social Impact Assessment

This Report presents the results of the Environmental and Social Impact Assessment (ESIA) of the NDPP which was carried out as legally required under Egyptian law and in compliance with the requirements of the three international banks.

The ESIA includes the following chapters:

Non-technical Executive Summary
1. Introduction
2. Legal requirements and administrative framework
3. Project description
4. Analysis of alternatives
5. Baseline environmental and social information and data
6. Environmental and social impacts of the project
7. Environmental and social management plan (ESMP)
8. Public consultation and disclosure
9. Conclusions
10. References and Contacts

2 LEGISLATIVE AND INSTITUTIONAL FRAMEWORK

A number of national and international laws and policies such as the Egyptian Environmental Law and the environmental and social policies of the African Development Bank (AfDB), European Bank for Development and Reconstruction (EBRD) and the European Investment Bank (EIB) apply to the investigated project as follows:

2.1 National framework

2.1.1 Environmental Framework

1. **The Egyptian environmental law No. 4 of year 1994** that was amended by 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.
    a. **Article 19** stipulates that an Environmental Impact Assessment should be undertaken for new establishments/projects and for expansions/renovations of existing establishments before construction. The law considers the EIA as a main condition for licensing and thus the project that does not prepare an EIA or does not abide by the EIA conditions could be subjected to its license revoke (Articles 10, 12 and 19 of the executive regulations of Law 4/1994, modified by the decree 1741/2005).
    The articles (19, 20, 21, 22, 23, 34, 70, 71, and 73) of Law no. 4 of 1994 stipulate measures and procedures related to the EIA. These are further clarified by the provisions of articles no. (10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 34, 57, 59, and 60) of the Executive Regulations (ERs) issued by the Prime Minister's Decree No. 338 of 1995, modified by decree no 1741/2005. Decisions of the ministerial committee no 18/06/0503 dated 26/6/2005 and no. 3/12/05/3 dated 5/12/2005 prohibit the establishment of industrial activities outside the ratified industrial areas/estates.
    b. **EEAA Guidelines for EIA** studies, January 2009, has classified "Power Plants" projects under Category- C Project, which requires a full EIA according to certain conditions, which have been followed in preparation of this study. These guidelines are as follows:
        - Section 6.4.2 outlines the EIA requirements of category-C projects.
        6.4.2.1 Requirements related to the Consultants
        6.4.2.2 Executive Summary

6.4.2.3 Project Description
6.4.2.4 Laws and Regulations
6.4.2.5 Baseline Description
6.4.2.6 Assessment of Impacts
6.4.2.7 Requirements for Alternatives Analysis
6.4.2.8 Requirement of Environmental Management Plan (EMP)

- Section 6.4.3 outlines the requirements of the public consultation
  6.4.3.1 Scope of Public Consultation
  6.4.3.2 Methodology of Public Consultation
  6.4.3.3 Documentation of the Consultation Results
- Section 6.4.4 outlines the requirements and scope of public disclosure.

c. **Article 29:** It is forbidden to displace hazardous substances and waste without a license from the competent administrative authority. The executive regulations of this Law shall determine the procedures and conditions for granting such a license and the authority competent to issue same.
d. **Article 30:** Management of hazardous waste shall be subject to the rules and procedures laid down in the executive regulations of this Law. The executive regulations shall designate the competent authority, which, after consulting EEAA, will issue the table of hazardous waste to which the provisions of this Law shall apply.
e. **Article 33:** Those engaged in the production or circulation of hazardous materials, either in gas, liquid or solid form, are held to take all precautions to ensure that no environmental damage shall occur.
   The owner of an establishment whose activities produce hazardous waste pursuant to the provisions of this Law shall be held to keep a register of such waste indicating the method of disposing thereof, and the agencies contracted with to receive the hazardous waste.
   The executive regulations shall determine the data to be recorded in the said register and the EEAA shall be responsible for following up the register to ensure its conformity with the facts. The owner of or the person in charge of managing an establishment from which hazardous waste is produced, shall be committed to decontaminating the establishment, the soil and the place where it was set up, in case of moving the establishment or stopping its activity. Decontamination should be done according to standards and conditions provided in the executive regulation of this law.

f. **Article 39:** All organizations and individuals shall be held, when carrying out exploration, excavation, construction or demolition works or when transporting the resultant waste or debris, to take the necessary precautions to secure the safe storage or transportation thereof to prevent loose particles from escaping into the air, in accordance with the provisions of the executive regulations.

g. **Article 40:** It is mandatory when burning any type of fuel or otherwise, whether for industrial, energy production, construction or other commercial purpose, that the harmful smoke, gases, and vapors resulting from the combustion process are within the permissible limits. Appendix no. (6): Gaseous emissions from fuel combustion sources and permissible stack heights and other specifications- permissible limits for gaseous emissions from various sources.

Table 2-1 : Maximum (permissible) limits for gaseous emissions from fuel combustion sources (energy generation) according to law 4/94

Fuel Type	**Maximum limit for emissions (mg/m^3)**			
	TSP	CO	SO_2	NOx
Natural gas	50	100	150	500
Diesel	100	250	1300	500

h. **Article 42**: All entities and individuals shall be committed, when carrying out production, service, or other activities, particularly operating machinery and equipment or using sirens and loudspeakers, to keeping the volume below the sound level permissible. Licensing authorities shall ensure that the total amount of noise produced by fixed and mobile sources in one area shall be within the permissible levels and that the establishment selects the appropriate machinery and equipment. Appendix no. (7): noise permissible limits.

Table 2-2 : Permissible limits for noise inside work places according to law 4/94

Noise level (dB)	90	95	100	105	110	115

Time of exposure (hr)	8	4	2	1	0.5	0.25

i. **Article 43:** The owner of an establishment is held to take all precautions and procedures necessary to prevent the leakage or emission of air pollutants inside the work premises except within the permissible limits as defined by the executive regulations of this Law, whether they result from the nature of the establishment activities or from malfunctioning equipment. He has to provide the necessary protective measures for workers in accordance with the conditions of occupational safety and health, including choosing the appropriate machinery, equipment, material and fuel, taking into account the period of exposure to these pollutants. He must also ensure adequate ventilation and install chimneys and other air purification devices. Appendix no. (8): Maximum (permissible) limits for air pollutants inside work places according to the type of each industry.

Table 2-3 : Maximum (permissible) limits for air pollutants inside work places according to law 4/94

Measurement Parameter (unit)	SO_2 (ppm)	H_2S (ppm)	NOx (ppm)	CO (ppm)	CO_2 (ppm)	Smoke ($\mu g/m^3$)
Max. Permissible Limit inside the working environment	2	10	3	25	5000	- *
Max. Permissible Limit in the ambient air (1 hour)	300 $\mu g/m^3$	-	300 $\mu g/m^3$	30 mg/m^3	-	150 (24-hour)

j. **Article 44:** The owner of an establishment shall take the necessary procedures to maintain temperature and humidity inside the work-place within the permissible limits. In cases where it is necessary to work beyond these limits, he shall be held to secure appropriate protective

measures for the workers, whether by providing them with special clothing or otherwise. Appendix no. (9): permissible limits for temperature and humidity.

k. **Article 45:** Closed and semi-closed public places must have adequate ventilation facilities consistent with the size of the place and its assimilative capacity as well as with the type of activity exercised therein to ensure renewal and purity of the air and maintain it at a suitable temperature. Appendix no. (8): ventilation instructions inside the work places.

2. **Law No. 48 of year 1982 on the Nile River, waterways and its executive amendment.**

   The Ministerial Decree 964 of 2015 stated the following limits for the wastewater discharge on aquatic environments:

Table 2-4 : Wastewater discharged into aquatic environments; standards and specifications

Parameter	Maximum Value
Temperature	Does not exceed 5 degrees above the dominant temperature with maximum of 38 °C.
pH	6-9
Color	Lack of coloring materials
BOD	60 mg/L
COD	100 mg/L
TSS	60 mg/L
H_2S	1 mg/L
Oil and grease	15 mg/L
Total P	2 mg/L
Total N	10 mg/L
Phenols	0.015 mg/L
Ammonia (N)	3 mg/L
V	0.002 mg/L
Se	0.001 mg/L
Hg	0.001 mg/L
Pb	0.01 mg/L
Cd	0.01 mg/L
As	0.01 mg/L
Cr	0.01 mg/L

Parameter	Maximum Value
Cu	1 mg/L
Ni	0.1 mg/L
Fe	1.5 mg/L
Mn	0.1 mg/L
Zn	1 mg/L
Ag	0.05 mg/L
Pesticides	0.2 mg/L
CN	0.01 mg/L
Coliform count (in 100 cm^3)	1000
B	0.4 mg/L

3. **Law No 63 of year 1974 for Electricity Sector institutions.**
4. **Law No. 18 of 1998 on certain provisions for the electricity distribution companies,** power plants and transmission grid, as well as amending some provisions of Law No. 12 of 1976 for establishing the Egyptian Electricity Authority.
5. **The Egyptian Labor Law no. 12 of year 2003.**
    a. 55/83 decree for safety and occupational health in the workplace; it includes tables of safety criteria due to risks.

    b. 116/91 decree – modifying the decree 35/83 organizing and formulating the occupational health and safety systems for factories including 50 workers or more, where it should include registry and statistics for accidents or discovery of occupational disease.

    c. 12/82 and 13/82 and 14/82 Decrees related to limiting age of laborers, and type of work allowed for each age range.

    d. 15/1982 decree specifying types of work where it is possible to limit rest hours.

    e. 23/1982 decree specifying possibility of gender work during nights and necessary safety and security requirements.
    f. Occupational health and safety is regulated by a number of articles as follows:
        - Article 202 discusses work injuries and defines occupational and chronic diseases.

- Article 204 regulates site requirements regarding the environment protection.
- Article 208 discusses the physical hazards; including heat stress and coolness, noise and vibrations, light intensity, harmful radiations, atmospheric pressure variations, static and dynamic electricity and explosion hazards.
- Article 209 discusses the civil hazards associated with handling of heavy equipment and instruments and with construction, digging activities, etc.
- Article 211 discusses chemical hazards and relevant precautions and requirements.
- Article 213 stipulates that ministerial decrees define the limit, precautions and requirements to avoid hazards discussed in articles (208, 209, 210, and 211).
- Article 214 discusses fire hazards and its precautions and requirements as determined by the responsible entity in the Ministry of Interior.
- Article 215 discusses the conductance of risk assessments for possible industrial and natural hazards, the preparation of a contingency plan and practical and reliable data.
- Article 216 regulates the medical checks on workers.
- Article 217 discusses training and awareness of workers.
- Article 218 obligates workers to Personal Protection Equipment (PPE).
- Article 219 discusses regular inspector surveys to find out occupational risks.
- Article 220 discusses the first aid and relevant requirements.
- Article 224 regulates an inspector team of specialists regarding the national security institutions.
- Article 225 defines the scope of work of the inspector team.
- Article 226 defines who has the right to inspect on occupational health and safety.
- Article 227 discusses that ministerial decrees define which institutions should have occupational health and safety department.
- Article 228 regulates reporting to disease and injury directorates.
- Article 229 defines the national institute of occupational safety and health as responsible for the central plans of occupational health and safety.

- Article 230 discusses the constitution of the Supreme Consultancy Council for occupational health and safety by a ministerial decree.
- Article 231 discusses the constitution of the Consultancy Committee for occupational health and at each government by a ministerial decree with the governorate as the committee chairman is the governorate.

6. **Law No. 93 of 1962 on industrial wastewater disposal** on domestic wastewater network and its implementing regulations.
7. **The Egyptian Code No. 105 of 2005 and the Ministerial Decree No. 44 of 2000** and amendments regulating the reuse of treated domestic wastewater.
8. **Law No. 102 of 1983 regarding the nature reserves**, and its complementary decrees in preservation of rare and endangered wild animals.
9. **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.
10. **The Presidential Decree with Law no. 142 of 2014** modifying some provisions of Traffic Law no. 66 of 1973.
11. **The Egyptian Environmental Affairs Agency (EEAA) Guidelines of Principles and Procedures for Environmental Impact Assessment**, 2nd edition published in January 2009. These guidelines define the EIA scoping and different procedures, requirements and tools of the EIA process and to ensure uniform application as well as emphasize the role of involved parties in the EIA process. In specific the guideline aim to:
    - Describe the objective of the EIA process and its legal requirements.
    - Identify the projects for which EIAs are required.
    - Indicate the criteria for classification and the different levels of assessment.
    - Describe the requirements for EIA of different categories.
    - Describe the requirements for public consultation.

2.1.2 Social Framework

a. The Egyptian environmental Law No. 4 of year 1994 amended with Law No. 9 of year 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.
b. Law No. 10 of 1990 on the expropriation of real estate for public interest.

c. Law 511 ISA, which was later amended by Law 252/60 and Law 13/162, establishes the provisions pertaining to the expropriation of real estate property for public benefit and improvement.
d. Law No. 27 of 1956, which stipulates the provisions for expropriation of districts for re-planning, upgrading, and improvement, and the amended and comprehensive
e. Law 117/1983 concerning the protection of monuments (not applicable).
f. Procurement Law No.89/1998
g. Law No 119 of year 2008 regarding building and housing.
h. Law No. 117of year 1983 on antiquities and cultural heritage.

All laws regulating land acquisition will not be applicable to this project scope of work. However, they will apply to the associated transmission lines project which, according to the EEAA guidelines, obligates to a full EIA study on the responsibility of the implementing company.

2.1.3 Institutional Roles and Responsibilities

Table 2-5: Roles and responsibilities of national institutions in the ESIA process

Role	Responsibility (National Institution)
Preparation of ESIA	West Delta Electricity Production Company
Preparation of ESMP	West Delta Electricity Production Company
Requests for approvals	Egyptian Electricity Holding Company
Permits	Egyptian Environmental Affairs Agency
	The Egyptian Armed Forces (Ministry of Defense)
	Ministry of Water Resources and Irrigation
	General Authority of Roads and Bridges
	Ministry of electricity coordinated with (disruptions of electricity and transport of electricity)
	Ministry of civil Aviation

2.2 International Regulations

2.2.1 African Development Bank (AfDB) Environmental and Social Policy

African Development Bank (AfDB) Environmental and Social Policy (AfDB Operational Safeguards OSs).

Table 2-6: The AfDB Operational Safeguards (OSs) and potential applicability

AfDB Operational Safeguards (OSs)	OS Triggered (Y/N)	Objective of OS
OS1. Environmental and Social Assessment	(Y)	• Mainstream environmental, climate change, and social considerations into Country Strategy Papers (CSPs) and Regional Integration Strategy Papers (RISPs); • Identify and assess the environmental and social impacts and risks— including those related to gender, climate change and vulnerability—of Bank lending and grant-financed operations in their areas of influence; • Avoid or, if avoidance is not possible minimise, mitigate and compensate for adverse impacts on the environment and on affected communities; • Provide for stakeholders' participation during the consultation process so that affected communities and stakeholders have timely access to information in suitable forms about Bank operations, and are consulted meaningfully about issues that may affect them; • Ensure the effective management of environmental and social risks in projects during and after implementation; and • Contribute to strengthening regional member country (RMC) systems for environmental

AfDB Operational Safeguards (OSs)	OS Triggered (Y/N)	Objective of OS
OS2. Involuntary resettlement land acquisition, population displacement and compensation	(Y)	This OS will not be triggered for the Power Plant project but it will be applicable for the associated projects (Gas Pipeline and OHTL) • Avoid involuntary resettlement\ where feasible, or minimize resettlement impacts where involuntary resettlement is deemed unavoidable after all alternative project designs have been explored; • Ensure that displaced people are meaningfully consulted and given opportunities to participate in the planning and implementation of resettlement programmes; • Ensure that displaced people receive significant resettlement assistance under the project, so that their standards of living, income-earning capacity, production levels and overall means of livelihood are improved beyond pre-project levels; • Provide explicit guidance to borrowers on the conditions that need to be met regarding • involuntary resettlement issues in Bank operations to mitigate the negative impacts of • displacement and resettlement, actively facilitate social development and establish a sustainable economy and society; and • Guard against poorly prepared and implemented resettlement plans by setting up a mechanism for monitoring the performance of involuntary resettlement programmes in Bank operations and remedying problems as they arise.
OS3. Biodiversity and Ecosystem Services	(N)	• Conserve biological diversity and ecosystem integrity by avoiding or, if avoidance is not possible, reducing and

AfDB Operational Safeguards (OSs)	OS Triggered (Y/N)	Objective of OS
		• Are located in any type of habitat; • Are located in areas providing ecosystem services upon which potentially affected stakeholders are dependent for survival, sustenance, livelihood or primary income, or which are used for sustaining the project; minimising potentially harmful impacts on biodiversity; • Endeavour to reinstate or restore biodiversity, including, where some impacts are unavoidable, through implementing biodiversity offsets to achieve "not net loss but net gain" of biodiversity; • Protect natural, modified, and critical habitats; and sustain the availability and productivity of priority ecosystem services to maintain benefits to the affected communities and sustain project performance. • Extract renewable natural resources as a main purpose (e.g., plantation forestry, • commercial harvesting, agriculture, livestock, fisheries and aquaculture); or • Involve the use and commercialisation of an indigenous knowledge system.
OS4. Pollution prevention and control, hazardous materials and resource efficiency	(Y)	• Manage and reduce pollutants resulting from the project— including hazardous and nonhazardous waste—so that they do not pose harmful risks to human health and the environment; and • Set a framework for efficiently using all of a project's raw materials and natural resources, especially energy and water.
OS5. Labour conditions, health and safety	(Y)	• Protect workers' rights; • Establish, maintain, and improve the employee–employer relationship; Promote

AfDB Operational Safeguards (OSs)	OS Triggered (Y/N)	Objective of OS
		compliance with national legal requirements and provide supplemental due diligence requirements where • national laws are silent or inconsistent with the OS; • Align Bank requirements with the ILO Core Labor Standards, and the UNICEF Convention on the Rights of the Child, where national laws do not provide equivalent protection; • Protect the workforce from inequality, social exclusion, child labour, and forced labour; and • Establish requirements to provide safe and healthy working conditions.

2.2.2 European Bank for Reconstruction and Development (EBRD)

European Bank for Reconstruction and Development (EBRD) Environmental and Social Policy (EBRD Performance Requirements); EBRD has adopted a set of specific Performance Requirement (PRs) covering key areas of environmental and social impacts. These reflect EBRD's commitment to promote EU environmental standards as well as the European Principles for the Environment. The PRs of relevance to the proposed project are shown below in table (2-7):

Table 2-7 : The EBRD Performance Requirements (PRs) and potential applicability

EBDR Performance Requirements (PRs)	PR Triggered (Y/N)	Objective of PR
PR1: Assessment and Management of Environmental and Social Impacts and Issues	(Y)	**The objectives of this PR are to:** • identify and evaluate environmental and social impacts and issues of the project • adopt a mitigation hierarchy[2] approach to address adverse environmental or social impacts and issues to workers, affected communities, and the environment from project activities • promote improved environmental and social performance of clients through the effective use

EBDR Performance Requirements (PRs)	PR Triggered (Y/N)	Objective of PR
		of management systems • develop an ESMS tailored to the nature of the project, for assessing and managing environmental and social issues and impacts in a manner consistent with relevant PRs.
PR2: Labour and Working Conditions	(Y)	The objectives of this PR are to: • respect and protect the fundamental principles and rights of workers promote the decent work agenda, including fair treatment, non-discrimination and equal opportunities of workers establish, maintain and improve a sound worker-management relationship promote compliance with any collective agreements to which the client is a party, national labour and employment laws protect and promote the safety and health of workers, especially by promoting safe and healthy working conditions
PR3: Resource Efficiency and Pollution Prevention and Control	(Y)	The objectives of this PR are to: • identify project-related opportunities for energy, water and resource efficiency improvements and waste minimisation • adopt the mitigation hierarchy approach to addressing adverse impacts on human health and the environment arising from the resource use and pollution released from the project • promote the reduction of project-related greenhouse gas emissions.
PR4: Health and Safety	(Y)	The objectives of this PR are to: • protect and promote the safety and health of workers by ensuring safe and healthy working

EBDR Performance Requirements (PRs)	PR Triggered (Y/N)	Objective of PR
		conditions and implementing a health and safety management system, appropriate to the relevant issues and risks associated with the project. • anticipate, assess, and prevent or minimise adverse impacts on the health and safety of project-affected communities and consumers during the project life cycle from both routine and non-routine circumstances.
PR5: Land Acquisition, Involuntary Resettlement and Economic Displacement (not triggered for this project but relevant for associated projects)	(Y)	The objectives of this PR are to: • avoid or, when unavoidable, minimise, involuntary resettlement by exploring alternative project designs • mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons' use of and access to assets and land by: (i) providing compensation for loss of assets at replacement cost; and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation and the informed participation of those affected • restore or, where possible, improve the livelihoods and standards of living of displaced personsto pre-displacement levels • improve living conditions among physically displaced persons through the provision of adequate housing, including security of tenure at resettlement sites.
PR6: Biodiversity Conservation and Sustainable Management of Living	(Y)	The objectives of this PO are to: • protect and conserve biodiversity using a precautionary approach • adopt the mitigation hierarchy approach, with

EBDR Performance Requirements (PRs)	PR Triggered (Y/N)	Objective of PR
Natural Resources		the aim of achieving no net loss of biodiversity, and where appropriate, a net gain of biodiversity • promote good international practice (GIP) in the sustainable management and use of living natural resources.
PR7: Indigenous Peoples	(N)	There are no Indigenous Peoples in the project area.
PR8: Cultural Heritage	(Y)	The objectives of this PR are to: • support the protection and conservation of cultural heritage • adopt the mitigation hierarchy approach to protecting cultural heritage from adverse impacts arising from the project • promote the equitable sharing of benefits from the use of cultural heritage in business activities • promote the awareness and appreciation of cultural heritage where possible.
PR9: Financial Intermediaries	(N)	This project does not involve Financial Intermediaries
PR10: Information Disclosure and Stakeholder Engagement	(Y)	The objectives of this PR are to: • outline a systematic approach to stakeholder engagement that will help clients build and maintain a constructive relationship with their stakeholders, in particular the directly affected communities • promote improved environmental and social performance of clients through effective engagement with the project's stakeholders • promote and provide means for adequate engagement with affected communities throughout the project cycle on issues that could potentially affect them and to ensure that meaningful environmental and social information

EBDR Performance Requirements (PRs)	PR Triggered (Y/N)	Objective of PR
		is disclosed to the project's stakeholders • ensure that grievances from affected communities and other stakeholders are responded to and managed appropriately.

2.2.3 The European Investment Bank (EIB)

The European Investment Bank (EIB) environmental and social safeguards which are based on the European Principles for the Environment (EPE) developed in version 9.0 of 02/12/2013:

Table 2-8: EIB Environmental and Social Standards

EIB Environmental and Social Standards	Triggered (Y/N)	Objective of the standard
1. Assessment and Management of Environmental and Social Impacts and Risks	(Y)	The overall objective of this Standard is to outline the promoter's responsibilities in the process of assessing, managing and monitoring environmental and social impacts and risks associated with the operations.
2. Pollution Prevention And Abatement	(Y)	The objectives of this Standard are: • avoidance of any deterioration in the quality of human health or the environment, and any loss of biodiversity, by avoiding, reducing and, if possible, compensating/remedying significant adverse effects of projects supported by the EIB; • support to the EU aims of reducing greenhouse gas emissions and enhancing resource efficiency, that will ease pressures on the environment and bring increased competitiveness through cost savings from improved efficiency, commercialisation of innovations and better management of resources over their whole life cycle; and, • promotion of an integrated approach to prevention and control of emissions into air, water and soil, to waste management, to energy efficiency and to accident prevention for the protection of the environment as a whole and therefore, avoiding the shift of pollution from one environmental medium to another.
3. EIB Standards on Biodiversity And Ecosystems	(Y)	• The maintenance of the integrity of areas of important biodiversity as well as the natural functions and processes of ecosystems and their resilience. • Where feasible, internalization of biodiversity and ecosystems values into the cost benefit

EIB Environmental and Social Standards	Triggered (Y/N)	Objective of the standard
		analysis and design of the project; • Consistency with EU environmental law; • Respect of international conventions and consistency with relevant provisions and standards contained in the international agreements and conventions • Ecosystems and land/seascape approach; • Ensuring the appropriate participation of local communities and Indigenous communities in the decision-making process, especially where impacts on ecosystems services adversely impact the livelihood of indigenous communities. • Implement adaptive management measures so as to efficiently protect biodiversity and ecosystems; and, • Efficient monitoring and reporting to track the promoter's overall impact and the achievement of the biodiversity actions and targets under the management plan.
4. EIB Climate-Related Standards	(Y)	The EIB Climate Standards, related to the value added by the EIB, require that its financing as a whole is aligned with EU climate policy.
5. Cultural Heritage	(Y)	The objective of this Standard is to outline the promoter's responsibilities in terms of cultural heritage management, involving the actions taken to identify, assess, decide and enact decisions regarding the impact on cultural heritage associated with operations supported by the EIB.
6. Involuntary Resettlement	(Y)	• Avoid or, at least minimise, project-induced resettlement whenever feasible by exploring alternative project designs; • Avoid and/or prevent forced evictions and provide effective remedy to minimise their negative impacts should prevention fail;

EIB Environmental and Social Standards	Triggered (Y/N)	Objective of the standard
		• Ensure that any eviction which may be exceptionally required is carried out lawfully, respects the rights to life, dignity, liberty and security of those affected who must have access to an effective remedy against arbitrary evictions; • Respect individuals', groups' and communities' right to adequate housing and to an adequate standard of living, as well as other rights that may be impacted by resettlement; • Respect right to property of all affected people and communities and mitigate any adverse impacts arising from their loss of assets, or access to assets and/or restrictions of land use, whether temporary or permanent, direct or indirect, partial or in their totality. Assist all displaced persons to improve, or at least restore, their former livelihoods and living standards and adequately compensate for incurred losses, regardless of the character of existing land tenure arrangements (including title holders and those without the title) or income-earning and subsistence strategies; • Uphold the right to adequate housing, promoting security of tenure at resettlement sites; • Ensure that resettlement measures are designed and implemented through the informed and meaningful consultation and participation of the project-affected people throughout the resettlement process; and • Give particular attention to vulnerable groups, including women and minorities, who may require special assistance and whose participation should be vigilantly promoted.

EIB Environmental and Social Standards	Triggered (Y/N)	Objective of the standard
7. Rights and Interests of Vulnerable Groups	(Y)	Standard 7 sets out to avoid or minimise, or otherwise mitigate and remedy potential harmful effects of EIB operations to vulnerable individuals and groups whilst seeking that these populations duly benefit from such operations. As a means to foster those project outcomes, Standard 7 proposes a framework and tools to address inequalities and other factors contributing to vulnerability, and, as appropriate, to allow for equal access to and enjoyment of project benefits for those individuals and groups.
8. Labour Standards	(Y)	With the present standards, the responsibilities of the promoter are defined to ensure that the project embraces the principles of International Labour Standards.
9. Occupational And Public Health, Safety And Security	(Y)	With the present standards, and in compliance with ILO's Guidelines on occupational safety and health management systems the EU's decent work agenda the OSH Framework Directive as well as the UN Guidelines on Business and Human Rights, the EIB stresses the employers' duty of care towards project workers and society, in safeguarding occupational and public health, safety and wellbeing within the area of influence of their operations and at associated facilities.
10. Stakeholder Engagement	(Y)	As a public institution, the EIB actively promotes the right to access to information, as well as public consultation and participation; the right to access to remedy, including through grievance resolution, is equally acknowledged and actively promoted by the EIB. Standard 10 affirms the EIB's expectation that promoters uphold an open, transparent and accountable dialogue with all relevant stakeholders at the local level targeted by its EIB operations. This Standard stresses the value of public participation in the decision-

EIB Environmental and Social Standards	Triggered (Y/N)	Objective of the standard
		making process throughout the preparation, implementation and monitoring phases of a project.

2.2.4 Relevant EU Regulations

The following is a listing of key European Union (UN) Commission Directives which apply because they are requirements of both EBRD and EIB:

Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011on the assessment of the effects of certain public and private projects on the environment applies to the assessment of the environmental effects of those projects which are likely to have significant effects on the environment.

Directive 2014/52/EU amends the above directive in Article 3, requiring the EIA to "identify, describe and assess in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of a project on the following factors:

a) Population and human health

b) Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC

c) Land, soil, water, air and climate

d) Material assets, cultural heritage and the landscape

e) The interaction between the factors referred to in points a) to d).

Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control brings together Directive 2008/1/EC (the 'IPPC Directive') and six other directives in a single directive on industrial emissions. This includes Directive 2001/80/EC on the limitation of emissions of certain pollutants from large combustion plants, which will be repealed with effect from 1 January 2016.

Directive 2008/50/EC on ambient air quality and cleaner air for Europe which, inter alia, defines and establishes objectives for ambient air quality designed to avoid, prevent or reduce harmful effects on human health and the environment as a whole.

Directive 2009/31/EC on geological storage of carbon dioxide (amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006) establishes a legal framework for the environmentally safe geological storage of carbon dioxide (CO2) to contribute to the fight against climate change.

Directive 2012/18/EU on the control of major-accident hazards involving dangerous substances (amending and subsequently repealing Council Directive 96/82/EC), obliges Member States to ensure that operators have a policy in place to prevent major accidents.

Directive 2002/49/EC defines a common approach intended to avoid, prevent or reduce on a prioritized basis the harmful effects, including annoyance, due to exposure to environmental noise, including, among other, assessment methods for the noise indicators.

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.

2.2.5 International Standards

Table 2-9: International standards for air quality limits (AQL) and noise levels

Stack emissions					
	SO_2	NO_x	CO	TSP	
Limit	N/A	25	-	N/A	
Measurement Unit	-	ppm	-	-	
Standard/ Guideline	IFC emission guidelines for combustion turbines (natural gas)	IFC emission guidelines for combustion turbines (natural gas)	-	IFC emission guidelines for combustion turbines (natural gas)	
Workplace air quality					
	SO_2	NO_x	CO	PM_{10}	
Limit (WHO guideline)	-	-	-	-	
Measurement Unit	-	-	-	-	
Standard/ Guideline	-	-	-	-	
Ambient air quality					
	SO_2	NO_x	CO	PM_{10}	
Limit	350 125	200	10	50	
Measurement Unit	µg/m^3-1hr µg/m^3-24hr	µg/m^3-1hr	mg/m^3 maximum daily 8-hr mean	µg/m^3-24hr	
Standard/ Guideline	European Commission(EC) Air Quality Standards	European Commission(EC) Air Quality Sta and WHO guideline	European Commission(EC) Air Quality Standards	European Commission(EC) Air Quality Standards and WHO guideline	
Noise Levels					
	Workplace		Outdoor*		
Limit	90			Daytime	Nighttime
			Residential, institutional	55	45

		and educational.		
		Industrial and commercial.	70	70
Measurement Unit	dB	dB		
Standard/ Guideline	Occupational Safety and Health Administration (OSHA)	IFC Environmental, Health, and Safety (EHS) Guidelines, General EHS Guidelines: Environmental Noise Management		
* Noise impacts should not exceed the levels presented, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.				

2.2.6 International Conventions

1. Aarhus Convention on environmental information. (Egypt did not sign this convention).
2. Stockholm Convention on Persistent Organic Pollutants, adopted by the Conference of Plenipotentiaries on 22 May 2001 in Stockholm, Sweden. The Convention entered into force on 17 May 2004.
3. 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).

3 PROJECT DESCRIPTION

3.1 PROJECT OWNER

The West Delta Electricity Production Company (WDEPC) is an Egyptian joint-stock company, part of the Egyptian Electricity Holding Company (EEHC). The company (WDEPC) supplies electricity to a geographical area covering the Elbehera, Alexandria and Matrouh Governorates.

3.2 SCOPE AND LOCATION OF THE PROJECT

The scope of work for the project includes the following:

- Clearance of existing tanks and other structures on the proposed project area.
- Construction of a new 2x900 MWe Combined Cycle Gas turbine power plant.

The project as such does not include the new gas supply pipeline nor the transmission lines connecting the new CCGT to the grid. These are separate projects with separate environmental and social impact assessments.

The new project is to be located on vacant land attached to an existing power generation plant in the Zaweyat Ghazal suburb of Damanhour town. This site is 4.5 km to the northwest of the city of Damanhour. The El-Mahmoudia canal and the Elbahr road lie to the north of the site, and to the south lies the company employees' housing complex. The Elkhandak canal lies to the east of the project site and agricultural land lies to the west of the site, together with Garboua' village.

The following Figures 3-1 and 3-2 show the project site and its surrounding area.

Figure 3-1 : Project site of Damanhour Power Plant and its surrounding area

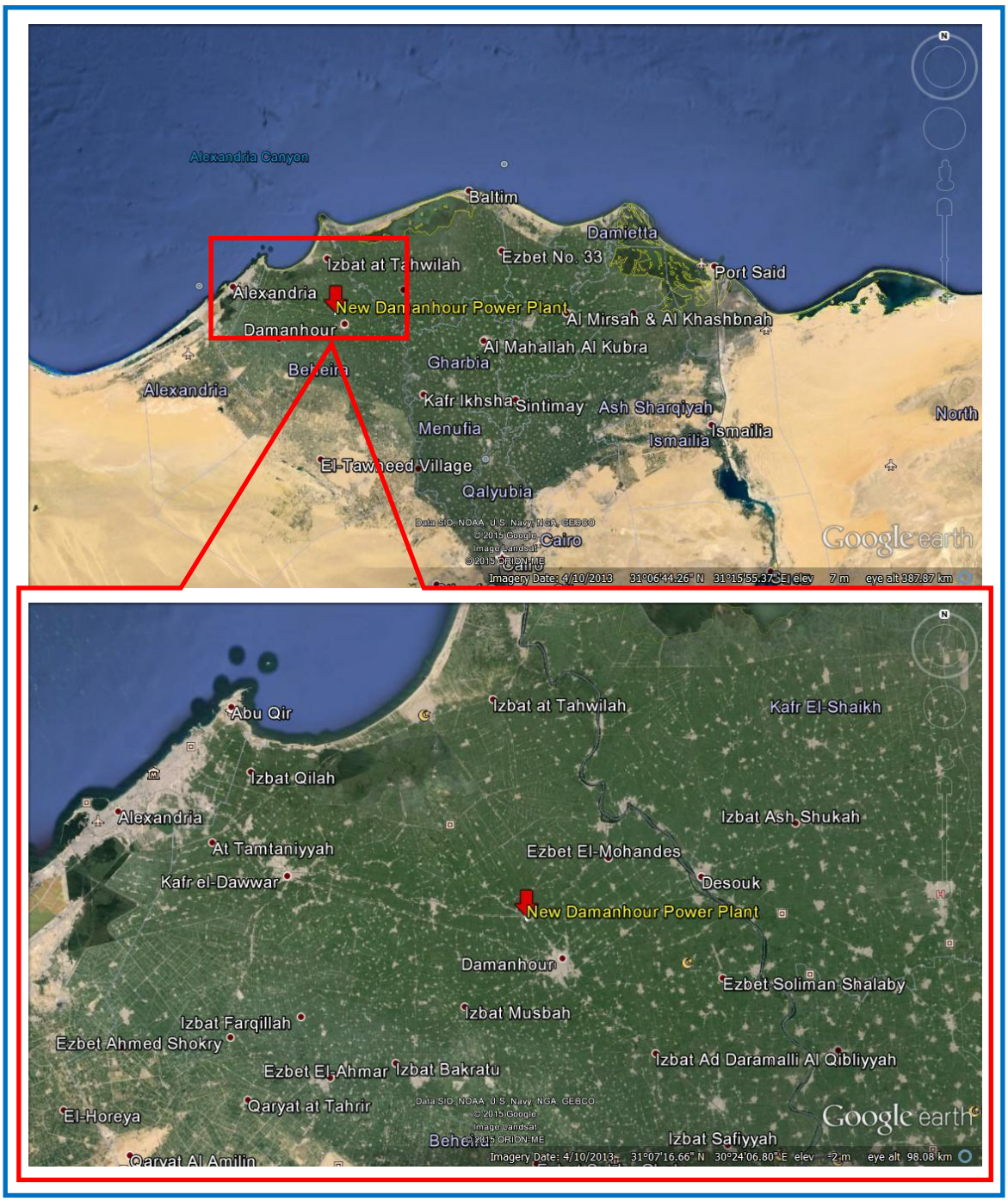


Figure 3-2 : Project site of Damanhour Power Plant and its wider surroundings

Damanhour power plant is next to the intersection of the El Mahmoudia Canal and the eastern ditch of the El-Khandak Canal. The distance between the station and any of the two canals is about 10 meters.

The site can be accessed via the Alexandria agricultural Road in two different ways:

- Via the International Bridge; this is about 8 km from Alexandria agricultural Road.
- Directly from the center of Damanhour City, at a distance of approximately 8.5 km.

The total area of the existing Damanhour Power plant, inclusive of the site for the new CCGT, extends to 412,000 m^2 with sufficient space for the new units inclusive of administrative buildings.

3.3 DESCRIPTION OF CURRENT OPERATIONS

Damanhour Power Plant was constructed in the 1960s. It started its commercial operations between 1968 and 1969 with three steam turbines. Each has an installed capacity of 65 MW giving it a total of 195 MW installed capacity. The three steam turbines are dual firing units using both natural gas and heavy fuel oil. These three turbines are still in operation and provide at present 105 MWe generating capacity.

Another steam unit was installed in 1991 (Damanhour EXT or Damanhour extension). It has 300 MWe installed capacity. It is similar to the three old turbines, dual firing turbine using natural gas and heavy fuel oil. Four gas turbines were added to the plant from in the period from 1985 to 1995. Each of these turbines has 25 MWe installed capacity. A combined cycle unit was also installed in the plant, which has 58 MW installed capacity. These five turbines are called Damanhour CC and have, together, a generating capacity of 158 MWh. The following map (Figure 3-3) shows the main components of the existing power station and the site for the new CCGT, plus surrounding residential and agricultural areas. The existing residential colony includes sporting courts, shops, a mosque, recreation areas, and agricultural areas, plus parking facilities.

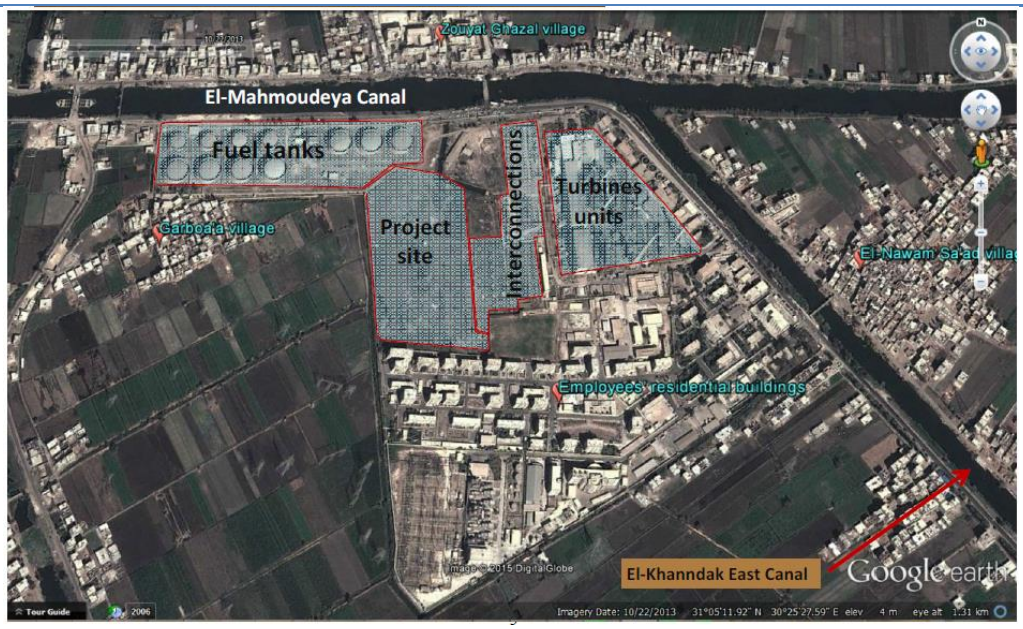


Figure 3-3 : Damanhour Power Plant and its main components

3.4 Description of the Project

3.4.1. Project overview

Key features of the proposed CCGT project are:

- Cycle Gas Combustion System
- Combined Air Cooling System
- 2x900 MW (nominal) net power generating capacity

The proposed power plant is a 1,800 MWe Combined Cycle Gas Turbines (CCGT) comprising two 900 MWe modules. Each module will include two gas turbines, each with a nominal electricity generating capacity of 300 megawatts (MWe) and two heat recovery steam generators (HRSG) feeding one steam generator with a nominal electricity generating capacity of 300MWe. The overall generating capacity of the power plant will be 1800MWe. The power plant is scheduled to become operational in its first phase in April 2018 (gas turbines only; 600 MWe generating capacity per module). The full combined cycle operation is scheduled for commissioning in 2019. The power output from the proposed plant will be fed into the Egyptian Electricity Transmission Company (EETC) grid.

By combining both gas and steam cycles, high input temperatures and low output temperatures can be achieved. A combined cycle plant has a thermodynamic cycle that operates between the gas-turbine's high firing temperature and the waste heat temperature from the condensers of the steam cycle. This large range means that the Carnot efficiency is high. The actual efficiency, while lower than this, is still higher than that of either plant on its own. If the plant produces only electricity, efficiencies of up to 59% can be achieved, depending on the condenser cooling system.

The power plant will utilize natural gas as its primary fuel, and also have the capability to operate using sollar (light fuel oil). The ability to "dual fuel" the power plant will provide security of electricity supply in the event that sufficient gas supplies are unavailable. In addition, a small oil fuelled emergency generator, installed for safe shut down of the plant, will also be provided on-site to supply electricity to the power plant.

The power plant will be cooled by an Air Cooling Condensate (ACC) system. An Air Cooled Condenser (ACC) is a direct dry cooling system where the steam is condensed inside air-cooled finned tubes. An Air Cooled Condenser (ACC) is made of modules arranged in parallel rows. Each module contains a number of fin tube bundles. An axial flow, forced-draft fan located in each module forces the cooling air across the heat exchange area of the fin tubes, instead of using water. Since there is no intermediate surface condenser like Indirect Dry Cooling, the overall performance is better. Additionally, an Air Cooled Condenser has long-term mechanical and thermal integrity, excellent corrosion and freeze resistance, low fan power consumption, reliable operation and low maintenance.

By using ACC the use of the Nile water for cooling purposes is avoided and water abstraction is limited to the amount of water needed to provide process water make-up in the boiler system and very small amounts for the hydrogen generation system. Potable water supplies will be drawn from the municipal water network supplying villages around the power plant site.

A wastewater treatment facility on the site will treat liquid wastes and produce an effluent suitable for the irrigation of non-edible plants, while the remaining amount is discharged onto the municipal network according the relative legislation. All oil waste effluents will be collected into a separate network and sent to an oil separator, then collected by a petroleum company for safe disposal.

The two indoor combustion turbine generator (CTG) units each CTG consists of six main parts, which are inlet, compressor, combustor, turbine, exhaust and rotor in addition to essential casing parts (Figure 3-4).

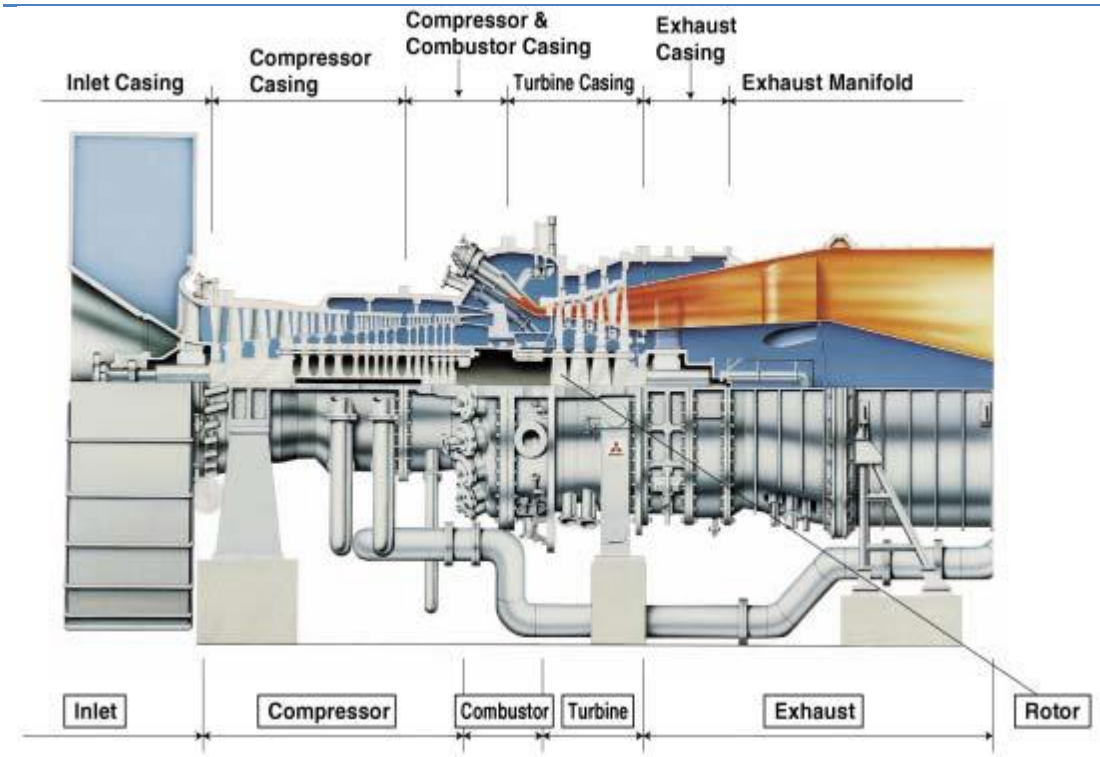


Figure 3-4 : Combustion Gas Turbine (CTG) main components

The auxiliary equipment provided to support each gas turbine (GT) operation consists of; an intake air system, exhaust system, lubricating oil system, control oil system, generator cooling system, fire protection system, fuel gas control system, fuel oil control system and gas turbine control system.

Each gas turbine (GT) drives a 50-Hz electric generator. The Generators coupled to each gas turbine is hydrogen (H_2) cooled and therefore storage cylinders for both Hydrogen and Carbon dioxide are provided. Carbon dioxide is used as the purge gas when filling or emptying the generator with Hydrogen. The H_2 and CO_2 cylinders are stored at a central location and piped to each of the generators.

The gas turbine is equipped with a dry low-NOx burner (combustor) which lowers NOx emissions. The key to this is to decrease flame temperature. This is achieved by Dry Pre-

Mix Combustion where gas and air are premixed resulting in a uniform flame temperature. This technique is proven to be efficient in NOx exhaust reduction but it has limited flame stabilization and a possibility of flash back.

Each gas turbine is housed in an enclosure and is provided with its own Carbon Dioxide (CO_2) fire protection system. Heat detectors are strategically arranged within the package enclosures to detect a fire.

There are two outdoor heat recovery steam generators (HRSGs) without supplementary firing. Each HRSG operates independently with its own gas turbine and produces steam to drive the common steam turbine. The HRSG operates with natural circulation at three pressure levels and includes a re-heater. Each HRSG produces steam at three different pressure levels; HP, IP and LP. Each of these levels includes economizer(s), evaporator(s) and superheater(s).

There is one indoor condensing steam turbine generator (STG) per unit. The steam turbine (ST) drives a 50-Hz electric generator. A horizontal air cooling condenser is used. Figure 3-5 shows the proposed layout of the new power plant.

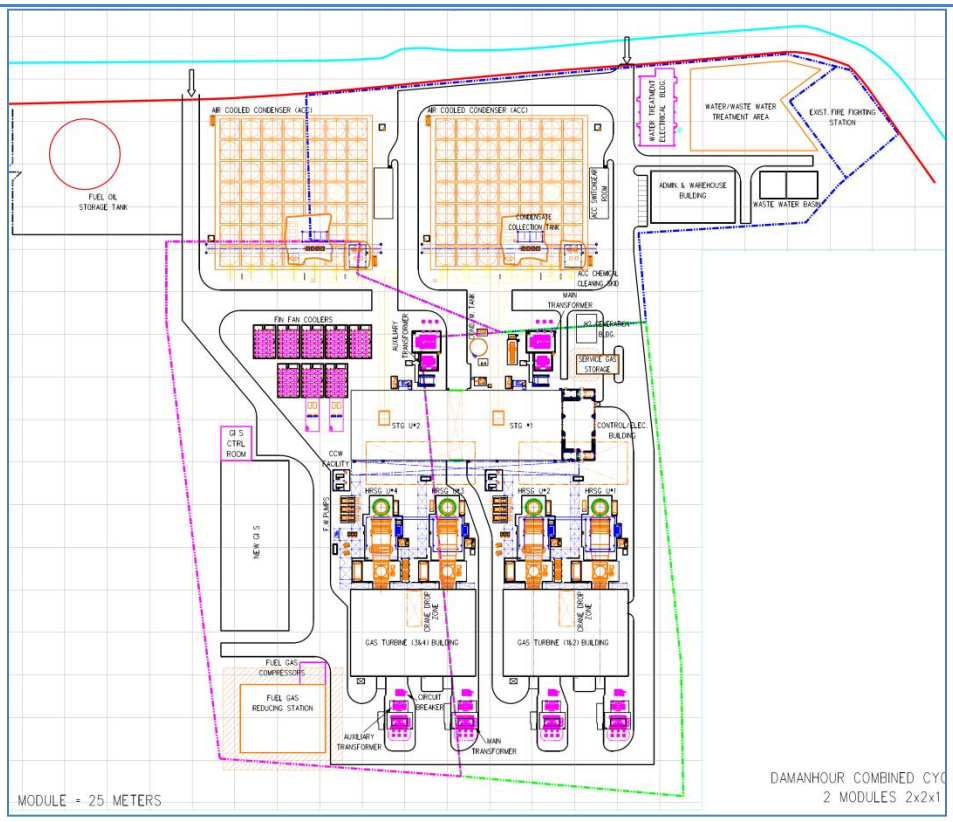


Figure 3-5: Proposed Project Layout

(**Note: This layout is subject to some changes according to the final design).**

3.4.2. The generating process

The key steps of the generating process of the proposed combined cycle power plant are as follows:

- The main inputs to the generating process consist of natural gas or solar oil (light fuel oil), which will be transported to the station via pipeline (gas) or by trucks (sollar oil).
- Natural gas (or sollar oil as a backup) will be mixed with air at the gas turbine unit compressor outlet and combusted to produce hot high pressure flue gas, which drives the gas turbine electrical generator. Gas turbine exhaust will be used to generate steam from demineralized water to drive one steam turbine generator.

- The steam is fed from the Heat Recovery Steam Generators through the turbine to a condenser. A direct, once-through air cooling system, cools the condenser. The condensate is then returned for re-circulation within the Heat Recovery Steam Generators.
- The final exhaust gases will be discharged to the atmosphere in accordance with emission standards set by the EEAA. The main byproducts from combustion of natural gas are carbon dioxide (CO_2), water vapour (H_2O), carbon monoxide (CO) and nitrogen oxides (NO_x). Sulfur dioxide (SO_2) and particulates, which are typically associated with coal and oil combustion, will not be produced other than in trace quantities during natural gas firing. When sollar oil (light fuel oil) is used instead of natural gas, SO_2 and particulates will also be key emissions from the power plant.

Projected emissions values compared to their relevant AQLs in the Egyptian Environmental Law are presented below.

Table 3-1: Projected air emissions

(Placeholder2)	Predicted Value *(Natural Gas Fuel)*	AQL	Predicted Value *(Light Fuel Oil)*	AQL
CO (mg/m^3)	20	100	20	250
NOx (mg/m^3)	40	500	70	500
SO_2 (mg/m^3)	0.5	150	650	1300
PM (mg/m^3)	3	50	5	100

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 will be used in irrigation of non-edible plants and the remaining portion will be discharged onto the municipal network. Any oil and residual solids will be removed before discharge and the pH of discharged water maintained at between 6 and 9. Waste water sources and discharge routes are summarized below in Table 3-2, with waste water parameters presented below (Tables 3-3 and 3-4).

Table 3-2: Wastewater sources and discharge routes

Release	Source	Discharge Route

Release	Source	Discharge Route
Heat Recovery Steam Generators blowdown	Heat Recovery Steam Generators System	To CWDS (waste water basin)
Backwash from HRSGs water filtration	2nd stage filtration system for HRSGs feed	To wastewater basin
Oil/water interceptor effluent	Oil/water interceptor system	To wastewater basin
Domestic sewage	Domestic system associated with offices, canteen, washrooms, colony etc.	To sewage treatment plant
Wastewater neutralization Effluent	Wastewater neutralization basin of demineralization system	Wastewater basin and CWDS. Also reused for plant irrigation
Operational site drainage	Head standing areas of operational plant, bunded areas	Irrigation of non-edible plants and the municipal network.
Rainwater run-off	All other areas, via storm sewer and storm water balancing pond	Irrigation of non-edible plants and the municipal network.

Table 3-3: Specifications of treated waste water

Parameter	projected value	Max. limits*
pH	6-9	**6-9**
T.D.S mg/l	<1000	**2000**
T.S.S mg/l	<10	**60**
Oil and grease Content mg/l	<7	**10**

Table 3-4: Specifications of treated sewage

Parameter	Projected value	Max. limits*
pH	6-9	**6-10**
BOD mg/l	60	**<100**

T.S.S mg/l	50	**<500**
TEMP. C	35	**40**
T.D.S mg/l	2000	**----**
Dissolved O_2 mg/l	2	**<350**
Oil Content mg/l	10	**<100**
Residual CL_2 mg/l	<0.5	**<10**

Chlorine will be added to the water used for industrial purposes to control bacterial and algal growth on various surfaces. The water discharge will contain residual quantities of chlorine at concentrations below the World Bank standard for free chlorine of 0.2mg/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_x combustors in the gas turbines, 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 meet international standards of performance as required by the International funding Institutions involved in financing the project.

3.5 BAT ASSESSMENT

A Best Available Techniques (BAT) assessment was carried out in accordance with the European Commission Reference Document on Best Available Techniques (BAT) for Large Combustion Plants (published in July 2006; amended new draft published online in June 2013).

Through the use of state-of-the-art turbine, the new unit will attain a net efficiency of 57.7%. The new unit will emit approximately 0.35 tCO2/MWh. This is viewed as BAT compliant. In comparison, the existing units are emitting approximately 0.69 tCO2/MWh. The plant will be among the most efficient in Egypt.

Table 3-5: BAT Assessment

Best Available Techniques (BAT) for the combustion of gaseous fuels				
1. Supply and handling of gaseous fuels and additives				
Material	Environmental Effect	BAT	BAT met (Y/N)	Project Compliance
Natural Gas	Fugitive emissions	- using fuel gas leak detection systems and alarms.	(Y)	Natural gas is the primary fuel used in the project.
	Efficient use of natural resources	- using expansion turbines to recover the energy content of the pressurized fuel gases - preheating the fuel gas by using waste heat from the boiler or gas turbine	(Y)	- Leak detection systems and alarms will be used. - Air cooling condenser saves water resources. - The combined cycle system conserves wasted heat and converts it into energy.
2. Thermal efficiency of gas-fired combustion plants				
BAT			BAT met (Y/N)	Project Compliance
- Combined cycle operation and co-generation of heat and power (Electrical efficiency 54-58 %)			(Y)	Combined cycle system is applied.
- The use of an advanced computerized control system to achieve a high boiler performance with increased combustion conditions that support the reduction of emissions.			(Y)	Advanced control system will be used.
- Preheating of the natural gas, before its supply to the combustion chambers or burners.			(Y)	Preheating is applied.
3. Dust and SO_2 emissions from gas-fired combustion plants				
BAT			BAT met (Y/N)	Project Compliance

- For gas-fired combustion plants using natural gas as a fuel, emissions of dust and SO_2 are very low. The emission levels of dust by using natural gas as a fuel are normally well below 5 mg/Nm^3 and SO_2 emissions are well below 10 mg/Nm^3 (15 % O_2), without any additional technical measures being applied.			(Y)	- See table (3-1) in this chapter. - Stacks will be equipped by online continuous emission monitoring system (CEMS).
4. NO_x and CO emissions from gas-fired combustion plants				
BAT	Emission levels associated with BAT (mg/Nm^3)		BAT met (Y/N)	Project Compliance
	NO_x	CO		
- Dry low NO_X premix burners (DLN) to reduce NO_x emissions with continuous monitoring.	20 - 50	5 - 100	(Y)	- Dry low-NO_x burner is applied. - See table (3-1).
- Complete combustion with good furnace design, the use of high performance monitoring and process control techniques and maintenance of the combustion system to reduce CO emissions.			(Y)	The project will apply to these.
5. Water pollution				
Source	BAT (to reduce waste water discharge)		BAT met (Y/N)	Comments
Regeneration of demineralizers and condensate polishers	- Neutralization and sedimentation.		(Y)	See section (3.6.3) of this chapter.
Elutriation	- Neutralization.		(Y)	
Washing of boilers, gas turbines, air preheater and precipitator	- Neutralization and closed loop operation, or replacement by dry cleaning methods where technically possible.		(Y)	
Surface run-off	- Sedimentations or chemical treatment and internal re-use.		(Y)	
Small amounts of oil-contaminated water	- Oil separation wells.		(Y)	

General treatment techniques	- filtration - pH correction/neutralisation - coagulation/flocculation/precipitation - sedimentation/filtration/flotation - dissolved hydrocarbon treatment - oil-water separation systems - biological treatment.	(Y)	
6. Combustion residues			
BAT		BAT met (Y/N)	Comments
- Utilization and re-use of combustion residues and by-products instead of depositing them in landfills.		(Y) separated oils (N) other by-products	

3.6 Additional Technical Installations

Hydrogen Generation and Storage System

Each combined cycle module of the project includes three generators (total of six generators for the two modules). Cooling of the generators is achieved through a hydrogen generation unit.

Fuel Supply

Natural gas (primary fuel) will be supplied to the project site by new 24-inch diameter pipeline, to be constructed by GASCO, at a pressure about 24-27 bar.

Light fuel oil (secondary fuel) is supplied and transported via trucks.

Power Transformers and Grid Connection

The project includes the following transformers

- Three main transformers (6 as total for 2 combined cycles).
- Two auxiliary transformers (4 as total for 2 combined cycles).
- Two tie transformer for 2 combined cycles
- Two generator circuit breakers (4 as total for 2 combined cycles).

- Three isolated phase buses for connection between Generators and main transformers. (6 as total for 2 combined cycles).

The grid connections are outside of the project and are subject to independent ESIAs.

Pumps and drives

- Raw water pumps and service water pumps.
- HP, IP and LP feed water pumps and condensate water pumps.

4 PROJECT ALTERNATIVES

A study of project alternatives is essential to determine the optimum technical and economical options with maximized positive environmental and social impacts and reduced or mitigated negative impacts. The following options were analysed: No-project alternative; site alternatives; fuel alternatives; and technology alternatives.

4.1 No-Project Alternative

Currently Egypt has an installed electricity generating capacity 26,000 MW, which is approximately 8,000-10,000 MW below capacity required to ensure secure supply and to meet growing demand which is increasing by approximately 6% p.a., leading to increasing shortages and supply interruptions. 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 'no project option' would therefore not be acceptable as it would have a serious negative impact on the country's development.

Furthermore, if the project were not to go ahead, the old plant would possible be kept operational, beyond its normal technical life span, operating on heavy fuel oil (mazoot) and with water-cooling from El-Mahmoudya canal. This would perpetuate the negative impacts on local air quality due to flue gases emissions and the impacts of thermal discharges on the surface water of the El-Mahmoudya canal.

4.2 Site Alternatives

The proposed project site consists of vacant land attached to the existing power generation plant in the Zawyet Ghazal suburb near Damanhour City. The site offers a number of advantages over a new site:

1- The site is already the property of West Delta for Electricity Production Company (WDEPC). This avoids any property disputes, population resettlement or migration, or change in land use.

2- The existing site is essentially derelict industrial land with no agricultural value; it is best used for industrial or commercial purposes.

3- The infrastructure required for a power station already exists.

4- There are gas supply pipelines close by, and connection to the national electricity grid is comparatively easy as existing transmission corridors can be used, thus reducing the environmental and social impact.

5- Well-trained workers with long experience are available, particularly once the old units cease production. In the case of closure of the old units jobs will have to be created for redundant employees.

6- The location will lead to a more stable local grid supply and will reduce any loss which would occur if long distance grid connections were necessary for the supply of the Nile Delta.

The he proposed project site is therefore considered the best available location for a new generating plant.

4.3 Fuel Alternatives

The project will use natural gas as a primary fuel and light fuel oil as an emergency fuel. Natural gas is readily available, does not incur any new fuel transport network, and is the cleanest fossil fuel available, with the lowest relative emissions to air. Additionally, Egypt has large national gas reserves.

The proposed combined cycle generating system is state-of-the-art technology and (with a thermal efficiency of almost 60%) makes best use of fuel.

4.4 Technology Alternatives

The technology currently mostly used in electrical power production is the combustion of fossil fuels. Renewable energy alternatives such as solar energy, wind energy and tidal energy are options but were not chosen for this project because

- Renewable energy power plants such as wind power plants or photo-voltaic plants are best suited for open areas with low residential density. It would be difficult to find suitable locations for wind turbines and solar installations in the Nile Delta which is densely populated and has the most fertile agricultural land.

- Wind turbines and solar installations would require extensive grid connection with, potentially, loss of more agricultural land and a greater social impact on the local residents.

- Renewable energy is considered in the country‘s power development as an option, as is the use of natural gas. The objective is to have a balanced mix of a variety of technological options to ensure a stable supply. Gas is an integral part of such a mix and a gas fired station can provide baseline supply or can be started comparatively quickly to meet demand, unlike renewables which largely rely on favourable atmospheric conditions (wind; solar radiation).

- Egypt has one of the world’s largest gas reserves which provide security of supply at viable cost.

5 ENVIRONMENTAL AND SOCIAL BASELINE

Baseline studies were carried out to establish the environmental and social baseline situation at the Damanhour Power Plant. This chapter presents the data and information of this analysis. It includes climate and meteorology; air quality; noise; soil and groundwater, the aquatic environment in the adjacent canals; flora and fauna on site and in the vicinity; and traffic plus the social baseline information on the population in the area.

5.1 Climate and Meteorology

Data were available from the Damanhour climate monitoring station of the Egyptian Meteorological Authority and also from nearby monitoring stations (www.wunderground.com).

The Climate in the study area (Zawyet Ghazal, Damanhour, Elbeheria Governorate) is semi-arid. It is characterized by short winters and long summers (from May to September). Clouds show a diurnal variation during the winter. Peaks occur at the early morning due to light layers of clouds which naturally disappear with the sunrise, and in the afternoon are replaced by heavier clouds. Solar radiation peaks in June and July; whilst the months of November, December, January and February are generally more cloudy.

Monthly temperature variations are shown in Tables 5-1 and 5-2. Annual minimum temperatures occur during January and February, maximum temperatures during the period of July – August. The annuals mean temperature for 2014 was 19.4 C°.

Table 5-1: Average Minimum and Maximum Temperature (°C), Damanhour climate monitoring station

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Avg. (Max)	19.4	20.3	22.6	26.3	19.9	31.7	32.1	32	31.2	29.2	25.2	21	26.6
Avg.	7.6	7.7	7.5	12	15.4	18.6	20.3	20.6	19	16.7	13.7	9.5	14.2

(Min)													

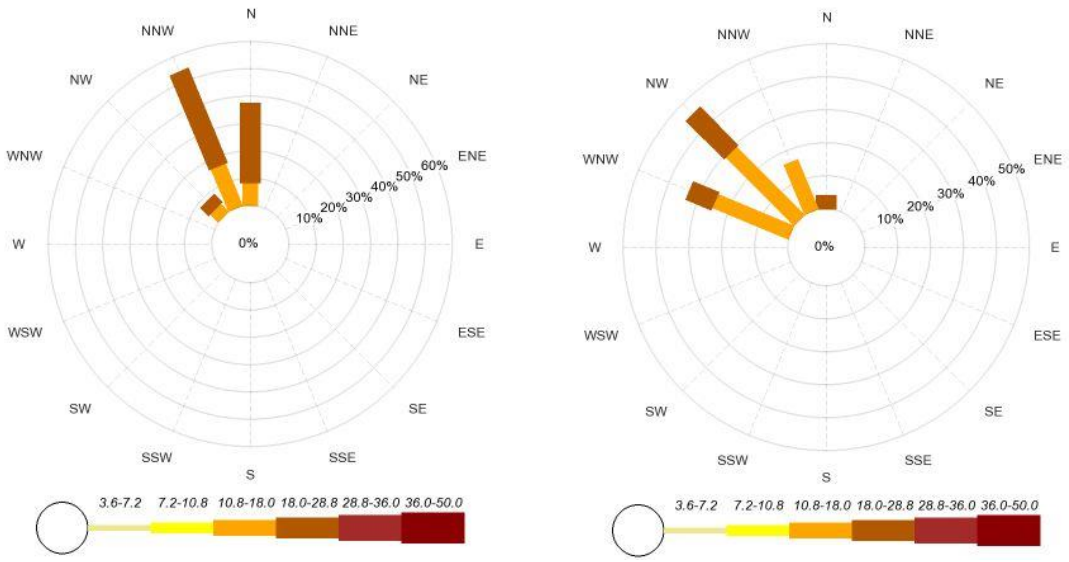
(Source: Egyptian Meteorological Authority, 2014)

Table 5-2: Monthly mean temperature values for the study area (year 2014)

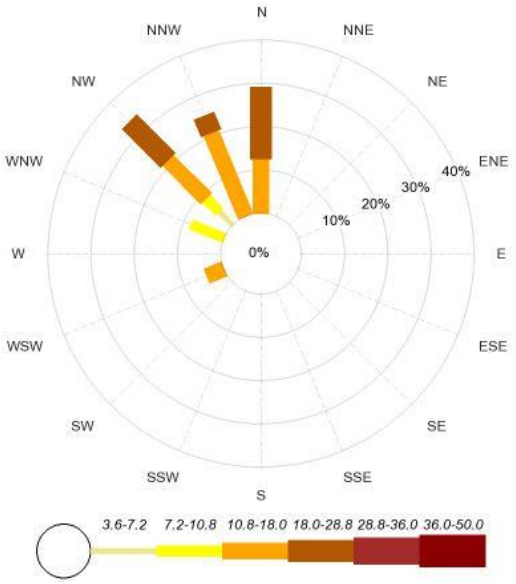
Month	Mean Temperature		
	Min.	Avg.	Max.
January	12	15	17
February	12	16	19
March	14	17	21
April	17	20	26
May	18	23	31
June	22	25	31
July	26	27	29
August	26	28	30
September	23	27	29
October	21	23	27
November	17	20	22
December	13	17	19

Relative humidity is almost stable all over the year ranging from 65-85% with an average of about 70%. Low values occur in the autumn. Precipitation is highest in December, January and February. The total annual rainfall is 99.6 mm per year.

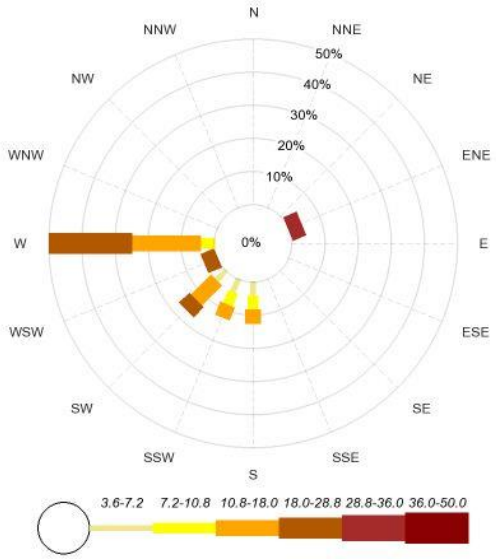
Wind in the study area is most frequently from North and North Westerly directions. Below are the wind roses illustrating the wind speed and direction at each of the four seasons of the year (Figure 5-1).



Wind rose in winter



Wind rose in spring



Wind rose in summer

Figure 5-1: Wind directions during the four seasons

5.2 Air Quality

There is a lack of historical monitoring data in the study area. The nearest monitoring station at Alexandria city (at approximately 65 km distance) ceased monitoring in 2009-2010. To fill this gap, and to obtain data relevant to the specific location of Damanhour, measurements were carried out to establish levels of air pollutants on-site and off-site the power plant.

The following table (Table 5-3) lists parameters and methodology of analysis.

Table 5-3: Methodology of air pollutant monitoring

Instrument	*Test Method*	*Reference*
Nitrogen Oxides Analyzer	*Ambient air –Determination of the mass concentration of nitrogen oxides– Chemiluminescence method*	*ISO 7996:1985*
Sulphur Dioxide Analyzer	*Ambient air –Determination of the sulfur dioxide –*	*ISO 10498:2004*

Instrument		Test Method	Reference
		Ultraviolet fluorescence Method	
CO analyzer		*Ambient air –Determination of carbon monoxide –Non – dispersive infrared spectrometry method*	*ISO 4224:2000*
Particulate Matter	***EVM-7***	*Laser Scattering and gravimetric method*	-
	Volume Samplers	*Gravimetric Method*	*ISO 12141:2002*
Hydrocarbons (Aldehydes)	***EVM-7***	*Photo-ionization Detector (PID)*	-

5.2.1 Air Quality Baseline Measurements within the project site boundaries

Measurements were undertaken on Tuesday December 23rd 2014, by the Air Pollution Lab team (Institute of Graduate Studies and Research- Alexandria University) at five locations, which represent the on-site baseline, and at the boundaries, which were assigned by WDEPC. Measurement locations are illustrated below on a site map (Figure 5-2).

Figure 5-2: Measurement Locations inside Damanhour Power Plant

The following table summarizes the measurements.

Table 5-4: Air quality measurements

Location	SO_2 (ppm)	H_2S (ppm)	NOx (ppm)	CO (ppm)	CO_2 (ppm)	Aldehydes (ppm)		TSP ($\mu g/m^3$)	Smoke ($\mu g/m^3$)
1	0.005	0.007	0.015	0.73	419	ND *		68	32
2	0.007	0.012	0.001	0.75	431	ND *		63	22
3	0.007	0.011	0.006	1.02	441	ND *		64	23
4	0.007	0.007	0.001	0.67	431	ND *		59	23
5	0.009	0.002	0.005	0.93	416	ND *		42	17
Air Quality Limits inside the working environment	**2**	**10**	**3**	**25**	**5000**	Acetaldehyde	25	**3 mg/m^3**	**- ****
						Formaldehyde	0.3		
Air Quality Limits in the ambient air (1-hour)	**300 $\mu g/m^3$**	**-**	**300 $\mu g/m^3$**	**30 mg/m^3**	**-**	**-**		**150 mg/m^3**	**150 (24-hour)**

** ND: not detected. The lower detection limit for aldehydes (LDL) is 0.01 ppm.*

*** The Egyptian Environmental Law no. 4/1994 does not set a permissible limit for smoke inside work places; however the maximum permissible limits of smoke in the ambient air are 150 $\mu g/m^3$ for 24-hour averaging time and 60 $\mu g/m^3$ for one-year averaging time.*

The air pollution measurements indicated that pollution levels are far below the permissible limits.

- **Sulphur dioxide** concentrations at the five locations ranged from 0.005 to 0.009 ppm which is well below the limit (2 ppm) and approximately represent 0.4% of the limit value.
- **Hydrogen sulphide** concentrations ranged from 0.002 to 0.012 ppm, well below the limit (10 ppm) and approximately 0.8% of the limit value.
- **Nitrogen oxides** concentrations ranged from 0.001 to 0.015 ppm, well below the limit (3 ppm) and approximately 0.2% of the limit value.
- **Carbon monoxide** concentrations ranged from 0.73 to 1.02 ppm, well below the limit (25 ppm) and approximately 3.6% of the limit value.
- **Carbon dioxide** concentrations ranged from 416 to 441 ppm, well below the limit (5000 ppm) and approximately 8.5% of the limit value.
- **Aldehydes** showed no detectable concentrations at the five locations (LDL=0.01 ppm).

- **Total Suspended Particulates (TSP)** at the five locations ranged from 42 to 68 µg/m^3 and **smoke** concentrations ranged from 17 to 32 µg/m^3, both of which indicate very low levels.

Additional measurements were conducted by the Central Lab of Scientific and Environmental Assessment team (City of Scientific Research and Technology Applications SRTA-City) for particulate matter levels of different particle sizes. These measurements were carried out in December 2014 and showed that suspended particulate matter including TSP, PM_{10}, $PM_{0.2}$ and smoke were present at low levels compared to the AQLs. This can be attributed to the lack of major sources for such emissions in the vicinity of Damanhour. TSP, PM_{10}, $PM_{0.2}$ and smoke were sampled over 24 hours while deposited dust was sampled for a period of two to four days. Data are provided in the following Tables

Table 5-5: Levels of air pollutants (TSP) at various sites in the new project area for West Delta for Electricity Production Co. at Damanhur, EL-Behira City, December, 2014.

Site Description	Air Quality Limit AQL=230 µg/m^3
	Average TSP (µg /m^3)
Site 1	2.148
Site 2	4.113
Site 3	0.126
Site 4	2.115
Site 5	0.105

Table 5-6: Levels of air pollutants (Dust fall) at various sites in the new project for West Delta for Electricity Production Co. at Damanhur, EL-Behira City, December, 2014

Site Description	Average concentration of DP (g /m2)
Site 1	0.105
Site 2	2.66
Site 3	2.69
Site 4	2.74
Site 5	4.39

Table 5-7: Levels of air pollutants less than (<PM0.2) at various sites in the new project for West Delta for Electricity Production Co. at Damanhur, EL- Behira City, December, 2014

Site Description	Average less than $PM_{0.2}$ (µg/m3)	%
Site 1	5.30	1.25
Site 2	9.24	5.20
Site 3	5.20	9.16
Site 4	7.25	2.21
Site 5	7.19	2.16

Table 5-8: Levels of air pollutants (Smoke) at various sites in the new project for West Delta for Electricity Production Co. at Damanhur, EL- Behira City, December, 2014

Site Description	Average concentration of Smoke (150 µg /m^3)
Site 1	0.42
Site 2	5.26
Site 3	7.27
Site 4	7.29
Site 5	8.15

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5.2.2 Air Quality Baseline Measurements outside the project site boundaries

The major sources of air pollution in the area are Damanhour power plant and traffic on the nearby roads. There is very little low-level commercial activity and no major sources of emissions in the area. Damanhour is a residential town with various commercial activities and services, but without heavy industry. The nearest industrial areas are at Kafr Eldawar town 35 km far to the west, with the nearest heavy industries located in Alexandria city 65 km to the northwest of Damanhour.

Measurements were carried out outside the plant boundaries by the Air Pollution Lab Team on Sunday May 10^{th} 2015. Measurements of carbon monoxide, nitrogen dioxide, sulfur dioxide, total suspended particulates (TSP) and respirable dust (PM_{10}) were made at six locations to the south, southeast and south-west of the project site, representing ambient air quality downwind the plant. Locations are shown on the map below (Figure 5-3). Measurement results are summarized in the table below (Table 5-9).

Figure 5-3: Measurement Locations outside of Damanhour Power Plant

Table 5-9: Measurement results of air pollutants outside Damanhour Power Plant

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/m^3-1hr 125 µg/m^3-24hr	**200** µg/m^3-1hr	**10** mg/m^3 maximum daily 8-hr mean	-	**50** µg/m^3-24hr

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

5.3 Noise

5.3.1 Noise Level inside Damanhour Power Plant

Noise is a key issue in the area of the existing (and proposed new) Damanhour power plant because the area immediately next to the site is populated. A noise survey was carried out by the PROMEC (Projects Management and Environmental Consultancy) team during the period from 21 December 2014 to 7 January 2015. Noise levels were monitored during day and night at the selected sites inside the power station as shown in Tables 5-11 and 5-12. These sites represent the working environment. The results indicated that all sites within this working environment had noise levels lower than the maximum allowable levels established by law 9/2009.

Table 5-10: Noise Levels (dB) inside Damanhour Power Plant

Site Description	N	E	Noise Levels dB			Allowable levels	Avg./Allowable %
			Range		Average		
			Max.	Min.			
site1 (northeastern corner)	31° 5'12.77	30°25'42.05	68.5	64.4	66.3	85	73.7
site2 (northwestern corner)	31° 5'11.48	30°25'38.27	71.2	66.2	68.2		75.8
site3 (southwestern corner)	31° 5'3.53	30°25'39.30	75.5	69.3	72.0		80.0
site4 (southeastern corner)	31° 5'2.97	30°25'45.53	67	64.3	66.0		73.3
site5 (central point)	31° 5'7.71	30°25'41.77	69.3	64.5	66.8		74.2

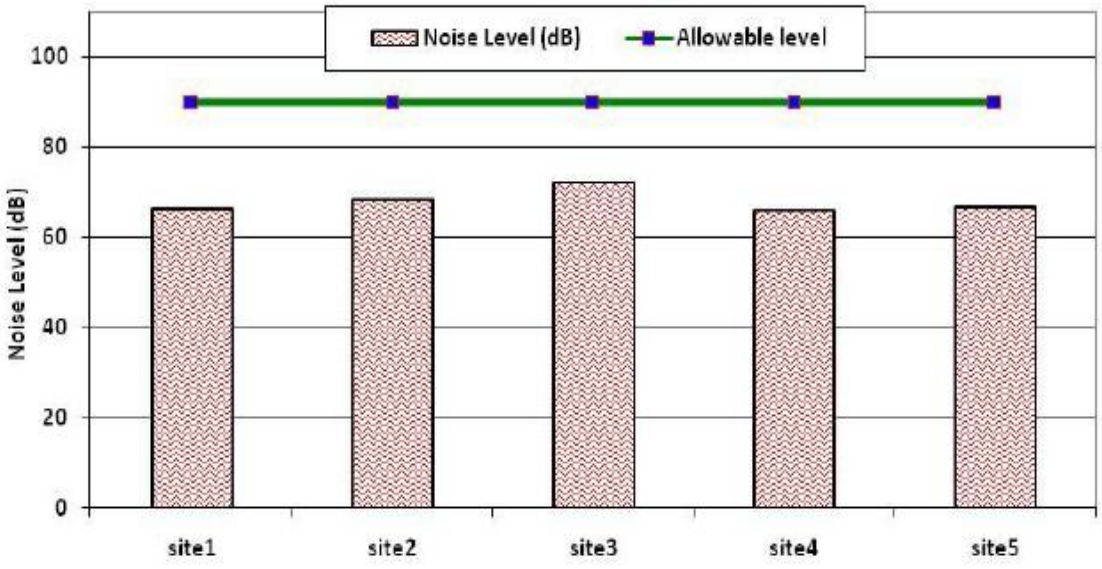

Figure 5-4: Noise Level inside Damanhour Power Plant

5.3.2 Noise Level outside Damanhour Power Plant during daytime

Noise levels were monitored during daytime (from 7am to 10pm) at selected locations outside Damanhour Power Plant as shown in Figures 5-5 and 5-6 during the period from December 21st 2014 to January 7th 2015. These locations represent the surrounding area off-site the new project. Some of the measurement locations are higher than the maximum allowable level, whereas other sites were lower than the maximum allowable level (65 dB).

Figure 5-5: : Noise Levels Measurement Locations

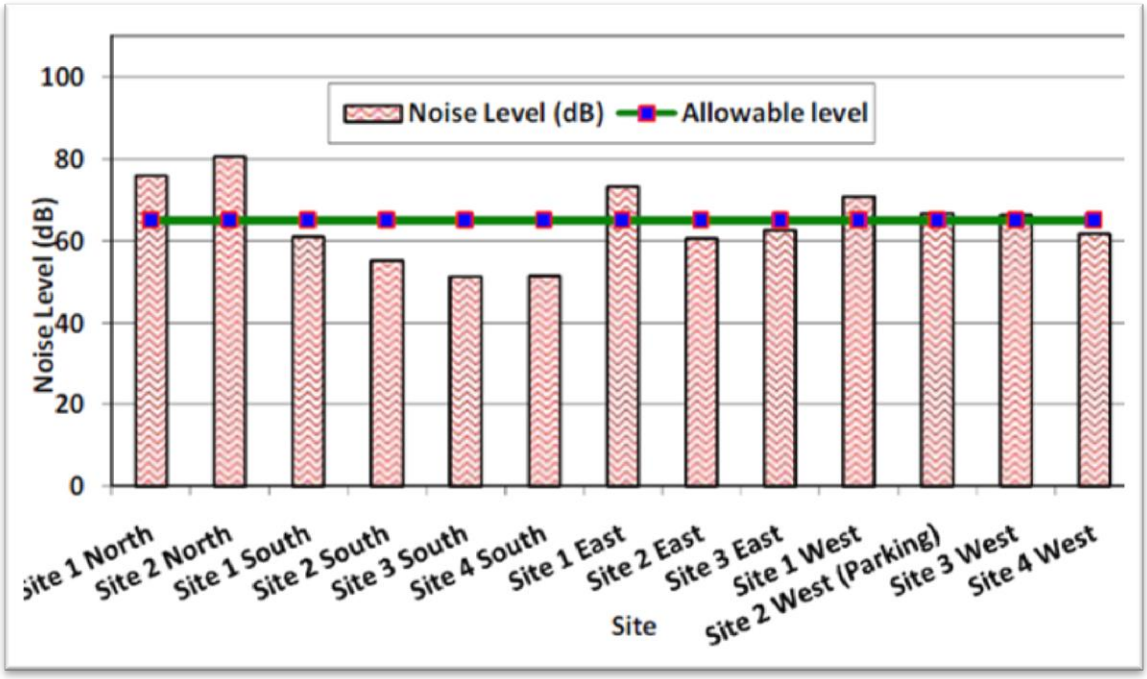

Figure 5-6: Noise Levels (dB) outside Damanhour Power Plant

5.3.3 Noise Level outside Damanhour Power Plant during night-time

Noise levels were monitored during night (from 10pm to 7am) at the selected sites outside Damanhour station as shown in Figure 5-7. These sites represent the surrounding area offsite the power plant. Some measured locations were higher than the maximum allowable level.

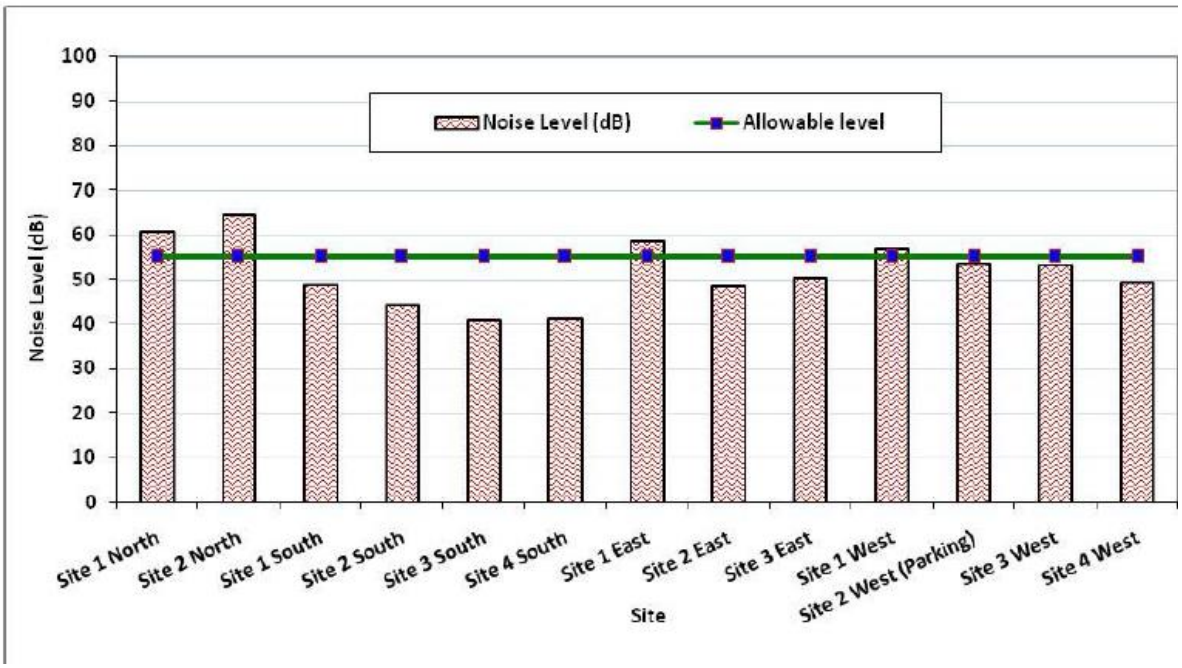

Figure 5-7: Noise levels at night outside Damanhour Power Plant during night time (10pm- 7am

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Noise hot spots inside the Damanhour Power Plant include workshops, generators, compressors and traffics inside the station. The hot spots outside include village workshops, microbus stations and general traffic (Figure 5-8).

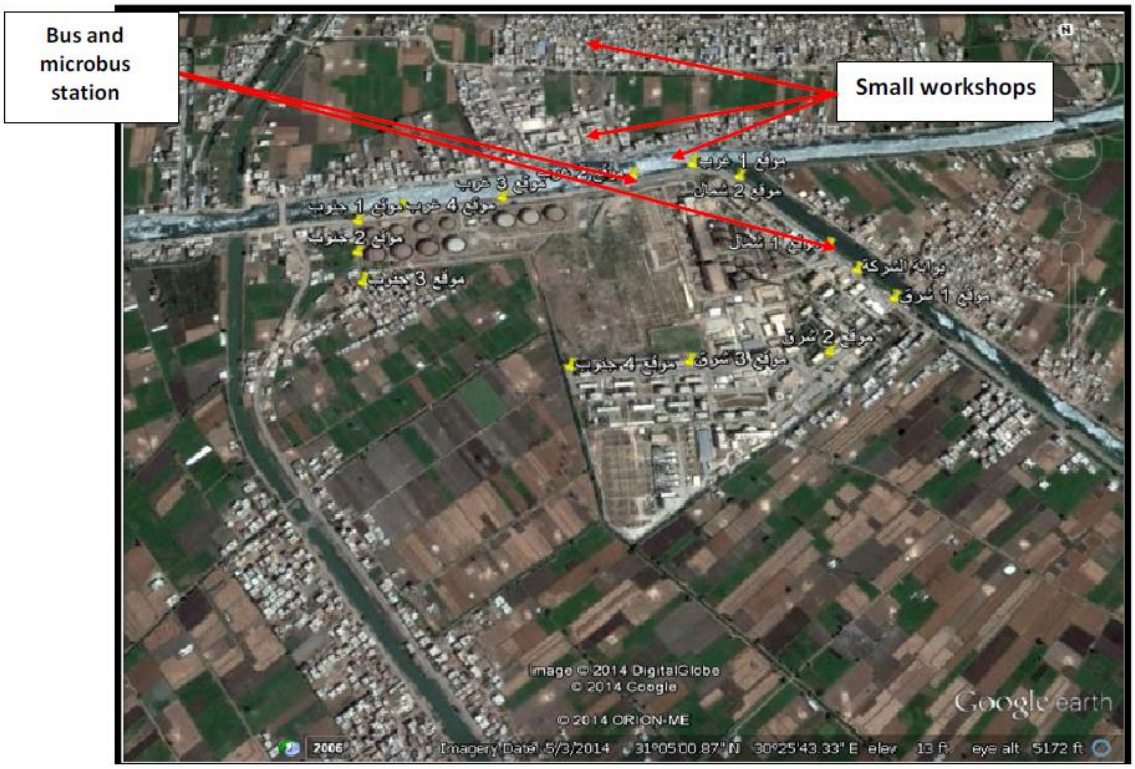

Figure 5-8: : Sources of noise (hot spots) surrounding Damanhour Power Plant

5.3.4. Conclusions

The levels of noise inside the Damanhour Power Plant are generally lower than the maximum allowable level (85 dB). Some sites outside the power plant show slightly higher day and night-time noise levels than stipulated by Egyptian law.

5.4 Water and Sediment Quality in Adjacent Canals

Seven samples of water and sediment were collected from waterways surrounding the power station (El-Mahmoudya canal and Khandak canal); one sample was collected from El-Khairy drainage) which receives domestic wastewater. Samples were analysed for a number of physical, chemical and biological parameters. Sampling locations were located on different distances along the canals as shown in Figure 5-9.

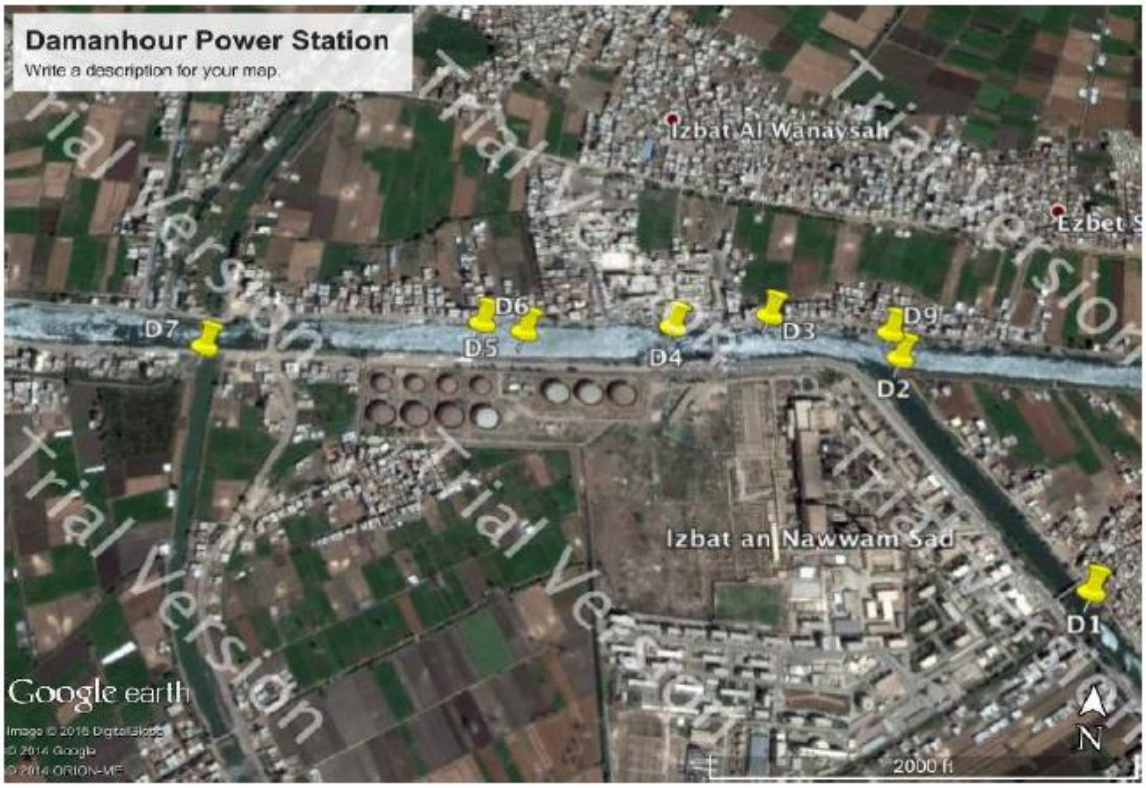

Figure 5-9: Water sampling locations from El-Mahmoudya canal

Key measured parameters are summarised below in the following table for the four sampling locations (D1, D2, D4 and D5).

Table 5-11: Key parameters at four selected locations (D1, D2, D4 and D5)

Parameter	Reading/ Concentration				Maximum allowable limits
	D1	**D2**	**D4**	**D5**	
Temperature °C	19.1	19.1	19.3	22.5	**38***
pH	7.66	6.94	7.24	7.25	**6 – 9**
Ammonia mg/L	0.16	0.71	1.56	0.87	**3**
BOD mg/L	< 2	< 2	< 2	< 2	**60**
COD mg/L	< 5	< 5	< 5	< 5	**100**
Phenol mg/L	< 0.01	< 0.01	< 0.01	< 0.01	**0.015**
Oil and grease mg/L	< 0.5	< 0.5	< 0.5	< 0.5	**15**

* heated discharges, e.g. cooling water, shall not exceed the prevailing temperature by 5 °C, with a maximum of 38 °C.

The physical and inorganic content of water were within the permissible limits but there were elevated levels of nitrogen input. Fecal coliform was present in an excessive amount, which is an indicator for sewage disposal in water. Of heavy metals only lead and chromium were detected in high levels. PCBs and pesticides were also recorded in high levels in the sediment.

5.5 Geology and Soil Quality

The study area is located in the Nile flood plain. The Nile flood plain occupies a narrow strip parallel to Rosetta Nile branch and the southern areas adjacent to El-Mohamoudia canal. It is composed of the Nile mud and it is considered one of the most productive agricultural areas. The area of the study almost falls within the 1-meter contour line above sea level. The water table is about 2 metres below surface level.

5.6 Flora and Fauna

Field surveys of the flora and fauna of the power station site and surrounding areas were carried out by Scientific Studies & Consultations Center team (Faculty of Science, Ain Shams University) in December 2014. Terrestrial plants have also been identified inside and along the El-Mahmoudia Canal, which receives the cooling water from the station. Recordings of bird species that frequent the area have been checked. The same applies to previous studies of the region and the El-Mahmoudia Canal in relation to relevant amphibians, reptiles, birds and mammals. The key results are summarized in the following text. Tables listing species are also presented in Annex 1.

Of the plant species on site, most were common and abundant in the area, none is protected, rare or of particular biodiversity value. This reflects the fact that the site of the NDPP is a derelict industrial location, occasionally used for materials storage.

There are four common species of amphibians known in the wider study area, i.e. the Nile Frog *Bufo regularis*, *Ptychadena mascareniensis* and the green toad *Bufo viridis*, and *Rana ridibunda*. A total of 27 species of reptiles in the study site were recorded in this area (Saber, 1999), plus 19 species of lizards and 8 species of snakes.

Most species are common and abundant. There are no endemic or endangered species in the region.

The same applies to birds. There are 71 species recorded for the area (Tharwat, 1997). The wider area of Damanhour habitats and canals has an abundance of water and food available for birds, and facilitates easy and safe way for migratory birds across the desert of northern areas. A vast number of species exploits this during migration season. There are also good habitats for the winter to large numbers of birds coming from the cold countries (Tharwat, 1997).

There are 10 species of endangered birds globally endangered present in Egypt in many regions (IUCN 2013; Red list of threatened animals), but none of them has been recorded in this region.

Rodents form the largest mammalian group of the area. The Red Fox *Vulpes vulpes* was recorded in areas around the aquatic canals. The Giant Musk Shrew; *Crocidura flavescens deltae*, was also recorded in many areas around the Mahmoudia canal.

In summary, the study showed that the ecosystem of the proposed power plant site and its vicinity is poor in diversity and structure. No significant habitats or species were encountered in the surveyed area. No protected areas for their conservation value are located on the project are or in its vicinity. No rare or threatened species are found in this area or recorded around it. Given that the potential impacts of construction and operation power plant area will likely to be localized, and good site management practices should be implemented, no significant effects are predicted.

5.7 Aquatic Ecology

5.7.1 Aquatic plants

Many aquatic plant species were recorded in the canal bank, in its three habitats; slope, water-edge and open-water. The following applies to the wider area and species listings cover a wider area and are not specific for the area immediately next to or downstream of the proposed site for NDPP.

The slopes of the El-Mahmoudia canal: Many species were recorded in this habitat; annuals and perennials. These include: *Plantago major, Amaranthus hybridus, Coriandrum sativum, Gnaphalium luteo-album, Lathyrus marmoratus, Phalaris*

paradoxa, Sisymbrium irio, and *Sonchus macrocarpus.* The most common species are: *Phragmites australis, Arthrocnemum macrostachyum, Sarcocornia fruticosa, Suaeda vera, Salsola kali, Senecio glaucus subsp. coronopifolius* and *Sonchus oleraceus.* There are also: *Paspalidium geminatum, Atriplex halimus, Ipomoea carnea, Ranunculus sceleratus, Cichorium endivia subsp. pumilum, Hordeum marinum, Medicago polymorpha* and *Anagallis arvensis.*

The water-edges of the canals: Species include: *Clerodendrum acerbianum, Sida alba, Medicago intertexa var. ciliaris, Rorippa palustris, Setaria verticillata* and *Setaria viridis.* The more common species are: *Phragmites australis, Sarcocornia fruticosa, Azolla filiculoides, Conyza dioscorides, Cyperus* sp. and *Imperata cylindrical.* There are also: *Halocnemum strobilaceum, Inula, crithmoides, Cynanchum acutum, Suaeda maritima, Centaurea calcitrapa, Sphaeranthus suaveolens, Tamarix tetragyna* and *Ammi visnaga*.

The open-water of the Canal Bank: A total of 14 species were recorded in this habitat. The common species are: *Phragmites australis, Eichhornia crassipes, Ceratophyllum demersum, Azolla filiculoides* and *Echinochloa stagnina*. There are also: *Arthrocnemum macrostachyum, Sarcocornia fruticosa, Lemna perpusilla, Potamogeton crispus* and *Salsola kali*. Among the noteworthy species in this habitat are two species that cause severe infestation to the water ditches of Egypt: *Phragmites australis* and *Potamogeton pectinatus*.

The ecosystem in front of the proposed power plant is poor in diversity and structure, without any significant habitats or species. No rare or threatened species were found in this area or recorded around it.

5.7.2 Fish

A large variety of fish species is inhabiting El-Mahmoudia canal; Tilapia zillii is widely distributed in this habitat because of its high tolerance; Oreochromis niloticus was the second common species of cichlids as well as Clarias gariepinus Sarotherodon galilaeus and another cichlid, Hemichromis bimaculatus.

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 no rare or threatened fish species were found in this area or recorded around it.

5.8 Areas of Cultural and Historical Importance

There are no areas/locations of cultural and historical importance near the project area. The nearest area is Wadi Elnatroon which is distinguished by its cultural heritage of the Coptic monastery and its natural reserves. Wadi Elnatron is about 80-85 km away from the plant site to the south direction which is out of the project area of impact.

5.9 Land Use, Landscape and Visual Appearance

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. Consequently, the landscape is composed of vast green areas with slow-rise buildings. Damanhour power plant with its stacks (the tallest of which is 138 metres high) is the most dominant structure.

The following photo shows the site for the new power station in the foreground. The existing 3x65 MWe units are on the left, the 300 MWe unit on the right. Stack height is 85 and 138 metres respectively.

Photo 5-1: Landscape at the vicinity of Damanhour Power Plant

5.10 Site Baseline Hazards

5.10.1 Seismic Activity

Egypt is a country of low to moderate seismic hazard and earthquakes are active in the north parts of the country. The Egyptian region classified into five zones coded as 1, 2, 3, 4 and 5. Damanhour and its surrounding are located in zone 2; the Egyptian code recommend that structures located in zone 2 should be capable to resist a ground acceleration of 0.125 from the gravitational acceleration. The site and its surrounding area have had minor seismic activity, during recent historic time (This data was obtained from the Egyptian Code, 1994).

5.10.2 Flash Floods

The project site does not contain any of the narrow Wadies (valleys), which collect the rainwater in concentrated streams and may cause flash floods. Accordingly, the project site is not affected by these drains and is considered protected from possible hazards of flash floods.

Industrial Hazards

The existing site risk includes fire and explosion hazards from fuel supply lines and tanks.

5.11 Social Baseline

5.11.1 Methodology

The objective of the study is to highlight the current socioeconomic conditions of the target areas as a supplementary to the social assessment of the ESIA of the project. That has been prepared to conform to the requirements of Egyptian Environmental Law No 4 of year 1994 and its executive regulations and the EIB, EBRD and ADBs procedures and regulations.

The study adopted a multi-data sources approach that utilizes both primary and secondary data. The primary data aimed at fulfilling the gaps of information related to the project, whereas, the secondary data aimed at fulfilling the baseline information and the legal framework. The following is a detailed discussion of the methodology and data sources of the study:

5.11.1..1. Secondary Data

Secondary data aimed at analyzing different reports related to the venue of the project (Zawyet Gazal and Damanhour Markaz within El Beheira Governorate). The secondary

data analysis method was used to review governmental documents. Moreover, provide a robust socioeconomic profile of the communities that will host the project. The following reports have been reviewed:

1. Egyptian Human Development Report 2010
2. Governorate Description by Information 2010
3. Egypt Description by Information, IDSC, 2010
4. Egypt Description by Information, IDSC, 2009
5. Census data provided by Information Center 2009

The above mentioned reports were analyzed and summarized in a comprehensive section in order to highlight the current socioeconomic conditions of the target areas. In the meantime, complementary primary data collection allowed the Consultant to verify the accuracy of secondary data and give in-depth to the analysis.

5.11.1..2. Primary Data

Primary data collection involves collecting data primarily from different potential stakeholders and project target groups including potential Project Affected People (PAPs), and other vulnerable groups including women and poor households. Diverse data collection tools were used.
For collecting latest social information, four trained investigators under the guidance of a socio-economic specialist were engaged in constructing primary data using structured questionnaire and focus group discussion. Although, the survey included other inhabited areas in the vicinity of Damanhour Power Plant, the focus of the household face-to-face interviews using the standardized questionnaire is the people living in the sub-villages of Zawyet Ghazal, El-Nawam Sa'ad and Garboa'a, in addition to the people living in the power plant employees' Colony . These four areas have the nearest populations to the plant site.

The following is a brief description of data collected:

Various tools were developed in order to highlight the perception of each target group. The study relied upon quantitative and qualitative data that were collected using the following tools:

1- Quantitative data

- **Structured questionnaire:**

The Study team designed and tested the survey questionnaire for the potential beneficiaries. The survey covers the potential project beneficiaries and affected persons. The questionnaire contained several sections, which are basic characteristics, household size and structure, education, housing conditions, income, health situation and healthcare, infrastructure (electricity, energy, drinking water, and sanitary sewage) and the impacts of the present activities of Damanhour Power Plant.

2- Qualitative data

The study team utilized additional qualitative research methods which aim to assist the study team in gathering an in-depth understanding of the current socioeconomic, livelihoods dynamics, nature of the households and other impacts on the family..

The qualitative methods are generally more interactive and participatory techniques that can pave the road with the local community to the introduction of the structured survey.

As much and diverse stakeholders as possible were approached by the Study team via qualitative methods with priority given to the vulnerable groups of the potential PAPs (the residents of electricity colony). Another important task for the qualitative tools is employing them to be part of the community consultation activities. The qualitative methods that were used included:

- **Group Discussions** (GDs) were utilized and used with the community people
  The main topics covered through the GDs were:
  - Characteristics of the community people
  - Their awareness about the project impacts and the needed mitigation measures, with emphasize on their own livelihood status
- **Comparative case analysis**: comparing the new project with other projects implemented recently in Egypt.

- **Maps , Photos and observation**
  Clear documentation with maps and photos was presented. Observation checklist of different areas was used in order to facilitate the process of community mapping which helped in the community profiling.

3- Data analyses

All collected data was reviewed and segregated into two categories, namely, qualitative and quantitative. Each category was analyzed using suitable data analysis approach. Nevertheless, all data was verified and evaluated in order to provide reliable information.

5.11.1..3. Sample

The sample surveyed were selected from, the areas located in the proximity of the Power Plant. Accordingly, the four residential settlements described in section 1.4 were represented in the sample. These are the sub-villages of Garboa'a, EL-Nawam Sa'ad and Zawyat Ghazal in addition to the residential colony affiliated to Electricity Company. The total selected sample is 118 households. The survey was carried out during January 2015.

The interviewed households were almost equally distributed among the four residential settlement locating in the proximity of Damanhour Power Plant. The employees' Colony and the two sub-villages of Zawyet Ghazal and Garboa'a each represent 26.3% of total sample size. El-Nawam Sa'ad sub-village forms 21% of the total sample size.

5.11.2 Study strengths and limitations

5.11.2.1. Study strengths

1- The study relied upon multiple sources of data which helped the team in verifying the collected data.
2- Utilization of both qualitative and quantitative data enriched the study with different types of information.
3- All results of the study were discussed during the data collection process with governmental agencies in order to verify the quality of data collected. The end results of such exercise are that the data collected was reliable and credible. It was also consulted upon in the various consultation activities.
4- Communication channels and outreach mechanisms were applied with the beneficiaries that facilitated the community's acceptance of the study team.

5.11.2.2. Study limitations and challenges

1- Time limitation was the key challenge that confronted the ESIA preparation process. However, the consultant tried to maximize the time by working with his team in parallel
2- Seeking for job opportunity was one of the most critical barriers that have been handled wisely in order not to raise the expectations of community people. Data collection team were ordered not to provide any promises to the communities in order not to jeopardize the project .

5.11.3 Socioeconomic Baseline

5.11.3.1. Administrative jurisdiction

Damanhour Power Plant is located in Markaz Damanhour in El-Beheira Governorate. El-Beheira governorate lies in the West of Delta region. It is bordered by the Mediterranean Sea in the north, by Rosetta branch in the east, by Alexandria and Matrouh in the west, and in the South by Giza and El-Menofya. El-Beheira is considered one of Alexandria region's governorates that encompass Alexandria, Matrouh, and El-Beheira Governorates. El-Beheira is by far the largest governorate as to area of agricultural lands which are estimated at 1623.59 thousand feddans (including the Nubaria lands). It has a total surface area of 9826 km^2 (State Information Service, 2013).

Figure 5-10:The administrative units and borders of El-Beheira Governorate

5.11.3.2. Populated area

The populated area of Damanhour Markaz comes to 396.11 km^2 and is administratively divided into 7 rural local units which consist of 50 villages and 458 hamlets. The Markaz's population reached 798.39 thousand people. The Markaz is an affiliate to Shura Council first precinct at Damanhour Police Station.. (source - Governorate Description by Information 2010)

5.11.3.3. Demographic characteristics and human development profile

Population size and sex structure

The project will be constructed inside Damanhour Power Plant within the jurisdiction of Zawyet Ghazal village. The total population size of the village including all its sub-villages

is 8868 individuals. Males represents 51.31% of the total population (Census 2006. CAPMAS)

Table 5-12: Population size and sex structure

	No. Of individuals			Sex ratio
	Male	Female	Total	(%)
Zawyet Ghazal	4550	4318	8868	105.4
%	51.31	48.69	100%	

Sex and age distribution

Age distribution of the different population categories in Zawyet Ghazal village shows that the distribution pattern of both age groups and the sex is skewed to the left indicating higher values for young segments of the village's population. The highest value falls in the age group between 15 and 20 years. For age groups above 20 years, there is a gradual decrease in number of individuals as the age increases. The comparison according to sex shows almost identical values between males and females.

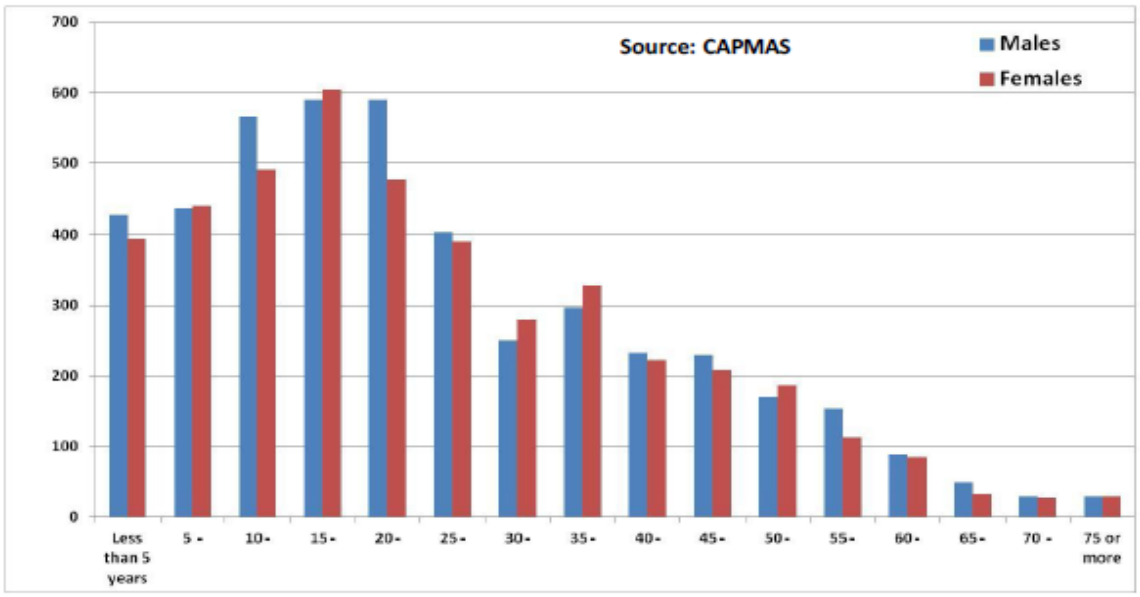

Figure 5-11: Distribution of Zawyet Ghazal village's population according to age categories and sex

Source: Information Center in Damanhour Markaz 2009

Education status

The number of illiterate people in Zawyet Ghazal village is significantly higher compared to other education status .The percentage of illiterate people is about 44.0%. It is much higher among females compared to males. Illiteracy rate is about 55.0 % among females

compared to the 34.0% among males in the village. This difference continues to be exhibited for other types of education status. However, the gap between the two sex groups is slightly reduced for the basic, secondary and above secondary education levels. The basic and secondary education levels are the second highest groups in terms of their relative size to the total population of the village above 10 years old. The number of people with educational level above secondary levels plunges significantly for both sex groups. The percentages of the people with education status above secondary education do not exceed 5% for the males and 3% for the females. It could be concluded that the education status in the village is generally low as shown by the high illiteracy rate and low values for higher education.

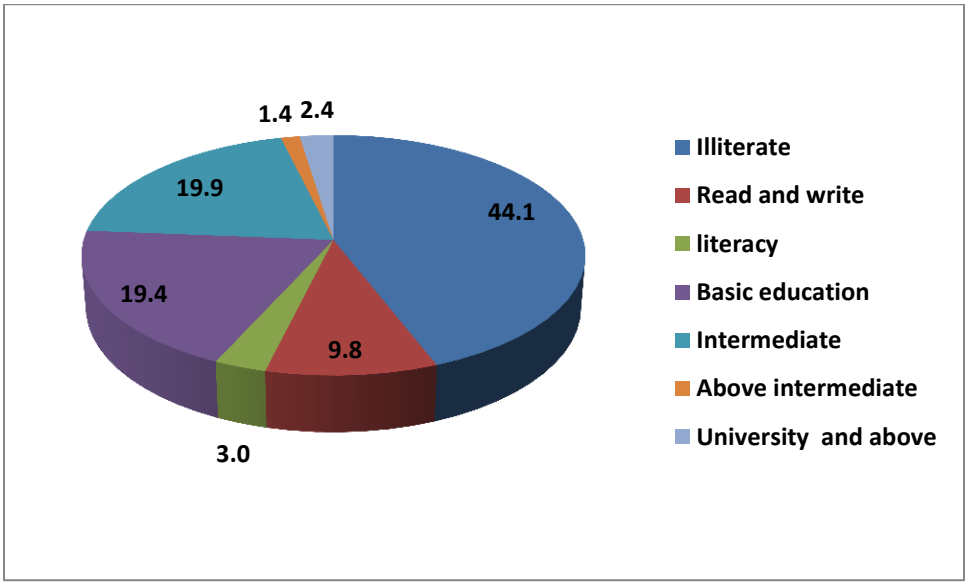

Figure 5-12: %Distribution of Zawyet Ghazal village's population according to educational status

Source: National Census 2006, CAPMAS

Marital status

About 64% of the people in Zawyet Ghazal village are in the marriage age. This percentage is higher for females than the males because marriage age is significantly lower among females than it is among males. This high marriage age was also reflected in the percentages of the population under age, which is expectedly higher in the males than the females. The largest group in relation to marital status in the village is by far the married people group, which more than the double for the unmarried group. The values of the males and females in terms of marital status do not exhibit large variation except for the never married, which has higher values for the males compared to the

females; and the widowed group, which is much higher for the females compared to the males. The number of widowed women represents about 6% of the total population about 10% of the people of marriage age.

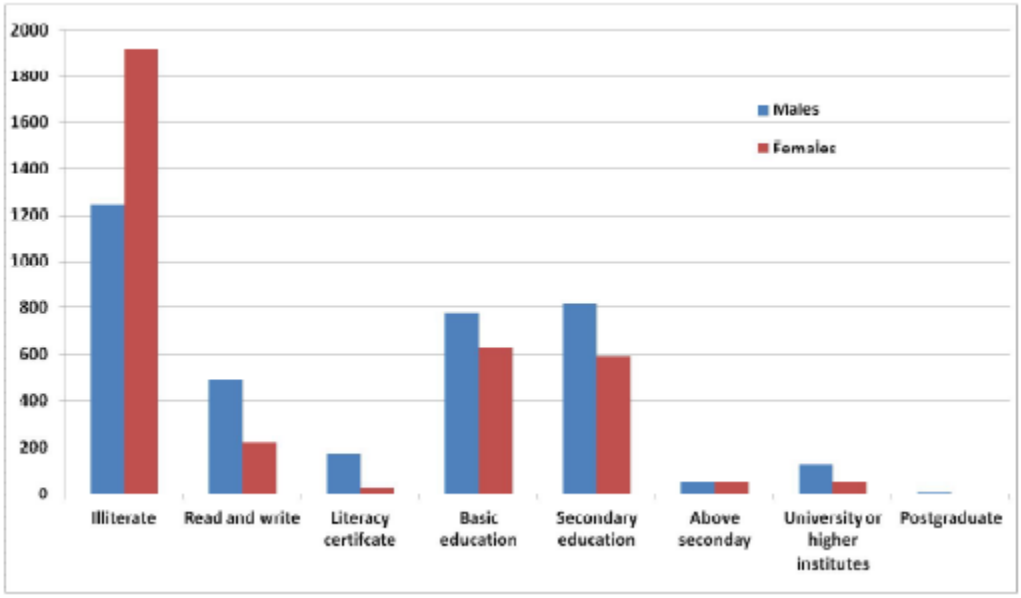

Figure 5-13: Distribution of the population (older than 10 years) of Zawyet Ghazal village according to education status and sex

Source: Information Center in Damanhour Markaz 2009

Table 5-13 Distribution of the population according to marital status and sex

		Marital statues(18 years old for male and 16 years for female)														
		Never Married		Marriage Contract		Married		Divorced		Widowed		Total		Under Age		Total
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	
Zawyet Ghazal	Male	860	19	34	0.75	1852	41	5	0.11	21	.46	2772	61	1778	39	4550
	Female	658	15	52	1.20	1875	43	16	.037	279	6	2880	67	1438	33	4318
	Total	1518	17	86	0.97	3727	42	21	.024	300	3	5652	64	3216	36	8868

Source: Information Center in Damanhour Markaz 2009

5.11.3.4. Poverty index

Zawyet Ghazal has significant poverty level in Damanhour villages. The poor represent 34.56% of the total population (source, Poverty Mapping, CAPMAS 2013). According to

this percentage and comparing that to the population estimation in 2013, the total number of poor people represents 3546 person.

5.11.3.5. Labor force and employment

The percentage of people aged 15 years or more inside the labor force of Zawyet Ghazal village is approximately 42.9% while those aged 15 years or more outside the labor force is about 57.1% (Table 5-15). The females comprise only about 9% of the people inside the labor force, which does not reflect their size in the general population of these cohorts especially that the sex ration for all cohorts is very close to 100%. This is mainly because the rural nature of the village where female working is not socially accepted. It could also be related to the high illiteracy rate among the female, which compromised their qualifications in the job market. The rural areas also provide limited activities that could be suitable for female labor. **Source: CAPMAS 2009**

The unemployment rate in Zawyet Ghazal village is about 13.2% of people (more than 15 years old) who are inside the labor force .The unemployment rate shows substantial difference between males and females inside the labor force. About 69% of the females inside the work force are unemployed. This could be attributes to the limited jobs available or suitable for women in such a rural setting. Such a rural setting could also make employers prefer hiring males. This is reflected in the very small number of hired females compared to the hired males, which is only 3% of the total hired labor force. The unemployed males represent about 7.5% of the male inside the labor force of the village. This means that 92.5% of the males in the village are employed. The vast majority (90%) of the males in the labor force work for salaries or wages at the private and governmental sectors. The number of males who are self-employed or business owners is about 1.4% of the total number of males inside the labor force.

Table 5-14 Distribution of the population (more than 15 years) according to labor force and sex

		Inside labor force	Outside labor force	Total
Zawyet	Male	2376	741	3117
Ghazal	Female	243	2748	2991
Village	Total	2619	3489	6108
	%	42.9	57.1	100

Source: Information Center in Damanhour Markaz 2009

The unemployment rate in Zawyet Ghazal village is about 13.2% of the people (more than 15 years old) who are inside the labor force. The unemployment rate shows significant difference between males and females inside the labor force. About 69% of females inside the work force are unemployed. This might attribute to the limited jobs available or suitable for women in the village. Such a rural setting could also make employers prefer hiring males. This is reflected on the limited number of hired females compared to the hired males, which is only 3% of the total hired labor force.

The unemployed males represent about 7.5% of the male inside the labor force of the village. This means that 92.5% of the males in the village are employed. The vast majority (90%) of the males in the labor force work for salaries or wages at the private and governmental sectors. The number of males who are self-employed or business owners is about 1.4% of the total number of males inside the labor force.

Table 5-15: Distribution of the population (more than 15 years) inside labor force according employment type and sex

Inside Labor Force								
	Business owner	Self employed	Works for cash wage or salary	Works without wage		Unemployed who used to work	Unemployed who never work	*total*
				For family	For others			
Male	13	21	2158	5	0	3	176	*2376*
Female	2	2	70	1	0	1	167	*243*
Total	15	23	2228	6	0	4	343	*2619*

Source: Information Center in Damanhour Markaz 2009

The majority of people aged more than 15 years outside the labor force of Zawyet Ghazal village are females). This is mainly attributed to the high number of females who are housewives. This also explains the low values of females inside the labor force. The second largest group of individuals outside the labor force in Zawyet Ghazal village is full-time students, which is followed by unemployed overage people and the pensioners. The people with disability and those who are uninterested in work comprise a very small portion of the individuals aged more than 15 years outside the labor force.

Table 5-16: Distribution of the population (more than 15 years) outside labor force according causes of being outside the and sex

Outside labor force								
	Full time student	House Wife	Pensioner	Unemployed overage	With disability	Un interested in work	other	total
Male	385	-	80	80	16	60	120	741
Female	290	2381	7	65	5	0	0	2748
Total	675	2381	87	145	21	60	120	3489

Source: Information Center in Damanhour Markaz 2009

5.11.4 Socio-economic Survey

This section presents the results of a study that have been obtained from the socio-economic survey. Only about 8 % of the people included in the survey have been living in the area for more than 20 years. All other households are in the area for at least 30 years with about 66% of the interviewed households live in the area for more than 40 years.

The average residency period in the area is 43.7 years with a standard deviation of 14.1 years. The minimum value for residency period in the area is 9 years while the maximum is 65 years. This long residency period is because most of the household are originally in the area for at least two generations. This argument is also valid for the households in the employee's Colony because they obtain a usufruct right for the residential units they obtained from the plant which can transferred to resident family members. This right is not cancelled even if the employee is retired due any reason.

5.11.4.1. Family composition and household head

The average family size of the interviewed families is about 6.06 persons .They exhibited large variation in family size as indicated by the standard deviation value. The family size in the area ranged between a minimum of two and a maximum of 16. Although, the average family size is generally not very high, it is still above the average family size in El-Beheira Governorate, which is 4.34 persons (CAMPAS website , 2014). The average number of adult males per family (age 15+) 1.89 person, whereas the average adult

females per family is 1.74. The average male children (less than 15 years) per family is 0.61, while the female children's average is 1.11. People aged 60+ represent on average 0.66 person. There is limited variation in the distribution of the family members by sex for age groups between 14 and 60 years. The sex ratio for this age group is very close to 100%. The children under 14 years have generally lower average number per family in the surveyed households compared to the older cohort for both males and females groups. The number of male children family member is lowest of all age and sex groups. It is also lower than its female cohort. The family with an age of above 60 years has the second lowest number of family members. It does not exceed two, which is for extended families with the grandfather and grandmother living in the same household with other members.

Most of the households in the survey are male-headed households. This is quite in accordance with the discussion in section of labor force, which indicates that most females in outside the labor force (> 15 years) are housewives. The average age of household head is about 53 years. Although, the household head age varies between 27 and 79 years, most of the interviewed household head have an age more than 40 years.

The profession of the household's head was of broad spectrum). About 30% of the interviewed household heads are employees at governmental establishments. Household heads who work as technicians working represent about 16% of the household head professions. The pensioners have similar value as the technician group. Although, the study area is located in rural settings, only 5% of the interviewed households have households who have farming as their main profession. Most of the female household heads are housewives representing 5% of the household head profession of the interviewed families.

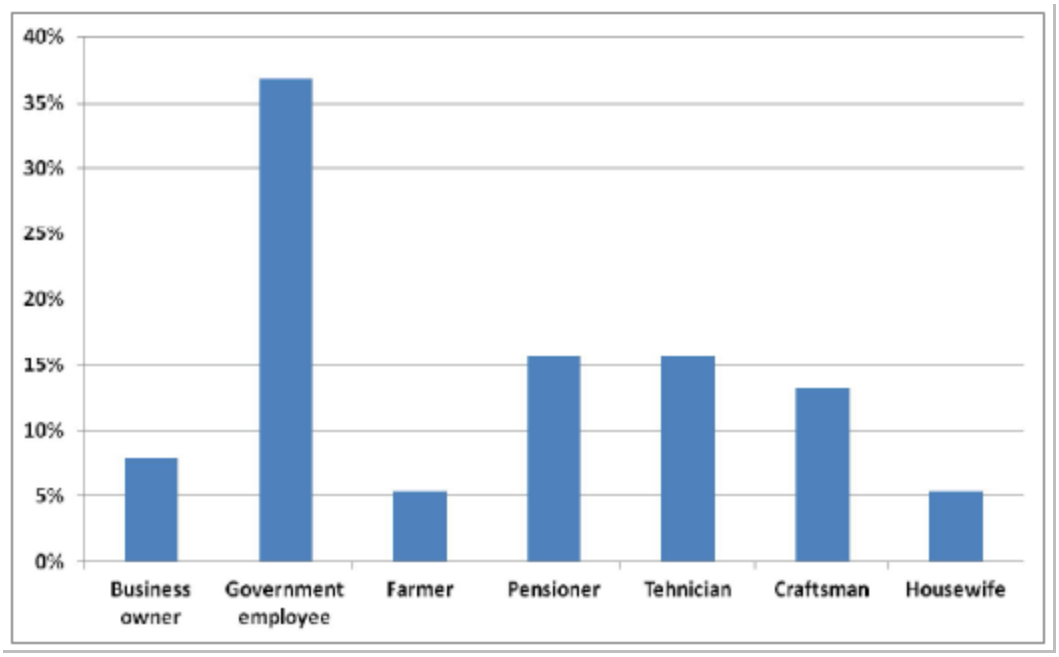

Figure 5-14 *% distribution of the household head by profession*

5.11.4.2. . Education status

The education status of the households included on the survey was analyzed excluding children under 12 years old. The highest completed educational level was recorded for each family member. The average percentages of the family members at each education level were calculated. The results show that the family members with secondary school have the highest average percentage of the family members. The secondary schooling includes the general secondary schools and the technical secondary schools for all its types' commerce and industrial. There were no records of family member with agricultural secondary school in the households included in the survey. The university level includes all post-secondary education of at least four years. Most of the surveyed households have people with bachelor degrees. The illiterate family members constitute the second the largest groups in terms of education level of surveyed households.

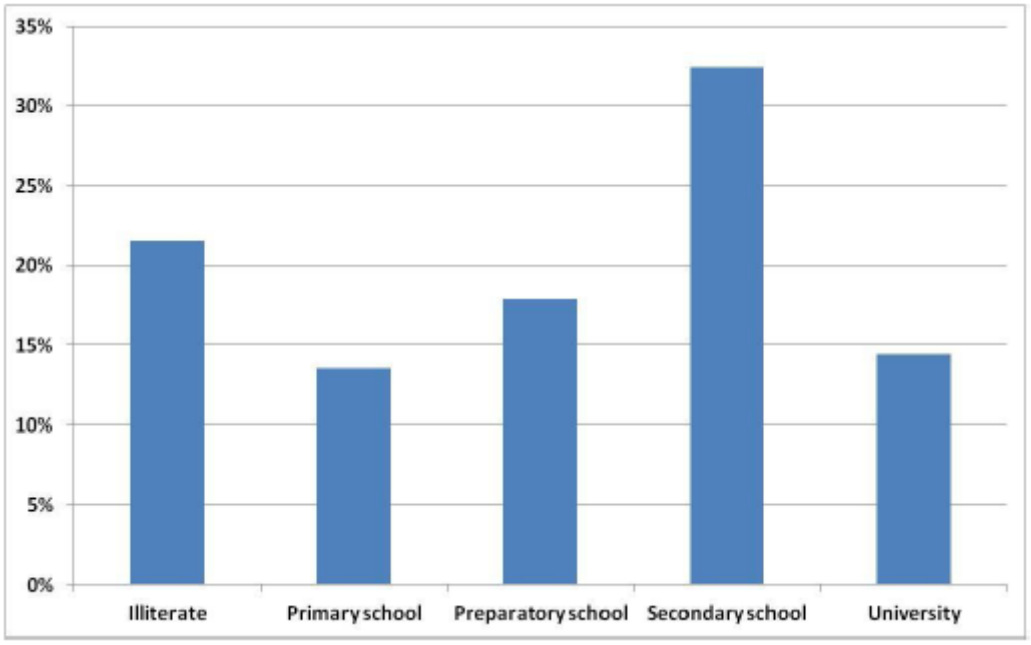

Figure 5-15: % distribution of family members by their educational levels

5.11.4.3. Household income

The households surveyed were asked about their average monthly income gained from all sources by all family members. It included income source which basically are wages, salaries, pensions (retirement and disablement), private business, remittance and social aids. The households with family income between 500 and 1,000 form the largest income group of all the interviewed sample. This class comprises about 26% of the households included in the survey. About 23% of the surveyed households had family income above 3,000 EGP/month. Most of the families in the high-income group live in the plant employees' Colony . The middle-income groups comprise together the highest percentage of the households. The families with monthly income below 500 EGP are only 2.5%.

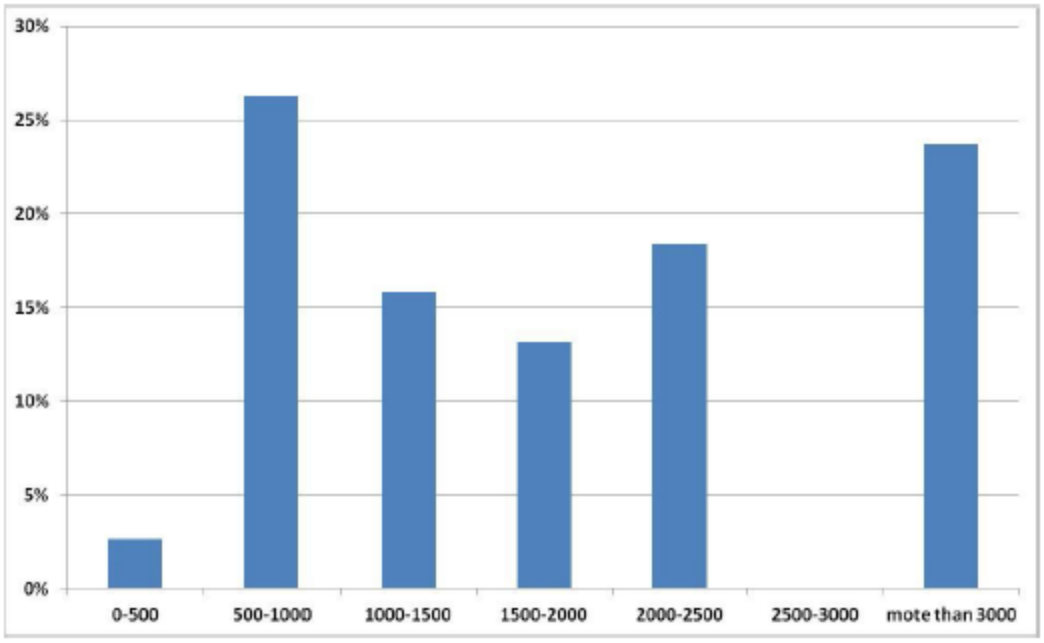

Figure 5-16: % distribution of households by their monthly income

5.11.4.4. Housing characteristics and Neighborhood conditions

About 55% of the survey families live in a separate house composed of a whole building. The remaining 46% live in a flat in a single or multi-storey building. Most of the households who live in a separate house belong to the three sub-villages. The households in the employees' Colony live in flats. All the families of the sub-villages have full ownership of their houses. The households in the employees' Colony have only usufruct right for their residential units. They have all the right to use the units but they can sell or rent it. This title can be transferred for the family members who are resident in the flat when the original owner of the right dies.

The average surface area of the houses of the households included in the survey is about 120.53 m2, with a minimum of 40 m2 and a maximum of 400 m2. This indicates that there are limited problems in terms of the size of the households' dwellings in the study area. This indication can be emphasized by the fact that the average share of a family member from the total surface areas of the dwelling is about 22.15 m2. This value can reach up to 50 m2/family member. All the houses included in the survey have concrete roofs, brick walls, and tiled concrete floors.

Photo 5-2: Residential units close to the station

Table 5-17: ***House area and house area per family member***

parameter	*average*	*minimum*	*maximum*
House area in m2	*120.53 m^2*	*40 m^2*	*400 m^2*
House area (m2)/ family member	*22.15 m^2*	*6.36 m^2*	*50 m^2*

Although, there are limited problems in terms of the physical conditions of the houses, the interviewed households expressed several problems related to the neighborhoods of the three sub-villages of Zawyet Ghazal, El-Nawam Sa'ad and Garboa'a as well as the plant employees' Colony . These problems were expressed by about 47% of the survey households while the other 52% did not find any problem with the house or the neighborhood.

Most of the household expressed neighborhood problems are located in the sub-villages of Zawyet Ghazal and El-Nawam Sa'ad. In the other two areas, limited number of households expressed neighborhood problems. The most frequently mentioned problem is related to the accumulation of garbage in the streets of the sub-villages which would stay for weeks before being removed. The respondents from El-Nawam Sa'ad sub-village mentioned that they have local initiative by some members of their community to collect and dispose the garbage from the sub-village streets. They usually collect a small fee from each house in the area, which is paid willingly.

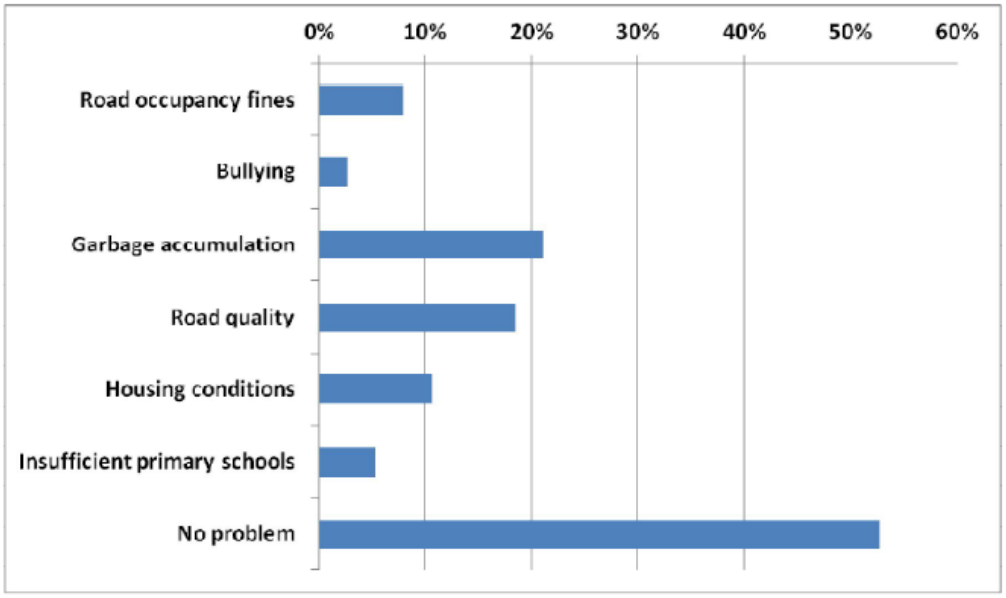

Figure 5-17: Housing and Neighborhood conditions

The second most frequent problem is related to the condition of the roads in the area. This problem was expressed by most of the respondents from El-Nawam Sa'ad sub-village. This village is located in the interconnection between El-Mahmoudia and El-Khandak East Canals. It is totally separated from the main roads except for a pedestrian bridge. The nearest bridge for vehicle is about 4 km south. This long distance and the bad conditions of the road affect the connection to and from the village especially in case of emergency. Other neighborhoods are connected to the main road either directly or by bridges for vehicles. This issue is related to the problems of insufficient primary schools in the area. The respondents explained that this is a major issue especially for small children enrolled in school away from the pedestrian bridge. It resulted in many road accidents to these young children on their way to or back from their schools. The housing conditions encompass several problems related to conditions of the buildings, the size of the house and the wall molding. These problems are expressed mainly by respondents from the employees' Colony . The problem of road occupancy fines is expressed only by households in Zawyet Ghazal sub-village where they pay almost every month fines for the road occupancy by their houses.

The most problematic issue that might affect the project is the invasion of constructions. After the 25th of January Youth Revolution thousands of houses were built on the agriculture lands. The illegal encroachers built their houses close to the Right of Way leaving limited area to any potential newly constructed Overhead Transmission lines.

Photo 5-3: Construction on the agriculture lands close to Gas pipeline

Photo 5-4:Construction of houses in the OHTL Right of Way

5.11.4.5. Infrastructure and utilities

Access to Electricity

All households in the four areas have access to the public electricity grid. The two major problems associated with electricity are related to the cost of electricity bills, indicated by 27% of surveyed households, and repeated power cuts which is stated by approximately 34% of the surveyed households.

The increased electricity cost is actual actions adopted by the Egyptian Government under the Subsidy Reform Policy on utilities and supplies. There are about 33% of the households did not find any problem with the electricity supply in their households. The remaining electricity problems discussed during the survey are to the instability in the electrical currents, which causes several malfunctions in the household appliances. It should be noted that households in the plant employees' Colony obtain their supply by the plant. They do not pay for their electricity consumption, which is freely provided by the plant.

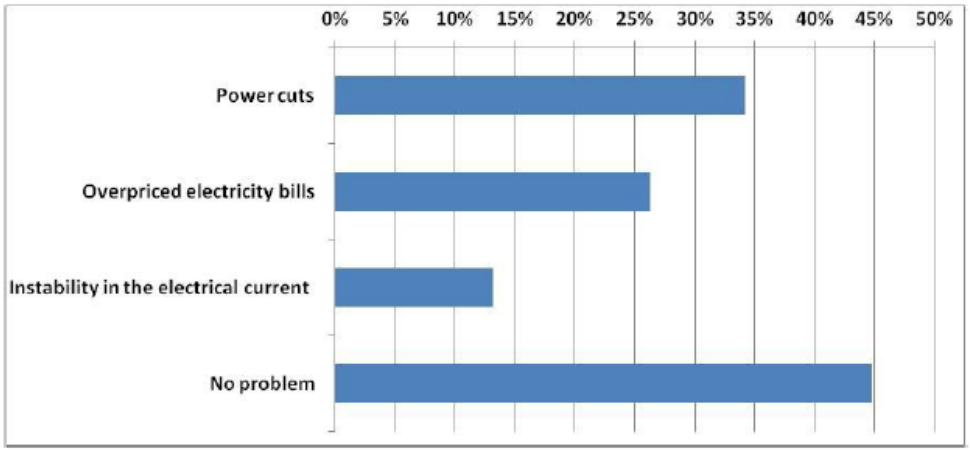

Figure 5-18 :% distribution of the sample by facing problems with electricity supply

Potable water

All interviewed household indicated that their houses have proper access to water supply. The households in the employees' Colony are supplied with drinking water from a treatment plant located within the premises of the Colony. They don't pay water consumption costs. Only 16% of the surveyed household do not face any problems with their water supply. The vast majority of the households (74%) considered their drinking water of average quality households indicated that the drinking water is of average quality while about 10% find it bad. These two groups encounter several problems, which are classified as shown below.

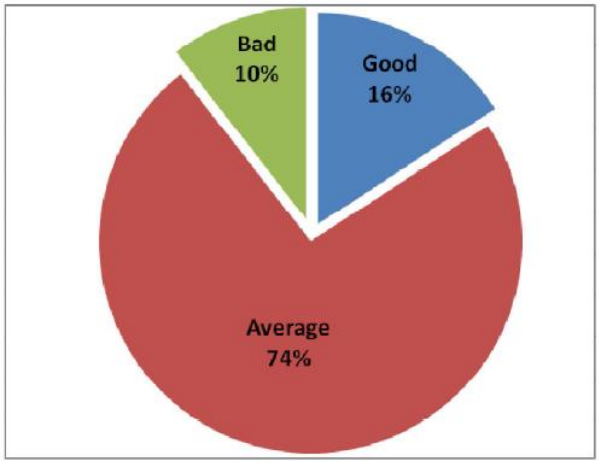

Figure 5-19 : % distribution of the sample by perception of potable water quality

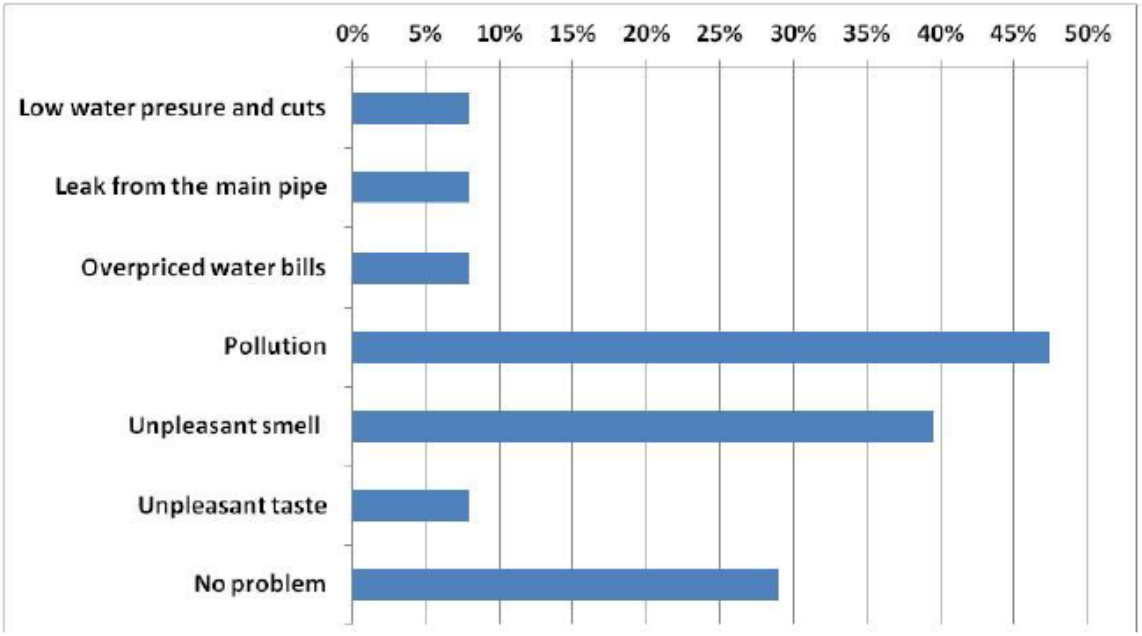

Figure 5-20:% distribution of the sample by problems associated to potable water

Almost half of the surveyed households stated that they think that the drinking water is contaminated. When they asked about how they determined that. The reasons were as follows:

1- The presence of particulates
2- They did a simple test like use medical cotton to filter water
3- They observe the residuals gathered in their domestic multistage water filters.
4- They suffer from illness, which attributed to contaminated water supply.

About 40% of the interviewed households stated that their drinking water smells bad. They attributed that to excessive usage of chlorination. Several households reported that their drinking water color is yellowish. They correlated that to the rust induced from the plumbing in their building. About 7.5% of the respondents considered the water bill overprice. This is, similarly to power supply, because of the recent utility subsidy reform policy. Similar percentages were calculated for the household who experience low pressure and instability in their drinking water supply.

Access to the sewage system

All household included in the survey have access to sewage network. They also have toilet facility that is linked to the sewage network. However, all households in the three sub-villages are connected to a local domestic network that was constructed by the

community people in the area. Those domestic networks are provided by pumping stations for disposal of the sanitary sewage. The households in the employees' Colony are connected to a sanitary sewage network constructed to serve the Colony. This service is provided for the houses in the Colony free of charge. People from this colony did not mention any problems associated with the sanitary sewage.

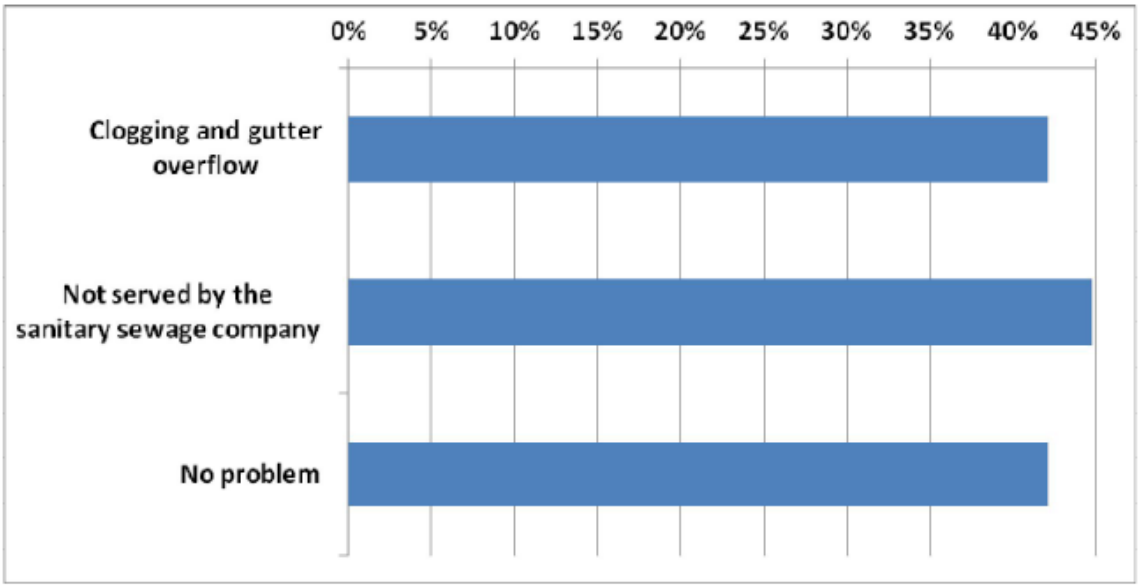

Figure 5-21: % distribution of the sample by problems associated to sanitary sewage

About 43% of the interviewed household stated that the sanitary sewage network in the area experience frequent clogging. That results in overflowing of the gutter and formation of sewage puddles. Such leakages might enter the gateways of adjacent buildings. Some households reported that such a problem could harmfully affect the foundations of the building especially that many of them are poorly constructed on agricultural land soils.

About 45% of the interviewed households indicated they have not only built the local network by initiatives from members of the community, they also provide the maintenance and repair required for the network. The sanitary sewage company does not provide any service to the area. Most of the people with such complaints are from the sub-villages of Zawyet Ghazal and El-Nawam Sa'ad.

Source of Energy

All households in the employees' Colony have access to natural gas. The installation and consumption costs are not incurred by the households. The interviewed households in the Colony indicated that this is a free service provide by the electricity plant.

Liquefied Gas cylinders are the main source of energy for cooking and other domestic activities (i.e. water heating) as indicated by all interviewed households in the three sub-villages. The households in the employees' Colony have not mentioned any problems related to energy supply. They were excluded from the analysis of the problems related to energy source as they have different energy supply system.

There were two major problems related to the supply of gas cylinders as mentioned by 61% of the households within the three sub-villages. First problems are related to cost of LPG cylinder. The second problem is related the intermittent supply of the cylinders. Most of these households are located in El-Nawam Sa'ad sub-village. All households in this sub-village complained about the price and supply issues related to gas cylinders. This problem is associated to the poor accessibility to the village as well as the poor road quality, which limit the number of vendors coming to the area. Therefore, they always seek for higher prices. The remaining 16% of the households stated that there are no problems associated to the gas cylinders supply.

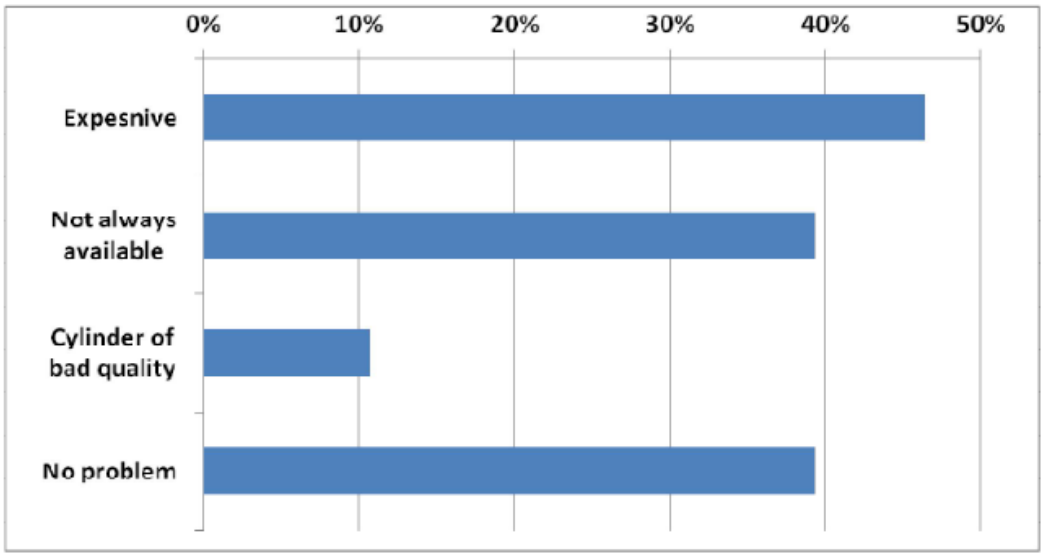

Figure 5-22: :% distribution of the sample by problems associated to energy sources in the three sub-villages

5.11.4.6. Health status

About 71% of the interviewed households had family member with chronic diseases or other illnesses that were diagnosed by a specialized physician. About 36% of the interviewed household had a family member with hypertension, while 32% have family member with diabetes. These are the two major diseases diagnosed in the area. They are followed by hepatic diseases, which mainly hepatitis C and hepatic fibrosis. The other diseases were mostly chronic in addition to the aforementioned three. Some of the mentioned diseases are heart diseases, cancer, systemic lupus erythematous, and recurring kidney stones.

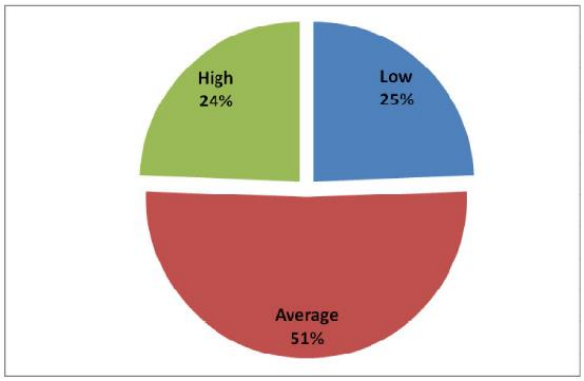

Figure 5-23: % distribution of the sample by severity of health problems

Respondents were asked about the severity of sick person's heath condition within their family members. Only 25% of the interviewed households have sick family member whose case is of low severity. The remaining households have cases that are either severe (24%) or average (51%).

The disease and its severity had a significant effect on the monthly healthcare cost of medical treatment, which included both the fees of healthcare provider and costs of medicines and other medical materials. The average monthly health care cost for the interviewed families is 276 EGP. People who work at the plant have health insurance that covers all their medical expenses. They comprise about 21% of the respondents.

The variation of the healthcare costs is also related to the health care provider. Most of the families (89%) included in the survey depend on private healthcare facility as their primary healthcare provider. Private healthcare providers are private clinics, polyclinics or hospitals. About 27% of the community people depend on the public hospitals especially in case of emergencies. Only 8% visit public health insurance facilities (hospitals or polyclinics).

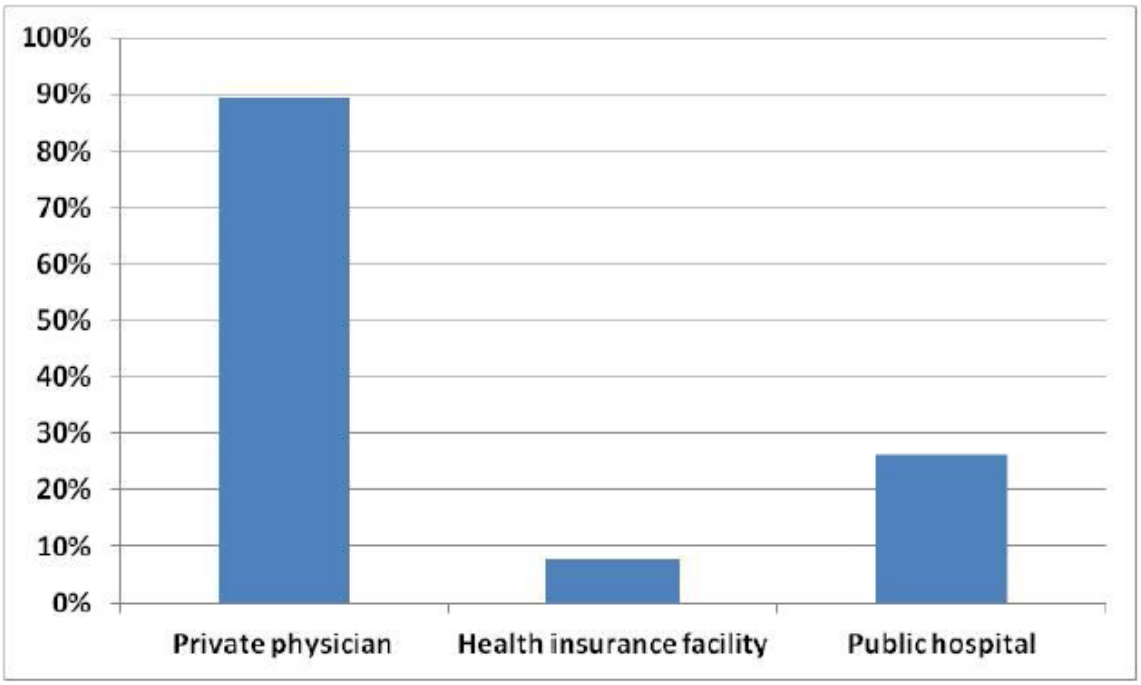

Figure 5-24: % distribution of the sample by healthcare provider

The reasons for high dependency on private health care facilities are attribute to poor governmental healthcare. According to the respondents' point of view, they had bad experience with public healthcare facilities. 45% of the interviewed families reported that they confronted problems with public health care. They summarized their problems with public health facility as follow:

1- Long waiting time,
2- being treated bad by the medical staff, and
3- low quality of provided and/or prescribed medicines.

The unavailability of public healthcare facility in the area or close to the area was considered a problem by about 40% of the households included in the survey. Most of the respondents with such a problem are found in El-Nawam Sa'ad sub village, whose inaccessibility and bad road conditions pauses serious problems especially in case of emergencies. About 8% of the respondents stated that one of their major healthcare issues is that they do not find the physician in the public hospitals when they visit them.

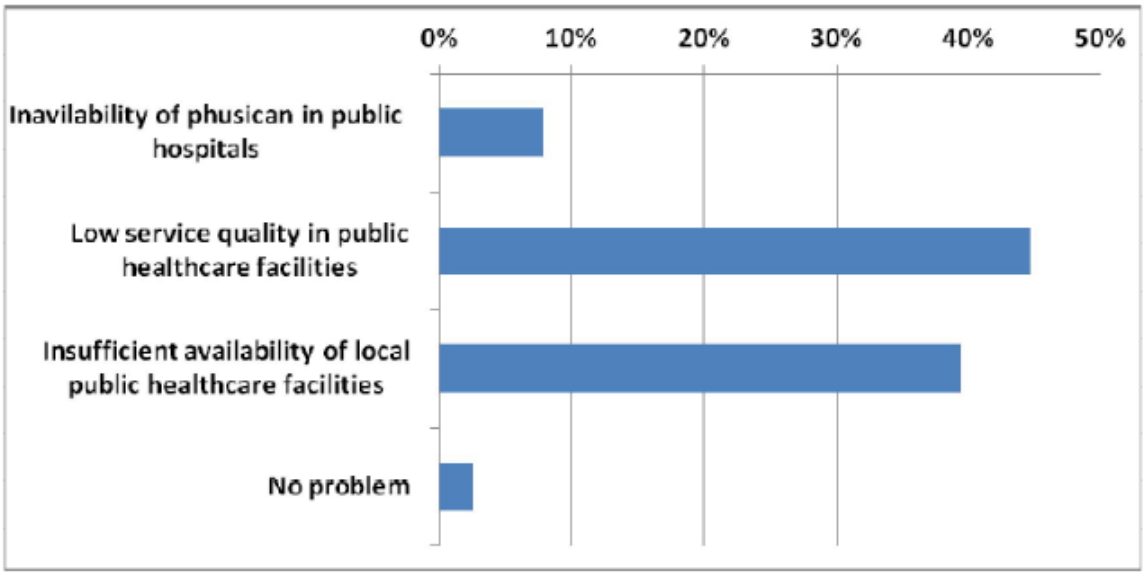

Figure 5-25: % distribution of the sample by problems with healthcare

5.11.4.7. Current impacts of Damanhour Power Plant

Aiming at identifying the project positive and adverse impacts, the study team targeted the interviewed sample with questions about the impact of the current power plant. The respondents shed light on both positive and negative impacts experienced with the current plant.

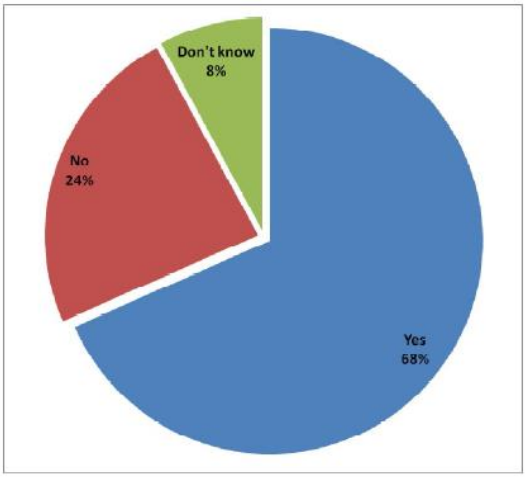

Figure 5-26: % distribution of sample surveyed by seeing positive impacts of the current plant

Positive impacts according to community perception

Most of the households (68%) reported that the project will result in positive impacts on the hosting communities. Yet, the households who do not find any positive impacts from the plant represent 24% of the surveyed households. The remaining 9% could not tell if the plant will result any positive impacts.

About half of the respondents indicated that the plant provide employment opportunity to the community people. The results show that this indication has similar distribution among the four areas included in this study with no prevalence from the households in the employees' Colony . The plant has 1175 employees. About 56% (660 employees) are from the neighboring villages and sub-villages (Damanhour Power Plant, personal communication). The second most frequent positive impact explained by the respondents is that the lights of the plant illuminate the neighboring areas, which has limited street lighting as a rural area. This impact was mostly expressed by the sub-villages of El-Nawam Sa'ad and Garboa'a that are the closest to the plant) to be affected by the lights of the plant.

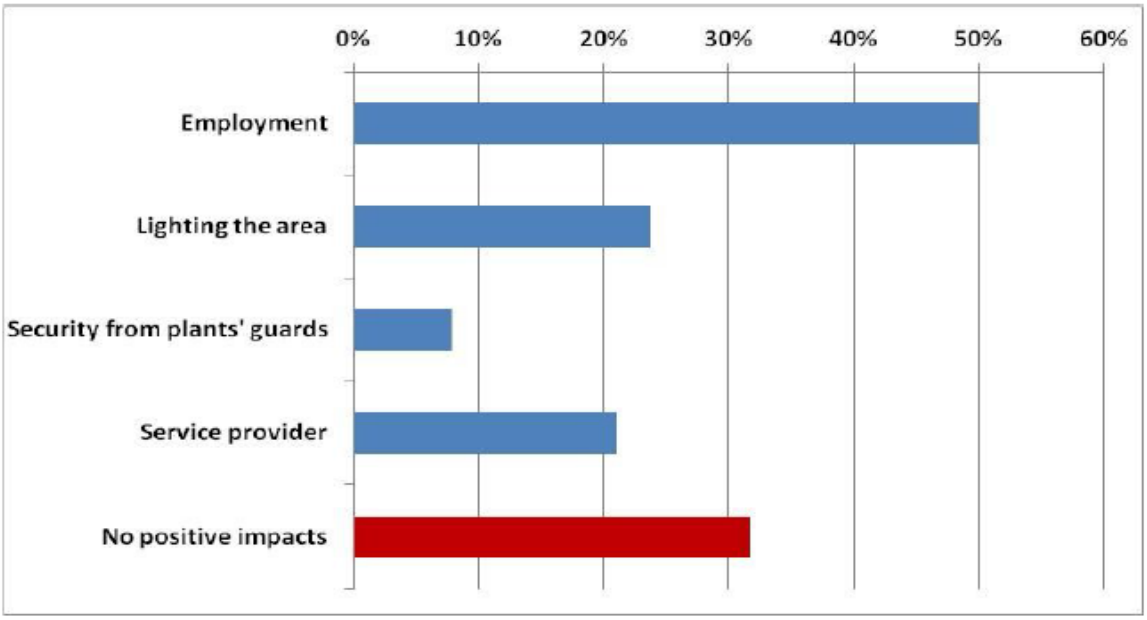

Figure 5-27: % Distribution of sample by their opinion regarding current positive impacts of Damanhour Power Plant

About 21% of the respondents reported that the plant will provide them with many services. This positive impact was expressed exclusively by the households in the employees' Colony. About 8% of the respondents expressed that the presence of plant's guard provide them with sense of security especially during the recent turmoil periods in the country, which reduce the security in these areas. This impact was expressed only by respondents from El-Nawam Sa'ad sub-village

Negative impacts according to community perception

Most of the household (71%) included in the interview stated that they might have negative impacts due to the project. The households who found no negative impacts represent 26% of the surveyed households, which are homogenously distributed among resplendent from the three sub-villages as well as the households from the employees' Colony.

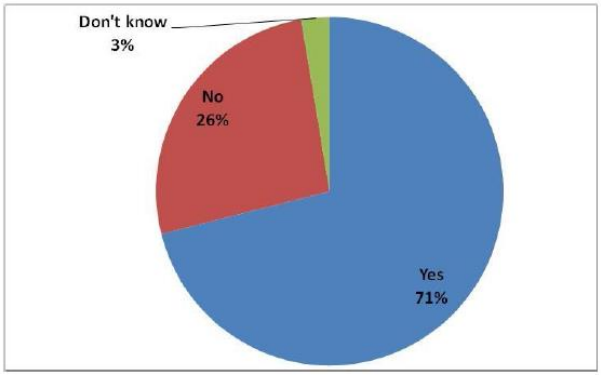

Figure 5-28: % distribution of sample surveyed by seeing negative impacts of the current plant

About 66% of the interviewed households emphasized the presence of frequent loud noises. These loud noises do not occur continuously but it might occur suddenly and continue for a while. Noise usually begins so suddenly and so loudly. Such noise terrifies community people especially during night.

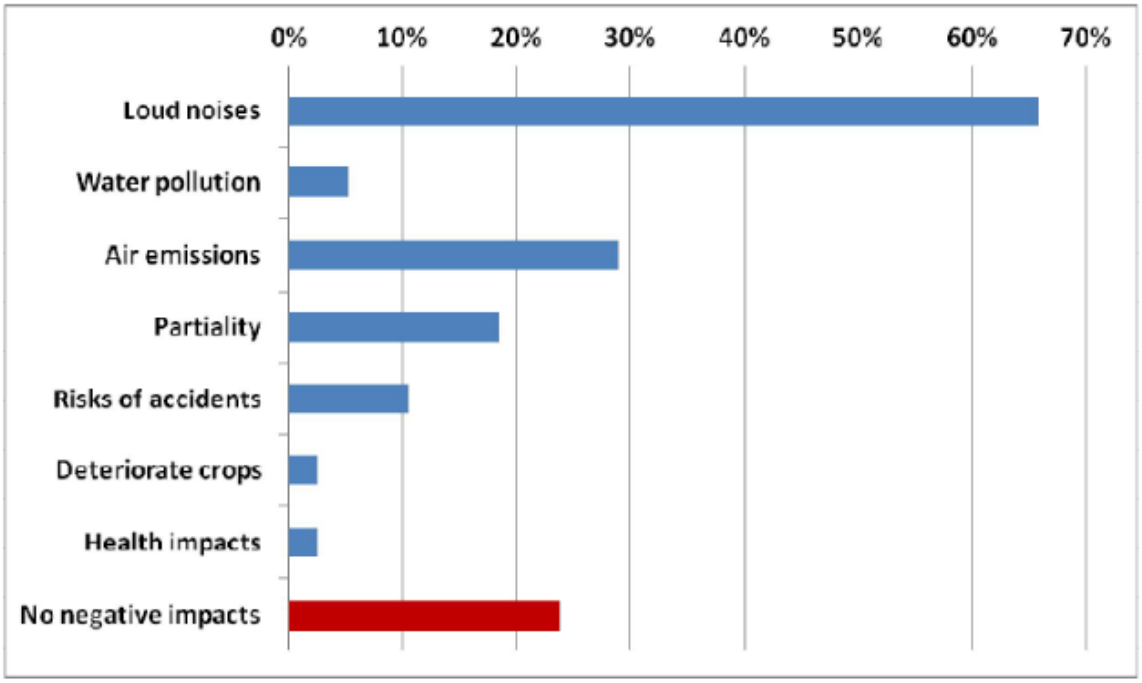

Figure 5-29: % Distribution of sample by their opinion regarding current positive impacts of Damanhour Power Plant

About 29% of the households witnessed smokes and suspended particulates coming out of the current Power Plant. It is usually accumulated on laundry hung out to dry and

covers the cloths with soot. The third most mentioned negative impact is partiality. It was expressed by about 18% of the total respondents. The respondents claimed that the plant does not provide equal opportunities when hiring employees. Although, it is more comment than an impact, the interviewed households insisted that it is a negative impact. They said the plant should hire more from their areas as they are the most affected. This is not quite in accordance with the fact that about 56% of the employees are from these areas. However, the high unemployment rate in these areas and the known fact that the plant employees have good salaries made most of the people in the area more willing to work in the plant.

Interaction between the plant and the local communities

Only 2.6% of the interviewed households in the three sub-villages indicated having services provided by the plant to the local communities. These services are limited to two schools located inside the employees' Colony that accept enrolling students from the neighboring areas. The households from the employees' Colony indicated that the plant provides several services such as:

- A bakery and a supermarket
- Utilities and infrastructure: natural gas, electricity, drinking water treatment plant and sanitary sewage treatment plant.
- There are two basic education schools (primary and preparatory) built and maintained by plant
- There are shuttle buses that take the people living in the compound to and from downtown Damanhour
- The streets are maintained by the plant.

Only 16% of the interviewed household indicated that the plant provide information about its activities. The provided information is restricted to wall-posted employment advertisements. The respondents also mentioned that they usually know about the plant activities from their friends or relatives who work in the plant. However, the plant does not have any organized activities to inform the local communities about its activities.

5.12 Traffic Status

A traffic baseline and impact study was conducted by the "New Commercial Services" consultant team during December 2014 and January 2015. A traffic-classification survey was conducted on Monday 6th 2015 for 24 hours. Ahead of the field work a comprehensive study was carried out to identify the traffic characteristics, the roadway conditions and the land use around the power plant.

The plant is accessible from Cairo through the route Cairo / Alexandria agriculture road - Damanhour / Desouk road – Elbahr road to the site of the proposed project. There are two entrances to the site; the first accesses the power plant from the eastern side, through Elbahr road. It is recommended because it is free from obstacles. The second access from the north side is not recommended because of a bridge over Elmahmoudia canal which is always congested by carts and pedestrians, thus restricting the movement of heavy vehicles which would be required particularly during construction. Regarding the regional roads leading to the Power Plant there are two main roads, Elbahr road which is adjacent to Elmahmoudia Lake and Damanhour / Desouk road which leads to the Cairo / Alexandria agriculture Highway.
Concerning the national Roads connecting the Power Plant to the main ports in Egypt the following are relevant:

- The International Highway.
- Cairo / Alexandria agriculture Highway.
- Cairo / Suez Highway.
- Port said / Suez Highway.
-

Access to the power plant: There are two entrances to the site.
The first entrance (Eastern entrance) is branching from Elbahr road directly towards the eastern boundary of the project site. This entrance has no obstacles to obstruct trucks (see Figure 5-30). The second entrance branches from from Elbahr road directly towards the northern boundary of the project site. The entrance is adjacent to a bridge over ELmahmoudia Lake, heading to Zawyet Ghzal village. The bridge in most day hours is crowded with traffic - mostly tok toks, carts and pedestrians.

Figure 5-30:: Entrances to Damanhour Power Station

6 ENVIRONMENTAL AND SOCIAL IMPACTS OF THE PROJECT

Potential environmental and social impacts arising from the construction of NDPP were analyzed for the construction and operation phase of the project. This included both direct and indirect impacts and also addresses cumulative impacts. Environmental impacts include emissions and subsequent ambient air quality; soil and groundwater; soil; surface water and groundwater; flora and fauna of the site and its vicinity; the aquatic ecosystem of the adjacent canals; waste and waste disposal; noise and other nuisances; traffic; and social impacts

6.1 Air Quality

The previous chapter on baseline conditions presented the available information on ambient air quality. The purpose of this section is to present an estimate (projection) of the air quality impact the new station is likely to have. This includes all relevant parameters - particulate matter, carbon monoxide and carbon dioxide, oxides of nitrogen and sulphur dioxide. Because of the fuel used, and the high efficiency of the new units, relative emissions are generally lower than for the old units using heavy fuel oil. The following Table 6-1 presents emission calculations.

Table6-1: Projected emissions for NDPP

Units	**NDPP (for each unit)**	**NDPP (two units)**
Load in MWe	**900**	**1800**
Type of fuel	**Natural Gas**	
Relative Emissions by Giga Joule		
SO2 (g/GJ)	negligible	
NOx (g/GJ)	267	
Total Annual Emissions		
SO2 annual total, million tons	negligible	negligible
NOx annual total, million tons	0.0064	0.0128
Relative Emissions per kWh		
SO2 (g/kWh)	negligible	
NOx (g/kWh)	3.2E-5	

According to these calculations, the total emissions from the New Damanhour Power Plant for SO_2 are negligible; and for NO_x are 0.0128 million tons. The NOx emissions will be in line with BAT requirements and the modeling of air quality indicates that NOx emissions will not result in the lowering of air quality in the area.

Data for CO2 are presented in the following Table 6-2. For CO_2 emissions, the relative emissions from the New Damanhour Power Plant are 56.1 kg/GJ. The total annual CO_2 emissions are estimated to be approximately 2.055million tons from one module and approximately 4.11 million tons from the two modules.

Table6-2: Projected carbon dioxide emissions from the New Damanhour Power Plant

Units	**NDPP (for each unit)**	**NDPP (two units)**
Load in MWe	**900**	**1800**
Type of fuel	**Natural Gas**	
Relative Emissions by Giga Joule		
CO_2 (kg/GJ)	**56.1**	
Total Annual Emissions		
CO_2 annual total, million tons	**2.055**	**4.11**
Relative Emissions per kWh		
CO_2 (t/MWh)	**0.35**	

To predict likely impacts from the NDPP, dispersion modelling was carried out for CO and NOx emissions from the new power plant. Dispersion models were conducted by the Air Pollution Lab team using Hybrid Single-Particle Lagrangian Integrated Trajectory — (HYSPLIT) Model. Air Resources Lab (ARL)'s HYSPLIT model is a highly-valued tool that helps explain the transport, dispersal, and deposition of chemicals and harmful material. HYSPLIT is used to track and forecast the release of radioactive material, volcanic ash, wildfire smoke, and pollutants from various emission sources. The strength of the dispersion modelling is the broad and effective transition from research to applications.

Through this study, dispersion models were conducted for carbon monoxide, nitrogen dioxide and sulphur dioxide concentrations which result from the current operations of Damanhour Power Plant.

The following Figures present the results for carbon monoxide and nitrogen dioxide dispersion for the four seasons.

Dispersion Models for projected Carbon Monoxide emissions

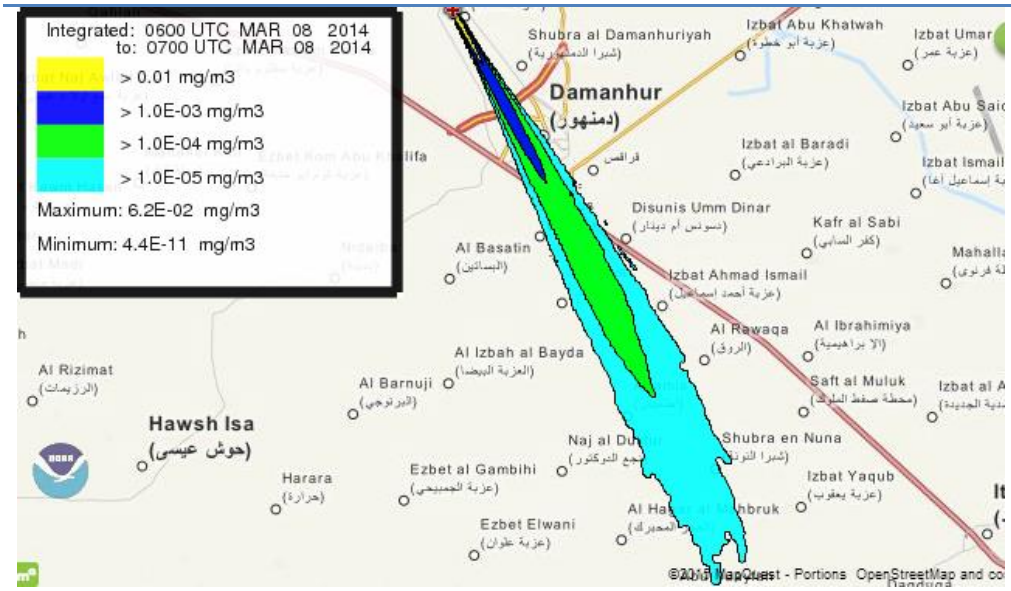

Figure 6-1: *Dispersion model of Carbon monoxide emission from Damanhour power plant during winter*

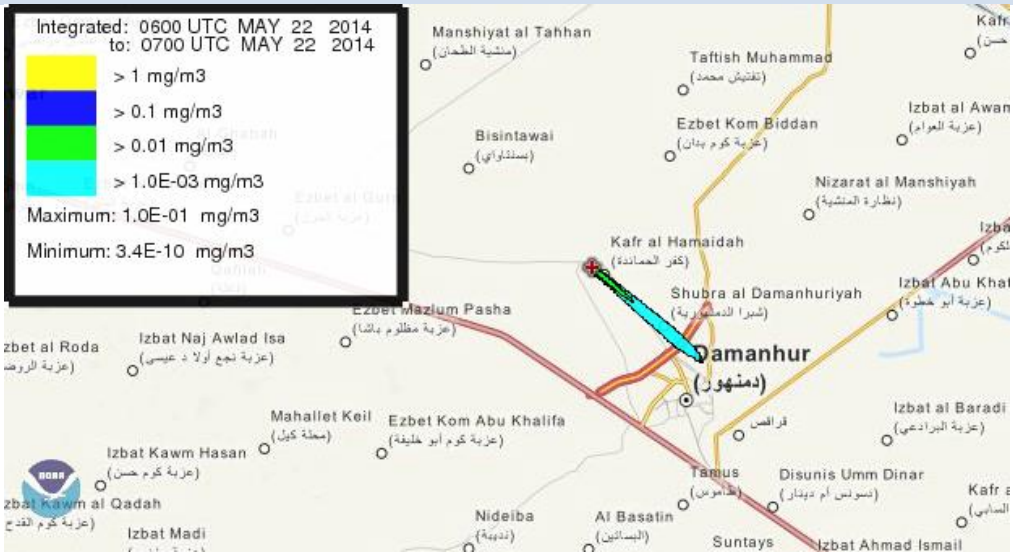

Figure 6-2: Dispersion model of Carbon monoxide emission from Damanhour power plant during spring

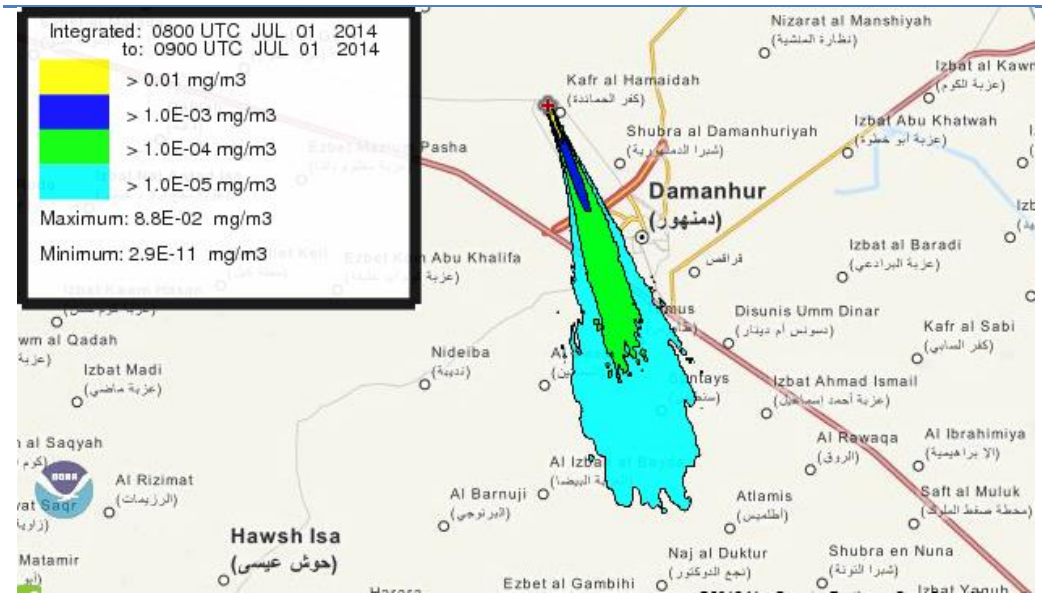

Figure 6-3: Dispersion model of Carbon monoxide emission from Damanhour power plant during summer

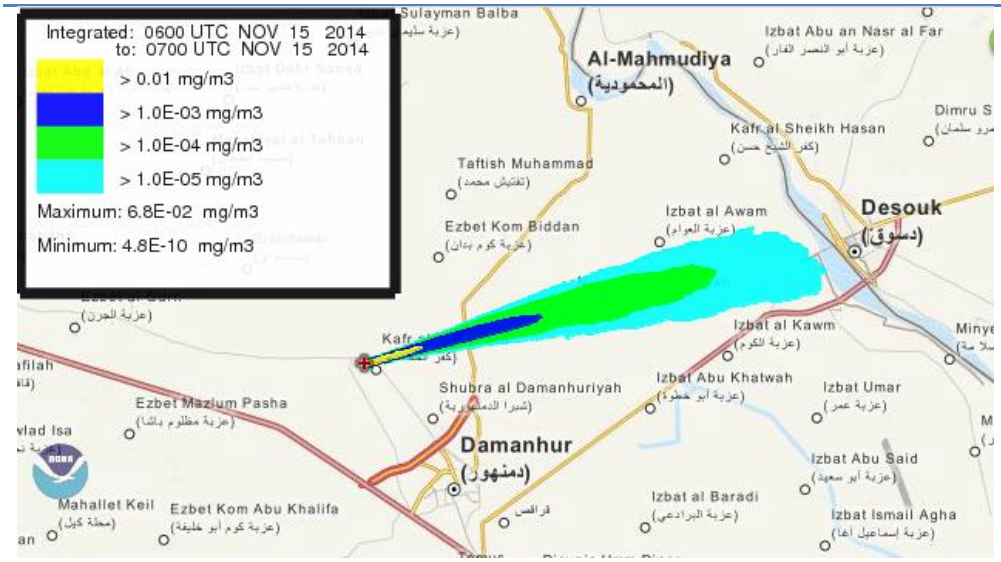

Figure 6-4: Dispersion model of Carbon monoxide emission from Damanhour power plant during autumn

The highest concentration range of **carbon monoxide** is (> 0.01 mg/m^3) and appears in the dispersion models of all the four seasons. It extends to a distance of approximately 1 km downwind the plant. This concentration represents an addition to the baseline air

quality by 0.03-0.3% of the AQL (30 mg/m^3). While the lowest projected concentration range (> $1*10^{-5}$ mg/m^3) appears in summer, autumn and winter. The highest dispersion distance for carbon monoxide is about 26 km projected during the winter with wind speed of 20-25 km/hr., while the least distance is about 6 km during the spring with wind speed of 10-15 km/hr.

Dispersion of the projected Nitrogen Dioxide emissions

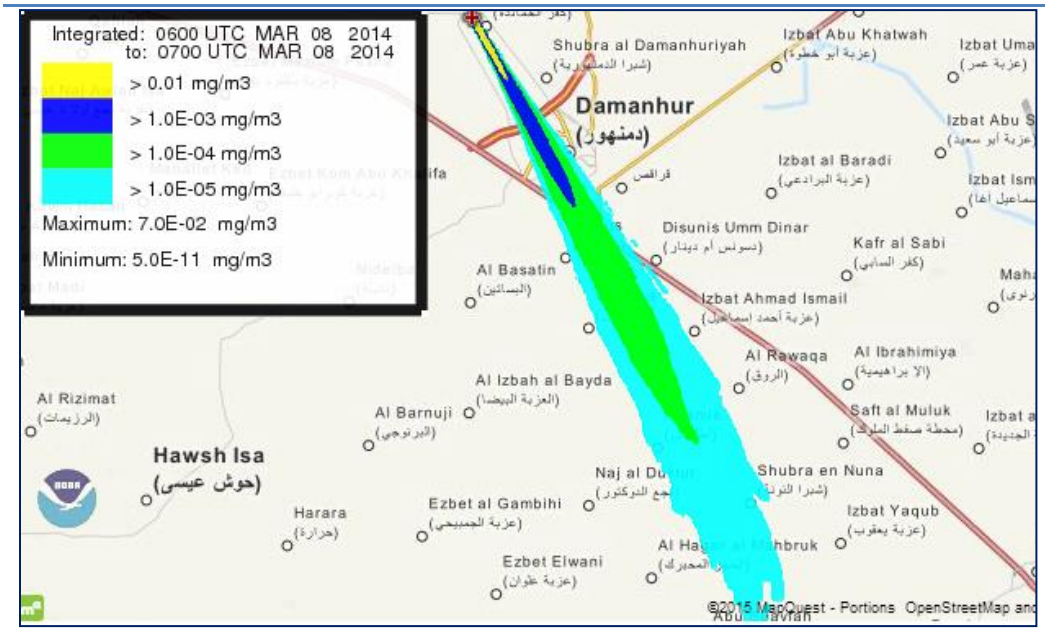

Figure 6-5: Dispersion model of Nitrogen Dioxide emission from Damanhour power plant during winter

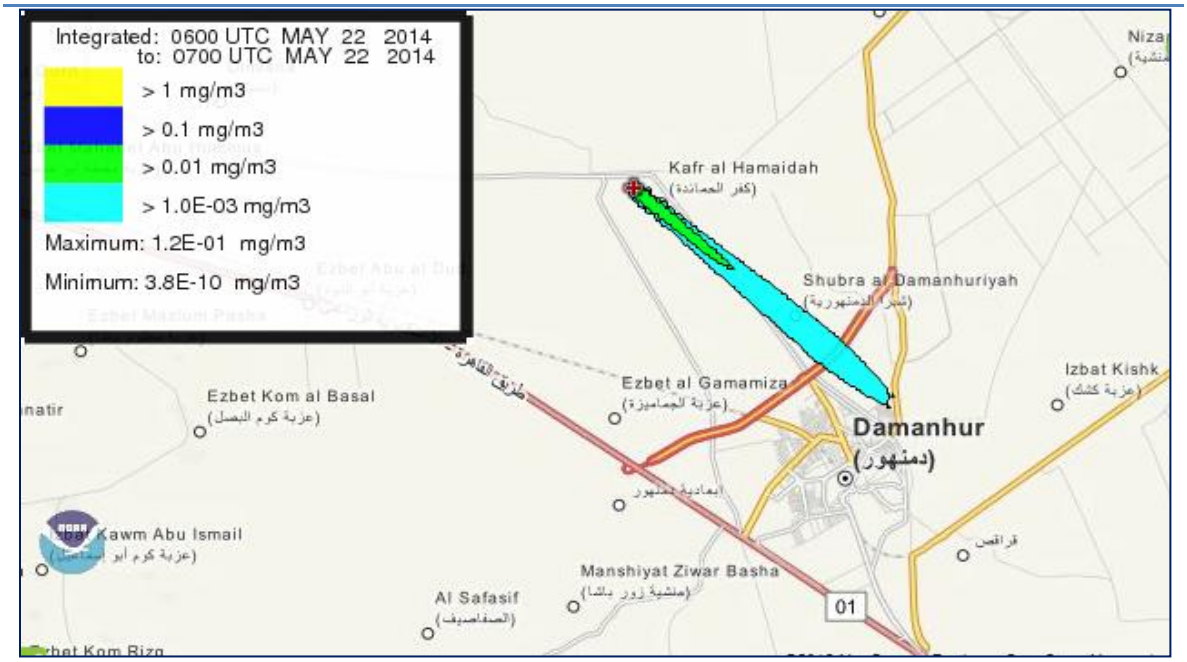

Figure 6-6: Dispersion model of Nitrogen Dioxide emission from Damanhour power plant during spring

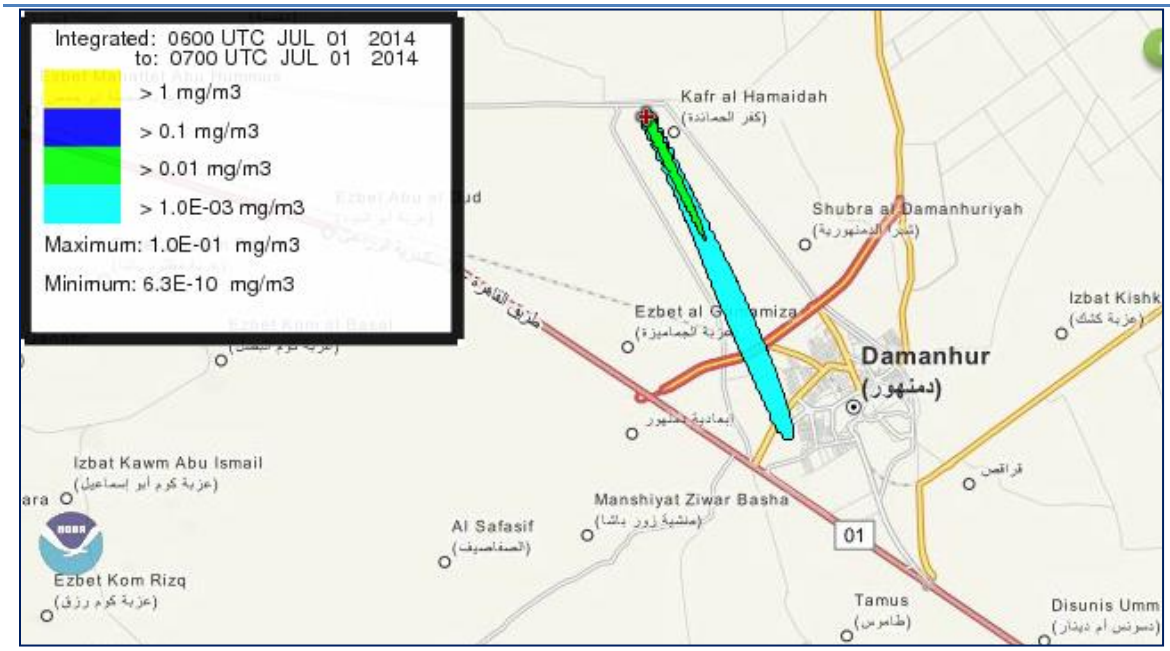

Figure 6-7: Dispersion model of Nitrogen Dioxide emission from Damanhour power plant during summer

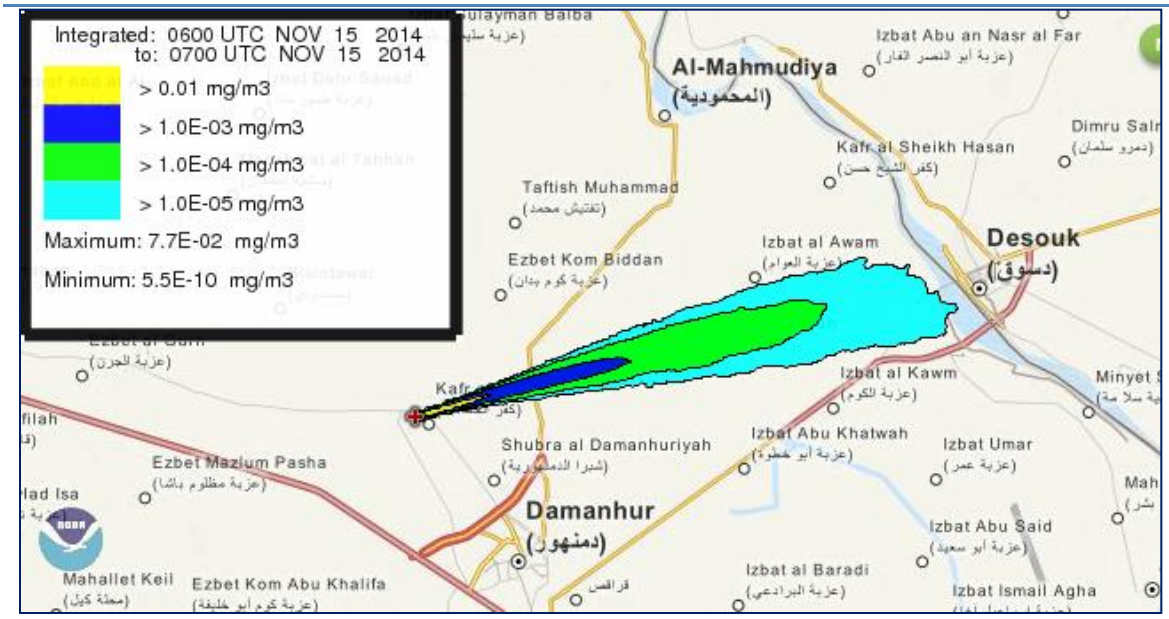

Figure 6-8: Dispersion model of Nitrogen Dioxide emission from Damanhour power plant during autumn

The highest concentration range of **nitrogen dioxide** is (> 0.01 mg/m^3 = 10 µg/m^3) and appears in the dispersion models of all the four seasons. It extends to a distance of approximately 1 km downwind of the plant. This concentration represents an addition to the baseline air quality by 3.3-33% of the AQL (300 µg/m^3). The lowest projected concentration range (> $1*10^{-5}$ mg/m^3) appears in summer, autumn and winter. The highest dispersion distance for nitrogen dioxide is about 26 km projected during the winter with wind speeds of 20-25 km/hr., while the least distance is about 6 km during the spring with wind speeds of 10-15 km/hr.

According to the dispersion model results and the role the meteorological parameters play through the dispersion process of pollutants, the highest projected concentrations of carbon monoxide and nitrogen dioxide (> 0.01 and 0.01 mg/m^3 respectively) for each one of the two combined cycle modules. Thus the two modules together would add to the baseline air quality 0.06 - 0.6% of carbon monoxide AQL (30 mg/m^3 per hour in urban and industrial areas) and 6.6 - 66% of nitrogen dioxide AQL (300 µg/m^3 per hour in urban and industrial areas). Carbon dioxide total annual emissions from the new Damanhour power plant are projected to be higher than these of the old plant (3x65 MW), but relative emissions per kilowatt hour (kWh) are lower.

The following **Table6-3** summarizes emission levels and total emission loads.

Units	Damanhour Project (NDPP)
SO_2 ppm	0
CO ppm	0.792
No_x ppm	15.84
CO_2 %	6.7
Gas flow rate t/h	699.84
Load M.W	900

6.2 Noise

The noise baseline measurements showed that some areas near the Damanhour Power Plant are exposed to noise levels above the permissible limits (65 dB during daytime and 55 dB during night-time).

During demolition and construction and pre-construction activities, noise is likely to occur due to use of heavy machinery and due to heavy traffic. The precise impact cannot be predicted. However, non-compliance with legal limit can be mitigated by appropriate measures such as avoidance of noisy activities during night time and construction of noise barriers. Equipment will need to be in compliance with national law to limit noise on-site to 85-dB at one-meter distance from noise generating equipment, and to limit noise exposure off-site to 65-dB during daytime and 55-dB during night-time at the plant boundaries.

6.3 Water Quality

According to the water quality baseline measurements the general water quality was acceptable, i.e. generally not exceeding the limits of the Egyptian law, except for high levels of nitrogen and fecal matter, attributed to fertilizers and to sewage discharges.

The use of the canal water for condenser cooling leads to a slight increase in temperature in the receiving water body, in compliance with legal limits. The use of Air-Cooling Condenser (ACC) technology will avoid the use of cooling water for these new units, which will reduce thermal discharges.

6.4 Flora and Fauna - Biodiversity

The site is characterized by the absence of any rare or endangered species and, overall poor biodiversity.

Construction of the new power plant and subsequent operation will not have any significant impact on this poor biodiversity value of the Damanhour Power Plant site and its surrounding area.

6.5 Areas of Cultural and Historical Importance

There are no areas of cultural and historical importance near the project that could be affected by its activities.

6.6 Landscape and Visual Appearance

There will be no appreciable change to land use of the specific site for the NDPP. The overall appearance of the site will remain, with NDPP being the dominant visual factor in the area.

6.7 Accidental Risks

Industrial risks can occur due to the use of large quantities of gas and the presence of a gas supply system. This risk can be assessed using Aloha (Areal locations of hazards atmosphere, NOAA National Oceanic and Atmospheric Administration), an emergency response model, intended for rapid development by responders and for emergency planning. It incorporates source strength as well as Gaussian and heavy gas dispersion models. Model output is in both text and graphic form, and includes a "foot print" plot of the area downwind of a release where concentration may exceed user-set threshold levels. It can predict rates of chemical release from broken gas pipes, leaking tanks, and evaporating puddles, and can model the dispersion of both neutrally-buoyant and heavier than air gases.

The following scenarios simulate potential accidents resulting in the release of natural gas and denser than air hydrocarbon gases. Such accidents can occur due to seismic activity. However, the area is not considered to be in danger.

Scenario1: Flammable gas escaping from pipe (not burning)

Chemical data

Chemical Name: METHANE Molecular Weight: 16.04 g/mol
PAC-1: 2900 ppm PAC-2: 2900 ppm PAC-3: 17000 ppm
LEL: 50000 ppm UEL: 150000 ppm
Ambient Boiling Point: -161.5° C
Vapor Pressure at Ambient Temperature: greater than 1 atm
Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

Atmospheric information

assuming the time of accident at month 12, day 10, hour 3
Wind: 2.6 meters/second from 220° true at 10 meters
Ground Roughness: open country Cloud Cover: 5 tenths
Air Temperature: 12° C Stability Class: F
No Inversion Height Relative Humidity: 50%

Source Strength:

Flammable gas escaping from pipe (not burning)
Pipe Diameter: 30 centimeters Pipe Length: 70 meters
Unbroken end of the pipe is connected to an infinite source
Pipe Roughness: smooth Hole Area: 707 sq cm
Pipe Press: 2.5 atmospheres Pipe Temperature: 12° C
Release Duration: ALOHA limited the duration to 1 hour
Max Average Sustained Release Rate: 1,100 kilograms/min
averaged over a minute or more Total Amount Released: 66,171 kilograms

Threat Zone

Model Run: Gaussian
Red : 794 meters --- (17000 ppm = PAC-3)
Orange: 2.3 kilometers --- (2900 ppm = PAC-2)
Yellow: 2.3 kilometers --- (2900 ppm = PAC-1)

Threat Point:

Concentration Estimates at the point:
East: 0.5 kilometers North: 0.5 kilometers
Max Concentration:
Outdoor: 1,630 ppm
Indoor: 365 ppm

Concentration Estimates at the point

East: 1.5 kilometers North: 1.5 kilometers

Max Concentration:

Outdoor: 185 ppm Indoor: 31 ppm

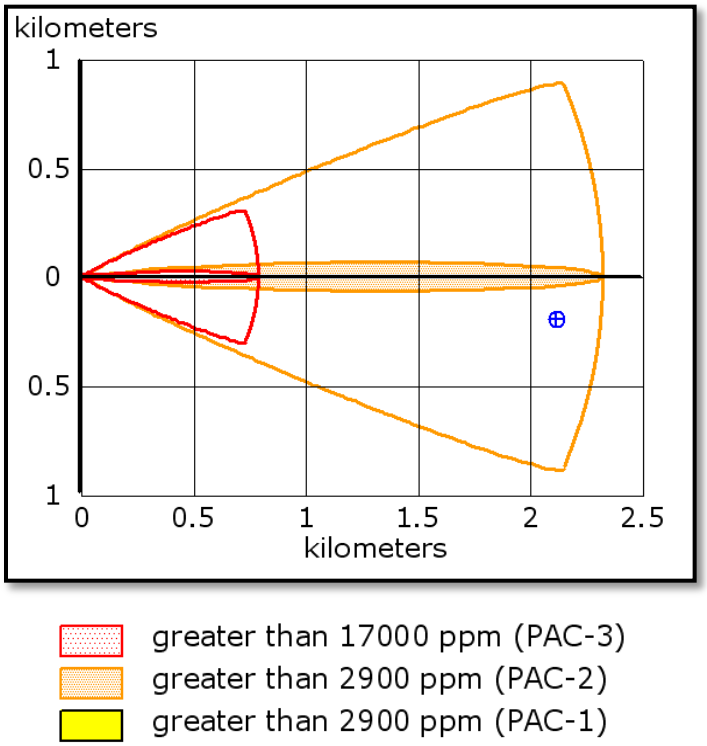

Figure 6-9: The Toxic Threat Zone-Flammable gas escaping from pipe (not burning

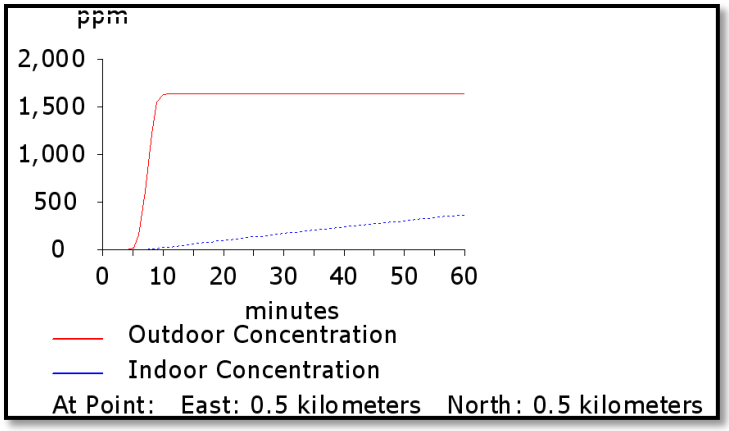

Figure 6-9: Concentration Estimates at the point

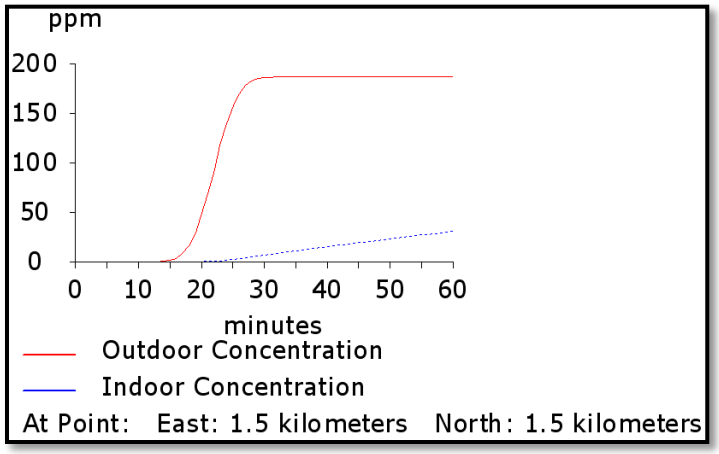

Figure 6-10: Concentration Estimates at the point

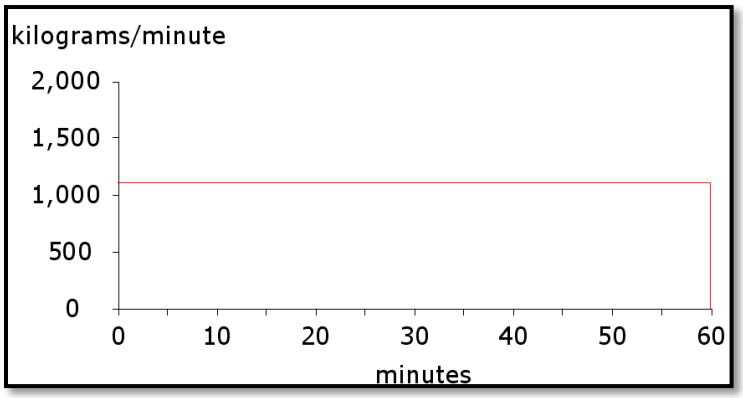

Figure 6-12: Source strength and release rate

Scenario 2: Flammable gas escaping from pipe (burning)

Site Data

Location: Damanhour, EGYPT

Building Air Exchanges Per Hour: 0.29 (unsheltered double storied)

Time: December 10, 2014 0320 hours ST (user specified)

Chemical data

Chemical Name: METHANE Molecular Weight: 16.04 g/mol

PAC-1: 2900 ppm PAC-2: 2900 ppm PAC-3: 17000 ppm

LEL: 50000 ppm UEL: 150000 ppm

Ambient Boiling Point: -161.5° C

Vapor Pressure at Ambient Temperature: greater than 1 atm

Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

Atmospheric information

Wind: 2.6 meters/second from 220° true at 10 meters
Ground Roughness: open country Cloud Cover: 5 tenths
Air Temperature: 12° C Stability Class: F
No Inversion Height Relative Humidity: 50%

Source Strength

Flammable gas is burning as it escapes from pipe
Pipe Diameter: 30 centimetres Pipe Length: 70 meters
Unbroken end of the pipe is connected to an infinite source
Pipe Roughness: smooth Hole Area: 707 sq cm
Pipe Press: 2.5 atmospheres Pipe Temperature: 12° C
Max Flame Length: 24 meters
Burn Duration: ALOHA limited the duration to 1 hour
Max Burn Rate: 1,120 kilograms/min
Total Amount Burned: 66,171 kilograms

Threat Zone:

Threat Modeled: Thermal radiation from jet fire
Red : 31 meters --- (10.0 kW/(sq m) = potentially lethal within 60 sec)
Orange: 48 meters --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)
Yellow: 77 meters --- (2.0 kW/(sq m) = pain within 60 sec)

Threat at point

Thermal Radiation Estimates at the point:
East: 1.5 kilometers North: 1.5 kilometers
Max Thermal Radiation: 0.00194 kW/(sq m)

Threat at point

Thermal Radiation Estimates at the point:
East: 0.5 kilometers North: 0.5 kilometers
Max Thermal Radiation: 0.0195 kW/(sq m)

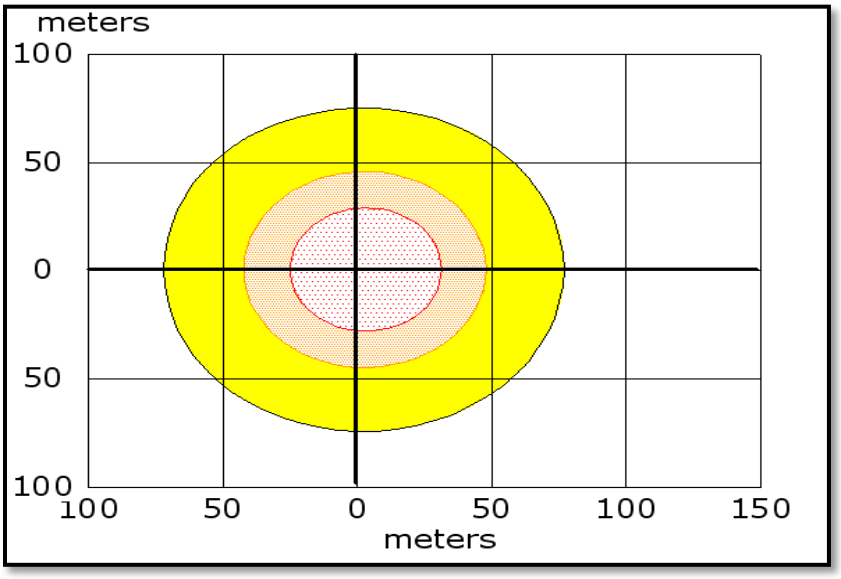

Figure 6-13: The Toxic Threat Zone-Flammable gas escaping from pipe

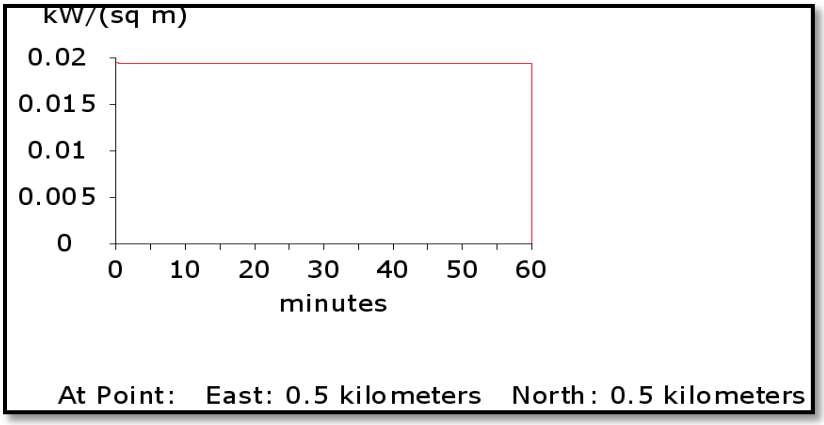

Figure 6-14:Thermal Radiation Estimates at the point (SENIRO 4)

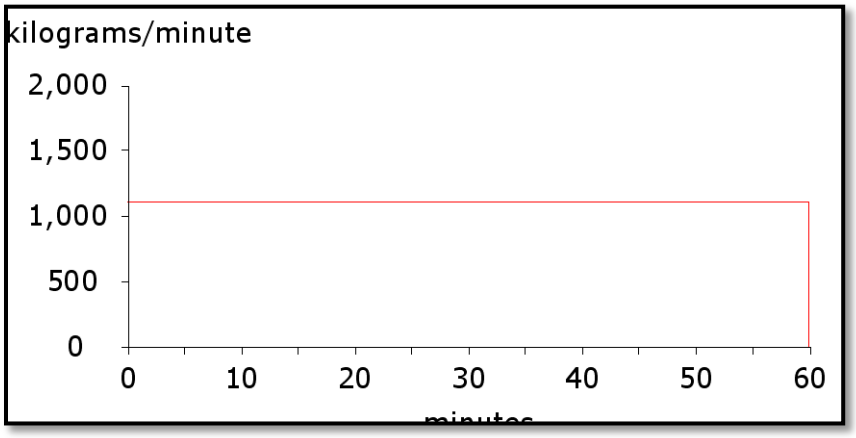

Figure 6-15:Source strength and release rate (SENIRO 4)

CONCLUSION

The risk associated with near range dispersions in both cases of normal operations or accidental releases is very low and does not constitute any significant risks to populations and/ or properties.

The risk associated with the very far field dispersion is also extremely low and does not constitute any significant risk.

Hence, the overall risks are very low and do not constitute any significant risks to adjacent population or workers. However, design and construction should take into consideration international regulations for quality assurance and quality control of construction and site codes for earthquake risks. Additionally, a detailed contingency plan is recommended, inclusive of training and equipment testing.

6.8 Socio-economic and Cultural Impacts

The following analysis of socioeconomic impacts relates to both the construction and operation phases. The impacts are separated, i.e. negative and positive ones. Additionally, the duration of impact needs to be considered, particularly regarding land use. This analysis relates to the new power plant but does not include the three associated projects (gas pipeline; HV lines).

6.8.1 Potential positive impacts

6.8.1.1 Positive impacts during the construction phase

Job creation: Project construction will add temporary job opportunities for technical and non-technical workers. West Delta Electricity Production Company states as a condition with the contractor that 90% of the labour must be of Egyptian nationality. Project construction provides about 1500-2000 temporary job vacancies during the construction period. The impact of job creation is therefore classified as major.

There will also be additional demand for transportation and provision of fast food in the project area.

6.8.1.2 Positive impacts during the operation phase

Job creation: 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 total number of permanent job opportunities, provided by the project during the operation phase, is 350. New employment represents 40% of the total, i.e. 140 job opportunities. Out of the 140 new employments, 20 jobs are high-skilled (14.3%), 100 jobs are semi-skilled (71.4%) and 20 jobs are low-skilled (14.3%).

Table 6-4: Summary of job opportunities to be created during the operation phase

Employment	**High-skilled**	**Semi-skilled**	**Low-skilled**	Total
New employment	20	100	20	140
Already WDEPC-employed	50	100	60	210
Total Number of Jobs	70	200	80	**350**

There are also benefits to the wider community through the provision of a secure electricity supply:

- Currently households are often not able to use electrical appliances due to the shortage of electricity supply. This is likely to change after the completion of the project. Consequently, the livelihood conditions will improve and residents will benefit from appropriate lighting, ventilation, refrigeration, and use of entertainment appliances.

- Women will be able to benefit from continuous electricity being available for laundry with electric washing machines which will lead to consuming less time for such chores.
- There will be less need for using alternative energy sources such as kerosene and consequently women will be less exposed to indoor fumes and fire risk.
- Additionally, most of the households in urban areas rely upon pumps for water supply. In case of electricity cut off, water supply also stops. Consequently, particularly apartments on the higher floors suffer due to the lack of water supply.
- Handicapped and old-age people will be able to use elevators
- Students will be able to study inside their homes at night. This will improve their educational performance. Similarly, improved electricity supply will also offer a better learning environment inside schools through using more advanced educational facilities

National income and GDP are likely to increase marginally. There will not be any appreciable change in the land price.

Better electricity supply is likely to attract investors for further projects creating jobs and income. The tourism sector is not affected by the construction activities and associated nuisances as the immediate area around the site is not touristic and construction impacts do not extend to a wider regional scale

Public health in the neighbouring areas will be improved due to reductions in air emissions and noise levels. Health conditions for on-site workers will improve; it is a commitment of the company that the workers comply with the appropriate PPE (Personal Protection Equipment) requirements and that they are well trained on safety issues and risks at their workplace and during emergencies. This will increase awareness of hazards and health and safety issues resulting in less work injuries. Furthermore, regular medical checks of workers are part of the commitment.

Land use is positively affected, as the enhanced electrical service in an area will flourish this area with commercial activities and a variety of community services. This leads the vacant and unused land resources to be rich in value and be invested in better ways.

The land price will be positively affected in areas that currently suffer from a shortage of power supply, and as a consequence increased commercial activities and

better communal services can be expected. In general, further local and foreign investments in the area are likely. This also includes the tourism sector.

6.8.2 Potential negative impacts

6.8.2.1 Negative impacts during the construction phase

Land use: There is no appreciable land use impact as the site for the new plant is within the (fenced-in) boundaries of the existing plant. Any impact can be classified as minor and no mitigation measures are needed.

Land use impacts could be significant for the OHTL connections and the gas supply pipeline, because of current activities within the RoW (e.g. agriculture and grazing). However, the limitation of construction activities to a narrow corridor could reduce such impacts. Any restrictions in land use will highlight the economic situation of the affected households which, in all probability, will not be able to find other land areas. Additionally, in case of increasing urbanization, areas within the ROW will not be available for construction.

Influx of workers and impact on village utilities: It is always anticipated that workers of any project will add a burden to community resources, especially bakeries and groceries. This impact is limited as the majority of workers will be from the district itself. Thus, this does not constitute a significant impact for this project.

Community health and safety: Accidents can occur when moving equipment and construction materials to the site. Additionally, community people might enter the site. However, this is very unlikely as the project area is fenced-in and as the project will follow strict traffic regulation. However, exhaust emissions, dust and smoke might have a significant impact on the community residents in the immediate vicinity of the project area.

6.8.2.2 Negative impacts during the operation phase

Influx of workers and impact on village utilities are two anticipated impacts. However, these are relatively limited as the majority of workers will be from the district itself. Thus, this is not significant.

Community health and safety: Once construction is completed no significant impacts are expected.

Conclusion

The overall impact of the project is positive, both on the socio-economic and cultural level.

Job opportunities will be generated to 1500-2000 persons during construction and 350 during operation.

The community standard of life and welfare will be improved due to the availability of electricity-based services, in individual houses and within the community as a whole. This includes lighting, use of any electric appliance in homes and work places, and also extends to better and more reliable public services. Essential needs such as production and delivery of drinking water to houses and apartments and subsequent waste water treatment will be more reliable.

Public health in the neighbouring areas will be improved due to reduction in air emissions (particularly SO2 and dust), leading to less cost for medication and treatment. Power plant workers will benefit from good working conditions, appropriate protective equipment and safety training.

The land price in areas with better electricity supply will also increase.

6.9 Traffic

Traffic on the access roads and roads close to the site (Elbahr, Damanhour-Desouk, The International Highway, Cairo-Alexandria Agricultural road, Cairo-Suez Highway and Port Said-Suez Highway) is expected to increase by about 5%m both during the construction phase and for the subsequent operation of NDPP.

6.10 Solid and Hazardous Waste

Site preparation, inclusive of the demolition of three large fuel oil tanks, will result in large volumes of materials which need to be disposed of. This includes non-hazardous solid waste such as soil from excavation for foundations, and hazardous materials from the oil tanks and supply pipes. These materials need to be disposed of in compliance with legal requirements. A detailed log of qualities; quantities; and disposal routes needs to be kept and contractors need to be checked for compliance.

6.11 Cumulative Impacts

Air Quality

The main air pollution sources in the area are the power plant and traffic on the nearby roads. The emissions of the New Damanhour Power Plant will be cumulative with those of the remaining units of the existing power station (notably the 300-MW unit) as well as emissions from local traffic.

Baseline measurements on-site and off-site the plant show that the relevant air pollutants are currently considerably below national air quality limits. The dispersion models for the projected emissions show that any additional concentrations from NDPP are very low. Thus the overall cumulative impact on air quality is acceptable and no significant negative impact is to be expected.

CO2 emissions, which have a global rather than a local or regional impact, will remain high but relative emissions (per kW of electricity produced) will be significantly lower for the new power plant when compared with the existing one.

Surface Water Quality

Regarding the physical quality of the canal water and its temperature, the project will use an air cooling system (hence no water use) and simultaneously the old plant (3x65) will cease operation. This will lead to a reduced demand for water, although the remaining two units (300-MW and 25-MW) will continue to use water for cooling. The net impact on the thermal discharges and subsequently water temperature at point of discharge is thus positive.

Noise

During construction, civil and installation works will be a major source of noise added to the existing operations and the noise from traffic.

The new project will be designed to comply with all legal requirements so that during operation noise levels will not exceed 85-db inside the workplace and 65 dB (during daytime) and 55-dB (during night-time) at the plant boundaries.

Traffic

Traffic impact will be cumulative with the normal traffic growth in the area. Overall, traffic is expected to increase by about 5%.

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6.12 Associated infrastructure Projects

There are three separate projects linked to the NDPP project. These are 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 a short overview of these three projects.

Associated Project: 14.5 km Grid Connection

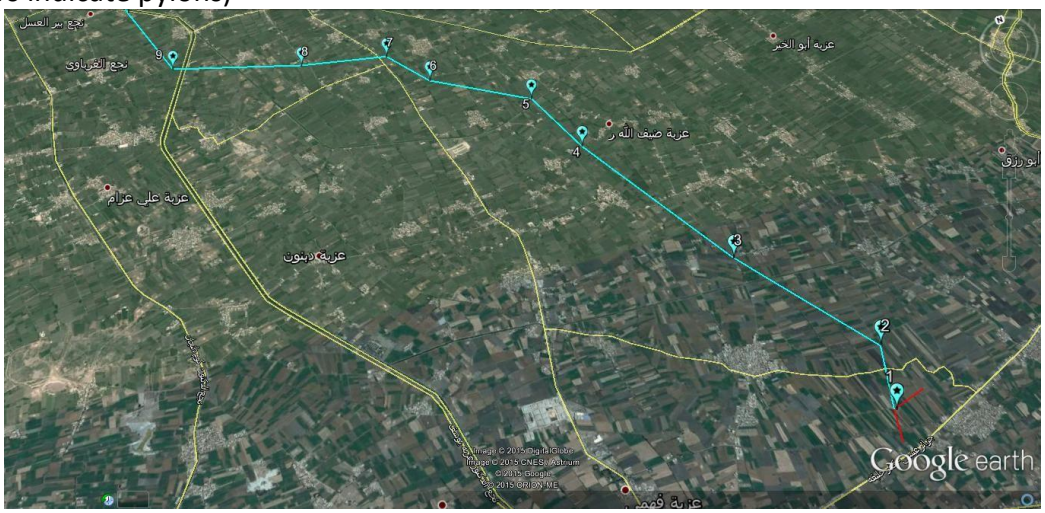
Company/Entity Responsible: Egyptian Electricity Transmission Company (EETC). This project is part of the Egyptian Power Transmission Project (EPTP) jointly funded by EIB, AFD, KfW and the EU.
Description: 500kVm OHTL In/Out connection from one circuit of the existing 500kV Kafr El-Zayat line. Total 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.

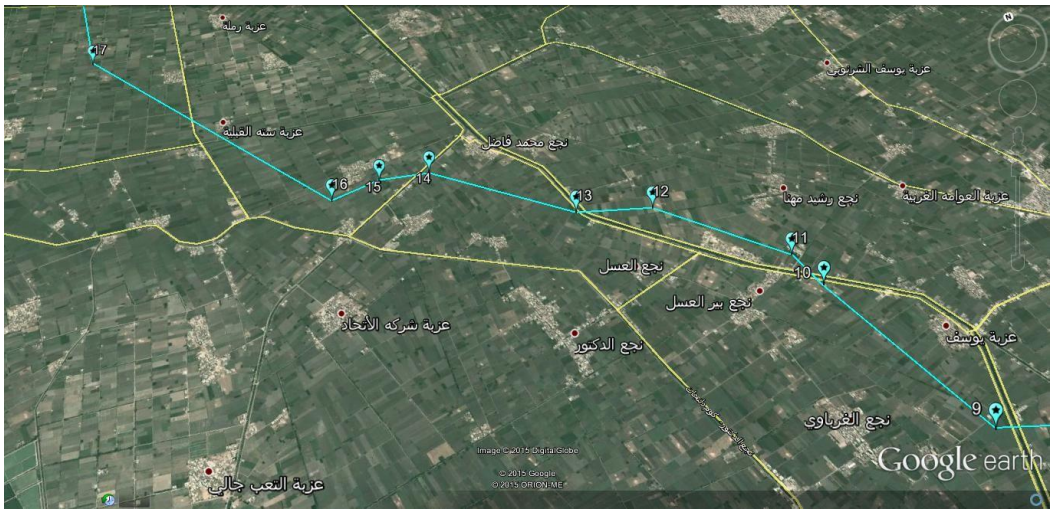
Social Impact: There will be very limited permanent loss of agricultural land (for pylon foundations) and loss of income due to construction impact on crops. The OHTL Right of Way (RoW; 25 meters either side from the center line) needs to be clear of trees and any structures but can be used for growing 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 6-16 and 6-17) show the proposed route near the power station (note the proximity of residential properties) and across agricultural land. The four maps (Figures 6-18 to 6-21) show the proposed route across agricultural land, avoiding settlements where possible. The markings and numbers indicate likely pylon locations.

Figures 6-16 and 6-17: 14.5 km HV line route near Damanhour power station

Figures 6-18 to 6-21; proposed route of the 14.5 km HV grid connection (markings and numbers indicate pylons)

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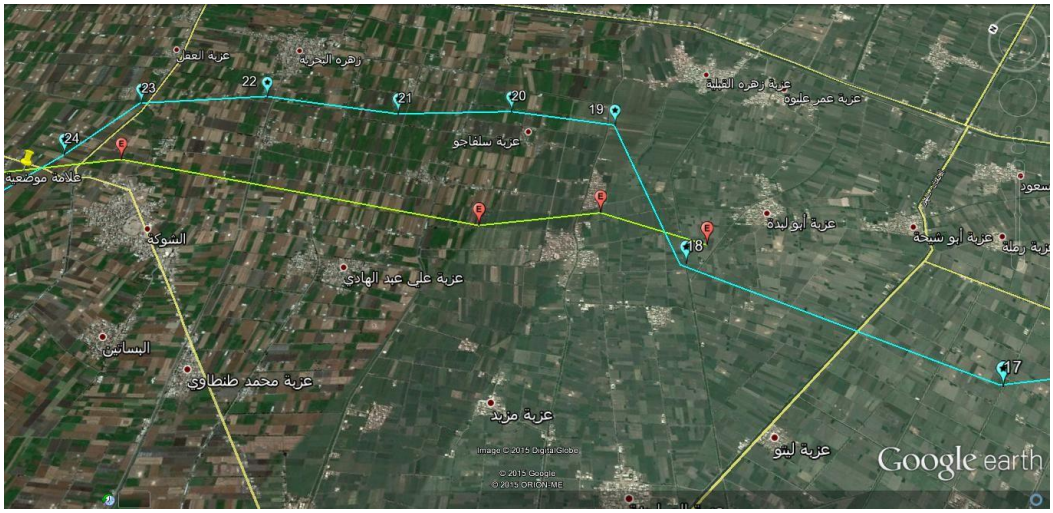
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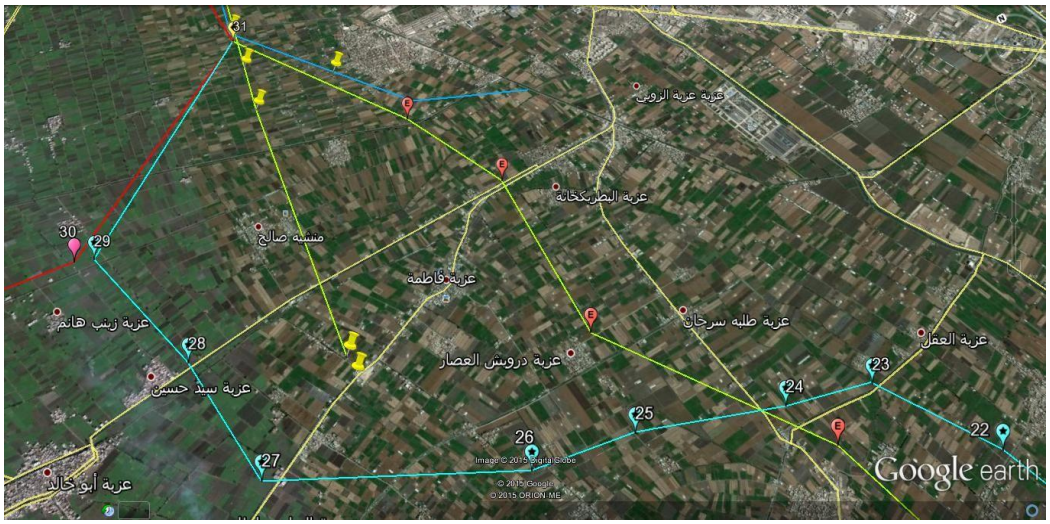
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Associated Project: 4 km Gas Supply Pipeline

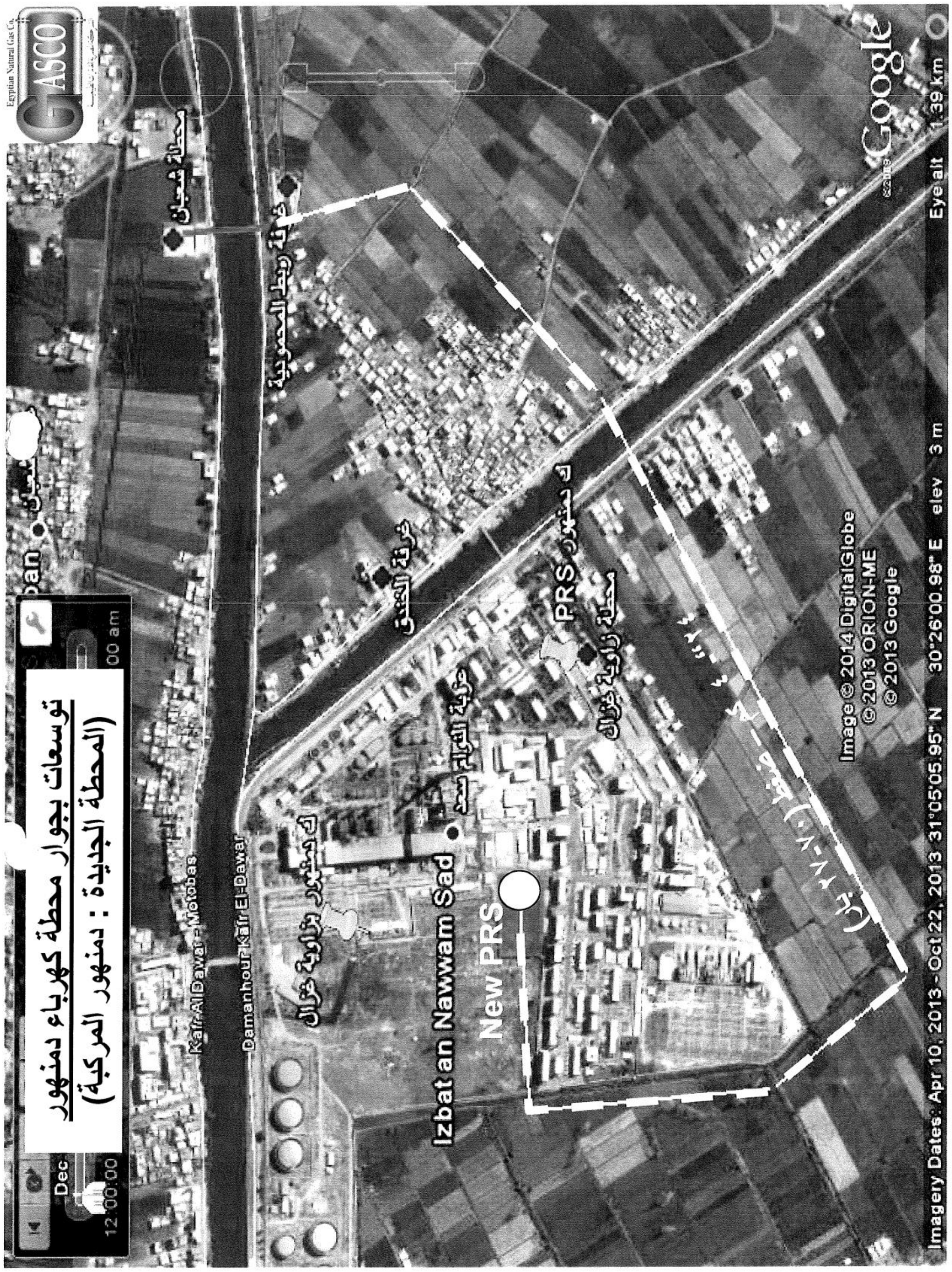
Company/Entity Responsible: GASCO. This is part of a package of 8 short gas supply pipelines (between 0.4 and 17 km) to be constructed under a World Bank loan.
Description: 24 inch diameter pipeline for gas transport; no pressure reduction stations (other than on the Damanhour Power Station Site).
Routing: 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.
No loss of valuable habitat or biodiversity.

The following photos (Figures 6-21 and 6-22) show the proposed route close to the power station and across a canal (note the proximity of residential properties).

Figures 6-21 and 6-22: Route of new gas supply pipeline between residential buildings and crossing a canal (see Figure 6-23 for the canal location)

The following map (Figure 6-23) shows that the routing is chosen to avoid housing areas as much as possible.

12|3|15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Izbat an Nawwam Sad
Damanhour Kafr El-Dawar
Kafr Al Dawar - Motobas
Image © 2014 DigitalGlobe
© 2013 ORION-ME
© 2013 Google
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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Additional 60 km Grid Connection

Company/Entity Responsible: Egyptian Electricity Transmission Company (EETC)

Description: 500kVm double-circuit, from NDPP 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

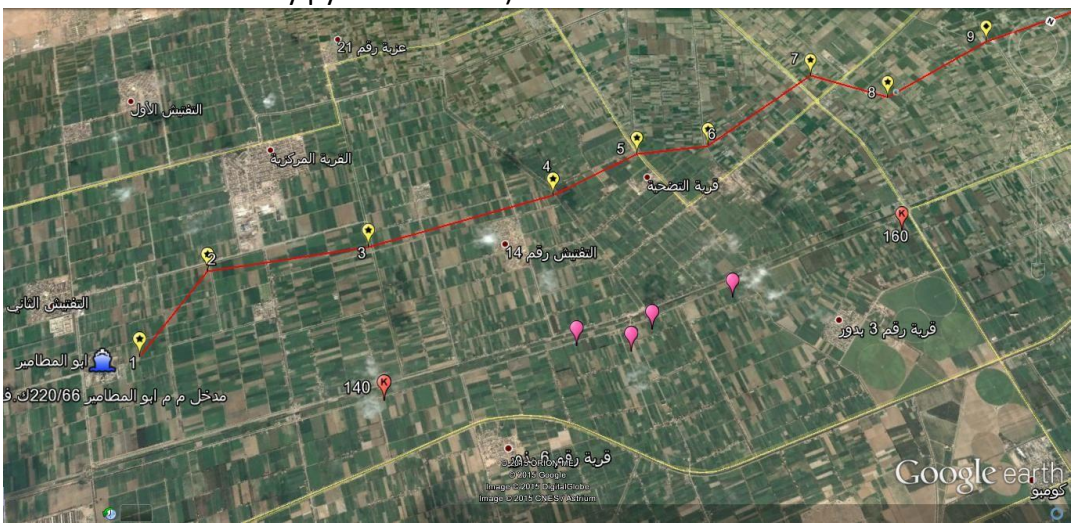
Environmental Impact: As this is agricultural land no loss of valuable habitat or any significant impact on biodiversity is to be expected.

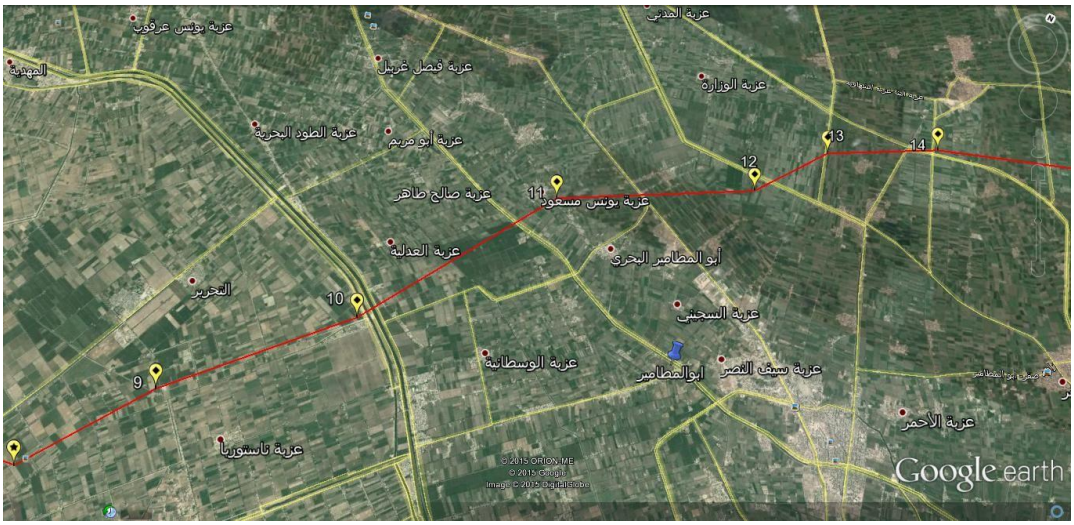
Social Impact: The line will in places be close to residential areas (e.g. where it connects to Damanhour power station). There will be very limited permanent loss of agricultural land (for pylon foundations) and loss of income due to construction impact on crops. The OHTL Right of Way (RoW; 25 meters 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 impact, temporary access roads and equipment storage areas will need to be restricted; the same applies to a site office and labourer camps.

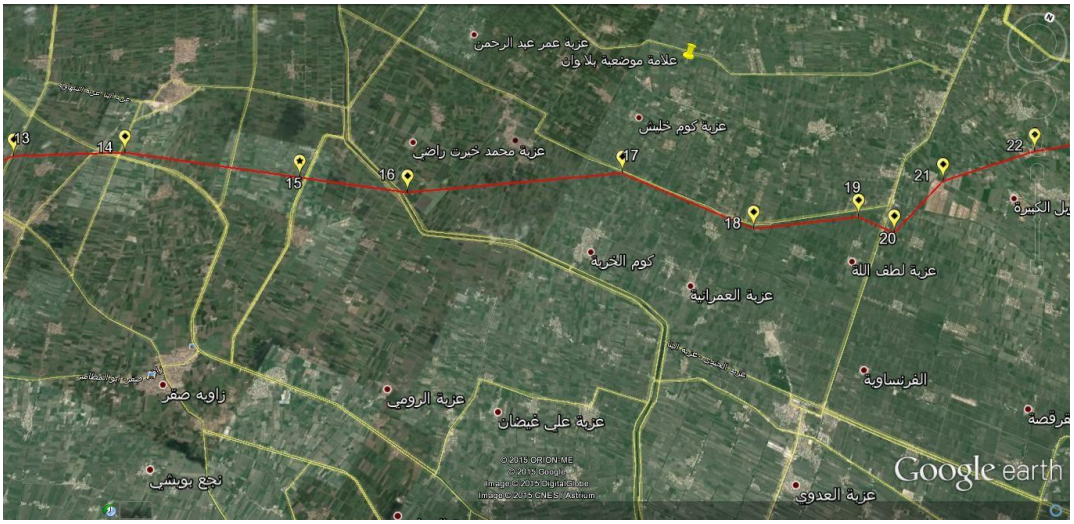
The following photo (Figure 6-24) shows the proposed route across a canal near the power station (note the proximity of residential properties). The six maps (Figures 6-25 to 6-30) show the proposed route across agricultural land, avoiding settlements where possible.

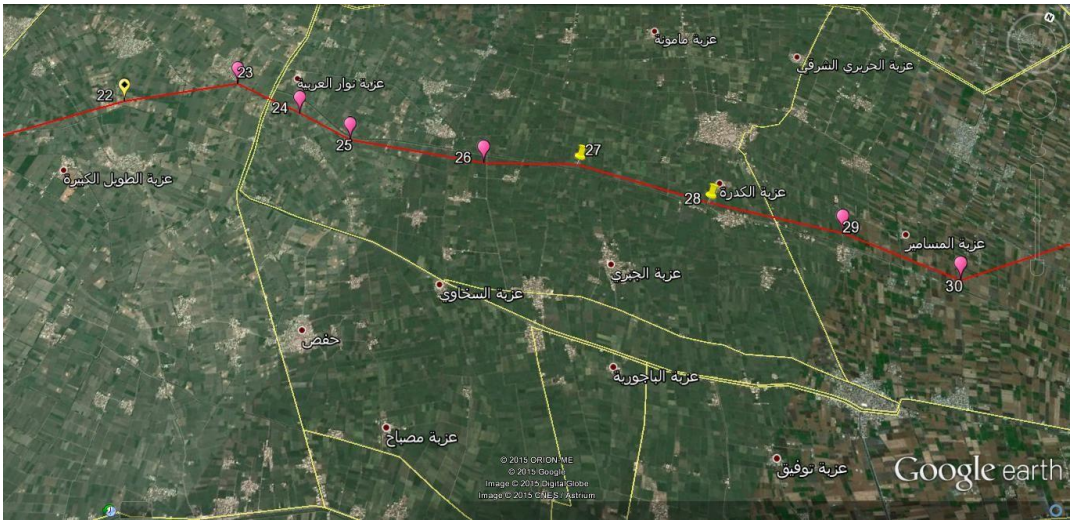
Figure 6-24: View of 60 km route near Damanhour power plant

Figures 6-25 to 6-30; proposed route of the 60 km HV grid connection (markings and numbers indicate likely pylon locations)





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6.13 Impacts Summary

A summary of impacts of NDPP construction and operation is provided below. It identifies impacts, assesses the extent and characteristics of this impact, and then assigns an impact rating. This is done for the demolition/construction phase and separately for the operational phase.

The following table defines the criteria used and Figure 6-16 presents the results of this impact analysis.

Table6-5: the criteria used to analyze the impacts

Aspect	Definition
Direct, Indirect	**Direct:** caused by the project and occur simultaneously with project activities. **Indirect:** associated with the project and may occur at a later time or wider area.
Extent	**On-site:** within the plant boundaries. **Local:** the surrounding area off-site the project. **Regional:** larger scale of impacts.
Magnitude	**Insignificant:** no or negligible change from status quo. **Minor:** slight change from status quo. **Moderate:** considerable change from status quo. **Major:** significant change from status quo.
Permanence	**Temporary:** bounded to temporary activities. **Permanent:** continuous with the continuity of activities.
Reversibility	**Reversible:** change can be eliminated. **Irreversible:** change cannot be eliminated.
Cumulativeness	**Cumulative:** combined effects of the project with other activities as well as synergic effects. **Non-cumulative:** single source effect from the project.

Aspect	Definition
Overall significance	**Major negative:** significant damage or violating standards to the component. **Minor negative:** slight damage or levels of pollutants are within the permissible limits. **Neutral:** no or negligible impact. **Minor positive:** slight benefit/ improvement to the components. **Major positive:** significant benefit/ improvement to the component.
N/A	Not applicable, or unknown.

Table6-6 : Impact Analysis Matrix

Phase	Component	Impact	Direct/ Indirect	Importance/ Extent (On-site/ Local/ Regional)	Magnitude (Insignificant/ Minor/ Moderate/ Major)	Permanence (Temporary/ Permanent)	Reversibility (Reversible/ Irreversible)	Cumulativeness (Cumulative/ Non-cumulative)	Overall Significance (Major/ Minor/ Neutral), (Negative/ Positive)
Construction and Pre-construction	**1. <u>Environmental Impacts</u>**								
	Air Quality	Particulate matter and gas emissions due to civil works of clearance and construction activities.	Direct	Local	Moderate	Temporary	Reversible	Cumulative	Minor, Negative
	Water Quality	Contribution to the total wastewater discharged. Areal depositions of pollutants.	Direct, indirect	Local	Insignificant	N/A	N/A	N/A	Neutral

Phase	Component	Impact	Direct/ Indirect	Importance/ Extent (On-site/ Local/ Regional)	Magnitude (Insignificant/ Minor/ Moderate/ Major)	Permanence (Temporary/ Permanent)	Reversibility (Reversible/ Irreversible)	Cumulativeness (Cumulative/ Non-cumulative)	Overall Significance (Major/ Minor/ Neutral), (Negative/ Positive)
	Soil Quality	No impact.	N/A	N/A	N/A	N/A	N/A	N/A	Neutral

Phase	Component	Impact	Direct/ Indirect	Importance/ Extent (On-site/ Local/ Regional)	Magnitude (Insignificant/ Minor/ Moderate/ Major)	Permanence (Temporary/ Permanent)	Reversibility (Reversible/ Irreversible)	Cumulativeness (Cumulative/ Non-cumulative)	Overall Significance (Major/ Minor/ Neutral), (Negative/ Positive)
	Noise	Civil works activities, machineries and trucks noise.	Direct	Local	Moderate	Temporary	Reversible	Cumulative	Minor, Negative

Phase	Component	Impact	Direct/ Indirect	Importance/ Extent (On-site/ Local/ Regional)	Magnitude (Insignificant/ Minor/ Moderate/ Major)	Permanence (Temporary/ Permanent)	Reversibility (Reversible/ Irreversible)	Cumulativeness (Cumulative/ Non-cumulative)	Overall Significance (Major/ Minor/ Neutral), (Negative/ Positive)
	Energy and Resources Efficiency	No impact.	N/A	N/A	N/A	N/A	N/A	N/A	Neutral

Phase	Component	Impact	Direct/ Indirect	Importance/ Extent (On-site/ Local/ Regional)	Magnitude (Insignificant/ Minor/ Moderate/ Major)	Permanence (Temporary/ Permanent)	Reversibility (Reversible/ Irreversible)	Cumulativeness (Cumulative/ Non-cumulative)	Overall Significance (Major/ Minor/ Neutral), (Negative/ Positive)
	Hazardous Wastes	Hazardous waste from cleaning and demolition of fuel tanks will be safely handled by licensed contractors and transported to an authorized secured landfill.	Direct	On-site	Insignificant	N/A	N/A	N/A	Neutral
	Traffic	5% traffic-increase.	Direct,	Local, Regional	Minor	Temporary	Reversible	Cumulative	Minor, negative
	Biodiversity	Physical stressors	Indirect	Local	Insignificant	N/A	N/A	N/A	Neutral

Phase	Component	Impact	Direct/ Indirect	Importance/ Extent (On-site/ Local/ Regional)	Magnitude (Insignificant/ Minor/ Moderate/ Major)	Permanence (Temporary/ Permanent)	Reversibility (Reversible/ Irreversible)	Cumulativeness (Cumulative/ Non-cumulative)	Overall Significance (Major/ Minor/ Neutral), (Negative/ Positive)
	Aquatic Ecosystem	No impact.	N/A	N/A	N/A	N/A	N/A	N/A	Neutral
	2. <u>Socio-economic Impacts</u>								
	Job opportunities	1500-2000 direct jobs. Indirect jobs implied.	Direct, indirect	Local	Moderate	Temporary	Reversible	N/A	Minor, positive
	Essential needs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Neutral
	Welfare	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Neutral
	Services	Off-site services (transportation, fast food... etc.)	Indirect	Local	Minor	Temporary	Reversible	Non-cumulative	Minor, positive

Phase	Component	Impact	Direct/ Indirect	Importance/ Extent (On-site/ Local/ Regional)	Magnitude (Insignificant/ Minor/ Moderate/ Major)	Permanence (Temporary/ Permanent)	Reversibility (Reversible/ Irreversible)	Cumulativeness (Cumulative/ Non-cumulative)	Overall Significance (Major/ Minor/ Neutral), (Negative/ Positive)
	Community health and safety	Impact of dust and gas emissions on sensitive population (people with respiratory problems, .e.g. asthma)	Indirect	Local	Minor	Temporary	N/A	N/A	Minor, negative
	Land use	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Neutral
	Land price	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Neutral
	Migration and resettlements	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Neutral
	Community civilization	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Neutral

Phase	Component	Impact	Direct/ Indirect	Importance/ Extent (On-site/ Local/ Regional)	Magnitude (Insignificant/ Minor/ Moderate/ Major)	Permanence (Temporary/ Permanent)	Reversibility (Reversible/ Irreversible)	Cumulativeness (Cumulative/ Non-cumulative)	Overall Significance (Major/ Minor/ Neutral), (Negative/ Positive)
	Investments	The general atmosphere encourages new investments	Indirect	Regional	Minor	N/A	N/A	N/A	Minor, positive
	Tourism	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Neutral

Operation	**1. <u>Environmental Impacts</u>**								
	Air Quality	Use of natural gas as the primary fuel and demolition of the old oil fired plant will reduce emissions of SO2 and particulates. Overall NOx and CO2 emissions will increase due to significantly higher installed capacity; Relative emissions per kW electricity will decrease significantly due to higher efficiency.	Direct	Local	Moderate	Permanent	Reversible	Cumulative	Partially positive (decrease of SO2 and particulate emissions; decrease of relative emissions) and partially negative (increase in overall NOx and CO2 emissions).

	GHG Effect	Decrease in relative CO_2-per kWh. Increase in overall emission.	Indirect	Global	Minor	Permanent	Reversible	Cumulative	Minor, negative

	Water Quality	Water-cooling is replaced by air cooling; less thermal discharges. Water is only used for steam generation and the hydrogen generation unit. Waste water (surface water run-off) Discharge only in small amounts and treated according to standards.	Direct	Local	Moderate	Permanent	Reversible	Cumulative	Major, positive

	Soil Quality	No impact.	N/A	N/A	N/A	N/A	N/A	N/A	Neutral
	Noise	Compliance with legal requirements (noise level at 85 dB at 1-meter from the equipment and 55 dB at the plant boundaries).	Direct	Local	Minor	Permanent	Reversible	Cumulative	Neutral
	Energy and Resources Efficiency	Combined cycle technology increases fuel efficiency. Use of Air Cooling increases efficient use of surface water resources.	Indirect	Regional	Major	Permanent	Reversible	Cumulative	Major, positive

	Hazardous Wastes	Hazardous waste is dealt with in compliance with legal requirements and best practice.	Direct	Local	Insignificant	N/A	N/A	N/A	Neutral
	Traffic	5% increase in traffic.	Direct	Local	Minor	Permanent	Reversible	Cumulative	Minor, negative
	Biodiversity	Physical stressors.	Indirect	Local	Insignificant	N/A	N/A	N/A	Neutral
	Aquatic Ecosystem	Use of air cooling instead of water cooling will decrease thermal discharges	Indirect	Local	Moderate	Permanent	Reversible	Cumulative	Minor, positive
	2. **Socio-economic Impacts**								

	Job opportunities	About 300 direct job opportunities plus indirect jobs.	Direct, Indirect	Local, regional	Moderate	Permanent	Reversible	Cumulative	Major, positive
	Essential needs (e.g. water supply)	Supply of electrical power supports the availability of essential needs.	Indirect	Regional	Minor	Permanent	Reversible	Cumulative	Minor, positive
	Welfare	Community welfare is enhanced.	Indirect	Regional	Minor	Permanent	Reversible	Cumulative	Medium, positive
	Services	Electricity-based communal services improve.	Indirect	Regional	Minor	Permanent	Reversible	Cumulative	Minor, positive

	Public health	Reduced air emissions should result in an improved status of public health.	Indirect	Local	Minor	Permanent	Reversible	Cumulative	Minor, positive
	Land use	No impact.	N/A	N/A	N/A	N/A	N/A	N/A	Neutral
	Land price	Electrical power service increases the land price.	Indirect	Regional	Minor	N/A	Reversible	Cumulative	Minor, positive
	Migration and resettlements	No impact.	N/A	N/A	N/A	N/A	N/A	N/A	Neutral
	Community Welfare	Overall community living conditions improve with adequate supply of electrical power.	Indirect	Regional	Minor	N/A	Reversible	Cumulative	Minor, positive

	Investments	Large investments are encouraged by available and secure power supply.	Indirect	Regional	Minor	N/A	Reversible	Cumulative	Minor, positive
	Tourism	No impact.	N/A	N/A	N/A	N/A	N/A	N/A	Neutral

7 IMPACT MITIGATION AND MONITORING: THE ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

NDPP is designed to minimize environmental and social impacts on the local community and the wider environment. This is part of the technical design as well as the objective of specific environmental and social management measures. These two aspects are described in this Chapter.

Key design features of the new CCGT with impact control and minimization are the following:

- The use of natural gas as the primary fuel for operation. Natural gas is the least polluting fossil fuel with negligible sulphur and dust content, and thus no SO2 and particulate emissions.
- Gas turbines are equipped with low-NOx burners which reduce emissions of nitrogen oxides (NOx). The key idea to decrease the exhaust NOx is to decrease flame temperature. This is achieved by Dry Pre-Mix Combustion where gas and air are premixed resulting in a uniform flame temperature.
- The use of Air-Cooling Condenser (ACC) technology instead of water cooling eliminates any negative impact on the surface water quality of El-Mahmoudia canal, unlike the current situation where water cooling causes substantive water use and subsequent discharges of heated cooling water back into the El-Mahmoudia canal.
- Regarding process water there is a closed-circle system for demineralized water used for steam generation. The condensate out of the ACC is recirculated in a closed system to generate further super-heated steam essential for operation of the steam turbine. This closed system guarantees efficient use of El-Mahmoudia canal waters only very small amount of water are used for makeup.
- Industrial wastewater will be treated to meet the specifications set by the respective environmental Law no. 93/1962 and will then be used for irrigation of non-edible plants and the remaining will be discharged into the domestic wastewater network of the city together with treated sewage. The treatment of industrial wastewater consists of a water/oil separator unit and a sewage treatment unit.
- All units and auxiliary equipment are designed to generate noise levels not exceeding 85 dB at one-meter distance from the equipment. The overall design also takes into account that the equivalent noise levels at the site boundaries will not exceed 55 dB.
- Solid wastes will be disposed of via licensed, authorized companies and a log of this will be kept.

- Oils collected from the water/oil separator unit will be safely handled and stored prior to disposal to a licensed company.
- Hazardous wastes, which are generated in small amounts, will be and safely managed and stored. Contracts will be in place with an authorized transportation company and with the Hazardous Waste Management in Alexandria Governorate for final disposal at El Nasserya Hazardous Waste Landfill.
- The north entrance of Damanhour Power Plant will be prepared for use as the plant main entrance. This action, as per the traffic impact study, will help reduce the effect on traffic and any congestion resulting from vehicles queues outside the entrance gate.

In addition to these technical design features management, training, supervision and monitoring of power station staff and all contractors will be put in place, together with social measures such as continuous consultation with the affected population. These measures are summarized in the Environmental and Social Monitoring Plan which is presented in the following Figure 7-1 which lists institutional measures; construction mitigation measures; and mitigation measures during operation of the CCGT after its commissioning.

Coordination with the Existing Damanhour Power Plant (DPP)

Although this is a new project and separate from the existing Damanhour Power Station, it is nevertheless associated with the existing plant and its structures and practices. This means that with regard to environmental and health and safety management structures, procedures and training the NDPP Project Management Unit (PMU) can rely on the practical experience of the existing Damanhour Power Station on the experience and facilities of WDEPC, e.g. on its training centres and their specialist training programs. DPP is a well managed power station without unresolved environmental, social and health and safety issues and a trusted relationship with its neighbours and the environmental and health and safety authorities. It has functioning structures in place which deal with those issues and any problems should those arise. It is therefore envisaged that the Project Management Unit for NDPP will work closely with DPP Management to make best use of local knowledge and site arrangements (e.g. traffic; waste management, preparedness for fire and other hazards etc.).

Responsibility, Monitoring and Reporting

The ultimate responsibility for all actions rests with the Project Management Unit and the Project Manager. Responsibility will later be transferred to the NDPP Station Manager and his staff. The PMU Manager is also the primary addressee for any reporting, from technical reporting (e.g. noise; dust; traffic measurements) to incidents and grievances. He will then either deal with the issue or direct it to authorities, the DPP Station Manager etc. He will also be responsible, together with WDEPC, for project implementation reporting as required by the banks.

The Environmental and Social Management Plan

The following describes what is to be put in place for NDPP. His is subject to some changes as the project develops and as practical experience from the existing power station is being transferred to the PMU. The first three actions deal with management structures. This will build on what is in place at Damanhour and in the case of environment and health and safety should be based on tried-and-tested international standards. These structures should be put in place prior to the beginning of any works on site and should remain in place not only during the demolition and construction period, but also for the subsequent operational period of NDPP. Priorities and practices will have to be changed accordingly.

Issue and Mitigation Action	Benefits	Requirement (Legal; IFI requirement; industry best practice)	Resources	Schedule	Target and Evaluation Criteria for Successful Implementation	Comments
1. Environmental Management						

Environmental Management Develop and implement an EMS, based on currently existing EM structures at Damanhour power station. This is to be done in preparation for site works on the new CCGT (demolition and site clearance; construction; subsequently operation of the new CCGT).	Optimisation of environmental management though a formalised system. Provides resources monitoring and assists in reducing environmental impacts such as emissions, aquatic discharges, solid wastes, traffic, noise and dust (from demolition works).	IFI requirement (e.g. EBRD PR2) IFI requirement (e.g. EBRD PR1) Voluntary and best practice	Internal WDEPC resources External consultants for ISO accreditation	Start now. 3 months for implementation of a formal EMS, to be in place at start of site works. Within 2 years ISO certification	Develop and implement an EMS Attain ISO 14001 or equivalent certification Annual EHS Report to the Bank	There is a functioning EMS system in place (responsibilities; training; procedures; records) which should be used as the an ISO based system.

Training Develop and implement a staff environmental training plan for the new project.	Benefit: Avoidance/minimisation of environmental incidents and associated liability.	Legal requirement IFI requirement Best Practice	WDEPC resources	Completion of training prior to the start of works	Minimisation of (ideally zero) incidents during construction and later plant operation	Staff of DPP are already trained and can be seconded.
2. Social Management						
Community Advisory Panel Put in place a system of regular meetings of the Panel. Ensure that these meetings and any results are immediately and effectively dissipated to the local community.	Benefit: Good relationship with stakeholders	IFI requirement (e.g. EBRD PR4) Best Practice	WDEPC resources	To be implemented now	Target is an effective response to grievances/claims	Benefits both the existing and the new station

Grievance Procedure Put in place an effective grievance procedure for neighbours and other stakeholders in the project. Ensure that grievances are dealt with speedily, effectively and fairly.	Benefit: Good relationship with stakeholders; helps to de-fuse disagreements and avoid liability claims	IFI requirement (e.g. EBRD PR4) Best practice	WDEPC resources	To be implemented now	Target is zero accidents and zero complaints	Benefits both the existing and the new station
3. Health and Safety Management						

H&S Management Develop and implement an occupational health and safety management system based on currently existing H&S management structures at Damanhour power station and structured to meet OHSAS requirements.	Benefit: Avoidance/minimisation of accidents and associated liability	Effective management is a legal requirement IFI requirement (e.g. EBRD PR2) Voluntary and best practice	WDEPC resources Consultants for accreditation	This is to be done in preparation for site works on the new CCGT. Within 2 years certification to OHSAS	Operate an efficient H&S Management System Attain OHSAS or equivalent certification within 2 years Annual EHS Report to the Bank	There is a functioning H&S management system in place (responsibilities; training; procedures; records) which provides an effective basis for a formal OHSAS/ ISO based and certified system.

H &S Training Develop and implement a staff H&S training plan for new staff. (This can be combined with environmental training).	Benefit: Avoidance/minimisation of accidents and associated liability	Legal requirement IFI requirement (e.g. EBRD PR2) Best practice	WDEPC resources	All staff to be trained at start of work		Staff at DPP are being trained; modify existing training procedures and plans
Actions/Mitigation Measures During Demolition and Construction Works						
4. Contractor Management						

Contractor Management Develop and implement and contractor control and management system for the new project. Provide training and supervision of Contractors working on-site and off-site; this is to include dust mitigation; noise reduction (e.g. limitation of working hours) and traffic control (routing of lorries; driver training; speed restrictions)	Benefit: Avoidance/minimisation of environmental incidents and associated liability	IFI requirement (e.g. EBRD PRs) Best Practice	WDEPC resources	Completion of a training program prior to start of works.	Minimisation of incidents	Can be based on current contractor management and supervision practises at DPP

Contractor Training Assess training needs for contractors and provide training as required.	Benefit: Avoidance/minimisation of accidents and associated liability	IFI requirement (e.g. EBRD PRs) Legal requirement Best practice	WDEPC resources	All contractors to be trained prior to start of work	Minimisation of incidents	
5. Equipment						

Machinery/Equipment Ensure that all machinery used during demolition and construction fully complies with national environmental and health and safety standards, This is particularly important for noise (noise levels on site not exceeding 85 dB).	Benefit: Avoidance/minimisation of accidents and associated liability	Legal requirement Best practice	NDPP Project specifications External noise measurements necessary (weekly and in case of complaints)	To be part of equipment specifications; monitoring of noise and use of PPE to be controlled from start of works	Target is avoidance of accidents, complaints and claims	

Personal Protective Equipment Assess the need for use of PPE for each job (permanent and temporary staff; well as contractors) on the NDPP project. Provide adequate PPE as required and regularly control its use.	Benefit: Avoidance/minimisation of accidents and associated liability	Legal requirement IFI requirement (e.g. EBRD PR2) Best practice	WDEPC resources	From start of demolition/ costruction works	Target is avoidance of accidents, complaints and claims	PPE is being provided for DPP staff; to be put in place for NDPP staff
6. Working Practices						

Emergency Response Put in place and train an Emergency Response Team. The role of the emergency response team is to handle any emergencies and incidents during demolition and construction. This includes including materials handling, spillages, rescue and fire control, and response co-ordination with all external emergency services (ambulance, fire brigade etc.).	Benefit: Ensures immediate and effective response to emergencies	Effective response is a legal requirement IFI requirement (e.g. EBRD PR2) Best practice	WDEPC resources	Put in place and fully trained prior to start of site works	Target is avoidance of accidents, complaints and claims	

Noise Regularly monitor noise levels (minimum weekly). Mitigate as appropriate (e.g. construction of noise barriers). Ensure that noise levels near machinery do not exceed national limits (85dB at one meter distance) and do not exceed 55 dB at the site boundary. If there is a technical need for temporary exceedences of noise (e.g. when piling) make sure all reduction measures are in place, work is only carried out during daytime, and neighbours have been instructed (e,g, via the Community Advisory Panel)	Benefit: Avoidance/minimisation of nuisances/accidents and associated liability	Legal requirement IFI requirement (e.g. EBRD PR2/4) Best practice	WDEPC resources	From the start of site works	Target is avoidance of accidents, complaints and claims	

Dust Ensure that working practices during demolition and construction reduce dust on site and in the vicinity of the power station (e.g. damping down dust with water during excavation). Control dust emissions regularly and modify working practices as required. Ensure that all staff exposed to dust (inclusive of contractors) use adequate PPE.	Benefit: Avoidance/minimisation of nuisances/accidents and associated liability	EBRD PR2 Legal requirement Best practice	WDEPC resources Responsibility of the NDPP Project Manager and the Environmental and H&S Managers of DPP	From start of works onwards	Target is avoidance of complaints and claims	To be put in place for NDPP

Traffic Prepare a detailed plan for site traffic, particularly heavy lorries during demolition and construction. Instruct and monitor all contractors and their drivers; ascertain that all drivers have the correct licenses and are trained for this project.	Benefit: Avoidance/minimisation of accidents and associated liability	EBRD PR2 Legal requirement Best practice	WDEPC resources Responsibility of the NDPP Project Manager and the Environmental and H&S Managers of DPP	Plan to be ready before start of works, for instruction/ training/control of drivers	Target is avoidance of complaints, accidents and claims	To be put in place for NDPP

Protection of the Adjacent Canals Ensure that no materials are dumped into the adjacent canals and that their riverbanks are not destroyed						

Solid Waste Disposal Prepare a detailed disposal plan for solid (non hazardous) wastes arising from site clearance and ground preparation NDPP. Ensure disposal in compliance with national requirements and keep a detailed log of wastes and disposal routes.	Benefit: Avoidance/minimisation of environmentally dangerous disposal and associated liability	EBRD PR3 Legal requirement Best practice	WDEPC resources Project Manager of NDPP; Environmental Manager of DPP	Start of works	Target is avoidance of complaints and liability for clean-up	To be put in place for NDPP

Hazardous and Toxic Wastes Similarly, prepare a detailed disposal plan for hazardous and toxic wastes (e.g. oils; asbestos) arising from site clearance. Ensure disposal in compliance with national requirements and keep a detailed log of wastes and disposal routes.	Benefit: Avoidance/minimisation of environmentally dangerous disposal and associated liability	EBRD PR3 Legal requirement Best practice	WDEPC resources Project Manager of NDPP; Environmental Manager of DPP	Start of works	Target is avoidance of complaints and liability for clean-up	To be put in place for NDPP

Impacts on the Neighbourhood As part of the EMS carry out regular assessments of the impact of demolition and building works on the residential areas close to the power station. Key issues will be noise, traffic (heavy lorries) and dust emissions.	Benefit: Avoidance/minimisation of incidents and associated liability	Best Practice	WDEPC resources During construction responsibility of the NDPP Project Manager; during subsequent operation of NDPP responsibility of the Station Manager of NDPP	From start of works	Avoidance of complaints and claims	To be put in place for NDPP

Traffic outside NDPP Regarding traffic during demolition and construction the following needs to be done: Adequate training of drivers to familiarize them with the narrow and congested roads in the Nile Delta. Instruction to use the International Highway for transport from the Port Said and Damietta ports to the power plant.	Benefit: Avoidance/minimisation of accidents and associated liability	Best Practice	WDEPC resources During construction responsibility of the NDPP Project Manager; during subsequent operation of NDPP responsibility of the Station Manager of NDPP	Completion of training to be a condition for work on the project (on and off-site)	Target is zero accidents and zero complaints	To be put in place for NDPP

Associated Projects Though not legally part of the new power plant, the three associated will nevertheless require adequate social due diligence and mitigation to avoid or minimize impacts on local residents	Benefit: Avoidance of negative impacts, complaints and claims ('damage by association')	Legal requirement EBRD/IFI requirement Best practice	EETC and GASCO are responsible for due diligence	HV lines and the gas pipeline need to be operational at time of power plant commissioning.	Target is a fair and transparent compensation for affected persons.	Though this is not part of the project, the PMu. WDEPD and the banks providing funding should monitor due diligence to ensure compliance with their requirements and best international practice.
7. Operation of the New Damanhour Power Plant						

Emission Monitoring As part of the EMS (and in compliance with national regulatory requirements and in line with the design specifications of NDPP) implement and operate a continuous emission monitoring system during the operation of NDPP.	Benefit: Allows effective control of emission levels and prevents accidental illegal emissions and associated liabilities	EBRD PR1 and 3 Legal requirement Best practice	WDEPC resources Station Manager of NDPP; Environmental Manager of NDPP	Commissioning of NDPP	Compliance with legal requirements	To be put in place for NDPP

8 PUBLIC CONSULTATION

8.1. Introduction

This chapter outlines the stakeholder engagement process regarding the New Damanhour Power Plant. The main objectives of involving the concerned public are as follows:

- Providing sufficient information to the stakeholders, including persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively;
- Listing the comments, ideas and concerns raised by stakeholders and recording the same for follow up;
- Demonstrate the project commitment to all stakeholders with respect to environmental and social issues;
- List corrective procedures suggested by stakeholders and include them in the project planning;
- Avoiding conflict by addressing impacts and issues raised by stakeholders promptly; particularly with the communities that will not be served by the project;
- Illustrate the ability to comply with standards and expectations that may arise in the future;
- Propose a guide for the systems to be implemented at the plant and how they combine to achieve an effective environmental management system (EMS);
- Fulfil the lender requirements with regard to public access to information and public involvement in the decision-making process.

8.2. Regulatory Context

8.2.1. EEAA legal requirements for stakeholder engagement (Public Consultation)

Under the Egyptian environmental law no. 4/ 1994 and its executive amendment no. 9/2009 modified with ministerial decrees no. 1095/2011 and no. 710/2012, a number of institutional stakeholders (representatives of the Egyptian Environmental Affairs Agency "EEAA" and its regional branches, related governmental authorities, governorate where the project is located, local parliaments and influenced groups of nearby institutions or residents) must be represented in the public consultation held prior to the approval for proposed projects that need an Environmental Impact Assessment (EIA). Other parties may participate such as the NGOs and the universities.

8.2.2. International legal requirements for stakeholder engagement (Public Consultation)

8.2.2.1 EBRD Environmental and Social Policy (May 2014)

The EBRD's appraisal requires the borrower to classify stakeholders potentially affected by and/or interested in the projects, disclose sufficient information about the impacts and issues arising from the projects and consult with stakeholders in a meaningful and culturally appropriate manner. In particular, the EBRD requires its clients to engage with relevant stakeholders, in proportion to the potential impacts associated with the project and level of concern. Such stakeholder engagement should be carried out bearing in mind the spirit and principles of the UNECE Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters. For projects subject to ESIA that have the potential to have significant environmental impacts across international boundaries, the Bank will encourage the approach of the UNECE Convention on Environmental Impact Assessment in a Transboundary Context, regardless of geographical location of a project or its potential impacts. The Bank may, in some cases, conduct its own public consultation activities to gauge stakeholder views. Stakeholder identification and engagement may also be built into the Bank's technical cooperation activities, as appropriate.

8.2.2.2 EIB Environmental and Social Practices Handbook

The following outlines EIBs requirements:

- The purpose of public consultation in the EIA process is to allow the promoter to identify and address public concerns and issues, and to provide the public with an opportunity to receive information and make meaningful input into the project assessment and development.
- The nature and magnitude of different stakeholder interests should be established. The interests of those most likely to be significantly impacted by the project should be addressed during the public consultation associated with the EIA, public hearings, via the media, or be drawn to the Bank's attention by the promoter, a civil society organisation, or a government body.
- The EU EIA Directive defines the term 'public' as: "one or more natural or legal persons and, in accordance with national legislation or practice, their associations, organisations or groups"; and 'public concerned' as: "the public affected or likely to be affected by, or having an interest in, the environmental decision-making procedures for the purposes of this definition, non-governmental organisations promoting environmental protection and

meeting any requirements under national law shall be deemed to have an interest".

- During appraisal, stakeholders' concerns or complaints should be established through EIA documents and discussions with the promoter. If necessary the mission should be organised to include meetings with concerned parties and understand better their issues regarding the project

8.2.2.3 African Development Bank Group's Policy on the Environment (2004)

The Bank believes in becoming a greater advocate of public consultation and participation within Regional Member Countries (RMCs) to strengthen and improve government organizations and CBOs / NGOs in the field of environment. Its Information Disclosure Policy will be reinforced to make provisions for more effective public consultations and disclosure on environmental information related to Bank financed projects.

The environmental assessment process provides ample opportunities to involve local populations in decisions regarding project conception and design. All stakeholders have to be identified during the scooping stage of ESIA and regularly consulted on the progress of the assessment. They will be kept informed of the results of the ESIAs and ESMPs through formal channels and their reactions recorded. Before the Bank Group proceeds to an appraisal mission for Category 1 projects, available ESIA studies shall be released in the borrowing country project area at some public place accessible to potential beneficiaries, affected groups and local Civil Society Organisation CSOs. Once the ESIA is released locally and submitted officially to the Bank, it will be made available to the general public through the ADB's Public Information Centre (PIC). If the Borrower objects to the broader release of the ESIA outside of the borrowing country, the Bank will not continue with the processing of the project.

The Executive Summary of the ESIA Report will be made available in the borrowing country at a public place readily accessible to potential beneficiaries, affected groups and local CSOs.

Summaries of Environmental and Social Impact Assessments for Category 1 projects, which are prepared by Bank staff with the project sponsor's consent and include the staff's conclusions and recommendations regarding environmental impacts and preventive or mitigation measures, will be made available to the public through the PIC.

In all cases, environmental information will be released according to the Bank Group's existing applicable timetables for such releases, i.e. one hundred and twenty (120) days prior to presentation to the Boards.

For Category 2 projects, a summary of the ESMP will be released to the public through the PIC at least 30 days prior to Board Presentation. Departments in the Operations complex shall address any public inquiry related to the information released by the Bank, with PSDU's assistance. The communications between the Bank and the public shall be documented and kept on file by the Operations department.

8.3. Consultation Methodology and Activities

According to EEAA Methodology of Public Consultation the following activities have been implemented for the NDPP Project.

8.3.1. Preparation of the Public Consultation Plan before Starting

Before starting the consultation activities in the EIA scoping phase, the project proponent prepared a plan indicating the methodology of the public consultation to be adopted in the two public consultation phases (EIA scoping phase and consultation on the draft EIA). The plan indicated the concerned parties that will be consulted, method of consultation and other points of interest. A meeting was held with EEAA to discuss the plan.
The plan is prepared in accordance with the following.

8.3.2. Public Consultation during EIA Scoping

The following outlines the objective and method of consultation in this phase

The EIA scoping phase aims to agree on the aspects and impacts that will be addressed and analysed in the EIA study, accordingly to the nature of the project and the affected environment. Accordingly, it was important to involve the concerned parties in indicating these aspects and impacts and seek their opinion in these potential impacts to ensure that all potential aspects have been addressed in the study.

Method of Consultation

Consultation in this phase was can be carried out in different ways. This can be meetings held with each concerned party, individually, or 'unified' meetings with all stakeholders. The project proponent is responsible for contacting the concerned parties to request for a meeting and the concerned party should indicate the meeting timing and should delegate its representative in the meeting.

For NDPP a unified meeting was held in 15th of March 2015 and all concerned parties were invited to attend the meeting together.

The following was presented in the meeting:

- Project components and the activities of each component and summary of the project location features;
- List of concerned parties identified on the basis of location and nature of the project;
- The proponents view of the project's environmental and social issues as well as potential impacts;
- Commitment of the project owner towards improving the environmental condition in the surrounding area and to support the neighbouring community.

8.3.3. Consultation on the Draft EIA Report

Objective of the Consultation in this Phase

After the draft EIA was prepared and before the submittal of the study to the EEAA, consultation is to be undertaken on the study to disclose its results and provide the concerned parties with the opportunity to be reassured that points indicated in the scoping meetings have been addressed in the study and to be comfortable with the mitigation measures to which the proponent is committed.

Method of Consultation

A unified meeting was held (hearing session) in the 29th of March 2015. The meeting was attended by representatives of all concerned parties, including those who have participated in the scoping meeting. This meeting was also held in a venue that was accessible to all participants and concerned parties delegated representatives to attend.

In the meeting, the following was presented:

- Results of the study while referring to the points raised by the concerned parties in the EIA scoping phase;
- Presentation of the mitigation measures to which the project proponent is committed, aimed to reduce or mitigate negative impacts;

More than one third of the meeting was dedicated to discussion. This related to the presentation and the mitigation measures. During the meeting, EEAA

representatives ensured the participants that all points raised by the concerned parties have been addressed.

8.3.4. Requirement and Scope of the Public Disclosure

Disclosure of relevant material has to be undertaken in a timely manner for all Category C projects. This process ensures that meaningful consultations between the project proponent and project-affected groups and local NGOs can take place.

Before the public consultation on the draft EIA, the draft technical summary (in Arabic language) was disclosed to all concerned parties. After the EIA process is complete, the EIA report will be stored at EEAA's central library or that of the Regional Branch Office of the projects region. Additionally, the Executive Summary of the final EIA will be available at West Delta Electricity Company website.

The project proponent identifies in a letter attached to the EIA the parts that he/she does not wish to disclose. These include sections that may have sensitivity related to trade, technology, or security.

8.4. Stakeholder Identification

There are a number of individuals and groups with an interest in the Project. These are summarised below in the following table (Figure 8-1)

Table 8-1:The New Damanhour Power Plant List of Stakeholders and their interests

New Damanhour Power Plant Stakeholders	
Stakeholder	**Interest**
Local Community people	
Zawyet Ghazal residents	Directly impacted population (neighbours)
Governmental entities	
Governorate Authority	The main role of the governorates is the provision of support to the project through providing various permissions needed.
Local Governmental units (District authorities and village authorities)	• Permissions for the road cut during the implementation • Permissions for the lands needed for the GAS pipeline and the overhead transmission line • Rehabilitation of roads, which is one of the major issues raised by the

	community, will be performed by the LGU.
The General Authority for Roads, Bridges & Land Transport	Permissions for the road cut during the implementation of the associated projects
Ministry of Water Resources and Irrigation	They are classified as direct beneficiaries of such projects due to the potential enhancement of the water quality of canals and drainage as a result of reducing cooling water
Ministry of Defence	Permitting the location of plant and the routes of overhead transmission line
Information Centres on the governorate level	Providing the project with necessary information on infrastructure as well as providing information about the surrounding communities
Environmental sector	
Egyptian Environmental Affair Agency (HQ and RBOs)	Responsible for reviewing and approving ESIAs, and monitoring implementation of the Environmental Management Plan
Environmental entities within the governorate	Responsible for monitoring of the project impacts during the operation phase
Traders and contractors	
Private companies	Mainly potential tenderers for the construction works
Traders	Provide workers with food and amenities.
Contractors	From project adjacent areas, may be affected.
Egyptian Electricity Transmission company EETC and GASCO	
GASCO	Responsible for providing the new plant with natural gas. As well as, preparation of the ESIA related to the pipeline
Egyptian Electricity Transmission company	Responsible for the transmission of produced electricity through an overhead transmission line. They are responsible for the preparation of an ESIA for the OHTL

8.5. Consultation Activities

Consultation activities have taken place through a number of steps. These are summarised below in the following Table 8-2 and in more detail presented in the following sections of this chapter.

Table 8-2: Summary of all consultation activities already completed

Time	Consultation activity/method	Number of people	Phase	Stakeholder(s) engaged

Time	Consultation activity/method	Number of people	Phase	Stakeholder(s) engaged
December 2014	Meetings	Not documented	Scoping phase	• EEAA • Ministry of Irrigation • Roads authority • Governorate environmental office representatives • GASCO (gas supplier contractor) • Funding agencies
December 2014	Letters, faxes and phone calls	Not documented	Scoping phase	• Operation authority of the Egyptian Armed Forces
December 2014-January 2015	Socio-economic baseline study including group discussions and household survey	118 household	Data-collection	• Populations located in the areas near Damanhour Power Plant. (Zawyet Ghazal residents)
15 March 2015	Pre- public consultation session	76 person	Pre-consultation	• Elbeheira governorate general court; • Egyptian Environmental Affairs Agency (EEAA)-Elbeheira branch; • Zawyet Ghazal village mayors and residents; and • Some attendants from industry.
29 March 2015	Final Public consultation session (public disclosure meeting)	117 person	Public disclosure	• Egyptian Environmental Affairs Agency (EEAA)-Central branch in Cairo and Elbeheira branch; • Elbeheira governorate general court; • Zawyet Ghazal village mayors and residents; and • Irrigation ministry • Ministry of Roads and transportation • Local TV and Press • Engineering Syndicate • Social Insurance • NGOs • Local village council • Some attendants from industry.

8.5.1 Consultation activities during the scoping phase

8.5.1.1 Description of stakeholders engaged

As the project will be implemented inside an existing electricity facility in Damanhur governorate the following entities were engaged:

- Local authorities, Egyptian Environmental Affairs Agency (EEAA)
- Ministry of Irrigation
- Roads authority
- Governorate environmental office representatives
- Operation authority of the Egyptian Armed Forces
- Lending agencies

- **Participants profile at the scoping phase**

  The total number of participants was 76 persons; 62 males and 14 females.

  It was expected that female participation in public events within Damanhour Governorate would be relatively limited due to local traditions and norms.

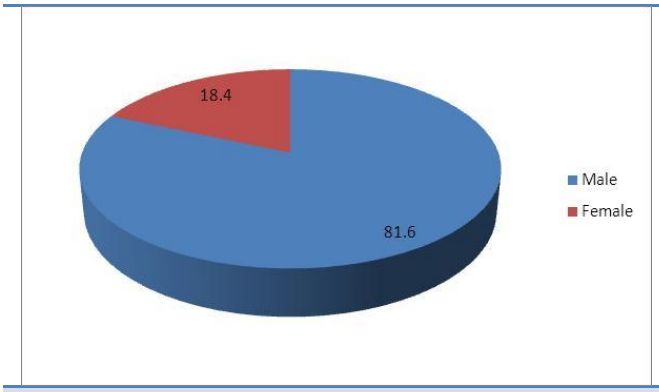

Figure 8-1 : % distribution of participants by sex

- **Profession of participants**

  The distribution of the participants by their occupation reflected that 51.1% of them are professionals (e.g. managers, professors, engineers, consultants). 28.6% of the participants belong to the higher managerial levels. 13 persons from the community were farmers, low skilled labourers and skilled labourers.

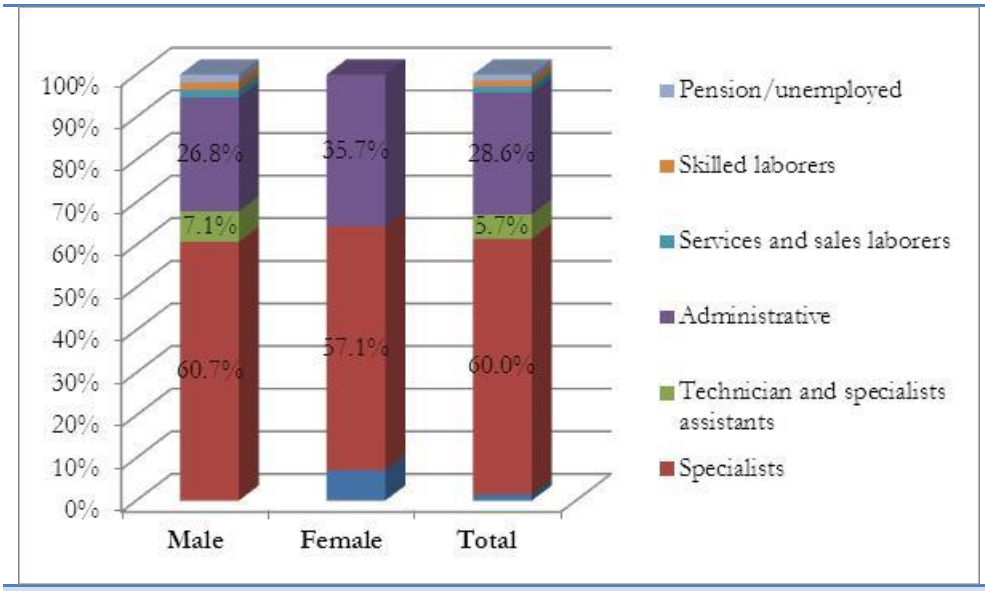

Figure 8-2: % distribution of scoping session participants' occupations by sex

- **Affiliation (entities)**

  The participants reflected various organizations and entities; 53.3% represented electricity companies in the region. 10.7% of the participants represented EEAA offices within the governorate. 8% of the participants represented the Local Governmental units, particularly the local District of El Beheira Governorate and other district authorities. The following table provides detailed distribution of the participants by entity.

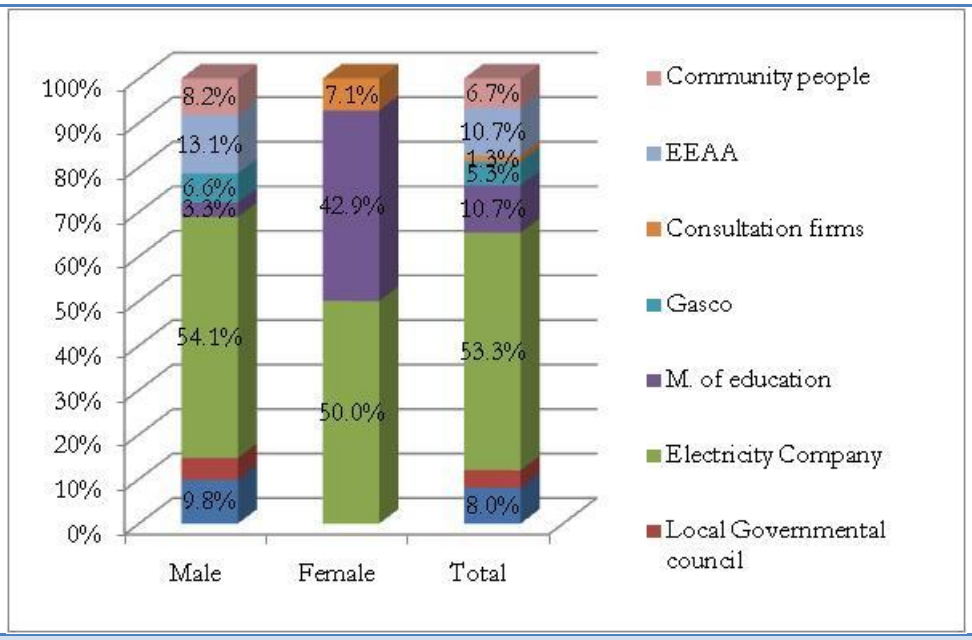

Figure 8-3: % distribution of participants' affiliation by sex

8.5.1.2 Main topics discussed (Summary of Discussion)

The meeting was introduced with an opening statement by engineer Hamdy Dergham (Chief of Technical Affairs Sectors in WDEPC). He gave an overall introduction of the new project's components and implementation. The environmental consultant Prof. Dr. Elsayed Shalaby then outlined the proposed project with emphasis on the environmental and social impacts predicted for both the construction and operation phases. Attendants were then invited to participate in an open discussion with the environmental consultant and the project's senior technical personnel.

Figure 8-4: Opening statement during scoping session

Figure 8-5: Presentation of study objectives and methodolgy

Figure 8-6: Participants of scoping session

Comments raised can be summarised as follows:

- WDEPC was asked to quickly contract with an environmental consultant
- Emphasis on the necessity to start the baseline measurements
- Following procedures to get permits from different concerned local authorities
- Complete project documentation as soon as possible

The following table lists specific questions.

Table 8-3: The discussed issues during scoping phase

Subject	Questions and comments	Responses	Actions to be taken

Subject	Questions and comments	Responses	Actions to be taken
Employment strategy and the share of Zawyet Ghazal people	What is the employment strategy and what is the share of Zawyet Ghazal people?	The residents of Zawyet Ghazal have priority in non-technical jobs, whereas the technical jobs candidates will be selected by competition according to technical criteria	A clear employment strategy should be prepared and shared with the community as part of the ESIA
Occupational health and safety requirements	An ex-parliament member and Zawyet Ghazal resident, emphasized the importance of occupational health and safety requirements. He raised a question regarding the noise the residents used to hear at the start-up of the units and whether the new project would cause such noise. He finally recommended that the new project needs to comply with legal standards of occupational health and safety	The New Damanhour Power Plant responsible person replied that WDEPC deals with an international consultant and all the projects comply with the international standards of occupational health and safety. However, regarding the noisy sound produced at the start-up of the units this is due to the pass-by of the steam and this noise is mitigated by a specific filter reducing the pressure and thus minimizing noise.	Such specific impact and mitigation measures should be properly presented in the ESIA
Natural Gas	An EEAA representative asked if there will be a new gas pipeline or if the project will use the existing pipelines	There is a supply line that will be upgraded; an EIA will be prepared for this line	
Time schedule	An EEAA representative also asked about the time schedule for project implementation	It is planned to start the units in June 2017 (This date was afterwards postponed to June 2018) and achieve full production in June 2019	A time schedule should be added to the ESIA

Subject	Questions and comments	Responses	Actions to be taken
Project funding	An EEAA representative asked about the project funding; whether totally from the state budget or if the private sector contributes to the funding	Funding will be through bank loans in addition to WDEPC internal resources	To be added to the project description
Cooling system	Is the project cooling system totally using air cooling technology with no water cooling at all ? Are discharges of the cooling system treated before discharge?	An air cooling system will be used in order to save water resources especially during the current water challenges that Egypt encounters. There will be no water used for cooling. In addition, only very small amounts of water will be used for steam makeup for the steam turbines. The project will have a treatment plant that receives very small amounts of wastewater and the treated water will not be harmful to the environment when discharged.	Cooling system should be discussed in the ESIA
Capacity building	Will the workers during construction receive any training to improve their professional skills ?	The NDPP responsible manager replied that the construction activities will be carried out by about 20 contractors who are responsible for the workers they employ. He added that good training of workers is a matter of concern for all new projects, and mostly so for those contractors who choose their labour force from the neighbouring area	Capacity building should be added to institutional arrangement

Subject	Questions and comments	Responses	Actions to be taken
Health facilities	A community member requested the renewal of the nearby clinic to be ready for emergencies	It will be considered	
Treatment units for wastewater and sewage water	A senior environmental inspector asked for details about the treatment units for wastewater and sewage water	More details will be included in the ESIA study	
Road conditions	It was recommended to handle the traffic professionally	A traffic impact study was carried out for the project	

8.5.1.3 Disclosed items after the scoping session

After the scoping sessions many press items discussed the events. Additionally, the governorate authority published some news items about it.

Figure 8-7: News item about scoping session
Source: http://elwatannews.com/news/details/7

8.3.2 Consultation activities during the data collection phase

8.3.2.1 Description of stakeholders engaged

Informal group discussions were held with the nearby residents through transect walks in order to inform the community about the project. Thereafter, a household survey was conducted with a target sample of 118 households of Zawyet Ghazal Administrative residents representing four residential agglomerations: the sub-village of Zowyat Ghazal, El-Nawam Sa'ad sub-village, Garboa'a sub-village and the employees' residential compound (colony).

Figure 8-8: Household survey during data collection

8.3.3 Consultation activities during the EIA Consultation Phase

8.3.3.1 Description of stakeholders engaged

According to the Egyptian Environmental Affairs Agency (EEAA), a second meeting with relevant stakeholders was held during the EIA consultation phase in March 29th 2015. The project stakeholders were represented in this session as follows:

- Egyptian Environmental Affairs Agency (EEAA)- Central branch in Cairo and Elbeheira branch;
- Elbeheira governorate general court;
- Zawyet Ghazal village mayors and residents; and
- Irrigation ministry
- Roads and transportation ministry
- Local TV and Press
- Engineering Syndicate
- Social Insurance
- NGOs
- Local village council

- Some attendants from industry.

A full list of attendants is attached to the Consultation Annex.

8.5.1.4 Participants profile

The total participants attended this meeting was 117, amongst them only 12 females. The representation of woman was limited as the majority of employed persons within the various entities are males. Additionally, the community people within the project areas prohibit women's participation in public events. That problem was anticipated and handled through meetings with females during community group meetings and the household survey.

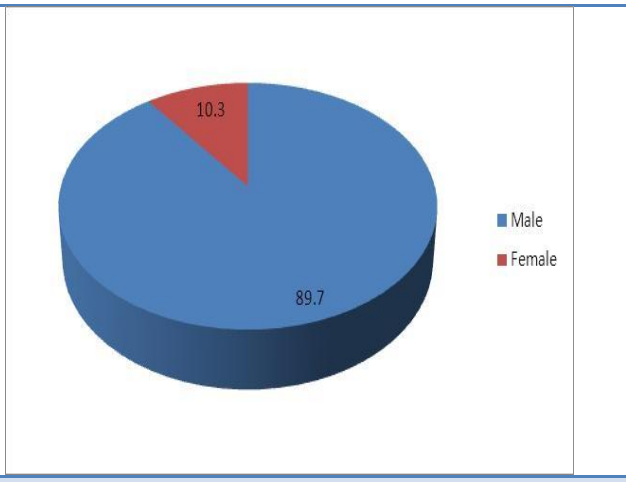

Figure 8-9: % distribution of participants by sex

8.5.1.5 Profession of participants

With regards to the distribution of participants by their occupation, it was found that about 39.5% of the sample were professionals (managers, doctors, professors, engineers, press people. etc); 20% of the participants were among the higher managerial group (chairmen, head of district. etc). The administrative groups and the sales persons represented about 21.9 % of the total participants. Farmers represented 5.3% of the total sample.

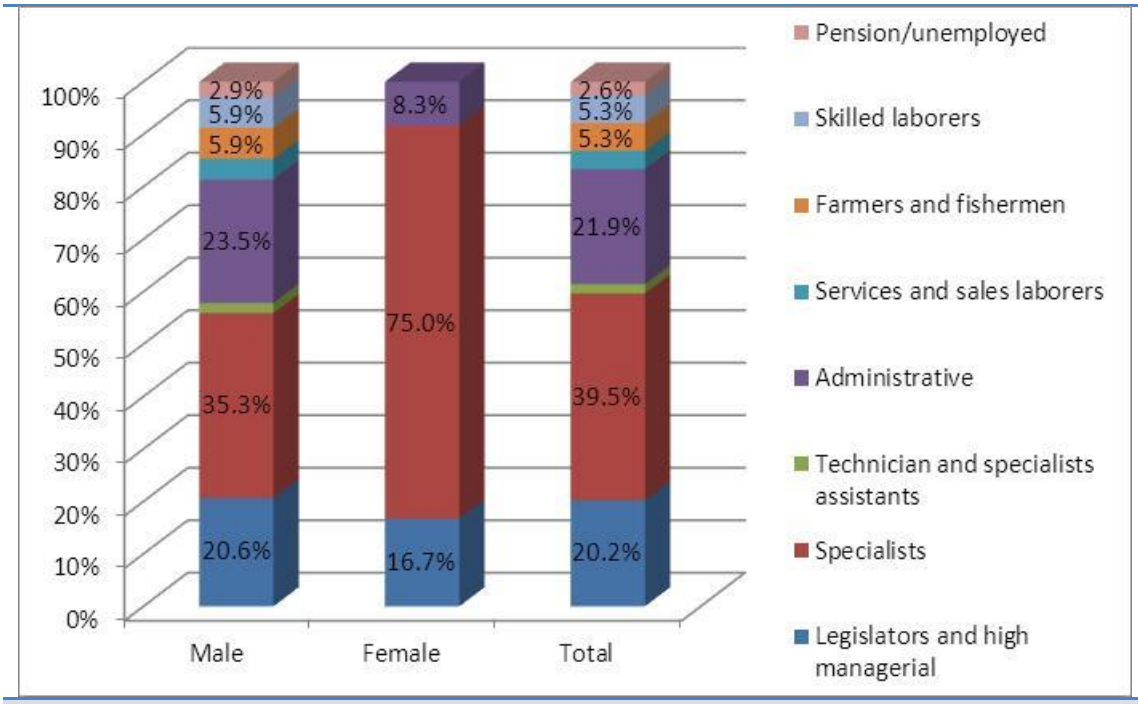

Figure 8-10: % distribution of participants' occupations by sex during public consultation

Affiliation (entities)

The participants reflected various organizations and entities, 54.9 % represented Electricity companies (production and transmission) from the region. 20.4% of the participants represented local community people. 3.5% of the total participants represent EEAA offices within the governorate. 5.3 % of the participants represented Local Governmental units.

The following table provides the detailed distribution of the participants by entity.

Table 8-4: % Distribution of public consultation participants by affiliation and sex

Organization	Male	Female	Total
Electricity Company	55.40%	50.00%	54.90%
Community people	21.80%	8.30%	20.40%
Local Governmental council	5.90%		5.30%
Local Governmental units and district authorities	4.00%		3.50%
EEAA	2.00%	16.70%	3.50%
Ministry of education	1.00%	16.70%	2.70%
Ministry of health	2.00%		1.80%
Ministry of agriculture	2.00%		1.80%
Consultation firms	1.00%	8.30%	1.80%
Police force	2.00%		1.80%
Communications Commission	1.00%		0.90%
Ministry of High education	1.00%		0.90%
Military Force	1.00%		0.90%

Organization	Male	Female	Total
Total	100.00%	100.00%	100.00%

8.3.3.2 Summary of discussions during the EIA Phase public consultation

The public consultation session was introduced with an opening statement by engineer Mohamed Darwish (WDEPC Chairman of the Board of Directors). He gave an overall summary of the new project and the new plans of the company to meet the needs for power supply. Following this, brief statements were given by the vice-governorate and the electricity transmission company representatives.

The environmental consultant Prof. Dr. Elsayed Shalaby then gave a short description of the proposed project and its components and described the environmental and social impacts during construction and operation phases through different scenarios. At the end of the presentation, attendants were welcomed to get involved in an open discussion, to express their opinion of the project and its projected impacts.

Figure 8-11: the Podium

Figure 8-12: **EIA consultant during presentation**

Figure 8-13: Participants of the public consultation

Figure 8-14: Response to questions

Figure 8-15: EIA consultant respond to the farmer

Figure 8-16: A farmer had a discussion with the consultant

Specific questions raised, and responses given, are presented in the following Table 8-18.

Table 8-5: Questions and comments during the public consultation

Subject	Questions and comments	Responses	Actions to be taken
Transportation of heavy loads	How will heavy equipment such as the turbines be transported?	Eng. Darwish answered that the transportation of equipment is not a new matter for WDEPC which has a long experience with it. He indicated that this matter will be well managed and meet all regulations Additionally, a full traffic impact study was carried out.	
Capacity building	It is strongly recommended to provide training programs to the workers and engineers in the new project, particularly new graduates	Regarding the training programs Eng. Darwish said that this matter will be viewed and discussed.	
Stakeholder engagement	Eng. Amany Salah, director of electricity projects management in the EEAA central branch in Cairo, stressed the need for complete representation of all stakeholders and interested parties.	Complete representation of all the stakeholders is assured at all project levels due to an active stakeholder engagement policy of WDEFP	

Subject	Questions and comments	Responses	Actions to be taken
Decommission of the old plant	Has an EIA study been prepared for demolition of the old plant?	The demolition of the old plant will be conducted separately and the public was assured that an EIA study will be conducted. Demolition will require a scope-EIA study according to the EEAA guidelines	
Noise modelling	An EEAA representative also asked if there are contour maps modelling the noise levels produced as a result of the project operation, especially for the areas outside the project site boundaries.	A comprehensive noise study was carried out which provides this information.	
Disposal of industrial wastes	A senior environmental inspector asked about the disposal of the industrial wastewater and its treatment.	The consultant explained the treatment and disposal of wastewater. Detailed descriptions were given of the combined cycle system and that wastewater is produced in very small volumes. Wastewater and oily wastewater subject to appropriate treatment. It was also emphasized that consumption of water is low due to the combined cycle system (unlike the single cycle) and most significantly due to the use of air-cooling for condensers (ACC).	
New infrastructure	A senior environmental inspector asked about the infrastructure; will there be new infrastructure developments or will the project use existing infrastructure	The new plant will be constructed and operated on a separate area. Demolition and use of traffic infrastructure for solid waste disposal be using existing infrastructure where possible.	

Subject	Questions and comments	Responses	Actions to be taken
Contingency plan	A well-managed contingency plan for the new project is strongly recommended	This will be considered	
Fuel	Another question regarding the maximum number of hours of running on the light fuel oil.	Light fuel oil is used for a total maximum of one week per year.	
Treatment requirement	A representative of the EEAA branch commented on the current operation of Damanhour Power Plant and recommended to keep up with the treatment requirements.	That will be considered	
Impact on the neighbouring area	A local resident claimed that the plant's direct neighbours are most affected by the plant noise and effluents, but the plant employs workers from outside Zawyet Ghazal residents.	12 comprehensive baseline studies were carried out for the new project, one of them is a complete study on noise impact and ways to reduce it. The existing plant employs a large number of local residents.	
Job opportunities	Zawyet Ghazal residents have the priority in the job opportunities provided by the new project.	Local workers are preferentially hired under company policy, but for the technical positions other relevant qualifications apply.	
Contractors	It was recommended that WDEPC deals with various contractors and not to deal with a single source. No single contractor specialized in all the project compartments.	WDEPC is keen on selecting the best quality at the lowest cost.	

Public Consultation Outputs

The main outputs of the public consultation carried out are summarized as follows:

- Emphasis on mitigation measures relating to project emissions and wastewater effluents as well as to noise levels;
- Recommendation of selecting the project labour from the plant's neighbouring area (Zawyet Ghazal residents);
- Effective involvement of interested public;
- WSEPC and contractors to comply with national occupational health and safety requirements; and
- New Damanhour Power Plant and contractors' to comply with all relevant environmental legislation and standards.

8.3.3.3 Disclosed items after the public consultation session

- The session was recorded and broadcasted on the local TV channel (Channel 5).
- Some newspapers and online press reported the session.

Figure 8-17: publication about the public consultation **http://www.akheralanbaa.com/** http://www.masralarabia.com/

8.6 Further Planned Consultation Activities

8.6.1 Community Advisory Panel

In order to ensure clear and consistent communication with the neighbouring areas, the new project will establish a Community Advisory Panel comprising of 6 residents of Zawyet Ghazal and 2 representatives of the New Damanhour Power Plant. The Company will continue to consult with the community panel during both the construction and operation of the project. The Committee will be formally registered with the Ministry of Electricity.

The committee will be responsible for the following:

- Facilitating access to information on the project;
- Informing stakeholders of on-going communications and meetings;
- Informing stakeholder about project progress, issues to expect, construction timetable etc.
- Providing feedback from stakeholders on issues that have been raised; and
- Alongside WDEPC, facilitate implementing community projects as appropriate.

The Committee will initially meet monthly, though more frequent meetings will be convened if requested by the village members. Meetings will be held in a convenient location, most likely to be at the NDPP offices. Minutes of all meetings will be taken and will be available on request. All meetings result should be summarised and included within the quarterly report to be submitted to funding agencies

8.6.2 Institutional arrangement for consultation

Until a permanent Stakeholder Consultation Officer for the New Damanhour Power Plant is appointed, Engineer Essmat Hassan Ibrahim (the Project Manager) will have the overall responsibility for handling the consultation and information disclosure process, including organisation of the consultation process, communication with identified stakeholder groups, collecting and processing comments/complaints, and responding to any such comments and complaints. Depending on the nature of a comment/complaint, comments or complaints will be provided to the appropriate person in the company for a response.

In order to ensure that all stakeholders have adequate access to information, Eng. Essmat Hassan Ibrahim will be the primary contact person.

Contact details for the company representatives are included in the next section (8.4.3).

8.6.3 Grievance and Redress Mechanism

Objectives: The objective of a grievance procedure is to ensure that all comments and complaints from any project stakeholder are considered and addressed in an appropriate and timely manner.

Disclosure of the GRM: The Community people will be fully informed about the Grievance procedures in simple language. Information about grievance mechanism will be tailored according to the community. Community leaders, social entities and the governmental units will be informed about the GRM

Mode of Grievance: The Company will accept comments and complaints associated with the project from any stakeholder. Comments can be made via email, post, fax, on the telephone or in person. The comments and complaints will be summarized and listed in a Complaints/Comments Log Book, containing the name/group of commenter/complainant, date the comment was received, brief description of issues, information on proposed corrective actions to be implemented (if appropriate) and the date of response sent to the commenter/complainant.

Response to grievances: All comments and complaints will be responded to either verbally or in writing, in accordance to the preferred method of communication specified by the complainant. Comments will be reviewed and taken into account in the project preparation; however they may not receive an individual response unless requested.

Registration of GRM: All grievances will be registered and acknowledged within 6 working days and responded to within one month. The project management will keep a grievance log and report on grievance management, as part of annual project progress reports, which will be available on the company (WDEPC) website.

Grievance channels: Comments and concerns regarding the project can be submitted in writing in through the following channels:

- Email: *essmat_771@yahoo.com*
- By telephone/ fax: **Tel**: 5756722-03**Fax**:5761375-03
- By post or hand delivered to: WDEPC 7 Reyad Basha St. Gleem- Alexandria

Confidentiality: Individuals who submit their comments or grievances have the right to request that their name be kept confidential, though this may mean that the company is unable to provide feedback on how the grievance is to be addressed.

Management of GRM: During construction of the NDPP plant, grievances in relation to construction activities will be managed by the Company and the construction contractor(s). The Company will provide contact information for the contractor to residents of Zawyet Ghazal before construction begins.

A separate grievance mechanism is available in the same manner for workers, including employees of both the NDPP-employed and contractors.

9 CONCLUSION

This ESIA studied the current environmental and social conditions at the existing Damanhour power station and its vicinity and assessed the potential impact of the proposed 1800 MWe new power station on the same site. The site for the new units is part of the existing power plant; it is vacant industrial land, currently largely unused, and close to residential areas and the El-Mahmoudiya canal. It has good transport connections and is already connected to the national electricity grid and the gas supply network.

The rationale for proposing to build the New Damanhour Power Plant is the need for additional, stable and commercially viable electricity generation in the region, to help avoid current disruptions in supply and to serve an increasing demand from private and commercial customers. When assessing the options it became clear that there is an over-riding need for additional capacity in the region; that combined cycle gas technology is technically the best technical option (high efficiency); that gas is the best fuel option (availability and existing supply infrastructure); that the location is ideal (existing site with no additional land-take; no social issues; existing infrastructure); and that the proposed technology and fuel offers the cleanest form of fossil fuel based electricity generation. Additionally, the new plant will allow WDEPC to de-commission three old oil fired generation units which are at the end of their technical life; are highly polluting; and require large volumes of water from the El-Mahmoudia canal for condenser cooling – whereas the new CCGT is air cooled.

The project is designed to meet national environmental and social legislative requirements, which includes an Environmental and Social Impact Assessment (ESIA) with full public participation. It will also meet the environmental and social requirements of the three International Financial Institutions (IFIs) which 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).

The site has most of the necessary infrastructure for the new plant already in place. This includes transport (road) access as well as connection routes to the gas supply and the national HV grid. In both cases existing corridors can be used for new lines which will reduce any environmental and social impact to a minimum and avoid further land-take.

The site and vicinity for the new power plant were studied in detail to obtain a baseline for all relevant parameters necessary to assess impact and make a decision on the

suitability of the site. This included studies of soil and groundwater characteristics; surface water quality and its flora and fauna; terrestrial flora and fauna, and birds; air quality; noise; traffic; natural and site (technical) risks; a wide range of social aspects.

On this baseline potential and likely impacts were analysed, both for the construction period and then for the operational period of the new plant.

Construction Phase

During construction (which includes demolition of three old oil tanks) traffic volumes and noise level can become a potential nuisance to local residents. For both issues strict site management procedures will be implemented to ensure compliance with national legal requirements and to minimize any risk or inconvenience to local residents. Similarly, control procedures will be put in place to reduce any risk to accidental dumping of materials into the canal or the risk of spillages with a potential for soil and groundwater contamination.

Regarding the socio-economic impact, the project will not result in any land acquisition as it will be implemented inside the current power station. However, the associated projects (gas pipeline and HV lines) might require limited land acquisition. 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 labor 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. This means increased income for the areas adjacent to the project through purchasing food products, water and construction materials. The supplies might be provided by the local companies in the proximity areas or from El Beheira Governorate.

Operational Phase

The impact of the new power plant on the ecology of the area is insignificant. The site is vacant industrial land and it and its surrounding areas are poor in their environmental characteristics – the biodiversity value is low, there are no rare or endangered species on the site; this applies to the terrestrial environment (flora and fauna on site) and to the aquatic environment (El Mahmoudiya canal). Impacts on soil and groundwater during building work and power plant operation can be easily controlled. To achieve this, a formal Environmental Management System is suggested as part of the project.

The power station is the largest single emitter of air pollutants in the area, followed by traffic and domestic emissions. Current emissions include sulphur dioxide, oxides of nitrogen, particulates (dust), carbon monoxide and carbon dioxide. The power station will remain the largest emission source but the emission characteristics will change. Dust and sulphur emissions will decrease due to the use of comparatively clean fuel (natural gas), The largest emissions will remain to be oxides of nitrogen and carbon dioxide. All

emission parameters will conform to national and international limits for health and environment.

Regarding social impacts the new power plant will create new jobs for operation and maintenance workers and the associated income and taxes paid to the state. The 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. Additionally, most of the educational web services come to a halt (this includes registration in college, information about the exam results, information about college's acceptance of enrolment and web exams). The residents will generally benefit from appropriate lighting, ventilation, refrigerating, and use of entertainment appliances.

In summary, analysis showed that the overall long-term benefits of the proposed project by far outweigh any temporary inconveniences. This is particularly relevant for the socio-economic situation of the local communities which will benefit during construction and power plant operation.

10 CONTACTS

The following are contributors to this ESIA:

Name	Position
(A)- Egypt Scientific Consultancy Team	
Elsayed Ahmed Shalaby	Consultancy Team Leader
Noha Mohamed Ali	Team Leader Assistant
Hossam Ahmed Said	Environmental Specialist (Impact Analysis)
Heba-Allah Ali Elsayed	Environmental Specialist (Dispersion modeling)
Elsayed Maher Saleh	Environmental Specialist (Impact Analysis)
Reham Ramadan Saber	Environmental Specialist (Air Quality Measurements)
Aya Mahmoud Kadry	Environmental Specialist (Air Quality Measurements)

Any comments and requests for information related to the Project should be addressed to:

Company Name	West Delta for Electricity Production Company (WDEPC)
Company Contact	Eng. Essmat Hassan Ibrahim
Postal Address	7 Ryad street- Gleem Alexandria, Egypt
Telephone/ Fax Number	002-03-5761375
Lines	002-03-5761378 002-03-5761379
Email Contact	aemeghed@yahoo.com
Company site	-