Appendix 5

Environmental and Social Study

ENVIRONMENTAL AND SOCIAL STUDY FOR THE MAPUTO GAS FIRED POWER PLANT DEVELOPMENT

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Japan International Cooperation Agency

MAPUTO, FEBRUARY 2013

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ACRONYMS AND ABBREVIATIONS

ACODESPU	Community Association for the Development of Public Health *(Associação Comunitária para o Desenvolvimento da Saúde Pública)*
ADI	Area of Direct Influence
AdM	Previous name of Mozambican Water Company *(Águas de Moçambique,* now called *Águas da Região de Maputo)*
AII	Area of Indirect Influence
ANE	Mozambique's National Roads Administration (*Administração Nacional de Estradas*)
CBO	Community Based Organisation
CCGT	Combined Cycle Gas Turbines
CMMaputo	Maputo City Council *(Conselho Municipal da Cidade de Maputo)*
°C	Degree Celsius
CLC	Civil Liability for Oil Convention
CO_2	Carbon dioxide
CTM	Maputo Thermal Power Plant Central Térmica de Maputo
DNAIA	National Directorate for Environmental Impact Assessment *(Direcção Nacional de Avaliação de Impacto Ambiental)*
DNE	National Directorate of Energy *(Direcção Nacional de Energia)*
EDM	Electricidade de Moçambique
EIA	Environmental Impact Assessment
EHS	Environment, Health & Safety
EIS	Environmental Impact Study
EIAR	Environmental Impact Assessment Report
EMP	Environmental Management Plan
EN	National Road *(Estrada Nacional)*
EP1	First Level Primary School (Grade 1-5)
EP2	Second Level Primary School (Grade 6 + 7)
EPC	Complete Primary School

EPDA	Scoping Study *(Estudo de Pré-viabilidade e Definição de Âmbito)*
ESG1	First Level Secondary School
ESG2	Second Level Secondary School
ESIA	Environmenal and Social Impact Assessment
ESU	Environmental and Social Unit of EDM
EPDA	Environmental Pre-feasibility and Scoping Study *(Estudo de Pré-viabilidade Ambiental e Definição de Âmbito)*
EU	European Union
FAO	Food and Agriculture Organization
FIPAG	Water Supply Investment and Patrimony Fund *(Fundo de Investimento e Património do Abastecimento de Água)*
FUNAB	Fund for Environmental Matters *(Fundo Nacional do Ambiente)*
FUND	Fund for Compensation for Oil Pollution Damage
GIS	Geographical Information Systems
GoM	Government of Mozambique
GTG	Gas Turbine Generator
GWh	Gigawatt Hour
HCB	Hydro-electrical Power Station of Cahora Bassa *(Hidroeléctrica de Cahora Bassa)*
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome
HRSG	Heat Recovery Steam Generator
ICP	Inductively Coupled Plasma
IFC	International Finance Corporation
INGC	National Disaster Management Institute *(Instituto Nacional de Gestão de Calamidades)*
ITCZ	Inter-tropical Convergence Zone
$\mu g/m^3$	Microgram per cubic metre
I&APs	Interested & Affected Parties
INAM	National Institute of Metheorology *(Instituto Nacional de Meteorologia)*
INE	National Institute of Statistics *(Instituto Nacional de Estatística)*
INGC	National Institute of Disaster Management (*Instituto Nacional de Gestão das Calamidades*)
ISO	International Organization for Standardization

IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
km²	kilometres
kV	Kilovolts
LAeq	Continuous A-weighted equivalent sound pressure level
LIIF	Local Initiative Investment Fund
Lmax	maximum sound level
Lmin	minimum sound level
m^3	Cubic metre
mg	milligrams
MGPP	Maputo Gas Power Plant
MICOA	Ministry for the Coordination of Environmental Affairs *(Ministério para a Coordenação da Acção Ambiental)*
ml	millilitres
mm	millimetres
MP	Measuring Point
MPDC	Maputo Port Development Company
MW	Megawatt
NE	North-East
NFPA	National Fire Protection Association
NGO	Non-governmental organization
NIOSH	National Institute for Occupational Safety and Health
NOx	Nitrogen oxide
NO_2	Nitrogen dioxide
OPRC	Oil Pollution Preparedness, Response and Co-operation
O_2	Oxygen
PET	Potential Evapo-transpiration
pH	Potential Hydrogen
PM_{10}	Particulate matter of aerodynamic diameter less than 10 µm
PMEE	Penman-Montieth Equivalent Evaporation method
PPE	Personal Protective Equipment
ppm	Parts per million

QAM	Questions and Answers Matrix
RSA	Republic of South Africa
SANS	South African National Standards
SAPP	Southern African Power Pool
SE	South-East
SEA	Simplified Environmental Assessment
SO_2	Sulphur dioxide
STDs	sexually transmitted diseases
ToR	Terms of Reference
UEM	Universidade Eduardo Mondlane
UNESCO	United Nations Educational, Scientific and Cultural Organization
US-EPA	United States Environmental Protection Agency
WHO	World Health Organisation
ToR	Terms of Reference
WWTP	Waste Water Treatment Plant
WMP	Waste Management Plan

1 INTRODUCTION

1.1 PURPOSE OF THIS REPORT

The purpose of the present report is to provide to the Japan International Cooperation Agency (JICA) the necessary baseline information on the surrounding environmental and social conditions of the proposed Gas-Fired Combined Cycle Power Plant project in Maputo for understanding the environmental and social implications of the project, in compliance with JICA Guidelines. For this purpose, an initial environmental examination has been carried out, the results of which are presented in this report.

1.2 PROJECT PROPONENT

The Project proponent is Mozambique's national public electricity provider company Electricidade de Moçambique, E.P. (EDM), with headquarters in Maputo city.

For this project, the proponent is being represented by:

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1.3 BACKGROUND OF THE PROJECT

Besides a considerable growth in the past years, the national electrification rate in Mozambique continues to be low with around 18% (2011), thus turning the increase of this rate into an important issue. There is a great need for providing assistance to electrical power production projects supposed to contribute to economical growth and poverty reduction.

Electricity consumption per capita per year in Mozambique is low with approximately 143 kWh and electricity produced corresponds only to 4.025 GWh/year with a maximum potency of 610 MW. Compared to this, the average annual electricity growth rate in terms of kWh and kW is above 10%, corresponding thus to a stable economical growth. The demand for electricity is expected to grow in a constant way during the next years.

The national electricity grid in Mozambique is interlinked with the *Southern Africa Power Pool* (SAPP) and operates as an integral part of the countries in the region. The electricity produced in the Hydro-electrical Power Station of Cahora Bassa (nominal capacity: 2.075 MW) is being exported to the SAPP and a part of it is consumed inside the country.

Eighty-eight (88%) percent of Mozambique's needs in terms of electrical power come from the Hydro-electrical Power Station of Cahora Bassa (HCB), which corresponds to approximately 21% of the total electricity produced by HCB (the percentage of 21% has been obtained by calculating 3.549 GWh of electricity bought divided by the 16.600 GWh electricity produced, data from 2009). The remaining 12% come from other hydro-electrical and thermal power stations in the country. There is a strong need for the electricity sector of Mozambique promoting the rehabilitation and reinforcement of the installed capacity of the existing thermal power stations, not only for maintaining the current capacity, but furthermore to guarantee the increase in capacity of electricity supply of a trustworthy source during future years.

In the regions, where the expansion of the electricity grid is not economically feasible, has been promoted electricity production by technologies, such as photo-voltaic technology and small hydro-electrical stations. The acceleration of the introduction of these technologies is highly foreseeable.

With the amplification of the Thermal Power Plant of Maputo (Central Térmica de Maputo - CTM), which will supply electricity to the Southern region of the country, especially for the metropolitan area of Maputo, it is expected that a stable electricity supply can be guaranteed and reinforced, apart from other benefits, which can be obtained from this project, such as the reduction of losses, the production at a competitive market price, the availability of supply capacity of good quality electricity, the contribution to energetic security in Mozambique (on the medium and long term), the efficient use of the existing EDM staff, the creation of jobs and economic growth, the reduction of CO_2 emissions, amongst others.

1.4 ASSUMPTIONS AND LIMITATIONS

Up to this stage, the final technical description of the project and design parameters, including dimensions, layout, building dimensions, characteristics of equipment were not available for the present study. Also no information was available for estimated amounts of gas and water needed, predicted kind and amounts of effluents (gas emissions or liquid effluents, if any), expected noise emissions of all major equipment and its expected acoustic enclosure performance by the manufacturer or by measurements at similar plants, the expected average and worst-case utilisation of the plant, as well as the construction programme and equipment to be used during the construction phase, all of which would be indispensable for a thorough and detailed identification of impacts, for both, the construction and the operation phase of the project.

Consequently, the identification and description of impacts and adequate mitigation measures could only be done to a limited extent. Also the project description had to be limited to a superficial description of the few details so far available.

2 APPROACH AND METHODOLOGY

2.1 PHASE 1: DESKTOP STUDIES

Desktop review was one of the methods used by all specialists. The desktop review is a method, where data is collected through the review of secondary sources, such as existing documents, reports and other referential materials. A review of the existing literature is particularly important for gathering background information, collecting information for developing data collection tools and for being able to answer basic what and how questions that are the main focus of baseline reports. Relevant national and municipal legal documentation was reviewed and technical specifications and performance data for a number of operational CCGT plants were obtained in order to contextualise the CTM expansion project. Since this study is comprised of a biophysical and social component, a desktop review approach was the preferred method, since it was necessary to describe, analyse, interpret and evaluate secondary sources of information. This review serves to explain the topic of the research, to build a rationale for the problem that is studied and the need for additional studies.

2.2 PHASE 2: FIELD SURVEY

Field visits involve the intensive investigation of individuals and situations. The fieldwork was designed in a way that elements could be studied in depth through an approach that relies on observation and gathering of information, using different methods required by each of the specialities evaluated in this report. The field visits for this study were carried out during the second half of November 2012 by the different specialists. Where necessary, Geographical Information Systems (GIS) and Google Earth were also used as tools for the evaluation of site.

2.3 PHASE 3: REPORT

With the information obtained in Phases 1 and 2, specialist reports have been prepared by the different specialists involved in the study. These specialist reports have been consolidated in the present report, which is divided into eleven chapters presenting the following chapters as detailed in Table 1 below.

Table 1: Structure of this report

Chapter	Description
Chapter 1	Introduction **Presents the purpose of the report, the Project proponent and background, assumptions and limitations and the structure of the report.**
Chapter 2	Approach & Methodology of the study **Describes the approach of the study by describing the different study phases.**

Chapter	Description
Chapter 3	Legal Requirements **Provides a brief overview of the Mozambican legal Framework, relevant international conventions, requirements of international financial institutions and international "Best Practices" standards, as well as other relevant requirements.**
Chapter 4	Description of the proposed Project **Presents a brief description of the project location, background information on CTM, project components, mobilisation of equipment and raw materials during construction, electricity and water supply, waste management and emissions, and personal.**
Chapter 5	Project Alternatives **Presents a brief discussion of alternatives considered for the project.**
Chapter 6	Environmental Baseline **Describes the existing biophysical and socio-economical environment, which could be affected by the project.**
Chapter 7	Environmental Impact Assessment and mitigation Measures **Provides an Environmental Impact Assessment of the different environmental components described in Chapter 6 during the Construction, Operation and Decommissioning phases and mitigation measures for each impact identified.**
Chapter 8	Potential "Fatal Flaws" **Identifies potential "Fatal Flaws" for the implementation of the proposed Project.**
Chapter 9	Stakeholder Engagement **Summarises the stakeholder meetings carried out during the present study in areas adjacent to the project location.**
Chapter 10	Environmental Management Plan **Summarises the objectives of the Environmental Management Plan (EMP).**
Chapter 11	Conclusions and Recommendations **Presents the final conclusions of the study and recommendations.**

2.4 PUBLIC PARTICIPATION AND STAKEHOLDER ENGAGEMENT

The guidelines for environmental and social considerations of the Japan International Cooperation Agency (JICA) specify with regard to consultations with local stakeholders that, in principle, the project proponents consult with local stakeholders through means that induce broad public participation to a reasonable extent, in order to take into consideration the environmental and social factors in a way that is most suitable to local situations, and in order to reach an appropriate consensus. In the case of Category A projects (which is here

the case), JICA encourages project proponents to consult with local stakeholders about their understanding of development needs, the likely adverse impacts on the environment and society, and the analysis of alternatives at an early stage of the project. For this reason, it was decided that the scope of the present study includes small stakeholder meetings involving those stakeholders considered to be directly affected by the planned Gas Power Plant project.

In coordination with the Luís Cabral suburb secretary, it has been decided that the most adequate level of consultation would be the organization of two consultation meetings at the level of the "Heads of 10 Houses" for both, Quarteirão 40 and Quarteirão 40a and a third meeting for consultation with the representatives of the industrial companies and of the Don Bosco Higher Institute, which are located along the N4 road in front of CTM. Given the precarious physical conditions at the headquarters of the suburb, it was opted to present the information on the planned Gas Power Plant project on two large posters to be put up at the wall of the venue. Given that January is the main holiday month in Mozambique, these meetings could only be scheduled for the end of January 2013.

3 LEGAL REQUIREMENTS

The present chapter provides an overview of the relevant legislative requirements and applicable standards for the project in appreciation. These include:

- Mozambique's relevant legislation;
- Relevant international treaties, conventions and protocols to which Mozambique is signatory;
- Relevant environmental and social guidelines and standards, such as the International Finance Corporation (IFC) Performance Standards, the Equator Principles.

3.1 MOZAMBICAN LEGAL FRAMEWORK

Some of the national legal instruments that are applicable to the proposed project are outlined in Table 2.

Table 2: National Legislation Applicable

Law	Main contents
Constitution of the Republic of Mozambique (2004)	Promulgates the fundamental right to a balanced environment and the corresponding obligation to defend it.
	Promulgates that the natural resources situated in the soil and the subsoil, in inland waters, in the territorial sea, on the continental shelf and in the exclusive economic zone, are property of the State.
	Determines that the State shall promote the knowledge, surveying and valorisation of the natural resources, and shall determine the conditions under which they may be used and developed,

Law	Main contents
	safeguarding the national interests.
	Determines that the State has the obligation to promote efforts to guarantee the ecological balance and the conservation and preservation of the environment, with a view to improving the quality of life of its citizens, including the prevention and control of pollution and erosion; to guarantee the rational use of natural resources and the safeguarding of their capacity to regenerate, ecological stability and the rights of future generations; and to promote territorial ordinance with a view to ensuring the correct location of activities, and balanced socio-economic development.
Environment Law (Law 20/97, of 1 October)	The purpose of this law is to define the legal bases for the proper use and management of the environment and its elements in order to establish a system of sustainable development in Mozambique.
	Stipulates a general prohibition to pollute and perform activities that cause environmental degradation outside of the legally established limits (environmental quality standards)
	Stipulates a general prohibition to perform activities that threaten the biodiversity, as well as the obligation to protect and conserve biodiversity.
	Envisages the creation of environmental protection areas at national, regional and local level, covering terrestrial, lacustrine, riverine or maritime areas.
	The Law prohibits the implantation of infrastructures that would provoke a significant negative impact on the environment, due to their size, nature or location, namely in the coastal zones, zones threatened by erosion and desertification, wetlands, environmental protection zones and other ecologically sensitive zones.
	Stipulates the environmental licensing, environmental impact assessment and environmental audit instruments.
Regulations for the Environmental Impact Assessment Process (Decree 45/2004, of 29 September)	Stipulates the environmental impact assessment process for public or private activities that directly or indirectly may influence the environmental components
	States that the following activities are classified as of Category A, thus subject to an Environmental Impact Study: those taking place in areas and ecosystems that are recognised as having a special protection status under national and international legislation, including, among others, coral reefs, mangrove forests, native forests, small islands, eminent erosion zones including seafront dunes, conservation and protection zones or areas, swamps; zones containing animal and/or plant species, habitats and ecosystems in extinction, and unique scenery zones.
Regulation for Environmental Quality and Effluent Emission	Stipulates the environmental quality and effluent emission standards, in order to control and maintain the admissible levels of

Law	Main contents
Standards (Decree 18/2004, of 2 June)	pollutant concentrations in the environmental components.
	Defines particularly the environmental quality and effluent emission standards for receiving water bodies, treatment technologies, systems and methods.
	It regulates the elimination of industrial liquid effluents into the receiving environment, which must be carried out through an appropriate entity for this purpose, and the final effluent must be discharged in accordance with specified emission or discharge standards. It requires that the location of the point of discharge or emission be determined during the environmental licensing process, so that there is no change to water quality in the receiving body, making the use of its water for other purposes impossible. The discharge of liquid effluent or pollutants that affects or may affect swimming areas must be controlled on the basis of sanitary quality monitoring of the respective waters and beaches.
Amendments to the Regulation for Environmental Quality and Effluent Emission Standards (Decree 67/2010, of 31 December)	This decree, among other items, amends the Standards for Receiving Entities (sea/ocean), now including a Table 1 relative to potentially hazardous chemical substances and Table 1A, relative to potentially harmful chemical substances (pesticides).
	Adds Annexes 1A and 1B dealing with Organic and Inorganic Carcinogenic Air Pollutants and Substances with Odoriferous Properties, respectively.
Regulation regarding the Environmental Auditing Process (Decree 25/2011, of 15 June)	This regulation defines environmental auditing as a management tool for the systematic, documented and objective evaluation of the functionality and organization in the environmental control and protection processes, and establishes standards for its operationalisation.
Regulation for Environmental Inspection (Decree 11/2006, of 15 June)	This Regulation is intended to regulate supervisory, control and auditing activities related to compliance with environmental protection standards at national level.
Regulation for Waste Management (Decree 13/2006, of 15 June)	Stipulates the rules for the production, emission or discharge into the soil and subsoil, into water or the atmosphere, of any toxic and polluting substances, as well as the performance of activities that accelerate the degradation of the environment, so as to prevent or minimize their negative impacts on health and the environment.
Atmospheric Emissions and Air Quality no 18/2004 of 2 June)	Defines the norms for emissions of pollutants deriving from fixed and mobile sources.
	Establishes the norms for the air quality and emission of effluents (Article 16 and Article 7 respectively) with the objective to guarantee the efficient control and monitoring of the quality of the environment and natural resources.

Law	Main contents
Noise - Decree no 18/2004 of 2 June)	Establishes that norms referring to the emission of noise will be approved by MICOA.
	Defines that the norms for the emission of noise will be established by taking into account the emitting source of the noise.
Regulation for the Prevention of Pollution and Protection of the Marine and Coastal Environment (Decree 45/2006, of 30 November)	In general, this regulation stipulates standards for the prevention and combat of marine and coastal pollution from terrestrial and marine sources
	Particularly, its objective is to prevent and limit pollution caused by illegal discharges done by ships, platforms or by land-based sources, off the Mozambican coast. A reference summary of the 73/78 Marpol Convention Rules with respect to oil and harmful liquid spills is annexed to the decree.
	Prohibits the casting or dumping of any toxic or harmful wastewater, as well as of any other substances or residues that in some way may pollute the water, beaches or margins, without observing the relevant legal provisions.
	Stipulates the legal bases for the protection and conservation of the maritime, lacustrine and riverine areas, belonging to the public domain, of beaches and fragile ecosystems. Protects particularly sensitive ecosystems, such as dunes, coral reefs, wetlands, mangrove areas and seagrass beds.
Regulation for the Management of Substances that Destroy the Ozone Layer (Decree 24/2008, of 1 July)	Prohibits the importation, exportation, production, trading and transit of substances that destroy the ozone layer.
National Land Policy (Resolution of the Ministers Council No. 10/95, from 17th October)	Establishes that the State has to provide land for all families having or constructing their own habitation and is responsible for the land use and physical planning, although these plans can be elaborated by the private sector.
Land Law – Decree no 19/97 of 1 October	Establishes the bases that define the land use, including details with regard to the rights and customary processes for the acquisition of land use and ownership rights by communities and individuals.
Land Law Regulations - Decree No. 66/98 of 8 December	Define total reserves indicated for activities of nature conservation and defence and security of the state, as well as partial reserve, in which land use rights cannot be acquired and activities cannot be implemented without obtaining a license.
	Define partial reserves, which include, amongst other aspects, the strip of land along river and lake margins up to fifty metres from the maximum water line; the strip of land up to a hundred metres around fountains; the coastline measured around the periphery of islands, bays and estuaries, from the high tide water line up to a hundred metres to the interior of the territory.

Law	Main contents
Electricity Law (Law 21/1997 of 1 October)	Secure the regular supply of power to a cost as low as possible in order to satisfy the current consumption needs and the economic development needs;
	Increase the availability of power for the domestic sector, in particular coal, kerosene, gas and electricity
	Strengthen the institutional capacity of the main institutions of power supply aiming at improving their performance
	Promote economically feasible investment programmes aiming at the development of energetic resources (hydro-electrical power, forests, coal and natural gas)
	Increase the exports of energetic products and increase the efficiency of power usage
	Promote the development of transformation technologies and the use of environmentally benign power (solar. eolian and biomass energy)
	Promote a more efficient, dynamic and competitive entrepreneurial sector
Electricity Act no 21/97	Defines the institutional and juridical Framework for the production, transmission, distribution and sale of electrical power in the country, as well as its exportation and importation and the attribution of concessions for these activities.
	The general legal framework for electrical energy generation, transmission, distribution and sale within the country, as well as its export to and importation from outside of the national territory, and the granting of concessions for such activities.
Ministerial Decree no 20/97	Defines the organic legal basis of the National Directorate of Energy (DNE), establishing its functions, areas of activity, management levels and structure, including the services to be provided by the various departments defined in the structure.
Forest and Wildlife Law (Law 10/99, of 7 July)	Stipulates the basic principles and standards for the protection, conservation and sustainable use of forest and wildlife resources in the scope of integrated management, for the economic and social development of the country.
	The Article 10 defines reserves as demarcated territorial areas, representative for the national patrimony, indicated for the conservation of the biodiversity and of fragile ecosystems or the conservation of animal or plant species.
Regulation of the Forest and Wildlife Law (Decree 12/2002, of 6 June)	Protects, through the inclusion of a list, a series of species, the hunting of which is prohibited.
Hydric Resources and Water	~~Approves the Water Policy and revokes The National Water Policy~~

Law	Main contents
	approved in the terms of the Resolution 7/95 of 23rd of August.
	This new policy aims at including pertinent aspects that have not been considered in the previous policy, such as the improvement of sanitation in the urban, suburban and rural areas, the hydrological networks, the development of new hydraulic infrastructures and the integrated management of hydrological resources with the participation of different stakeholders.
Quality (Resolution 46/2007 of 30 October)	The Decree No. 18/2004 from 2nd June regulates the Environmental Quality Standards and the Emission of Effluents, defining the parameters for characterising water quality. The parameters for water quality in water supply systems are defined in the Law 180/2004 from 15th September, which regulates the Water Quality for Human Consumption. These regulations are applicable to the drinking water supply systems for human consumption, including surface and underground water used for the direct consumption or for the production of water for human consumption. The Ministry of Health is responsible for the supervision of the water quality for human consumption.
Fisheries Law (Law 3/90, of 26 September)	Defines the legal framework regarding fisheries planning and management, the implementation of the licensing regime, the adoption of resource conservation measures, the inspection of the quality of fishing products for exportation, and regarding the fishing activity inspection area.
Tourism Law (Law 4/2004, of 17 June)	Stipulates the legal framework for the promotion and performance of tourism activities.
	Stipulates the general rule that the development of tourism activities should respect the environment, particularly forest, wildlife, energetic and water resources and protected zones.
	Envisages the creation of Tourism Interest Zones, in areas that, due to the relevant characteristics of their natural and cultural resources and historical value, can produce tourist flows.
	Establishes that tourism in de conservation areas should comply with biodiversity protection and conservation principles.

3.2 INTERNATIONAL CONVENTIONS

The International Treaties and Conventions, to which the Government of Mozambique is signatory are presented in Table 3 below:

Table 3: International Treaties and Conventions signed by GoM

Year	Convention
	Habitats and Biological Diversity

Year	Convention
1968	African Convention on the Conservation of Nature and Natural Resources
1971	Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention)
1979	Convention on the Conservation of the Migratory Species of Wild Animals (Bonn Convention)
1985	Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region; Protocol for Protected Areas, Wildlife and Vegetation; and Protocol for Cooperation in the Fight against Pollution in Emergency Situations
1992	United Nations Convention on Biodiversity
1999	SADC Protocol on Wildlife Conservation
2001	SADC Protocol on Fisheries
2002	SADC Protocol on Forestry
2003	African Convention on the Conservation of Nature and Natural Resources. Revised version
	Water Resources
1990	International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC)
1992	International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND)
1992	International Convention on Civil Liability for Oil Pollution Damage, (CLC Protocol)
	Archaeology and Cultural Heritage
1972	UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage
	Hazardous Waste
1991	Convention on the Ban of the Import into Africa and the Control of Transboundary Movements and Management of Hazardous Wastes within Africa (Bamako Convention)
1992	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
	Other Conventions
2002	Stockholm Convention on Persistent Organic Pollutants

3.3 REQUIREMENTS OF INTERNATIONAL FINANCIAL INSTITUTIONS AND INTERNATIONAL BEST PRACTICE STANDARDS

International Finance Corporation (IFC) Performance Standards

The IFC has a Sustainability Policy and set of Performance Standards on Social and Environmental Sustainability (in force from July 2006). These Standards replace the prior safeguard policies and will be used to evaluate any project seeking funding through the IFC. The Performance Standards are listed in **Box 1**.

BOX 1: IFC PERFORMANCE STANDARDS

- PS 1: Social and Environmental Assessment and Management System;
- PS 2: Labour and Working Conditions;
- PS 3: Pollution Prevention and Abatement;
- PS 4: Community Health, Safety and Security;
- PS 5: Land Acquisition and Involuntary Resettlement;
- PS 6: Biodiversity Conservation and Sustainable Natural Resource Management;
- PS 7: Indigenous Peoples; and
- PS 8: Cultural Heritage.

IFC Environmental, Health and Safety (EHS) Guidelines (2007)

The IFC EHS Guidelines are technical reference documents, providing general and industry-specific examples of good international practice in environmental management. They are used by the IFC as part of the appraisal of projects under the IFC's project evaluation mandate. The IFC EHS Guidelines represent the performance standards normally considered acceptable by the IFC, and generally considered to be achievable in new facilities at reasonable cost by existing technology. When host country regulations differ from the levels and measures presented in the EHS Guidelines, the IFC recommends that projects should achieve whichever is more stringent. The specific IFC EHS Guidelines considered relevant to the Project are those regarding the development of a power plant.

World Bank Group Operational Policies

Environmental Assessment is one of the 10 environmental and social Safeguard Policies that the World Bank uses to examine the potential environmental risks and benefits associated with World Bank lending operations. The World Bank's Environmental Assessment policy and procedures are described in Operational Policy/Bank Procedures - OP/BP 4.01.

Detailed advice and guidance on the conduct of environmental assessment is provided publicly by the World Bank in its Environmental Sourcebook and Updates[1]. During project preparation, the World Bank examines the implications of the proposed project for a series of 'safeguard' policies. These are:

- Environmental Assessment;
- Natural Habitats;
- Forestry;

[1]http://www.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/EXTENVASS/0,,contentMDK:20282864~pagePK:148956~piPK:216618~theSitePK:407988,00.html

- Pest Management;
- Cultural Property;
- Indigenous Peoples;
- Involuntary Resettlement;
- Safety of Dams;
- Projects in International Waters; and
- Projects in Disputed Areas.

Equator Principles

Banks working in the project finance sector developed 10 environmental and social Principles in 2003, called Equator Principles, to apply globally when addressing environmental and social risks in project financing. Equator Principles Banks will only loan to projects that are in conformity with these Principles.

These Principles, shown in **Box 2** reflect the IFC-inspired environmental and social best practice guidelines in the financing of large projects and have been revised to adhere to the new IFC Performance Standards (but do not reference the Sustainability Policy).

BOX 2: EQUATOR PRINCIPLES
1. Review and categorisation
2. Social and environmental assessment
3. Applicable social and environmental standards (IFC)
4. Action plan and management system
5. Consultation and disclosure
6. Grievance mechanism
7. Independent review
8. Covenants
9. Independent monitoring and reporting
10. EPFI reporting, at least annually

3.4 OTHER REQUIREMENTS

There are a number of other important requirements of international financial institutions and best practice standards regarding thermal power plants. **BOX** 3 provides information of these requirements that are relevant for the Maputo Power Plant project.

BOX 3: Other Important Requirements of International Financial Institutions and Best Practice Standards

- Thermal Power: Guidelines for new plants (1998)
- IFC Environmental, Health & Safety Guidelines for Thermal Power Plants (2008)
- IFC Environmental, Health & Safety Guidelines for Geothermal Power Generation (2007)
- World Health Organisation (WHO) Guidelines for Drinking Water (4th Edition)
- World Health Organisation (WHO) Guidelines for Community Noise (1998)
- World Bank / IFC Ambient Noise Guidelines
- World Health Organisation (WHO) Guidelines for Ambient Air Quality (2005)
- IFC Environmental, Health & Safety Guidelines – Waste Management (2007)

3.5 THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS IN MOZAMBIQUE

In Mozambique, an EIA is a legal requirement under the Environmental Law (Law 20/97) and is set out in the Regulations on the Environmental Impact Assessment Process (Decree 45/2004).

According to Article 2 of the Regulations on the Environmental Impact Assessment Process the dispositions of this diploma apply to all public or private activities that can, directly or indirectly, influence the environment, in accordance to the terms of the Article 3 of the Environmental Law[2].

As per 4.7a) of Appendix 1 of the EIA Regulations: Hydroelectric power plants; thermal power stations; geothermal installations and nuclear power stations require an EIA.

Article 5 describes the institutional competences for environmental impact assessment:

The Environmental Impact Assessment Authority is responsible for[3]:

- Managing and coordinating the EIA process;
- Naming and chairing the Technical Evaluation Committee for each category A activity, whenever deemed necessary;
- Conducting and guiding the analysis of EPDA, ToR, EIA Reports as well as their approval for Category A activities;
- Requesting the participation of specialist technicians from the public sector or hire private sector consultants whenever necessary for the EIA process;
- Holding public meetings and ensuring that public participation is complied with in accordance to the terms of this Regulation;
- Notifying the proponent on the payment of environmental licensing fees in accordance to the terms of the current Regulation;
- Issuing environmental licenses;

[2] The Decree N.º 45/2004 of 29th September is published in the Boletim da República No. 39, 1st Series, Supplement, of 29th September 2004

[3] i.e. The National Directorate for Environmental Impact Assessment, MICOA.

Carrying out, in coordination with the sectoral authorities bodies responsible for the activity, the post-evaluation process including analysis of monitoring reports, environmental auditing and promoting inspection and supervision of licensed activities.

According to the EIA Regulations the granting of an Environmental License is a prerequisite to a range of development activities (defined in the Regulations, Annexes I, II and III). The Proponent can only begin the project implementation once the Environmental License has been granted.

The EIA Regulations define three project categories (A, B and C) on basis of which the extent of the environmental assessment is determined by MICOA. Three categories of project are defined by the new Regulations (Article 3):

- Category A: Activities presented in Annex 1 are considered to have significant adverse impacts on the environment and are subject to an EIA;
- Category B: Activities listed in Annex II are those for which potential environmental impacts are less adverse than those of Category A projects and are subject to a Simplified Environmental Assessment (SEA); and
- Category C: Activities listed in Annex III are exempt from an EIA and SEA but still require observance of good management practices.

In accordance with EIA Regulations, there are three distinct steps to carrying out an EIA for a Category A Project:

- Registering the EIA with the Ministry for the Coordination of Environmental Affairs (MICOA) ("Instrução do Processo");
- Preparation of an Environmental Pre-feasibility and Scope Definition Study (EPDA) ("Estudo de Pré-viabilidade Ambiental e Definição de Âmbito") and Terms of Reference for the EIS;
- The EIA Study, *per se*.

Registration of the EIA

In the first instance the proponent must register the project with MICOA in order for the project to be classified (Category A, B or C).

The documentation for registering the EIA with MICOA are as follows:

- Descriptive Memoir;
- Description of the activity;
- Justification for the Activity;
- Legal framework;
- Summary bio-physical and socio-economic description of the area;
- Resource use in the area;
- Information about the environment in the area of the proposed activity;

- Information about the EIA steps, i.e. production and submission of the Terms of Reference (TOR), Environmental Pre-feasibility and Scoping Study (EPDA); and
- Preliminary Environmental Information Form (available at the National Directorate for Environmental Impact Assessment).

Environmental Pre-feasibility and Scoping Study and Terms of Reference

Upon confirmation from MICOA that a project is classified as a Category A the proponent must prepare an Environmental Pre-feasibility and Scoping Study Report (EPDA Report) and prepare Terms of Reference (ToR) for the EIS.

EPDA Report contains as a minimal the following information[4]:

- Non-technical Summary, including the main issues addressed, as well as conclusions and recommendations;
- Identification and address of the Proponent and the multi-disciplinary team responsible for conducting the EIS;
- The limits of the indirect influence area of the activity and land use patterns in the direct and indirect influence areas;
- Description the activity and the anticipated actions, as well as the respective alternatives in planning, implementation and operation (or deactivation, in case of temporary activities);
- Biophysical and socio-economic description of the area;
- Identification and evaluation of any potential fatal flaws of the activity;
- Identification and description of the issues to be addressed in detail in the EIS; and

The Terms of Reference for the preparation of EIS must include, at least[5]:

- Description of specialist studies, identified as necessary during the EPDA and to be carried out during the EIS, in the case of category A activities;
- Description of identified feasible alternatives and that must be investigated in the EIS;
- Methodology to identify and evaluate environmental impacts in the construction, operation and deactivation phases;
- Description of the public participation process;
- Identification of the proponent;
- Identification of the team responsible for the preparation of the EIS;
- Requirements for additional information needed.

The EPDA Report and corresponding ToR for the EIS must be submitted to the DNAIA in the form of hard copy reports written in Portuguese. The proponent must submit the number of hard copy reports as specified following registration of the project with DNAIA. In addition, one sealed digital copy must be submitted.

[4] Article 10
[5] Article 11

Environmental Impact Study

Upon approval of the EPDA and ToR for the EIS by MICOA, the proponent may proceed with the EIS, *per se*.

The minimum contents of an EIS Report include the following:

- Abbreviations and acronyms;
- Executive Summary;
- Introduction;
- Description of the proposed project and its social and economic integration;
- Description of the implementation area;
- Outline of the legislation, regulations and administrative organization;
- Approaches and techniques utilized for collection of information and analysis of the impacts;
- Consultation with the stakeholders;
- Description of the environmental impacts over the proposed project area;
- Proposal for mitigation methods;
- List of people/institution contacted; and
- Bibliography/References.

Guidelines and procedures for EIA are further defined in General Directives for Environmental Impact Assessment.[6]

Public Consultation

Public Consultation is an integral part of the EIA process for projects classified as Category A as laid out in Article 14 of the EIA Regulations:

> "Public participation from the phase of the conception of the activity until of the EIA Report is the responsibility of the proponent."

An invite for any public meeting shall be made public 15 days before it takes place using the means deemed adequate for its advertisement. All interested or affected parties, directly or indirectly, are entitled to take part in the EIA process. All technical reports produced within the scope of the EIA shall be made available for public consultation.

The final EIA Report submitted to MICOA shall include a Public Consultation Report.

The Guidelines for Public Participation are further defined in the General Directive for the Public Participation Process in the Environmental Impact Assessment Process.[7]

[6] The Ministerial Diploma 129/2006 published in the Boletim da República No. 29, 1st Series, of the 19 July 2006

[7] The Ministerial Diploma 130/2006 published in the Boletim da República No. 29, 1st Series, of the 19 July 2006

Review of EPDA[8]

The Environmental Impact Assessment Authority will designate a Technical Evaluation Committee to review the EPDA comprising the following elements:

a) A representative of DNAIA who will chair the Committee.

b) A representative of the Ministry responsible for the activity.

c) Other representative(s) of government agencies, teaching institutes or research centres.

d) Technicians specialized in a particular area as required (by request or under contract)

Upon final review of the EPDA the Technical Committee a will prepare a technical review report and minutes signed by all members of for submission to DNAIA.

Reviews of EIS Report [9]

The same Technical Evaluation Committee that evaluated the EPDA will evaluate the EIS Report.

The Technical Committee will review the EIS Report and submit a technical report to DNAIA. DNAIA must communicate the results of the technical evaluation to the proponent and may request complementary information. The proponent has 10 working days to comply with the request for additional information.

After a final review of the EIS Report the Technical Evaluation Committee will prepare a technical review report with minutes signed by all the members. The signed minutes forms the basis for decision to issue an environmental license.

Deadlines to inform about decisions

The Environmental Impact Assessment Authority must comply with the following deadlines:

a) Pre-assessment – up to five working days;

b) EPDA and ToR – up to thirty working days;

c) Environmental impact study – up to forty-five working days.

Fees for environmental licensing

For environmental licensing for a Category A Project a fee of 0.2% of the investment is applied and is payable to the Ministry of Finances.

[8] Article 15

[9] Article 16

4 DESCRIPTION OF THE PROPOSED PROJECT

4.1 PROJECT LOCATION

The proposed Maputo Gas Power Plant project will be implemented on the premises of the already existing Thermal Power Plant of Maputo, which is located 3 km in the northwest from Maputo Port at the margins of Maputo Bay. The exact location is indicated in Figure 1 below.

Figure 1: Location of the Maputo Thermal Power Plant

4.2 BACKGROUND INFORMATION OF CTM

The Maputo Thermal Power Station (CTM) was originally established to supply the Mozambique's capital Maputo. The main production units have initially been coal-fired, but currently three turbines are in place, of which two are burning diesel and one is burning jet fuel. In the early 90ies, the station started facing serious maintenance problems and the replacement of machinery was considered crucial to ensure reliable production. In consequence, an additional gas generator was installed. Since the early 1970s, the Maputo area has been connected to the South African grid system through a 120 MW capacity interconnection. This link eventually became the main supply to the area, leaving CTM as a stand-by unit and for peaking purposes.

The turbines currently in operation CTM have been installed in 1967 (manufacture year 1965), 1974 (manufacture year 1973) and 1992 (manufacture year 1990) and their capacity totals 68 MW, as shows the table below:

Table 4: Technical specifications of the currently existing turbines at CTM

	GTG1			GTG2		GTG3	
	Bristhol Siddley BS (burning Jet Fuel)			BBC (burning diesel)		Alstom (burning diesel)	
	Gas generator	Power Turbine	Generator	Turbine	Generator	Turbine	Generator
Manufacture	Bristol Siddley	Bristol Siddley	GEC	BBC	BBC	Alsthom	Alsthom
Model/Type	BS 2006 m	BS Olympus		11-B	WT17L-052	MS 5001/P	T180-180Y
Nominal capacity (MW)	17.5	-	26.25	36	48.2	25.8	22
Shaft Speed (rpm)	6615/8018	3000	3000	3634	3000	5120	3000
Manufacture year	1965			1973		1990	
Installation year	1967			1974		1992	
Total running hours	2020.3			8331.6		373.3	
Total number of starts	1223			986		130	

Note: The gas generator of this gas turbine was installed in 1990 and it has only 60 running hours

Source: EDM, 2013

4.5 PROJECT COMPONENTS: BRIEF DESCRIPTION

The Figure 2 below shows the preliminary layout for the proposed Maputo Gas Power Plant at the CTM location. Some of the project components are described briefly below.

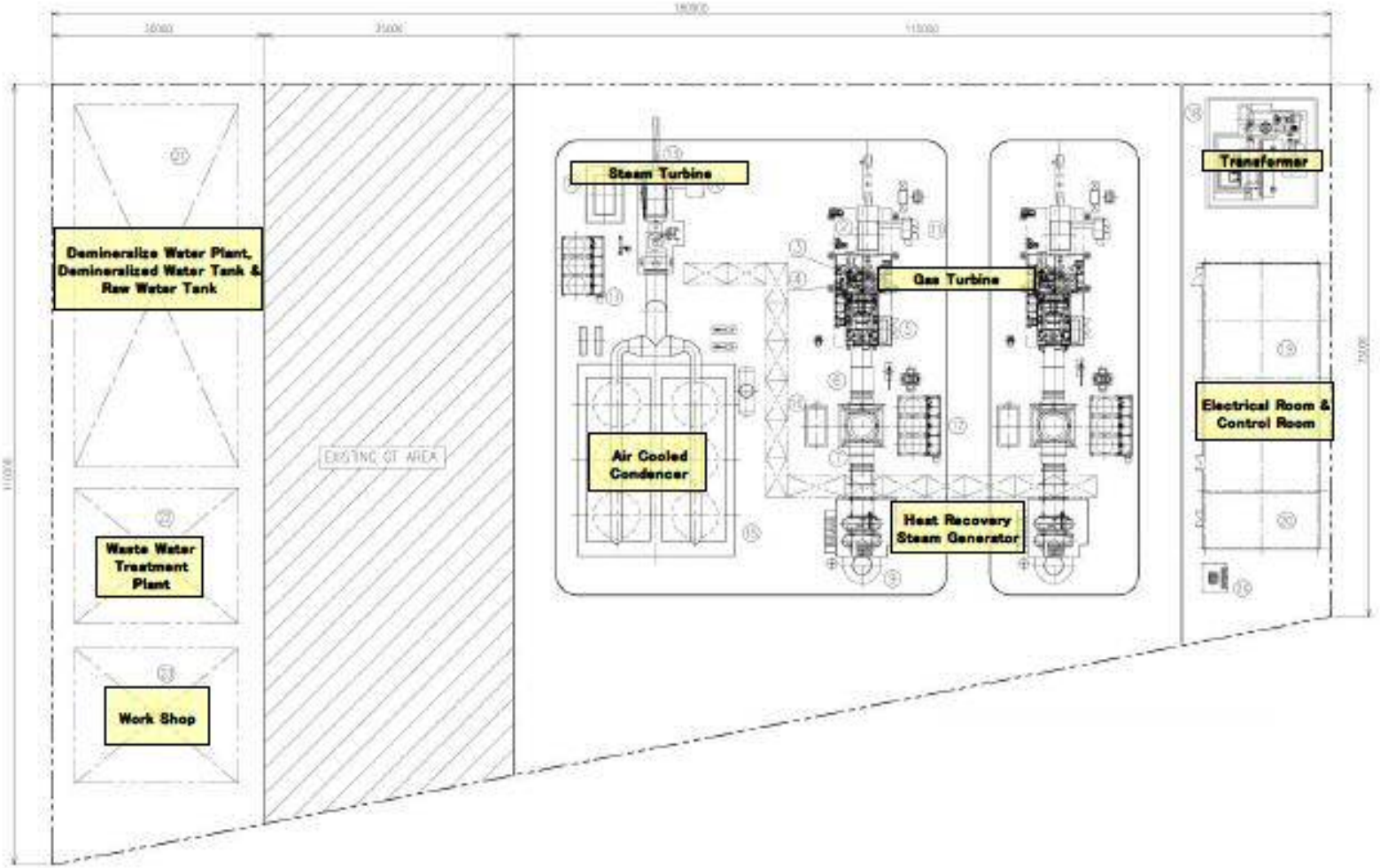


Figure 2: Preliminary layout for the Gas Power Plant with different components

After the expansion of the CTM, there will be operating the already existing turbines GTG2 and GTG3 (refer to Table 4 above) with natural gas and in an open cycle with a capacity of 30 MW and 21 respectively, as well as 2 new gas turbines operating in a combined cycle with a capacity between 70 and 100 MW.

Gas Turbine

The gas turbine shall be of an open cycle heavy duty single-shaft type, of which the turbine inlet temperature level is of F-class. The gas turbine shall be capable of operating on a simple cycle mode, as it is scheduled to be put into commercial operation in advance, separately from the bottoming system, in view of the present impending power supply shortage situation in Mozambique. To this end, it is a requirement that the gas turbine should be equipped with an exhaust gas bypass facility.

The gas turbine shall be operated with natural gas and shall be of an advanced design to meet the NOx emission requirement of less than 25 ppm (15% O^2 basis on dry volume) on a dry condition for operation on the specified natural gas under 75 – 100% load (Source: JICA 2012).

Steam Turbine

The steam turbine shall be of the double-pressure, condensing type, directly connected to the generator. The steam shall be downward or axially exhausted to a surface condenser, which is cooled by the fresh circulating water, which is in turn cooled with a forced draft wet type cooling tower.

The steam turbine and auxiliary systems will be designed to run continuously under all specified operating conditions over the specified lifetime of the plant. The maximum capability will be such as satisfies the conditions of steam pressure, temperature, flow as developed by the Heat Recovery Steam Generator (HRSG), when the gas turbine is operated on the maximum capability ambient conditions. In case that the HRSG is supplementary fired, the steam turbine will be sized to cope with the maximized capability of the HRSG in consideration of the supplementary firing over the specified ambient condition (Source: JICA 2012)s.

Fuel Supply System

The new plant shall be operated on natural gas. The gas turbine and heat recovery steam generator will be designed to operate on the specified natural gas. The fuel gas supply system shall cover all the equipment required for the start-up, shutdown and continuous operation of the gas turbine. A booster compressor station, a pre-treatment system, and a gas pressure-regulating device will be included. The pre-treatment system will be facilitated to clean the specified gas to the extent that it will be used for the gas turbine without any difficulties (Source: JICA 2012).

Water Treatment System

The processed water, such as the demineralised water, drinking water, clean water, water for fire-fighting, and water for miscellaneous use will be split from the water piping at the entrance of the CTM Power Plant and produced, if necessary, by use of a pre-treatment system. Demineralised water will be used for supplying make-up water to the HRSGs, cooling of the gas turbine air intake, cooling of the auxiliary machine and the water supply for chemical injection. The pre-treatment system consists of a coagulator and filter, etc. The de-mineraliser system will consist of chemical storage and regeneration equipment, etc. (Source: JICA 2012).

Wastewater System

Wastewater shall consist of neutralised regeneration waste from HRSG blow-down, floor drains from the gas turbine and steam turbine buildings and contaminated yard drains from the transformer area. Sewage and sanitary wastewater shall be treated in a purifying facility. Floor drains from the gas turbine and steam turbine building and contaminated yard drains from the transformer area will be treated in oil/water separators. After treatment, these clean wastewater streams shall be discharged through the main drainage pipe to Maputo Bay (Source: JICA 2012).

Fire Fighting System

The CTM Maputo CCGT will be designed and built with the provision of a safe operating environment and personnel. This will be achieved by separation and segregation of equipment with sufficient distances and by selection of suitable equipment and materials. Hazardous areas are designated and suitable equipment is selected for use in these. Different fire fighting systems will be installed depending on the operational characteristics of the equipment, area and building to be protected. The fire fighting capacity of the CTM Maputo CCGT has to withstand a fire during two (2) hours, according to NFPA 850 will be minimum 300 m3 and pressure of approximately 10 bar (Source: JICA 2012).

The CTM Maputo CCGT will have its own fire water fighting system with pump house and the fire water will be provided from the raw water tanks. The new pumps consist of:

- one 100% electric jockey pump
- one 100% electric driven main pump
- one 100% diesel engine driven main pump

The water demand and required pressure for the worst case condition will be ensured by electrically driven main pump, the second duty diesel engine driven pump shall be on stand-by, for the case of main supply failure. The engine driven pump will be of the same capacity than the electric driven main pump.

The fire fighting system of the CTM Maputo CCGT will generally follow the applicable stipulations of NFPA codes. Extinguishers will be sized, rated and spaced in accordance with NFPA 10. Local buildings fire alarms, automatic fire detectors and the fire signalling panel will be in accordance with NFPA

It will be assured that a dedicated two (2) hour fire water supply to cover the system design flow rate is available for the facility in accordance with NFPA.

A main firewater pipeline will be provided to serve strategically placed yard hydrants and supply water to the sprinkler and spray system. The firewater distribution system will incorporate sectionalising valves so that a failure in any part of the system can be isolated, while allowing the remainder of the system to function properly. Fuel oil tanks are furnished with foam fire fighting systems (Source: JICA 2012).

4.6 SUMMARY OF THE PROJECT COMPONENTS

The equipment to be installed for the new Maputo Gas Power Plant consist in the following components:

Table 5: Summary of facilities planned for the MGPP

No.	Facilities	No. of Units
1	Gas-turbine power generator	2
2	Steam-turbine power generator	1
3	Heat recovery steam generator	2
4	Air-cooled condenser	1
5	Electric room, central operation room, office building	1
6	Fuel gas reception facility and supply facility (compressor, decompression facility)	1
7	Water treatment facility	1
8	Effluent treatment facility	1
9	Fire extinguishing facility	1
10	Drain collection facility	1
11	Bearing cooling facility	1
12	Power generator voltage rising transformer	1
13	In-premise transformer	1
14	Emergency power generator	1

4.7 MOBILIZATION OF EQUIPMENT AND RAW MATERIALS DURING CONSTRUCTION

Transportation of Heavy Equipment

The CTM site faces the river mouth to Maputo Bay. However, the shore in front of the site is a tidal flat with mangroves, so there is no possibility of direct unloading from the river. Therefore, the heavy equipment for the project, such as the main transformer and gas turbine, which are estimated to weigh approximately 100 tons, should be unloaded at Port Maputo and transported by road (Source: JICA 2012).

Unloading at Port Maputo

Port Maputo is currently operated and controlled by MPDC (Maputo Port Development Company) with the concession given by Mozambique government up to 2033. According to MPDC, the berth No. 15 is designed for heavy cargo with a connecting road and is most suitable for unloading heavy equipment for this project (Source: JICA 2012).

There is no lifting equipment for 100 tons class cargo at Port Maputo. Therefore, heavy equipment should be transported by heavy-lift ship (Source: JICA 2012).

Inland Transportation

The weight and size of vehicles on the road are limited by Decree No. 14/2008 and the limits for trailers are as follows:

Total weight should not exceed the following weights:

- 3 axles: 25 tons
- 4 axles: 34 tons
- 5 axles: 42 tons
- 6 axles: 48 tons
- 7 axles or more: 56 tons

In terms of size the maximum length are defined as 22 m and the maximum height from the ground as 4.3 m. The weight and size of heavy equipment, such as the main transformer and gas turbine exceed the above limits. In such a case, the transportation method (e.g. by using multi-axle trailers designed for super-heavy cargo) based on a road survey should be proposed to ANE for their approval (Source: JICA 2012).

It should be noted that the special multi-axle trailer necessary for the transportation of super-heavy equipment is not available in Mozambique and needs to be arranged from South Africa.

Route of Inland Transportation

As shown in the Figure 4 below, the route proposed for the inland transportation from Port Maputo to the CTM site will be as follows:

Berth No.15 → Road in Port Maputo → N1 →Crossover-1 above railway →EN2 → Crossover-2 above railway → CTM Maputo site (Source: JICA 2012).

(Source: JICA 2012)

Figure 3: Proposed transportation route from Maputo Port to CTM site

This route including two crossovers is on major trunk roads with heavy daily traffic. Therefore, it is considered that the heaviest equipment, such as the main transformer and the gas turbine, can be transported by special multi-axle trailer designed for super-heavy cargo.

4.8 ELECTRICITY AND WATER SUPPLY

During the construction phase and the operation phase, both, electricity and water will be supplied through installations already existent at the CTM site. Thus, there will be no need for using diesel generator groups. The exact quantity of water and electricity to be used during the construction phase has not yet been determined. During the operation phase, electricity will be used for the operation of the sub-stations (illumination and control) and natural gas will be used for the production of electrical power. For the combined cycle operation it is estimated that approximately 20 m^3/hour of drinking water will be consumed, which will be supplied by FIPAG (Fundo de Investimento e Património do Abastecimento de Água – Water Supply Investment and Patrimony Fund) in the same conditions, in which the existing installations are supplied.

The technical study currently underway will propose, which one of the three different types of cooling systems may be used as the condenser cooling system of the steam turbine: once-through cooling system, mechanical draft cooling tower system, and air-cooled condenser system.

Both, the once-through cooling system and the wet cooling system would always require cooling water in addition to the above mentioned 20m^3/h water for the plant, namely 7.000 m^3/h and

300 m^3/h respectively. While the first option would also require an inlet channel about 1.2 km long and the construction of an intake tower, the second option would not require large-scale, additional facilities up to a water source, because the city water pipeline stretches to the neighbourhood of the site. If the third option, namely an air-cooling condenser is used, no water other than the make-up water for the plant will be necessary.

4.9 WASTE MANAGEMENT AND EMISSIONS

Unlike coal-fired power plants, CCGT's do not produce large solid waste streams. Natural gas is a relatively "clean" hydrocarbon fuel and consequently most solid wastes associated with natural gas-fuelled electricity generation are attributable to other stages of the lifecycle of the electricity, including the natural gas extraction process and wastes arising from the gas distribution network. A limited inventory of wastes will be generated during the construction, commissioning and operational phases of the project.

General waste originating from the CCGT at CTM will be disposed of at one of two municipal dumpsites in the Maputo/Matola area, situated in each of the Hulene and Malhampsene suburbs. The material entering Hulene and Malhampsene is not subject to any form of recycling process or treatment (e.g. incineration) and is left to decompose with time. These dumpsites have been identified as no longer suitable for waste disposal and will be closed following the commissioning of a new landfill in Matola (also refer to Chapter 10 of this report).

With regard to hazardous waste, the only facility suitable for receiving this is the Mavoco landfill in Boane Suburb, Maputo province. The site is owned by the Fund for Environmental Matters (FUNAB) and managed by a private company specialized in waste management, Enviroserv, for a period of 5 years.

4.10 PERSONAL

Part of the less non-qualified or semi-qualified labour necessary for the construction will be recruited locally (Maputo city and Maputo province) for executing tasks that do not imply specialised labour. The labour required for the erection and fitting of the plant and the equipment will be specialised and its recruitment will depend to a large scale on the company selected for the construction and installation works.

During operation and maintenance of the gas power plant, labour is expected to total 16 Mozambican workers, both qualified and non-qualified. However, the exact number of labour to be employed at the power plant is yet to be confirmed.

5 PROJECT ALTERNATIVES

5.1 NO-ACTION ALTERNATIVE

The Cahora Bassa Hydroelectric Dam (HCB) is the main source of electrical power supply in Mozambique. Part of the power produced is being transported to the Central and Northern regions of the country by means of a 220 kV AC transmission line, the other part is being transported to the neighbouring country Zimbabwe by means of a 400 kV AC transmission line. However, the largest part of the power produced by HCB is being sent to the Apollo substation in South Africa through a 535 kV DC transmission line and part of it is then supplied to the SAPP region.

Mozambique's national power grid is interlinked with the Southern Africa Power Pool (SAPP) and operates as an integral part of the countries in the region. As the power system of the Southern region, which includes Maputo City, is located more than 1,000 km away from the HCB, the power is being imported from the SAPP through the power networks of South Africa and Swaziland through a 400 kV AC transmission line. As a result, more than 80% of the internal power demand is being supplied via South Africa.

Currently, the demand for electrical power in the entire country corresponds to approximately 610 MW and 4,025 GWh/year of power consumption, with a maximum potency of 610 MW. However, the average annual growth rates during the past 5 years reached values between 10.6% and 13.8%. The prevision is that the demand for power will continue to increase at high rates during the next years because of the new economical activities underway or starting and the expected increase in income levels.

The entire Southern region, which includes the metropolitan area of Maputo, has an electrification rate of 42%, considerably higher than the average national rate of 18%. Maputo city has a rate of 82%. On the other hand, the maximum potency reached in the Southern region is 369 MW, corresponding to 60% of the above mentioned 610 MW, which represents a constant average annual growth rate of 11.3%.

The demand for electrical power is expected to increase continuously at a constant rhythm in the next future. However, the purchase of electrical power from the Cahora Bassa Hydro-electrical Dam, which corresponds to 88% of the power supply capacity of the municipality, is limited to 300 MW of firm energy and 200 MW of not firm potency. Any increase in these numbers is considered to be difficult, as this requires cession negotiations with other countries affiliated in the SAPP.

With the No-Action Alternative (No-Go), possibilities of expanding the access to stable electrical power of good quality to more households and new industries in the metropolitan area of Maputo would be highly restricted by the needs of other countries affiliated in the SAPP.

Because of the expected growth of the demand for power supply, there is a need for the energy sector of Mozambique promoting the rehabilitation and reinforcement of the thermal power stations existing in the country, not only to maintain the current capacity, but above all to guarantee an increase in the capacity of power supply from a trustworthy source in the years to come. Within this context, in order to guarantee electrical power to the metropolitan area of Maputo, the expansion of the Thermal Power Plant in Maputo with the installation of new gas turbines of combined cycle seems to be indispensible.

5.2 PROJECT ALTERNATIVES

Project Site Alternatives

An alternative location for the project has already been assessed and compared from technological and economical viewpoints with the CTM site, namely an EDM plot in the Beluluane industrial complex. The different items surveyed for the site selection were site area, access, topographic/geographical features, vegetation, meteorology, natural disaster, cooling water and condenser cooling system, service water, fuel, transmission network, environmental and social considerations, environment impact (cooling water route) and transportation of heavy objects.

For selecting the future power plant construction sites, the site area necessary for layout, present situation, accessibility, topography, geology, weather conditions of the site, constraints of the system, fuel supply constraints, condenser cooling method and selectivity of CCGT equipment were objectively and compressively compared and studied, based on the items of the survey carried out before. Amongst other aspects, the alternative Beluluane site revealed less advantageous when considering the aspects “transmission line constraints” (lower capacity) and “steam turbine condenser cooling” (insufficient water resource). In a workshop in October 2012, the CTM site was officially selected as the development point of the gas power plant.

6 ENVIRONMENTAL BASELINE

6.1 BIOPHYSICAL

6.1.1 CLIMATE AND METEOROLOGY

Climate

The study area (Maputo) is of a tropical savannah climate that borders on a humid subtropical climate. It has noticeably warmer and cooler seasons. The warmer months are December to February, while the cooler months are June to August. The city falls within a summer rainfall region, with an average of 761 mm of precipitation per year. The majority of the annual rainfall occurs between December and March.

The average conditions for Maputo, e.g. minimum, maximum temperatures and precipitation, are given in Figure 4. Average daily maximum temperatures range from 31°C in February to 24°C in July, with daily minima ranging from 22°C in January to 13°C in July.

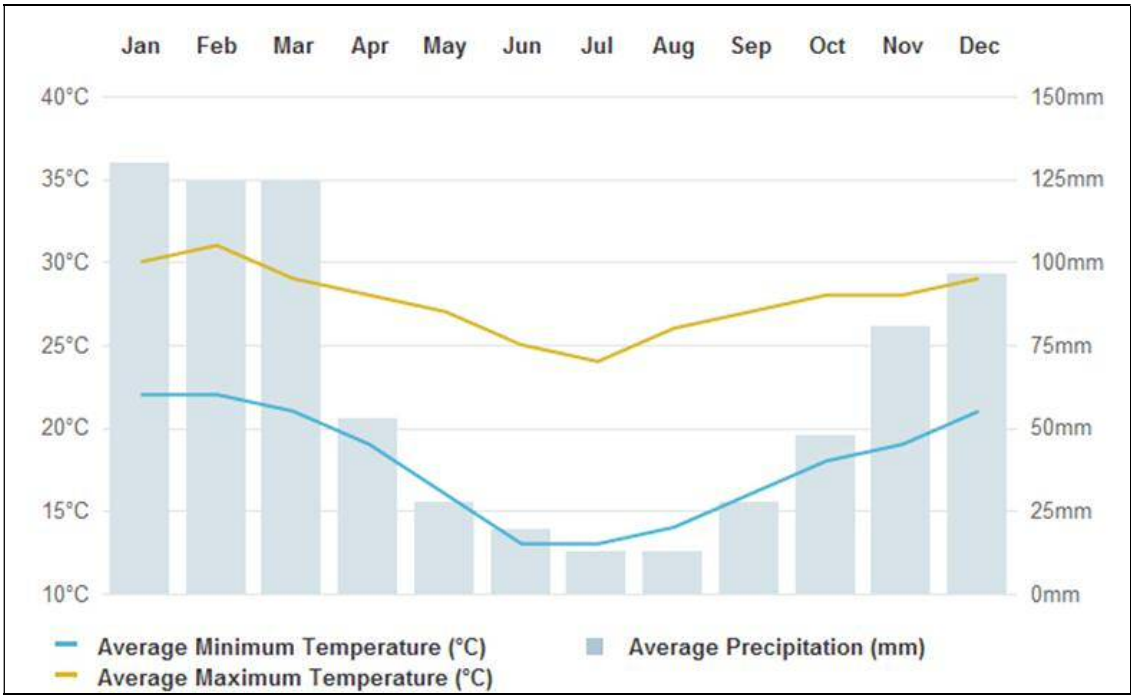


Figure 4: Average minimum, maximum temperatures and precipitation for Maputo
(http://www.bbc.co.uk/weather/1040652)

Data from the National Institute of Meteorology for a period of 30 years (1966-1997) indicate the following extreme values:

- Maximum value of monthly average temperature: 30.9 °C (January 1969);
- Minimum value of monthly average temperature: 13.3 °C (July 1980);
- Absolute maximum temperature: 44.1 °C (January 1980);
- Absolute minimum temperature: 8.6 °C (June 1984).

The wind rose shown in Figure 5 below was generated using hourly meteorological data obtained from the Maputo airport weather station for the time period of January 2007 to December 2011. The weather station is about 4.5 km north-east from the project site.

The wind rose consists of 12 petals, which represent the directions from which winds blew during the period. The colours used in the wind roses below, reflect the different categories of wind speeds. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. The frequency with which calms occurred, i.e. periods, during which the wind speed was below 0.5 m/s are also indicted.

As it can be seen, the predominant wind direction was from the south-southwest, with approximately 16% of occurrence. The second predominant wind direction was from the east.

The wind frequency distribution was also created and shown in Figure 5. Winds in the region were mostly light and moderate (2.1 – 5.7 m/s), which occurred about 54.7% of the time. Fresh

winds (5.7 – 8.8 m/s) were less frequent, about 19.7% of the time. Strong winds with speed greater than 8.8 m/s were uncommon; the occurrence was about 1.1%.

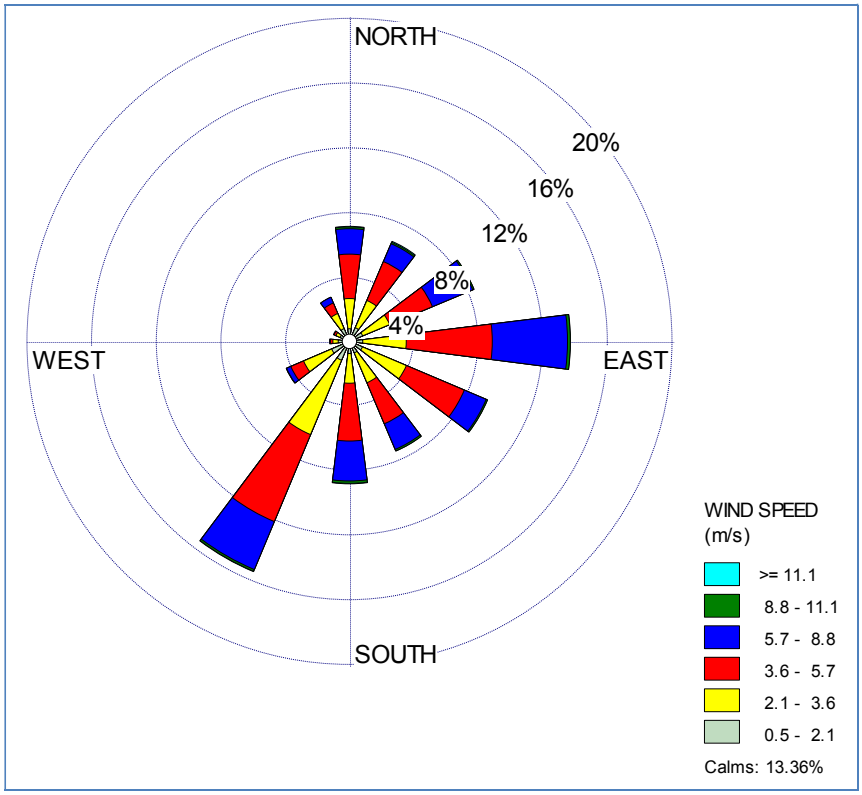


Figure 5: Wind Rose for Maputo (2007-2011)

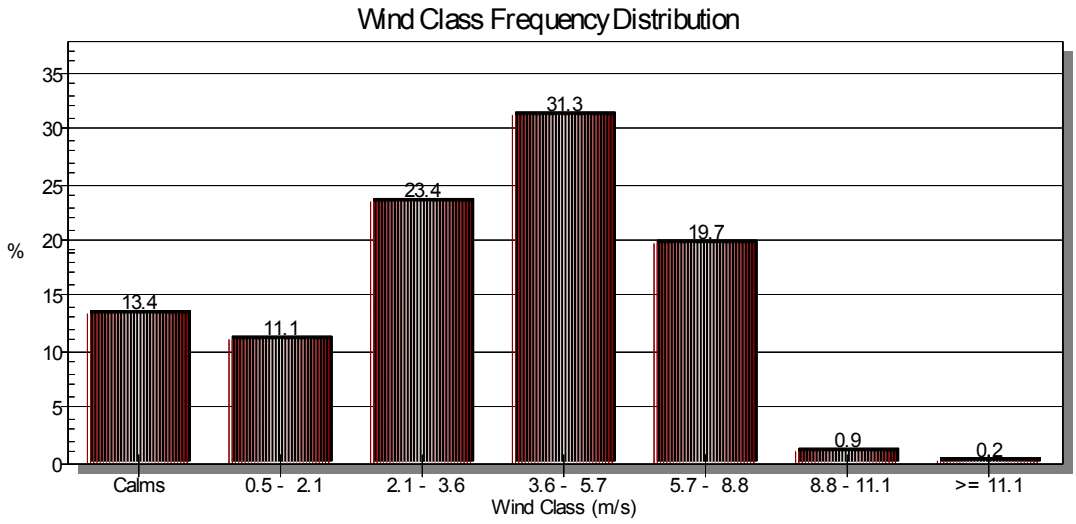


Figure 6: Wind Class Frequency Distribution for Maputo (2007-2011)

Rainfall and Evaporation

Monthly rainfall and evaporation data for the site were sourced using the Food and Agriculture Organization (FAO) dataset. These results include two weather stations datasets, as well as a site-specific interpolated value using data from other surrounding weather stations. The two weather stations used for site comparison have the following details:

- Maputo-Mavalane 4.5 km NE 30 years of record from 1961
- Maputo-Obs. 7.6 km SE 37 years of record from 1961

The Maputo-Obs. weather station only has precipitation available, while the Maputo-Mavalane weather station includes potential evaporation and temperature records. The Maputo-Mavalane weather station is located at the Maputo International airport. Consequently, it is expected that the data from the Maputo-Mavalane weather station is relatively accurate. Figure 7 presents the climate data for the Maputo-Mavalane weather station, while Figure 8 presents the regional hydrology and rainfall stations about the site.

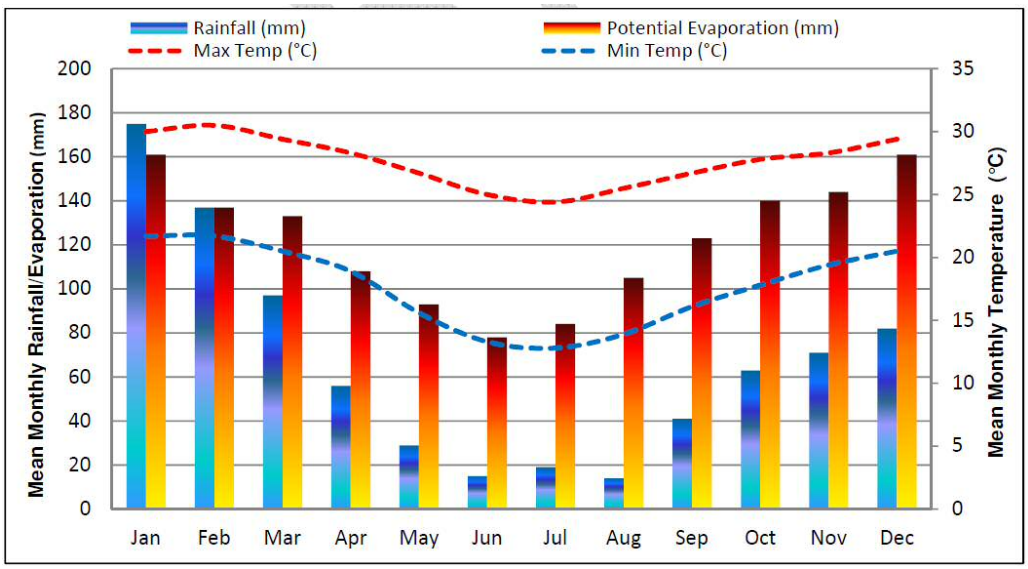


Figure 7: Monthly rainfall, evaporation and temperature distribution

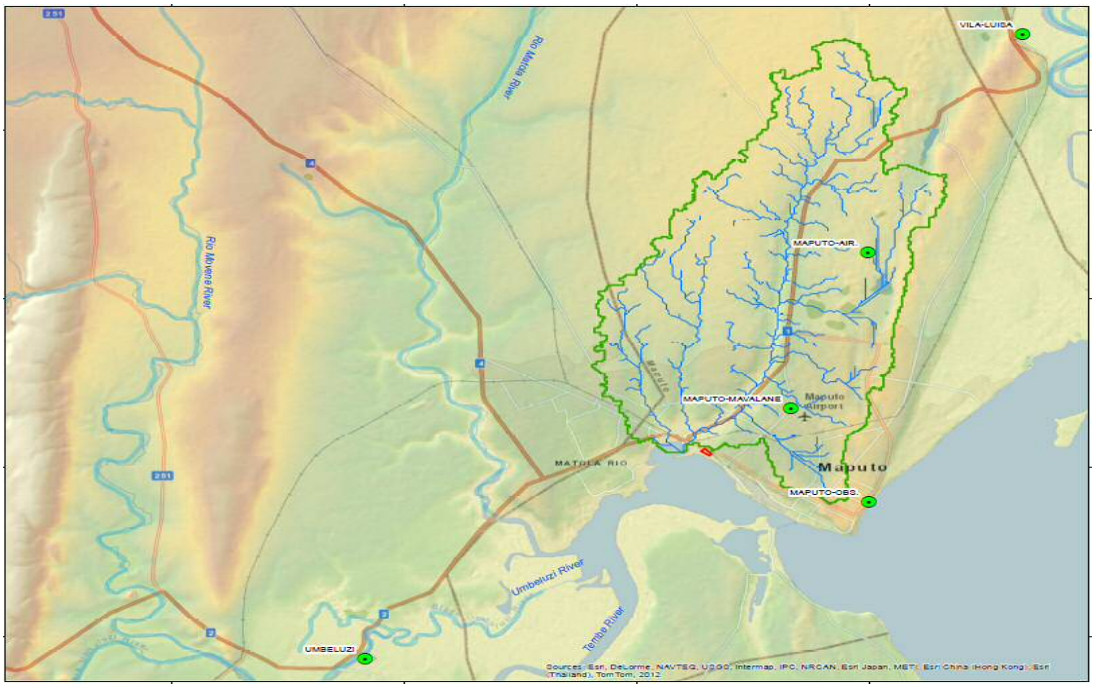


Figure 8: Regional Hydrology and Rainfall Stations

Rainfall Estimate

The FAO dataset uses the long-term records of local weather stations, while paring with an interpolating tool supplied by the FAO. The observed records for weather stations neighbouring a specific site can thereby be interpolated, in order to present a site specific rainfall estimate, with weather stations closer to site having a greater influence on the site's results. An altitude correction factor is included to account for the variation of rainfall with altitude. The details of this dataset are provided in the FAO (1995) report. Table 5 presents the observed monthly rainfall record of the two weather stations and the interpolated rainfall record of the site.

Table 6: Estimate of Monthly Rainfall on Site

Month Rainfall Depth (mm)			
	Maputo-Mavalane	Maputo-Obs	Site
January	175	149	155
February	137	116	123
March	97	89	89
April	56	48	54
May	29	32	29
June	15	21	20
July	19	20	19
August	14	15	15
September	41	26	34
October	63	65	63
November	71	83	73
December	82	84	84
Total	799	748	758

Source: FAO 1995

Evaporation Estimate

Due to the current unavailability of direct measurement of evaporation for the site, alternative means for determining site evaporation were required. Consequently, an estimate of Potential Evapo-transpiration (PET) for the site was sourced from the FAO estimate for the site. The FAO have used the Penman-Montieth Equivalent Evaporation method (PMEE) for calculating PET based upon related climatic data such as temperature. The PET is indexed against short grass, i.e. the PET is based on an area covered with short grass. The point estimate was based upon the same dataset and methodology as the point estimates for rainfall as outlined above. The results of the FAO calculation are contained in Table 7.

Table 7: Estimate of Monthly Evaporation on Site

Month	Potential Evaporation (mm)	
	Maputo-Mavalane	Site
January	161	147
February	137	124
March	133	119
April	108	95
May	93	79
June	78	62
July	84	66
August	105	83
September	123	95
October	140	114
November	144	124
December	161	143
Total	1467	1251

Source: FAO 1995

Extreme Weather Events and Climate Change

From 35 depressions and cyclones that hit Mozambique (1946-2001 records of INAM), only three reached the Maputo region: Claude in December 1965, Demoina in January 1984 and Eline in February 2000. In these situations, the rain associated with cyclones may reach more than 250 mm in 24 hours and winds can exceed 30 m/s.

Heavy rains that occur during short periods and have a high erosive power are more frequent. Rainwater of particular intensity may occur in 10 year cycles.

The precipitation recorded on the night of 28 January 2000 (119 mm in 6 hours) and heavy rains that followed on days 4, 5 and 6 of February (approximately 350 mm in total, with a maximum of about 243 mm in 17 hours) were the main cause of very serious problems of erosion and land collapse.

With regard to climate change, the study area lies in the area of the Maputo Port that according to a study done by the National Disaster Management Institute - INGC (Study on the impacts of climate change on disaster risk in Mozambique) could be affected by a potential sea level rise, as well as associated inundation by flood action.

6.1.2 GEOLOGY AND GEOMORPHOLOGY

Along the southern coast of Mozambique, the regional geology includes a series of non-marine, shallow marine and estuarine sediments. Slightly elevated dune formations revealing a fairly recent origin occur inland. Coastal sediments comprising silt and clay mixed with coastal alluvial sediments make up the intertidal zone and the riverbed of Espírito Santo estuary.

From a geological point of view, the Maputo region can be divided into two areas: the coastal plains with wet soils (characterised by mobile dunes and alluvial soils) and a high area with inland, fixed and old dunes.

The following configurations can be recognised:

- Tide deposits towards the South;
- Coastal areas, with maximum quotas of 8 m and consisting of mobile dunes and alluvial soils;
- The inland platform (or plateau), with an average elevation of 40 to 50 m, consists mainly of old dunes;
- The so-called *Barreiras* of Maputo have quotas between 50 to 60 m above the mean sea level and consist of a set of consolidated dunes designated Ponta Vermelha Formation.

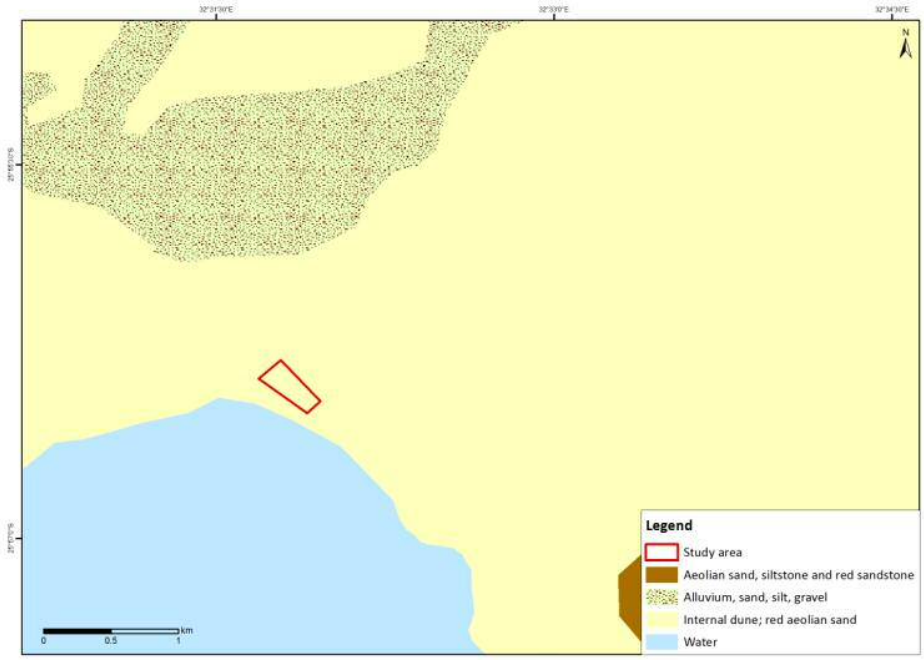


Figure 9: Geological features in the project area

6.1.3 TOPOGRAPHY, SOILS AND LAND COVER

Maputo city has three distinct topographical zones: a lower zone, an upper zone and a buffer zone, which makes the transition between the first two.

The general topography of the area includes rolling hills, sloping to the south from an intermediate quota between 40 and 60 meters above sea level, towards the sea and the estuary.

This topography directs the main water courses and determines the rainwater natural drainage lines.

Elevations on the site are low (<16 m Above Mean Sea Level - AMSL) due to the coastal location. The CTM sites topography is regular with elevations descending steadily towards the coast, and consequently slopes are mild.

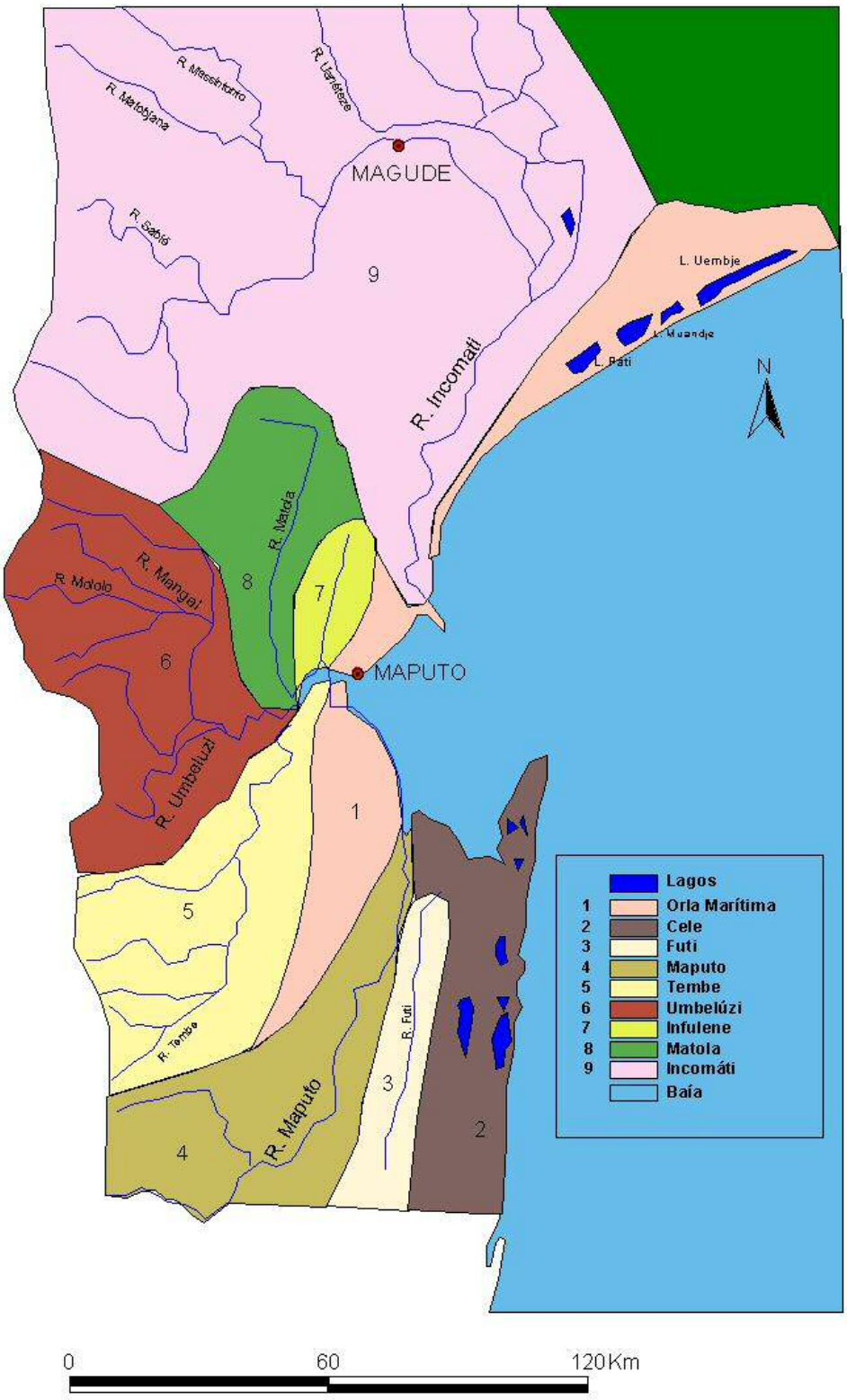
In the Maputo area, the main soil types that can be found are the following:

- Sandy soils of various types and colourings;
- Alluvial clay soils;
- Marine and estuarine sediment soils.

Soil textures on site were noted during the site visit as being sandy-clay-loam in nature and likely from alluvial deposits associated with the proximity of the site to major river systems. Although the soils in the study area are predominantly marine and estuarine sediments (lowland marshes), the CTM site is a brown field site. Land cover for the site has consequently been significantly altered from its original natural state, as an embankment has been done to a significant area in the lower zones in order to accommodate existing land uses. The site is characterised by approximately one third hard standing, with grassed areas accounting for the remaining two thirds. The proposed gas power plant will increase the amount of hard standing on site. Land cover over the greater site boundary is comprised of a mixture of hard standing and subsistence farmlands, with the bulk of the greater area made up of grasslands.

6.1.4 HYDROLOGY AND GEOHYDROLOGY

The area about the site is associated with a single river, namely the Infulene River. The Infulene River is situated approximately 300m west of the CTM site. The Infulene River drains approximately 230 km² of Western Maputo into Maputo Bay. Other rivers of significance in the area include the Umbeluzi River, Matola River and Tembe River, all of which flow into the west of Maputo Bay (see Figure 10 below).



(Source: MOPH, DNA, Watershed Map 1:2.000.000)

Figure 10: River Basins in Maputo region

Fronting the CTM site is an intertidal zone that has been delineated according satellite imagery and the site visit (all mangroves are assumed intertidal, as are comprised of both tidal flats and mangroves). This intertidal zone extends up to the site boundary (both the CTM boundary and the greater site boundary). There is evidence to suggest that the intertidal zone extends slightly into the southern end of the CTM site.

To the north of the site there is a railway line. During the site visit, a stormwater channel was noted running parallel to the railway line. At two points along this stormwater channel, culverts passed beneath the railway enabling the routing of stormwater in the Maputo Bay in one instance, and beneath the site in another instance. These were the only two points allowing water to pass beyond the railway that were noted during the site visit.

A thorough investigation of additional culverts was not possible due to the health and safety risk of traversing the railway. The open channel to the east of the site (running into Maputo Bay) was recorded as having some flow. The origin of this flow (which may be either stormwater, sustained baseflow or municipal waste water) is unknown. A 'saturated surface depression' was also noted to the north of the CTM site. This depression runs parallel to the CTM boundary (and railway). The depression was coincident with sedges indicating that the soils in the area are wet for a significant part of the year. The source of the water saturating this area is unknown and may be due to a number of reasons such as surface water run-on and an associated impermeable depression, groundwater extrusion or a burst pipe. The likelihood of a burst pipe is given more credence since during the site visit water was noted as seeping out of the ground (at a point in the greater site area) and was attributed by local workers as being from a burst water mains pipe.

6.1.5 WATER QUALITY

During the site visit, four surface water samples were taken at various points in and around the site. The objective of the exercise was to obtain suitable baseline information for surface waters to firstly understand the quality of the water in and around the site and secondly, to obtain a reference for assessing the impact of the proposed operation over time.

During the site visit, monitoring parameters such as pH, Temperature and Electrical Conductivity were measured on site. The samples for metal analysis were acidified with nitric acid, while the samples for biological analysis were taken with a biological preservative. All samples were kept in a cool environment as far as was possible. The samples were then transported to Waterlab in South Africa (Pretoria) for the analysis of major anions/cations, ICP scan for metals, biological analysis, as well as the presence of hydrocarbons. The results were then compared to the following drinking water standards:

- World Health Organisation (WHO) Guidelines for drinking water (Fourth Edition);
- Mozambique National Drinking Water Standard and Regulations (Issued by the Ministry of Health);

Four samples were taken during the site visits:

- Sample 1 was taken from a tap on site which supplies domestic water. This water is apparently sourced from the Umbeluzi River, located approximately 15km from the site;
- Sample 2 was taken to the west of the site from the Infulene River;
- Sample 3 was taken from the Maputo Bay intertidal area in close proximity to the site; and
- Sample 4 was taken from a stormwater canal to the south-east of the site, which is understood to drain upstream roads and settlement areas.

Figure 11: Water Measuring Points

From the results it is evident that water from sample point 1 is of good quality. The only parameter which is highlighted as of concern is that of Aluminium. It must however be understood that the Aluminium concentrations can be skewed through the mobilisation of Al under lower pH values (acidified bottles). Samples 2 and 3 indicate saline environments with extremely elevated concentrations of Chloride, Sulphate, Aluminium, Boron, Calcium, Magnesium and Sodium. Total dissolved solids and electrical conductively are also excessively high and in the order of 30 times permissible drinking limits for Mozambique. E-Coli were also present in both samples 2 and 3, presumably from the immediate upstream informal settlement. Sample 4 showed the highest levels of E-Coli (47/100 ml) with elevated concentrations above

drinking water quality limits for Chloride, Sulphate, Aluminium, Boron, Calcium, Iron, Magnesium, Manganese, Sodium and Phosphorus. Total dissolved solid concentrations were also in excess of 3,000 mg/l. All samples were tested for hydrocarbons via TPH BTEX testing. None of the samples indicated the presence of hydrocarbons.

According to the WHO drinking water guidelines, all water directly intended for drinking should not contain any detectible concentrations of E-Coli per 100 ml sample. This therefore makes samples 2, 3 and 4 unsuitable for domestic purposes, as there would be a high risk of infectious disease transmission.

6.1.6 AIR QUALITY

In the greater area around the Maputo Power Station, Maputo Bay and at the Matola Terminal, a number of other industries and port activities are currently in operation. These air pollution sources are:

- Cement processing;
- Light fuel refining;
- Several smaller boilers;
- Maize and food storage silos;
- Coal storage and ship loading;
- Informal industries; and
- Waste material burning.

The main sources of air pollution in close proximity to the power station site are the vehicular traffic on the N4 highway, the trains on the line to the Maputo Cargo Terminal, the coal burning in the adjacent community, the ships travelling within Maputo Bay and the ships loading at the Maputo Cargo Terminal.

The sampling of SO_2, NO_2 and PM_{10} were carried out in accordance with NIOSH methods. The ambient samples were collected using precision sampling pumps. All the pumps were calibrated on site with a portable flow calibrator. The sampling duration was approximately 24 hours for each sample. All the samples collected were then sent to an accredited laboratory for analysis.

Figure 12: Air Quality Monitoring Point

The measured seven daily ambient concentrations for PM_{10}, SO_2 and NO_2 are shown in Table 8 below. As can be seen, the SO_2 concentrations were below the Mozambican 24-hour guideline of 365 µg/m^3, as well as the EU and RSA guideline of 125 µg/m^3. The measured ambient NO_2 concentrations were also well within the Mozambican 24-hour guideline of 200 µg/m^3. The measured ambient PM_{10} concentration were within the current RSA 24-hour guideline of 125 µg/m^3, but above the EU and WHO guideline of 50 µg/m^3 for 5 out of the 7 sampling days. There are no guidelines for PM_{10} in Mozambique.

Table 8: Daily Ambient Concentrations for PM_{10}, SO_2 and NO_2

Sample No.	PM_{10} (µg/m^3)	SO_2 (µg/m^3)	NO_2 (µg/m^3)
1	72.9	< 0.01	19.51
2	60.4	5.01	2.66
3	75.3	4.11	10.72
4	12.6	4.10	4.60
5	33.5	5.36	16.04
6	78.4	1.58	14.71
7	76.7	0.07	5.11

Based on the monitoring results, the main pollutant of concern is PM_{10}, which is to be expected due to the close proximity of the monitoring location to the N4 and the other existing sources, such as the CTM coal terminal and the Maputo Cargo Terminal.

6.1.7 NOISE

The baseline noise monitoring study was based on noise measurements in accordance with the international standards ISO 1996 Part 1 & 2 "Description, Assessment and Measurement of Environmental Noise".

Ambient noise measurements were carried out at 10 pre-selected points as indicated in Figure 13 below, these were:

- Five monitoring points at the project site
- Five monitoring points at the local community

In addition, one additional point was chosen to carry out a 24-hour continuous noise measurement. The noise measurements at the 10 above-mentioned locations were performed intermittently over several days, in order to cover four time periods representing weekdays and weekends. The 24-hour period was categorised as follows:

- Morning: 06:00-08:00
- Daytime: 08:00-18:00
- Evening: 18:00-23:00

- Night-time: 23:00-06:00

In each period the continuous A-weighted equivalent sound pressure level (LAeq) of at least a 10-minute duration was taken. A 01dB SIP95 Type 1, Data-logging Precision Impulse Integrating Sound Level Meter and a Field Calibrator (01dB Cal01) were used for the measurements. For the continuous measurements, a 01 dB DUO Type 1, Data-logging Precision Impulse Integrating Sound Level Meter, was used. All measurements were A-weighted equivalent sound pressure levels (LAeq) obtained via I-time weighting. The occurring maximum and minimum levels during the measurement period were also recorded.

Figure 13: Noise Monitoring Point Locations

In addition to the LAeq, the L10, L50, and L90, as well as the occurring maximum (Lmax) and minimum levels (Lmin) during the measurement period were also recorded. These measurements are appropriate for the determination of:

- The noise levels with existing and future operations in progress.
- The background noise, i.e. when no activities are contributing to the ambient noise levels.
- The nature and extent of the noise.

All the noise measurements were performed in compliance with the weather condition requirements, as specified by the ISO Codes. Therefore, measurements were not performed, when the steady wind speed exceeded 5 m/s or wind gusts exceeded 10 m/s. The wind speed

was measured at each location with a portable weather meter, capable of measuring the wind speed and wind gusts in meters per second.

The noise level (LAeq) for each monitoring point and period can be seen in Table 9 below. It should be noted that the Gas Turbine No. 2 was in operation during the weekend night-time measurements, thus generating higher noise levels at all monitoring positions.

Table 9: Noise Levels at Monitoring Points

Monitoring Points	Area Type	Noise Level L_{Aeq} (dB(A))							
		Morning 06:00-08:00		Daytime 08:00-18:00		Evening 18:00-23:00		Night-time 23:00-06:00	
		WD [a]	WE [b]	WD	WE	WD	WE	WD	WE
MP01	Industrial	55.4	60.8	56.2	56.8	53.8	56.5	41.6	60.5 [c]
MP02		50.8	60.1	55.3	57.8	57.9	57.5	48.5	72.1 [c]
MP03		55.2	59.4	55.2	59.3	60.5	59.3	55.7	64.7 [c]
MP04		74.4	56.2	64.3	56.4	60.0	56.6	41.3	66.9 [c]
MP05		52.2	67.4	46.7	58.4	67.6	61.2	52.0	54.2 [c]
MP06	Residential	60.6	64.5	65.7	62.4	64.8	61.0	56.7	61.9 [c]
MP07		59.3	60.6	62.7	61.3	64.1	59.9	52.6	58.6 [c]
MP08		60.0	57.1	68.6	58.1	61.3	66.7	41.0	50.9 [c]
MP09		55.9	59.1	54.9	59.0	60.6	58.9	43.1	49.2 [c]
MP10		57.9	60.8	60.6	59.4	62.3	59.6	52.9	54.4 [c]

[a] WD: weekday.
[b] WE: weekend or public holiday.
[c] Note: The Gas Turbine No. 2 was in operation during the weekend night-time measurements.

At point MP11 the sound parameters were measured continuously over 9 days, i.e. from Friday the 23rd of November to Saturday the 1st of December 2012. The measured LAeq at this location averaged for each hour over the 9 days can be seen in Figure 14 below. From the time series, it is evident that at the MP11 location there was a 20 dB noise level increase when the Gas Turbine No. 2 was in operation.

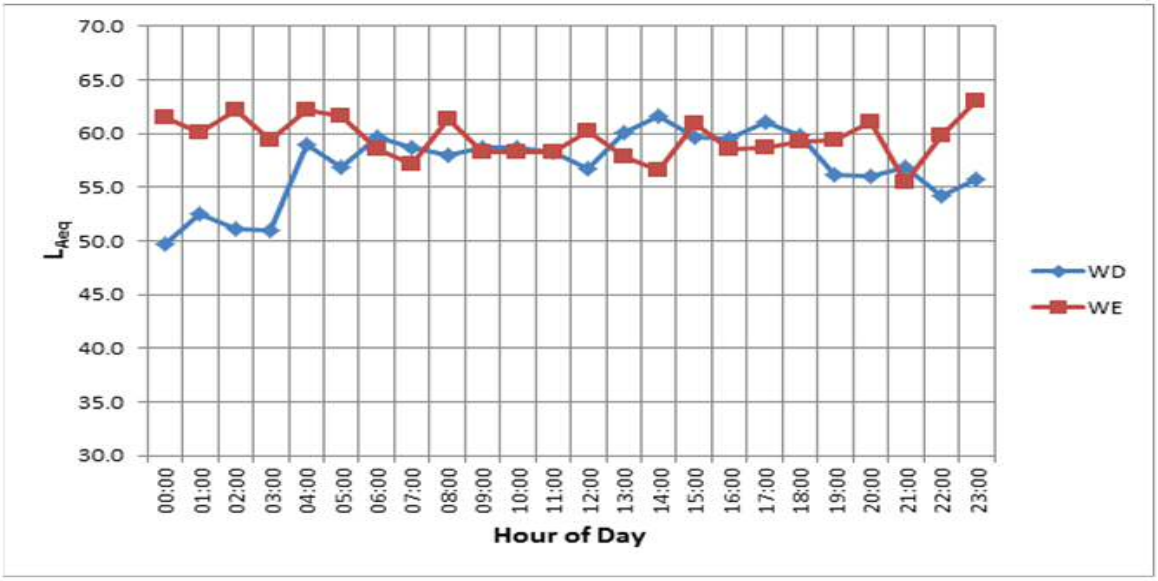


Figure 14: Average noise at MP11 (over 9 days)

Based on the site visit observation and the measurement results, the following can be indicated regarding the baseline noise environment at each monitoring location.

- MP01: this point is situated at the entrance of the Power Station site. It is approximately 100 m from the N4 highway. The noise environment was mainly affected by the traffic noise from the N4 and the noise from the gas turbines when in operation. The distance of this point to Gas Turbine No. 2 is approximately 180 m. The measured ambient noise levels at this point were below the World Bank/IFC Ambient Noise Guidelines of 70 dB(A) for industrial zones.
- MP02: is at the centre of the site, approximately 120 m from the N4 highway and 60 m from the No. 2 Gas Turbine. The noise environment at this point was dominated by the gas turbine operation and otherwise by the highway traffic. When the No.2 Gas Turbine was in operation, the noise level reached 72.1 dB(A). The noise levels for the remaining time periods were all below the World Bank/IFC Ambient Noise Guidelines of 70 dB(A) for industrial zones.
- MP03: this point is located near the northern corner of the site, approximately 50 m from the N4 highway. The noise environment at this point was dominated by the road traffic and the gas turbine operation. In addition, the noise levels were intermittently elevated due to passing trains. The measured ambient noise levels at this point for all time periods were below the World Bank/IFC Ambient Noise Guidelines of 70 dB(A) for industrial zones.
- MP04: this point is located at the centre of the north-eastern fence line of the site, approximately 100 m from the N4 highway and 120 m from the No. 2 Gas Turbine. The predominant noise sources at this point were the vehicular traffic from the highway and the gas turbine, when it was in operation. Similar to MP03, the noise levels at MP04 were intermittently elevated due to the passing trains. The measured ambient noise

levels were below the World Bank/IFC Ambient Noise Guidelines of 70 dB(A) for industrial zones, except for a weekday morning measurement, reaching 74.4 dB(A), due to a passing train from the Maputo Terminal.

- MP05: this point is located near the south-eastern corner of the site. It is approximately 150 m from the N4 highway. The noise environment at this point was primarily affected by the N4 road traffic and the railway activity. The two elevated noise levels measured, i.e. 67.4 dB(A) and 67.6 dB(A), were all due to passing trains. In the evenings, the noise levels at this point were increased due to insect and frog activity. The evening noise levels, without the influence of the passing trains, reached 61.2 dB(A).The measured noise levels at this point for the remaining time periods were around 50 dB(A). As can be seen from the weekend night-time measurement, the gas turbine operation did not cause any significant increase of the noise level at MP05. This was due to the fact that nearby buildings provided shielding from the noise generated by the turbine operation.
- MP06: this point is at the northern border of the Bairro Luís Cabral community, about 20 m from the N4 highway. The noise environment at this point was primarily affected by the vehicular traffic on the EN4.The measured noise levels at this location were above the World Bank/IFC Ambient Noise Guidelines for residential and the SANS guidelines for urban districts with main roads. The average measured noise level reached 62.2 dB(A).
- MP07: the location of this point is within the Bairro Luís Cabral community, approximately 120 m from the site's fence line and 25 m from the N4 highway. The main contributor to the noise environment at this location was the vehicular traffic on the EN4.The measured noise levels at MP07 were above the World Bank/IFC Ambient Noise Guidelines for residential zones and the SANS guidelines for urban districts with main roads.
- MP08: this point lies within the Bairro Luís Cabral community, approximately 70 m from the site's fence line and the N4 highway. The noise environment is affected by the vehicular traffic on the N4 and localised domestic activities, including music, peoples' conversations, children playing and other human activities. The measured noise levels at this point were above the World Bank/IFC Ambient Noise Guidelines for residential and the SANS guidelines for urban districts with main roads.
- MP09: this point is situated within the Bairro Luís Cabral community, approximately 100 m from the N4 highway. Similar to MP08, the main noise sources here were the traffic from the N4 and domestic activities. The noise from gas turbine operation was audible at this point, but not intrusive. The measured noise levels at this point were slightly above the World Bank/IFC Ambient Noise Guidelines for residential, but within the SANS guidelines for urban districts with main roads.
- MP10: this point is close to the northern border of the Bairro Luís Cabral community, approximately 35 m from the N4 highway. The noise environment at this point was primarily affected by the vehicular traffic on the above-mentioned road. The measured noise levels at this point exceeded the World Bank/IFC Ambient Noise Guidelines for

residential areas and were slightly above the SANS guidelines for urban districts with main roads.

- MP11: the MP11 is situated 70 m south-west of point MP02 at the centre of the site, close to the existing fuel tanks and the No. 2 Gas Turbine. The noise environment at this point was primarily dominated by the gas turbine operation and otherwise by the vehicular traffic on the EN4. When the No.2 Gas Turbine was in operation, the noise levels reached 74 dB(A), thus exceeding the World Bank/IFC Ambient Noise Guidelines of 70 dB(A) for industrial zones. The noise levels for the remaining time periods were all below the World Bank/IFC Ambient Noise Guidelines for industrial areas.

The main conclusions regarding the baseline noise conditions are:

i. The main noise sources within and around the project area were the vehicular traffic from the N4 highway, the trains to and from the Maputo Terminal and the gas turbines of the existing power station. The primary contributing noise source at the Bairro Luís Cabral community was the vehicular traffic on the N4 highway.

ii. The ambient noise levels at the monitored points within the Power Station site were found to be below the World Bank/IFC Ambient Noise Guidelines of 70 dB(A) for industrial zones, except for MP02 and MP11, which were in close proximity to Gas Turbine No. 2.

iii. Noise from the gas turbine operation increased the noise levels on site, but had much lesser effect on the noise levels at the Bairro Luís Cabral community.

iv. The noise levels at the Bairro Luís Cabral community during the weekend night-time were found to be higher than those during weekdays. This may be attributed to the increased night-time activity, such as loud music, coupled with noise from the traffic and the gas turbine.

v. The ambient noise levels at the Bairro Luís Cabral community exceeded the World Bank/IFC Ambient Noise Guidelines for residential areas and the SANS guidelines for urban districts with main roads.

6.1.8 FLORA AND HABITATS

General description and Sensitive Marine Areas

Maputo Bay and its associated estuaries, channels and wetlands comprise a set of integrated ecosystems that are very sensitive and comprised of rich and unique biodiversity. These are considered nationally-important ecosystems, both economically and ecologically. The power plant is located in one of the estuaries adjacent to the Maputo Bay, often referred to as *Estuário de Espírito Santo* (Holy Spirit Estuary).

The Maputo Bay and the *Estuário de Espírito Santo* are extremely productive areas and phytoplankton is the main source of primary production. Primary production is a basic source of

food for all living organisms and therefore represents the amount of organic matter that is synthesized by the different organisms that undergo photosynthesis and chemosynthesis.

In addition to its economic importance, the Maputo Bay includes a number of important factors that make this area remarkable for their biological and ecological value: mangroves, seagrass beds and coral reefs.

Mangroves are one of the best known forms of vegetation that is typical in transition zones between terrestrial and marine environments. They occur in intertidal zones along sheltered shores and river banks in tropical and subtropical regions. In Mozambique, there are approximately 10 mangrove species. It is thought that there are at least three species of mangroves in the Maputo Bay and these are *Rhizophora mucronata, Avicennia marina* and *Ceriops tagal*. The most prominent mangrove species in the study area is *Avicennia marina*. Figure 15 shows the location of mangroves adjacent to the power plant in Maputo.

Mangroves are of great importance since they provide a range of environmental, economic and social services. These play an important role in preventing erosion in coastal areas and river banks, in attenuating waves and floods and also in terms of breeding and feeding of several species. Mangroves provide habitats for a diversity of species including birds, crustaceans, fish and molluscs. Mangroves are also known for their importance regarding fish and shrimp commercial farming. They are also a source of traditional medicines, building materials and wood fuel. Shellfish harvested in the mangroves are an important source of protein for the local population.

Figure 15: Mangrove location in the Project area

The seagrass beds are ecosystems that thrive in shallow coastal habitats. Seagrasses consist of erect branches with leaves and roots or rhizomes that are the only flowering plants that can live underwater. In Mozambique, there are a number of seagrass species including *Cymodocea rotundata, C. serrulata, Enhalus acoroides, Halodule uninervis, H. wrightii, Halophila ovalis, H. ovata, H. stipulacea, Syringodium isoetifolium, Thalassadendron ciliatum,Thalassia hemprichii*

and *Zoostera capensis*. It is thought that the *Thalassadendron ciliatum* is the most common species in the Maputo Bay and therefore the most likely to occur in the Estuário de Espírito Santo.

Figure 16: *Avicennia Marina* in the study area

Coral reefs are marine ecosystems found in a number of different regions ranging from deep and cold waters to warm shallow tropical waters. In the south of Mozambique, reefs are sparsely inhabited by corals, which owe their existence to a number of factors that include clear subtropical waters carried south by the warm Mozambican current, the absence of rivers carrying sediment and the presence of a suitable substrate in the form of sandstone rocks. Although there are 10 genera of soft corals and 19 genera of hard corals recorded in Maputo Bay, it is believed that there are no coral reefs near the CTM power plant and within the Estuário de Espírito Santo.

6.1.9 FAUNA AND PROTECTED SPECIES

The *Estuário de Espírito Santo* has a rich and diverse fauna. In the area, there are invertebrates of high ecological value and commercial including cnidarians (corals), echinoderms, molluscs and crustaceans.

In a given region, the herpetofauna refers to reptiles (snakes, lizards, tortoises, turtles and crocodiles) and amphibians (toads and frogs). There is little or no knowledge regarding the ecological value of the area in terms of reptiles and amphibians, but in the adjacent region named Matutuíne, 36 species of amphibians and 94 species of reptiles were recorded. It is believed that in the power plant area, the number of species of reptiles and amphibians have

been declining mainly due to human activity and exploitation of the direct area of influence for the construction of the previously established plant.

According to the knowledge gathered regarding the distribution of bird species in the Maputo district (Parker, 1999) there are approximately 75 species of birds in terrestrial, marine and freshwater environments. These species are migratory; therefore it is believed that they may exist in the areas adjacent to the power plant. According to the 1997 Census, the Matola saltpans had a record of large numbers of birds associated with this habitat in the area. In 1997, 4 600 birds were recorded, that included 413 flamingos.

Figure 17: Flamingos in areas adjacent to the power plant

Along the Mozambique Channel 18 species of marine mammals are known to occur, including dolphins, whales and dugongs. Some of these show a distribution that have been confirmed by studies, while others are not confirmed but they are most likely to occur. The occurrence of dugongs was restricted until recently to the Maputo Bay, especially near Inhaca Island, although presently there is no viable population of this species in the southern area of the coast of Mozambique. Dugongs do not occur in the *Estuário de Espírito Santo*.

It is believed that in the mangroves found in the estuary adjacent to the power plant, bivalves like the oyster sand (*Striostrea margaritacea*) and crabs such as the mangrove crab (*Scylla serrata*) and the pelagic crab (*Portunus pelagicus*) are likely to occur.

The existence of protected and iconic species such as sea turtles and dolphins in the area is not known. It is believed that water in the estuary is not suitable for these species, since they are marine species.

6.1.10 PROTECTED AREAS AND HIGH ECOLOGICAL VALUE HABITATS

The area comprising Maputo Bay, Inhaca Island and the *Estuário de Espírito Santo*, as well as the Piti Lagoon, is designated as the Maputo Bay/Machangulo Complex, considered an area of global importance and a priority for biodiversity conservation within the larger East African

Marine Ecoregion. In this region exists a great diversity of habitats, a current resulting in high productivity and a high level of endemism that includes species of soft corals, fish and plants. The beaches are important nesting areas for sea turtles and about 2 500 humpback whales pass through the area during their migration. The region is also the northern limit of migration of the southern right whale (*Eubalaena australis*). This area is also used by other species of whales, great white sharks, whale sharks as well as by many migratory birds.

In the Maputo area, there are habitats that have been internationally recognised for their value. The International Association named Wetlands International, which performs wetland censuses worldwide, identified the saltpans in Matola and the region between Catembe and the Maputo River Delta as areas of international significance and importance.

6.2 SOCIO-ECONOMICS

6.2.1 DEMOGRAPHICS AND ADMINISTRATIVE DIVISION

The proposed Maputo Gas Power Plant will be located at the former Thermal Power Plant (Central Térmica), which is part of and surrounded to the East, North and West by the Luís Cabral suburb and to the South by the Maputo Bay.

The Luís Cabral suburb is part of the former Urban District No. 5 of Maputo City, nowadays called Ka Mubukwana District, which is extending from Maputo Bay to the limit with Marracuene district on the Eastern side of the main national road (EN1). Mubukwana District comprises a total 14 suburbs, namely Luís Cabral, Jardim, Nsalene, Inhagóia "A" and "B", 25 de Junho "A" and "B", Bagamoio, George Dimitrov, Malhazine, Zimpeto and Magoanine "A", "B" and "C".

While each Urban District is headed by an Administrator nominated by the President of the City Council, the suburbs are headed by a Suburb Secretary. Each suburb is further divided into city blocks delimited by roads or avenues, the so-called "Quarteirões". The size and arrangement of such city blocks can vary a lot and are defined in the Urban Structure Plan of the Maputo Municipal Council, taking into account criteria, such as geographic dimension and demography (Boletim da República, III Series, Number 3, 3rd Supplement, 23rd January 2012). Quarteirões are numbered and each is headed by a Head of the Quarteirão. Luís Cabral suburb is divided into 83 Quarteirões. The Quarteirões surrounding the project site are the Quarteirões 40 and 40a, as illustrates the Figure 18 below.

Figure 18: Project site and close-by residential areas (Quarteirões)

Given the uncontrolled growth of these suburbs in Maputo City, these Quarteirões multiplied over the decades, resulting in that these Quarteirões got further subdivided. For example, the Quarteirão 39 was, in the meantime, subdivided into another seven sub-Quarteirões, so that nowadays exist, apart from the "mother"-Quarteirão 39, the sub-Quarteirões 39a-39g. In the case of the Quarteirão 40, there exist further also the sub-Quarteirões 40a and 40b.

In administrative terms, the unit below the quarteirão is 10 Houses, which is headed by the Head of 10 Houses.

Demographics

As mentioned above, Ka Mubukwana District comprises a total 14 suburbs. Of these suburbs, the Luís Cabral suburb had the second highest number of inhabitants in 2007, namely 33,800 inhabitants, of which 16,621 (49.2%) were male and 17,179 (50.8%) female (CMMaputo, 2010).

In accordance with the Population Census from 1997, Ka Mubukwana had in 1997 211.008 inhabitants and ten years later, in 2007, 293,995 inhabitants, thus registering between 1997 and 2007 a population increase of 39.3%. Contrary to this, the number of inhabitants in Luís Cabral suburb did only increase by 247 inhabitants during the same time period, which corresponds to only 0.7%. The result is that while Luís Cabral suburb in 1997 still accounted for 15.9% of the entire population of Ka Mubukwana District and 3.5% of the capital's population, these percentages dropped to 11.5% and 3.1% in 2007. On the contrary, Ka Mubukwana District's

share in population of Maputo city increased from 21.8% in 1997 to more than a quarter, namely 26.9%.

The number of households registered in Luís Cabral suburb in 2007 amounted to 6,985, thus indicating an average household size of 4.8 members per household.

Table 10: Population growth in 1997 and 2007 of Luís Cabral suburb

	Census 1997	Census 2007	Growth (%) 1997-2007
Maputo City	966,837	1,094,315	13.2
Ka Mubukwana	211.008	293,995	39.3
Luís Cabral suburb	33.553	33.800	0.7
% pop. in urban district	15.9%	11.5%	- 4.4%

Source: adapted from INE 1999, INE 2010 and CMMaputo 2010

Currently, the local authorities do not dispose of population figures disaggregated by city blocks (Quarteirões). In consequence, the exact number of population residing in the immediate surroundings of the proposed Maputo Gas Power Plant is not available. However, the suburb authorities have planned for January 2013 a census of households, which will enable an estimate of population in the area.

The reduced increase in population of Luís Cabral suburb seems to be an indication that there is no space left for expansion and for the settlement of new families in this suburb, while the Urban District of Ka Mubukwana is growing towards the Northern limit of the capital.

6.2.2 ECONOMIC ACTIVITIES

Luís Cabral suburb counts with only one formal market, which is currently in rehabilitation. This market is equipped with 548 concrete tables, but until now it has been open air without roof. The rehabilitation underway involves also the construction of a roof made of the old covering material dismantled in the Central Market of Maputo city, which was rehabilitated recently.

The suburb counts furthermore with 3 formal canteens. The first belongs to the former local consumer cooperative, which has rented it out to the above mentioned company CLIMATIC. The second canteen is for general sale of basic household and consumption goods, while the third canteen is a wholesaler, selling mainly cold drinks and beer.

However, all around the suburb can be found numerous informal kiosks, stands and bars, selling sweets and basic household items, drinks and food, but also clothes, as illustrates Figure 19 below.

Figure 19: Different informal businesses in Luís Cabral suburb

The Luís Cabral suburb also hosts Maputo City's main cemetery, the Lhanguene cemetery, considered to absorb a lot of labour, both formal (cemetery staff, grave-diggers) and informal, although the informal activities involve a lot of child labour (sale of flowers and water, watering graves, guarding and washing cars, etc.). Over the past decades and given the high population density in the Luís Cabral suburb, families have invaded and occupied large extensions of the Lhanguene cemetery, which is supposed to be closed in the near future, with a new cemetery to be opened soon outside town.

Apart from informal sales activities, the families in the Quarteirões 40 and 40a near the proposed project site practice a number of other activities for guaranteeing their subsistence. These activities include, amongst others, agriculture (maize crops), poultry breeding, preparing food stuffs for sale and fishing, as shows Figure 20 below.

Figure 20: Other subsistence activities: agriculture, poultry, sale of food stuffs and fishing (quarteirão 40a)

Given the dense settlement pattern in Luís Cabral suburb and, particularly, in the Quarteirões 40 and 40a next to the proposed project site, as well as the saline soils in the area, agricultural activities are, however, limited to very small maize plots in backyards for domestic consumption.

In 2006, the Government of Mozambique (GoM) introduced the Local Initiative Investment Fund (LIIF), commonly known as "7 Millions" to contribute to poverty reduction through the financing of individual projects in the areas of food production and income generation. Although initially designed only for the 128 rural districts of the country, it was expanded in 2011 to the urban districts of the municipalities, in order to reduce urban poverty. According to the local authorities, in 2012, the LIIF provided funds to a total 288 individual beneficiaries in Luís Cabral suburb for aviculture (14) and agriculture (274) activities in the so-called "Green Zones" (Infulene Valley) of the city. This is an indication that a considerable part of the Luís Cabral residents practices agriculture in the "Green Zones" outside Luís Cabral suburb.

According to the local authorities, population from the Quarteirão 40 has been associated in the past with the constant theft of fuel from the Port of Maputo. As part of that population makes a living with fishing, they used the boats by night to enter the port area and steal fuel for re-sale. This activity has in the meantime been brought to an end with the total fencing of the port area.

However, thefts of commodities from trains and trucks entering and leaving the port area are still associated with the inhabitants from the Quarteirões 40 and 40a.

6.2.4 FISHERIES

It is believed that the first people settling in the Luís Cabral suburb (then called Chinhambanine) were from Inhambane province and were practising fishing in Maputo Bay. However, today fishing does not have much economic significance in the suburb and small-scale fishing with small wooden boats is only practised in those areas next to Maputo Bay.

Figure 21: Fisher boats in Quarteirão 40a next to the proposed project site

6.2.5 INDUSTRY

Very few formal industrial businesses are presently installed in the Luís Cabral suburb. The existing industries include automobile companies, such as FORD (opposite the proposed Gas Power Plant), VOLVO and HYUNDAI, JOACO (preparation of concrete), FRESPO (truck transport), Intertek (inspection, verification, testing & certification services), ANE (National Road Administration), CLIMATIC (small company for repair of air conditions and freezers) and a mechanical workshop called “Estrela”. The number of people formally employed in these companies could not be obtained.

Figure 22: Automobile companies in the vicinity of the proposed project site

6.2.6 INFRASTRUCTURES AND SERVICES

Luís Cabral suburb counts with a police station, namely the 18th police station of Maputo City, which is located in the proximities of Lhanguene Cemetery and which covers both, the Luís Cabral and Malanga suburbs. According to the local authorities, in the recent past, criminality has been relatively low, mainly limited to thefts of cell phones and chicken from hencoops. The reduction in criminality is attributed to the reinforcement of the community patrolling two months ago.

In terms of public social infrastructure, the Luís Cabral suburb counts only with three primary schools, but no health infra-structures. Roads inside the suburb are generally sand roads and inside the Quarteirões next to the proposed Maputo Gas Power Plant, even sand roads for vehicle access are inexistent, as the houses are built too close together.

According to the local authorities, no sports facilities can be found anywhere in Luís Cabral suburb, not even a rudimentary football or basketball field. The only existent playgrounds are inside the three primary schools. Similarly there are no cinemas or parks for recreation.

6.2.7 HOUSING

Housing can vary considerably in Luís Cabral suburb, with more sophisticated concrete houses in the areas closer to the EN 1 highway (Av. de Moçambique) and predominantly reed houses or huts further to the interior of the suburb or in the Quarteirões 40 and 40a next to the proposed project site. The reed houses in the Quarteirões 40 and 40a are generally covered with zinc roofs and equipped with a front door, generally made from either wood or tin sheets, but no windows. Inside they are generally divided into two compartments with a compacted mud floor. The yards are generally confined by a reed fence. However, there are also some concrete houses in the area, as Figure 23 below shows:

Figure 23: Reed and concrete houses in quarteirão 40a

6.2.8 EDUCATION

In 2008, Ka Mubukwana Urban District counted with a total 39 public schools, of which 17 were EP1 primary schools (1st – 5th class) and 14 were the so-called EPC primary schools, lecturing both EP1 and EP2 (6th and 7th class) levels. It also counted with another 19 primary schools, lecturing only the EP2 level, as well as one combined school lecturing the EP2 and the first level of the secondary education ESG1 (8th to 10th class). Furthermore, Ka Mubukwana District hosts 6 ESG1 schools and 2 secondary schools lecturing both, the ESG1 and ESG2 (11th and 12th class) levels. In the same year, another 12 private schools (5 EP1, 1 EPC, 1 ESG1, 2 EP2/ESG1 and 3 EP2/ESG1/ESG2) and 6 community schools (3 EP1, 1 EP1/2/ESG1, 1 EP2/ESG1/2 and 1 lecturing all levels) in this urban district were functioning.

Although Luís Cabral suburb accounts for over 10% of Ka Mubukwana's population, the suburb only counts with 3 complete primary schools, but no secondary school. The primary schools are EPC Luís Cabral, EPC Unidade 5 and EPC Unidade 6 with a total 5,334 students enrolled.

Table 11: Primary schools of Luís Cabral suburb and students enrolled in 2012

Primary School (ESC)	Masc.	Fem.	Total	% Female
Luís Cabral	998	947	1,945	48.7
Unidade 5	581	572	1,153	49.6
Unidade 6	972	1,264	2,236	56.5
Total	2,551	2,783	5,334	52.2

Source: Luís Cabral Suburb Secretary

If taking into account that in Ka Mubukwana Urban District 28.3% of the population is between 5 and 14 years old (INE, 2012) and if this same rate is applied to Luís Cabral suburb, some 9,565 children in this age group can be estimated to live in the suburb. Compared with the 5,334 currently enrolled in the three schools, this indicates that approximately 44% of children in school age are either enrolled in schools in other suburbs or are not frequenting school at all.

Two faculties of Mozambique's oldest university, the Universidade Eduardo Mondlane (UEM), are located within the limits of Luís Cabral suburb, namely the Engineering Faculty and the Veterinary Faculty. Both are located side by side along the Avenida de Moçambique (or EN1) and are not close to the proposed Gas Power Plant.

Another higher education institution has been established more recently in the proximity of the proposed project site. It is the Higher Institute for Training in Teaching and Management of Technical-Professional Education, or simply, the Dom Bosco Higher Institute, which was newly constructed in 2007 by the Salesian Congregation on the former "Maquinag" plot of land opposite of the proposed Gas Power Plant. This institute aims at training teachers and started off in 2007 by training 113 teachers by distance learning. In 2008, the institute further introduced courses in the areas of tourism and administration with a duration of three years. Currently, a total 458 students are enrolled in the institute, the majority of which is female (266 or 58%).

Figure 24: Luís Cabral primary school; Dom Bosco higher institute

6.2.9 HEALTH

Luís Cabral suburb does not dispose of a health centre for its 33.800 inhabitants and can also not count on a smaller health post. In case of sickness, the inhabitants resort to the José Macamo Hospital, the second largest hospital in the capital, which is located not far from the proposed project site, but belonging to Malanga suburb (Urban District Nlhamankulu, formerly No. 2).

Because of this, it is not possible to obtain the specific epidemiological profile for the Luís Cabral suburb, but the local authorities identified malaria, tuberculosis and HIV/AIDS as most frequent diseases amongst the suburb's population, whereas the latter two diseases are often linked.

6.2.10 WATER SUPPLY

The water infra-structure in Mozambican cities belongs to FIPAG (Fundo de Investimento e Património de Abastecimento de Água), the Mozambican Water Authority. The public provider of tapped water to households in Maputo City is Águas de Moçambique (AdM, since 2011 denominated Águas da Região de Maputo). According to AdM, of the 14 suburbs of Ka Mubukwana Urban District, only 10 were covered in 2008 by AdM's water supply. In 2007, 26,524 households in this urban district were linked to AdM's public water supply network. This number rose to 26,952 in 2008 (AdM in CMMaputo, 2010), which corresponds to an increase of 1.6%.

According to the local authorities, the major part of Luís Cabral suburb is covered by public water supply network. However, not the entire suburb has a domestic link for potable water. In the Quarteirões 39 (which comprises quarteirão 39 and 39a-39f) and quarteirão 40 (which comprises quarteirão 40 and 40a-40b), households have no tapped water supply in their residences. A public water fountain has been installed in the each one of the "mother"-Quarteirões (which means in city blocks 39 and 40), where households from the sub-Quarteirões 39a-30f and 40a and 40b are fetching the water they need. In some cases, this implies that people have to cross the N4 highway to get potable water.

Figure 25: Water supply and transport in Quarteirão 40a

6.2.11 ELECTRICITY SUPPLY

In terms of electricity, the entire Luís Cabral suburb is linked to the national electricity grid and theoretically all households could benefit from the electricity provided by the national electricity provider Electricidade de Moçambique (EDM). However, a considerable part of the households cannot afford to pay for the electricity and thus has no domestic linkage to the electricity network. According to the suburb secretary, this is mostly the case in the Quarteirões 40 and 40a next to the proposed project site, where people are generally poor.

Figure 26: Electricity post and TV antenna in quarteirão 40a

Furthermore, in these Quarteirões next to the proposed Maputo Gas Power Plant exists no public street lighting.

6.2.12 SANITATION

Luís Cabral suburb is not linked to a public sewage system. Thus, the residences further to the northern limit and close to the N1 generally dispose of an own septic tank or an improved latrine. This is not the case of the households in the Quarteirões next to the proposed Maputo Gas Power Plant, which generally only dispose of traditional latrines.

To improve this situation, the international NGO Family Health International is financing the project "Estamos", which promotes the construction and distribution of cement slabs for improved latrines. To implement the project in the Quarteirões 40 and 40a, "Estamos" works through a Community Based Organisation (CBO) called Associação Comunitária para o Desenvolvimento da Saúde Pública (ACODESPU – Community Association for the Development of Public Health), which was end of last year officially recognised as legal entity.

Figure 27: Traditional latrine in the project area; production of cement slabs by ACODESPU

With regard to solid waste collection, Luís Cabral suburb is served by a micro-business contracted by the Maputo City Council. With this system, the residents are required to deposit their domestic solid waste in the next container available and this waste collection company regularly collect the containers to take them to the city's landfill.

This system, however, is only operational in a small part of quarteirão 40a, but the remainder of quarteirão 40a and quarteirão 40 are not served, given the lack of road access to these areas. Thus, local residents get rid of their local waste by ether burning it or, else, by burying it in the mangroves at Maputo Bay or by throwing it into the small river crossing the area, where it eventually will be washed into Maputo Bay.

Figure 28: Mangroves and river margin in the project area polluted by solid waste

6.2.13 ACCESSIBILITY AND TRANSPORT

Although located relatively quite centrally in Maputo City and next to the Av. de Moçambique (EN1), which is the main access road to the city from the North, the tar road linking the N1 to the Luís Cabral suburb ends abruptly after some fifty metres. Inside the suburb, roads consist in sand roads without maintenance, mostly in a deplorable state (see Figure 29 below). While the roads closer to the N1 are rather wide, they become increasingly narrower further inside the suburb because of the dense settlement pattern, often only allowing for one vehicle to pass.

Figure 29: State of the wider roads closer to the EN1

Because of the bad state of the roads, Luís Cabral suburb is not served by any public transport system and the common informal buses, the so-called *chapas*, also do not access this suburb. Thus, the only possibility for the local population is to catch public transport at the EN1, obliging them to carry their loads for long distances. At the EN1, however, there exists no official bus stop for Luís Cabral suburb. As a result, the inhabitants of Luís Cabral suburb are forced to often

wait for long periods of time until a *chapa* from other suburbs stops, which has some empty space for additional passengers.

Figure 30: Women carrying their loads from the N1 into Luís Cabral suburb

In the Quarteirões next to the project site, namely the Quarteirões 40 and 40a, the settlement pattern is so dense that vehicles have no access, as there are no roads, as illustrates Figure 32 in Section 6.2.16 below.

6.2.14 LAND USE AND NATURAL RESOURCES

With regard to the land use in Luís Cabral suburb, the major part of its extension is occupied by dwellings (see Figure 29 below). Only a tiny strip at the Western limit with Jardim suburb consists in cultivated land. The Lhanguene Cemetery and an industrial zone occupy the Eastern part of the suburb. The other industrial zones are the project area and the industries opposite of the project area along the N4 highway. Swampy areas are located in the Northern part of the suburb, as well as in the extreme Southern part around the project area and close to quarteirão 40a. Mangroves form part of the Southern limit of Luís Cabral suburb.

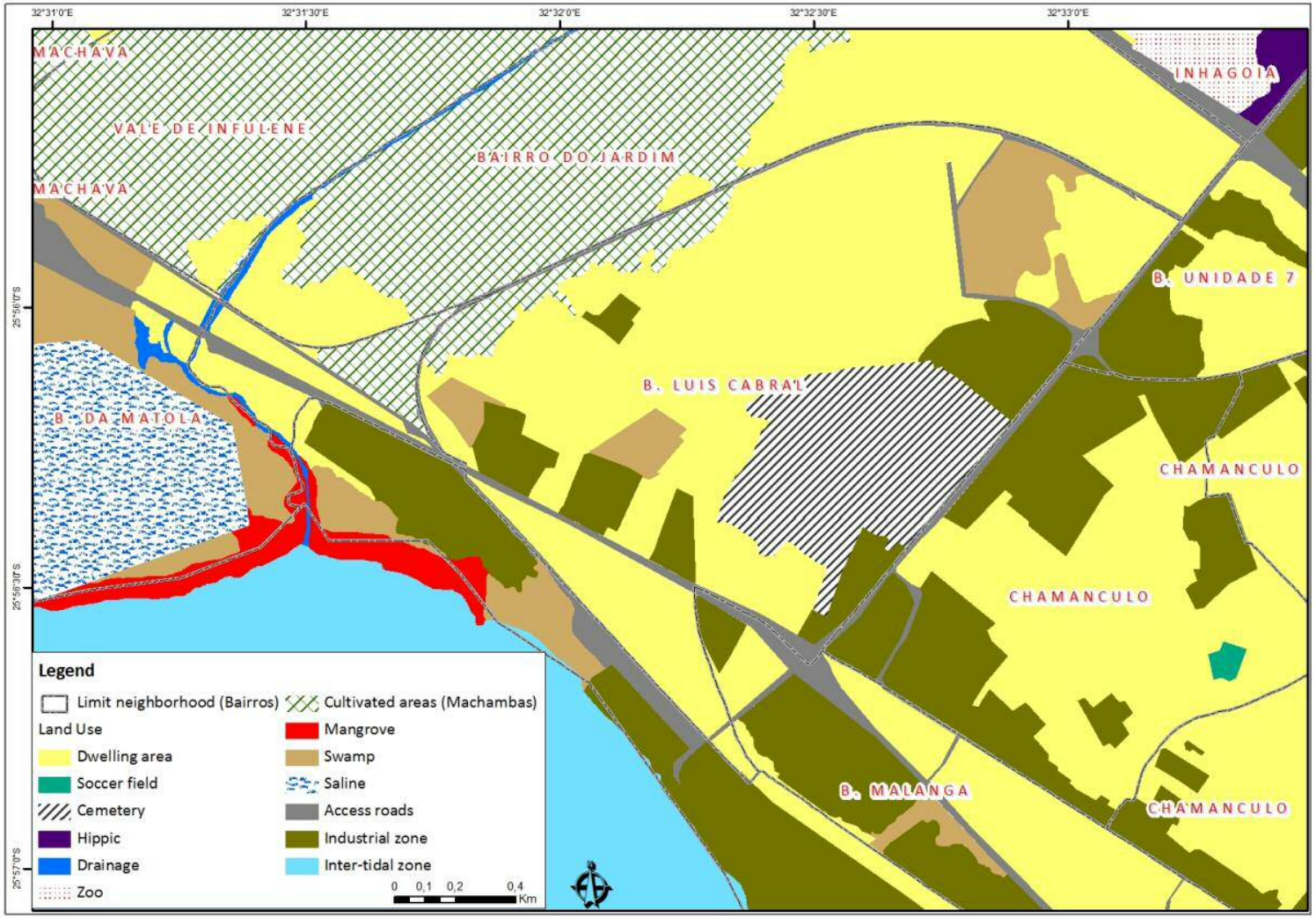


Figure 31: Land use in Luís Cabral suburb and in the project area

6.2.15 SACRED SITES AND CULTURAL AND HISTORIC ASPECT

There are no specific sacred sites in Luís Cabral suburb, where people hold ceremonies, nor archaeological sites.

Historically, this suburb emerged – as did others -, after the Portuguese colonial government elaborated in 1952 an urbanisation plan, which foresaw the development of Lourenço Marques (today Maputo) along the coastal line. During this period, the industrial boom had reached Lourenço Marques, with industries being installed in the western part of the city, causing that the major part of the population also started to settle to the West. It was during the last decade of the colonial regime, when the African population installed itself in suburbs, such as Chamanculo, Jardim, Chinhambanine (today Luís Cabral), Benfica and Mahotas, because of the new employment opportunities in commerce and industry. The so-called "reed" suburbs occupied a vast surface of the city and the major part emerged spontaneously.

The Luís Cabral suburb also emerged most probably in the 1960ies. Ever since its emergence, the name of the suburb had been Chinhambanine, most probably because the major part of people settling there at that time came from Inhambane province. It was only after the independence of the country, when the then President of the Republic Samora Machel, accompanied by Luís Cabral, the then president of Guinea Bissau, attributed this name in honour of the latter.

6.2.16 SETTLEMENT PATTERN

To understand the settlement pattern found in peripheral suburbs of Maputo city, one needs to look at the above described historical context, in which these suburbs started to emerge and develop into what they are today.

The extreme population density, which can be observed today and which probably has reached its geographical limits, as indicates the reduced population growth in the suburb between 1997 and 2007 (see Section 6.2.1 above), especially in those parts of the suburb close to the EDM Thermal Power Plant (quarteirão 40 and 40a), is the result of a phenomenon, which can also be observed in other peripheral suburbs of the capital. According to the local authorities, when people leave the rural areas and come to Maputo city in search for employment, they generally get accommodated by other family relatives already living there. Normally, after some time, these relatives will offer a small portion of their own plot, where the "newcomer" can construct his own reed hut. Thus, over time, the space inside the original plots became more and more densely populated, and the Quarteirões started to develop further sub-Quarteirões, as the administrative numbering of the Quarteirões in the suburbs indicates (see Section 6.2.1). This process has been further accelerated during the armed conflict between 1978 and 1992, where people fled from the rural areas into the cities because of the war.

The result is that the most densely populated areas of Luís Cabral suburb, such as the Quarteirões 40 and 40a next to the Thermal Power Plant, have no space left for the installation of social services, such as schools, health posts, sports facilities, bus terminals or even roads, which would allow the access of vehicles (see Figure 32 below). To eventually allow the installation of social services in these areas, a so-called territorial "re-qualification" process is required, which will imply the relocation and resettlement of some of the local households. In fact, the local authorities confirmed that the re-qualification of some areas in this suburb has already been announced by the municipal authorities, but it is unclear, when this process will start. However, very soon some families of quarteirão 40 will already face resettlement, because of the construction of a new circular road around Maputo, which has already started. These families will be resettled as far as in Tchumene suburb in Matola City.

Figure 32: Settlement pattern in Quarteirão 40 without adequate road access

7 ENVIRONMENTAL IMPACT ASSESSMENT AND MITIGATION MEASURES

7.1 INTRODUCTION

One of the main objectives of the Scoping Phase is to conduct a preliminary identification of those impacts most likely to be significant and therefore need to be addressed in the EIA.

The main objectives of the EIA are as follows:

- to identify and assess the main potential environmental impacts (negative and positive) of the proposed project, taking into account the biophysical and socioeconomic domains; and
- to identify the mitigation, environmental management and environmental monitoring measures that will allow for minimizing potential negative impacts and to enhance potential positive impacts of the project, so as to ensure that it can be implemented in an environmentally sound manner.

Each specialist involved in the different specialist studies contained in this report will identify and describe potential impacts of the project pertaining to his/her area of expertise. Potential impact is defined as a change on the environmental and socio-economic components that could result directly or indirectly from project implementation.

It is worth recalling that not all impacts are negative and that positive impacts can also be expected, which will bring benefits to the society and the economy of Mozambique.

The methodology proposed for identification and assessment of the potential impacts is outlined below.

7.2 IMPACT ASSESSMENT METHODOLOGY

An impact assessment is based on a comparison of environmental scenarios, *viz.* the existing scenario prior to project implementation (baseline situation) and the expected scenario after project

implementation. The assessment of impacts proceeds through an interactive process considering the following criteria:

- **Nature** (positive or negative impact);
- **Probability** (possibility of impact occurrence);
- **Extension** (the geographical area that may be affected by the impact);
- **Duration** (period along which the impact is expected to occur);
- **Magnitude** (effect on environmental and social processes);
- **Significance** (the level of importance of the impact).

The categories to be considered for each of the criteria above are indicated in the **Table** below.

Table 12: Criteria for assessment of potential impacts of the project

CRITERIA	DESCRIPTION
Nature	**Nature of the environmental change**
Positive	Beneficial environmental change
Negative	Adverse environmental change
Probability	**Degree of possibility of impact occurrence**
Low	The possibility of occurrence is low, either due to the project design or due to the project nature, or due to the characteristics of the project area
Probable	There is possibility of impact occurrence
Highly Probable	Possibility of impact occurrence is almost certain
Definite	There is certainty that the impact will occur
Extension	**The geographical area that may affected by the impact**
Local	Only the place where the activities directly related to the construction and operation may occur, located within the boundaries CTM
Regional	Project region, in particular the administrative areas potentially affected by the project (Maputo city, Matola city and Maputo province)
National	Mozambique
International	Mozambique and other countries (neighbouring or non-neighbouring countries)
Duration	**Period along which the impact is expected to occur**
Short-term	Less than 6 (six) months
Medium-term	Between 6 (six) months and 5 (five) years
Long-term	Project's lifetime
Permanent	The impact remains beyond the activity's lifetime, regardless of implementation of mitigation measures
Magnitude	**Effect on environmental and social processes**
Low	Small effect on the functioning of environmental and social processes
Moderate	Functioning of environmental and social processes is moderately affected
High	Functioning of environmental and social processes is considerably affected

All human activities impose some type of disturbance to some features of the natural and social environments, either in the form of a change in the natural systems or due to interactions with other human activities or with human systems. The assessment of **Significance** helps inform the relevant authorities and the public about the relative importance of the different impacts of the project. The

assessment of impact significance results from a combination of the criteria above indicated, in particular Extension, Duration and Magnitude, as shown below in the Table 12.

Table 13: Criteria for assessment of significance of potential impacts of the project

Significance	Relation with the other criteria that describe the impact	Relation with mitigation measures
Negligible	- Low Magnitude, with any combination of other criteria.	- No further investigation, mitigation or environmental management is required.
Low (Low Significance Impact)	- Low Magnitude, with any combination of other criteria (except for Long-term Duration and National or International Extension); - Moderate Magnitude, with Local Extension and Short-term Duration.	- No specific mitigation is required, though it is subject to best environmental practices.
Moderate (Significant Impact)	- Low Magnitude, with National or International Extension and Long-term Duration; - Moderate Magnitude, with any combination of other criteria (except for: Local Extension and Short-term Duration; and National Extension and Long-term Duration); - High Magnitude, with Local Extension and Short-term Duration;	- Mitigation and Management is required to reduce the impact to an acceptable level (applicable to negative impacts).
High (High Significance Impact)	- Moderate Magnitude, with National or International Extension and Long-term Duration; - High Magnitude, with any combination of other criteria (except for Local Extension and Short-term Duration)	- If the impact cannot be mitigated/managed, it should influence decision as regards to particular aspects of the project (applicable to negative impacts).

This approach to impact assessment aims at minimising the subjectivity inherent to the evaluation of Significance. It is worth noting, however, that the context of the impact (i.e. the identity and the characteristics of the impact receptor), as well as compliance/non-compliance with norms, standards or legal instruments, must also be taken into account. Therefore, the use of this methodology also always has to take into consideration the specific conditions that may apply to each impact, regardless of the proposed combinations of Extension, Duration and Magnitude.

The objective of an impact assessment is also to define technically acceptable, practicable and cost-effective mitigation measures for the environmental and social impacts identified. The overall purpose is to avoid unnecessary damage to the environment; safeguard valued or finite resources, natural areas, habitats and ecosystems and protect humans and their social environments.

Mitigation measures are developed to avoid, reduce, remedy or compensate for any negative impacts identified and to create or enhance positive impacts such as environmental and social benefits. In this context the term “Mitigation Measures” includes operational controls, as well as management actions. These measures are often established through industry standards and may include:

- Changes to the design of the project (e.g. changing the development approach for some specific project components);
- Engineering controls and other technical measures (e.g. waste water treatment facilities, communication procedures, etc.);
- Operational plans and procedures (e.g. waste management plans; safety procedures);
- The provision of like-for-like replacement, restoration or compensation, directed towards particular environmental elements potentially affected by the project.

Where significant residual impacts remain, further options for mitigation may be considered and impacts re-assessed, until they are as low as reasonably practicable for the project.

7.3 POTENTIAL IMPACTS TO BE ANALYSED DURING IMPACT ASSESSMENT

7.3.1 CONSTRUCTION PHASE

7.3.1.1 BIOPHYSICAL IMPACTS

Impact 1-C: Loss of flora and fauna due to construction activities

For the construction of the power plant it will be necessary to remove some terrestrial vegetation. It should be noted, however that, the vegetation on-site is very few and common throughout the country and is already disturbed by human activities. For the reasons above, the fauna is very poor in the region and no species of conservation concern have been identified.

However some sensitive marine areas were identified in the area (*Estuário de Espírito Santo)*. These areas have sensitive habitats such as mangroves and the Matola salt pans, which hosts a colony of flamingos. This project may imply the destruction and/or contamination of parts of particularly important habitats that will be identified in detail later in the EIA.

Based on the information available, the risks and impacts related to the flora and fauna on the site are likely to be as follows:

Evaluation of impact:

- Nature – negative impact;
- Probability – probable;
- Extension – local;
- Duration –medium term
- Magnitude – low
- Significance – low

Mitigation Measures:

- Restrict the Contractor's access outside of the project implementation area and to reduce the construction work area to a minimum in these areas.
- All vehicles and machinery should only use indicated routes and access roads and therefore no off-road driving.
- Monitor the construction and operational phases and to check compliance with special contractual conditions (if these exist).
- Avoid contamination of the sensitive habitats, by implementing, for instance, good waste, wastewater and chemical handling management plans.
- Reduce noise impact.

Impact 2-C: Air pollution due to pollutants emissions from transportation and construction activities

The air quality in the construction site and it's vicinity will be altered during the construction phase mainly due to (i) the potential for dust (particulate matter such as PM_{10}) generation from transportation and construction activities (*e.g.* vegetation clearing, topsoil removal), and (ii) increased motor vehicle emissions (*e.g.* CO_2, NO_x, SO_2) related to the transportation of materials to and from the site and the movement of construction equipment such as earthmovers and bulldozers. However, this environmental impact is considered to be relatively small due to the limited duration of the construction works.

Evaluation of impact:

- Nature – negative
- Probability – highly probable
- Extension – local
- Duration - short term
- Magnitude - low
- Significance - low

Mitigation measures:

Reduce emissions *on-site*:

- Loads on vehicles carrying dusty construction materials should be covered.
- Loading and unloading bulk construction should be in areas protected from the wind on in calm conditions.
- Vehicles carrying dusty materials should be washed before leaving the site (washing facilities should be available).
- Limit access to construction site to construction vehicles only.
- Impose vehicle speed restrictions on the construction site.
- Maintain high moisture content on exposed surface and roads by spraying with water.
- Maintenance programme for construction vehicles to ensure optimum performance reduced emissions.

Impact 3-C: Increase in noise levels due to transportation and construction activities

The vegetation clearing activity, as well as the movement of vehicles and the operation of heavy machinery will cause an increase in the levels of noise in the site and its vicinity, causing nuisance to the workers and neighbouring community (Bairro Luís Cabral). In general, the construction noise is intermittent and depends on the type of operation, location and functionality of the equipment and its life cycle. Noise decreases with distance. For example, the noise level from excavations, with activities from vehicles such as trucks, will approximately be 85 dBA at a distance of 15 m, but decrease by about 3-4 dBA for each doubling of distance, and would decrease to about 70 dBA (World Bank/IFC Ambient Noise Guidelines for industrial zone) at a distance of about 240 m (still inside the premises). Despite the moderate magnitude of this impact (due to the proximity of a residential area and to employees) since the area is categorized as an industrial area and the impact is local and with short duration its significance may be low, if mitigation measures are in place.

Evaluation of impact:

- Nature – negative
- Probability – highly probable
- Extension – local
- Duration - short term
- Magnitude - moderate
- Significance - low

Mitigation measures:

Sound emissions resulting from the construction phase fall, mostly, within the levels allowed by the World Bank for industrial and commercial areas (70 dBA), however, to avoid public nuisance and complaints and occupational hazard to the employees, a few aspects should be taken into account:

- The Contractor should take measures to inform the communities about the start of the works and the time limit foreseen for their conclusion, the working hours established by law should be adhered to and respected. Work continuation during evenings, weekends and holidays should be avoided.
- Machines and vehicles should be repaired regularly to keep noise levels to a minimum. Well-maintained equipment is in general more silent.
- Whenever possible, machines and vehicles should be equipped with silencers.
- Use noise barriers if necessary. When possible use natural noise barriers such as materials resulting from earthworks, trees.
- All construction workers must be issued with the necessary protective equipment.
- Construction work should be limited to the daytime (08:00-18:00).

- Environmental noise monitoring: This should be carried out regularly at specific positions to detect deviations from predicted noise levels and enable corrective measures to be taken where warranted

Impact 4-C: Increase of soil erosion and/or compaction due to the construction activities

Construction activities have the potential to cause soil erosion and/or compaction as well as soil pollution (see Impact 5C).

Erosion may result from the movement of heavy machinery, the removal of the vegetative cover and exposure of the soil surface. Erosion of the soil and run-off from construction materials could also cause and/or increase turbidity and siltation of the water bodies in the surrounding areas (e.g. Maputo Bay). In general the potential for erosion in the study area is low.

Compaction is almost inevitable during the construction phase as vehicles driving over soils will compact them, as will the storage of construction materials, etc. Compaction may lead to difficulty in root penetration and reduced infiltration of water. The latter will lead to increased run-off and the associated risk of erosion. Compaction may also cause waterlogging, resulting from water being unable to move easily through the compacted soil.

Due to the fact that the duration of the construction activity is short and the proposed project area is small the significance of this impact may be low, if mitigation measures are implemented.

Evaluation of impact:

- Nature – negative
- Probability – probable
- Extension – local
- Duration - short term
- Magnitude - low
- Significance - low

Mitigation measures:

- Limit access to the project area to the necessary minimum and remove as little vegetation as possible.
- Avoid creating large open expanses of bare soil as these are most susceptible to wind and run-off erosion. In such areas, if necessary, create windbreaks should (e.g. a tree screen).
- Suitable drainage systems should be installed to direct water and prevent waterlogging and erosion.
- After construction, all non-paved areas should be reinstated with the topsoil to allow the reestablishment of the indigenous herbaceous vegetation. All bare areas should be re-vegetated as soon as possible.
- All vehicles and machinery should only use indicated routes and access roads.
- All temporary access roads should be rehabilitated at the end of the construction phase.

Impact 5-C: Soil and water (superficial and groundwater) pollution due to the construction activities

During the construction phase, several machines and vehicles will be used. There may be oil and fuel spills, causing soil pollution. Depending on the place and the quantities involved, the pollution risk may vary from insignificant to extremely significant. However, with adequate management most of the spills may be collected and treated *in situ*.

Furthermore, improper management/disposal of waste (e.g. oil filters, lubricants and other chemicals) and wastewater can also increase the surrounding soil and water contamination risk.

Assuming proper handling/storage/management of chemicals, fuels and waste/wastewater and due to the fact that the construction activity is short-termed the significance of this impact will be low.

Evaluation of impact:

- Nature – negative
- Probability – probable
- Extension – local
- Duration - short term
- Magnitude - low
- Significance – low

Mitigation measures:

- Ensure all activities involving the transfer, storage and disposal with potential for contamination are confined to appropriately bunded areas. All such storage areas, including those for fuels and other chemicals, should be properly signalised and constructed on impermeable cemented bays in order to contain possible spills.
- All workers involved in the use of such materials should receive proper induction and protective equipment (such as gloves, masks, uniforms, etc.).
- The following precautions on the storage and handling of fuels and lubricants are recommended to avoid possible spills:
  - Fuel storage facilities with a capacity greater than 1000 litres shall be located on flat or gently sloping ground. A bund (spills containment basin) shall surround the area and be capable of containing at least 125% of the total capacity of the storage containers. The bund and the floor of the storage area shall be constructed with impermeable material or be lined to ensure that petroleum products cannot escape.
  - Any chemicals shall be stored away from any potential or natural drainage paths.
  - All fixed storage areas shall be enclosed by a security fence with a lockable gate. Symbolic signs depicting ‘no smoking’ ‘no naked flames’ and ‘danger’ shall be displayed, and shall conform to a recognised standard. It is advisable to use local languages, in addition to Portuguese.
  - Vehicles and machinery maintenance should be done regularly to avoid spills during their operation. Maintenance should only be done in the workshops designated for this purpose. No maintenance should be permitted outside the designated area. If it is not possible to remove the vehicle to the camp’s workshop, maintenance can be permitted if the following recommendations are adhered to:

  - Prohibit vehicle and machine maintenance outside the designated area for this purpose. If it is not possible to remove the vehicle and/or machine to the workshop, maintenance may only be done outside it with due precautions (e.g. using drip trays to contain spills).
  - Cleaning and spill collection techniques must be used.
  - In case the soil is contaminated, it must be immediately removed for treatment.
  - Soil contaminated with oils and fuels must be treated (e.g. through bioremediation).
  - Clean and rehabilitate areas affected and/or contaminated with oils, fuels, etc.
- Any and all chemicals (solid, liquid or gas) brought to site shall be cleared with the resident engineer prior to storage and use and such clearance procedure shall at the very least include a written motivation with full specifications, including a risk assessment of any environmental hazards which may pertain to the chemical (include MSDS of the products). The Contractor shall propose a mitigation to store such chemicals to the Engineer for approval prior to the chemical being accepted on site.
- An emergency response plan to remediate any contaminated soils must be submitted prior to the start of works and shall identify inter alia; methods for excavation of contaminated ground, temporary stockpile area and the method of quarantine, final disposal of contaminated material, a quality control system to track the process. This must be established during site establishment and shall remain operational for the duration of the project and shall not be on or near to a natural drainage path.
- Construct proper draining and treatment systems to collect and treat wastewater resulting from run-off, cleaning of yards and maintenance areas, sewage and sanitary wastewater.
- Implement the Waste Management Plan (see Section 10).
  - Guarantee compliance with Decree nr. 13/2006 of 15th of June (Mozambique Regulations on Waste Management) and other relevant legal requirements should be enforced.
  - Principle: Reduce, re-use, recycle, treat and dispose.

Impact 6-C: Change of the natural water drainage

This phase of the site preparation involves rendering the terrain impermeable and disturbance of the soil for the construction of the various types of infrastructures and services (at least 3 ha will be permanently impermeable), which may result in a change of the natural water drainage pattern (including increase in superficial flow, particularly peak flows) in the area, especially important during the rainy season. The site will in fact, not interrupt any natural watercourses, so the main issue will be the increase in run-off, although the impermeable area will be only 0.01% of the catchment area. The catchment north of the site is currently managed by a stormwater channel running parallel to the railway and draining into Maputo Bay. This channel may potentially provide sufficient capacity for the "clean water" generated by the catchment north of the site, although this will need to be confirmed in a later study. If a proper stormwater management plan is implemented the impact will be low.

Evaluation of impact:

- Nature – negative
- Probability – probable
- Extension – local

- Duration - long-term (in terms that the area will be impermeable through the life time of the project)
- Magnitude - low
- Significance – low

Mitigation measures:

- Develop and implement a stormwater management plan.
- During land use planning, drainage channels should be the first to be established.
- These channels can be protected against erosion with vegetation or lined with cement.
- The vegetation in the drainage channels protected with vegetation should be trimmed, leaving the channels free from sediments and remains.
- It is important to ensure that ditches and drains are kept free from waste and invasive vegetation. These ditches and drains should be cleaned regularly and manually.
- The movement of surface water to and in the drainage channels should not be obstructed, i.e. the water should run freely.
- The size of the drainage channels should be maintained, so that they may require periodical re-establishment to their original form and capacity.
- A routine road maintenance programme should be established, creating conditions for the water to run freely during the rainy season.
- The roads themselves should have drainage mechanisms for rain- and other water.
- It is also recommended that any change in the natural drainage pattern will only take place in the last resource, and if necessary for the works.

7.3.1.2 SOCIOECONOMIC IMPACTS

Impact 7-C: Disturbance and interference associated with local traffic

The movement of heavy vehicles and equipment will be a factor of “disturbance” in terms of their interference with local traffic, especially as the all trucks leaving the N4 road in one direction. In case the trucks need to return to the other direction, they will have to make a manoeuvre in front of the toll station.

On the other hand, the movement of heavy vehicles will not significantly affect the neighbouring suburbs, as they will not cross these.

Based on the information available, the risks and impacts related to flooding on the site are likely to be as follows:

Evaluation of impact:

- Nature – negative impact;
- Probability – probable;
- Extension – local;
- Duration – short to medium term;

- Magnitude – moderate
- Significance – low

Mitigation Measures:

- The movement of all vehicles and machines should be restricted to designated routes, so as not to cause an excessive concentration of traffic or conflicts with other road users of the area. The vehicles should also circulate at low speed to avoid accidents between vehicles, with the local population and with workers (pedestrians). In case, manoeuvring at the toll station cannot be avoided, necessary traffic precautions need to be taken.
- The workers and machine and vehicle operators should receive training about taking care and observing the traffic rules in the area (including the proper signalling and right-of-way rules).

Impact 8-C: Social conflict due to physical presence of external workers

During the construction phase, construction workers will be hired. The exact number is, however, not yet determined. Workers will, naturally, interact with the local population, and conflicts may occur of a socio-cultural nature. However, given the relative isolation of the CTM site, this impact is thought not to be very significant.

Evaluation of impact:

- Nature – negative impact;
- Probability – low;
- Extension – regional;
- Duration – short to medium term;
- Magnitude – low
- Significance – low

Mitigation Measures:

- Both, workers and local communities, should be subject to awareness-raising campaigns, so as to promote good relations, thus avoiding the occurrence of conflicts.
- The workers should also receive special health care and health education, particularly regarding the spread of sexually transmitted diseases (STDs) and HIV/AIDS. In public places and of easy access for the workers condoms should be made available.

Impact 9-C: Rise in employment opportunity expectations

During the construction phase, there may arise high expectations in the surrounding communities with regard to the creation of unskilled job opportunities. These could be disappointed, as it is expected that a company with its own work force will be contracted for construction work.

Evaluation of impact:

- Nature – negative impact;
- Probability – low;

- Extension – regional;
- Duration – short to medium term;
- Magnitude – low
- Significance – low

Mitigation Measures:

- If local workers (non-specialised and/or semi-specialised) will be necessary, the project must as far as possible incorporate and maximise the use of local labour. This should be best coordinated with the local authorities and with the Maputo city Directorate of Labour.
- In the Contractor's contract, the number of work places to be opened for local staff should be stipulated, the hiring requirements, the maximum duration of the work, the recruitment procedures and wage levels.

Impact 10-C: Increased noise levels through construction works and increased vehicle movement

The vegetation clearing activity, as well as the movement of vehicles and the operation of heavy machinery will cause an increase in the levels of dust and noise, causing a bit of nuisance and health problems to the affected communities.

In general, the construction noise is intermittent and depends on the type of operation, location and functionality of the equipment and its life cycle.

Excessive noise could have an impact on the neighbouring communities, as well as on the construction workers. However, the impact will be temporary and restricted to the site, as well as the immediate vicinity of the site.

Evaluation of impact:

- Nature – negative impact;
- Probability – highly probable;
- Extension – regional;
- Duration – short to medium term;
- Magnitude – low
- Significance – low

Mitigation Measures:

Sound emissions resulting from the construction phase have to fall within the levels allowed by the World Bank for industrial and commercial areas (70 dBA), so that no mitigation measures are required. However, to avoid public nuisance and complaints, a few aspects should be taken into account:

- The Contractor should take measures to inform the communities about the start of the works and the time limit foreseen for their conclusion, the working hours established by law should be adhered to and respected. Work continuation during evenings, weekends and holidays should be avoided.
- Machines and vehicles should be repaired regularly to keep noise levels to a minimum. Well-maintained equipment is in general more silent.

- Whenever possible, machines and vehicles should be equipped with silencers.
- All workers should be provided with effective mufflers.

Impact 11-C: Increased generation of dust

Construction activities such as vegetation clearing, topsoil removal and movement of heavy machinery generate dust, which will influence the air quality in the immediate vicinity of the construction activity. However, given the relative isolation of the CTM site, this impact is thought not to be very significant.

Evaluation of impact:

- Nature – negative impact
- Probability – low
- Extension – regional
- Duration – short to medium term
- Magnitude – low
- Significance – low

Mitigation Measures:

- Define speed limits for the circulation of vehicles at the construction site
- Ensure that regular water spraying takes place at the construction site

7.3.1.3 OCCUPATIONAL HEALTH AND SAFETY IMPACTS

Impact 12-C: Injury and occupational disease caused by lack of general risk awareness

Description: Due to the type of construction work that will be carried out on site, there is a potential risk of injuries and work accidents that can occur, such as falling from heights, excavations & scaffolding collapsing and exposure to occupational health risks. The contractor must therefore ensure that general health & safety awareness and the communication of risks, management controls and mitigation measures for potential health & safety risks exposed to are adequately communicated and controlled.

Evaluation of impact:

- Nature: negative
- Probability: highly probable
- Extension: local
- Duration: short to medium-term
- Magnitude: moderate
- Significance: moderate

Mitigation measures:

- All contractor teams involved in works during the construction phase shall be briefed on their obligations towards health & safety controls and methodologies. The briefing must take the form of a presentation and demonstration. The education / awareness programme should be aimed at all levels of management and general staff within the Contractor teams. An attendance register shall be signed at this briefing. Local labourers hired for the construction phase must receive training related to health & safety awareness prior to commencement of the works.

Impact 13-C: Fires, explosion, injury or occupational diseases caused by inadequate management controls

Due to the nature and inherent risks associated with the proposed project, there is a significant potential for serious injuries, fire and explosions taking place due to inadequate controls being implemented. Therefore effective mitigation measures, management and system controls must be implemented during the construction phase to prevent incidents from taking place.

Evaluation of impact:

- Nature: negative
- Probability: highly probable
- Extension: local
- Duration: short to medium-term
- Magnitude: high
- Significance: moderate

Mitigation measures:

- Prepare a Health and Safety Management Plan, which addresses hazards identified and includes safe work procedures to mitigate, reduce or control the hazards identified and provide it to any contractor hired for construction works.

- Take reasonable steps to ensure that the health and safety management plan is implemented and maintained on the construction site.

Impact 14-C: Fatalities and serious injuries caused by collapsing excavations

Numerous fatalities have occurred on construction sites by collapsing excavations. Strict controls and management practices must be implemented to ensure the safety of construction personnel working in or near excavations.

Evaluation of impact:

- Nature: negative
- Probability: highly probable
- Extension: local
- Duration: long-term
- Magnitude: moderate

- Significance: low

Mitigation measures:

The following rules regarding excavations need to be followed to ensure the safety of construction personnel:

- Ensure that all excavation work is carried out under the supervision of a competent person;
- Evaluate before excavation work begins, as far as is reasonably practicable, the stability of the ground.
- Ensure that the excavation is safe before authorising access into the excavation.

Impact 15-C: Hearing loss induced by noise from construction work

The use of heavy machinery, grinding operations and general construction operations producing noise levels above 85dBA for a time weighted period of 8 hours causes noise induced hearing loss.

Evaluation of impact:

- Nature: negative
- Probability: probable
- Extension: local (construction site)
- Duration: permanent
- Magnitude: moderate
- Significance: moderate

Mitigation measures:

- Provide Personal Protective Equipment (PPE) to all construction workers involved in the construction work.
- Impose obligatory use of PPE by workers
- Adhere to the relevant health and safety standards pertaining to noise, such as wearing ear protection when operating plant, noisy equipment (e.g. angle grinders) or heavy machinery above 85dBA.

Impact 16-C: Fatalities and serious injuries by falling from heights

Working at heights implies the use of scaffolding, thus bearing considerable risks to get injured or killed, when accidentally falling down.

Evaluation of impact:

- Nature: negative
- Probability: probable
- Extension: local
- Duration: permanent
- Magnitude: moderate

- Significance: moderate

Mitigation measures:

- Provide fall prevention equipment, which prevents persons from falling from elevated positions, such as body harness, body belts, lanyards, lifelines or physical equipment, guardrails, screens, barricades, anchorages or similar equipment;

- Elaborate a fall protection plan, which sets out the procedures and methods to be applied in order to eliminate or reduce the risk of falling from heights.

Impact 17-C: Accidents of vehicles involved in construction work

The construction work will also involve an increased circulation of construction vehicles at the CTM site. Inadequate driving and speeding in the CTM site could imply accidents with between construction vehicles or between these and construction workers.

Evaluation of impact:

- Nature: negative
- Probability: probable
- Extension: local
- Duration: short to medium-term
- Magnitude: moderate
- Significance: moderate

Mitigation measures:

The following management controls must be put in place:

- Ensure that all construction vehicles and mobile plant are of an acceptable design & construction and are used according to their design.

- All construction and mobile equipment must be operated by operators, who have been trained and certified as competent.

- Properly organise the circulation of vehicles on site, including establishment of speed limits at the construction site.

Impact 18-C: Injuries and occupational disease caused by welding operations

Welding, cutting, and brazing are hazardous activities that pose a unique combination of both safety and health risks to workers. The health effects of welding exposures are manifold, representing a threat to different parts of the human body: lungs, heart, kidneys and central nervous system (welding smoke) and eyes and skin (welding flame).

Evaluation of impact:

- Nature: negative

- Probability: highly probable
- Extension: local
- Duration: medium to long-term
- Magnitude: moderate
- Significance: moderate

Mitigation measures:

- Implement adequate management controls for welding, flame cutting, soldering or any similar operation is carried out. These controls must be communicated to all concerned and compliance must be monitored.
- Not allow any welding, flame cutting, grinding, soldering or similar work to be undertaken in respect of any tube, tank, pipeline, drum, vessel or similar object or container, where such object or container:
  a) is completely closed, unless a rise in internal pressure cannot render it dangerous; or
  b) contains any substance which, under the action of heat, may:
     I. ignite or explode; or
     II. React to form dangerous or poisonous substances,
- Ensure that personnel carrying out welding, flame cutting, soldering or any similar operation wear suitable respiratory protective equipment to protect them from the harmful vapours (smoke) present.
- Ensure that any personnel carrying out welding, flame cutting, soldering or any similar operation is properly qualified to carry out this type of work.

Impact 19-C: Electrocution caused by temporary electrical installations on construction site

Improperly fitted temporary electrical installations can cause electric shocks and burns, which can in themselves cause serious and sometimes fatal injury. People may also fall from ladders, scaffolds and other equipment as a consequence of the shock, which can result in further injury.

Evaluation of impact:

- Nature: negative
- Probability: probable
- Extension: local
- Duration: medium to long-term
- Magnitude: high
- Significance: moderate

Mitigation measures:

Ensure that before construction commences and during the progress thereof the following precautionary measures must be taken:

- All temporary electrical installation must be installed using the same safety specifications as fixed installations.

- All temporary electrical installation must be inspected at least once a week by a competent person and such inspection recorded.
- The control of a temporary electrical installation on a construction site must be designated to an appointed competent person.

Impact 20-C: Explosions/fires caused by inadequate handling and storage of flammable liquids

The handling and storage of flammable liquids, when not done properly, can cause fires and/or explosions, thus threatening human lives and causing heavy material damage.

Evaluation of impact:

- Nature: negative
- Probability: probable
- Extension: local
- Duration: medium to long-term
- Magnitude: moderate
- Significance: moderate

Mitigation measures:

- All flammable liquids used on the construction site must be stored in such a manner that they will not cause any fire or explosion and are adequately ventilated.
- The storage area must be made from fire resistant material.
- All employees working with flammable liquids must be provided with and use the appropriate PPE.
- Those instances, where flammable liquids are used, people are prohibited from smoking and signage accordingly posted.
- Adequate fire fighting equipment must be provided with adequate and appropriate signage.
- Steps must be taken to ensure that no flammable (combustible) material, such as cotton waste, paper, cleaning rags, etc. are stored with flammable liquids to prevent spontaneous ignition hazard.

7.3.2 OPERATION PHASE

7.3.2.1 BIOPHYSICAL IMPACTS

Impact 1-O: Loss of flora and fauna due to CTM operation

During the operation of the CTM the possible water pollution due to discharges into the bay (runoffs, wastewater etc) may affect the sensitive habitats in *Estuário de Espírito Santo* and associated fauna.

Based on the information available, the risks and impacts related to the flora and fauna on the site are likely to be as follows:

Evaluation of impact:

- Nature – negative

- Probability – probable
- Extension – local
- Duration – medium term
- Magnitude – low
- Significance – low

Mitigation Measures:

- Avoid contamination of the sensitive habitats, by implementing, for instance, good waste, wastewater and chemical handling management plans (see mitigation measures for the impacts above)
- Reduce noise impact (see mitigation measures for the impacts above)

Impact 2-O: Air pollution due to pollutants emissions during CTM operation

The air quality in the vicinity of the construction site will be altered during CTM operation mainly due to the burning of natural gas in the two new turbines. Therefore the main pollutants of concern resulting from the proposed power plant will consist of mainly NO_x (Nitrogen Oxides) and CO (Carbon Monoxide).

Given the power plant location, nearby EN4 highway, train lines, Maputo port and industries the emission of combustion gases from the turbines into the atmosphere may aggravate, even if slightly, the air quality in the adjacent premises. And even if presently the measured daily ambient concentrations for SO_2 and NO_2 and PM_{10} are still within Mozambican and international standards (see Section 6.1.6), this may change and it will be important to monitor emissions and air quality parameters to assess the contribution of the new gas turbines to the deterioration of the air quality in the region. Note that there are sensitive receptors, such as residential areas located nearby.

Evaluation of impact:

- Nature – negative
- Probability – probable
- Extension – local
- Duration – long term
- Magnitude - low
- Significance - moderate

Mitigation measures:

Compliance:

- Emission values and air quality standards should comply with the Regulation for Environmental Quality Standards and Effluent Emissions (Decree 18/2004, 2 of June, Annex II) and/or with International guidelines such as IFC Standards (e.g. Environmental, Health, and Safety Guidelines for Thermal Power Plants, 2008), World Health Organisation (WHO) Guidelines and JICA guidelines.

On-site measures:

- The discharge of pollutants into the atmosphere should be done through a tower with adequate height to allow a good dispersion of pollutants and protect the environment and human health.
- If necessary, filters should be incorporated into the tower and/or take up other mechanisms of gas treatment prior to release into the atmosphere.

Monitoring:

- Monitoring programme should be developed to assess emission values from the exhausting tower.
- Develop and implement an air quality monitoring programme if deemed necessary

Impact 3-O: Increase in noise levels due to CTM operation

The increase on noise levels at the site will be mainly due to the operation of the new gas turbines (three principal sources of noise: inlet, casing and exhaust).

The increase in noise levels is particular important due to the fact that presently, in some points, the noise levels are near or already above (near Gas Turbine No. 2) the World Bank/IFC Ambient Noise Guidelines of 70 dB(A) for industrial zones.

On the other hand, at the nearest sensitive receptor (Bairro Luís Cabral), it was found that the main noise source was the vehicular traffic on the EN4 highway and not the power station (actually, ambient noise levels exceeded the World Bank/IFC Ambient Noise Guidelines for residential areas and the SANS guidelines for urban districts with main roads).

Nevertheless the increase of noise in the power station should be monitor to minimise occupational hazard on site and nuisance at the sensitive receptors nearby.

Based on the information available the impacts on areas surrounding the site are likely to be as follows:

Evaluation of impact:

- Nature – negative
- Probability – probable
- Extension – local
- Duration - long term
- Magnitude - moderate
- Significance - moderate

Mitigation measures:

Compliance:

- Noise levels should comply with: a) World Bank/IFC Ambient Noise Guidelines (IFC General EHS Guidelines, 2007); b) SANS guidelines for urban districts with main roads.

On-site measures:

- The sound emissions from power equipment can be mitigated to comply with regulatory limits by applying noise control devices or specifying low-noise equipment.
- If necessary, isolate source by acoustic enclosure and/or introduce noise barriers (use, as possible, natural noise barriers such as trees).
- Equipment noise audits: Standardised noise measurements should be carried out on individual equipment at the delivery to site to construct a reference data base and regular checks carried out to ensure that equipment is not deteriorating and to detect increases which could lead to increase in the noise impact over time and increased complaints.
- Employees must use Personal Protection Equipment (PPE).

Monitoring:

- Develop and implement a noise monitoring programme, if deemed necessary

Impact 4-O: Water pollution (surface and groundwater) due to CTM operation

Water (surface and groundwater) pollution may increase mainly due to:

- Spillage of pollutants (e.g. hydrocarbon fluids, hazardous chemicals) during handling or runoff from, for instance, storage yards.
- Wastewater discharge - sewage and sanitary wastewater, process water (e.g. neutralised regeneration waste from HRSG blow-down), contaminated water from yard drains (including from cleaning the facility), wastewater from the water treatment plant and storm water.
- Inappropriate waste management, especially, of hazardous waste.

Regarding surface water quality it should be mentioned that total suspended solids, E-coli and metals (aluminium, iron) were above permissible drinking limits for Mozambique, according to the samples taken in point 2 (west of the site from the Infulene River) and 3 (Maputo Bay - final receptor of the wastewater) (see Section 6.1.5). Note however that none of the samples indicated the presence of hydrocarbons.

No samples were taken from groundwater, but due to the fact that the substrate is permeable, the water table is located relatively near the surface and there are pollutant activities in the area (train lines, highway, industries etc), it is probable that the ground water is contaminated.

Due to the abovementioned the increase in pollution resulting from the operation of the CTM may have a moderate impact on water quality.

Evaluation of impact:

- Nature – negative
- Probability – probable
- Extension – local
- Duration - long term

- Magnitude - moderate
- Significance - moderate

Mitigation measures:

Compliance:

- The discharge of wastewater should conform to the Regulation for Environmental Quality Standards and Effluent Emissions (Decree 18/2004, 2 of June, Annex III) and/or International standards such as IFC standards (e.g. Environmental, Health, and Safety Guidelines for Thermal Power Plants, 2008), World Health Organisation (WHO) Guidelines and JICA guidelines.

On-site measures:

Wastewater treatment plant (WWTP):

The project already anticipates the construction of a wastewater treatment plant. Some recommendations for the operation of the WWTP are presented below.

- Effluents treatment equipment shall be periodically maintained (*e.g.* decanting tanks, pumps)
- The Waste Water Treatment Plant (WWTP) efficiency shall be monitored by performing laboratorial analysis to water samples collected from upstream (treated effluent) and downstream the plant. The parameters that should be analysed are:
  - COD – Chemical Oxygen Demand (mg O_2/l)
  - BOD –Biochemical Oxygen Demand (mg O_2/l)
  - TSS – Total Suspended Solids (mg/l)
  - pH
  - Total phosphorous (mg P/l)
  - Total nitrogen (mg N/l)
  - Oils and fats
  - Others, that during operation are found necessary (e.g. hydrocarbons);
- If the treated effluent values obtained are not in compliance with legal requirements, the cause for the lack of efficiency needs to be identified and sorted;
- The WWTP operator should be trained
- The WWTP should be the most automated as possible

Draining system recommendations:

- The drainage system must be separative, assuming the separation of uncontaminated stormwater from the remaining wastewater. The project already anticipates two draining systems; one that collects wastewater from the industrial process and from the cleaning of the yard, maintenance areas etc. and the other that collects the sewage and sanitary wastewater. However, a stormwater management also requires consideration in the development of the site. A stormwater management plan will consequently need to be developed. At this time it is expected that 'clean water' generated by the catchment north of

the site will require diversion around the site. The railway stormwater channel will potentially provide sufficient capacity for this purpose, but this will need to be confirmed later on.

- The wastewater from the Water Treatment Plant and from the sludge treatment (if any) should be drained to the WWTP.
- Inclusion of water and oil/sediment separators in all drainage systems
- Do not sweep towards the drainage ditches for rainwater;
- Regular maintenance of the drainage systems(e.g. cleaning, especially during rainy season), preventing them from exceeding their capacity;

Others

- The mitigation measures presented in Impact 4C should also be considered (spills, waste management, etc).
- Follow as possible IFC Environmental, Health and Safety General Guidelines (2007) and JICA guidelines.

Monitoring:

- Inspections of the neighbouring drainage lines, Maputo Bay, watercourses (visual checks and collection of water samples for analysis), periodic sampling of surface water on (e.g. at the WWTP) and outside the premises, should be carried out. Water quality monitoring to ensure that the parameters are within the acceptable limits should be done at least every three months. The monitoring results should be analysed at regular intervals and compared with the acceptable standards, so that any necessary corrective actions may be taken. Records of the monitoring results should be kept in an acceptable format.
- Groundwater analysis should be done at least on six-monthly basis and whenever necessary. The same parameters should be analysed as above and the values should conform to the Regulation on Water Quality for Human Consumption (Ministerial Diploma 180/2004). The groundwater samples should be collected at random and taken both from fixed points (e.g. 2 observation holes) and from randomly selected spots within and around the CTM.

Impact 5-O: Soil pollution due to CTM operation

During the CTM operation, the soil may be contaminated in particular due to spillage of hydrocarbon or other chemicals and contaminated runoff.

Furthermore, improper management/disposal of waste (e.g. oil filters, lubricants and other chemicals) and wastewater can also increase the risk of soil contamination.

Assuming proper handling/storage/management of chemicals, fuels and waste/wastewater the significance of this impact may be low.

Evaluation of impact:

- Nature – negative

- Probability – probable
- Extension – local
- Duration – long term
- Magnitude -low
- Significance – low

Mitigation measures:

- Same as Impact 4C and 3O.

Impact 6-O: Flood risk (Tidal flood, Fluvial flood and Surface water flooding)

Tidal flood risk at the CTM site is significant due to the proximity of the site to an intertidal zone and the low lying elevations of the site. Fluvial flood risk to the CTM site is minimal; however, a risk exists to the west of the greater site area from the Infulene River. Surface water flooding is also a consideration in the proposed development of the gas power plant on the CTM site. The catchment north of the site is currently managed by a railway stormwater channel. In the event that the capacity of this channel is exceeded, surface water flooding of the site could occur. Furthermore, the presence of a culvert running beneath the site (which is hydraulically connected to the railway stormwater channel) and the subsequent potential for this culvert to route surface water generated north of the site into the site itself – poses another risk of surface water flooding. A saturated depression is also evident to the north west of the CTM site. This depression poses a potential flood risk to infrastructure in the area dependant on the source of water saturating the area (i.e. leak from municipal pipe, groundwater ingress or surface water run-on).

Note, however, that the area drains the excessive flow relatively easy.

Based on the information available, the risks and impacts related to flooding on the site are likely to be as follows:

Evaluation of impact:

- Nature –negative;
- Probability – probable;
- Extension – local;
- Duration – long term
- Magnitude – moderate
- Significance – moderate

Mitigation measures:

- A tidal hydrograph (for at least the 1 in 100 year event, but possibly also for the 1 in 200 year event including allowance for storm surge, climate change, wave action and possibly the influence of tidally locked rivers) would enable a more detailed assessment of the tidal flood risk to the site without requiring detailed modelling. With the aforementioned, it would be possible to inform the need for detailed tidal modelling.
- Natural vegetation of the surrounding area should be kept intact, as possible.

- Develop and implement a stormwater management plan.
- Design flood protection infrastructures if necessary.

7.3.2.2 SOCIOECONOMIC IMPACTS

Impact 7-O: Economic development in the region through increased access to stable electrical power of good quality by more households and industries

The construction of the Maputo Gas Power Plant will allow for expanding the access to stable electrical power of good quality to more households and new industries in the metropolitan area of Maputo, thus promoting the economic development of this region and improving the livelihoods of the local population.

Evaluation of impact:

- Nature – positive
- Probability – definite
- Extension – regional
- Duration – long term
- Magnitude – high
- Significance – high

Enhancement Measures:

Stable electrical power of good quality will not only depend on the expansion of the CTM plant, but also on further investments in other equipments necessary for the distribution of electricity to households and industries, such as transport lines, transformers and sub-stations, etc., many of which have been facing difficulties in the past because of old age or capacity limits.

7.3.2.3 OCCUPATIONAL HEALTH AND SAFETY IMPACTS

Impact 8-O: Work accidents/fatalities

As this is an area extensively used for the storage and handling of hydrocarbons, the risk of accidents is likely.

Evaluation of impact:

- Nature – negative
- Probability – probable
- Extension – local
- Duration – long-term to permanent
- Magnitude – moderate
- Significance – moderate

Mitigation measures:

So as to mitigate the risk of accidents and/or fatalities, the following is recommended:

- Periodic training for all workers (on the first day of work and then monthly);
- Inclusion of periodic exercises (e.g. simulation of fires) in the emergency procedures (quarterly). These exercises should count on the support of the fire brigade;
- Guarantee that all visitors receive instructions about potential dangers and necessary precautionary measures;
- Guarantee the existence of adequate first-aid equipment and staff training for its use;
- Prohibit the use of cigarettes in specific areas through signboards with the appropriate signs.
- Placing and regular maintenance of fire extinguishers
- Avoid the storage of timber and other inflammable materials next to the main fire risk areas;
- Chemicals should be stored separately in locked places and should be labelled. The person in charge of the warehouse should know the specific danger of each product and have information about the measures to be taken in cases of accidents or incidents;
- Accidental spills of any chemical should be cleaned immediately and the incident reported to the supervisor;
- The use of protective equipment (work clothes, boots, gloves, ear protectors, glasses, etc) should be obligatory.
- EDM should dispose of internal procedures, including those dealing with accidents, incidents and emergencies, in writing. These should be stuck at places where all workers have access.

7.3.3 SUMMARY OF IMPACTS: CONSTRUCTION AND OPERATION PHASES

Table 14: Summary of impacts during construction phase

Construction Phase	
Impact	**Significance**
Impacts on the Biophysical Environment	
Loss of flora and fauna due to construction activities	Low
Air pollution due to pollutants emissions from transportation and construction activities	Low
Increase in noise levels due to transportation and construction activities	Low
Increase in soil erosion and/or compaction due to the construction activities	Low
Soil and water (superficial and groundwater) pollution due to the construction activities	Low
Change of the natural water drainage	Low
Impacts on the Socioeconomic Environment	
Disturbance and interference associated with local traffic	Low

Social conflict due to physical presence of external workers	Low
Rise in employment opportunity expectations	Low
Increased noise levels through construction works and increased vehicle movement	Low
Increased generation of dust	Low
Occupational Health and Safety Impacts	
Injury and occupational disease caused by lack of general risk awareness	Moderate
Fires, explosion, injury or occupational diseases caused by inadequate management controls	Moderate
Fatalities and serious injuries caused by collapsing excavations	Low
Hearing loss induced by noise from construction work	Moderate
Fatalities and serious injuries by falling from heights	Moderate
Accidents of vehicles involved in construction work	Moderate
Injuries and occupational disease caused by welding operations	Moderate
Electrocution caused by temporary electrical installations on construction site	Moderate
Explosions/fires caused by inadequate handling and storage of flammable liquids	Moderate

Table 15: Summary of impacts during operation phase

Operation Phase	
Impact	**Significance**
Impacts on the Biophysical Environment	
Loss of flora and fauna due to CTM operation	Low
Air pollution due to pollutants emissions during CTM operation	Moderate
Increase in noise levels due to CTM operation	Moderate
Water pollution (surface and groundwater) due to CTM operation	Moderate
Soil pollution due to CTM operation	Low
Flood risk (Tidal flood, Fluvial flood and Surface water flooding)	Moderate
Impacts On The Socioeconomic Environment	
Economic development in the region through increased access to stable electrical power of good quality by more households and industries	N/A
Occupational Health and Safety Impacts	
Work accidents/fatalities	Moderate

7.3.4 DECOMMISSIONING PHASE

The decommissioning of the Maputo Gas Power Plant is not yet predicted, however once a decision will be taken to proceed with the decommissioning of the power plant, a decommissioning project scoping document must be prepared to define the ultimate decommissioning objective (e.g. demolition, dismantling of all equipment, closure and rehabilitation of all disturbed areas, etc.) and end-points (detailed specification of conditions to be achieved for the facility's spaces, systems and major equipment) and to establish the initial estimates of technical scope, costs and time schedule for the project.

In the natural environment, a general principle that applies to decommissioning activities is the recovery of a specific area to a status as similar as possible to the one that existed before the project development. In this case, the principle is to restore the area to a condition that does not result in any additional environmental, social or health and safety impacts, but making use of any features of the project that may have resulted in a positive impact.

General issues associated with decommissioning activities are as follows:

- Decommissioning shall be planned and implemented in such a way as to avoid detrimental effects on the environment and the public. The primary environmental issues to considerer on planning decommissioning shall be prevention of pollution of the environment and prevention of safety risks for the workers and the public. In line with this, it is recommended that EDM prepares a decommissioning plan and submit it to the Ministry of Energy, and subsequently to the Ministry for the Coordination of Environmental Affairs (MICOA) at least three months ahead of commencement of the decommissioning activities, unless stated otherwise by the Ministry in this regard[1]. This plan should include measures to deal with the waste that will be generated during decommissioning, as well as general measures to protect the health and safety of the workers and the public, etc.;
- All temporary infrastructures considered unnecessary for the subsequent use of the area shall be removed; any materials or equipment that could be recovered/reutilized by the proponent in any other place shall be removed to its appropriate destination;
- No potential sources of pollution shall be left in the area.

It can be assumed that decommissioning activities will involve (but not be limited to) the actions listed below:

- Demolition of temporary infra-structure (in case this will not be subject to other usage); and
- Cleaning of rubble/debris from demolition.

Although is not yet possible to predict with certainty the impacts on the environment (social and biophysical), the impacts are basically the same as those discussed during the construction phase and most of the mitigation measures proposed for that phase may also be applicable.

[1] It is the proponent's responsibility to ensure the Mozambican Government's approval for any activities associated with decommissioning.

7.7 CUMULATIVE IMPACTS

Cumulative impacts are impacts that by acting together are causing other impacts (including those from concurrent or planned future third party activities) to affect the same environmental resource or receptor.

Cumulative impacts may occur on the following receptors:

- biodiversity (especially marine);
- environmental quality (emissions, discharges, solid waste);
- traffic and risk;
- infrastructure and services; and
- socio-economic and cultural effects.

The main concern in terms of cumulative impacts is related to an increased impact to the natural and social environment. At this stage, it can be stated that cumulative impacts are likely to occur (e.g. noise from the high way and noise from the gas power plant, etc). These will be identified in detail during the EIA study.

8 POTENTIAL "FATAL FLAWS"

At this stage of the environmental assessment, no "fatal flaws" have been identified that could prevent the Maputo Gas Power Plant project from proceeding. From the environmental point of view and subject to a detailed impact assessment, it is considered that the project could be implemented without causing any major detrimental effects on the physical, biological and socio-economic environments provided that the mitigation measures are fully implemented. It is very important that impacts be analysed in more detail during the Environmental Impact Study process. For these impacts, mitigation measures will be designed to minimise or eliminate the negative impacts. The Environmental Impact Study Report will include an Environmental Management Plan (EMP) and a Waste Management Plan (WMP), which will clearly define responsibilities and obligations in implementing the mitigation measures and in monitoring their implementation.

9 STAKEHOLDER ENGAGEMENT

Impacto Lda. has been tasked to organise stakeholder consultations with identified affected people. In this way, two separate information meetings were held on 24th and 25th January 2013.

The selection of the participants was done in close collaboration with the local suburb authorities of the Luís Cabral ward, where the project is located, through an evaluation of the people, who could be directly affected by potential impacts of the project, whereas it was determined that these would be the residents living in the urban blocks (Quarteirões) 40 and 40a, as well as the industries and institutions located in front of the thermal power plant.

The Luís Cabral suburb secretary was responsible for the invitation to the meeting with the residents of the urban blocks 40 and 40a. The companies and institutions were invited by means of sending them personalised letters.

During the meetings, an illustrative poster was presented (see Stakeholder Consultation Report), which contained information on the project location, justification and summary description of the project, as well as the potential impacts to be studied during the EIA. This included an aerial picture of the location of the Maputo Thermal Power Plant (CTM), as well as pictures of the current thermal plant, the proposed layout for the expansion of CTM and a picture of a typical combined cycle gas power plant.

The meetings were held in Portuguese language. However, the meeting with the residents of the urban blocks 40 and 40a, counted with the consecutive translation from Portuguese to local language and vice versa done by the suburb secretary with the objective to facilitate the understanding of all participants in the meeting.

All questions raised, as well as the respective answers given by both, the Consultant and the Proponent, have been registered in a Questions and Answers Matrix contained in the Stakeholder Consultation Report.

A more comprehensive stakeholder consultation will be organised during the EIA phase, which will involve stakeholders (Interested and Affected Persons) from government, private sector and civil society.

10 ENVIRONMENTAL MANAGEMENT PLAN AND WASTE MANAGEMENT PLAN

Environmental Management Plan (EMP)

The Environmental Management Plan (EMP) is an instrument, which will allow Electricidade de Moçambique (EDM) to integrate environmental components during the construction, operation and decommissioning of the Maputo Gas Power Plant. The main objectives of the EMP are the following:

- Provide the Ministry for Environmental Coordination (MICOA) with an instrument that facilitates the objective evaluation of the different project phases, keeping in mind the Mozambican Environmental Legislation, and
- Provide the Proponent of the Project with clear and obligatory instructions with regard to his environmental responsibilities during all project phases.

To ensure the fulfilment of the EMP is the responsibility of the project proponent, in this case of EDM.

The EMP comprises a set of general and specific recommendations, which altogether serve as a basis for the environmental management (mitigation of the impacts). Thus, the EMP serves to identify and describe the principles, responsibilities and activities, which EDM will be obliged to adopt in order to manage environmental aspects and impacts in an efficient way during the different phases of the project.

Normally the specifications in the EMP are designed to reach an optimal environmental protection based on best practices. However, situations can occur where technical difficulties could limit the norms specified in the EMP. In these situations, a pragmatic approach will be needed, which allows some flexibility for determining the best way in order to fulfil with the original intention and objective of the specific measure, in a way to ensure that the necessary intervention will satisfy the objective of the mitigation measure.

The EMP is considered to be an "alive" document that should be sufficiently flexible, using available and "reasonable" techniques without compromise the environmental protection, including socioeconomic aspects. In the cases where the specific conditions cannot be fulfilled and where there is no reasonable technical basis for modifying the stipulated conditions, any amendments to the EMP needed will require the approval of MICOA.

The Basic principles of the Environmental Management Plan are:

- ***Principle 1: Environmental Consciousness***

The proponent will be sensitised about the needs of the environment. The construction, operation and decommissioning phases will take into account the environmental aspects and not degrade (or degrade only to a minimum) the existing environmental conditions.

- ***Principle 2: Mitigation***

All the activities related with the life cycle of the Project will include appropriate mitigation measures in a way to guarantee that the negative environmental impacts will be duly mitigated and managed. The mitigation implies the identification of the best options to adopt, the minimisation or elimination of the negative impacts, the enhancement of the benefits related to the proposed project and the protection of public and individual rights. Thus, practical measures are looked for to reduce the adverse impacts or to enhance the beneficial impacts of the project.

- ***Principle 3: Responsibility***

The project proponent assumes complete responsibility for the implementation and control of the actions prescribed for managing the environmental impacts. The efficiency of the environmental mitigation measures needs to be evaluated by the proponent. The proponent and contractors need to control the environment during the different project phases, in accordance with the Environmental Management Plan.

According to the article 20 of the Regulation for the Environmental Impact Assessment (Decree No. 45/2004), the Environmental License for Category 3 activities is valid for a period of 5 years and can be renewed for the same period of time based on a formal request submitted to MICOA.

Activity	Impact	Objective	Actions to be carried out to mitigate the Environmental Impact	Implementation	Frequency/ Phases	Supervision/ Auditing
Description of the Activity	**Specific Impact**		**Necessary Actions**			
BIOPHYSICAL– CONSTRUCTION PHASE						
Construction activities (e.g. vegetation clearing, noising and pollutant activities)	Loss of flora and fauna	Reduce contamination and loss of fauna and flora	▪ Restrict the Contractor's access outside of the project implementation area and to reduce the construction work area to a minimum in these areas. ▪ All vehicles and machinery should only use indicated routes and access roads and therefore no off-road driving. ▪ Monitor the construction and operational phases and to check compliance with special contractual conditions (if these exist). ▪ Avoid contamination of the sensitive habitats, by implementing, for instance, good waste, wastewater and chemical handling management plans. ▪ Reduce noise impact.	Contractor	Construction phase	DPCA Maputo and EDM
Construction activities (e.g. vegetation clearing, topsoil removal) and transportation	Air pollution	Reduce air pollutants emissions	▪ Loads on vehicles carrying dusty construction materials should be covered. ▪ Loading and unloading bulk construction should be in areas protected from the wind on in calm conditions. ▪ Vehicles carrying dusty materials should be washed before leaving the site (washing facilities should be available). ▪ Limit access to construction site to construction vehicles only. ▪ Impose vehicle speed restrictions on the construction site. ▪ Maintain high moisture content on exposed surface and	Contractor	Construction phase	DPCA Maputo and EDM

			roads by spraying with water. ▪ Maintenance program for construction vehicles to ensure optimum performance reduced emissions.			
Construction activities (e.g. vegetation clearing, topsoil removal) and transportation	Increase on noise levels	Reduce noise levels	▪ The Contractor should take measures to inform the communities about the start of the works and the time limit foreseen for their conclusion, the working hours established by law should be adhered to and respected. Work continuation during evenings, weekends and holidays should be avoided. ▪ Machines and vehicles should be repaired regularly to keep noise levels to a minimum. Well-maintained equipment is in general more silent. ▪ Whenever possible, machines and vehicles should be equipped with silencers. ▪ Use noise barriers if necessary. When possible use natural noise barriers such as materials resulting from earthworks, trees. ▪ All construction workers must be issued with the necessary protective equipment. ▪ Construction work should be limited to the daytime (08:00-18:00). ▪ Environmental noise monitoring: This should be carried out regularly at specific positions to detect deviations from predicted noise levels and enable corrective measures to be taken where warranted	Contractor	Construction phase	DPCA Maputo and EDM
Construction activities (e.g. vegetation clearing, topsoil removal) and transportation, including movement of	Increase of soil erosion and/or compaction	Reduce soil erosion and compaction	▪ Limit access to the project area to the necessary minimum and remove as little vegetation as possible. ▪ Avoid creating large open expanses of bare soil as these are most susceptible to wind and run-off erosion. In such areas, if necessary, create windbreaks should (e.g. a tree	Contractor	Construction phase	DPCA Maputo and EDM

heavy machinery			screen). ▪ Suitable drainage systems should be installed to direct water and prevent waterlogging and erosion. ▪ After construction, all non-paved areas should be reinstated with the topsoil to allow the reestablishment of the indigenous herbaceous vegetation. All bare areas should be re-vegetated as soon as possible. ▪ All vehicles and machinery should only use indicated routes and access roads. ▪ All temporary access roads should be rehabilitated at the end of the construction phase.			
Construction activities (risk of spills, waste and wastewater) and transportation	Soil and water (superficial and groundwater) pollution	Reduce pollutant emissions	▪ Ensure all activities involving the transfer, storage and disposal with potential for contamination are confined to appropriately bunded areas. All such storage areas, including those for fuels and other chemicals, should be properly signalized and constructed on impermeable cemented bays in order to contain possible spills. ▪ All workers involved in the use of such materials should receive proper induction and protective equipment (such as gloves, masks, uniforms, etc.). ▪ The following precautions on the storage and handling of fuels and lubricants are recommended to avoid possible spills: ✓ Fuel storage facilities with a capacity greater than 1000 litres shall be located on flat or gently sloping ground. A bund (spills containment basin) shall surround the area and be capable of containing at least 125% of the total capacity of the storage containers. The bund and the floor of the storage area shall be constructed with impermeable material or be lined to ensure that petroleum products cannot	Contractor	Construction phase	DPCA Maputo and EDM

			escape. ✓ Any chemicals shall be stored away from any potential or natural drainage paths. ✓ All fixed storage areas shall be enclosed by a security fence with a lockable gate. Symbolic signs depicting 'no smoking' 'no naked flames' and 'danger' shall be displayed, and shall conform to a recognized standard. It is advisable to use local languages, in addition to Portuguese. ✓ Vehicles and machinery maintenance should be done regularly to avoid spills during their operation. Maintenance should only be done in the workshops designated for this purpose. No maintenance should be permitted outside the designated area. If it is not possible to remove the vehicle to the camp's workshop, maintenance can be permitted if the following recommendations are adhered to: - Prohibit vehicle and machine maintenance outside the designated area for this purpose. If it is not possible to remove the vehicle and/or machine to the workshop, maintenance may only be done outside it with due precautions (e.g. using drip trays to contain spills). - Cleaning and spill collection techniques must be used. - In case the soil is contaminated, it must be immediately removed for treatment. - Soil contaminated with oils and fuels must be treated (e.g. through bioremediation). - Clean and rehabilitate areas affected and/or contaminated with oils, fuels, etc.			

			▪ Any and all chemicals (solid, liquid or gas) brought to site shall be cleared with the resident engineer prior to storage and use and such clearance procedure shall at the very least include a written motivation with full specifications, including a risk assessment of any environmental hazards which may pertain to the chemical (include MSDS of the products). The Contractor shall propose a mitigation to store such chemicals to the Engineer for approval prior to the chemical being accepted on site. ▪ An emergency response plan to remediate any contaminated soils must be submitted prior to the start of works and shall identify inter alia; methods for excavation of contaminated ground, temporary stockpile area and the method of quarantine, final disposal of contaminated material, a quality control system to track the process. This must be established during site establishment and shall remain operational for the duration of the project and shall not be on or near to a natural drainage path. ▪ Construct proper draining and treatment systems to collect and treat wastewater resulting from run-off, cleaning of yards and maintenance areas, sewage and sanitary wastewater. ▪ Implement the Waste Management Plan.			
Construction activities (pavement, construction of infrastructures, etc.)	Change of the natural water drainage	Reduce impact on natural water drainage	▪ Develop and implement a stormwater management plan. ▪ During land use planning, drainage channels should be the first to be established. ▪ These channels can be protected against erosion with vegetation or lined with cement. ▪ The vegetation in the drainage channels protected with vegetation should be trimmed, leaving the channels free	Contractor	Construction phase	DPCA Maputo and EDM

			from sediments and remains. ▪ It is important to ensure that ditches and drains are kept free from waste and invasive vegetation. These ditches and drains should be cleaned regularly and manually. ▪ The movement of surface water to and in the drainage channels should not be obstructed, i.e. the water should run freely. ▪ The size of the drainage channels should be maintained, so that they may require periodical re-establishment to their original form and capacity. ▪ A routine road maintenance program should be established, creating conditions for the water to run freely during the rainy season. ▪ The roads themselves should have drainage mechanisms for rain- and other water. ▪ It is also recommended that any change in the natural drainage pattern will only take place in the last resource, and if necessary for the works.			

Activity Description of the Activity	Impact Specific Impact	Objective	Actions to be carried out to mitigate the Environmental Impact Necessary Actions	Implementation	Frequency/ Phases	Supervision/ Auditing
SOCIOECONOMY– CONSTRUCTION PHASE						
Construction activities associated with movement of heavy vehicles and equipment	Disturbance and interference associated with local traffic	Reduce traffic jam	▪ The movement of all vehicles and machines should be restricted to designated routes, so as not to cause an excessive concentration of traffic or conflicts with other road users of the area. The vehicles should also circulate at low speed to avoid accidents between vehicles, with the local population and with workers (pedestrians). In case, manoeuvring at the toll station cannot be avoided, necessary traffic precautions need to be taken. ▪ The workers and machine and vehicle operators should receive training about taking care and observing the traffic rules in the area (including the proper signalling and right-of-way rules).	Contractor	Construction phase	DPCA Maputo, EDM, TRAC and ANE
Construction activities	Social conflict due to physical presence of external workers	Avoid conflicts	▪ Both, workers and local communities, should be subject to awareness-raising campaigns, so as to promote good relations, thus avoiding the occurrence of conflicts.	Contractor EDM	Construction phase	DPCA Maputo and DPT

Construction activities	High expectations with regard to employment opportunities	Level work expectations	▪ If local workers (non-specialized and/or semi-specialized) will be necessary, the project must as far as possible incorporate and maximize the use of local labour. This should be best coordinated with the local authorities and with the Maputo city Directorate of Labour. ▪ In the Contractor's contract, the number of work places to be opened for local staff should be stipulated, the hiring requirements, the maximum duration of the work, the recruitment procedures and wage levels.	Contractor EDM	Construction phase	DPCA Maputo, DPT Local authorities - Luís Cabral suburb

Activity Description of the Activity	Impact Specific Impact	Objective	Actions to be carried out to mitigate the Environmental Impact Necessary Actions	Implementation	Frequency/ Phases	Supervision/ Auditing
OCCUPATIONAL HEALTH AND SAFETY – CONSTRUCTION PHASE						
Construction activities	Injury and occupational disease caused by lack of general risk awareness	Reduce risk of injury	▪ All contractor teams involved in works during the construction phase shall be briefed on their obligations towards health & safety controls and methodologies. The briefing must take the form of a presentation and demonstration. The education / awareness program should be aimed at all levels of management and general staff within the Contractor teams. An attendance register shall be signed at this briefing. Local labourers hired for the construction phase must receive training related to health & safety awareness prior to commencement of the works.	Contractor EDM	Before and during construction phase	DPCA Maputo DPS DPT
Construction activities	Fires, explosion, injury or occupational diseases caused by inadequate management controls	Reduce risk of fires and explosions	▪ Prepare a Health and Safety Management Plan, which addresses hazards identified and includes safe work procedures to mitigate, reduce or control the hazards identified and provide it to any contractor hired for construction works. ▪ Take reasonable steps to ensure that the health and safety management plan is implemented and maintained on the construction site.	Contractor EDM	Construction phase	DPCA Maputo DPS DPT
Excavations associated with construction activities	Fatalities and serious injuries caused by collapsing excavations	Reduce the risk of collapsing excavations	The following rules regarding excavations need to be followed to ensure the safety of construction personnel: ▪ Ensure that all excavation work is carried out under the supervision of a competent person; ▪ Evaluate before excavation work begins, as far as is reasonably practicable, the stability of the ground.	Contractor EDM	Construction phase	DPCA Maputo DPS DPT

			▪ Ensure that the excavation is safe before authorizing access into the excavation.			
Construction activities	Hearing loss induced by noise from construction work	Reduce noise levels	▪ Provide Personal Protective Equipment (PPE) to all construction workers involved in the construction work. ▪ Impose use obligatory use of PPE by workers ▪ Adhere to the relevant health and safety standards pertaining to noise, such as wearing ear protection when operating plant, noisy equipment (e.g. angle grinders) or heavy machinery above 85dBA.	Contractor EDM	Construction phase	DPCA Maputo DPS DPT
Construction activities – Working at heights	Fatalities and serious injuries by falling from heights	Avoid falling from heights	▪ Provide fall prevention equipment, which prevents persons from falling from elevated positions, such as body harness, body belts, lanyards, lifelines or physical equipment, guardrails, screens, barricades, anchorages or similar equipment; ▪ Elaborate a fall protection plan, which sets out the procedures and methods to be applied in order to eliminate or reduce the risk of falling from heights.	Contractor EDM	Construction phase	DPCA Maputo DPS DPT
Construction activities – Working with vehicles, in particular heavy vehicles and equipment	Accidents of vehicles involved in construction work	Reduce risk of accidents with vehicle and equipment in the campsite	▪ Ensure that all construction vehicles and mobile plant are of an acceptable design & construction and are used according to their design. ▪ All construction and mobile equipment must be operated by operators, who have been trained and certified as competent. ▪ Properly organize the circulation of vehicles on site, including establishment of speed limits at the construction site.	Contractor EDM	Construction phase	DPCA Maputo DPS DPT

Construction activities – Welding, cutting, and brazing	Injuries and occupational disease caused by welding operations	Reduce risk of injuries caused by welding, cutting, and brazing	▪ Implement adequate management controls for welding, flame cutting, soldering or any similar operation is carried out. These controls must be communicated to all concerned and compliance must be monitored. ▪ Not allow any welding, flame cutting, grinding, soldering or similar work to be undertaken in respect of any tube, tank, pipeline, drum, vessel or similar object or container, where such object or container: ✓ is completely closed, unless a rise in internal pressure cannot render it dangerous; or ✓ contains any substance which, under the action of heat, may: - ignite or explode; or - React to form dangerous or poisonous substances, ▪ Ensure that personnel carrying out welding, flame cutting, soldering or any similar operation wear suitable respiratory protective equipment to protect them from the harmful vapours (smoke) present. ▪ Ensure that any personnel carrying out welding, flame cutting, soldering or any similar operation is properly qualified to carry out this type of work.	Contractor EDM	Construction phase	DPCA Maputo DPS DPT
Construction activities – electrical installations	Electrocution caused by temporary electrical installations on construction site	Reduce risk of electrocution	▪ All temporary electrical installation must be installed using the same safety specifications as fixed installations. ▪ All temporary electrical installation must be inspected at least once a week by a competent person and such inspection recorded. ▪ The control of a temporary electrical installation on a construction site must be designated to an appointed competent person.	Contractor EDM	Construction phase	DPCA Maputo DPS DPT
Construction activities - handling and storage of flammable liquids	Explosions/fires caused by inadequate handling and storage of flammable liquids	Reduce risk of explosions/fires	▪ All flammable liquids used on the construction site must be stored in such a manner that they will not cause any fire or explosion and are adequately ventilated.	Contractor EDM	Construction phase	DPCA Maputo

			▪ The storage area must be made from fire resistant material. ▪ All employees working with flammable liquids must be provided with and use the appropriate PPE. ▪ Those instances, where flammable liquids are used, people are prohibited from smoking and signage accordingly posted. ▪ Adequate fire fighting equipment must be provided with adequate and appropriate signage. ▪ Steps must be taken to ensure that no flammable (combustible) material, such as cotton waste, paper, cleaning rags, etc. are stored with flammable liquids to prevent spontaneous ignition hazard.			DPS DPT

Activity Description of the Activity	Impact Specific Impact	Objective	Actions to be carried out to mitigate the Environmental Impact Necessary Actions	Implementation	Frequency/ Phases	Supervision/ Auditing
BIOPHYSICAL– OPERATION PHASE						
Operation of CTM (activities that can disturb or contaminate flora and fauna)	Loss of flora and fauna due to CTM operation	Reduce disturbance and contamination of flora and fauna	▪ Avoid contamination of the sensitive habitats, by implementing, for instance, good waste, wastewater and chemical handling management plans (see mitigation measures for the impacts above) ▪ Reduce noise impact (see mitigation measures for the impacts above)	EDM	Operation Phase	DPCA Maputo
Operation of CTM (combustion emissions)	Air pollution	Reduce air pollutants emissions	<u>Compliance:</u> ▪ Emission values and air quality standards should comply with the Regulation for Environmental Quality Standards and Effluent Emissions (Decree 18/2004, 2 of June, Annex II) and/or with International guidelines such as IFC Standards (e.g. Environmental, Health, and Safety Guidelines for Thermal Power Plants, 2008) and World Health Organisation (WHO) Guidelines. <u>On-site measures:</u> ▪ The discharge of pollutants into the atmosphere should be done through a tower with adequate height to allow a good dispersion of pollutants and protect the environment and human health. ▪ If necessary, filters should be incorporated into the tower and/or take up other mechanisms of gas treatment prior to release into the atmosphere. <u>Monitoring:</u> ▪ Monitoring programme should be developed to assess emission	EDM	Operation Phase	DPCA Maputo

			values from the exhausting tower. ▪ Develop and implement an air quality monitoring programme if deemed necessary			
Operation of CTM (machinery and equipment operation)	Increase on noise levels due to CTM operation	Reduce noise levels	<u>Compliance:</u> ▪ Noise levels should comply with: a) World Bank/IFC Ambient Noise Guidelines (IFC General EHS Guidelines, 2007); b) SANS guidelines for urban districts with main roads. <u>On-site measures:</u> ▪ The sound emissions from power equipment can be mitigated to comply with regulatory limits by applying noise control devices or specifying low-noise equipment. ▪ If necessary, isolate source by acoustic enclosure and/or introduce noise barriers (use, as possible, natural noise barriers such as trees). ▪ Equipment noise audits: Standardised noise measurements should be carried out on individual equipment at the delivery to site to construct a reference data base and regular checks carried out to ensure that equipment is not deteriorating and to detect increases which could lead to increase in the noise impact over time and increased complaints. ▪ Employees must use personal protection equipment (PPE). <u>Monitoring:</u> ▪ Develop and implement a noise monitoring programme, if deemed necessary	EDM	Operation Phase	DPCA Maputo
Operation of CTM (activities involving wastewater, waste, risk of spills)	Water pollution (surface and groundwater)	Reduce water pollutants emissions	<u>Compliance:</u> ▪ The discharge of wastewater should conform to the Regulation for Environmental Quality Standards and Effluent Emissions (Decree 18/2004, 2 of June, Annex III) and/or International standards such as IFC standards (e.g. Environmental, Health, and Safety Guidelines for Thermal Power Plants, 2008) and World Health Organisation (WHO) Guidelines.	EDM	Operation Phase	DPCA Maputo

			On-site measures: *Wastewater treatment plant (WWTP):* The project already anticipates the construction of a wastewater treatment plant. Some recommendations for the operation of the WWTP are presented below. ▪ Effluents treatment equipment shall be periodically maintained (e.g. decanting tanks, pumps) ▪ The Waste Water Treatment Plant (WWTP) efficiency shall be monitored by performing laboratorial analysis to water samples collected from upstream (treated effluent) and downstream the plant. The parameters that should be analysed are: ✓ COD – Chemical Oxygen Demand (mg O_2/l) ✓ BOD –Biochemical Oxygen Demand (mg O_2/l) ✓ TSS – Total Suspended Solids (mg/l) ✓ pH ✓ Total phosphorous (mg P/l) ✓ Total nitrogen (mg N/l) ✓ Oils and fats ✓ Others, that during operation are found necessary (e.g. hydrocarbons); ▪ If the treated effluent values obtained are not in compliance with legal requirements, the cause for the lack of efficiency needs to be identified and sorted; ▪ The WWTP operator should be trained ▪ The WWTP should be the most automated as possible *Draining system recommendations:* ▪ The drainage system must be separative, assuming the			

			separation of uncontaminated stormwater from the remaining wastewater. The project already anticipates two draining systems; one that collects wastewater from the industrial process and from the cleaning of the yard, maintenance areas etc. and the other that collects the sewage and sanitary wastewater. However, a stormwater management also requires consideration in the development of the site. A stormwater management plan will consequently need to be developed. At this time it is expected that 'clean water' generated by the catchment north of the site will require diversion around the site. The railway stormwater channel will potentially provide sufficient capacity for this purpose, but this will need to be confirmed later on. ▪ The wastewater from the Water Treatment Plant and from the sludge treatment (if any) should be drained to the WWTP. ▪ Inclusion of water and oil/sediment separators in all drainage systems ▪ Do not sweep towards the drainage ditches for rainwater; ▪ Regular maintenance of the drainage systems(e.g. cleaning, especially during rainy season), preventing them from exceeding their capacity <u>Others</u> ▪ The mitigation measures presented in Impact 4C should also be considered (spills, waste management, etc). ▪ Follow as possible IFC Environmental, Health and Safety General Guidelines (2007) and JICA guidelines <u>Monitoring:</u> ▪ Inspections of the neighbouring drainage lines, Maputo Bay, watercourses (visual checks and collection of water samples for analysis), periodic sampling of surface water on (e.g. at the WWTP) and outside the premises, should be carried out. Water quality monitoring to ensure that the parameters are within the acceptable limits should be done at least every three months. The monitoring results should be analyzed at regular intervals			

			and compared with the acceptable standards, so that any necessary corrective actions may be taken. Records of the monitoring results should be kept in an acceptable format. ▪ Groundwater analysis should be done at least on six-monthly basis and whenever necessary. The same parameters should be analyzed as above and the values should conform to the Regulation on Water Quality for Human Consumption (Ministerial Diploma 180/2004). The groundwater samples should be collected at random and taken both from fixed points (e.g. 2 observation holes) and from randomly selected spots within and around the CTM.			
Operation of CTM (activities involving wastewater, waste, risk of spills)	Soil pollution due to CTM operation	Reduce soil pollutants emissions	▪ Same as Impact "Soil and water (superficial and groundwater) pollution" – construction phase ▪ Same as Impact "Water pollution (surface and groundwater)" – operation phase	EDM	Operation Phase	DPCA Maputo
Operation of CTM – physical presence	Flood risk (Tidal flood, Fluvial flood and Surface water flooding)	Reduce the impacts of flooding on CTM	▪ A tidal hydrograph (for at least the 1 in 100 year event, but possibly also for the 1 in 200 year event including allowance for storm surge, climate change, wave action and possibly the influence of tidally locked rivers) would enable a more detailed assessment of the tidal flood risk to the site without requiring detailed modelling. With the aforementioned, it would be possible to inform the need for detailed tidal modelling. ▪ Natural vegetation of the surrounding area should be kept intact, as possible. ▪ Develop and implement a stormwater management plan. ▪ Design flood protection infrastructures if necessary.	EDM	Operation Phase	DPCA Maputo

Activity Description of the Activity	Impact Specific Impact	Objective	Actions to be carried out to mitigate the Environmental Impact Necessary Actions	Implementation	Frequency/ Phases	Supervision/ Auditing
SOCIOECONOMY– OPERATION PHASE						
Operation of CTM	Economic development in the region through increased access to stable electrical power of good quality to more households	Guarantee long term power of good quality for as many households and industries as possible	▪ Stable electrical power of good quality will not only depend on the expansion of the CTM plant, but also on further investments in other equipments necessary for the distribution of electricity to households and industries, such as transport lines, transformers and sub-stations, etc., many of which have been facing difficulties in the past because of old age or capacity limits.	EDM/ Ministry of Energy /FUNAE	Operation Phase	DPCA Maputo Ministry of Energy Government of Mozambique FUNAE

Activity	Impact	Objective	Actions to be carried out to mitigate the Environmental Impact	Implementation	Frequency/ Phases	Supervision/ Auditing
Description of the Activity	**Specific Impacto**		**Necessary Actions**			
OCCUPATIONAL HEALTH AND SAFETY – OPERATION PHASE						
CTM operation	Work accidents/fatalities	Reduce accidents and fatalities	▪ Periodic training for all workers (on the first day of work and then monthly); ▪ Inclusion of periodic exercises (e.g. simulation of fires) in the emergency procedures (quarterly). These exercises should count on the support of the fire brigade; ▪ Guarantee that all visitors receive instructions about potential dangers and necessary precautionary measures; ▪ Guarantee the existence of adequate first-aid equipment and staff training for its use; ▪ Prohibit the use of cigarettes in specific areas through signboards with the appropriate signs. ▪ Placing and regular maintenance of fire extinguishers ▪ Avoid the storage of timber and other inflammable materials next to the main fire risk areas; ▪ Chemicals should be stored separately in locked places and should be labelled. The person in charge of the warehouse should know the specific danger of each product and have information about the measures to be taken in cases of accidents or incidents; ▪ Accidental spills of any chemical should be cleaned immediately and the incident reported to the supervisor; ▪ The use of protective equipment (work clothes, boots, gloves, ear protectors, glasses, etc) should be obligatory. ▪ EDM should dispose of internal procedures, including those dealing with accidents, incidents and emergencies, in writing.	EDM	Operation Phase	DPCA Maputo DPS DPT

			These should be stuck at places where all workers have access.			

Waste Management Plan

The regulating authorities and service providers for waste collection, treatment and disposal in Mozambique are district and municipal, while environmental protection is enforced at a central and provincial level. The Environmental Law (Lei do Ambiente) no. 20/97, of 1 October 1997 is the umbrella law for environmental matters and is an important instrument for the enactment of specific regulations, most notably the Regulation on Waste Management no. 13/2006 which provides the rules concerning the production, deposit on soil and subsoil, throwing to the water or to the atmosphere, of any toxic and polluting substances. In addition, the Regulation defines competencies in waste management, waste classifications, obligations for entities handling waste and environmental licensing obligations and collection, among others.

Additionally, the Municipality Law no. 8/97 obligates local municipalities to ensure basic sanitation and quality of life. Municipal responsibilities include the development of programmes for ecological protection and procedures for the removal of solid, treatment and disposal of solid residues including medical and hazardous waste. The Maputo City Waste Management Strategy, adopted in September 2006, is one such strategy and has as its main objective the implementation and improvement of the current system of solid waste management, based on the adoption of global best practice such as the "polluter pays" principle, the development of a sustainable waste collection system and the pursuit of cost/ revenue equilibrium.

Other key pieces of legislation pertinent to the treatment and disposal of solid waste include Article 6 of Environmental Law outlining coordinating the actions for environmental management, the regulation on Environmental Impact Assessment (No. 76/98 RB No. 51 Series I, December 1998) and a further Regulation on Environmental Impact Assessment EIA (Decree 45/2004) requiring an Impact Assessment Study and the issue of an environmental licence for all entities/processes resulting in legally significant waste streams. This regulation also stipulates that vehicles used for waste transportation and all waste management operators require licences.

Article 9 of the Regulation of Waste Management (13/2006) obliges the producers of waste to minimize waste generated. In addition, the Environmental Law (20/97) imposes strict liability on entities causing environmental damage. The government is responsible for setting the compensation amount on a case by case basis, which includes the cost of remediation of the affected area.

Obligations under Article 9 include:

- Ensure the segregation of the different categories of waste;
- Ensure the treatment of the waste before its deposition;
- Ensure the protection of all workers engaged in the handling of waste against accidents and diseases resulting from their exposure to the same;
- Ensure that all waste to be transported contains minimum hazard of contamination, for the workers engaged in this process, for the general public and for the environment;
- Build the capacity of their workers in matter of health, occupational safety and environment;
- Ensure that the disposal of waste inside and outside the production site does not have a negative impact on the environment or on the public health and safety;

- Make a detailed annual record of the origins, quantities and types of waste handled, transported, treated, recovered or disposed of and keep it during the five years subsequent to the respective record.

Waste Stream Identification and Classification

Unlike coal-fired power plants, CCGT's do not produce large solid waste streams. Natural gas is a relatively "clean" hydrocarbon fuel and consequently most solid wastes associated with natural gas-fuelled electricity generation are attributable to other stages of the lifecycle of the electricity, including the natural gas extraction process and wastes arising from the gas distribution network. A limited inventory of wastes will be generated during the construction, commissioning and operational phases of the project.

To ensure identification of all inputs and aspects together with the waste streams and emissions arising from the CCGT constructing, commissioning and operation, it is important to interrogate the full process cycle including all related and subsidiary activities associated with the process operations. Each step in the process should be considered and waste streams identified.

Preliminary assessments of the likely waste streams generated during the three project phases are presented in Table 13 below.

Table 16: Anticipated Waste Streams

Project phase	Description of waste stream		
	Waste type	**Solid/Liquid**	**Description**
Construction phase	General	Solid	Excavated Material: Construction will involve the excavation and removal of topsoil
	General	Solid	Concrete: Concrete waste will be generated through the construction of building foundations and structures
	General	Solid	Miscellaneous Building Materials: Other wastes anticipated include cladding, block work and roofing materials, shuttering, drainage pipes, electrical cabling, etc.
Commissioning phase	Hazardous	Liquid	Waterside cleaning of the heat recovery steam generator (HRSG) tubes is carried out during commissioning to remove deposits of metals and other impurities on the tubes surfaces. This work is typically undertaken by specialist contractors and will involve the use of acids, alkalis and proprietary chemicals.
Operational phase	Hazardous	Solid	Spent Catalyst: Generated every one to five years from the selective catalytic reduction (SCR) unit of the gas turbine.
	Hazardous	Solid	Air Filters: Filters on air intakes will require periodic changing
	Hazardous	Liquid	Auxiliary Cooling Water: Drainage solution contains antifreeze and possible corrosion inhibitors
	Hazardous	Liquid	HRSG Washing: Insoluble and precipitated

			materials from treatment of HRSG wash water
	General	Solids and Liquids	Canteen Waste: Waste from food preparation, including packaging
	Hazardous	Liquid	Gas Turbine Washing: Intermittent liquid effluent arising from offline washing of the air compressor with detergent
	Hazardous	Solid	General Cleaning: Oily rags produced as a result of maintenance and cleaning activity
	General and Hazardous (fluorescent tubes)	Solid	Lighting Bulbs/Batteries: Lighting replacement
	General	Solid	Metal Waste: Scrap metals
	Hazardous	Solids and Liquids	Oil Interceptors/ Separators: Oily sludge from the cleaning of oil interceptors or oil traps
	General	Solid	Pumphouse Screens: General debris and sludges removed from screens on the incoming cooling water stream at the pump house.
	Hazardous	Liquid	Waste Oils: Waste oils generated through equipment maintenance activity
	Hazardous	Solid	Water Treatment: Spent ion exchange resins (probable but dependant on system)
	General	Solid	Packaging Waste: Wooden pallets, cardboard, plastic wrapping etc.

It will be necessary to confirm each of the waste streams above and additionally, to classify and categorise each in terms of Articles 5 and 6 of the Regulation on Waste Management. This will mean establishing whether a waste is hazardous based on the nature of its physical, health and environmental hazardous properties as well as the degree or severity of the hazard posed. This definition will typically form part of procedures of a comprehensive site waste study.

For each of the routine and non-routine waste streams presented above however, no significant impacts are anticipated for normal plant operations.

Waste Recycling, Re-use and Disposal

General waste originating from the CCGT at CTM will be disposed of at one of two municipal dumpsites in the Maputo/ Matola area, situated in each of the Hulene and Malhampsene suburbs. A third informal dumpsite is located at Infulene in Matola. The material entering Hulene and Malhampsene is not subject to any form of recycling process or treatment (e.g. incineration) and is left to decompose with time. These dumpsites have been identified as no longer suitable for waste disposal and will be closed following the commissioning of a new landfill in Matola.

Mozambique has one facility suitable for receiving hazardous waste, namely Mavoco in Boane Suburb, Maputo. The site is owned by the Fund for the Environmental Matters (FUNAB), who have contracted a private company specialized in waste management, Enviroserv, to operate it for a period of 5 years. Enviroserv and Mozal (the largest aluminium producer in Mozambique) have agreed on a waste

disposal tax and it is the responsibility of Enviroserv to pay a percentage to FUNAB. In accordance with the national strategy on hazardous waste management that is currently developed by the ministry of Coordination of Environmental Affairs (MICOA), this site is the central disposal site for hazardous waste and accepts industrial and hazardous waste from all regions in Mozambique.

Mozambique has no restrictions on the export of hazardous wastes and other wastes for recovery. The Matola/Maputo Municipalities have no involvement in, or policy in place, for waste recycling. Recycling is not practised on a formal, organised level. One of the most active private waste recycling companies operating in the Greater Maputo area is the waste management company Neoquímica.

11 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Considering that the CTM site already exist, its location in an industrial area close to the Maputo Port and its relative isolation on the other hand, both, the biophysical and socioeconomic impacts during the construction phase are rather small and of low significance, while the majority of Occupational Health and Safety impacts are of moderate significance.

The most significant impacts identified so far refer mainly to the construction phase. For the operation phase of the CTM-CCGT, the identification of impacts has been limited because of the lack of technical information available at this stage, especially when referring to the expected type and quantity of liquid effluents or gas emissions, but also to the expected average and worst-case utilisation of the plant. Thus, more impacts may be identified for the operation phase, once this information has been made available. Concrete mitigation measures will have to be reformulated taking into consideration these technical specifications.

Recommendations

As pointed out in Chapter 8, at this stage of the EIA, no fatal flaws have been identified that could prevent the Maputo Gas Power Plant project from proceeding. From the environmental point of view and subject to a detailed impact assessment, it is considered that the project could be implemented without causing any major detrimental effects on the physical, biological and socio-economic environments provided that the mitigation measures are fully implemented. It is very important that impacts be analysed in detail during the Environmental Impact Study and based on the final project design. For these impacts, mitigation measures will then be designed to minimise or eliminate any negative impacts. The Environmental Impact Study Report will include an Environmental Management Plan, which will clearly define responsibilities and obligations in implementing the mitigation measures and in monitoring their implementation.

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Appendix 6

Records of Discussion during Stakeholders Meeting

1) Highlight of Discussion

a) Stakeholders' Consultation with Heads of 10 houses-Urban Blocks (quarteroes) 40 and 40a, January 24, 2013 at Luis Cabral Community School

Comment 1
We thank for EDM's information related to the expansion project of the Maputo thermal power station. This project will bring many benefits. We would like to ask that at the time of resettlement, this will be done in an organized form. **Simião Machava – Head of the Quarteirão 40**
Answer
This project does not foresee any resettlement. The project site belongs to EDM and inside this area there is no population and no agricultural activity. **(Isa Gerster, Impacto)**
Question 2
We thank for the information method of EDM, even before the project will start. The EDM project is appreciated, as we need power and gas. We will pass this information to those people who were unable to participate in the meeting. **Alzira Camacho, Head of 10 Houses of Q. 40a**
Answer
EDM will acquire no new area for this project. This project is an expansion of the thermal power plant already existing in this area. This project will only be developed inside this area, which belongs to EDM. Therefore, people will not be relocated. This relocation will happen within the scope of the Circular Road project and not of the EDM project. **(Firmino Chiau, Luís Cabral Suburb Secretary)** Within the EDM plot exists an area, which will not be used, but which is reserved for future expansion projects of EDM. **(Isa Gerster, Impacto)**
Comment 3
We thank for this Project, which is apprecated for the benefit of the population. **Carlos Ernesto, Head of Quarteirão 40a**
Answer
Comment taken.
Comment 4
We appreciate the importance of this information process for the residents of Luís Cabral suburb in particular, as this project will benefit the entire city of Maputo. When people get informed right from the beginning, this cuts short possible rumours and conflicts amongst the people. **Firmino Chiau, Luís Cabral Suburb Secretary**
Answer
Comment taken.

b) Stakeholders' Consultation with Industries and Institutions adjacent to the Project Site: January 25, 2013 at Luis Cabral Community School

Comment 1
It was referred during the presentation that no boilers will be installed, however, there will be gas and steam turbines. Therefore, how will the steam be produced? **Henriques Gulele, Petroauto Ltd., representative of Volvo**
Answer
We cannot really discuss the technical aspects of the project, as the exact model has not yet been decided upon, thus there are various options. This even more because of the fact that the technical part is being developed in Japan by JICA, where the pros and contras of the different models are being evaluated. Impacto is only responsible for the environmental impact study of the project. **(Isa Gerster, Impacto)**

Comment 2
Which will the potency to be installed in terms of power production capacity, for us to better understand, if this capacity will be sufficient to supply the companies existing here. **Henriques Gulele, Petroauto Ltd., representative of Volvo**
Answer
In the registration document of the project, submitted by EDM, the capacity of 70 to 170 MW is expected. During this project phase, still no studies on specifications have been carried out. There are previsions, but no decision has yet been taken with regard to the definitive model of the Maputo thermal power plant. **(Aissa Naimo, EDM)**
Comment 3
The fact that the new plant is projected for the old SONEF installations: is this for making use of these installations or is there any other advantage, because it has been mentioned with regard to impacts that there could be some influence on rivers and the sea. Has no other location been identified with less impacts, which could be feasible for this project? **Afonso Macingarela, Somotor, S.A.**
Answer
This aspect was also studied. At the beginning, when this power plant was projected, two sites were studied. This site of the former SONEF in reference already belongs to EDM. Some installations will continue on the plot and other will be reused for offices and sub-stations. The major part of the infrastructures will continue; that one which is not going to be used, will be destroyed. The other area studied was in Beluluane, where EDM has a smaller plot. These were compared based on a large number of criteria and it was concluded that this area would have more advantages. One of the reasons of this decision was the fact that Beluluane has a chronic lack of water. Another aspect was that the capacity of power production in Beluluane was smaller. Another reason is the proximity to Maputo. **(Isa Gerster, Impacto)**
Comment 4
I would like to know if the quarteirões surrounding the project area will be relocated to other locations? **Ernesto Manhique, 1º Secretary of Party Cell "B"**
Answer
The project area is completely fenced since it has been created and nobody is residing inside this area and there are no cultivated field, as this area is not an area of public access. Therefore, within the scope of this project, there will be no resettlement. **(Isa Gerster, Impacto)**
Comment 5
The figure shown on the poster has chimneys. Is this power plant run with coal? **Henriques Gulele, Petroauto Ltd., representative of Volvo**
Answer
The referred picture is the current thermal power plant, which is also run by gas. The purpose of the picture is to show what exists at this moment, apart from other infrastructure, and what is still operational and is sometimes being used to assist the production of electricity. **(Isa Gerster, Impacto)**
Comment 6
It is necessary that we receive all information with regard to the project, because without it, it is difficult to discuss the technical aspects. **Henriques Gulele, Petroauto Ltd., representative of Volvo**
Answer
Impacto is responsible for studying the environmental impacts of what will be installed. The technical aspects of the project will be presented later when the final model of the new power plant has been defined. This project is still in the preliminary phase. At this moment, the objective is to make known that an expansion of the old power plant will be implemented and to gather the sensibilities of the people resident close to the project area. When the study will start and we know the technical aspects, more all-inclusive public consultation meetings will be organised, in which this

information will be presented.

A project classified by MICOA as Category A has to pass through the entire impact evaluation process before the environmental license is obtained. One starts with the registration of the project, which is when the proponent registers the project with MICOA. Then MICOA categorises it in A, B or C, depending on the nature of each project. When a project is categorised as A, follows the Environmental Scoping Study (EPDA), the study which determines the referential situation of the project are and which determines, if there are any fatal flaws that turn the project unfeasible. In the contrary case, the Terms of Reference (ToR) are then elaborated for the Environmental Impacto Assessment (EIA). It is in this phase, where one proposes to MICOA, what needs to be studied in the EIA. After the evaluation and approval of the ToRs by MICOA, the proper EIA starts. It is in this phase, when the impacts are being determined and analysed and the respective mitigation measures are being defined and compiled in an Environmental Management Plan (EMP). This EMP has to be followed by EDM and monitored by MICOA. Even if EDM subcontracts a contractor to construct the power plant, this obligatory will have to follow the EMP, monitored by both, EDM as well as MICOA. At this moment, EDM has already submitted the Registration Document to MICOA and this categorised the project as Category A.

However, JICA (Japan International Cooperation Agency), will be financing this project and is responsible for the technical design of the project, but there does not yet exist a final decision on the model. JICA has some complex policies in place and decided for a survey of the existing situation on site and of which potential impacts could exist and need to be studied, for which it contracted Impacto to carry out the preliminary environmental study, identical to an EPDA.

Apart from that policy, JICA also demands that the population or the people, who potentially could be affected by the project, are being informed in advance.

MICOA determines in the EIA Regulations that the public consultation needs to be carried out in one of the phases of the EIA. However, Impacto's policy is that for Category A projects two public consultations are held, one in the EPDA phase and another in the EIA phase, following all procedures of the Public Consultation Process, through publication of public advertisements in the information organs, identification of possible affected persons, invitations and organisation of public meetings, open to any person interested, in which the project and the study are presented. At the end, the report on the entire process is being elaborated and submitted to MICOA with all questions raised by the participants. These questions, depending on their relevance, are incorporated into the studies.

These present meetings have been organised within the scope of the request made by JICA in order to inform those people, who could be directly affected, on the possible implementation of this project.

Therefore, Impacto analysed jointly with the Luís Cabral suburb secretary, where the project will be implemented, which would be the people directly affected by the project, and determined that this would be the population of the urban blocks 40 and 40a and the industries and institutions opposite of the power plant.

Before the approval of the EIA for obtaining the Environmental License, MICOA submits the report to various institutions linked to the sector of the project, requesting their judgement for different areas, namely, institutions of the area of energy, fuel, fishing, etc. An EIA takes approximately nine months, including the studies and the evaluation and approval time of MICOA, which varies from each phase of the process. If one of these institutions sends its judgement, this needs to be evaluated and incorporated into the study.

It is expected that once the JICA study is concluded, the scoping study will advance. **(Isa Gerster, Impacto)**
Comment 7
Will the new power plant replace the old one? **Isaura dos Santos, Dom Bosco Higher Institute**
Answer
This project is an expansion of that already existing on the site. **(Aissa Naimo, EDM)**
Comments 8
Therefore, when this project is concluded, we will have electricity of quality. Because Luís Cabral suburb has suffered a lot with power cuts, which can last half a day or approximately 12 hours. Is it possible that we will cease to be supplied by the network that is functioning at this moment and we will be supplied directly by the expanded power plant, means for Maputo and Matola? **Henriques Gulele, Petroauto Ltd., representative of Volvo**
Answer
The electricity of the power plant will feed into the already existing electricity network. Possibly there are other power plants feeding the same network. EDM has only one electricity distribution network. The new power plant will increase the capacity of the network and there will be much more electricity available. However, it is necessary to clarify that it is not only the gas power plant, which will solve the problem of the quality of the electricity, given that the entire network, which consists also of other components, such the transformers, cables, wires, posts, etc., which are factors that determine the quality of the electricity. EDM has a list of projects that have to be implemented for guaranteeing the quality of the electricity, but these need to be financed. Therefore, it is not the power plant that will solve all the problems, but it is the key element. **(Isa Gerster, Impacto)**
Comment 9
I do not understand the reason, why the electricity line supplied by EDM can stay 12 hours without power, when a power cut occurs. We hope that the study will be well done, because one can implement this project and we continue with the same problems. It seems to me that EDM has many alternatives to feed the power line and the more time passes, it seems that EDM registered some improvements; there are more opportunities, EDM has more production of electricity, there exist Motraco, the HCB, the National Spine, which all run to the common point, which is the supply of quality electricity and within the time needed for the industries and households. In conclusion, it does not make sense that there are still power cuts and it takes hours to re-establish the electricity, if EDM has many options. For example, some time before, EDM announced a power cut lasting two days for the maintenance of the network. However, there were protests from various companies and institutions against the lack of electricity for 48 hours and EDM send another communication to inform that the power cut would not last for a long time, because the technicians went to the field to study in detail the possibility of not having power cuts with the inclusions of other lines. Therefore, EDM has a technical deficit and not a material one, if analysing the different possibilities that can exist to supply a given power line. **Henriques Gulele, Petroauto Ltd., representative of Volvo**
Answer
Although I belong to the environmental department of EDM, I have to inform that the expansion of the Maputo thermal power plant is one of the methods to improve the quality of the electricity. To increase the quality of electricity it is not sufficient to increase the quantity of the electricity production, but this also needs to be complemented by the replacement of old transformers, electrical cables, amongst other components. The power cuts experienced are related with the process of replacing the above mentioned components, given that it is not possible to effect the replacement and maintenance of the equipment without this period of power cut. The announcement of a 24 hour power cut was the warning period, but which never lasted for this entire period. In fact, the improvement of the quality of the electricity is one of EDM's priorities, not only the replacement and maintenance of electrical cables, but also the electricity production. The countries of Southern Africa are interlinked through a network, which is the SAPP, and each

one has its percentage in term of electricity. The South of Mozambique is linked to the South African power grid, which on its turn is linked with other countries. EDM has projects to improve the quality of electricity, but it is a joint activity and does not only depend on the production, given that it depends on various steps that constitute a priority for EDM. **(Aissa Naimo, EDM)** It is necessary to also take into account that Maputo city is growing and that there are new suburbs, in the way that for EDM the current challenge is to expand in geographical terms. On the other hand, there is an ever increasing consumption of power from the already existing electricity grid, because of the fact that households acquire more electrical equipment, which they did not have before, perhaps because their purchasing power has increased. Because of this, EDM needs to accompany this increase, so that the power cuts, which exist, do not occur; it needs to expand the network and do maintenance. On the other hand, the existing power lines are exterior and this has a negative impact on the quality, because they are exposed to accidents by trucks and thefts, etc. in other countries, power lines are subterranean. **(Isa Gerster, Impacto)**
Comment 10
What worries me is that EDM today continues to make projects with hanging power lines. Development demands that modern projects should be implemented and that are the subterranean power lines. Thus it gets more expensive to later change the hanging power lines into subterranean power lines, thus creating more impacts. **Henriques Gulele, Petroauto Ltd., representative of Volvo**
Answer
This aspect is related to the costs, given that subterranean power lines are much more expensive. **(Isa Gerster, Impacto)**
Comment 11
When will the project start? **Mário Sevene, Intertek**
Answer
The project as such has already started and for the Japanese financing this power plant, a preliminary study was ordered and is in the phase, in which we are now. The level of detail of this study is that of an EPDA (Isa Gerster explained once again the stages of an EIA process). This meeting is part of JICA study for presenting the project. When this study ends, EDM will consecutively advance with the EPDA and with the EIA. It is foreseen that the Environmental License will be obtained by August. **(Isa Gerster, Impacto)**
Comment 12
Why is there not more adherence to this meeting? **Mário Sevene, Intertek**
Answer
This meeting is not meant to be a public consultation meeting in the proper sense, as it would be organised during an EIA. It is part of the JICA policy that when requesting a study, to consult the most affected people and to present the respective project. Therefore, in this case no public advertisement of the meetings was published. In coordination with the suburb secretary, we analysed, which people could be most affected, in case there would be impacts of the project (a list of potential impacts has been presented) and it was decided that the most affected would probably be those surrounding the power plant, namely two urban blocks (40 and 40a), with which we had the meeting yesterday, and the companies located on the other side of the N4 road in this meeting. Therefore, it was decided to organise one meeting with the Heads of 10 Houses from these two urban blocks and another, to which were invited some 8 identified companies. However, not all showed up. **(Isa Gerster, Impacto)**
Comment 13
After the implementation of this project, will the previous and the new power plant operate? **Isaura dos Santos, Dom Bosco Higher Institute**
Answer
This project is an expansion of the previous, which will be integrated into the new one. **(Isa Gerster, Impacto)**
Comment 14
Based on the figure, will the power plant above be eliminated because of the power plant below?

Firmino Chiau, Luís Cabral Suburb Secretary
Answer
This project is the modernisation and amplification of the previous power plant and it is not yet known, which of the components that already exist will be destroyed. In principle, what exists on the site will be expanded with new components. Therefore, not everything existing there will be destroyed; some components will be installed in the already existing infrastructure. **(Isa Gerster, Impacto)**
Comment 15
The modern power plant will be constructed from the scratch in the same way as we can see here? **Isaura dos Santos, Dom Bosco Higher Institute**
Answer
The final design of the power plant to be expanded does not yet exist. The picture has been used of an example type for a combined cycle gas power plant to provide an idea of what the project will be. At this moment, the pros and contras are being studied, but the final decision has not yet been taken. The Japanese will propose some studied models and EDM will have to decide. **(Isa Gerster, Impacto)**
Comments 16
With regard to the water to be used for the cooling of the turbines: it would be convenient to use sea water. **Firmino Chiau, Luís Cabral Suburb Secretary**
Answer
The use of sea water requires some particularities, such as a pipeline to the sea, which already exists at the old power plant. However, one needs to take into account the water levels and the expansion of Maputo Port, amongst other aspects. **(Isa Gerster, Impacto)**
Comment 17
Does this mean there will also be a public meeting? **Isaura dos Santos, Dom Bosco Higher Institute**
Answer
The public meeting will not be organised in the current phase, but afterwards, in the EPDA and EIA phases, through public advertisements and in these phases, the final design of the plant will already be available. **(Isa Gerster, Impacto)**

2) Meeting Material

ELECTRICIDADE DE MOÇAMBIQUE, E.P.

Projecto de Expansão da Central Térmica de Maputo – Instalação de Turbinas a Gás de Ciclo Combinado

Localização

A central Térmica de Maputo localiza-se na cidade de Maputo e próximo do limite com a cidade da Matola. É limitada a norte pela linha férrea que liga o porto de Maputo e a Suazilândia, e a auto-estrada (EN4) situada a norte da referida linha férrea.

Localização da Central Térmica de Maputo

Justificação

- Aumento da demanda de energia devido a maior actividade económica
- Limites no fornecimento de energia por causa da reduzida quota dos países SAPP
- Muitas famílias sem acesso a energia
- Qualidade de energia é baixa

Actual da Central Térmica de Maputo

O Projecto

Planta geral de ampliação proposta na Central Térmica de Maputo

- Simples de projectar e de construir uma vez que não precisam de caldeiras
- A produção de energia eléctrica pode ser regulada dependendo da demanda
- O gás natural é menos poluente que os combustíveis fósseis
- Geradores das centrais a gás são compactos e não produzem muito ruído
- Fácil acesso a reservas de gás
- Baixos custos operacionais; baixos custos de manutenção.
- Aumento do acesso a energia eléctrica de boa qualidade para a população e para novas actividades económicas (positivo).

Potenciais Impactos a Serem Estudados na AIA

- Risco de inundação (marés e das águas pluviais)
- Qualidade do ar (formação de partículas suspensas)
- Qualidade da água
- Vegetação (mangais)
- Contaminação das águas subterrâneas
- Aumento do número de trabalhadores externos e expectativas ligadas à oportunidade de emprego a nível local
- Distúrbio e interferência associado ao tráfego local
- Ruído

Planta Típica da Central de Ciclo Combinado

3) Attendance List

Projecto de Expansão da Central de Maputo

REGISTO DOS PARTICIPANTES

Reunião de Informação no Bairro Luís Cabral com os Chefes de 10 Casas (Quarteirão 40 e 40A)
Maputo, 24 de Janeiro de 2013

NOME	INSTITUIÇÃO / COMUNIDADE	POSIÇÃO / RESPONSABILIDADE	CONTACTO
Carlos Ernesto	B. Cabral Q.40 C.213	Chefe de 10 casas	820561830
Veronica, Adão	Q.40 C 5	11	8275-90170
Guilherme, Rodrigues	Q 40 A C 222	Chefe 10 casas	823581690
Alzira Camacho	Q.40 A C. N.º 13	11	82 66 86 262
Helena Tembe	Q. 40 A C. 21	11	?

Projecto de Expansão da Central de Maputo

REGISTO DOS PARTICIPANTES

Reunião de Informação no Bairro Luís Cabral com os Chefes de 10 Casas (Quarteirão 40 e 40A)
Maputo, 24 de Janeiro de 2013

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Olga Guezi	Q.40A Casa Nº 301	Chefe de 10 casas	847379243
Sara Sebastião Matola	Q.40A Casa Nº 228	11	862249896
Teresa Matusse	Q.40A Casa Nº 100	11	827993050
Inocência Vicente Nhaca	Q 40 A Casa Nº 191	11	848716789
Joaquim Raimundo Correia	Q 40A Casa Nº 90	11	848540151

Projecto de Expansão da Central de Maputo

REGISTO DOS PARTICIPANTES

Reunião de Informação no Bairro Luís Cabral com os Chefes de 10 Casas (Quarteirão 40 e 40A)
Maputo, 24 de Janeiro de 2013

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Ana Faz Cosa	CHPC do Q	845315814	
Maria Antónia	Lolar 827135966		
Belarmina Tivane Jossias	Electricidade de Moçambique	Planeadora Ambiental	82-3689502
Veronica A Tsamaine	Secretaria do B. Luis cabral	Aux. Administrativa	847721929

Projecto de Expansão da Central de Maputo

REGISTO DOS PARTICIPANTES

Reunião de Informação no Bairro Luís Cabral com os Chefes de 10 Casas (Quarteirão 40 e 40A)
Maputo, 24 de Janeiro de 2013

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Isabel Stário	Luis Cabral Q.40 casa 49	BMM adjunto	824025870
Isaura Joaninga	Q.40 casa 177	O.M.M.	822156764
Firmino Chian	Secretário do Bair	Secretário	829780807
Isa Gerster	Impacto Lda.	Consultora	833168160
Sandra Fernandes	Impacto, Lda	Assistente de Consulta Pública	823046650

Projecto de Expansão da Central Térmica de Maputo

REGISTO DOS PARTICIPANTES

Reunião de Informação com Representantes das Empresas Adjacentes à Central Térmica Maputo, Bairro Luís Cabral, Escola Dom Bosco, 25 de Janeiro de 2013, 10 Horas

NOME	INSTITUIÇÃO	POSIÇÃO / RESPONSABILIDADE	CONTACTO
Ernesto A. Mandlate	Bairro Luis Cabral	1º Secret. C. B'	828524400
Firmino A. Chiau	" " "	Secretário	829780800
Afonso Macingarrela	SOMOTOR, SA	Técnico de Recursos Humanos	823277230
Henriques Gulele	Petroauto, SARL	Gestor de Competências / Postar (attachment) to my email	824420720 ch_gulele@yaha.com.br
Arissa Abdurremane Nauruo	EDM, -> Direcção de Planeamento e Sistemas	Eng. Ambiental (Técnica)	823935966

Projecto de Expansão da Central Térmica de Maputo

REGISTO DOS PARTICIPANTES

Reunião de Informação com Representantes das Empresas Adjacentes à Central Térmica Maputo, Bairro Luís Cabral, Escola Dom Bosco, 25 de Janeiro de 2013, 10 Horas

NOME	INSTITUIÇÃO	POSIÇÃO / RESPONSABILIDADE	CONTACTO
Isaura dos Santos	Instituto Superior DB	Serv. aos Gerais	82/84-3449302
TANIA E. SEJENE	[illegible]	P.A. Dir. [illegible]	844575755
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Appendix 7

Environmental Checklist

Environmental Checklist

The JICA Preparation Study on Gas Fired Power Plant Development in Southern Mozambique

Category		Environmental Items	Checklist Details	Remarks				Confirmation of Environmental Considerations
				Yes	Not Yet	No	unclear	
1	Licenses, Permits and Explanation	•EIA and Environment Licenses and Permits	① Are EIA Reports have been officially completed?		X			① EDM is on the process of preparing the required EIA Reports by MICOA.
			② Are EIA Reports have been officially approved by MICOA?		X			② As above
			③ Are EIA Reports have been unconditionally approved? If conditions are imposed, are the conditions been responded and satisfied?		X			③ As above
			④ In addition to the above approvals, are the environmental license and related permits have been obtained from other appropriate regulatory authorities? (construction waste and other related waste disposal permits, construction permits, etc)		X			④ As above
		•Public Participation	① Are the contents of the project and its related impacts have been adequately explained to the public based on Mozambique EIA Law on public participation and information disclosure policy?		X			① Public participation is required under the EIA Law of Mozambique, hence it is assured that concerns, needs and interests of the stakeholders will be accommodated and satisfied.
			② Is awareness and understanding on the project and its impacts by the general public have been achieved?		X			② As above
			③ Are comments and concerns on the project from the public and regulatory authorities have been properly responded and satisfied?		X			③ As above
			④ Are plans for continuing public participation or mechanisms for a sustainable public engagement have been considered as part of the monitoring mechanism of the project?				X	④ A continuing public participation and engagement can be an important tool that will serve as a monitoring and feedback mechanisms, particularly on some environmental items identified in the environmental checklist in order to strike a check and balance. Recommended to be included in the monitoring plan.
		•Examination of alternatives plans	① Have alternative plans been studied and examined for environmental and social considerations?	X				① Alternative plans are included as a significant part of the EIA Report.
			② Are these alternative plans understood by the stakeholders?		X			② Alternative plans are also presented to the public during the stakeholders' consultation as a significant part of the public participation and engagement.
2	Pollution Control Measures and Environmental Quality	•Air Quality	① Are adequate measures undertaken to mitigate the effect of ambient air quality as a result of the possibility of air pollutants emitted during project's construction and operations and maintenance?	X				① Air quality is one of the significant environmental items where appropriate mitigation measures are developed and established.
			② Is the ambient air quality emitted by the project complies with the Air Quality Standard in Mozambique?	X				② Requires periodic monitoring and evaluation on the appropriateness of the mitigation measures.
			③ With the existing air pollution sources in the project area, is there a possibility that the project will contribute to the worsening air pollution in the area?			X		③ The current concentration of SO_2 is measured to be around 5.36 μg/m^3, NO_2 is measured around 19.51 μg/m^3, while PM_{10} is measured to be around 78.4 μg/m^3. These concentrations are below the air quality standards set by Mozambique, RSA and WHO. (Refer to Chapter 11 Sections 11.2 and 11.3) The maximum future concentration of NO_2 is predicted to be around 22.04μg/m^3 in normal conditions and

Category		Environmental Items	Checklist Details	Remarks				Confirmation of Environmental Considerations
				Yes	Not Yet	No	unclear	
2	Pollution Control Measures and Environmental Quality							about 38.44 μg/m^3 on special conditions, which are lower that the ambient air quality standard set by Mozambique and IFC/World Bank. (Refer to Chapter 11 Section 11.8)
		•Water Quality	① Are adequate measures have been undertaken to prevent/mitigate spills and discharges of crude oils and other hazardous materials to the surrounding water areas?	X				① The proposed power plant will not use water to condense the process fluid for the power plant operation so that there is no significant impact on surface water. However, mitigation measures are vigorously implemented to prevent spills of hazardous materials to the surrounding water areas.
			② If spills and discharges cannot be prevented, does the project comply with the environmental quality and effluent emissions standards in Mozambique?	X				② Requires periodic monitoring and evaluation on the appropriateness of the mitigation measures.
			③ Do the effluents from the power plant in general comply with the effluent standards in Mozambique?	X				③ As above
			④ Is there a possibility that the effluents generated by the project will worsen the ambient water quality standards or will cause any significant temperature rise in Infulene River? Any measures to mitigate this adverse condition?			X		④ Waste waters are treated before discharge and mitigation measures are in place for any adverse conditions.
		•Noise and Vibration	① Are adequate measures been undertaken to prevent/mitigate the effect of noise and vibrations from facility operations?	X				① Noise and vibration is the major environmental concern of the project where mitigation measures are vigorously implemented.
			② Will the noise and vibration from the facility operations comply with environmental quality and effluent emission standards in Mozambique?	X				② The current maximum value is measured at 74.0 $L_{Aeq}$for daytime and 61.2 L_{Aeq} for night time. (Refer to Chapter 11 Section 11.2) The predicted noise level at 1 meter on plant boundary will not exceed 70 dB(A) and the noise close to the source will not exceed 85 db (A). (Refer to Chapter 11 Section 11.8) However, noise and vibration levels require periodic monitoring and evaluation on the appropriateness of the mitigation measures.
		•Soil/Site Contamination	① Are soils in the project site and its surroundings been examined for possible contamination considering its land use utilization in the past? If contaminations are found, are measures been undertaken to cure or minimize its tendencies to worsen?	X				① Contamination issues in the site need to be studied and established in order to determine quality of soil in the site. This is important because of its previous land use and utilization. The soil is contaminated with leachate originated from the former coal stockyard located at the north site of the site
		•Waste Management	① Are sludge containing pollutants such as oils, greases, heavy metals generated, among others have been properly treated and disposed of in accordance to standards in Mozambique?	X				① Waste management is another environmental item of significance where mitigation measures are developed and vigorous monitoring and evaluation are established.
			② Does the project consider developing a waste management plan?	X				② Waste management plan will provide policy and management directions, hence an important component of the project management cycle.
		•Climate change factors	① Are climate change factors been considered?	X				① Climate change will be an integral component in the mitigation and monitoring mechanism of the project.

Category		Environmental Items	Checklist Details	Remarks				Confirmation of Environmental Considerations
				Yes	Not Yet	No	unclear	
3	Natural Environment	•Topography and Geology	① Is there a possibility that the installation of structures will cause a considerable alteration of topographic and geological features around the project site?			X		① Topography and geological features of the site will not be affected by any installation of structures or implementation of the project in general.
		•Hydrology	① Are potential flood risks in the project have been studied and assessed considering the low elevation of the project site, its proximity to intertidal zone, saturated depression in the northwest side of the site caused by Infulene River, among other hydrological issues?	X				① Hydrological studies have conducted and hydrological issues and flood risks measures have been integrated into the mitigation measures and monitoring plans.
			② Are adequate water quality control measures taken to minimize water quality degradation caused by the installation of structures?	X				② Requires periodic monitoring and evaluation on the appropriateness of the mitigation measures.
		•Ecosystem	① Does the project site will encompass ecologically valuable habitats such as mangroves, rain forests, wildlife, etc?			X		① There will no ecological system affected or any ecological impact expected caused by the implementation of the project.
			② Does the project site will affect the habitats of endangered plants, animals species designated by Mozambique or other international treaties and conventions?			X		② As above
			③ If significant ecological impacts are expected, are adequate measures taken to mitigate its impacts?			X		③ As above
		•Protected Areas	① Is the project site located within or near protected areas designated by Mozambique, international treaties and conventions?			X		① The project in general will not affect any protected areas or areas designated under internal treaties and conventions.
		•Areas of environmental significance	① Does the project will affect any areas of environmental significance such cultural heritage, etc?			X		① The project in general will not affect any areas of environmental significance including any recognize cultural heritage in Mozambique.
			② If significant impact is expected, are adequate measures undertaken to minimize/mitigate its impact?			X		② As above
4	Social Environment	•Resettlement	① Is involuntary/ voluntary resettlement expected by the implementation of the project? If involuntary resettlement is expected, is adequate explanation on relocation and compensation provided to affected settlers prior to resettlement?			X		① The project in general will not affect any resettlement of legal or illegal settlers.
			② Is resettlement plan, including among others compensation package, restoration of livelihoods developed based on socio-economic studies and in accordance to the guidelines and laws of Mozambique on Resettlement?			X		② As above
		•Minorities and Indigenous Peoples	① Does the project will have a substantive impact on minorities and indigenous peoples? If impact is expected, does the project comply with the Mozambique's law on Ethnic Minorities and Indigenous People's rights?			X		① The project in general will not significantly affect any minorities nor indigenous peoples.
			② Are considerations given to reduce the impact on the culture of indigenous peoples?			X		② As above
		•Cultural Heritage	① Is there a possibility that the project will affect or cause damage to archeological, cultural and religious heritage sites?			X		① The project in general will not affect any archeological, cultural and religious heritage.
			② Are adequate considerations given to protect these sites in accordance to the laws and regulations in Mozambique?			X		② As above

Category		Environmental Items	Checklist Details	Remarks				Confirmation of Environmental Considerations
				Yes	Not Yet	No	unclear	
5	Others	•Impacts during Construction	① Are adequate measures considered to reduce the impacts of noise, vibrations, dust, turbid water, exhaust gases and wastes?	X				① Measures to reduce the impacts during construction have been laid out (refer to Chapter 11 Section 11.9to 11.10)
			② Does construction activities adversely affect the following: ➢ Traffic in surrounding areas and impede the movement of people ➢ Social environment including HIVs, If so, are adequate measures considered to prevent or reduce the impacts?	X				② As above.
			③ Are health and safety education sessions (traffic safety, public health, etc) considered to be provided to workers and project personnel?	X				③ Health and safety education sessions will be including in the mitigation measures to enhance safety awareness and understanding of personnel and workers.
		•Accident Prevention Measures	① Are adequate prevention plans and mitigation measures developed and established, including safety rules, installation of prevention facilities and equipments, and safety education for project personnel and workers?	X				① Accident prevention measures are incorporated into the mitigation and monitoring plans.
			② Are adequate accident prevention measures, including installation of prevention facilities, equipments and prevention management system) developed to provide awareness and prevent any accidents?	X				② As above.
		•Monitoring Mechanism	① Does monitoring plan developed to monitor significant impacts contained in the environmental checklist? If so, are monitoring methods and frequencies included to evaluate its appropriateness?	X				① Monitoring plan are developed including implementation mechanisms to make the plan functional and operational. Compliance with all regulatory requirements in accordance with the law and regulations in Mozambique.
			② Are adequate monitoring implementation mechanisms and frameworks including organizational arrangement, manpower resources and budget institutionalized and adopted to sustain monitoring activities?	X				② As above
			③ Does the project comply with any regulatory requirements on monitoring and reporting systems in accordance with the EIA guidelines and other related laws and regulations in Mozambique?	X				③ As above

Appendix 8

Itinerary for the First Site Survey

Time Schedule for Preparatory Study on Gas-Fired Power Plant Development in Southern Mozambique

September and October 2012

No.	Date		Activities	Yu	Wa	Ao	Iw	Mi	Ki	Ok	Ko	Sa	Ts	Iv	An
1	Sept 16	Su	Yu/Wa/Iw/Mi/Ko/Sa: 18:25 Leave Narita (by NH911) 22:05 Arrive at Hong Kong 23:50 Leave Hong Kong (by SA287)	x	x		x	x			x	x			
2	Sept 17	Mo	Yu/Wa/Iw/Mi/Ko/Sa: 07:00 Arrive at Johannesburg 09:45 Leave Johannesburg (by SA142) 10:50 Arrive at Maputo 15:00 JICA Office (Mr. Nasu, Mr. Miyazaki, Ms. Oe)	x x	x x		x x	x x	x		x x	x x			
3	Sept 18	Tu	Yu/Wa/Iw/Mi/Ko/Sa/Iv/An: EDM(Kick-off Meeting) 13:00 Site Visit (CTM) 15:00 Dispatch center	 x x	 x x		 x x	 x x			 x x	 x x		 x x	 x x
4	Sept 19	We	Yu/Wa/Iw/Mi/Ko/Sa/Iv/An: EDM Yu/Wa/Iw/Mi/Iv: 13:30 FIPAG	 x x	 x x		 x x	 x x			 x	 x		 x x	 x
5	Oct 20	Th	Iw/Mi/Ko/Sa/An: 10:00 INAHINA Mi/Sa/An: 13:00 MICOA Yu/Wa/Iw/Ko: 15:00 Embassy of Japan	 x	 x		 x x	 x x			 x x	 x x			 x x
6	Sept 21	Fr	Yu/Wa/Iw/Mi/Ko/Sa/An: 14:00 INAM	 x	 x		 x	 x			 x	 x			 x
7	Sept 22	Sa	Ao,Ki,: 18:25 Leave Narita (by NH911) 22:05 Arrive at Hong Kong 23:50 Leave Hong Kong (by SA287)			x			x						
8	Sept 23	Su	All except Ao,Ki: (off) Ao,: 07:00 Arrive at Johannesburg 09:45 Leave Johannesburg (by SA142) 10:50 Arrive at Maputo			 x			 x						
9	Sept 24	Mo	All except Ok, Ts: 08:30-14:30 Site Visit (CTM, Belulunane)	x	x	x	x	x	x		x	x		x	x
10	Sept 25	Tu	Iw/Mi/Ko: 9:00 Port of Maputo				x	x			x				
11	Sept 26	We	Yu/Wa/Ao/Iw/Mi/Ki/Iv: 10:00 Norway Consultant (at EDM) Sa:	x	x	x	x	x	x					x	

Time Schedule for Preparatory Study on Gas-Fired Power Plant Development in Southern Mozambique

September and October 2012

			10:00 EDM EIA expert14:00 Arrive at Nacala									x			
			Yu/Wa/Ao/Ki/:												
			14:00 TL network expert (at EDM)	x	x	x			x						
12	Sept 27	Th	Iw/Mi/Ko/Iv:												
			8:30 DNA (Mr.Isac Filomone)				x	x			x			x	
			Iw/Mi/Ko/Iv:												
			10:30 MPWH				x	x			x			x	
			Yu/Wa/Ao/Iw/Mi/Ki/Ko/Sa:												
			16:00 JICA	x	x	x	x	x	x		x	x			
13	Sept 28	Fr	Yu/Ws/Iw/Mi/Ko/Iv:												
			9:00 ENH	x	x		x	x			x			x	
			Yu:												
			10:30 Market operator of EDM	x											
			Yu/Ki:												
			14:00 EDM System Planning Engineer at EDM	x					x						
14	Sept 29	Sa	Ts:												
			19:00 Leave London (by SA235)										x		
15	Sept 30	Su	All except for Ok/Ts:												
			(off)												
			Ts:												
			07:20 Arrive at Johannesburg										x		
			09:45 Leave Johannesburg (by SA142)												
			10:50 Arrive at Maputo												
			Ok:												
			18:25 Leave Narita (by NH911)							x					
			22:05 Arrive at Hong Kong												
			23:50 Leave Hong Kong (by SA287)												
16	Oct 01	Mo	Ok:												
			07:00 Arrive at Johannesburg							x					
			09:45 Leave Johannesburg (by SA142)												
			10:50 Arrive at Maputo												
			All:												
			Technical meeting with EDM	x	x	x	x	x	x	x	x	x	x	x	x
			Ts/Iv:												
			11:00 USAID										x	x	
17	Oct 02	Tu	Ts:												
			9:45 Finance Department of EDM										x		
			15:00 Norway consultant										x		
18	Oct 03	We	All except for Ts:												
			09:00 Meeting with EDM	x	x	x	x	x	x	x	x	x		x	x
			13:30 Workshop	x	x	x	x	x	x	x	x	x		x	x
			Ts:												
			15:30 USAID										x		
19	Oct 04	Th													
20	Oct 05	Fr	Yu/Wa/Ao/Iw/Ki/Ok:												

Time Schedule for Preparatory Study on Gas-Fired Power Plant Development in Southern Mozambique

September and October 2012

			11:50 Leave Maputo (by SA143) 13:00 Arrive at Johannesburg 16:50 Leave Johannesburg (by SA286) 10:00 Norconsult Economic & Financial Expert	x	x	x	x		x	x					
21	Oct 06	Sa	12:10 Arrive at Hong Kong 14:30 Leave Hong Kong (by NH1172) 19:40 Arrive at Haneda	x	x	x	x		x	x					
22	Oct 07	Su													
23	Oct 08	M o	Mi/Ko/Sa 15:00~ JICA					x			x		x		
24	Oct 09	Tu	Ts: 8:30 Market Operation Dep. 10:15 Commercial Dep. Ko/An: 11:00 WBHO 14:00 Maputo Sul								x x x x		x x	 x	x
25	Oct 10	W e	Ko/An: 9:00 Camargo Correa Mi/Iv: 9:00 INAHINA 10:00 DNA					x x			x			x x	x
26	Oct 11	Th	Ko/An: 9:00 Soares De Costa Ts: 10:00 Finance Dep. Ko/An: 11:00 Manica Mi/Ts/Iv: 13:30 ENH					x			x x		x x	 x	x x
27	Oct 12	Fr	Ts: 15:55 Leave Maputo (by SA145) 17:05 Arrive at Johannesburg 19:45 Leave Johannesburg (by SA234)										x		
28	Oct 13	Sa	06:25 Arrive at London												
29	Oct 14	Su	Ko: 11:50 Leave Maputo (by SA143) 13:00 Arrive at Johannesburg 16:50 Leave Johannesburg (by SA286)								x				
30	Oct 15	M o	Ko: 12:10 Arrive at Hong Kong 15:00 Leave Hong Kong (by SA7138) 20:20 Arrive at Narita Mi/Sa/Iv/An: 9:00 Bid opening for environmental survey 14:00 Bid opening for soil investigation					x x			x	x x		x x	x x
31	Oct 16	Tu													

Time Schedule for Preparatory Study on Gas-Fired Power Plant Development in Southern Mozambique

September and October 2012

32	Oct 17	We	Mi/Iv: 8:15 INAHINA					x						x	
33	Oct 18	Th													
34	Oct 19	Fr													
35	Oct 20	Sa													
36	Oct 21	Su													
37	Oct 22	Mo													
38	Oct 23	Tu	Sa: 11:50 Leave Maputo (by SA143) 13:00 Arrive at Johannesburg 16:50 Leave Johannesburg (by SA286)									x			
39	Oct 24	We	12:10 Arrive at Hong Kong 15:00 Leave Hong Kong (by SA7138) 20:20 Arrive at Narita									x			
40	Oct 25	Th													
41	Oct 26	Fr													
42	Oct 27	Sa	Mi: 11:50 Leave Maputo (by SA143) 13:00 Arrive at Johannesburg 16:45 Leave Johannesburg (by SA286)					x							
43	Oct 28	Su	12:15 Arrive at Hong Kong 15:20 Leave Hong Kong (by SA7138) 20:15 Arrive at Narita					x							

Remarks:

1) Personnel symbol: Yu: Mr. Yukimura, Wa: Mr. Watanabe, Ao: Mr. Aoki, Iw: Mr. Iwaki, Mi: Mr. Miyashita, Ki: Mr. Kinoshita, Ok: Mr. Okano, Ko: Mr. Kono, Sa: Ms. Sato, Ts: Mr. Tsumura, Iv: Ms. Ivone (Interpreter 1), An: Mr. Antonio (Interpreter 2)

Appendix 9

Itinerary for the Second Site Survey

Time Schedule for Preparatory Study on Gas-Fired Power Plant Development in Southern Mozambique

December 2012

No.	Date		Activities	Yu	Wa	Ao	Kb	Mi	Ki	Ok	Ko	Sa	Iv	An
1	Dec 7	Fr	Yu/Wa/Ao/Kb/Mi/Ki/Ko/Sa: 18:25 Leave Narita (by NH911) 22:35 Arrive at Hong Kong 23:40 Leave Hong Kong (by SA287)	x	x	x	x	x	x		x	x		
2	Dec 8	Sa	Yu/Wa/Ao/Kb/Mi/Ki/Ko/Sa: 07:05 Arrive at Johannesburg 09:40 Leave Johannesburg (by SA142) 10:45 Arrive at Maputo 13:00 Team Meeting	x	x	x	x	x	x		x	x		
3	Dec 9	Su	Yu/Wa/Ao/Kb/Mi/Ki/Ko/Sa: Team meeting Ok: 18:25 Leave Narita (by NH911) 22:35 Arrive at Hong Kong 23:40 Leave Hong Kong (by SA287)	x	x	x	x	x	x	x	x	x		
4	Dec 10	Mo	Ok: 07:05 Arrive at Johannesburg 09:40 Leave Johannesburg (by SA142) 10:45 Arrive at Maputo Yu/Wa/Ao/Kb/Mi/Ki/Ko/Sa: 10:00 JICA Office 1430-1630 DSP office 15:00-16:30 EDM Meeting							x				
5	Dec 11	Tu	All: 10:00-15:00 Workshop	x	x	x	x	x	x	x	x	x	x	x
6	Dec 12	We	All: 10:00-13:00 Workshop Ok: 13:00-16:30 ENH Yu/Sa: 15:00-16:30 EIA Wa/Kb: 15:00-16:30 O & M Ao: 15:00-16:30 EDM Meeting	x x	x x	x x	x x	x	x	x x	x	x x	x	x
7	Dec 13	Th	All: 11:00-12:30 wrap-up meeting with EDM 15:00-16:30 JICA Office, the Japanese Embassy	x x	x x	x x	x x	x x	x x	x x	x x	x x	x x	x x
8	Dec 14	Fr	All: 11:45 Leave Maputo (by SA143)	x	x	x	x	x	x	x	x	x		

Time Schedule for Preparatory Study on Gas-Fired Power Plant Development in Southern Mozambique

December 2012

			12:55 Arrive at Johannesburg 16:45 Leave Johannesburg (by SA286)											
9	Dec 15	Sa	Yu/Wa/Ao/Kb/Ki: 12:15 Arrive at Hong Kong 14:25 Leave Hong Kong (by NH1172) 19:15 Arrive at Haneda Mi/Ko/Sa: 12:15 Arrive at Hong Kong 15:20 Leave Hong Kong (by SA7138) 20:15 Arrive at Narita	x	x	x	x	 x	x	x	 x	 x		

Remarks:

1) Personnel symbol: Yu: Mr. Yukimura, Wa: Mr. Watanabe, Ao: Mr. Aoki, Kb: Mr. Kobayashi, Mi: Mr. Miyashita, Ki: Mr. Kinoshita, Ok: Mr. Okano, Ko: Mr. Kono, Sa: Ms. Sato, Ts: Mr. Tsumura, Iv: Ms. Ivone (Interpreter 1), An: Mr. Antonio (Interpreter 2)

Appendix 10

List of Key Persons whom the Survey Team Met

List of Key Persons whom the Survey Team Met

Organization	Department
Administração Nacional de Estradas (ANE)	Road Maintenance Capacity Development Project
Camargo Corrêa	Administration
Electricidade de Mocambique (EDM)	Market Operation Directorate
Electricidade de Mocambique (EDM)	Finance Directorate
Electricidade de Mocambique (EDM)	Environmental Unit
Empresa Nacional de Hidrocarbonetos (ENH)	Statistic
Camargo Corrêa	New Business
Manica Freight Services	Ships Operation
Imapcto, Lda	Sociology
Electricidade de Mocambique (EDM)	Board of Directors
Electricidade de Mocambique (EDM)	EDM-ATSU
Electricidade de Mocambique (EDM)	Transmission Network Directorate

Organization	Department
Empresa Nacional de Hidrocarbonetos (ENH)	Engineering Department
IMPACTO, Lda	Directorate
Instituto Nacional de Hidrografia e Navegacao（INAHINA）	Maintenance and Infrastructure Service
Instituto Nacional Meteorologia (INAM)	Research & Application Dep.
Manica Freight Services	Forward Managment
Maputo Port Development Company (MPDC)	Port Captain
Mitsui & Co. Europe PLC	Maputo Office
Norconsult Associate	Economic and Finance
Norconsult	Electrical Engineering
Poyry (Norconsul Associate)	Electrical Engineering
Soares Da Costa	Board of Directors
WBHO	Comercial

Appendix 11

List of Collected Data and Information

List of Collected Data and Information

No.	Name of documents	Form	Issuing Institution
General-1	Matriz do Plano Estratégico de Energia (2009 – 2013)	PDF File	Ministry of Energy
General-2	Plano Estratégico do Sector de Energia (2009 -2013)	PDF File	Ministry of Energy
General -3	Organization	PDF File	Ministry of Energy
General -4	SAPP Vision and Objectives	PDF File	Ministry of Energy
General -5	Electricity Tariff Table	PDF File	Ministry of Energy
General -6	Map around project site (scale 1:5,000) A21-144-E5-3	PDF File	CENACARTA (Centro Nacional de Cartografia e Teledetecção)
General -7	Map around project site (scale 1:5,000) A21-144-E5-4	PDF File	CENACARTA (Centro Nacional de Cartografia e Teledetecção)
General -8	Map around project site (scale 1:5,000) A21-144-E5-7	PDF File	CENACARTA (Centro Nacional de Cartografia e Teledetecção)
General -9	Map around project site (scale 1:5,000) A21-144-E5-8	PDF File	CENACARTA (Centro Nacional de Cartografia e Teledetecção)
General -10	General View of Ring Road Project	PDF File	Maputo Sul
General -11	List of berth at Port Maputo	PDF File	MPDC
General -12	Regulation of load, dimension, combination of distribution of load in vehicles and trailers	PDF File	ANE
Environmental-1	Mozambique Gas Engine Power Plant: Air Quality Impact Assessment, March 2012	PDF	Sasol New Energy Holdings (Pty) Ltd & EDM
Environmental-2	Mozambique Gas Engine Power Plant: Environmental Noise Specialist Report, March 2012	PDF	Sasol New Energy Holdings (Pty) Ltd & EDM

No.	Name of documents	Form	Issuing Institution
Environmental-3	Mozambique Gas Engine Power Plant: Traffic Impact Study Report, March 2012	PDF	Sasol New Energy Holdings (Pty) Ltd & EDM
Environmental-4	Mozambique Gas Engine Power Plant: Socio-economic and Land use Specialist Draft Report, March 2012	PDF	Sasol New Energy Holdings (Pty) Ltd & EDM
Environmental-5	Mozambique Gas Engine Power Plant: Hydrological Specialist Draft Report, March 2012	PDF	Sasol New Energy Holdings (Pty) Ltd & EDM
Environmental-6	Avaliação De Impacto Ambiental Para O Projecto De Distribuição De Gás Natural Em Maputo E Distrito De Marracuene Egasoduto Maputo-Matola	PDF	ENH
Environmental-7	Decree 45/2004 – Environmental Impact Assessment Regulation in Mozambique	PDF	MICOA
Environmental -8	Decree 19/97 – Environmental Law in Mozambique	PDF	MICOA
Environmental-9	EIA Supplemental Law 66/98	PDF	MICOA
Financial-1	Annual Report of EDM, 2007	PDF	EDM
Financial-2	Annual Report of EDM, 2008	PDF	EDM
Financial-3	Annual Report of EDM, 2009	PDF	EDM
Financial-4	Annual Report of EDM, 2010	PDF	EDM
Financial-5	Statistical Summary of EDM, 2008	PDF	EDM
Financial-6	Statistical Summary of EDM, 2010	PDF	EDM
Financial-7	Statistical Summary of EDM, 2011	PDF	EDM
Financial-8	Annual Statistical Report of EDM, 2007	PDF	EDM
Financial-9	Annual Statistical Report of EDM, 2008	PDF	EDM
Financial-10	Annual Statistical Report of EDM, 2009	PDF	EDM
Financial-11	Annual Statistical Report of EDM, 2010	PDF	EDM
Financial-12	Selected EDM Current and Future Industrial Off Take Agreements with Big Customers by 2015/2016	Microsoft Word	EDM
Financial-13	Performance Indicators	Microsoft Word	EDM

No.	Name of documents	Form	Issuing Institution
Financial-14	Number of Clients by Distribution Area 2011	Hardcopy	EDM
Financial-15	Statistical Yearbook 2011	Hardcopy	National Institute of Statistics
Financial-16	The first Draft of Chapter 5, Supply Analysis, of Master Plan Update Report	PDF	Norconsult
Civil-1	Topographic maps for Maputo / Matola areas with a scale of 1/50,000 (3 sheets)	TIFF	CENACARTA
Civil-2	Daily meteorological data at Mavalane observatory, Maputo from 2007 to 2011 (relative humidity, barometric pressure, maximum temperature and minimum temperature) at Mavalane observatory, Maputo	EXCEL	INAM
Civil-3	Meteorological data at Mavalane observatory, Maputo from 5 to 8 February, 2000 (barometric pressure at 3-hour intervals, digital barometric pressure graphics and daily precipitation)	EXCEL, JPEG	INAM
Civil-4	Monthly maximum wind speed data with directions at Mavalane observatory in Maputo from 1960 to 2010	EXCEL	INAM
Civil-5	Daily precipitation at Mavalane observatory, Maputo from 1991 to 2011	EXCEL	INAM
Network-1	Draft of the Reinforcement of Maputo Transmission Final (1)	Power Point File	Ministry of Energy
Network-2	Load Forecast Report - EDAP Master Plan Appendix E	PDF File	Ministry of Energy
Network-3	Monthly Peak Load and Duration	Excel File	Ministry of Energy
Network-4	Standard Construction cost	E-mail	Ministry of Energy
Network-5	Actual voltage records in 2011-2012	Excel File	Ministry of Energy
Network-6	Actual power flow records in 2011	Excel File	Ministry of Energy
Network-7	Actual power flow records in 2012	Excel File	Ministry of Energy
Network-8	Network analysis data for PSSE	Digital File	Ministry of Energy

Appendix 12

Minutes of Meeting of the 1st Mission

MINUTES OF MEETING
OF
THE 1ST MISSION OF THE
PREPARATORY STUDY ON GAS FIRED POWER PLANT DEVELOPMENT
IN SOUTHERN MOZAMBIQUE

AGREED UPON BETWEEN
ELECTRICIDADE DE MOZAMBIQUE
AND
THE STUDY TEAM OF
JAPAN INTERNATIONAL COOPERATION AGENCY

MAPUTO, 3RD OCTOBER 2012

ELECTRICIDADE DE MOZAMBIQUE

Ildo R. A. DOMINGOS
Director Power Generation
Electricidade De Mozambique
Maputo – Mozambique

THE JICA STUDY TEAM

Hideki YUKIMURA
Team Leader
JICA Study Team

The JICA Study Team has been conducting the Preparatory Study on Gas Fired Power Plant Development in Southern Mozambique (referred to as the Study), and received the Electricidade de Mozambique (EDM) Team in Maputo, Mozambique, to further discuss and agree on the outcomes of the Study.

I. Kick-off Meeting

The JICA Study Team inaugurated the meeting and welcomed the EDM Team led by Mr. Ildo R. A. DOMINGOS .

The JICA Study Team presented the following items.

1. Member Introductions
2. Outline of the Study (General Contents and Schedule)
3. Points in each technical section
4. Agenda of 1st Workshop for Site Selection
5. Confirmation of Undertakings

II. The outcome of main points of discussion and agreements

The JICA Study Team and the EDM Team had a number of discussions at working level and eventually a workshop inviting the board members of EDM and JICA officials from its Mozambique office on 3 October, 2012. The outcome of main points is as follows;

1. Selection of the site

- The CTM Maputo was duly selected as a project site for Combined Cycle Gas Turbine (hereinafter referred to as CCGT) power plant with the generation capacity of up to 110MW.
- The major determining factor is transmission network capacity constraints where the CTM can install 110MW or more generation capacity while the Beluluane is limited to install at most 50MW.

2. Major specifications of the envisaged CCGT

- The rated generation capacity is 110MW at a maximum in line with the available volume of fuel gas. In addition, setting the range of generation capacity like 70 to 110MW is expected in consideration of stimulating proper and competitive bidding circumstances.
- The CCGT is envisaged to be built adjacent to the existing Open Cycle Gas

Turbine (hereinafter referred to as OCGT) power plants at the premise of the CTM Maputo power station. In order to seek proper and flexible power generating operations entirely at the power station, EDM would like to consider integrating the independent operation control systems of the existing OCGT plants into the control system of the CCGT, and separating the premise of the power station from that of the adjacent sub-station physically by building fences for security purpose. EDM also requested to put those into the scope of the CCGT project.

- 2-2-1 configuration of combination of gas turbine, generator and steam turbine is anticipated from the higher thermal efficiency point of view.
- Air cooled condenser was duly selected instead of once-through cooling by sea water as for steam turbine condenser cooling. This is expected to simplify construction permission processes and reduce the number of potential environmental impacts.
- All the parties have clearly recognized that EDM's Environmental Impact Assessment (hereinafter referred to as EIA) process under the Mozambican EIA regulations could be one of the critical paths for smooth implementation of the CCGT project. In this regard, TOR and the scope of works for environment study to be conducted by the JICA Study team are shared with EDM's environment team so that EDM can properly organize its EIA study without any duplication of works.

III. Next Step

- The JICA Study team and the EDM team will hold the 2nd Mission for discussions on a proposed Draft Final Report in the first week of December, 2012 in Maputo, inviting relevant institutions and stakeholders.
- The JICA Study team organizes a workshop in Japan in the middle of January, 2013 where EDM people concerned including top management and technical staffs involved into the project will be held. In consultation with JICA Head Office, the JICA Study team will prepare and send an invitation letter to the CEO of EDM in which the number of participants, itinerary and program, and related information are mentioned.

IV. Attachments

1) Presentation materials for the Kick-off meeting
2) Draft of Progress Report
3) Questionnaire

Meeting Sign-In Sheet

Project Name	JICA Preparatory Study on Gas Fired Power Plant Development in Southern Mozambique
Meeting Title	1st Mission of Preparatory Study on Gas Fired Power Plant Development in Southern Mozambique
Period - Date	Oct. 3, 2012
Meeting Venue	

	Name	Organization	Title	Telephone	E-Mail	Signature
1	Adriano Jonas	EDM	Board Member	823083410	ajonas@edm.co.mz	Jonas
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Meeting Sign-In Sheet						
Project Name	JICA Preparatory Study on Gas Fired Power Plant Development in Southern Mozambique					
Meeting Title	1st Mission of Preparatory Study on Gas Fired Power Plant Development in Southern Mozambique					
Date						
Meeting Venue						

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APP12-5

Appendix 13

Minutes of Meeting of the 2nd Mission

MINUTES OF MEETING

OF

THE 2ND MISSION OF THE

PREPARATORY STUDY ON GAS FIRED POWER PLANT DEVELOPMENT

IN SOUTHERN MOZAMBIQUE

AGREED UPON BETWEEN

ELECTRICIDADE DE MOZAMBIQUE

AND

THE STUDY TEAM OF

JAPAN INTERNATIONAL COOPERATION AGENCY

MAPUTO, 13th DECEMBER 2012

ELECTRICIDADE DE MOZAMBIQUE

Ildo R.A. DOMINGOS
Director Power Generation
Electricidade de Mozambique
Maputo – Mozambique

THE JICA STUDY TEAM

Hideki YUKIMURA
Team Leader
JICA Study Team

The JICA study team has been conducting the Preparatory Study on Gas Fired Power Plant Development in Southern Mozambique (referred to as the Study), and prepared the Draft Final Report (DFR). The JICA study team has submitted DFR to the Electricidade de Mozambique (EDM) Team in Maputo, Mozambique. The JICA study team and EDM (referred to as both parties) have discussed and agreed the following focal points through (i) Technical Workshop held on Dec. 11, 2012, and (ii) the Meeting with EDM Board Members, on Dec.12, 2012.

A. Technical Workshop

The JICA study team held jointly with EDM team a Technical Workshop on Dec. 11, 2012 at the Central Térmica de Maputo (CTM) Training Center Maputo from 8:30hr to 12:30hr led by Mr. Ildo R.A. Domingos, for discussing on the DFR. The discussion points of the DFR during the Technical Workshop are as follows;

1. Introduction and summary of the DFR
2. Basic Design
   2a. Power Block and B.O.P
   2b. Civil Works
   2c. Electrical and Control System
3. Network Analysis Results
4. Project Cost
5. Project Implementation Plan
6. Financial and Economic Analysis
7. Environmental and Social Consideration
8. Way forward

Detailed discussion had been made among the engineers of EDM and the JICA study team, and both parties reached a broad agreement on the DFR with high satisfactions of the both sides. A detailed discussion is summarized in clause C.

B. Meeting with EDM Board Members

The JICA study team participated the meeting with the EDM Board, held at the EDM Headquarter Office on Dec. 12, 2012, and the JICA study team made a presentation to the Board Members of EDM in terms of the following discussion points on the DFR;

1. Project Outline
2. Site Selection & Basic Design
3. Network Analysis

4. Project Cost & Schedule
5. Organizational Structure & Personnel Training
6. Environmental and Social Consideration
7. Financial & Economic Performance
8. Conclusion & Recommendations

Detailed discussion had been made among the CEO, the board members and the JICA study team, and the parties had reached a broad agreement on the DFR with high satisfactions of the both sides. A detailed discussion is summarized in clause C.

C. Focal Points on discussion through the Technical Workshop and Meeting with EDM Board Members

Both parties have discussed and agreed the following focal points on DFR through the Technical Workshop and Board Meeting as follows;

C-1 Power Development Plan

- The JICA study team presented the projections of capacity balance (kW balance) and energy balance (kWh balance) in the Southern region based on its power supply/demand analyses. Both parties recognized that the Combined Cycle Gas Turbine (hereinafter referred to as CCGT) project at CTM can make great contribution to reducing imbalance of supply/demand in kW, and moreover supplying low-cost base power to maintain energy balance in kWh.
- In case the CCGT project were not into operation by the appointed time, the southern region could suffer from serious power shortages during the period until 2026.

C-2 Power Generation Facility

- Technical specifications of the CCGT project are confirmed by both parties as follows;
  - Rated capacity: 70 to 110 MW
  - Plant efficiency: over 50% (LHV)
  - CCGT configuration: multi-shaft 2-on-1
  - Steam turbine condenser cooling system: Air cooled condenser
  - Fuel gas: Natural gas
- The proposed basic design of CCGT has been basically agreed on between both parties where main facility (GTs, ST, HRSGs, and generators) is installed at the existing diesel tank area, and auxiliary facility (raw water treatment, waste water treatment, workshop, etc.) is installed at the vacant lot adjacent to the existing No.3 GT plant. The EDM team suggested that the layout of the auxiliary facility might be changed to other areas from the area proposed by the JICA study team. This will be considered before appraisal process starts.

- The performance effect indices were temporarily set up as follows for the monitoring purpose. Those numbers should be reconsidered when the Detailed Design is available.
  - Maximum output: 110MW
  - Plant load factor: 83%
  - Availability factor: 90%
  - Gross thermal efficiency: approx. 50% (LHV)
  - Outage hours by human errors: zero
- In addition, the JICA study team has recommended that a GT inlet air cooling system be considered for boosting up power output under the high ambient air temperature condition.

C-3 Electrical and I&C Facility

- The electric power generated in the Maputo CCGT can be stabilized and transmitted to 66kV Maputo substation. Connecting to a 33kV system was denied because of making the power system unstable according to the network stability analysis.
- Gas Turbine Generator (GTG)-A uses an independent 2-winding transformer. GTG-B and Steam Turbine Generator (STG) use 1 transformer of 3-winding type. It explained that the bay of a connection place was only two sets and the reason for using 3 winding transformer was for connecting three generators to this two bays.
- Control of Maputo power station adopts Distributed Control System (DCS). The existing Gas Turbine (GT-2 and GT-3) will be integrated and operated from the new Central Control Room (CCR) based on the EDM's request, however, details of DCS system depends on the manufacturer's detailed design.

C-4 Network Analysis

- Power generated at the CCGT can be transmitted stably by using the existing 66kV lines in terms of dynamic stability.
- In the existing network, with expected demand growth until 2016, around 14 lines of 66kV will be overloaded. After introducing the CCGT project at CTM, the number of the overloaded 66kV line will be reduced to 7.
- The installation of the CCGT will result in increasing fault current, but the maximum fault current is estimated to be 16.6kA, which is lower than the permissible value of 25kA.
- Since 275kV network is under consideration after 2016, it is noted that fault current increases to the permissible value at a certain condition of the network operation.

C-5 Civil works

- The soil investigation revealed that the hard clay (N-value>50), which is rated high enough for the foundation for heavy loads, lays about 10 meters below the ground level. Since foundation settlement should be avoided for the major equipment and structures, a pile foundation is basically adopted. Spread foundations could be used for pipe racks and other miscellaneous structures.
- CTM site does not require ground elevation against high tidal wave according to meteorological and didal data analysis.
- A surface drainage system at the site should be developed in order to avoid inundation caused by heavy rains.

C-6 Project Cost

- Entire project cost was estimated at approximately US$ 200 million, including taxes (VAT & Custom duties), of which cost for EPC and Project Management Consultant (PMC), is around US$ 180 million (including contingency).
- The total project cost will be reviewed during the JICA appraisal process.

C-7 Project Implementation Schedule

- Project implementation schedule was presented and it shows that the commercial operation of CCGT is estimated to be around middle of 2018. All the parties recognized needs to make efforts in order to shorten substantially the project duration by forwarding the timing of EIA process completion, commencement of consultant selection and the conclusion of loan agreement.

C-8 Construction

- There is possibility that the Maputo Ring Road Project might interfere with the CTM Maputo site. Therefore, the progress of planning of Maputo Ring Road Project should be closely monitored, and confirm no-interference

C-9 Organization and Personnel

- The organizational framework at the CTM Maputo would consist of vertical organization including personnel affairs, finance and accounting, operation and maintenance. Approximately twenty personnel for construction and fifty to sixty personnel for O&M will be required. Smooth transition of organization and training schemes, from the engineering stage to the construction and the commissioning stages, should be properly introduced. In order to conduct self-sufficient operation at the CCGT, the capacity building programs are required to make EDM personnel qualified.
- The EDM team expressed its great interest in enhancing capacities of EDM's personnel who are in charge of power development planning and O&M of the proposed CCGT power plant.

C-10 Environmental and Social Consideration (ESC)

- The local consultant commissioned by JICA study team will produce the EPDA and EIA TOR as part of its deliverable in order to facilitate and fast-track the EIA process to be continued by EDM.
- In order to expedite the EIA process and the target of environmental license issued as planned, the following are recommended;
    1) Commissioning of Local Consultants to be done at least before the end of January 2013.
    2) Utilization of the Consultant (IMPACTO) that JICA study team commissioned to conduct the ESC study as IMPACTO already has a comprehensive understanding of the project.
    3) The target activities and schedule proposed by the JICA study team are observed.
    4) EDM shall exert efforts to enhance engagement of relevant stakeholders as early as possible in order to lobby and generate support to the project.

C-11 Financial and Economic Analyses

- The Financial Internal Rate of Return (FIRR), or Project IRR, is preliminarily estimated at 3.9%, assuming 80% of the average retail tariff as selling price.
- The levelised production cost at the bus bar of the new power station is preliminarily estimated at 8.47USc/kWh, which is lower than the power purchase price from IPPs.
- The Economic Internal Rate of Return (EIRR) of the Project is estimated at around 20%. Since it exceeds the hurdle rate of the public works in Mozambique of 10%, the project is judged to be economically viable. The project also brings many other benefits to the country to justify its implementation, which includes economic development, job creation, poverty reduction, etc.
- The additional questions on financial and economic performance of the project were raised by the JICA study team. EDM will answer to these questions no later than Dec. 21, 2012.

D. Next Step

The JICA study team and the EDM team agreed on the following points regarding the next steps.

- **Reporting**
    - The comments on DFR shall be summarized by the EDM as an official comment, and be submitted to the JICA study team in a prompt manner, but no later than Dec. 24, 2012. The receiving points are "h-yukimura@tepsco.co.jp" and "toshi-kobayashi@tepsco.co.jp".
    - Submission of Final Report : End of February,2013
    - Completion of the Study : End of March,2013

- **Technical Workshop in Japan**
  - Duration: Jan.19-Jan.26, 2013, for eight days
  - Destination: IHI and Hitachi GT factories, A 100MW CCGT plant in Tokyo Bay area, the other CCGT plants, and technical discussions with JICA study team

- **JICA Missions**
  - A fact-finding mission is planned to be dispatched in January or February 2013, by JICA headquarters to collect necessary information for its appraisal process.
  - An appraisal mission will be dispatched in March or April 2013, by JICA headquarters after necessary arrangements with the Japanese Government.

E. Others

The CEO of EDM and the EDM team showed their satisfaction with the performance of the JICA study team who could achieve timely getting basic design and feasibility assessment in spite of limited time frame of the study, and therefore expressed their acknowledgment to both the JICA mission and the JICA study team.

F. Attachments

- F-1: Technical Workshop Material and participant list
- F-2: Board Meeting Presentation Material