

République du Sénégal

Un Peuple – Un But – Une Foi



ASER SOLAR RURAL ELECTRIFICATION PROJECT

**Rural Electrification Project using solar mini-grids to supply 1000
villages in seven (07) regions of SENEGAL**

**Fatick, Kaffrine, Kaolack, Kolda, Kédougou, Tambacounda and Saint-
Louis**

Non-Technical Summary of the Environmental and Social Impact Assessment (ESIA)

Preliminary Version

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March 2020



1. Background to the programme

The rate of access to electricity is relatively low in Senegal with only 61.7% at the national level (Base 2017). There is a great disparity between urban and rural populations with access rates of 90% in urban areas (Base 2016) and 42.3% in rural areas (Base 2018).

Faced with this situation, the Government of Senegal had initiated a National Rural Electrification Programme (PNER). The objective was to achieve a rural electrification rate of 60% at the national level by 2017, with a minimum of 30% per department, with a view to achieving universal access to electricity by 2025, one of the priorities of the Emerging Senegal Plan (ESP).

The PNER will therefore make it possible to considerably improve the overall service level of the energy sector and consequently improve the living conditions of rural populations (Mr. M. FAYE, November 2016).

To achieve this, the Government of Senegal, through the Senegalese Rural Electrification Agency (ASER) has just drawn up an Operational Plan for universal access in 2025 for an overall investment cost of approximately one billion euros.

This program is structured around the following components:

- Electrification of villages by extension of the Medium Voltage network
- Electrification of remote villages by off-grid systems (mini-grids and individual solar systems).

In order to mobilize the financial resources required for PNER implementation, the State intends to seek the support of development partners and the private sector to complete the overall financing of the programme.

To this end, a programme for the electrification of 1000 villages by mini-grids has been developed by ASER, which, with co-financing from the State of Senegal/Green Climate Fund (GCF)/BOAD, intends to mobilize the resources required for the installation of mini-grids in 1000 villages remote from the interconnected grid of Senegal and to provide access to electricity for about 340,000 inhabitants living in rural areas affected by poverty and long stranded by previous rural electrification programmes mainly based on the extension of the grid.

2. Goals of the ESIA

The main goals of the environmental and social strategy are, inter alia, to:

- ensure that socio-environmental concerns are taken into account in the project implementation process;
- to analyse the environmental and social compliance of planned activities with the regulations;
- propose operational solutions / measures for environmental and social management that are technically feasible and socially acceptable by including them in an action plan;
- propose a global strategy for environmental and social management of project interventions and acquisitions;
- identify the risks associated with the execution of the project;
- define the mitigation and management procedures and measures that will have to be implemented.

3. Methodological approach

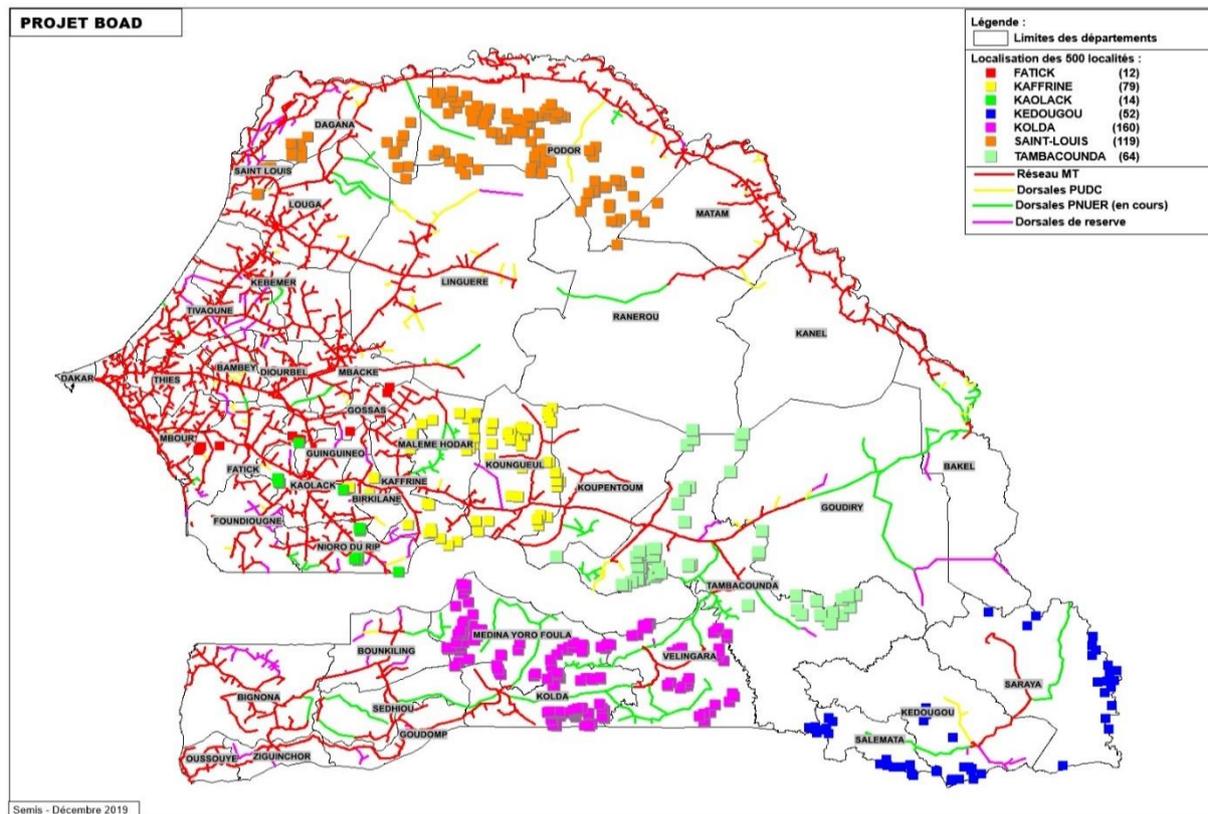
The mission was organized according to the methodological approach approved by ASER.

The methodological approach followed during the conduct of this strategic environmental assessment was articulated around the following steps:

- preparatory activities prior to the start of the mission
- collection of basic data
- literature review
- processing and analysis of collected information

4. Description of the project

The project sites are located in 1000 villages spread over seven (07) administrative regions of Senegal. They are Kaffrine, Kaolack, Fatick (in the Centre), Kolda, Kédougou, Tambacounda (in the South) and Saint-Louis (in the North). The location of the villages concerned is shown on the maps below (Figure 2).



The project will involve approximately the installation of photovoltaic fields. These modules will generate a maximum electrical power of around 32 MW peak, making it possible to electrify a rural population of around 340,000 inhabitants living in 1,000 targeted villages.

The project consists of the installation, in each village concerned, of a solar power plant (power from 15 to 45 kWp) associated with low voltage (LV) lines, public lighting and residential equipment. Generators could also be provided to cover some of the needs of the villages concerned in case of total blackout of the solar photovoltaic (PV) system.



The principle is to provide the users of each village (domestic, professional, community uses and public lighting among others) with a PV solar power plant with a three-phase power supply. For this purpose, the technical solutions to be studied and implemented at the level of the beneficiary localities, including all the necessary equipment requirements for rural electrification are defined below:

- **Kit 1:** 15 kWp - 48 V 1545 AhC10, which can cover a floor area of 650 m², is intended to supply 30 connection points;
- **Kit 2:** 23 kWp - 48 V 2317 AhC10, which can cover a floor area of 1000 m², is designed to supply 45 connection points;
- **Kit 3:** 30 kWp - 48V 2x1545 AhC10, which can cover a floor area of 1500 m², is intended to supply 60 connection points;
- **Kit 4:** 45kWp - 48V 2x2317 AhC10, which can cover a floor area of 1800 m² and is designed to supply 90 connection points.

NB: The type of PV solar power plant to be installed at a locality will depend on the daily load profile of the locality and will be based on the corresponding range among those described above.

Each Kit will consist of the following main technical components:

- a photovoltaic field which allows the direct transformation of sunlight into electrical energy;
- photovoltaic inverters;
- charging inverters;
- an energy storage system using lead-acid batteries;
- a technical room containing the various components of the PV solar power plant;
- a protection and remote control and monitoring device.

The project will be spread over different phases as shown in the table below.

Component	Activities
Surveys & Engineering	Awareness raising of stakeholders, identification of areas, studies and calculation notes per village.
Validation and control of components	Approval of calculation notes for confirmation of designs and orders electrical components
Civil Engineering	Perimeter fences, laying of slabs and studs for metal structures; laying of foundations for posts and public lighting.
Electrification	Installation of solar panels, cables, electronic components up to powering up.
Reception of the works by village	Mechanical completion (Cold Commissioning), energisation (Hot Commissioning), provisional and final acceptance by village.

The main stakeholders of the project are:

PROJECT OWNERSHIP	CONTACT PERSON	EMAIL
Senegalese Rural Electrification Agency (ASER)	Ousmane Fall SARR	ofsarr@yahoo.com
ENVIRONMENTAL & SOCIAL ASSESSMENT	CONTACT PERSON	CONTACT
PYRAMIDE Environnemental Consultants	Momar SOW, Manager	pyramideconsultants@gmail.com
FUNDERS	CONTACT PERSON	CONTACT
BOAD		

5. Policy and regulatory framework

5.1. Domestic requirements

⇒ *Analysis of the national policy and strategic framework*

- Constitutional Act No. 2016-10 of 5 April 2016 revising the Constitution;
- Senegal's third poverty reduction strategy (2013-17), now called: National Strategy for Economic and Social Development;
- The Sectoral Policy Letter on Regional Planning, Decentralization and Local Development;
- The Energy Sector Development Policy Letter (LPDSE);
- The National Action Plan on Energy Efficiency (NAPEE);
- The Emerging Senegal Plan.

⇒ *Sectoral environmental policy framework*

- The National Sustainable Development Strategy (March 2005 version);
- The National Implementation Strategy for the Climate Change Convention;
- The National Action Plan to Combat Desertification;
- Policy Letter of the Environment and Sustainable Development Sector (2016-2020);
- Senegal's Forest Policy (2005-2025);
- The Strategy and Action Plan for Biodiversity Conservation;
- The National Adaptation Programme of Action (NAPA);
- Regional Environmental Action Plan (REAP).

⇒ *National laws and regulations applicable to the project*

- Law 2001 -01 of 15 January 2001 on the Environment Code ;
- Water Code;
- Law No. 8371 of 5 July 1983 on the Hygiene Code;
- Law N°64-46 relating to the national domain;
- Law N° 76-67 of July 2, 1976;
- Decree n° 80-268 of March 10, 1980 on the organization of livestock routes and setting the conditions of use of pastures;
- Law No. 2013-10 of 28 December 2013 on the general code of local authorities;
- Forestry Code;



- Law No. 71-12 of 25 September 1971 establishing the regime of historical monuments and that of excavations and discoveries and Decree No. 73-746 of 8 August 1973 implementing Law No. 71-12 of 25 January 1971 determines the policy for the preservation of these sites;
- Hunting and Wildlife Protection Code;
- Law No. 97-17 of 1 December 1997 on the Labour Code;
- Law No. 2008-43 of 20 August 2008 on the Town Planning Code;
- Highway Code;
- Decree n°99-172 of 4 March 1999 repealing and replacing Decree n°93-1288 of 17 November 1993 adopting the National Relief Organization Plan;
- Ministerial Order n°18050 M.INT of December 9, 1965 fixing the instructions applicable to the fire surveillance service in establishments open to the public;
- Interministerial Order n°5945 M.INT-P.C. of 14 May 1969 instituting safety rules against the risks of fire and panic in establishments open to the public;
- Interministerial Order n° 41321 M.INT. -P.C. of 24 September 1979 establishing the context of the security register ;
- Interministerial Order No. 4862 of 14 July 1999 making it compulsory to draw up an Internal Operation Plan (POI) in certain classified establishments and a Specific Response Plan (PPI) in local authorities with classified installations within their territorial perimeter that are subject to the drawing up of a POI.

5.2. BOAD's Environmental and Social Safeguard Policies

BOAD's environmental and social safeguard policies include operational policies and response procedures.

They were approved in 2001 and revised in 2019 to reflect updated information, improved processes and new knowledge contained in the Integrated Safeguard System (ISS). The adoption and application of the new procedures from 2013 onwards will improve the environmental and social performance of the Bank's operations and thus enhance project results. The new procedures also help to improve decision-making and project performance by ensuring that operations financed by the Bank comply with the requirements set out in the Operational Safeguards (OS) and are therefore sustainable.

They also reduce the need for loan conditionality as corrective measures can be taken in advance and project alternatives are considered and taken into account in project design.

During the project implementation phase, borrowers must ensure the implementation of environmental and social management plans developed to avoid or mitigate adverse effects, while monitoring project impacts and outcomes. Operational staff must supervise the borrowers' work and verify compliance through supervision missions and/or environmental and social audits, whenever necessary.

Throughout the project cycle, the joint involvement of environmental and social experts in project formulation, scoping, field missions and audits is invaluable. Borrowers are responsible for integrating environmental and social considerations into BOAD-financed projects.

BOAD's main operational policies (OPs) are as follows:

- the OP in terms of environmental and social impact assessment ;
- the OP on public participation;

- the OP on natural habitats;
- the OP on forest management;
- the OP on dam safety;
- the OP on international waterways projects;
- OP on projects in disputed areas;
- OP on resettlement of populations
- the OP on indigenous peoples;
- the OP on cultural heritage;
- the OP on Pest Control;
- the OP on the consideration of cumulative effects in environmental and social impact studies;
- the OP on the resolution of global and transboundary issues in environmental and social impact assessment.

5.3. International texts and agreements applicable to the project

- Algiers Convention of 15 September 1968 on the Protection of Nature and Natural Resources;
- United Nations Framework Convention on Climate Change (adopted in Rio on 5 June 1992 and ratified in June 1994) and the Kyoto Protocol (in force since February 2005);
- Bamako Convention adopted in Bamako on 30 January 1991 and ratified on 16 February 1994;
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal It was adopted in March 1989 and entered into force on 5 May 1992.

6. Institutional framework

The institutions/administrative entities involved in the implementation of the project:

Strategic level		Operational level
Ministry of the Environment and Sustainable Development	Department of the Environment and Classified Establishments	Regional Division of Environment and Classified Establishments
	Department of Water, Forests, Hunting and Soil Conservation	Regional Inspectorate of Water and Forestry (IREF) and Water and Forestry Sectors (SEF)
Ministry of Petroleum and Energy	National Electricity Company (SENELEC)	-
	National Agency for Renewable Energies (ANER)	-
	Senegalese Rural Electrification Agency (ASER)	-
	Department of Urban Planning and Architecture	

Strategic level		Operational level
Ministry of Town Planning and Housing	Directorate of Construction	Regional Department of Town Planning and Architecture
Ministry of Regional Planning and Local Authorities	Department of Local Authorities	Regional Support Service for Local Development
	Department of Territorial Development Strategies	
	Local Development Support Department	
	National Agency for Spatial Planning	Regional Planning Department
Departmental Councils		Regional Development Agency
<i>Other entities involved</i>		
Municipalities concerned		
Non-Governmental Organizations and CBOs		
Regional Technical Committees (RTC) / Regional Environmental Monitoring Committees (REMC)		
The Local Development Support Centres (CADL)		

7. Analysis of variants

7.1. Choice of power generation technology

The production of renewable energy from solar photovoltaic has many advantages. It is a technology that allows for simple assembly of equipment and a design that adapts to any type of site. The operating cost of such an installation is also low (low maintenance and servicing costs).

Moreover, during the operating phase, these installations do not cause any significant nuisance (no discharge into the natural environment or presenting pollution risks).

Finally, photovoltaic solar energy is a renewable energy source, whose existing technologies have a long lifespan.

Ultimately, solar energy is a renewable energy that does not consume fossil resources. It is produced as close as possible to the consumer, with no transport losses.

7.2. Choice of load-bearing structures

There are two options for this project:

- ✓ 1st option: the choice of fixed load-bearing structures;
- ✓ 2nd option: a solution of mobile load-bearing structures (trackers), allowing to increase the energy production per m² of installed panels.

However, the overall output for the 2nd option is not optimized due to the spacing of the upper tables, which is necessary to limit shading from one table to another. Investment and maintenance costs are also higher due to the use of moving mechanical parts.

Fixed structures, on the other hand, allow optimization of the yield in terms of kWh produced per hectare of the plant's footprint.

The fixed structure solution appears to be the most suitable for the site for technical and economic reasons.

7.3. Selected photovoltaic technology

There are several families of photovoltaic cells. Currently, the most widespread on the market are crystalline silicon cells and thin film cells. Others exist but are at the Research and Development stage.

Crystalline silicon cells	They consist of thin silicon wafers (0.15 to 0.2 mm), connected in series with each other and covered with protective glass. The three forms of silicon allow three types of technologies (monocrystalline, polycrystalline, ribbon), with different yields and costs. They represent a little less than 90% of the current market.
Thin-film cells	They are manufactured by depositing one or more semi-conductive and photosensitive layers on a support of glass, plastic, steel, etc. The most common are made of amorphous silicon, consisting of silicon projected onto a flexible material. There are also those using cadmium telluride (CdTe), copper-indium-selenium (CIS). This technology is currently undergoing strong development, with a market share of around 10% (compared to 2% a few years ago).



Photo 1: Polycrystalline module (left) and monocrystalline module (right)
 (Source: photovoltaique.info)

The table below summarizes the main characteristics of the different photovoltaic technologies. The yield is the ratio between the solar energy captured and the electrical energy produced.

Table 1: Characteristics of Different Photovoltaic Technologies

		Yield in %	Surface area in m ² /KWp	Cost constraint / m ²
Crystalline technologies	polycrystalline silicon	12 to 15	10	+++ ¹
	monocrystalline silicon	15 to 18	8	++++ ²
	silicon ribbon	◆ 12 to 15	◆ 10	◆ +++
Thin film technologies	amorphous silicon (a-Si)	6	16	+ ³
	cadmium telluride	7-10	12-16	++ ⁴

Source: HESPUL, Guide MEDDTL 2011 / NCA Environnement 2016 modified by Pyramide E.C

This table highlights the interest of crystalline technology in relation to the yield obtained. Therefore, for this project, it is proposed that crystalline technology (monocrystalline modules) should be chosen, due to a better yield/cost ratio.

NB: The final technology will, however, be determined following detailed technical and financial studies. **ASER** will also decide on the final choice of the type of panels at a later stage.

7.4. Choice of the type of ground anchorage

Depending on the geotechnical quality of the terrain, two (02) types of ground anchoring can generally be considered:

- steel piles driven into the ground;
- concrete footings (or stringers).

Photo 2: Foundation types - driven piles (left) and concrete footing (right)



(Source: Guide MEDDTL 2011 – NCA, 2015)

NB: ASER will choose an anchorage according to the characteristics of the soil.

1 Satisfactory
2 Very satisfactory
3 Not satisfactory
4 Little satisfactory

8. Results of Public Consultations

8.1. Perception of the project

The perception of the Senegalese Rural Electrification Agency (ASER)'s rural electrification project is positive for all the people met who made recommendations for the success of this project. They all understood the objective of the mini power plants in each targeted locality which will make it possible to:

- provide electricity to households;
- provide a better living environment and improve the daily life of the village inhabitants;
- facilitate the provision of equipment to relieve women of domestic chores;
- create employment;
- make people and property more secure with the installation of public lighting.

8.2. Major concerns raised

The few fears that are for the most part, are related to a certain apprehension such as:

- the effectiveness of the project;
- the safety of the plant in relation to livestock and children;
- the quality of service;
- the lack of care for people likely to be affected by the project.

Therefore, the issues at stake in this program are safety, quality of service, creation of activities for local workers, raising awareness of the positive impacts of solar power plants and ownership of the project by the recipients.

8.3. Main recommendations

Suggestions and recommendations must be carefully implemented as formulated by the stakeholders consulted as they are the factors for the success and sustainability of the project. The aim of the consultation is to ensure compliance with environmental and social management standards and legislation. The most prominent recommendations can be summarised as follows:

- ensure the criteria for the choice of localities;
- respecting safety and health standards for employees and the population;
- compensate those affected;
- taking into account cultural and social realities;
- Set up high-power plants to not only enable the boreholes to be operated but also to connect the localities polarized by the target villages;
- involve administrative and local authorities in all stages of the project;
- accompany the programme with development projects that generate income for the local population.

9. Geographical situation and location of the intervention area

The size of the study area suggests that the target regions be divided into three (03) zones. The proposed division is presented below:

- - North zone (Saint Louis);
- - Central Zone (Fatick, Kaolack & Kaffrine);
- - South Zone (Tambacounda, Kédougou & Kolda).

It should be noted that not all departments in these administrative regions are concerned by this study.

The departments actually concerned are 15 in number and are presented below (Table 3).

Table 2: The targeted departments and regions of the study area

Area	Regions	Departments
NORTH	Saint Louis	Dagana, Podor
CENTRE	Fatick	Fatick, Gossas
	Kaolack	Kaolack, Nioro
	Kaffrine	Kaffrine, Mbirkilane, Koungheul, Malem Hoddar
SOUTH	Tambacounda	Tambacounda
	Kédougou	Kédougou, Saraya, Salémata
	Kolda	Kolda, Médina Yoro Foulah, Vélingara

10. Organisational scheme proposed by the environmental management

At the organisational level, in line with the recommendations of the stakeholder consultation, **ASER** will have to:

10.1. Integrate harmonisation meetings of interventions at the regional level

This point remains important because during the public consultations, the technical services and local authorities drew the consultant's attention to poor planning of interventions marked by poor targeting (in some cases hamlets are targeted instead of large villages, in other cases the targeted localities no longer exist).

10.2. Regarding environmental and social management

➔ *At the national level*

ASER will have to approach the Ministry in charge of the Environment, through the Directorate of the Environment and Classified Establishments in order to establish a channel of cooperation in the form of a convention so that the latter supports them in the technical implementation of the measures of Environmental and Social Management (ESM).

➔ *At the regional level*

At the regional level, **ASER** will have to rely on technical assistance from the DREECs for the operational implementation of the management plan for environmental and social safeguard measures.

Through the DEEC and the DREEC, **ASER** will be able to mobilize the technical services involved in the follow-up of the strategy of environmental and social management (ESM) of the interventions, through the Regional Committee of Environmental Follow-up (CRSE). This

technical support could be done through the signature of an agreement between the DEEC and ASER for the environmental management of the interventions of the project.

10.3. Taking the environment into account in the planning phase

In the project planning phase, "ASER", with the support of CED/DREEC (through the proposed agreement), will have to carry out a preliminary environmental diagnosis (including problem identification, preliminary consultations, field reconnaissance and initial summary description of the project and the host site). The objective of this diagnosis is to:

- define the environmental issues associated with the host site;
- classify the project.

➔ *Environmental and social diagnosis or preliminary screening*

Given the context of the project, marked by the realization of 1000 mini-solar power plants in an emergency context, the environmental and social diagnosis or preliminary sorting will have to replace the environmental and social assessment procedure. Indeed, a procedure leading to the realization of 1000 environmental studies in compliance with the regulations could compromise the feasibility of the project.

This approach will thus make it possible to:

- make the ICPE classification of the projects;⁵
- identify projects that are likely to have negative environmental and social impacts;
- identify the environmental measures to be applied if necessary.

It will be carried out using the form that has been proposed in the form of a questionnaire to identify the environmental and social impacts of each project (see the preliminary screening form in Appendix 2).

The process includes:

- the completion of the selection form by the DREEC with the support of "ASER".
- validation of the form and GHG measures by the ESRB ;
- transmission of the form to "ASER" via CED.

As a reminder, the preliminary sorting activity must be carried out in the presence of representatives of the project's beneficiary populations.

The results of this work should enable "ASER" to finalize the clauses and other environmental and social measures to be integrated into the DAO with the specific measures drawn from the preliminary sorting.

⁵ Pour ce qui des ICPE, les centrales solaires ne sont pas classées dans la nomenclature sénégalaise (version 2005). Il n'y a que les groupes électrogènes qui sont classés. Et à ce stade du projet, les détails sur le nombre de groupes par localité, la puissance de ces groupes, etc. ne sont pas disponibles.

	Rural Electrification Project using solar mini-grids to supply 1000 villages in seven (07) regions of SENEGAL Environmental and Social Impact Assessment <i>(Executive Summary)</i>	Provisional Version 22/03/2020
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➔ ***Integration of environmental and social measures in the DAO/DRP and DE***

ASER shall ensure that recommendations and other environmental and social management measures are incorporated into tender documents, requests for information and quotations, and project implementation documents.

Cost elements related to environmental and social measures shall be incorporated in the detailed estimates and price schedule.

Social aspects will be particularly monitored in the integration of measures in the DAO and DRP, with particular attention to the following points:

- the participation of the most vulnerable groups;
- gender mainstreaming;
- social support measures;
- etc.

To this end, the analysis grid for technical offers should include an environmental criterion in the scoring, which takes into account the environmental and social measures proposed in the intervention methodology by the companies.

11. General environmental management measures during the construction phase

11.1. Regulatory measures

The start of the work should be subject to the implementation of the following measures:

- ✓ **the ICPE declaration (Installation Classified for the Protection of the Environment):** the company must declare the ICPE operated in the site base to the Regional Division of the Environment and Classified Establishments of the region concerned;
- ✓ **Authorisation from the Water and Forestry Services:** all deforestation / clearing of plant species on all work sites must be authorised by the forestry service of the region concerned (site base installation, etc.).

11.2. General measures to mitigate the negative impacts of the works

➔ ***Environmental guidelines for contractors***

The following recommendations should be incorporated into the contracts of the companies in charge of the work.



Measures	Proposed actions
General implementing measures	<ul style="list-style-type: none"> - Make a well-considered and motivated choice of location: During the preparatory phase, in order to mitigate electrical and fire risks during the operation of solar PV power plants, particular attention should be paid to the choice of location for the photovoltaic fields and related installations. This choice should take into account the following recommendations: <ul style="list-style-type: none"> ✓ location outside of flood zones or waterways. For this purpose, areas located less than 20 m from watercourses shall be avoided; ✓ siting in places where the risk of natural hazards and forest fires is high; ✓ siting in an area easily accessible to public rescue services; ✓ siting far from residential areas (at least 50 m from dwellings). - Carry out a communication and awareness campaign prior to the work. - Ensure compliance with health and safety measures for construction site facilities - Carry out signage of work - Give priority to employing local labour - Ensuring that safety regulations are observed during work - Ensuring the collection and disposal of waste from the works - Carry out awareness campaigns (hygiene, work safety, etc.). - Closely involve the Communes in the monitoring of the implementation. - Compensate affected persons for destruction of property or loss of activities
Measures in the event of archaeological discoveries	<ul style="list-style-type: none"> - During infrastructure works, all fossils, coins, valuables or antiquities, structures and other remains or objects of archaeological interest discovered on the site shall be deemed to be the absolute property of the country; - In the event of the discovery of such archaeological objects, the Contractor shall take the following measures: <ul style="list-style-type: none"> ✓ stop the work and delimit the area concerned; ✓ refer the matter to the Ministry responsible for culture for further action. - The Contractor in charge of the Work shall take reasonable precautions to prevent its workers or any other person from removing or damaging these objects and shall notify ASER or its designated representative on the site of such discovery.

Good environmental and social practices	<ul style="list-style-type: none"> - Planting new trees at the end of the work in the event that the - Avoid destroying animal habitats; - Use the official landfill site authorized by the local authorities; - Do not obstruct the passage of local residents; - Ensure compliance with health and safety measures for construction site installations; - Protect the properties surrounding the work site; - Avoid damaging existing vegetation; - Avoid compacting the soil outside the buildings and making it impermeable and unfit for infiltration; - Avoid harming the local population by using materials that make a lot of noise; - Do not burn waste on the construction site; - Ensure the collection and disposal of waste caused by the works; - Recruit, as far as possible, people from the community to avoid conflicts between the construction site personnel and the local population; - To proceed, if necessary, to the rational management of the quarries according to the regulations in force; - Sensitize site personnel on STI/HIV/AIDS; - Respect cultural sites; - Take into account the nuisances (noise, dust, odors) and the safety of the population when organizing the work site; - Avoid any discharge of waste water into foundation channels and quarries, which are sources of potential contamination of the water table and the development of disease-carrying insects; - Move the sites of material deposits away from houses, places of worship, schools, etc. as far as possible; - Watering to reduce the spread of dust; - Avoid any discharge of sewage, accidental or unintentional spillage of used oil and the dumping of pollutants on the ground, in surface or ground water, etc. ; - Install/build structures to avoid obstruction of natural storm water run-off paths so as not to expose the infrastructure to flooding ; - Put a cover over construction debris destined for the landfill site; - Take and ensure the application of safety measures for site personnel; - Provide potable water for site personnel. - Give priority to employing local labour.
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11.3. General environmental management measures in the operation phase

Regulatory measures

➔ Administrative compliance obligations

Topic	Reference	Content	Relevance
Prior approvals			
Operation of a Classified Facility	Environmental Code - Article L10	Installations referred to in Article L 9 shall be divided into two classes. Depending on the danger or the seriousness of the inconveniences which	ASER will install ICPE (power station generators) which, depending on their size, will have to be authorized or declared prior to commissioning.

Topic	Reference	Content	Relevance
		may arise from their operation, they are subject to either a permit or a declaration.	
Environmental taxes			
ICPE Tax	Environmental Code - Article L27	Annual fees and taxes relating to ICPE are collected by the Ministry of the Environment. They are made up of surface taxes, taxes on appliances, etc., and are collected by the Ministry of the Environment.	These fees are due for the authorisation of classified installations, for their annual operation.
OHS Declarations			
OHS policy	Labour Code, Decree No. 2006-1256 of 15 November 2006 on the employer's obligations in terms of health and safety at work and Decree No. 94-244 of 7 March 1994.	Transmission of the report on the general health and safety situation of the establishment to the labour inspector	There are OSH risks associated with the operation of mini-solar power plants.
Fire Safety			
Fire Safety	Interministerial Order making the installation of lightning conductors compulsory on establishments and installations at risk.	Installing a lightning conductor	The mini power stations must be equipped with lightning conductors before being put into service.
Fire Safety	Article 48 of decree 2006-1261 on general health and safety measures.	The employer must take the necessary first aid and fire-fighting measures suited to the nature of the activities	Due to the fire risks associated with the mini power plant installations and the absence of fire stations in some areas of the intervention zone, fire extinguishing means must be provided on site to fight any fire outbreak.

Technical measures

Impacts	Management measures
Impacts on populations (development of pests)	Establish a periodic maintenance program to avoid the development of wildlife at risk (under signs) for workers and populations (snakes, scorpions, etc.).
Impact on water resources (change in runoff conditions)	Because of the small areas mobilized for the installation of the facilities, the project will have a nil to negligible impact on the modification of water runoff conditions. In addition, <u>no facility will be</u>



Impacts	Management measures
	<u>located on slopes or areas that could cause disturbance to runoff (site acceptance criterion).</u>
Impacts on water resources (pollution risks)	In order to avoid pollution of the soil and possibly the subsoil and groundwater, the project will use cleaners based on essential oils and natural surfactants, also alcohol-free, for the maintenance of the panels. For black water, watertight pits will have to be provided on site.
Waste Impacts	Put in place a waste management plan with : <ul style="list-style-type: none"> - the orientation of common waste towards authorized landfills; - the orientation of hazardous waste (used oils, used batteries and accumulators, etc. to authorized channels).
Fire hazards	<ul style="list-style-type: none"> - Install continuous monitoring of the plant with an alert system in case of an incident. In addition, set up a remote control system for the technical room; - Implement efficient fire extinguishing means; - Equip the technical rooms with suitable extinguishers; - Weeding a 10 m wide corridor around the mini power plant to prevent fires (firewall); - To have a well dimensioned lightning arrester; - To have a fire safety plan before the mini power plant is commissioned. <p><u>Technical Provisions</u></p> <ul style="list-style-type: none"> - the implementation of the installations (inverters, cables, etc.) will comply with NFC 15100 and UTE C15-71261. Its conformity will be periodically checked by approved bodies; - the implementation of electrical equipment (connection box, cables, inverters, etc.) must comply with the standards in force. Cables must be of category C2 and the installations must have only fixed conduits; - the cables between the Panels and the inverter must be installed in technical ducts protected in the event of a fire: <ul style="list-style-type: none"> ✓ these chimneys must provide a fire stop rating identical to the fire stability rating of the building, or else with a minimum of 30 minutes (I30). ✓ these chimneys must not pass through spaces with special hazards. - the cable and cable tray crossings must be protected (caulked) to ensure at least the same fire resistance time as the wall being crossed; - the installation of the inverters shall be carried out in a volume as close as possible to the photovoltaic modules, which must not be accessible to the public or to unauthorised occupying personnel. The security of this volume will be carried out in compliance with the security regulations for electrical service rooms of the type of building concerned; - The use of pluggable or rotary locking connectors is preferred;

Impacts	Management measures
	<ul style="list-style-type: none"> - the use of systems that allow the operation of safety installations in the event of fire: <ul style="list-style-type: none"> ✓ a thermo-fuse type cut-off system which trips at a temperature of around 250°C; ✓ system of an emergency switch positioned close to the PVs and which can be operated remotely. - the personnel working in the installations must be trained in electrical risks and have a certificate of authorization adapted to the types of work carried out. <p>The main existing preventive or protective measures are compliance with the electrical standards, which are listed below:</p> <ul style="list-style-type: none"> - fire detection at the inverter and the presence of extinguishing means in the vicinity if the configuration allows it; - the presence of a breaking device (short-circuit or thermal switch); - the obligation to have a work permit for each hot spot for companies working on or near this equipment; - the installation of protection against lightning.
Risks related to maintenance operations	<ul style="list-style-type: none"> - Disconnect power and ground live power lines before undertaking work on or near these lines; - Ensure that work on live wires is carried out by trained workers and in strict compliance with safety and insulation standards; - Provide operators with the necessary personal protective equipment prior to any work on electrical works, namely: insulating helmet, UV safety glasses, insulating gloves, work clothes made of fireproof material, insulating safety shoes, etc.

11.4. Measures to be taken into account in equipment controls (Design consideration)

The provisions and measures to be taken into account in the design (equipment design) are recalled here:

Topic	Reference	Measures to be taken into account when ordering equipment
Pollution management	Annex IV of NS 05-062: The height of chimneys may not be less than 10 m.	All installations/equipment with a channelled discharge of air pollutants (generators, etc.) must be equipped with a chimney of at least 10 m in length.
Nuisance Management / Occupational Health	Articles 13 and 14 of Decree No. 2006-1252 of 15 November 2006 on ambient physical factors: the daily noise exposure level received by a worker throughout the working day must not exceed eighty-five (85) A-weighted decibels (dB -A-).	All equipment orders must take into account the noise level not to exceed 85 decibels A-weighted (dB -A-).

Topic	Reference	Measures to be taken into account when ordering equipment
Worker Protection / Occupational Health	Article 39 of Decree 2006-1251 of 15 November 2006 on work equipment: Where necessary and in all cases where it is technically impossible to totally eliminate the nuisance caused by work equipment, the employer must provide workers with suitable personal protective equipment.	All equipment orders must take into account the provision of PPE suitable for the equipment.
Fire Safety	Article 48 of Decree 2006-1261 on general health and safety measures	ASER must take the necessary measures in terms of first aid, firefighting, adapted to the nature of the activities on each site/installation.
Fire Safety	Levelling of risk areas of the safety signs/guidelines	All sites must be marked out (display of safety instructions to be respected according to the level of risk on site) before being put into service.

In general, the following measures should be taken into account in the ordering and selection of equipment, depending on the components of the projects:

➔ ***Electrical installations of the plant***

In order to prevent any electrical risk associated with photovoltaic plants and related installations, the design and operation of the works shall provide for the following measures:

- the panels and electrical elements shall be equipped with DC and AC surge arresters and protection devices in accordance with the international standard IEC 61024, which is the international reference on the subject;
- the installation will be equipped with a lightning conductor whatever the level of lightning strikes in the area where the solar power plant is located;
- the equipotentiality of all the conductive elements and metallic masses (excluding the battery bank) by means of earth connections;
- the LV electrical structures will be installed and operated in accordance with NFC 15-100;
- the training and certification (B2 and BP types) of the operators who will install and operate the electrical equipment of the photovoltaic system;
- a maintenance and preventive maintenance plan with visual inspections, electrical measurements, technical room checks, and replacement of defective elements;
- for the technical room:
 - it will be secure, insulated, air-conditioned and watertight;
 - it will have fire walls of degree 2h;
 - the installation of the DC and AC protection boxes, as well as the inverter, will be done at a height of more than 120 cm from the ground in order to make them inaccessible to children;
 - the presence of an autonomous emergency lighting unit including the mains power supply;
 - the presence of an insulating stool and a device for checking the absence of voltage and a rescue pole;

- Safety signs and markings (safety instructions, installation hazards and emergency telephone numbers);
- a set of personal protective equipment (PPE) in the form of electro-safety cases will be placed at the entrance to the technical room to enable intervention on the electrical structures in the event of an incident. Minimum PPE is to be provided such as: insulating helmet, anti-UV safety glasses, insulating gloves, insulating safety shoes;
- the maintenance and periodic cleaning of the room and the prohibition of eating and/or drinking in or near the room will help to fight against rodents;
- Suitable and sufficient extinguishing means will be provided for extinguishing fires of electrical origin (2 kg and 6 kg CO2 extinguishers).

➔ *Electricity storage batteries*

To mitigate the risks associated with the operation of batteries, the following measures are required:

- the batteries will be completely closed and delivered without external acid;
- a retention will be built into each battery bank with a capacity equal to 100% of the total volume of electrolyte contained in all cells of the bank;
- the shielding of the battery terminals and non-insulated conductors;
the training of personnel in health and safety and raising public awareness of risk management;
- the provision of an eye washer kit for rinsing in the event of accidental contact with sulphuric acid;
- used batteries will not be stored in residential areas.

➔ *Generating sets*

In order to mitigate the risks associated with the operation of generating sets, it is necessary to:

- choose soundproof groups;
- train operating personnel in health and safety and risk management;
- raising awareness among the surrounding population on the operation of the groups and the associated risks;
- provide appropriate PPE and require them to be worn for the maintenance of the units;
- avoid, as far as possible, the storage of lubricants and waste oils on site;
- have a PS-50 type fire extinguisher and a sandbox close to each unit.

➔ *Prevention of the risks of malevolence and theft*

Acts of malice and vandalism can be prevented by the following measures:

- The entire photovoltaic plant will be fenced off and a remote monitoring and surveillance system is planned;
- the technical room will remain locked and not accessible to the public for security reasons. Only dealers and ASER representatives will be allowed inside;
- raising awareness of the surrounding populations.

➔ *Fire safety*

Measures to prevent and combat a fire outbreak include, among others:

- choice of electrical equipment meeting strict technical standards and flame-retardant cables;
- no smoking in the technical room and its surroundings;
- training in the use of fire-fighting equipment;
- regular maintenance of the site by clearing brush over a radius of 50 m; this will avoid the development of tall grass that could encourage the spread of a fire;
- a 5 m wide fire-break strip will be maintained around the site;
- accesses and paths will be kept accessible at all times and in good traffic condition for the emergency services.

11.5. End of life of equipment

Impacts	Mitigation measures
Pollution risk	Formalise the management of end-of-life or used facilities with the implementation of a dismantling and rehabilitation plan.

12. Implementation of environmental and social management

The process includes the following steps:

Steps	Technical Activity and Responsible Entity/ies	Tools / Deliverables
Step 1: Formulation of environmental and social conditionality criteria for each project	In this stage, the environmental and social selection form for projects in Annex 2 will be filled in, the site of the mini power plants will be validated and their environmental and social classification will be carried out. The initial selection form will be filled in by the DREEC, on the basis of the DEEC- ASER agreement, with the support of the relevant technical services: forestry service, ARD, etc. The DREEC will then submit the initial selection form to the DREEC.	Screening form (see Annex 2 of the main report)
Step 2: Validation of the environmental and social classification of the project	The validation of the environmental and social classification will have to be carried out by the CED. NB: Given the context of the project, marked by the construction of 1,000 solar power plants in an emergency context, the environmental and social diagnosis or preliminary screening will have to replace the environmental and social assessment procedure. Indeed, a procedure that would lead to the completion of 1000 environmental assessments could compromise the feasibility of the project.	Consolidated and validated screening form (see Annex 2 of the main report)



Steps	Technical Activity and Responsible Entity/ies	Tools / Deliverables
	<p>This specificity of the project will have to be taken into account within the framework of the DEEC - ASER convention.</p>	
<p>Step 3: Execution of the environmental and social work of the project / Integration of the environmental measures in the tender documents / DRP and DE</p>	<p>As part of the work, the contractual documents of the contract will require the company to <u>produce a worksite GEP</u> based on the measures defined in section 7.2.2 <i>General environmental management measures during the work phase</i>. This on-site GHG management plan, which must allow the operationalization of GHG measures, must be examined and validated by CED.</p> <p>ASER, with the support of CED and CEDRD, will ensure that recommendations and other environmental and social management requirements are incorporated into the tender and project implementation files. The DAOs can only be launched when all environmental and social due diligence is effectively taken into account and integrated into the call for tenders.</p> <p>Particular attention will have to be paid to the cost elements related to environmental and social measures that have to be integrated in the detailed estimates and price schedule.</p> <p>Social aspects will be particularly monitored in the integration of the measures in the DAO and DRP, with particular attention to the following points:</p> <ul style="list-style-type: none"> - the participation of the most vulnerable groups; - gender mainstreaming; - social support measures; - etc. <p>In general, contracting companies must commit themselves to:</p> <ul style="list-style-type: none"> - implement environmental and social measures; - comply with the directives and other environmental requirements contained in works contracts as contractual components. <p>With regard to equipment, ASER will have to ensure the integration of design measures (see section 7.2.3.2. <i>Measures to be taken into</i></p>	<p>Finalised environmental and social clauses</p>

Steps	Technical Activity and Responsible Entity/ies	Tools / Deliverables
	<i>account when ordering equipment in the CADs of the equipment components).</i>	
Step 4: Implementation and monitoring of environmental and social measures <u>in the works phase</u>	<p>For each project, private providers and companies are responsible for the implementation of environmental and social measures. However, beforehand, they will have to prepare and implement a site Environmental and Social Management Plan (ESMP).</p> <p>The implementation will be monitored as follows:</p> <ul style="list-style-type: none"> the supervision of the activities will be ensured by ASER. close monitoring of the implementation of environmental and social measures will have to be carried out by the control offices to be appointed. To this end, the presence of an HSE manager in the control mission team will be required. Monitoring will be carried out by the DEEC and the DREECs through the DEEC - ASER agreement. 	<ul style="list-style-type: none"> Environmental and Social Management Plan (ESMP) for the site Follow-up report / monitoring
Step 5: Implementation of environmental and social measures <u>in the operation phase</u>	<p>In the operations phase, the implementation of GHG measures will be the responsibility of the structures in charge of operations. To this end, the retrocession clauses of the measures will have to integrate the obligation to implement the GHG measures.</p>	<ul style="list-style-type: none"> Retrocession clauses integrating environmental and social measures Follow-up report / monitoring

The operationalisation of this framework is based on the device shown in the following table.

Steps	Activities	Implementation	Monitoring
1	Formulation of environmental and social conditionality criteria for each project (Filling in the Environmental and Social Selection of Projects form in Annex 2)	<ul style="list-style-type: none"> DREEC Forestry department, ARD Etc. 	<ul style="list-style-type: none"> DEEC ASER
2	Validation of environmental and social cross compliance criteria	DEEC	ASER
3	Integration of environmental and social provisions in the tender and work execution documents	ASER	DEEC

4	Execution of environmental work (Site ESMP)	Companies	<ul style="list-style-type: none"> - DEEC - ASER
5	Implementation and Monitoring	<ul style="list-style-type: none"> - Companies - Control office 	<ul style="list-style-type: none"> - DEEC - ASER - CRSE - DREEC

13. Recommendations for implementation

13.1. Implementation of procedures

➔ *Internal communication procedure*

Effective environmental and social management will be based on a clear organisation of communication between stakeholders. Indeed, a clear path of handling environmental events is essential to ensure a rapid and efficient implementation of the necessary actions (especially in emergency situations).

This procedure has the advantage of:

- to define the mechanisms for stopping the work if the situation is deemed to be of concern;
- feedback through which ASER ensures that the correction is made;
- initiate an incident investigation to determine the causes of the incident and assess whether changes in specifications, requirements or methods are warranted to prevent recurrence of such a situation.

For this purpose, it is important for **ASER** to:

- - define the penalties applicable in the event of non-compliance found during the performance of the services from an environmental and social point of view ;
- - to designate resource persons and set up an organisational scheme aimed at providing prompt responses to critical situations arising on the site;
- - to set a timing for the processing of files at each level of the chain of intervention, to ensure a certain efficiency in the responses to be provided.

➔ *External consultation procedure (Consultation Plan)*

✓ *Consultation mechanisms and procedures*

The mechanisms and procedures for information, consultation and negotiation to be put in place should be based on the following points:

- knowledge of the project's areas of intervention;
- the social acceptability of the project.

Consultation tools and techniques will have to conform to a logic of communication and awareness-raising.

✓ *Strategy*

The start of strategic planning and the provision of information on the project should be marked by forums in the form of DRBs organized in the regions.

The objectives are :

- to ensure the consistency of the project's interventions;
- the establishment of a consultation framework allowing early consideration of the difficulties noted in the implementation of the project;
- the follow-up of interventions.

In this context, it is important to set up a local information and monitoring committee (CLIS) in each community concerned. The role of this committee will be to

- to support "ASER" in the social appropriation of the project;
- to mobilize the various actors present in the community for a peaceful implementation of the project;
- to serve as a framework for the amicable resolution of possible conflicts (land or other).

A local NGO or association specialized in social mobilization could help facilitate the establishment and operations of these sectoral or socio-professional groups, but above all ensure quality and equity in representation (marginalized groups, gender, etc.).

✓ *Consultation steps*

The Consultation Plan can take place through three (03) axes:

- local consultation or the forum organisation;
- the organisation of open days on the project and its achievements;
- sectoral meetings of social and/or interest groups.

✓ *Consultation process*

The public consultation process should be structured along the following lines:

- In the preparation / formulation of projects:
 - Preparation of project execution files including project screening;
 - Definition and validation of GHG measures.
- In the construction phase:
 - Communication on activities and agendas ;
 - Raising awareness on the scope of the interventions and the areas concerned.

➔ *Procedure for receiving, handling and following up complaints and grievances*

Complaint management is an essential part of the "societal engineering" component. Indeed, if bold support measures are not implemented to benefit these targets, the negative impacts of the worksite could be heavy on local residents, particularly the underprivileged social classes, and lead to situations of marginalization and exclusion.

A specific directory will therefore be dedicated to comments and complaints. To carry out this work of facilitation and social support for the populations, sharing and information workshops bringing together the various stakeholders will be set up. These participatory management spaces



will enable the impacted populations to express their grievances about possible nuisances (air and noise pollution due to worksite work, insecurity due to speeding, etc.).

Complaints/complaints booklets will be designed and made available at the local level (village chief or town hall) of the polarized zones. Depending on their nature, these complaints will be collected regularly and processed without delay with the utmost diligence by the Company.

A register will be made available to local and customary populations, notables and authorities to enable them to register their complaints and grievances with the Company in charge of the works.

The purpose of the register is to establish a permanent channel of communication between the populations and the Company.

Any complaint or grievance recorded in this register will be processed by the Company and the outcome will be brought to the attention of the complainant and, if necessary, of any other person who may be affected by it. Hence the need to always clearly indicate the contact details of the initiators of the complaints and/or grievances.

13.2. Prerequisites for starting the construction work

Prior to the implementation of projects, the following measures are recommended:

- **detailed technical studies of the infrastructure and its related components should be carried out;**
- **Information and awareness of all stakeholders:** before the start of work, information sessions will be organized with the people in charge of the riparian populations to provide information on the project and the planned environmental measures. These sessions will also make it possible to clarify the roles and responsibilities of each party in order to ensure participation in the execution of the project;
- **preparation of a classified establishment file:** as some site facilities are categorized as ICPE, companies will have to prepare and submit a classified establishment file to the DEEC ;
- **Deepening of the initial state and preparation of the site's ESMP:** some information remains undetermined at the time of the screening (site location of the worksite base, etc.). In this context, even if procedures have been defined for the choice of sites for setting up the worksite base, etc., it is not possible to determine the exact location of the worksite base at the time of the screening. In this context, even if procedures were defined for the choice of sites for the construction site base, etc. (see 8.2.2.2 General mitigation measures during the construction phase), the impacts related to these components could not be precisely apprehended. To this end, the Company will be asked to produce, at the same time as its execution project, a precise and detailed Environmental and Social Management Plan (ESMP) for the worksite, whose procedures and content must comply with the major orientations defined by Senegalese regulations on the management of pollution, nuisances and worksite management. Once approved by **ASER** and the DEEC, the ESMP of building site will be contractual for all the parties, and will be used as reference framework for the follow-up of building site.

13.3. Responsibilities and obligations

The Company in charge of the work will be obliged to comply with the clauses of the Procurement Contract and the GHG measures that will be sent to it in the form of **Technical Specifications**.

Compliance with these documents will in particular condition the final acceptance of the worksite and the payment of the related financial deadline.

14. Estimated costs of environmental and social measures

The estimated costs of environmental and social measures are summarised below:

14.1. Estimated costs of general environmental and social management measures

Activities	Quantity	Cost per unit (FCFA)	Total cost (FCFA)
Environmental and social monitoring	Flat rate	Flat rate	150 000 000
Environmental and social monitoring (support to CED)	Flat rate	Flat rate	300 000 000 (Works)
Evaluation (mid-term and final)	Annual flat rate	Flat rate	25.000.000 (Operationalisation)
Elaboration & validation of the dismantling / rehabilitation plan of the site	2 evaluations	25 000 000	50 000 000
Environmental and social monitoring	Flat rate	Flat rate	115 000 000
TOTAL			640 000 000

14.2. Estimated cost of specific environmental and social management measures

Activities	Quantity	Cost per unit (FCFA)	Total cost (FCFA)
Miscellaneous authorizations	Fixed amount	Flat rate	70 000 000
Compensatory Reforestation	PM	PM	PM
TOTAL			70.000 000

14.3. Costs of Training and Awareness-Raising Measures

Concerned stakeholders	Topic	Quantity	Cost per unit	Total cost
Training				
- CRSE - Local elected officials	Module 1: Environmental and Social Assessment - Procedure definition of environmental and social management measures and impact indicators	1 workshop / region	Flat rate	80 000 000
- CRSE - Companies	Module 2: Training on Environmental and Social Monitoring - Knowledge of the environmental monitoring process; - Environmental and social monitoring methodology; - Environmental and social monitoring indicators.	1 workshop / region	PM	PM (taken into account in the DEEC-ASER agreement)

Workers	<u>Module 3: HSE training</u> - Training & awareness of security risks related to certain tasks; - Firefighting procedures and emergency response; - Training on risks related to worksites and safety procedures to be followed (meaning of sound signals and rules to be followed in case of sound signals, etc.)	Continuously	PM	PM
Operators	<u>Module 4: HSE training</u> - Training & awareness on safety risks related to solar power plants; - Firefighting procedures and emergency response in solar power plants.	1 workshop / region		70.000.000
Information and Awareness Raising				
- People, - Administrative authorities - Local Authorities	- Information on the start and duration of the work - Information on safety procedures and impacts related to the work			PM (Taken into account in company contracts)
TOTAL				150 000 000

Total cost of environmental and social measures: 515 000 000 FCFA