CONSTRUCTION AND OPERATION OF A 120 DUAL-FUEL POWER PLANT PROJECT IN MALICOUNDA, THIES REGION

Non-Technical Summary

Realized by :

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I. NON-TECHNICAL SUMMARY

I.1. INTRODUCTION

Despite the rising production capacity on the national level and the significant advancements, the energy sector is facing obstacles and challenges of various orders that must be faced. In fact, the part of available energy for each household remains insufficient to promote the socio-economic emergence and development despite SENELECs efforts.

Hence, the introduction and the realization of the project for the construction and operation of the Malicounda thermal power plant were initiated by SENELEC which would allow them to enter into a new era for the energy sector during which the self-sufficiency in energy will become a reality throughout the whole country.

I.2. PROJECT DESCRIPTION

I.2.1. GENERAL PRESENTATION OF THE PROJECT

The project consists of the construction and operation of a 120 MW thermal fuel power plant running on heavy fuel HFO, equipped with seven (07) identical engines and one (01) steam turbine in continuous operation on the site of Malicounda.

The power plant will include seven (07) reciprocating engines running on fuel oil each with an 18 MW capacity. A combined-cycle is also planned, which will allow to have a higher efficiency.

The Malicounda power plant will use heavy fuel oil as fuel and then will switch gas once it becomes available in Senegal (around the year 2021).

The thermal power plant will be built on a land parcel of approximately 06 ha to be distracted from the 18 ha that were already conceded by the municipal council of Malicounda on the 13th of June 2018.

I.2.2. OPERATING PRINCIPE OF A COMBINED CYCLE THERMAL POWER PLANT

The operation of the power plant is carried out according to different steps:

- Unloading, storage and fuel heating;
- Purification, filtration and fuel dispatch towards the engines for combustion;
- Transformation of the mechanical energy into electrical energy in the engines by the generators;
- Cooling and engine components lubrication with respectively, water and new or regenerated Lube oil;
- Engine exhaust gas evacuation towards the stack pipes;
- Electricity production due to the steam driving the turbine connected to an alternator.

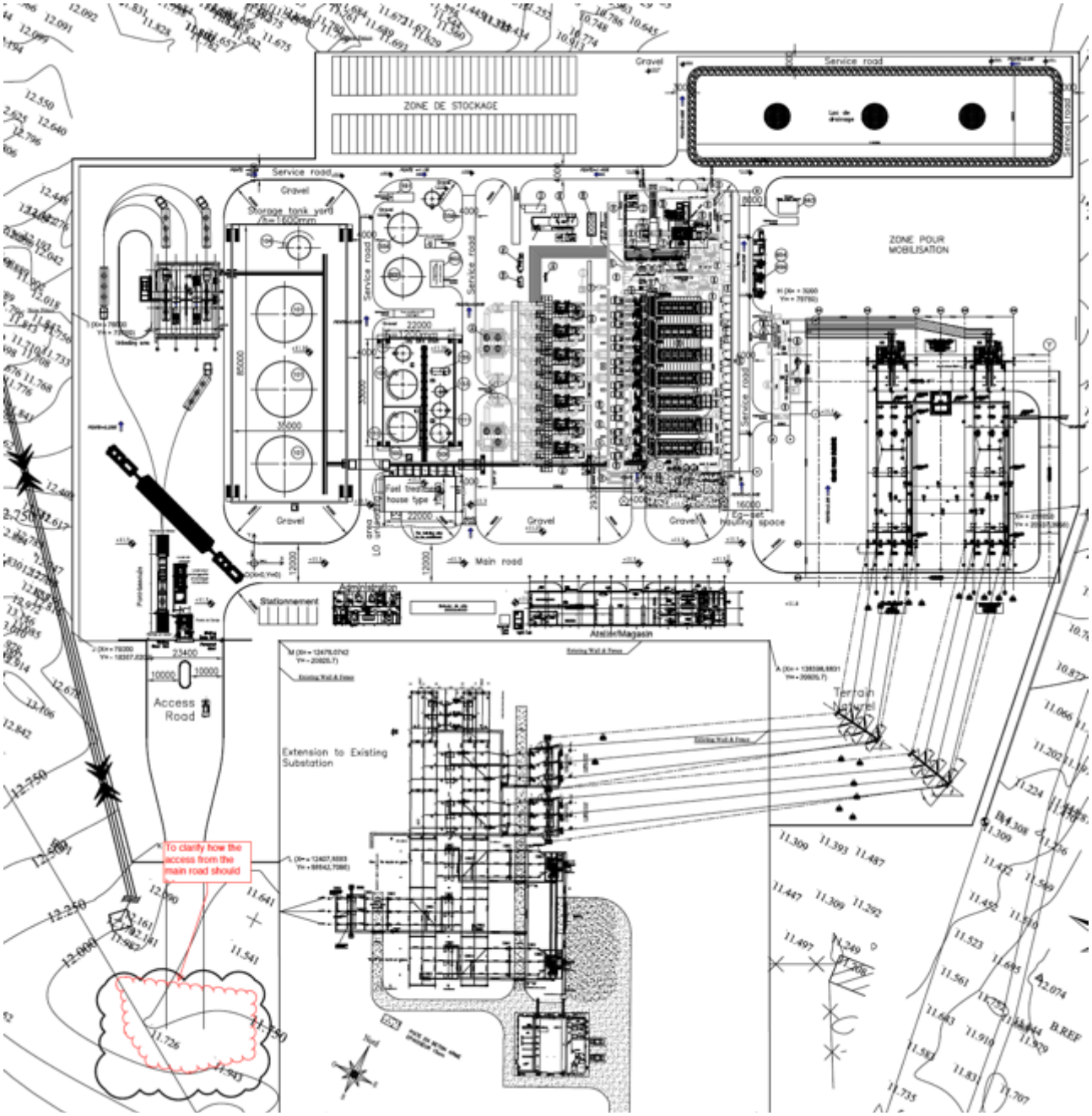


Figure 1 : Lay out of the Power Plant

I.2.3. SUMMARY OF THE MAJOR TECHNICAL COMPONENTS

Table 1 : Main equipment of the Malicounda Power Plant

Units	Components
Electricity production system	07 Wärtsilä generating sets 07 stacks 02 separators 01 auxiliary boiler
Combined-Cycle	01 steam turbine 07 recovery boilers

Units	Components
	02 condensers
Heavy Fuel Oil storage	03 storage tanks : 3000 m3 each 01 daily tank : 560 m3 01 buffer tank : 560 m3
Light fuel oil (Gasoil) storage	01 tank : 200 m3
Lube oil storage	01 new lube oil tank : 75 m3 01 used lube oil tank : 25 m3 01 maintenance lube oil tank : 16 m3
Water storage	01 raw water tank : 500 m3 01 demined water tank : 80 m3 01 firefighting tank : 1 000 m3
Air Storage	07 bottles of compressed cooled air : 0.12 m3
Transformers	02 transformers 90MVA/225/15 kV ONAF
Building and Auxiliary installations	Control room Administrative building Warehouse Mechanical workshop Cafeteria Laboratories Loading/unloading zone Firefighting zone Maintenance workshop Fence

The construction work will be spread over a period of 18 months and the construction of the power plant will require recruitment of about 400 employees while its operation requires 50 employees.

Water supply to the power plant during the construction and the operation will be assured by one (01) borehole.

I.3. POLITICAL, JUDICIAL AND INSTITUTIONAL FRAMEWORK

I.3.1. ENVIRONMENTAL AND SOCIAL MANAGEMENT POLITICAL FRAMEWORK

Essential environmental and social political texts of which the content and objectives are applicable to the project on the national and international level are identified in this sub-chapter. We can cite, among other texts, the Senegalese Emergent Plan (PSE), the Letter of Development Policy of the Energy Sector (LPDSE), the Letter of Environment Development and Sustainable Development Policy (LPDEDD) and the United Nations Convention to combat desertification

I.3.2. ENVIRONMENTAL AND SOCIAL MANAGEMENT JUDICIAL FRAMEWORK

In connection with the context and the project activities, the national judicial framework is marked by many texts that deal with the environmental and social aspects.

Mainly, these are the Constitution of Senegal, the Environment Code and its applied texts as well as the environmental norms (NS 05-061 and NS 05-062).

Other legal texts which concern the environment as well as the natural resources management which may apply to the project are the Water Code, the Hygiene Code, the Sanitation Code, the Labor Code, the Forestry Code and the Urbanism Code. Land, electricity sector and decentralization related texts, must also be taken into account.

On the community level, different energy and environmental sector texts that was adopted, take part in the legal arsenal applicable to the project.

Internationally, the applicable texts are related to the environmental and social procedures of the African Development Bank (AfDB), the World Bank and agreements and conventions ratified by Senegal. These procedures refer to the 10 principles of the Equator ("Equator principles –EP") in its III version of 2016 (EPIII). It consists of a set of provisions made for a healthy environmental and social issues management. By voluntary signing the Equator Principles (EP), the bank engages in taking into account a certain number of environmental and social evaluation criteria when choosing projects that it will fund. We can consider these principles as an application of the CSR in the domain of finance. These AfDB Environmental Norms have not been the subject of a Convention nor a signed agreement with the Senegalese State. Hence, they will be respected by all the clients of the Bank when receiving financing for a project that will affect the site environment. The Integrated Backups System (SSI) is divided into five (05) Operational Safeguards:

- **Operational Safeguard N^0 1:** Environmental and Social Assessment
- **Operational Safeguard N^0 2:** Involuntary Resettlement, land acquisition, population displacement and compensation.
- **Operational Safeguard N^0** 3: Biodiversity, renewable resources and ecosystem services
- **Operational Safeguard N^0** 4: Pollution prevention and control, greenhouse gas, hazardous materials and resource efficiency.
- **Operational Safeguard N^0 5:** Labor conditions, health and safety.

Other norms and relevant guidelines remain applicable once they are launched within the SSI framework. Mainly consisting of:

- Bank Gender Policy (2001);
- Civil Society Engagement Framework (2012);
- Dissemination and Data Access Policy (2012);
- Handbook for Consultation and stakeholders' participation in the Bank activites (2001);
- Bank Policy related to population and implementation strategies (2002);
- Environmental and Social Evaluation Procedures for the Bank activities (2015).

Among the international conventions and agreements, we can mention the Convention on nature protection and wildlife preservation, the African Convention on the conservation of nature and natural resources, Maputo (Mozambique), and the ILO Conventions on safety, hygiene and health.

Table 2 : AfDB Operational Safeguards

AfDB Operational Safeguards (OS)	**Application to the Project**
OS N^0 1: Environmental and Social Assessment This OS governs the process of environmental and social category determination of the project, and thereunder the environmental and social evaluation conditions.	This Operational Safeguard updates and consolidates the engagement policies outlined in the environmental policy of the Bank. This OS is applicable to the project in whole. The project of the construction of a power plant in Malicounda requires a certain environmental and social evaluation level adapted to the potential risk significance, in a way that allows to the borrower to prepare and implement an ESMP in the case of this investment project. This comprehensive ESIA was defined as class A and confirmed by the Directorate of the Environment and the Classified Establishments (DEEC) of the Ministry of Environment and Sustainable Development of Senegal in its validation letter for the terms of reference of ESIA (addressed to the Quality, Security and Environment Director of SENELEC) n^0 181 of the 15th of January 2018/MEDD/DEEC/DEIE and its annex on the detailed axes of the ESIA expected report.
OS N^{0}2: Involuntary resettlement, land acquisition, population displacement and compensation This OS N^{0}2 consolidates the engagements and political conditions set forth in the AfDB policy on the involuntary resettlement and incorporates a certain number of enhancements willing to increase the operational efficiency of these conditions.	In accordance with the OS 2 of the AfDb Bank, the promoter must ensure a fair and equitable compensation for the PAP who lost their lands with the emergence of the project and the resettlement that enhances their lifestyle and the global livelihood means. In this study, it is highlighted that SENELEC ensures the OS respects and pays the compensations to the concerned persons through the PAR which is in progress. For the PAR preparation of the Malicounda Power Plant, the consultant refers to the documents of this OS 2. The OS 2 constitutes the main reference for the PAR elaboration and has three (03) main objectives: 1. The minimization of the resettlement while studying all the alternatives in the project conception (buffer zone of 260 m circumscribed on the land of 18 ha of the power plant site). 2. When a displacement is inevitable with goods loss, the resettlement activities must be conceived under a program in order to allow the affected persons to benefit from the project. In addition, these persons must be consulted in a way to participate in the planning and the implementation of the resettlement, compensation and livelihood means restoration program.

	3. The affected persons must find a higher or equal lifestyle to the one they had before their displacement.
OS N°3: Biodiversity, renewable resources and ecosystem services The most important objective of this OS is to conserve the biological diversity and to promote the sustainable use of natural resources. Mainly the water resource in respect of the United Nations Convention on the biological diversity. The OS sheds the light on the necessity of "Respect, conserve and maintain [the] knowledge, innovations and practices of the native and local collectivities etc. [and] to protect and foster the use of biological resources according to the cultural traditional practices compatible with the conservation or sustainable use requirements of the natural resources".	The OS 3 guidelines are applied to the project whose promoter has legal, judicial, regulatory and development standards cited in the report of ESIA. Plant species, small mammals and reptiles can be very sensitive towards certain pollutants. Furthermore, a risk of a small fauna drops (small reptiles or rodents) in the open excavations can be noted during the power plant construction works and could lead to the disappearance or the degradation of the vegetation and a temporary micro fauna perturbation. Hence, the site is highly marked by the human presence with the inauspicious cultural practices to the conservation of the natural vegetation. The OS 3 recommends conserving the biological biodiversity and promoting the sustainable use of natural resources. In order to minimize the potential impacts on the fauna and the flora, the enterprise in charge implements written recommendations to the section VIII.3.
OS N°4 : Pollution prevention and control, **Greenhouse gas, hazardous materials and resource efficiency** This OS 4 covers the whole pollutions, waste and hazardous substances effects range for which there are international conventions and special industry complete norms that are applicable by other MBD. It also introduces a vulnerability follow up analysis framework for the greenhouse gas emissions levels and offers a detailed analysis for the possible decrease or compensatory measures.	The OS 4 guidelines are applicable to the project. In fact, the power plant functioning will provoke pollutants and dust emissions (like Sox, NOx, PM10, PM2.5 and CO) and to a lesser extent, volatile organic compounds (VOC) and aromatic polyclinic hydrocarbons (PAH). The concentration in SOx, NOx, PM10, PM2.5 modeled with NUMTECH, respect the threshold values of the Senegalese repositories and the international standards except the second interim target of the WHO 125 µg/m3 is exceeded on a limited area (section VIII.3.1.2.1). It is important to add to these results, that the power plant is conceived to move to the gas by the year 2021. As a result, a chimney altitude of 42 m was considered enough in the frame of this study and allows to respect the regulatory limits and the OS 4. The power plant operator has to limit the waste production (non-hazardous and hazardous) but also recuperate and reuse the waste ecologically according to the OS 4 principles.

	The promoter has to control these GHG emissions according to the signed agreement in Paris in 2015 while observing the respect of the Senegal Engagement to GHG emissions reduction for the Senegal by the year 2035, during the Paris Agreement on the climate in 2015. The main attenuation proposed measures are: • Ensuring a NOx, SO_2 and PM atmospheric emissions follow up on the chimneys and provide particular and molecular filters in the chimneys; • Insure the use of a sulfur-based fuel (less than 2%). As for the water supply, it will be insured by the borehole (6 m3/h). The hydrogeological study done by the operator allowed to ensure the resource availability and the possibility of implementing this borehole without major consequences. However, during the construction and operation works, water will be rationally used according to the OS 3, in order to preserve the resource and not compete people water supply. The main attenuation proposed measures are: • Proceed to the desulfurization of combustion gas and use low-carbon torch NOx; • Create green spaces for the environment protection and the people lifestyle quality, but also promote the CO2 photosynthesis absorption, main greenhouse gas. A management procedure for hazardous substances will be also developed during the operation phase in order to establish manipulation and storage methods, and security work techniques.
OS N°5: Labor conditions, health and safety This OS 5 defines the AfDB requirements towards its borrowers or clients, related to labors work conditions, their rights and protection from mistreatment or abuse.	According to the OS 5, the operator and the enterprises have to elaborate a human resource policy as well as nature procedures, the project size and the labor force size. They must also guarantee to their employees a healthy and secure work environment. In the event of recourse to an expatriate employee, the operator has to abide to the OS 5 of the AfDB and the migrant employees must be treated in conformity with the local laws and benefit from the same work conditions as the non-migrant employees doing the same work. The promoter provides an internal human resources management policy outlined in the section VII.8.2 and according to the in force Labor Code and the OS 5 requirements. It will focus on the following aspects:

	• The prerequisites before the startup of any activity (enterprise establishment declaration and labors movements records declaration and IRTSS contracts types records; • Human resources policy and procedures with an internal reregulation valid by the labor inspector (schedule, behavior, security measures), communicated and accessible to all the enterprises employees; • Work conditions (respect of the collective conventions of electricity, work conditions enhancement through the hygiene, health and security respect); • Terms of employment and chance equal opportunities and sex. This human resource management policy, proposed to the project enterprise in the ESIA framework must be necessarily communicated and understood by the staff and people.

I.3.3. INSTITUTIONAL FRAMEWORK

The environmental and social management of this project implies many institutions, national, regional and local structures.

The different identified institutions and structures in the framework of the project are:

- Ministry of Petroleum and Energy (MPE);
- Directorate of Electricity (DE);
- SENELEC;
- Commission of Regulation of the Electricity Sector (CRSE);
- Ministry of the Economy, Finance and Planning (MEFP);
- Directorate of the Environment and Classified Establishments (DEEC);
- Directorate of Urbanism and Architecture (DUA);
- Directorate General of Labor and Social Security (DGTSS);
- Regional Agency for Development (ARD);
- National Agency for Land Displacement (ANAT);
- Control Commission of state land Operations (CCOD).

I.4. DESCRIPTION OF INITIAL ENVIRONMENT

I.4.1. GEOGRAPHICAL, ADMINISTRATIVE SITUATION AND LOCALIZATION OF THE POWER PLANT SITE

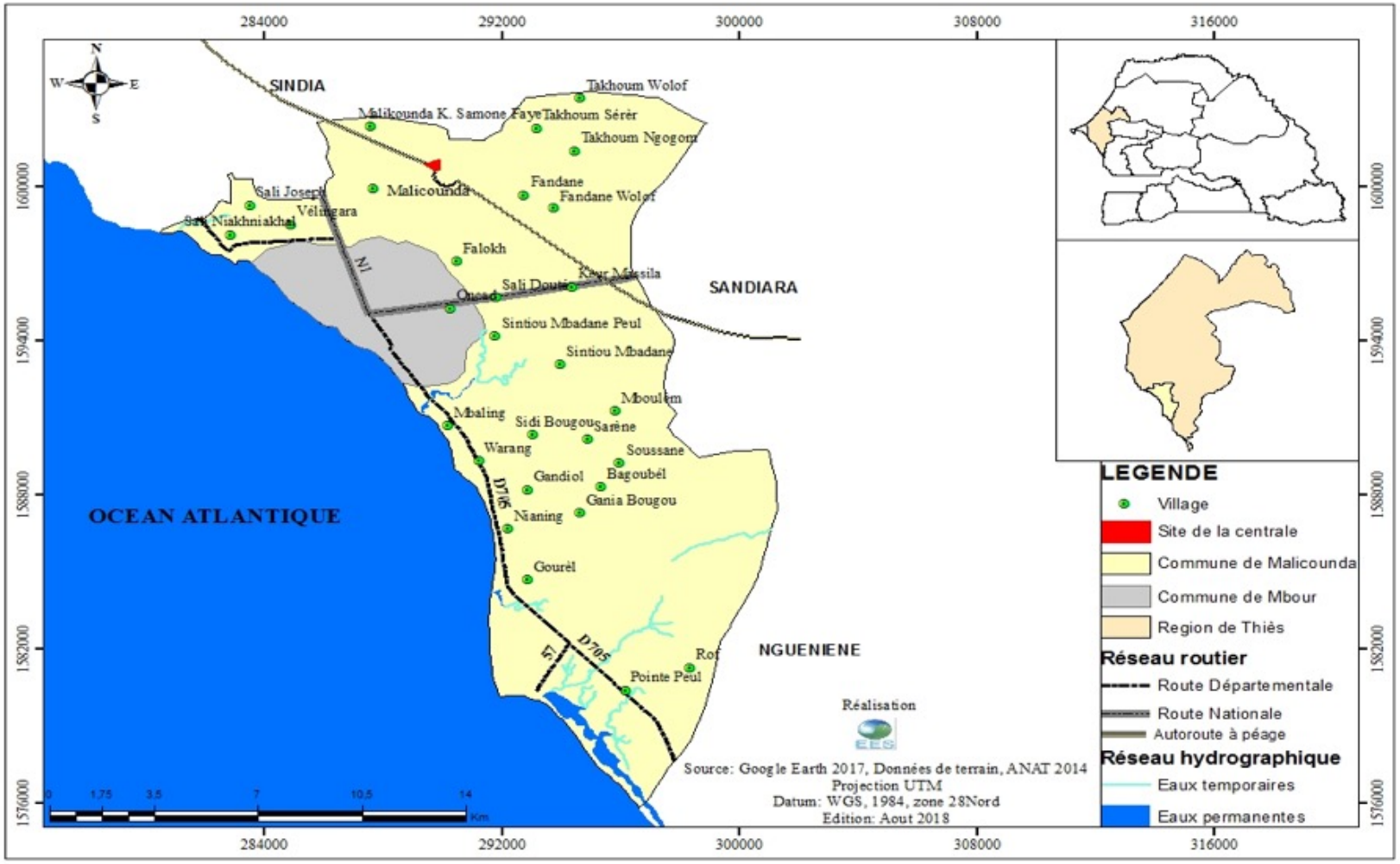
The intended site for the construction and operation of the thermal power plant located in the Malicounda commune, Mbour Department, Thies Region.

The power plant will be implemented in Keur Maissa Faye village (Malicounda Wolof), Malicounda commune, situated south-west of Thies Region, this commune covers an area of 124 km2 and counts 22 villages. It also possesses a coastline on the Senegalese littoral.

I.4.2. LOCALIZATION OF THE POWER PLANT SITE

The power plant site is situated to the west of Keur Maissa Faye village, north (about 55m) of the road linking the national road N1 at Malicounda. The site is limited:

- To the north, by rainfed agriculture fields and few buildings under construction;
- To the east, by Keur Maissa Faye street (Malicounda Wolof), an orchard and rainfed agricultural fields;
- To the west, by the national tolling road and by rainfed agricultural fields
- To the south, by the toll highway and rainfed agriculture fields.



Map 1 : Localization of the Power Plant Site

Legend: Village/Site of the power plant/Commune of Malicounda/Commune of Mbour/Region of Thiès/Road network/ Secondary road/Highway/Toll road/Hydrographic network/Temporary waters/ Permanent waters

I.4.3. LAND LOCALIZATION AND OCCUPATION OF INFLUENCES REGIONS

The area of influence corresponds to the space where the potential incidences (dust, noise, discharge in the natural places, etc.) of a project can be noticeable. It depends on the project type and the natural places (fauna habitats, flora, etc.) and surrounding humans.

Concerning the site grasp, this area covers the 18 ha already deliberated by the municipal council of Malicounda on the 13rd of June 2018 in favor of SENELEC envisioning the construction and operation of the thermal power plant on approximately 06 ha.

This area is actually characterized by agriculture lands. In fact, the site is used by the local population who are practicing rainfall agriculture with as dominant speculations peanuts, millet and cow peas.

The table below summarizes the different identified entities in the immediate environment of the site.

Table 3 : Immediate surrounding of the site

Entities	Distance according to the site border	Distance according to the future power plant border	Orientation according to the power plant
Building under construction	Passed by the power plant border	82 m	North
Building under construction	82 m	241 m	
Graveyard	100 m	170 m	
Malicounda Ngueurigne	256 m	362 m	
Verger	14 m	40 m	East
Houses (K. Maissa Faye)	40 m	150 m	
Building under construction	18 m	115 m	
Toll highway	40 m	118 m	West
Life base Ageroute	124 m	219 m	
henhouse	148 m	219 m	
Paved road	55 m	233 m	South
Subdivision	20 m	195 m	
Houses (K. Maissa Faye)	39 m	164 m	

I.4.4. DESCRIPTION PF PHYSICAL ENVIRONMENT

Situated on the Senegalese littoral bordering, the commune of Malicounda, implantation area of the power plant, is situated in the North-Sudanese coastal climatic domain.

Overall, the relief of the welcoming area of the project is relatively flat. At the power plant site, the altitudes range between 10 and 15 m.

The table below represents the major characteristics of Malicounda commune.

Table 4 : Major characteristics of the Commune of Malicounda

Characteristics	Average / Normal Value
Wind speed	2.7 m/s
Temperature	27.3 ^{O} C
Insolation	242 h/month

Rainfall	610.7 mm

I.4.5. DESCRIPTION OF THE BIOLOGICAL ENVIRONMENT

The study of the biological environment includes the description of the initial state of the fauna and flora but focuses on performing the analysis of eventual impacts of the installation of the thermal power plant on the natural environment.

The area that must host the Malicounda power plant is situated is the Sudanese domain which is by excellence that of savannah under different physiognomies. In fact, the vegetation of the project area is wooded and shrubby savannah type with an herbaceous carpet that dries out generally from the month of November. The faunal potential is less important in the project area mainly because of the pressure exerted by the humans on the faunal habitats.

The essential of the area species is concentrated in the Bandia reserve situated at approximately 09 km from the power plant and the Classified Forests (CF) of the area being that of Balabougou and Nianning, situated respectively at 15 and 16 km from the power plant.

I.4.6. DESCRIPTION OF THE HUMAN ENVIRONMENT

Malicounda Commune covers an area of 124 km² for an estimated population at 69 932 habitants in 2018. (Projection ANSD 2015)

At Malicounda, the cultural diversity is promoted by the presence of different ethnic communities mostly composed of wolofs, sereers and bambaras. Moreover, these ethnics mainly Muslim are concentrated in the respective villages holding the name of the dominant community (Malicounda Wolof, Malicounda Sereer and Malicounda Bambara).

The drinking water supply of the area is mediocre due to the fact of the discrepancy of the coverage of the four (04) boreholes managed by ASUFOR. In addition, the electricity of the Commune of Malicounda is managed by the Senegalese Agency for Rural Electrification (ASER) through the Tunisian society.

The main activities of the commune are:

- Agriculture
- Fishing
- Livestock
- Aviculture

Therefore, concerning the last activity, none of the three (03) identified farms is situated in the direct area of influence, namely the envisioned 18 ha.

I.5. ANALYSIS OF THE VARIANTS

The analysis of the variants is an ESIA chapter that allows the comparisons among different options of the project in order to propose the best possible alternative on the technological plan with an acceptable cost and a minimum of possible negative impacts.

The different studied alternatives are based on:

- The “no project” option

- The displacement variants
- The water supply
- The site access
- The techniques of energy production

N**o Project option**

The non-realization of the project allows to avoid the potential negative impacts linked to the construction and the operation of the power plant (agricultural land loss, waste generation, noise pollution, etc.).

However, it will be in disagreement with the energetic policy of the country which consists in insuring the energy supply of the country in sufficient quantity and expanding people's access to the modern energy services.

In addition, the non-realization of the project is considered an opportunity loss for the enhancement of people standard of living through the creation of job vacancies, the increase of the commune incomes, the business opportunities for the SME/SMI, etc. On the basis of this analysis, the Malicounda thermal power plant project, despite the negative potential environmental and social impacts, is a necessity to allow the optimization of the energy production means.

Displacement Variants

Concerning the location choice of the different installations of the power plant on the site grip land, many options were analyzed taking into account certain parameters and environmental and security criteria. The three studied variants of positioning, the option 2 was the selected one (final version visible on the layout presented in the annex) because it is considered as the best location according to the installations and in an exhibition to the eventual effects of certain impacts. This choice allows to circumscribe the buffer zone of 260 m in the grip of 18 ha deliberated for the realization of the project. Besides, it will not require a relocation of the habitations nearby the site.

Water supply variants

The water consumption of the project during its different phases constitute a major challenge from the environmental and socio-economic point of view. Thus, two (02) water supply variants were studied, namely:

- The supply from ASUFOR;
- The supply from a borehole put in place by the power plant operator.

From these two alternatives, the selected one is the borehole construction because it allows the insurance of power plant's water autonomy and the avoidance of the competition with the people's water consumption (ASUFOR).

Site access variants

One of the proposed alternatives in this section is the restoration of the paved road leading to the site (since the RN1 to the power plant site) given its advanced deterioration state.
The other studied alternative is the construction of a new access road to the site in the construction phase. In the operation phase, the trucks and the service vehicles that have to drive the site will take the troll highway which is actually under construction.
From these two alternatives, the construction of a new access road was selected. In fact, this option will permit health and security preservation although it requires the acquisition of a new land.

Technical Variants of energy production

The different studied techniques of energy production are:

- Diesel classic plant running on HFO;
- Steam plant running on coal;
- Diesel plant running on gas.

Comparison criteria on the environmental, economic, operational, health and security plan were used to classify the different alternatives in order to identify the most optimal.

Following this analysis, it is shown that the best option is the classic plant running on HFO due to its fuel supply easiness and the low sanitary risk compared to the coal plant if however, the pollutants emissions remain within the acceptable norms.

I.6. PUBLIC CONSULTATIONS

In this section, all the consulted stakeholders have expressed their satisfaction concerning the cabinet process that realizing the present study to the meeting of the stakeholders in order to inform them and gather their opinion.

In the spirit of a good consultation planning, the EES cabinet has elaborated and followed a communication plan that has as an objective the good documentation of the preparatory phase of the public consultation.

It consists in identifying the concerned actors, the characteristics and the specific sensitivities of different localities that will be affected by the project. The institutions and resources-persons to meet target were constrained to the sites and potential PAP as well as members of the environmental and social impacts monitoring process structures.

Therefore, the Technical Committee members will have an important role in the validation of this environmental and social impact study.

After the identification of the actors, the EES cabinet has addressed to each structure, which its implication has been judged relevant, a prior information letter.
Regarding the populations, the socio-economists of the study have done in situ displacements in order to hold a first meeting with the resources-persons designated by the communities.

These consultations permit a big portion of the Project appropriation-acceptance with all the actors. They will allow to take into consideration the environmental and social dimensions of the project and all the actors' categories sensitivities representing human implications (houses and/or economic activities), local representatives and local authorities (administrative and technical services of the State) of the host area.

Different methods were carried out to attain the objectives assigned to the public consultation:

- Individual meetings were privileged during the reunions with the administrative authorities, technical services of the State and the local collectivities concerned by the construction and operation of the Malicounda power plant project;
- Focus-groups organized for the populations, street associations. For these categories of stakeholders, there was an open discussion and everyone could express his opinion by expressing his concerns, expectations and project recommendations.

In all case, the meeting with different actors were held in this way:

- Project presentation;
- Environmental evaluation objectives and the necessity of actively involving the stakeholders in the steps of the evaluation process;
- Questions, opinions, concerns and recommendations gathering.

The below table provides information about the public consultations realization planning.

Table 5 : Consultation Plan with the administrative and municipal authorities

Area	Structure	Place	Date (DD/MM/YYYY)	Number of attending persons
Thies Region	Thies Governance	Governance	11/07/2017	01
	Thies ARD	Thies ARD	11/07/2017	01
Mbour Department	Mbour Prefect	Prefecture	12/07/2017	01
	Sindia subprefect	S/prefecture	14/07/2017	
	Mbour departmental council	Mbour	13/07/2017	01
Malicounda Commune	Municipal Council	Malicounda	12/07/2017	01
Total of administrative and municipal authorities				06

Table 6 : Consultation plan of the technical services of the state on the national and regional levels

Structure	Place	Date (DD/MM/YYYY)	Number of attending persons
National level			
Ageroute	Point E Dakar	10/07/2017	02
Regulation Commission of the electricity sector	Dakar	12/07/2017	01
African Refining Association	Mbao Dakar	14/07/2017	05
Division of the Environmental Impacts Evaluation	Directorate of the Environment and Classified Establishments, Carnot Dakar Street	31/07/2017	01
Division of Pollutants and Noise Prevention and control		31/07/2017	01
Air Quality Management Center		26/07/2017	01
Directorate of the water resources Management and Planning	Camp Lat Dior Dakar	31/07/2017	01
Directorate of the Civil Protection	Dakar	14/01/2017	01
Directorate of the Electricity	Petersen Dakar	14/01/2017	01
Total of the national technical services			14
Departmental and Regional level			

Regional Inspection for Labor and Social Security	IRTSS Thies	13/07/2017	01
Regional Division of the Environment and Classified Establishments of Thies	DREEC Thies	11/07/2017	01
Regional Service of Spatial Planning	Thies spatial planning	11/07/2017	01
Regional Service of Sanitation	Thies Sanitation	11/07/2017	01
Regional Service of Mines and Geology	Thies mines and geology	12/07/2017	01
Departmental Service of Urbanism	Mbour Urbanism	12/07/2017	01
Regional Division of Hydraulic	Hydraulic Thies	19/07/2017	01
Thies Regional Agency of Development	ARD Thies	11/07/2017	01
Thies Regional Service of Statistics and Demography	SRSD/ANSD Thies	14/07/2017	01
Mbour Cadaster Office	Mbour cadaster	12/07/2017	01
Mbour Hygiene Brigade	Mbour hygiene service	12/07/2017	01
Mbour Firefighters	E-mail exchange	17/07/2017	01
Total of the technical services consultations on the regional and departmental levels			**12**

Table 7 : Consultation plan with the beneficiary persons

Village	Date (DD/MM/YYYY)	Number of attending persons
Malicounda Wolof	10/07/2017	**28**
Malicounda Serere		**51**
		19
Malicounda Bambara	23/07/2018	**100**
Number of consulted persons		**198**

The consultations have taken place on the 10th of July 2017 and the 23rd of July 2018. They have permitted to consult 230 stakeholders distributed as follows:

- Municipal and administrative authorities: 06
- Technical service on the national level: 14
- Technical service on the regional and departmental levels: 12
- Consulted population in the three (03) villages surrounding the site: 198

A relatively good acceptance of this project that will enforce the energetic tissue of the country appeared after the different meetings.

Therefore, the question linked to the land title appeared many times and was asked by all the stakeholders (administrative authorities, local people) and this shows to what extent it is an important concern and its resolution is unavoidable for the success of the project.

The safety and the atmospheric pollutant emissions linked to the power plant operations were also present in the questions. The relative recommendation is to respect the relative regulation.

I.7. RESULTS OF THE ANALYSIS OF THE ENVIRONMENTAL AND SOCIAL IMPACTS

The major impacts related to the project during the construction and the operation phases of the Malicounda thermal power plant were identified and management measures were proposed for each environment component (physical, biological, human) affected by the project in order to mitigate or improve.

Table 8 : Enhancement measures of positive impacts

Component	Impact source activities	Potential Impact	Enhancement Measures
Enhancement impacts during the construction phase			
Socio-economic activities	**Pre-construction and construction activities**	Direct jobs creation	● Implement the Regional Inspection of Labor and Social Security (IRTSS) for the employees' identification ● Prioritize the PAP recruitment ● Promote the local populations mainly the persons with low wages to the non-qualified employments (local labor-force, cleaning, guarding, etc.) and promote their continuous training ● Create a local recruitment committee
		Development of new economic activities	● Arrange and secure spaces that host the new activities (small commerce, restoration, etc.) ● Promote the development of these activities
		Business Opportunities for the SME/SMI	● Develop the subcontracting in order that the small local enterprises acquire market shares and experience
Enhancements Impacts during the operation phase			
Socio-economic activities	**Power plant Operation**	Jobs Creation Goods and services purchase	● Involve the local collectivity in the procedures of recruitment ● Promote the local employment if the profiles are available and insure the continuous training of employees ● Promote the respect of the national labor and employment rights
		Reinforcement of the energetic sector	● Densify the electrical distribution network in the commune ● Study the cost reduction possibilities linked to the Malicounda Commune electricity
		Increase of the commune incomes	● Insure the payment of the Local Economic Contribution (CEL) and the Added and Local Value (VAL)

Table 9 : Mitigation plan of the major negative impacts of the projects

Affected components	Impact source activities	Potential Impact	Mitigation Measure
Impacts mitigation during the construction phase			
Air Quality	Pre-construction and construction works	Alteration of the air quality: • Dust through the use of vehicles and field engines • Atmospheric pollutants emissions	● Irrigate or pulverize the field soil and the circulation roads in order to minimize the dust generation ● Recover the field material transportation trucks with tarps ● Reduce to the minimum the construction material assembling operations on the transshipment places ● Restrict the speed of trucks to 30 km/h to the right of houses and on field ● Stop the unused vehicles and engines by avoiding the standby position like a slow-motion engine ● Insure a preventative and curative maintenance of the exhaust gas transmitter equipment ● Ensure that the vehicles and engines make a full-scale technical visit ● Define the technical specifications for the field engines according to the national and international norms in terms of exhaust gas ● Inform and raise the awareness of the labors and the coastline populations on the field activities and the HSE procedures (activity planning, circulation plan, risks associated to the field activities, etc.)
Soils, surface and underground waters	Pre-construction and construction works	● Local topography and land restructuring modification ● Waterproofing, compaction and settlement ● Soil, surface and underground waters pollution:	● Define the heavy vehicles itineraries (work roads) and the work areas in a way that limits the rolling and compaction surfaces ● Return the premises in state after the works ● Collect the solid and light wastes according to an efficient waste management ● Raise the staff awareness concerning waste management to avoid every form of pollution
Water resources used by the populations	Pre-construction and construction works	● Water consumption at the cost of the local populations consumption	● Put in place a draining network to ensure the rainfall water run-off towards the natural circuit flow ● Get closer to the DGPRE and the Regional Division of Hydraulic to obtain the required approvals to set up a borehole

Affected components	Impact source activities	Potential Impact	Mitigation Measure
			● Raise the employee awareness on the water importance and the necessity of water reservation and water wasting avoidance
Fauna and flora	Site preparation works	● Loss of vegetation ● Loss of the protected species (e.g.: baobab) ● Fauna habitats deterioration ● Perturbation of the fauna	● Limit the field grip strictly to the necessary surface ● respect the administrative procedure before any action on the flora ● contact the IREF to get a technical opinion ● Set up a reforestation plan and ensure the follow-up in collaboration with the Mbour forest sector. ● Avoid the accidental or voluntary introduction of exotic species and allogeneic species presenting a high risk of invasive behavior. ● Avoid impacts on the habitats situated outside the perimeter by delimiting the work and circulation areas (mark-up the field)
Living environment	Preparatory and construction works	● Living environment pollution and disturbance ● Various waste production and field imputable emissions (noise emissions, dust and smokes, liquids discharge, and packaging, etc.)	● Respect the limit of 85 dB (A) at 1 m for the equipment and used tools ● Perform the works that make noise over the break hours ● collect, sort and route the wastes towards the authorized dischargements ● organize the hazardous waste management (oil, diluents, emptying oils, etc.) and ensure the recuperation and the treatment by specialized enterprises proceeding to regular emptying of septic pits by a registered organism
	Pre-construction and construction works Equipment and material transportation	● Traffic disturbance following the trucks rotation for the excavation works, construction material transportation between unloading areas and the site ● Accidents risks	● Develop a periodic circulation plan for the material and equipment delivery and put indicator billboards for the most dangerous places ● Plan the arrival of heavy equipment ● Use a professional escort between Dakar and the site ● Inform the stakeholders (communes, populations, etc.) of the convoy date (through the radio, newspapers) on the itineraries, the risks and measures to be taken to avoid accidents
Allocation and land use	Site release	● Lands loss ● Production loss ● Wages loss	● Comply with the OS 2 and the AfDB requirements for the involuntary displacements of economic activities ● Create a census and evaluation commission for the disbursements composed by the technical services of the State (STE), SENELEC representatives, PAP and the Sub-prefect of SINDIA

Affected components	Impact source activities	Potential Impact	Mitigation Measure
			● Identify and compensate the producers and the cells tenderers in the PAR framework ● Provide the restoration of livelihood means for the PAP in the PAR
Cultural heritage	Pre-construction and construction works	Cement industries impacts	● Close the graveyard once the works start ● Inform the concerned authorities in case of archaeological remains during the works ● Raise the employees awareness on their behavior in case of archeological remains ;
Hygiene, health and security	Pre-construction and construction works	● Respiratory or dermal diseases development ● Insalubrity following the anarchic waste discharge ● Injury risks	● Put at the disposal of the employees the hygienic and adequate toilets ● Set up an HSE team to ensure the protection and the prevention of professional and environmental risks ● Provide adapted EPI for the employees and ensure that they put them ● Establish a plan and circulation rules in the field ● Put danger pictograms, protection tags and ban billboards and signaling in all the danger places ● Make information and awareness campaigns about the populations behavior
Impacts mitigation during the operation phase			
Air Quality climate	● Equipment functioning ● Heavy fuel combustion ● Operation activities	● Air quality alteration	● Ensure a NOx, SOx and PM atmospheric emissions monitoring on the chimneys and target points levels ● ensure the use of a good quality gasoline ● create green spaces ● Make reforestation campaigns
Soil, surface and underground waters	● Fuel manipulation (transportation, unloading, storage, etc.) ● Oil use and storage	● Soil pollution ● Runoff and underground water contamination	● Set up a rainfall water management plan ● Use the retention cuvettes or containment basins for the chemical products storage ● set up intervention procedures in case of an accidental spill or leak ● sort then recycle and storage the waste in a sealed storage area ● Make a regular follow-up for the solid and liquid waste that might be pollutants

Affected components	Impact source activities	Potential Impact	Mitigation Measure
	● Power plant maintenance and cleaning		● find the approved sectors for the transportation, storage and waste elimination
Water resources used by the populations	Power plant water supply	● Water excessive consumption on the cost of the local population consumption ● Resource pressure	● Set up a water rational management policy ● Repair on time every deterioration that causes a water leakage ● Set up a piezometer with an automatic data recorder for a better monitoring
Fauna and flora	● power plant operation activities ● noise and waste generation	● Fauna disturbance ● Annoyance of the fauna mainly the avian	● Avoid the proliferation of exotic species in rapid growth ● ensure the noise reduction caused by the engines through regular technical visits ● create green spaces in the power plant ● Make reforestation campaigns
Living environment	Power plant operation activities	● Sound pollution ● Waste generation	● Ensure the strict application of the waste management plan ● Opt for an oil valorization, used grease and centrifugation slurry in a cement industry like SOCOCIM ● Equip and request to the employees the anti-noise helmet ● Make acoustic measurements in property limit if the maximum noise limits were not surpassed

Affected components	Impact source activities	Potential Impact	Mitigation Measure
Hygiene, health and security	● Power plant startup ● Organizational, technical or mechanical failures ● Gasoline transportation and storage	● Respiratory affections ● Fires ● Injury risks ● Insalubrity following the anarchic waste management ● Circulation accidents	● Set up a POI ● Establish an HSE committee and designate a person in charge ● Provide Data and security Sheets (DSS) to the concerned employees ● Put signals indicating the danger's type and the prohibitions in all requiring places ● Identify ATEX areas and set up security advice ● Set up security showers and ocular showers near the dangerous products areas ● Make the regular inspections and the preventative maintenance of the installations and equipment (storage tubs, retentions, etc.) ● ensure the tanks truck drivers habilitation; ● raise the awareness among the populations on the precautions to be taken during combustible transportation

I.8. RISK ASSESSMENT

The risks assessment has revealed the presence of risks that might affect the physical integrity of employees and the surrounding populations. According to the initial risks and the accidental scenarios, domino effects are likely inside and outside the site. The major accident scenario identifies the trigger of a classic boil-over.

In using upper-bound distance hypothesis, the effect distances caused by a classic boil-over of a heavy fuel exceeds the site borders. The targets that are likely to get affected are the orchards and the cultivation lands situated in the site surroundings and the unmanaged lands. This phenomenon of boil-over was also modeled by INERIS for this project.

The modelling of such a phenomenon consequences and the determination of different intermediate magnitudes, according to the methodology described in the INERIS Ω13 report, were realized on the basis of a storage container of 16m diameters and 16m of height until a diameter of 14 m of liquid, during the fire outbreak.

The outbreak time is estimated at two (02) days and three (03) hours. The maximal ray of the fire ball is 148m. The irreversible, lethal and non-lethal effects distances are respectively 260, 351 and 440 m.

In the case of a fix roof bin like the project case, a phenomenon leading to the roof disappearance and a fire will outbreak an internal explosion for example, knowing that it will not lead to the roof opening. The fire will last long before the phenomenon occurrence, two (02) days and three (03) hours.

Regarding the protection means, for the concerned installation, the first security measure is a drain system to evacuate continuously the water. **In the absence of water, the boil-over phenomenon is impossible**. It is important to mention that, for the phenomenon occurrence, water must be shaped, a continuous sheet. For the roof of concave and convex types, the necessary water quantity for the boil-over outbreak as calculated is relatively important. Therefore, the occurrence probability of the phenomenon will be significantly reduced in the case of a concave roof.

The second important measure is the organizational nature with POI and the implementation, in case of fire, an anti-fire extinction system.

These measures allow to reduce the occurrence probability of the boil-over phenomenon.

It is necessary to mention that:

- The annual occurrence probability of the phenomenon is extremely low (of 10^{-5} or 10^{-6} even less);
- The kinetic of the phenomenon is slow and in this way it allows the mobilization of agents and relief means and when needed, the setup of protection means for the populations during the fire.

The power plant that extends over about six (06) ha is situated inside an 18 ha site. An efficient application of prevention, intervention and protection measures can reduce the security distance of 260 m maximum, corresponding to the distance of irreversible effects.

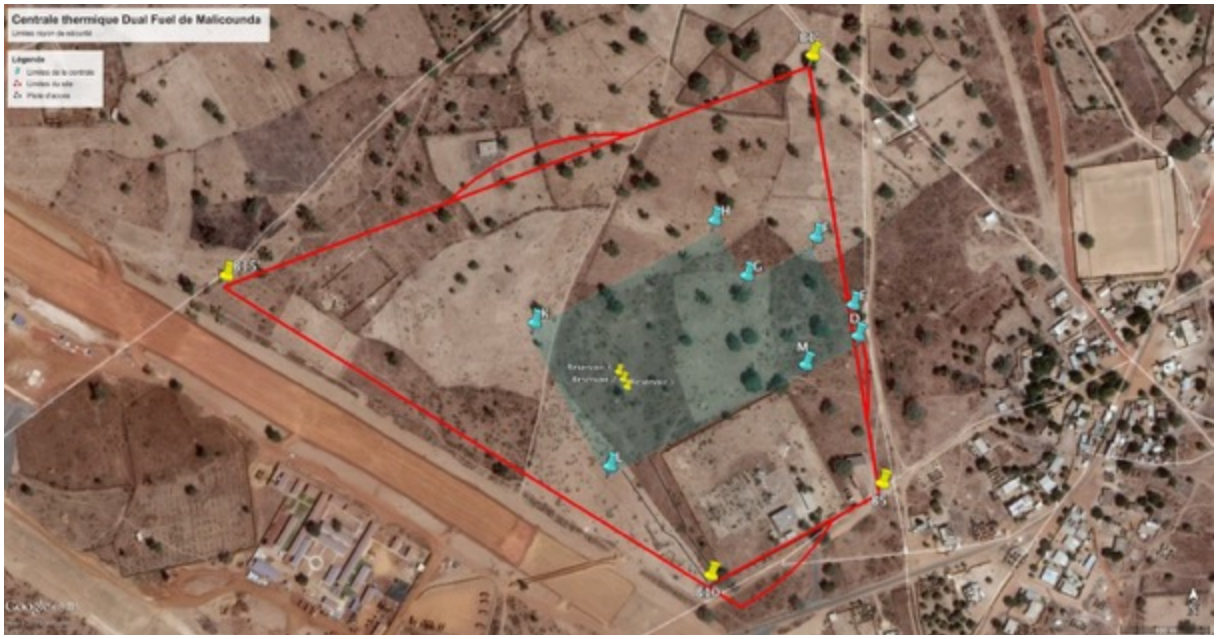


Image Google Earth 1 : Limit of the site requiring a RAP following the risk assessment

I.9. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The Environmental and Social Management Plan (ESMP) aims at ensuring the correct realization and the set deadlines, of all the negative impacts mitigation measures and the enhancement of positive impacts.

I.9.1. ENVIRONMENTAL SURVEILLANCE AND MONITORING PLAN

I.9.1.1. ENVIRONMENTAL SURVEILLANCE

The environmental surveillance is the operation that allows the application of elaborated mitigation measures (ESMP) and the respect of law and regulations in terms of the environment. The environmental surveillance is under the responsibility of the project company (SENELEC and Malicounda Power).

Table 10 : Recap of surveillance measures

Concerned components	Recommended measures	Period	Cost[1] in CFA F	Person in charge
Air quality	Make noise and dust measures in the field	During the works	6 000 000 (Equipment acquisition)	MP
	Set up speed restrictions on the road access from the start of the construction phase	Before the works	For the record	Enterprise in charge of works
	Establish a monitoring on each chimney during the whole operation phase	Operation phase once per month	6 500 000 (Equipment acquisition)	MP

[1] This cost is indicative and serves as the basis to know the expenditures to be made in the social and environmental management framework.

Concerned components	Recommended measures	Period	Cost[1] in CFA F	Person in charge
	Make continuous measures of the ambient air quality (SO_2, NO_X) for 10 points on the site surroundings via passive tubes	Construction phase (monthly)	4 500 000 per year	MP
	Make measures for the ambient air quality (SOx, NOx, CO, PM, COV) for a minimum 10 points on the site surroundings before the start of the construction phase	Operation phase (once per month)	5 000 000	MP
Noise	Make measures for the ambient noise level before the start of works	Quarterly Operation phase	For the record	MP
	Make surveillance for the noise level in work area	Quarterly operation phase	For the record	MP
Surface and underground waters	Set up a piezometer with an automatic data recorder for the groundwater follow-up	Construction phase	For the record	MP
	Provide from the beginning of the works, drain channels for the rainfall and used waters	Construction phase	For the record	MP
	Conduct hydrogeological studies to confirm the water availability (necessary for the drill)	Before the works	For the record	MP
Fauna and Flora	Apply the convention between SENELEC and the Waters and Forests on the land taxes to obtain the tree cutting permit	Before the works	For the record	SENELEC/MP
	Set up a green belt all around the power plant borders (Convention with the waters and forest service)	construction Phase	For the record	SENELEC/MP
Living environment	Set up an engagement plan for the stakeholders before the construction phase	Before the works and during the construction and operation phases	Cost included in the operation budget	SENELEC/MP
	Set up a grievance regulations mechanism	Before the works	Cost included in the operation budget	SENELEC/MP
	Communicate with the commune on the convention concerning the non-hazardous waste collection and elimination	Before the works	For the record	MP
	Contract with a registered provider for the hazardous waste collection and elimination	Operation phase	For the record	MP

Concerned components	Recommended measures	Period	Cost[1] in CFA F	Person in charge
Socio-economic impacts	Set up a local recruitment commission to promote the local employment (taking charge the organization and logistic commission fees)	Before the works	200 000 by session (with in average 5 sessions per year)	MP / SENELEC / local Authorities
	Set up a resettlement action plan (RAP) for PAP	Before the works	40 000 000	SENELEC / CDREI
	Execute the RAP	Before the works	To evaluate in the RAP	SENELEC / CDREI
Environmental and social management	Set up an internal HSE management system with a dedicated team	Operation phase	Cost included in the operation	MP
	Set up an HSE team for the work supervision and the implementation of engagement stakeholders plans and grievances regulations mechanisms	Operation phase	Cost included in the operation	MP
	Make a reinforcement of the DEEC capacities with thermal power plant environmental and social management trainings (See paragraphs X.5.2 and X.6)	Operation phase	20 000 000 (unique subvention)	MP
	Provide an annual budget for the surveillance and environmental and social monitoring committee functioning, managed by the DEEC (see paragraphs X.5.2 and X.6)	construction and operation phases	3 000 000 (construction phase) 1 500 000 per year (operation phase)	MP

I.9.1.2. ENVIRONMENTAL MONITORING

The environmental monitoring is the time and space control of proposed mitigation measures. In fact, it describes the selected measures by the ESMP in order to verify, on the field, the evaluation accuracy of certain impacts and the efficiency of certain mitigation or compensation measures.

The monitoring is ensured by the State authorities with the DEEC and concerned technical services.

The monitoring committee budget is estimated at 20 000 000 FCAF for the reinforcements of the capacities, in addition to the annual budget related to the committee's functioning during the construction and operation phases.

Table 11 : Elements of the environmental monitoring

Aspect	Monitoring Type and place	Method / Indicators to follow	Periodicity	Date of implementation
PAP Livelihood means	Monitoring the PAP on the local populations level	Elaboration of the livelihood means restitution plan and PAP support measures	To be determined in the PAR	Before the works
Air quality emissions	NOx, SO_2, CO, O_2 concentration measures on the stacks level	By a registered enterprise handheld analyzer; Deviation between the measures results and the VLE of the norm NS 05-062; Corrective measures modifications.	Annually	Since the power plant implementation
Air quality emissions	NOx, SO_2 concentration measures in the ambient air surrounding the power plant, in the property limits and in function of the wind dominants	Concentration measures by dissemination tubes; Deviation between the measures results and the VLE of the norm NS 05-062; Corrective measures modifications.	The whole six (06) months, in collaboration with CGQA laboratory	Before the implementation and during the operation
Used rejected waters quality	Sampling on the discharge points level	Parameters measures of used waters of the power plant (pH, MEST, DBO_5, DCO, total azote, total Phosphor, total hydrocarbons, etc.); Deviation between the measures results and the VLE of the norm NS 05-061.	The whole six (06) months	Since the beginning of the implementation
Underground waters quality	Sampling starting from the power plant borehole and the piezometer with automatic data recorder	Periodic analysis of the water physio-chemicals characteristics; Deviation according to the potability norm.	The whole six (06) months	From the implementation date
Water consumption	Counters and flowmeters pose on the drilling pump level	Aquifer productivity control and behavior evaluation of the groundwater level; Overconsumptions control.	The whole months in collaboration with DGPRE	From the implementation date
Noise	Acoustic power level of the power plant equipment (diesel engines, turbo-compressors, air compressors, etc.)	Realization of the noise measures by a sonometer integrator class 1; Noise cartography; Number of anti-noise installed device.	The whole six (06) months	Since the power plant implementation
	Sound level in the power plant property limits	Realization of the noise measures by a sonometer integrator class 1; Noise cartography; Number of anti-noise installed device.	The whole six (06) months	At the beginning of the operation phase