Azito Energie

Environmental and Social Impact Assessment (ESIA) for the Azito Phase IV Expansion Project

Final

March 2018

www.erm.com

The business of sustainability

ERM

Azito Energie

Environmental and Social Impact Assessment (ESIA) for the Azito Phase IV Expansion Project

March 2018

For and on behalf of
Environmental Resources Management

Approved by: Camille Maclet

Signed: 

Position: Partner

Date: 12 March 2018

ENVIRONMENTAL RESOURCES MANAGEMENT LIMITED

INCORPORATED IN THE UNITED KINGDOM WITH REGISTRATION NUMBER 1014622

REGISTERED OFFICE: 2ND FLOOR, EXCHEQUER COURT, 33 ST MARY AXE, LONDON, EC3A 8AA

0 NON TECHNICAL SUMMARY

0.1 INTRODUCTION

This Non-Technical Summary presents the findings of the Environmental and Social Impact Assessment (ESIA) for the Phase IV Expansion Project of the existing Azito Power Plant in Abidjan, referred to as the 'Project'.

The Project is being developed under a memorandum of understanding between Azito Energie and the government of Côte d'Ivoire.

In line with international best practice, the Project has chosen to broaden the scope of the ESIA by being in line with applicable Ivoirian laws and regulations as well as international standards (i.e. IFC Performance Standards and EHS Guidelines). It is noted that an ESIA for the previous Phase III extension was completed in-line with the IFC Performance Standards and validated by ANDE on September 12th 2012.

As required under the Environment Code of the republic of Côte d'Ivoire, the Terms of Reference (ToRs) for Phase IV were validated by the Agence Nationale de l'Environnement (ANDE) on 30th of November 2016. The ESIA was subsequently developed based on those approved ToRs. The ESIA report will be submitted to the ANDE in order to apply for a certificate of Environmental Compliance.

0.2 THE PROJECT

The existing Azito gas-fired power plant (Phases I and II) was commissioned in January 1999 and was subsequently converted from open-cycle to combined cycle as part of the Phase III expansion, and commissioned in 2015.

The operational company in charge of operations of the Azito facility is Azito Operations and Maintenance (AZOM).

At the time of issuing this report, the facility has a total installed capacity of approximately 430 MW_e. The Phase IV expansion will increase the power delivery of the overall plant by approximately 250 - 335 MW_e through the installation of a new combined cycle gas turbine (CCGT) and associated equipment.

In total, this expansion will increase the overall plant installed capacity to approximately 680 – 765 MWe. This will improve the power generation capacity of Côte d'Ivoire and contribute to developing a more reliable power supply in the country.

The Project is located in Azito village in the Yopougon District, 300 m southeast from Béago village, as shown in *Figure 0.1*. Phase IV will be located

within the existing Azito plant site boundaries and immediately to the east of the existing power generating facilities.

The Phase IV facility will be capable of running in either open cycle mode or combined cycle mode. It is anticipated that plant will achieve open cycle operation (OCGT) in the second half of 2018. The plant will then run in open cycle mode until the plant achieves combined cycle operation in the second half of 2019. The new power train will utilise a single gas turbine combusting natural gas as primary fuel. It will also have the possibility to operate on distillate diesel oil (as backup only, less than 5% of the operating time). The operating schedule will be 24 hour per day, 7 days per week, excluding shutdowns.

Water will be supplied from an existing water wells installed as part of Phase III. Chemical handling and storage practices will be very similar to those implemented during Phase III. Phase IV will share some utilities with the existing power plant facility.

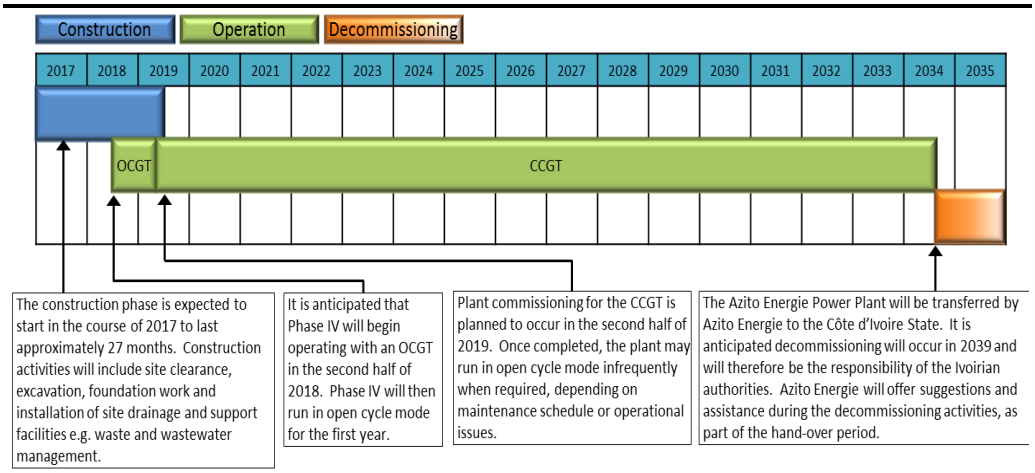
In the construction phase, the Project will include a laydown area, an access road and possibly the establishment of a camp for workforce housing. For the purpose of this study, it is assumed that these will be located within the vicinity of the existing plant. At this stage, several options are currently under consideration, and will be selected on the basis of detailed design. It is also possible that construction workers will be housed in existing lodgings in the surrounding communities, for example Azito and Béago villages.

No resettlement of third parties will be required as part of the Project.

Figure 0.1 Project Location

The Project will be carried out in three phases as described in *Figure 0.2* including: construction, operation, and decommissioning.

Figure 0.2 ***Project Phases***



0.3 *STAKEHOLDER ENGAGEMENT*

In line with Ivoirian regulations and international good practice, AZOM engages with stakeholders as part of routine operations. Specific Stakeholder engagement was also undertaken to support this ESIA.

Stakeholders include relevant regulatory and administrative bodies, communities affected by the Project, and other interested parties such as local businesses, associations and cooperatives, Ivoirian and international non-governmental organisations (NGOs), and other interest groups.

The programme of consultations undertaken as part of the ESIA was designed to inform stakeholders about the developing plans and give them an opportunity to express views on the Project and on impacts that should be investigated in the ESIA.

- In September 2016, consultations with the ANDE, the Technical Service of Yopougon, the village of Azito and the village of Béago. These consultations focussed on providing information about the Project and the ESIA process as well as supporting the analysis of baseline sensitivities (see *Figure 0.3*).
- Submission and presentation of the ESIA's Terms of Reference to the ANDE in November 2016 accompanied by ANDE site visit to the site in November 2016;

The results of these consultations were taken into account during the process of completing the ESIA assessment and are discussed in the ESIA Report.

Following the submission of this ESIA report to the ANDE, another round of public consultations will take place, whereby the ESIA report will be made

widely available for public comment, and its findings communicated to affected communities through a wide variety of means. Comments made on the Project, its impacts and the proposed mitigation will be considered in developing and operating the Project.

Figure 0.3 Photographs illustrating the public consultations held for the ESIA

Top left: Consultation with the Municipality of Yopougon. Top right: Meeting with the representatives (chefferie) of the Azito village. Bottom left: Visit of the Azito school, part of the CSR program of Azito Energie. Bottom right: Meeting with the representatives (chefferie) of the Béago village

0.4 ASSESSMENT OF POTENTIAL IMPACTS

Table 0.1 presents a summary of the potential impacts including an overview of key mitigation measures and the resulting residual impacts.

As Phase IV will be very similar to Phase III, mitigation measures have been built upon good practices and experiences gained through Phase III.

Residual impacts are defined as those impacts that remain following the implementation of the mitigation measures proposed. Mitigation measures for each area of environmental and social impact are discussed in full in the relevant technical chapters.

Table 0.1 Summary of Potential Impacts

Topic	Potential Impacts	Residual Impact
Air Quality [(a)]	Increased dust generation from construction activities leading to nuisance/human health impacts	Negligible - Minor
	Increased emissions from traffic leading to nuisance/human health impacts	Minor (PM_{10} and $PM_{2.5}$ from vehicle exhaust) Negligible (NO_2 from vehicle exhaust and Dust)
	Increased operational emissions of NO_2 and NO_X in OCGT mode resulting in impacts on human health and sensitive ecological receptors	Minor for the NO_2 1 hour maximum Negligible for all other pollutants of interest
	Increased operational emissions of NO_2 and NO_X in CCGT mode resulting in impacts on human health and sensitive ecological receptors	Moderate for the NO_2 1 hour maximum Negligible for all other pollutants of interest
Noise	Noise generated by construction works resulting in impacts to sensitive receptors	Minor
	Noise generated by construction traffic resulting in impacts to sensitive receptors	Minor – Negligible (depending on receptor location)
	Noise generated during operation resulting in impacts to sensitive receptors	Minor – Negligible (depending on receptor location)
Climate Change	Increased GHG emissions from operation of the gas turbine train	Significant
Water	Increased groundwater abstraction leading to saline intrusion in the aquifer and reduced water availability	Negligible (if optional mitigation applied)
	Consumption of water resources and reduced water availability	Negligible
	Degradation of surface water quality from site runoff, discharges of sanitary effluent or marine transportation (if applicable)	Negligible
Biodiversity	Habitat loss resulting from construction activities	Negligible
	Accidental introduction and spread of invasive species	Negligible
Socio-Economics	Direct employment opportunities and skills enhancement	Positive

Topic	Potential Impacts	Residual Impact
	Potential impacts on the local and national economy from increased power generation capacity	Positive
	Potential loss of livelihood due to temporary land leasing	Negligible
	Pressure on infrastructure, resources and services due to in-migration	Minor to Negligible
Community Health, Safety and Security	Interaction with local communities and communicable diseases	Minor
	Workers influx and sociocultural changes	Negligible
Worker Health, Safety, Security and Labour and Working Conditions	Workers health and safety and security	Minor to Negligible (depending on the EPC contractor's safety culture)
	Labour and working conditions	Minor to Negligible (depending on the EPC contractor's safety culture)
Ecosystem Services	Impact assessed in: degradation of surface water quality from site runoff, discharges of sanitary effluent or marine transportation (if applicable); and Increased groundwater abstraction leading to saline intrusion in the aquifer and reduced water availability	Not applicable
Cultural Heritage and Traditions	Damage or degradation of cultural heritage during construction activities	Negligible
Waste Management	Increased waste generation during construction and operation	Minor

Note:
(a) The atmospheric dispersion modelling is based on an 'E-class' gas turbine; however, the Project is still considering multiple turbine design options. If an alternative design is selected, the Project will revise the air dispersion modelling.

Note on Decommissioning Phase

Over the years of the Project's operation until decommissioning, environmental and social conditions in the area will change. It is not possible therefore to precisely determine decommissioning impacts at this early stage. The specific impact and mitigations for the decommissioning phase will be assessed nearer the time by Azito Energie as part of formulating a decommissioning plan compliant with relevant regulations and standards.

In many respects, decommissioning activities are similar to construction activities, hence many mitigation measures presented in the ESIA for the construction phase are likely to apply to the decommissioning phase.

0.5 MANAGEMENT OF POTENTIAL IMPACTS

The main tool for the management of potential impacts is the Environmental and Social Management Plan (ESMP).

The ESMP summarises mitigation measures that have been committed to by the Project. It also identifies the parties responsible for implementation of the measures, the proposed timing of the measures, and indicators that may be monitored to verify the effectiveness of these measures. This ESMP is presented in detail as Annex D, at the end of the ESIA report.

The main parties responsible for implementation of the mitigation measures will be Azito Energie and the EPC contractor during construction. Azito O&M will be responsible for implementation of mitigation measures during operations.

0.6 STRUCTURE OF THIS REPORT

The structure of this document is set out in *Table 0.2*.

Table 0.2 Structure of the ESIA

Report Location	Description
Non-Technical Summary	
Section 1	Introduction
Section 2	Project Description
Section 3	Legal and Policy Framework
Section 4	Scope of the ESIA
Section 5	Methodology
Section 6	Stakeholder Engagement
Section 7	Baseline Conditions
Section 8	Assessment of Potential Impacts
Section 9	Management of Potential Impacts
Annex A	Supporting Documentation for Air Quality Assessment
Annex B	Supporting Documentation for Noise Assessment
Annex C	Alternatives Assessment
Annex D	Environmental and Social Management Plan (ESMP)
Annex E	Additional Social Data
Annex F	Terms of Reference
Annex G	Stakeholder Engagement

0.7 NEXT STEPS

In accordance with the Environment Code of the Republic of Côte d'Ivoire, and EIA regulations, this ESIA report will be submitted to the ANDE in support of an application for a Certificat de Conformité Environnementale.

As aforementioned this submission will be followed by a programme of disclosure and stakeholder engagement designed to provide all interested parties with an opportunity to understand and comment on the proposals and their impacts.

Once the Certificat de Conformité Environnementale is duly issued by the Ministry in charge of environment, the Project will proceed to detailed engineering, construction and subsequent operation. Agreed mitigations measures will be implemented as defined in the ESMP.

TABLE OF CONTENTS

GLOSSARY

Term	Definition
Access Road	Refers to the 0-39 km section of road from the COF. Becomes the infield haul road at 39 km to connect the COF to the JV and Adjacent Area.
Additional Mitigation Measures	Any mitigation measures identified through the ESHIA which are in addition to those already considered as embedded.
Area of Influence	Under International Finance Corporation (IFC) Performance Standard 1, "Area of Influence" is defined to encompass: • *The area likely to be affected by:* o *the project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project;* o *impacts from unplanned but predictable developments caused by the project that may occur later or at a different location;* o *indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.* • *Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable;* • *Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.*
Biodiversity Action Plan	A set of future actions that will lead to the conservation or enhancement of biodiversity.
Biodiversity	The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems (Convention on Biological Diversity, 1992).
Biodiversity Offsets	Measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken (IFC 2012a).
Critically Endangered (CR)	A category on the IUCN Red List of Threatened Species, indicating a taxon is considered to be facing extremely high risk of extinction in the wild (IUCN, 2000).
Critical Habitat	Areas with high biodiversity value, including habitat of significant importance to critically endangered or endangered species, restricted range or endemic species, globally significant concentrations of migratory and/or congregatory species, highly threatened and/or unique ecosystems and key evolutionary processes (paragraph 16: IFC, 2012a).
Critical Habitat Assessment	An evaluation as to whether a given region contains any areas that qualify as Critical Habitat under the definition above.
Cumulative Impact	Potential impacts that result from the incremental impact on areas or resources used or directly impacted by the project from existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.

Term	Definition
Direct Impact	Potential impacts that result from a direct interaction between the Azito Phase IV Project (construction and operation) and a resource/receptor (e.g. between development of a plot of land and the habitats which are affected).
Discrete Management Unit	An area with a clearly demarcated boundary within which the biological communities and/or management issues have more in common with each other than they do with those in adjacent areas (GN65: IFC, 2012b).
Ecosystem services	The benefits that people, including businesses, derive from ecosystems. Ecosystem services are organized into four categories: (i) provisioning services, which are the products people obtain from ecosystems; (ii) regulating services, which are the benefits people obtain from the regulation of ecosystem processes; (iii) cultural services, which are the nonmaterial benefits people obtain from ecosystems; and (iv) supporting services, which are the natural processes that maintain the other services (paragraph 2: IFC, 2012a). (see also: Priority ecosystem services).
Embedded mitigations	Mitigations taken into consideration when determining the significance of a potential impact. These may take the form of design measures, existing company plans and procedures, regulatory requirements or control measures included in Company plans and contract requirements.
Endangered (EN)	A category on the IUCN Red List of Threatened Species which indicates a taxon is considered to be facing a very high risk of extinction in the wild (IUCN, 2000).
Endemic	Any species whose range is restricted to a limited geographical area (UNEP WCMC Biodiversity a-z).
Hazard	Potential source of harm.
Impact magnitude	The term 'magnitude' is used as shorthand to encompass all the dimensions of the potential impact including: • the nature of the change (what may be affected and how); • its size, scale or intensity; • its geographical extent and distribution; and • its duration, frequency, and reversibility.
Impact significance	There is no agreed universal definition of significance for impact assessments; however, the following practical definition has been used for this ESIA: An impact is significant if, in isolation or in combination with other impacts, it should, in the judgement of the ESIA team, be taken into account by others in making decisions on the project. • An impact of **negligible** significance is one where a resource/receptor (including people) may not be affected in any perceivable way by a particular activity or is indistinguishable from natural background variations. • An impact of **Minor** significance is one where a resource/receptor may experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude is expected to be within applicable standards. • An impact of **Moderate** significance has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to and including applicable standards or legal limits. • An impact of **Major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors.

Term	Definition
Indigenous peoples	In IFC Performance Standards, this term is used in a generic sense to refer to a distinct social and cultural group possessing a number of characteristics in varying degrees (see IFC Performance Standard 7, paragraph 5).
Indirect impacts	Potential impacts that follow on from direct interactions between the Azito Phase IV and its environment as a result of interactions between different aspects of the environment (e.g. viability of a species population resulting from loss of part of a habitat as a result of the Azito Phase IV developing additional land).
Initial risk	Risks that are assessed with a level of mitigation that is consistent with the requirements of national regulations.
Induced impacts	Potential impacts that result from other activities (which are not part of the Azito Phase IV) that may be related to the Azito Phase IV (e.g. an increase in stress and reduced wellbeing in the community caused by perceived health impacts).
Invasive Alien Species	A species, subspecies or lower taxon, introduced outside its natural past or present distribution; includes any part, gametes, seeds, eggs, or propagules of such species that might survive and subsequently reproduce (CBD Secretariat, 2002; UNEP WCMC Biodiversity a-z).
Legally Protected Area	A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values. For the purposes of IFC Performance Standard 6, this includes areas proposed by governments for such designation (IUCN definition 2008, footnote 16: IFC, 2012a).
Mitigation measures	A feature, procedure or other action that the project commits to implement to avoid or reduce the magnitude of an adverse impact, or to enhance the magnitude of a positive impact. Interventions, controls and barriers that proactively reduce the likelihood and/or significance of a potential impact (or potential top event) and recovery measures which further reduce the significance of potential impacts (or consequence of unplanned events) after they have arisen.
Modified Habitat	Areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition (paragraph 11: IFC, 2012a). In practice, natural and modified habitats exist on a continuum that ranges from largely untouched, pristine natural habitats to intensively managed modified habitats (GN27: IFC, 2012b).
Natural Habitat	Areas composed of viable assemblages of plant and/or animal species of largely native origin and/or where human activity had not essentially modified an area's primary ecological functions and species composition (paragraph 12: IFC, 2012a).
Net Gain	Net gains are additional conservation outcomes that can be achieved for the biodiversity values for which Critical Habitat was designated, after any significant adverse project impacts have been mitigated (see footnote 15: IFC, 2012a).
New Project Support Facility (Associated Facility)	A new or expanded facility that is: • Utilised by Azito Phase IV; and • Whose viability is dependent on Azito Phase IV; and /or • Whose goods or services are essential to Azito Phase IV.

Term	Definition
No Net Loss	The point at which the project-related impacts on biodiversity are balanced by measures taken to avoid and minimize the project's impacts, to undertake on-site restoration and finally to offset significant residual impacts, if any, on an appropriate geographic scale (e.g. local, landscape-level, national, regional) (footnote 9: IFC, 2012a).
Outcomes	A range of possible consequences arising from a top event.
Primary Supply Chain	A third party facility that is: • Supplying Azito Phase IV with a service or supply via contract; and • Providing a service classified as a higher potential impact; and/or • Depending on Azito Phase IV for their viability and existence (or more than 50% of business/income from Azito Phase IV).
Priority ecosystem services	Priority ecosystem services are two-fold: Type I are those services on which project operations are most likely to have an impact, resulting in adverse impacts on affected communities. Type II are those services on which the project is directly dependent for its operations (e.g. water) (paragraph 24: IFC, 2012a).
Project component	Facility and activity, service and supply necessary to enable the project.
Protected area	See Internationally Recognised Area and Legally Protected Area.
Receptor	Humans and other ecological features that is sensitive to, or has the potential to be affected or impacted by project activities. These are addressed in the impact assessment process in the same way as resources.
Restricted range	Species with a geographically restricted area of distribution (UNEP WCMC Biodiversity a-z). In IFC Performance Standard 6, restricted range is defined for terrestrial vertebrates as an extent of occurrence of 50,000km^2 or less, and for marine species as 100,000km^2 or less (GN80: IFC, 2012b).
Residual risk	Risk levels remaining after additional mitigation measures, those which go beyond embedded mitigations, are applied.
Resource	An element of the physical, biological, cultural or human environment which is not a human or other animal (these are referred to as receptors) which can be impacted by the project activities. Typical resources include, but are not necessarily limited to: • in the physical environment: geological resources; sediments; land; water quality; water supply; air quality; noise level; vibration levels; light. • in the biological environment: terrestrial, freshwater and marine habitats; flora; biodiversity at the community, species and genetic levels; protected areas; ecosystem services. • in the human or cultural environment: subsistence resources; community health, welfare, amenity and safety; employment and incomes; business and economic activity; land use; traffic; sites and features of archaeological, historic, traditional, cultural or aesthetic interest. These are often referred to as sources of human capital, or livelihood assets.
Spatial Scope	The spatial scope represents the Area of Potential Impact, also referred to as the Area of Influence under the IFC Performance Standards.

Term	Definition
Secondary Supply Chain	Secondary Supply Chain: A third party facility: • Supplying Azito Phase IV with a service or supply via contract; and • Providing a service classified as a low potential impact and/or; • Whose viability and existence do not depend on Azito Phase IV for their existence (less than 50% of business/income from Azito Phase IV).
Technical scope	The range of resources/receptors addressed in the ESIA. The technical scope was determined as part of the scoping exercise.
Temporal scope	The time period over which project activities that have the potential to result in impacts will occur.
Unplanned event	Potential accidental events, as opposed to routine events or emissions. For the purpose of this ESIA: • events considered to have probability 1 of occurring are considered planned events; and • events that have probability <1 of occurring are unplanned events. However, this description is just a guide. There are some unplanned events that are very likely to occur. In these cases, the impacts and necessary risk reduction measures are assessed within the planned events section, where there is more focus on the impacts on different receptors.
Unplanned impacts	Potential impacts which may occur as a result of an unplanned event such as loss of containment into a water body
Valuable Ecological Component	Fundamental element of the physical, biological or socio-economic environment including air, water, soil, terrain, land use, vegetation, fish, birds and mammals that may be affected by a proposed project
Vulnerable group	Vulnerable groups include people who, by virtue of gender, sexuality, ethnicity, age, physical or mental disability, economic disadvantage or social status may be more adversely affected by a project than others, and who may be limited in their ability to take advantage of a project's development benefits.
Worst case	A major hazard scenario that can realistically be conceived from a specific cause.

ACRONYMS

Acronym	Description
AERMOD	Dispersion Model
AfDB	African Development Bank
ANARE	National Regulatory Authority of Electricity Sector of Côte d'Ivoire
ANDE	Agence Nationale de l'Environnement
AoI	Area of Influence
AZOM	Azito Energie and Azito O&M
BS	British Standard
CBD	Convention on Biological Diversity
CCGT	Combined Cycle Gas Turbine
CDC	
CH_4	Methane
CHSCT	Health, Safety and Working Conditions Committee
CIAPOL	Centre Ivoirien Antipollution
CIE	Compagnie Ivoirienne d'Electricité
CIPREL	Compagnie Ivoirienne de Production d'Electricité
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CLO	Community Liaison Officer
CNPS	National Social Insurance Fund
CNR	
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
DDO	Distillate Diesel Oil
DEG	
DGH	General Manager of Hydrocarbons
DMRB	Design Manual for Roads and Bridges
EBRD	European Bank of Reconstruction and Development
ECOWAS	Economic Community of West African States
EHS	Environmental, Health and Safety
EPC	Engineering, Procurement and Construction Contractor
ERM	Environmental Resources Management
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
FPIC	Free, Prior and Informed Consent
FMO	
FNDE	Environmental National Funds
GDP	Gross Domestic Product

Acronym	Description
GHG	Greenhouse Gases
GIIP	Good International Industry Practice
GPS	Global Positioning System
GM	Grievance Mechanism
GoCI	Government of Côte d'Ivoire
HGV	Heavy Goods Vehicle
HP	High Pressure
HRSG	Heat Recovery Steam Generator
ICP	Informed Consultation and Participation
ICPE	Classified Installations for Environmental Protection
IFC	International Finance Corporation
ILO	International Labour Organization
INS	Institut National de la Statistique
IUCN	International Union for Conservation of Nature and Natural Resources
LP	Low Pressure
MARPOL	International Convention for the Prevention of Pollution from Ships
MEEF	
MPE	Ministry of Petroleum and Energy
MW	Megawatt
NGO	Non-Governmental Organization
NO_2	Nitrogen Dioxide
N_2O	Nitrous Oxide
NSR	Nearest Sensitive Receptors
OCGT	Open Cycle Gas Turbine
OHS	Occupational Health and Safety
O&M	Operation and Management
ONEP	National Potable Water Office
PC	Process Contribution
PEC	Predicted Environmental Concentration
PETROCI	National Company for Petroleum Operations in Côte d'Ivoire
PHC	Primary Health Care
PM	Particulate Matter
PSs	Performance Standards
SAoI	Social Area of Influence
SDIIC	Sous-direction de l'Inspection des Installations Classées
SEP	Stakeholder engagement plan
SMP	Security Management Plan
SO_2	Sulfur Dioxide
SODECI	National Water Company
STIs	Sexually Transmitted Infections
ToR	Terms of Reference

Acronym	Description
TSS	Total Suspended Solids
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UNIPOL	United Nations Anti-pollution Police Unit
US EPA	United States Environmental Protection Agency
WB	World Bank
WHO	World Health Organization
WMP	Waste Management Plan

1 INTRODUCTION

1.1 THE PROJECT

This document is the Environmental and Social Impact Assessment (ESIA) for the Phase IV Expansion Project of the existing Azito Power Plant in Abidjan, hereinafter referred to as the 'Project'. Azito Energie is the Project Company.

The existing Azito gas-fired power plant (Phases I and II) was commissioned in January 1999 and was converted from open-cycle to combined cycle in 2015 as part of the Phase III expansion.

The Phase IV expansion will increase the power delivery of the overall plant by approximately 250 - 335 MW_e through the installation of a new combined cycle gas turbine (CCGT) and associated equipment. The Project location is shown in *Figure 0.1*.

1.2 THE PURPOSE OF THIS DOCUMENT

Azito Energie is seeking financing from multinational financial institutions to fund the Project. The ESIA has been undertaken in accordance with Ivorian legislative requirements and the IFC requirements. It has been prepared on behalf of Azito Energie by Environmental Resources Management Limited (ERM).

1.3 NEED FOR THE PROJECT

Since 1984, unusually dry weather and ensuing hydroelectricity shortage in Côte d'Ivoire demonstrated the vulnerability of generating electricity from hydroelectric facilities and sensitized the government to the need to define and direct a comprehensive and coherent energy policy.

The available generating capacity in 2015 was approximately 1770 MW_e, consisting of the existing Azito plant (430 MW_e), the CIPREL plant (540 MW_e), the Aggrekko plant (100 MW_e), all located close to Abidjan, plus the contribution of hydropower plants located a few hundred kilometers away from the consumption centers. There is no power reserve available and the existing plants have to run continuously at close to maximum output in order to meet consumer demand.

This Project will increase long-term delivery of electricity in Côte d'Ivoire and contribute to developing a more effective power supply in the country. The proposed Azito expansion Project stems from a memorandum of understanding between Azito Energie and the government of Côte d'Ivoire to install an additional capacity of approximate 250 - 335 MW_e at the Azito facility. The upgraded plant will provide a total installed capacity of approximate 680 - 765 MW_e.

2 PROJECT DESCRIPTION

2.1 PROJECT OVERVIEW

2.1.1 Project Background

Azito Energie proposes to expand its existing 430MW combined cycle gas turbine (CCGT) power plant (Phase I, II and III) in the district of Azito, in the city of Abidjan, Côte d'Ivoire. The expansion (Phase IV) consists of adding one gas turbine, one heat recovery steam generator (HRSG), and one steam turbine with air cooled condenser on a 1-1-1 configuration with a combined additional output of approximately 250 – 335 MW.

This expansion will increase the overall plant output to approximately 680 - 765 MWe. This Project will increase long-term delivery of electricity in Côte d'Ivoire and contribute to developing a more effective power supply in the country.

In line with the Ivorian Policy Framework to increase electricity supply and to meet the growing national need for electricity as early as possible, it is anticipated that Phase IV will be operating with an open cycle gas turbine (OCGT) in the second half of 2018. Phase IV will then run in open cycle mode for approximately 12 months until the plant achieves CCGT commercial operation in the second half of 2019 (see *Section 2.3.1*).

The following *Sections* provide a detailed description of the Project, including the power plant itself and its associated facilities (1).

As part of the Project, an additional connection to the adjacent existing substation will need to be constructed. At this stage, the need for additional transmissions lines to evacuate the additional power that will be produced by the expanded plant has not yet been confirmed and has not been assessed as part of this ESIA. It is noted that upgrading works of the substations might be needed but no associated impacts are expected. The need for upgrading the substation will be determined as the design progresses.

2.1.2 Côte d'Ivoire Power Sector Context

Since 1984, unusually dry weather and ensuing hydroelectricity shortage in Côte d'Ivoire demonstrated the vulnerability of generating electricity from hydroelectric facilities and sensitised the government to the need to define and direct a comprehensive and coherent energy policy.

In 1990, the Ivoirian Government initiated an important restructuring phase of the power sector by granting the management of the national public service

(1) Associated facilities are facilities that would not have been constructed or expanded if the project did not exist and without which the project would not be viable (IFC, 2012). In particular of relevance for this Project are worker accommodations camp during construction, laydown area, and substation upgrade.

for generation, transmission, distribution, export and import of electrical energy to a private company. This restructuring was aimed at securing self-financing and the sector's financial stability as well as optimising the operation of the electric utility system.

The discovery at the end of 1993 and 1994 of the "Lion" offshore oil and associated gas field, and of the "Panther" offshore dry gas field, gave the government the opportunity to consider thermal energy as an option for further development of its generating facilities.

With this in mind, the government signed an agreement in 1994 with a private operator, Compagnie Ivoirienne de Production d'Electricité (CIPREL), for the construction, operation and transfer of ownership of a thermal power generating facility of approximately 210 MW capacity (Vridi II, in the Abidjan area). The public-private partnership agreement reached with CIPREL, the first of its kind in Côte d'Ivoire and in Sub-Saharan Africa, demonstrates the Government's intent to divest from the electricity generation sector.

With the strength of this first successful experience in the field of independent electricity production, the Government intended to pursue and intensify its policy for cost reduction and efficiency improvement of the sector, to support the economic growth in Côte d'Ivoire. These objectives were to be reached through the efficient use of oil and gas resources available in the country, as well as by allowing the establishment of other independent producers, thus promoting competitiveness in the sector.

The available generating capacity in 2015 was approximately of 1770 MW_e, consisting of the existing Azito plant (430 MW_e), the CIPREL plant (540 MW_e), the Aggrekko plant (100 MW_e), all located close to Abidjan, plus of the contribution of hydropower plants located a few hundred kilometers away from the consumption centers. There is no power reserve available and the existing plants have to run continuously at close to maximum capacity to meet consumer demand.

The proposed Azito expansion Project stems from a memorandum of understanding between Azito Energie and the government of Côte d'Ivoire to install an additional capacity of approximately 250 - 335 MW_e at the Azito facility.

2.1.3 Project Location

As illustrated in *Figure 0.1* in the *Non Technical Summary*, the Azito plant is located approximately 300 m from Azito village in the Yopougon District, approximately six kilometres west of the port of Abidjan (the site). The site is located alongside the western arm of the Ebrié lagoon, approximately 10 km from the inlet of the Vridi canal. Béago village is located 300 m to the northeast of the Azito site. Phase IV will be located within the existing Azito plant site boundaries (see *Figure 2.2*).

The site is bordered by two gas treatment units, independently operated by Foxtrot for the first one and Petroci for the second one, which provide condensate-free feed gas to Azito (along the northern fence), and by an electrical switchyard operated by the *Compagnie Ivoirienne d'Electricité* (CIE – national electricity distribution company) and a construction yard for concrete caissons.

2.1.4 Existing Installations

Overview

The existing Azito Energie Power Plant (the Power Plant) has a total capacity of approximately 430 MW_e, including three phases, each of around 144 MW. Phase I (one gas turbine) was completed in January 1999 and Phase II (similar to Phase I) was commissioned in February 2000. Phase III (upgrading the plant from open cycle to combined cycle power generation) was completed in 2015.

An ESIA for Phase III was completed in-line with the IFC Performance Standards in 2015.

Figure 2.1 View of the Existing Power Plant

Source: Presentation for General Directory of Energy, Azito Energie, 23 September 2016

Source of Gas

The gas used to run the power plant since commissioning of the first two phases of Azito comes from three sources within Côte d'Ivoire: the Devon fields (Lion/Panther), the Foxtrot field, and the CNR fields (Espoir/Baobab). To-date, however, gas is primarily supplied to the plant by the Foxtrot field.

The initial gas study undertaken for Phase I and II confirmed the availability of gas reserves until 2022. The Sponsors have commissioned a gas supply study which will be provided to the Lenders and which will provide updated information on the gas supply in Côte d'Ivoire and the supply to the expanded plant. Gas will continue to be supplied to the Azito power plant from these sources once Phase IV of Azito is operation; there will be no new gas supply.

Storage of Hazardous Products

The products and chemicals routinely stored on site are relatively low.

Two fuel tanks, with a capacity of 6,000m³ each were installed during the initial construction phase in 1999. A few production tests were performed with distillate diesel oil in 2000, since then the turbines have always been operated with gas. Azito Energie has now emptied the tanks.

The current annual water consumption of the site is 7,500 m³ (2,500 m³ coming from the municipality and 5,000 m³ from the borehole).

Personnel

The existing Plant currently employs 35 permanent personnel, headed by the Plant General Manager. The majority have been employed at the plant since Phase I in 1999. The plant personnel have developed skills and experience through the operation of the existing Azito facility and execution of the recent Phase III expansion.

2.2 PROPOSED SITE LAYOUT

Figure 2.2 below illustrates the conceptual site layout and the main components of the proposed Phase IV combined cycle plant.

2.3 PROJECT COMPONENTS

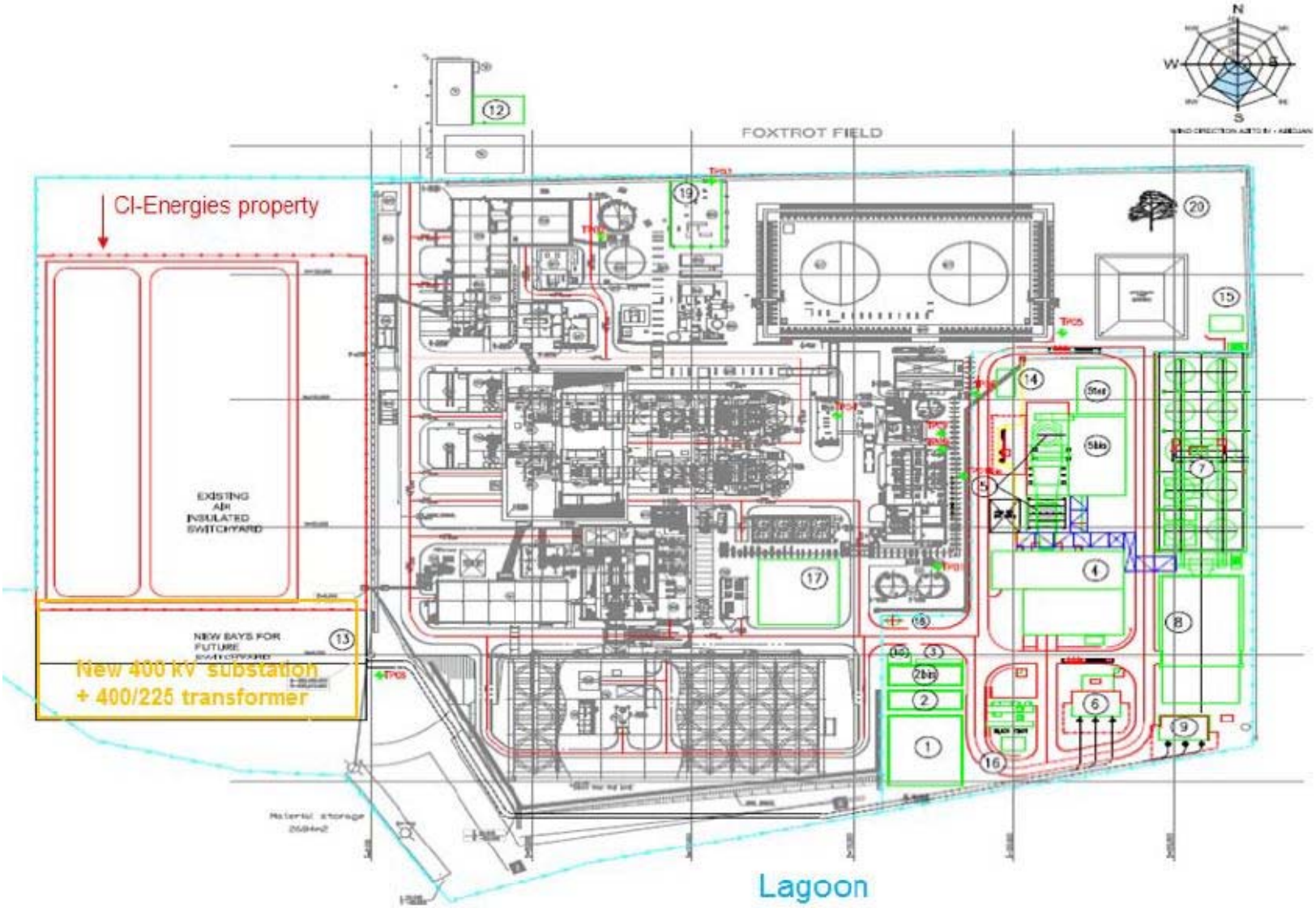
The design of Azito Phase IV will be similar to the design of the existing combined cycle (Phase I, II and III) hence certain balance of plant equipment have spare capacity and would be potentially used for Phase IV (this is still currently under investigation).

The main components of the Project are described in *Table 2.1* (further details are provided in *Figure 2.2).*

Table 2.1 Main Phase IV Components

Expanded Plant Main Components	Description
Gas Turbine	A new gas turbine of approximately 250 – 335 MW capacity will be installed for Phase IV
Thermal Process (HRSG)	The flue gases from the new gas turbine will be led to the heat recovery steam generator (HRSG). Steam is generated in the HRSG by heat transfer from the flue gases to the water/steam cycle, which is converted into superheated steam. The HRSG is a dual pressure boiler comprising a high pressure steam system and a low pressure steam system.
Steam Turbine	Superheated steam from the HRSG will be fed into a new steam turbine installed as part of Phase IV
Gas Turbine Exhaust System	Exhaust from the gas turbine can either be discharged to the atmosphere at a high level via a by-pass stack or an exhaust stack at the outlet of the HRSG.
Main Cooling System	The steam exhaust from the steam turbine will be cooled and condensate to water via an air-cooled condenser (ACC).
Closed Cooling Water System	A closed cooling water system will be provided to supply cooling water to the various plant equipment.
Compressed Air System	The compressed air system will consist of instrument air and service air. The compressed air is generated in a centralized compressor station, which supplies the two different air qualities. The instrument air is filtered and dried and the service air is just filtered.
Chemical Laboratory	The chemical laboratory will include all equipment which is necessary to carry out routine water analysis. Water quality of the condensate, cooling water system, and make-up water for the cooling system can be analyzed.
Buildings	The new steam turbine will be housed in a new building with a new overhead crane. The gas turbine will be housed in a building which is open at the sides. In addition, the existing warehouse building at the Phase III site will be expanded on the existing plant site.
Plant Electrical System	The gas turbine and steam turbine generators will be connected to step-up transformers via a generator circuit breaker and isolated phase bus ducts (one separate system for each).
Distributed Control System	A new plant distributed control system to provide common human machine interface for the operator in the existing control room. The existing central control room will be reorganized in order to house the workstations and the printing devices.
Power Evacuation and Transmission	As part of the Project, an additional connection to the adjacent existing substation will need to be constructed. At present the need for additional transmission lines are required for the evacuation of the additional power that will be produced by the expanded plant at this stage has not been confirmed.

Figure 2.2 Conceptual Layout for Phase IV (Combined Cycle)



Source: Azito Energie, 2016

2.3.1 Power Plant

The power plant will be capable of running in either open cycle gas turbine (OCGT) or closed cycle gas turbine (CCGT) mode. It is anticipated for the plant to achieve open cycle operation in the second half of 2018. The plant will run in open cycle mode for approximately the first 12 months until the plant achieves combined cycle operation in the second half of 2019. Once completed, the plant will be capable to operate in open cycle mode in case of unavailability of the steam cycle.

The new power train will utilise a single gas turbine combusting either natural gas (the primary fuel) or distillate diesel oil (as backup fuel). The potential operating schedule will be 24 hour per day, 7 days per week, excluding shutdowns.

A description of each of these operating modes is provided in the following *Sections*.

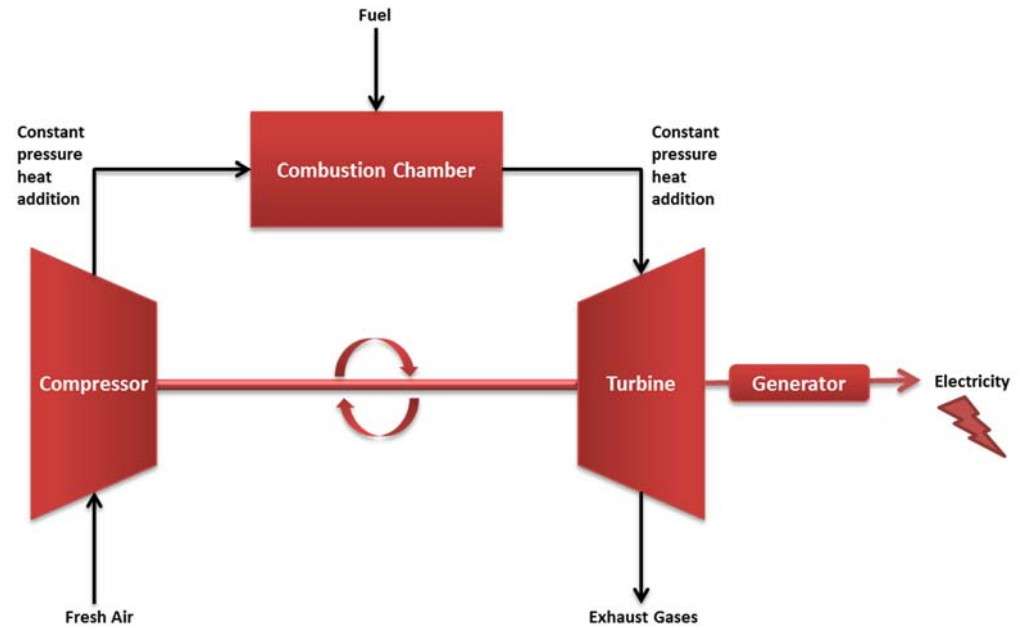
2.3.2 OCGT Process

An OCGT process consists of a gas turbine and a generator. The gas turbine comprises a compressor, combustion system and a power turbine section driving the electricity generator. The gas turbine compressor draws in fresh air and raises the air pressure by compressing it. Fuel is added to the compressed air in the combustion chamber of the gas turbine and ignited. The resulting expanding burning gases turn the power turbine, which is connected to the generator, thereby creating electricity.

The OCGT power plant will run in a base load regime, with an availability factor [(1)] of >90 percent such that the power will be offered to the system operator for dispatch whenever it is available. Power will be offered on a net basis (e.g. the plants internal load will be satisfied from generation before the main power plants fiscal meters).

(1) The availability factor is defined as the amount of time that the power plant is able to produce electricity over a specified period, divided by the amount of the time in the period.

Figure 2.3 A Graphical Representation of the OCGT Power Generation Process

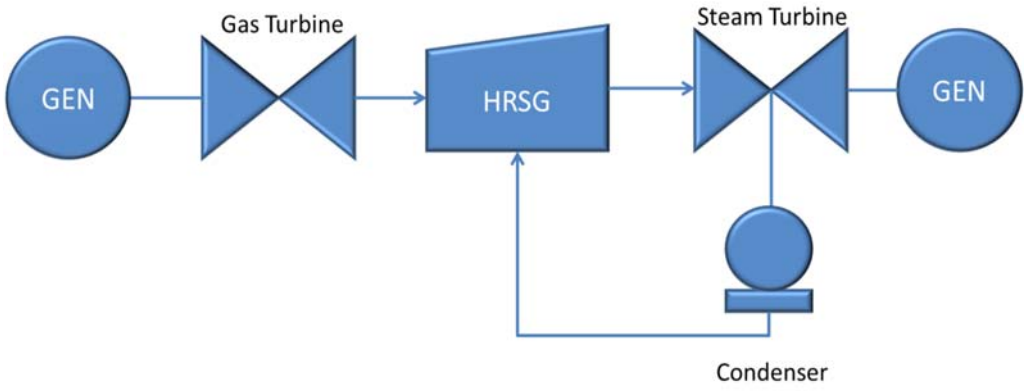


2.3.3 *CCGT Process*

In the CCGT process, the "combined" part of combined cycle refers to the production of both electricity and superheated steam by using the exhaust heat from the gas turbine. Hence, the heat from the gas turbine exhaust gases is re-used in the combined cycle process to generate more electricity through a steam turbine generator.

In addition to the equipment described above in the OCGT process, the combine-cycle equipment will comprise an HRSG, steam turbine generator set and an air cooled condenser. The waste heat from the hot exhaust gases of the gas turbine is recovered and utilised in an HRSG. The HRSG captures heat from high temperature exhaust gases to produce high temperature and high pressure superheated steam, which is then supplied to a steam turbine to generate additional electric power. The HRSG is a dual pressure boiler comprising a high pressure steam system and a low pressure steam system. The hot exhaust gases transfer heat to the feed water in the HRSG, generating both superheated high pressure (HP) steam and low pressure (LP) steam. Steam from each pressure level will be admitted to the steam turbine. A condenser will convert exhaust steam from the steam turbines back into water. The plant will have a main cooling system as well as a closed cooling water system. The main cooling system will cool the steam exhaust from the steam turbine through an air- cooled condenser. The closed cooling water system will supply cooling water to balance of plant equipment.

Figure 2.4 Schematic of the Proposed CCGT Expansion



2.3.4 Gas Turbines

Currently the Project is evaluating both 'E-class' and 'F-class' turbines from various manufacturers. Indicative specifications for emissions from these turbines are presented in *Table 2.2*. These are based on the IFC EHS Guidelines rather than a specific turbine model; however, the models being considered for Phase IV should be below these parameters.

Table 2.2 Indicative Emission Parameters for Phase IV

	Liquid Fuels	**Natural gas**
Noise (dB)	85	85
NO_x (mg/m^3)	152	51
CO (mg/m^3)	100	100
SO_x (mg/m^3)	431	0

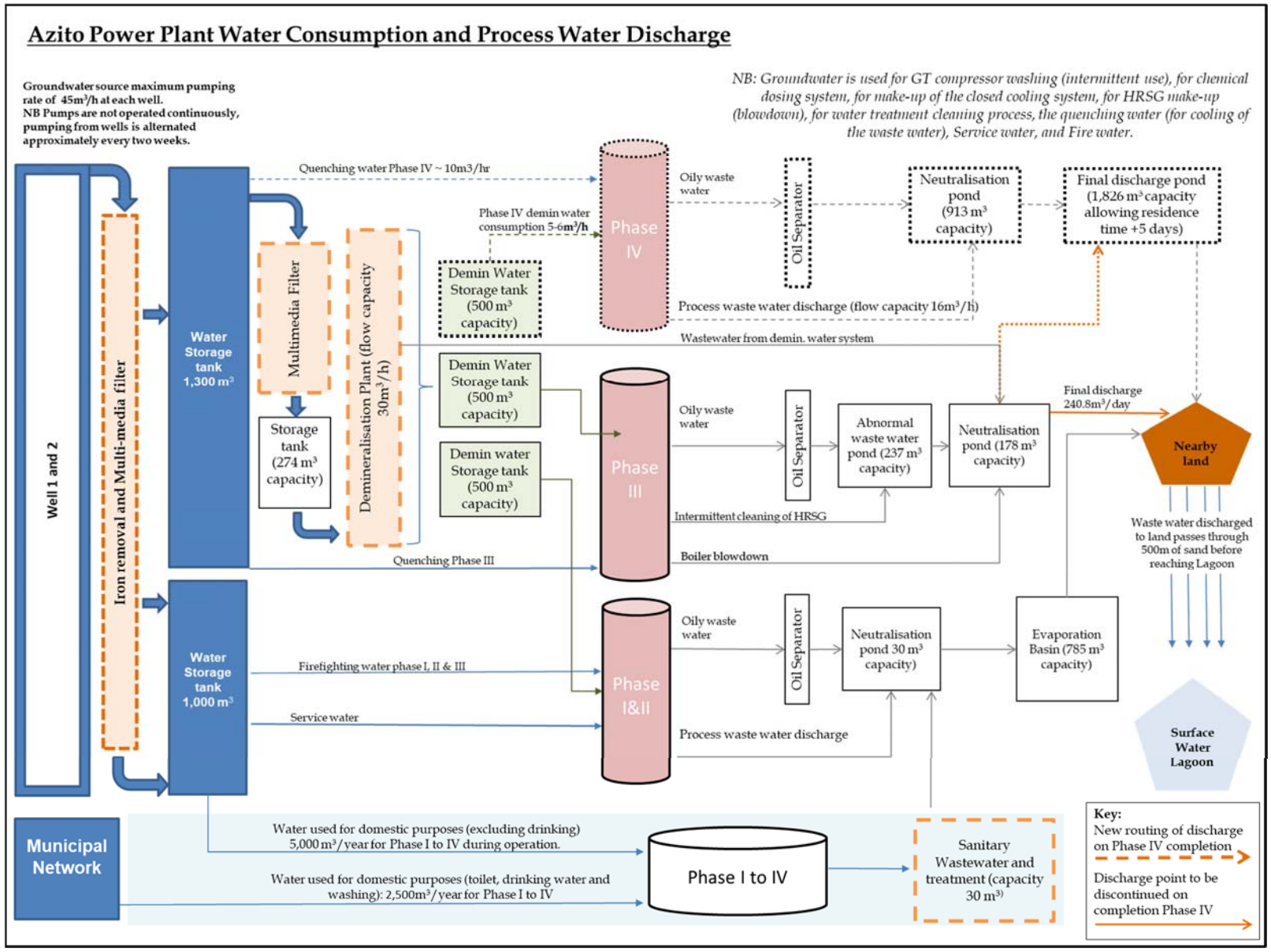
Source: IFC EHS Guidelines for Thermal Power Plants, 2008.

2.3.5 Water Consumption

Two wells (Well 1 and Well 2) provide the site with water. They are used interchangeably and the maximum flow rate is 45 m^3 / h. This maximum flow will not increase for Phase IV. Total water use for the plant, including Phase IV, is shown in *Figure 2.6*.

Figure 2.5 Well Location

Figure 2.6 Water Consumption



Raw water will be used for processes used in Phase IV, including: gas turbine compressor washing (intermittent use), make-up water, chemical dilution injection water for the removal of NO_x (during operation with DDO), the make-up water to the closed cooling water system. Raw water is also needed for several systems at the plant such as fire-fighting water, sanitary water, etc.

The raw water consumption of Phase IV should be around 16 m^3 / hr when operating on gas. It should be higher when running on diesel fuel, mainly because of increasing water use related to water injections to reduce NO_x emissions; however, diesel operation is only an emergency solution.

The use of potable water during expansion will be minimal and will be provided from the same municipal sources that provide the power plant in place.

2.3.6 Chemical Handling and Storage Management

During construction activities, fuel oil, lube oil, paints, and maintenance products are likely to be required. No bulk storage of chemicals is anticipated. Chemical handling and storage practices will be very similar than the one implemented during Phase III construction.

During operations, limited quantities of chemicals are likely to be stored on-site, which mainly includes demineralised water treatment chemicals. Chemical handling and storage practices are unlikely to differ from current practices at the existing Azito plant. The location of the products and chemicals currently routinely stored on site are provided in *Table 2.3*.

Table 2.3 List of Products/Chemicals Stored Onsite and Storage Location

Product/Chemical	Location
Sulfuric acid	Hazardous product storage area
	Demineralization area
	Battery storage area
	Fire pumps area
Caustic soda	Hazardous product storage area
	Demineralization area
Butane gas (bottles)	Hazardous product storage area
	Boiler area
	Restaurant
	Chromatography area
DDO	Hazardous product storage area
	Fire pumps area
	Diesel generator
Solvents	Hazardous product storage area
Lubricating oils	Hazardous product storage area
Transformer oil	Hazardous product storage area
Natural gas	From the Foxtrot gas treatment unit to the gas turbines
Acetylene, oxygen	Hazardous product storage area
	Mechanical workshop

Source: Azito, 2016.

2.4 ANCILLARY FACILITIES

2.4.1 Temporary Construction Worker Accommodation

The location has yet to be determined, with several options currently under consideration. The Project will either include the construction of a worker accommodation camp or workers will be housed in rental accommodations in the village of Azito like for Azito Phase III. The option will be selected based on certain criteria to avoid impacts to sensitive receptors. If avoidance is not possible, impact will be minimised in line with IFC Performance Standards. Recommendations are included in *Chapter 8: Assessment of potential impacts*. No resettlement will be required. For further details, refer to Annex C: Alternatives Chapter.

2.4.2 Temporary Laydown Area for Construction

A temporary laydown area will be required during the construction phase. The location has yet to be determined, with several options currently under consideration. The final site will be selected based on certain criteria to avoid impacts to sensitive receptors. If avoidance is not possible, impact will be minimised in line with IFC Performance Standards. Recommendations are included in *Chapter 8: Assessment of potential impacts*. No resettlement will be required. For further details, refer to the Annex C: Alternatives Chapter.

2.4.3 Access Road for Construction

During construction, the site dedicated for Phase IV could be accessed via existing routes however some upgrades may be required to accommodate the associated vehicle movements. Given the proximity to the newly built camp and laydown area for the expansion work of the container port of Abidjan, and infrastructure built for this installation, the delivery of the equipment could potentially be delivered by barge or by using the existing access road. In order to deliver large loads to the site a number of existing overhead lines may need to be diverted or lifted to enable delivery to the Phase IV site.

The need for new access roads will be determined as the design progresses.

The final option will be selected based on certain criteria to avoid impacts to sensitive receptors. If avoidance is not possible, impact will be minimised in line with IFC Performance Standards. Recommendations are included in *Chapter 8: Assessment of Potential Impacts*.

2.4.4 Security

The Project site will be secured by a permanent fence at an early stage of construction. As it is the case for the existing power plant, security guards will be employed to patrol the site and control access on a 24 hour/7 day basis. All vehicles entering and leaving the site will be screened and searched. All personnel will be required to display personal identification and all

visitors will be required to sign in. The Contractor(s) will be responsible for site security during construction.

2.5 *PROJECT PHASES*

The Project will be carried out in three phases, each outlined below.

2.5.1 *Construction Phase*

Timing

As soon as the ESIA has been approved and the loan granted, Azito management wishes to start the construction. The construction phase is expected to start in the course of 2017 to last approximately 27 months in total, leading to the commissioning of the upgraded facility in two stages: the Open Cycle Operation in 2018 and the Combined Cycle Operation in 2019.

Construction Activities

The construction phase will include the following activities:

- Demarcating the area to be cleared and establishing fencing and other security controls to get access to the site;
- Clearance of vegetation;
- Excavation works and backfill;
- Levelling of the site;
- Steel works/platform/masonry/cladding, etc.
- Foundation work including pilling activities;
- Installation of site drainage and erosion protection and equipment installation; and
- Installation of support facilities including waste and wastewater management equipment, diesel-powered generators, lighting, fuel tanks and storage areas.

Excavation works will follow the site clearance and include the excavations necessary to achieve the works (e.g. for foundations).

Once excavation work is completed, the site will need to be levelled in order to accommodate the power plant equipment. The actual average elevation of the construction area is between +1.50 m and +4.50 m above sea level, whereas the reference platform level of the existing power plant is at +4.50 m above sea level. Based on this, infill will be required in lower areas as part of site preparation. It is estimated that 1m topsoil will be removed and 5.5m infill will be required to raise the site.

Trucks will be used to deliver infill material (e.g. aggregate, sand, soil etc.) to site. It is expected that the infill material will be sourced at a local quarry but the exact location of the quarry and transport routing has not yet been

determined. The peak of Heavy Goods Vehicle (HGV) traffic flow will be for approximately 2 months whilst infill material is delivered to site. During this period, approximately 30 trucks per hour will be used, during daytime hours.

Site preparation works will also include the development of a site drainage system and erosion protection including grading of surfaces to manage stormwater and installation of surface drains to convey run-off storm water to suitable discharge points.

After approximately one month of the construction schedule, piling will be carried out in areas where ground-bearing capacity is insufficient. Once the area is infilled, graded to the correct level and the piles in place, a layer of capping material consisting of graded fill material will be used to form a stable and suitable base upon which to assemble the equipment for Phase IV. Finally the Gas Turbines and other large items of equipment will delivered and installed.

The construction phase is estimated to employ up to 1,000 people at peak workforce, with an average of 400 workers over the construction phase (of approximately 27 months). A resources plan will be prepared by the EPC contractor to identify specific workforce needs and analyse local capabilities, with the aim of maximising local hiring and procurement, including within the wider area of the Municipality of Yopougon. An estimate of the breakdown of national, regional and local employees for construction is not yet available. Due to the short construction timeframe and potential limited availability to provide suitable skills training within this period, it is unlikely that there will be any significant local recruitment, particularly for skilled or semi-skilled workers, and any jobs would likely be temporary. However, local employment will be preferred where possible and incentivised by the Project Company. In addition to employment, the Project will need to procure goods and services. Although the source of these has not yet been determined, the Project will prioritise local procurement where feasible.

2.5.2 *Operational Phase*

Timing

It is anticipated that Phase IV will begin operating with an OCGT from the second half of 2018. Phase IV will then run in open cycle mode until the plant achieves CCGT operation in the second half of 2019.

Operation Activities

The power plant will be operated on a 24 hour, 7 days a week basis. The Project may employ approximately five new people on a full time basis, in addition to the existing workforce at the Azito Power Plant. These may include semi-skilled operators who will operate and maintain the Plant, and are expected to be local staff.

Mainly activities will be related to maintenance work. During commercial operations there will be some traffic bringing supplies to the power plant. This will increase during shutdowns and periods of major maintenance.

2.5.3 Decommissioning Phase

Having entered commercial operation in 1999 (Phase I) and in 2000 (Phase II), the gas turbines and associated installation are currently 17 and 16 years old respectively. When conversion to combined cycle was completed in 2015, another 20 years of useful service was anticipated. Decommissioning should therefore not take place before 2035. Anticipating that the Phase IV plant reaches combined cycle COD 2019 the Phase IV plant will be decommissioned in 2039.

As described in the convention signed with the Ivoirian government, the Azito Power Plant will be transferred by Azito Energie to the Côte d'Ivoire State 20 years after the construction of Phase III (completed in 2015). The decommissioning work will therefore be the responsibility of the Ivoirian authorities. Decommissioning activities should be consistent with Ivoirian regulations and internationally-recognized guidelines and standards. Azito Energie will offer suggestions and assistance during the decommissioning activities, as part of the hand-over period.

3 LEGAL AND POLICY FRAMEWORK

3.1 INTRODUCTION

This ESIA has been prepared in line with applicable Ivoirian laws and regulations as well as the IFC Performance Standards (see *Section 3.3)*. The following sub-sections outline the current institutional, legal, and regulatory framework that are applicable to the Project or have the potential to significantly influence the Project during planning, construction, and operation.

3.2 IVORIAN INSTITUTIONAL CONTEXT

3.2.1 Ivorian Institutional Context

The main national state bodies involved in environmental and social governance in Côte d'Ivoire are describe below.

The Ministry of the Environment, Urban Sanitation and Sustainable Development

Environmental policies are implemented by the Ministry of Environment, Urban Sanitation and Sustainable Development (*Ministère de l'Environnement, de la Salubrité Urbaine et du Développement Durable*) which is also in charge of the definition of national environmental policies and environmental management regulations and requirements. In addition, the role of the Ministry covers the implementation of the Environmental Code and legislation for the protection of nature and the environment.

National Environment Agency

The National Environment Agency (*ANDE: Agence Nationale de l'Environnement*) is a national public agency created in 1997. As outlined in Decree n°97-393 of July 9th, 1997 the ANDE is responsible for implementing the procedure for impact assessment and the assessment of the macroeconomic policies impact on environment.

Ivorian Anti-Pollution Ivoirian Centre (CIAPOL - Centre Ivoirien Antipollution)

The CIAPOL is a public agency created in 1991. As outlined in Decree n°91-662, the missions of the CIAPOL are to assess any type of pollution and nuisance, organise systematic sampling/analysis campaigns for water, waste and residues, collect and publish environmental data, monitor the marine and lagoon environmental conditions and develop an emergency intervention plan against accidental pollution at sea, lagoon or on coastal areas (Pollumar).

The Sous-direction de l'Inspection des Installations Classées (SDIIC) is formerly attached to the Office of the Minister of Environment. SDIIC was

integrated to CIAPOL as Sub-Department, by Order No. 044 / MINEM / IG 24 March 2004. Main SDIIC missions are:

- identify, inspect and control throughout the country, all inconvenient, unhealthy and dangerous installations;

- ensure implementation and enforcement of existing regulations by such installations; and

- ensure adequate management of industrial waste by developing a procedure of disposal of such waste.

The Anti-pollution Police Unit (UNIPOL) was established by Decree No. 00996 of 28 November 2007 amending the Decree No. 556 of 27 February 2002.

Ministry of Health and Fight Against AIDS

The Ministry of Health is responsible for the implementation and monitoring of the Government's policy on health and fight against AIDS. The Côte d'Ivoire health policy is based on the Primary Health Care (PHC). In the regions, this policy is implemented by the Regional Directorates and their decentralized structures.

Ministry of State, Ministry of Employment, Social Affairs and Vocational Training

The Ministry of State, Ministry of Employment, Social Affairs and Vocational Training is responsible for the implementation and monitoring of the government's policy of employment, fighting against poverty and issues related to social affairs. The structures under the supervision of the ministry who will be involved in this study include:

- National Social Insurance Fund (CNPS) It manages the compulsory Social Security private and assimilated. It also operates in the field of health and social; and

- Inspection of Labour, which monitors the implementation of legislation and labour regulations, employment and Social Security, advises the parties and arbitrates individual disputes and ensures compliance with the regulations on occupational medicine.

The Ministry of Petroleum and Energy

The Ministry of Petroleum and Energy (MPE) designs and coordinates the implementation of national policy on hydrocarbons. It is the first official contact for petroleum and energy operators in Côte d'Ivoire. The MPE provides the following services of relevance to this Project:

- General Manager of Hydrocarbons (DGH): the department is responsible for implementing the national policy on hydrocarbons. It is also responsible for investigation of permit requests, distribution and transport of hydrocarbons on national territory.

- PETROCI (National Company for Petroleum Operations in Côte d'Ivoire): the state oil operations company, was established in 1975. PETROCI aims to promote national potential oil and gas resources; develop the hydrocarbon industry; identify and develop oil potential through national campaigns; sign partnership agreements with international companies in the sector; etc.

ANARE

The National Regulatory Authority of Electricity Sector of Côte d'Ivoire (ANARE)

The missions of the ANARE can be summarised as:

- Monitoring of compliance amongst the operators in the electricity sector;
- Dispute resolution by arbitration or mediation;
- Consumer protection interest;
- Advice and assistance to the State and operators for all matters relating to the electricity sector.

CI-ENERGIES

The Ivorian Electricity Company is a private operator who is responsible for the supply of electricity in Côte d'Ivoire since 1990. It is linked to the State of Côte d'Ivoire through a concession agreement that was renewed in October 2005 for another 15 years. This agreement entrusts IC-Energie, the operation of generation facilities, transmission and distribution, marketing, import and export of electrical energy across the country and in the sub-region.

3.2.2 *Ivoirian Legislation Related to the Project*

The regulatory framework in Côte d'Ivoire is in the form of laws, decrees, circulars, or ministerial orders promulgated from time to time. The most important regulatory frameworks relevant to the Project activities are listed in the following sections.

Environnemental Act (Code de l'Environnement) - Law n°96-766 of 3 Octobre 1996

The Code de l'Environnement (Environmental Act) Law n°96-766 of 3 October 1996; establishes principles for environmental protection at the national level and the foundations of the environmental policy, based on the preservation of natural resources, protection of the environment and sustainable economic development.

The Code de l'Environnement is complemented by five decrees of relevance to the Project:

- Decree n°96-894 of 8 November 1996 determining rules and procedures applicable to environmental and social impact assessment (ESIA) for development projects;

- Decree n°97-678 of 3 December 1997 on the protection of the lagoon and marine environments against pollution;

- Decree n° 98-42 du 28 January 1998 on the organization of emergency plans against accidental pollution at sea, lagoon and coastal areas;

- Decree n°98-19 of 14 January 1998 on the creation and organization of the Fonds National De l'Environnement (FNDE – Environmental National Funds); and

- Decree n°98-43 of 28 January 1998 on "Installations Classées Pour l'Environnement" (ICPE – Classified Installations for Environmental Protection).

Impact Assessments - Decree 96-894 of 8 November 1996

Decree n°96-894 (1996) defines rules applicable to the elaboration of ESIAs, their processing by the ANDE and the ministerial approval process for projects subject to ESIA. The decree includes several annexes, the most important of which are:

- Annex I: lists of projects for which a full ESIA must be submitted to the ANDE.

- Annex II: lists of projects requiring a simplified environmental statement.

- Annex III: lists of projects requiring a complete environmental impact assessment study.

Order n°00972/MEEF of 14 November 2007 is related to the application of decree 96-894 of 8 November 1996. According to the terms of this order, "*the ANDE is the environmental authority responsible for supervising, monitoring and validating all activities related to environmental impact assessments for development projects*" (Article 5).

The Environmental Code is implemented by the Ministry of Environment and ANDE. ANDE is responsible for matters related to the environmental and social impact assessment licensing procedure. ANDE also acts as Secretariat through the Technical Committee. The Technical Committee gives its opinion and ensures compliance with the law, especially with respect to procedures applied through the ESIA and report content.

It is noted that the EIA regulations have a set of criteria for what activities or quantity of substances trigger the requirement for an ESIA. Any projects

meeting these criteria are considered as an *Installation Classified for the Protection of the Environment (ICPE)* under the Environmental Code. Criteria are stated by Decree and are listed in a register (referred to as *Nomenclature des Installations Classées*) which defines the types of ICPE. The Project activities or the quantity of substances used by the proposed Project trigger an ESIA.

Following this regime, the Project proponent will need to follow the procedure as required by Order n° 00972. This process is described step-by-step in *Figure 3.1*.

3.2.3 Land Acquisition

Law n°98-750 of 23 December 1998 (amended on the 9 July 2004) on Rural Land Propriety

This law sets the foundation for land policies in rural areas by acknowledging the existing customary management of rural areas. This law also acknowledges the associations of village authorities and rural communities in the management of these rural areas and their customary rights. This law is complemented by two decrees:

- Decree n°99-594 is the application decree of the Law n°98-750 on Rural Land Propriety.

- Decree n°96-884 of October 25th 1996 on expropriation for the general interest.

In addition, access to and use of land in rural areas continues to be managed in some instances by customary and non-formal land tenure systems. As such, land cannot be sold but in many rural areas land is available for allocation by local council or traditional authorities. Under these systems rights are passed from generation to generation within the founding lineage. The ownership rights of the founding family mean that they have been entrusted with the custodianship and management of the village lands on behalf of the community. These families are considered to hold a form of ownership rights to this land and as a result are responsible for allocating land to other community members. However, they do not hold absolute rights as under statutory law.

3.2.4 Worker Health and Safety

The Ivorian Labour Code is defined by law n°95-15 of 12 January 1995 modified by law n°97-400 of 11 July 1997. Other important pieces of legislation include:

- Law n°99-477 of 02 August 1999, defining the Code of Social Security;

- Law n°88-651 of 07 July 1988 for the protection of the public health and the environment against the effects of the toxic and nuclear industrial waste and the harmful substances;

- Decree n°98-40 of 28 January 1998 concerning the consultative technical committee for the study for questions interesting workers hygiene and safety; and

- Decree n°96-206 of 07 March 1996 concerning hygiene, safety and working conditions committee.

With regard to child labour, article 23.8 of the law n°95-15 states that: "*Children cannot be employed in a company, even as apprentices, before the age of 14, unless otherwise stipulated by the regulations*".

Article 41.1 states that "*To protect the life and health of the employees, the employer is required to consider all the useful and appropriate measures to ameliorate the company's working conditions. The company must in particular adapt the installations and working conditions in order to protect the employees from accident and disease* ".

Article 1 of decree n°96-206 of 7 March 1996 related to the health, safety and working conditions committee states that "*In accordance with the requirements of Article 42.1 of the Labour Code, every company employing more than fifty persons must set up a health, safety and working conditions committee (CHSCT)"* .

3.2.5 Environmental Protection

Law related to the Forestry Code, the Hunting Code and Protection of the Fauna and related Decree are described below.

Law n°96-766 of 3 October 1996, Code de l'Environnement (Environmental Act), Establishing Principles of Environmental Protection at National Level

Decree 97-678 of 3 December 1997 is related to the protection of the lagoon and marine environment. Article 17 of the decree states that discharging objects, garbage and toxic products in marine and lagoon waters as well as in coastal zones, is prohibited.

Legislation on Environmental Audit

The key regulation related to environmental audits in Côte d'Ivoire, as applicable to the Project, is decree n° 2005-03 of 6 January 2005.

According to article 8 of the decree, environmental audits of existing developments must be undertaken by assessing "*the compliance, effectiveness and efficiency*" of a development's environmental management plan, and the environmental management system.

Internal audits must be performed every three years. It must be undertaken by a consulting firm appointed by the operator. The audit report is submitted to ANDE for approval. An external audit can be ordered by the Ministry for the environment, based on recommendations of the ANDE.

Ordonnance n° 2012–487 du 07 juin 2012 portant Code des Investissements.

The main objective of this investment code is to encourage and promote productive and green investment and socially responsible in Côte d'Ivoire and encourage also the creation and development of activities oriented particularly towards the transformation of local raw materials, the creation of sustainable and decent jobs, production of competitive goods for the domestic market and export, promotion of technology, research and innovation. It takes into account the protection of the environment and improving the quality of life, etc.

This order for the investment code sets the conditions, benefits and general rules applicable to direct domestic and foreign investments made in Côte d'Ivoire.

Act ("Arrêté") n°98-755 of 23 December 1998 Constituting the Water Code

This text specifies the main rules related to the preservation and rehabilitation of waters and to violations and penalties. Both the continental and territorial maritime waters are concerned by the Water Code. Article 49 states that "*any discharge of wastewater into the environment must comply with the standards applicable*". According to Article 51: "Any discharge into the sea, watercourses, lakes, lagoons, ponds, canals, groundwater of any used material, fermentable residues of vegetal or animal origin, any solid or liquid, toxic or flammable substance liable to constitute a hazard or cause a fire or explosion is prohibited".

Waste Management

Waste management is the responsibility of the Ministry of Environment. Decree n° 97- 678 of 3 December 1997 related to the protection of the lagoon and marine environment against pollution, also deals with measures related to waste discharge in the sea and in coastal zones.

Order n° 171 \PM\CAB, of 18 September 2006 establishes the creation, duties, composition and operation of the Operational Coordination Cell managing the National toxic Waste Defence Plan. Order n° 166\PM\CAB of 14 September 2006 nominated the Coordinator of the National Toxic Waste Defence Plan.

Decree No. 2013-327 of 22 May 2013 Prohibiting the Production, Import, Marketing, Possession and use of Plastic Bags in Côte d'Ivoire

This decree prohibits the production, importation, commercialisation, possession and the use of any non-biodegradable plastic bags made of lightweight polyethylene, or similar plastic derivate, with a thickness of less than 50 microns.

Petroleum Code

The Ivorian oil and gas sector is regulated by Law n°96-669 dated 29 August 1996 as amended by Ordinance n°2012-369 dated 18 April 2012 (Petroleum

Code) as well as Decree n°96-733 related to the application conditions of the Petroleum Code dated 19 September 1996 (Application Decree).

According to this Code, petroleum contracts must among other things address the following issues: obligations with respect to the environment, health and safety and rehabilitation of sites and local employment.

Decree 98-43 January 1998 on Classified Installations for Environmental Protection

This decree states in its Article 1 : "*installations subjected to the provisions of this decree are factories, warehouses, construction sites, quarries, underground storage facilities, shops, workshops, and general facilities that may present dangers or disadvantages for environmental protection.* "

Regulations on Water

The main regulatory text on water in Côte d'Ivoire, applicable to the Project, is act ("Arrêté") n°98-755 of 23 December 1998 constituting the Water Code.

This text specifies the main rules related to the preservation and rehabilitation of waters and to violations and penalties. Both the continental and territorial maritime waters are concerned by the Water Code.

Article 49 states that "*any discharge of wastewater into the environment must comply with the standards applicable*". According to Article 51: "*Any discharge into the sea, watercourses, lakes, lagoons, ponds, canals, groundwater of any used material, fermentable residues of vegetal or animal origin, any solid or liquid, toxic or flammable substance liable to constitute a hazard or cause a fire or explosion is prohibited*".

3.2.6 The ESIA Approval Process

Decree n°96-894 (1996) defines rules applicable to the elaboration of ESIAs, their processing by the ANDE and the ministerial approval process for projects subject to ESIA. The decree includes several annexes, the most important of which are:

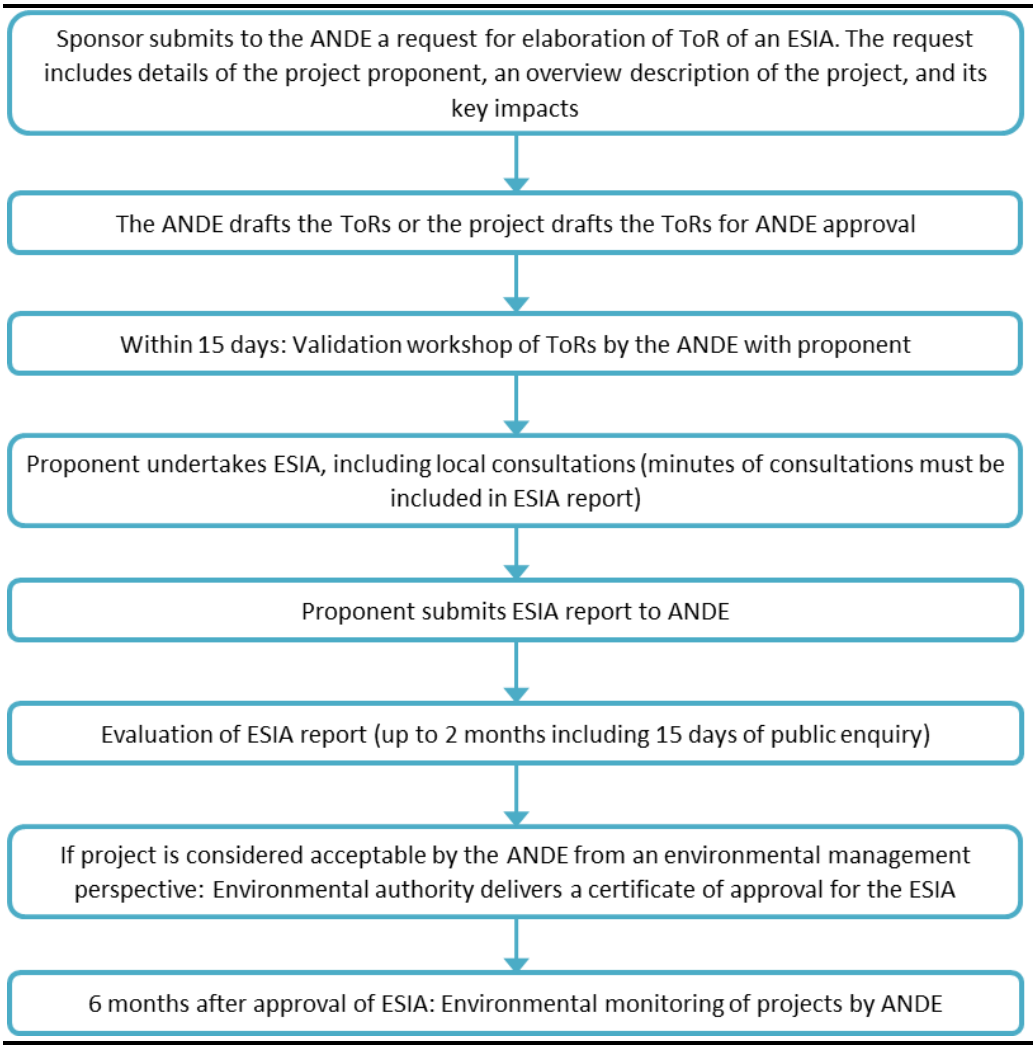
- Annex I: lists of projects for which a full ESIA must be submitted to the ANDE for approval (applicable for the Azito Project).
- Annex II: lists of projects subjected to a simplified environmental statement.
- Annex III: lists of projects subject to a complete environmental impact assessment study.

The key stages, head-times and financial implications of the environmental permitting process are defined by order 00972 of 14 November 2007 for the application of decree 96-984.

Process and Timeline

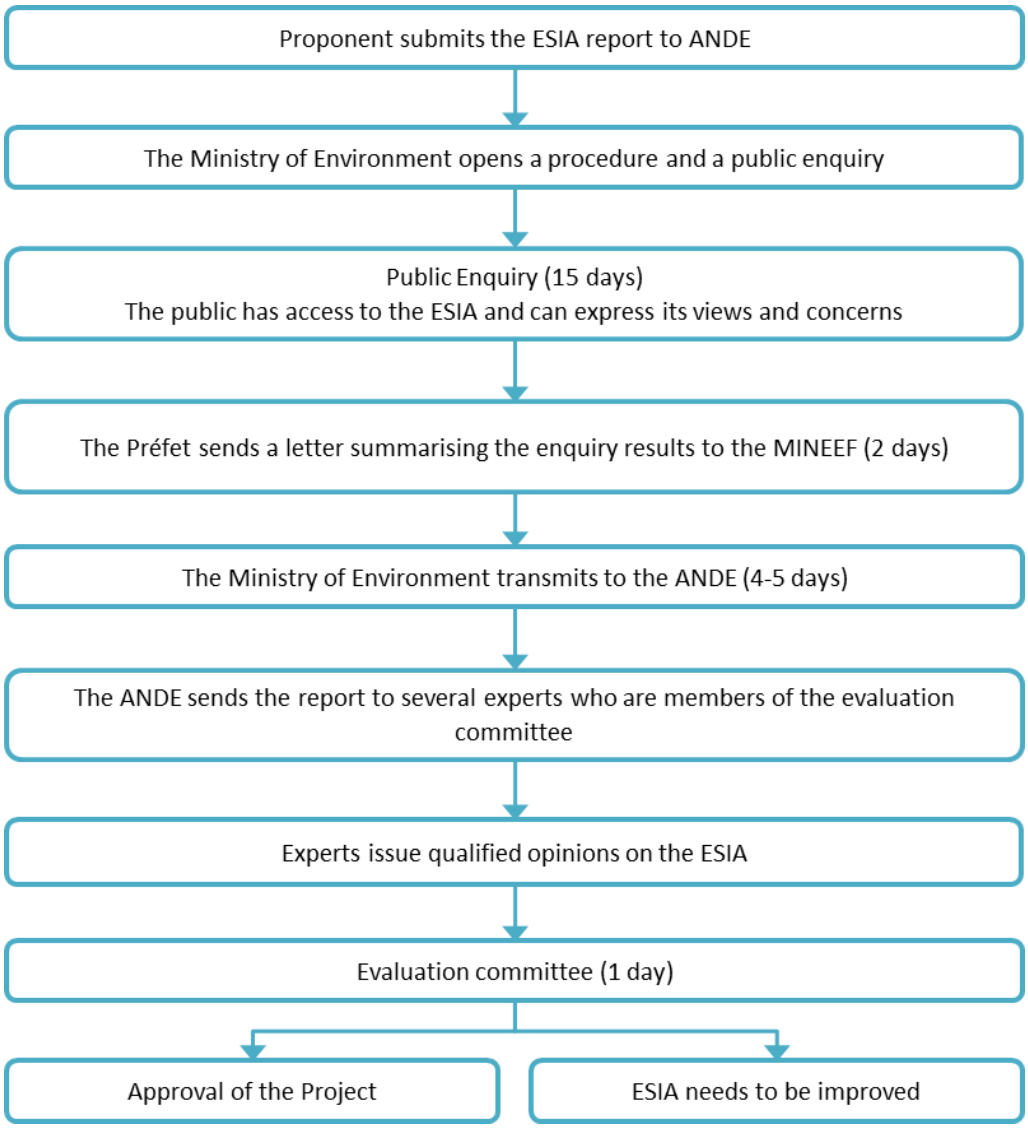
Figure 3.1 presents the key stages of environmental permitting, as established by order n° 00972. The overall timeline is indicative and depends on a range of factors: project complexity and size, sensitivity of the projects receiving environment (receptors) and public enquiry process managed by the ANDE as part of the approval procedure.

Figure 3.1 Key Stages of the Permitting Process



A more detailed account of the ESIA approval procedure and the public enquiry once the ESIA has been submitted to the ANDE is provided in *Figure 3.2*

Figure 3.2 ESIA Approval and Public Enquiry Procedure



Permitting Procedure Applicable to the Azito Project

The Azito project is already officially approved, under the terms of an environmental permit delivered by the Ministry in charge of the environment, on 9 September 1999. This initial permit covers Phases I to III of the Azito project development plan, including the retrofitting of combined cycle equipment also known as Phase III.

Since Phase IV was not developed as per the original schedule directly following the Phase I, II and III installations, a new ESIA covering this particular phase was requested. In November 2016, ERM and Azito Energie met with the Director of the ANDE and the Director of the ESIAs department, Mr Kouassi, to present the Project and ESIA methodology. As part of the validation process of the Terms of Reference for the ESIA of Phase IV, ANDE visited the existing Azito plant and proposed location for Azito Phase IV with Azito and ENVAL on 18th of November 2016. The Terms of Reference was

validated by ANDE on the 30th of November 2016. A summary is provided in *Section 6: Stakeholder Engagement*.

3.2.7 International Treaties and Conventions

In addition to being in compliance with Ivoirian statutory requirements, the Project should also be consistent with the international treaties applicable to the Project and to which Côte d'Ivoire is a signatory. The international treaties and conventions applicable to the Project are presented in *Table 3.1*.

Table 3.1 International Treaties Applicable to the Project

Name of the Convention	Date of Ratification by Côte d'Ivoire	Objective of the Convention	Aspects Related to the Project
International Labour Organization Convention 182, Geneva, 1999	7/02/2003	Prohibition and Immediate Action for the Elimination of the Worst Forms of Child Labour	Working conditions and regulation on site during construction and operation of the Phase IV Project
International Labour Organization Convention 138, Geneva, 1973	7/02/2003	Minimum Age for Admission to Employment	Working conditions and regulation on site during construction and operation of the Phase IV Project
United Nations Vienna Convention, 1985	30/11/1992	Protection of the Ozone Layer	Atmospheric emissions (cooling installation) during construction and operation of the Phase IV Project
United Nations Framework Convention on Climate Change (UNFCCC) of 1992	14/11/1994	The objective of the Convention is to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system	Greenhouse gases emission during construction and operation of the Phase IV Project
United Nations Convention on Biological Diversity (CBD), Rio, June 1992	24/11/1994	The objective of this Convention is to develop national strategies for the conservation and sustainable use of biological diversity and a fair and equitable sharing of benefits arising from genetic resources	Protection of the biodiversity in the surrounding of the Site during construction, operation and decommissioning phases of the Project
Basel Convention on the control of transboundary movements of hazardous wastes and their disposal, March 22, 1989	9/06/1994	International treaty that was designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries	Waste management during the construction and operation of the Phase IV Project

Name of the Convention	Date of Ratification by Côte d'Ivoire	Objective of the Convention	Aspects Related to the Project
Bamako Convention on the Ban of the import into Africa and the control of transboundary movement and management of hazardous wastes within Africa, January 31, 1991	9/06/1994	This Convention defines strict rules concerning waste imports and movements, which have to be authorised by the authorities of each country and prohibiting the import of any hazardous (including radioactive) waste.	Waste management during the construction and operation of the Phase IV Project
Ramsar Convention on wetlands of international importance, February 2, 1971	02/1993	Treaty on the conservation and sustainable utilization of wetlands, to stem the progressive encroachment on and loss of wetlands now and in the future, recognizing the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value	Ebrié Lagoon and associated wetlands to be considered within the Phase IV expansion Project development.
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), also known as the Washington Convention, March 3, 1973	3/02/1993	Treaty developed to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species.	Protection of the biodiversity and species in the surrounding of the Site during construction, operation and decommissioning phases of the Project
International Union for Conservation of Nature and Natural Resources (IUCN)		Founded in 1948, the International Union for Conservation of Nature and Natural Resources (UICN) is an international organisation working on natural resources protection and sustainable use. The IUCN is the world's main authority on the conservation status of species. IUCN established a red list set upon precise criteria to evaluate the extinction risk of thousands of species and subspecies.	Protection of the biodiversity and species in the surrounding of the Site during construction, operation and decommissioning phases of the Project
United Nations Montreal Protocol on substances that deplete the ozone layer, Montreal, September 16, 1987	30/11/1992	Protection of the ozone layer by phasing out the production of numerous substances believed to be responsible for ozone depletion.	Atmospheric emissions (cooling installation) during construction and operation of the Phase IV Project

Name of the Convention	Date of Ratification by Côte d'Ivoire	Objective of the Convention	Aspects Related to the Project
Convention for the protection and highlighting of marine and coastal area of West and Central Africa, Abidjan, March 23, 1981	15/01/1982	Develop scientific and technological collaboration (including the exchange of information and expertise), for the identification and management of environmental issues.	Technical collaboration on environmental issues to be developed and communicated as Côte d'Ivoire is signatory of the Convention

3.3 *INTERNATIONAL LENDER'S ENVIRONMENTAL AND SOCIAL ASSURANCE REQUIREMENTS*

3.3.1 *Stakeholder Engagement*

Table 3.2 below highlights the key elements of the best practice guidance for stakeholder engagement, titled Stakeholder Engagement: A good practice handbook for companies doing business in emerging markets (IFC, May 2007), which will form the standard for stakeholder engagement for the Project.

It is noted that a Stakeholder Engagement Plan was implemented by AZOM and a number of activities with Azito's stakeholders have been taking place as part of this Plan. Stakeholder engagement activities for Phase IV will be integrated to this Plan.

Table 3.2 Stakeholder Engagement Handbook

Applicable IFC Guideline
PART ONE
1. Key Concepts and Principles of Stakeholder Engagement
2. Stakeholder Identification and Analysis - Directly and indirectly affected stakeholders - Identify "interests" that determine stakeholders - Strategic and prioritisation - Existing information and consultation - Socio-economic fact sheets focused on vulnerable groups - Verify stakeholder representatives - Engage with stakeholders in their own communities - Government as a key stakeholder - NGOs and community-based organisations - Recognise employees as a good channel of communication
3. Information Disclosure - Transparency - Good practice principles - Risks and benefits - Sensitive and controversial Issues
4. Stakeholder Consultation - Iterative consultation - Informed participation - Consultation with Indigenous Peoples - Gender considerations

Applicable IFC Guideline
5. Negotiation and Partnerships - Timing - Negotiate in good faith - Negotiation style - Strategic partnerships
6. Grievance Management - Process - Scale to project needs - Publicise - Third parties - Accessibility - Transparency and response - Record Keeping and reporting - Obstruction to legal remedies
7. Stakeholder Involvement in Project Monitoring - Promote participation and monitoring - Benefits
8. Reporting to Stakeholders - Reporting - International standards - Sustainability reporting - Benefits
9. Management Functions - Coordinate activities and assign overall responsibility - Personnel - Reporting lines (Community liaison function and senior management) - Communicate the strategy internally - Stakeholder database - Commitments register - Stay in control of "third-party" engagement - Manage contractor risks - Track changes in the quality of stakeholder relationships
PART TWO
10. Integrating Stakeholder Engagement with the Project Cycle - Project cycle - Feasibility studies and project planning - Construction - Operations - Downsizing, decommissioning and divestment

3.4 *SPECIFIC ENVIRONMENTAL REGULATIONS AND INTERNATIONAL LENDER'S ENVIRONMENTAL AND SOCIAL ASSURANCE REQUIREMENTS APPLICABLE TO THE PROJECT*

3.4.1 *Applicability of Ivorian Regulations*

The Azito facility and Phase IV Project is considered as a classified installation, subject to Ministerial Order n°01164 of 04 November 2008 defining regulations of the discharges and emissions of classified installations for environmental protection. This order defines national standards particularly for noise emissions, atmospheric emissions and liquid discharges.

It is noted that as a result of significant changes experienced in the area since the construction of Phase III (i.e. the container port construction and operation

adjacent to the east side of site the leading to the creation of a fluvial traffic and increase of a road traffic, increase of residential areas in Yopougon etc.), the Project's area have changed. In lights of this, following the definition provided by the Ministerial Order n°01164 of 04 November 2008, the ESIA considers the Project's area for the Phase IV Project as falling into the category of : "Urban residential areas, with some workshops or business centers, or with fairly large land, river, or air traffic routes or in rural communes" ("*zones résidentielles urbaine, avec quelques ateliers ou centres d'affaires, ou avec des voies de trafic terrestre, fluvial, ou aérien assez importantes ou dans les communes rurale*").

3.4.2 Applicability of World Bank / IFC guidelines

The existing Azito power plant was funded through Azito Energie shareholders as well as by loans contracted with commercial banks and international financial and development institutions (IFC, CDC, AfDB, FMO, DEG, and the World Bank). All of these institutions require that the Project comply with international-level standards of environmental and social management and performance. Therefore, the ESIA for Phase IV is undertaken in line with IFC PSs and EHS Guidelines as it was the case for the ESIA for Phase III.

The most widely accepted international standards are the International Finance Corporation's Environmental and Social Performance Standards ("IFC PSs"). The International Finance Corporation (IFC) is a subsidiary of the World Bank Group dedicated to supporting private sector growth in developing countries. The IFC's Sustainability Framework (updated 1 January 2012), is widely considered as one of the most complete set of standards for environmental and social management.

The IFC PSs are a central element of this framework with eight thematic standards establishing principles for integrating environmental, health and safety considerations into projects. They are designed to assist project developers to avoid, mitigate and manage risks and impacts so that they develop their activities in a sustainable manner. The IFC PSs are outlined in *Table 3.3*

Table 3.3 IFC Standards (2012)

PS	Title	Objectives
1	Assessment and Management of Environmental and Social Risks and Impacts: defines requirements for ensuring appropriate environmental and social management, policy implementation and accountability throughout the life of a project.	• To identify and evaluate environmental and social risks and impacts of the project. • To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment. • To promote improved environmental and social performance through the effective use of management systems.

PS	Title	Objectives
		• To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately. • To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.
2	Labour and Working Conditions: defines requirements for ensuring fair labour management and safe and healthy working conditions.	• To promote the fair treatment, non-discrimination, and equal opportunity of workers. • To establish, maintain and improve the worker-management relationship. • To promote compliance with national employment and labour laws. • To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties and workers in the supply chain. • To promote safe and healthy working conditions and the health of workers. • To avoid the use of forced labour.
3	Resource Efficiency and Pollution Prevention: defines requirements for ensuring an appropriate level of pollution prevention and abatement.	• To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities. • To promote more sustainable use of resources, including energy and water. • To reduce project-related Greenhouse Gas emissions.
4	Community Health, Safety and Security: defines requirements for ensuring that adverse impacts from the project on the receiving community are managed and controlled.	• To anticipate and avoid adverse impacts on the health and safety of the Affected Communities throughout the life of the project from both routine and non-routine circumstances. • To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to Affected Communities.
5	Land Acquisition and Involuntary Resettlement: defines requirements to minimize adverse social and economic impacts from involuntary resettlement, land acquisition, or restrictions on land use.	• To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs. • To avoid forced eviction. • To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation and the informed participation of those affected. • To improve, or restore, the livelihoods and standards of living of displaced persons. • To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.
6	Biodiversity Conservation and Sustainable Management of Living	• To protect and conserve biodiversity. • To maintain the benefits from ecosystem services.

PS	Title	Objectives
	Natural Resources: defines requirements for ensuring that the project's impacts on nature, ecosystems, habitats and biodiversity are appropriately managed.	• To promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.
7	Indigenous Peoples: defines requirements for the protection of Indigenous peoples (not deemed applicable to the Project, as there should not be Indigenous people as defined by IFC PS7 in the Project area).	• To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture and natural resource-based livelihoods of Indigenous Peoples. • To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts. • To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with Indigenous Peoples affected by a project throughout its life cycle. • To ensure the Free, Prior and Informed Consent (FPIC) of Indigenous Peoples when the circumstances in this Performance Standard are present.
8	Cultural Heritage: defines requirements to protect cultural heritage from the adverse impacts of project activities, to support its preservation and to promote the equitable sharing of benefits from the use of cultural heritage.	• To protect cultural heritage from the adverse impacts of project activities and support its preservation. • To promote the equitable sharing of benefits from the use of cultural heritage.

In addition, based on information available for this assessment, it is considered that the following IFC Environmental, Health & Safety (EHS) Guidelines are applicable in terms of managing the Project's current and anticipated impacts:

- Performance Standards on Environmental and Social Sustainability (International Finance Corporation (IFC), January 2012) (the *Performance Standards*)

- Environmental, Health and Safety (EHS) General Guidelines (World Bank Group, April 2007); and

- EHS Guidelines for Thermal Power Plants (19th December 20008).

With regard to the Phase I and II of the Azito project, these phases were initially developed in the late nineteen-nineties, for construction and commissioning of Phase I over the period 1999-2000. At this the Sponsor's policy was to develop the project in compliance with the then-applicable

World Bank Health and Safety Guidelines (*World Bank Environment, Health and Safety Guidelines, Thermal Power Plants, October 1996*).

Phase III was designed to comply with the IFC EHS Guidelines as of 2007 and IFC Performance Standard as of 2012.

3.4.3 Noise

Limits for ambient noise levels generated by industrial facilities are defined in Order n°01164 of 04 November 2008. Reference is also made to the IFC General EHS guideline (2007).

Table 3.4 Regulatory and IFC Limit Values for Ambient Noise Levels at Receptor Location

Reference	**Ivorian Order n°01164 for new facilities (2008)***	**World Bank / IFC Guideline** (one hour LAeq)**	
Type of area	*Rural residential with pocket of waterways, terrestrial transport (case of Azito Project's area with the construction of the container port)*	*Industrial*	*Residential (case of Azito)*
Day-time	60 dBA	70 dBA	55 dBA
Intermediate period	55 dBA	-	-
Night-time	45 dBA	70 dBA	45 dBA

** Order n°01164 was adopted in 2008, ie 10 years after the initial Azito EIA and 7 years after the commissioning of the Azito Phase I and Phase II units. These standards apply to new facilities.*
*** This guideline is consistent with the guideline used in the initial 1998 and 2011 ESIA.*

When considering these standard and IFC EHS Guidelines, all phases in operation (Phases I, II, III and IV) shall not increase the relevant baseline noise level by more than 3 dB(A) at the Nearest Sensitive receptors (NSR)'s located off-site (refer to IFC EHS Guideline 2007).

Construction Noise Criteria

There are no national or international standards for noise from temporary sources such as construction but best practice (as described in the UK construction noise guidance document BS 5228) is that noise levels ($L_{Aeq,12h}$ façade) from construction activities should not exceed 75 dB at the nearest noise sensitive receptors during the daytime. Any construction works carried out at night will be limited to quiet activities which do not produce significant levels of noise at the nearest Noise Sensitive Receptors (NSRs).

Construction noise levels above the criterion are considered to be Medium or above, whilst construction noise levels which do not exceed the criterion are considered to be Small or below. This is summarised in *Table 3.5*.

Table 3.5 Magnitude of Noise Impacts from Construction Activities

	Daytime Noise Level at Property Façade, $L_{Aeq,12h}$ dB
Negligible	< 70
Small	70 - 75
Medium	> 75 – 80
Large	> 80

3.4.4 Atmospheric Emissions and Ambient Air Quality

A comparison of Ivorian guidelines (Order n°01164) and the IFC EHS guidelines are provided in *Table 3.6* and *Table 3.7.*

Table 3.6 Atmospheric Emissions Limits

Determinant	Maximum concentration in exhaust (mg/m³)	
	Ivorian Order n°01164 for new facilities (2008)*	**IFC/World Bank Environmental Health and Safety Guidelines for Thermal Power Plants (2008)**
Total Particulates	50	-
NO_2	50	Gas: 51 (NO_x) DDO: 152 (NO_x)
SO_x	-	Gas: - DDO: 431
CO	-	Gas/DDO: 100

** Order n°01164 applies to new facilities only and does not explicitly distinguish between modes of operation (ie gas-fired or DDO-fired). Because this standard was applicable to the Phase III expansion and ANDE did not require the facility to meet the 50 mg/m3 level when firing DDO (which would only occur in emergency situations), it is assumed that this standard would only apply to Phase IV when firing gas*

Table 3.7 IFC Ambient Air Quality Guidelines

Pollutant	Averaging period	Limit / Guideline (in µg/m³)
Sulfur dioxide (SO2)	24-hour	125 (Interim target-1)* 50 (Interim target-2) 20 (guideline)
	10 minutes	500 (guideline)
Nitrogen dioxide (NO2)	1-year	40 (guideline)
	24-hour	200 (guideline)
Particulate Matter PM10	1-year	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline)
	24-hour	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter PM2.5	1-year	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline)

Pollutant	Averaging period	Limit / Guideline (in µg/m³)
	24-hour	75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

* Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines The Project is committed to meet the IFC Guidelines.

3.4.5 Liquid Effluents

A comparison of Ivorian guidelines (Order n°01164) and the IFC guidelines are provided in *Table 3.8*.

Table 3.8 Regulatory Limits and IFC Guidelines for Liquid Effluents

Determinant	Maximum Concentration in Effluent (mg/L)	
	Ivorian Order n°01164 for New Facilities (2008)*	**World Bank / IFC Guideline**
pH	5.5 - 8.5 or 5.5 - 9.5 in case of chemical treatment	6 – 9
Temperature	<40°C	• Site specific requirement to be established by the relevant environmental authorities. • Elevated temperature areas due to discharge of once-through cooling water (e.g. 1 Celsius above, 2° Celsius above, 3° Celsius above ambient water temperature) should be minimized by adjusting intake and outfall design through the Project depending on the sensitive aquatic ecosystems around the discharge point.
Total suspended solids	Abatement of 80% or 150 mg/l if flux >< 15 kg/j 100 mg/l if flux > 15 kg/j	50
Oil and grease	30 mg/l if flux < 5 kg/j 10 mg/l if flux > 5 kg/j	10
Total hydrocarbons	10 mg/l if flux > 100 g/j	-
Total residual chlorine	-	0.2

According to the IFC PS: "*when host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent.*" Therefore the Project is committed complying with IFC EHS Guidelines values with respect to liquid effluents discharge value.

3.5 ESIA PROJECT LEGISLATION AND STANDARDS SUMMARY

The ESIA has been prepared in line with applicable Ivoirian laws and regulations as well as international standards and guidelines (i.e. IFC

Performance Standards and IFC EHS Guidelines). Further information is provided in *Figure 3.3*.

ESIA Project Standards

IFC Performance Standards

The Performance Standards specify the IFC's conditions for environmental and social performance for projects seeking external financing. The IFC Performance Standards are divided into eight categories to identify and evaluate the potential environmental and social impacts which may occur as a result of project activities. A summary of the scope of the IFC Performance Standards and the applicability to the Project is provided below.

N°	Title	Scope	Applicable to the Project
1	Assessment and Management of Social and Environmental Risks and Impacts	Defines requirements for ensuring appropriate environmental and social management policy implementation and accountability, including Environmental and Social Impact Assessment requirements	✓
2	Labour and Working Conditions	Defines requirements for ensuring definition and implementation of fair recruitment and workforce management policies	✓
3	Resource Efficiency and Pollution Prevention	Defines requirements for ensuring an appropriate level of pollution prevention and abatement	✓
4	Community Health, Safety and Security	Defines requirements for ensuring that adverse impacts from the Project on the receiving community are managed and controlled	✓
5	Land Acquisition and Involuntary Resettlement	Defines requirements for land tenure management and community resettlement as part of Project development	✗ No resettlement will occur as part of the Project.
6	Biodiversity Conservation and Sustainable Management of Living Natural Resource	Defines requirements for ensuring that the Project's impacts on nature, ecosystems, habitats and biodiversity are appropriately managed	✓
7	Indigenous Peoples	Defines requirements for ensuring that the rights of autochthonous minorities are respected and that indigenous people may beneficiate from the Project	✗ No indigenous peoples are present in the Project area.
8	Cultural Heritage	Defines requirements for managing the Project's impacts on material and immaterial cultural heritage	✓

IFC EHS Guidelines

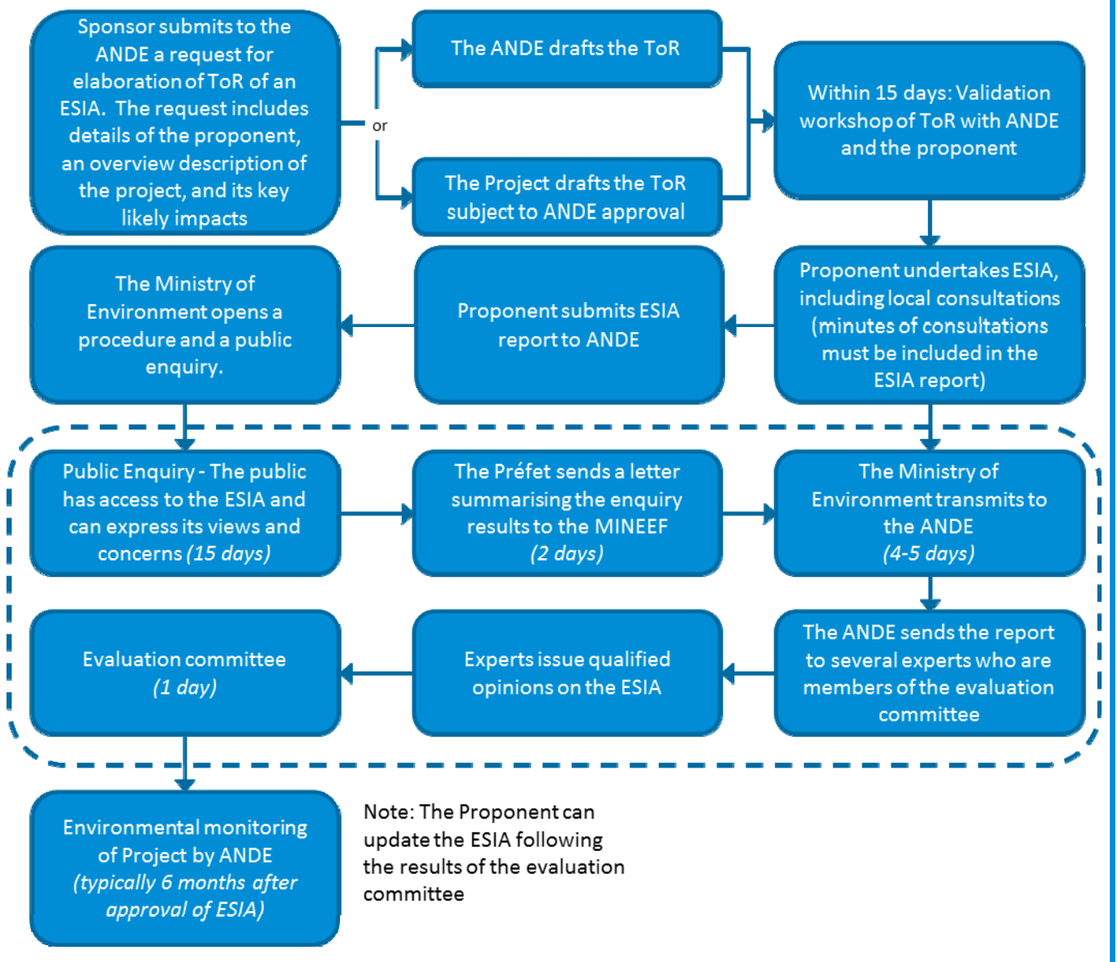
The IFC EHS Guidelines are technical reference documents, providing general and industry-specific examples of good practice. They are used by the IFC as part of the appraisal of projects under the IFC's project evaluation mandate as described in the IFC's Environmental and Social Review Procedures Manual. 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 IFC EHS Guidelines include general overarching guidelines as well as industry specific guidelines.

The IFC EHS Guidelines considered relevant to the Project are:

- Environmental, Health & Safety General Guidelines (April 2007)
- Thermal Power Plants (2008)

Ivorian Standards

The key stages of environmental permitting, as established by order n° 00972. The overall timeline is indicative and depends on a range of factors: Project complexity and size, sensitivity of the Projects receiving environment (receptors) and public enquiry process managed by the National Environment Agency (ANDE) as part of the approval procedure.



Note Côté d'Ivoire has adopted a number of international conventions which are applicable to the Project. These include International Labour Organization Conventions 182 and 183 and the International Union for Conservation of Nature and Natural Resources (IUCN).

DRAWING NUMBER AND TITLE:	FIG No:	Client:		Size:	Date: October 2016	Checked: SW	Project No:	Project:
ESIA Project Standards	3.3	Azito Energie	ERM 2nd Floor Exchequer Court, 33 St Mary Axe, London EC3A 8AA Tel: 020 3206 5200 Fax: 020 3206 5440	A3	Drawn: SF	Approved: CM	0366124	Azito Energie Phase IV Expansion

4 SCOPE OF THE ESIA

4.1 DEFINING THE SCOPE OF THE ESIA

The scoping process identifies the potentially most important/significant impacts and effects (including secondary, indirect and cumulative) for the assessment to address.

The scope of the ESIA is established by answering the following key questions:

- **What?** What are the Project components (facilities and activities) being assessed? What are the assessment topics being evaluated?
- **Where?** What is the physical footprint of the Project for the assessment?
- **When?** When will the activities occur? What is the temporal footprint of the Project for the assessment?

Those Project activities unlikely to have impacts that result in significant effects were "scoped out" of the assessment.

4.2 PROJECT COMPONENTS

The IFC Performance Standards require project proponents to identify and manage environmental and social risks and impacts within their Area of Influence. The Area of Influence (AoI) is defined in Performance Standard 1 as:

- *The area likely to be affected by: (i) the project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project;(ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.*
- *Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.*
- *Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.*

The appropriate level of assessment and management of risks and impacts is determined by the degree of control that the Project is able to exercise over its facilities or activities; and by the importance of the facilities or activities to the Project's successful operation. The first step in defining the Area of Influence

is to classify the facilities and activities ('the project components') that make up the Project. The following project component categories are considered for this Project:

- **Core component.** Facilities constructed and operated by the Project, and activities directly associated with their construction and operation. The Project is expected to have full control of these components in terms of management of risks and impacts. *Table 4.1* provides a full list of the core components.

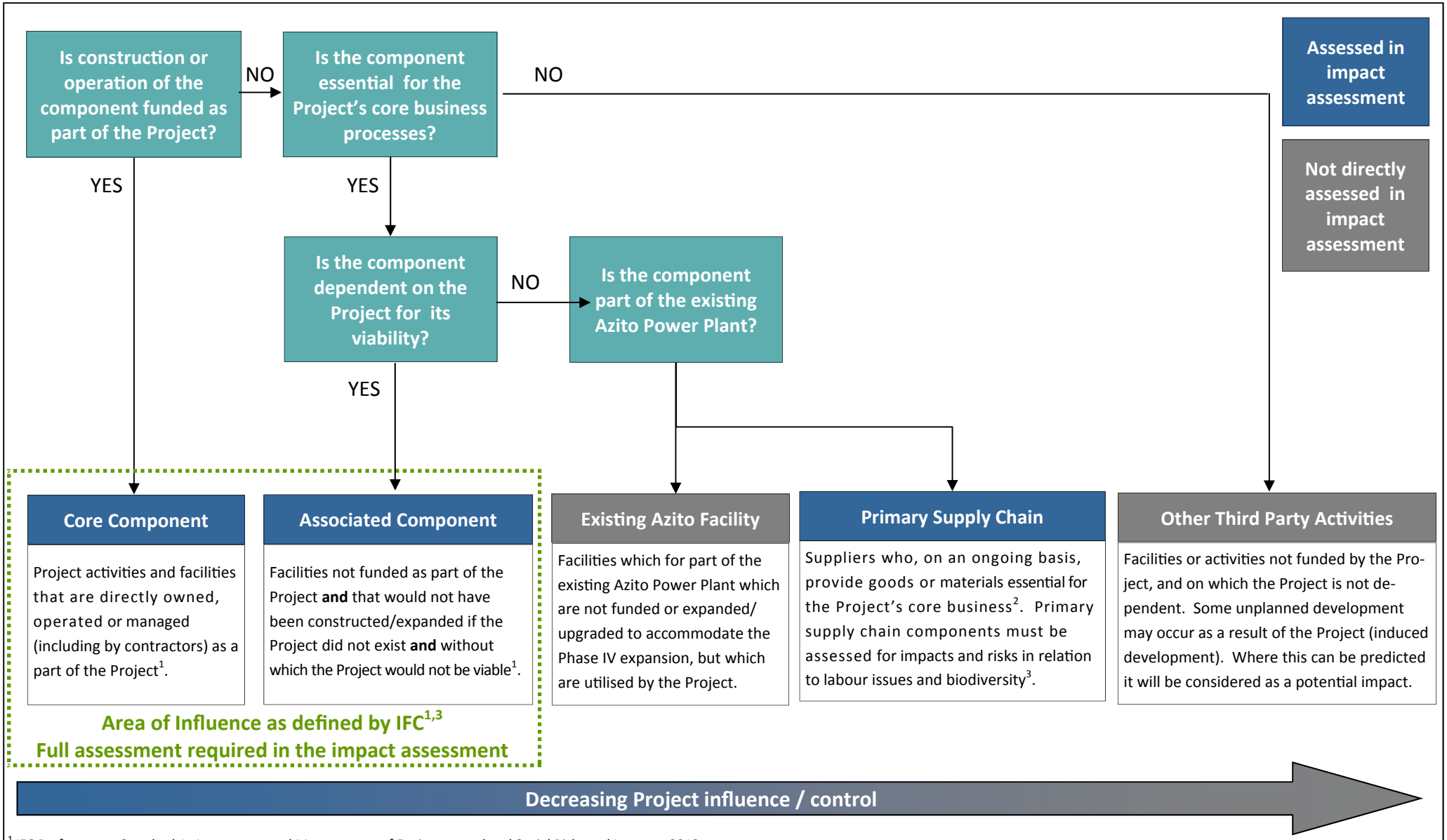
- **Associated component.** Third party facilities that have been constructed or expanded as part of the Project and that are essential to its successful operation. Activities associated with constructing and operating these facilities are also considered associated components. As the component is dependent on the Project, and vice versa, the Project is expected to have a high level of control. Note that these types of components are considered to meet the definition of an associated facility per Performance Standard 1. No components of the Project have been identified as associated components.

- **Primary supply chain.** Third parties supplying goods or materials that are essential to the successful operation of the Project, on an ongoing basis. The level of control the Project can exercise may be limited, especially for suppliers further along the supply chain. Primary supply chain elements for the Project include quarries providing gravel.

- **Other third party activities.** Facilities constructed or operated by third parties, and associated activities, which are not essential to the successful operation of the Project, for example use of the container port. These are not within the Project's area of influence. A possible exception would be development that occurs as a result of the Project's existence, but that is not part of the Project itself. The potential for this kind of induced development to occur will be considered as part of the impact assessment.

Figure 4.1 demonstrates the process for classifying project components.

The design of Azito Phase IV will be similar to Phase III hence a number of the existing services, such as fire water, would be potentially used by Phase IV (this is still currently under investigation). These would form primary supply chain components. An initial classification of the project components that are currently planned as part of Phase IV is presented in *Table 4.1*.



[1] IFC Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts. 2012.
[2] IFC Performance Standard 2: Labor and Working Conditions. 2012.
[3] IFC Guidance Note 1: Assessment and Management of Environmental and Social Risks and Impacts. 2012.

Environmental Resources Management Ltd
2nd Floor, Exchequer Court
33 St Mary Axe
London, EC3A 8AA

Classifying Project Components

Table 4.1 Classification of Project Components

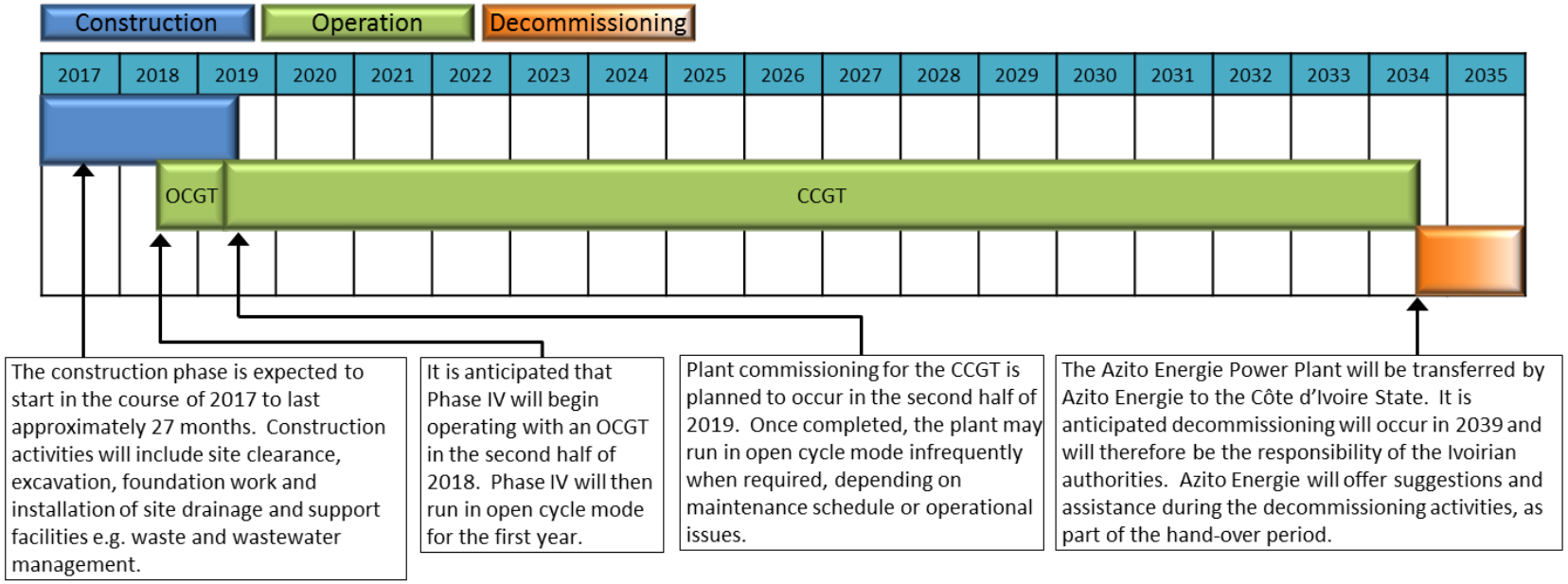
Project Facilities and Activities	Classification
Gas Turbine Train and Associated Equipment (e.g. heat recovery steam generator, steam turbine, black start, demin water storage tanks, etc.)	Core component
Gas Turbine Exhaust System	Core component
Main Cooling System	Core component
Closed Cooling Water System	Core component
Compressed Air System	Core component
Chemical Laboratory	Core component
New Buildings	Core component
Plant Electrical System	Core component
Distributed Control System	Core component
Power Evacuation (additional connection to existing substation)	Core component
Substation Upgrade	Core component
Temporary Construction Worker Accommodation	Core component
Temporary Laydown Area for Construction	Core component
Access Road for Construction	Core component
Fuel Tanks	Core component
Demineralised Water Storage Tanks	Core component
Vehicle Movements	Core component
Quarry	Primary Supply Chain
Gas supply	Primary Supply Chain
Hazardous Products Storage Area	Existing Azito Facility
Power Evacuation and Transmission	Existing Azito Facility
Other existing services to be shared with Phase III	Existing Azito Facility
Container Port	Other Third Party Activities
Raw Water Supply (water borehole)	Other Third Party Activities
Potable Water Supply (municipal supply)	Other Third Party Activities

4.3 TEMPORAL SCOPE

For the purposes of the impact assessment the Project has been divided into three phases: construction, operation and decommissioning (or handover) (see *Figure 4.2*).

Further details of the activities occurring within each phase of the Project can be found in *Section 2: Project Description*.

Figure 4.2 *Temporal Scope*



4.4 SPATIAL SCOPE

The next step in defining the Area of Influence is to define the spatial scope. This varies depending on the potential impact being considered. The spatial scope includes all areas within which potentially significant impacts may occur. The spatial scope for each topic area has been illustrated as buffers around the project components, which are the potential sources of impact. The distances for each of these buffers are provided in *Table 4.2* and *Table 4.3*. A composite of these buffers then forms the overall spatial scope of the impact assessment.

Figure 4.3 and *Figure 4.4* illustrate the spatial scope for the construction and operation phases of the Project.

Table 4.2 Construction Spatial Scope

Topic	Spatial Scope Distances
Air quality	500m from roads and construction site (Phase IV footprint and laydown area)
Noise & Vibration	1km from access road and construction equipment sources (Phase IV footprint and laydown area)
Biodiversity	**Direct:** 2km buffer around Physical footprint of construction works, laydown area, expanded substation and existing power plant infrastructure. **Indirect:** Air Quality Construction Area of Influence
Surface Water	Ébrié Lagoon, and the main surface water features and drainage regime
Groundwater	Underlying aquifers for Project area
Waste	Waste sites within the region
Cultural Heritage	Physical footprint of construction works & laydown area
Social	**Direct:** • Village of Azito approximately 300m to the west; • Village of Béago approximately 700m to the north-east; • Quartier of Yopougon-Kouté approximately 300m to the north • The eastern side of Niangon-Sud quartier **Indirect:** Youpougon commune, the Ébrié lagoon and Port of Abidjan Authority concession area

Table 4.3 Operation Spatial Scope

Topic	Spatial Scope Distances
Air quality	15km from major emissions sources (centred on CCGT)
Noise & Vibration	1km from operational noise sources (Phase IV footprint area)
Biodiversity	**Direct:** 2km buffer around physical footprint expansion, expanded substation and existing power plant infrastructure. **Indirect:** Air Quality Operation Area of Influence (15km)
Surface Water	Ébrié Lagoon, and the main surface water features and drainage regime
Groundwater	Underlying aquifers for Project area
Waste	Waste sites within the region
Cultural Heritage	Physical footprint of construction works & laydown area
Social	**Direct:** • Village of Azito approximately 300m to the west; • Village of Béago approximately 700m to the north-east; • Quartier of Yopougon-Kouté approximately 300m to the north • The eastern side of Niangon-Sud quartier **Indirect:** Youpougon commune, the Ébrié lagoon and Port of Abidjan Authority concession area

Figure 4.3 *Spatial Scope for Construction*

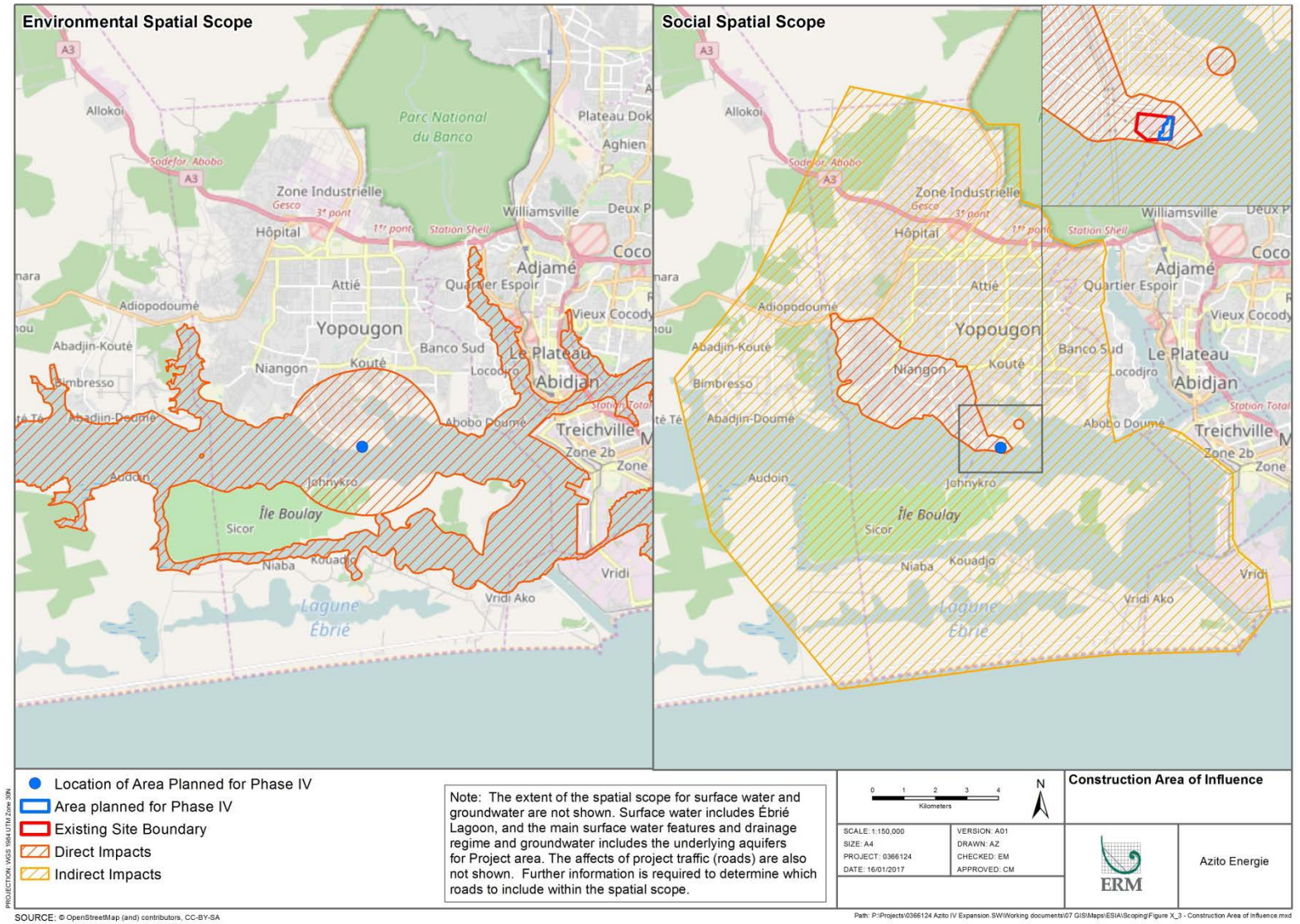
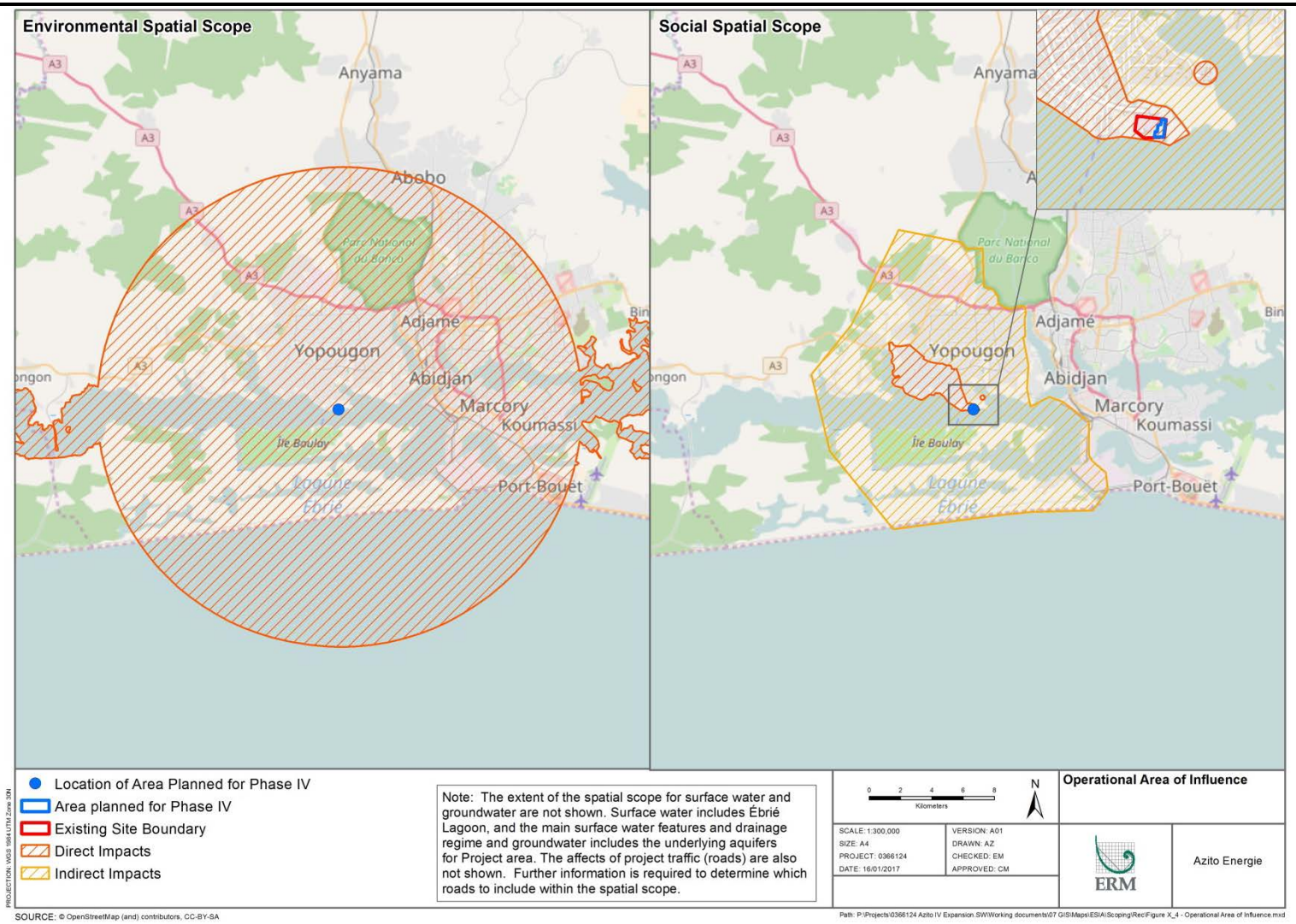


Figure 4.4 *Spatial Scope for Operation*



4.5 SCOPING SUMMARY

A summary of the scoping assessment is provided in *Table 4.4*. This includes the justification for scoping out a topic.

Scoping has focussed on construction and operation given the uncertainties around decommissioning at this time (see *Figure 4.2*).

As part of scoping, potential impacts have been classified as 'scoped in', 'scoped in (limited assessment)' or 'scoped out'. Where potential impacts have been 'scoped in (limited assessment)', the assessment will be limited, based on the likely significance rating of the impact. It will focus on reviewing management procedures, either in-place or planned, to manage the impact. An example of this would be assessing the risk scenarios and management systems in place regarding emergency response.

Table 4.4 Summary of Scoping

Topic	Phase	Receptors	Scoped In/Out?	Justification for Scoping Out
Air Quality	Construction	Human health	In	
		Habitats	Out	Due to the nature of emissions from mobile equipment and vehicles, and the relatively short stacks that they are discharged from, dispersion should be localised (i.e. within 1 km) to the site of emission. This has been scoped out on the basis that the anticipated volumes will not exceed the WHO guidelines for the protection of vegetation (1).
	Operation	Human health	In	
		Habitats	In (limited assessment)	Limited assessment - focus on management measures
Noise & Vibration	Construction	Human health	In	
		Fauna	Out	Construction noise impacts on fauna have been scoped out on the basis that the Project is located in an area which already experiences noise disturbance from the existing operations and the incremental construction noise will be minimal. Marine traffic levels will be commensurate with existing levels. No nearshore piling is planned.
	Operation	Human health	In	
		Fauna	Out	Operational noise impacts on fauna have been scoped out on the basis that the Project is located in an area which already experiences noise disturbance from the existing operations and the incremental operation noise will be minimal. Fauna present are already tolerant of noise levels experienced.
Surface Water	Construction	water users (human/ecology)	Out	Surface water impacts have been scoped out on the basis that in comparison to existing discharges, construction phase discharges will not be material. Dust management will be high due to the sensitivity of existing asset.
	Operation	Water users (human/ecology)	In (limited assessment)	

(1) Air Quality Guidelines for Europe, Second Edition, World Health Organization, 2000.

Topic	Phase	Receptors	Scoped In/Out?	Justification for Scoping Out
Soils	Construction	Soil users (human)	Out	Soil impacts have been scoped out on the basis that the laydown area selected will meet the geotechnical requirements and the rest of the Project site where earthworks will occur is located within the footprint of the existing Azito Power Plant.
	Operation	Soil users (human)	Out	No earthworks are planned during operation.
Groundwater	Construction	Water users (human)	In	The Project is considering various options for water sourcing (i.e. existing wells, recycling of process water, drilling of a new well).
	Operation	Water users (human)	In	
	Operation	Soil users (human)	Out	
Ecology	Construction	Flora	In (limited assessment)	For the shipping it is assumed that any shipping traffic (if selected) will use existing shipping routes to travel to site. Although the number of ship movements is not currently confirmed, it is expected that the numbers will not represent a relatively small increase in relation to the existing levels of shipping traffic in Ébrié lagoon.
		Fauna	In (limited assessment)	
	Operation	Flora	In (limited assessment)	
		Fauna	In (limited assessment)	
Cultural Heritage	Construction	Tangible cultural heritage	In (limited assessment)	
		Intangible cultural heritage	Out	The Project is not anticipated to significantly change socio-cultural sense of place given that is an expansion Project of an existing power generation facility.
	Operation	Tangible cultural heritage	Out	No significant earthworks are anticipated during operation.
		Intangible cultural heritage	Out	The Project is not anticipated to significantly change socio-cultural sense of place given that is an expansion Project of an existing power generation facility.
Social	Construction	Local communities	In	
		Local economy	In	
		Workforce	In	
		Ecosystem services (e.g. fishing/recreation)	In	

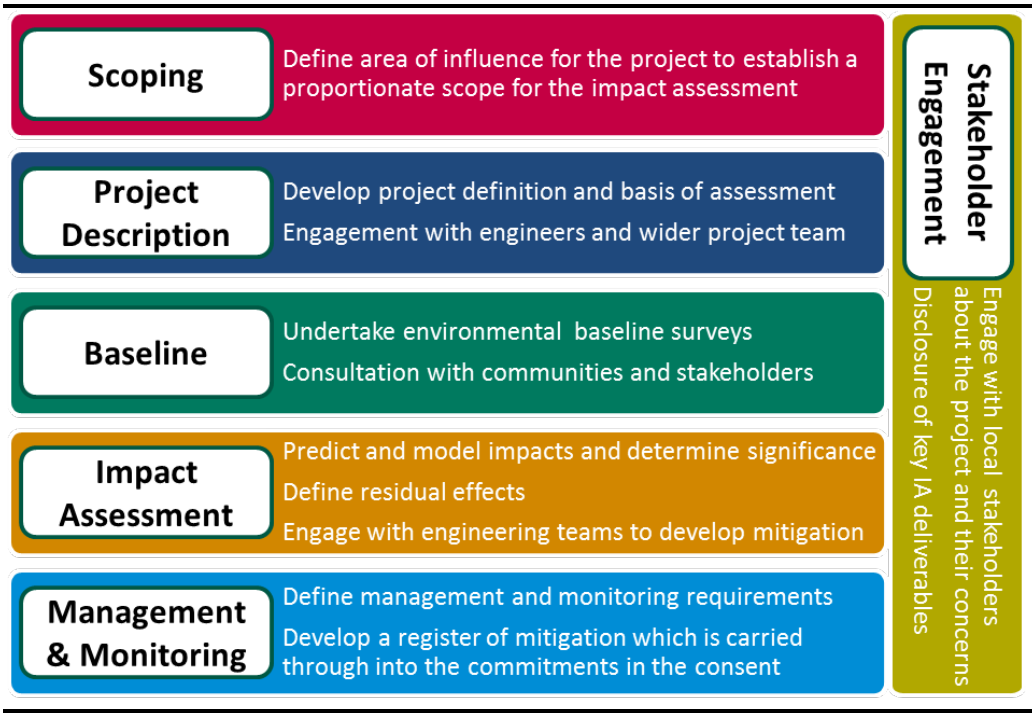
Topic	Phase	Receptors	Scoped In/Out?	Justification for Scoping Out
		Local livelihoods	In (limited assessment)	
		Social infrastructure	Out	At this stage then need for additional transmissions lines for the evacuation of the additional power that will be produced by the expanded plant has not yet been confirmed and has not been assessed as part of this ESIA
	Operation	Local communities	In	
		Local economy	In	
		Workforce	In	
		Ecosystem services (e.g. fishing/recreation)	In	
		Local livelihoods	Out	During operation no impacts to local livelihoods are anticipated. No land take during operations.
		Social infrastructure	In	
Waste	Construction	Other waste infrastructure users	In (limited assessment)	
		Environmental receptors near waste sites	In (limited assessment)	
	Operation	Other waste infrastructure users	In (limited assessment)	
		Environmental receptors near waste sites	In (limited assessment)	
Unplanned Events	Construction	Local communities	In (limited assessment)	
	Operation	Local communities	In (limited assessment)	

5 ESIA METHODOLOGY

5.1 THE ESIA PROCESS

Impact assessment is the key step in the overall ESIA process (as illustrated in *Figure 5.1*). It draws on the outputs of scoping, uses the results of baseline data collection and provides a central input into the stakeholder engagement process. The impact assessment process identifies the potential significant impacts that may result from the Project. It takes into consideration design measures. The ESIA then identifies mitigation measures that may be used to avoid, prevent, mitigate or compensate for the potential impacts. These mitigation actions will form the basis of long-term management measures.

Figure 5.1 *ESIA Process*



5.2 IMPACT ASSESSMENT METHODOLOGY

The purpose of the impact assessment process is to identify any likely significant effects on receptors/resources as a result of impacts from a project and develop appropriate mitigation measures to effectively manage these environmental and social effects. The process is iterative and can be summarised in *Figure 5.2*.

The detailed impact assessment methodology that will be used complies with international best practice for impact assessment.

Figure 5.2 Impact Assessment Methodology

Introduction

The purpose of the impact assessment process is to identify any likely significant effects on receptors/ resources as a result of impacts from a Project and develop appropriate mitigation measures to effectively manage these environmental and social effects. The process is iterative and can be summarised by the figure to the right.

The detailed impact assessment methodology that will be used complies with international best practice for impact assessment. The overarching principles of this methodology are illustrated here, but each ESIA topic area will have specific criteria for defining receptor sensitivity/vulnerability and impact magnitude.

Residual Impacts

Is it still significant?

Once mitigation has been identified, a re-assessment of impacts to determine the magnitude and significance of any residual effects (after mitigation) will be undertaken.

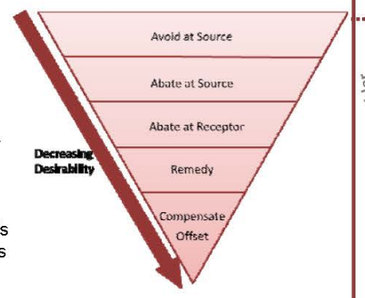
The results will be represented in the final ESIA Report and with an explanation of how the impacts have been reduced to as low as reasonably practicable (ALARP) and why further mitigation of any remaining significant effects is not technically or financially feasible.

Mitigation

If it is significant can anything be done about it?

Measures to avoid, reduce and, if necessary, mitigate environmental and social impacts will be built into the Project parameters. Where significant effects have been identified, we will identify practical and affordable ways of mitigating those impacts as far as possible.

Where a significant effect is identified, a hierarchy of options for mitigation will be considered to identify the preferred approach. However, it is envisaged that the majority of the 'Avoid at Source' types of mitigation (i.e. avoidance) will have been considered and implemented at the design stage. Therefore, it is assumed that some of the key environmental and social impacts will have been avoided prior to impact assessment.



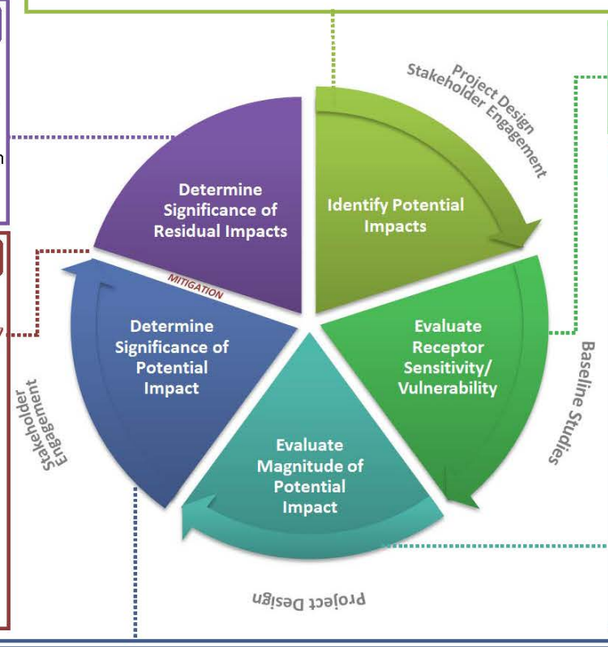
Identifying Potential Impacts

What will happen to the environment as a consequence of this Project?

The scoping process identifies the potentially most important/significant impacts and effects (including secondary, indirect and cumulative) for the assessment to address. This is done through a combination of:

- looking at the nature of the project activities and the impacts they will give rise to;
- looking at the project's environmental and social setting and its aspects which are likely to be most sensitive/vulnerable to impacts from the project;
- applying professional understanding gained from the evidence base; and
- considering inputs from stakeholders through consultation.

Decisions are then made on which impacts and effects to assess or to prioritise in the assessment (scoping in and scoping out) and how to assess them.



Receptor Sensitivity/Vulnerability

The sensitivity/vulnerability of receptors is evaluated through the use of topic specific criteria, as provided in the individual topic methodologies.

Predicting the Magnitude of Impacts

Positive/negative? Does this impact matter? How important or significant is it?

The impact assessment will describe what will happen to the environment and communities by predicting the magnitude of impacts and quantifying this to the extent practicable. The term '**magnitude**' is used as shorthand to encompass various possible dimensions of the predicted impact, such as:

- the nature of the change (what is affected and how);
- its size, scale or intensity;
- its geographical extent and distribution;
- its duration, frequency, reversibility; and
- where relevant, the probability of the impact occurring as a result of accidental or unplanned events.

For readily quantifiable impacts, such as noise, numerical values can be used, whilst for other topics a more qualitative classification is necessary. Some activities will result in changes to the environment that may be immeasurable or undetectable or within the range of normal natural variation. Such changes will be assessed as having no impact or to be of *negligible magnitude*.

Evaluation of Significance

The significance of the potential effect on receptors/resources is determined through the combined consideration of:

- the sensitivity/vulnerability of the affected environment, and
- the magnitude of the potential impact.

There is no statutory or agreed definition of significance however, for the purposes of this assessment, the following practical definition is proposed:

An impact will be judged to be significant if, in isolation or in combination with other impacts, the effects will be a notable change from baseline conditions and may require mitigation to management environmental/social effects/risks.

Magnitude and vulnerability/sensitivity will be looked at in combination to evaluate whether an impact is significant and if so its degree of significance. The principle is illustrated in the matrix to the right.

Magnitude of Impact	Sensitivity/Vulnerability/Importance of Receptor or Resource: Low	Medium	High
Negligible	Negligible	Negligible	Negligible
Small	Negligible	Minor	Moderate
Medium	Minor	Moderate	Major
Large	Moderate	Major	Major

Environmental Resources Management Ltd
2nd Floor, Exchequer Court
33 St Mary Axe
London, EC3A 8AA

Figure 5.2 Environmental and Social Impact Assessment Method

5.3 TOPIC-SPECIFIC METHODOLOGIES

5.3.1 Overview

Each ESIA topic area has specific criteria for defining receptor sensitivity/vulnerability and impact magnitude (see *Table 5.1*).

Table 5.1 Topic Specific Methodologies

Topic	Figure Number
Air Quality (Dust)	Figure 5.3
Air Quality (Point Source)	Figure 5.4
Biodiversity	Figure 5.5
Cultural Heritage	Figure 5.6
Ecosystem Services	Figure 5.7
GHG Methodology	Figure 5.8
Noise	Figure 5.9
Social and Health	Figure 5.10
Unplanned Events	Figure 5.11
Waste Management	Figure 5.12
Water	Figure 5.13

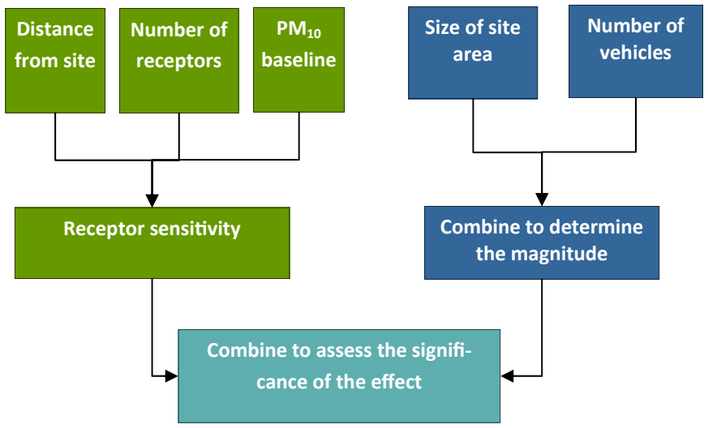
Step 1

Evaluate the characteristics of the proposed development and the surrounding environment

Identify sensitive receptors (i.e. human or fauna).

Step 2

Assess the impacts



Step 3

Apply mitigation and assess residual effects

Propose measures to mitigate adverse effects → Assess the significance of the residual effects

Magnitude of Change

The dust emission magnitude is based on the scale of the anticipated works and can be classified as Small, Medium, or Large. This methodology applies to earthworks and construction.

Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. This may also involve levelling the site and landscaping. The magnitude definitions for earthworks are:

Large: Total site area >10,000 m², potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes;

Medium: Total site area 2,500 m² – 10,000 m², moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m - 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes; and

Small: Total site area <2,500 m², soil type with large grain size (eg. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <20,000 tonnes, earthworks during wetter months.

Factors which determine the dust emission magnitude from trackout are vehicle size, vehicle speed, vehicle numbers, geology and duration. As with all other potential sources, professional judgement must be applied when classifying trackout into one of the dust emission magnitude categories.

The definitions for trackout are given below.

- **Large:** >50 HGV (>3.5t) outward movements[(1)] in any one day[(2)], potentially dusty surface material (e.g. high clay content), unpaved road length >100 m;
- **Medium:** 10-50 HGV (>3.5t) outward movements[(1)] in any one day[(2)], moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m; and
- **Small:** <10 HGV (>3.5t) outward movements[(1)] in any one day[(2)], surface material with low potential for dust release, unpaved road length <50 m.

Receptor Sensitivity

The sensitivity of the area takes account of a number of factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors; and
- in the case of PM_{10}, the local background concentration.

Table 1 Sensitivity of the Area to Dust Soiling Effects on People & Property

Receptor sensitivity	Number of receptors	Distance from the source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 2 Sensitivity of the Area to Human Health Effects from PM_{10} exposure

Receptor sensitivity	Annual mean baseline PM_{10} concentration (µg/m³)	Number of receptors	Distance from the source (m)				
			<20	<50	<100	<200	<350
High	> 32	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Environmental Resources Management Ltd
2nd Floor, Exchequer Court
33 St Mary Axe
London, EC3A 8AA

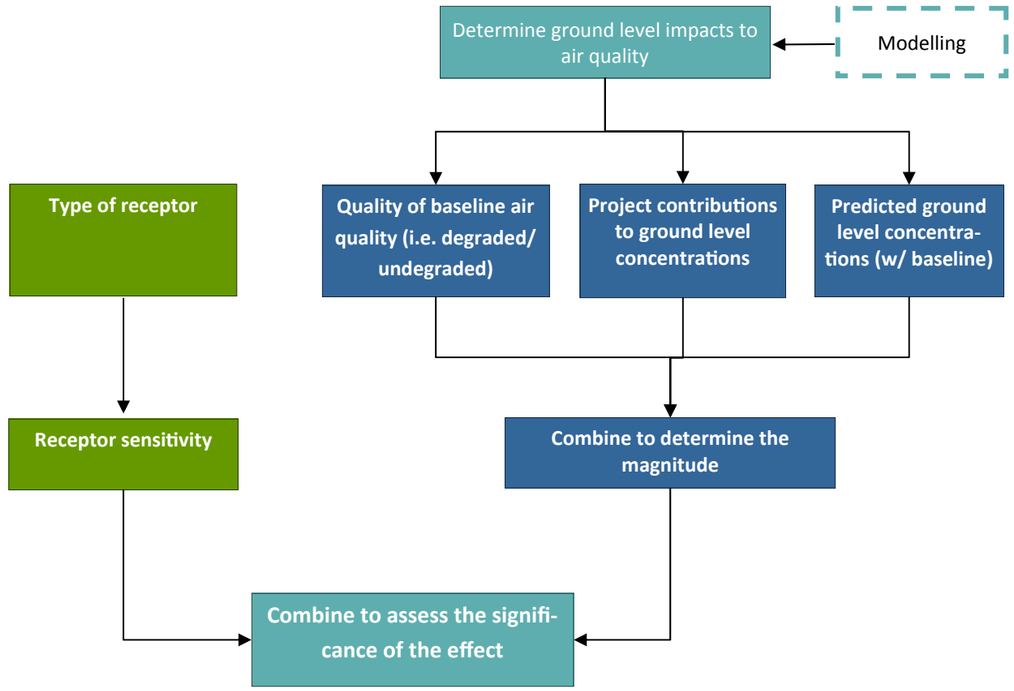
Step 1

Evaluate the characteristics of the proposed development and the surrounding environment

- Identify sensitive receptors (i.e. human or fauna).
- Determine baseline air quality levels for surrounding environment.
- Determine pollutants of concern based on emission sources

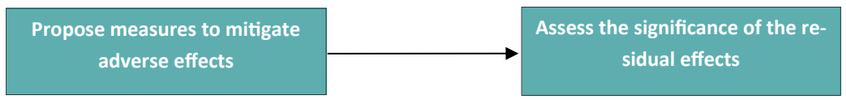
Step 2

Assess the impacts



Step 3

Apply mitigation and assess residual effects



Receptor Sensitivity

The sensitivity of ecological receptors is defined on the basis of their designated importance as an ecological resource. Any significant ecology impacts from air quality on non-designated sites will be assessed qualitatively as part of the Ecology assessment. This is typically determined on the basis of the statutory protection conferred on a receptor (for example, under the Ramsar convention).

Sensitivity	Human	Ecology
Negligible	N/A	Non-designated habitats
Low	N/A	Locally designated sites
Medium	General population	Nationally designated sites
High	Particularly vulnerable individuals, e.g. a hospital with intensive care ward	Internationally designated sites

Magnitude of Change

The results of the air dispersion modelling are compared to the relevant air quality standards or guidelines (either for human health or ecology). Different standards/ guidelines will apply depending on the pollutant of concern and the averaging period. To determine magnitude, the Project's Contributions (PCs) to ground level pollutant concentrations are assessed in tandem with the total Predicted Environmental Contributions (PECs), where the PEC is the sum of the baseline concentration and the PC for a particular pollutant. The criteria used is presented below. Where national guidance exists for impact magnitude levels, this should take precedent to the value provided below.

PC as % of AQS	Magnitude
Undegraded Airsheds Where PEC < Air Quality Standards/Guidelines	
<25%	***Negligible***
25-75%	***Small***
75-100%	***Medium***
>100%	***Large***
Previously Undegraded Airsheds Where PEC > Air Quality Standards/Guidelines	
<25%	***Negligible***
25-75%	***Medium***
75-100%	***Large***
>100%	***Large***
Already Degraded Airsheds	
<1%	***Negligible***
1-5%	***Small***
5-10%	***Medium***
>10%	***Large***

Note that in some countries a site-specific methodology is required to assess ecology impacts from air emissions (e.g. acid deposition and eutrophication). In such cases, an additional assessment would be required using site-specific ecology criteria.

Environmental Resources Management Ltd
2nd Floor, Exchequer Court
33 St Mary Axe
London, EC3A 8AA

Step 1

Evaluate the characteristics of the proposed development and the surrounding environment

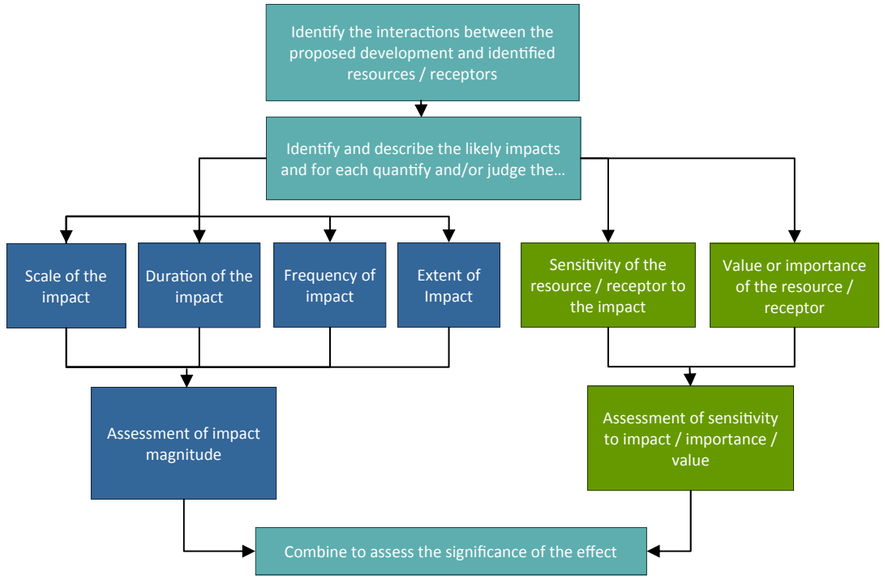
Define the preliminary scope of the biodiversity impact assessment and determine the study area. Both direct and indirect impacts should be considered.

Identify ecological resources and receptors

Establish the existing baseline conditions with particular reference to distribution of habitats and species, their uniqueness in the affected area, and their value / importance

Step 2

For each impact...



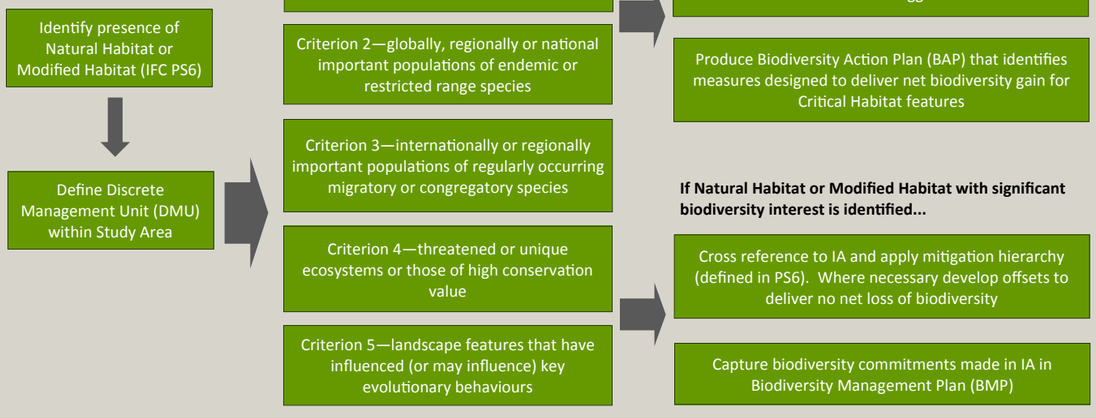
Step 3

Apply mitigation and assess residual effects

Propose measures to mitigate adverse effects

Assess the significance of the residual effect

Critical, Natural and Modified Habitat Assessment



Magnitude of Change

Ranking	Habitat	Environmental factors e.g. presence, ambient air quality, noise
Negligible	Immeasurable, undetectable or within the range of normal natural variation change to the extend and condition of a habitat.	Change is within the normal range of natural variation.
Small	Minimal disturbance and/or loss of habitat, such that there is no loss of viability or function of the habitat.	Slight change expected over a limited area and returning to background levels within a few metres or tens of metres. No exceedances of benchmark limits. A temporary and localised physical change / source of disturbance.
Medium	Localised disturbance and/or loss of a habitat that does not threaten the long term viability or function of the habitat	Temporary or localised change and/or occasional exceedance of benchmark limits. A physical change in the medium term over a relatively large area.
Large	Widespread and/or permeant disturbance or loss of a habitat, threatening the long term viability or function of the habitat.	Change over a large area that lasts over the medium to long term, likely to cause secondary effects on ecology and/or routine exceedance of benchmark limits. A long term physical change that affects a large area or introduces a permanent physical barrier to migration

Sensitivity

Sensitivity is not an inherent characteristic of a receptor or resource. Receptor or resource sensitivity is the degree to which it is tolerant of, adaptable to and able to recover from a change in its environment. Therefore in addition to considering the importance/quality/value of the affected receptor or resource, its response (or sensitivity) to a particular impact is also considered. This is typically informed by literature review and the evidence base.

Ranking	Tolerance	Adaptability	Recoverability
High	Receptor unable to tolerate effect resulting in permanent change in its abundance or quality.	Receptor unable to avoid impact.	Receptor unable to recover resulting in permanent or long term change (e.g. >10 years).
Medium	Receptor has some ability to tolerate this effect but a detectable change (e.g. a change in distribution) will occur.	Receptor has some ability to avoid the most negative consequences of the impact or can partially adapt to it (e.g. by moving to other suitable areas).	Receptor recovers to an acceptable status over the short term to medium term (e.g. 1-10 years).
Low	receptor unaffected or positively affected.	Receptor can completely avoid the impact or adapt to it with no detectable changes.	Receptor recovers fully within e.g. 1 year.

Value / Importance

Ranking	Habitats	Species
Low	Habitats with no, or only a local designation / recognition. Habitats of significance for species listed as of Least Concern (LC) on IUCN Red List. Marine habitats which are common and widespread within the region, or with low conservation interest.	Species that are abundant, common or widely distributed and are generally adaptable to changing environments. Species are not endangered or protected, but may be listed as LC.
Medium	Habitats within nationally designated or recognised areas. Habitats of importance to globally Vulnerable (VU), Near Threatened (NT) or Data Deficient (DD) species, and species with nationally restricted ranges. Habitats supporting nationally significant concentrations of migratory species (more than 1% of national population) and / or congregatory species, and habitats used by species of medium value.	Species listed as VU, NT or DD. Species that have low abundance, restricted ranges, are currently under pressure or are slow to adapt to changing environments. Species are valued locally / regionally and may be endemic, endangered or protected. Species that do not meet criteria for High Value linked to IFC critical habitats.
High	Habitats within internationally designated or recognised areas. Habitats of importance to globally Critically Endangered (CR) or Endangered (EN) species, endemic and/or globally restricted-range. Habitats supporting globally significant concentrations of migratory species and / or congregatory species, highly threatened and/or unique ecosystems, areas associated with key evolutionary species, and low or medium value habitats used by high value species.	Species listed as CR or EN. Range restricted or endemic as defined in IFC criteria for Tier 1 or Tier 2 assessment (Guidance notes 81-83) Species that are valued nationally /globally and are listed as endangered or protected.

(1) The integrity of a site is assessed in terms of: the extent and distribution of the habitats of the qualifying features; the structure and function of the habitats of the qualifying features; the supporting processes on which the habitats of the qualifying features rely; the population of each of the qualifying features, and the distribution of the qualifying features within the site.

Environmental Resources Management Ltd
2nd Floor, Exchequer Court
33 St Mary Axe
London, EC3A 8AA

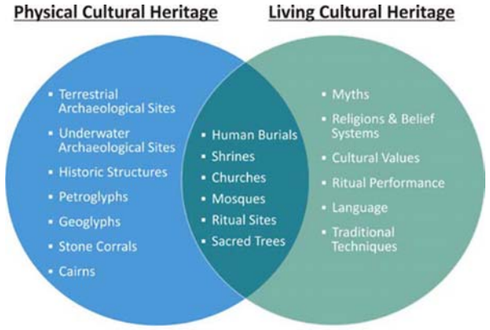
Assessing Biodiversity Impacts

Cultural Heritage

Definitions—what does it involve?

Cultural Heritage - the tangible and intangible legacy we inherit from previous generations and comes in a vast array of concepts and terminology.

It includes buried assets (such as archaeology and unmarked human burials), above ground assets (such as buildings and monuments), marine sites and assets, landscapes and Intangible heritage (such as language, belief systems and folklore).



Step 1

Evaluate the characteristics of the proposed development and the surrounding environment

Collect and collate a baseline of heritage to understand the existing situation

Define the preliminary scope of the cultural heritage impact assessment and determine the study area:

- Review potential presence of known/likely cultural heritage resources.
- Identify sources of existing information.
- Take account of degree of previous research – absence of known cultural heritage does not necessarily mean that none exists.
- Assess which techniques are likely to be needed in order to identify the presence of cultural heritage.
- Depending on which standards apply (national legislation or international standards) assess level of effort required.

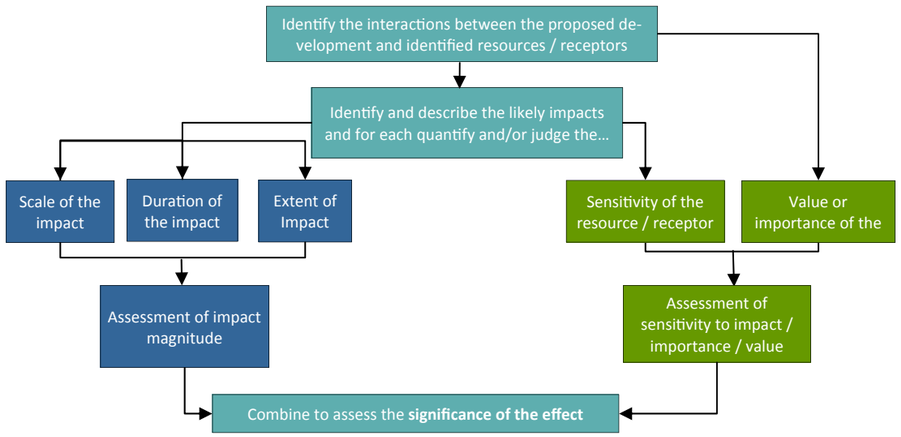
Identify cultural heritage resources and receptors. Establish the existing baseline conditions with particular reference to distribution of tangible and intangible heritage resources, their uniqueness in the affected area, and their value / importance.

The known information about an affected area represents a starting point. Addition data collection allows a fuller picture of the potential presence of unidentified remains to be developed. Additional information is gathered through:

- site reconnaissance;
- intrusive fieldwork ;
- non-intrusive fieldwork; and
- stakeholder consultation.

Step 2

For each impact...



Step 4 - Mitigation

Apply mitigation and assess residual effects

Propose measures to mitigate adverse effects of identified impacts on cultural heritage. These measures can be included within a combined Environmental and Social Management Plan (ESMP) or within a stand alone management plan .

Assess the significance of the residual effect.

Magnitude of Change

Ranking	Tangible/Intangible Cultural Heritage	Relevant factors (e.g. presence)
Negligible	No discernible change in the physical condition, archaeological potential, setting or accessibility and enjoyment of the site/ feature. No perceived change to an intangible resource/asset.	Change is insufficient to affect the value of the site or resource.
Small	Small part of the site is lost or damaged resulting in a loss of scientific or cultural value or archaeological potential: the setting undergoes a temporary or permanent change that has a limited effect on the site's perceived value to stakeholders. Public and expert access to the site/resource may be temporarily restricted.	Slight change expected over a limited area and duration. A temporary and localised physical change / source of disturbance not leading to a permanent reduction in value/importance to stakeholders.
Medium	A majority of the site is damaged or lost resulting in a loss of scientific or cultural value and perceived/actual value to stakeholders. The setting undergoes permanent change that diminishes the site's value. Access to the site is permanently reduced or restricted.	A physical and/or perceived change that alters the physical ,scientific and community value of a site or resource.
Large	The entire site or resource is damaged or lost resulting in a loss of all scientific or cultural value or archaeological potential. The setting of the site or resource is impacted to such a degree as to cause almost complete loss of value to stakeholders and loss of access to the site or resource.	A long term physical or cultural change that affects the value of a site or resource on a permanent basis.

Sensitivity

Sensitivity is not an inherent characteristic of a receptor or resource. Receptor or resource sensitivity is the degree to which it is tolerant of, adaptable to and able to recover from a change in its environment. Therefore in addition to considering the importance/ quality/value of the affected receptor or resource, its response (or sensitivity) to a particular impact is also considered. This is typically informed by literature review and the evidence base.

Ranking	Characteristics
High	A site is considered to be of high sensitivity if: • it is protected by local, national, and international laws or treaties; • the site cannot be moved or replaced without major loss of cultural value; • the legal status specifically prohibits direct impacts or encroachment on site and/or protection zone; • the site has substantial value to local, national, and international stakeholders; and/or • the site has exceptional scientific value and similar site types are rare or non-existent (equivalent of IFC Performance Standard (PS) 8 Critical Cultural Heritage).
Medium	A site is considered to be of medium sensitivity if: • it is specifically or generically protected by local or national laws but laws allow for mitigated impacts; • the site can be moved or replaced, or data and artefacts recovered in consultation with stakeholders; • The site has considerable cultural value for local and/or national stakeholders; and/or • the site has substantial scientific value but similar information can be obtained at a limited number of other sites (equivalent of IFC PS8 Non-Replicable Cultural Heritage).
Low	A site is considered to be of low sensitivity if: • it is not specifically protected under local, national, or international laws or treaties; • the site can be moved to another location or replaced by a similar site, or is of a type that is common in surrounding region; • the site has limited or no cultural value to local, national, or international stakeholders; and/or • the site has limited scientific value or similar information can be obtained at numerous sites (equivalent of IFC PS8 Replicable Cultural Heritage).

Environmental Resources Management Ltd
2nd Floor, Exchequer Court
33 St Mary Axe
London, EC3A 8AA

Ecosystem services are benefits that ecosystems provide to people. Following the guidance of the Millennium Ecosystem Assessment, [1] these have been classified into four categories:

Provisioning services are the goods or products obtained from ecosystems, such as food, timber, medicines, fibres and freshwater.

Regulating services are the benefits obtained from an ecosystem's control of natural processes, such as climate regulation, disease control, erosion prevention, water flow regulation, and protection from natural hazards.

Cultural services are the nonmaterial benefits obtained from ecosystems, such as recreation, sacred sites and aesthetic enjoyment.

Supporting services are the natural processes, such as soil formation, nutrient cycling and primary production, that maintain the other services

The Nord Stream 2 **Biodiversity Management Policy** (W-HS-EMS-GEN-PAR-800-BDPOLIEN-02) sets out the Company's policy and strategy for ecosystem services. This includes adherence to the biodiversity policy objectives of the International Finance Corporation (IFC) Performance Standard 6 and the guidance from the IFC Guidance Notes and from the CSBI Cross-Sector Guide for Implementing the Mitigation Hierarchy.
The Company also undertaken the following commitments with respect to the management of ecosystem services:

- Conduct a systematic review to identify priority ecosystem services for Affected Communities and for the Project itself which may be impacted.
- Apply the mitigation hierarchy; avoid, minimise, restore and offset; to the management of ecosystem services.Where impacts are unavoidable, the Project will minimise them and implement mitigation measures that aim to maintain the value and functionality of priority services.
- The mitigation/management strategy needs to take into consideration the role of ecosystem services in other IFC PSs, notably 3, 4, 5, 7 and 8.

Step 2

Assess the impacts

Conducted as part of the relevant topic areas, but summarised in a dedicated ecosystem services section

The IFC Performance Standards require that the ESHIA assess impacts on priority ecosystem services. From Step 1, these are those services rated as *high* or *critical* priority for beneficiaries or for the Project.

The assessment of ecosystem services is incorporated into each of the relevant topic area sections of the impact assessment. Impacts on priority ecosystem services are also summarised in a standalone ecosystem services section. **The ecosystem services section does not re-classify or re-assess impacts, but highlights interlinkages and summarises impacts and mitigation measures for priority ecosystem services.**

The full assessment of the significance of impacts on individual ecosystem services is undertaken within the other impact assessment sections of the report, using the methodology appropriate to a given section. For social and health impacts, for example, the significance of impacts takes into account vulnerability of the receptors, including assessing impacts on vulnerable groups separately as appropriate. For physical and ecological services (e.g. erosion control, habitat provision, coastal protection) the appropriate measure of sensitivity to change is considered and applied. These sections indicate when a particular impact relates to an ecosystem service, but in general integrate ecosystem services into the standard impact assessment format.

Social experts have utilised the outputs of the environmental and physical impact analyses where these have implications for the livelihoods, health and safety or cultural traditions of local communities. Spatial information on the location of habitats providing ecosystem services and communities utilising those services has been integrated into the impact assessment sections as appropriate. The ecosystem services section serves as both a guide and a summary capturing the linkages across these impacts and analyses.

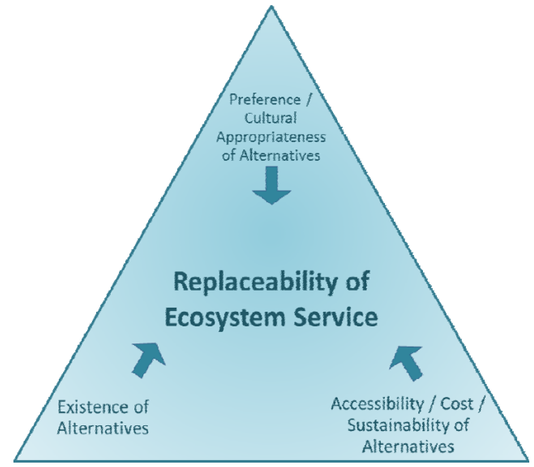
The concept of ecosystem services is ultimately tied to human beneficiaries; therefore, the final summary of impacts on priority ecosystem services is incorporated into the social section of the ESHIA.

Step 1

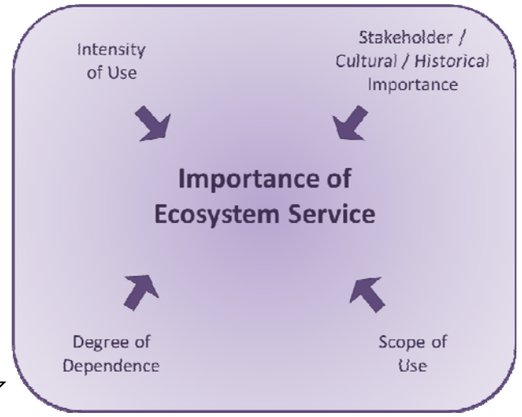
Ecosystem Services Prioritisation

Verify screening and scoping, and establish value of ecosystem services to beneficiaries.

Assess Replace-ability of Service



Assess Importance of Service



		Replaceability of Service		
		High *(many spatial alternatives)*	**Moderate** *(some spatial alternatives)*	**Low** *(few to no spatial alternatives)*
Importance of service	**Essential**	**High**	**Critical**	**Critical**
	High	Medium	**High**	**Critical**
	Moderate	Low	Medium	**High**
	Low	Low	Low	Medium

[1] http://www.maweb.org/en/index.aspx

Introduction

When evaluating climate change effects, there are two aspects to consider:

- what are the potential effects on receptors/resources ***FROM*** the Project, i.e. from greenhouse gas (GHG) emissions; and
- what are the climate change risks ***TO*** the Project (e.g. flooding, increase heat fatigue to staff)?

This methodology addresses only the former, with climate risks being assessed through a separate Climate Risk Assessment process.

Step 1

Quantify the greenhouse gas emissions, both direct and indirect.

Obtain GHG emissions data from Project

For each phase of the Project, quantify the annual Scope 1 and Scope 2 GHG emissions using the GHG Protocol.

Step 2

Assess the impacts

Are the annual GHG emissions greater than 25 000 tCO_2e for any year?

Yes | **No**

GHG emissions are considered ***Significant***

GHG emissions are considered ***Not Significant***

Step 3

Apply mitigation and assess residual effects

Can GHG emissions be reduced to below the significance threshold?

If not, basic mitigation measures that will apply for ***Significant*** impacts are: as follows

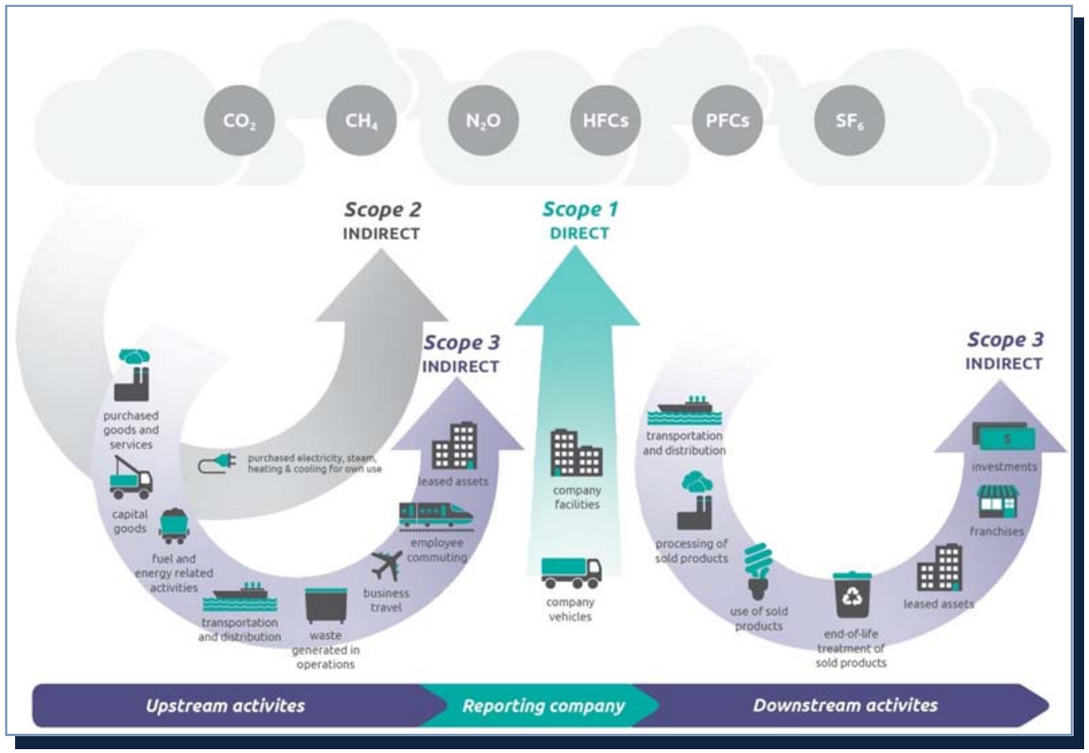
- Quantify GHG emissions annually in accordance with internationally recognised methodologies and good practice.
- The Project shall have a system in place to periodically review annual GHG performance and evaluate options for improving energy efficiency over the life of the Project.
- The Project will develop and implement a routine maintenance plan for all key GHG emission sources.

The GHG Inventory

The most internationally accepted guidance for estimating GHG emissions for this purpose is 'The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard', published by the World Resources Institute. This protocol was prepared through a partnership between the World Resources Institute and the World Business Council for Sustainable Development.

GHGs included in the GHG assessment methodology are the gases under the UNFCCC/Kyoto Protocol: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbon (PFC), sulfur hexafluoride (SF_6) and nitrogen triflouride (NF_3). GHG emissions are expressed in tonnes CO_2 equivalents (tCO_2e). Emissions are estimated by multiplying activity data (e.g. fuel consumption) with the corresponding emission factor. All emissions are then converted into CO_2 equivalents by multiplying emissions by the global warming potential factor of the specific GHG.

The GHG Protocol defines three emissions 'scopes' for GHG accounting and reporting purposes: Scope 1, Scope 2 and Scope 3. These scopes are illustrated in the figure below from the GHG Protocol. According to the GHG Protocol requirements, organisations must separately account for and report Scope 1 and Scope 2 emissions at minimum.



Scope 1 - Direct GHG emissions from the Project

Scope 2 - Indirect GHG emissions associated with consumption of energy produced off-site (i.e. electricity from the grid).

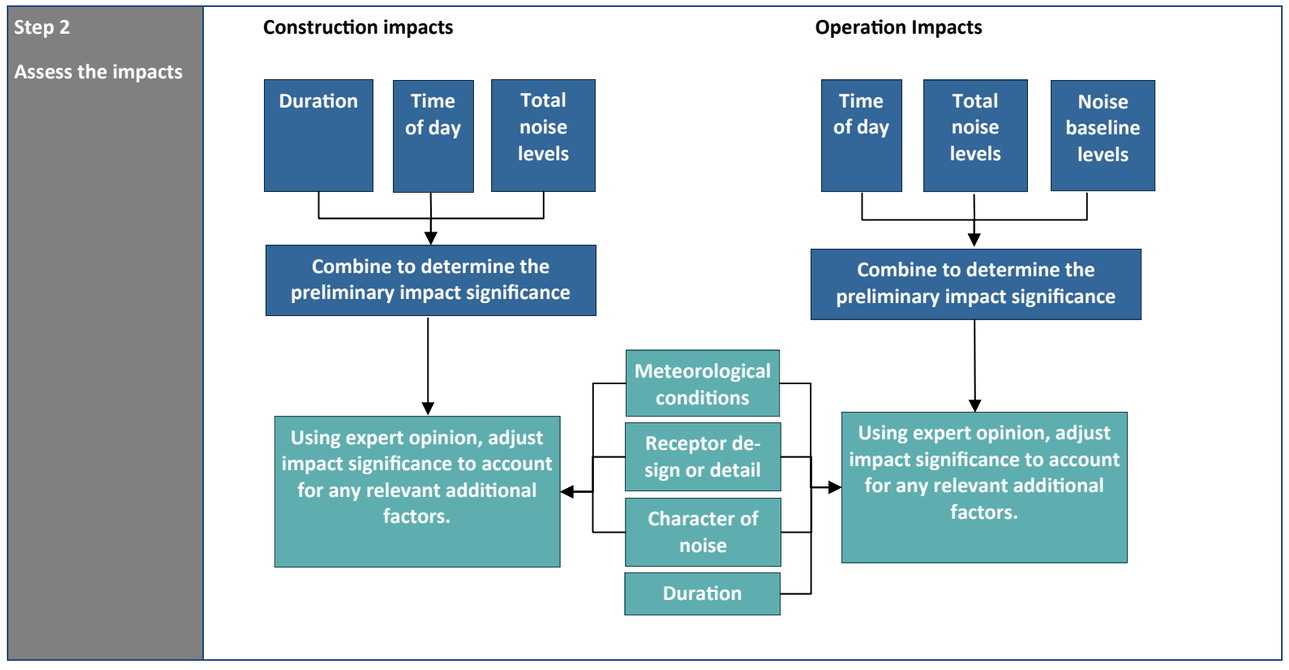
Scope 3 - All other indirect emissions, such as (but not limited to) contracted and other associated activities. *For this initial GHG inventory, no Scope 3 emissions associated with the Project have been included.*

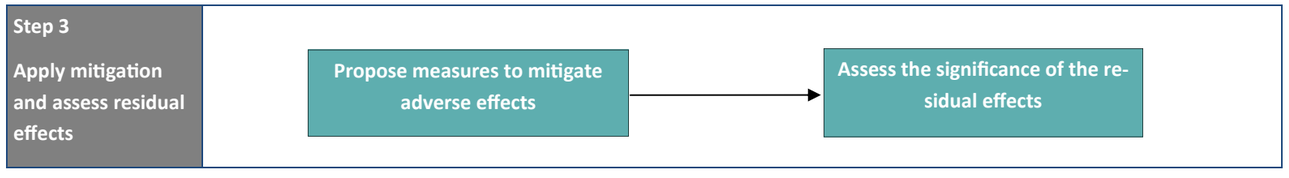
Significance

Because the potential impacts covered in this assessment are global in nature, impact significance cannot be determined in the same way that other topic areas are (i.e. by evaluating receptor sensitivity and magnitude). Climate change effects do vary in significance according to magnitude and local sensitivities, but this is determined by geography and does not necessarily correlate to the source location of the GHG emissions contributing to climate change effects. For this reason, the assessment does not try to assign significance in the traditional way (i.e. Negligible, Minor, Moderate, or Major), but rather only assigns overall significance based on the threshold of 25 000 tCO_2e set out in the IFC's Performance Standard 3.

Overview

When assessing effects on humans from noise impacts, impact significance is not determined in the same way that it is for most other technical disciplines, i.e. using a matrix of impact magnitude and receptor sensitivity. Consideration of receptor sensitivity is instead made at the start of the assessment, and impacts are only assessed where sensitive receptors are identified. Additionally, receptor sensitivity is used to determine the appropriate standards or guidelines that should be used to determine the magnitude of the impact, and, therefore ,the impact significance. Presented below is the process followed to assess noise impacts and effects on humans.





Construction Phase Noise Impact Magnitude/Preliminary Impact Significance

Construction noise impact magnitude is usually judged by exceedance of absolute noise thresholds (L_{Aeq}), because it is usually well above baseline noise levels (where this is not the case, the noise change approach can be used with caution, allowing for duration). Whilst the IFC gives no guidance on construction noise, the below levels are based on the relative effects to the IFC's absolute noise thresholds for day and night time.

Exposure	Disturbance Impact			
	Negligible	Minor	Moderate	Major
Short-term (< 1 month)	Day-time L_{Aeq}: <70 dB	Day-time L_{Aeq}: 70-75 dB	Day-time L_{Aeq}: 76-80 dB	Day-time L_{Aeq}: >80 dB
	Night-time L_{Aeq}: <55 dB	Night-time L_{Aeq}: 55-60 dB	Night-time L_{Aeq}: 61-65 dB	Night-time L_{Aeq}: >65 dB
Medium-term (1 to 6 months)	Day-time L_{Aeq}: <65 dB	Day-time L_{Aeq}: 65-70 dB	Day-time L_{Aeq}: 71-75 dB	Day-time L_{Aeq}: >75 dB
	Night-time L_{Aeq}: <45 dB	Night-time L_{Aeq}: 45-55 dB	Night-time L_{Aeq}: 56-60 dB	Night-time L_{Aeq}: >60 dB
Long-term (> 6 month)	Day-time L_{Aeq}: <55 dB	Day-time L_{Aeq}: 55-60 dB	Day-time L_{Aeq}: 61-65 dB	Day-time L_{Aeq}: >65 dB
	Night-time L_{Aeq}: <45 dB	Night-time L_{Aeq}: 45-50 dB	Night-time L_{Aeq}: 51-55 dB	Night-time L_{Aeq}: >55 dB

Operational Phase Noise Impact Magnitude/Preliminary Impact Significance

Two types of impact are considered here: disturbance impacts and amenity impacts. Disturbance impacts are assessed using two parameters: the change in absolute noise levels associated with the Project (Project Noise Δ) and the absolute noise (L_{Aeq}) for a given period (i.e. 1 hour). The former only applies if the noise baseline levels are below applicable noise standards/guidelines.

Amenity impacts are only significant where the noise levels were low prior to the Project, and as such, the impact magnitude/preliminary significance is determined by the difference in noise levels before and after the Project ($L_{Aeq,\ 1hr} - L_{A90,\ 1\ hr}$).

The below levels of significance are based on the IFC's absolute noise thresholds for day and night time. Where national noise standards exist, these will instead be used as the basis.

Period	Disturbance Impact				Amenity Impact			
	Negligible	Minor	Moderate	Major	Negligible	Minor	Moderate	Major
Noise baseline *BELOW* noise standards/guideline								
Day	Project Δ: 0-3 dB	Project Δ: 3-5 dB	Project Δ: 5-10 dB	Project Δ: >10 dB	$L_{Aeq,\ 1hr} - L_{A90,\ 1\ hr}$: <5 dB	$L_{Aeq,\ 1hr} - L_{A90,\ 1\ hr}$: 5-10 dB	$L_{Aeq,\ 1hr} - L_{A90,\ 1\ hr}$: 11-15 dB	$L_{Aeq,\ 1hr} - L_{A90,\ 1\ hr}$: >15 dB
Night	Project Δ: 0-3 dB	Project Δ: 3-5 dB	Project Δ: 5-10 dB	Project Δ: >10 dB	$L_{Aeq,\ 1hr} - L_{A90,\ 1\ hr}$: <5 dB	$L_{Aeq,\ 1hr} - L_{A90,\ 1\ hr}$: 5-10 dB	$L_{Aeq,\ 1hr} - L_{A90,\ 1\ hr}$: 11-15 dB	$L_{Aeq,\ 1hr} - L_{A90,\ 1\ hr}$: >15 dB
Noise baseline *ABOVE* noise standards/guideline								
Day	$L_{Aeq,\ 1hr}$: <50 dB	$L_{Aeq,\ 1hr}$: 50-55 dB	$L_{Aeq,\ 1hr}$: 56-60 dB	$L_{Aeq,\ 1hr}$: >60 dB	N/A	N/A	N/A	N/A
Night	$L_{Aeq,\ 1hr}$: <40 dB	$L_{Aeq,\ 1hr}$: 40-45 dB	$L_{Aeq,\ 1hr}$: 46-50 dB	$L_{Aeq,\ 1hr}$: >50 dB	N/A	N/A	N/A	N/A

Environmental Resources Management Ltd
2nd Floor, Exchequer Court
33 St Mary Axe
London, EC3A 8AA

Step 1

Evaluate the characteristics of the proposed development and the surrounding environment

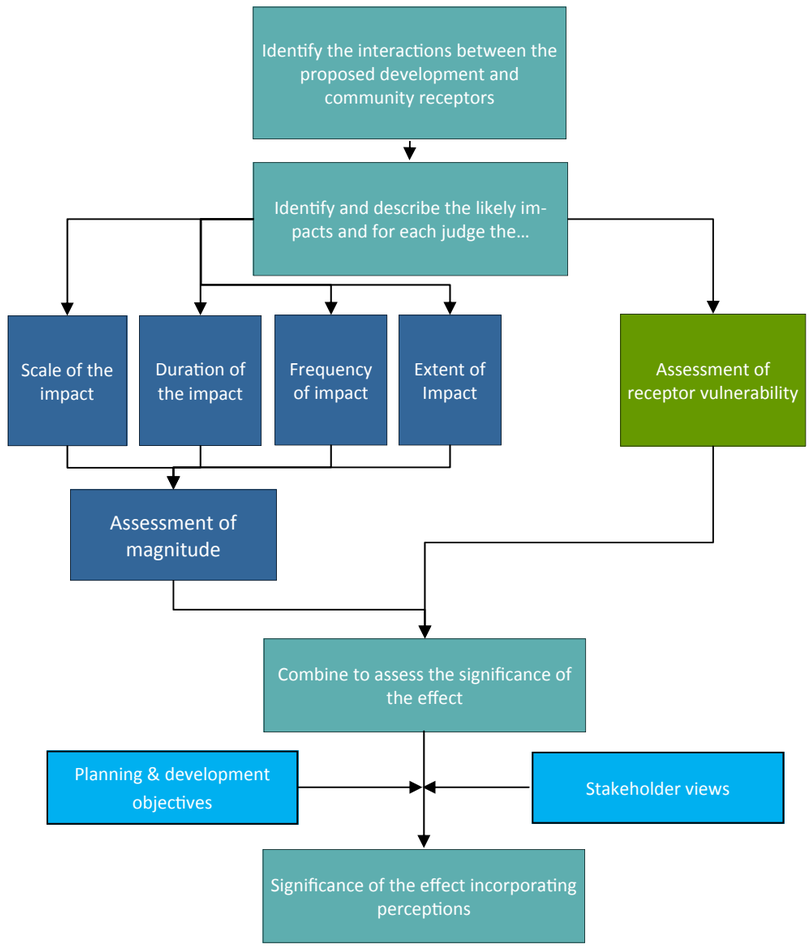
Define the preliminary scope of the social and health impact assessment and determine the study area

Identify receptors to social and health impacts.

Establish the existing baseline that does not rely on people's perceptions. Common techniques include desktop review, household survey, focus group discussions, participatory data collection and key informant interviews.

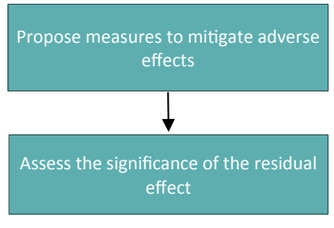
Step 2

Assess the impacts



Step 3

Apply mitigation and assess residual effects



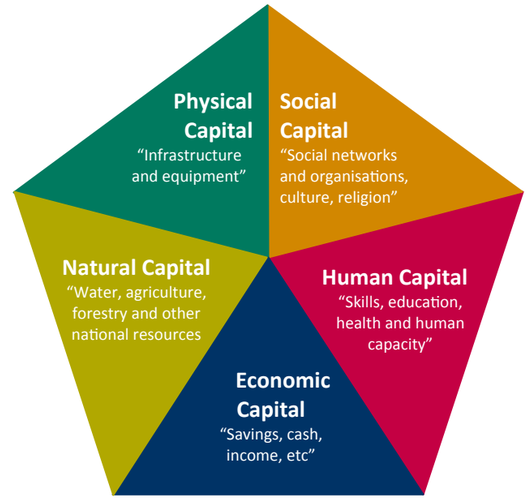
Magnitude of Change

The approach for designating magnitude for social or community health impacts takes a "best fit" approach whereby the various characteristics contributing to magnitude (scale, duration, extent, frequency) are considered in together, and the appropriate description is selected based on the overall combination of characteristic values using the judgement of the practitioner.

Magnitude	Community Receptors
Negligible	Change remains within the range commonly experienced within the household or community.
Small	Perceptible difference from baseline conditions. Tendency is that impact is local, rare and affects a small proportion of receptors and is of a short duration.
Medium	Clearly evident difference from baseline conditions. Tendency is that impact affects a substantial area or number of people and/or is of medium duration. Frequency may be occasional and impact may potentially be regional in scale.
Large	Change dominates over baseline conditions. Affects the majority of the area or population in the area of influence and/or persists over many years. The impact may beexperienced over a regional or national area.
Positive	In the case of positive impacts, it is generally recommended that no magnitude be assigned, unless there is ample data to support a more robust characterisation. It is usually sufficient to indicate that there will be a positive impact, without characterising the exact degree of positive change likely to occur.

Determining Vulnerability

Vulnerability describes the sensitivity of the receiving environment (i.e. societies, communities and households) that will experience impacts. A vulnerable individual or group is one that could experience adverse impacts more severely than others, based on his/her vulnerable or disadvantaged status. Vulnerability is a pre-existing status that is independent of the project under consideration. It is important to understand the vulnerability context as it will affect the ability of social receptors to adapt to socio-economic/cultural or bio-physical changes. A higher level of vulnerability can result in increased susceptibility to negative impacts or a limited ability to take advantage of positive impacts. More vulnerable receptors will tend to lack one or more livelihoods assets that could help them to respond to, or manage, change (see figure—right). The characteristics that underpin vulnerability will be specific to each social setting, however, the following general definitions can apply.



Vulnerability	Community Receptors
Low	Minimal areas of vulnerabilities; consequently with a high ability to adapt to changes brought by the Project
Medium	Some but few areas of vulnerability; but still retaining an ability to at least in part adapt to change brought by the Project
High	Profound or multiple levels of vulnerability that undermine the ability to adapt to changes brought by the Project

Integrating Stakeholders, Policy and Planning Perceptions

Impacts should be considered within the context of the local setting as set out in policy or development objectives and / or the view and perceptions of the local people. These priorities and views should be integrated into the assessment when evaluating the effect significance, ideally after an initial significance has been rated.

It is possible that the community will have a different perception of an impact than that expected; this is commonly referred to as a perceived impact. The effects of a perceived impact can be just as 'real' as those from other impacts and should be captured, but should be clearly differentiated. Failure to adequately address perceived impacts and the effects they cause is just as likely to result in project delays as other impacts assessed.

Environmental Resources Management Ltd
2nd Floor, Exchequer Court
33 St Mary Axe
London, EC3A 8AA

Overview

To evaluate potential impacts from unplanned events, a risk-based approach is used to define: 1) the most likely unplanned events leading to environmental, social and/or community health impacts; and 2) those unplanned events with the most significant potential environmental, social and/or community health impacts overall. Impact significance for unplanned events is therefore determined by evaluating the combination of likelihood and consequence.

Step 1

Assess the Scale of Consequence

Indicative levels of consequence for potential impacts from unplanned events can be defined for the physical, biological, and social environment as provided below.

	Incidental	Minor	Moderate	Major	Severe
Physical Environment	Impacts such as localised or short term effects or environmental media, meeting all environmental standards	Impacts such as widespread, short-term impacts to environmental media, meeting all environmental standards	Impacts such as widespread, long-term effects on environmental media, meeting all environmental standards	Impacts such as significant, widespread and persistent changes in environmental media OR Exceedance of environmental standards	Exceedance of environmental standards and fine/ prosecution
Biological Environment	Impacts such as localised or short term effects on habitat or species	Impacts such as localised, long term degradation of sensitive habitat or widespread, short-term impacts to habitat or species	Impacts such as localised but irreversible habitat loss or widespread, long-term effects on habitat or species	Impacts such as significant, widespread and persistent changes in habitat or species	Impacts such as persistent reduction in ecosystem function on a landscape scale or significant disruption of a sensitive species.
Social Environment	Slight, temporary, adverse impact on a few individuals	Temporary (<1 year), adverse impacts on community which are within international health standards	Adverse specific impacts on multiple individuals that can be restored in <1 year OR One or more injuries, not lost-work injuries.	Adverse long-term, multiple impacts at a community level, but restoration possible. OR One or more lost-work injuries to a member of the public including permanently disabling injuries.	Adverse long-term, varied and diverse impacts at a community level or higher – restoration unlikely. OR Fatalities of public.

Step 2

Assess the Likelihood

For the purposes of assessment, the likelihood of an unplanned event occurring can be classified as follows:

1 - Very unlikely, not known in the industry

2 - Unlikely to occur but known of in the industry

3 - Likely to occur once or more in life of the Project

4 - Likely to occur once or twice per year

5 - Will likely occurs more than twice per year, or is continuous or certain to occur

Step 3

Assess the Significance

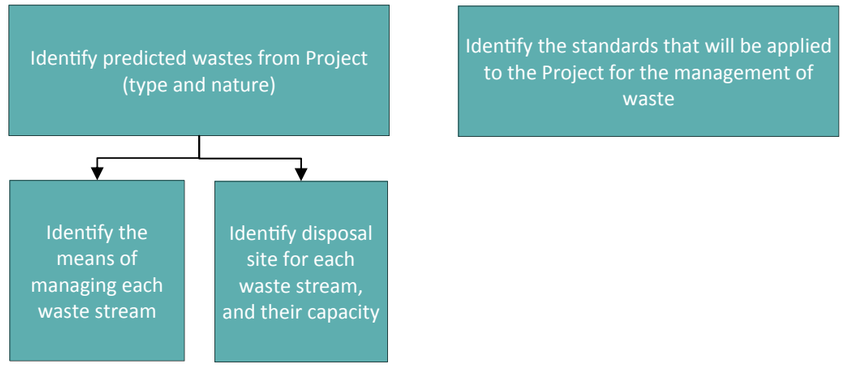
The consequences and likelihood of potential unplanned events are combined to determine the overall impact significance using the risk matrix shown here.

For potential impacts that are determined to have an impact significance of Moderate or Major, mitigation measures are identified. Note that mitigation can include measures that reduce the likelihood of the event from occurring (i.e. barriers) and those that reduce the consequences on sensitive receptors/resources if the event were to occur.

			Likelihood of Occurrence				
			1	2	3	4	5
Consequence	Incidental	A	Negligible	Negligible	Negligible	Negligible	Negligible
	Minor	B	Negligible	Minor	Minor	Minor	Moderate
	Moderate	C	Minor	Minor	Moderate	Moderate	Major
	Major	D	Moderate	Moderate	Major	Major	Major
	Severe	E	Major	Major	Major	Major	Major

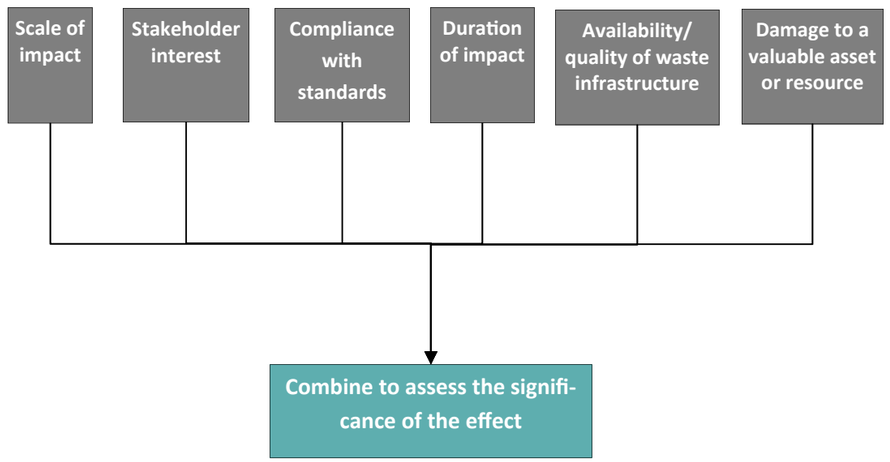
Step 1

Identify the waste streams, disposal sites/management, and applicable standards



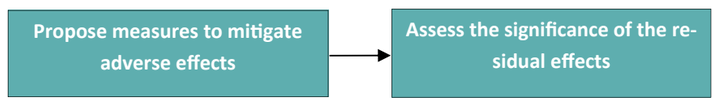
Step 2

Assess the impacts



Step 3

Apply mitigation and assess residual effects



Introduction

The potential for impacts relating to waste management are assessed based on the following key considerations:

- anticipated waste arising from the Project;
- the proposed means of managing/disposing of the different wastes generated by the Project; and
- The standards to be employed by the Project for waste management.

Waste management standards apply to the following activities:

- handling and storing of waste prior to treatment or disposal;
- transport of waste from the point of arising to final treatment or disposal (including measures taken to track the waste);
- any landfill sites to be used;
- any incinerators to be used;
- any wastewater facilities to be used; and
- any recycling facilities (assuming information is available).

In the case of waste management, a discrete quantification of the impact magnitude and receptor sensitivity is not carried out. Rather the assessment is focused on the quantification of potential waste arising, the availability of suitable treatment and disposal facilities and the potential need to store wastes for which no treatment and/or disposal capacity exists in the region. As such the overall impact significant is determined following the considerations listed below. Note, in situations where stakeholder interest is high, it may be appropriate to increase the impact significance by one level higher than otherwise predicted to account for these concerns.

Impact Significance	Description
Negligible	The effect is temporary, of low scale/ magnitude, within accepted standards etc., and of little concern to stakeholders. For example: The waste can be managed at approved/licensed facilities which meet international standards with little or no impact on the capacity for wastes from other local sources to be managed appropriately.
Minor	The waste causes an adverse effect on a sensitive receptor although the effect is either temporary or mainly within currently accepted standards. The impact should be mitigated where cost effective measures are available. For example: The waste can be managed at locally approved/licensed facilities although the facilities may not fully align with international standards and/or the management of the project's wastes will adversely impact on the local waste management capacity.
Moderate	The effect on a sensitive receptor must be mitigated (either because it breaches relevant standards, norms, guidelines or policy, or causes long–lasting damage to a valuable or scarce resource). For example: The waste can be managed at a locally licensed/permitted site although the performance standards of the site are well below international standards and/or the management of the project's wastes will have a serious impact on the local waste management capacity.
Major	The waste causes an unacceptable effect on a sensitive receptor (either because it breaches standards or norms relating to human health and livelihood, or causes irreversible damage to a valuable asset or resource). For example: Dumping of waste at unlicensed sites or which is likely to cause pollution of drinking water resources or uncontrolled burning of the waste resulting in smoke which may impact health of nearby residents.

Environmental Resources Management Ltd
2nd Floor, Exchequer Court
33 St Mary Axe
London, EC3A 8AA

Step 1

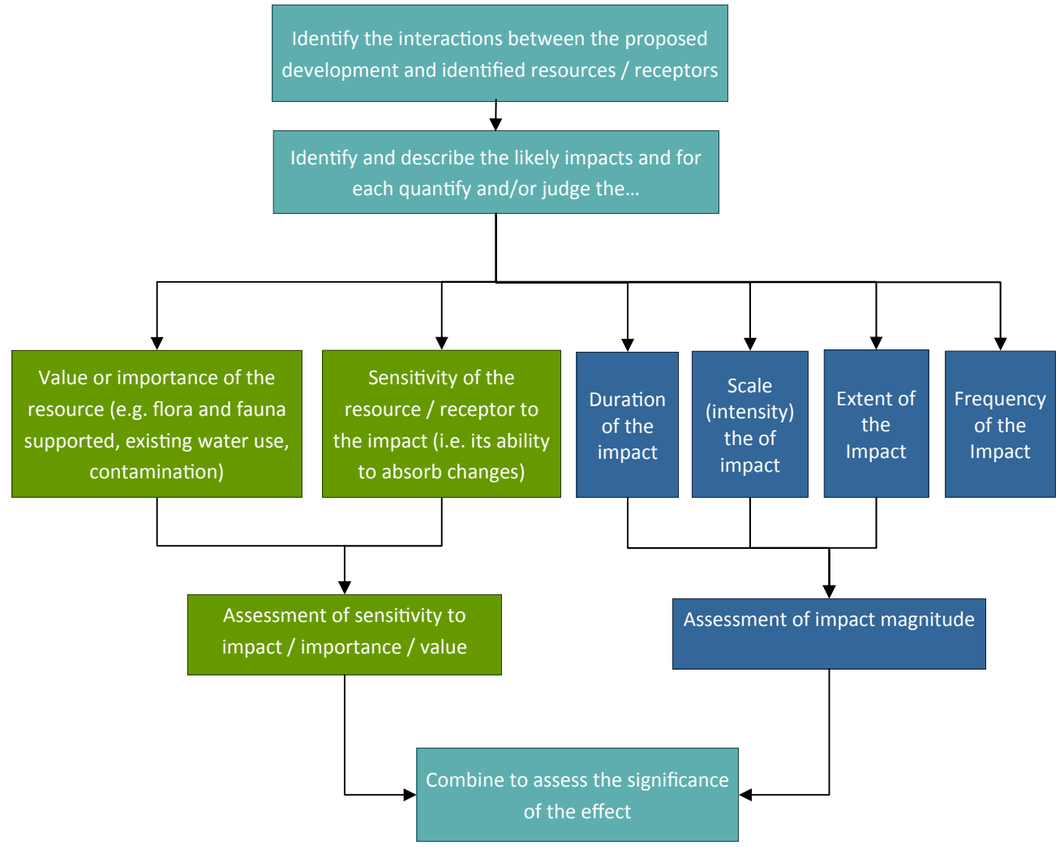
Evaluate the characteristics of the proposed development and the surrounding environment

- Define the preliminary scope of integrated water management impact assessment and study area
- Identify sensitive resources and receptors

  Establish the existing baseline conditions, including water quality, resource capacity, existing users and the dependency of communities, businesses and ecology on the resource.
- Determine likely and potential physical and chemical quality impacts from construction and operation

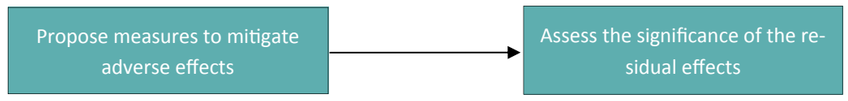
Step 2

Assess the impacts



Step 3

Apply mitigation and assess residual effects



Importance / Value / Sensitivity

Criteria	Low	Medium	High
Supporting role in maintaining soils	Resource has little to no role in maintenance.	Resource plays some role in maintenance (e.g. periodic flooding)	Resource is critical to maintenance of soil structure and quality.
Regulating role in hydrological cycle	Resource has little to no role as a regulating service.	Resource has local role in terms of storage, flows and flood alleviation.	Resource has a regional role in terms of storage, flows and flood alleviation, and may have transboundary influence.
Provisioning role to communities, or its importance in terms of national resource protection objectives, targets and legislation	Resource is not currently used, but is of sufficient quality and yield to be used in the future.	Resource is an important supply and is currently used, but there is capacity and / or opportunity for alternative sources of comparable quality.	Resource is wholly relied upon locally with no suitable alternatives, or is important at a regional or transboundary level for water supply or contribution to groundwater dependent ecosystems.
Supporting role in terms of biodiversity	Resource used, but does not support diverse habitat or populations.	Resource supports diverse or susceptible habitat or populations.	Resource supports important or unique species or provides essential habitat to sustain such species.
Provision of cultural services	Resource has little to no role in terms of amenity or recreational use.	Resource has small or occasional role in terms of amenity or recreational use.	Resource is important to amenity and recreational on an ongoing basis.

Magnitude of Change

Magnitude Criteria	Negligible	Small	Medium	Large
Water quality / reduced value to users	Change is within natural variation	Change is 75% of standard/guideline levels.	Occasional exceedances of ambient / seasonal range or standard / guideline levels; localised and / or limited duration.	Repeated exceedances of ambient / seasonal range or standard / guideline levels; not localised and / or occurring over a prolonged duration.
Quantity / scarcity	Change is within natural variation for the time of year	Short-term consumption that does not restrict other users consumption.	Long-term consumption. Project consumption is <25% of the resource available at the time of use.	Long-term consumption. Project consumption is >25% of the resource available at the time of use.
Surface water Run-off	No alteration to existing drainage regimes and characteristics	Some alteration to existing drainage regimes and characteristics but not material.	Significant alteration to existing drainage regimes and patterns over a short-term period or localised area.	Significant alteration to existing drainage regimes and patterns over a long-term period for a localized area or a short-term period for a large area.

Environmental Resources Management Ltd
2nd Floor, Exchequer Court
33 St Mary Axe
London, EC3A 8AA

6 STAKEHOLDER ENGAGEMENT

This *Section* provides a summary of the stakeholder engagement activities undertaken by Azito Energie and Azito O&M (AZOM) to date, a description of the Project's stakeholders, consultations conducted with them during the ESIA in line with the International Finance Corporation (IFC) Performance Standards (PS) and the grievance mechanism that will be developed for the Project. An overview of the stakeholder's views and potential concerns raised during these consultations is also provided.

The plan for engagement activities both during the ESIA process, and following submission of the ESIA will be integrated into the existing Stakeholder Engagement Plan (SEP) of AZOM. This SEP is a live document which will be maintained and updated by AZOM through the Project.

6.1 OBJECTIVES

Stakeholder engagement is a key component of sustainable project development and as part of an ESIA process to help ensure buy-in from key stakeholders including affected communities throughout the lifecycle of a project.

It involves those stakeholders interested in, or affected by a proposed development working to actively identify opportunities, risks and issues of concern.

Stakeholder engagement assists in accounting for locally relevant conditions and designs onto an existing social, health and biophysical environment.

The primary objectives of stakeholder engagement are as follows:

- ensuring that adequate and timely information is provided to stakeholders;
- providing sufficient opportunity to stakeholders to voice their opinions and concerns, and to ensure that these concerns influence Project decisions; and
- establishing a relationship and form of communication between the proponent, government regulators, affected communities and other interested parties for the lifetime of the Project.

Stakeholder engagement is a requirement of the Ivoirian ESIA regulations. It is also a requirement of international lenders within the IFC Performance Standards (namely Performance Standard 1) as it is recognised that failure to engage stakeholders can create significant risks to development of a project.

6.2 STAKEHOLDER ENGAGEMENT MANAGEMENT OVERVIEW

6.2.1 Procedure for Managing Internal and External Communication

AZOM developed a procedure for managing its internal and external communication in 2003 (last updated in 2015). The procedure describes:

- How stakeholder engagement activities are incorporated into the Company's management system;
- The resources and responsibilities allocated for implementing the procedure;
- The key stakeholder groups, focusing on affected communities;
- The community and worker grievance mechanisms set up for the Azito operation.

To support the implementation of this procedure, AZOM has regularly evaluated its engagement with stakeholders. This has included a stakeholder mapping exercise which identifies and prioritises key stakeholder groups, community development related initiatives and stakeholder engagement activities. Community development initiatives (See *Section 6.2.2*) and stakeholder engagement activities are informed by satisfaction surveys conducted annually in the neighbouring villages of Azito and Béago.

There is a full time employee of AZOM in charge of community liaison and community projects management ("*Assistante Développement Durable*"). This person is responsible for engaging the neighbouring communities and to manage and set up community investment projects.

External communication (defined as engagement activities with national authorities) is conducted by Azito Energie.

In addition, Azito Energie developed a communication mechanism which involves the participation of the chief of Azito Village and its village elders. Dedicated staff is assigned for its implementation. As part of this mechanism Azito Energie established an email channel to allow the neighbouring villagers to report any disturbance or issue related to the Azito Energie projects.

6.2.2 Community Relations and Social Investment

Since 2001, the AZOM management team has run an annual satisfaction survey among key stakeholders in Azito village and more recently also for Béago village.

Through the survey, AZOM seeks feedback from communities on how effectively their views are considered and issues are being resolved. Investigation and analysis of survey results are conducted by the community liaison and community projects manager, and reported in the management review meetings.

The most recent stakeholder satisfaction survey shows that in general the Azito project's relationships with neighboring communities are good, with the main concern raised being lack of local employment opportunity. It should however be noted that the satisfaction surveys is only administered to key stakeholders, including the beneficiaries of Azito's social investment projects and could be extended to seek for further representativeness.

Both Azito Energie and AZOM have established separate long-standing social investment programme that targets the development projects in the villages of Azito and Béago, as well as in the other villages that are inhabited by employees. Examples of such projects are presented in *Figure 6.1*.

Social investment related projects are based on four pillars:
(1) local economic development;
(2) protection of the environment;
(3) social equity; and
(4) promotion of health.

Each year, the management funds between 1 and 4 grants to local development projects (see *Figure 6.1*). The management also supports local schools and a cooperative of women producing attiéké (from cassava). As an example, AZOM is also associated with and co-investing is health-related programmes implemented by external agencies (anti-AIDS Committee in Azito, support to the Azito health center, etc.).

Figure 6.1 Community Development Projects

Source: ERM Site Visit, 2016
Top left: school in Béago village. Top right: health center in Azito village. Bottom left and right: Attiéké factory in Azito village and in Béago village

6.2.3 *EHS Performance Overview*

Both Azito Energie and AZOM have been committed to meeting all requirements of Ivoirian law and to the IFC's Policies and Performance Standards on Environment and Social Sustainability.

At the power plant site itself, Azito's environmental and social policy is well advertised, highlighting the company's leadership on environmental, health and safety as well as social impact management – this is particularly evident from the generally good housekeeping and absence of apparent environmental and EHS issues on the operational site, as well as abundant signposting for raising awareness and educating about sustainable development across the site.

6.3 *MAIN STAKEHOLDERS OF THE PROJECT*

Stakeholders include individuals or groups that may influence or be impacted by the Project, as described in *Box 6.1*.

Box 6.1 Definition of a Stakeholder [1]

"Stakeholders are persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively. Stakeholders may include locally affected communities or individuals and their formal and informal representatives, national or local government authorities, politicians, religious leaders, civil society organizations and groups with special interests, the academic community, or other businesses."

The level of interest and impact of any given group of stakeholders is dependent on a number of factors including level of authority, socio-economic context, influence, education and cultural factors.

Figure 6.2 is based on AZOM's stakeholder mapping and presents the main stakeholders of relevance to the Phase IV Project, as well as other institutional or relevant financial stakeholders. The Figure does not consider the internal stakeholders of the Project (owners, sponsors and operators) as they are presented in *Section 1*.

Figure 6.2 Main Stakeholders of the Project

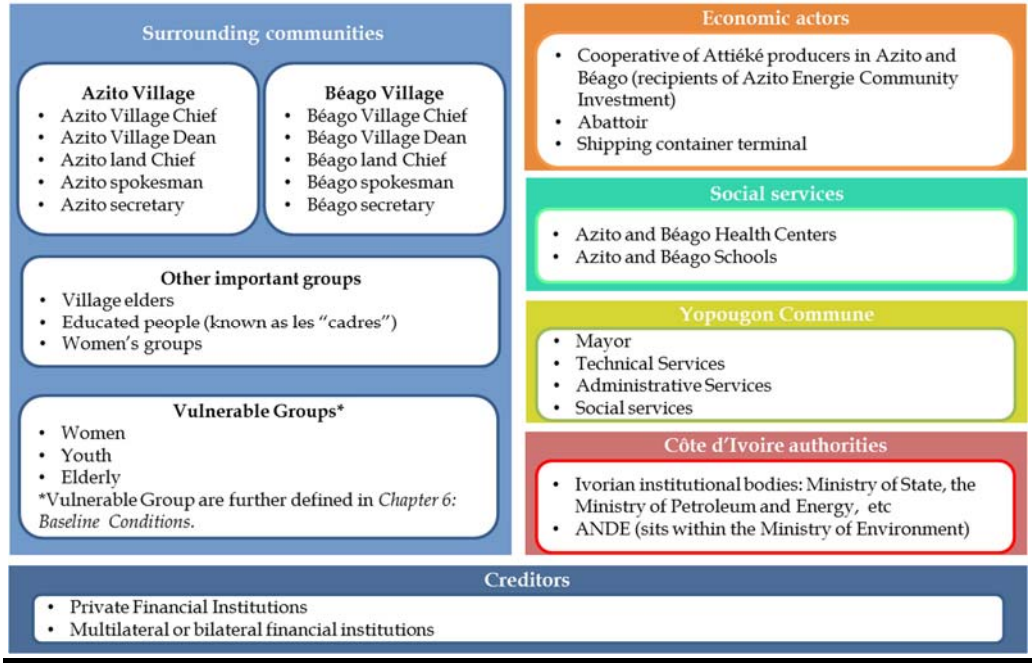


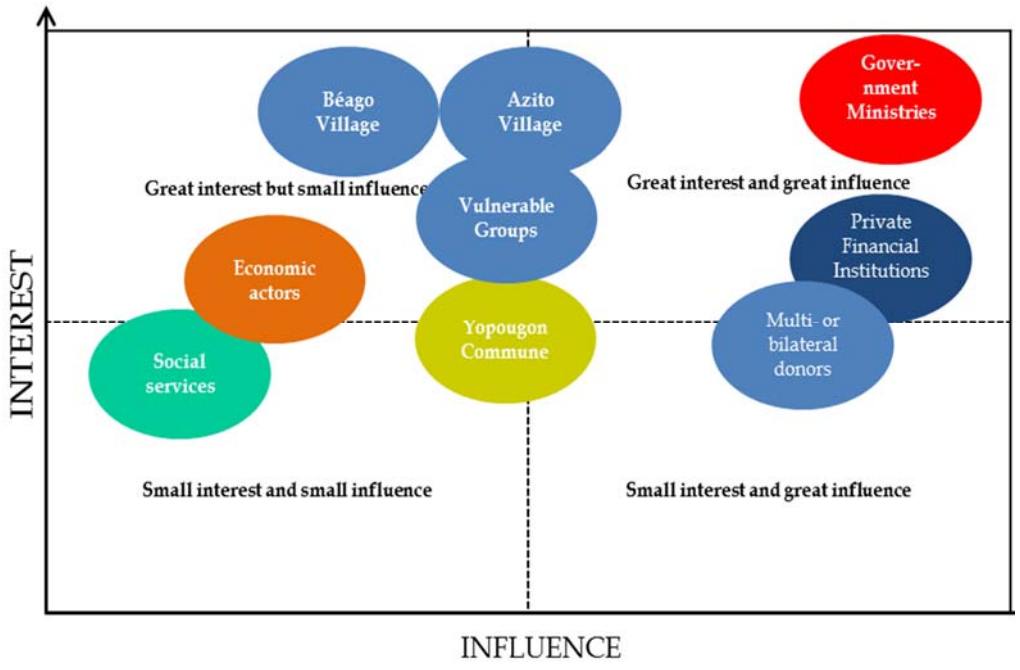
Figure 6.3 maps the key stakeholders to enable the planning of engagement activities and is based on ERM's evaluation of:

a) their interest in the Project; and

(1) IFC (2007) Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets Available at: http://www.ifc.org/wps/wcm/connect/938f1a0048855805beacfe6a6515bb18/IFC_StakeholderEngagement.pdf?MOD=AJPERES (Accessed 05.06.16)

b) their ability to influence the Project in terms of permitting, financing, implementation and operation.

Figure 6.3 Interest and Influence of Stakeholders



The village of Azito is the nearest community surrounding the Project and its residents are therefore the most significant stakeholder group, both in terms of interest in and influence on the Project. As for the village of Béago, whilst the village is more remote and 'out of the way', its recent expansion and proximity to the Azito plant makes some residents relatively sensitive to the plant's air and noise emissions, and the inhabitants of Béago are likely to have an interest in potential economic benefits associated with the Project. Since the development of the Phase I&II power plant, Azito Energie and AZOM have recognised that maintaining appropriate communication and a harmonious relationship with its stakeholders is key in maintaining a social license to operate for the project.

6.4 ESIA CONSULTATION ACTIVITIES

This *Section* provides an overview of the stakeholder consultations undertaken to date in the ESIA process as well as those planned to take place after the ESIA process has been completed. The stakeholder engagement that has been completed so far is for the scoping stage at the start of the ESIA process.

6.4.1 Methodology and Agenda

In line with IFC's requirements, the ESIA included consultations with Project-affected communities through disclosure of information, consultation, and

informed participation. The extent of this engagement should be in proportion with the risks to and impacts on the affected communities. *Figure 6.4* below present the requirements for the consultation process as described in the IFC policies.

It should be noted that under Ivoirian regulation, stakeholder consultation activities are only required after submission of the ESIA, however based on best international practice, consultation during the scoping stage was undertaken, and it is felt that early stage consultation eases the consultation in the advanced stage of the ESIA process when results are disclosed.

Figure 6.4 Typical Requirements for the Consultation Process

The process applied to consultation and disclosure throughout the ESIA is summarized below.

1. Identify a sufficiently broad sample of stakeholders to meet the consultation objectives and record them in a stakeholder database. The sample is chosen to ensure representative involvement of the various types of stakeholders.

2. Prepare disclosure materials for the consultations, including Project information for disclosure and a meeting or focus group format/technique suitable for the specific objective.

3. Arrange and carry out stakeholder consultations, ensuring that relevant protocol is met and that the consultation format (meetings/focus groups) is suitable for each stakeholder group.

4. Document the consultation process, ensuring that viewpoints and issues of concern raised by stakeholders are included in subsequent reports for further research or assessment, and demonstrating how these have been taken into consideration in the Project decision-making process and design.

5. Ensure that all information for disclosure is disclosed early enough to allow adequate consideration prior to consultation; fully accessible; and relevant and understandable (for example, including non-technical summaries, appropriate graphics and languages etc.).

Within the context of the Project to build the power plant extension, stakeholder participation and consultation took the form of information meetings and discussions with national and regional technical services, local elected representatives and members of local associations, as well as with communities neighbouring the power plant development Project, located in the Yopougon district of Abidjan.

The consultation was carried out at three different levels: local level, which involved mainly the municipalities potentially concerned by the Project, whilst consultations at regional and national level were used to consult with the regional offices and national institutions concerned.

For Phase IV, preliminary or 'scoping' consultations took place between the 19th and 23rd of September 2016.

Figure 6.5 Photographs Illustrating the Public Consultations Held for the ESIA

Top left: Consultations involving Azito Energie, AZOM and ERM with the Municipality of Yopougon. Top right: Meeting with the representatives (chefferie) of the Azito village. Bottom left: Visit of the Azito school, part of the CSR program of Azito Energie. Bottom right: Meeting with the representatives (chefferie) of the Béago village

A variety of communication methods were used during the ESIA engagement phase. They were selected by considering the level and objectives of engagement required, as well as the target group(s). Communication materials included presentations outlining the Project and ESIA process, maps and a Background Information Document that was left with stakeholders and provided details on the Project, the ESIA, stakeholder engagement and how to provide feedback.

Consultations were undertaken in French.

Attendance registers and minutes were taken at all meetings and are presented in *Annex G.*

6.4.2 *Summary of the Site Visit Conducted by ANDE*

As part of the validation process of the Terms of Reference for the ESIA of Phase IV, ANDE visited Azito site and proposed location for Phase IV with Azito and ENVAL on 18th of November 2016. The Terms of Reference was validated by ANDE on the 30th of November 2016. A summary is provided in *Table 6.1.*

Table 6.1 Summary of the Site Visit Conducted by ANDE

Summary of Topics Raised	Response Given / How Addressed in the ESIA
• How the Company will manage waste and emissions. • Will Azito Energie be creating any local jobs with the current work programme?	• The Authority was aware of the projects conducted previously by Azito Energie and AZOM and this was received favourably. • Azito Energie and AZOM and its shareholders have high environmental and social impact management standards (the Company follows the Ivoirian legislation and also considers international standards such as the IFC Performance standards) and will make sure that these standards are met i.e. for waste and air emissions. • There will be some impacts but they are expected limited given that Phase IV is only an expansion project. • Emissions of dust and exhaust gases arising from increased traffic of construction vehicles, operation of generators and construction activities. This is expected to be minimal but will be thoroughly assessed through the ESIA and adequate measures developed. • As the Project has only just started the planning stage, the Project mentioned that it was not possible to say with accuracy how many local jobs will be created at a local level (estimated 1,000 workers at the peak of the construction stage including local, national and expatriate workers). The EPC contractor with the support of the Project will seek to maximise the opportunities for employing people from the local community as feasible based on skills. It is noted that unskilled and skilled job position will be created. • Once the Project will have a clearer construction and workforce plan, then the Project will communicate the number and type of jobs available. • An Employment Plan and any local employment opportunities will be communicated in a transparent and culturally appropriate manner involving relevant stakeholders.

6.4.3 Summary of ESIA Consultation Meetings

A summary of ESIA consultation meetings held is provided overleaf. This summary includes consultations conducted by Azito Energie, AZOM ERM and ENVAL from the 19th and 23rd of September 2016.

Table 6.2 Summary of ESIA Consultation Meetings

Stakeholder	Aim of the Meeting	Summary of Topics Raised	Response Given / How Addressed in the ESIA
ANDE	Clarify the development of the Terms of Reference and inform and discuss with ANDE about the ESIA approach, key issues and analysis of potential impacts (such as the assessment of their relative significance).	• ANDE received the Project Notification ("Avis de Project") prior to the meeting and was aware of the Project. The Project was received favorably. • ANDE mentioned that a formal version of the ToR should be sent to their offices directly and a sit visit should be organised. • ANDE mentioned that no ESIA was received for the port container adjacent to the Project • The timeframe provided by the Governor regarding the ToR validation is 2 weeks. The Governor mentioned	• The ToRs were sent to the ANDE on the 8th of November 2016 and a site visit including ANDE, Azito Energie, AZOM and ENVAL occurred on the 18th of November 2016. • The Authority was aware of the projects conducted previously by Azito Energie and AZOM and this was received favourably.

Stakeholder	Aim of the Meeting	Summary of Topics Raised	Response Given / How Addressed in the ESIA
Technical Service of Yopougon	Discuss with the local authorities about the ESIA approach, key issues and analysis of potential impacts with a focus on the employment procedure.	• Any new urban project planned to be constructed in the region. • The Authority emphasized the need for a transparent and adequate local content and employment processes to reduce potential tension with communities. • He also stressed the fact that the region currently faces frequent energy shortage.	• The authority confirmed that as part of the region master plan the region plans to build a highway on the north east side 2 km from the side to decongestion traffic in Abidjan. • The Authority was aware of the Project and this was received favourably. • As the Project has only just started the planning stage, the Project mentioned that it was not possible to say with accuracy how many local jobs will be created. The EPC contractor with the support of the Project will seek to maximise the opportunities for employing people from the local community as feasible based on skills. It is noted that unskilled and skilled job position will be created. • Once the Project will have a clearer construction and workforce plan, then the Project will communicate the number and type of jobs available. • An Employment Plan and any local employment opportunities will be communicated in a transparent and culturally appropriate manner involving relevant stakeholders.

Stakeholder	Aim of the Meeting	Summary of Topics Raised	Response Given / How Addressed in the ESIA
Village of Azito	Inform local stakeholders about the Project design and schedule and to discuss potential impacts and proposed mitigation measures. This consultation enabled the ESIA team to refine the ESIA analysis of potential impacts (such as the assessment of their relative significance).	• Stakeholders (particularly local communities and local government) emphasized the need for local content and employment, particularly youth employment and existing local businesses. • The chiefs indicated they should be first informed about local employment opportunities than labour agencies. • Training should be provided to maximise local employment and build local capacities. • Stakeholders recognized that Azito have completed a number of social in the village (Attiéké Project, health center and waste Project) and they mention that they would like to see more initiative in their village for Phase IV. • Stakeholders expressed disappointment that the power generated by the plant as it has not been extended to the surrounding communities. • Stakeholders engaged in this meeting explained that the interactions of the previous EPC contractor personnel [*for the Phase 3 project*] with the village inhabitants had not always been positive and cordial and they felt the EPC contractors had not always treated them respectfully. The meeting participants requested that this be addressed in the process to engage the EPC contractor for Phase IV and ensure they respected community members.	• As the Project has only just started the planning stage, the Project mentioned that it was not possible to say with accuracy how many local jobs will be created. The EPC contractor with the support of the Project will seek to maximise the opportunities for employing people from the local community as feasible based on skills. It is noted that unskilled and skilled job position will be created. • Once the Project will have a clearer construction and workforce plan, then the Project will communicate the number and type of jobs available. • An Employment Plan and any local employment opportunities will be communicated in a transparent and culturally appropriate manner. • Employment opportunities are proposed mitigation are considered in the *Section 8: Assessment of Potential Impacts*. • Azito Energie and AZOM will seek to further continue its social investment activities as feasible and relevant based on the community need and will engage with communities regarding these activities. • The process for distributing power in the country was explained and that it was not solely in the control of the Project to provide Power. • Construction will be undertaken in line with international best practice to minimise any potential impacts of the Project. Impacts associated with construction are assessed in the ESIA and appropriate mitigation has been developed to avoid negative impacts.

Stakeholder	Aim of the Meeting	Summary of Topics Raised	Response Given / How Addressed in the ESIA
Village of Béago		• Need to ensure proper waste management to limit impacts on the environment especially given that the lagoon is already polluted. • Stakeholders (particularly local communities and local government) emphasized the need for local content and employment, particularly youth employment and existing local businesses.	• Same answer provided regarding local procurement and employment. • Regarding Management of waste, Azito Energie and AZOM and its shareholders have high environmental and social impact management standards (the Company follows the Ivoirian legislation and also considers international standards such as the IFC Performance standards) and will make sure that these standards are met by the EPC contractors. It was also noted that a Management Plan will be specifically developed for the construction stage.

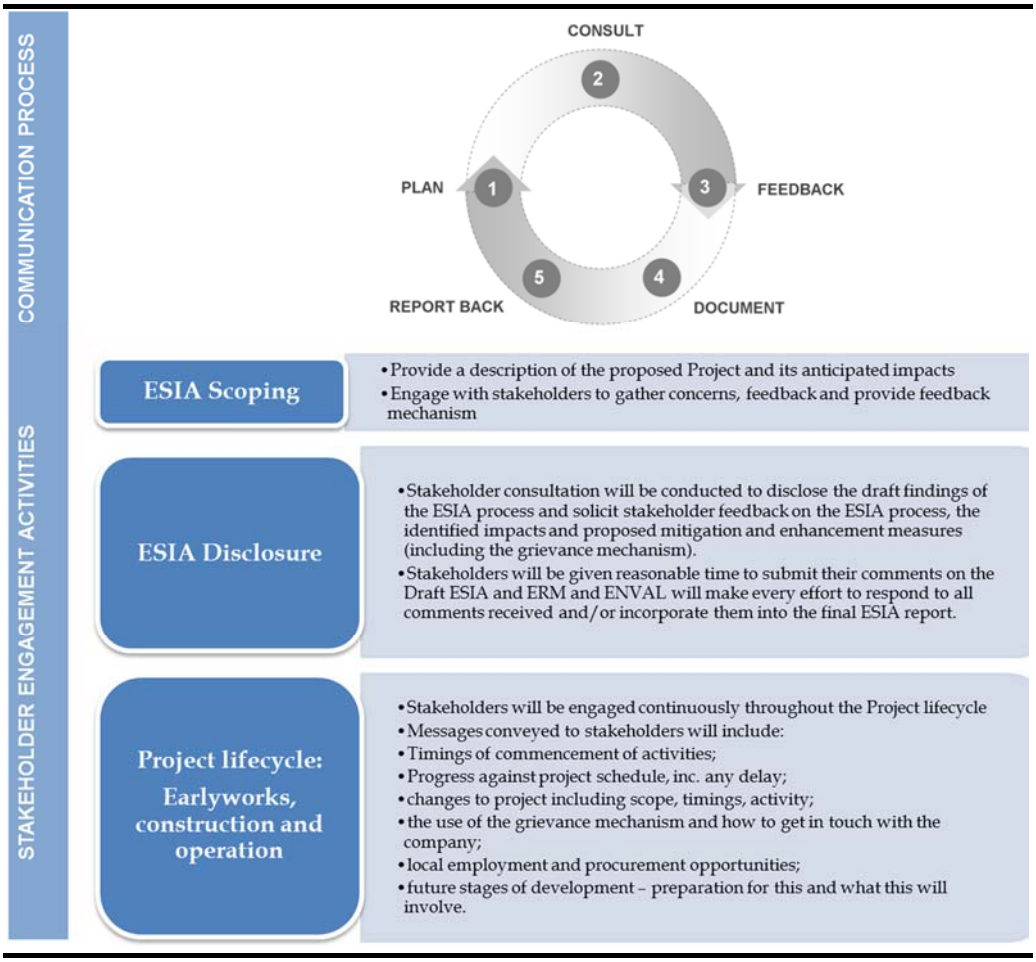
6.5 CONSIDERATIONS FOR FUTURE ENGAGEMENT ACTIVITIES

The information provided above focusses on the engagement steps that were involved in the scoping for, and development, of the Impact Assessment. It is, however, important that the Project builds on and maintains the relationships which it has developed and ensures informed prior consent.

The focus of this section is on implementation of the existing Stakeholder Engagement Plan for disclosing the information contained in the ESIA and thereafter, pending approval and 'go-ahead' of the Phase IV Expansion Project, the engagement activities that should take place on a continuous basis through the rest of the Project lifecycle including construction, operation and decommissioning.

The Stakeholder Communication Process suggested for this Project and recommended next steps are shown in *Figure 6.6.*

Figure 6.6 *ESIA and Project Lifecycle Stakeholder Communication Process and Engagement Activities*



6.6 *GRIEVANCE MECHANISM*

Identifying and responding to any grievances supports the development of positive relationships between the Project and its stakeholders. A grievance is a complaint or concern raised by an individual or organisation who judges that they have been adversely affected by the Project during any stage of its development. Grievances may take the form of specific complaints for actual damages or injury, general concerns about Project activities, incidents and impacts, or perceived impacts. The Grievance Mechanism will not impede access to other judicial or administrative remedies.

IFC PS 1 requires that a Grievance Mechanism (GM) provides a structured way of receiving and resolving grievances. It should be clearly communicated and understood by stakeholders, and be free of any impediment in reaching out to the company. To this regard, a grievance mechanism has been implemented by AZOM and Azito Energie for the previous phase.

In accordance with international good practice, the Project proposes to establish a specific mechanism for dealing with grievances related to the proposed Phase IV.

The proposed GM will address complaints promptly using an understandable and transparent process that is culturally appropriate and readily acceptable to all segments of affected communities, and is at no cost and without retribution. The mechanism will be developed in a manner to be appropriate to the scale of impacts and risks presented by the Project and beneficial for both the company and stakeholders. Based on the principles described above, the grievance mechanism process will involve 5 stages as illustrated in *Figure 6.7*.

It should also be noted that it is expected that during construction most of the stakeholder engagement activities will be managed by Azito Energie and AZOM to ensure consistency. However as the EPC contractor that will be selected for the Project will be responsible for managing the construction activities, it will be important for said EPC contractor to have a good understanding of the process for receiving, documenting and responding to grievances in line with IFC PS 1 and as described in *Figure 6.7.* Both Azito Energie and AZOM, being accountable for the ultimate delivery of the Project, will need to ensure that the EPC contractor understands the process for reporting grievances, in case one of its representatives is the first point of contact for the stakeholder who wishes to raise a grievance.

Figure 6.7 Grievance Mechanism Procedure

6.7 *MONITORING AND REPORTING STAKEHOLDER ENGAGEMENT ACTIVITIES*

It will be important to monitor and report on the on-going stakeholder engagement activities to ensure that the desired outcomes are being achieved, and to maintain a comprehensive record of engagement activities and the issues raised. This will be done through this SEP, where the following will be recorded in line with this plan:

- updates to the stakeholder database;
- recording of all consultations held; and
- updates to the issues and responses table.

These records and outputs will be regularly updated and appended to the Environmental and Social Management Plan ('ESMP') document (see *Annex D: ESMP*). In other words, this will serve as a tool not only to plan future engagements but also to record previous phases of the process and track any actions that may arise and that require follow up.

7 BASELINE CONDITIONS

7.1 INTRODUCTION

This *Section* describes the baseline environmental and social characteristics of areas potentially affected by activities during the construction and operation phase of the Project include the following aspects:

- air quality;
- noise;
- geology, soil and water(including non-marine surface waters and groundwater);
- biodiversity; and
- social.

This *Section* also describes the respective study areas, data collection methodologies and summarises the key sensitivities of particular interest to this ESIA.

The Phase IV Project will be developed within the existing Azito facilities site. This environmental and social description will therefore consider the current situation, including the Phases I to III Project and the related facilities (1), as the baseline situation.

7.2 AIR QUALITY

7.2.1 Study Area

For the Project, an air study area has been identified for construction and for operation activities. The study areas are based on identified sensitive receptors likely to be worst affected by air emissions from the Project.

The construction study area was defined based on the likely construction activities and typical air emission levels. The air quality study area for construction comprises the area within 500 m of the Project footprint and related facilities.

For operation, this is extended to comprise the area within 15 km of the main Project emissions sources within the Project footprint.

(1) Related facilities (also described in Section 2) include a laydown area, an access road and if relevant the establishment of a camp. It is assumed that these related facilities will be located within the vicinity of the existing plant. It is noted that the need for a temporary purpose-built camp to accommodate the construction workforce has not yet been established. It is possible that construction workers will be housed in existing lodging in the surrounding communities, for example Azito and Béago.

7.2.2 *Sensitive Receptors*

Sensitive Receptors during Construction

The main sensitive receptors in relation to construction activities are:

- Azito village, which lies approximately 300 m to the west of the existing Power Plant site boundary, with isolated properties situated closer to the Project site; and

- Béago village is located approximately 300 m to the northeast.

Sensitive receptors in relation to construction traffic comprise human receptors and sensitive vegetation receptors identified within 200 m of roads used to access the site and deliver construction materials, primarily the village of Azito.

Sensitive Receptors during Operation

Sensitive receptors have been identified within the study area and include:

- Human receptors: as aforementioned, there are several residential locations in the study area, the closest being Azito and Béago villages to the west and northeast of the plant and further away the Municipality of Yopougon and the City of Abidjan.

- Fauna/flora receptors: the biodiversity assessment identified the following habitats as being potentially sensitive to air quality impacts:
  - Banco National Park situated 7.5 km to the north of the site; and
  - Protected forest Audoin 11.8 km to the west of the site.

The air sensitive receptors likely to be worst affected by air emissions from the Project are presented in *Figure 7.2.*

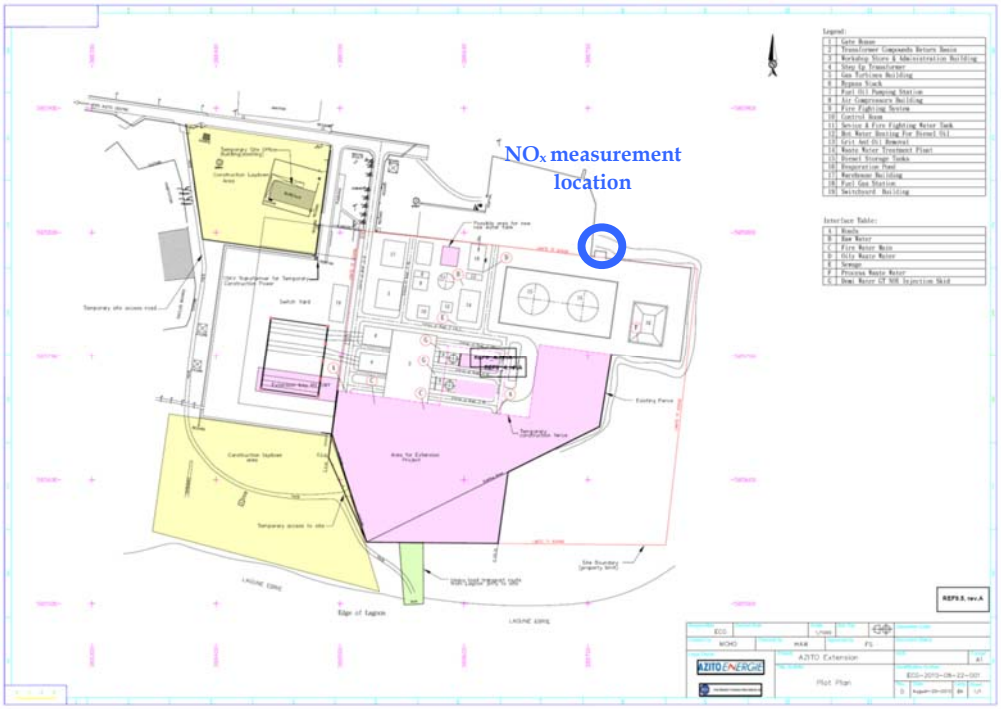
7.2.3 *Data Collection Methodology*

Ambient concentrations of air pollutants are not routinely monitored on a widespread basis in Côte d'Ivoire.

A one month baseline air quality monitoring campaign was undertaken by Azito Energie in 2001. This focussed on sulphur dioxide (SO_2) in the Yopougon district using diffusion tubes.

A continuous nitrogen oxides (NO_x) analyser was installed in 1999 for baseline air quality monitoring. The analyser was initially installed 300 m away from the turbines but transferred in 2009 to the site following a flood event (*Figure 7.1).*

Figure 7.1 Location of NO_x Analyser used by AZOM since 2009



Source: Azito Energie

In addition, as recent developments including the new container terminal and expansion of residential areas are not captured in the 2011 baseline data therefore a field survey was undertaken in September - December 2016 to quantify the current baseline. This survey captures current ambient concentrations of NO_2 at eight monitoring sites using diffusion tubes. *Figure 7.2* shows the location of the monitoring sites.

Figure 7.2 Air Quality Monitoring Sites

Details of the survey are provided in *Section 7.2.7* below.

7.2.4 *Climate*

Côte d'Ivoire is situated in the equatorial tropical climatic zone. The climate of the country is influenced by the seasonal displacement of the Inter-Tropical Convergence Zone (ITCZ). The alternation of dry and rainy seasons results from the annual north-south migration of the ITCZ, which is due to the yearly positional changes of the earth in relation to the sun. The average air temperature recorded near Abidjan is 26°C.

7.2.5 *Rainfall and Humidity*

The study area for construction and operation is characterized by high rainfall with precipitations that vary between 1,500 and 2,000 mm per year in Abidjan. The average annual rainfall for Abidjan between 1960 and 2012 was 1,910 mm [(1)].

The main rainy season generally occurs between May and July. The short rainy season occurs between October and November. The months of August and September, often named as the short dry season, are dry and cool. The main warm and dry season occurs between December and April.

(1) Danumah, J.H., Odai, S.N., Saley, M.B., Szarzynski, J, Adjei, K., and Kouame, F. K. (2013), A Stocahstic Eather Generator Model for Hydroclimatic Provision in Urban Floods Risk Assessment in Abidjan District (Cote d'Ivoire) in Filho, W. L. ed., *Innovation in Climate Change*, Switzerland: Springer International

Relative humidity in Abidjan typically exceeds 80% throughout the year [1].

7.2.6 *Winds System*

The prevailing wind direction is almost exclusively from the southwest in the Abidjan region (see *Figure 7.3*). *Table 7.1* identifies the average wind speed between 2012-2016. Wind speeds greater than 3m/s are the most common, occurring approximately 92% of the time. Wind speeds greater than 5.3 m/s are very common as well, occurring approximately 57% of the time.

The Ivoirian continental shelf is subject to the anti-cyclonic system of the Southern hemisphere. In the same way as the equatorial zone, it is subject to the influence of the trade winds. There is a significant seasonal and inter-annual variability in the wind field. The monsoon trade winds blow 10 months of the year from the southwest and southeast. They are generally weak (3 to 4 m/s), regular and characterised by a daily cycle. Their speed can increase during the northern summer (4 to 6 m/s).

Table 7.1 Average Wind Speed (2012 – 2016)

Month	Number of Hours Above 3 m/s	Number of Hours Above 5.3 m/s
January	673	430
February	648	426
March	708	501
April	467	464
May	682	471
June	672	499
July	665	463
August	679	384
September	635	251
October	682	322
November	695	394
December	662	355
Annual	8079	4960

Source: Weather Research and Forecasting [2] (WRF) meteorological data for the study area obtained through Lakes Environmental, 2012 – 2016. Processed through the USEPA AERMET program.

(1) UNEP, Cote d'Ivoire's Summary, http://www.unep.org/DEWA/water/groundwater/africa/English/reports/CountrySummaries/Coted'voire/Eng-COTE%20D'IVOIRE%20SUMMARY.pdf Accessed 09/11/16

(2) The Weather Research and Forecasting (WRF) Model is a next-generation mesoscale numerical weather prediction system designed for both atmospheric research and operational forecasting applications.

Figure 7.3 Wind Roses

Source: WRF data from 2012-2016

7.2.7 Baseline Air Quality

Introduction

The baseline air quality in the vicinity of the Project site is influenced by the urban area of Abidjan, as well as local sources of emissions. In particular, air quality in the area is in flux due to nearby developments e.g. growth of residential areas around the plant. This urban growth can contribute to increased emissions from sources such as vehicle emissions. Air quality is variable both spatially and over time and is further described herein.

Existing Emissions Sources

The Azito Phase IV site is located on the south-western side of Yopougon and the baseline air quality at sensitive receptors will principally depend upon localised sources of emissions in the area. In particular, the district is characterised by a nearby container port facility, small-scale local industry and low-rise residential housing. Likely sources of emissions to air in the Project area are:

- traffic emissions (private vehicles and commercial transport mainly);
- domestic fuel and charcoal use for open-fire cooking and heating;
- vehicle and shipping activities associated with the container port;
- local industry: industrial activities around the Azito site are limited to small-scale activities and crafts; the Yopougon industrial area lies some six kilometres to the northeast; and
- the existing Azito Power Plant.

Air Quality Monitoring

The NO_2 concentrations recorded during the 2016 survey are presented in *Table 7.2*.

Table 7.2 Baseline Survey (September – December 2016)

Location	NO_2 (µg/m³)[a]		
	September-October	**October - November**	**November-December [b]**
AQ1	9.92	12.5	-
AQ2	4.79	10.5	12.6
AQ3	5.71	10.5	11.8
AQ4	9.70	12.7	16
AQ5	7.65	10.7	12.4
AQ6	7.55	12.5	13.5
AQ7	6.40	9.03	-
AQ8	12.4	14.5	-
Average	**8.02**	**11.6**	**13.23**
Maximum	**12.4**	**14.5**	**16**

Location	NO_2 ($\mu g/m^3$)[(a)]
Total Average	**10.6**

Note:
(a) Note the above concentrations are influenced by emission sources outside the project e.g. increase vehicle emissions near dense urban areas.
(b) No laboratory results available (tubes missing/broken)

Baseline Air Quality

Baseline air quality survey results (2001 and 2016) and air ambient guidelines values are described in *Table 7.3.*

As aforementioned data from the 2016 baseline survey have been used to complement the baseline data identified for other pollutants that was collected in 2001 baseline.

Based on the 2011 survey, the maximum SO_2 values recorded at the sampling locations ranged from <0.8 $\mu g/m^3$ to 11.6 $\mu g/m^3$. Based on the 2016 survey, the maximum NO_2 concentration measured is 16 $\mu g/m^3$. Based on the 2011 survey, the maximum NO_x concentration measured, presented in Azito's annual environmental report, is 6.52 $\mu g/m^3$. Compared against the more current NO_2 data, the 2011 NO_x data can be considered outdated. This assessment therefore uses a conservative estimate for NO_x by applying a factor 2 to the 2016 NO_2 data.

Table 7.3 Baseline Air Quality Survey Results (2001 and 2016) and Air Ambient Guidelines Values

Pollutant	Concentration (µg/m³)	Description	Averaging Period	Guideline (µg/m³) (1)	Degraded/Undegraded Airshed
Human Health					
NO_2	10.6	Average recorded in 2016	Annual mean	40	Undegraded
	21.2	Double concentration of long term	1 hour maximum	200	Undegraded
			1 hour mean (not to be exceeded more than 18 times per year)	200 (2)	
PM_{10}	N/A	No data available	Annual mean	20	Undegraded during the wet season **Potentially degraded** during the dry season (worst case)
			24 hour (not be exceeded more than three times per year)	50	
$PM_{2.5}$	N/A	No data available	Annual mean	25	Undegraded during the wet season **Potentially Degraded** during the dry season (worst case)
			24 hour maximum	125	
SO_2	11.6	Maximum recorded in 2001	24 hour maximum	500	Undegraded
	23.2	Double concentration of long term	10 minute maximum	30	Undegraded
Ecological Receptors					
SO_2			Annual and winter mean	30 (Agricultural crops) 20 (Forests and natural vegetation)	
			Annual mean	10	
NO_x	21.2	Double concentration of annual NO_2 baseline recorded in 2016 (Note 1)	Annual mean	30	Undegraded
	42.4	Double concentration of long term	24 hour maximum	75	Undegraded

Pollutant	Concentration (µg/m³)	Description	Averaging Period	Guideline (µg/m³) (1)	Degraded/Undegraded Airshed

Source:

(1) Air quality guidelines are taken from Air Quality Guidelines for Europe, Second Edition http://www.euro.who.int/__data/assets/pdf_file/0005/74732/E71922.pdf unless otherwise stated

(2) Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0050&from=en

Note 1 – No NO_x monitoring has been undertaken at the protected habitat. The assumption that NO_x is double the NO_2 is considered conservative, considering that when calculating NO_x to NO_2 conversion in the plume at ratio of 0.8 is used.

7.3 NOISE

7.3.1 Study Area

For the Project, the noise study area has been identified for construction and operation activities.

The construction study area was defined based on the likely construction activities and typical noise levels. The construction study area includes the spatial extent of the Project footprint and related facilities (i.e. laydown area during construction) and noise sensitive receptors located within a 1 km radius of the Project footprint.

The operation study area includes the spatial extent of the Project footprint and related facilities (i.e. laydown area during construction) and noise sensitive receptors located within a 1 km radius of the Project footprint.

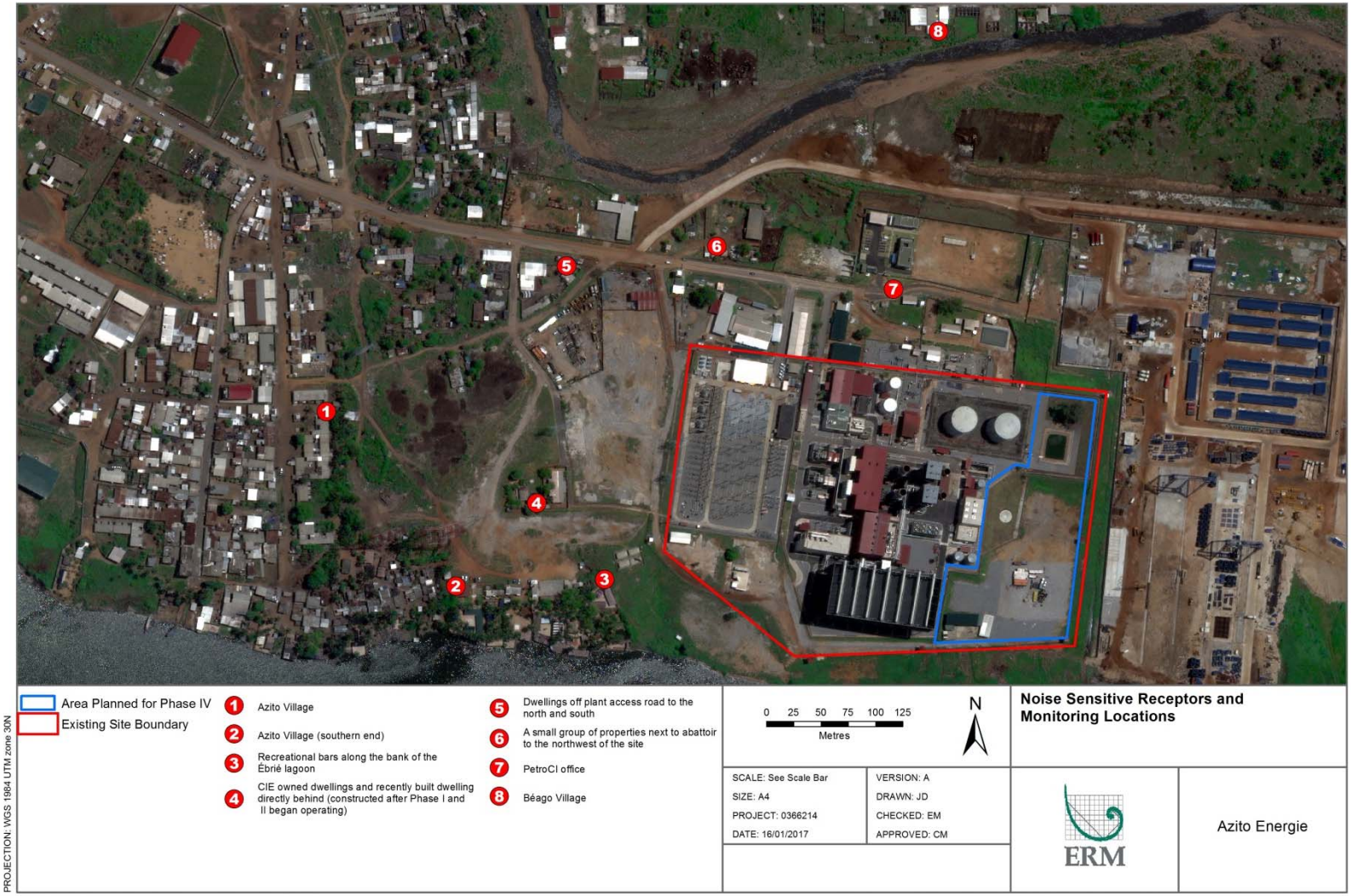
7.3.2 Sensitive Receptors

The noise sensitive receptors chosen to represent the nearest properties, likely to be worst affected by noise from the Project, are presented in *Figure 7.4*.

In summary, as aforementioned, Azito village lies approximately 300 m to the west of the existing Power Plant site boundary, with isolated properties situated closer to the Project site. In Azito village, a small group of properties, understood to be used only during certain times of the year, lie close to the northern plant boundary, next to a slaughterhouse. To the south of the site lies the Ébrié lagoon. Also a number of recreational bars are situated along the edge of this lagoon, approximately 50 m from the plant boundary at their closest point. To the east, adjacent to the site, is a container port.

Béago village is located approximately 300 m to the north at its nearest point.

Figure 7.4 Noise Sensitive Receptors and Monitoring Locations



7.3.3 Data Collection Methodology

A baseline noise field survey was carried out in September 2016 to quantify the existing noise environment at the nearest noise sensitive receptors. Details of the survey are provided in *Annex B*.

7.3.4 Existing Ambient Noise

Table 7.4 summarises the existing noise levels at the nearest noise sensitive receptors based on the baseline noise survey carried out in September 2016.

During the daytime, existing average noise level measurements ($L_{Aeq,30mins}$) ranged between 47 dB and 56 dB. The only exception was at the PetroCI offices, located next to the Foxtrot plant, where a level of 63 dB was measured. During the night-time, average noise measured levels ($L_{Aeq,30mins}$) ranged between 46 dB and 54 dB. Measurements were not carried out at the PetroCI offices as it is not noise sensitive at night.

L_{A90} noise levels are a statistical measure of the noise level exceeded for 90% of the measurement period. They exclude brief noises which can influence average noise level measurements, and can provide a good indication of the steady, background noise level.

Table 7.4 identifies where the L_{A90} noise level recorded at a noise sensitive receptor exceeds the IFC noise level guidelines.

Daytime background noise levels ($L_{A90,30mins}$) ranged between 45 dB and 48 dB, except at the properties close to the abattoir, where higher levels of 52 dB were measured. At night, measured levels ($L_{A90,30mins}$) were generally between 44 dB and 46 dB. A level of 49 dB was measured at *Receptor 4* (CIE owned dwellings and dwelling directly behind), which was slightly higher than the level of 46 dB measured during the day. At *Receptor 6* (a small group of properties close to an abattoir to the northwest of the site, close to the Foxtrot plant), the measured background level, $L_{A90,30mins}$, was significantly higher, at 53 dB.

The noise environment was influenced by a number of significant noise sources, including: people; music; cars; the gas treatment plant (independently run by Foxtrot) situated close to the northern site boundary; the existing Power Plant; and the container port. Higher noise levels were measured at locations to the north of the Power Plant where elevated noise from the Foxtrot plant was measured.

Table 7.4 Summary of Baseline Noise Levels

Noise Monitoring Location/ Receptor	IFC Noise Level Guidelines $L_{eq,1h}$ dB(A) Day (7am to 10pm) [a]	Daytime Noise Level (30 minutes, free-field), dB [b]				IFC Noise Level Guidelines $L_{eq,1h}$ dB(A) Night (10pm to 7am) [a]	Night-time Noise Level (30 minutes, free-field), dB [b]				Commentary on the Noise Environment
		L_{Aeq}	$L_{Amax,f}$	L_{A10}	L_{A90} [c]		L_{Aeq}	$L_{Amax,f}$	L_{A10}	L_{A90} [c]	
Receptor 1 Azito Village	55	50	62	52	45	45	48	52	50	44	During the daytime: distant sounds from the Power Plant, pedestrians and cars. At night: distant sounds from the Power Plant, music from the village.
Receptor 2 Azito Village (southern end)	55	49	61	51	45	45	49	60	50	**46**	During the daytime: people, cars, distant noise from the Power Plant. At night: distant noise from the Power Plant (noise dominated by the air condensers), people, dogs barking.
Receptor 3 Recreational bars along the bank of the Ébrié lagoon [d]	55	47	52	49	46	N/A	N/A	N/A	N/A	N/A	During the daytime: the Power Plant.
Receptor 4 CIE owned dwellings and recently built dwelling directly behind (constructed after Phase I and II began operating)	55	49	55	51	46	45	50	52	51	**49**	During the daytime: distant sound of the Power Plant, people. At night: distant sound of the Power Plant (especially the air condensers), people, dogs barking.

Noise Monitoring Location/ Receptor	IFC Noise Level Guidelines $L_{eq,1h}$ dB(A) Day (7am to 10pm) [a]	Daytime Noise Level (30 minutes, free-field), dB [b]				IFC Noise Level Guidelines $L_{eq,1h}$ dB(A) Night (10pm to 7am) [a]	Night-time Noise Level (30 minutes, free-field), dB [b]				Commentary on the Noise Environment
		L_{Aeq}	$L_{Amax,f}$	L_{A10}	L_{A90} [c]		L_{Aeq}	$L_{Amax,f}$	L_{A10}	L_{A90} [c]	
Receptor 5 Dwellings off plant access road to the north and south	55	55	64	60	48	45	46	48	46	45	During the daytime: people, (very few) cars, the Power Plant. At night: people, music and noise from the Power Plant.
Receptor 6 A small group of properties next to abattoir to the northwest of the site	55	56	69	57	52	45	54	63	55	**53**	During the daytime: distant sound of the Power Plant, pedestrian crossing and vehicles (very little traffic). At night: noise from the Power Plant, the Port of Abidjan extension site
Monitoring Location 7 PetroCI office [e]	55	63	68	64	62	N/A	N/A	N/A	N/A	N/A	During the daytime: noise from the Foxtrot installation dominates.
Receptor 8 Béago Village [f]	55	51	62	51	48	45	N/A	N/A	N/A	N/A	During the daytime: distant sound of the Power Plant, people.

Note:

a) IFC Noise Level Guidelines for residential, institutional, educational facilities. Note the IFC do not set noise level guidelines for recreational bars or office buildings. Instead, the level for institutional and educational uses has been used for these.

b) Lowest measurement reported.

c) Bold text indicates that the L_{A90} exceeds the IFC Noise Level Guideline value $L_{eq,1h}$ dB(A)

d) Baseline noise measurements not carried out at night as noise sensitive receptor is not sensitive to noise during the night.

e) The sensitivity of this receptor is deemed limited given the fact that CIE employees are mostly located inside the building, and only present during their work hours. Baseline noise measurements not carried out at night.

f) Baseline noise measurements not carried out at night because of difficulties accessing a suitable measurement location during the night

7.4 GEOLOGY, SOIL AND WATER

7.4.1 Study Area

The Project study area for water impacts encompasses the Ébrié Lagoon, and the main surface water features and drainage regime in the vicinity. Some discussion of soils and geology has also been included as they relate to erosion and groundwater resources.

7.4.2 Data Collection Methodology

The baseline for geology, soil and water related aspects is based on the following secondary data:

- a desk top review of publically available information;
- geographic reconnaissance conducted in September 2016 with identification of the Project site's GPS coordinates;
- two geotechnical studies commissioned by Azito Energie to assess water supply options for the combined cycle operations;
  - Forage d'eau à la centrale thermique d'Azito à Yopougon, Etude Géophysique (*Water well at the Azito Power Plant in Yopougon, Geophysical Study*) SOTEFO, March 2014;
  - Etudes Géophysiques pour l'implantation d'un forage d'eau *(Geophysical studies for the implantation of a water well)*, Geodrill Technologies LTD, March 2015; and
- Dossier technique des travaux du forage F2, (*Technical studies - drilling works of well F2*) Geodrill Technologies LTD, August 2015; and
- Analyse physico-chimique et hydrocarbures des eaux usées (*Water quality results, evaporation pond*), ENVAL Laboratoire, October 2015.

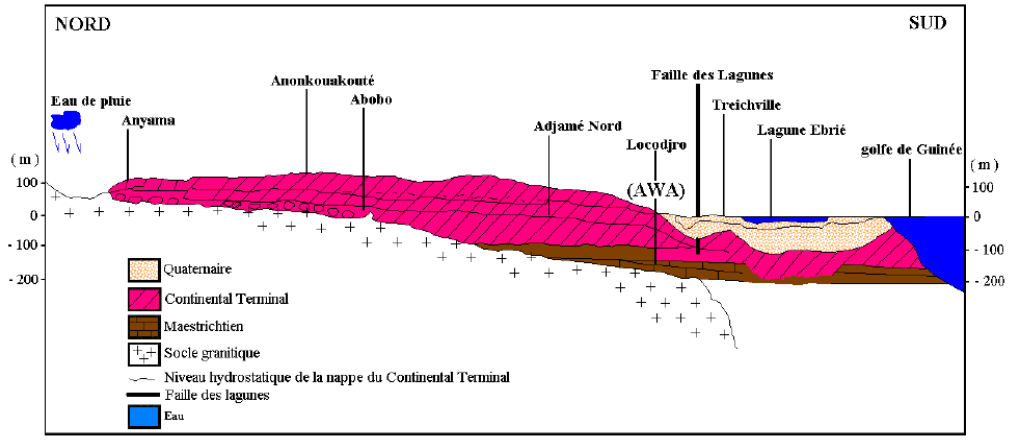
7.4.3 Geology and Soils

The geological substratum of the Abidjan district is formed of two main types of rocks, the Precambrian basement and the coastal sedimentary basin. The geology of the Project study area corresponds to the coastal sedimentary basin which extends approximately 400 km in length and 40 km in width, equating to approximately 2.5% of the land mass of the country.

As illustrated by *Figure 7.5*, this area is represented by medium to coarse grained sandy strata with depths in excess of 70 m and contains isolated layers of clay. The strata is underlain by a 40 m layer of limestone and sandstone, which is in turn underlain by shale and granite gneiss.

The altitude at the Azito Power Plant site varies between 0.5 m and 5.0 m over a distance of about 500 m with a gentle slope of approximately 1% towards the lagoon in the south and southeast.

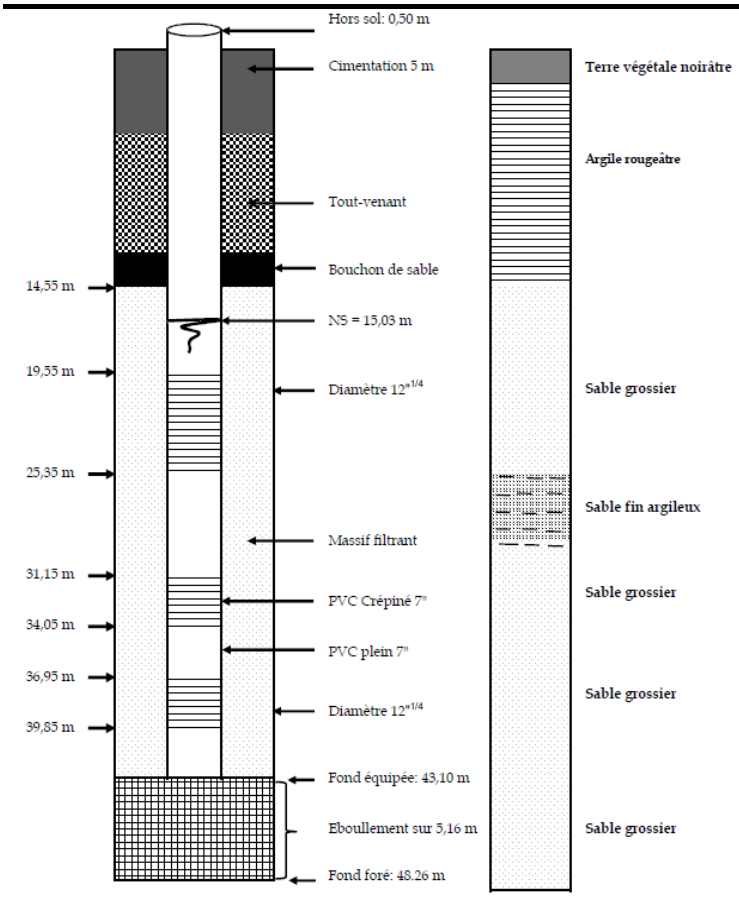
Figure 7.5 Subsoil in the Abidjan Area



Source: Geodrill Technologies LTD, 2015

Figure 7.6 illustrates the characteristics of the soil based on drilling works conducted at the site in 2015. The soil unit identified is characterised by a layer of clay, approximately 12 m thick, located from 2.5 m to 15 m below the surface. Below this layer coarse sands can be found at depth between 15 m and 30 m. A pocket of fine clayey sand is observed between approximately 25 m to 30 m.

Figure 7.6 Geotechnical Log at the Azito Water Well Drilled in 2015



Source: Geodrill Technologies LTD, 2015

7.4.4 The Ébrié Lagoon

Lagoon Hydrology

The Ébrié Lagoon is one of the largest lagoon systems in West Africa, approximately 140 km long, 4 km wide and 8 m deep. It has a total surface area of 566 km² and total estimated perimeter of 644 km. The Ébrié lagoon connects to the Atlantic Ocean via the Vridi Canal (see *Figure 7.7*), which was opened in July 1950 to facilitate the expansion of the Port of Abidjan.

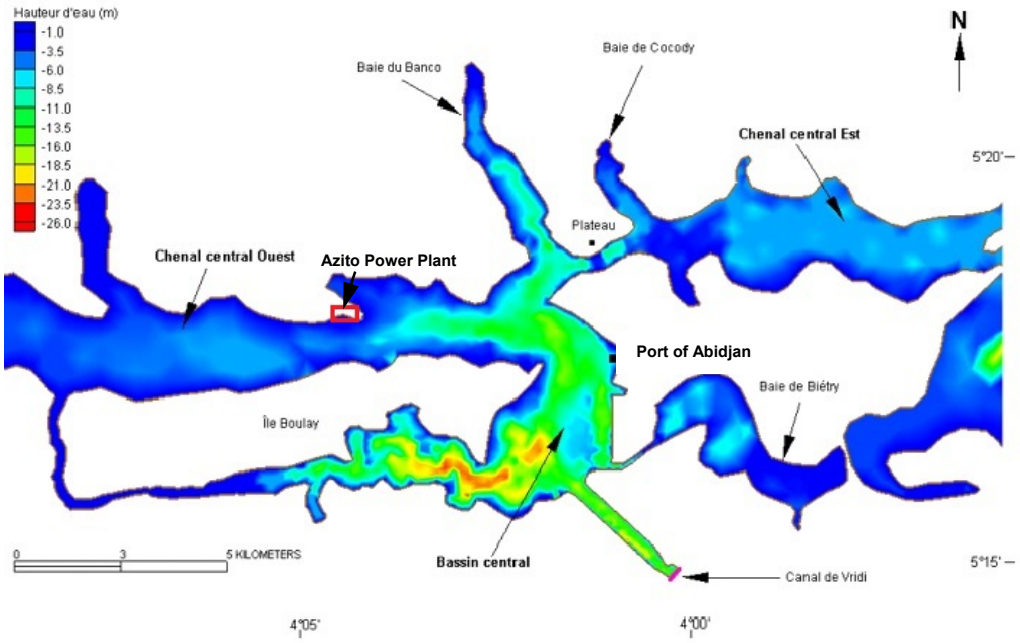
As the lagoon is connected to the ocean, the volume of marine water entering the lagoon varies seasonally and is dependent upon:

- the relative hydraulic levels of the lagoon (maximum during the dry season, minimum during flood events): the Ébrié lagoon collects water from Agneby, Comoé and Mé rivers but also from smaller streams and from precipitation within the lagoon area; and

- the ocean: marine water intrusion occurs during the dry season between January and April.

With the exception of the port of Abidjan area, the depth of the lagoon does not exceed 8 m (see *Figure 7.7* below). Around the site, the water depth ranges from approximately 1 to 3 m.

Figure 7.7 Bathymetry of the Ébrié Lagoon



Source: Wango et al. 2002.

Water Quality

According to the United Nations Environment Programme (1), Ébrié Lagoon is highly polluted with solid and liquid urban waste from Abidjan. The lagoon has suffered from years of major pollution and currently industrial and domestic waste waters are discharged in the lagoon. However, the lagoon is still a resource for fisheries and is also used for navigation purposes.

As illustrated in *Table 7.5*, water from the Ébrié lagoon presents high bacteriologic contamination, mainly due to waste water discharge and the lack of sanitary networks in the city of Abidjan.

Table 7.5 Coliforms in Low Water Season

Location	WHO Guideline Value (a)	Total Coliforms (TC) (cfu/ per 100 mL) (b)
Ile Boulay	0	0
Yop Santé	0	**220**
Baie Banco	0	**1735**

Note:
(a) WHO Guidelines for Drinking Water Quality (2011)
(b) **Bold** text indicates an exceedance of the WHO Guideline value for drinking water quality
Source: ETIALAG, 2003

(1) http://www.unep.org/newscentre/Default.aspx?DocumentID=26844&ArticleID=35453; consulted in October 2016.

The Ébrié lagoon hydrological regime depends on terrestrial and marine exchanges, hydrodynamics, morphology and bathymetry. This can result in variability in a number of the parameters defining water quality throughout the year, in particular temperature, salinity and pH, turbidity and dissolved oxygen. The ESIA Phase III indicates the following:

- **Temperature:** Water temperatures in the Ébrié Lagoon show similar seasonal patterns to the air temperature, with a minimum of 27.4°C in August at the end of the main rainy season and maximum of 31.2°C in April. Sample taken at the site shows that temperature is 24.8 °C but the average water temperature observed in the Ébrié Lagoon is 29.5°C. These water temperatures can be considered representative for the whole water column in the area where the site is except between January and May. Between January and May there is a slight temperature difference, up to 3.3°C, between the temperature at the surface and bottom of the water column.

- **pH and Salinity:** pH variations depend on salinity conditions. During periods of high salinity, pH is alkaline whereas periods of low salinity are associated with acidic conditions. The Project study area is complex in terms of hydrodynamics, with a range of saline conditions occurring throughout the year. The salinity of the lagoon decreases between May and November as freshwater inflow from river catchments dominates. Throughout the lagoon there are enclosed areas with a high renewal rate of fresh water which may become seasonally stratified. These areas are unstable estuarine areas with mixing and interactions with marine water. A weak salinity gradient is observed in the area surrounding the site during January to May (salinity gradient is less than two parts per thousand during flood periods in the Vridi canal). From June to December water column is mixed (salinity gradient can reach 25 parts per thousand in the Vridi canal).

- **Turbidity:** The turbidity of the water can be very high depending on the location and influence of the marine exchanges. Average turbidity levels measured in the surface layers at the site between January 1973 and November 1974 are 122 mg/L.

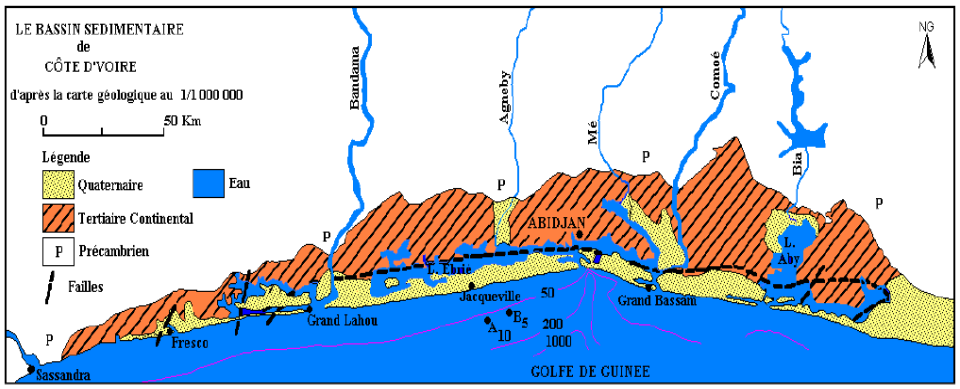
- **Dissolved oxygen:** Dissolved oxygen observed in the surrounding of the site is generally greater than 80% saturation. Towards the east of the lagoon, in the deeper water body of the Abidjan basin, oxygen levels are significantly lower. The oxygen level decreases further, even become anaerobic, in enclosed areas where inflow of fresh water is limited such as the Bietri basin.

7.4.5 Non-Marine Surface Waters

In the region, the three main rivers discharging into the Ébrié Lagoon are the *Agneby* to the west of the study area and the *Comoé* and the *Mé* to the east (see *Figure 7.8*). The Comoé river, located 40 km east of the site, is the major source

of fresh water for the lagoon with a catchment area of 78,000 km². The river system drains the savannah region located in the north of Côte d'Ivoire and in the southern part of Burkina Faso. The other two major sources of fresh water are the Mé and Agneby rivers. The Mé river catchment covers an area of 4,300 km² and is located approximately 20 km to the east. The Agneby River catchment is approximately 8,900 km² and is located 30 km to the west of the site. The lower annual average discharge and the seasonal runoff pattern reflect the rainfall distribution in the coastal area (*Section 7.2.5*). All water discharged from the eastern and western parts of the lagoon flows through the Ébrié Lagoon to the sea via the Vridi Canal.

Figure 7.8 Hydrology in the Abidjan Area



B_5 - A_{10} Emplacement des échantillons prélevés par carottage sur le continental terminal

Source: Geodrill Technologies LTD, 2015

A new container port has been constructed to the east of the existing Azito Power Plant. As part of this development a small watercourse located to the north of the site was diverted as illustrated in *Figure 7.9* and *Figure 7.10*. According to the site, this watercourse was more of an open air sewer than a river.

Figure 7.9 presents satellite imagery acquired in 2015 prior to the development of the container port. *Figure 7.10* presents imagery acquired in 2016 on which the container port development and modified watercourse are visible.

Figure 7.9 Prior to Construction of the Container Port (2015)

Figure 7.10 Construction of the Container Port Commenced (2016)

No flood events have been recorded since the installation of the Azito Power Plant at the site.

7.4.6 *Groundwater*

Overview in Abidjan

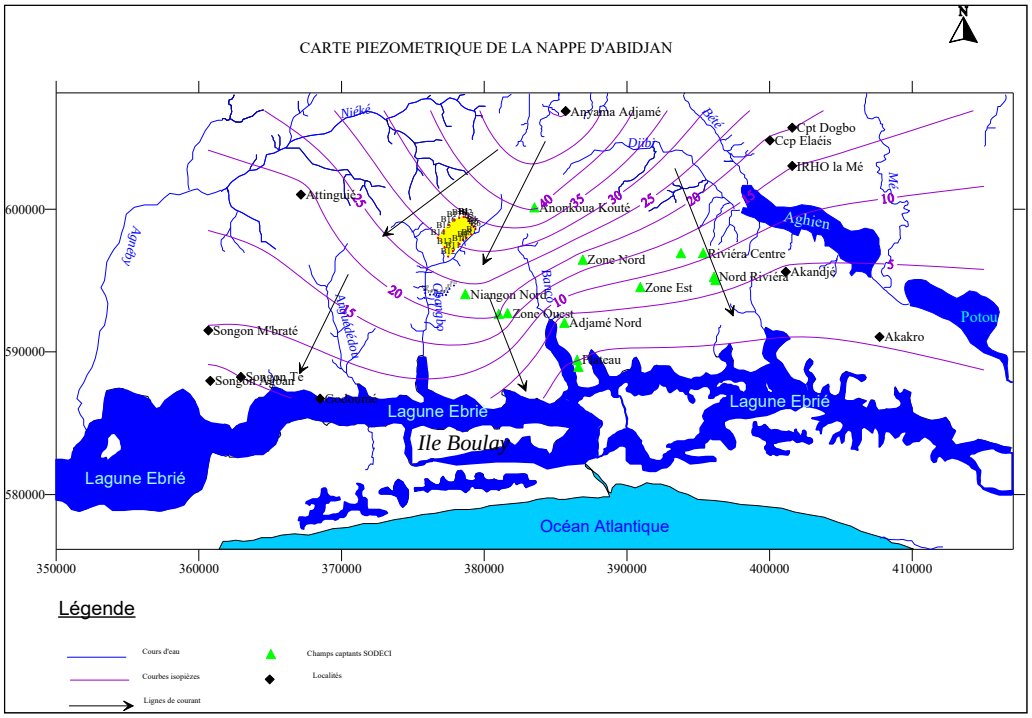
The city of Abidjan has a population of 4.8 million in 2014 (1). The communities located close to the Azito Power Plant abstract water from the underlying groundwater aquifers via groundwater wells. Groundwater of the area flows to the south and east in the direction of the lagoon. Most of these wells are situated less than 10 km to the north of the lagoon area and are located parallel to the shoreline. Groundwater in the area is abstracted at a depth of approximately 100 m.

The sedimentary formation to the north of the lagoon houses an important aquifer, which represents a major source of potable water for Abidjan. In certain parts of the water body, particularly around Abidjan and other urban areas, the levels of nitrate, nitrites and ammonia in groundwater are high due to pollution from sewage sources.

Elevated concentrations of chlorine occur, particularly in the Plateau area, east of the Ébrié lagoon. These elevated concentrations are caused by saline intrusion from the Atlantic Ocean via the Ébrié lagoon and by excessive groundwater abstraction resulting in a decrease of groundwater levels beneath the lagoon water level. Excessive groundwater abstractions are prevented in most areas due to inspection by the government services of National Office for Drinking Water (*ONEP - Office National de l'Eau Potable*) and monitoring of groundwater abstraction. Generally, saline intrusion is limited to a 1 km zone inland from the lagoon.

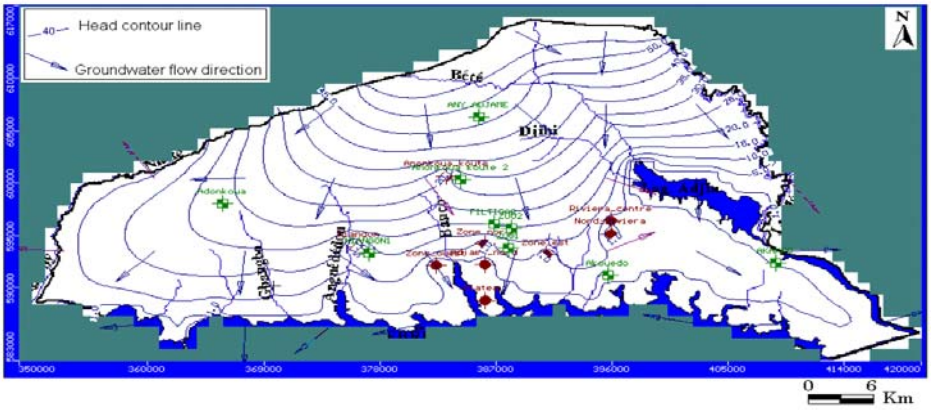
(1) Republic of Côte d'Ivoiré (2015), Periodic Report of the Republic of Côte d'Ivoiré, http://www.achpr.org/files/sessions/59th/state-reports/2nd-2012-2015/cote_divoire_periodic_report_2012_2015_eng.pdf

Figure 7.11 Groundwater Contours in Abidjan Area



Source: Collected by ENVAL, per communication with ONEP - Office National de l'Eau Potable

Figure 7.12 Simulated Drawdown for Abidjan Public Water Supply wells - 2015



Source: Modeling of Groundwater Flow and Drawdown Evolution, Simulation of Abidjan Aquifer (Cote D'Ivoire). Kouame et al, Journal of Asian Scientific Research, 2013, 3(4):344-364

Research undertaken by Kouame et al. (op cit) simulates the evolution of drawdown in the aquifer with continued abstractions. The major effects of drawdown are noted to be away from the study area.

Groundwater at the Site

At a local level, according to the study completed by Geodrill Technologies (2015) the main aquifer located within the vicinity of the site is located at a depth of 30 to 50 m in the coarse sand layer.

As illustrated in *Figure 2.6 (Section 2: Project Description)* Azito Power Plant is currently abstracting water from two groundwater wells:

- A well installed in 1999 with a 60 m depth and a flow rate of 45 m^3/h. The abstracted groundwater pumped is temporarily stored in a 1,000 m^3 tank for fire-fighting purposes and industrial cleaning operations after demineralization. The water is brought to the Power Plant via a water pipe.

- A well installed in 2015, with a depth of around 40 m depth and a flow rate of 45 m^3/h to meet the water demands for the operation of Phase III. The water is brought to the Power Plant via a water pipe.

The depths of the wells have been designed to enable the site to abstract fresh water and avoid salt intrusion. Both wells are located within the vicinity of the small watercourse channel noted and illustrated in *Section 7.4.5* above.

Table 7.6 Groundwater Quality at the Site

Parameters	Units	Date of Analysis	Well reference / results	
			Well 1	Well 2
pH	-	27/07/2017	6.7	5.75
Temperature*	°C	27/07/2017	26.3	26.4
Turbidity	NTU	27/07/2017	2.1	0
Colour	mgPtCo/L	27/07/2017	<15	<15
Conductivity	µS/cm	27/07/2017	209	167
Odour		27/07/2017	not detected	not detected
Sulphates	mgSO_4/L	31/08/2017	<6	<6
Phosphates	mgPO_4/L	28/08/2017	0.19	0.15
Ammonium	mgH4/L	28/08/2017	5.2	1.12
Hardness (total)	F	28/08/2017	4	2
Nitrites	mgNO_2/L	28/08/2017	0.429	0.025
Nitrates	mgNO_3/L	01/08/2017	0.978	13.414
Total Inorganic Carbon	F	28/08/2017	7.7	0.2
Carbonates	mg$CaCO_3$/l	28/08/2017	77	2
BiCarbonates	mcHCO_3/L	28/08/2017	94	2

The above table shows groundwater quality in two samples taken from the site wells in July 2017. The results show low salinity and are consistent with previous samples taken historically.

7.4.7 Wastewater

Process Water

The procedure for Waste Management Plan and Wastewater Management Plan was updated for Phase III. In addition, wastewater treatment equipment and facilities for potentially contaminated water were installed for Azito Energie Phase III which include:

- a new industrial waste water treatment pond (with a capacity of 237 m^3); and
- an oil/water separator and a new neutralization pond (with a capacity of 178 m^3).

Ultimately the Phase I, II and III wastewater streams are directed to the evaporation pond (785 m^3). The capacity of the evaporation pond was not increased for Phase III.

Process water potentially contaminated from the operations of the Power Plant (i.e. water blowdown from the boilers) will be directed to the Phase I and II or the Phase III respective water treatment pond.

Rain Water

Rain water runoff drained on site is directed to one of the two existing oil/water separators. Run-off water drained to the oil/water separator is directed to the neutralization pond for pH control. After this treatment the water is discharged in the existing evaporation pond. Rain water from building roofs will be collected with the existing storm water discharge ditches, leading to the discharge point.

Sanitary Wastewater

Sanitary wastewater is treated by splash mixing and settling and is then directed to the existing neutralization pond (constructed for Phase I and II) and the evaporation pond.

Water Discharge

Ultimately, all wastewater streams generated by Phases I, II and III operations are directed to the evaporation pond. When the water level of the evaporation pond (containing treated process water, sanitary water and run-off water) is high, a contractor (ENVAL) performs analyses to assess the quality of a sample. The results are compared to the Ivorian limits base on Order n°137/MINEF/CAB/SIIC of 9th of September 1998 (see *Table 7.7)*. If the water quality results meet Ivoirian regulations wastewater from the evaporation pond is discharged in an area adjacent to the plant which is ultimately drained to the lagoon.

Table 7.7 Effluent Water Analytical Results

Parameter	Unit	IFC	Ministerial Order N°137/MINEF /CAB/SIIC Du 09 September 1998	Evaporation Pond October 2015
Physico-chemical				
pH	-	6-9	5.5-9.5	9,3 to 29,4°C
Temperature	°C	-	40	29,4
COD	mg/L	-	150	35,2
BOD_5	mg/L	50	80	10,2
Suspended solids	mg/L	50	30	<5
Organic micro pollutants				
Oil and grease	mg/L	10	5	<0.5
Total hydrocarbons	mg/L	-	20	<1

Source: ENVAL Laboratoire, October 2015.

7.5 BIODIVERSITY

7.5.1 Study Area

The biodiversity study area includes the spatial extent of the Project footprint and related facilities (e.g. laydown area during construction) and, for the purpose of this study, was extended to a 2 km radius of the Azito Project site ('the immediate study area'). The study area has also been defined with a view to assess potential impacts on protected areas sensitive to hydrological effects or changes in air quality, an area of up to 15 km from the site ('the wider study area').

7.5.2 Data Collection Methodology

Given the habitats present in the Project's AoI, which are mostly urban or peri-urban and characterised by ongoing industrial activities, primary data collected in 2010 and 2011 and secondary data collected for the Project as presented below is considered to be sufficient to inform the current baseline of the Project Site.

Field Survey

A rapid biodiversity survey was undertaken during 2010 and 2011 to inform the 2012 ESIA for the Phase III expansion of the Azito Energie site. The field survey was conducted by a flora and fauna expert and covered the existing Azito Energie site, including the area proposed for the planned Phase IV expansion, and a 300 m buffer zone. The survey identified the key habitats present as well as the flora and fauna species present.

Desk Based Study

The existing field survey data was supplemented by a desk based review of publically available data. This data review covered an area of 15 km from the Project site.

Sources of information reviewed include:

- Interpretation of aerial photography (Google Earth Pro – accessed 12 October 2012).
- United Nations Environment Programme, Cote d'Ivoire Post-Conflict Environmental Assessment, July 2015.
- Plan National d'Action Environnemental (PNAE – National Environmental Action Plan) for 1996-2010.
- Stratégie et Plan D'Action Pour La Diversité Biologique Nationale, 2016, 2020.
- Online biodiversity databases including:
  - World Database on Protected Areas (WDPA) (www.protectedplanet.net);
  - Important Bird Areas (www.birdlife.org/action/science/sites);
  - Ramsar wetlands (www.ramsar.wetlands.org/Database/AbouttheRamsarSitesDatabase/tabid/812/Default.aspx);
  - Alliance for Zero Extinction (AZE) (http://www.zeroextinction.org/sitesspecies.htm); and
  - Nationally, or locally, protected areas.
- Information on threatened species including:
  - IUCN red list (www.iucnredlist.org);
  - Regional/local red lists; and
  - National protected species lists.

7.5.3 Baseline Conditions in the Immediate Study Area

Overview

The Azito Energie Power Plant is an existing Power Plant on the southern side of the city of Abidjan, located on the edge of the Ébrié lagoon, on the coast of Côte d'Ivoire. The Project's immediate area has seen significant changes in the last 5 years, namely in increasingly industrial land use in the immediate surroundings of the Azito Energie Power Plant and in population size.

As illustrated in *Figure 7.13* the Project's surrounding area once had a greater proportion of vegetation cover and has since became more industrial e.g. the new shipping container terminal (part of the Port of Abidjan concession) on the eastern side of the site, under construction since 2015. Also can be seen a

number of settlements/residential and clearance of a plot of land for industrial purposes on the western side of the site in 2010.

Figure 7.13 Change in Land Use 2010 -2016

As a result, the area is now marked by low biodiversity (see *Figure 7.14*).

Figure 7.14 Degraded Biodiversity Conditions at Site

Terrestrial Habitats and Flora

Open Lands with Ruderal Species

The majority of the Phase IV expansion site is comprised of hard standing and ruderal plants. Ruderal species are defined as species that commonly developed naturally in areas inhabited and modified by humans. Only the southern edge of the site supports semi-natural coastal vegetation, as outlined below.

The ruderal species observed during the assessment are: *Amaranthus spinosus, Amaranthus viridis, Ricinus communis, Cyperus rotondus, Boerhavia diffusa, Euphorbia hirta, Lantana camara, Tridax procumbens, Sida acuta, Boerhavia erecta, Ageratum conyzoides, Croton hirtus, Dactyloctenium aegyptium, Emilia sonchifolia, Emilia sonchifolia* and *Portulaca oleracea.*

None of these species are listed on the IUCN as being rare, threatened or endemic or are protected by Ivoirian regulations.

Modified Habitat, Activities and Ornamental Plants

As aforementioned, the immediate study area is influenced by human activities. Since the site survey was undertaken, much of the semi-natural habitat to the east of the Project site has been cleared of vegetation for the construction of a port facility.

Some limited market gardening related activities appears to take place on small plots of land to the west of the Azito Power Plant some 300 metres

away. Extensive use of land for farming is not practiced within the vicinity of the Project.

Ornamental plants were also identified on site and surroundings during the 2010 and 2011 assessment.

None of the species identified during the assessment within the immediate study area are listed on the IUCN as being rare, threatened or endemic or are protected by Ivoirian regulations.

Pond and Mangrove Area

This habitat is located on the southern side of the site, between the lagoon shore and the site boundary but is highly degraded (see *Figure 7.15)*. Mangroves are characterised by the presence of *Rhizophora racemosa* (only a few young trees within the Study Area), and are generally located in the interstitial zones of tropical coastlines. Species observed in this area during the reconnaissance survey are; *Dalbergia ecastaphyllum, Acrostichum aureum, Flagellaria guineensis, Drepanocarpus lunatu* and *Paspalum vaginatum.*

A few species observed in the former wetlands during the 1998 ESIA are still present *Chrysobalanus icaco, Cnestis ferruginea, Baphia nitida, Bambusa vulgaris, Baphia bancoensis* and *Elaeis guineensis.*

None of these species are listed on the IUCN as being rare, threatened or endemic or are protected by Ivoirian regulations.

Figure 7.15 Example of Habitats Present in the Immediate Biodiversity Study Area

Floral Species

This 2011 botanical field survey resulted in the identification of 121 species of plants spread between 101 genus and 51 families. The most represented genus are *Cassia* (four species), *Cyperus* (four species), *Annona* (three species), *Sida* (three species). The majority of the species recorded are African taxons (inter-tropical Africa) and pantropical taxons (common to all tropical countries).

None of these species identified during the assessment are listed on the IUCN as being rare, threatened or endemic or are protected by Ivoirian regulations.

Terrestrial Faunal Species

Due to the low biological diversity and the increasing human pressure in the area, there is very limited terrestrial fauna within the immediate study area. Species recorded or reported within the site are described in *Table 7.8*.

Table 7.8 Terrestrial Faunal Species Recorded within the Immediate Vicinity of the Project

Category	Species	Protection status
Small mammals	Only rodents were recorded for example the Gambian rat (*Cricetomys emini*, in French "rat géant d'Emin") is reported in the area.	None of the species identified during the assessment within the immediate study area are listed on the IUCN as being rare, threatened or endemic or are protected by Ivoirian regulations
Avifauna	The Project's coastal area along the lagoon is a suitable habitat for water birds. The cattle egret (*Bubulcus ibis*, in French "Héron Garde Boeuf"), various sunbird species (*Trochilidae spp.*) (colibris) and ravens species (*Corvus spp*) were observed on the site during the assessment. A significant amount of *Chrysobalanus icaco* shrubs are present within the proposed site. The seeds of these plants constitute a source of food for birds. These shrubs are common throughout the West African coastal region.	
Bats	No specific survey targeting bats has been undertaken in the Project area. Widespread presence in the wider area of Abidjan of hammer-headed fruit bat *Hypsignathus monstrosus* and African Straw-coloured Fruit-bat *Eidolon helvum* , but these are not specifically reported within the Project AoI.	
Amphibians and reptiles	The common agama, or red-headed agama *Agama agama* (in French "margouillat" or "agame des colons") is observed throughout the site.	
Crustaceans	Crab (*Cardisoma*) nests were observed along the shore of the lagoon.	
Insects	Termite colonies were observed within the study area. Additionally, various types of ants, butterflies and coleoptera were identified.	

Aquatic Habitats and Species

The site is located at 200 m from the Ébrié lagoon. The lagoon and the hydrodynamically connected small watercourse located to the north of the site are the only aquatic habitats found within the immediate vicinity of the site. The lagoon is comprised of a range of biotopes from estuaries, to brackish and

freshwater, depending on the distance from the connection with the sea. This is due to the balance and interaction between diurnal variations from sea water intrusion and seasonal freshwater inflows. The dynamic physico-chemical conditions of the lagoon, resulting from the interaction between different water masses, play an important role on the ecology of the lagoon in terms of species composition, the spatial and temporal structure of communities and also population dynamics (migration, reproduction, growth rates etc.)

The three main rivers discharging into the Ébrié Lagoon are the Agneby to the west of the study area and the Comoé and The Mé to the east. The Ébrié lagoon also collects water from smaller streams and from precipitation within the lagoon area. All water discharged from the eastern and western parts of the lagoon will flow through the Ébrié Lagoon to the sea via the Vridi Canal. The volume of marine water entering the lagoon varies seasonally and depends on the relative hydraulic levels of the lagoon and the ocean (maximum during the dry season, minimum during flood events).

As aforementioned, the Ébrié lagoon is highly polluted but still supports a range of fish species, many of which feed on phytoplankton and zooplankton. The population of plankton varies seasonally with temperature, salinity and the source of water.

Three groups comprise the majority of the benthos in the lagoon: polychaetes, molluscs and crustaceans. The molluscs present in the lagoon include edible species such as the mangrove oyster *Crassostrea gasar* and the clams *Iphigenia delesserti*. The crustaceans include several commercially important species of penaeid shrimps which have great economic importance, and constitute an important part of the lagoon biomass. Prawns of the genus *Macrobarchium*, particularly *M. Vollenhovenii,* are prevalent close to the river and stream outlets.

The lagoon houses numerous fish species which have adapted to the changing chemical characteristics of the water over the last 40 years. These include *Ethmalosa fimbriata*, which is of great importance from an economic and ecological point of view, comprising 70% of the total fish catches. This fish is able to adapt to large variations in salinity and temperature.

Most of the fishing in the Project's AoI and Abidjan basin is dominated by seine netting from boats ('les sennes tournantes') and seine netting from the shore ('les sennes de rivage') mainly by collective fisherman. Due to a decline in fish catches, probably due to over-fishing of undersize fish, managed aquaculture has been introduced to the lagoon for species such as the catfish *Chrysichthys nigrodigitatus*, *Heteribranchus longfilis* and *Sarotherodon melanotheron*.

The West African Manatee (*Trichechus senegalensis*) is reported to occur in the less developed and less disturbed parts of the Ébrié lagoon, particularly around the mouths of the River Comoé in the east and River Agneby in the

west. Manatees are reported to have completely disappeared from the waters around Abidjan as a result of ongoing development (1). They are therefore not considered to occur in the immediate study area.

None of the species identified during the assessment are listed on the IUCN as being rare, threatened or endemic.

7.5.4 Baseline Conditions in the Wider Study Area

Protected Areas

Three protected areas can be found within 15 km of the Site as listed in *Table 7.9.* The closest protected area is the Banco National Park, located about 7.5 km north-west from the Site (see *Figure 7.16*). Cote D'Ivoire's network of protected forests are understood to have a lower level of protection than National Parks.

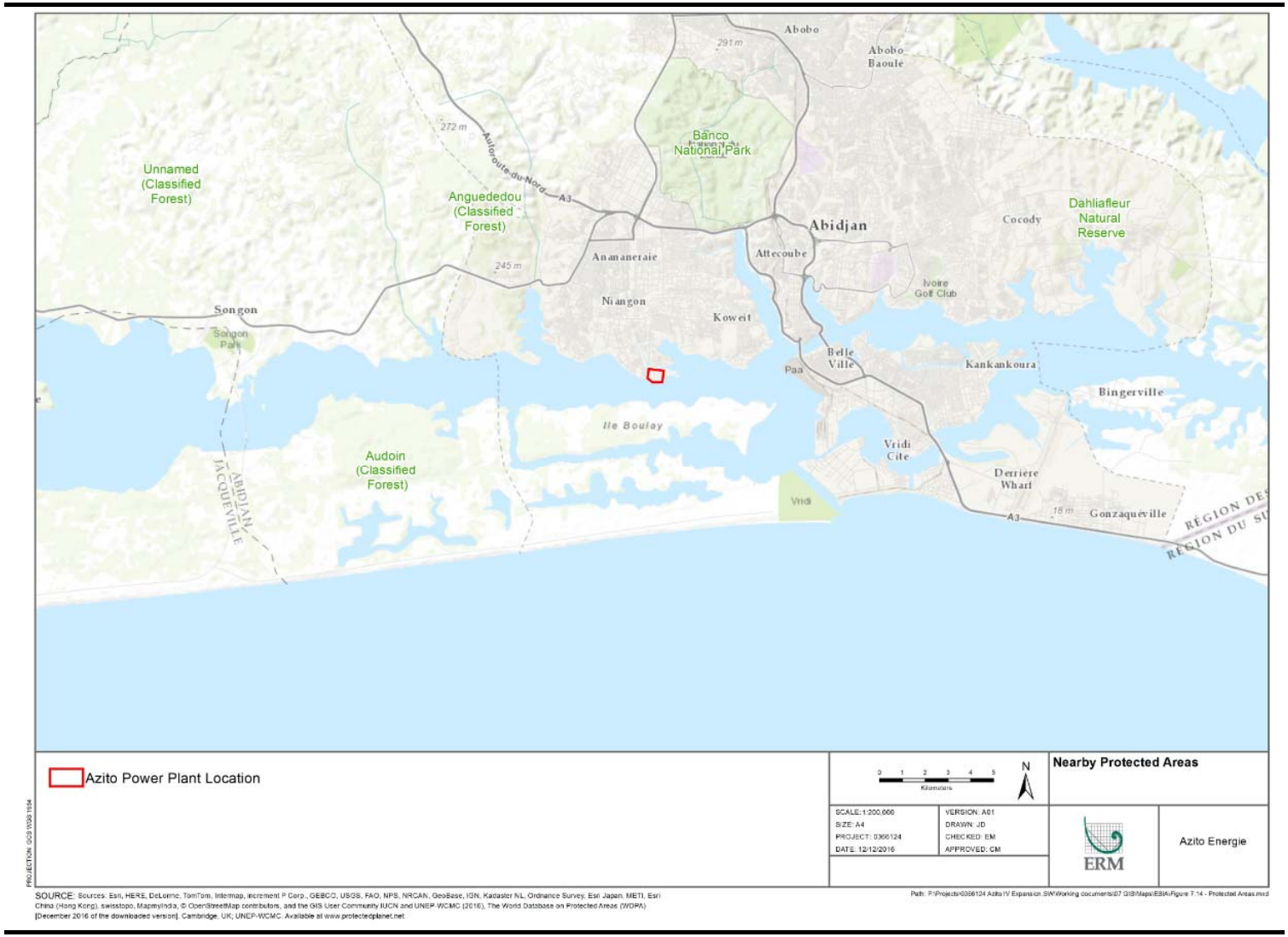
Table 7.9 Protected Areas within 15km of the Site

Name of the protected area	Description of the area	Distance from the site
Banco National Park	Integral reserve. The Banco National Park is located along the Highway North in the district of Attécoubé (Abidjan). The Banco National Park was designated in 1953, covers 30 km² and is an example of primary forest.	7.5 km
Anguededou	Classified forest**	10.5km
Audoin	Classified forest	11.8 km

* An integral reserve in Cote d'Ivoire is one of the highest level of protection which implies that all activities are prohibited i.e. hunting or fishing, all logging, agriculture or mining, grazing, excavation, circulation, etc.
** A Classified Forest is dedicated to the timber production only.

(1) Keith Diagne, L. 2016. Trichechus senegalensis. The IUCN Red List of Threatened Species 2016: e.T22104A97168578. Downloaded on 28 October 2016.

Figure 7.16 Nearby Protected Areas



7.5.5 Modified, Natural, and Critical Habitat Assessment Screening

Natural and Modified Habitat Determination

In relation to IFC PS6 (1) , modified habitat is defined as "*areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition*" (IFS PS6 paragraph 12).
Natural habitat is defined as *"areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition" (*IFC PS6 paragraph 13*).*

Given the location of the project site on the outskirts of Abidjan, the findings of the site visit in 2011 and the ongoing development taking place around the site, the Project site is considered to be modified habitat.

Critical Habitat Determination

Critical Habitat identification is required by PS6 to manage risks and avoid, mitigate, and offset impacts to areas with high biodiversity value including:

1) habitat of significant importance to Critically Endangered (CR) and/or Endangered (EN) species;

2) habitat of significant importance to endemic and/or restricted-range species;

3) habitat supporting significant global concentrations of migratory species and/or congregatory species;

4) highly threatened and/or unique ecosystems; and/or

5) areas associated with key evolutionary processes.

Critical Habitat is only relevant to a development project if it can be impacted by that project. A critical habitat determination has been undertaken for the protected areas, habitats and species identified in the baseline in the immediate or wider study area for biodiversity. The criteria and thresholds used in the determination are set out in IFC Guidance Note 6 (2).

This initial screening assesses if any of the features are likely to be identified as Critical Habitat triggers, and is presented in *Table 7.10.* The results of the screening assessment show that the Project Site and the majority of the Project Study Area do not meet the thresholds for critical habitat as defined by IFC

(1) IFC 2012. Performance Standards on Environmental and Social Sustainability, published January 2012. Available in English at: http://www.ifc.org/wps/wcm/connect/115482804a0255db96fbffd1a5d13d27/PS_English_2012_Full-Document.pdf?MOD=AJPERES.
(2) https://www.ifc.org/wps/wcm/connect/a359a380498007e9a1b7f3336b93d75f/Updated_GN6-2012.pdf?MOD=AJPERES

PS6. However the Banco National Park, approximately 7.5 km north of the Project site, and the Audoin Classified forest, approximately 11.8 km southwest of the Project site, both support the IUCN globally Endangered species Ghana river frog (*Phrynobatrachus ghanensis*). The presence of this species means both of these sites are Critical Habitat, as defined by Criterion 1 of IFC PS6. However it is noted that no activities will occur in these areas and no impact will occur in these areas (See *Section 8*) hence these are not considered as a critical habitat for this Project.

Table 7.10 Critical Habitat Assessment Screening

Species/Feature	Description/Distribution	Qualifies as Critical Habitat (Y/N)	Tier 1 or Tier 2 (for Criteria 1-3)
Criterion 1 – Critically Endangered and Endangered Species			
None present.	No nationally or internationally CR or EN species known to occur on the Project Site or the majority of the Project AoI. Globally Endangered Ghana river frog (*Phrynobatrachus ghanensis*) has been recorded from the Banco National Park and Audoin classified forest. It has an estimated extent of occurrence (EOO) of 61,463 km². It has been recorded from nine protected areas, but is likely to be under recorded across its range. (1) (2)	Although the species identified qualify as critical habitat the site is located 7 km away from the Project hence cannot be considered as a critical habitat for this Project)	
Criterion 2 – Endemic/Restricted Range Species			
None present.	No endemic or restricted range species are known to occur on the Project Site or within the Project AoI.	N	N/A
Criteria 3 - Migratory /Congregatory Species			
None present.	No areas which support internationally important concentrations of migratory or congregatory species are known within the Project Site or AoI.	N	N/A
Criteria 4 – Highly Threatened or Unique Ecosystems			

(1) http://www.inaturalist.org/projects/west-and-central-africa-amphibian-red-list-assessment-forum/assessments/653-phrynobatrachus-ghanensis

(2) Mark-Oliver Rödel, Arne Schiøtz. 2004. Phrynobatrachus ghanensis. The IUCN Red List of Threatened Species 2004: e.T58112A11732033. http://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T58112A11732033.en. Downloaded on 18 October 2016(.) Assemian, N, E., Kouame, N, G., Tohe, B., Gourene, G. & Rodel M-O (2006) The anurans of the Banco National Park, Cote d'Ivoire, a threatened West African rainforest. Salamandra 41, 1, 41-510

Species/Feature	Description/Distribution	Qualifies as Critical Habitat (Y/N)	Tier 1 or Tier 2 (for Criteria 1-3)
None present.	The Banco National Park supports highly threatened primary lowland rainforest.	Although the Banco National Park qualifies as critical habitat the site is located 7 km away from the Project hence cannot be considered as a critical habitat for this Project	N/A
Criteria 5 – Key Evolutionary Processes			
None present.	No areas which support key evolutionary processes are present in the Project AoI.	N	N/A

7.6 SOCIAL COMPONENT

This Section describes the socio-economic characteristics of the Social Study Area. The baseline conditions are described in details at a local level when data was available. Should this not be the case national data is provided for context where deemed of relevance.

7.6.1 Study Area

For the Project, a Social study area has been identified and is based on identified sensitive receptors likely to be worst affected by the Project activities during construction and operation activities.

The study area (see *Figure 7.17)* was defined based on the likely construction and operation activities. The study area includes the spatial extent of the Project footprint and related facilities (i.e. laydown area during construction) and social sensitive receptors which includes:

- the village of Azito approximately 300 m to the west;
- the village of Béago approximately 700 m to the north-east;
- the quartier of Yopougon-Kouté; and
- the eastern side of Niangon-sud quartier.

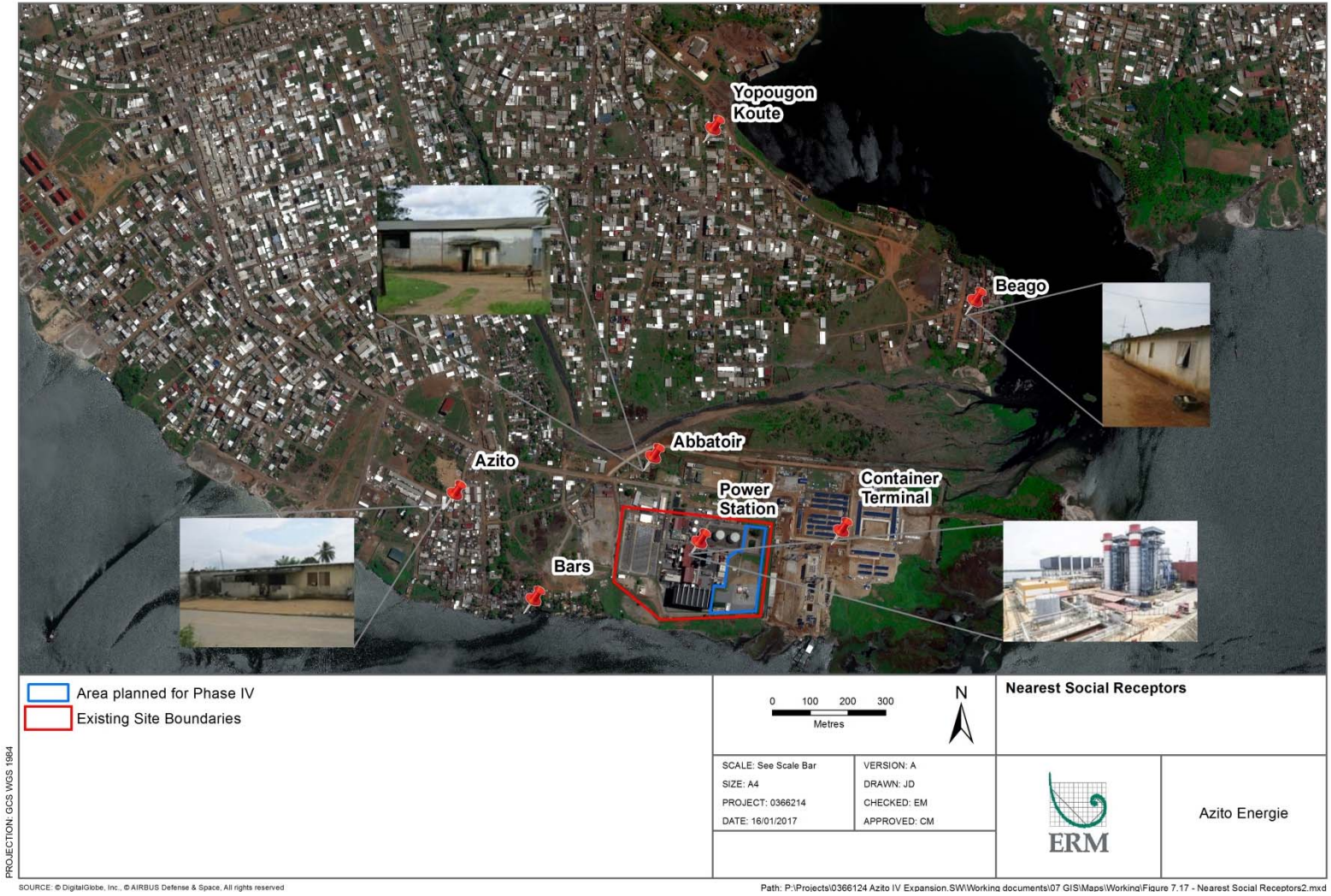
In particular the study area includes the nearest receptors to the Azito Power Plant (hereinafter referred to as 'the site'). As show in *Figure 7.17*, these include:

- a slaughterhouse to the north-west, near the entrance road to the Azito power plant);

- a number settlements/residential areas; and

- a shipping container terminal laydown area and worker camp adjacent to its eastern side, in construction since 2015 and currently in operation, and is part of the Port of Abidjan Authority concession area.

Figure 7.17 Social Area of Influence



7.6.2 *Methodology*

The information provided in this Section is based on primary baseline data collected for Azito Phase III in 2012 and those publically available secondary information, in particular data provided by the National Statistics Institute of Côte d'Ivoire ("Institut National de la Statistique" or "INS") based on the latest population census in 2014.

This Section is also based on the consultations conducted by ERM (see *Section 6 - Stakeholder Engagement*) and observations during the ERM site visit conducted in the week of the 21st of September.

7.6.3 *Administrative Structure*

Abidjan has a two-tier administrative structure.

Azito Power Plant (hereinafter referred to as 'the site') is situated in the Yopougon commune of Abidjan which is one of the ten communes of Abidjan. The ten communes of Abidjan are listed in *Annex E.*

Based on national census data from 2014, Yopougon commune covers an area of 127 km^2 (1), the largest of the ten communes of the city of Abidjan in terms of size and population

Yopougon is sub-divided into 27 *quartiers* with 14 villages (see *Annex E*). Azito and Béago are two of the 14 villages (2). The site and Azito village are situated in the *quartier* of Niangon-Sud. Béago is situated in the *quartier* of Yopougon-Kouté. Further detail is provided in *Annex E*.

The eastern part of the Yopougon commune is mostly occupied as residential areas, while the main industrial zone is located in its northern part. In the southern section of Yopougon commune is the Ile Boulay, located on the other side of the Ebrié lagoon from the Azito Power Plant. Despite its proximity to Abidjan, the island is rural and sparsely populated.

(1) Data provided by the National Statistics Institute (Institut National de la Statistique) of Côte d'Ivoire, on 18th October 2016

(2) Note that villages fall within *quartiers*.

7.6.4 *Demographics*

National Overview

The local socio-demographic context is marked by a rapid growth of population associated with urbanisation and industrialisation. An overview of national-level population indicators is provided in *Table 7.11*. It shows that Cote d'Ivoire has been experiencing substantial population growth in the last couple of decades, a pattern consistent with demographic transitions occurring in the wider region whereby birth rates and total fertility are higher than death rates and hence has led to a significant population growth. The latest General Population and Household Census (1) indicates that the annual population growth rate of Côte d'Ivoire's population has been slowing down to 2.6% with a total population of approximately 23 million. Determinants for this marked in-migration to the area are both historical and current, including nationals fleeing the deteriorated socio-economic conditions due to civil conflict in the first decade of this century seeking safety and a better quality of life in Abidjan, as well as the economic transition currently being experienced in Cote d'Ivoire and the villages' proximity to Abidjan. Cote d'Ivoire is the largest economy in the West African Economic and Monetary Union (2).

The rate of urbanisation has been growing, with 54.2% of the population are estimated living in the urban areas, compared to 43% in 1998.

36% of the population are aged between 15 and 34, this rises to 78% when considering the proportion of those aged less than 35.

Table 7.11 Summary demographic indicators, Côte d'Ivoire, 1998, 2011, 2014

Indicator	1998*	2011** to 2014*	Most recent UN estimates (2010-2015) for comparison***
Total population	15, 366,672	22,671,331*	23,254,000
Urban population (%)	42.5	51.7*	54.2
Women of reproductive age	3 685 805	5,433,314#	Not available
Annualised growth rate (%)	3.3	2.6*	2.4
Crude birth rate (per 1,000 population)	40.6	35.7	Not available
Total fertility rate (live births per woman of reproductive age)	5.4	4.8	5.1
Crude death rate (per 1,000 population)	14.2	12.9	Not available
Life expectancy at birth (years)	50.9	53.1	51.9/50.2
Non-Ivorian's / International Migrants as a Proportion of the Total Population (%)	2,163,644 / 14	data not available	2,175,400 /9.6

Sources: **INS figures based on the General Population and Housing Censuses of 1998 and 2014;* **Côte d'Ivoire Demographic and Health Survey 2011 – 2012; and ***UN data (3).

(1) Abidjan.net on 23 December 2014 "RGPH 2014: "*Exactement" 23 millions de personnes vivent aujourd'hui en Côte d'Ivoire dont 4/5 ont moins de 35 ans*" Available at: http://news.abidjan.net/h/518922.html accessed on 18 October 2016
(2) World Bank Côte d'Ivoire Country Profile available at: http://www.worldbank.org/en/country/cotedivoire consultaed on 21 October 2016
(3) Available at: Avilable at : http://data.un.org/CountryProfile.aspx?crName=Côte d'Ivoire#Summary consulted on 25th October 2016

Local Overview

Abidjan has experienced significant population increase, particularly since 1998.

Based on the most recent data for 2014, Yopougon has a population of just over one million (1,071,543), making up 24% of Abidjan's total population. Yopougon's population growth was 51% between 1998 and 2014. The 2014 census found that the annual population growth rate for Yopougon commune was 2.9% (see *Annex E*). If this annual growth rate maintains constant, the population of Yopougon commune could be doubled in 2039.

The villages of Azito and Béago as well as the quartier named Yopougon-Kouté, have experienced considerable population growth, sustained by in-migration flows due to economic reason.

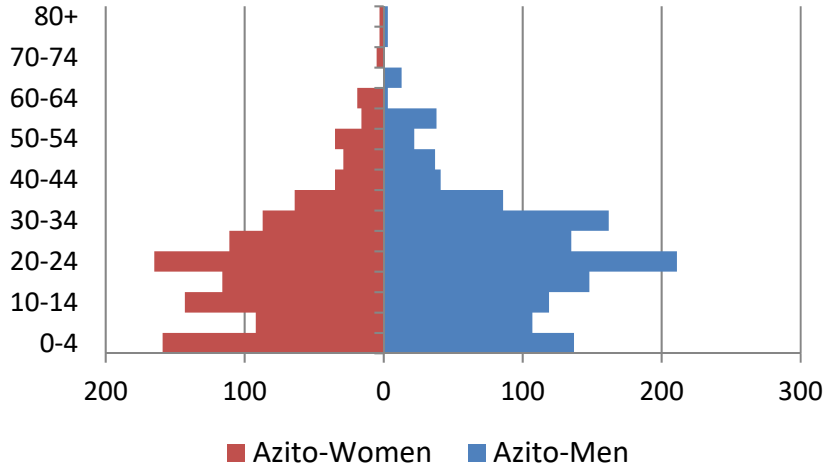
As illustrated in *Figure 7.13* the Project's surrounding area once had a greater proportion of vegetation cover and has since became more industrial i.e. the new shipping container terminal (part of the Port of Abidjan concession) on the eastern side of the site, under construction since 2015. Also can be seen a number of settlements/residential and clearance of a plot of land for industrial purposes on the western side of the site in 2010.

Azito

According to 1998 census data, the population of Azito was 1,479, 54% of which were male. Assuming a population growth rate of 2.6% (based on the population growth rate for Yopougon as a whole between the 1998 and 2014 censuses) and taking into account the increased demographic pressure in Abidjan over the last 10 years, it can be estimated that the population of Azito village would now (i.e. 2016) be over 2,200.

As illustrated in *Figure 7.18* Azito has a significant young population structure.

Figure 7.18 Population Structure, Azito, 2014 Estimates

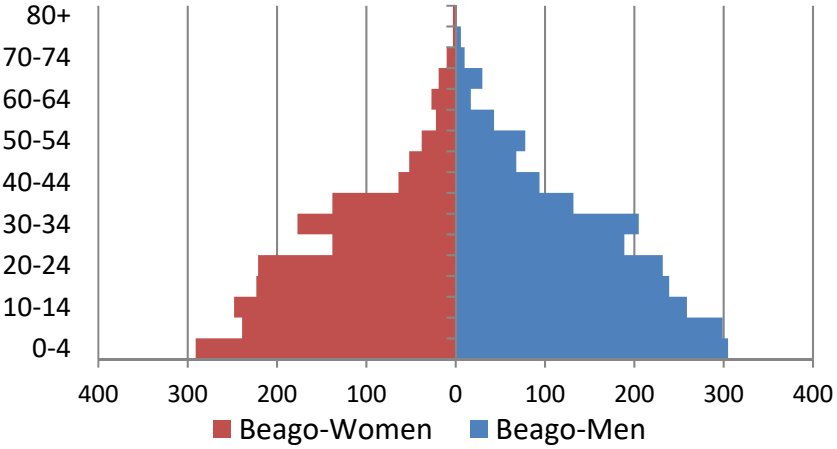


Source: INS Côte d'Ivoire, October 2016

Béago

Béago has a larger population and therefore a larger surface area than Azito. Like Azito, it is mainly inhabited by Ivorians of which the majority are indigenous Ebrié people. As illustrated in *Figure 7.19* the population/ demographic structure of Béago is similar to that of Azito, which has a larger percentage of population aged between 20 and 24. Sixty two percent of its population is aged less than 25 years, a young demographic structure similar to Azito. The economically active age group (15-49 years) represents 53% of the total population, a lower proportion compared to that of Azito.

Figure 7.19 Population Structure, Béago, 2014 Estimates



Source: INS Côte d'Ivoire, October 2016

Migration and Ethno-Linguistic Groups

Côte d'Ivoire attracts a significant amount of migrants. Around 10% of the population is foreign-born. The majority of these foreigners are nationals of other ECOWAS Member countries with (see *Annex E*) Burkina Faso and Mali being the main countries of origin [(1)].

The 2014 census found that 22% of population in Abidjan District were non-Ivorian. In contrast, the ESIA for the Azito Phase III project in 2012 stated that "*Yopougon is still mainly populated by native inhabitants (88.6% according to the 1998 census). This native population consists mostly of indigenous Ebrié. Approximately 11.4% of inhabitants of the town are foreigners, mainly originating from 15 ECOWAS member states*." Similarly, the 2014 census found that nine percent of the population is non-Ivorian. This proportion of non-Ivorian is substantially lower than other communes of Abidjan, such as Abobo (15% non-Ivorians), Cocody (21%) and Treichville (40%).

There are 69 different ethnic groups living in Yopougon as a whole. The INS does not provide detailed information in that respect but based onthe Phase III ESIA, it is noted that the indigenous Ebrié is the largest ethnic group (15.4% of the population), followed by the Baoulé (12.4%) and the Agni (12.2%). Smaller communities or ethnic groups were also observed in 1998, they are Bete community (4%), the Appolonien (also called Nzima) (3.9%), the Dida (2.9%), the Malinke or Dioula (2.8%), the Attié (2.7%) and the Senufo (2.5%).

Azito

According to data from 1998 (as indicated by the ESIA for Phase III), three ethnic groups represent 40% of the population of Azito: the Ebrié – recognised as the original inhabitants of the area, the Agni and the Baoulé.

No information has been made available for Béago but it is assumed to be the same repartition as Azito.

7.6.5 Culture and Traditions

Culture and Tradition of the Ebrié People

The communities in the project area have a mixed population of Ivorian and foreign ethnic groups, with the main one being the Ebrié. They are the indigenous Ivorian ethnic group that traditionally inhabited in these areas (also called Tchaman in anthropological texts) [(2)]. The Ebrié is believed to have been settled on the northern shores of the Ebrié Lagoon (including the villages

(1) UN Department of Economic Development and Social Affairs (2015) A Survey on Migration Policies in West Africa from *the Workshop on strengthening the collection and use of international migration and data for development* Available at: http://www.un.org/en/development/desa/population/migration/events/other/workshop/2015/docs/Workshop2015_CotedIvoire_Migration_Fact_Sheet.pdf accessed 20 October 2016

(2) Konin A (2010) Aspectes de l'Art Musical des Tchaman de Cote d'Ivoire Musée Royal de l'Afrique Centrale, Tervuren (Belgique) Available at: http://www.africamuseum.be/docs/research/publications/rmca/online/tchaman.pdf

of Azito and Béago) between the 15th and 18th centuries. They are members of the Akan ethno-linguistic group and were traditionally fishermen and farmers.

The Ebrié comprises nine tribes or kinship groups (1), namely Kwè, Bidjan (Kobriman), Yopougon, Nonkoua, Songon, Bobo, Diapo, Bia and Niangon, Azito, and Béago. The villages of Azito and Béago belong to the Yopougon tribal grouping.

Traditionally, every Ebrié situates/positions themselves within their society based on their generational group. These generation/age groups are divided in four: *dougbô, tchagba, blésswé, niando.*

Cultural, religious and political life in the villages is based on the organisation of generational categories of the inhabitants and the transition between them is according to prescribed traditions and rituals.

The *fatchué* or *afatchué* is an initiation ceremony that marks the passage from one age class to the next in the lives of young girls and boys in the same age class, composed of one generation. The *fatchué* or *afatchué* initiation ceremonies are important to define an individual position/role within their groups.

Religious Beliefs

The INS does not provide detailed information in that respect but based on the Phase III ESIA it is understood that inhabitants of Azito and Béago villages are predominantly Christians and Muslim. There is a mosque in each village attended by those of Muslim faith and a number of churches attended by those of various Christian denominations (Methodist, Catholic Church of the Assemblies of God, Celestial Church). Despite the relatively recent spread of the Christian faith, the indigenous Ebrié inhabitants remain attached to the worship of their ancestors. Every village has an ancient cemetery considered to be a sacred place where the founder ancestors live. These cemeteries are a cultural heritage site for indigenous Ebrié or 'Tchaman'.

7.6.6 *Livelihoods, Employment and Economic Activity*

National Overview

The World Bank states that the estimated share of the population living below the poverty line increased nearly five-fold from around 10% in 1985 to about 49% in 2008 and then decreased slightly to 46% in 2015. The poverty rate in Cote d'Ivoire reduced slightly between 2011 and 2015 from an estimated 51% to 46%, attributed to the rebound of economic growth brought by increased stability since political conflict ended in 2011 (2).

(1) Konin A (2010) Aspectes de l'Art Musical des Tchaman de Cote d'Ivoire Musée Royal de l'Afrique Centrale, Tervuren (Belgique) Available at: http://www.africamuseum.be/docs/research/publications/rmca/online/tchaman.pdf
(2) The World Bank Cote d'Ivoire Overview. Available at : http://www.worldbank.org/en/country/cotedivoire/overview accessed 24 October 2016.

Poverty continues to be the overwhelming disparities in access to basic services, and gender disparities across wealth and urban-rural groups. Some economists believe that the disparity between the poor and those benefit from an annual GDP growth of 8% is leading to a two-tier society as this growth is not inclusive, wealth is not being redistributed and long-term employment is not being stimulated (1).

Local Overview

Economic activity

Yopougon is the largest industrial area of the Côte d'Ivoire. With the port area and more than 300 companies are based there, this commune of Abidjan plays an important economic role at the national level. The Yopougon municipality houses 22 markets for various goods trade, four banks, a hundred hotels and over one thousand "maquis" (restaurants). This town is best known for the presence of the Industrial Commercial and Gastronomic Fair (FICGAYO).

In the last 4 years there has been an increase in industrial activity in the Project area, mirrored by the changes in land use already illustrated in *Figure 7.13.*

Some limited market gardening related activities appears to take place on small plots of land to the west of the Azito power plant some 300 metres away. Extensive use of land for farming is not practiced within the vicinity of the Project.

Some rearing of livestock is evidenced in the project area, poultry farming being a key activity in the area. A limited number of cattle were observed within 300 m from the Azito power plant during the day (see *Figure 7.20*).

Based on the socio-economic baseline data collection for the Phase III expansion cattle are owned by Ivoirian citizens and managed on a day-to-day basis by Malian migrants. Although there is no formal agreement between the management of the power plant and the farmers, small-scale cattle grazing activities were observed within the study area during the socio-economic baseline data collection for the Phase III expansion.

(1) Le Monde on 02 May 2016. 'Le principal défi de la Côte d'Ivoire est d'assurer un emploi de qualité pour tous ' Available at : http://www.lemonde.fr/afrique/article/2016/05/02/le-principal-defi-de-la-cote-d-ivoire-est-d-assurer-un-emploi-de-qualite-pour-tous_4912266_3212.html accessed on 24 October 2016

Figure 7.20 Cattle Grazing Close Within 300 m From the Azito Power Plant during the Day Zone

As indicated in *Section 7.6.1,* the nearest receptors from the Project's site include a slaughterhouse and bar. The slaughterhouse has been in operation since 1998 and is still in operation. The slaughterhouse operates mainly at night (to supply meat to the local markets in the morning). The bar was constructed in 2012.

In addition, there are several resorts and bars located between the site and Azito village, along the shores of Ebrié lagoon, as depicted in *Figure 7.17.* Another important source of livelihood in the Study Area is the production of Attiéké. The staple food of attiéké, a traditional couscous made from ground and fermented cassava roots, is traditionally made by women in villages across the country and in the outskirts of Ivorian main cities, especially in southern and central Cote d'Ivoire (1).As described in *Section 6 - Stakeholder Engagement,* Azito O&M has been supporting the women attiéké producer's cooperatives of both Azito and Béago villages since 2008.

Employment

At time of writing, detailed information of employment activities, unemployment rates and other livelihoods in the Azito and Béago were not made available.

Overall, the private sector employs the majority of the population in Yopougon. Private employment opportunities are generally associated with small businesses, shops, bars and restaurants ("maquis"), artisanal fishing, crafts and tailoring. For example, the Phase III ESIA in 2012 stated that in Azito village, a large percentage of the population (nearly 40%) was employed in the public or private sector. About 25% of the population was unemployed, 20% were pupils or students, 13% housewives, and the rest of the population retired workers.

(1) BBC News on 07 August 2016. 'Attieke - Ivory Coast's answer to champagne' Available at : http://www.bbc.co.uk/news/world-africa-36986299 accessed 26 October 2016

Women are mainly employed in the private sector. The income-generating activities are trade of donuts, fried bananas ("alloco"), and attiéké. The latter is the main source of income for women in Azito.

Common occupations of the Yopougon population are civil servants, traders, labours, fishermen, students, the unemployed, pensioners and security guards. The formal employment opportunities are mainly industry-related jobs or jobs in the public sector. Women mainly worked as market or street vendors (selling mainly fish, meat, poultry, donuts, fruits, roasted or fried plantain, and attiéké). Among employees in the private and public sectors, there are a numbers of technicians, opticians, teachers and customs officers.

Fishing activities remain an important livelihood in the region. In the Ebrié Lagoon it is traditionally done using canoes and nets. Today, very few indigenous young people are involved in this activity and professional and commercial fishing is mostly conducted by non-Ivorian nationals, including Ghanaians and Malians.

7.6.7 Land Ownership

In the area of Yopougon, land ownership can be of various kinds. Traditionally, local Ebrié people exercise customary rights to land. With this right, they are allowed to build houses for populations and communities. In the village of Béago and Azito, part of the land is owned by the village community, families and individuals. The first two categories represent ancestral lands passed down from generation to generation. The last category is land purchased by individuals.

In Béago the strip of land connecting the "Tchacha" peninsula with the Azito Power Plant, the area of the "Petit Séminaire" (Chapoulie Center) and the port site operated by ALPI-CI are considered as land owned by the village community.

National law and municipal regulations are superimposed over this traditional ownership structure. According to the national law, the Ivorian state owns all land within the Ivory Coast. According to the municipal law, since the creation of Yopougon in 1980, the land of the villages belongs to the municipality.

Even though the local village chief has the most senior customary roles, the "chef de terres" (chief of land) holds significant local power in the village.

According to the Phase III ESIA, a recurrent source of tensions in the city of Abidjan is land ownership and access. In Yopougon, this type of conflict can arise when Ebrié families, the holders of customary land rights in the area, are obliged to give up part of their land to the national government, to local municipalities or to development projects. In most cases, the Ebrié families are not satisfied with the level of compensation that they receive in exchange for their land.

This is supported by several news articles in the local press that discuss land-based conflict across the Yopougon commune owing to issues such as improper process for purchase and development of properties, lack of payment for land rights leading to insecurity of tenure (1), as well as overlapping claims leading to forced evictions (2) and reports of false land ownership claims or title deeds (3).

There was previously an outstanding conflict between the inhabitants of Azito village and the Government of Côte d'Ivoire (GoCI) over compensation for the land-take that was allocated for construction of the Azito power plant in 1998. This included economic relocation, carried out by the GoCI. Following this conflict a protocol was signed in December 2007 between a GoCI representative and the Azito village chief/head men for issuing compensation and the allocation of a plot of land of 25 hectares to the village. It is understood that discussion between the village of Azito and the GoCI to finalise this compensation process is still underway at the time of writing.

7.6.8 Schooling and Education

In terms of education, the previous socio-economic baseline reported that the settlements of Azito and Béago each had a public elementary/primary school that provided housing for its teachers. These institutions were characterized by overpopulation and lack of desks.

Since then, Azito O&M has undertaken a series of social investments in the educational services and infrastructure of its neighbouring communities of Béago and Azito.

In addition to the two basic primary/elementary schools in either settlement reported in the previous socio-economic baseline, Azito O&M has constructed three additional classrooms at a second primary school in Azito and supplied materials to it including boards, desks, chairs and school materials (4). Azito O&M has also advocated for increased attendance by school-age children who, despite their proximity to a school, are still engaged in labour to earn money to supplement their household income to support their parents.

In the Béago primary school, Azito O&M completed the construction of additional school buildings as well as the provision of hygiene/sanitation facilities. In 2013, the company renovated two of the existing buildings and

(1) L'Infodrome on 02 March 2016. 'Conflit foncier a Yopougon-Niangon Lokoa: 200 duplex et villas menacés de démolition' Available at : http://www.linfodrome.com/societe-culture/25079-conflit-foncier-a-yopougon-niangon-lokoa-200-duplex-et-villas-menaces-de-demolition accessed 24 October 2016
(2) eburnienews on 07 May 2015. 'Conflit foncier à Yopougon-Quartier Obama : 12 000 personnes menacées de déguerpissement' Available at : http://eburnienews.net/conflit-foncier-a-yopougon-quartier-obama-12-000-personnes-menacees-de-deguerpissement/ accessed 25 October 2016
(3) Notre Voie on 3 December 2009. 'Cote d'Ivoire: Conflit autour d'un espace vert à Yopougon - Les habitants de Sicogi crient à l'expropriation' Available at : http://fr.allafrica.com/stories/200912310600.html accessed on 24 October 2016
(4) Globeleq website, 15 October 2015. "*Azito continue à avoir un impact sur des vies*" Available at : http://www.globeleq.com/news/announcement/62/Azito-continue-avoir-un-impact-sur-des-vies

constructed an additional two buildings and principal's office in 2014-5 (1) which comprise a total of nine classrooms. According to the Globeleq website, primary school graduation rates has risen from 50% in 2011-2 to 95% in 2014-15. The number of students in the school has risen from 380 to 519 students in the last three years. This may also be attributed to the general trend of population increase in the surrounding area. There is no high school or vocational training centre in the project area.

7.6.9 Health

The medical system in Côte d'Ivoire is designed after the French system. At one point, the nation offered some of the best care in the West Africa. However, due to the political instability and recurrent violence between 2000 and 2011, the standard of health care deteriorated, particularly in the north of the country that was held by a rebel group during that period.

Yopougon has several health facilities (public and private). These include:

- a medical university (CHU);
- an urban clinic (FSU);
- eleven community-based health centres (FSC);
- a school health centre;
- a Pasteur institute; and
- several private clinics.

For their medical care, local residents usually visit the local clinic in Azito and nearby health facilities (FSC in Kouté and the PMI of SICOGI area). In case of serious illness, they are referred to the medical university.

As part of their corporate social responsibility programme, Azito O&M and Azito Energie have sponsored the local health centre in Azito since 2008, which is frequented mainly by residents of the Azito village. In 2013, Azito O&M and Azito Energie rehabilitated the Azito health centre in collaboration with an NGO called Terre des Hommes Italie.

According to World Health Organisation figures (2) HIV, tuberculosis and malaria are the main causes of death for adult in Côte d'Ivoire. The country has the highest HIV infection rate in the West Africa region and this is the major cause of death, killing 32,200 people in 2012 and accounted for 12.7% of deaths. The DHS for 2011-2012 (3) shows that national HIV infection rate has reduced from 4.7% in 2005 to 3.7% in 2011-12. Though prevalence appears to be decreasing, it is noted that female has higher HIV infection rate (4.6% in 2011-12) than male (2.7% in 2011-12).

(1) Globele website, 05 March 2016 "*Azito Completes School Buildings at Béago Village*" Available at : http://www.globeleq.com/news/announcement/66/Azito-Completes-School-Buildings-at-Bago-Village

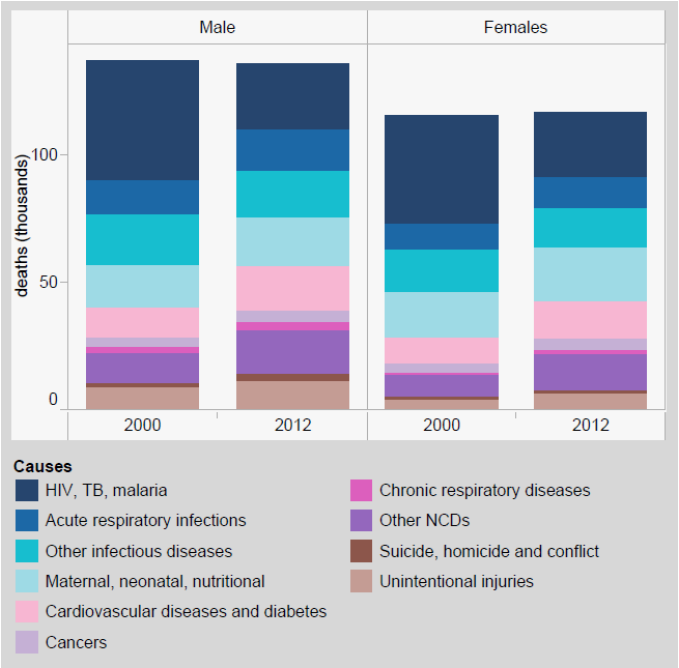
(2) World Health Organisation, Cote d'Ivoire: WHO Statistical Profile http://www.who.int/gho/countries/civ.pdf?ua=1 accessed 17 October 2016

(3) Institut National de la Statistique (INS) et ICF International. 2012. Enquête Démographique et de Santé et à Indicateurs Multiples de Côte d'Ivoire 2011-2012. Calverton, Maryland, USA : INS et ICF International. http://dhsprogram.com/pubs/pdf/FR272/FR272

The population of Abidjan has the highest HIV prevalence rate in the country (total 5.1%; female 5.9%; 4.1%) [1]. Members of the Krou ethnic grouping have the highest HIV prevalence rates at 4.9%. Among persons infected with HIV, 58% of females and 60% of males do not know their HIV status [2].

HIV/AIDS is followed closely by lower respiratory tract infections (11.3% of deaths) as a leading cause of death [3]. Further information on causes of mortality as estimated by the WHO is provided in *Figure 7.21.*

Figure 7.21 Deaths by Broad Cause Group, Côte d'Ivoire, 2000-2012



Source: World Health Organisation, Cote d'Ivoire: WHO Statistical Profile (Available at: http://www.who.int/gho/countries/civ.pdf?ua=1 accessed 17 October 2016)

Epidemiological secondary data are not available at a local level for the villages of Azito and Béago. However, a study published in 2013[4] on the link between sanitation and health in Yopougon provides data on the health status for the wider Yopougon town. This study highlights the link between health and poor environmental hygiene, where untreated urban wastewater is discharged into the lagoon through the existing sewer system. The study finds that malaria is prevalent in Yopougon, accounting for 58% of all visits to local health centres. Acute respiratory infections (ARI) account for 28% of visits while diarrheal diseases account for 14% of visits to local health centres.

(1) Institut National de la Statistique (INS) et ICF International. 2012. Enquête Démographique et de Santé et à Indicateurs Multiples de Côte d'Ivoire 2011-2012. Calverton, Maryland, USA : INS et ICF International. http://dhsprogram.com/pubs/pdf/FR272/FR272
(2) Institut National de la Statistique (INS) et ICF International. 2012. Enquête Démographique et de Santé et à Indicateurs Multiples de Côte d'Ivoire 2011-2012. Calverton, Maryland, USA : INS et ICF International. http://dhsprogram.com/pubs/pdf/FR272/FR272
(3) WHO (2012) Cote d'Ivoire: WHO statistical profile http://www.who.int/gho/countries/civ.pdf?ua=1
(4) Wolfgang Y.T. et al (2013) Effects of poor sanitation on public health: case of Yopougon town (Abidjan), African Journal of Environmental Science and Technology Vol. 7(3), pp. 87-92, March 2013

Malaria accounted for 69% of all cases of illness in children under the age of five. Diarrheal diseases were also higher in children under-five, accounting for 26% of recorded illnesses. ARI accounted for the remaining 5% of illnesses in children under-five.

In a calendar year, incidents of malaria in Yopougon are highest in June and July while ARI is highest in February, July and November, corresponding to dry. Both illnesses are affected by the dry and rainy seasons while diarrheal illnesses are constant throughout the year. The survey assessed how the population sought treatment for illness. Most households opt for self-medication (68%). Poor sanitation is a contributing factor to the high rate of malaria, with stagnant sewerage pools present in the district. This is also thought to contribute to the high level of diarrheal illnesses.

7.6.10 Public Infrastructure

Investment in Infrastructure

National Overview

The government of Côte d'Ivoire adopted a National Development Plan for 2016-2020 encompassing major structural reforms to the economy to achieve a sustained private-sector led and inclusive growth (1). Included in this national development plan are major investments in infrastructure, especially roads, bridges and port expansions. This includes new projects as well as older ones delayed by the political instability. In early 2016, Cote d'Ivoire managed to raise $15 billion in pledges from donors and lenders to fund this investment plan (2). The aim is to enable it to capitalise on its position as a major regional trader and exporter of agricultural goods, the home of West Africa's largest port, and sharing of borders with countries that are landlocked and depend on it for imports.

An example of such an infrastructure investment is the 37-km extension of the Abidjan-Yamoussoukro motorway, to the town of Tiébissou. It represents a further step towards the government's goal of extending the highway to Bouaké (66 km from Tiébissou), the country's second city, and eventually all the way to the Burkina Faso border.

Local Context

Infrastructure and urban development projects financed by funds raised for the national development plan are also being developed in Abidjan and Yopougon commune.

(1) World Bank Cote d'Ivoire Country Information available at:
http://www.worldbank.org/en/country/cotedivoire/overview accessed 25 Ocotber 2016
(2) Monier O, Mieu B on 18 May 2016. Ivory Coast Attracts $15.4 Billion in Pledges, Twice Its Budget. Bloomberg. Available at:www.bloomberg.com/news/articles/2016-05-18/ivory-coast-attracts-15-4-billion-in-pledges-twice-its-budget

The lagoon-front expressway has undergone major repairs. A fourth bridge is planned to link the Yopougon mainland with the Boulay Island and the Boulay Island with the coastal shore (1), a project that was delayed due to the post-election crisis of 2010. Local news outlets have also reported construction of a bridge linking Yopougon to Le Plateau, a small commune located across the stretch of water (the Baie du Banco) to the east of Yopougon commune, will commence in late 2016 (2).

Port upgrades and expansion are a priority of the GoCI infrastructure drive given their economic importance (3).

As well as the ongoing construction of the second shipping container terminal for the Port of Abidjan on the Azito peninsula (the one adjacent to the Power Plant), the Port of Abidjan Authority plans to extend its facilities with development of another container terminal on Boulay Island to the south and on the barrier beach along the Atlantic shoreline. It is noted that the area close to the power plant is the camp for the workers and the facility area for the container port.

Roads

In the Ivory Coast the road network consists of national roads, district routes and municipal tracks. The national roads connect cities and also provide links to neighbouring countries. International routes passing through Yopougon are the Northern Highway, the road to civil prison and the road connecting Yopougon with Dabou.

The two district routes parts of the Yopougon network are as follows:

- a connection to Abobo passing through Doumé, part of Attécoubé municipality: 7.3 km length; and

- a crossroads used by SODECI (water Distribution Company): 5.8 km length.

As for local roads, they connect the various neighbourhoods of Yopougon. These pathways consist of:

- 91 km of tarred roads;
- 234 km of dirt roads ; and
- 89 km roads under development.

(1) Economist Intelligence Unit Country Profile for Cote d'Ivoire on 29 April 2015
http://country.eiu.com/article.aspx?articleid=243120608&Country=C%C3%B4te%20d'Ivoire&topic=Econom_6
(2) Ivoire Matin, 09 September 2016. "*Le début des travaux du pont Yopougon-Plateau annoncé pour la fin 2016*" Available at: http://www.ivoirematin.com/news/Economie/le-debut-des-travaux-du-pont-yopougon-pl_n_4475.html
(3) Ivoire Matin, 09 September 2016. "*Le début des travaux du pont Yopougon-Plateau annoncé pour la fin 2016*" Available at: http://www.ivoirematin.com/news/Economie/le-debut-des-travaux-du-pont-yopougon-pl_n_4475.html

The total length of the roads network in the commune of Yopougon is approximately 454 km.

The main road leading to the Azito Power Plant is a tarred. Roads in Azito are paved for the majority. Azito have started to renovate some of its main roads but roads are currently found in poor condition and worsen during heavy rains. Roads in Béago are not paved.

Housing

Yopougon is characterized by three different housing types: modern, villagers and precarious settlers.

The modern type of housing is typically built by real estate projects. In some instances these can be constructed by individuals. These modern houses cover approximately 45% of residential area. In the Ebrié villages, these modern houses are found in residential areas provided with sewage and sanitation systems.

The villagers' houses cover about 18% of the residential area of the municipality. Nearly half (45%) of these residences are "common courtyards" and are located in the urban center (Yopougon Attié, Port-Bouet II), in the villages and in the suburbs (Kouté, Azito, Béago, Niangon Lokoua, etc.).

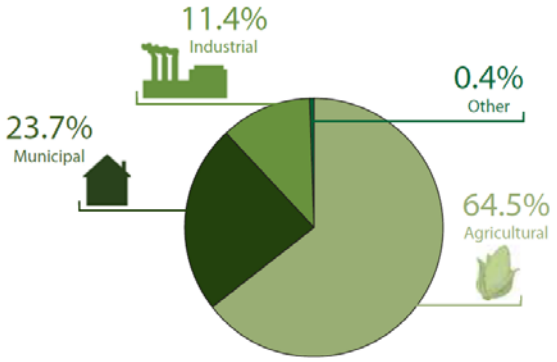
Figure 7.22 Example of Housing Structures in Béago (left) and Azito (right)

7.6.11 Other Infrastructure

Water Supply and Availability

The villages of Azito and Béago are equipped with a modern system for water distribution managed by the Water Supply Company of Ivory Coast.

Figure 7.23 ***Water Withdrawals by Sector (as % of Total Water Withdrawal), Cote d'Ivoire, 2000***



Source: Africa Water Atlas, 2010 (Available at: http://www.unep.org/pdf/africa_water_atlas.pdf consulted on 26th October 2016.)

The sedimentary aquifers straddling the border between Côte d'Ivoire and Ghana are the principal water source for Abidjan (1). The aquifers are under intense pressure from domestic, industrial, and agricultural use. *Figure 7.23* shows the proportion of water withdrawals by sector in Cote d'Ivoire, with industrial activity accounting for 14% of water consumption.

In some places water quality has deteriorated as over-abstraction has led to sea-water intrusion, although salinity in the aquifers remains relatively minor (2). There are also some areas where domestic waste disposal and agricultural pollution have degraded water quality creating high concentrations of nitrates. According to the Africa Water Atlas in 2010 (3) the city of Abidjan's water requirement was 500,000m^3 a day but actual availability was well below this at 350 000 m^3, leaving many unable to use the city's central water supply.

Electricity

Most households are equipped with electricity. However, local residents complain of insufficient public lighting.

Waste Management

Waste management in the city of Abidjan is a major challenge. From 1990 to 1996, the annual amount of waste produced by the District of Abidjan showed an annual growth rate of 4%. The average ratio of waste per capita is 1.04 kg / day in the shantytowns and 1.23 kg / day in more developed modern areas.

In 2000, the budget allocated by the city of Abidjan in waste management was 3 billion FCFA. The budget for waste management has tripled. Despite these

(1) UNEO (2010) Africa Water Atlas Available at: http://www.unep.org/pdf/africa_water_atlas.pdf consulted on 26th October 2016.
(2) UNEO (2010) Africa Water Atlas Available at: http://www.unep.org/pdf/africa_water_atlas.pdf
(3) UNEO (2010) Africa Water Atlas Available at: http://www.unep.org/pdf/africa_water_atlas.pdf

investments, only 70% of the generated waste is actually collected and land filled.

In addition, several areas of the city of Abidjan were not covered by the waste collection services, this includes Azito and Béago. In Azito, the generated waste is collected by the companies in charge of waste collection in Yopougon but not in Béago. There are no formal collection points or recycling yards that can be used by villager to dispose appropriately of their waste in Béago. As a result, people burn their waste or discharge directly into the lagoon.

Telecommunications

All two villages have mobile phone and radio connection. Phone reception is good and all of the main communication providers (ie Vodafone, Airtel) are in use. Internet access is facilitated largely by means of cell phone modem or 3G data connectivity.

Wastewater and Rainwater Management

Abidjan once had a well-designed wastewater and rainwater collection system. Wastewater was collected in underground sewers that led to main collection points and then on to a treatment facility. Rainwater was collected in open channels that fed into large open-air collectors that fed into the Ebrie Lagoon. Before the crisis, with the exception of Yopougon and some areas of Abobo, most parts of the city were connected to the wastewater sewage system. Due to the influx of people that began in 2002, the wastewater collection system was unable to cope with demand. People use makeshift conections to the open rainwater channels or discharge their wastewater directly into the open in hollows, valleys or the lagoon. It is estimated that 70-80% of wastewater is discharged without being treated [(1)]. In areas without solid waste collection services, many of the open rainwater drains are also jammed with solid waste.

The wastewater collector for Yopougon takes in wastewater from the Yopougon industrial zone and household wastewater from approximately one million people. It ends downstream of the industrial zone. Wastewater from the collector and adjacent areas is discharged into the open, and over time that process has carved a deep valley. In the rainy season, the valley fills up with water and further erodes the valley edges. House built on the bank of the valley collapse and are swept away by the flood. Sometimes people fall into the sewer and drown, their corpses found in the lagoon. Water pipes laid underground by SODECI, which use to carry drinking water, now hang suspended in the air, the ground them having been eroded by rivers of sewage. Two major projects are underway to improve wastewater collection.

(1) UNEP (2015) Côte d'Ivoire Post-Conflict Environmental Assessment Available at: http://postconflict.unep.ch/publications/Cote%20d'Ivoire/UNEP_CDI_PCEA_EN.pdf accessed on 14 October 2016

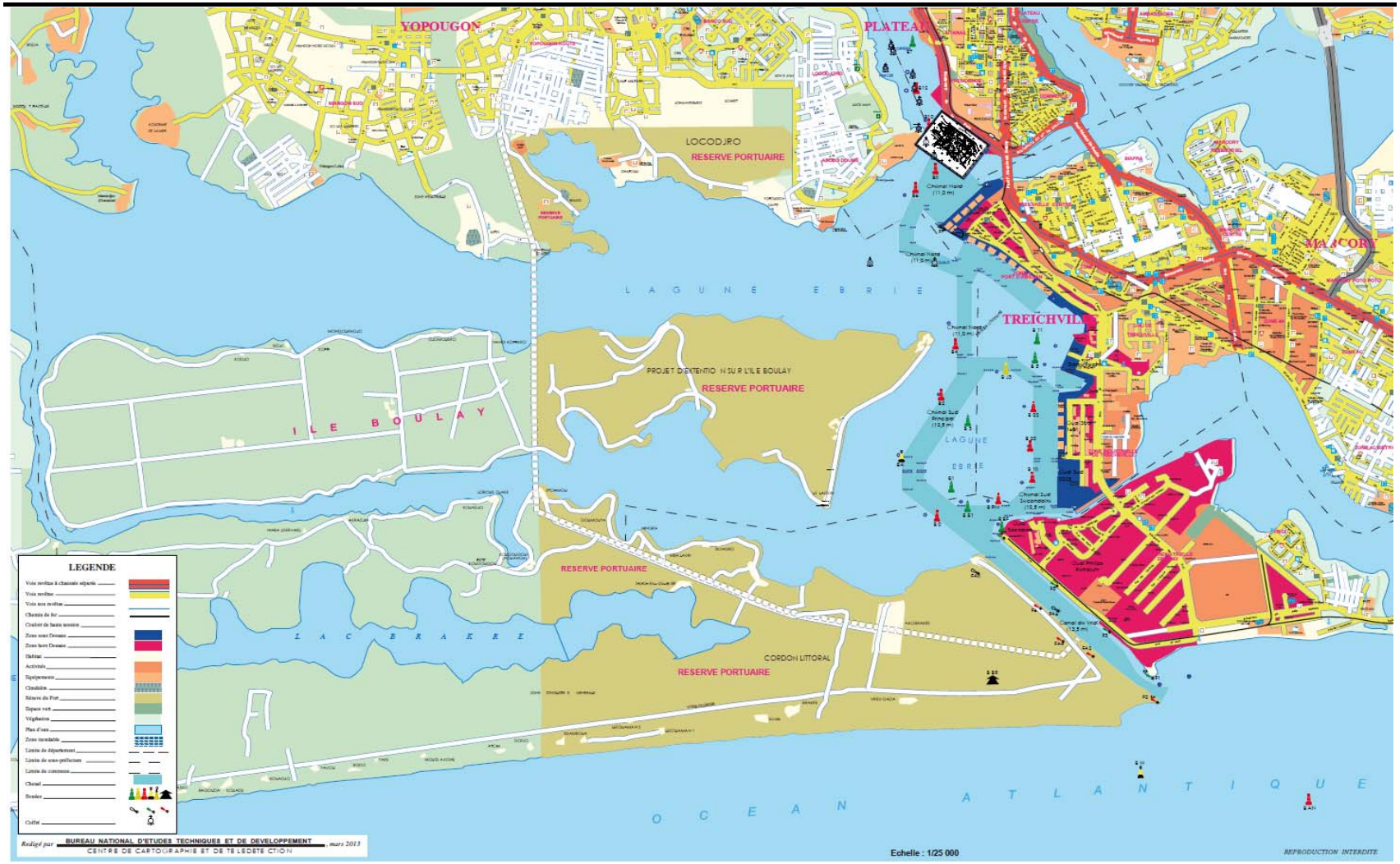
Shipping and Maritime Transportation

The Port of Abidjan accounts for around 70% of total government revenue (1) signalling that movement of exports and imports through the country and onwards to its landlocked neighbours is a key economic driver for the country. *Figure 7.24* provides a map of the Port of Abidjan Authority concession area where the existing Port of Abidjan is located and new developments are taking place or are planned to be implemented. There are plans to expand, upgrade and build new port infrastructure to increase the throughput and storage capacity of the Port (see *Figure 7.24* the reserve portuaire).

Passenger transportation on the Ebrié Lagoon is provided by 24 boats managed by the Abidjan Transport Company. These waterbuses are limited to shuttle service between the Banco Plateau, Treichville, Cocody and Yopougon. Next to these modern vessels, other artisanal boats, called Pinasses, provide transport to local inhabitants.

(1) Ivoire Matin, 09 September 2016. "*Le début des travaux du pont Yopougon-Plateau annoncé pour la fin 2016*" Available at: http://www.ivoirematin.com/news/Economie/le-debut-des-travaux-du-pont-yopougon-pl_n_4475.html

Figure 7.24 Port of Abidjan Authority Concession Area (light brown colour), Cote d'Ivoire



Source: Port Autonome d'Abidjan, Rapport d'Actvités 2015 (1)

(1) Available at: http://www.portabidjan.ci/sites/default/files/document-pdf/rapport_dactivite_2015_version_francaise.pdf accessed on 25 October 2016

7.6.12 Palaeontology, Archaeology and Cultural Heritage

Little information is available on cultural heritage at a regional and local level in Côte d'Ivoire as little systematic archaeological work has been undertaken. According to the ESIAs 2014 (Phase I, II and III Power Plant) reviewed there are no archaeological or sacred sites within the power plant site. However no specific study on this aspect was conducted as part of the ESIA to ascertain whether cultural heritage sites (including sacred sites) may or not be present within or in close proximity to the site.

The Ébrié Lagoon provided the foundation for Abidjan's social and economic development (dating back to sometime between the 15th and 18th centuries when people are thought to have first settled on the shores of lagoon in large numbers (1)) as the early Ebrié settlers in the area were fishermen. It is noted that, the power plant is located in the Ebrié region and as such among rural Ebriés, both men and women enter adulthood through the Fatchué ceremony at a certain age. After this important ceremony, people of this age group have the right to speak during the meetings and thus participate in the decisions of the village. These ceremonies are often carried out in sacred areas. The locations of these sites are not located within the direct social study area.

During the Phase III expansion baseline assessment for the Azito power plant carried out in 2012, no archaeological or cultural heritage site was identified in the planned extension area. The Phase III ESIA concluded that cultural heritage considerations and impact would not apply to the project.

It is noted that the location of the laydown area have not been defined at this stage but is expected to be temporary and located in such a way so that to minimise impact. This will be assessed in the social portion of *Section 8: Assessment of Potential Impacts*.

7.6.13 Community Relationships and Investment

According to the Azito annual corporate social investment report, conflicts or disagreements with the GoCI in 1998, 2007 and 2008 led the community of Azito to block the main access road to the power plant. This prevented its employees, and the employees of 'riverine' businesses (those business activities linked to the lagoon), from reaching their workplace.

Table 7.12 presents the milestones/key events marking the company-community relationship between the Azito Project and the local community.

(1) Konin A (2010) Aspectes de l'Art Musical des Tchaman de Cote d'Ivoire Musée Royal de l'Afrique Centrale, Tervuren (Belgique) Available at: http://www.africamuseum.be/docs/research/publications/rmca/online/tchaman.pdf

Table 7.12 Relationship between the Azito Plant and the Local Community

Date	Events
1998-1999	At the time of the construction, 345 persons were displaced by the Project, most of them on a temporary basis. Ivory Coast Government promises the displaced population to compensate the loss of their land with an equivalent, new, piece of land.
2001	Azito power plant management launches its annual satisfaction survey, targeting Azito village.
2007	The inhabitants of Azito village barricade the main and only road access to the power plant, preventing employees to go to work. They protest against the Government for not keeping its promise to compensate them with new land.
Spring 2008	The Government and Azito village reach a settlement. The Government financially compensate the village up to 350 million FCFA.

For more than 10 years Azito Power Plant has carried out annual surveys of the population in Azito and Béago to monitor and understand the perceptions and opinions that the local community holds about the neighbouring power plant. Overall, the results of the annual surveys have shown that the communities of Azito and Beago have a positive perception of the Project. Issues related to ambient noise emissions and low employment levels/opportunities for local communities are however frequently highlighted by inhabitants.

In addition to the annual perceptions survey, the team also conducts regular visits to Azito village and holds meetings with the community leaders.

As part of its efforts to become a contributor to local development, since 2009 Azito O&M has implemented and funded many community investment projects in Azito and Beago villages in support of local socio-economic development of the local riverine communities. This has contributed to an improvement in company-community relations and dialogue. The Azito O&M annual corporate social responsibility report stated that its social investment projects in 2015 totalled 100,984,234 FCFA and included:

- A scholarship for a Master in Law for an inhabitant of Azito.
- A campaign in collaboration with the Ministry of Solidarity, Family, Women and Children to launch an education rights awareness campaign aimed at the local parents using messages on Azito's local radio, student/parent parades and banners in the village.
- Construction of a new 3-classroom building in the Centre de Protection de la Petite Enfance in Azito.
- Construction of a new 3-classroom building for the Beago primary school in collaboration with the Ministry of Education.

- Construction of a health centre in the village of Koitienkro (where some of the employees come from).

- A study for the extension of the Azito health centre and installation of air conditioning.

- Training provided for the women attiéké producers cooperative in Azito.

- Donation of a cassava grinder to the women attiéké producers cooperative in Béago.

7.6.14 Ecosystem Services

Priority ecosystem services are those that are of high importance to beneficiaries and for which there are few alternatives available (see *Box 7.1*). These are also a priority for the Project impact assessment. Due to the urban nature of the Project study area there are fewer ecosystems services that apply to it, though they are no less important.

Box 7.1 Ecosystem Services

Ecosystems services are benefits that ecosystems provide to people. The Millennium Ecosystems Assessment classified them into four main categories to provide a clear and consistent classification scheme:

- **Provisioning services** are the goods or products obtained from ecosystems, such as food, timber, medicines, fibres and freshwater.

- **Regulating services** are the benefits obtained from an ecosystem's control of natural processes, such as climate regulation, disease control, erosion prevention, water flow regulation, and protection from natural hazards.

- **Cultural services** are the nonmaterial benefits obtained from ecosystems, such as recreation, sacred sites and aesthetic enjoyment.

- **Supporting services** are the natural processes, such as soil formation, nutrient cycling and primary production that maintain the other services.

Applicable ecosystems services in the Project area include:

- **Provisioning services:** include fish from the lagoon for either household consumption or sale; and groundwater from the local aquifer.

- **Regulating services:** none identified.

- **Cultural services:** none identified to date as the Project will be constructed within the existing footprint of Azito site (already fenced). To be assessed further once the laydown area location is established.

- **Supporting services:** the freshwater ecosystem of the Ebrié Lagoon that supports the fisheries (see Provisioning Services above).

8 ASSESSMENT OF POTENTIAL IMPACTS

8.1 INTRODUCTION

8.1.1 Purpose of this Section

The objective of this Section is to identify aspects of the Project (during both construction and operation phases) that are likely to result in significant impacts on physical, biodiversity and socio-economic resources or receptors; and define appropriate mitigation and/or enhancement measures to manage these impacts, detailing them as commitments in the Project's Environmental and Social Management Plan (ESMP).

The impact assessment is based on *Section 4, Scope of the ESIA* (which "scopes in" and "scopes out" impacts to be assessed in this Section) as well as *Section 5, ESIA Methodology* and *Section 7, Baseline Conditions.*

The delivery mechanism for developing and implementing mitigation measures identified in this *Section* is outlined in *Section 9 Management of Potential Impacts.*

8.1.2 Mitigation

The EPC contractor that will be selected for the Project will be responsible for managing the construction activities and Azito Energie and/or Azito O&M will be ultimately accountable for the performance of the EPC contractor. It will be important for the Project to ensure that both parties work closely together throughout construction, and that the EPC contractor effectively implements the controls and mitigations that it has committed to. Adequate supervision and contractor management by Azito Energie will allow for a proactive approach in identifying potential newly arising issues early on.

As a result, in the 'Mitigation and Monitoring' section of this *Section*, each impact is divided into items that are i) to be conducted during construction or operation and that are ii) under the responsibility of Azito Energie and those or under the responsibility of the EPC contractor.

In addition, as Phase IV will be very similar to Phase III, mitigation measures have been built upon good practices and experiences gained through Phase III.

8.1.3 Note on Decommissioning Phase

Over the years of the Project's operation until decommissioning, baseline conditions in the Project area will be subject to change. It is not possible therefore to precisely determine the nature and extent of decommissioning impacts at this early stage. In light of this, impacts and mitigations of decommissioning will be assessed nearer the time by Azito Energie, or a

delegated consultancy, in order to formulate a decommissioning plan in line with IFC PS and Côte d'Ivoire law.

However, it should be noted that decommissioning activities are by nature construction-related, hence many mitigation measures outlined below in relation to construction would also help minimising impacts of the decommissioning phase.

8.2 *AIR QUALITY IMPACT ASSESSMENT*

8.2.1 Overview

This section identifies potential impacts as a result of increased emissions from the Project. The key potential impacts associated with increased emissions within the Project Area of Influence (AoI) are:

- impacts from increased dust generation resulting from construction activities;
- impacts from increased emissions from construction vehicle traffic; and
- impacts from increased emissions during operation.

Each impact is assessed separately below.

8.2.2 Potential Impacts from Increased Dust Generation from Construction Activities

Impact Description

The construction activities will last for approximately 27 months through to commissioning of the Combined Cycle Gas Turbine (CCGT). Construction activities include earth moving activities and ground preparation, movement of vehicles over open ground onsite, and concrete batching, handling of friable materials and stockpiling.

Climatic conditions within the Project area are not conductive for dust generation for most of the year, with low wind speeds (ranging from 3 to 4 m/s) and periodic rainfall for much of the year. Most of the road access to the site is tarmacked, which also limits dust arising from traffic. Therefore, exposure to dust generating activities and associated dust emissions are only likely to occur for a relatively limited amount of time, mostly at the construction site and potential access road.

Sensitive Receptors

The sensitive receptors in relation to dust arising from construction activities at the site are principally Béago and Azito, the residential area to the northeast

and west of the power plant respectively. Receptor sensitivity is considered to be *Medium*.

Impact Significance

The potential impacts on sensitive receptors from dust during the construction phase relate to dust generation during construction activities and construction traffic movements. The impact is summarised in *Table 8.1*.

Table 8.1 Impact Assessment: Dust Impacts during Construction

Nature and Type: Direct negative **Receptor Sensitivity:** Medium **Impact Magnitude:** Medium **Impact Significance (pre-mitigation):** ***Moderate*** for receptors within 200 m[1] of source and ***Negligible*** impacts at receptors greater than 200 m.

On this basis, the worst-case unmitigated impact to air quality due to dust emissions is considered to be ***Moderate*** for receptors within 200 m of the source. Unmitigated impacts at receptors greater than 200 m from the source are expected to have ***Negligible*** impacts.

Mitigation and Monitoring

Particular attention to dust controls should be paid during periods that are dry, windy, hot or when the wind is blowing inland.

Table 8.2 outlines the mitigation measures identified and responsibility for implementation of the measures.

Residual Impacts

During the construction phase there is the potential for significant impacts to arise due to emissions of dust from construction activities. Implementation of mitigation should render residual impacts to ***Negligible - Minor*** significance depending on local conditions (*Table 8.3*).

[1] The 200 m is defined based on the location of the nearest sensitive receptors, likely to be worst affected by air emissions from the Project – see *Section7 Baseline*.

Table 8.2 ***Mitigation Measures for Increased Dust Generation from Construction Activities***

Management Control	Responsibility - Organisation	Timing
Verify that the as built design of Phase IV is the same as the design conditions modelled in the air dispersion modelling for the ESIA.	EPC	Prior to construction
Employ dust prevention measures during construction to minimise impacts on local communities include: • Select routes to maximise use of paved roads and avoid unpaved roads; • Keep vehicles clean to avoid tracking dirt around and off the site; • Cover vehicles transporting friable materials; • Cover exposed ground and earthworks areas where practicable; • Use localised dampening and activity specific dampening to reduce localised emissions of dust; • Minimise stockpiling of material; • Locate any stockpiles as far away from offsite residences as much as practicable; • Use water sprays when tipping friable fill material; and • Erect wind breaks around the key construction activities and, if possible, in the vicinity of potentially dusty works.	EPC	During construction
Monitor and supervise the EPC contractor during construction to verify that dust control measures are being implemented in-line with the Project's requirements.	Azito Energie	

Table 8.3 ***Residual Impact from Construction Dust***

	Impact Significance
Pre-mitigation	*Moderate*
Post-mitigation	*Negligible - Minor*

8.2.3 Potential Impacts from Increased Emissions from Traffic

Impact Description

Construction vehicles constitute a source of atmospheric emissions during the Project construction phase. The exhaust gas from vehicle engines contains (among other compounds) sulphur dioxide (SO_2), nitrogen oxides (NO_x) and particulate matter (PM). However, those sources of air emissions represent scattered, limited, intermittent sources, releasing marginal quantities of pollutants in the atmosphere compared to the overall traffic in the city of Abidjan.

NO_2 and PM_{10} from vehicle emissions are predicted at given distances from

the roadside using the UK Highways Agency developed screening methodology for assessing impacts of road traffic on air quality in the Design Manual for Roads and Bridges (DMRB) (see *Annex A: Supporting Documentation for Air Quality* for further details). The results are compared to the relevant air quality standards or guidelines.

The potential impacts from the Project are defined using the following terminology:

- Process Contribution (PC) –the impact associated with emissions from the Project only;

- Predicted Environmental Concentration (PEC) –the impact associated with emissions from the Project added to the existing background conditions.

The PC and PECs for NO_2 and PM_{10} have been calculated for comparison with the relevant IFC guidelines, based on the air quality point source methodology set out in *Section 5, Methodology*.

The approach has been taken whereby the highest PC has been considered, and judgement based upon aerial photography has been used to assess whether the impacted location is likely to be a residential or rural area, or a commercial or industrial area.

It has been assumed that settlements will be impacted by commuter traffic and material deliveries only (for the purpose of this Project, the study has taken a conservatory approach by assuming 411 annual average daily traffic movements which may last for two or three months. After this stage, the amount of daily movement will be significantly reduced).

Sensitive Receptors

The potential road routes may pass through local communities, including Azito Village. Receptor sensitivity is considered to be *Medium*.

Impact Significance

Exact road routes for construction vehicles are not yet known, however satellite imagery identifies that most of the major road routes which connect to the site are paved therefore it is anticipated that paved roads will be utilised. Dust emissions from construction vehicles on paved roads are considered to be ***Negligible***.

Table 8.4 and *Table 8.5* present the results for PM_{10} and NO_2 contributions from vehicle exhaust emissions.

Table 8.4 Phase IV Power Plant Construction Traffic Impacts, PM_{10} from Vehicle Exhausts Only

Averaging Period	Air Quality Guideline	Baseline Conditions of Airshed	PC	PC/Guideline	Magnitude	Significance
	µg/m³		µg/m³	%		
PM_{10} 24 hour mean	50	Degraded	0.89	1.77%	Small	*Minor*
PM_{10} annual mean	20	Degraded	0.272	1.36%	Small	*Minor*
$PM_{2.5}$ 24hr mean	25	Degraded	0.89	3.55%	Small	*Minor*
$PM_{2.5}$ annual mean	10	Degraded	0.272	2.72%	Small	*Minor*

Table 8.5 Phase IV Power Plant Construction Traffic Impacts, NO_2 from Vehicle Exhausts Only

Averaging Period	Air Quality Guideline	Baseline Concentration	Baseline Conditions of Airshed	PC	PC/Guideline	PEC	PEC/ Guideline	Magnitude	Significance
	µg/m³	µg/m³		µg/m³	%	µg/m³	%		
Annual mean	40	28	Undegraded	2.74	6.86%	30.7	76.9%	Negligible	*Negligible*
1 hour maximum	200	56	Undegraded	16.9	8.43%	72.9	36.4%	Negligible	*Negligible*

The potential impacts on sensitive receptors from dust during the construction phase relate to dust generation during construction activities and construction traffic movements. The impact is summarised in *Table 8.6*.

Table 8.6 Impact Assessment: Construction Traffic Impacts during Construction

Nature and Type: Direct negative **Receptor Sensitivity:** Medium **Impact Magnitude:** Small **Impact Significance (pre-mitigation):** ***Minor*** for PM_{10} and $PM_{2.5}$ from exhaust and ***Negligible*** impacts for NO_2 from exhaust and Dust.

On this basis, the worst-case unmitigated impact to air quality due to construction vehicles is considered to be ***Minor*** forPM_{10} and $PM_{2.5}$ and ***Negligible*** for NO_2.

Mitigation and Monitoring

Whilst pre-mitigation impact significance is considered to be ***Minor,*** there are industry good practice measures that could be applied to further reduce potential impacts. These are identified in *Table 8.7*, including responsibility for implementation of the measures.

Table 8.7 Good Practice Measures for Increased Emissions from Traffic

Management Control	Responsibility - Organisation	Timing
Vehicles will be regularly inspected and maintained to ensure they are in good working order as relates to exhaust emissions.	EPC	During construction
Monitor and supervise the EPC contractor during construction to verify that vehicles are being properly maintained for exhaust emissions.	Azito Energie	

Residual Impacts

No additional mitigation measures have been identified therefore the residual impacts remain ***Minor - Negligible*** (*Table 8.8*).

Table 8.8 Residual Impact from Construction Traffic

	Impact Significance
Pre-mitigation	*Minor (PM_{10} and $PM_{2.5}$ from vehicle exhaust)*
	Negligible (NO_2 from vehicle exhaust and Dust)
Post-mitigation	*Minor (PM_{10} and $PM_{2.5}$ from vehicle exhaust)*
	Negligible (NO_2 from vehicle exhaust and Dust)

8.2.4 Potential Impacts from Increased Operational Emissions

Impact Description

During routine operations the new gas turbine train will utilise a single gas turbine (e.g. Siemens SGT5-2000E or similar) combusting gas. The preferred configuration is as CCGT; however, for the Project will have the operational flexibility to operate in OCGT (Open Cycle Gas Turbine) mode as well. See *Section 8.13 (Unplanned Events)* for a consideration of potential impacts associated with operations on liquid fuel (i.e. distillate diesel oil), which will only be used for emergency backup in the event of a loss of gas supply for less than 5% of the operational time. The potential operating schedule will be 24 hours a day, 7 days per week, excluding shutdowns. During the operational phase the main pollutant of interest is nitrogen dioxide (NO_2) when operating on natural gas.

The air quality impact assessment considers the concentrations of pollutants arising at ground level as a result of emissions to air from the Project, in combination with the baseline air quality. As for construction air quality impacts, PC (Project Contribution) and PEC (Predicted Environmental Concentration) have been predicted.

The US EPA-approved AERMOD atmospheric dispersion model was used to predict the PC arising from the emissions from the Project (see *Annex A: Supporting Documentation for Air Quality* for further details on the modelling undertaken). The atmospheric dispersion modelling has considered the designs proposed by the two potential EPC contractors being considered. These both utilise the Siemens SGT5-2000E turbine; however, if an alternative turbine design is selected, the Project will revise the air dispersion modelling accordingly.

Embedded mitigation measures considered during the impact assessment are presented in *Table 8.9*.

Table 8.9 Air Quality Embedded Mitigation Measures

Embedded Mitigation Measures	Responsibility - Organisation	Timing
When combusting natural gas, the emission rate for NOx will not exceed 51 mg/Nm3, where normalised conditions are dry and 15% O2. When combusting liquid fuel, the emission rate for NOx will not exceed 15mg/Nm3, where normalised conditions are dry and 15% O2. (Stack height required to maintain process contributions to ambient concentrations of pollutants below 25% of the air quality guideline values.) As per the IFC/World Bank emissions guidelines for power generation when combusting diesel fuel, the liquid fuel combusted will have a sulphur content of 1% or less.	EPC Azito Energie	Embedded mitigation

Embedded Mitigation Measures	Responsibility - Organisation	Timing
The HRSG stack height will be designed for a minimum height of 55 m (from ground level). The OCGT exhaust stack height will be designed for a minimum height of 40 m (from ground level). (Stack height required to maintain process contributions to ambient concentrations of pollutants below 25% of the air quality guideline values.)	EPC	

Sensitive Receptors

There are several residential locations in the study area, the closest being the villages of Azito and Béago to the west and northeast of the plant and further away the Yopougon District and Abidjan. Receptor sensitivity is considered to be *Medium*.

The biodiversity assessment also identified the following potentially sensitive habitats sensitive to air quality impacts:

- Banco National Park situated 7.5 km to the north of the site; and
- Protected forest Audoin 11.8 km to the west of the site.

Impact Significance

The predicted impacts of the two normal operational modes (i.e. combined cycle versus open cycle, firing gas) are set out in *Table 8.10* and *Table 8.11*.

The PCs set out represent the maximum impacts at any off-site location for NO_2 and the maximum NO_x at the protected habitats. The results are based upon the maximum predicted impact for any of the five consecutive years of meteorological data evaluated.

Table 8.10 shows that when operating in open cycle mode with gas as fuel impacts with respect to NO_2 and NO_X are ***Negligible*** with the exception of the IFC/WHO NO_2 1 hour maximum which is ***Moderate***. This ***Moderate*** rating is because the Process Contribution (PC) to 1 hour NO_2 is over 25% (see *Table 8.10*). As shown in *Figure 8.1* and *Figure 8.2*, the area where the PC is above 25% is quite localised. As the preferred mode of operation will be combined cycle, not open cycle, this level of impact will only occur for a short period of time. (It is anticipated that the plant will operate in combined cycle mode from the second half of 2019 onwards.)

Table 8.11 shows that when operating in combined cycle mode with gas as fuel impacts with respect to NO_2 1 hour mean and annual mean are ***Minor***; and NO_X impacts are ***Negligible***.

Table 8.10 Phase IV Power Plant Impacts in Open Cycle Mode, Firing Gas

Pollutant and Averaging Period	Area	Air Quality Guideline	Baseline	Degraded / Undegraded Airshed	PC	PC% of Guideline	PEC	PEC% of Guideline	Magnitude	Significance
		µg/m³	µg/m³		µg/m³	%	µg/m³	%		
NO_2 Annual mean	Anywhere off-site	40	10.6	Undegraded	1.69	4.23%	12.3	30.7%	Negligible	*Negligible*
NO_2 1 hour maximum	Anywhere off-site	200	21.2	Undegraded	96.2	48.1%	117	58.7%	Medium	*Moderate*
NO_x Annual mean	Sensitive ecological habitats	30	21.2	Undegraded	0.180	0.598%	21.4	71.3%	Negligible	*Negligible*
NO_x 24 hour maximum	Sensitive ecological habitats	75	42.4	Undegraded	0.751	1.00%	43.2	57.5%	Negligible	*Negligible*

Note:
The preferred mode of operation for Phase IV will be combined cycle, and open cycle.

Table 8.11 Phase IV Power Plant Impacts in Combined Cycle Mode, Firing Gas

Pollutant and Averaging Period	Area	Air Quality Guideline µg/m³	Baseline µg/m³	Degraded / Undegraded Airshed	PC µg/m³	PC% of Guideline %	PEC µg/m³	PEC% of Guideline %	Magnitude	Significance
NO_2 Annual mean	Anywhere off-site	40	10.6	Undegraded	5.42	13.50%	16	40.00%	Small	*Minor*
NO_2 1 hour maximum	Anywhere off-site	200	21.2	Undegraded	44.7	22.40%	65.9	33.00%	Small	*Minor*
NO_x Annual mean	Sensitive ecological habitats	30	21.2	Undegraded	0.321	1.07%	10.9	36.40%	Negligible	*Negligible*
NO_x 24 hour maximum	Sensitive ecological habitats	75	42.4	Undegraded	2.56	3.42%	45	59.90%	Negligible	*Negligible*

Note:
The preferred mode of operation for Phase IV will be combined cycle, and open cycle.

Contour plots are presented for:

- the NO_2 annual mean PC for the OCGT mode in *Figure 8.1;*
- the NO_2 1 hour maximum PC for the OCGT mode in *Figure 8.2;*
- the NO_2 annual mean PC for the CCGT mode in *Figure 8.3*;
- the NO_2 1 hour maximum PC for the CCGT mode in *Figure 8.4;*
- the NO_2 annual mean PEC for the OCGT mode in *Figure 8.5*;
- the NO_2 1 hour maximum PEC for the OCGT mode in *Figure 8.6;*
- the NO_2 annual mean PEC for the CCGT mode in *Figure 8.7*;
- the NO_2 1 hour maximum PEC for the CCGT mode in *Figure 8.8;*

Figure 8.1 NO_2 annual mean PC for the OCGT mode

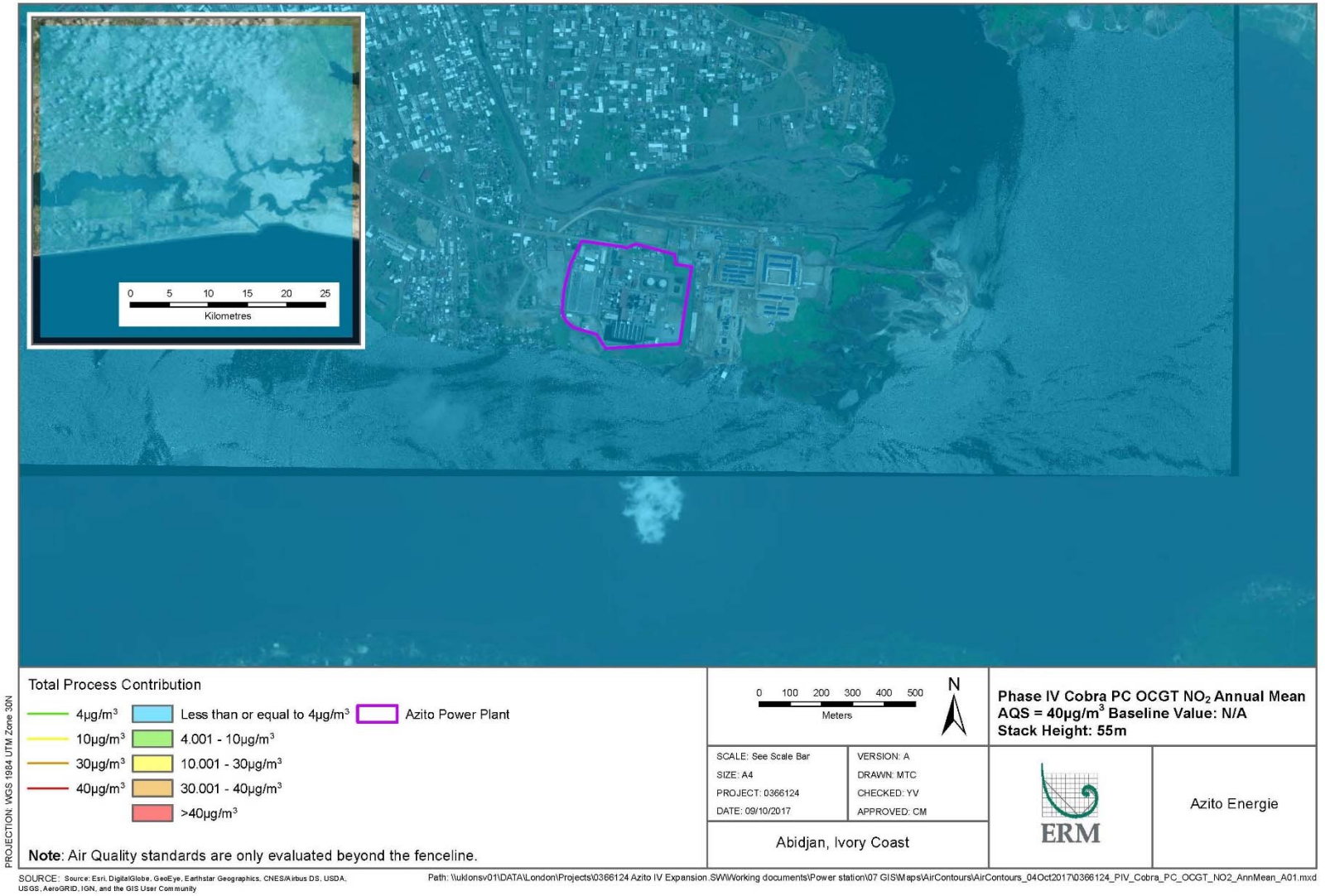


Figure 8.2 NO_2 1 hour maximum PC for the OCGT mode

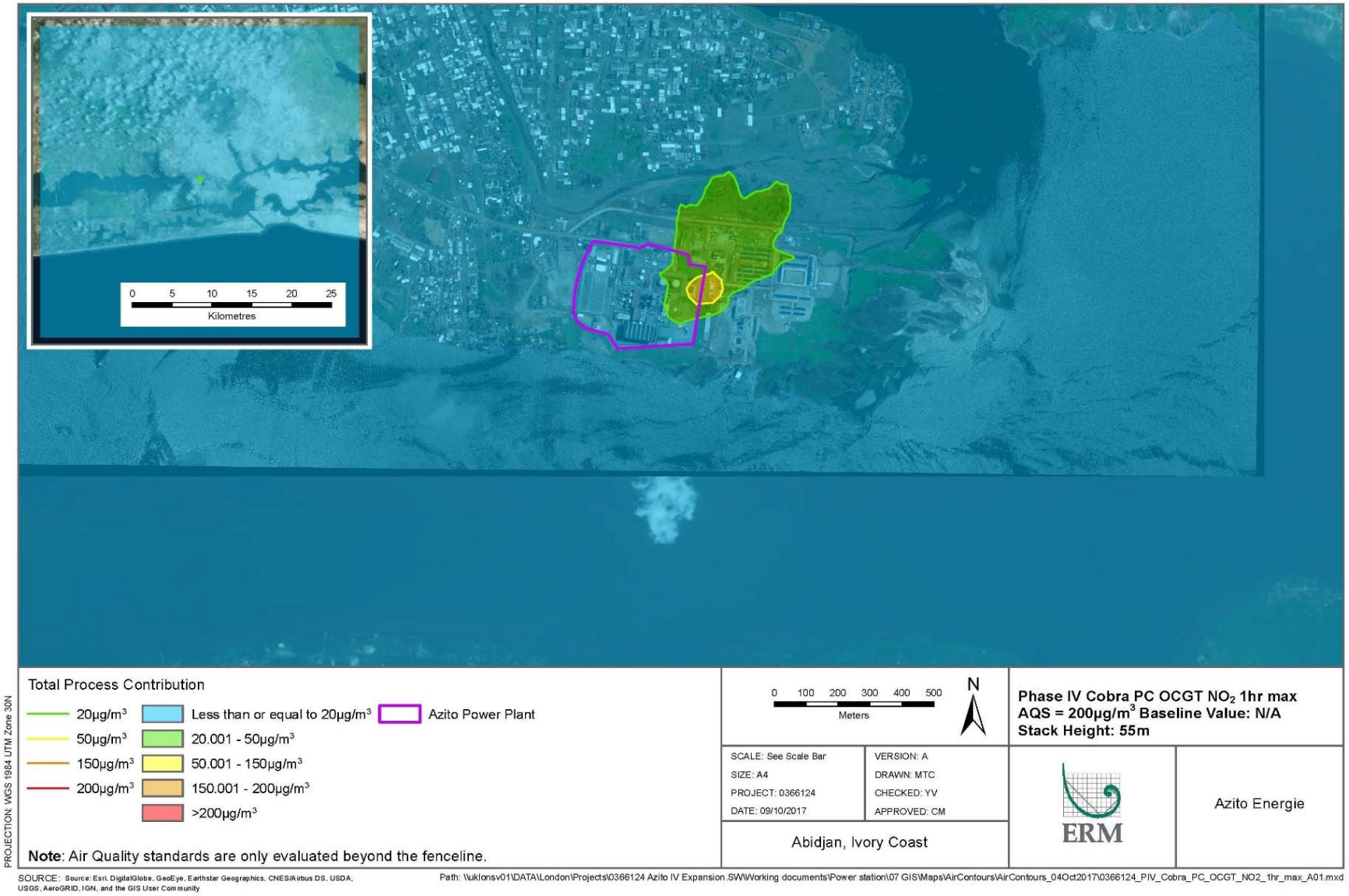


Figure 8.3 NO_2 annual mean PC for the CCGT mode

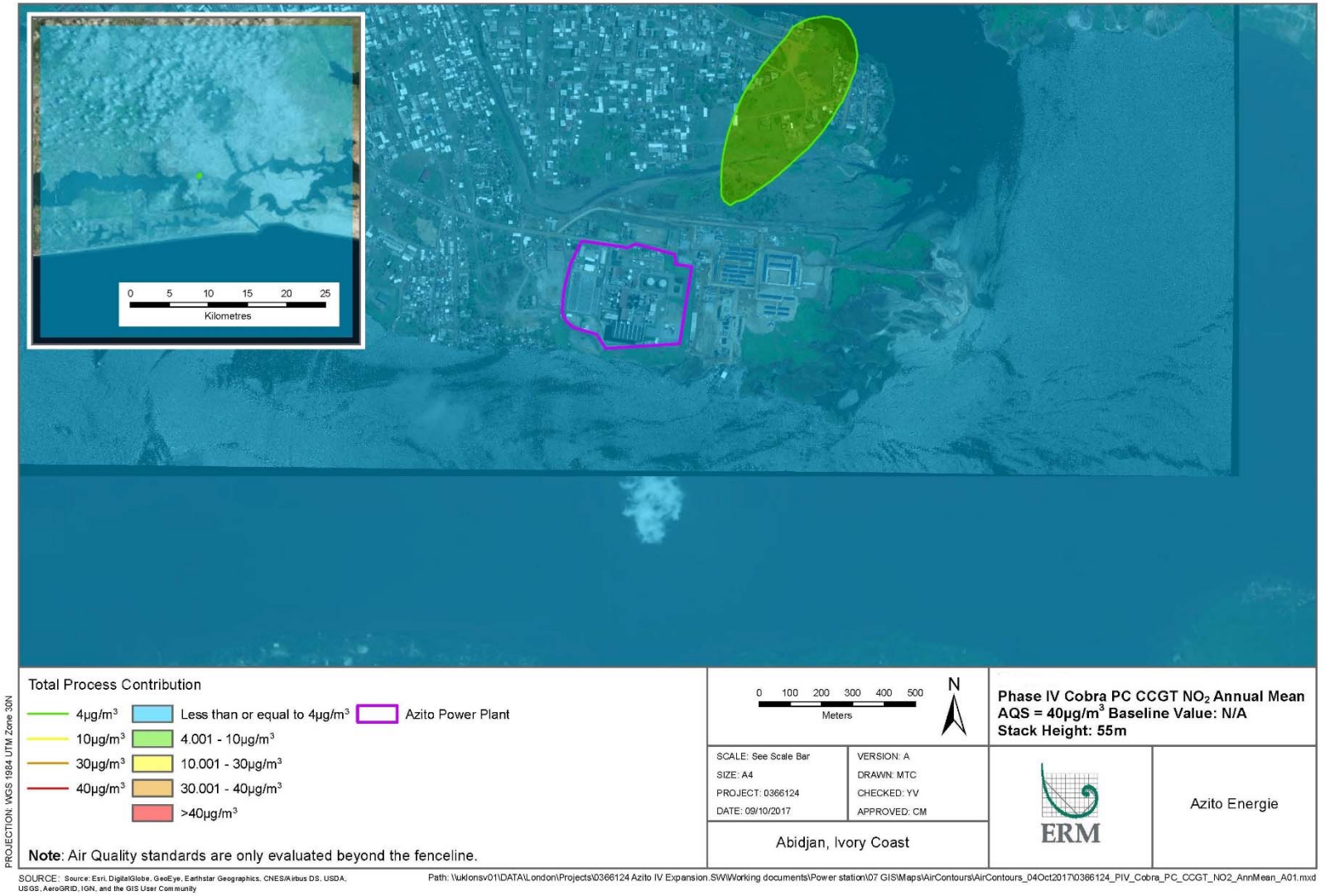


Figure 8.4 NO_2 1 hour maximum PC for the CCGT mode

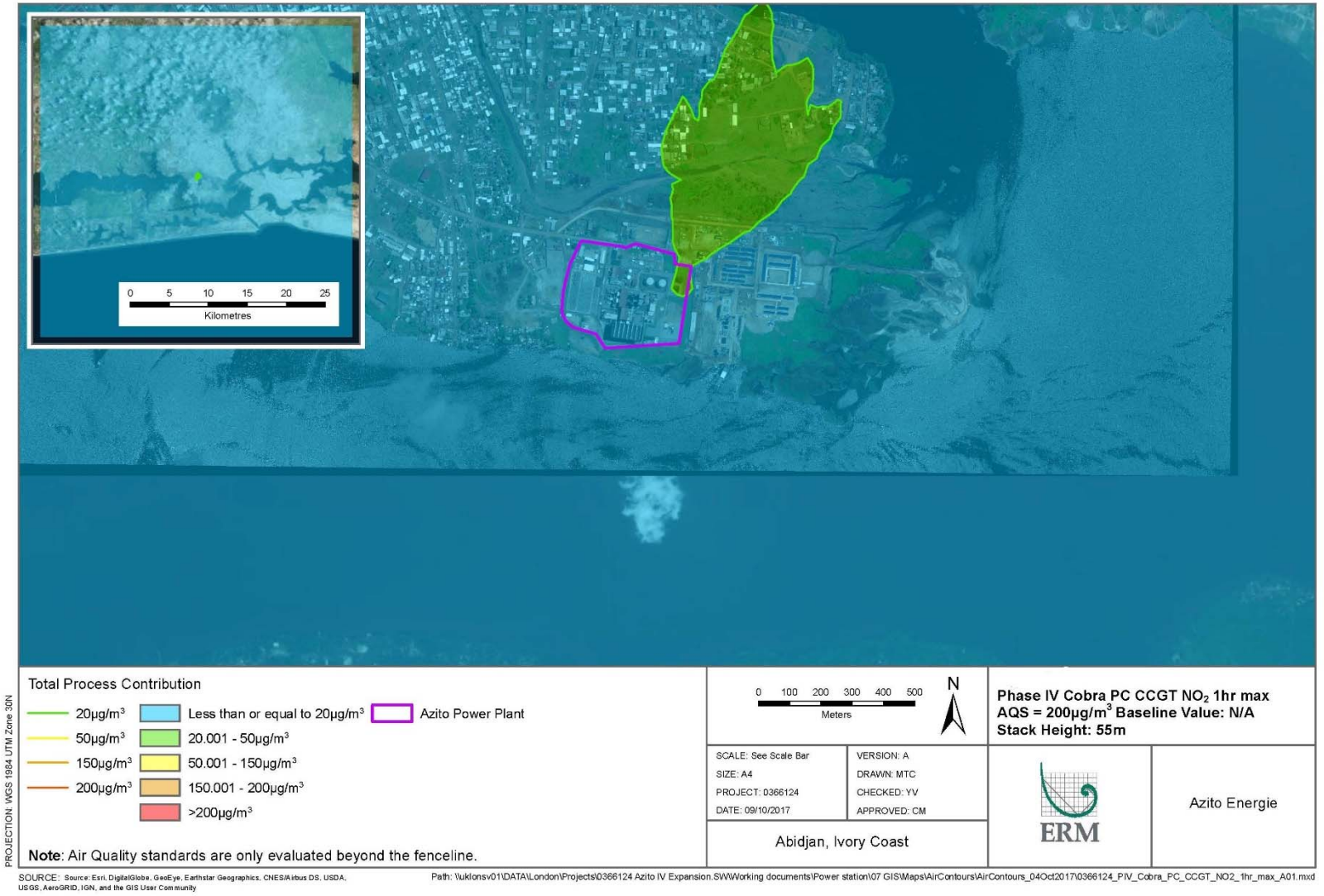


Figure 8.5 NO_2 annual mean PEC for the OCGT mode

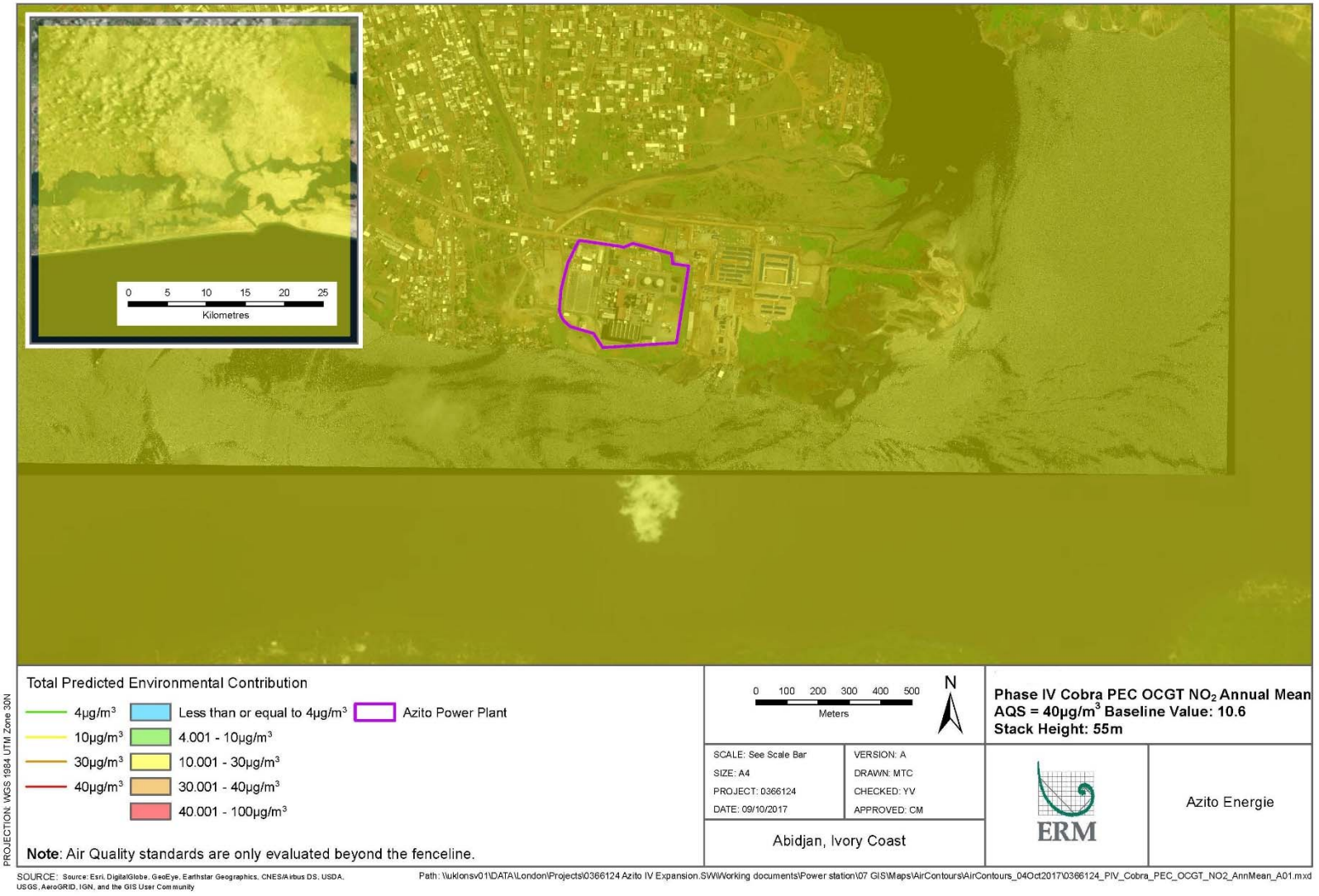


Figure 8.6 NO_2 1 hour maximum PEC for the OCGT mode

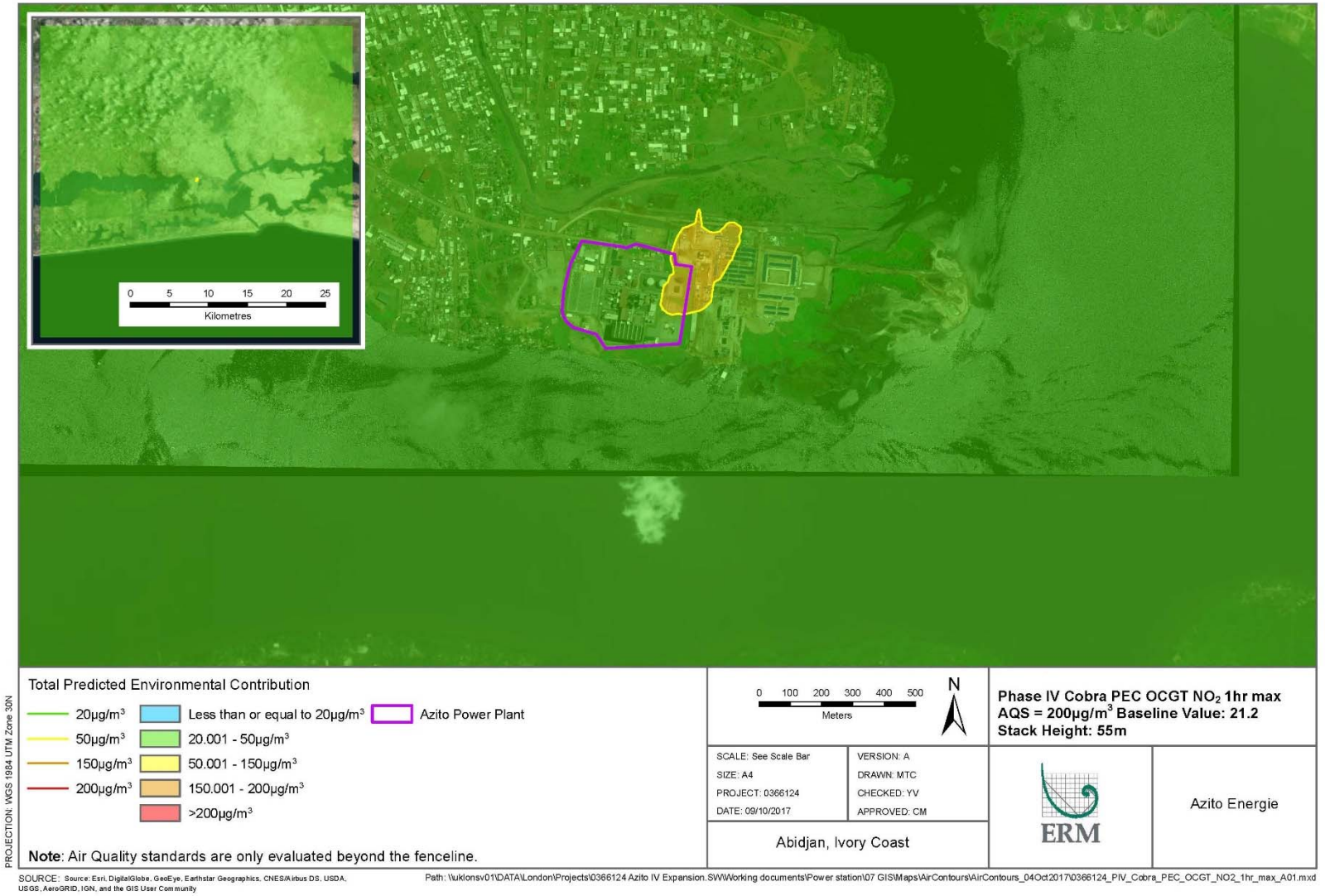


Figure 8.7 NO_2 annual mean PEC for the CCGT mode

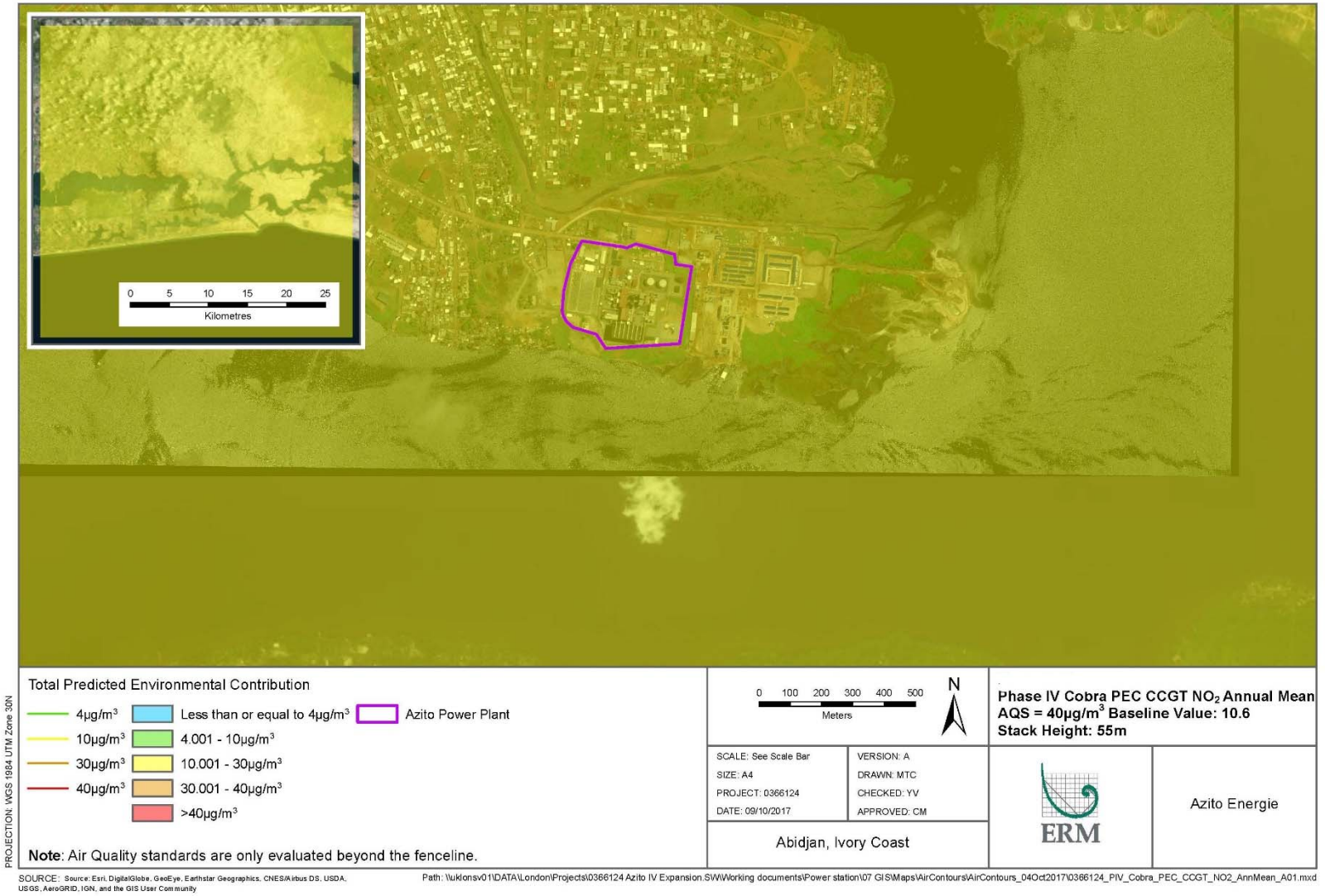
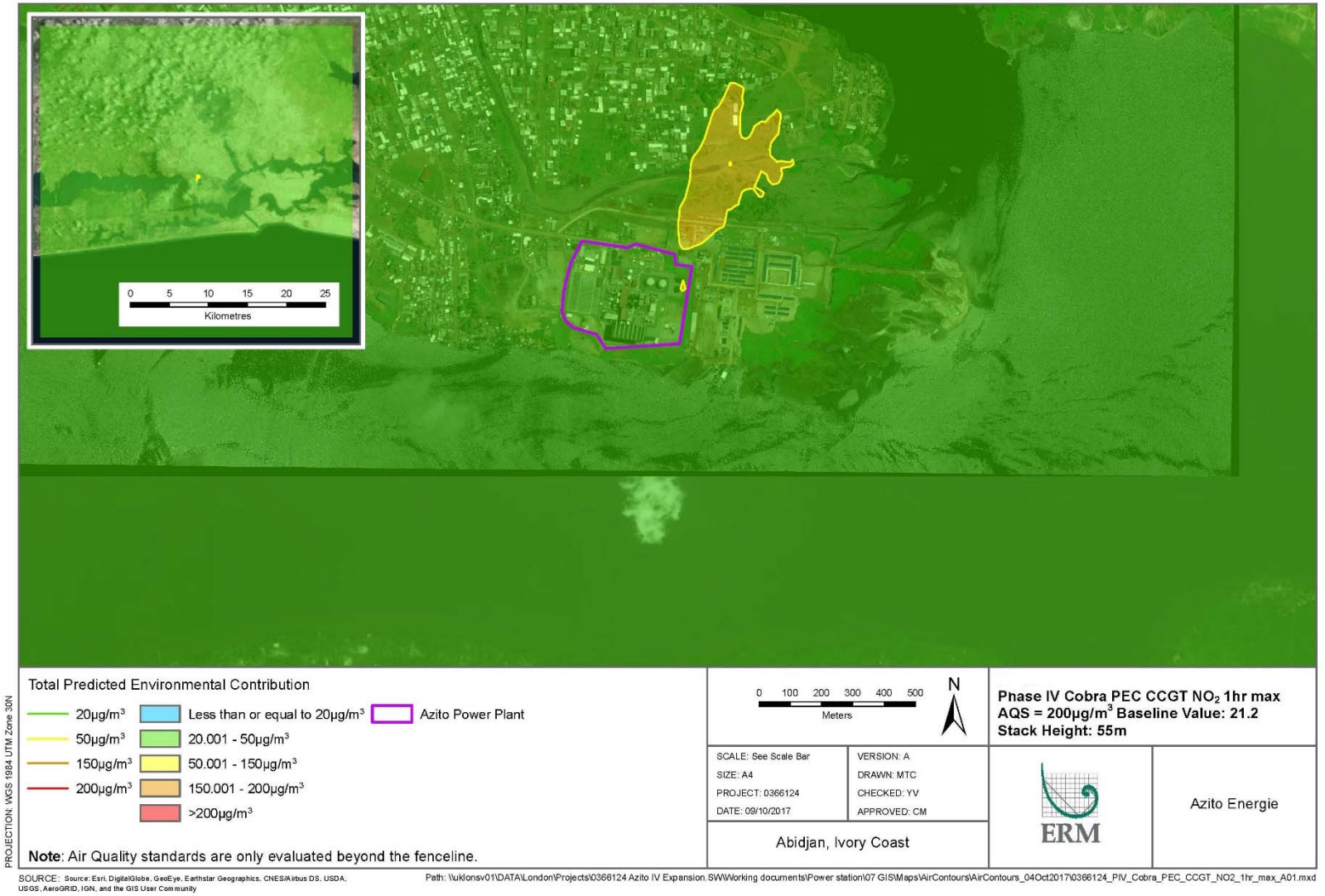


Figure 8.8 NO_2 1 hour maximum PEC for the CCGT mode



The potential impacts on sensitive receptors from increased air pollutant emissions during operation primarily relate to combustion emissions associated with the gas turbine train. The impact is summarised in *Table 8.12.*

Table 8.12 Impact Assessment: Impacts from Increased Emissions during Operations

OCGT Operation
Nature and Type: Direct negative **Receptor Sensitivity:** Medium **Impact Magnitude:** Medium for the NO_2 1 hour maximum and Negligible for all other pollutants of interest **Impact Significance (pre-mitigation):** ***Moderate*** for the NO_2 1 hour maximum and ***Negligible*** for all other pollutants of interest ***Note that CCGT Operation is the preferred mode of operation. Phase IV will run in OCGT mode until the plant achieves CCGT commercial operation (anticipated in the second half of 2019).***
CCGT Operation
Nature and Type: Direct negative **Receptor Sensitivity:** Medium **Impact Magnitude:** Negligible for all pollutants of interest **Impact Significance (pre-mitigation):** ***Negligible*** for all pollutants of interest

Mitigation and Monitoring

The project conducted stack height sensitivity analysis, using air dispersion modelling to determine a minimum stack height of 55m for the CCGT exhaust to keep process contributions to ambient concentrations of pollutants below 25% of the air quality guideline values. The fact that the Project used the results of this analysis to inform the project design is considered embedded mitigation.

Additional mitigation measures related to air quality impacts are provided below.

Table 8.13 Preventative Mitigation Measures for Increased NO_2 Emissions

Management Control	**Responsibility - Organisation**	**Timing**
Implement an air quality monitoring programme for the first year of the CCGT operations phase that measures the actual ground level concentrations of NO_2 and SO_2. The survey should include the placement of diffusion tubes at the monitoring locations included in the baseline survey. Individual tubes should be in place for no more than one month in duration and a minimum of 6 months of data should be collected. (This monitoring will be used as a verification of the predicted air dispersion modelling results for NO_2, as well as providing an updated baseline for ambient SO_2 concentrations.)	Azito O&M	During operation

Management Control	Responsibility - Organisation	Timing
If the Phase IV site layout and/or turbine exhaust characteristics change from those previously modelled, revised air dispersion modelling will be conducted to verify that predicted impacts to air quality do not increase from those presented in the ESIA. If this modelling indicated ground level concentrations exceeding the ambient air quality guideline values, the design will be modified to improve dispersion and bring predicted ground level concentrations to within guidelines.	Azito Energie	Prior to construction

Residual Impacts

No additional mitigation measures are proposed for operational phase impacts so the impact significance remains unchanged (see *Table 8.14*).

Table 8.14 Residual Impact from Increased Emissions

	Impact Significance
OCGT Operations	
Pre-mitigation	*Moderate* for the NO_2 1 hour maximum
	Negligible for all other pollutants of interest
Post-mitigation	*Moderate* for the NO_2 1 hour maximum
	Negligible for all other pollutants of interest
CCGT Operations	
Pre-mitigation	*Negligible* for all pollutants of interest
Post-mitigation	*Negligible* for all pollutants of interest

8.3 *NOISE IMPACT ASSESSMENT*

8.3.1 Overview

This section addresses potential significant impacts from noise and vibration during the construction, operation and decommissioning of the proposed Project which will introduce a new gas turbine generator, HRSG and associated steam turbine generator. The equipment may operate in either closed cycle mode (i.e. with HRSG and steam turbine) or in open cycle mode (i.e. gas turbine only).

Vibration during construction, operation and decommissioning is not expected to be perceptible at the nearest receptors which are in excess of 100 m from the site, and has been scoped out on this basis.

The key impacts associated with increased noise emissions within the Project AoI are identified as follows:

- potential impacts from increased noise generation resulting from construction activities;

- potential impacts from increased noise generation resulting from construction traffic; and

- potential impacts from increased noise generation during operation.

8.3.2 Potential Impacts from Noise Generated by Construction Works

Impact Description

The construction phase is expected to start in the course of 2017 and to last approximately 27 months. Noisy works will be limited to daytime and noise emissions will be intermittent and variable within the construction phase.

Construction works will include clearance, excavation, foundation works (which may include piling) and installation works.

Noise modelling was conducted (See *Annex B: Supporting Documentation for Noise Assessment*) to predict the expected noise levels at the nearest noise sensitive receptors.

Embedded mitigation measures considered during the impact assessment are presented in *Table 8.15*.

Table 8.15 Noise Construction Phase Embedded Mitigation Measures

Embedded Mitigation Measures	Responsibility - Organisation	Timing
To reduce construction noise emissions, implement best possible means to minimise noise and vibration from the site at all times and special consideration shall be given to the methods used to control noise at source. Consider methods such as the following to achieve noise limit:: • Use alternatives to audible reversing alarms, such as visual and/ or broadband noise indicators that provide a safe system of work; or configuring the Project work sites to maximise forward movements of mobile plant. • Onsite chutes and bins will be lined with damping material. • Use of compressors, generators and pumps fitted with properly lined and sealed acoustic covers or enclosures, which will be kept closed whenever the machines are in use. • Fitting of mufflers or silencers of the type recommended by manufacturers.	EPC	Embedded mitigation

Impact Significance

Noise predictions for the noisiest phase of construction are presented in *Table 8.16*.

Table 8.16 Predicted Construction Noise Levels (façade) at Noise Sensitive Receptors

Noise Sensitive Receptor	Predicted Façade Noise Level, ($L_{Aeq,12h}$) dB	Magnitude of Noise Impacts from Construction Activities considered as negligible in dB (1)	Impact Magnitude	Impact Significance
1, Azito Village	61		Negligible	***Negligible***
2, Azito Village (southern end)	64		Negligible	***Negligible***
3, Recreational bars along the bank of the Ébrié lagoon	67		Negligible	***Negligible***
4, CIE owned dwelling and recently built dwelling (after Phase I and II began operating) directly behind (note – the sensitivity of this receptor is deemed limited given the fact that CIE employees are mostly located inside the building, and only present during their work hours.	66	< 70	Negligible	***Negligible***
5, Dwellings to the north and south of road leading to the plant	64		Negligible	***Negligible***
6, A small group of properties close to an abattoir to the northwest of the site	67		Negligible	***Negligible***
7. PetroCI office (daytime receptor only)	73		Minor	***Minor***
8, Béago Village	65		Negligible	***Negligible***

(1) See Section 3: Legal and policy framework

Noise levels from construction works are predicted to be below the criterion at all noise sensitive receptors, therefore impacts are ***Minor***.

The impact is summarised in *Table 8.17*.

Table 8.17 Impact Assessment: Increased Noise Generation by Construction Activities

Nature and Type: Direct negative **Receptor Sensitivity:** The sensitivity of the receptor is taken account of when calculating the impact magnitude as the criteria take into account the receptor's sensitivity to noise. **Impact Magnitude:** Minor **Impact Significance (pre-mitigation):** *Minor*

Mitigation and Monitoring

Whilst pre-mitigation impact significance is considered to be ***Minor***, there are optional industry good practice measures that could be applied to further reduce potential impacts. These are identified in *Table 8.18*, including responsibility for implementation of the measures.

Table 8.18 Good Practice Measures for Noise Generated by Construction Activities

Management Control	Responsibility - Organisation	Timing
To reduce construction noise impacts, the EPC shall implement the following measures: • Any construction works carried out at night will be limited to quiet activities which do not produce significant levels of noise at the nearest noise sensitive receptors. • Where practicable noisy equipment will be sited as far away as possible from noise sensitive receptors. • Use alternatives to audible reversing alarms, such as visual and/ or broadband noise indicators that provide a safe system of work; or configuring the Project work sites to maximise forward movements of mobile plant • Use of compressors, generators and pumps fitted with properly lined and sealed acoustic covers or enclosures, which will be kept closed whenever the machines are in use. • Fitting of mufflers or silencers of the type recommended by manufacturers • When not in use, throttle settings will be reduced and equipment and plant turned off. • Equipment will be regularly inspected and maintained to ensure it is in good working order. For machines with fitted enclosures, doors and door seals will be checked to ensure they are in good working order; also that the doors close properly against the seals. • Onsite chutes and bins will be lined with damping material.	EPC	During construction
Monitor average noise levels, L_{aeq}, at the nearest noise sensitive receptors (R3 and R7 as shown in Figure B1.1 in Annex B) and compare them with the construction noise criterion of 70 dB, below which construction noise impacts are considered Negligible. If monitored levels exceed 70 dB, EPC will implement any corrective actions required.	EPC	

Management Control	Responsibility - Organisation	Timing
Monitor and supervise the EPC contractor to ensure that the measures related to construction noise are implemented in-line with the Project's requirements.	Azito Energie	
Maintain Azito's grievance procedure to collect and manage potential complaints from local communities with regards to noise, and seek appropriate solutions to resolve the grievance.		
Work with Azito Energie to respond to any grievances received from the local community.	EPC	

Residual Impacts

Residual impacts are set out in *Table 8.19*.

Table 8.19 Residual Impact from Construction Activities

	Impact Significance
Pre-mitigation	*Minor*
Post-mitigation	*Negligible*

8.3.3 Potential Impacts from Noise Generated by Construction Traffic

Impact Description

The peak HGV traffic flow will be for approximately two months whilst infill material is delivered to site. During this period approximately 30 trucks per hour will be used, during daytime hours.

Baseline traffic flow data are not available, however it is anticipated that exiting traffic flows on this route are low. Noise from the peak construction traffic flow period described above at the closest noise sensitive receptors to the access route (approximately 10 m away) is predicted to be 68 dB (façade), $L_{Aeq,T}$, which is below the construction criterion.

The nearest noise sensitive receptors to the route and to the site may experience noise from construction traffic in addition to construction noise from the site. The receptor likely to be worst affected by this cumulative noise is *Receptor 6* (a small group of properties close to an abattoir to the northwest of the site), which lies at a distance of approximately 10 m from the traffic route and 330 m from on-site construction works. Cumulative noise levels at this sensitive receptor are predicted to be 70 dB, $L_{Aeq,12h}$ façade, which does not exceed the construction criterion. At noise sensitive receptors further away from the site, noise from on-site construction activities will be lower and therefore cumulative noise including construction traffic will also be lower than 70 dB(A).

Impact Significance

The impact is summarised in *Table 8.20*.

Table 8.20 Impact Assessment: Increased Noise Generated by Construction Traffic

Nature and Type: Direct negative **Receptor Sensitivity:** The sensitivity of the receptor is taken account of when calculating the impact magnitude as the criteria take into account the receptor's sensitivity to noise. **Impact Magnitude:** N/A (The methodology in *Section 5: Methodology* does not utilise magnitude in the determination of significance.) **Impact Significance (pre-mitigation):** ***Minor – Negligible (depending on receptor location)***

Mitigation and Monitoring

No additional mitigation measures have been identified.

Residual Impact

As no additional mitigation measures have been identified the residual impact will be ***Minor - Negligible*** (*Table 8.21*).

Table 8.21 Residual Impact from Construction Traffic

	Impact Significance
Pre-mitigation	*Minor - Negligible (depending on receptor location)*
Post-mitigation	*Minor - Negligible*

8.3.4 Potential Impacts from Noise Generated during Operation

Impact Description

There are a number of key items of equipment included in Phase IV, and the associated substation improvements, that have the potential to produce high levels of noise during operation and may require specific mitigation in order to meet the required noise levels. These are:

- Phase IV Area:
  - HRSG stack exit
  - HRSG Stack wall
  - HRSG boiler / inlet
  - Open cycle stack exit
  - Open cycle stack wall
  - Air cooled condenser
  - Air cooled water cooler
  - Step up transformers

- Substation:
  - Auto transformer
  - GIS Buildings

A number of pumps and pipes are expected to be located outdoors; however, these are not expected to produce high levels of noise following implementation of embedded design mitigations.

Because the EPC contractor has not yet been selected, and the specific equipment design and layout will be dependent on this decision, detailed noise modelling will not be performed until after an EPC contractor is selected.

Azito Energie will, as a minimum, verify that noise levels from Phase IV equipment, including the substation, do not exceed 45 dB(A) at the residential noise receptors listed in *Table 8.22* or 55 dB(A) at non-residential noise receptors listed in *Table 8.22*. Additionally, Azito Energie will verify that noise emissions from Phase IV (including the substation) will not result in an increase of more than 3 dB at any noise sensitive receptors listed in *Table 8.22*. On this basis, potential impacts will be no greater than ***Minor*** in significance.

Note that verification of these commitments will be done through a combination of noise modelling and monitoring. Monitoring of noise levels and sensitive receptors will be used to verify compliance with the 3 dB commitment, but because monitoring cannot measure the noise levels from just Phase IV, modelling will be used to verify this commitment.

Meeting these noise levels will be achieved through a combination of noise reduction at source and other embedded mitigation measures, the details of which will be addressed in the detailed design phase.

The selected EPC contractor will conduct modelling using SoundPlan to confirm the selected design meets these requirements. Once the EPC contractor completes the noise modelling, this will be submitted as an addendum to demonstrate compliance with the above commitments and to provide details of the embedded mitigation measures that will be implemented.

Table 8.22 Operation Noise Assessment Results

Noise Sensitive Receptor	Relevant Criterion ($L_{Aeq,T}$, dB)	Baseline Noise Level, $L_{A90,30mins}$	Significance of Impact
1. Azito Village	45 (a)	44 (c)	*Minor or below*
2. Azito Village (southern end)	45 (a)	46 (c)	*Minor or below*
3. Recreational bars along the bank of the Ébrié lagoon	55 (b)	46 (c)	*Minor or below*
4. CIE owned dwellings and recently built dwelling	45 (a)	46 (c)	*Minor or below*

Noise Sensitive Receptor	Relevant Criterion ($L_{Aeq,T}$, dB)	Baseline Noise Level, $L_{A90,30mins}$	Significance of Impact
5. Dwellings to the north and south of the road leading to the plant	45 (a)	45 (c)	*Minor or below*
6. A small group of properties near abattoir	45 (a)	53 (c)	*Minor or below*
7. PetroCI office (daytime receptor only)	55 (b)	62 (c)	*Minor or below*
8. Béago Village	45 (a)	48 (d)	*Minor or below*

a) IFC night-time noise level guideline.
b) The IFC do not set noise level guidelines for recreational bars or office buildings. Instead, the level for institutional and educational uses has been used for these noise sensitive receptors which are noise sensitive during the daytime only.
c) Lowest day or night-time measurement adopted
d) Lowest daytime measurement adopted as measurement location inaccessible at night.

Impact Significance

Azito will mitigate noise emissions from the Project to ensure that noise impacts will be ***Minor*** or below at all noise sensitive receptors.

Existing baseline noise levels at noise sensitive receptors 6 and 7 are relatively high, due in part to the Foxtrot plant. Despite this, noise from Phase IV will not result in an increase of more than 3 dB over current baseline conditions at either location.

The impact is summarised in *Table 8.23.*

Table 8.23 Impact Assessment: Increased Noise Generation during Operation

Nature and Type: Direct negative **Receptor Sensitivity:** The sensitivity of the receptor is taken account of when calculating the impact magnitude as the criteria take into account the receptor's sensitivity to noise. **Impact Magnitude:** Small **Impact Significance (with embedded mitigation):** ***Minor – Negligible*** at all noise sensitive receptors

Mitigation and Monitoring

Embedded mitigation measures will be defined following the detailed noise modelling. Additional mitigation is required in order to verify that the noise standards are being met (see *Table 8.24*).

Table 8.24 Mitigation Measures for Noise Generated during Operation

Management Control	Responsibility - Organisation	Timing
Conduct modelling using a reputable model, e.g. SoundPlan, to confirm the selected design (including the substation) meets the Project's commitments for noise levels at the identified noise sensitive receptors. Specifically, the following noise levels shall be met by Phase IV (as demonstrated through the modelling):	EPC	prior to construction
Review the EPC's noise modelling to confirm the performance guarantees are met.	Azito Energie	prior to construction
Submit the results of the noise modelling to ANDE.	Azito Energie	prior to construction
Maintain Azito's grievance procedure to collect and manage potential complaints from local communities with regards to noise, and seek appropriate solutions to resolve the grievance.	Azito O&M	During construction and operation

Receptor	Target Noise Level, $L_{eq,1h}$ dB
R1. *Azito Village*	44
R2. *Azito Village (S)*	45
R3. *Recreational bars by lagoon*	46
R4. *CIE owned dwellings*	45
R5. *Dwellings to N & S of the plant access road*	45
R6. *properties close to abattoir (NW of site)*	45
R7. *PetroCI office*	55
R8. *Beago Village*	45

Residual Impact

The residual impact taking into consideration the mitigation measures outlined is ***Minor - Negligible*** (*Table 8.25*).

Table 8.25 Residual Impact from Increased Noise Generation during Operation Activities

	Impact Significance
Pre-mitigation	*Not reported, but potentially significant*
Post-mitigation	*Minor – Negligible (depending on receptor)*

8.4 CLIMATE CHANGE IMPACT ASSESSMENT

8.4.1 Increased GHG Emissions

Overview

This assessment of GHG emissions associated with the Project is in accordance with the methodology described in *Section 5: Methodology*.

Because climate change affects global receptors, the impact magnitude and receptor sensitivity cannot be determined in the same way it can be for other topic areas. For this reason, impact significance is only determined to be

Significant or ***Not Significant*** using the IFC threshold value of 25,000 tonnes of carbon dioxide equivalent (tCO_2e).

Impact Description

The estimate of the Project GHG footprint was done based on the Greenhouse Gas Protocol Corporate Accounting Standard (1).

GHGs included in the GHG assessment methodology are the gases under the UNFCCC/Kyoto Protocol. Of these, carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) are considered the main GHG pollutants for the Project based on the planned activities.

The GHG Protocol defines three emissions 'scopes' for GHG accounting and reporting purposes: Scope 1, Scope 2 and Scope 3. Scope 1 includes direct GHG emissions coming from the Project. Scope 2 includes indirect GHG emissions associated with consumption of energy produced off-site (i.e. electricity from the grid). Scope 3 includes all other indirect GHG sources.

A summary of the Scope 1, Scope 2 and Scope 3 emissions included in the Project is provided in *Box 8.1*.

Box 8.1 Scope 1, 2 and 3 Emissions Related to the Project

Scope 1 emissions include combustion sources (i.e. gas turbine). **For this initial GHG inventory, Scope 1 emissions have been included for the gas turbine train, assuming an electrical delivery of 250 - 335 MW. Emissions have been estimated using assumed overall energy efficiencies of 38% (open cycle) and 55% (combined cycle) and pollutant emission factors from the US EPA for general gas turbines.**

Scope 2 emissions include all emissions associated with electricity imports, heat imports, as well as with cold imports and compressed air imports. **Because the purpose of the Phase IV Expansion is to provide more power to the grid, the Project will be a net exporter of power and therefore will not utilise additional power from the grid. Indirect Scope 2 GHG emissions are therefore assumed to be zero for the purposes of this preliminary GHG inventory.**

Scope 3 emissions include all other indirect emissions, such as (but not limited to) contracted and other associated activities. As an example, this includes emissions associated with any machine or vehicle operated by a supplier. **For this initial GHG inventory, no Scope 3 emissions associated with the Project have been included.**

Impact Significance

The annual estimate of GHG emissions, using the assumptions stated, are reported in the following *Table 8.26*. Note that these are estimates only, and actual emissions would vary depending on factor such as the final turbine model selected and the actual operating schedule.

(1) The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard, Revised, World Resources Institute.

Table 8.26 Estimated GHG Emissions per Year

Activity	GHG Emissions			
	CO_2 [tonnes/year]	CH_4 [tonnes/year]	N_2O [tonnes/year]	all GHGs, also called CO_2e [tonnes CO_2e/year]
Year 1 – Open Cycle	911 298	77	27	991 346
Future Years – Combined Cycle	904 813	53	18	684 930

Where the following have been assumed:

- *Emission factors (from IFC Carbon Emissions Estimation Tool (CEET) February 2014)*
  - *CO_2: 2.693 tonnes CO_2/tonne fuel*
  - *N_2O: 0.000005 tonnes N_2O/tonne fuel*
  - *CH_4: 0.000048 tonnes CH_4/tonne fuel*
- *Global warming potentials (from 2007 IPCC AR4)*
  - *N_2O: 298*
  - *CH_4: 25*
- *338 107 tonnes/year fuel (calculated for open cycle mode to deliver 250 MW)*
- *335 701 tonnes/year fuel (calculated for combined cycle mode to deliver 250 MW)*
- *Approximately 8760 hours of operation per year*
- *Year 1 100% open cycle mode; following years 100% combined cycle mode*

Annual GHG emissions will be greater than 25 000 tCO_2e. On the basis of this preliminary GHG emission inventory, the Project's GHG emissions during the operational phase are considered ***Significant*** (*Table 8.27*).

Table 8.27 Impact Assessment: Climate Change

Nature and Type: Direct negative
Receptor Sensitivity: N/A (because receptors for this impact are global, the methodology in *Section 5: Methodology* does not specifically consider receptor sensitivity)
Impact Magnitude: N/A (the methodology in *Section 5: Methodology* does not specifically consider impact magnitude)
Impact Significance (pre-mitigation): Significant

Mitigation and Monitoring

To comply with the IFC Performance Standards, projects with GHG emissions greater than 25,000 tCO_2e must quantify GHG emissions annually in accordance with internationally recognised methodologies and good practice.

The following mitigation measures will be implemented during the construction and operation phases (see *Table 8.28*).

Table 8.28 Mitigation Measures for Potential Climate Change Impacts

Management Control	Responsibility - Organisation	Timing
Develop and implement a routine maintenance plan for all key GHG emission sources identified in the annual GHG inventory.	Azito O&M	During operation

Management Control	Responsibility - Organisation	Timing
Have a system in place to periodically review annual GHG performance and evaluate options for improving energy efficiency over the life of the Project.	Azito O&M	
Quantify GHG emissions annually in accordance with internationally recognised methodologies and good practice.	Azito O&M	
Verify that the EPC is 1) implementing a system to periodically review annual GHG performance and evaluate options for improving energy efficiency over the life of the Project and 2) is implementing a maintenance plan in place for all major sources of GHG emissions.	Azito O&M	

Residual Impacts

On the base of the Impact Assessment Methodology set out in *Section 5*, the potential residual impacts related to GHG emissions are considered to be ***Significant*** and annual quantification of GHG emissions is required (*Table 8.29*).

Table 8.29 Climate Change Residual Impact

	Impact Significance
Pre-mitigation	*Significant*
Post-mitigation	*Significant*

8.5 *WATER IMPACT ASSESSMENT*

8.5.1 Overview

This assessment identifies potential impacts to water resources as a result of the Project. The key impacts associated with water resources within the Project area are identified as follows:

- Degradation of surface water quality;
- Consumption of water resources and reduced water availability; and
- Degradation of surface water ecology due to increased sediment load (resulting from increased erosion and dust generation).

8.5.2 Groundwater Abstraction, Saline Intrusion in the Aquifer and Water Availability

Impact Description

As presented in the Phase III ESIA report, abstraction of groundwater can result in the development of a cone of depression in the aquifer being used. If

the groundwater levels fall below those in the lagoon, it could lead to saline intrusion in the aquifer. This could result in abstraction of saline water at the well and have an impact on other boreholes - particularly those used for water supply for Abidjan to the north. In addition, water availability problems could occur if the demand for water for Phase IV exceeds the amount available.

During operation, industrial water (for example, make-up for the closed-circuit steam generation, for industrial cleaning and firefighting purposes) is supplied by the existing wells used by Azito Phase III (see *Figure 2.6*). The current abstraction rate from the wells is limited to 45 m^3/hr, and the estimated total usage of water for Phase I – IV is expected to be 25 m^3/hr.

Preliminary calculations were undertaken on the basis of available data and a simplified Dupuit equation(1) to compare the ability of Well 2 to maintain constant water flows to Phase IV industrial water requirements (this represents worst case scenario as continuous abstraction above 45 m^3/hr will not occur, and wells are interchanged, see *Table 8.30).* Using these conservative assumptions, the current capacity of the Well 2 is estimated to be sufficient to cover the need of the Phase I, II, III and Phase IV expansion plant during operation and would not lead to saline intrusion from the lagoon.

Table 8.30 Simplified Calculation of Radius of Influence and Pumping Rate for Phase IV

Parameters	Results
Worst case abstraction assumption for Phase I - IV	49 m^3/h
Q (well discharge rate)	55 m^3/h
k (hydraulic conductivity of aquifer)	1 m/h
rp (radius of the pumping well)	0.08 m
H0 (rest water level)	28 m
Hp (steady-state head in the pumping well)	27 m
H0-hp	0.6
Ra (radius of well influence)	0.7 m

Source: Technical studies - drilling works of well F2, Geodrill Technologies LTD, August 2015 and Azito O&M.

Initial calculations regarding the likely position of the saline intrusion using the method of Todd (2008) would suggest that the saline intrusion is possibly located at depth beneath the wells. The exact position is unknown but in theory, for Well 2, this is likely to be in the region of some 70 – 80 m below ground level and for Well 1, this is likely to be slightly shallower. However, the location of the wells within an area considered to be an existing or former alluvial channel would suggest that the saline interface will be less affected by pumping as the relative supply of fresh water in a permeable channel will be greater.

Recent monitoring of groundwater quality from both wells does not show significant degradation in water quality with respect to saline intrusion or

(1) The Dupuit-Forchheimer hypothesis estimates that groundwater flows horizontally into an unconfined aquifer and that groundwater flow is proportional to the thickness of the saturated aquifer. It was formulated by Jules Dupuit and Philipp Forchheimer in the 1800s to simplify the groundwater flow equations for analytical solutions.

other parameters (see *Section 7.4.5*). This would suggest that the situation has not changed to the point where salinity is affecting the wells currently.

In addition, the SODECI (National Water Distribution Company) have developed regulations to prevent saline intrusion into the major boreholes used to provide potable water for Abidjan. These boreholes are situated 5 to 10 km from the coast. The existing wells installed by Azito falls within a zone defined by the SODECI as requiring protection and is therefore subject to such controls. Several measures have been adopted by SODECI to ensure protection of the groundwater resources. In addition, all abstractions are subject to permit from the Ministry of Forestry and Ecology and thus are regulated for the protection of degradation of water resources. This is imposed through abstraction limits and any increase in abstraction proposed would have to follow the relevant permitting and licensing process.

During construction, the volumes to be abstracted for the different construction activities and the source of water have not been defined at this stage of the Project. However based on Phase III, the water needed for the construction phase of the Project is mainly related to

- General cleaning and control of airborne dust;
- Site maintenance; and
- Concrete preparation.

The exact impacts to groundwater will need to be established through a further evaluation. It should be noted that the Project is commit ensuring that water will be obtained from local surface/underground waters or from existing or new boreholes and will be conducted in line with IFC PS and Ivoirian Law.

Receptor Sensitivity

Sensitivity is assessed as being *Medium* considering that water abstracted by the Project is currently used by users at a local level only and alternative sources of comparable quality could be used.

Impact Significance

The impact is summarised in *Table 8.31*.

Table 8.31 Impact Assessment: Groundwater Abstraction, Saline Intrusion in the Aquifer and Water Availability

Nature and Type: Direct negative **Receptor Sensitivity:** Medium **Impact Magnitude:** Small **Impact Significance (pre-mitigation):** ***Minor***

Mitigation and Monitoring

Whilst pre-mitigation impact significance is considered to be ***Minor***, there are industry good practice measures that Azito Energie will apply to further reduce potential impacts. These measures will also help mitigate the risk to the project from reduced water availability/water quality from the aquifer in the future. These are identified in *Table 8.32*, including responsibility for implementation of the measures.

Table 8.32 Good Practice Measures for Groundwater Abstraction, Saline Intrusion in the Aquifer and Water Availability

Management Control	Responsibility - Organisation	Timing
Develop a site-wide Water Management Plan that 1) evaluates ways to improve water efficiency, 2) reduce water consumption during construction and 3) includes a regular monitoring regime to evaluate changes in water quality.	EPC	During construction
Develop a site-wide Water Management Plan that 1) evaluates ways to improve water efficiency, 2) reduce water consumption during operations and 3) includes a regular monitoring regime to evaluate changes in water quality.	Azito Energie	
Implement Water Management Plan (including monitoring of water consumption to inform consideration of water efficiency improvement).	Azito O&M	During operation
Implement the site-wide Water Management plan which evaluates ways to improve water efficiency and reduce water consumption during operations. Maintain internal audit records of how the Plan is being implemented.	Azito O&M	

Residual Impact

If the optional mitigation measures are applied the residual impact will be ***Negligible*** (*Table 8.33*).

Table 8.33 Residual Impact for Groundwater Abstraction, Saline Intrusion in the Aquifer and Water Availability

	Impact Significance
Pre-mitigation	*Minor*
Post-mitigation	*Negligible (if optional mitigation applied)*

8.5.3 Consumption of water resources and reduced water availability;

Impact Description

Drinking water availability problems could occur if the demand for water for Phase IV exceeds the amount available.

During construction and operation, the Project will not directly abstract water and should be supplied by water mains of the SODECI. Water consumption for domestic use during construction can be estimated at about 200 litres per person per day (mostly from sanitary use – showers, toilets). Azito expects that the peak construction workforce will reach up to approximately 1000 workers at peak of which some would be directly employed from the surrounding local communities and wouldn't need to stay in the worker camps. Assuming that all workers from outside of Yopougon are accommodated on-site (a construction camp, the maximum daily consumption of domestic water for the workers at peak construction workforce installations can be estimated to be 200 m^3 per day. This peak water requirement can easily be supplied by water mains of the Société des Eaux de Côte d'Ivoire (SODECI), or trucked on site using tanker trucks and stored in temporary water storage tank.

Receptor Sensitivity

Sensitivity is assessed as being *Medium* considering that water abstracted by the Project is currently used by users at a local level only and alternative sources of comparable quality could be used.

Impact Significance

The impact is summarised in *Table 8.34*.

Table 8.34 Impact Assessment: Drinking Water Consumption and Water Availability

Nature and Type: Direct negative **Receptor Sensitivity:** Medium **Impact Magnitude:** Negligible **Impact Significance (pre-mitigation):** ***Negligible***

Mitigation and Monitoring

No additional mitigation measures are required.

Residual Impact

No additional mitigation measures have been identified therefore the residual impacts remain ***Negligible*** (*Table 8.35*).

Table 8.35 Residual Impact for Drinking Water Consumption and Water Availability

	Impact Significance
Pre-mitigation	*Negligible*
Post-mitigation	*Negligible (if optional mitigation applied)*

8.5.4 Degradation of Surface Water Quality

Impact Description

During construction impacts on water quality from the construction phase may result from:

- run-off from the construction site, during rainy events;
- direct discharges of sanitary effluent; and
- marine transportation (if applicable).

If the construction phase requires the use of equipment transportation by boat, it is assumed that vessels used will be incompliance with all MARPOL requirements (1). Potential impacts associated with the marine transportation will be localised and temporary. The benthic community of the lagoon is characterised by a number of opportunistic species that are able to re-colonise disturbed sediments very rapidly.

Accidental leaks and spills are covered as part of the unplanned events assessment, see *Section 8.13 Unplanned Events*.

Impacts from contaminated and/or turbid run-of will be minimal, given the relatively small footprint during construction. Good practice related to site run-off management will be implemented, using site surface profiling, drainage ditches and sediments traps. Note that turbid run-off may happen during rainy events, largely during the rainy seasons; at those times of year, water turbidity in the lagoon is already high due to general run-off from streams, the city of Abidjan and the lagoon shores.

There will be no direct discharge of sanitary effluents from the construction site. Sanitary wastewater will be treated in a mobile sewage treatment facility. The treated effluent released into the lagoon will meet the discharge criteria specified by the general IFC's EHS General Guidelines (2).

During the construction activities, surface and ground water quality can also be affected by an accidental release of chemical, fuel or oil from temporary storage tanks or vehicles used on-site. Small changes are likely to be

(1)International Convention for the Prevention of Pollution from Ships (MARPOL) http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-(MARPOL).aspx accessed November 2016
(2) http://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES

reversible, but larger accidental spills of fuel or chemicals could result in medium-term decreases in water quality.

During operation impacts on water quality may result from direct discharges of:

- process water;
- sanitary wastewater; and
- run-off water.

All wastewater generated by Phase IV will be discharged in line with IFC EHS water discharge limit values and Ivorian Law.

Wastewater potentially contaminated from the operations of the power plant (i.e. water blowdown from the boilers) will be directed to a new or the existing industrial water treatment pond.

Rain water runoff drained on site will be directed to new or existing oil/water separators. Run-off water drained to the oil/water separator will be directed to the neutralisation pond for pH control. After this treatment the water will be discharged in a new or the existing evaporation pond.

Sanitary wastewater will be treated by splash mixing (barbotage) and settling (décantation) and will be then directed to a new or existing neutralisation pond and the existing evaporation pond.

Embedded mitigation measures considered during the impact assessment are presented in *Table 8.36*.

Table 8.36 Embedded Mitigation Measures to Reduce Degradation of Surface Water

Management Control	Responsibility - Organisation	Timing
Discharge of any effluents will only be undertaken following treatment to meet standards and IFC/World Bank discharge guidelines. (See Table 3.8 from the ESIA for the discharge standards that must be met.)	EPC	
All discharges to the external environment will be subject to granting of the necessary permits from the relevant authorities.		Embedded mitigation
There will be no direct discharge of sanitary effluents from the construction site. Sanitary wastewater will be treated in a mobile sewage treatment facility or removed from site by tanker to licenced treatment facility.	EPC	

Receptor Sensitivity

The main surface water body in the Project area is the Ébrié lagoon. The Azito site for Phase IV and its associated laydown area, access road and potential worker camp will be located within 200 m of the lagoon. The Ébrié lagoon is important for amenity/ recreational purposes on an ongoing basis. Also local

communities partly relied upon the Ébrié lagoon i.e. for fishing activities with no suitable alternatives. Based on these considerations, the sensitivity is considered to be *Medium* from a human receptor basis.

According to the United Nations Environment Programme (1), the Ébrié Lagoon is highly polluted with solid and liquid urban waste from Abidjan. However, it still supports a range of fish species, many of which feed on phytoplankton and zooplankton. The population of plankton varies seasonally with temperature, salinity and the source of water. The lagoon houses numerous fish species which have adapted to the changing chemical characteristics of the water over the last 40 years. These include *Ethmalosa fimbriata*, which is of great importance from an economic and ecological point of view, comprising 70% of the total fish catches. This fish is able to adapt to large variations in salinity and temperature. Based on these considerations, the sensitivity is considered to be *Low* from a biodiversity receptor basis.

Impact Significance

The impact is summarised in *Table 8.37*.

Table 8.37 Impact Assessment: Degradation of Surface Water

Nature and Type: Direct negative **Receptor Sensitivity:** Medium **Impact Magnitude:** Small **Impact Significance (pre-mitigation):** ***Minor***

Mitigation and Monitoring

Whilst pre-mitigation impact significance is considered to be ***Minor***, there are optional industry good practice measures that could be applied to further reduce potential impacts.

These are identified in *Table 8.38*, including responsibility for implementation of the measures.

(1) http://www.unep.org/newscentre/Default.aspx?DocumentID=26844&ArticleID=35453; consulted in October 2016.

Table 8.38 Good Practice Measures for Surface Water Quality

Management Control	Responsibility - Organisation	Timing
Prior to construction, develop a site Drainage Management Plan to reduce uncontrolled runoff into the neighbouring environment from the site during construction, in particular the plan should include the following provisions: • Minimise the amount of land left bare and re-vegetating any slopes as quickly as possible. • Any temporary stockpiles should be protected from erosion by using a reduced slope angle where practical, and by incorporating sediment traps in drainage ditches. • Long-term stockpiles will be seeded to prevent erosion and to maintain soil quality. • Surface water management structures within the construction areas must include silt fencing, silt traps, stream diversion channels, internal run-off capture and diversion channels, to control sedimentation where necessary. • Inspections will be carried out during the course of the works, and upon completion of Project activities to verify the effectiveness of erosion and surface water management measures being implemented.	EPC	Prior to construction
As part of the implementation of the Drainage Management Plan, carrying out inspections during the course of the works, and upon completion of Project activities to verify the effectiveness of erosion and surface water management measures being implemented.	EPC	During construction
Verify that measures related to surface water quality are being implemented.	Azito Energie	
Drinking water will not be used as process water for any of the construction activities of Phase IV.	Azito Energie	
When the water level of the evaporation pond (containing treated process water, sanitary water and run-off water) is high, a contractor will analyse if the sample is compliant with the IFC and Ivorian discharge limits. (See Table 3.8 from the ESIA for the discharge standards that must be met.) No discharge can be made prior to verification of compliance with these standards.	Azito O&M	During operation

Residual Impact

Implementation of mitigation should render residual impacts of ***Minor*** predicted significance (*Table 8.39*).

Table 8.39 Residual Impact from Degradation of Surface Water

	Impact Significance
Pre-mitigation	*Minor*
Post-mitigation	*Negligible*

8.6 BIODIVERSITY IMPACT ASSESSMENT

8.6.1 Overview

This assessment identifies potential impacts on biodiversity as a result of the Project. The key impacts associated with biodiversity within the Project Area of Influence (AoI) are identified as follows:

- habitat loss resulting from construction activities;
- potential contaminated drainage and wastewater discharge from construction and operation activities and disturbance of benthic communities or an area of degraded mangrove habitat located on the southern side of the site; and
- transportation during construction and operation and accidental introduction and spread of invasive species.

Each impact is assessed separately below.

8.6.2 Habitat Loss Resulting from Construction Activities

Impact Description

The Project site will need to be cleared and levelled in preparation for the Project infrastructure but no significant vegetation is present on this location.

The Phase IV plant will be located within the existing Azito plant site boundaries and so the permanent Project footprint will not require a footprint increase.

The laydown area, access road and if relevant the establishment of a camp is assumed to be located within 2 km from the site area that minimise physical disturbance. The land plot required for these facilities are expected to be limited in size. The scale of the impact is considered to be small given the small area of habitat loss compared to the habitat in the surrounding area.

It should be noted that the need for a temporary purpose-built camp to accommodate the construction workforce has not yet been established. It is possible that construction workers will be housed in existing lodging in the surrounding communities, for example Azito and Béago, as it was during the construction of Azito III.

It is noted that if the land required for the Project associated facilities is not located in the vicinity of the site (see *Annex C Alternatives*) this will require a specific site setting assessment to ensure that impacts are mitigated in-line with IFC PS 6 and with Côte d'Ivoire law.

Receptor Sensitivity and Value/Importance

Section 7: Baseline Conditions indicates that the Project site and the majority of the Project's AoI (with the exception of Banco Forest, which located more than 7 km away from the site hence not at risk of being impact by any direct Project impact) can be categorised as a modified habitat. Modified habitats are considered to have a Low sensitivity due to their degraded nature, the common occurrence in the local area, and as they do not support any protected flora species. As such this habitat would not be sensitive to change and would be able to recover quickly.

The flora and fauna on site are also considered to have a Low sensitivity, as they would tolerate the loss of the habitat and would quickly adapt. No flora or fauna of international conservation importance (i.e. IUCN Red listed) were recorded in the area during the baseline data collection. A limited faunal community has been recorded in the terrestrial and lagoon edge habitats in the Project area, including the Gambian rat, bird species and the common agama. The species are considered to be accustomed to disturbances and the presence of humans, as they are already living in an industrialised area on the edge of an existing power plant. The species are likely to disperse a short distance into adjacent suitable habitat, with limited effect on their behaviour.

Impact Significance

The impact is summarised in *Table 8.40*.

Table 8.40 Habitat Loss Resulting from Construction Activities

Nature and Type: Direct negative **Sensitivity/Vulnerability/Importance of Resource or Receptor:** Low **Impact Magnitude:** Small **Impact Significance (pre-mitigation):** ***Negligible****
Note: *Assuming that the laydown area, access road and if relevant the establishment of a camp will be located within the vicinity of the existing plant.

Mitigation and Monitoring

If the land required for the establishment of the laydown area, access road and if relevant the worker camp is not located in any of the potential areas considered in *Annex C Alternatives,* this will required a specific site setting selection assessment to ensure that impacted are mitigated in-line with the IFC PS and with Côte d'Ivoire law.

Whilst pre-mitigation impact significance is considered to be ***Negligible***, there are optional industry good practice measures that could be applied to further reduce potential impacts. These are identified in *Table 8.41*, including responsibility for implementation of the measures.

Table 8.41 Good Practice Measures for Habitat Loss Resulting from Construction

Management Control	**Responsibility - Organisation**	**Timing**
Review the EPC's Siting Plan for the establishment of the construction facilities to verify that requirements and procedures are adequately addressed by the EPC contractor.	Azito Energie	Prior to construction

Residual Impact

If the optional mitigation measures are applied the residual impact will be ***Negligible*** (*Table 8.42*).

Table 8.42 Residual Impact from Habitat Loss Resulting from Construction Activities

	Impact Significance
Pre-mitigation	*Negligible* assuming laydown area, access road and if relevant the establishment of a camp will be located within the vicinity of the existing plant.
Post-mitigation	*Negligible (if optional mitigation applied)*

8.6.3 Accidental Introduction and Spread of Invasive Species

Impact Description

The construction of the Project will involve the movement of vehicles, which creates the risk of accidental introduction of alien and invasive species through transport of seed or plant materials or small faunal species on the vehicles. These species may add to the current burden of invasive species present in the remaining habitats in the area.

Trucks will be used to deliver infill material (e.g. aggregate, sand, soil etc.) to site as well as other material. Between circa 30 and 40 tonne trucks or equivalent barges will be needed per hour for two to six month period to move this infill material.

It has not yet been defined whether items of equipment and construction material for Phase IV will or will not be transported by barge from Port Bouët across the Ébrié Lagoon and offloaded close to the Project site at the newly constructed container terminal. It should be noted that invasive species can be introduced through ballast water exchange, infected equipment and hull fouling. Ballast water is carried by ships to provide stability and adjust a vessel's trim for optimal steering and propulsion. The use of ballast water

varies among vessel types and with cargo and sea conditions. As part of normal ship operations, ballast water can be discharged in ports. Ballast water appears to be the most important vector for the transfer of marine species throughout the world.

The main impact will be during construction activities. The ongoing maintenance of the power plant will involve the long distance movement of vehicles, which creates the risk of accidental introduction of alien and invasive species however this transportation is expected to be very limited in number and duration and would involve local transportation only.

Receptor Sensitivity and Value/Importance

Based on the analysis provided above sensitivity is assessed to be *Low*.

Impact Significance

The impact is summarised in *Table 8.43*.

Table 8.43 Accidental Introduction of Invasive Species

Nature and Type: Direct negative **Sensitivity/Vulnerability/Importance of Resource or Receptor:** Low **Impact Magnitude:** Small **Impact Significance (pre-mitigation):** Negligible

Mitigation and Monitoring

No additional mitigation measures have been identified.

Residual Impact

As no additional mitigation measures have been identified the residual impact remains ***Negligible*** (*Table 8.44*).

Table 8.44 Residual Impact from Accidental Introduction and Spread of Invasive Species

	Impact Significance
Pre-mitigation	*Negligible*
Post-mitigation	*Negligible*

8.7 SOCIO- ECONOMIC IMPACT ASSESSMENT

8.7.1 Overview

This assessment identifies potential impacts on socio-economic aspects as a result of the Project. The key impacts associated with socio-economic aspects within the Project's AoI (Area of Influence) are identified as follows:

- Direct employment opportunities and skills enhancement;

- Local and national economy;
- Potential loss of livelihood due to temporary land leasing; and
- Pressure on infrastructure, resources and services.

8.7.2 Direct Employment Opportunities and Skills Enhancement

Impact Description

The development of the Project will offer opportunities for employment of local and non-local people with the necessary skills and experience. The most significant positive socio-economic impact is expected during the construction phase. Alternatively, community relations may be adversely affected if employment opportunities are not managed and communicated in an appropriate and transparent manner.

The duration of the full construction period, including the combined cycle, will be approximately 27 months. During this time, workers will be engaged directly by the EPC contractor or its subcontractors.

Construction activities will require a number of specialised workers though a number of unskilled and semi-skilled positions will also be created. Due to the need for skilled labour, a large proportion of the employee work force is likely to be hired from outside the local area; however local employment opportunity will also be created.

As the Project is still in the design stage, the number of unskilled, semi-skilled and skilled jobs, as well as the proportion of local to expatriate roles to be filled is to be defined. These positive impacts will be temporary in nature and last throughout the construction phase. Further, employment levels throughout the construction phase are expected to fluctuate and will not remain at 'peak' workforce numbers throughout. However it is estimated that the EPC contractor will provide direct jobs for up to 1000 workers at peak time with an average of 400 workers over the construction phase.

Those who secure jobs will have access to a regular income during their employment and the opportunity to develop new skills and work experience. This in turn will help them secure further work in future.

During operation, it is thought the Project may employ approximately up to five (5) new workers on a full time basis, in addition to the existing workforce at the Azito Energie Power Plant.

Receptor Sensitivity

Since Azito Phase III ESIA was published, there has been an increase in industrial activity in the Project area and a number of jobs have been created in the AoI. However, the unemployment rate in Yopougon is still high and the informal sector employs the majority of the population in Yopougon.

Some but few areas of vulnerability were identified through the baseline i.e. woman and young people (see *Section 7: Baseline Conditions*). Hence the sensitivity of the potential receptors identified in the AoI (e.g. communities and households) is assessed to be high.

Impact Significance

The impact is summarised in *Table 8.45*.

Table 8.45 Potential Impacts from Direct Employment Opportunities and Skills Enhancement

Nature and Type: Direct positive **Receptor Sensitivity:** High **Impact Magnitude:** Positive **Impact Significance (pre-mitigation):** ***Positive***

Enhancement Measures

Measures will be taken to maximise the opportunities for local employment in the AoI. The high expectations that Project stakeholders have with regards to the employment opportunities that will be offered by the Project need to be managed through careful communication. Measures are presented in *Table 8.46.*

Table 8.46 Enhancement Measures for Direct Employment Opportunities and Skills Enhancement

Management Control	Responsibility - Organisation	Timing
Develop an Employment Plan that sets out requirements and procedures to be followed when identifying and developing Project's employment opportunities, managing employees, recording and reporting employment data, terminating work contracts, and other labour-related issues. This Plan will comply with the national Labour Code and IFC Performance Standard 2 on Labour and Working Conditions and with Cote d'Ivoire law. This Plan should be in line with the principles of equal employment opportunities and anti-discrimination (opposing all types of discrimination regardless of race, religion or belief, gender, disability, age, nationality, sexual orientation or ethnicity).	EPC	Prior to construction
Review the EPC Employment Plan (See Annex D ESMP) to verify that requirements and procedures are adequately addressed by the EPC contractor.	Azito Energie	
Integrate the Employment Plan (See Annex D ESMP) related activities as part of the Project's Stakeholder Engagement Plan (SEP) to ensure that relevant stakeholders are adequately engaged and that this is communicated to the EPC contractor.	Azito Energie	

Management Control	Responsibility - Organisation	Timing
Sensitise workforce to the short term nature of the construction work. Encourage people to save part of their monthly salary for future opportunities, investment and financial security until they find another job/livelihood.	EPC	
Monitor through the construction phase the number of local employment created work contracts, and other labour-related issues.	EPC	
Monitor and supervise the EPC contractor to ensure that Employment Plan is implemented in line with the Project's requirements. It is recommended to formalise and centralise local recruitment procedures through a Community Liaison Officer to manage local expectations and deter casual enquiries for employment at the site. The Employment Plan and any local employment opportunities will be communicated in a transparent and culturally appropriate manner. The EPC contractor will seek support from the Company and its Stakeholder Engagement Plan when advertising employment opportunities to ensure that employment opportunity clearly define the skills, qualifications and experience required for the available positions and refers candidates to the local employment offices. Unskilled labour will be preferentially hired from the local communities where possible subject to job applicants being suitable qualified. All employment-related decisions, including hiring, placement, promotion, benefits, training, discipline and dismissals, will be based solely on the skills, experience, performance and qualifications of employees and applicants.	Azito Energie	During construction
As part of the Project Stakeholder Engagement Plan, implement a grievance mechanism that will be communicated to relevant stakeholders so that to collect and address as required grievances in line with IFC Performance Standards and with Cote d'Ivoire law. This will include coordination with local authorities – in particular the municipality of Yopougon and the Azito and Béago village chiefs and elders.	Azito Energie	
Prior to operation, update the Employment Plan to cover the operation phase.	Azito O&M	During operation
Update the Local Content Plan to cover the operation phase.	Azito O&M	

Residual Impact

The residual impact is ***Positive*** (see *Table 8.47)*.

Table 8.47 Residual Impact

	Impact Significance
Pre-mitigation	*Positive*
Post-mitigation	*Positive*

8.7.3 Local and National Economy

Impact Description

At a national level when the Phase IV extension of the Azito Power Plant is in operation, it is likely to have a positive impact on the national economy and livelihoods of Ivoirians. This will result from the increased power generation capacity to provide electricity to households and businesses in the domestic market as well as for export to neighbouring countries lacking infrastructure to meet their electricity needs. The proposed Project may also indirectly benefit neighbouring countries as Côte d'Ivoire exports power.

Indirect impacts stem from potential increase in productivity and growth of service industries and development of small businesses through a decrease in power outages.

At a local level, the Project will need to procure goods and services which is expected to have a positive impact on local businesses and economy in AoI. Alternatively, community relations may be adversely affected if economic opportunities are not managed and communicated in an appropriate and transparent manner.

The most significant positive impact on the local economy is expected during the construction phase. The presence of a large construction workforce will further increase the demand for local goods and services.

Additional jobs or business opportunities may be created by companies securing contracts. This may potentially increase opportunities for local households in benefiting from jobs with these companies. Although it is not possible at this stage to accurately quantify this, reports from a number of sources indicate that the employment multiplier (number of direct, indirect and induced jobs for each direct job created) for infrastructure projects often exceeds two (2) during construction phase. (1)

Additionally, revenue will be generated from taxes on income and for goods and services procured in Côte d'Ivoire, and duty on imported products. This will result in a positive impact on the national economy.

(1) IFC Available at: http://www.ifc.org/wps/wcm/connect/83affa004f7ce00bb812fe0098cb14b9/chapter6.pdf?MOD=AJPERES Consulted on 16/11/16

Receptor Sensitivity

As aforementioned, the sensitivity of the potential receptors identified in the AoI (i.e. societies, communities and households) is assessed to be high.

The unemployment rate in Yopougon is still high and the informal sector employs the majority of the population in Yopougon. Some but few areas of vulnerability were identified through the baseline i.e. woman and young people (see *Section 7: Baseline Conditions*).

Impact Significance

The impact is summarised in *Table 8.48*.

Table 8.48 Potential Impacts on the Local and National Economy

Nature and Type: Direct positive **Receptor Sensitivity: High** **Impact Magnitude:** Positive **Impact Significance (pre-mitigation):** ***Positive***

Enhancement Measures

Measures will be taken to maximise the opportunities for local procurement in the AoI. The high expectations that Project stakeholders have with regards to the local procurement that will be offered by the Project need to be managed through careful communication. Measures are presented in *Table 8.46*.

Table 8.49 Enhancement Measures for Local and National Economy

Management Control	Responsibility - Organisation	Timing
Develop an Employment Plan which will set out requirements and procedures to be followed when identifying and developing Project's employment opportunities, managing employees, recording and reporting employment data, terminating work contracts, and other labour-related issues. This Plan will comply with the national Labour Code and IFC Performance Standard 2 on Labour and Working Conditions and with Cote d'Ivoire law. This Plan should be in line with the principles of equal employment opportunities and anti-discrimination (opposing all types of discrimination regardless of race, religion or belief, gender, disability, age, nationality, sexual orientation or ethnicity).	EPC	Prior to construction
Prior to construction, develop a Local Content Plan which will set out requirements and procedures to be followed for procurement and employment activities, and identify feasible implement initiatives to support local capacity building of Small and Medium-sized Enterprises. Plan to be reviewed and developed in conjunction with Azito O&M SED manager.	EPC	

Management Control	Responsibility - Organisation	Timing
The Project will support the EPC Contractor on the implementation of the Local Content Plan.	Azito Energie	
As part of the Project Stakeholder Engagement Plan, implement a grievance mechanism that will be communicated to relevant stakeholders so that to collect and address as required grievances in line with IFC Performance Standards and with Cote d'Ivoire law. This will include coordination with local authorities – in particular the municipality of Yopougon and the Azito and Béago village chiefs and elders.	Azito Energie	During construction
Monitor and supervise the EPC contractor to ensure that the Local Content Plan is duly implemented.	Azito Energie	
Update the Local Content Plan to cover the operation phase.	Azito O&M	During operation

Residual Impact

The residual impact is ***Positive*** (see *Table 8.50)*.

Table 8.50 Residual Impact

	Impact Significance
Pre-mitigation	*Positive*
Post-mitigation	*Positive*

8.7.4 Potential Loss of Livelihood due to Temporary Land Leasing

Impact Description

The Phase IV project components will be located within the existing Azito plant site boundaries and so the permanent Project footprint will not require acquisition of additional land.

During construction, it is anticipated that limited land plot will be required for a temporary laydown area and access road if relevant the establishment of a camp. It is assumed that these Project associated facilities will be located in the vicinity of the site (see *Annex C Alternatives*).

Although the land plot(s) for establishment of these construction facilities have not yet been selected, the land take will be located in an area that avoids physical displacement. Also, at this stage the land required will be located within the direct AoI which provide limited option as to where the Project construction facilities could be located. Therefore, at most land take could cause a temporary loss of access to land that may be used for an alternative economic or livelihood activity.

Any land take that happens will be temporary and likely require a rental /lease agreement from the owner.

The need for a temporary purpose-built camp to accommodate the construction workforce has not yet been established. It is possible that, like for Azito Phase III, construction workers will be housed in existing lodging in the surrounding communities, for example Azito and Béago. If the EPC contractor selected however decides to accommodate its workers in a purpose built camp close to the work site then this will also require some land take.

It is noted that if the land is not be located in the vicinity of the site (see *Annex C Alternatives*) this will required a specific site setting assessment to ensure that impacted are mitigated in line with IFC PS and with Cote d'Ivoire law.

Embedded mitigation measures considered during the impact assessment are presented in *Table 8.51*.

Table 8.51 Potential Loss of Livelihood due to Temporary Land Leasing Embedded Mitigation Measures

Management Control	Responsibility - Organisation	Responsibility - Individual
Design, construct and manage any worker accommodation in line with the standards outlined in the EBRD Workers' Accommodation: Processes and Standards dated 2009.	EPC	Design team

Receptor Sensitivity

Although the locations of to be used for the laydown area, access road and worker camp have not been identified, the sensitivity of the receptors (land users / owners) is deemed low. This assessment is made on the basis that any land used that is close to the Azito Power Plant will be:

- Fallow or vacant land due to the increasingly industrial nature of the area;
- Dearth of agricultural activity in the area means it is not likely to be used for key livelihood activities such as farming; and
- Owners of the land are therefore not likely to be highly dependent on the land to be used for these Project components.

Impact Significance

The impact is summarised in *Table 8.52*.

Table 8.52 Potential Impacts from Loss of Livelihood due to Temporary Land Leasing

Nature and Type: Indirect Negative
Receptor Sensitivity: Low
Impact Magnitude: Small
Impact Significance (pre-mitigation): ***Minor***

Mitigation and Monitoring

Whilst pre-mitigation impact significance is considered to be ***Minor,*** there are optional industry good practice measures that could be applied to further reduce potential impacts. These measures are presented in *Table 8.53*.

Table 8.53 Good Practice Measures for Potential Loss of Livelihood due to Temporary Land Leasing Impacts

Management Control	Responsibility - Organisation	Timing
Prepare a Siting Plan for review and approval by the owner. The siting plan will demonstrate that specific siting requirements for road access, temporary worker camp, and laydown area are met as follows: • The land take avoids any displacement of peoples' homes and their community facilities (i.e. wells); • The land take avoid highly productive agricultural land (these type of area are not found within 2 km from the site but could be identified in the rest of the AoI). • Any associated impacts with this temporary land take are assessed and adequate mitigation developed; • The footprint of construction works will be limited to the minimum required area; and • A plan for decommissioning the site in-line with IFC PS and with Côte d'Ivoire law.	EPC	Prior to construction
Review the EPC's Siting Plan for the establishment of the construction facilities to verify that requirements and procedures are adequately addressed by the EPC contractor.	Azito Energie	
As part of the Project SEP, implement a grievance mechanism that will be communicated to relevant stakeholders so that to collect and address as required grievances in line with IFC Performance Standards and with Cote d'Ivoire law. This will include coordination with local authorities – in particular the municipality of Yopougon and the Azito and Béago village chiefs and elders.	Azito Energie	During construction
Monitor and supervise the EPC contractor to ensure that the Siting Plan is implemented in line with the Project's requirements.	Azito Energie	

Residual Impact

If the optional mitigation measures are applied the residual impact will be ***Negligible*** (*Table 8.54*).

Table 8.54 Residual Impact

	Impact Significance
Pre-mitigation	*Minor*
Post-mitigation	*Negligible*

8.7.5 Pressure on Infrastructure, Resources and Services

Impact Description

The Project will increase the population in the AoI during construction in particular; largely through introduction of a migrant workforce but also to a lesser extend through potential economic in-migrants settling in the area with the intention of securing employment with the Project or seeking other economic opportunities indirectly generated by Project activities. This has the potential to increase demand on services and existing infrastructure in the AoI, such as health centres, water supply, markets, etc. Pressure exerted by arrival/influx of construction workforce on social services and social/physical infrastructure in the AoI is a potential short to medium-term pressure on the local population.

Section 7, Baseline Conditions indicates that the majority of the population within the AoI has access to power (albeit it is understood power is intermittent) but limited access to the following infrastructures:

- Solid waste and wastewater treatment systems;
- School;
- Health facilities i.e. clinic and hospital.

Roads are generally of poor quality however it is noted those roads are currently being renovated in Yopougon.

Receptor Sensitivity

The sensitivity of the communities in the AoI to the additional pressure on social amenities is rated as *low* due to pre-existing weaknesses (pressures due to general population growth) in sanitation infrastructure, schools and health facilities.

Increased pressure on local infrastructure and social services, such as increased waiting times in the local health facility, could however disproportionately impact vulnerable groups such as women and children, as well as the elderly. The sensitivity of these groups would therefore be greater and is deemed to be *Medium*.

Impact Significance

The impact is summarised in *Table 8.55*.

Table 8.55 Potential Impacts due to Pressure on Infrastructure, Resources and Services

Nature and Type: Direct negative **Receptor Sensitivity:** Low to Medium (for Vulnerable Groups) **Impact Magnitude:** Medium **Impact Significance (pre-mitigation):** *Moderate*

Mitigation and Monitoring

Table 8.56 outlines the mitigation measures identified and responsibility for implementation of the measures.

Table 8.56 Mitigation Measures due to Pressure on Infrastructure, Resources and Services

Management Control	Responsibility - Organisation	Timing
Ensure that workers will be provided with primary health care, sanitation and clean water in the construction camp.	EPC	
Liaise with Azito Energie to develop actions to limit pressure on local infrastructures as much as possible.	EPC	
Through stakeholder engagement and frequent contact with local service providers monitor the situation on the ground to identify any changes to infrastructure use and pressure on services. If it is identified that presence of the construction workforce is putting pressure on them, Azito Energie will develop a mitigation plan to address this, in collaboration with local authorities.	Azito Energie	Prior to construction
On the basis of SEP activities liaise with the EPC contractor to develop action to limit pressure on local services and infrastructures as much as possible.	Azito Energie	
Promote the implementation of joint planning approaches with government and other key stakeholders for infrastructure projects where possible.	Azito Energie	
Monitor and supervise the EPC contractor to ensure that the actions to limit pressure on local services and infrastructures are implemented in line with the Project's requirements.	Azito Energie	
As part of Azito's Socio-economic development programme, continue to support public services in the vicinity of the plant, including health facilities and school in Azito and in Béago. Azito Energie will provide support to local health facilities should there be a noticeable increase in pressure on the service during Phase IV construction.	Azito Energie	During construction
Promote the implementation of joint planning approaches with government and other key stakeholders for infrastructure projects where possible.	Azito Energie	

Residual Impact

Following implementation of mitigation the residual impact is ***Minor*** to ***Negligible*** (see *Table 8.57)*.

Table 8.57 Residual Impact

	Impact Significance
Pre-mitigation	*Moderate*
Post-mitigation	*Minor to Negligible*

8.8 *COMMUNITY HEALTH AND SAFETY*

8.8.1 Overview

This *Section* identifies potential impacts on community health and safety aspects as a result of the Project.

The key impacts associated with socio-economic aspects within the Project AoI's are identified as follows:

- Interaction with local communities and communicable diseases;
- Interaction with local communities and human rights;
- Workers influx and sociocultural changes.

Potential impacts on public health and safety associated with increased traffic are covered in the unplanned events assessment (see *Section 8.13 Unplanned Events*).

8.8.2 Interaction with Local Communities and Communicable Diseases

Impact Description

The rate of spread of communicable diseases may increase within communities as a result of the construction and interaction with communities. This understanding is based on the experiences of other similar projects. This is likely largely due to:

- Potential interactions between the construction workforce and local communities could lead to increased occurrence and transmission of communicable diseases i.e. sexually transmitted infections (STIs) including HIV/AIDS. Similarly, it is possible that the influx of the construction workforce will attract commercial sex workers to the AoI.
- To a lesser extent, potential in- migrants to the area bringing new diseases or varying disease profiles compared to the existing community. The migrant population may have a different disease/epidemiological profile to that of the Project-affected population in the AoI.

Receptor Sensitivity

As mentioned in *Section 7.5 Social Baseline Conditions*, communicable diseases represent a significant health challenge in Côte d'Ivoire. This has the potential to affect local women that engage in commercial or transactional sex work with these groups. Conversely, it could also affect the members of the workforce who engage commercial sex workers. The sensitivity level is therefore assessed as *Medium*.

Impact Significance

The impact is summarised in *Table 8.58*.

Table 8.58 Potential Impacts due to Interaction with Local Communities and Communicable Diseases

Nature and Type: Direct negative **Receptor Sensitivity:** Medium **Impact Magnitude:** Medium **Impact Significance (pre-mitigation):** ***Moderate***

Mitigation and Monitoring

Table 8.59 outlines the mitigation measures identified and responsibility for implementation of the measures.

Table 8.59 Mitigation Measures due to Interaction with Local Communities and Communicable Disease

Management Control	Responsibility - Organisation	Timing
Develop a Code of Conduct and deliver training on it to the workforce prior to commencing construction activities. The Code of Conduct will include specific guidelines on worker-community interactions and worker interactions. It will detail rules to be upheld to minimise the risk of anti-social behaviours. Appropriate disciplinary procedures will be developed and enforced to ensure that the Code of Conduct is upheld by all Project contractors and subcontractors.	EPC	Prior to construction
Review the EPC Code of Conduct to ensure that requirements and procedures are adequately addressed by the EPC contractor.	Azito Energie	
As part of Azito's Community Development Programme seek collaboration with existing AIDS prevention programmes in Côte d'Ivoire to develop initiative (as feasible).	Azito Energie	
Monitor and supervise the EPC contractor to ensure that the Code of Conduct is being implemented in-line with IFC Performance Standards.	Azito Energie	During construction

Management Control	Responsibility - Organisation	Timing
Deliver a health risk training and awareness programme, tailored to the needs of different groups, within the construction workforce.	EPC	
Verify that contractors and subcontractors receive training at start-up of construction to improve their awareness of the risks of HIV and other STIs, their transmission routes and prevention methods. Training about other prevalent communicable diseases and health risks, will be covered as appropriate. Training and awareness initiatives will be front-loaded in inductions at the start-up stage of construction.	EPC	

Residual Impact

Following implementation of mitigation the residual impact is ***Minor*** (see *Table 8.60)*.

Table 8.60 Residual Impact

	Impact Significance
Pre-mitigation	*Moderate*
Post-mitigation	*Minor*

8.8.3 Workers Influx and Sociocultural Changes

Impact Description

Workers influx can lead to negative impacts on the local community through changes in social cohesion and competition for resources such as jobs, accommodation and goods.

Receptor Sensitivity

All residential areas and settlements in the AoI and the Commune of Yopougon more widely have experienced in-migration of people in the last 15 years. It is assumed that there have been changes to the socioeconomics and the sociocultural environment in the past years that are far greater than any changes that could be occasioned by the proposed Project.

The sensitivity of the communities in the AoI to socioeconomic changes and influx is therefore considered low. The area is already characterized by commercial and industrial activities, as well as construction work at the container terminal; the Project is undertaking an expansion of the existing Azito Power Plant and so is not something new. Construction workers from outside of the area have been present in the area before.

Impact Significance

The impact is summarised in *Table 8.61*.

Table 8.61 Potential Impacts from Worker Influx and Sociocultural Changes

Nature and Type: Direct Negative **Receptor Sensitivity:** Low **Impact Magnitude:** Medium **Impact Significance (pre-mitigation):** ***Minor***

Mitigation and Monitoring

Construction phase

Whilst pre-mitigation impact significance is considered to be ***Minor,*** there are optional industry good practice measures that could be applied to further reduce potential impacts. These measures are presented in *Table 8.65*.

Table 8.62 Good Practice Measures for Workers Influx and Sociocultural Changes

Management Control	Responsibility - Organisation	Timing
Develop a Code of Conduct and deliver training on it to the workforce prior to commencing construction activities. The Code of Conduct will include specific guidelines on worker-community interactions and worker interactions. It will detail rules to be upheld to minimise the risk of anti-social behaviours. Appropriate disciplinary procedures will be developed and enforced to ensure that the Code of Conduct is upheld by all Project contractors and subcontractors.	EPC	Prior to construction
Implement a no hiring 'at the gate' policy when hiring construction workforce: It will be made clear that there will be no recruitment of workforce and people "at the gate", and the formal recruitment process will be clearly advertised, so as to discourage settlement of opportunistic demands and tension.	EPC	
As part of the Project SEP, implement a grievance mechanism that will be communicated to relevant stakeholders so that to collect and address as required grievances in line with IFC Performance Standards and with Cote d'Ivoire law. This will include coordination with local authorities – in particular the municipality of Yopougon and the Azito and Béago village chiefs and elders.	Azito Energie	During construction
Provide induction training to all Project personnel including communication of the Code of Conduct, associated disciplinary procedures, and awareness raising on cultural sensitivities relevant to worker activities in and interactions with local communities.	EPC	

Residual Impact

If the optional mitigation measures are applied the residual impact will be ***Negligible*** (*Table 8.63*).

Table 8.63 Residual Impact

	Impact Significance
Pre-mitigation	*Minor*
Post-mitigation	*Negligible*

8.9 *WORKER HEALTH, SAFETY, SECURITY, AND LABOUR AND WORKING CONDITIONS*

8.9.1 Overview

This *Section* identifies potential impacts on workers' aspects as a result of the Project. The key impacts are identified as follows:

- Workers' health, safety, security;
- Labour and working conditions.

8.9.2 Workers Health and Safety and Security

Impact Description

Construction activities will involve the operation of heavy equipment and trucks, working at height, working in confined spaces, construction traffic, use of electric devices, handling of hazardous materials and other hazardous activities. Due to the nature of the activities being undertaken during construction and decommissioning, worker H&S is a key risk with the potential for accidents that may result in injuries and fatalities as well as lost man-hours.

The main impact is expected during construction.

Unsafe working conditions put the whole workforce at risk of occupational illness or injury. It is possible that local sub-contractors, which may be contracted by the Project EPC Contractor, may not fully meet the international safety requirements and standards required by the Project or by the EPC Contractor's internal standards and procedures. Local sub-contractors may lack capacity to fully implement an internal risk management system or safe operating procedure and may require initial or ongoing support and guidance from the EPC Contractor to ensure they develop these.

As some workers may not be accustomed to working under structured and safety-controlled conditions that will be in place at the site during construction. They will also require ongoing coaching and supervision to develop their skills and experience.

Receptor Sensitivity

The sensitivity of the construction workforce, especially those with less exposure to high-risk work sites and safe working practices, is therefore assessed to be *Medium*.

Impact Significance

The impact is summarised in *Table 8.64*.

Table 8.64 Potential Impacts Related to Worker Health, Safety and Security

Nature and Type: Direct Negative **Receptor Sensitivity:** Medium **Impact Magnitude:** Medium **Impact Significance (pre-mitigation):** ***Moderate***

Mitigation and Monitoring

Table 8.65 outlines the mitigation measures identified and responsibility for implementation of the measures.

Table 8.65 Mitigation Measures Related to Worker Health, Safety and Security

Management Control	Responsibility - Organisation	Timing

Develop a Health and Safety Management Plan (H&S) in line with applicable national law and IFC Guidelines and with Cote d'Ivoire law which should be supported and implemented by the following procedures and documents in line with good practices (i.e. IFC Performance Standards) at a minimum:
• Risk Audit document;
• Emergency response planning procedure;
• Job Hazard Analysis and Permit to Work systems;
• Occupational H&S specific procedures related at a minimum to worker fatigue, lifting activities; being crushed between moving objects; noise, cuts.
• Training Programme;
• Medical examination Program: to ensure that pre-employment and an annual occupational health medical examinations are conducted by a qualified occupational health physician in line with Cote d'Ivoire law and the exposure of the job. All members of the construction workforce will be certified as medically fit to do their work.
• Subcontractor screening procedure to adequately review and approve sub contractors' H&S plans prior to any activities i.e. construction activities.
  • Those procedures should be validated by the Project and communicated to the all workers and subcontractors prior to any activities.
  • Ensure that those plans are pragmatic and informed by the Job Hazard Analysis.
	EPC	Prior to construction

Management Control	Responsibility - Organisation	Timing
Develop a Security Management Plan (SMP) containing measures to protect the Project facilities and personnel against potential violent protest or social unrest in line with the UN Voluntary Principles for Security and Human Rights. The security system will include, among other things, selection or personnel based on a careful background screening, training with regards to human rights requirements, and monitoring of performance. Ensure that SMP is aligned and coordinated with current Azito security arrangements.	EPC	
Establish strict procedures facilitating the reporting of health and safety incidents and ensuring that any reported incidents are addressed in an appropriate and culturally sensitive manner.	EPC	
Review the H&S Management Plan and SMP prepared by the EPC and verify that this Plan is in-line with Ivorian Law and IFC Performance Standards and Guidelines. Verify that procedures for reporting are being implemented and appropriate action being taken to address incidents..	Azito Energie	
Provide training to all workers on H&S key requirements as set out in the Ivorian Law and IFC Performance Standards. This should include the applicable plans and procedures, as well as the importance of PPE.	EPC	
Supervise and provide support to its subcontractors to ensure that labour and working conditions are in line with Cote d'Ivoire law through gap analysis and capacity building.	EPC	
The EPC should ensure that the following measures are in place to protect the workforce and surrounding community: • Put in place healthcare and treatment arrangements for the workforce in the event of an occupational illness or injury, and in line with Cote d'Ivoire law. • Undertake medical examination to ensure that workers are fit to work. • Implement a risk audit program in-line with international best practice standards to determine Job Hazard Analysis and Permit to Work systems. • Provide access to free condoms (ideally male and female) in bathrooms and discrete locations to ensure that should construction workers engage in commercial or casual sex, it is done safely at reduced risk to the worker and sexual partner. • Monitor and evaluate the success of these activities.	EPC	During construction

Management Control	Responsibility - Organisation	Timing
In line with the Code of Conduct, put in place measures to ensure that workers do not present to work under the influence of alcohol, which could adversely affect their fitness or ability to perform work and adversely affect their health and safety as well as that of others around them. This will require the EPC contractor to implement a workplace alcohol breath testing system/policy to ensure that proportionate and consistent measures are taken in the event that someone presenting at work is found to be under the influence of alcohol.	EPC	
Select Security personnel based on their commitment regarding safeguarding of community human rights in line with the UN Voluntary Principles for Security and Human Rights.	EPC	
Audit and supervise the EPC contractor to monitor compliance of the EPC's contractor on Health, Safety and Security aspects.	Azito Energie	
The EPC will ensure their subcontractors fully meet the IFC Standards and other EHS requirements as laid down in the ESIA, it is the overall responsibility of the EPC to support any subcontractor in developing their capacity to meet the necessary standards.	EPC	

Residual Impact

Following implementation of mitigation the residual impact is ***Minor*** to ***Negligible*** (depending on the EPC contractor's safety culture) (see *Table 8.66)*.

Table 8.66 Residual Impact

	Impact Significance
Pre-mitigation	*Moderate*
Post-mitigation	*Minor to Negligible* (depending on the EPC contractor's safety culture)

8.9.3 Labour and Working Conditions

Impact Description

Inappropriate management of Project personnel could lead to real, or perceived, curtailment of workers labour and working conditions.

In addition, the Project will potentially build temporary accommodation for a part of the workers during construction (the need for a temporary purpose-built camp has not yet been established). If not appropriately designed and managed basic human rights may be violated, e.g. the right to a standard of living adequate for the health and well-being.

Receptor Sensitivity

The sensitivity of the construction workforce, especially those with less exposure to high-risk work sites and safe working practices, is therefore assessed to be *Medium*.

Impact Significance

The impact is summarised in *Table 8.67*.

Table 8.67 Potential Impacts on Labour and Working Conditions

Nature and Type: Direct Negative **Receptor Sensitivity:** Medium **Impact Magnitude:** Medium **Impact Significance (pre-mitigation):** ***Moderate***

Mitigation and Monitoring

Table 8.68 outlines the mitigation measures identified and responsibility for implementation of the measures.

Table 8.68 Mitigation Measures Related to Labour and Working Conditions

Management Control	Responsibility - Organisation	Timing

Undertake all employment procedures (suggested to be coordinated via the CLO) in accordance with the Employment Plan.
• Employment during work activities will be managed so as to:
  • Comply with all relevant national legislation and International Labour Organisation (ILO) conventions;
  • Ensure appropriate management of labour-related risks;
  • Ensure that child labour will be strictly forbidden during construction. Contractors, suppliers and recruitment agencies will not hire workers under the age of 16 and employment of young workers between 16 and 18 years will only be for light work of limited duration, where the work does not interfere with education, and is not dangerous or harmful to the physical, mental or moral development of young workers.
  • Discrimination because of race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth, actual or perceived HIV status or other status will be strictly forbidden.
  • Ensure that workers will have the right to form and to join trade unions and create their own worker committees and worker representatives in accordance with the requirements and rights set out in the Ivoirian Labour Code.
  • Salaries will be just and favourable ensuring the worker and the worker's family have an existence worthy of human dignity.
  • Discrimination because of race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth, actual or perceived HIV status or other status will be strictly forbidden.
	EPC	During construction

Audit and supervise the EPC contractor to monitor compliance with labour and working conditions measures.	Azito Energie	

Residual Impact

Following implementation of mitigation the residual impact is ***Minor*** to ***Negligible*** (depending on the EPC contractor's safety culture) (see *Table 8.69)*.

Table 8.69 Residual Impact

	Impact Significance
Pre-mitigation	*Moderate*
Post-mitigation	*Minor to Negligible* (depending on the EPC contractor's safety culture)

8.10 *ECOSYSTEM SERVICES*

No priority ecosystem services have been identified as part of this assessment. The assessment of impacts on ecosystem services has therefore been captured through the other relevant topic areas (e.g. biodiversity, hydrology and hydrogeology, cultural heritage).

8.11 *CULTURAL HERITAGE AND TRADITIONS*

8.11.1 Potential Impacts on Cultural Heritage from Construction Activities

Impact Description

The construction of a temporary laydown area, access road if relevant the establishment of a camp could potentially lead to displacement or damage of features of tangible cultural heritage that have not been identified previously.

Receptor Sensitivity

No historical or archaeological sites were identified within the Project area and during construction of Phase I, II and III. Sensitivity is therefore assessed to be *Low*.

Impact Significance

The impact is summarised in *Table 8.70*.

Table 8.70 Potential Impacts on Cultural Heritage

Nature and Type: Direct Negative **Receptor Sensitivity:** Low **Impact Magnitude:** Small **Impact Significance (pre-mitigation):** ***Negligible***

Mitigation and Monitoring

Although the potential risk of encountering buried archaeology is Low, the Project will operate a "Chance Finds" (*Table 8.71*).

Table 8.71 Mitigation Measures for Cultural Heritage

Management Control	Responsibility - Organisation	Timing
Although the potential risk of encountering buried archaeology is low, the Project will operate a Chance Finds procedure in accordance with IFC Performance Standard 8.	EPC	Prior to construction

Residual Impact

The residual impact is ***Negligible*** (see *Table 8.72)*.

Table 8.72 Residual Impact

	Impact Significance
Pre-mitigation	*Negligible*
Post-mitigation	*Negligible*

8.12 *WASTE MANAGEMENT IMPACT ASSESSMENT*

8.12.1 Impacts from Increased Waste Generation

Impact Description

The Project construction will generate the following type of waste:

- General solid waste: household waste (including organic waste), plastics, paper, food, packaging, glass, office equipment, scrap metal etc.
- Hazardous waste: waste oil, oily rags, filter cartridges, absorbent materials, medical waste, paint waste and paint cans and lead-acid batteries.
- Excavated soils and materials excavated corresponding to the foundations of the installations.

Given the early state of the Project design, estimated volumes of these different types of wastes are not yet available. Based on feedback and experience with similar projects, volumes of special waste materials produced during the construction phase should be small and it is anticipated that most of the waste products can be easily reprocessed through existing facilities. It is estimated that 100 m^3 of ordinary waste (i.e. one truckload) will be generated every month during the construction period of Phase IV. Most of the hazardous waste will comprise oil contaminated materials.

Volumes of excavated soils should be relatively small in view of the level topography and absence of any basements in the buildings (relatively small foundations). Some of the excavated soil will be used for levelling the land. The sub-contractor with responsibility for civil engineering will be contractually responsible for dealing with the soils and will contact the local authorities for details of places where the deposit of excavated materials is authorised.

The storage area for waste products will be waterproofed and covered to avoid the waste coming into contact with rain water. The storage area for liquid waste will be bunded.

The main waste products expected during the operational phase are as follows:

- Domestic waste generated by the workforce and offices comprising household waste (including organic waste), plastics, paper, food, packaging, glass, office equipment, etc.; and

- Hazardous waste (mostly from the maintenance workshop) comprising lubricants and waste oils and their containers, used filters, oily rags, solvents used for cleaning, small amounts of paint waste from maintenance, and small amounts first aid etc.

It is expected that the Project will not produce significant quantities of solid process waste given the Project design; however, estimated volumes are not yet available given the early state of design for the Project. Packaging and general domestic waste will be collected by an independent waste management company (currently, Azito Energie has contracted the Ivorian company Lassire as waste removal and disposal contractor) and disposed of at the municipal waste disposal area in Abidjan.

Impact Significance

If waste is not appropriately managed and disposed of the potential exists for contamination to occur. The impact is summarised in *Table 8.73*.

Table 8.73 Waste Production

Construction Phase
Nature and Type: Direct negative **Impact Significance (pre-mitigation):** ***Moderate*** Although low quantities of waste will be generated, this will be disposed of at offsite waste disposal facilities. Prior to implementation of mitigation measures the potential exists that wastes may be disposed of at sites which are below national, international or company standards.
Operation Phase
Nature and Type: Direct negative **Impact Significance (pre-mitigation):** ***Moderate*** Although low quantities of waste will be generated, this will be disposed of at offsite waste disposal facilities. Prior to implementation of mitigation measures the potential exists that wastes may be disposed of at sites which are below national, international or company standards.

Mitigation and Monitoring

Table 8.65 outlines the mitigation measures identified and responsibility for implementation of the measures.

Table 8.74 Mitigation Measures Related to Waste Management

Management Control	Responsibility - Organisation	Timing
A detailed Waste Management Plan (WMP) will be developed for Phase IV or the existing WMP will be modified to include Phase IV prior to the construction of Phase IV. The WMP shall cover the management of both construction and operations waste for Phase IV. The Waste Management Plan will include requirements related to: • the application of a waste mitigation hierarchy (i.e. 1) prevention, 2) re-use, 3) recycling, 4) recovery, 5) disposal); • waste minimisation through measures such as using less material in design, reduction (e.g. keeping products for longer or designing to last longer), and reuse; • the promotion of waste recycling, particularly used oils, containers, equipment, paper, plastics; • information on the storage and retention of hazardous liquid waste; • the sorting and separation of hazardous and ordinary waste, providing clear, understandable differentiation of wastes; • storage and treatment of waste undertaken in a manner that protects the environment: use of specific installations, authorisation prior to burying waste, accreditation of specialised companies; and • the traceability of hazardous waste, detailing the type of waste, quantity and identification of both carrier and destination. The WMP should also consider any lessons learned regarding waste management during the previous phases.	EPC	Prior to construction
Waste management contractors will be selected based on capabilities and quality of service, and audited to ensure that wastes are being managed in a manner compliant with Ivorian Law, international good practice, and Azito Energie contract requirements.	EPC	
The current companies responsible for the waste collection will be contacted to determine how wastes are being managed.	Azito Energie	
Implement a waste management plan and wastewater management plan.	EPC	
Conduct and document training on the procedures included in the EPC WMP for all staff responsible for elements of waste management.	EPC	During construction
Brief all staff on the core waste management principles, which should be set out in the EPC WMP.	EPC	

Management Control	Responsibility - Organisation	Timing
A post-construction survey of the construction area will be conducted to confirm that all debris and wastes have been removed and properly treated/disposed at the end of the construction phase.	EPC	
Revise the existing Waste Management Plan for the site to include Phase IV operations.	Azito O&M	
Implement a waste management plan and Water Management Plan (which includes management of waste water).	Azito O&M	
Conduct and document training on the procedures included in the WMP for all staff responsible for elements of waste management.	Azito O&M	During operation
Brief all staff on the core waste management principles, which should be set out in the Waste Management Plan.	Azito O&M	

Residual Impacts

The residual impacts are presented in *Table 8.75*.

Table 8.75 Residual Impact from Waste

	Impact Significance
Construction Phase	
Pre-mitigation	*Moderate*
Post-mitigation	*Minor*
Operation Phase	
Pre-mitigation	*Moderate*
Post-mitigation	*Minor*

8.13 UNPLANNED EVENTS

8.13.1 Significant Potential Impacts

Based on the Project activities, the potential unplanned events that are considered to have the highest potential risks to the Project are as follows:

- operational disruption on gas supply, resulting in the need to operate using liquid fuel (distillate diesel oil);
- spill of oils or chemicals (e.g. DDO leakage);
- major event on a DDO storage tank
- a rupture of gas pipeline;
- a traffic accident (involving people, protected fauna, or livestock); and
  It is noted that, although not under the Project's control, an accident at the container port (involving tipping of a container or tank) leading to personal injury and/or environmental contamination could occur.

Therefore, given the proximity of the container port this event is considered in this Section.

Potential impacts from these events are described in detail below. These impacts are studied as part of Phase 4 of the project but are applicable to the overall plant.

These potential impacts have been classified using the risk-based impact assessment methodology for unplanned events included in *Section 5: Methodology*. Note that this methodology is different than that applied to potential impacts from planned activities, as the assessment of potential impacts from unplanned events must consider likelihood as well. Because a risk-based assessment methodology has been used, worst case scenarios have been considered.

A summary of potential Project-related hazards, contributing causes, and consequences for the Project workforce, nearby communities and/or surrounding environment are summarised in *Table 8.76*. This table also provides a risk ranking for each potential impact pre-implementation of Project embedded controls.

Table 8.76 Potential Impacts from Unplanned Events and Pre-Mitigation Risk Ranking

No.	Hazard	Cause	Consequence	Risk Ranking
1a	Gas pipeline rupture	Corrosion or damage to pipeline	**Communities -** Unignited gas release leading to risk of suffocation to nearby community receptors and leading to potential fatalities or ignited gas release leading to jet/flash fires or explosions.	2E (Major)
1b			**Environment –** Release of natural gas to atmosphere	2B (Minor)
2a	Increased emissions due to need to run on liquid fuel	Operational issues, lack of natural gas fuel	**Communities** – Increased emissions of NO_2 and SO_2 potentially resulting in exceedances of the IFC/WHO guideline values for human health which could cause adverse impacts to individuals.	3C (Moderate)
2b			**Environment** – Increased emissions of NO_2 and SO_2 which may result in localised, short term impacts on habitats.	3A (Negligible)
3a	Oil spillage and chemical leakage (including hazardous waste)	Corrosion, dropped objects, overpressure, over temperature or other damage to storage vessels; failure to secure	**Communities** –Based on the liquid fuel storage volumes the potential exists for exposure to contaminated water or soil and resulting in long term effects on surrounding communities utilising groundwater resources if a spill is not contained.	4D (Major)
3b			**Environment** - Based on the liquid fuel storage volumes potential for loss of containment of oil/chemicals into ground of surrounding area, including nearby surface water resources resulting in localised, potentially long term, degradation.	4B (Minor)
4a	Vehicle/vessel movements transporting personnel or materials resulting in a collision	Wet / dark conditions, driver distraction, fatigue, other dangerous drivers, variable road conditions; rural areas with pedestrian road users	**Communities** (1) – Traffic accidents that involve community members, resulting in injury or fatality. Accidents may require use of local medical emergency services in the Project area and could temporarily decrease access to these services for local residents.	2E (Major)
4b		As 2a above with livestock in the road	**Community** - Traffic accident with livestock leading to death of livestock and loss/reduction in community member's livelihood.	2B (Minor)
5a	Accident and resulting injury from unsafe	Inadequate H&S standards or implementation; movement of heavy machinery.	**Community** - Container accident resulting in injuries to community workforce at port; however, these would not likely result in a fatality (only lost work injuries).	1E (Major)

(1) 'Communities' refers to all individuals not directly or indirectly employed by the Project but living and/or working in proximity to Project infrastructure or areas of Project activity such that they are at risk of potential impacts from a Project-related unplanned event

No.	Hazard	Cause	Consequence	Risk Ranking
5b	conditions at port *Not under the Project's control but considered here given the proximity of the port and mitigation measures developed accordingly (see Annexe D ESMP)		**Environment** –Potential for loss of containment of oil/chemicals from truck or equipment into ground of surrounding area, including nearby surface water resources. Given the volumes, any contamination would be extremely localised.	1B (Negligible)
6a	Accident and resulting injury from unsafe conditions at construction sites	Inadequate H&S standards or implementation; movement of heavy machinery; inadequate signage and fencing and unsecured sites (where community members could access)	**Communities –** Construction site accidents involving community members could occur if sites are unsecured. Accidents may require use of local medical emergency services in the Project area and could temporarily decrease access to these services for local residents.	4D (Major)
7a	Major escalated event on DDO storage tanks (e.g. Boil-Over, fireball)	Uncontrolled fire near a DDO storage tank (e.g. storage tank top fire or bund fire)	**Communities –** DDO fire with high thermal radiations leading to potential injuries / fatalities	1E (Major)

8.13.2 Mitigation

General Mitigation Strategies

In order to reduce Project risk from the key potential unplanned events, the standard mitigation hierarchy should be applied. For the purposes of this assessment mitigation measures are discussed in the following sections where the pre-mitigation significance of the unplanned event is greater than *Minor*.

Unlike impacts from planned activities, mitigation of unplanned events should consider both pre-event preventative actions (that reduce the likelihood of the cause of the potential impact) and post-event mitigation that reduces the magnitude of the consequence.

Impacts from a Gas Pipeline Rupture (1a)

There is a risk that a pipeline could rupture (when uncontrolled gas is released from the pipeline) due to, for example, corrosion, external interference (e.g. excavation, accident, natural hazards) or operational error.

All preventative and mitigation measures proposed to prevent an accident from occurring and to protect community safety and the environment from pipeline ruptures are provided in *Table 8.77*.

Table 8.77 Preventative and Mitigation Measures for Pipeline Rupture

Management Control	Responsibility - Organisation	Timing
Ensure the gas supply pipeline, within the Azito site boundary, is buried to the appropriate a minimum depth of 1 m depth in line with international standards.	EPC	
Ensure the buried pipeline is indicated on site with marks or plots and that people working nearby are aware of the pipeline route.	EPC	Embedded Mitigation
For aboveground section of the pipeline, ensure access to the pipeline is restricted (e.g. barriers, plots)	EPC	
Implement EPC Emergency Response Plan. Maintain internal audit records of how the Plan is being implemented.	EPC	During construction

Impacts due to Traffic Accidents (2a)

All preventative and mitigation measures proposed to reduce the likelihood and severity of traffic accidents are summarised in *Table 8.78*.

Table 8.78 Preventative and Mitigation Measures for Traffic Accidents

Management Control	Responsibility - Organisation	Timing
Develop a Traffic Management Plan for construction that includes: • an Emergency Procedure, taking into account potential impacts on local communities and measures needed to ensure the safety and security of individuals in this regard; • provision of a traffic plan for heavy equipment/major items during construction by the EPC contractor to be made available to concerned stakeholders; • provision of a traffic access map to send to all contractors and suppliers involved in the construction phase; • restricting the speed of construction vehicles; • consideration of the reduction of heavy goods vehicles during the morning, afternoon and evening peak/rush hour times; • provision of sufficient advanced notice of all traffic diversions and road closures, together with details of whom to contact at the construction site in the case of complaints; • clear signing of all diversions; • requirements for driver behaviours, competency and training (i.e. they don't just have to have a drivers licence); and • vehicle specifications to include safety controls such as reversing alarms and use of a spotter when reversing a heavy vehicle with large blind spots. • If the transportation of material will be by boat the Traffic Management Plan should include avoidance measures for fishing areas.	EPC	Prior to construction
Prior to construction, review the EPC Traffic Management Plan to ensure that requirements and procedures are adequately addressed by the EPC contractor. Integrate the Traffic Management Plan related activities as part of the Project's Stakeholder Engagement Plan (SEP) to ensure that relevant stakeholders are adequately engaged. It is recommended to formalise and centralise communication through a Community Liaison Officer. As part of the Project SEP implement a grievance mechanism that will be communicated to relevant stakeholders so that to collect and address as required grievances in line with IFC PS and with Cote d'Ivoire law.	Azito Energie	
Develop Vehicle Maintenance Plan.	EPC	
Review Vehicle Maintenance Plan.	Azito Energie	
Implement the Traffic Management Plan. Maintain internal audit records of how the Plan is being implemented.	EPC	During construction

Management Control	Responsibility - Organisation	Timing
Monitor and supervise the EPC contractor to ensure that the Traffic Management Plan is implemented in line with the Project's requirements. It is recommended to formalise and centralise communication through the CLO to ensure that key stakeholder (including affected communities but also relevant authorities) will be provided with appropriate information communicating the nature and extent of any potential incidents that could arise and procedures to be followed in the case of an unplanned accident or emergency.	Azito Energie	
Implement Vehicle Maintenance Plan.	EPC	
Verify implementation of Vehicle Maintenance Plan.	Azito Energie	

Accident and Resulting Injury from Unsafe Conditions at Port (3a)

As the port is not operated by the Project, minimal management measures can be put in place. However, as the risk to community members only exists if they are present on-site, Azito Energie should review the port's security access measures and confirm that access is restricted as feasible. In the case the port will be used by the Project during construction, the Project will conduct a risk assessment to cover this activity.

On-site Accidents with Community Members (4a)

Measures to protect worker safety are managed outside the scope of the ESIA; however there is a risk that if community members gain access to Project areas, accidents could result in injury to community members.

The most effective way to manage these potential impacts is to restrict access to the Project sites. All preventative and mitigation measures proposed to prevent accidents from occurring and to protect community safety from such accidents are provided in *Table 8.79*.

Table 8.79 Preventative and Mitigation Measures for On-site Accidents

Management Control	Responsibility - Organisation	Timing
Develop Site Security Plan	EPC	Prior to construction
Review Site Security Plan	Azito Energie	
If the adjacent port will be used, review the port's security access measures and confirm that access is restricted.	Azito Energie	

Management Control	Responsibility - Organisation	Timing
Implement Site Security Plan. This should include measures such as: • Secure the Project site, including the lay-down area, with a permanent fence at an early stage of construction; • Employ security guards to patrol the site and control access on a 24 hour/7 day basis to restrict access to community members. Security will serve to prevent theft and damage of equipment on-site and to avoid potential injury to community members; and • Require all personnel to display personal identification and all visitors will be required to sign in to prevent unauthorised access.	EPC	During construction
Revise existing Site Security Plan to include Phase IV operations.	Azito O&M	
Monitor and supervise EPC contractor's security measures (implementation of Site Security Plan)	Azito Energie	
Implement revise existing Site Security Plan to include Phase IV operations. Maintain internal audit records of how the Plan is being implemented.	Azito O&M	During operation

In the event of an accident at a Project site resulting in a community member(s) being injured, the Project will contact local emergency services to provide medical support.

Impacts due to Accidental Spills (5a)

All preventative and mitigation measures proposed to reduce the likelihood and severity of accidental spills are summarised in *Table 8.80*.

Table 8.80 Preventative and Mitigation Measures for Accidental Spills

Management Control	Responsibility - Organisation	Timing
Design the site to include good site management practices to ensure that the products are properly stored on site (e.g. secondary containment, double walled tanks, over filling alarm system, etc.).	EPC	Embedded Mitigation
Develop Emergency Response Plan for Phase IV construction activities.	EPC	Prior to construction
Review EPC Emergency Response Plan for Phase IV construction activities.	Azito Energie	
Implement EPC Emergency Response Plan. Maintain internal audit records of how the Plan is being implemented.	EPC	During construction

Increased NO_2 and SO_2 Emissions Impacting Community Members (6a)

Natural gas is the preferred fuel source for operations and liquid fuel will only be used as an emergency backup fuel when natural gas is not available. *Table 8.81* and *Table 8.82* present the outcome of air emissions modelling undertaken.

Table 8.81 Phase IV Power Plant Impacts (OCGT – DDO)

Pollutant and Averaging Period(1)	Area	Air Quality Guideline	Baseline	Degraded / Undegraded Airshed	PC	PC% of Guideline	PEC	PEC% of Guideline
		µg/m³	µg/m³		µg/m³	%	µg/m³	%
NO_2 1 hour maximum	Anywhere off-site	200	27.88	Undegraded	**186**	93.2%	213.9	**107%**
SO_2 24 hour maximum	Anywhere off-site	125	23.2	Undegraded	10.9	8.8%	34.1	27.3%
SO_2 10 min maximum	Anywhere off-site	500	23.2	Undegraded	359	72%	382	76%
PM_{10} 24 hour not to be exceeded more than three times per year	Anywhere off-site	50		Undegraded	1.18	0.790%		
$PM_{2.5}$ 24 hour maximum	Anywhere off-site	25		Undegraded	3.34	4.45%		
NO_x 24 hour maximum	Sensitive ecological habitats	75	13.04	Undegraded	1.91	2.55%	15	19.9%
Note: As the Phase IV power plant will operate on DDO maximum 5% of the time, only short term impacts are considered								

Table 8.82 Phase IV Power Plant Impacts (CCGT – Liquid Fuel)

Pollutant and Averaging Period (1)	Area	Air Quality Guideline	Baseline	Degraded / Undegraded Airshed	PC	PC% of Guideline	PEC	PEC% of Guideline
		µg/m³	µg/m³		µg/m³	%	µg/m³	%
NO_2 1 hour maximum	Anywhere off-site	200	27.88	Undegraded	**452**	226%	479.9	**240%**
SO_2 24 hour maximum	Anywhere off-site	125	23.2	Undegraded	77	62%	100	80%
SO_2 10 min maximum	Anywhere off-site	500	23.2	Undegraded	**871**	174%	894	**179%**
PM_{10} 24 hour not to be exceeded more than three times per year	Anywhere off-site	50		Undegraded	17.3	11.5%		
$PM_{2.5}$ 24 hour maximum	Anywhere off-site	25		Undegraded	23.6	31.4%		
NO_x 24 hour maximum	Sensitive ecological habitats	75	13.04	Undegraded	7.16	9.55%	20.2	26.9%

Notes:
Bold text indicates an exceedance of the air quality guideline.
As the Phase IV power plant will operate on DDO maximum 5% of the time, only short term impacts are considered

Mitigation measures proposed to reduce the severity of emissions if it becomes necessary to operate on liquid fuel are summarised in *Table 8.83*.

Table 8.83 Mitigation Measures for Increased NO_2 and SO_2 Emissions When Operating on Liquid Fuel

Management Control	Responsibility - Organisation	Timing
Revise existing site Emergency Response Plan to include Phase IV operations activities. This should specifically include: - operational measures to reinstate normal operation (on gas) as soon as possible; - information of local authorities and the local communities to alert them of the risk of significant air quality impact, so that they can take measure to limit their exposure to air pollutants (e.g. by reducing outdoor physical activity); - continued ambient air quality monitoring to document impacts on air quality from DDO operation.	Azito Energie	Prior to construction

Impacts from a Major Escalated Event on DDO Storage Tanks (7a)

In the unlikely of an uncontrolled and long lasting fire near a DDO storage tank, there is possibility for an escalated event to the storage tanks. Two large scales events could potentially occur:

- Boil-over: this event involves a tank or bund fire which causes the evaporation of the water at the bottom of the tank or mixed with the fuel. A boil-over can only occur if water is present in the storage tank, if there is a fire nearby and if the hydrocarbon is viscous. In this case DDO is not too viscous and the boil-over would be of a smaller scale than with HFO for example
- Fireball: tank pressurisation could occur if exposed to a fire and when the product evaporates quicker than it is vented by the vents. When the internal pressure reaches/exceeds the tank design pressure, the tank ruptures and a large amount of superheated liquid ignites into a fireball

Typical preventative and mitigation measures to reduce the likelihood and severity of such events are provided in *Table 8.84*.

Table 8.84 Preventative and Mitigation Measures for Major Escalated Event on DDO Tanks

Management Control	Responsibility - Organisation	Timing
Ensure design includes periodic purge of water inside tanks (prevents boil-over to occur)	EPC	Embedded Mitigation
Vents appropriately sized on the tanks to prevent pressurisation in case of a fire (prevents fireball to occur)	EPC	

Management Control	Responsibility - Organisation	Timing
Ensure design includes control of ignition sources.	EPC	
Update/verify that the site's Emergency Response Plan in case of Oil spillage and fires on site (detection, firefighting, evacuation) associated with DDO storage.	Azito Energie	Prior to construction

8.13.3 Residual Impacts

Because the majority of the mitigation presented in the previous section is preventative, the primary goal of these measures is to reduce the likelihood of the unplanned event from occurring. However, if these unplanned events occur, ***Major*** impacts could still result. In these cases, the post-event measures described in the previous section would apply to minimise impacts. The exception would be Scenario 4, where mitigation measures would reduce access and thereby reduce the likelihood. Assuming the residual likelihood would be '2' out of 5, the residual risk would drop from ***Major*** to ***Moderate***.

8.14 *CUMULATIVE EFFECTS*

8.14.1 Significant Potential Impacts

Cumulative impacts are those that arise as a result of an impact of the Project when added to impacts from other projects or developments. The assessment extends to potential interactions with Project activities and other activities. Cumulative impacts may have the potential to arise during any stage of the Project.

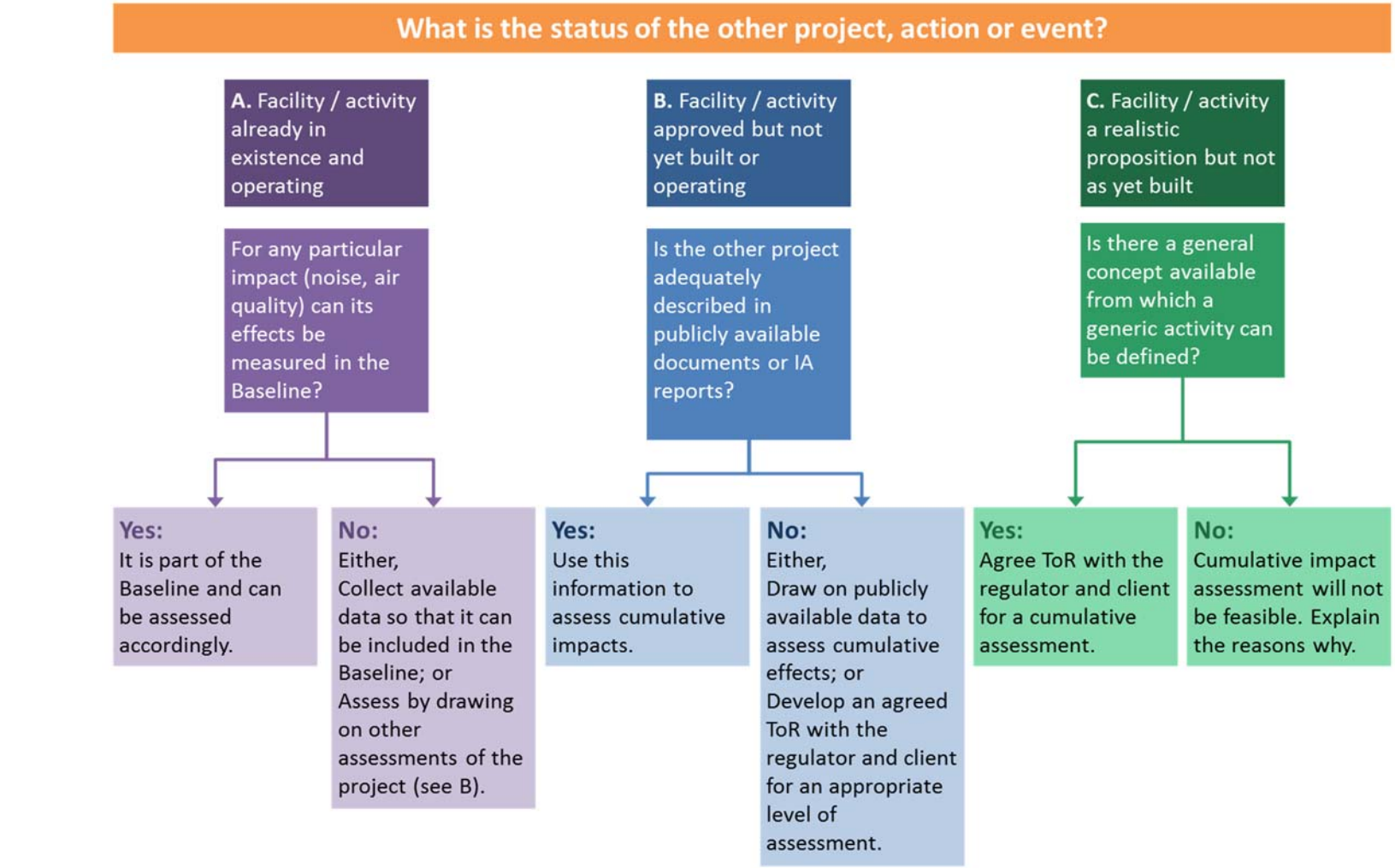
The Area of Influence as regards cumulative impacts as defined under IFC PS 1 encompasses:

> *"…cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted. Cumulative impacts are limited to those impacts generally recognized as important on the basis of scientific concerns and/or concerns from Affected Communities".*

The process for assessing how cumulative impacts from other projects have been assessed as part of this ESHIA is provided in *Figure 8.9*. . Cumulative impacts are measured for all activities and developments not captured in the ESIA baseline. These include Type B projects (approved but not yet built or operating) and Type C projects (projects with a realistic proposition of being developed). The assessment of cumulative impacts therefore relies on an understanding of future development plans for the Project AoI. Unlike Type B and C projects, Type A projects are not considered in the cumulative effects assessment because their impacts will have already been assessed in the ESIA.

Given the densely populated nature of much of the surrounding area, there is little space available for development projects. The only other projects identified in the area are the existing Power Plant, and the construction of the container port to the east of the site (it is understood that construction is not yet fully complete). As the container port is already mostly constructed, and Phase III has been constructed, both are considered as Type A (see *Figure 8.9*), and the cumulative effects to the surrounding environment have already been captured in the current baseline conditions. No further assessment of cumulative impacts is therefore required.

Figure 8.9 How Cumulative Impacts from Other Projects Are Considered



9 MANAGEMENT OF POTENTIAL IMPACTS

9.1 INTRODUCTION

This *Section* introduces the framework Environmental and Social Management Plan (ESMP) for the Azito Energie Phase IV Project. The purpose of the framework ESMP is to ensure that these recommendations are translated into practical management actions which can be adequately resourced, monitored and reported against through the phases of the Project.

The ESMP has been structured into a series of tables that set out the embedded mitigation measures, the pre-construction mitigation measures, the construction mitigation measures, and the operations mitigation measures. These tables are provided in *Annex D*.

9.1.1 Overview and Scope

The ESMP is intended to cover those Project activities described in *Section 2* of this ESIA report during construction and operation. This will be subject to thorough reviews prior to the commencement of each stage of Project activities to ensure completeness and will be updated as necessary.

The ESMP details the mitigation and enhancement measures the Project has committed to implement (also summarised in *Section 8*) and includes desired outcomes; performance indicators; targets or acceptance criteria; costs and timing for actions and responsibilities. The Project will have principal responsibility for all measures outlined in the ESMP, but may delegate responsibility to its contractors, where appropriate. In cases where other individuals or organisations will be delegated to, the responsibility for mitigation measures is clearly indicated in the ESMP table.

Capacity building and environmental and social training requirements are also described in this *Section*, where these relate to specific skills required to deliver the ESMP action in question. General staff training, including health and safety, is not included in the ESMP.

9.1.2 Management Plans

Azito Phase IV will be managed in accordance with the Project ToR and includes the following aspects:

- air quality and greenhouse gas emissions;
- noise and vibration management;
- integrated water management;
- health, safety and security of communities and employees;
- management of transport linked to Azito's activities;
- waste management;

- site rehabilitation and closure;
- prevention and intervention in case of emergency; and
- stakeholder engagement plan.

Since Phase IV is an expansion of the existing project, the impact management measures outlined in the Phase IV ESMP will be incorporated into existing management plans already in place for the Azito power plant once this new phase commences.

9.2 APPROACH TO MANAGEMENT OF IMPACTS

Management measures identified in the ESMP have been developed to align with national regulatory requirements and Good International Industry Practice (GIIP), including that set out by the IFC Performance Standards and the IFC EHS Guidelines. The ESMP incorporates the following components:

- **Issue / Aspect:** an indication of the issue or aspect that needs appropriate mitigation and/or management.

- **Potential impact:** an indication of the potential impact and its priority.

- **Management control:** a description of the mitigation/management measures that will be implemented to manage each significant impact/risk.

- **Performance Measure:** measurable indicators for each significant impact that provide an indication of the extent to which actions have been implemented and desired outcomes achieved.

- **Responsibility:** the party responsible for implementing the action is outlined. Actions have been clearly assigned to individuals where possible. The responsibility of other organisations (including the EPC) is also included.

- **Phase / Stage:** the Project phase or stage that the impact and mitigation measure is applicable, i.e. prior to construction, construction and commissioning, and during operation.

- **Cost estimate:** a cost estimate range is provided for each impact and mitigation measure.

9.3 GUIDING PRINCIPLES

Guiding Principles used in the development of the ESMP and management plans for the Project are presented below. The detailed ESMP is presented in *Annex D*.

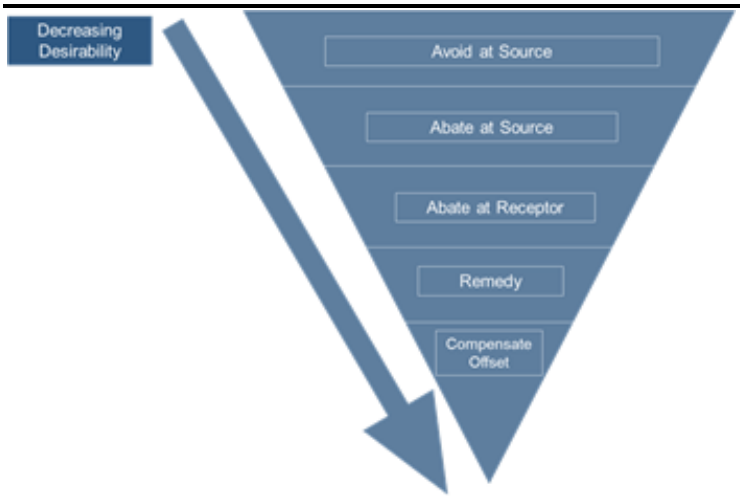
9.3.1 Planning and Risk Identification

- Compliance with the laws and regulations of IFC, World Bank Group and Cote D'Ivoire.
- Completion of pre-construction / works surveys proposed in the ESMPs prior to the commencement of any works and activities.

9.3.2 Management and Control

- Commitment to the mitigation hierarchy in *Figure 9.1*, regarding the potential issues and risks from the Project.
- Commitment to regular reporting and the completion of corrective actions (where required) under the responsibility of EHS Management.
- Application of relevant and appropriate design standards and controls.
- Use of competent and qualified staff (including sub-contractors) to undertake actions, each of whom will have the required level of responsibility and resources.
- Commitment to the provision of advance training for all works staff (including sub-contractors) as part of their induction, and also in advance of all works.
- Being prepared for emergency incidents and having adequate response plans in place (including health, safety, environment and community response).

Figure 9.1 Mitigation Hierarchy



9.3.3 Ownership and Maintenance

Azito Energie will have ultimate responsibility for implementing the management measures outlined in the ESMP and management plans. Azito Energie is also responsible, via contract conditions, for ensuring that the EPC and other responsible organizations implement all mitigation measures relevant to their activities. Azito Energie is required to monitor the EPC and other organizations on their implementation of the ESMP and relevant management plans.

The ESMP and management plans are live, working documents and as such will require periodic review and updates if there are:

- Changes or updates to Cote D'Ivoire legislation or regulations;
- Changes to the Project's social or environmental profile or other aspects with potential for significant impacts on the environment or communities;
- Changes or updates to the IFC Performance Standards and World Bank EHS Guidelines; and
- Lessons learned from incidents, audits or grievances.

9.3.4 Roles and Responsibilities

The ESMP identifies three key responsible parties for various actions: Azito Energie, the EPC Contractor, and Azito O&M. These parties and their general responsibilities with regards to environmental and social management are described below.

Azito Energie – Employer

Azito Energie will engage HSE advisor to implement Globeleq requirements during construction and enforce contract requirements (including HSE obligations) with regards to the EPC Contractor. Part of this role will also be to act as community liaison officer and liaise on regular basis with Azito O&M Socio-Economic Development Manager (existing permanent position responsible for community relations and development projects).

EPC Contractor

The EPC Contractor will be responsible for the design and construction of Phase IV, with oversight from Azito Energie. The EPC Contractor will engage as a minimum one HSE advisor responsible for implementing all EPC HSE obligations under the contract. (Note: the role of EPC Contractor has not yet been awarded to a specific firm.)

Azito O&M

Their role during planning and construction is very limited, as the Phase IV Project is run by Azito Energie. Where required their team will liaise with

Azito Energie and EPC during construction and commissioning phase. Once the project is in the operations phase, Azito O&M will take over management of the project and will implement their existing procedures and HSE management process to incorporate Phase IV.

9.4 COST ESTIMATION

The ESMP also includes estimated costs for each of the Phase IV mitigation measures. These costs are not detailed costs, but rather indicative ranges of costs (i.e. <$10 000 or <$50 000).

Annex A

Air Quality Supporting Information

A1 EMISSION SOURCES

A1.1 POTENTIALLY SIGNIFICANT PROJECT EMISSION SOURCES

The Project will emit pollutants to air during the construction phase and the operational phase.

During the construction phase the pollutants of interest will be dust and particulate matter, evaluated as PM_{10}, $PM_{2.5}$ [(1)] and Total Suspended Particulates (TSP), nitrogen dioxide (NO_2) and oxides of nitrogen (NO_x), and sulphur dioxide (SO_2) arising from construction traffic. Sources of dust and particulate matter include earthworks, access road construction and traffic along the existing road that connects the site to the main access road.

The new gas turbine train gas turbine will utilise a single gas turbine (i.e. Siemens SGT5-2000E) combusting either natural gas, the primary fuel, or distillate diesel oil (DDO) used as an emergency backup. The potential operating schedule will be 24 hours a day, 7 days per week, excluding scheduled maintenance. During the operational phase the main pollutants of interest will be NO_2 when operating on natural gas.

A1.2 SCOPED OUT EMISSION SOURCES

There are some emissions from the Project that have been scoped out of the assessment and will therefore not be considered in detail as part of the ESIA. These include:

- **Shipping –** materials for the construction of the Project will be delivered by ship. The emissions from these ships are considered to have a negligible impact on air quality due to the small number of ships and the period over which they will be present.

- **Operational phase traffic –** traffic movements during operation are anticipated to be sufficiently limited to not result in a significant impact on air quality.

- **Operational phase carbon monoxide (CO) emissions –** carbon monoxide is emitted at a similar order of magnitude as NO_2 from the fuel combustion process; however, air quality guidelines and standards are two orders of magnitude larger for CO. Because of this, impacts from CO emissions are not considered significant for these types of thermal plants.

[(1)] 'PM_{10}' shall mean particulate matter which passes through a size-selective inlet as defined in the reference method for the sampling and measurement of PM_{10}, EN 12341, with a 50 % efficiency cut-off at 10 µm aerodynamic diameter; and '$PM_{2.5}$ shall mean particulate matter which passes through a size-selective inlet as defined in the reference method for the sampling and measurement of $PM_{2.5}$, EN 12341, with a 50 % efficiency cut-off at 2.5 µm aerodynamic diameter. All emissions of particulate matter are assumed to occur in both the PM_{10} and $PM_{2.5}$ size range. This assumption is valid as particles of <2.5µm dominate when arising from combustion sources.

This is supported by the key pollutant identified in the IFC's Environmental, Health, and Safety Guidelines for Thermal Power Plants.

- **Operational phase volatile organic compound (VOC) emissions –** emissions of VOCs from the operation of the power plant will be negligible, as the high combustion temperatures will thermally destroy these compounds. VOC emissions from storage tanks are also considered to be negligible, as breather emissions will be minimal.

- **Operational phase SO_2, PM_{10}, and $PM_{2.5}$ emissions from natural gas combustion –** these pollutants are only generated in significant quantities from the combustion of liquid fuels. This assumes that only sweet natural gas (i.e. low sulphur content) will be combusted.

- **Start-up and shutdown emissions –** the Project will provide baseload electricity generation, so there will be only minimal numbers of start-up and shutdown periods in any year. These emission scenarios are therefore not considered representative of typical routine operations.

A1.3 METHODOLOGY

A1.3.1 Construction Traffic

The UK Highways Agency developed a screening methodology for assessing impacts of road traffic on air quality in the Design Manual for Roads and Bridges (DMRB) (1). DMRB uses a 'dispersion curve' to predict the PC of NO_2 and PM_{10} at given distances from the roadside. The dispersion curve is based upon conservative factors derived using the AMDS-Roads model in seven atmospheric stability classes ranging from stable to neutral and unstable. Whilst this dispersion curve has been derived using a UK based methodology, the dispersion curve reflects the stability of the atmospheric in different thermal convection and wind speed conditions and is therefore broadly similar globally. The emissions from the vehicle fleet of interest are then calculated and applied to the dispersion curve to predict the total concentration at a given distance from the roadside.

DMRB provides emission factors for NO_x and PM arising from vehicle exhausts. Emissions of NO_x are provided with a methodology for converting NO_x to NO_2, as NO_2 rather than NO_x is of interest for human health. The conversion requires knowledge of baseline NO_x and the limited NO_x monitoring undertaken in Azito village has been used. The details of the equations and emissions profiles used, are detailed in the DMRB document.

Emissions of NO_x and PM from the vehicle fleet depend on the age, specification and maintenance of the vehicles. It is expected that the vehicle

(1) UK Highways Agency (2007) Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1 Air Quality http://www.standardsforhighways.co.uk/dmrb/vol11/section3/11s3p01.pdf

fleet in Côte d'Ivoire will be somewhat aged, of a lower specification than would typically be found in Europe or North America, and is likely to have a lower standard of maintenance. In order to reflect this difference, the assumption is made that the Côte d'Ivoire vehicle fleet has an emissions profile similar to the Euro I standard. This is not the latest Euro emission standard (this being Euro VI), but does assume that the fleet is not multiple years old.

DMRB does not provide a method for calculating emissions of dust from unpaved roads. Instead, emissions are calculated using the USEPA AP-42 emission factors for unpaved roads (1).

Vehicle Movements

The exact numbers of vehicles are not known. However an estimated 30 to 40 Heavy Goods Vehicles (HGVs) trips per hour for the delivery of fill will be required over a six month period (*see Section 2*). For the purpose of this Project, the study has taken a conservative approach by assuming 411 annual average daily traffic movements which may last for 2 to 3 months. For the remainder of the construction period, commuter traffic and material deliveries are expected to generate considerably lower traffic movements. DMRB uses the Annual Average Daily Traffic (AADT), and extrapolating the HGVs per day over the six month fill delivery period over a whole year will account for other traffic generated by material deliveries and workforce commuting.

Other Input Data

In addition to the vehicle movements, the following data is used:

- DMRB:
  - Emissions profile: Euro I HGVs (assumed);
  - Vehicle speed: 48kph (30mph) (assumed);
  - Distance from road centre receptor: 5m (assumed); and
  - Road type: Highway.

- USEPA Emission factor for unpaved roads:
  - Silt content 8.5% (from AP-42); and
  - Vehicle weight: 30 US tons (assumed).

The use of a receptor 5m from the road is worst case and represents a receptor immediately adjacent to the kerbside.

Limitations

The DMRB screening tool is designed to directly assess only the annual mean, and does not directly predict impacts for shorter periods. Therefore, 1 hour

(1) USEPA (2007) AP 42, Fifth Edition, Volume I Chapter 13: Miscellaneous Sources

mean, 24 hour mean and monthly mean have been calculated from the annual mean using the power law (*annual mean * [Time$_1$/Time$_2$]^0.2*).

A1.3.2 Operational Phase Impacts

The air quality impact assessment ascertains the concentrations of pollutants arising at ground level as a result of emissions to air from the Project, in combination with the baseline air quality. The potential impacts from the Project are defined as:

- **Process Contribution (PC) –** this is the impact associated with emissions from the Project only;

- **Predicted Environmental Concentration (PEC) –** this is the impact associated with emissions from the Project added to the existing background conditions.

Dispersion modelling using the US EPA's AERMOD model is used to predict the PC arising from the emissions from the Project. This considers the Project and other plant emission parameters, plant design, local meteorology, local land use and terrain.

The significance of the impacts identified for operational impacts are determined on the basis of the significance criteria set out in the topic specific methodologies contained in *Section 5: Methodology*.

A2 DISPERSION MODEL INPUTS AND METHODOLOGY

A2.1 EMISSION INVENTORY

The dispersion modelling included scenarios for the designs being proposed by the two EPC contractors that the Project is considering for selection (i.e. COBRA and SEPCO III). These designs include different building layouts and exhaust parameters, so to verify that air quality impacts are acceptable for whichever EPC is selected, the following scenarios were considered.

COBRA's design:

- Combined cycle using natural gas (normal operation);
- Open cycle using natural gas (initial operation);
- Combined cycle using DDO (emergency only); and
- Open cycle using DDO (emergency only).

SEPCO III's design:
Combined cycle using natural gas (normal operation);

- Open cycle using natural gas (initial operation);
- Combined cycle using DDO (emergency only); and
- Open cycle using DDO (emergency only).

The Project emissions inventory is set out in *Table A2.1*. The location of the stacks and the associated buildings are set out in *Figure A2.1 and Figure A2.2*. Both EPC designs include the use of the Siemens SGT5-2000E turbine.

The model assumes that the Project will operate at a worst-case 100% capacity on a continuous basis throughout the year i.e. 8760 hours per year.

Table A2.1 Phase IV Project Emission Parameters

Parameter	Units	OCGT – Gas		OCGT - DDO		CCGT – Gas		CCGT – DDO	
		COBRA	SEPCO III	COBRA	SEPCO III	COBRA	SEPCO III	COBRA	SEPCO III
Number of Stacks		1	1	1	1	1	1	1	1
Stack height actual	m	40	35	40	35	55	57	55	57
Flue exit diameter	m	6.7	5.8	6.7	5.8	5.52	6.5	5.52	6.5
Emission velocity	m/s	35	46.9	31.6	42.3	23	16.6	23	18.5
Volume flow rate Normalised	Nm^3/s	395	396	342	342	391	392	342	342
Volume flow rate Actual	Am^3/s	1236	1244	1114	1116	551	546	612	608
Emission temperature	Celsius	561	563	496	497	99	94	149	147
SO_2	mg/Nm^3	0	0	164	164	0	0	164	164
NO_x	mg/Nm^3	51	51	152	152	51	51	152	152
PM_{10}	mg/Nm^3	0	0	50	50	0	0	50	50
Emission rates									
SO_2	g/s	0	0	56	56	0	0	56	56.1
NO_x	g/s	20.1	20.2	52	52	19.9	20	52	52
PM_{10}	g/s	0	0	17.1	17.1	0	0	17.1	17.1

Notes:
OCGT = Open Cycle Gas Turbine mode
CCGT = Combined Cycle Gas Turbine Mode

Figure A2.1 Location of Plants, Stacks and Buildings (COBRA Layout)

Red represents emission points /Blue represents buildings

ID	*Description*	*Height (m)*	*Diameter/ Length x Width (m)*	*ID*	*Description*	*Height (m)*	*Diameter/ Length x Width (m)*
1	Phase IV Steam Turbine Building	23.6	25 x 32.5	7	Phase III Gas Turbine Building	19.6	59.2 x 39.5
2	Phase IV HRSG	30.2	22.5 x 15.4	8	Phase III HRSG I + HRSG II	42.5	15.3 x 12.8
3	Phase IV Cooling	34.5	25 x 90	9	Tank A + Tank B	14.8	24.9
4	Phase IV Gas Turbine Building	18.1	34.9 x 14.1				
5	Phase III Cooling	34.5	42.6 x 95.5	A	Phase IV OCGT bypass stack	40	6.7
6	Phase III Steam Turbine Building	18.8	37.2 x 33.3	B	Phase IV CCGT stack	55	5.52

Figure A2.2 Location of Plants, Stacks and Buildings (SEPCOIII Layout)

Red represents emission points /Blue represents buildings

ID	*Description*	*Height (m)*	*Diameter/ Length x Width (m)*	*ID*	*Description*	*Height (m)*	*Diameter/ Length x Width (m)*
1	Phase IV Steam Turbine Building	20.5	18.5 x 35	7	Phase III Gas Turbine Building	19.6	59.2 x 39.5
2	Phase IV HRSG	38.7	16.2 x 25.1	8	Phase III HRSG I + HRSG II	42.5	15.3 x 12.8
3	Phase IV Cooling	36	38.7 x 66.7	9	Tank A + Tank B	14.8	24.9
4	Phase IV Gas Turbine Building	18.1 11.3	40 x 12.6 14 x 18.8				
5	Phase III Cooling	34.5	42.6 x 95.5	A	Phase IV OCGT bypass stack	35	5.8
6	Phase III Steam Turbine Building	18.8	37.2 x 33.3	B	Phase IV CCGT stack	57	6.5

A2.2 METEOROLOGICAL DATA USED IN THE MODEL

Meteorological data was sourced from Lakes Environmental in the form of AERMET-ready Weather Research and Forecasting[1] (WRF) data.
In line with IFC guidelines best practice, five years of hourly sequential meteorological data were used in the study, 2012 to 2016. This is to ensure that year on year meteorological variability was taken into account in the study. The wind roses produced from this meteorological data set are presented in *Figure A2.3* identifying that the prevailing wind direction is predominantly from the southwest for all years assessed. *Table A2.2* presents the average wind speed.

With the prevailing wind direction being almost exclusively from the southwest, air quality impacts from the Project will therefore be predominantly experienced to the northeast of the Project site for both short term and annual average concentrations.

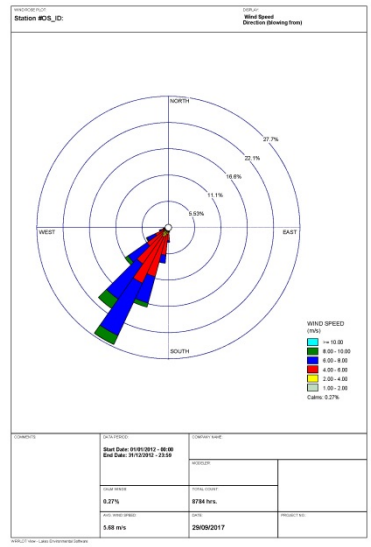
Table A2.2 Average Wind Speed (2012 – 2016)

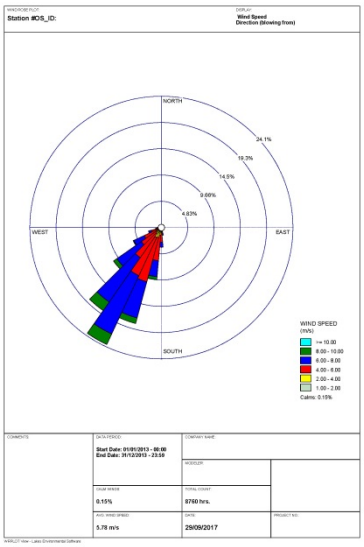
Month	Number of Hours Above 3m/s	Number of Hours Above 5.3m/s
January	673	430
February	648	426
March	708	501
April	467	464
May	682	471
June	672	499
July	665	463
August	679	384
September	635	251
October	682	322
November	695	394
December	662	355
Annual	**8079**	**4960**

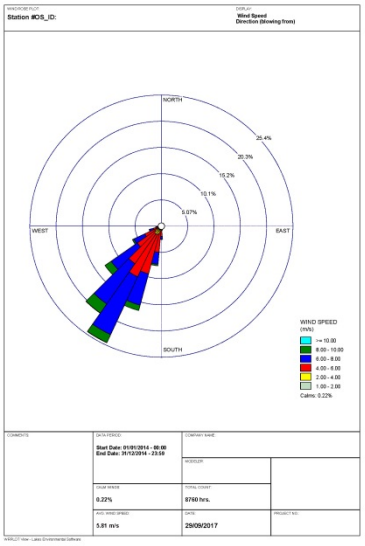
Source: Weather Research and Forecasting (WRF) meteorological data for the study area obtained through Lakes Environmental, 2012 – 2016. Processed through the USEPA AERMET program.

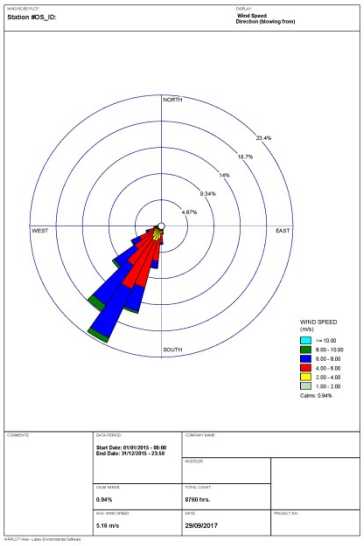
[1] The Weather Research and Forecasting (WRF) Model is a next-generation mesoscale numerical weather prediction system designed for both atmospheric research and operational forecasting applications.

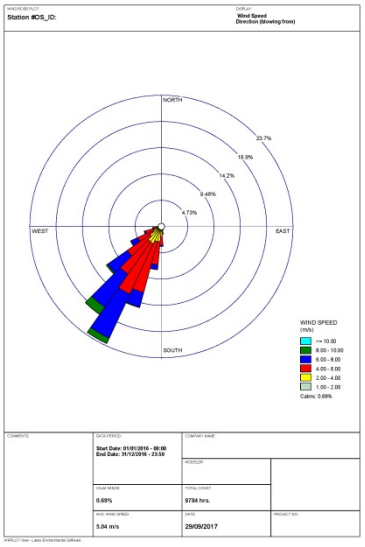
Figure A2.3 Wind Roses











Source: WRF data from 2012-2016

A2.3 CONVERSION OF NO_X TO NO_2

Emissions from the Project contain oxides of nitrogen, occurring as both nitric oxide (NO) and NO_2. The ratio of these two gases in the exhaust gases from combustion processes varies, but is typically in the ratio of 90-95% NO to 5 – 10% NO_2. With regard to the assessment of impact on human health NO_2 is the pollutant of interest as NO has little effect on human health at concentrations typically encountered in ambient air.

Within the atmosphere various processes oxidise NO to create NO_2 but this process will not occur quickly or completely before the plume reaches ground level. Therefore it is overly pessimistic to assume 100% conversion from NO to NO_2, and it is necessary to use a factor to estimate ground level concentrations of NO_2 based upon total NO_x emitted.

A number of international agencies have developed guidelines for including in assessments the conversion of NO to NO_2. A summary of selected guidelines are set out below in *Table A2.3* which indicates that a wide range of ratios to convert NO to NO_2 are recommended by a variety of agencies.

Table A2.3 Recommended NO to NO_2 Conversion Ratio

Country	Averaging Period	Recommended NO to NO_2 Conversion Ratio
United States	1 hour	80%
	Annual	75%
Germany	24 hour	60%
	Annual	60%
United Kingdom	Short term (1 hour)	35%
	Annual	70%
Hong Kong	24 hour	20%
	Annual	20%
Ontario, Canada	24 hour	52%
	Annual	68%

On the basis of those factors identified, the worst case is those derived by the USEPA. On this basis, an 80% conversion rate has been used for short term, whilst a 75% conversion rate has been used for long term. These conversion factors have been applied in the results interpretation.

A2.4 TERRAIN AND LAND USE

The land use and terrain around the Project will affect dispersion. Airflow over the ground is disturbed by protuberances into the air, for example buildings, trees, vegetation etc. The surface roughness length is a representation of the disruption of airflow close to the ground due to these obstructions. In this case, the land is characterised by open marshland, industrial and urban areas and for the main part open water.

Hills, mountains and valleys can affect dispersion by directing the plume. This only occurs to a significant degree where there is a sustained gradient of greater than 1 in 10. As this is not the case within the Study Area, terrain is not considered in this assessment.

A2.5 BUILDINGS

When air flow passes over buildings, a phenomenon known as building downwash occurs where the air is entrained in the lee of the building and drawn down to ground level. This effect can bring the plume from the stack down to ground level quicker than would otherwise be the case, and therefore increase the ground level concentration relative to a case where there are no buildings. Building effects are typically a consideration where the buildings are greater than one third the height of the stacks.

Phase IV plants includes associated buildings housing the generation equipment which have been included in the model. Where building dimensions were not identified in primary sources of information, these were calculated from aerial imagery. Details of the buildings included in the model are set out in *Figure A2.1* and *Figure A2.2*.

A2.6 MODEL DOMAIN

The dispersion model uses a Cartesian grid to determine the maximum PC and the PC arising at sensitive receptors and in each receptor classification. A grid of 20 km by 20 km, centred on the Project stack location has been used. A grid resolution of 50 m has been used within 5km of the plant, 100 m within 10 km from the plant and 200 m further afield (up to 20 km of the plant) in order to give sufficient grid density to capture the maximum impacts.

Annex B

Supporting Documentation for Noise Assessment

B1 NOISE BASELINE SURVEY

B1.1 INTRODUCTION

Baseline noise measurements have been carried out within the study area to measure the existing ambient noise environment. ENVAL carried out a baseline noise survey in September 2016. This was performed in order to assess the existing noise environment at the site boundary and closest noise sensitive receptors to the site.

B1.2 METHODOLOGY

Noise measurements were carried out during daytime over the period from the 21st to the 26th of September 2016. Similarly, night-time measurements were performed on the 11th and 12th of October.

A Class 2 sound level meter was used to measure noise levels. Measurements were carried out at a height of 1.5 m using a tripod, at least 3.5 m away from hard reflecting surfaces. The microphone was fitted with a windshield throughout. The sound level meter was calibrated prior to carrying out each survey and checked on completion of the survey; no significant drift was found to have occurred. Weather conditions during the survey period were dry and favourable to noise monitoring, with low levels of wind.

B1.3 MONITORING SITES

Monitoring was carried out at 3 boundary locations (points B1, B2 and B3) and 7 noise sensitive receptors (points 1-6 and 8), as shown in *Figure B1.1*. Noise sensitive receptors were chosen to represent the properties likely to be worst affected by noise from the plant. Boundary measurements were carried out to characterize and further aid the description of noise from the plant.

B1.4 RESULTS

The measured baseline noise levels are presented in *Table B1.1*. A summary of the baseline noise environment is included in the main report.

Figure B1.1 Measurement Locations

Table B1.1 Baseline Noise Measurements

Noise Monitoring Location/ Receptor	Date	Time	Daytime Noise Level (30 minutes, free-field), dB (1)				Commentary on the Noise Environment
			L_{Aeq}	$L_{Amax,f}$	L_{A10}	L_{A90}	
R1, Azito Village	22/09/2016	AM	54	70	55	46	During the daytime: distant sounds from the power plant, pedestrians and cars.
	23/09/2016	PM	50	62	52	45	
	22/09/2016	00.06 – 00.36	48	52	50	44	At night: distant sounds from the power plant, music from the village.
R2, Azito Village (southern end)	22/09/2016	11.50 – 12.20	52	65	54	47	During the daytime: people, cars, distant noise from the power plant.
	21/09/2016	14.30 – 15.00	49	61	51	45	
	11/10/2016	23.30 – 00.00	49	60	50	46	At night: distant noise from the power plant (noise dominated by the air condensers), people, dogs barking
R3, Recreational bars along the bank of the Ébrié lagoon	22/09/2016	11.15 – 11.45	50	53	51	48	During the daytime: the power plant.
	23/09/2016	13.50 – 14.20	47	52	49	46	
R4, CIE owned dwelling and recently built dwelling (after Phase I and II began operating) directly behind	23/09/2016	10.30 – 11.00	49	55	51	46	During the daytime: distant sound of the power plant, people.
	21/09/2016	17.30 – 18.00	51	56	52	49	
	11/10/2016	23.00 – 23.30	50	52	51	49	At night: distant sound of the power plant (especially the air condensers), people, dogs barking.
R5, Dwellings to the north and south of road leading to the plant	21/09/2016	16.54 – 17.24	55	64	60	48	During the daytime: people, (very few) cars, the power plant.
	21/09/2016	22.25 – 22.55	46	48	46	45	At night: people, music and noise from the power plant.

Noise Monitoring Location/ Receptor	Date	Time	Daytime Noise Level (30 minutes, free-field), dB (1)				Commentary on the Noise Environment
			L_{Aeq}	$L_{Amax,f}$	L_{A10}	L_{A90}	
R6, A small group of properties close to an abattoir to the northwest of the site	22/09/2016	10.30 – 11.00	59	74	61	53	During the daytime: distant sound of the power plant, pedestrian crossing and vehicles (very little traffic).
	21/09/2016	15.27 – 16.07	56	69	57	52	
	11/10/2016	21.41 – 22.11	54	63	55	53	At night: noise from the power plant, the Port of Abidjan extension site
R7, PetroCI office	22/09/2016	10.00 – 10.30	63	68	64	62	During the daytime: noise from the Foxtrot installation dominates.
	21/09/2016	16.11 – 16.41	64	66	65	61	
R8, Béago Village	23/09/2016	09.10 – 09.40	51	62	51	48	During the daytime: distant sound of the power plant, people.
B1 Boundary North	21/09/2016	12.57 – 13.57	72	74	73	71	
B2 Boundary East	21/09/2016	14.10 – 14.40	58	66	59	56	Plant noise dominates
B3 Boundary South	21/09/2016	12.20 – 12.50	69	70	69	68	

B2 CONSTRUCTION NOISE

B2.1 CONSTRUCTION NOISE METHODOLOGY

Noise from construction has been predicted using the 'activity L_{Aeq}' methodology in BS 5228-1 (1). This method uses a noise source level to account of the number and type of construction plant items that are likely to operate at the site during a particular construction phase. This standard provides a database of equipment noise source levels for this purpose which has been used.

The predictions have been based on a typical plant layout scenario. A sound power noise source level, L_{WA} of 125 dB has been used which represents the noisiest period of the main construction phases and includes excavators, vibratory compactors, dump trucks and a drop hammer piling rig working simultaneously. Noise from construction activities has been predicted assuming 50 percent of the intervening ground is acoustically soft (e.g. fields). The effect of screening from intervening structures has not been considered, which is conservative. Any construction works carried out at night will be limited to quiet activities which do not produce significant levels of noise at the nearest noise sensitive receptors.

Noise from construction traffic has been predicted using the method in BS 5228-1 for 'mobile plant using a regular well-defined route (e.g. haul route)'. The predictions have been based on the peak HGV traffic flow of approximately 30 trucks per hour which will continue for approximately 2 months whilst infill material is delivered to site.

Construction noise criteria are presented in *Section 5: Methodology.*

(1) BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites,- Part 1: Noise, BSi 2014

Annex C

Alternatives Assessment

C1 PROJECT ALTERNATIVES

C1.1 INTRODUCTION

For the Phase IV Expansion Project the main alternatives for consideration are the turbine design options and the site selection for the Project's temporary related facilities required for the construction phase.

C1.2 POWER GENERATION

The base design case for power generation a new gas turbine train operating primarily in combined cycle mode. The gas turbine train will operate in open cycle configuration for approximately 12 months until the plant achieves combined cycle commercial operation in the second half of 2019. The gas turbine will be operated primarily on natural gas, with the option to utilise diesel fuel as backup fuel during emergencies. The combined-cycle operation will have an output of approximately 250 - 335 MW_e and will be of a standard industrial turbine design.

This assessment of alternatives evaluates: i) turbine type; ii) configuration of turbines and energy recovery; iii) NO_x control method, and iv) fuel type.

Note that additional options for power generation (e.g. reciprocating engines) have not been considered as technically feasible as continuity with the existing plant design (i.e. gas turbines) is considered a design priority.

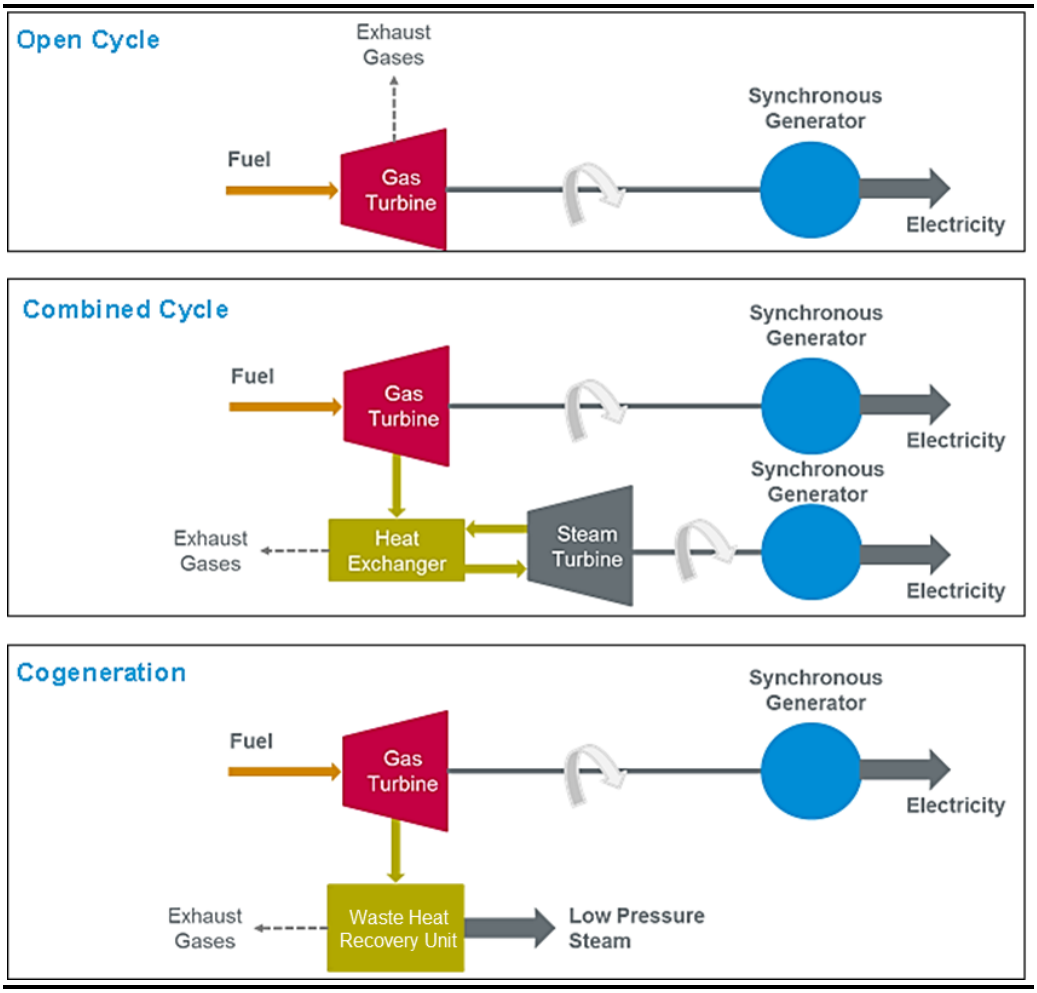
C1.2.1 Turbine Configuration

The Project can be operated in open cycle or combined cycle mode also called the cogeneration mode (see *Figure C1.1*).

'Open cycle' essentially refers to a standard industrial gas turbine operating in basic mode (with no recycling or heat recovery). The design complexity is lower than for other turbine configurations and the capital costs are lower too. However, open cycle configuration is less efficient than combined cycle, thus requiring additional fuel usage to supply the power needed.

The combined cycle system incorporates two types of turbines (gas turbine and steam turbine) into one generation unit to maximise energy efficiency. The first cycle is used to produce energy with the waste heat remaining used in a boiler to produce superheated steam. The steam is then put through a steam turbine, producing additional power. There are significant efficiency gains in using a combined-cycle turbine compared to open cycle systems. The addition of a second cycle allows for heat, which would otherwise have been emitted through the exhaust and wasted, to be used to create additional power.

Figure C1.1 Turbine Configuration



C1.2.2 NO_x Control

In addition to turbine type and turbine configuration it is noted that alternative options exist with respect to NO_x control. The Project is committed to meeting the standards identified in the IFC EHS guidelines (see *Table C1.4*). Depending on the turbine selected the manufacturers recommended NO_x control method will be implemented.

C1.2.3 Fuel Type

The gas turbine to be used for the Project will be designed to operate on both gaseous and liquid fuel. Emissions to air from the combustion of gaseous fuels are much lower than for combustion of liquid fuels. For this reason, the Project's use of natural gas as the primary fuel source is considered the best environmental option and no further evaluation has been included.

C1.2.4 Azito Phase IV Alternative Options Evaluated in this Section

A range of options and combinations have been selected to represent a realistic range of plausible alternatives to the base case that could be viable as summarised below (*Table C1.1*).

Table C1.1 Potential Options for Gas Turbine

	Base Case (Option 1)	Option 2	Option 3	Option 4
Turbine Configuration				
Combined Cycle	✓		✓	
Open Cycle		✓		✓

The selection criteria considered with respect to turbine type and configuration are:

- power generation requirements;
- emission performance requirements;
- overall efficiency;
- water discharges, waste streams and potential disturbance (e.g. noise); and
- CAPEX and OPEX (predominantly related to raw material requirements).

For all turbine options and configurations noise generation and wastewater emissions will comply with IFC EHS Guidelines and will not therefore be a determining factor between the different options. Taking into consideration the power generation requirements, for the assessment options comprise one standard industrial turbine and two aeroderivative turbines in open cycle or combined cycle configuration.

A summary of the performance of each option is provided in *Table C1.2.* This confirmed a standard industrial turbine in combined cycle configuration is an appropriate technology choice.

Table C1.2 Summary of the Performance of Each Option against the Appraisal Objectives

Option	Performance Against Objectives		
	Emissions	**Cost**	**Efficiency**
Option 1 (Base Case)	Average	Average	Good
Option 2	Average	Good	Poor
Option 3	Average-Poor	Poor	Average
Option 4	Average-Poor	Poor	Average

A discussion of the specific environmental performance of each alternative against the objectives is provided in *Table C1.3.*

Table C1.3 Performance of Alternatives

Option	Performance Against Objectives		
	Emissions	**Cost**	**Efficiency**
1 (base case)	• Meets international and Ivorian emission limits • Manufacturer recommended NO_x control measures will be installed if required	• Ranked #2 for CAPEX • Ranked #1 for OPEX • Standard industrial turbines are typically cheaper than aeroderivative turbines. • Combined cycle is more expensive that open cycle. • OPEX differences relate primarily to fuel requirements.	• Ranked #1 for efficiency • Combined cycle is more efficient than open cycle.
2	• Emission rates will be comparable to Option 1	• Ranked #1 for CAPEX • Ranked #2 for OPEX • Standard industrial turbines are typically cheaper than aeroderivative turbines. • Open cycle is cheaper than combined cycle. • Open cycle is less efficient than combined cycle requiring additional fuel to supply the required power.	• Ranked #4 for efficiency • Less efficient than aeroderivative turbines. • Open cycle is less efficient than combined cycle.
3	• Emissions rate will be comparable to Option 1 however an additional turbine is required increasing overall emissions generated	• Ranked #4 for CAPEX • Ranked #3 for OPEX • Aeroderivative turbines are typically more expensive and two turbines would be required to meet requirements. • Combined cycle is more expensive than open cycle.	• Ranked #2 for efficiency • Combined cycle is more efficient than open cycle. • Aeroderivative turbines are more efficient.
4	• Emissions rate will be comparable to Option 1 however an additional turbine is required increasing overall emissions generated	• Ranked #3 for CAPEX • Ranked #4 for OPEX • Aeroderivative turbines are typically more expensive and two turbines would be required to meet requirements. • Open cycle is cheaper than combined cycle.	• Ranked #3 for efficiency • Aeroderivative turbines are more efficient. • Open cycle is less efficient than combined cycle.

C1.2.5 Turbine Selection

There are several models and classes of turbines available in the market; however, there is very little difference in the environmental performance between the newest models. Currently the Project is evaluating both 'E-class' and 'F-class' turbines from various manufacturers.

All of the designs being considered can achieve the IFC EHS Guidelines. *Table C1.4* provides a summary of the applicable emission limits outlined in the General IFC EHS Guidelines and IFC EHS Guidelines for Thermal Power Plants.

Table C1.4 Comparison to Applicable Emission Limits for Combustion Turbines (>50MW$_{th}$)

Source	Fuel	Emission Limits	Compliant?
Air			
IFC EHS Guidelines Thermal Power Plants (2008)	Natural Gas	NO_x: 51 mg/Nm^3 (25 ppm)	✓
	Fuels other than Natural Gas	Particulate Matter: 50 (non-degraded airshed), 30 (degraded airshed)	✓
		Sulphur dioxide (SO_2): Use of 1% or less S fuel (non-degraded airshed), use of 0.5% or less S fuel (degraded airshed)	✓
		NOx: 152 mg/Nm3 (74 ppm)	✓
Noise			
IFC General EHS Guidelines (2007)	N/A	Noise: Equivalent level 85dB LA_{eq},8h	✓
Wastewater[a]			
IFC EHS Guidelines Thermal Power Plants (2008)	N/A	**Parameter** / **mg/L, except pH and temp** pH: pH 6-9 TSS: 50 Oil and grease: 10 Total residue chlorine: 0.2 Chromium total (Cr): 0.5 Copper (Cu): 0.5 Iron (Fe): 1 Zinc (Zn): 1 Lead (Pb): 0.5 Cadmium (Cd): 0.1 Mercury (Hg): 0.005 Arsenic (As): 0.5 Temperature increase by thermal discharge from cooling system: Site specific requirement to be established by the EA. Elevated temperature areas due to discharge of once-through cooling water (e.g., 1°C above, 2°C above, 3°C above ambient water temperature) should be minimized by adjusting intake and outfall design through the project specific EA depending on the sensitive aquatic ecosystems around the discharge point.	✓
Greenhouse Gases			
	N/A	GHG quantification and inventory	✓

Note:
a) Applicability of heavy metals should be determined in the ESIA (or EA). Effluent guidelines are applicable for direct discharges of treated effluents to surface waters for general use. Site-specific discharge levels may be established based on the availability and conditions in the use of publicly operated sewage collection and treatment systems or, if discharged directly to surface waters, on the receiving water use classification as described in the General EHS Guideline.

C1.3 RELATED FACILITIES FOR CONSTRUCTION

This Section provides a summary of relevant requirements for the siting of the Project's related facilities to minimise the potential for impacts on the environment and communities, and achieve design outcomes.

Related facilities (also described in *Section 2: Project Description*) required during the construction phase include a temporary laydown area, an access road and if relevant the establishment of a camp. It is noted that the need for a temporary purpose-built camp to accommodate the construction workforce has not yet been established. It is possible that construction workers will be housed in existing lodging in the surrounding communities, for example Azito and Béago villages.

Whilst it is assumed that these related facilities will be located within the vicinity of the existing plant, given that the Project is still at a conception stage, the exact location has yet to be determined, with several options currently under consideration by the Design Team and construction Team.

Therefore, a site selection assessment will be undertaken to identify and review potential sites having regard to social, environmental and economic considerations (see *Figure C1.2*).

IFC PS provides some overarching environmental & social principles that are relevant to the siting of related facilities. Note that IFC PS is integrated in the ESIA and taken into account in preparing the Environmental and Social Impact Assessment (see *Annex D*).

The Principles for siting and design that underlie the Project's approach to the establishment of these temporary related facilities during construction are summarised below:

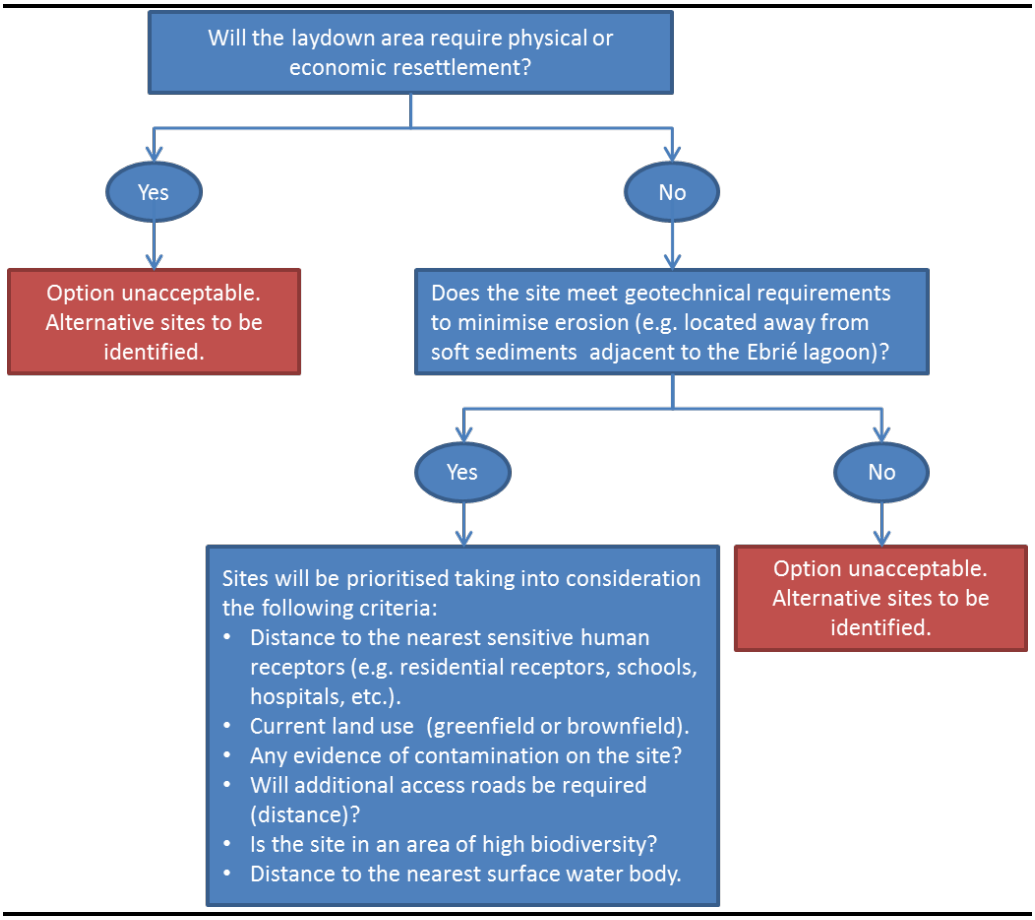
- **Principle 1:** Avoid physical displacement of people and avoid or minimise economic displacement of people;
- **Principle 2:** Avoid loss of biodiversity in areas of critical and natural habitat and avoid or minimise environmental loss of biodiversity in modified or natural habitats;
- **Principle 3:** Avoid disruption of water features;
- **Principle 4:** Undertake stakeholder engagement to inform relevant stakeholders on the sitting decisions as part for the Stakeholder Engagement Plan of the Project.

The siting and design should be primarily consistent with these principles. The potential to utilise an area within the adjacent port at Abidjan is also being investigated.

The final site will be selected based on these Principles to avoid impacts to sensitive receptors as detailed below.

The site selection process identified below will be used to identify an appropriate location for the temporary laydown area.

Figure C1.2 Site Selection Process Flow Chart



Annex D

Environmental and Social Management Plan (ESMP)

Ref No	Aspect	Potential Impact Managed	Priority	Management Control	Responsibility - Organisation	Responsibility - Individual	How has implementation been documented?
E-1	Air quality	Human health impacts from gas turbine emissions during operations	High	When combusting natural gas, the emission rate for NO_x will not exceed 51 mg/Nm^3, where normalised conditions are dry and 15% O_2. When combusting liquid fuel, the emission rate for NOx will not exceed 15mg/Nm^3, where normalised conditions are dry and 15% O_2. (Stack height required to maintain process contributions to ambient concentrations of pollutants below 25% of the air quality guideline values.)	EPC	Design team	EPC Technical Specification, Doc II, Annex 6, Performance Guarantees
E-2	Air quality	Human health impacts from gas turbine emissions during operations	High	The gas turbine selected will comply with the IFC/World Bank emissions guidelines for power generation when combusting diesel fuel. Per the guidelines, this means that the liquid fuel combusted will have a sulphur content of 1% or less.	Azito Energie	Management	PPA, Fuel Specification
E-3	Air quality	Human health impacts from gas turbine emissions during operations	High	The HRSG stack height will be designed for a minimum height of 55 m (from ground level). The OCGT exhaust stack height will be designed for a minimum height of 40 m (from ground level). (Stack height required to maintain process contributions to ambient concentrations of pollutants below 25% of the air quality guideline values.)	EPC	Design team	EPC Technical Specification Exhibit 1
E-4	Noise	Noise impacts from construction activities of Phase IV	Low	To reduce construction noise emissions, implement best possible means to minimise noise and vibration from the site at all times and special consideration shall be given to the methods used to control noise at source. Consider methods such as the following to achieve noise limit: •Use alternatives to audible reversing alarms, such as visual and/ or broadband noise indicators that provide a safe system of work; or configuring the Project work sites to maximise forward movements of mobile plant. •Onsite chutes and bins will be lined with damping material. •Use of compressors, generators and pumps fitted with properly lined and sealed acoustic covers or enclosures, which will be kept closed whenever the machines are in use. •Fitting of mufflers or silencers of the type recommended by manufacturers.	EPC	Design team and the construction team	Include name of design document EPC Technical Specification Exhibit 1
E-5	Social	Worker health and safety	High	Design, construct and manage any worker accommodation in line with the standards outlined in the EBRD Workers' Accommodation: Processes and Standards dated 2009.	EPC	Design team	EPC Technical Specification Exhibit 8, Environmental and Social Requirements
E-6	Surface water	Degradation of surface water quality	High	Discharge of effluents will only be undertaken following treatment to meet national standards and IFC/World Bank discharge guidelines. (See Table 3.8 from the ESIA for the discharge standards that must be met.) All discharges to the external environment will be subject to granting of the necessary permits from the relevant authorities.	EPC	Design team and the construction team	EPC Technical Specification Exhibit 1
E-7	Surface water	Degradation of surface water quality	High	There will be no direct discharge of sanitary effluents from the construction site. Sanitary wastewater will be treated in a mobile sewage treatment facility and sludge disposed of through an approved contractor.	EPC	Design team and the construction team	EPC Technical Specification Exhibit 8, Environmental and Social Requirements
E-8	Unplanned events	Environmental and social impacts associated with a spill or loss of containment	High	Design the site to include good site management practices to ensure that the products are properly stored on site (e.g. secondary containment, double walled tanks, over filling alarm system, etc.).	EPC	Design team	EPC Technical Specification Exhibit 1

Ref No	Aspect	Potential Impact Managed	Priority	Management Control	Responsibility - Organisation	Responsibility - Individual	How has implementation been documented?
E-9	Unplanned events	Environmental and social impacts associated with an accidental release from the gas supply pipeline.	High	Ensure the gas supply pipeline, within the Azito site boundary, is buried to a minimum depth of 1 m.	EPC	Design team	EPC Technical Specification Exhibit 1
E-10	Unplanned events	Environmental and social impacts associated with an accidental release from the gas supply pipeline.	High	Ensure the buried pipeline is indicated on site with marks or plots and that people working nearby are aware of the pipeline route.	EPC	Design team	EPC Technical Specification Exhibit 1
E-11	Unplanned events	Environmental and social impacts associated with an accidental release from the gas supply pipeline.	High	For aboveground section of the pipeline, ensure access to the pipeline is restricted (e.g. barriers, plots).	EPC	Design team	EPC Technical Specification Exhibit 1
E-12	Unplanned events	Environmental and social impacts associated with major escalated event related to the DDO Tank	High	Ensure design includes periodic purge of water inside tanks (prevents boil-over to occur)	EPC	Design team	EPC Technical Specification Exhibit 1
E-13	Unplanned events	Environmental and social impacts associated with major escalated event related to the DDO Tank	High	Vents appropriately sized on the tanks to prevent pressurisation in case of a fire (prevents fireball to occur)	EPC	Design team	EPC Technical Specification Exhibit 1
E-14	Unplanned events	Environmental and social impacts associated with major escalated event related to the DDO Tank	High	Ensure design includes control of ignition sources.	EPC	Design team	EPC Technical Specification Exhibit 1

Ref No	Aspect	Potential Impact Managed	Priority of Impact Managed	Management Control	Responsibility - Organisation	Responsibility - Individual	Completion indicator	Type of action (e.g. management action, monitoring, meetings, training)	Timeframe for completion	Cost estimate
P-1	Air quality	Human health impacts from gas turbine emissions during operations	High	If the Phase IV site layout and/or turbine exhaust characteristics change from those previously modelled, revised air dispersion modelling will be conducted to verify that predicted impacts to air quality do not increase from those presented in the ESIA. If this modelling indicated ground level concentrations exceeding the ambient air quality guideline values, the design will be modified to improve dispersion and bring predicted ground level concentrations to within guidelines.	Azito Energie	HSE Advisor	Air dispersion modelling indicating compliance	Management action	1 month	<$10K
P-2	Noise	Noise impacts from operation of Phase IV	High	Conduct modelling using a reputable model, e.g. SoundPlan, to confirm the selected design (including the substation) meets the Project's commitments for noise levels at the identified noise sensitive receptors. Specifically, the following noise levels shall be met by Phase IV (as demonstrated through the modelling):Conduct modelling using a reputable model, e.g. SoundPlan, to confirm the selected design (including the substation) meets the Project's commitments for noise levels at the identified noise sensitive receptors. Specifically, the following noise levels shall be met by Phase IV (as demonstrated through the modelling): **Receptor** — **Target Noise Level, $L_{Aeq,1h}$ dB** R1. *Azito Village* — 44 R2. *Azito Village (S)* — 45 R3. *Recreational bars by lagoon* — 46 R4. *CIE owned dwellings* — 45 R5. *Dwellings to N & S of the plant access road* — 45 R6. *properties close to abattoir (NW of site)* — 45 R7. *PetroCI office* — 55 R8. *Beago Village* — 45	EPC	HSE Advisor	Noise modelling indicating compliance	Management action	1 month	<$50K
P-3	Noise	Noise impacts from operation of Phase IV	High	Review the EPC's noise modelling to confirm the performance guarantees are met.	Azito Energie	HSE Advisor	Noise modelling indicating compliance	Management action	1 month	<$10K
P-4	Noise	Noise impacts from operation of Phase IV	High	Submit the results of the noise modelling to ANDE.	Azito Energie	HSE Advisor	Noise modelling indicating compliance	Management action	1 month	<$10K
P-5	Social	Interaction with Local Communities and Communicable Diseases & Workers Influx and Sociocultural Changes	Medium	Develop a Code of Conduct and deliver training on it to the workforce prior to commencing construction activities. The Code of Conduct will include specific guidelines on worker-community interactions and worker interactions. It will detail rules to be upheld to minimise the risk of anti-social behaviours. Appropriate disciplinary procedures will be developed and enforced to ensure that the Code of Conduct is upheld by all Project contractors and subcontractors.	EPC	HSE	Code of Conduct developed	Management action	1 month	<$10K
P-6	Social	Interaction with Local Communities and Communicable Diseases	Medium	Review the EPC Code of Conduct to ensure that requirements and procedures are adequately addressed by the EPC contractor.	Azito Energie	HSE	Code of Conduct reviewed	Management action	1 month	<$10K
P-7	Social	Interaction with Local Communities and Communicable Diseases	Medium	As part of Azito's Community Development Programme seek collaboration with existing AIDS prevention programmes in Côte d'Ivoire to develop initiative (as feasible).	Azito Energie	HSE	Conjoint Actions developed	Management action	As required	<$10K
P-8	Social	Cultural Heritage	Low	Although the potential risk of encountering buried archaeology is low, the Project will operate a Chance Finds procedure in accordance with IFC Performance Standard 8.	EPC	HSE Advisor	Chance find procedure developed	Management action	1 month	<$10K
P-9	Social	Direct employment opportunities and skills enhancement	Medium	Develop an Employment Plan that sets out requirements and procedures to be followed when identifying and developing Project's employment opportunities, managing employees, recording and reporting employment data, terminating work contracts, and other labour-related issues. This Plan will comply with the national Labour Code and IFC Performance Standard 2 on Labour and Working Conditions and with	EPC	HR	Employment Plan developed	Management action	2 months	<$10K
P-10	Social	Direct employment opportunities and skills enhancement	Low	Review the EPC Employment Plan to verify that requirements and procedures are adequately addressed by the EPC contractor.	Azito Energie	HSE	Employment Plan reviewed	Management action	2 months	<$10K
P-11	Social	Direct employment opportunities and skills enhancement	Medium	Integrate the Employment Plan related activities as part of the Project's Stakeholder Engagement Plan (SEP) to ensure that relevant stakeholders are adequately engaged and that this is communicated to the EPC contractor.	Azito Energie	HSE	Employment Plan stakeholder related activities included in the SEP	Management action	1 month	<$10K
P-12	Social	Local procurement	Medium	Prior to construction, develop a Local Content Plan which will set out requirements and procedures to be followed for procurement and employment activities, and identify if feasible initiatives that support local capacity building of Small and Medium-sized Enterprises. Plan to be reviewed and developed in conjunction with Azito O&M SED manager.	EPC	HR	LPC developed	Management action	6 months	<$10K
P-13	Social	Local procurement	Medium	The Project will support the EPC Contractor on the implementation of the Local Content Plan.	Azito Energie	HSE	Minutes of meetings record	Meeting	As required	<$10K
P-14	Social	Potential Loss of Livelihood due to Temporary Land Leasing	Low	Prepare a Siting Plan for review and approval by the owner. The siting plan will demonstrate that specific siting requirements for road access, temporary worker camp, and laydown area are met as follows: • The land take avoids any displacement of peoples' homes and their community facilities (i.e. wells); • The land take avoid highly productive agricultural land (these type of area are not found within 2 km from the site but could be identified in the rest of the AoI). • Any associated impacts with this temporary land take are assessed and adequate mitigation developed; • The footprint of construction works will be limited to the minimum required area; and • A plan for decommissioning the site in-line with IFC PS and with Cote d'Ivoire law.	EPC	HSE Advisor	sitting plan developed	Management action	2 months	<$10K
P-15	Social	Potential Loss of Livelihood due to Temporary Land Leasing	Medium	Ensure that workers will be provided with primary health care, sanitation and clean water in the construction camp.	EPC	HSE Advisor	Monitoring record	Monitoring	Bi-annually	<$10K
P-16	Social	Pressure on Infrastructure, Resources and Services	Medium	Liaise with the Azito Energie to develop actions to limit pressure on local infrastructures as much as possible.	EPC	HSE Advisor	Minutes of meetings record	Meeting	As required	<$10K

Ref No	Aspect	Potential Impact Managed	Priority of Impact Managed	Management Control	Responsibility - Organisation	Responsibility - Individual	Completion indicator	Type of action (e.g. management action, monitoring, meetings, training)	Timeframe for completion	Cost estimate
P-17	Social	Pressure on Infrastructure, Resources and Services	Medium	Through stakeholder engagement and frequent contact with local service providers monitor the situation on the ground to identify any changes to infrastructure use and pressure on services. If it is identified that presence of the construction workforce is putting pressure on them, Azito Energie will develop a mitigation plan to address this, in collaboration with local authorities.	Azito Energie	HSE	Minutes of meetings	Meeting	As required	<$10K
P-18	Social	Pressure on Infrastructure, Resources and Services	Medium	On the basis of SEP activities liaise with the EPC contractor to develop action to limit pressure on local services and infrastructures as much as possible.	Azito Energie	HSE	Action Plan developed	Management action	2 months	<$10K
P-19	Social	Pressure on Infrastructure, Resources and Services	Medium	Promote the implementation of joint planning approaches with government and other key stakeholders for infrastructure projects where possible.	Azito Energie	HSE	Action Plan developed	Management action	As required	<$10K
P-20	Social	Pressure on Infrastructure, Resources and Services	Medium	Develop a Health and Safety Management Plan (H&S) in line with applicable national law and IFC Guidelines and with Cote d'Ivoire law which should be supported and implemented by the following procedures and documents in line with good practices (i.e. IFC Performance Standards) at a minimum: o Risk Audit document; o Emergency response planning procedure; o Job Hazard Analysis and Permit to Work systems; o Occupational H&S specific procedures related at a minimum to worker fatigue, lifting activities; being crushed between moving objects; noise, cuts. o Training Programme; o Medical examination Program: to ensure that pre-employment and an annual occupational health medical examinations are conducted by a qualified occupational health physician in line with Cote d'Ivoire law and the exposure of the job. All members of the construction workforce will be certified as medically fit to do their work. o Subcontractor screening procedure to adequately review and approve sub contractors' H&S plans prior to any activities i.e. construction activities. • Those procedures should be validated by the Project and communicated to the all workers and subcontractors prior to any activities. • Ensure that those plans are pragmatic and informed by the Job Hazard Analysis.	EPC	HSE Advisor	H&S Plan developed	Management action	1 month	<$10K
P-21	Social	Pressure on Infrastructure, Resources and Services	Medium	Develop a Security Management Plan (SMP) containing measures to protect the project facilities and personnel against potential violent protest or social unrest in line with the UN Voluntary Principles for Security and Human Rights. The security system will include, among other things, selection or personnel based on a careful background screening, training with regards to human rights requirements, and monitoring of performance. Ensure that SMP is aligned and coordinated with current Azito security arrangements.	EPC	HSE Advisor	SMP developed	Management action	2 months	<$10K
P-22	Social	Workers Health and Safety and Security	Medium	Establish strict procedures facilitating the reporting of health and safety incidents and ensuring that any reported incidents are addressed in an appropriate and culturally sensitive manner.	EPC	HSE Advisor	Incident identification, reporting, and follow up procedure clearly defined.	Management action	1 month	<$10K
P-23	Social	Workers Health and Safety and Security	Medium	Review the H&S Management Plan and SMP prepared by the EPC and verify that this Plan is in-line with Ivorian Law and IFC Performance Standards and Guidelines. Verify that procedures for reporting are being implemented and appropriate action being taken to address incidents.	Azito Energie	HSE Advisor	H&S and SMP reviewed	Management action	1 month	<$10K
P-24	Social	Workers Influx and Sociocultural Changes	Low	Implement a no hiring 'at the gate' policy when hiring construction workforce: It will be made clear that there will be no recruitment of workforce and people "at the gate", and the formal recruitment process will be clearly advertised, so as to discourage settlement of opportunistic demands and tension.	EPC	HSE Advisor	No hiring at the gate procedure implemented	Management action	1 month	<$10K
P-25	Social, Biodiversity	Potential Loss of Livelihood due to Temporary Land Leasing, Habitat Loss from Construction	Low	Review the EPC's Siting Plan for the establishment of the construction facilities to verify that requirements and procedures are adequately addressed by the EPC contractor.	Azito Energie	HSE Advisor/CLO	Sitting plan reviewed	Management action	1 month	<$10K
P-26	Surface water	Degradation of surface water quality	Medium	Prior to construction, develop a site Drainage Management Plan to reduce uncontrolled runoff into the neighbouring environment from the site during construction, in particular the plan should include the following provisions: • Minimise the amount of land left bare and re-vegetating any slopes as quickly as possible. • Any temporary stockpiles should be protected from erosion by using a reduced slope angle where practical, and by incorporating sediment traps in drainage ditches. • Long-term stockpiles will be seeded to prevent erosion and to maintain soil quality. • Surface water management structures within the construction areas must include silt fencing, silt traps, stream diversion channels, internal run-off capture and diversion channels, to control sedimentation where necessary. • Inspections will be carried out during the course of the works, and upon completion of Project activities to verify the effectiveness of erosion and surface water management measures being implemented.	EPC	HSE Advisor	Drainage Management Plan developed	Management action	2 months	<$10K

Ref No	Aspect	Potential Impact Managed	Priority of Impact Managed	Management Control	Responsibility - Organisation	Responsibility - Individual	Completion indicator	Type of action (e.g. management action, monitoring, meetings, training)	Timeframe for completion	Cost estimate
P-27	Unplanned events	Community health and safety impacts associated with a traffic accident	High	Develop a Traffic Management Plan for construction that includes: • an Emergency Procedure, taking into account potential impacts on local communities and measures needed to ensure the safety and security of individuals in this regard; • provision of a traffic plan for heavy equipment/major items during construction by the EPC contractor to be made available to concerned stakeholders; • provision of a traffic access map to send to all contractors and suppliers involved in the construction phase; • restricting the speed of construction vehicles; • consideration of the reduction of heavy goods vehicles during the morning, afternoon and evening peak/rush hour times; • provision of sufficient advanced notice of all traffic diversions and road closures, together with details of whom to contact at the construction site in the case of complaints; • clear signing of all diversions; • requirements for driver behaviours, competency and training (i.e. they don't just have to have a drivers licence); and • vehicle specifications to include safety controls such as reversing alarms and use of a spotter when reversing a heavy vehicle with large blind spots. • If the transportation of material will be by boat the Traffic Management Plan should include avoidance measures for fishing areas.	EPC	HSE Advisor	Traffic Management Plan developed	Management action	2 months	<$10K
P-28	Unplanned events	Community health and safety impacts associated with a traffic accident	High	Prior to construction, review the EPC Traffic Management Plan to ensure that requirements and procedures are adequately addressed by the EPC contractor. Integrate the Traffic Management Plan related activities as part of the Project's Stakeholder Engagement Plan (SEP) to ensure that relevant stakeholders are adequately engaged. It is recommended to formalise and centralise communication through a Community Liaison Officer. As part of the Project SEP implement a grievance mechanism that will be communicated to relevant stakeholders so that to collect and address as required grievances in line with IFC PS and with Cote d'Ivoire law.	Azito O&M	HSE Advisor/CLO	Record of reviewed Minutes of meetings record	Management action	1 month	<$10K
P-29	Unplanned events	Environmental and social impacts associated with a spill or loss of containment	High	Develop Emergency Response Plan for Phase IV construction activities.	EPC	HSE Advisor	Emergency Response Plan developed	Management action	2 months	<$10K
P-30	Unplanned events	Environmental and social impacts associated with a spill or loss of containment	High	Review EPC Emergency Response Plan for Phase IV construction activities.	Azito Energie	HSE Advisor	Emergency Response Plan reviewed	Management action	1 month	<$10K
P-31	Unplanned events	Environmental and social impacts associated with unplanned leaks/emissions from vehicles.	High	Develop Vehicle Maintenance Plan.	EPC	HSE Advisor	Vehicle Maintenance Plan developed	Management action	2 months	<$10K
P-32	Unplanned events	Environmental and social impacts associated with unplanned leaks/emissions from vehicles.	High	Review Vehicle Maintenance Plan.	Azito Energie	HSE Advisor	Vehicle Maintenance Plan reviewed	Management action	1 month	<$10K
P-33	Unplanned events	Injury to a community member from unauthorised access during construction.	High	Develop Site Security Plan	EPC	HSE Advisor	Site Security Plan developed	Management action	2 months	<$10K
P-34	Unplanned events	Injury to a community member from unauthorised access during construction.	High	Review Site Security Plan	Azito Energie	HSE Advisor	Site Security Plan reviewed	Management action	1 month	<$10K
P-35	Unplanned events	Injury to a community member from unauthorised access during construction.	Medium	If the adjacent port will be used, review the port's security access measures and confirm that access is restricted.	Azito Energie	HSE Advisor	Port security documentation	Management action	1 month	<$10K
P-36	Unplanned events	Environmental and social impacts associated with major escalated event related to the DDO Tank	High	Update/verify that the site's Emergency Response Plan includes measures to manage potential oil spillage and fires on site (detection, firefighting, evacuation) associated with DDO storage.	Azito Energie	HSE Advisor	Emergency Response Plan	Management action	1 month	<$10K
P-37	Unplanned events	Environmental and social impacts associated with major escalated event related to the DDO Tank	High	Revise existing site Emergency Response Plan to include Phase IV operations activities. This should specifically include the following measures when combusting DDO: - operational measures to reinstate normal operation (on gas) as soon as possible; - information of local authorities and the local communities to alert them of the risk of significant air quality impact, so that they can take measure to limit their exposure to air pollutants (e.g. by reducing outdoor physical activity); - continued ambient air quality monitoring to document impacts on air quality from DDO operation	Azito Energie	HSE Advisor	Emergency Response Plan	Management action	1 month	
P-38	Waste Management	Environmental and social impacts associated with the incorrect handling of waste	Medium	A detailed Waste Management Plan (WMP) will be developed for the construction phase of Phase IV. The Waste Management Plan will include requirements related to: • The application of a waste mitigation hierarchy (i.e. 1) prevention, 2) re-use, 3) recycling, 4) recovery, 5) disposal); • waste minimisation through measures such as using less material in design, reduction (e.g. keeping products for longer or designing to last longer), and reuse; • the promotion of waste recycling, particularly used oils, containers, equipment, paper, plastics; • information on the storage and retention of hazardous liquid waste; • the sorting and separation of hazardous and ordinary waste, providing clear, understandable differentiation of wastes; • storage and treatment of waste undertaken in a manner that protects the environment: use of specific installations, authorisation prior to burying waste, accreditation of specialised companies; and • the traceability of hazardous waste, detailing the type of waste, quantity and identification of both carrier and destination. The WMP should also consider any lessons learned regarding waste management during the previous phases.	EPC	HSE Advisor	Waste water management plan	Management action	2 months	<$10K
P-39	Waste management	Environmental and social impacts associated with the incorrect handling of waste	Medium	Waste management contractors will be selected based on capabilities and quality of service, and audited to ensure that wastes are being managed in a manner compliant with Ivorian Law, international good practice, and Azito Energie contract requirements.	EPC	HSE Advisor	Records of review	Management action	1 month	<$10K
P-40	Waste management	Environmental and social impacts associated with the incorrect handling of waste	Medium	The current companies responsible for the waste collection will be contacted to determine how wastes are being managed.	Azito Energie	HSE Advisor	Records of review	Management action	1 month	<$10K

Ref No	Aspect	Potential Impact Managed	Priority of Impact Managed	Management Control	Responsibility - Organisation	Responsibility - Individual	Completion indicator	Type of action (e.g. management action, monitoring, meetings, training)	Frequency	Cost estimate
C-1	Air quality	Impacts on local communities related to dust emissions	Medium	Employ dust prevention measures during construction to minimise impacts on local communities to dust. These measures include: • Select routes to maximise use of paved roads and avoid unpaved roads; • Keep vehicles clean to avoid tracking dirt around and off the site; • Cover vehicles transporting friable materials; • Cover exposed ground and earthworks areas where practicable; • Use localised dampening and activity specific dampening to reduce localised emissions of dust; • Minimise stockpiling of material; • Locate any stockpiles as far away from offsite residences as much as practicable; • Use water sprays when tipping friable fill material; and • Erect wind breaks around the key construction activities and, if possible, in the vicinity of potentially dusty works.	EPC	HSE Advisor	Inspection records	Management action	Continuously	<$10K
C-2	Air quality	Impacts on local communities related to dust emissions	Medium	Monitor and supervise the EPC contractor during construction to verify that dust control measures are being implemented in-line with the Project's requirements	Azito Energie	HSE Advisor	Audit record	Audit	Every 6 months	<$10K
C-3	Air quality	Impacts on local communities related to dust emissions	Medium	Verify that the as built design of Phase IV is the same as the design conditions modelled in the air dispersion modellin for the ESIA.	EPC	HSE Advisor	Design records	Management action	Once	<$10K
C-4	Air quality	Impacts on local communities related to vehicle emissions	Low	Vehicles will be regularly inspected and maintained to ensure they are in good working order as relates to exhaust emissions.	EPC	HSE Advisor	Maintenance records	Management action	Every 6 months	<$10K
C-5	Air quality	Impacts on local communities related to vehicle emissions	Low	Monitor and supervise the EPC contractor during construction to verify that vehicles are being properly maintained for exhaust emissions.	Azito Energie	HSE Advisor	Audit record	Audit	Every 6 months	<$10K
C-6	Groundwater	Groundwater Abstraction, Saline Intrusion in the Aquifer and Water Availability, Drinking Water Consumption and Water Availability	Low	Develop a site-wide Water Management Plan that 1) evaluates ways to improve water efficiency, 2) reduce water consumption during construction and 3) includes a regular monitoring regime to evaluate changes in water quality.	EPC	HSE Advisor	Water consumption records	Monitoring	Continuous	<$10K
C-7	Groundwater	Groundwater Abstraction, Saline Intrusion in the Aquifer and Water Availability, Drinking Water Consumption and Water Availability	Low	Develop a site-wide Water Management Plan that 1) evaluates ways to improve water efficiency, 2) reduce water consumption during operations and 3) includes a regular monitoring regime to evaluate changes in water quality.	Azito Energie	HSE Advisor	Water Management Plan developed	Management action	2 months (duration)	<$10K
C-8	Noise	Community disturbance due to construction noise emissions	Low	To reduce construction noise impacts, the EPC shall implement the following measures: • Any construction works carried out at night will be limited to quiet activities which do not produce significant levels of noise at the nearest noise sensitive receptors. • Where practicable, noisy equipment will be sited as far away as possible from noise sensitive receptors. • Use alternatives to audible reversing alarms, such as visual and/ or broadband noise indicators that provide a safe system of work; or configuring the Project work sites to maximise forward movements of mobile plant. • Use of compressors, generators and pumps fitted with properly lined and sealed acoustic covers or enclosures, which will be kept closed whenever the machines are in use. • Fitting of mufflers or silencers of the type recommended by manufacturers • When not in use, throttle settings will be reduced and equipment and plant turned off. • Equipment will be regularly inspected and maintained to ensure it is in good working order. • For machines with fitted enclosures, doors and door seals will be checked to ensure they are in good working order; also that the doors close properly against the seals.	EPC	HSE Advisor	Inspection records	Management action	Verify at the start of construction and every 6 months thereafter	<$10K
C-9	Noise	Community disturbance due to construction noise emissions	Low	Monitor average noise levels, Laeq, at the nearest noise sensitive receptors (R3 and R7 as shown in Figure B1.1 in Annex B) and compare them with the construction noise criteria of 70 dB, below which construction noise impacts are considered Negligible. If monitored levels exceed 70 dB, , to establish whether any corrective actions are required.	EPC	HSE Advisor	Monitoring record	Monitoring	At the start of each new construction phase or after significant changes in plant location	<$10K
C-10	Noise	Community disturbance due to construction noise emissions	Low	Monitor and supervise the EPC contractor to ensure that the measures related to construction noise are implemented in-line with the Project's requirements	Azito Energie/ Globeleq	HSE Advisor	Audit record	Audit	Every 6 months	<$10K
C- 11	Noise	Community disturbance due to construction noise emissions	Low	Maintain Azito's grievance procedure to collect and manage potential complaints from local communities with regards to noise, and seek appropriate solutions to resolve the grievance	Azito Energie / O&M	HSE Advisor	Grievance log	Management action	Continuously	<$10K
C- 12	Noise	Community disturbance due to construction noise emissions	Low	Work with Azito Energie to respond to any grievances received from the local community.	EPC	HSE Advisor	Grievance log	Management action	Continuously	<$10K
C-13	Noise	Community disturbance due to noise emissions	Medium	Carry out a noise survey during commissioning to ensure equipment meets the noise standards set out in the equipment requisition documents	EPC	HSE Advisor	Monitoring records	Monitoring	At the end of construction	<$50K
C-14	Social	Interaction with Local Communities and Communicable Diseases	Medium	Monitor and supervise the EPC contractor to ensure that the Code of Conduct is being implemented in-line with IFC Performance Standards.	Azito Energie	CLO	Monitoring record	Monitoring	Prior to any new staff activity	<$10K
C-15	Social	Direct employment opportunities and skills enhancement	Medium	Sensitise workforce to the short-term nature of the construction work. Encourage people to save part of their monthly salary for future opportunities, investment and financial security until they find another job/livelihoo	EPC	HR	Training record	Training	Every 6 months	<$10K
C-16	Social	Direct employment opportunities and skills enhancement	Medium	Monitor through the construction phase the number of local employment created work contracts, and other labour-related issues.	EPC	HR	Monitoring record	Monitoring	Every 6 months	<$10K
C-17	Social	Direct employment opportunities and skills enhancement	Medium	Monitor and supervise the EPC contractor to ensure that Employment Plan is implemented in line with the Project's requirements. It is recommended to formalise and centralise local recruitment procedures through the CLO to manage local expectations and deter casual enquiries for employment at the site. The Employment Plan and any local employment opportunities will be communicated in a transparent and culturally appropriate manner. The EPC contractor will seek support from the Project and its Stakeholder Engagement Plan when advertising employment opportunities to ensure that employment opportunity clearly define the skills, qualifications and experience required for the available positions and refers candidates to the local employment offices. Unskilled labour will be preferentially hired from the local communities where possible subject to job applicants being suitable qualified. All employment-related decisions, including hiring, placement, promotion, benefits, training, discipline and dismissals, will be based solely on the skills, experience, performance and qualifications of employees and applicants.	Azito Energie	CLO	Monitoring record	Monitoring	Every 6 months	<$10K
C-18	Social	Direct employment opportunities and skills enhancement, Potential Loss of Livelihood due to Temporary Land Leasing, Local procurement, Workers Influx and Sociocultural Changes	High	As part of the Project SEP, implement a grievance mechanism that will be communicated to relevant stakeholders so that to collect and address as required grievances in line with IFC Performance Standards and with Cote d'Ivoire law. This will include coordination with local authorities – in particular the municipality of Yopougon and the Azito and Béag village chiefs and elders.	Azito Energie	CLO	Grievance mechanism communicated	Meeting	Continuously	<$10K
C-19	Social	Interaction with Local Communities and Communicable Diseases	Medium	Deliver a health risk training and awareness programme, tailored to the needs of different groups, within the construction workforce.	EPC	HSE Advisor	Induction Program implemented	Training	Annually	<$10K
C-20	Social	Interaction with Local Communities and Communicable Diseases	Medium	Verify that contractors and subcontractors receive training at start-up of construction to improve their awareness of the risks of HIV and other STIs, their transmission routes and prevention methods. Training about other prevalent communicable diseases and health risks, will be covered as appropriate. Training and awareness initiatives will be front-loaded in inductions at the start-up stage of construction	EPC	HSE Advisor	Induction Program implemented	Training	Prior to any new staff activity	<$10K
C-21	Social	Interaction with Local Communities and Communicable Diseases	Medium	As part of Azito's Community Development Programme, seek collaboration with existing AIDS prevention programmes in Côte d'Ivoire to develop initiative (as feasible).	Azito Energie	CLO	Conjoint Actions developed	Management action	As required	<$10K

Ref No	Aspect	Potential Impact Managed	Priority of Impact Managed	Management Control	Responsibility - Organisation	Responsibility - Individual	Completion indicator	Type of action (e.g. management action, monitoring, meetings, training)	Frequency	Cost estimate
C-22	Social	Labour and Working Conditions	Medium	Undertake all employment procedures (suggested to be coordinated via the CLO) in accordance with the Employment Plan. • Employment during work activities will be managed so as to: o Comply with all relevant national legislation and International Labour Organisation (ILO) conventions; o Ensure appropriate management of labour-related risks; o Ensure that child labour will be strictly forbidden during construction. Contractors, suppliers and recruitment agencies will not hire workers under the age of 16 and employment of young workers between 16 and 18 years will only be for light work of limited duration, where the work does not interfere with education, and is not dangerous or harmful to the physical, mental or moral development of young workers. o Discrimination because of race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth, actual or perceived HIV status or other status will be strictly forbidden. o Ensure that workers will have the right to form and to join trade unions and create their own worker committees and worker representatives in accordance with the requirements and rights set out in the Ivoirian Labour Code. o Salaries will be just and favourable ensuring the worker and the worker's family have an existence worthy of human dignity. o Discrimination because of race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth, actual or perceived HIV status or other status will be strictly forbidden.	EPC	HSE Advisor	Audit record	Audit	Monthly	<$10K
C-23	Social	Labour and Working Conditions	Medium	Audit and supervise the EPC contractor to monitor compliance with labour and working conditions measure	Azito Energie	HSE Advisor	Audit record	Audit	Monthly	<$10K
C-24	Social	Local procurement	Low	Monitor and supervise the EPC contractor to ensure that the Local Content Plan is duly implemente	Azito Energie	CLO	Monitoring record	Monitoring	Every 6 months	<$10K
C-25	Social	Potential Loss of Livelihood due to Temporary Land Leasing	Low	Monitor and supervise the EPC contractor to ensure that the Siting Plan is implemented in line with the Project's requirements.	Azito Energie	HSE Advisor/CLO	Monitoring record	Monitoring	Annually	<$10K
C-26	Social	Pressure on Infrastructure, Resources and Services	Medium	Monitor and supervise the EPC contractor to ensure that the actions to limit pressure on local services and infrastructures are implemented in line with the Project's requirements	Azito Energie	CLO	Monitoring record	Monitoring	Annually	<$10K
C-27	Social	Pressure on Infrastructure, Resources and Services	Medium	As part of Azito's Socio-economic development programme, continue to support public services in the vicinity of the plant, including health facilities and school in Azito and in Béago. Azito Energie will provide support to local health facilities should there be a noticeable increase in pressure on the service during Phase IV constructio	Azito Energie	CLO	CSR program updated	Management action	As required	<$10K
C-28	Social	Pressure on Infrastructure, Resources and Services	Medium	Promote the implementation of joint planning approaches with government and other key stakeholders for infrastructure projects where possible.	Azito Energie	CLO	Action Plan developed	Management action	As required	<$10K
C-29	Social	Workers Health and Safety and Security	Medium	Provide training to all workers on H&S key requirements as set out in the Ivorian Law and IFC Performance Standards This should include the applicable plans and procedures, as well as the importance of PPE	EPC	HSE Advisor	Training record	Training	Prior to any new staff activity	<$10K
C-30	Social	Workers Health and Safety and Security	Medium	Supervise and provide support to its subcontractors to ensure that labour and working conditions are in line with Cote d'Ivoire law through gap analysis and capacity building	EPC	HSE Advisor	Training record	Training	Prior to any new subcontractor activity	<$10K
C-31	Social	Workers Health and Safety and Security	Medium	The EPC should ensure that the following measures are in place to protect the workforce and surrounding community: • Put in place healthcare and treatment arrangements for the workforce in the event of an occupational illness or injury, and in line with Cote d'Ivoire law. • Undertake medical examination to ensure that workers are fit to work. • Implement a risk audit program in-line with international best practice standards to determine Job Hazard Analysis and Permit to Work systems. • Provide access to free condoms (ideally male and female) in bathrooms and discrete locations to ensure that should construction workers engage in commercial or casual sex, it is done safely at reduced risk to the worker and sexual partner. • Monitor and evaluate the success of these activities.	EPC	HSE Advisor	H&S records	Management action	Continuously	<$10K
C-32	Social	Workers Health and Safety and Security	Medium	In line with the Code of Conduct, put in place measures to ensure that workers do not present to work under the influence of alcohol, which could adversely affect their fitness or ability to perform work and adversely affect their health and safety as well as that of others around them. This will require the EPC contractor to implement a workplace alcohol breath testing system/policy to ensure that proportionate and consistent measures are taken in the event that someone presenting at work is found to be under the influence of alcohol.	EPC	HSE Advisor	Security Management Plan develop	Management action	Continuously	<$10K
C-33	Social	Workers Health and Safety and Security	Medium	Select Security personnel based on their commitment regarding safeguarding of community human rights in line with the UN Voluntary Principles for Security and Human Rights	EPC	HSE Advisor	Training record	Training	Prior to any new staff activity	<$10K
C-34	Social	Workers Health and Safety and Security	Medium	Audit and supervise the EPC contractor to monitor compliance of the EPC's contractor on Health, Safety and Security aspects.	Azito Energie	HSE Advisor	Audit record	Audit	Monthly	<$10K
C-35	Social	Workers Health and Safety and Security	Medium	The EPC will ensure their subcontractors fully meet the IFC Standards and other EHS requirements as laid down in th ESIA, it is the overall responsibility of the EPC to support any subcontractor in developing their capacity to meet the necessary standards.	EPC	HSE Advisor	Training record	Training	Prior to any new subcontractor	<$10K
C-36	Social	Workers Influx and Sociocultural Changes	Low	Provide induction training to all Project personnel including communication of the Code of Conduct, associated disciplinary procedures, and awareness raising on cultural sensitivities relevant to worker activities in and interactions with local communities.	EPC	HSE Advisor	Induction Program implemented	Training	Prior to any new staff activity	<$10K
C-37	Surface Water	Degradation of surface water quality	Medium	As part of the implementation of the Drainage Management Plan, carry out inspections during the course of the works and upon completion of Project activities to verify the effectiveness of erosion and surface water management measures being implemented.	EPC	HSE Advisor	Drainage Management Plan developed	Management action	Monthly and upon completion of any key construction works	<$10K
C-38	Surface Water	Degradation of surface water quality	Medium	Verify that measures related to surface water quality are being implemented	Azito Energie	HSE Advisor	Audit record	Audit	Annually	<$10K
C-39	Surface Water	Degradation of surface water quality	Low	Drinking water will not be used as process water for any of the construction activities of Phase IV	Azito Energie	HSE Advisor	Audit record	Audit	Annually	<$10K
C-40	Unplanned events	Community health and safety impacts associated with a traffic accident	High	Implement the Traffic Management Plan. Maintain internal audit records of how the Plan is being implemented.	EPC	HSE Advisor	Implementation records	Management action	Continuous	<$10K
C-41	Unplanned events	Community health and safety impacts associated with a traffic accident	High	Monitor and supervise the EPC contractor to ensure that the Traffic Management Plan is implemented in line with the Project's requirements. It is recommended to formalise and centralise communication through the CLO to ensure that key stakeholder (including affected communities but also relevant authorities) will be provided with appropriate information communicating the nature and extent of any potential incidents that could arise and procedures to be followed in the case of an unplanned accident or emergency.	Azito Energie	HSE Advisor/CLO	Audit record	Audit	Every 6 months	<$10K

Ref No	Aspect	Potential Impact Managed	Priority of Impact Managed	Management Control	Responsibility - Organisation	Responsibility - Individual	Completion indicator	Type of action (e.g. management action, monitoring, meetings, training)	Frequency	Cost estimate
C-42	Unplanned events	Environmental and social impacts associated with a loss of containment or combustion of liquid fuel in the gas turbine	High	Revise existing site Emergency Response Plan to include Phase IV operations activities. This should specifically include consideration of: what will be done to manage impacts from SO2 emissions in the event of needing to combust liquid fuel, as well as a loss of containment for the DDO storage tanks, and include consultation with local emergency services and local communities.	Azito O&M	HSE Advisor	Emergency Response Plan developed	Management action	2 months (duration)	<$10K
C-43	Unplanned events	Environmental and social impacts associated with an a gas supply line rupture, Environmental and social impacts associated with spills, loss of containment, loss of gas supply	High	Implement EPC Emergency Response Plan . Maintain internal audit records of how the Plan is being implemented.	EPC	HSE Advisor	Self-audit record	Audit	Annually	<$10K
C-44	Unplanned events	Environmental and social impacts associated with unplanned leaks/emissions from vehicles.	High	Implement Vehicle Maintenance Plan.	EPC	HSE Advisor	Maintenance records	Management action	Continuously	<$10K
C-45	Unplanned events	Environmental and social impacts associated with unplanned leaks/emissions from vehicles.	High	Verify implementation of Vehicle Maintenance Plan.	Azito Energie	HSE Advisor	Audit record	Audit	Every 6 months	<$10K
C-46	Unplanned events	Injury to a community member from unauthorised access during construction.	High	Implement Site Security Plan in line with the UN Voluntary Principles for Security and Human Rights. . This should include measures such as: • Secure the Project site, including the lay-down area, with a permanent fence at an early stage of construction; • Employ security guards to patrol the site and control access on a 24 hour/7 day basis to restrict access to community members. Security will serve to prevent theft and damage of equipment on-site and to avoid potential injury to community members; and • Require all personnel to display personal identification and all visitors will be required to sign in to prevent unauthorised access.	EPC	HSE Advisor	Site design and security documentation	Management action	Continuous	<$10K
C-47	Unplanned events	Injury to a community member from unauthorised access during construction.	High	Revise existing Site Security Plan to include Phase IV operations.	Azito O&M	HSE Advisor	Site Security Plan developed	Management action	2 months (duration)	<$10K
C-48	Unplanned events	Injury to a community member from unauthorised access during construction	High	Monitor and supervise EPC contractor's security measures (implementation of Site Security Plan)	Azito Energie	HSE Advisor	Audit record	Audit	Every 6 months	<$10K
C-49	Waste management	Environmental and social impacts associated with the incorrect handling of waste	Medium	Implement a waste management plan and wastewater management plan.	EPC	HSE Advisor	Waste management plan	Management action	Continuously	<$10K
C-50	Waste management	Environmental and social impacts associated with the incorrect handling of waste	Medium	Conduct and document training on the procedures included in the EPC WMP for all staff responsible for elements of waste management.	EPC	HSE Advisor	Training records	Training	Prior to any new staff activity	<$10K
C-51	Waste management	Environmental and social impacts associated with the incorrect handling of waste	Medium	Brief all staff on the core waste management principles, which should be set out in the EPC WMP.	EPC	HSE Advisor	Training records	Training	Prior to any new staff activity	<$10K
C-52	Waste management	Environmental and social impacts associated with the incorrect handling of waste	Medium	A post-construction survey of the construction area will be conducted to confirm that all debris and wastes have been removed and properly treated/disposed at the end of the construction phase.	EPC	HSE Advisor	Post-construction survey record	Management action	Following the completion of all construction activities	<$10K
C-53	Waste Management	Environmental and social impacts associated with the incorrect handling of waste	Medium	Revise the existing Waste Management Plan for the site to include Phase IV operations.	Azito O&M	HSE Advisor	Waste water management plan	Management action	2 months	<$10K

Ref No	Aspect	Potential Impact Managed	Priority of Impact Managed	Management Control	Responsibility - Organisation	Responsibility - Individual	Completion indicator	Type of action (e.g. management action, monitoring, meetings, training)	Frequency	Cost estimate
O-1	Air emissions	Meet requirements in IFC EHS Guidelines related to air ambient quality values	Medium	Implement an air quality monitoring programme for the first year of the CCGT operations phase that measures the actual ground level concentrations of NO2 and SO2. The survey should include the placement of diffusion tubes at the monitoring locations included in the baseline survey. Individual tubes should be in place for no more than one month in duration and a minimum of 6 months of data should be collected. (This monitoring will be used as a verification of the predicted air dispersion modelling results for NO2, as well as providing an updated baseline for ambient SO2 concentrations.)	Azito O&M	HSE Advisor	Laboratory analysis of diffusion tube samples	Monitoring	6 months	<50K
O-2	Climate Change	Meet requirements in IFC Performance Standard 3 related to greenhouse gas emissions	Medium	Develop and implement a routine maintenance plan for all key GHG emission sources identified in the annual GHG inventory	Azito O&M	HSE Advisor	Maintenance records	Management action	Continuous	<$10K
O-3	Climate Change	Meet requirements in IFC Performance Standard 3 related to greenhouse gas emissions	Medium	Have a system in place to periodically review annual GHG performance and evaluate options for improving energy efficiency over the life of the Project	Azito O&M	HSE Advisor	Maintenance records	Management action	Every 2 years	<$10K
O-4	Climate Change	Meet requirements in IFC Performance Standard 3 related to greenhouse gas emissions	Medium	Quantify GHG emissions annually in accordance with internationally recognised methodologies and good practice.	Azito O&M	HSE Advisor	GHG Inventory	Management action	Annually	<$10K
O-5	Climate Change	Meet requirements in IFC Performance Standard 3 related to greenhouse gas emissions	Medium	Verify that the EPC is 1) implementing a system to periodically review annual GHG performance and evaluate options for improving energy efficiency over the life of the Project and 2) is implementing a maintenance plan in place for all major sources of GHG emissions	Azito O&M	HSE Advisor	Audit record	Audit	Every 2 years	<$10K
O-6	Ground Water	Groundwater Abstraction, Saline Intrusion in the Aquifer and Water Availability, Drinking Water Consumption and Water Availability	Low	Implement Water Management Plan (including monitoring of water consumption to inform consideration of water efficiency improvement).	Azito O&M	HSE Advisor	Reduction in water consumption	Management action	Annually	<$10K
O-7	Ground Water	Groundwater Abstraction, Saline Intrusion in the Aquifer and Water Availability, Drinking Water Consumption and Water Availability	Low	Implement the site-wide Water Management plan which evaluates ways to improve water efficiency and reduce water consumption during operations. Maintain internal audit records of how the Plan is being implemented.	Azito O&M	HSE Advisor	Self-audit record	Management action	Continuous	<$10K
O-8	Noise	Community disturbance due to noise emissions	Low	Maintain Azito's grievance procedure to collect and manage potential complaints from local communities with regards to noise, and seek appropriate solutions to resolve the grievance	Azito O&M	HSE Advisor	Audit record	Audit	Continuously	<$10K
O-9	Social	Direct employment opportunities and skills enhancement	Medium	Prior to operation, update the Employment Plan to cover the operation phase.	Azito O&M	HR	Employment Plan updated	Management action	Prior to operation	<$10K
O-10	Social	Local procurement	Medium	Update the Local Content Plan to cover the operation phase	Azito O&M	SED Manager	LCP updated	Management action	Prior to operation	<$10K
O-11	Surface Water	Degradation of surface water quality	Medium	When the water level of the evaporation pond (containing treated process water, sanitary water and run-off water) is high, a contractor will analyse if the sample is compliant with the IFC and Ivorian discharge limits. (See Table 3.8 from the ESIA for the discharge standards that must be met.) No discharge can be made prior to verification of compliance with these standards.	Azito O&M	HSE Advisor	Water consumption records	Monitoring	As needed	<$10K
O-12	Unplanned events	Environmental and social impacts associated with spills, a loss of containment, or combustion of liquid fuel in the gas turbine	High	Implement revised site Emergency Response Plan that includes Phase IV operations activities. Maintain internal audit records of how the Plan is being implemented.	Azito O&M	HSE Advisor	Self-audit record	Management action	Continuous	<$10K
O-13	Unplanned events	Injury to a community member from unauthorised access during construction.	High	Implement revise existing Site Security Plan to include Phase IV operations. Maintain internal audit records of how the Plan is being implemented.	Azito O&M	HSE Advisor	Self-audit record	Management action	Continuous	<$10K
O-14	Unplanned events	Short-term community health impacts from increased NO_2 and SO_2 emissions when operating on liquid fuel	High	Implement operational measures to reinstate normal operation (on gas) as soon as possible;	Azito O&M	HSE Advisor	Maintenance records	Management action	When plant is operating on DDO	<$10K
O-15	Unplanned events	Short-term community health impacts from increased NO_2 and SO_2 emissions when operating on liquid fuel	High	If combusting DDO, monitor the direction of the wind and the wind speed.	Azito O&M	HSE Advisor	Meteorological data records	Monitoring	When plant is operating on DDO	<$10K
O-16	Unplanned events	Short-term community health impacts from increased NO_2 and SO_2 emissions when operating on liquid fuel	High	If the wind is blowing towards the northeast (i.e. towards Beago village) whilst combusting DDO, the site's Emergency Response Plan should be implemented with regards to community notification so that they can take measure to limit their exposure to air pollutants (e.g. by reducing outdoor physical activity).	Azito O&M	HSE Advisor	Maintenance records	Management action	When plant is operating on DDO	<$10K
O-17	Waste management	Environmental and social impacts associated with the incorrect handling of waste	Medium	Implement a Waste Management Plan and Water Management Plan (which includes management of waste water).	Azito O&M	HSE Advisor	Waste management plan	Management action	Continuously	<$10K
O-18	Waste management	Environmental and social impacts associated with the incorrect handling of waste	Medium	Conduct and document training on the procedures included in the Waste Management Plan for all staff responsible for elements of waste management.	Azito O&M	HSE Advisor	Training records	Training	Prior to any new staff activity	<$10K
O-19	Waste management	Environmental and social impacts associated with the incorrect handling of waste	Medium	Brief all staff on the core waste management principles, which should be set out in the Waste Managemen Plan.	Azito O&M	HSE Advisor	Training records	Training	Prior to any new staff activity	<$10K

Annex E

Additional Social Data

E1 ADDITIONAL SOCIAL DATA

E1.1 QUATIER OF YOPOUGON

Data from the National Statistics Institute show that Yopougon is sub-divided into 27 *quartiers* shown in *Box E1.1*.

Box E1.1 Quartiers of Yopougon

- Adiapo Doume
- Ancien Quartier SICOGI
- Andokoi
- Azito
- Banco 2
- Beago
- Camp Militaire
- Gare-Sud SODECI-GFCI
- GESCO Manutention
- Ile Boulay
- Km 17
- Koute Village
- Mairie
- Niangon Adjame
- Niangon Lokoa
- Niangon Nord
- Niangon Sud
- Nouveau Quartier SOPIM Banco
- Port-Bouet 2
- SIDECI-SICOGI Location-Ventel
- SOGEFIHA Koute Municipalite
- Toit Rouge
- Yopougon Attie
- Yopougon Sante
- Zone Industrielle
- Banco-Nord
- Banco-Sud

Source: Institut National de la Statistique, Côte d'Ivoire, 2014

E1.2 POPULATION AND HOUSEHOLD NUMBERS FOR ABIDJAN COMMUNES

Table E1.2 identifies the population and household numbers for Abidjan communes in 1988, 1998 and 2014 based on population census data.

Table E1.1 Population and Household Numbers for Abidjan Communes - 1988, 1998 and 2014 Population Census

Commune	Population			Number of Households		
	1988[1]	1998	2014[2]	1988	1998	2014
Abobo	405,615	654,375	1,030,658	72,283	119,540	208,683
Adjamé	204,089	260,507	372,978	36,846	52,296	77,362
Attécoubé	164,751	214,638	260911	33,561	45,235	56,952
Cocody	134,875	260,159	447,055	26,561	54,011	105,180
Koumassi	233,807	325,044	433,139	46,715	71,973	92,986
Marcory	149,668	180,192	249,858	29,338	41,176	61,006
Plateau	12,184	10,141	7,488	2,331	1,965	1,571
Port Bouët	171,002	216,287	419,033	35,065	51,607	102,013
Treichville	110,835	123,520	102,580	20,101	19,647	22,963
Yopougon	372,190	708,155	1,071,543	59,828	133,572	219,651
Total	**1,959,016**	**2,953,018**	**4,395,243**	**362,629**	**591,040**	**948,367**

Source: Institut National de la Statistique, Côte d'Ivoire, 2014

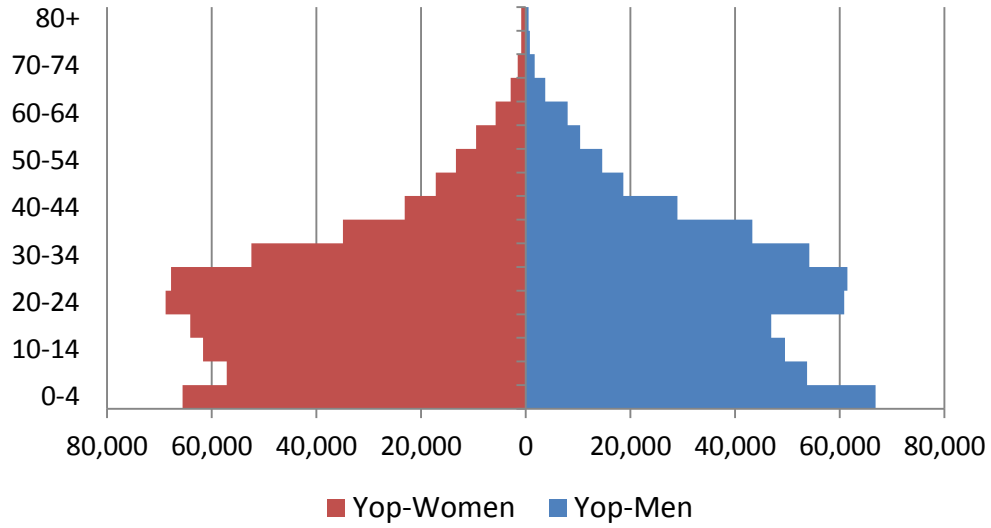
(1) [1] Appessika K (2003) *Understanding Slums: Case Studies for the Global Report on Human Settlements 2003* University College London http://www.ucl.ac.uk/dpu-projects/Global_Report/pdfs/Abidjan.pdf

(2) [2] Institut National de la Statistique (2014) http://cotedivoire.opendataforafrica.org/apps/atlas/Abidjan-Region

E1.3 POPULATION STRUCTURE, YOPOUGON COMMUNE

Figure E1.1 presents the population structure for Yopougon Commune, based on the General Housing and Population Census (2014).

Figure E1.1 Population Structure, Yopougon Commune, General Housing and Population Census, 2014



Source: INS Côte d'Ivoire, 18 October 2016

E1.4 UNEMPLOYMENT RATE

Table E1.3 presents the unemployment rate by sex and age in 2008.

Table E1.2 Unemployment Rate by Sex and Age in 2008

	Sex	14-19	20-24	25-29	30-44	45-59	60-100	Total
Abobo	Male	12.7	18.3	24.9	18.5	11.0	12.3	17.6
	Female	17.9	33.6	28.3	19.6	16.5	2.3	22.6
	Total	15.8	26.1	26.4	19.0	13.5	7.3	20.1
Yopougon	Male	16.3	36.7	32.6	18.4	8.4	13.3	23.5
	Female	19.3	32.9	37.3	28.0	16.8	13.4	27.9
	Total	18.1	34.6	34.7	22.6	12.3	13.3	25.7
Urban	Male	3.1	12.1	14.5	3.9	7.9	0.0	7.2
	Female	16.6	25.5	31.6	7.4	7.6	3.3	15.9
	Total	10.3	19.9	23.8	5.6	7.8	1.7	11.7
Rural	Male	5.3	12.1	4.2	2.9	0.4	2.2	4.2
	Female	5.2	16.3	11.3	6.4	2.6	0.0	7.3
	Total	5.2	14.2	8.1	4.6	1.4	1.3	5.7
West	Male	4.8	12.5	6.7	3.1	1.7	1.9	4.9
	Female	8.1	18.5	16.1	6.6	3.6	0.8	9.2
	Total	6.5	15.6	11.9	4.8	2.6	1.4	7.0

Institut National de la Statistique (INS) 2011, (data dated 2008).

E1.5 ACCESS TO HEALTH CARE SERVICES

Box E1.2 presents barriers to accessing health care identified by a sample of females aged 15-49 years in Abidjan.

Box E1.2 Barriers to Accessing Health Care Reported by 2,440 Females Aged 15-49 Years, Abidjan, DHS 2011-2012 (3)

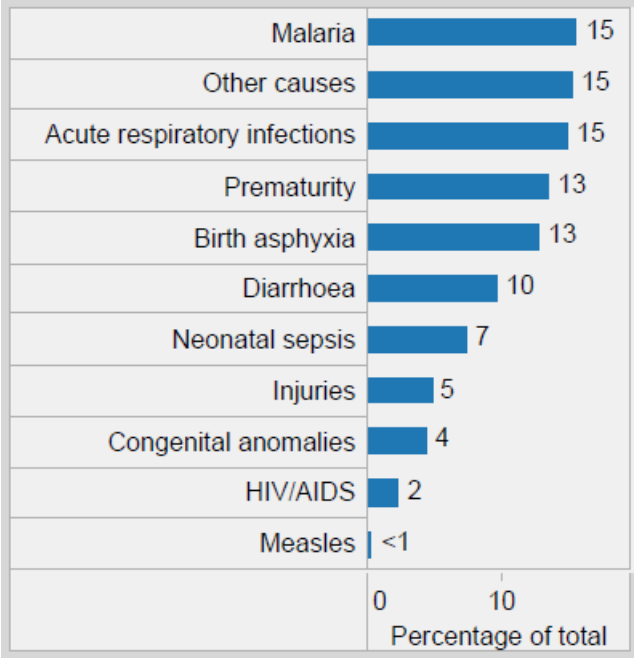
- Not having the money to pay for treatment (64%)
- Not receiving permission to seek medical care (27%)
- Distance to the health facility (27%)
- Not wishing to go alone (16%)

Source: Institut National de la Statistique (INS) et ICF International. 2012.

E1.6 DISTRIBUTION OF CAUSES OF DEATH IN CHILDREN UNDER AGE 5

Figure E1.2 presents the distribution of causes of death in children under 5 years in Cote d'Ivoire.

Figure E1.2 Distribution of Causes of Death in Children Under Age 5, Cote d'Ivoire, 2013



Source: World Health Organisation, Cote d'Ivoire: WHO Statistical Profile [4]

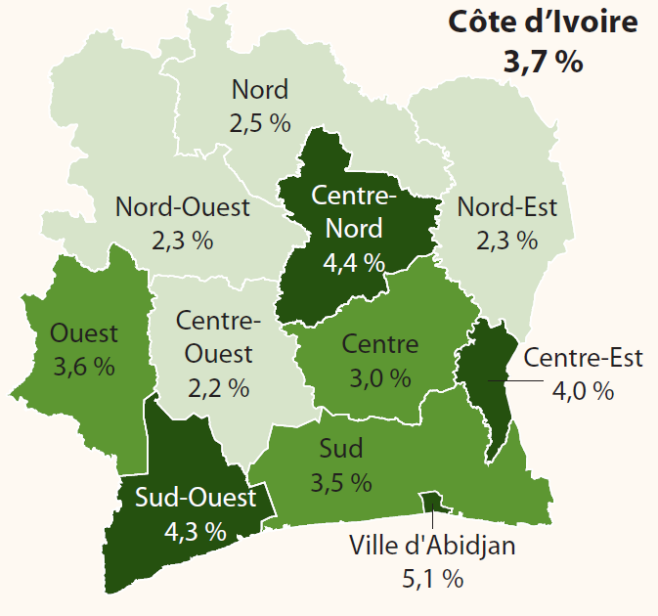
E1.7 HIV PREVALENCE BY REGION, COTE D'IVOIRE

Figure E1.3 presents HIV prevalence by region for Cote d'Ivoire.

(3) Institut National de la Statistique (INS) et ICF International. 2012. Enquête Démographique et de Santé et à Indicateurs Multiples de Côte d'Ivoire 2011-2012. Calverton, Maryland, USA : INS et ICF International. http://dhsprogram.com/pubs/pdf/FR272/FR272

[4] World Health Organisation, Cote d'Ivoire: WHO Statistical Profile http://www.who.int/gho/countries/civ.pdf?ua=1 accessed 17 October 2016

Figure E1.3 HIV Prevalence by Region, Cote d'Ivoire, 2011-12

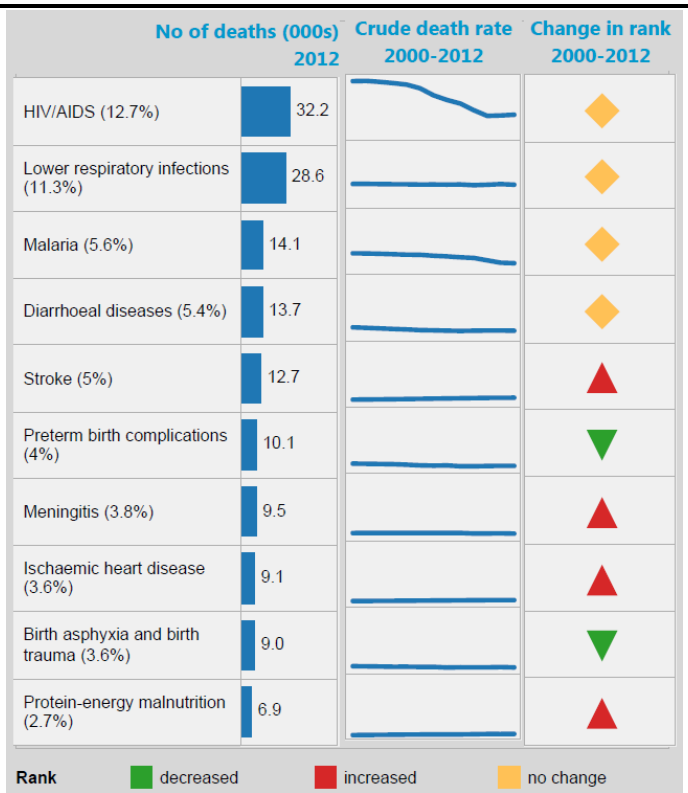


Source: Cote d'Ivoire Demographic and Health Survey 2011-12

E1.8 TOP 10 CAUSES OF DEATH, CÔTE D'IVOIRE

Figure E1.4 presents the top 10 causes of death in Côte d'Ivoire from 2000-2012.

Figure E1.4 Top 10 Causes of Death, Côte d'Ivoire, 2000 - 2012



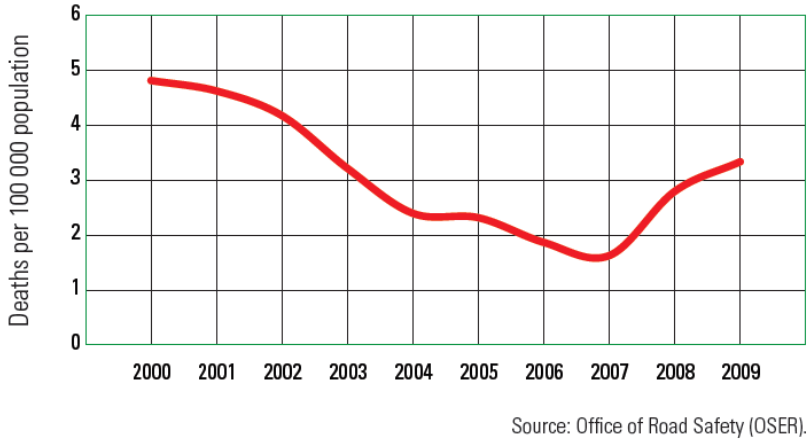
Source: World Health Organisation, Cote d'Ivoire: WHO Statistical Profile [5]

[5] http://www.who.int/gho/countries/civ.pdf?ua=1 accessed 17 October 2016

E1.9 ROAD TRAFFIC ACCIDENT

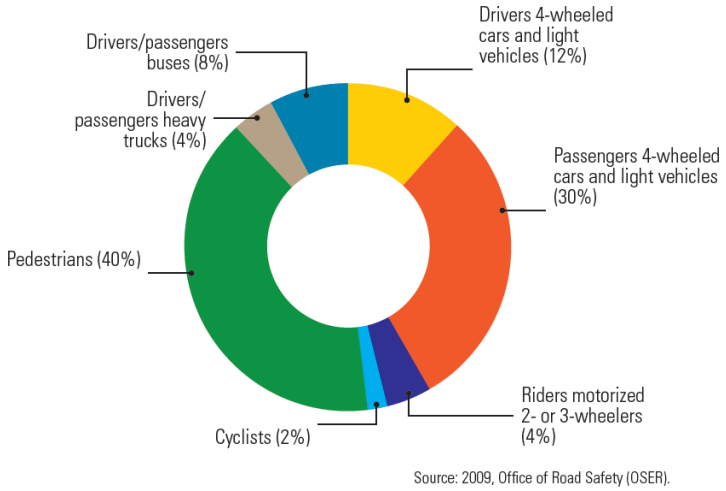
Figure E1.5 presents the trends in road traffic accidents in Cote d'Ivoire from 2000-2009 whilst Figure E1.6 presents deaths by road user category in Cote d'Ivoire in 2009.

Figure E1.5 Trends in Road Traffic Accidents, Cote d'Ivoire, 2000-2009



Source: WHO Traffic Injuries, Country Profiles 2013. http://www.who.int/topics/injuries_traffic/en/ accessed on 14 October 2016

Figure E1.6 Deaths by Road User Category, Cote d'Ivoire, 2009



Source: WHO Traffic Injuries, Country Profiles 2013. http://www.who.int/topics/injuries_traffic/en/ accessed on 14 October 2016

Annex F

Project Notice and Terms of References

Azito O&M

A L'ATTENTION DE
MONSIEUR LE DIRECTEUR DE
L'AGENCE NATIONALE DE L'ENVIRONNEMENT
(ANDE)

Le xxx

Objet : Avis de projet de modification d'installation classée, Projet d'extension de la centrale existante d'Azito par ajout d'une nouvelle turbine en cycle combiné (Azito Phase IV)

Monsieur le Directeur,

L'adoption de la Loi n° 96-766 du 03 octobre 1996, portant Code de l'Environnement et la promulgation du décret n°96-894 du 08 novembre 1996 relatif aux règles et procédures applicables aux Etudes d'Impact Environnemental en République de Côte d'Ivoire, imposent au promoteur des projets d'investissement publics ou privés susceptibles de porter atteinte à l'Environnement soit une Etude d'Impact Environnemental (EIES), soit un Constat d'Impact, selon leur nature technique, leur ampleur et selon la sensibilité de leurs milieux d'Implantation.

A cet effet, j'ai l'honneur de vous informer que la société Operations and Management (Azito O&M) prévoit l''extension de la centrale électrique d'Azito, implantée près du village du même nom, dans la commune de Yopougon.

Ce Projet sera entreprit par Azito O&M, filiale d'Azito Holding. Les actionnaires d'Azito Energie sont Globeleq et Azito Energie Holding SA, filiale d'Industrial Promotion Services (IPS).

Ce projet d'extension, aussi nommé Azito Phase IV, consiste à augmenter la capacité de la centrale d'Azito par l'ajout d'une turbine à gaz en cycle combiné. Cette extension se traduira donc par :

- l'ajout d'une nouvelle turbine à gaz ;
- l'ajout de deux nouvelles chaudières de récupération de la chaleur ; et
- l'ajout d'une nouvelle turbine à vapeur.

Ces ajouts permettront une augmentation de capacité de 250 MW. La centrale passera donc d'une puissance totale installée actuelle de 430 MW à 680 MW.

Cette nouvelle augmentation de capacité contribuera ainsi de manière significative à la sécurisation de l'approvisionnement électrique de la République de Côte d'Ivoire.

La technologie utilisée sera sensiblement la même que pour la centrale existante (refroidissement à l'air, sans rejet thermique en lagune).

Toutes les installations de l'extension (Phase IV) seront implantées sur une réserve de terrain déjà allouée à la centrale d'Azito, sans générer d'emprise supplémentaire sur le foncier public ou privé.

De fait, les impacts environnementaux et sociaux attendus de cette extension seront très limités. Ils se traduiront néanmoins par une augmentation des rejets atmosphériques et des émissions de bruit, du fait de l'ajout d'une unité de turbine. Nous proposons d'évaluer ces impacts en détail dans le cadre de l'étude d'impact environnemental et social à réaliser.

Les impacts principaux potentiels identifiés à ce jour et l'approche envisagée pour leur évaluation sont présentés dans le tableau ci-après.

Impacts potentiels	**Activités du Projet ayant potentiellement un impact significatif**	**Récepteurs**	**Approche proposée pour l'analyse des impacts**
Rejets atmosphériques	Emissions des véhicules/engins liées aux activités de construction. Emissions provenant de l'exploitation de l'extension de la centrale électrique.	Populations locales.	Evaluation des émissions suivant les différentes phases du projet. Compilation des données collectées par le site et modélisation des émissions par un calcul de dispersion atmosphérique des émissions de la centrale en phase d'opération (à l'aide du Model AIRMOD).
Bruit			Evaluation des niveaux de bruit suivant les différentes phases du projet. Collecte de données de terrain et modélisation des émissions (à l'aide du Model SoundPLAN).
Ecologie	Déblaiement et défrichement du site et des zones de travail durant construction. Emissions provenant de l'exploitation de l'extension de la centrale électrique.	Faune et Flore.	Ces impacts seront analysés par rapport à la Norme de performance no.6 de la Société Financière Internationale avec comme objectif la conservation de la biodiversité et gestion durable des ressources naturelles vivantes. Considération à la fois des milieux aquatiques et terrestres.
Patrimoine culturel	Déblaiement et défrichement du site et des zones de travail durant construction.	Patrimoine culturel (découverte fortuite).	Cet impact sera analysé en particulier par rapport à la Norme de performance no.8 de la Société Financière Internationale : Patrimoine culturel.
Social	Interactions entre les travailleurs et les Populations locales. Emploi (positif).	Populations locales.	Compilation des données pour la caractérisation des effets socio-économiques du projet (effets directs et indirects).

			Evaluation des impacts positifs (création d'emplois). Evaluation selon les informations disponibles des aspects sécurité, conditions de travail.
Déchets	Gestion et l'élimination des déchets.	Installation approuvée pour l'élimination des déchets Populations locales.	Inventaire et classification des déchets. Evaluation des procédures de stockage et manutention. Evaluation des filières d'élimination prévues ou envisageables.
Evénement exceptionnel	Accident de circulation Fuite de gaz.	Populations locales	Recensement des types d´impacts et récepteurs pouvant être sujets à des événements exceptionnels. L´évaluation des impacts seront estimés dans une section séparée.

Aussi, dans le cadre de ces études nous proposons de conduire une consultation avec les parties prenantes pour laquelle nous consulterons l'ANDE en vue de la bonne marche de celle-ci. Le but de cette consultation est d'initier un processus d'information préalable des autorités et des communautés, et la consultation des personnes affectées par le projet. Cette consultation ne se substitue pas aux consultations publiques est du ressort de l'Agence Nationale de l'Environnement (ANDE) comme instituée par le décret n°96-894 du 8 Novembre 1996.

Afin de réaliser l'EIES de ce nouveau projet, nous avons mandaté la société de conseil internationale ERM, en collaboration avec ENVAL, bureau d'étude en environnement renommé en Côte d'Ivoire. ERM et ENVAL nous accompagneront dans la réalisation technique des études, ainsi que dans nos activités de consultation publiques et nos démarches auprès de l'ANDE.

Je vous assure de l'entière collaboration d'Azito O&M à la procédure d'autorisation qui sera menée par vos services, et vous prie d'agréer, Monsieur le Directeur, l'expression de mes salutations respectueuses.

AZITO ENERGIE

Société Anonyme avec Conseil d'Administration
au Capital de 51 377 490 000 FCFA
R.C.N° CI-ABJ-1997-B-215950 – C.C. N° : 9811829 X
Régime d'imposition réel normal – Centre d'impôt DGE
Banque : BICICI ABIDJAN SUD
N° Cpte : CI006 01561 0116786 000 06 35
CI006 01561 0116772 000 38 33

Siège Social :
Immeuble Grand Siècle
Cocody Route du Lycée Technique
B.P. 1296 Abidjan Cidex 1
République de Côte d'Ivoire

Tél. : (225) 22 40 02 36 / 40
(225) 22 44 66 31 / 32
(225) 01 65 46 46
Fax : (225) 22 44 66 38

E-mail :
info@azitoenergie.com
Site Web :
www.azitoenergie.com

Abidjan, le 31 Août 2016,

A L'ATTENTION DE
MONSIEUR LE DIRECTEUR DE
L'AGENCE NATIONALE DE L'ENVIRONNEMENT
(ANDE)

COCODY-DEUX PLATEAUX

Objet : Avis de projet de modification d'installation classée, Projet d'extension de la centrale existante d'Azito par ajout d'un nouveau cycle combiné (Azito Phase IV)

Monsieur le Directeur,

L'adoption de la Loi n° 96-766 du 03 octobre 1996, portant Code de l'Environnement et la promulgation du décret n°96-894 du 08 novembre 1996 relatif aux règles et procédures applicables aux Etudes d'Impact Environnemental en République de Côte d'Ivoire, imposent au promoteur des projets d'investissement publics ou privés susceptibles de porter atteinte à l'Environnement soit une Etude d'Impact Environnemental (EIES), soit un Constat d'Impact, selon leur nature technique, leur ampleur et selon la sensibilité de leurs milieux d'Implantation.

A cet effet, nous avons l'honneur de vous informer que la société AZITO ENERGIE prévoit l''extension de la centrale électrique d'Azito, implantée près du village du même nom, dans la commune de Yopougon.

Ce Projet sera réalisé par AZITO ENERGIE, dont les actionnaires sont Globeleq Africa Holding Ltd et IPS West Africa/Aga Khan Fund for Economic Development.

Ce projet d'extension, aussi nommé Azito Phase IV, consiste à augmenter la capacité de la centrale d'Azito par l'ajout d'un nouveau cycle combiné. Cette extension se traduira donc par :

- l'ajout d'une nouvelle turbine à gaz ;
- l'ajout d'une nouvelle chaudière de récupération de chaleur ; et
- l'ajout d'une nouvelle turbine à vapeur.

Ces ajouts permettront une augmentation de capacité de 250 MW. La centrale passera donc d'une puissance totale installée actuelle de 430 MW à 680 MW.

Cette nouvelle augmentation de capacité contribuera ainsi de manière significative à la sécurisation de l'approvisionnement électrique de la République de Côte d'Ivoire.

La technologie utilisée sera sensiblement la même que pour la centrale existante (refroidissement à l'air, sans rejet thermique en lagune).

Toutes les installations de l'extension (Phase IV) seront implantées sur une réserve de terrain déjà allouée à la centrale d'Azito, sans générer d'emprise supplémentaire sur le foncier public ou privé.

De fait, les impacts environnementaux et sociaux attendus de cette extension seront très limités. Ils se traduiront néanmoins par une augmentation des rejets atmosphériques et des émissions de bruit, du fait de l'ajout de deux unités de turbines à gaz et à vapeur et d'un récupérateur de chaleur. Nous proposons d'évaluer ces impacts en détail dans le cadre de l'étude d'impact environnemental et social à réaliser.

Les impacts principaux potentiels identifiés à ce jour et l'approche envisagée pour leur évaluation sont présentés dans le tableau ci-après.

Impacts potentiels	**Activités du Projet ayant potentiellement un impact significatif**	**Récepteurs**	**Approche proposée pour l'analyse des impacts**
Rejets atmosphériques	Emissions des véhicules/engins liées aux activités de construction. Emissions provenant de l'exploitation de l'extension de la centrale électrique.	Populations locales.	Evaluation des émissions suivant les différentes phases du projet. Compilation des données collectées par le site et modélisation des émissions par un calcul de dispersion atmosphérique des émissions de la centrale en phase d'opération (à l'aide du Model AIRMOD).
Bruit			Evaluation des niveaux de bruit suivant les différentes phases du projet. Collecte de données de terrain et modélisation des émissions (à l'aide du Model SoundPLAN).
Ecologie	Déblaiement et	Faune et Flore.	Ces impacts seront analysés

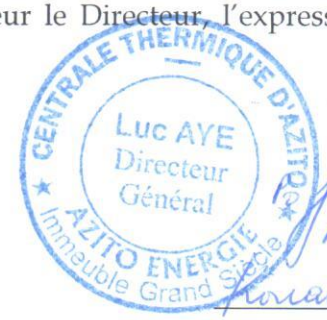
Impacts potentiels	Activités du Projet ayant potentiellement un impact significatif	Récepteurs	Approche proposée pour l'analyse des impacts
	défrichement du site et des zones de travail durant construction. Emissions provenant de l'exploitation de l'extension de la centrale électrique.		par rapport à la Norme de performance no.6 de la Société Financière Internationale avec comme objectif la conservation de la biodiversité et gestion durable des ressources naturelles vivantes. Considération à la fois des milieux aquatiques et terrestres.
Patrimoine culturel	Déblaiement et défrichement du site et des zones de travail durant construction.	Patrimoine culturel (découverte fortuite).	Cet impact sera analysé en particulier par rapport à la Norme de performance no.8 de la Société Financière Internationale : Patrimoine culturel.
Social	Interactions entre les travailleurs et les Populations locales. Emploi (positif).	Populations locales.	Compilation des données pour la caractérisation des effets socio-économiques du projet (effets directs et indirects). Evaluation des impacts positifs (création d'emplois). Evaluation selon les informations disponibles des aspects sécurité, conditions de travail.
Déchets	Gestion et l'élimination des déchets.	Installation approuvée pour l'élimination des déchets Populations locales.	Inventaire et classification des déchets. Evaluation des procédures de stockage et manutention. Evaluation des filières d'élimination prévues ou envisageables.
Evénement exceptionnel	Accident de circulation Fuite de gaz.	Populations locales	Recensement des types d´impacts et récepteurs pouvant être sujets à des événements exceptionnels. L´évaluation des impacts seront estimés dans une section séparée.

Aussi, dans le cadre de ces études nous proposons de conduire une consultation avec les parties prenantes pour laquelle nous consulterons l'ANDE en vue de la bonne marche de celle-ci. Le but de cette consultation est d'initier un processus d'information préalable des autorités et des communautés, et la consultation des personnes affectées par le projet. Cette consultation ne se substitue pas aux consultations publiques qui sont du ressort de l'Agence Nationale de l'Environnement (ANDE) comme instituées par le décret n°96-894 du 8 Novembre 1996.

Afin de réaliser l'EIES de ce nouveau projet, nous avons mandaté la société de conseil internationale ERM, en collaboration avec ENVAL, bureau d'étude en

Environnement renommé en Côte d'Ivoire. ERM et ENVAL nous accompagneront dans la réalisation technique des études, ainsi que dans nos activités de consultation publiques et nos démarches auprès de l'ANDE.

Nous vous assurons de l'entière collaboration d'AZITO ENERGIE à la procédure d'autorisation qui sera menée par vos services, et vous prions d'agréer par le présent courrier, Monsieur le Directeur, l'expression de nos sentiments distingués.



Luc AYE
Directeur Général

AZITO ENERGIE

Société Anonyme avec Conseil d'Administration
au Capital de 51 377 490 000 FCFA
R.C.N° CI-ABJ-1997-B-215950 – C.C. N° : 9811829 X
Régime d'imposition réel normal – Centre d'impôt DGE
Banque : BICICI ABIDJAN SUD
N° Cpte : CI006 01561 0116786 000 06 35
CI006 01561 0116772 000 38 33

Siège Social :
Immeuble Grand Siècle
Cocody Route du Lycée Technique
B.P. 1296 Abidjan Cidex 1
République de Côte d'Ivoire

Tél. : (225) 22 40 02 36 / 40
(225) 22 44 66 31 / 32
(225) 01 65 46 46
Fax : (225) 22 44 66 38

E-mail :
info@azitoenergie.com
Site Web :
www.azitoenergie.com

Abidjan, le 13 Octobre 2016

Monsieur le Directeur
de l'Agence Nationale de
l'Environnement (ANDE)

ABIDJAN

N/Réf. : 09200-2016/ARL/NKJ/ak

Objet : Projet de termes de références pour l'extension de la Centrale Thermique d'Azito existante par ajout d'un nouveau cycle combiné (Azito Phase IV)

Monsieur le Directeur,

Pour faire suite à notre courrier du 31/08/2016 relatif à l'affaire citée en objet, nous vous prions de trouver ci-joint pour avis et observations, le projet de termes de références pour l'extension de la centrale thermique existante par ajout d'un nouveau cycle combiné appelé AZITO Phase IV.

Dans l'attente, nous vous prions d'agréer, Monsieur le Directeur, l'expression de nos salutations distinguées

CENTRALE THERMIQUE D'AZITO
Luc AYE
Directeur Général
AZITO ENERGIE
Immeuble Grand Siècle

Luc AYE
Directeur Général

PJ : Projet de termes de référence pour l'extension de la centrale thermique d'Azito existante par ajout d'un cycle combiné (Phase IV)

AGENCE NATIONALE DE L'ENVIRONNEMENT
13-10-16
Secrétariat
Tél : 41 17 04
ANDE

Extension de la Centrale Electrique d'Azito - phase IV
Abidjan, Côte d'Ivoire

Etude d'Impact Environnemental et Social (EIES)

Termes de Référence EIES _N°87-1116_kkb
_Validés par l'ANDE

Azito Energie - Globeleq

AZITO ENERGIE

GLOBELEQ

AGENCE NATIONALE DE L'ENVIRONNEMENT
ANDE

ERM

Enval CABINET ENVAL

_The Business of Sustainability

Extension de la Centrale Electrique d'Azito - Phase IV – Abidjan, Côte d'Ivoire

Termes de Référence

Azito Energie - Globeleq

Version 2

Pour ERM

Signé par : Camille Maclet

Fonction : Associé

Date : 25 novembre 2016

TABLE DES MATIERES

I- INTRODUCTION

1.1- CONTEXTE

Dans le cadre de la politique d'accès à l'électricité du gouvernement ivoirien et en réponse aux besoins croissants en électricité de la Côte d'Ivoire, Azito Energie SA (Azito Energie) prévoit d'augmenter la capacité de production d'électricité de la Centrale Électrique d'Azito près du village du même nom, dans la commune de Yopougon, dans la ville d'Abidjan.

Ce projet, aussi nommé Azito phase IV, comprend l'installation d'une nouvelle turbine à gaz (TAG), d'une chaudière de récupération de chaleur, d'une turbine à vapeur (TAV), et d'un aérocondenseur comme système de refroidissement, ainsi que les équipements auxiliaires associés. La puissance supplémentaire installée sera de 250 MW environ. La centrale passera donc d'une puissance totale installée actuelle de 430 MW à 680 MW.

L'adoption de la Loi n° 96-766 du 03 octobre 1996, portant Code de l'Environnement et la promulgation du décret n°96-894 du 08 novembre 1996 relatif aux règles et procédures applicables aux Etudes d'Impact Environnemental en République de Côte d'Ivoire, requiert du promoteur des projets d'investissement publics ou privés susceptibles de porter atteinte à l'Environnement soit une Etude d'Impact Environnemental (EIES), soit un Constat d'Impact, selon leur nature technique, leur ampleur et selon la sensibilité de leurs milieux d'implantation.

Dans le cadre des dispositions légales et réglementaires susvisées, la construction d'une centrale thermique et son exploitation font l'objet d'une Etude d'Impact Environnemental et Social (annexe I, chapitre 3, alinéa a du décret n° 96 - 894 du 08 novembre 1996 relatif à l'EIES).

En effet, au-delà des opportunités économiques, financières et de création d'emplois qu'offre cette quatrième phase de la centrale thermique à cycle combiné, les impacts potentiels sur l'environnement social et environnemental seront à évaluer.

Dans ce contexte, les présents Termes De Référence (TDR) de l'Etude d'Impact Environnemental et Social constituent un guide pour le promoteur en vue du projet d'expansion de sa centrale électrique d'Azito phase IV. La conduite de cette EIES sera menée en conformité avec les exigences légales de la Côte d'Ivoire et en considération des normes de performance environnementales et sociales de la Société financière internationale (SFI).

1.2- JUSTIFICATION DE L'ETUDE D'IMPACT ENVIRONNEMENTAL ET SOCIAL (EIES)

Le projet Azito phase IV, de par sa nature sera réalisé dans le strict respect des textes et directives en vigueur, notamment la loi n°96-766 du 03 octobre 1996 portant Code de l'Environnement, le décret n°96-894 du 08 novembre 1996 déterminant les règles et procédures applicable aux études relatives à l'impact environnemental des projets de développement et les politiques de sauvegarde de la Banque mondiale. En effet, au-delà du fait qu'il constitue une réponse aux différents problèmes d'énergie, il est important de ne pas occulter les éventuels impacts négatifs environnementaux et sociaux de sa réalisation.

1.3- CONSIDERATIONS D'ORDRE METHODOLOGIQUE

L'Etude d'Impact environnemental et social doit être présentée d'une façon claire et concise et se limiter aux éléments pertinents à la bonne compréhension du projet et de ses impacts. Ce qui peut être schématisé ou cartographié doit l'être, et ce, à des échelles adéquates. Les méthodes et les critères utilisés doivent être présentés et explicités en mentionnant, lorsque cela est possible, leur fiabilité, leur degré de précision et leurs limites d'interprétation. En ce qui concerne les descriptions du milieu, on doit retrouver les éléments permettant d'apprécier leur qualité (localisation des stations d'inventaire et d'échantillonnage, dates d'inventaire, techniques utilisées, limitations). Les sources de renseignements doivent être fournies en référence. Le nom, la profession et la fonction des personnes ayant contribué à la réalisation de l'étude d'impact doivent être indiqués.

1.4- OBJECTIFS des TDR

Ces Termes de Référence ont donc pour objectifs :

- d'exposer comment le promoteur du Projet entend élaborer un rapport d'EIES conforme aux législations en vigueur ainsi que des exigences des institutions financières internationales (en référence aux Normes de Performance en Matière de Durabilité Environnementale et Sociale de la Société Financière Internationale);
- de préciser le canevas méthodologique de l'EIES incluant les enjeux majeurs du projet ;
- de poser les principes d'une démarche explicite et homogène visant à fournir les informations pertinentes nécessaires à l'EIES dudit projet par les instances compétentes ;

Ainsi, ces TDR ont été élaborés sur la base :

- ✓ des informations recueillies lors des autres phases de la centrale d'Azito (phase I, II et III) ;
- ✓ des informations contenues dans le dossier technique du projet phase IV; et des spécificités de l'environnement du site du projet, après une visite du site de l'ANDE le vendredi 18 novembre 2016 et qui a nous permis de prendre en compte les paramètres environnementaux et sociaux nécessaires à l'élaboration du rapport de l'EIES ;
- ✓ des consultations préliminaires avec les communautés et autres parties prenantes concernées par le projet (comprenant un entretien avec l'Agence Nationale de l'Environnement).

1.5- OBJECTIF DE L'ETUDE

L'Etude d'Impact Environnemental, de façon globale, est destinée à identifier les éléments sensibles existants dans l'environnement du projet, à déterminer les parties du projet susceptibles d'avoir des effets (impacts) sur l'environnement, à évaluer l'importance de ces impacts, et à recommander des mesures et actions d'atténuation là où cela est nécessaire.

De manière spécifique, et conformément au Décret n° 96-894 du 08 novembre 1996, déterminant les règles et procédures applicable aux études relatives à l'impact environnemental des projets de développement, l'EIES du projet Azito phase 4 consistera à :

- Presenter l'existant (Azito phase I, II et II), la difference, les similitudes entre l'existant et la phase IV, les pratiques actuelles en terme de protection de l'environnement;
- décrire de façon synthétique l'ensemble du projet en incluant les rejets et nuisances et expliquer le contexte de sa réalisation (raison et justification environnementales et techniques du choix du projet) ;
- présenter et décrire l'ensemble des composantes des milieux naturels et humains (état initial) du site du projet susceptible d'être affecté;
- démontrer comment le projet s'intègre dans le milieu, en présentant l'analyse détaillée des impacts potentiels (positifs et négatifs) et en définissant les mesures destinées à corriger les impacts néfastes à la qualité de l'environnement et à maximiser ceux susceptibles de l'améliorer ;
- développer une méthodologie d'évaluation de l'importance des impacts de manière qualitative et/ou quantitative en utilisant, le cas échéant, l'outil d'évaluation économique des dommages environnementaux;
- prévoir des programmes de surveillances et de suivi (Plan de Gestion Environnementale) pour assurer le respect des exigences légales et environnementale et pour vérifier pour l'essentiel, la pertinence et l'efficacité des mesures de protection de l'environnement qui ont été proposées ;

Le contenu de cette étude exige un certain nombre de tâches au Consultant ou Bureau d'Etudes Environnementales agréé par le Ministère de l'Environnement, des Eaux et Forêts qui sera chargé de son exécution.

II- TACHES DU BUREAU D'ETUDES ENVIRONNEMENTALES CHARGE DE L'EXECUTION DE L'EIES

Au regard du contexte et des objectifs de l'étude, les taches du Bureau d'Etudes Environnementales chargé de l'EIES porteront sur les points suivants :

II.1 – DESCRIPTION DU PROJET

Le Bureau d'Etudes Environnementales procédera à la description du projet. Cette description du projet inclura tous les détails utiles à l'identification des sources d'impacts et à la compréhension de leurs effets sur les composantes pertinentes de l'environnement susceptibles d'être affectées.

À cet égard, les éléments à décrire porteront sur les composantes, caractéristiques techniques, fonctionnements et activités pendant les différentes phases du projet, y compris les activités connexes impliquées.

Cette description prendra en compte les points suivants:

II.1.1 - Contexte du projet

Cette section de l'étude vise à connaître les éléments à l'origine du projet, les raisons qui ont motivé la réalisation dudit projet et de dégager les enjeux environnementaux, sociaux, économiques et techniques du projet à l'échelle locale, régionale et Internationale.
La description du contexte du projet, comprend une courte présentation de l'initiateur, ainsi qu'un exposé des motifs du projet de façon à situer celui-ci dans son environnement.

- ***Présentation de l'initiateur du projet :***

Le Bureau d'Etudes Environnementales présentera Azito Energie les raisons sociales, ses partenaires ou associés sur le projet, la localisation de son siège et, s'il y a lieu, ses sous-traitant sur le projet. Cette présentation inclut des renseignements généraux sur ses antécédents en relation avec le projet envisagé, le secteur d'activité dans lequel se situe le projet, etc. La politique en matière d'hygiene, de la santé et environnement du promoteur sera également présentée (Politique HSE)

- ***Présentation du contexte du projet:***

Les informations ou données utiles à recueillir pour l'exposé du contexte du projet sont :

- l'historique du projet, les problèmes à résoudre, les besoins à combler, les occasions de marché dans le secteur d'activité du projet ;
- les objectifs liés au projet ;
- les aspects favorables ou défavorables du projet en relation avec ces problèmes ou besoins et avec l'état du marché (avantages et inconvénients) ;
- les intérêts et les principales préoccupations des diverses parties concernées ;
- les exigences techniques et économiques du projet pour son implantation et son exploitation,
- les politiques gouvernementales à l'égard du secteur d'activité du projet ;
- etc.

II.1.2- LOCALISATION DU SITE

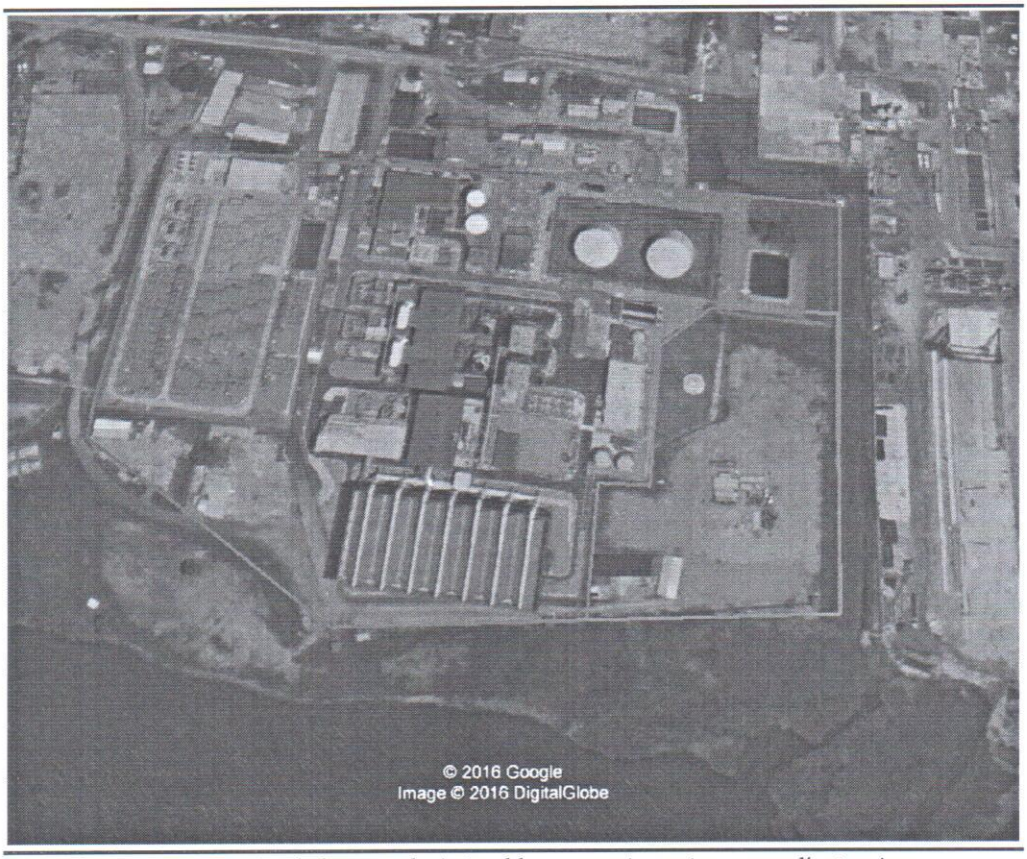
Le site est implanté près du village d'Azito (300 m au sud-est ce celui-ci), dans la commune de Yopougon, à environ 6 km à l'ouest du port d'Abidjan. Il longe le bras ouest de la Lagune Ebrié, à environ 10 km du Canal de Vridi. Le village de Béago se situe à 1 km au nord-est du site. Le site identifié pour l'extension phase IV se trouve au sein de l'emprise actuelle de la centrale (voir *Figure 0.1* et *Figure 0.2*)

Des zones d'habitations sont situées à l'ouest et au nord de la centrale d'Azito (la distance avec les habitations les plus proches du village d'Azito est de l'ordre de 300 mètres). Un chantier de construction d'extension du Port Autonome d'Abidjan se trouve à l'est du site du Projet. Enfin, le site est bordé par la lagune Ebrié au sud.

Figure 0.1 Localisation de la centrale d'Azito

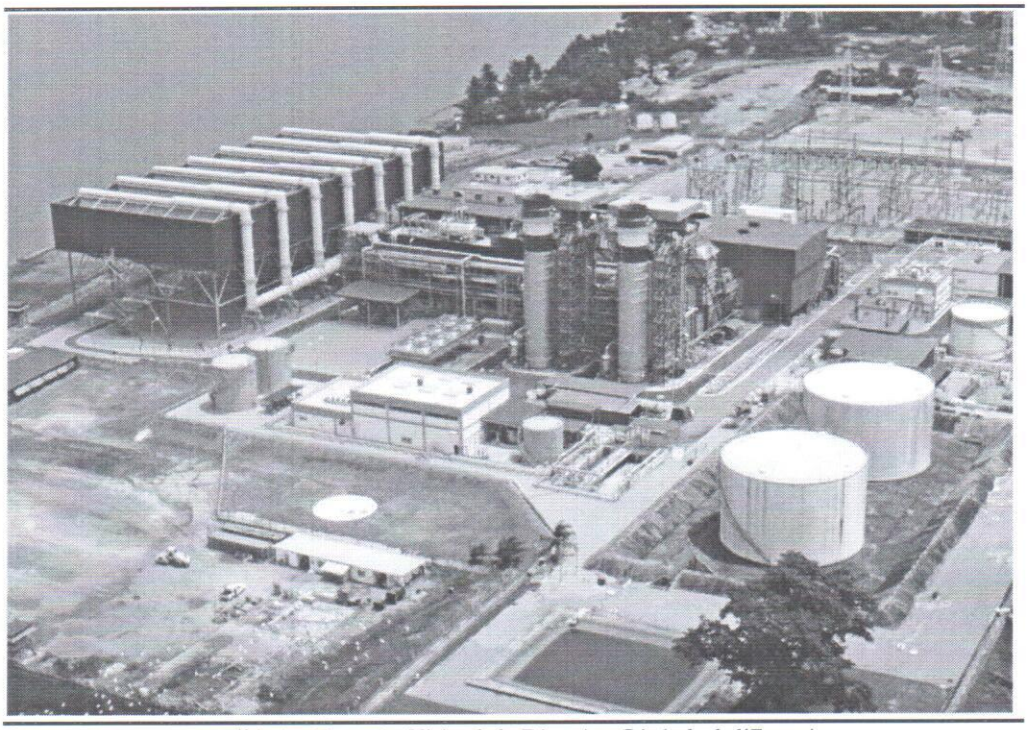
Légende : polygone rouge= emprise de la centrale Azito

Figure 0.2 Localisation de l'emplacement pour l'extension



Légende : rouge= emprise de la centrale Azito, bleu= emprise prévue pour l'extension

Figure 0.3 Vue de la centrale existante d'Azito



Source: Présentation d'Azito Energie, *Visite de la Direction Générale de l'Energie 23 Septembre 2016*

Figure 0.4 Emplacement prévu pour l'extension de la centrale d'Azito (chantier du port en fond)

Source: ERM, mission de terrain, septembre 2016

II.1. 3 - Description du processus de mise en œuvre et fonctionnement du projet

Au niveau du processus de mise en œuvre du projet

Il se fera à travers trois phases:

- Phase Preparation et de construction;
- Phase exploitation;
- Phase fermeture.

- ***LA DESCRIPTION DE LA PHASE PREPARATION DU SITE ET MOBILISATION DES EQUIPEMENTS :***

Le Bureau d'Etudes Environnementales procédera à la description des activités de préparation préalables à la mise en service de la centrale électrique phase IV qui comprendront :

- le nivellement, compactage et dressage des sols pour créer des surfaces planes (les remblais et agrégats seront issus de sources locales) ;
- l'aménagement d'un système de drainage du site ; et
- l'aménagement de surfaces en dur pour accueillir des aires de dépôt, routes, pistes, etc.

Dans le cadre de la realisation de ces activités, le BEEA devra décrire le Matériel et équipements à mobiliser

- technologies et équipements spécifiques utilisés;
- utilisation, fonctionnement;
- origine, taille, encombrement, type, nombre;
- capacité, puissance, spécifications techniques;
- de la natures et caractéristiques de l'installations du chantier .

- *LA DESCRIPTION DE LA PHASE CONSTRUCTION:*

Les activités en phase de construction se concentreront principalement sur les aspects suivants :

- l'aire de dépôt temporaire ;
- la gestion des émissions sonores et atmosphériques ;
- la gestion des déchets ;
- la création d'emploi ;
- la gestion des effluents ; et
- la gestion du transport lié aux activités du projet.

Aire de stockage temporaire du matériel de construction

Comme mentionné préalablement toutes les installations de l'extension seront implantées sur une réserve de terrain déjà allouée à la centrale d'Azito, sans générer d'emprise supplémentaire sur le foncier public ou privé (voir *Figure 0.1)*. Seule la phase de construction nécessitera une aire de dépôt temporaire. Son emplacement est encore en cours de discussion.

Gestion du transport lié aux activités du projet

Le site est actuellement accessible via son entrée située au nord-ouest de la centrale. La construction de la centrale entraînera une augmentation temporaire de la circulation de véhicules acheminant le personnel depuis et vers le site et des camions transportant des matériaux de construction. Il est prévu de développer un plan de gestion du trafic avec les parties prenantes afférentes.

L'acheminement des équipements par barge ou par route est encore à l'étude dans le cadre de l'EIES.

Gestion des effluents

En phase de construction, les effluents seront principalement issus de l'unité de production de béton implantée sur le site et les eaux usées domestiques produites par les employés. Tous les effluents seront collectés et traités dans une station d'épuration mobile et les eaux traitées utilisées pour l'arrosage des espaces verts, ou déversées dans le système d'assainissement public (dont l'acceptabilité sera soumise à confirmation dans l'EIES et à l'approbation des autorités). Des eaux de ruissellement du chantier sont susceptibles d'être produites pendant la saison humide. Celles-ci seront prises en charge dans le cadre des pratiques courantes de gestion du chantier de construction.

Gestion des émissions sonores et atmosphériques

Les émissions sonores et atmosphériques attendues seront essentiellement associées aux camions, engins de construction, générateurs mobiles, activités de montage etc.

Gestion des déchets

Le projet produira différents types de déchets en phase de construction, à savoir :

- bois d'emballage ;
- carton ;
- résidus de ciment ;
- métaux ;
- plastiques ; et
- huiles usées et chiffons souillés.

Il est à noter qu'il prévu de développer un plan de gestion des déchets.

Création d'emploi

Les activités de construction permettront de créer des emplois directs et indirects. Jusqu'à 1000 employés (au maximum) devraient être appelés en phase de construction pour assurer les tâches de génie civil, mécanique, et électrique. Les emplois au niveau local seront favorisés dans la mesure du possible.

- *LA DESCRIPTION DE LA PHASE EXPLOITATION.*

La mise en service de la centrale est prévue au second semestre 2018 pour le cycle ouvert et au second semestre 2019 pour le cycle combiné. Il s'agit ici de décrire le fonctionnement de la centrale en cycle combiné. Cette description concernera les points suivants:

- ✓ les techniques de fonctionnement des turbines à gaz et à vapeur, de l'unité de traitement de l'eau usées, etc.... ;
- ✓ le process de refroidissement de l'eau au niveau des tours;
- ✓ l'entretien et réparations des infrastructures et équipements;

Les principaux aspects environnementaux et sociaux seront les suivants :

- alimentation en eau du circuit de refroidissement de la centrale (circuit fermé);
- gestion des effluents ;
- gestion des émissions;
- création d'emploi ;
- gestion des déchets.

Gestion des effluents

Le système de refroidissement utilisé pour la phase IV (similaire au système utilisé pour la phase III) devrait employer des condenseurs à air en circuit fermé et donc utiliser une quantité limitée d'eau. Cette quantité d'eau doit être Précisée.
Les effluents et eaux usées seront traités sur site au moyen de la station de traitement conçue pour s'assurer que les rejets soient conformes aux normes locales et internationales en vigueur. Les caractéristiques de cette station de traitement doivent être fournies.
En phase d'exploitation, les seules sources d'effluents seront de faibles volumes incluant : les eaux de process (purge par exemple), les eaux de ruissellement et les eaux usées domestiques produites par les employés intervenant sur-site (environ 50 personnes).

Un système de drainage sera aménagé sur-site en phase d'exploitation et raccordé aux canaux de drainage du périmètre pour évacuer les eaux pluviales des zones adjacentes. Le réseau sera dimensionné de sorte à limiter la possibilité de rejets incontrôlés, en tenant

compte de facteurs spécifiques au site tels que l'espace disponible, l'inclinaison, la surface drainée, les débits de ruissellement attendus ainsi que l'usage en amont et en aval des cours d'eau récepteurs. Pour une question de cohérence, il est impératif de faire un état des lieux en identifiant et décrivant le réseau d'assainissement existant dans la zone (type, caractéristiques et état) ; ce permettra d'aménager un système de drainage cohérent, adapté et efficace.

- ***Gestion des émissions***

Bruit

Les émissions sonores attendues seront associées au fonctionnement de la centrale (cheminées, chaudières, turbines, systèmes de refroidissement).

Emissions atmosphériques

La combustion du gaz par la turbine de la phase IV constituera la principale source d'émissions atmosphériques rejetées par le projet d'extension.

Au niveau du fonctionnement du projet

Afin de comprendre le fonctionnement des installations du projet, le Bureau d'Etudes Environnementales procédera à la description des points suivants:

- ***Approvisionnement en eau***
  - ✓ Besoin en eau sur le site ;
  - ✓ Quantité et qualité des réserves d'eau ;
  - ✓ Mode d'approvisionnement.

- ***Gestion des eaux usées et déchets solides:***

Le projet générera des volumes limités de déchets en phase d'exploitation. A cet effet, le BEEA devra :

- ✓ Identifier les déchets ;
- ✓ Faire la typologie de ces déchets ;
- ✓ Préciser leur mode de gestion

- ***Pollutions***
  - ✓ Eléments polluants émis lors du fonctionnement des infrastructures et leur lieu d'émission (eau, sol, air…);
  - ✓ Quantité d'éléments polluants émis ;
  - ✓ Périodicité des pollutions ;
  - ✓ Risques présentés par les pollutions lors du fonctionnement normal, toxicité pour les milieux (humain, faune, flore, écosystème), prise en compte des seuils et des phénomènes d'accumulation ;
  - ✓ Prise en compte des risques de pollutions accidentelles et de leurs conséquences.

- ***Sécurité et hygiène***
  - ✓ Risques présentés par la manipulation des matériels, des engins, des équipements spécifiques, toxiques, dangereux ;

- ✓ Prise en compte des risques et prévention d'accident, d'explosion ;
- ✓ Prise en compte des problèmes et mesures d'hygiène ;
- ✓ Prise en compte des effets, de bruit, d'odeur, de vibration etc.

NB : la description du projet devra également traiter les aspects suivants :

- ❖ le calendrier de réalisation selon les différentes phases ;
- ❖ la durée des travaux (dates de début et de fin et séquence généralement suivie) ;
- ❖ la main-d'oeuvre requise et les horaires quotidiens de travail, selon les phases du projet ;
- ❖ la durée de vie du projet et les phases futures de développement ;
- ❖ les coûts estimatifs du projet.

Cette description doit être mise en relation avec l'existant. Il s'agira de faire ressortir les différences et les similitudes entre l'existant et le projet à venir. La présentation et la description des pratiques actuelles en matière de gestion de l'environnement et de développement durable. Les expériences dans ce domaine doivent être présentées ainsi que les innovations à apporter. Dans ce contexte les données sur les émissions atmosphériques (niveau d'émission), les émissions acoustiques (mesures du bruit), dans le cadre du fonctionnement de la centrale existante en comparaison avec les valeurs admises ainsi que les dispositions prises pour leur atténuation. Le mode de gestion actuel des déchets sera également decrit.

- *PHASE DE FERMETURE (DEMANTELEMENT) :*

Les activités de démantèlement incluront la mise en sécurité du site, le nettoyage des équipements, le démontage des équipements et structures, ainsi que la dépollution de la surface du site, conformément aux prescriptions réglementaires applicables et de la convention relative à l'occupation du site.

II.2- CADRE JURIDIQUE & NORMES APPLICABLES :

Cette section a pour objectif de présenter l'approche qui sera prise lors de la réalisation de l'EIES afin de décrire le cadre institutionnel et réglementaire qui sous-tend ce type de projet. L'EIES sera préparé en conformité avec les lois ivoiriennes applicables ainsi que les normes internationales de la SFI.

II.2.1- CADRE INSTITUTIONNEL

Dans le cadre de l'EIES, ERM et Enval procéderont à la description du cadre institutionnel de l'étude à travers un inventaire des différents départements ministériels et administrations locales du site qui sont concernés par le projet.

Sous l'égide du Ministère de l'Environnement et du Développement Durable, il sera fait mention de la Direction Générale de l'Environnement (DGE), de la Direction Générale du Développement Durable (DGDD), de l'Agence Nationale De l'Environnement (ANDE), du Centre Ivoirien Antipollution (CIAPOL).

Egalement, les services et directions du Ministère du Pétrole et de l'Energie (Direction Générale de l'Energie, CI-ENERGIES), du Ministère d'Etat, Ministère de l'Intérieur et de la Sécurité, du Ministère de la Construction et de l'Urbanisme (Direction de la Construction); du ministère de la Salubrité Urbaine et de l'Assainissement (Direction de l'Assainissement et du Drainage ; l'Agence Nationale de la Salubrité Urbaine (ANASUR), etc.) ; du Ministère des Infrastructures Economiques à travers la Direction du Domaine Public de l'Etat ; du Ministère de la Santé et de la Lutte contre le SIDA, le Ministère des Eaux et Forêts et du Ministère de l'Industrie et des Mines seront pris en compte dans le processus.

Les missions de toutes ces structures doivent préciser ainsi que leur lien avec le projet.

Cette liste pourra être complétée dans le cadre de la réalisation de l'EIES.

II.2.2- CADRE JURIDIQUE

II.2.2.1- Vue d'ensemble des textes et lois applicable au projet

L'EIES fournira un aperçu des principaux textes de lois applicables au projet, notamment :

- la loi 96-766 du 3 octobre 1996 portant Code de l'Environnement ;
- loi portant de l'eau ;
- loi portant de l'électricité ;
- loi sur l'orientation du développement durable ;
- le décret 96-894 du 8 novembre 1996 déterminant les règles et procédures applicable aux études relatives à l'Impact Environnemental des projets de Développement ;
- l'arrêté d'application 00972/MEEF du 14 novembre 2007 du Décret 96-894 sur les modalités d'études d'impact.
- le décret 97-393 du 9 juillet 1997 sur la création et l'organisation de l'organisme public et administratif, l'Agence Nationale de l'Environnement (ANDE);

- le décret 98-43 du 28 janvier 1998 sur les Installations Classées Pour l'Environnement (ICPE).
- la loi 95-15 of 12 janvier 1995 modifiée par la Loi 97-400 du 11 juillet 1997 portant Code du Travail.
- le décret 97-678 du 3 décembre 1997 relatif à la protection de la lagune et les milieux marins contre la pollution.
- l'Arrêté N° 01164 du 04 Novembre 2008, portant Réglementation des Rejets et Emissions des Installations Classées pour la Protection de l'Environnement. En accord avec cet Arrêté N° 01164 il est à noter que compte tenu de présence de la zone portuaire (le port à conteneur est adjacent au site de la centrale d'Azito), de la centrale d'Azito Phase I à Phase III ainsi que de l'agglomération de Yopougon nous proposons de définir la zone en ligne avec l'Arrêté N° 01164 du 04 Novembre 2008, portant Réglementation des Rejets et Emissions des Installations Classées pour la Protection de l'Environnement comme étant une : « Zones résidentielles urbaine, avec quelques ateliers ou centres d'affaires, ou avec des voies de trafic terrestre, fluvial, ou aérien assez importantes ou dans les communes rurale.

Cette liste est loin d'être exhaustive. Elle doit être complétée en prenant attache avec les différents Ministères et d'autres structures administratives impliquées dans le projet. Par ailleurs, les textes réglementaires (Constitution, lois, décrets, etc.) inventoriés doivent être présentés dans une matrice comme suit :

Intitulés des textes réglementaires	Dispositions liées aux activités du projet
Constitution Ivoirienne de 2016	
Loi cadre n°96-776 du 3 octobre 1996, portant code de l'environnement	

II.2.2.2- Vue d'ensemble des conventions applicables au projet

Plusieurs conventions ou accords ont été signés par la Côte d'Ivoire dans le domaine de la protection de l'Environnement. Ces différents textes seront référencés dans l'EIES.

Par ailleurs, les textes inventoriés doivent êtres présentés dans une matrice comme suit :

Intitulés de la convention ou accord	Date de ratification par la Côte d'Ivoire	Objectif visé par la convention ou accord	Aspects liés aux activités du projet

II.2.2.3- NORMES DE PERFORMANCE DE LA SFI

Azito Energie envisage de financer le Projet avec l'appui d'institutions financières internationales (IFI). Ces IFI exigeront du Projet qu'il réponde aux normes internationales applicables en matière de protection de l'environnement et de durabilité sociale. Les normes internationales les plus communément acceptées sont les Normes de Performance en Matière

de Durabilité Environnementale et Sociale (2012) ou NP de la SFI. La Société Financière Internationale (SFI) est une filiale du Groupe de la Banque Mondiale dont le but est de soutenir la croissance du secteur privé dans les pays en développement. Le Cadre de Durabilité de la SFI (mis à jour le 1er janvier 2012), est généralement considéré comme l'une des séries de normes les plus complètes en matière de gestion environnementale et sociale.

Les Normes de Performance de la SFI sont un élément central de ce cadre. Cet ensemble de huit normes thématiques établit les principes d'intégration des considérations à caractère environnemental, sanitaire et sécuritaire dans les projets. Elles ont été pensées pour aider les porteurs de projets à prévenir, limiter et atténuer les risques et impacts, de sorte qu'ils puissent développer leurs activités de manière durable. Les NP de la SFI sont exposées dans la *Table 0.1*.

Table 0.1 Normes de Performance de la SFI (2012) prises en compte dans le cadre du projet

NP	Intitulé	Champ d'Application
1	Evaluation et gestion des risques et des impacts environnementaux et sociaux	Définit les dispositions permettant de garantir une bonne gestion des aspects E&S, l'application des politiques et responsabilités associées, notamment par le biais d'une Etude d'Impact Environnemental et Social pour laquelle la NP n°1 définit des exigences.
2	Main d'œuvre et conditions de travail	Exigences en matière de gestion équitable de la main d'œuvre et de conditions de travail sûres et saines.
3	Utilisation rationnelle des ressources et prévention de la pollution	Définit les dispositions visant à assurer un niveau adapté de prévention et de réduction de la pollution.
4	Santé, sécurité et sûreté des communautés	Définit les dispositions visant à s'assurer que les impacts négatifs d'un projet sur la communauté hôte sont gérés et maîtrisés.
5	Acquisition de terres et réinstallation involontaire	Définit les dispositions visant à minimiser les impacts sociaux et économiques négatifs de toute réinstallation involontaire, acquisition de terres, ou restrictions quant à leur utilisation.
6	Conservation de la biodiversité et gestion durable des ressources naturelles vivantes	Définit les dispositions visant à s'assurer que les impacts d'un projet sur la nature, les écosystèmes, les habitats et la biodiversité sont dûment gérés.
7	*Peuples autochtones (non applicable au projet)*	*Définit les dispositions visant à protéger les peuples autochtones (aspect jugé non applicable au projet, étant donné l'absence de peuples autochtones au sens de la définition de la NP n°7 de la SFI dans la zone d'implantation du projet).*
8	*Patrimoine culturel (non applicable au projet)*	*Définit les dispositions visant à protéger le patrimoine culturel des impacts négatifs des activités du projet, contribuer à sa préservation et promouvoir le partage équitable des bénéfices issus de l'utilisation du patrimoine culturel.*

II.2.2.3- DIRECTIVES DE LA BANQUE MONDIALE

Les Directives Environnementales, Sanitaires et Sécuritaires Générales (ESS) du Groupe de la Banque Mondiale/Société Financière Internationale (SFI), d'avril 2007 remplacent le Guide de la Banque Mondiale publié en 1998.

Par ailleurs, les Directives ESS pour les Centrales Thermiques (décembre 2008) seront prises en compte.

Les Directives ESS actualisées constituent un référentiel technique pour appuyer l'application des Normes de Performance de la SFI.

Quand les réglementations environnementales ivoiriennes diffèrent des niveaux et mesures présentés dans les Directives ESS, le projet devra respecter les valeurs les plus contraignantes.

II.3- DESCRIPTION DE L'ETAT ENVIRONNEMENTAL ET SOCIAL INITIAL

II.3.1- Définition de la zone d'influence du projet

La zone d'influence du projet sera définie dans l'EIES comme la zone couvrant:

- les zones où se dérouleront les activités prévues du projet (zone d'implantation du projet et abords immédiats) ; et
- une zone étendue susceptible d'être vulnérable aux impacts directs et indirects sur l'environnement naturel et humain. D'après l'examen initial des sensibilités environnementales et sociales, cette zone correspond dans l'ensemble à un secteur dans un rayon de 2 km autour du site d'implantation du projet (zone étendue). Toutefois, la plupart des impacts devraient se produire dans un rayon de 500 m autour du site, et il s'agira donc de la principale zone d'étude.

La zone d'étude sociale a été définie selon l'influence potentielle du projet sur le milieu récepteur des communautés environnantes.

La définition de cette zone d'influence doit se faire conformément à la nomenclature des installations classées pour la protection de l'environnement (ICPE).

II.3.2- Milieu l'environnement socio-économique

L'environnement socio-économique susceptible d'être impacté par le Projet fera l'objet d'une discussion.

La centrale d'Azito est située à l'extrémité d'une route d'accès en provenance de la commune de Yopougon. Yopougon couvre une superficie de 153 km² répartis dans 32 quartiers et 14 villages. La centrale est entourée par:

- le village Azito à l'ouest et le village Béago au nord;
- un abattoir au nord-ouest (près de la route d'entrée à l'usine Azito); et
- des maquis (bars) le long de la rive de la lagune Ebrié, au sud-ouest.

II.3.3- Milieu physique

Cette section de l'EIES décrira l'environnement physique du projet (climat et météorologie, température, vents, hydrologie, hydrogéologie, qualité de l'air ambiant, ambiance sonore).

Les résultats des campagnes de suivi de la qualité de l'air (tubes à diffusion passive) et de l'ambiance sonore seront présentés dans l'EIES. Ces campagnes sont présentées plus en détail dans la *Section 0* sur *la* méthodologie d'évaluation des impacts et mesures d'atténuation.

II.3.4- Milieu biologique :

Cette section de l'EIES décrira l'environnement physique du projet (faune et flore, zones protégées dans la zone). L'extension sera développée sur une zone industrielle, les sensibilités du milieu biologique devraient être relativement limitées.

II.4- IDENTIFICATION ET EVALUATION DES IMPACTS :

Cette section porte sur :

- l'identification et l'analyse des impacts,
- l'évaluation de l'importance des impacts du projet, lors des différentes phases de réalisation du projet.

Méthodologie d'identification et d'évaluation des impacts et mesures d'atténuation :

L'identification et l'évaluation des impacts suivront une approche itérative articulée autour de quatre questions :

1. Prédiction – Qu'adviendra-t-il de l'environnement et des communautés du fait de la présence de cette centrale électrique.
2. Evaluation – Cet impact pose-t-il problème ? Quelle en est la sévérité ou l'importance ?
3. Atténuation – S'il est sévère, existe-t-il une solution pour en éviter ou réduire les effets négatifs ou optimiser les bénéfices ?
4. Evaluation des impacts résiduels – L'impact est-il toujours sévère après application des mesures d'atténuation ?

II.4.1 – Identification et analyse des impacts

Le Bureau d'Etudes Environnementales procédera à l'identification et à l'analyse des impacts à travers une description des relations entre le projet (activités sources d'impact) et les différentes composantes de l'environnement (éléments du milieu récepteur affectés).

Le Bureau d'Etudes Environnementales décrira les outils ou méthodologies utilisés : matrices, réseaux, etc. et expliquera ce choix. Il procédera également à l'analyse de ces impacts identifiés afin de les catégoriser selon qu'ils sont positifs et négatifs, directs et indirects et, le cas échéant, déterminer les impacts cumulatifs, synergiques et irréversibles liés à la réalisation du projet.

En fonction des différentes phases du projet, les impacts significatifs identifiés doivent être décrits selon leur nature et leurs caractéristiques (impacts directs ou indirects, négatifs ou positifs, temporaires ou permanents, continu ou intermittents, réversibles ou irréversible s, à court, moyen ou long terme, plus ou moins aptes à être corrigés ou compensés, interagissant ou non avec d'autres impacts etc.). Le caractère significatif des impacts devra être apprécié en tenant compte du contexte local et des opinions et valeurs des groupes potentiellement

affectés telles que la vulnérabilité et la sensibilité du milieu (présence d'espèces rares ou en danger, vivrier marin ou zone de passage de banc de poisson etc.).

Le Bureau d'Etudes Environnementales synthétisera dans une matrice, présentée ci-dessous, tous les impacts significatifs sur chaque composante de l'environnement.

Matrice de synthèse des impacts

Phase du projet	Zone concernée	Activités/source d'impact	Composante du milieu affectée	Nature de l'impact

L'évaluation des impacts décrira ce qu'il adviendra de l'environnement et des communautés en prédisant et quantifiant l'intensité des impacts, dans la mesure du possible. Le terme "**intensité**" est utilisé par souci de simplification pour englober plusieurs dimensions possibles de l'impact prédit, à savoir :

- la nature du changement intervenu (quels aspects sont affectés et de quelle manière) ;
- la taille, échelle ou intensité ;
- l'étendue et la répartition géographiques ;
- la durée, fréquence, réversibilité, etc. ; et
- le cas échéant, la probabilité d'occurrence de l'impact, suite à un accident ou un phénomène imprévu.

L'étape suivante de l'évaluation consistera à utiliser les données relatives à l'intensité des impacts et d'en expliquer la signification en termes d'importance pour la communauté et l'environnement, afin que les décideurs déterminent le poids à donner à la problématique, au moment de se prononcer sur le projet. Cette étape est connue sous le nom d'**Evaluation de la Sévérité des Impacts.** Il n'existe toutefois aucune définition réglementaire ou communément acceptée de la sévérité des impacts. Nous proposons donc la définition pratique suivante :

Un impact sera jugé sévère si, pris individuellement ou en conjonction avec d'autres, il devait, d'après l'équipe en charge de l'EIES, figurer dans le Rapport d'EIES de sorte à être pris en compte dans le processus de décision visant à définir si le projet devait se poursuivre ou non, et dans l'affirmative, sous quelles conditions.

L'intensité de l'impact et la valeur/sensibilité de la composante seront étudiées conjointement pour évaluer si un impact est sévère et dans l'affirmative, déterminer son degré de sévérité. Ce principe est illustré dans la *Table 0.2*. Les notes s'appliquent aux impacts positifs et négatifs.

Les critères spécifiques utilisés pour évaluer la sévérité de chaque type d'impact seront clairement définis dans l'évaluation des impacts.

II.4.2- Evaluation de importance des impacts:

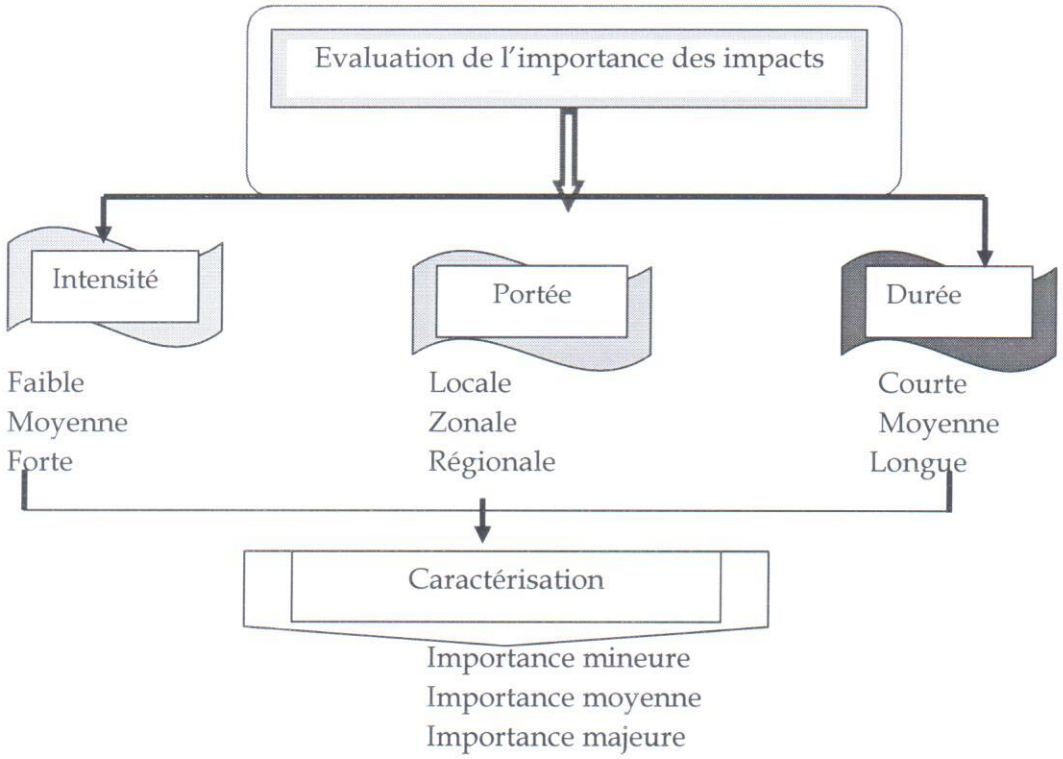
Le Bureau d'Etudes Environnementales procédera à l'évaluation de l'importance des impacts en utilisant une méthode et des critères appropriés pour classifier les impacts selon divers niveaux d'importance.

Les critères à considérer sont :

- l'intensité ou l'ampleur de l'impact,
- l'étendue ou portée de l'impact,
- la durée de l'impact.

En fonction de ces critères, le Bureau d'Etudes Environnementales appréciera chaque impact à travers des hypothèses qu'il devra définir et expliquer.

Sur la base des critères et hypothèses d'appréciation, le Bureau d'Etudes Environnementales déterminera un niveau d'importance de l'impact selon que l'impact est mineur, moyenne ou majeure. Le schéma ci-dessous peut aider à mettre en évidence la méthodologie proposée.



Pour l'évaluation de l'importance des impacts on retiendra ceci :

Intensité	Portée	Durée	Importance
Fa : Faible	Lo : Locale	Co : Courte	Mi : Mineure
Mo : Moyenne	Zo : Zonale	Mo : Moyenne	Mo : Moyenne
Fo : Forte	Re : Régionale	Lg : Longue	Ma : Majeure

La matrice ci-dessous met en évidence la présentation générale. Cette présentation devra concerner chaque phase du projet.

Phase du projet	Zone concernée	Activités/source d'impact	Composante du milieu affectée	Nature de l'impact	Evaluation de l'importance de l'impact			
					Intensité	Portée	Durée	Importance de l'Impact

La matrice de sévérité des impacts pourrait être également utilisée comme une alternative.

Table 0.2 Matrice de Sévérité des Impacts

		Sensibilité / Vulnérabilité / Importance de la Ressource/du récepteur		
		Faible	**Moyenne**	**Forte**
	Négligeable	Négligeable	Négligeable	Négligeable
Intensité de l'Impact	**Faible**	Négligeable	Mineure	Modérée
	Moyenne	Mineure	Modérée	Majeure
	Forte	Modérée	Majeure	Majeure

PRINCIPAUX IMPACTS POTENTIELS IDENTIFIES ET APPROCHE D'EVALUATION PROPOSEE

Les impacts principaux potentiels identifiés à ce jour et l'approche envisagée pour leur évaluation sont présentés dans le

Impacts potentiels	Activités du projet ayant potentiellement un impact significatif	Récepteurs	Approche proposée pour l'analyse des impacts
Rejets atmos-phériques	Emissions des véhicules/engins liées aux activités de construction. Emissions provenant de l'exploitation de l'extension de la centrale électrique.	Populations locales. En particulier, les récepteurs sensibles les plus proches susceptibles d'être affectés par une dégradation de la qualité de l'air occasionnée par le projet sont la population qui vit aux abords immédiats du	Evaluation des émissions suivant les différentes phases du projet. Compilation des données collectées par le site et modélisation des émissions par un calcul de dispersion atmosphérique des émissions de la centrale en phase d'opération (à l'aide du Model AIRMOD). **Collecte de données d'état initial :** les informations relatives à la qualité initiale de l'air seront recueillies dans la zone d'implantation du projet et ses environs. Des tubes à diffusion seront mis en place pour mesurer les concentrations ambiantes de NO2 au niveau de huit emplacements différents au maximum, choisis par nos experts en émissions atmosphériques, sur la base de données bibliographiques et informations obtenues lors de la visite initiale du site. Les tubes seront récupérés tous les mois pendant trois mois et envoyés à un laboratoire européen certifié, en vue de leur analyse. **Etude technique :** une modélisation de la dispersion atmosphérique sera réalisée. Pour la centrale électrique, elle permettra de simuler les concentrations au sol de NOX, NO2, SO2 et particules induites par les activités du projet dans le bassin atmosphérique. Le modèle

		site autour du site d'implantation du Projet.	utilisé sera la suite logicielle CALMET-CALPUFF, approuvée par l'agence américaine pour la protection de l'environnement (US EPA). Les résultats seront illustrés de manière cartographique sous forme de courbes de concentrations et d'une analyse des concentrations maximales et de leur répartition spatio-temporelle. Les impacts des émissions atmosphériques sur la qualité de l'air ambiant seront évalués pour déterminer la sévérité probable desdites émissions sur les zones sensibles autour de la centrale par rapport aux normes nationales et internationales (SFI et Organisation Mondiale de la Santé - OMS) en vigueur.
Bruit et vibration	Emissions des véhicules/engins liées aux activités de construction. Emissions provenant de l'exploitation de l'extension de la centrale électrique.	Populations locales. En particulier, les récepteurs sensibles les plus proches susceptibles d'être affectés par les émissions de bruit sont la population qui vit aux abords immédiats du site autour du site d'implantation du projet.	Evaluation des niveaux de bruit suivant les différentes phases du projet. Collecte de données de terrain et modélisation des émissions (à l'aide du Model SoundPLAN). **Collecte de données primaires :** les niveaux de bruit (en journée et de nuit) seront mesurés dans le cadre d'une campagne de terrain. Les paramètres mesurés sur de courts intervalles (15 à 30 minutes par mesure), incluront les indicateurs suivants : • niveau de bruit équivalent (Leq court) mesuré sur de courts intervalles (de l'ordre de 1 s) - permettant d'identifier les émissions sonores à court terme ; • niveau de bruit équivalent général (LAeq) intégré sur l'ensemble de l'intervalle de mesure (fournissant une valeur de fond moyenne) ; • niveaux de bruit minimums (Lmin), maximums (Lmax), et statistiques (L50, L10, L90) (pour évaluer la variabilité des niveaux de bruit aux points de mesure). Les conditions météorologiques, susceptibles d'affecter les mesures, seront consignées (notamment les vents à des vitesses supérieures à 3 m/s, leur orientation et les précipitations), ainsi que les principales sources de bruit dominant entendu en cours de mesure (heure, localisation et nature de la source). Les points de mesure proposés se situeront à la limite/clôture du site et au niveau des récepteurs sensibles les plus proches (des échantillons des habitations et bâtiments aux abords immédiats et écoles/centres médicaux les plus proches seront déterminés par l'expert acousticien dépêché sur le site). **Etude technique :** les impacts sur les niveaux sonores ambiants seront évalués au moyen d'exercices de modélisation à l'aide du logiciel SoundPLAN v7.2 pour calculer les émissions sonores issues des activités du projet, en mettant l'accent sur le fonctionnement des moteurs alternatifs et la circulation associée. Les impacts seront évalués pour déterminer la sévérité probable desdites émissions sur les zones sensibles autour de la centrale par rapport aux normes nationales et internationales (SFI et Organisation Mondiale de la Santé - OMS) en vigueur.
Gaz à effet de serre	Emissions des véhicules/engins liées aux activités de construction (transport de personnel et de	Populations locales et réchauffement climatique	La quantité de gaz à effet de serre sera calculée en tonnes de CO_2 équivalent sur la base d'estimation des facteurs d'émissions utilisées issus du bilan carbone de l'UNFCCC ou de l'ADEME.

	marchandises). Emissions provenant de l'exploitation de l'extension de la centrale électrique.		
Utilisation des ressources en eaux et pollution potentielle des eaux souterraines ou de surface	Activités de construction et d'exploitation de la centrale électrique et gestion des effluents.	Milieux physique et flore/faune.	Une évaluation sera également effectuée en tenant compte des types de matériaux utilisés et manipulés ainsi que des effluents et déchets générés en phases de construction et d'exploitation et, en cas de risque d'impacts sévères issus de rejets accidentels ou intentionnels dans le milieu naturel, des mesures visant à atténuer lesdits impacts seront identifiées. Un inventaire des déchets sera établi dans le cadre de cette évaluation.
Appauvrissement des sols	Activités de construction et d'exploitation de la centrale électrique.	Sol.	L'évaluation s'assurera de la prise en compte du risque d'érosion et de sédimentation. Conjointement à une identification cartographique des sols, les impacts seront préalablement identifiés par le biais d'une évaluation qualitative approfondie des problèmes liés à l'érosion.
Ecologie	Déblaiement et défrichement du site et des zones de travail durant construction. Emissions provenant de l'exploitation de l'extension de la centrale électrique.	Faune et Flore.	Analyse qualitative. Considération à la fois des milieux aquatiques et terrestres.
Patrimoine culturel	Déblaiement et défrichement du site et des zones de travail durant construction.	Patrimoine culturel (découverte fortuite).	Cet impact sera analysé de manière qualitative. Le Projet sera implanté sur une aire déjà partiellement aménagée en bordure de la centrale existante d'Azito.
Social	Interactions entre les travailleurs et les Populations locales. Emploi (positif). Activités de construction et d'exploitation de la centrale électrique.	Populations locales.	Compilation des données pour la caractérisation des effets socio-économiques du projet (effets directs et indirects) comprenant également une identification des flux potentiels de chercheurs d'emplois durant la phase de construction. Les effets du projet seront évalués de façon à identifier les bénéfices positifs du projet ainsi que les impacts potentiels sur la population locale. Aussi l'étude comprendra une évaluation des services écosystémiques (qualitative à ce stade). Evaluation selon les informations disponibles des aspects sécurité, conditions de travail. Dans le cadre de l'EIES, les principales dimensions sociales seront passées en revue sur la base de la visite de terrain, des entretiens et documentations (études bibliographiques, d'images satellites et de cartes). Cette approche donnera une vision du contexte socioéconomique local et contribuera à l'élaboration de l'évaluation des impacts. Ce contexte est la base ("situation de référence") du plan de suivi qui sera constitué d'indicateurs de synthèse sur la zone impactée.
Santé, sûreté	Activités de	Employés et	Les impacts potentiels du projet, sur la santé, sûreté et sécurité des

et sécurité	construction et d'exploitation de la centrale électrique.	Populations locales.	employés, y compris des sous-traitants seront identifiés et décrits. Les aspects santé, sûreté et sécurité communautaires seront également pris en compte.
Trafic	La construction et l'exploitation du projet induiront des transports additionnels (transport routier et transport fluvial à l'étude).	Populations locales.	Les effets de ces transports seront évalués qualitativement : estimation de la nature et la quantité des transports envisagés pendant la phase de construction et la phase d'exploitation. Evaluation des effets directs et indirects de la construction ou amélioration de pistes, aménagement de l'embarcadère, augmentation du transport fluvial.
Déchets	Gestion et l'élimination des déchets.	Installation approuvée pour l'élimination des déchets Populations locales.	Inventaire et classification des déchets attendus du Projet. Description des procédures de stockage, manutention, transport, traitement et élimination, en s'appuyant sur les pratiques déjà existantes dans l'installation d'Azito.
Evéne-ment excep-tionnel	Accident de circulation Fuite de gaz.	Populations locales	Recensement des types d´impacts et récepteurs pouvant être sujets à des événements exceptionnels. L´évaluation des impacts seront estimés dans une section séparée.

Tableau 0.3 ci-après.

Compte tenu du fait que le projet se restreint à un projet d'extension seulement, les impacts de l'extension sont censés être limités.

L'étude s'appuiera sur l'expérience d'Azito Energie et les mesures déjà mises en place par le site pour gérer ces impacts principaux potentiels en phase d'exploitation et les mesures développées lors de la phase de construction.

Impacts potentiels	Activités du projet ayant potentiellement un impact significatif	Récepteurs	Approche proposée pour l'analyse des impacts
Rejets atmos-phériques	Emissions des véhicules/engins liées aux activités de construction. Emissions provenant de l'exploitation de l'extension de la centrale électrique.	Populations locales. En particulier, les récepteurs sensibles les plus proches susceptibles d'être affectés par une dégradation de la qualité de l'air occasionnée par le projet sont la population qui vit aux abords immédiats du site autour du site d'implantation du Projet.	Evaluation des émissions suivant les différentes phases du projet. Compilation des données collectées par le site et modélisation des émissions par un calcul de dispersion atmosphérique des émissions de la centrale en phase d'opération (à l'aide du Model AIRMOD). **Collecte de données d'état initial :** les informations relatives à la qualité initiale de l'air seront recueillies dans la zone d'implantation du projet et ses environs. Des tubes à diffusion seront mis en place pour mesurer les concentrations ambiantes de NO_2 au niveau de huit emplacements différents au maximum, choisis par nos experts en émissions atmosphériques, sur la base de données bibliographiques et informations obtenues lors de la visite initiale du site. Les tubes seront récupérés tous les mois pendant trois mois et envoyés à un laboratoire européen certifié, en vue de leur analyse. **Etude technique :** une modélisation de la dispersion atmosphérique sera réalisée. Pour la centrale électrique, elle permettra de simuler les concentrations au sol de NO_X, NO_2, SO_2 et particules induites par les activités du projet dans le bassin atmosphérique. Le modèle utilisé sera la suite logicielle CALMET-CALPUFF, approuvée par l'agence américaine pour la protection de l'environnement (US EPA). Les résultats seront illustrés de manière cartographique sous forme de courbes de concentrations et d'une analyse des concentrations maximales et de leur répartition spatio-temporelle. Les impacts des émissions atmosphériques sur la qualité de l'air ambiant seront évalués pour déterminer la sévérité probable desdites émissions sur les zones sensibles autour de la centrale par rapport aux normes nationales et internationales (SFI et Organisation Mondiale de la Santé - OMS) en vigueur.
Bruit et vibration	Emissions des véhicules/engins liées aux activités de construction. Emissions provenant de l'exploitation de l'extension de la centrale électrique.	Populations locales. En particulier, les récepteurs sensibles les plus proches susceptibles d'être affectés par les émissions de bruit sont la population qui vit aux abords immédiats du site autour du site d'implantation du projet.	Evaluation des niveaux de bruit suivant les différentes phases du projet. Collecte de données de terrain et modélisation des émissions (à l'aide du Model SoundPLAN). **Collecte de données primaires :** les niveaux de bruit (en journée et de nuit) seront mesurés dans le cadre d'une campagne de terrain. Les paramètres mesurés sur de courts intervalles (15 à 30 minutes par mesure), incluront les indicateurs suivants : • niveau de bruit équivalent (Leq court) mesuré sur de courts intervalles (de l'ordre de 1 s) - permettant d'identifier les émissions sonores à court terme ; • niveau de bruit équivalent général (LAeq) intégré sur l'ensemble de l'intervalle de mesure (fournissant une valeur de fond moyenne) ; • niveaux de bruit minimums (Lmin), maximums (Lmax), et statistiques (L50, L10, L90) (pour évaluer la variabilité des niveaux de bruit aux points de mesure). Les conditions météorologiques, susceptibles d'affecter les mesures, seront consignées (notamment les vents à des vitesses supérieures à 3 m/s, leur orientation et les précipitations), ainsi que les principales sources de bruit dominant entendu en cours de mesure (heure, localisation et nature de la source). Les points de mesure proposés se

			situeront à la limite/clôture du site et au niveau des récepteurs sensibles les plus proches (des échantillons des habitations et bâtiments aux abords immédiats et écoles/centres médicaux les plus proches seront déterminés par l'expert acousticien dépêché sur le site). **Etude technique :** les impacts sur les niveaux sonores ambiants seront évalués au moyen d'exercices de modélisation à l'aide du logiciel SoundPLAN v7.2 pour calculer les émissions sonores issues des activités du projet, en mettant l'accent sur le fonctionnement des moteurs alternatifs et la circulation associée. Les impacts seront évalués pour déterminer la sévérité probable desdites émissions sur les zones sensibles autour de la centrale par rapport aux normes nationales et internationales (SFI et Organisation Mondiale de la Santé - OMS) en vigueur.
Gaz à effet de serre	Emissions des véhicules/engins liées aux activités de construction (transport de personnel et de marchandises). Emissions provenant de l'exploitation de l'extension de la centrale électrique.	Populations locales et réchauffement climatique	La quantité de gaz à effet de serre sera calculée en tonnes de CO_2 équivalent sur la base d'estimation des facteurs d'émissions utilisées issus du bilan carbone de l'UNFCCC ou de l'ADEME[1].
Utilisation des ressources en eaux et pollution potentielle des eaux souterraines ou de surface	Activités de construction et d'exploitation de la centrale électrique et gestion des effluents.	Milieux physique et flore/faune.	Une évaluation sera également effectuée en tenant compte des types de matériaux utilisés et manipulés ainsi que des effluents et déchets générés en phases de construction et d'exploitation et, en cas de risque d'impacts sévères issus de rejets accidentels ou intentionnels dans le milieu naturel, des mesures visant à atténuer lesdits impacts seront identifiées. Un inventaire des déchets sera établi dans le cadre de cette évaluation.
Appauvrissement des sols	Activités de construction et d'exploitation de la centrale électrique.	Sol.	L'évaluation s'assurera de la prise en compte du risque d'érosion et de sédimentation. Conjointement à une identification cartographique des sols, les impacts seront préalablement identifiés par le biais d'une évaluation qualitative approfondie des problèmes liés à l'érosion.
Ecologie	Déblaiement et défrichement du site et des zones de travail durant construction. Emissions provenant de l'exploitation de l'extension de la	Faune et Flore.	Analyse qualitative. Considération à la fois des milieux aquatiques et terrestres.

[1] http://www.energies-davenir.com/bibliotheque-ea/production_energie_reseau_alimentation/bilan_carbone_guide_facteurs_emissions_V5.pdf

	centrale électrique.		
Patrimoine culturel	Déblaiement et défrichement du site et des zones de travail durant construction.	Patrimoine culturel (découverte fortuite).	Cet impact sera analysé de manière qualitative. Le Projet sera implanté sur une aire déjà partiellement aménagée en bordure de la centrale existante d'Azito.
Social	Interactions entre les travailleurs et les Populations locales. Emploi (positif). Activités de construction et d'exploitation de la centrale électrique.	Populations locales.	Compilation des données pour la caractérisation des effets socio-économiques du projet (effets directs et indirects) comprenant également une identification des flux potentiels de chercheurs d'emplois durant la phase de construction. Les effets du projet seront évalués de façon à identifier les bénéfices positifs du projet ainsi que les impacts potentiels sur la population locale. Aussi l'étude comprendra une évaluation des services écosystémiques (qualitative à ce stade). Evaluation selon les informations disponibles des aspects sécurité, conditions de travail. Dans le cadre de l'EIES, les principales dimensions sociales seront passées en revue sur la base de la visite de terrain, des entretiens et documentations (études bibliographiques, d'images satellites et de cartes). Cette approche donnera une vision du contexte socioéconomique local et contribuera à l'élaboration de l'évaluation des impacts. Ce contexte est la base ("situation de référence") du plan de suivi qui sera constitué d'indicateurs de synthèse sur la zone impactée.
Santé, sûreté et sécurité	Activités de construction et d'exploitation de la centrale électrique.	Employés et Populations locales.	Les impacts potentiels du projet, sur la santé, sûreté et sécurité des employés, y compris des sous-traitants seront identifiés et décrits. Les aspects santé, sûreté et sécurité communautaires seront également pris en compte.
Trafic	La construction et l'exploitation du projet induiront des transports additionnels (transport routier et transport fluvial à l'étude).	Populations locales.	Les effets de ces transports seront évalués qualitativement : estimation de la nature et la quantité des transports envisagés pendant la phase de construction et la phase d'exploitation. Evaluation des effets directs et indirects de la construction ou amélioration de pistes, aménagement de l'embarcadère, augmentation du transport fluvial.
Déchets	Gestion et l'élimination des déchets.	Installation approuvée pour l'élimination des déchets Populations locales.	Inventaire et classification des déchets attendus du Projet. Description des procédures de stockage, manutention, transport, traitement et élimination, en s'appuyant sur les pratiques déjà existantes dans l'installation d'Azito.
Evéne-ment excep-tionnel	Accident de circulation Fuite de gaz.	Populations locales	Recensement des types d´impacts et récepteurs pouvant être sujets à des événements exceptionnels. L´évaluation des impacts seront estimés dans une section séparée.

Tableau 0.3 Principaux impacts potentiels identifiés

a. EVALUATION DES IMPACTS RESIDUELS

Une fois toutes les mesures d'atténuation validées et appliquées, les impacts feront l'objet d'une réévaluation finale pour déterminer l'intensité et la sévérité de tous les impacts résiduels. Les résultats figureront dans le rapport d'EIES final, accompagnés d'une explication sur la manière dont les impacts ont été réduits à un niveau aussi bas que raisonnablement possible et des raisons pour lesquelles aucune mesure d'atténuation complémentaire des impacts résiduels sévères n'est envisageable d'un point de vue technique ou financier.

b. EVALUATION DES IMPACTS CUMULATIFS

L'EIES évaluera les impacts cumulatifs susceptibles de survenir des impacts incrémentaux du projet, en tenant compte des autres développements prévus qui ont reçu une autorisation administrative.

Certains aspects du projet donneront lieu à une évaluation actualisée/complémentaire des impacts cumulatifs notamment les points suivants mais pas uniquement :

- qualité de l'air dans la zone ;
- ambiance sonore dans la zone ;
- consommation et pollution de l'eau ;
- gestion des migrations internes ; et
- développement des compétences.

Les autres thématiques qui pourraient s'avérer nécessaires de considérer dans le cadre de l'évaluation des impacts cumulatifs, incluent l'intensification de la circulation sur la route existante, la pression accrue sur les infrastructures, la gestion des eaux de ruissellement et la consommation d'eau.

L'évaluation des impacts cumulatifs sera effectuée en s'appuyant sur le manuel de la SFI intitulé *Good Practice Handbook: Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets* (manuel de bonnes pratiques relatives à l'évaluation et la gestion des impacts cumulatifs pour le secteur privé sur les marchés émergents).

II.5- MESURES D'ATTENUATION :

Ce chapitre, dans la réalisation de l'Etude d'Impact Environnemental et Social, vise trois principaux objectifs à savoir :

- rechercher les meilleures alternatives de mise en œuvre du projet ;
- définir un programme d'actions cohérent visant à atténuer, réduire les impacts négatifs les plus significatifs ou à compenser les préjudices subis par les personnes affectées par le projet ;
- rechercher la rentabilité environnementale du projet pour une gestion durable des ouvrages et des équipements réalisés.

En d'autres termes, les mesures de protection de l'environnement doivent être techniquement faisables, économiquement appropriées et socialement acceptables. Le Bureau d'Etudes Environnementales doit chercher à optimiser ces mesures, de telle sorte que l'efficacité de l'une n'interfère pas avec celle de l'autre et qu'aucune mesure ne cause elle-même d'autres impacts négatifs.

En effet, l'évaluation des impacts a pour objet de s'assurer que les décisions relatives aux projets sont prises en parfaite connaissance de leurs répercussions probables sur l'environnement et les communautés, mais aussi pour identifier les mesures susceptibles d'être prises pour que lesdits impacts soient aussi faibles que possible d'un point de vue technique et financier.

Pour ce faire, il s'agira d'identifier les secteurs où des impacts sévères pourraient se produire, puis de collaborer avec l'ensemble de l'équipe en charge du projet pour identifier des moyens pratiques et économiques de les atténuer au mieux.

Quand un impact sévère est identifié, des solutions d'atténuation seront envisagées selon la hiérarchie suivante :

- prévention à la source – élimination de la source de l'impact potentiel, par exemple en déplaçant une composante du projet pour éviter un site sensible ;
- réduction à la source – réduction de la source d'impact ;
- atténuation – réduction de l'impact entre la source et le récepteur ;
- réduction au niveau du récepteur – réduction de l'impact au niveau du récepteur ;
- réparation – réparation des dommages une fois l'impact produit ; et
- compensation – remplacement d'une ressource perdue ou endommagée par une ressource similaire ou différente, mais de valeur égale.

Il convient de noter que toutes ces mesures doivent être compatibles avec les impacts identifiés.

Toutes les mesures préconisées pour la maîtrise des impacts seront également synthétisées par le Bureau d'Etude Environnementales dans une matrice, donnant une vue synoptique de la situation décrite pour chaque composante de l'environnement.

Matrice de Synthèse des mesures préconisées

Phase du projet	Zone concernée	Activités/source d'impact	Composante du milieu affectée	Nature de l'impact	Mesure d'atténuation préconisées

II.6 - GESTION DES RISQUES ET DES ACCIDENTS

La mise en œuvre et l'exploitation du présent projet peut être à l'origine d'accidents aux conséquences majeures.

Le Bureau d'Etudes Environnementales doit identifier les dangers associés au projet et en ressortir les possibilités d'accidents technologiques majeurs pouvant mettre en péril la sécurité publique ou porter atteinte à l'environnement.

L'analyse des risques et des dangers doit permettre de circonscrire les zones de danger et de connaître les composantes menacées en cas d'accidents. L'étude doit décrire les mesures de sécurité qui seront prises sur le site du projet et le plan de mise en œuvre. Cette analyse tiendra compte des lois, des règlements et des codes de pratiques auxquels doit se conformer le projet. Les exigences du code du travail en Côte d'Ivoire seront d'une importance capitale dans cette analyse.

II.7 - PLAN DE GESTION ENVIRONNEMENTALE ET SOCIALE (PGES)

L'objectif majeur étant d'améliorer les conditions environnementales du projet, il est indispensable de proposer un Plan de Gestion Environnementale e sociale (PGES) qui devra traduire les recommandations de l'EIES sous forme de plan opérationnel. Par conséquent, le Bureau d'Etude Environnementales décrira les mécanismes mis en place (actions requises) pour assurer le respect des exigences environnementales et le bon fonctionnement des travaux, des équipements et des installations ainsi que le suivi de l'évolution de certaines composantes du milieu naturel et humain, affectées par le projet.

Le Bureau d'Etudes Environnementales distinguera deux aspects au niveau du PGES. Il s'agit de la surveillance environnementale et du suivi environnemental. Il définira les objectifs visés par chaque aspect et définira les organismes responsables de leur mise en œuvre.

Le PGES élaboré par le Bureau d'Etudes Environnementales sera présenté à partir des indicateurs de suivi environnemental et social et des indicateurs de performance permettant d'observer les évolutions au regard des objectifs préalablement définis.

Le PGES devra être établi avec le souci de concilier les moyens logistiques et financiers à mettre en œuvre et les résultats souhaitables. Il mettra également en exergue les différents partenaires et leurs responsabilités.

En effet, le Bureau d'Etudes Environnementales devra indiquer les acteurs aptes à exécuter les actions proposées dans le PGES, évaluer sommairement leurs capacités et définir les besoins de renforcements de capacités ou de renforcement institutionnels pour les mettre dans les meilleures conditions pour assumer cette mission.

Une matrice de synthèse sera élaborée par le Bureau d'Etudes Environnementales et tiendra compte des aspects suivants : les impacts et les mesures d'atténuation en fonction des différentes phases de mise en œuvre du projet et des indicateurs environnementaux pertinents et judicieusement identifiés. Cette matrice est présentée ci-après.

Ainsi donc, les mesures d'atténuation validées seront regroupées dans le Plan de Gestion Environnementale et Sociale (PGES) pour la phase de construction et d'exploitation. Le PGES sera préparé conformément à la réglementation Ivoirienne et considéra également le système de gestion environnemental et social déjà mis en place par Azito Energie, les référentiels internationaux et les meilleures pratiques industrielles, dans la mesure où ils sont applicables et pertinents dans le contexte du projet.

L'étude s'appuiera sur l'expérience d'Azito Energie et les mesures déjà mise en place par le site développé ce PGES afin de l'intégrer au système de gestion environnemental et social déjà mis en place par Azito.

Plusieurs plans de gestion séparés, spécifiques à certaines activités, proposés dans l'EIES pour apporter des informations complémentaires relatives à des aspects spécifiques clés, notamment :

- qualité de l'air et émissions de gaz à effet de serre ;
- gestion du bruit et des vibrations ;
- gestion intégrée de l'eau ;
- santé, sécurité et sûreté des communautés et des employés ;
- gestion du transport lié aux activités d'Azito;
- gestion des déchets ;
- réhabilitation et fermeture du site ; et
- prévention et intervention en cas d'urgence ; et
- plan d'engagement des parties prenantes.

Matrice du Plan de Gestion Environnementale (PGE)

Phase du projet	Zone concernée	Activités/ source d'impact	Composante du milieu affectée	Nature de l'impact	Mesures d'atténuation préconisées	Responsable d'exécution ou de surveillance	Responsable de suivi	Indicateurs de suivi environnementaux	Coût	Source de verification	Source de financement

NB : Une estimation du coût des mesures d'atténuation doit être faite

III- INFORMATION ET PARTICIPATION PUBLIQUE

Conformément à l'article 16 du Code de l'Environnement, une enquête publique est exigée pour tout projet soumis à l'Etude d'Impact Environnemental. Compte tenu des enjeux sociaux majeurs liés au présent projet, le bureau d'études organisera des séances de consultation des populations riveraines et celles qui sont situées dans la zone d'influence théorique du site du projet. L'ANDE quant à elle soumettra le rapport d'EIES à une enquête publique.

Dans le cadre de cette approche participative, une large consultation des personnes affectées par les activités du projet et de toutes les parties prenantes du projet sera faite pour qu'elles participent à toutes les étapes de l'étude de manière constructive. Sur cette base, la participation du public (populations, Ministères techniques, structures privées, ONG, etc.) dans le processus de planification et de décision est exigée par les institutions nationales et internationales dans la mise en œuvre des projets de développement.
Dans le cas du présent projet, il s'agira pour le Consultant, de proposer un processus d'information et de consultation des populations selon les exigences de la politique des institutions financières internationales. Ainsi, le Consultant précisera l'étendue des consultations qu'il aura entreprises en vue de recueillir les points de vue et les préoccupations de toutes les parties intéressées par la réalisation du projet et prendra contact avec les autorités administratives, locales et coutumières, ainsi que la population cible.
Il s'agira d'effectuer :

- des enquêtes auprès des personnes ressources ;
- une analyse du contexte ;
- une identification des acteurs locaux importants et influents ;
- une identification des structures internes et externes ;
- l'identification des stratégies possibles pour la consultation et la sensibilisation des populations.

Important :

Le Consultant présentera de façon claire **la méthodologie de la consultation des parties prenantes et la manière dont les résultats de ces consultations ont été documentés :**

a) Méthodologie de la consultation

A ce niveau, le Consultant présentera:

- ***le calendrier ou programme de réalisation des consultations***. Il s'agit de présenter les différentes étapes de la consultation en mettant en exergue le temps nécessaires et les entités rencontrées.
- ***les supports ayant servis pour la consultation***. Ces supports qui devront comporter entre autres un résumé de l'objectif du projet proposé, la description du projet et les impacts potentiels. Les différents supports utilisés seront annexés au rapport de l'étude.
- ***les voies appropriées pour consulter***. Selon les caractéristiques des différents groupes de personnes consultées, les problèmes à débattre, la tradition locale et autres considérations spécifiques de la zone du projet, le Consultant présentera les moyens utilisés, les techniques et les instruments de collecte de données. Il s'agira par exemple de réunions publiques, de discussions de groupe (focus groupes), d'enquêtes auprès des ménages, etc.

- le contenu des consultations

Le Consultant décrira de manière exhaustive:

- les aspects avantageux ou impacts positifs du projet à discuter;
- les impacts négatifs du projet pouvant engendrer une dégradation de la qualité de vie qui doivent être connus par les parties prenantes.

b) Documentation des résultats des consultations

Il s'agira ici, pour le Consultant de donner les résultats de la consultation à travers les procès-verbaux des réunions publiques, des discussions de groupe, des enquêtes auprès des ménages, etc. Ces procès-verbaux présenteront en détail les éléments majeurs suivants :

- les informations communiquées ou discutées ;
- les questions ou préoccupations soulevées par les parties prenantes ;
- les réponses apportées aux préoccupations soulevées ;
- la manière dont les commentaires et suggestions reçus pendant les consultations ont été pris en compte dans les décisions concernant la conception du projet et les modalités de mise en œuvre ;
- les accords conclus ou les désaccords avec les parties prenantes.

Ces procès-verbaux ainsi que les listes de présence des personnes consultées doivent être dûment signés par les différentes parties et annexés au rapport.

Le Consultant annexera également au rapport les accusés de réception du courrier adressé aux différentes parties prenantes.

Les conclusions de ces consultations seront présentées dans l'EIES.

III - DUREE DE L'ETUDE

La durée probable de l'étude est laissée à l'appréciation du maître d'ouvrage à savoir : Azito Energie. Le Bureau d'Etudes Environnementales proposera un planning d'exécution de l'étude en tenant compte des aspects indicatifs suivants :

- la consultation des autorités administratives locales,
- les enquêtes socio-économiques,
- etc.

IV - EQUIPE D'EXPERTS

L'Etude doit être réalisée par un Bureau d'Etudes Environnementales agrée par le Ministère de l'Environnement et du Développement Durable. Les experts requis par le Bureau d'Etudes Environnementales pour la réalisation de l'étude auront une qualification suffisante et justifieront d'au moins cinq (5) années d'expérience pour le Chef d'équipe EIE et trois (3) années pour les autres experts. Une expérience dans les études ou projets connexes est requise.

L'équipe chargée de l'élaboration de l'EIE sera composée des profils suivants:

- ***un Gestionnaire en Environnement, spécialiste en EIE***: Chef d'équipe, il sera chargé de coordonner les activités des membres de l'équipe et de la rédaction des différents rapports d'étape. En particulier, il orientera les membres de l'équipe sur les activités à prendre en compte. Il précisera la méthodologie à mettre en œuvre et organisera les échanges.

- ***un Socio-économiste*** : il sera chargé d'identifier les déterminants sociaux et analyser les répercussions possibles du projet sur les activités socio-économiques.

- ***un Biologiste, spécialisé en hydrobiologie marine ou expert en océanologie*** : chargé de décrire le milieu de vie biologique du site du projet et de déterminer les impacts du projet sur le milieu et de préconiser les mesures d'atténuation.

- ***un Ingénieur, spécialisé en sécurité industrielle et en gestion des risques*** : Il sera chargé d'apprécier les incidences des activités sur l'environnement naturel et humain et de proposer les mesures idoines.

- ***Un ingénieur en électromécanique ou en électricité*** : Il sera chargé d'identifier les impacts liés au process de fonctionnement de l'unité.

IV- STRUCTURE PROPOSEE DU RAPPORT D'EIES

La structure proposée du rapport d'EIES et la suivante :

Section	Description du contenu
0. Résumé non technique	Résumé concis afin de comprendre les résultats de l'EIES.
1. Présentation et Cadre Réglementaire	Historique du projet, présentation du promoteur, présentation du contexte juridique ivoirien, analyse des exigences règlementaires applicables à l'EIES et de la méthodologie adoptée pour l'EIES. Une analyse détaillée sera conduite sur la législation environnementale et sociale applicable au projet et sur le contexte administratif et le cadre institutionnel ivoirien,
2. Description du projet	La description du projet fournira des détails techniques sur la localisation, la conception et les phases de construction, d'exploitation et de réaménagement du projet et expliquera l'historique de son développement.
3. Analyse des Alternatives	Description et analyses des alternatives au projet, en termes d'impacts environnementaux et sociaux.
4. Caractérisation d'Etat Initial	Description de l'environnement à l'état initial pour chaque thème étudié.
5. Impacts sur l'Environnement Physique, Biologique, Humain	Chaque section thématique fournira les informations suivantes : • Une présentation du thème, des sources et des types d'impact abordés dans le chapitre. • Une description des impacts et caractérisation de leur importance. • Présentation des mesures d'atténuation prévues pour éviter ou réduire les impacts, suivie par une évaluation de l'importance des impacts résiduels après mise en place des mesures d'atténuation.
6.. Plan de Gestion des Risques Sociaux, Environnementaux et Sanitaires	Cette partie décrira le cadre à utiliser pour s'assurer de l'application des mesures d'atténuation. Le rendu consistera en un tableau récapitulatif présentant l'ensemble des mesures d'atténuation et leur échéance, plan de suivi et de surveillance.
Annexes	Des informations afférentes seront fournies dans les annexes, lorsque cela sera nécessaire et incluront ce qui suit : • Les termes de référence approuvés, • Les informations sur la conception des travaux proposés, • Les données de base sur l'état initial, • Les consultations ; • Les détails des calculs et études de modélisation.

V- *CALENDRIER DE L'EIES*

Le planning de l'EIES suivant est proposé :

1. Préparation de l'Avis de projet et transmission à l'ANDE (soumis à l'ANDE le 31 août 2016);
2. Préparation des TDR de l'EIES et transmission à l'ANDE (soumission pour validation prévue début octobre 2016);
3. Réalisation de l'EIES (octobre à décembre) :
    a. Actualisation et finalisation de la description technique du projet à mesure que les données techniques sont disponibles, collaboration étroite avec les ingénieurs du projet pour confirmer les détails tels que l'agencement final de l'installation ainsi que les plans de construction et d'exploitation.
    b. Réalisation de consultations complémentaires et étude approfondie du cadre de l'EIES en fonction des besoins.
    c. Collecte de données complémentaires relatives à l'état environnemental et social initial au travers de recherches documentaires et d'études de terrain pour obtenir une description détaillée du contexte environnemental et social.
    d. Mise au point de mesures d'atténuation et d'optimisation et élaboration de la structure du Plan de Gestion Environnementale et Sociale (PGES) incluant une approche de suivi.
    e. Rédaction du rapport d'EIES.

4. Transmission du rapport d'EIES à l'ANDE pour information, examen et validation (prévu en décembre 2016).

VI- CONCLUSION ET LIMITES DE L'ETUDE

La phase de cadrage a permis d'identifier différentes interactions du projet susceptibles de donner lieu à des impacts sévères sur les ressources environnementales et sociales/économiques à évaluer de manière approfondie dans l'EIES.

Ce rapport présente une vue d'ensemble du projet étant donné que le programme des activités était en cours de finalisation à la date de rédaction du rapport. Diverses problématiques nécessitant une analyse complémentaire ont été identifiées en phase de cadrage, sur la base des données disponibles à ce stade. Toutefois, des informations complémentaires développées dans le Rapport d'EIES, comme les études environnementales et sociales à l'état initial, études techniques et retours des parties prenantes, permettront de définir et améliorer les descriptifs du projet dans le but de réduire les impacts environnementaux et sociaux.

Une description détaillée et plus actuelle du site d'implantation du projet sera présentée dans l'EIES, sur la base de données primaires et secondaires collectées ainsi que les consultations entreprise pour ce projet. Les TDR ont donc utilisé les données disponibles au niveau national et local ainsi que les informations collectées lors des précédentes phases du projet.

Annex G

Stakeholder Engagement

G1 STAKEHOLDER ENGAGEMENT

G1.1 ATTENDANCE REGISTERS AND MINUTES

Attendance registers and minutes were taken at the ESIA consultation meetings and are appended as follows:

- Azito Village;
- Béago Village; and
- ANDE.

Formulaire – Registre d'engagement des communautés / parties prenantes

Date et version du document: 1.0 le 12 Septembre 2016

Date et heure de la réunion	JJ / MM / AAAA 00:00	21/09/2016 - 14h15
Lieu de la réunion		

Réunion	☒	Demande	☐	Plainte	☐	Initiative	☐

Ordre du jour de la réunion / Principaux points de discussion	
1.	Réunion de avec la chefferie d'Azito
2.	Information sur le projet d'extension Phase IV.
3.	Discussion
4.	
5.	

Nom (y compris Azito Energie, Azito O&M, Globeleq, ERM, ENVAL)	Titre et fonction	Village / organisation representée	Coordonnées	Empreinte digitale / Signature
Djoman Denis	Doyen	AZITO		
BOKA David	Fils du village	AZITO	05-29-0400 40-07-03-05	
NAHO INES	secretaire de la cooperative	Azito	07-30-86-62 01-22-74-74	
MOBIO PATRICIA	presidente de la cooperative	AZITO		
Akré Simplice	Porte-Parole	Azito	48228710	
DJAKO Etienne	11	11	44080976	
Djako André	Porte parole	11	01-45-76-06	
Yobou Samuel	fils du village	11 11	4486-22-35	
Sawa Jacques	fils du village	11	01-45-74-40	

Nom (y compris Azito Energie, Azito O&M, Globeleq, ERM, ENVAL)	Titre et fonction	Village / organisation representée	Coordonnées	Empreinte digitale / Signature
Bouedou Athur	fils du village	Azito	06-17-50-86 01-11 27 23	[signature]
Sowa Samuel	fils du village	Azito		[signature]
Abouadou SC	fils du Village	Azito	06 236226 03 44 38 36	[signature]
Mandjui David	Notable	"		[signature]
Mandan Joseph	Notable	"		
Mobio Firmin	Notable	"		
Ehouman Etienne	Notable	"		
Ezan Blaise	secretaire chefferie	"		
Adji Roger	Notable	"		
Djako James	Chef du Village	"		
Djako Denis	Doyen du village	"		
N'Guessan Marc	"	"		
AKRE Mandan Joseph	Notable	"	07 48 84 81	[signature]
MOBIO Firmin	Notable	"	/	[signature]
Sommian ETIENNE	Notable	"	47 63 16 68	[signature]
EZAN Blaise	secretaire de la chefferie	"	07 22 72 85 02 42 37 74	[signature]
Adobbi Samuel	Notable	"	07 22 21 77	[signature]
Adja Roger	Notable	"	08 84 60 49	[signature]
DJAKO James	chef du village	"	04 69 11 60	[signature]

Détails / Notes de la réunion:

Kouassi N'GA	AZE	04 170342	
Marie Bleou	AZOTT	08 62 80 53	
ZEAN ERIC	ENVAL	08730263	
Mandagout Estelle	ERM	+44 7557 938 138	
Maarten van Rensseur	Globeleq	+44 7391417615	

Photographie(s) :

Les actions de suivi (y compris les engagements pris)

Description de l'action	Priorité	Personne responsable	Date d'achèvement
1. DJAKO D. Louis	Doyen	08 87 60 52	Doyen
2. Nampé Rare	Doyen	—	
3. Awassa Gnamien	Notable	07 54 13 16	
4. KOUTOUAN JONAS	Portpardé	40-18-47-50	
5.			

Formulaire – Registre d'engagement des communautés / parties prenantes

Date et version du document: 1.0 le 12 Septembre 2016

Date et heure de la réunion	JJ / MM / AAAA 00:00	22/09/2016 11h00 -
Lieu de la réunion	BEAGO	

Réunion	☒	Demande	☐	Plainte	☐	Initiative	☐

	Ordre du jour de la réunion / Principaux points de discussion
1.	Réunion avec la Chefferie de BEAGO
2.	Information sur le projet AZITO phase IV
3.	Discussion
4.	
5.	

Nom (y compris Azito Energie, Azito O&M, Globeleq, ERM, ENVAL)	Titre et fonction	Village / organisation representée	Coordonnées	Empreinte digitale / Signature
KOTAN Daniel	NOTABLE	BEAGO	–	
N'Koussè gabriel	Notable	4	–	
Toba Jacob	Retraité	Beago	09-24-05-18	
TOBA ENDJEREZ	—	Beago	55-09-4233	
obo SYLVAIN	—	11	45-07-9104	
KOKO Nicaise	Manson	11	49965888	
Koko georgette	Menagère	11	—	
Abrogou Martine	11	11		
Abou Emilienne	11	11	08484298	

Nom (y compris Azito Energie, Azito O&M, Globeleq, ERM, ENVAL)	Titre et fonction	Village / organisation representée	Coordonnées	Empreinte digitale / Signature
Goua Bernadette	//	//	09-79-9197	
Dantho Thérèse	//	//	46-82-67 88	
N'paly Josephine	//	//		
Koko Jacqueline	//	//		
Anno Françoise	//	//	09 06 49 56	
JEAN ERIC	Consultant Sociologue	ENVAL	08730263	
Marie Rleon	Asso Dantho DD	Azito O&M	08 62 85 53	
Margaret Estill	Env	ERM	+447557978150	

Formulaire – Registre d'engagement des communautés / parties prenantes

Détails / Notes de la réunion:

Photographie(s) :

Les actions de suivi (y compris les engagements pris)

Description de l'action	Priorité	Personne responsable	Date d'achèvement
1.			
2.			
3.			
4.			
5.			

Formulaire – Registre d'engagement des communautés / parties prenantes

Date et version du document: 1.0 le 12 Septembre 2016

Date et heure de la réunion	20/01/2016 10:00
Lieu de la réunion	ANDE

Réunion	☒	Demande	☐	Plainte	☐	Initiative	☐

Ordre du jour de la réunion / Principaux points de discussion	
1.	Presentation de l'equipe EIES.
2.	Discussion de la démarche de l'EIES.
3.	
4.	
5.	

Nom (y compris Azito Energie, Azito O&M, Globeleq, ERM, ENVAL)	Titre et fonction	Village / organisation representée	Coordonnées	Empreinte digitale / Signature
Mandigout Estelle ERM	Consultant	/	+33 757578150	[signature]
DONNISSEAU THOMAS	Consultant Environnement	ERM	+33 72605890	[signature]
Maarten van Reussen	ESG Manager	Globeleq	+44 739141761	[signature]
Dr GBE Didier	ANDE/Directeur	ANDE	+00 225 47087819 gbdidier@yahoo.fr	[signature]
KOUASSI B. N'Gbin	SID EIE-CP (ANDE)	ANDE	05646393	[signature]
YAPO Clement	Directeur operations	Cabinet ENVAL	77701172	[signature]
Jacky JUAN-TREICH	AZITO project engineer	Azito Energie	05646478	[signature]

Formulaire – Registre d'engagement des communautés / parties prenantes

Date et version du document: 1.0 le 12 Septembre 2016

Date et heure de la réunion	21 / 09 / 2016 11:45
Lieu de la réunion	Mairie de Yopougon

Réunion	☒	Demande	☐	Plainte	☐	Initiative	☐

	Ordre du jour de la réunion / Principaux points de discussion
1.	Présentation du projet d'extension de la centrale Azito (Phase IV).
2.	Présentation de l'équipe Projet pour l'étude d'impact
3.	Presentation de l'approche pour l'étude d'impact
4.	
5.	

Nom (y compris Azito Energie, Azito O&M, Globeleq, ERM, ENVAL)	Titre et fonction	Village / organisation representée	Coordonnées	Empreinte digitale / Signature
Bamba Pancrace	S/DST Mairie Technique	Mairie de Yop.	07651821	
Maarten van Rensen	ESG Manager	Globeleq		
JEAN ERIC	CONSULTANT SOCIOLOGUE	ENVAL	08730263	
KONE MOUSTAPHA	ASSISTANT D.I.	MAIRIE YOPOUGON	02640812	
Marie Bleou	Azito ODT Assistante DD	Azito ODT	08628033	
Estelle Judgont	ESJ	—	—	