BURKINA FASO

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*Unité-Progrès-Justice*

**ZINA SOLAIRE SA**

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# ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF THE PROJECT TO BUILD A PHOTOVOLTAIC POWER PLANT IN ZINA IN THE RURAL COMMUNE OF KONA MOUHOUN PROVINCE, MOUHOUN OF MOUHOUN REGION

**FINAL VERSION**

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AEPS | : Simplified drinking water supply |
| AGR | : Income Generating Activities |
| ANEREE | : National Agency for Renewable Energy and Energy Efficiency |
| ANEVE | : National Agency for Environmental Assessments |
| APFR | : Attestation de Possession Foncière Rurale |
| BDOT | : Base de Données sur l'Occupation des Terres |
| BUNASOL | : National Soil Office |
| CAMELIA | : Calcul Métrique des Lignes Aériennes |
| CCN | : Digital Command and Control |
| UNFCCC | : United Nations Framework Convention on Climate Change |
| CIMAC | : Comité Interministériel d'Action sur la Convention |
| CLO | : Community Liaison Officer |
| COTEVE | : Technical Committee on Environmental Assessment |
| COVID 19 | : Coronavirus disease 19 |
| CSPS | : Centre de Santé et de Promotion Sociale |
| CVD | : Village Development Council |
| WEEE | : Waste Electrical and Electronic Equipment |
| DID | : Hazardous Industrial Waste |
| EAS | : Exploitation et Abus Sexuel/ Harcèlement Sexuel |
| EHS | : Environmental Health and Safety |
| ESIA | : Environmental and Social Impact Assessment |
| EPI | : Personal Protective Equipment |
| GDT | : Sustainable Land Management |
| GHG | : Greenhouse Gas |
| GIRE | : Integrated Water Resources Management |
| GPS | : Global Positioning System |
| IEC | : Information Education and Communication |
| IPEAD | : Environmental Preservation Engineering for Sustainable Development |
| STI | : Sexually Transmitted Infection |
| Km | : Kilometre |
| KV | : Kilo Volts |

| | |
|---|---|
| KVA | : Kilo Volts Amps |
| MCPD | : Modes of Consumption and Sustainable Production |
| MGP | : Complaints Management Mechanism |
| MTEE | : Ministère de la Transition Ecologique et de l'Environnement |
| MW | : Mega Watt |
| NIE | : Environmental Impact Statement |
| OCADES | Catholic Organisation for the Development of Solidarity |
| MDG | : Millennium Development Goals |
| NGO | : Non-Governmental Organisation |
| PAN/LCD | : National Action Plan to Combat Desertification |
| NAPA | : National Action Programme for Adaptation to Climate Variability and Change |
| PANE | : National Action Plan for the Environment |
| PANED | : National Action Plan for Environmental Education for Sustainable Development |
| PAP | : Person Affected by the Project |
| PDI/OCAD | : Integrated Development Programme/ Organisation |
| PRF | : Rehabilitation and Closure Plan |
| PGES | : Environmental and Social Management Plan |
| PPCB | : Contagious bovine pleuropneumonia |
| PRME | : Plan de Restauration des Moyens d'Existence |
| PV | : Procès-Verbal |
| PV | : Photovoltaic panels |
| PV/HIV | : Person Living with Human Immunodeficiency Virus |
| PVC | : Polyvinyl chloride |
| RGPH | : Recensement Général des Populations et de l'Habitat |
| SEMAFO | : Société d'Exploitation Minière de l'Afrique de l'Ouest |
| IFC | : International Finance Corporation |
| AIDS | : Acquired Immunodeficiency Syndrome |
| SONABEL | : Société Nationale de l'Electricité du Burkina |
| STD | : Service Technique Déconcentré |
| TDR | : Terms of reference |
| UTM | : Universal Transverse Mercator |
| VBG | : Gender-based violence |
| VCE | : Violence Against Children |

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## NON-TECHNICAL SUMMARY

### Background and rationale for the study

The present study is an update of the data on the environmental, biophysical and human components of the project for the construction of the Zina solar power plant with photovoltaic technology with a capacity of 26.6 MWp (22.4 MVA of inverters). The update of the Environmental and Social Impact Notice of the project is justified by the fact that the project had obtained an environmental feasibility opinion dating from November 2015 which expired in accordance with Article 33 of Decree No. 2015-1187/PRES-TRANS/PM/MERH/MATD/MME/MS/MARHASA/MRA/MICA/MHU/MIDT/MCT of 22 October 2015 on the conditions and procedures for the conduct and validation of the strategic environmental assessment, the study and the environmental and social impact notice after three (03) years of non-implementation.

Indeed, Article 33 of the decree stipulates that: ***"In case of a favourable opinion, the promoter has three (03) years to implement his project under penalty of nullity".*** Given the failure to meet the deadline for the implementation of the project, this provision obliges the promoter ZINA SOLAIRE SA to update the study for which it had obtained a favourable opinion and to respect the sustainability criteria of the International Finance Corporation.

### Description of the project

The promoter of this project is ZINA SOLAIRE SA, a company incorporated under Burkinabe law and owned by AMEA POWER based in Dubai. AMEA POWER has solar projects all over Africa. The Deputy Managing Director of the company is Mr Assane YAMEOGO. Postal address: 14 BP 318 Ouaga ZAD Burkina Faso; sector 13, Avenue Babanguida, door 333.

The plant site covers an area of 74 hectares, of which 36 hectares will be used for the implementation of the solar power plant. The main activities of this project will include

- Levelling of the site with an even slope and trenches in and around the site to facilitate drainage;
- installation of 84,480 poly-crystalline solar panels inclined at 12° to the south;
- installation of junction boxes connected to the inverters by solar cables buried in trenches;
- installation of eleven (11) power blocks for inverters, electrical applications and oil transformers (the latter being placed outside the container but within the technical room);
- construction of technical and office buildings ;
- drilling ;

The site of the 22.4 MWac (26.6 MWp) solar power plant, which is the subject of this study, is located on the land of the village of Zina (hence the name of the Zina solar power plant), approximately three (3) kilometres from the chief town of the Commune (Kona), Mouhoun province/ Boucle du Mouhoun region. The site is located 1 km from the village of Zina on uninhabited land.

**Policy, legal and institutional framework**

The project must be carried out in accordance with the political and legal context of the environmental and social sector in Burkina Faso and the requirements set by the International Finance Corporation.

The national policy framework to be considered is mainly :

- the National Economic and Social Development Plan II;
- the National Environmental Action Plan (1991-2005) and its Environment and Sustainable Development Plan (2005-2020);
- The Forest and Wildlife Management Framework Programme;
- the National Action Plan to Combat Desertification (NAP/CD) and the sectoral energy policy 2014-2025.

In terms of legislation and regulations, the main ones are

- the Constitution of Burkina Faso;
- Law No. 006-2013/AN of 2 April 2013 on the Environmental Code in Burkina Faso;
- Law No. 034-2012/AN of 2 July 2012, on Agrarian and Land Reorganisation (RAF) in Burkina Faso;
- Law n°003/2011/AN of 5 April 2011 on the Forestry Code;
- Decree N°20151187/PRESTRANS/PM/MERH/MATD/MAE/MARHASA/MRH/MICA/MHU/MIDT/MCT of 22 October 2015 on the conditions and procedures for carrying out and validating the strategic environmental assessment, the study and the environmental and social impact notice And the international conventions ratified or signed by the Burkinabe State which are automatically part of the country's legal arsenal.

At the institutional level, the implementation of the project is under the control of the company AMEA POWER, represented by the company ZINA SOLAIRE Several ministries and organisations are involved in the implementation of this project, including (i) the Ministry of Environment, Energy, Water and Sanitation (MEEEA) through the National Agency for Environmental Assessments (ANEVE) and the National Agency for Renewable Energies; (ii) the Ministry of Territorial Administration, Decentralization and Security through the municipalities and prefectures of Kona and Bana as well as the Decentralized Technical Services (STD) concerned by the implementation of the project. This NIES is also subject to the requirements of the International Finance Corporation.

**Description of the current state of the environment**

Within the framework of the updating of biophysical and human data. Three (03) zones of influence were defined, taking into account the administrative division and the radii of the inventories. These zones are defined as follows:

- the zone of direct influence, which concerns the site of the solar power plant on which the felling of trees and the construction of the infrastructure and equipment of the solar power plant will be carried out;
- the local influence zone concerns the village of Zina in the commune of Kona;
- the regional influence zone, which concerns the Boucle du Mouhoun region.

***Characteristics of the biophysical environment***

The commune of Kona is located in the Centre-West of Burkina Faso in the Boucle du Mouhoun region, precisely 72 km from Dédougou, capital of the Mouhoun province, with an area of 605.175 km². It has 17 villages including the village of Zina.

The rural commune of Kona, like all the communes of the Mouhoun loop region, is located in the Sudanian climatic zone with isohyets ranging from 700 to 1000 mm. It is characterised by two (2) main seasons:

- a rainy season from June to October. Rainfall is usually concentrated between July and August but during the latter months. Average temperatures are around 28°C.
- a dry season from November to May with high temperatures sometimes exceeding 40°C. (source Kona February 2020).

The commune of Kona is crossed by a rather diffuse hydrographic network made up of shallow streams attached to the lower watershed of the Mouhoun River. Generally speaking, these streams are areal and dry up as soon as the dry season sets in. The hydrographic network includes temporary rivers such as the Konzié, Karouko and Niagan. Only the chief town of the commune (Kona) has a bouli.

The territory of the Kona municipality is located on three main soil types (BUNASOL). These are :

- little developed soils: covering an area of 151.09 km$^2$ , i.e. 24.96% of the municipality, in the form of patches scattered throughout the municipality, particularly in the north, centre and south
- mull soils: which belong to the group of brown eutrophic soils, are found mainly in the south-eastern part of the commune (Nana, Blé, Soungoulé, Yankoro). They cover an area of 23.54 km$^2$ , or only 3.89% of the commune.
- sesquioxide soils: which are soils with a high degree of primary mineral alteration cover 432.07 km$^2$ , i.e. 71.17% of the municipality's territory.

Groundwater is collected by means of wells and boreholes. In addition to the watercourses, the commune has small lowlands that can be developed in its northern, eastern and southern parts, notably in Goulo, Tâ, Sanflé, Toton, Tyouré, Nana and Zina. The commune of Kona belongs to the Sudanian phytogeographical domain, which is characterised by a shrubby to woody savannah with gallery forests along the rivers. Thus, the very varied vegetation is dense and is favourable to the creation of protected areas and the development of forestry potential. However, there are climatic hazards and significant pressure on plant resources (uncontrolled clearing, bush fires, overgrazing, demographic pressure).

The diverse wildlife resources include small game such as monkeys, hares, partridges, wild guinea fowl, rats and turtle doves.

***Human characteristics of the environment***

The site of the solar power plant is located in an uninhabited area without any buildings. At its eastern end, the road is located nearby. The site is located more than 1 km from the village of Zina, which has a population of approximately 1,690 (2015 census).

According to the results of the 2006 General Census of Population and Housing (RGPH), the commune of Kona had 3,494 households with a total population of 19,606 inhabitants, 51.72% of whom were women and 50.2% men. According to the 2019 RGPH, the population is estimated at 28,321 inhabitants. In 2024 (at the horizon of the plan), the population of the commune will be 30,311 inhabitants.

The PAPs identified in the solar power plant area come from four (4) villages: Yona with three (3) people, Kona with 11 people, Zina with six (6) people and Blé with one (1) person. Thus, a total of 21 PAPs were identified at the solar power plant. All these PAPs have been compensated.

There are mainly 4 ethnic groups in the commune, in numerical order: the Marka, the Bwabas, the Mossis and the Peulhs. Islam is the dominant religion, followed by Christianity. Traditional religion (ancestor worship) is the least widespread religion officially, but in reality, the populations live a religious syncretism, because almost all the natives submit to certain rites of ancestral religions.

The commune of Kona has a Basic Education District. This CEB comprises a total of 24 schools, all of which are functional and spread over the various villages. One of them is in the village of Zina. The commune of Kona has a total of 4 post-primary schools (Kona, Dangouna, Pié, Lah), 2 secondary schools including the departmental high school and one public school.

The commune of Kona has five health facilities. These are the CSPSs of Kona, Kouana, Dangouna, Lah and Pié. In addition, there is only one hospital ward (in Kona) and a pharmaceutical depot in Lah. Of the CSPSs mentioned above, all five are functional. The commune has a total of 17 qualified health workers for 13 nursing units. The commune of Kona has 125 water points divided into 76 boreholes (12 of which are not functional), 5 AEPS (1 of which is not functional) and 4 standpipes. The drinking water coverage rate is relatively satisfactory. Including one (01) functional borehole and one (01) non-functional borehole in Zina.

**Environmental and social issues**

The analysis of the biophysical and socio-economic environment revealed a number of environmental and social issues that will require attention during the execution of the works:

- supply of electrical energy to the population
- preservation of vegetation ;
- preservation of health (STI/HIV and COVID 19) and the living environment;

- preservation of the peace and quiet of the local population;
- safety of workers and neighbouring populations;
- respect for customs and traditions.

**Potential impacts of the project**

The realisation of the solar power plant project will certainly generate potentially positive social, economic and environmental impacts, but also negative ones. The positive environmental and social impacts are :

- creation of temporary jobs in the locality for men, women and vulnerable groups in the site.
- building energy capacity in the area.
- improvement of the living conditions of the beneficiaries.
- Public lighting of the main roads will contribute to the safety of people and property and will facilitate cultural events;
- Improved study conditions for pupils and students who will now be able to study at home or on the main roads in neighbourhoods with public lighting;
- Improving the working conditions of health centres for better patient care.

The implementation of the project will have both positive and negative impacts such as

- creation of permanent and temporary posts ;
- solid and liquid waste generation ;
- impacts on the microclimatic condition ;
- minor alterations and/or damage to the landscape ;
- loss of wildlife habitat,
- change in terrain ;
- soil pollution
- disruption of human-nature interaction; probable displacement of fields.
- modification of the physico-chemical properties of soils;
- loss of local plant species ;
- various nuisances (noise, vibrations, dust) for the local population during the construction and installation of the solar panels.

**Potential risks**

The various potential risks that may occur during the implementation of the project activities:

- risk of injury and illness ;
- risk of noise pollution ;
- risk of air pollution ;
- risk of accidents to workers and the community
- fire risks ;

- risks of soil pollution ;
- risks of spills of hazardous materials ;
- risk of electric shock.

**Environmental and Social Management Plan**

The Environmental and Social Management Plan (ESMP) describes the arrangements for implementing the activities of the remedial action and enhancement, environmental monitoring and surveillance, and capacity building programmes and indicates the overall cost of implementing these programmes.

It aims to ensure that project activities comply with environmental and social requirements. The overall cost of the ESMP is **26,655,000 FCFA**.

**Closure/rehabilitation plan ;**

A photovoltaic plant has a lifetime of 25 years. At the end of its life, it must be dismantled and the site restored. The restoration of the site will consist of returning the land to a state as close as possible to the initial state before the implementation of the sub-project.

The closure and rehabilitation plan aims to return the sub-project site to a similar state as before the project intervention.

The specific objectives of the closure and rehabilitation plan are

- to rehabilitate the soil of the site bases at the end of the works;
- dismantle all installations (photovoltaic modules, inverters, cables, supports, support foundations, premises, etc.);
- draw up a protocol for site clearance and management of the various components of the dismantled plant (photovoltaic modules, inverters, cables, supports, etc.).

**How the public is consulted**

The solar power plant construction project has incorporated the issue of stakeholder participation and consultation. In the process of integrating the project with the population, a monitoring committee for the livelihoods restoration plan has been set up. This committee includes the representative of the promoter, the community relations officer, the administrative and decentralised authorities (prefects and mayors) of Kona and Bana, the deconcentrated technical services of the Environment and Livestock, the customary authorities, the CVDs, the women's associations, the PAPs and the representative of the vulnerable people of the communes concerned. As a reminder, the 2014 Notice had identified 21 PAPs whose properties were identified and compensated. The project continues to communicate with stakeholders and the population through its social staff, namely the social specialist and the CLOs.

As part of the NIES update, a stakeholder consultation was carried out with all stakeholders to ensure a good understanding of the issues at stake, the positive and negative impacts and environmental risks, and the various mitigation and compensation measures for the project.

At this meeting the following recommendations were made to the promoter:

- to respect the commitments made to the population and to ensure that they are respected by the service providers;
- ensure that the procedure for recruiting local labour is respected;
- consider the initial inventory of trees on the line;
- recruit neutral and non-political community workers.

## INTRODUCTION

Burkina Faso, a landlocked country, has made the development of the energy sector a priority in its sustainable development strategy. The government has therefore made enormous efforts to promote this sector. Despite these major efforts by the state, the sector remains marginalised, thus compromising the country's socio-economic development. The demand for electrical energy is increasing in view of the growing population and the need for investors.

Energy is fundamental to a country's development as a factor in improving people's living conditions, but also because it reduces a country's dependence on hydrocarbons and stimulates economic growth.

It is in this context that the construction project of the 26.6 MWp Zina photovoltaic power plant in the commune of Kona/Mouhoun Province (in the west of Burkina Faso) commissioned an Environmental and Social Impact Assessment in 2015 in order to comply with the environmental legislation and regulations in force.

This project had obtained an order n°2015-116/MERH/CAB issuing an environmental feasibility opinion for the project to set up a solar power plant in Zina (rural commune of Kona, Mouhoun province) for the benefit of the WINDIGA Energie company on 10 July 2015.

Due to a number of technical and financial difficulties, the promoter has not been able to undertake the construction activities of the solar power plant. Having resolved these difficulties, the promoter wishes to undertake the activities of implementation of the solar power plant but is confronted with the provisions of Article 33 of Decree No. 2015-1187/PRES-TRANS/PM/MERH/MATD/MME/MS/MARHASA/MRA/MICA/MHU/MIDT/MCT of October 22, 2015 on the conditions and procedures for the realization and validation of the strategic environmental assessment, the study and the notice of environmental and social impact, which states that: ***"In case of a favourable opinion, the promoter has three (03) years to implement his project under penalty of nullity".*** This provision obliges the promoter ZINA SOLAIRE SA to update the study for which it had obtained a favourable opinion.

It is in this context that this Environmental and Social Impact Statement is presented. The report is structured around the following points in accordance with Annex 2 of Decree N°2015-1187/PRESTRANS/PM/ MERH/MATD/MAE/MARHASA/MRH/ MICA/MHU/MIDT/MCT of 22 October 2015 on the conditions and procedures for carrying out and validating the strategic environmental assessment, the study and the environmental and social impact notice:

- non-technical summary ;
- policy, legal and institutional framework ;
- project description ;
- generalities and methodology ;

- description of the initial state of the environment ;
- analysis of project variants ;
- identification and assessment of the environmental impacts of the project ;
- environmental risk assessment of the project ;
- environmental and social management plan ;
- conclusion;
- closure/rehabilitation plan ;
- modalities of public consultation and participation.

# 1 POLITICAL, LEGAL AND INSTITUTIONAL FRAMEWORK

## 1.1 Policy framework

In the context of environmental protection, Burkina Faso has adopted a wide range of relevant policies, strategies and legal instruments, the main points of which are presented in this Environmental Impact Statement.

### National Economic and Social Development Plan (PNDES II) 2021-2025

The National Economic and Social Development Plan (PNDES II), aims at a democratic, stable, prosperous and just nation for all, through a structural transformation of the national economy to put it on a high growth trajectory, while profoundly reducing social inequalities and rural and urban poverty.

Based on these foundations and considering the challenges of the structural transformation of the national economy, the RND's vision for 2025 is as follows *"Burkina Faso, a nation of solidarity, democracy, resilience and peace, transforming the structure of its economy to achieve strong, inclusive and sustainable growth".*

To realise its vision, the RND 2021-2025 has set itself the overall objective of restoring security and peace, strengthening the nation's resilience and structurally transforming the Burkinabe economy for strong, sustainable and inclusive growth.

### Energy Sector Policy 2014-2025

Adopted in November 2016, the main vision of this policy is to rely on endogenous resources and regional cooperation to ensure universal access to modern energy services. Achieving this vision will result in universal access to energy services through, among other things, supplying the country with energy at lower cost, developing the supply of modern energy in rural areas, accessible to all sections of the population and respectful of the environment, and developing the use of renewable energy sources.

### National Gender Policy (NGP)

The general objective of the National Gender Policy is to promote participatory and equitable development of men and women (by ensuring equal and equitable access and control over resources and decision-making spheres) in respect of their fundamental rights. The project, in its design and implementation, is sensitive to the living conditions of vulnerable groups in accessing energy.

### National Spatial Planning Policy (PNAT), 2006

Adopted by decree n° 2006-362/PRES/PM/MEDEV/MATD/MFD/MAHRH/MID/MECV of 20 July 2006. It constitutes an orientation guide for planning studies and actors acting on the ground, in order to translate the strategic orientations contained in the national prospective study 2025 into spatial terms.

### Health development policy

The main aim of Burkina Faso's national health policy is to promote the well-being of the population. This goal is defined by the vision of a national health system that must be an integrated system, guaranteeing health for all with solidarity, equity, ethics and offering quality promotional, preventive, curative and rehabilitative care, accessible geographically and financially, with the effective and responsible participation of all actors.

Thus, the national health policy is implemented through National Health Development Plans (NHDP) planned by decade.

The general objective of the second PNDS 2011-2020 is to improve the state of health of the population in a context marked by the imperative of achieving the MDGs and by the national development perspectives defined through the PNDS 2015-2020, the National Territorial Development Plan (SNAT), and the National Prospective Study "Burkina 2025".

In terms of its structure, the PNDS is organised around the eight strategic orientations of the National Health Policy (PNS), which are: the national development perspectives defined through the Accelerated Growth Strategy for Sustainable Development (SCADD) 2011-2015, the National Territorial Development Plan (SNAT), and the national prospective study "Burkina 2025". Thus, the achievement of this general objective will be organised around the eight strategic orientations of the NSP which are

- leadership and governance development in the health sector;
- improving the delivery of health services;
- human resources for health development ;
- health promotion and disease control ;
- development of health infrastructure, equipment and products;
- improving the management of the health information system;
- promotion of research for health ;
- increasing health financing and improving people's financial accessibility to health services.

### National policy for securing land in rural areas

The PNSFR adopted by decree N°2007-610/PRES/PM/MAHRH of 04 October 2007, which adopts the National Policy on Land Tenure Security in Rural Areas (PNSFMR), formulates for 10 years (2007-2017) the directions to be given to public action in the field of land tenure security for rural development actors. It aims to ensure that all rural actors have equitable access to land, that their investments are guaranteed and that land disputes are managed efficiently, in order to contribute to poverty reduction, the consolidation of social peace and the achievement of sustainable development. Its objectives are therefore to

- guarantee the legitimate right of access of all rural actors to land, in a dynamic of sustainable rural development, poverty reduction and promotion of equity and legality;
- to contribute to the improvement of conflict prevention and resolution related to land and natural resource management;
- to help create the basis for the viability and development of local authorities by providing them with their own land resources and effective management tools;
- increase the effectiveness of state and local government services in providing an appropriate and effective public service for securing land in rural areas;
- promote the effective participation of grassroots actors and civil society in the implementation, monitoring and evaluation of the PNSFMR.

The adoption on 16 June 2009 of Law 034/2009/AN is part of the implementation of this policy.

- **National public health policy ;**

Approved by the Government in March 2003, the PNHP aims to, among other things (i) prevent diseases and poisoning.

It is also important to mention that Burkina Faso has had a sanitation sub-sector strategy since 1996, the objectives of which are to safeguard the natural and human environment.

- **National Environmental Action Plan**

The development of this policy is part of a context marked by the political will to create a reference framework for the consideration of environmental issues in development policies and strategies. This has already been reflected in the adoption and implementation of several frameworks, instruments and tools. Thus, in 1991, Burkina Faso adopted a National Action Plan for the Environment (PANE), which was revised in 1994 following the United Nations Conference on the Environment held in Rio de Janeiro in 1992. This concept, although logical and allowing for the inclusion of all aspects relating to the preservation of the environment, has proved insufficient from the point of view of intersectoral coordination and monitoring of its implementation. Indeed, the practical implementation of each of the NAP programmes was the responsibility of several ministerial departments, which are more concerned with the implementation of sectoral strategies developed within them than with those relating to the NAP programmes.

- **National Action Plan of the Sustainable Energy for All Initiative "SE4ALL" 2030 ;**

Burkina Faso recognises access to modern energy services as an essential component of the government's energy policies and an indispensable element. Also, the Government has adhered to the

United Nations Secretary General's "Sustainable Energy for All (SE4ALL) " initiative which aims to achieve, by 2030, three major goals:

- ensure universal access to modern energy services;
- double the rate of energy efficiency improvement ;
- double the share of renewable energy in the global energy mix.

The objective of doubling energy efficiency is not operational for a country like Burkina Faso where this potential is still very little exploited. Similarly, Burkina Faso's contribution to doubling the share of renewable energy in the energy mix is difficult to quantify. It will be replaced by an objective in terms of RE penetration in the electricity mix.

- **National Climate Change Adaptation Plan (NAP) Horizon 2050 ;**

The content of the NAPs has been reviewed and a new programming framework called the National Climate Change Adaptation Plan (NAP) has been adopted. The vision of the NAP is to manage economic and social development more effectively through the implementation of planning mechanisms and measures that take into account resilience and adaptation to climate change by Burkina Faso

This new vision has the advantage of achieving greater consideration of climate change

### 1.2 Legal framework

- **Constitution of 02 June 1991**

The preamble of the constitution of Burkina Faso adopted on 2 June 1991 and revised by law n°023-2012/AN of 18 May 2012 mentions the absolute need to protect the environment. The following articles are particularly noteworthy:

- Article 14: enshrines natural resources as national heritage and their rational use for the improvement of living conditions in the following terms: "the sovereign people of Burkina Faso are aware of the absolute necessity to protect the environment" and that "natural wealth and resources belong to the people. They are used for the improvement of their living conditions";
- Article 29: recognises the citizen's right to a healthy environment. It thus places obligations on the State towards citizens. However, in return for these rights, Article 29 of the Constitution places an obligation on citizens to protect, defend and promote the environment;
- Article 30: recognises another important right of the citizen, that of initiating or joining a collective action in the form of a petition against acts that damage the environment or the cultural or historical heritage.

The present study is concerned with the preservation of natural resources and the risk of environmental pollution, and must therefore comply with the provisions of the constitution relating to the protection of the

environment and the improvement of the living conditions of the populations living in the vicinity of the sub-project.

- **Agrarian and land reorganisation**

Law N°034-2012/AN of 02 July 2012, on Agrarian and Land Reorganisation in Burkina Faso, together with its amendments, defines the instruments for land use planning and development.

According to Article 5 paragraph 2 of Law N°034-2012/AN of 2 July 2012 on Agrarian and Land Reorganisation (RAF), the national land estate constitutes a common heritage of the nation and the State, as guarantor of the general interest, organises its management in accordance with the principles set out in the Law. This national land domain is composed of the State's land domain, that of the local authorities and the land heritage of private individuals.

Even if the RAF recognises the rights of individuals to land, it provides in Article 295 that 'any holder of real property rights may be obliged to dispose of (...) when the public interest or the general interest so requires, after fair and prior compensation', which is the consecration of expropriation in the public interest.

The development of the sub-project, to the extent that it will require the acquisition of land, which is often located on national land, will require that the land issue be addressed with the greatest possible care.

- **Law on expropriation in the public interest and compensation for those affected**

Law n°009-2018/AN of 3 May 2018 on expropriation for public utility and compensation of affected persons aims to "determine the rules and fundamental principles governing expropriation for public utility and compensation of persons affected by public utility and general interest developments and projects in Burkina Faso".

Under Article 3, ZINA SOLAIRE is one of the legal entities authorised to initiate operations whose realisation requires expropriation for public utility.

Article 40 specifies that: "Expropriation in the public interest shall be carried out in return for fair and prior compensation".

The procedure for expropriation for public utility is only triggered once the technical opinion of the Minister of the sector of activity concerned and the environmental and social feasibility opinion of the Minister in charge of the environment have been obtained. (Article 9).

ZINA SOLAIRE will ensure compliance with the general principles governing expropriation for public utility and compensation of affected persons in accordance with this law.

- **Environmental Code of Burkina Faso**

It was adopted by law N°006-2013/AN of 02 April 2013, the Environment Code is devoted to the Strategic Environmental Assessment (SEA), the Environmental Impact Assessment and Notice (EIA, NIE) in its

articles 25 to 34. According to Article 25 of this law, activities likely to have significant impacts on the environment are subject to the prior opinion of the Minister in charge of the environment. The opinion is established on the basis of a Strategic Environmental Assessment (SEA), an Environmental Impact Assessment (EIA) or an Environmental Impact Statement (EIS).

- **Forestry Code of Burkina Faso**

Adopted by loin°003/2011/AN of 05 April 2011 "The purpose of the code is to set the fundamental principles of sustainable management and development of forest, wildlife and fisheries resources" (Article 1). Paragraph 2 of article 4 stipulates that: "...the sustainable management of these resources is a duty for all. It implies the respect of the regulations in force concerning the protection, exploitation and development of the forest, wildlife and fisheries heritage'. To this end, it states in article 48 that 'any major work involving clearing is subject to prior authorisation from the minister in charge of forests on the basis of an environmental impact study'. Any clearing operation that proves to be significant must be reported to the forestry administration so that appropriate measures can be taken to preserve the vegetation.

- **Water Management Policy Law**

Law N°002-2001/AN of February 6, 2001, a guideline law on water management in Burkina Faso, was adopted in 2001 and replaces the Water Code. Articles 24, 26 and 27 indicate that hydraulic developments and, in general, installations, works and activities carried out by any natural or legal person, public or private, and likely to present dangers for public health and safety, to reduce water resources, to substantially modify the level, the flow mode or the regime of water, or to seriously affect the quality or diversity of aquatic ecosystems, are subject to prior authorisation or declaration.

- **Rural land tenure**

Article 2 of the law specifies that it applies to rural land located within the administrative boundaries of communes, including land in villages attached to urban communes, and intended for production and conservation activities.

Article 5 states that rural land is divided into the following categories

- State rural land ownership;
- rural land ownership by local authorities ;
- rural land of private individuals.

Article 6 specifies that rural land tenure is the legitimate de facto power exercised over rural land with reference to local land use and customs, and Article 34 completes that rural land tenure may be exercised individually or collectively.

This law on rural land tenure defines local land charters as *'local conventions inspired by local customs, practices or land uses, drawn up at the local level and aiming, within the framework of the application of this law, to take into consideration the diversity of ecological, economic, social and cultural contexts in rural areas'* (art. 6).

Local land charters contain four headings (art. 13). The modalities of access to and use of rural land specify the nature of the land rights granted to each user (temporary, permanent) and all local land uses (inheritance, loan, transfer, lease, sale).

These legislative and regulatory texts highlight the commitment of each ministry to sustainable development and, more specifically, the need to take the environment into account during the execution of projects or programmes.

- **General code of local authorities**

Law N°055-2004/AN of 21 December 2004 on the General Code of Territorial Communities stipulates that territorial communities have their own land domain, consisting of parts of the national land domain transferred as property by the State. The development and management of the transferred land is the responsibility of the communes, with prior authorisation from the supervisory authority (Article 84). This justifies the need to involve the communes directly concerned by the present project.

- **Orientation law on sustainable development**

Law N°008-2014/AN on the orientation law on sustainable development in Burkina Faso was adopted on 08 April 2014. It is based on the fundamental principles essential for economic efficiency, environmental sustainability and social equity. It aims to:

- create a unified national reference framework to ensure the coherence of actors' interventions through appropriate legal, policy and institutional reforms;
- ensure economic efficiency, environmental sustainability and social equity in all development actions.

It applies to all laws and regulations, policies, strategies,

It defines the main orientations through which the National Sustainable Development Policy (NSSP) will be implemented. It defines the main orientations through which the National Policy for Sustainable Development (PNDD) will be implemented.

### Law on the Orientation of Pastoralism

Article 1 of Law n°034-2002/an on the orientation law on pastoralism in Burkina Faso sets out the principles and modalities for the sustainable, peaceful and integrated development of pastoral, agropastoral and sylvo-pastoral activities.

Article 28 of this law states that 'in application of the provisions relating to the water regime, pastoralists have the right to access water points in order to water their animals. Access to water for watering animals shall be in accordance with this law and the law on water management. This article adds that the pastoral use of water resources in times of drought is done in compliance with the measures provided by the government in application of the provisions of the water regime. The conditions of access to water are spelled out in Articles 29 to 35. Pollution or dumping of toxic products in an animal watering point is prohibited (Article 29).

Article 32 of this law specifies the conditions for the exploitation of the surroundings of watercourses and water points. Indeed, the clearing and cultivation of land in the immediate vicinity of animal watering points is prohibited. A joint decree of the ministers responsible for agriculture, livestock, forestry and water specifies the distances to be respected for the cultivation of land located near watercourses and water points.

In view of the recurrent conflicts encountered in the management of pastoralism, the development of the future project will have to take account of pastoral areas which will have to be compensated for if they exist.

### Health Code

Law No. 23/94/ADP of 13 May 1994 on the Public Health Code in Burkina Faso defines in its fundamental principles *"the rights and duties inherent in the protection and promotion of the health of the population",* as well as *"the promotion of environmental health"*. In addition, the code deals with several other matters in the field of the environment, including atmospheric pollution, toxic waste, noise and various nuisances, as well as the sanctions incurred for non-compliance with the regulatory provisions in force.

The implementation of the project will take into account the provisions made in this code.

### Public Health Code

Law n°0022-2005/AN of 24 May 2005, on the public hygiene code in Burkina Faso, in its article 3 mentions that: *"Any natural or legal person who produces or holds waste under conditions likely to produce harmful effects on the soil, flora or fauna, to degrade the landscape, to pollute the air or water, to generate noise or odours and generally to harm human and animal health and the environment is required to ensure or have ensured the elimination of such waste in accordance with the provisions of this law under conditions likely to avoid the said effects.*

As for Article 106, it makes the communes responsible by mentioning that: "each decentralised community is required to set up a treatment system for its hazardous industrial or commercial waste. The technical conditions of the treatment system are set by regulation. In addition, Article 124 specifies that: 'Noise emissions from vehicles and other motorised equipment must comply with the regulations in force'.

As hygiene is an essential parameter for the well-being of the population, the project takes into account the provisions contained in the Public Hygiene Code.

- **Labour Code**

Law 28-2008/AN of 13 May 2008 on the Labour Code in Burkina Faso provides a framework for working conditions through its provisions on the prohibition of discrimination in employment and work, as well as the worst forms of child labour (Articles 149 and 153). Also, according to Article 36 of this same law, the employer is obliged on the construction site *"to comply with the health and safety conditions set out in the regulations in force".*

### *1.2.1 National regulatory framework*

For the conduct of the Environmental and Social Impact Assessment, a number of regulatory texts at national level have been listed:

- Decree N°2015-1187/PRES-TRANS/PM/MERH/MATD/MME/MS/MARHASA/MRA/MICA/MHU/MIDT/MCT of 22 October 2015 on the conditions and procedures for carrying out and validating the strategic environmental assessment, the study and the environmental and social impact notice;
- Decree n°2015-1470/PRES-TRANS/PM/MEF/MARHASA of 7 December 2015 determining the rates and collection methods of the raw water withdrawal tax;
- Decree N°2004-581/PRES/PM/MAHRH/MFB of 15 December 2004, definitions and procedure for the delimitation of protection areas for water intended for human consumption;
- Decree No. 2005-515/PRES/PM/MAHRH of 6 October 2005 on procedures for authorising and declaring installations, works and activities;
- Decree n°98-322/PRES/PM/MEE/MCIA/MEM/MS/MATS/METSS/MEF of 28 July 1998 on the conditions of opening and operation of dangerous, unhealthy and unsuitable establishments;
- Decree n°2015-1203/PRES-TRANS/PM/MERH/MJDHPC of 28 October 2015 on the organisation and conduct of environmental inspections;
- Decree n°2015-1204/PRES-TRANS/PM/MERH/MME/MS/MARHASA/MICA/MIDT/MRSI of 28 October 2015 on the management of radioactive waste

- Decree N°2015-1205/PRES-TRANS/PM/MERH/MEF/MARHASA/MS/MRA/MICA/MME /MIDT/MATD / of 28 October 2015 on the standards and conditions for the discharge of waste water;
- Order No. 2004-019/MECV of 7 July 2004 determining the list of forest species benefiting from special protection measures;
- Decree No. 98-321/PRES/PM/MEE/MIHU/MATS/MEF/MEM/MCC/MCIA of 28 July 1998 on the regulation of landscaping in Burkina Faso;
- Decree n°2007-408/PRES/PM/MRA/MAHRH/MATD of 03 July 2007 on the conditions for exploiting water resources for pastoral purposes: this text specifies the characteristics of access corridors (width of at least 100 metres) and the safety zone (radius of at least 100 metres) around livestock watering points (ponds, wells, boreholes, etc.);
- Decree n° 2014-481/PRES/PM/MATD/MEF/MHU of 03 June 2014 determining the conditions and modalities of application of law n°034-2012/AN of 02 July 2012 on agrarian and land reorganisation in Burkina Faso;
- Decree No. 2001-251/PRES/PM/MS of 30 May 2001 adopting the documents entitled "Strategic framework for the fight against HIV/AIDS 2001-2005" and "Plan of action to fight HIV/AIDS in Burkina in 2001";
- Decree No. 2001-731/PRES/PM/MJDH of 28 December 2001 on the adoption of the policy and action plan for the promotion and protection of human rights;
- The order n°2009-20/MRA/SG/DGEAP of 08 June 2009 concerning the norms for cattle tracks, which specifies the modalities and criteria to be respected for the fixing of track markers;
- Decree N°2004-262/PRES/PM/MECV/MAHRH/MESSRS/MRA/MCPEA/MJGS of 18 June 2004 on the adoption of national rules on safety in biotechnology.

### *1.2.2 International regulatory framework*

- **International Conventions**

Several major international conventions on environmental protection have been ratified by Burkina Faso. These include

**Table 1** Main conventions related to the project

| Title of the agreement | Links to the project | Date of ratification |
|---|---|---|
| **Convention on Biological Diversity** | Article 14 of the Convention provides that each Contracting Party shall, as far as possible and as appropriate, :<br>- adopt procedures to require the assessment of the environmental impacts of its proposed projects that are likely to have significant adverse effects on biological diversity with a view to avoiding and minimising such effects, and, where appropriate, allow for public participation in such procedures ;<br>- take appropriate steps to ensure that the environmental effects of its programmes and policies that are likely to have significant adverse effects on biological diversity are duly taken into account. | 02-09-1993 |
| **United Nations Framework Convention on Climate Change** | As mining activities have the potential to increase the emission of greenhouse gases, and thus to contribute further to the concentration of greenhouse gases in the atmosphere, the Convention calls for practices to prevent dangerous anthropogenic interference with the climate system. | 02-09-1993 |
| **United Nations Convention to Combat Desertification** | The project will have to take measures against abusive deforestation and the protection of local species in accordance with the requirements of the convention | 26-01-1996 |
| **Vienna Convention for the Protection of the Ozone Layer** | The products and substances to be used in the project should be chosen so as not to further destroy the ozone layer | 28-06-1988 |
| **Paris Convention concerning the Protection of the World Cultural Heritage** | As the subsoil of Burkina Faso is very little explored, the project activities, in that they will consist of excavations, could lead to the discovery of priceless hidden cultural and natural heritage of universal significance. The Convention will be applied in dealing with such situations. | 03-06-1985 |
| **African Convention on the Conservation of Nature and Natural Resources** | The Contracting States shall be under an obligation (i) to conserve and improve the soil, and shall pay particular attention to combating erosion and land measurement; (ii) to conserve ground and surface water, and shall endeavour to ensure an adequate and continuous supply of suitable water for the population; (iii) to protect the flora; (iv) to give special protection to animal and plant species which are threatened with extinction or which may become so, and to the habitat necessary for their survival; (v) to protect the environment and the health of the population; (iii) the protection of flora; (iv) the special protection of animal and plant species threatened with extinction or likely to become so, as well as the habitat necessary for their survival; (v) the conservation, rational use and development of wildlife and their environment.<br>Measures will be taken by the project to ensure compliance with these obligations. | 28-09-1969 |

| | | |
|---|---|---|
| **Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal** | Article 4, which deals with the obligations of the parties, provides: To ensure that the generation of hazardous wastes and other wastes within the country is minimised; To ensure the provision of adequate disposal facilities, which shall, as far as practicable, be located within the country, for the environmentally sound management of wastes; To ensure that those engaged in the management of hazardous wastes or other wastes within the country take the necessary measures to prevent pollution resulting from such management. | Other waste |
| **Bamako Convention on the Ban of the Import into Africa of Hazardous Wastes and on the Control of Transboundary Movements and Management of Hazardous Wastes generated in Africa** | Article 4 of the Convention sets out the obligations of each party in relation to the import of hazardous waste into the sea, inland waters and waterways, and the generation of waste in Africa.<br>The promoter will ensure that Burkina Faso's commitments in this area are respected by making sure at all times that no material used in the project works is prohibited by this convention or by national legislation. Appropriate measures will also be taken in conjunction with the competent bodies if prohibited pollutants are found during the works. | 20-09-1993 |
| **Bern Convention on the conservation of wild fauna and flora and their natural habitats** | Article 4, paragraph 1: "Each Contracting Party shall take the appropriate legislative and regulatory measures necessary to protect the habitats of wild species of flora and fauna, in particular those listed in Annexes I and II, to safeguard natural habitats threatened with extinction. | 28-09-1969 |
| **Stockholm Convention on Persistent Organic Pollutants** | A specific legal instrument to limit the lists of products that accumulate in terrestrial and aquatic ecosystems and have the potential to enter humans through the food chain.<br>The mine complies with measures taken to reduce the total volume of anthropogenic discharges of certain substances such as: Aldrin; Chlordane; Dieldrin; Endrin; Heptachlor; Hexachlorobenzene; Mirex; Toxaphene; Polychlorinated biphenyls | 20-07-2004 |
| **Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade** | aims to promote shared responsibility and cooperation among Parties in the international trade of certain hazardous chemicals in order to protect human health and the environment from potential harm and to contribute to the environmentally sound use of such chemicals by facilitating the exchange of information on their characteristics, by establishing a national decision-making process for their import and export and by ensuring that such decisions are communicated to Parties | 11-11-2002 |

### The International Finance Corporation (IFC) Performance Standards

The IFC's Sustainability Framework sets out the Corporation's strategic commitment to promoting sustainable development, and is an integral part of the institution's approach to managing risk. The Framework consists of the IFC's Environmental and Social Sustainability Policy, the corresponding Performance Standards and the Access to Information Policy. The Environmental and Social Sustainability Policy describes the IFC's commitments, roles and responsibilities in this area. The Access to Information Policy represents the IFC's commitment to promoting transparency and good governance in its operations, and sets out the conditions for disclosure of information required of the IFC in connection with its investments and advisory services.

The Performance Standards are intended to provide guidance to clients in identifying risks and impacts, and are designed to help them avoid, mitigate and manage risks and impacts so that they can continue to operate in a sustainable manner. In this regard, they also cover clients' obligations to engage with stakeholders and communicate information about project-level activities. The IFC requires its direct investment clients (including project finance and corporate finance provided through financial intermediaries) to apply the Performance Standards to manage environmental and social risks and impacts in ways that enhance development opportunities. The IFC uses the Sustainability Framework along with other strategies, policies and initiatives to guide its activities to achieve its overall development goals. The Performance Standards can also be applied by other financial institutions.

The eight (8) performance standards define the criteria that a client must meet over the life of an IFC investment:

- assess and manage risks and social and environmental impacts;
- secure working conditions ;
- efficient use of resources and pollution prevention ;
- health, safety at work & physical security of the community ;
- managing the negative impacts on displaced persons & communities;
- conserve biodiversity and manage living natural resources in a sustainable way;
- protect indigenous people ;
- reserve cultural heritage.

## 1.3 Institutional framework

The management of environmental policy has been entrusted to a ministerial department. However, given the cross-cutting nature of the field, a large number of actors, including ministerial departments whose activities have an environmental impact, are involved in its protection.

### Ministry in charge of the Environment, Energy, Water and Sanitation

It is the main institutional guarantor for environmental management in Burkina Faso. The Ministry comprises five main structures in charge of environmental issues and natural resource management on the one hand and the EIA/EIS procedure on the other: the Directorate General of Environmental Preservation (DGPE), the Directorate General of Water and Forests (DGEF), the Directorate of Institutional Development and Legal Affairs (DDIAJ) and the National Agency for Environmental Assessments (ANEVE), 13 regional directorates, 45 provincial directorates and the departmental environmental services.

- **National Environmental Assessment Agency (ANEVE):** Is responsible for monitoring and implementing strategic environmental assessments in development projects and programmes in relation to the relevant ministerial departments;
- **Directorate General for Environmental Preservation (DGPE):** Ensures the design, orientation, support and monitoring-evaluation of the implementation of the national policy for the improvement of the living environment, environmental education, the fight against pollution and various nuisances and landscaping.
- **National Renewable Energy Agency**

  In application of article 12 of law n°14 AN of 20 April 2017 on electricity regulation in Burkina Faso, ANEREE's mission is to promote, encourage, coordinate, facilitate and carry out any operation aimed at developing renewable energy and energy efficiency.
- **The Directorate General for Energy** is responsible for the design, development, coordination and implementation of energy policy. In order to bring the administration of the energy sector closer to the population, regional directorates of mines and energy have been created. The operationalisation of these directorates will be progressive;
- **The Directorate General for Water implements** and monitors the government's water and sanitation policy. It is responsible for : Monitoring and control of the quality of water resources; Consideration of environmental and social impact studies and notices; Application of the law on the Financial Contribution for Water; Protection and restoration of water resources and aquatic systems

### Minister of Agriculture, Animal Resources and Fisheries

The Ministry of Agriculture, through the General Directorate of Land Tenure, Training and Organisation of the Rural World (DGFFOMR), is responsible for carrying out actions to secure rural land tenure and for contributing to studies and research for the sustainable management of land resources.

Within the framework of the sub-project, the DGFFOMR can be a key player in contributing to the resolution of land conflicts and the purging of customary rights.

- **Ministry of Territorial Administration, Decentralisation and Security**

This ministry, through the General Directorate of Local Authorities, is responsible for assisting and supervising local authorities in the fields of planning, equipment and local development.

In this respect, the commune of Kona is called upon to contribute to the implementation of the project.

- **Ministry of Public Service, Labour and Social Protection**

Issues related to labour legislation and occupational safety in the mining sector are the responsibility of the Ministry of Public Service, Labour and Social Protection, in particular: the development of occupational safety and health regulations; the control of the application of occupational safety and health laws and regulations, in relation with the Minister in charge of health.

- **Other actors involved**

The other actors involved in the project are, among others, the company in charge of carrying out the activities, NGOs or associations,

# 2 PROJECT DESCRIPTION

## 2.1 Presentation of the promoter

The promoter of this project is ZINA SOLAIRE SA, a company incorporated under Burkinabe law and owned by AMEA POWER based in Dubai. AMEA POWER has solar projects all over Africa. The Deputy Managing Director of the company is Mr Assane YAMEOGO. Postal address: 14 BP 318 Ouaga ZAD Burkina Faso; sector 13, Avenue Babanguida, door 333.

## 2.2 Location of the project

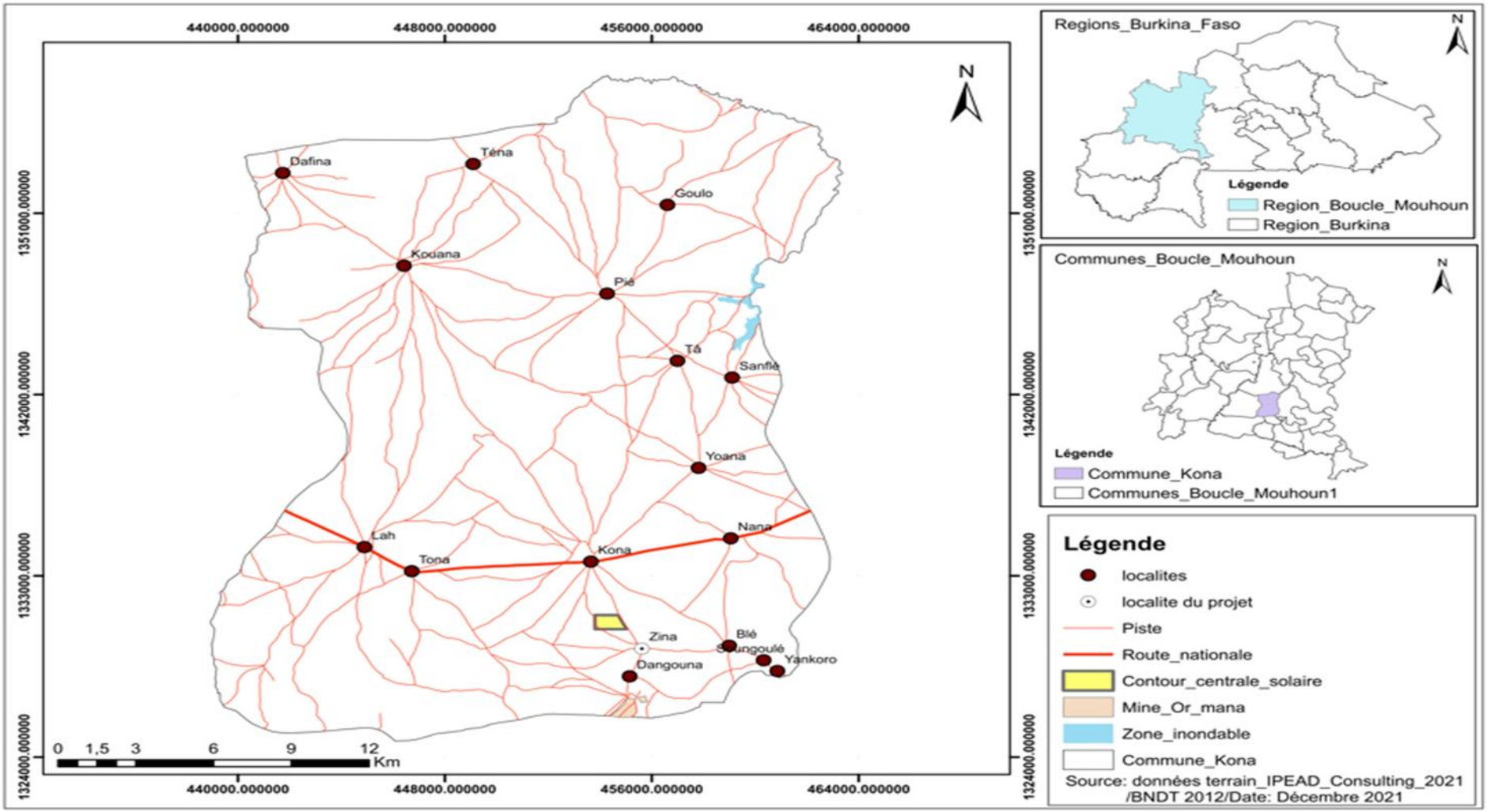
The site of the 22.4 MWac (26.6 MWp) solar power plant, which is the subject of this study, is located on the land of the village of Zina (hence the name of the Zina solar power plant), approximately three (3) kilometres from the main town of the Commune (village of Kona). The site is located 1 km from the village of Zina on uninhabited land. The village of Kona is located approximately 60 km from Boromo (capital of the Bale province) and 180 km from Ouagadougou, the capital of Burkina Faso. Administratively, the project site therefore falls within the commune of Kona.

The table below shows the GPS coordinates of the Zina solar power plant's right-of-way

Table 2Geographical coordinates in UTM, WGS 84, Zone 30 P

| Points | Village | X | Y |
|---|---|---|---|
| **B1** | Zina | 454 696.52 | 1 331 052.04 |
| **B2** | Zina | 454 859.67 | 1 330 700.47 |
| **B3** | Zina | 455 022.18 | 1 330 353.35 |
| **B4** | Zina | 454 614.27 | 1 330 353.67 |
| **B5** | Zina | 454 207.47 | 1 330 353.04 |
| **B6** | Zina | 453 803.08 | 1 330 352.21 |
| **B7** | Zina | 453 800.49 | 1 330 703.37 |
| **B8** | Zina | 453 800.04 | 1 331 056.01 |
| **B9** | Zina | 454 249.07 | 1 331 052.41 |

Source: Land booklet 2016 ;




Source: IPEAD, 2021

## 2.3 Description of the project

### *2.3.1 Layout design*

The photovoltaic field will occupy an area of about 32 ha and the installations will take up 3 to 4 ha. The concept foresees the connection of the solar power plant to SONABEL's 90 KV line, which will supply the SEMAFO mine from the Wona substation and eventually the villages in the area according to SONABEL's electrification plans.

### *2.3.2 Project components*

Within the framework of the realisation of the solar power plant the following components and activities will be carried out

- Levelling of the site with an even slope and trenches in and around the site to facilitate drainage;
- installation of 84,480 poly-crystalline solar panels inclined at 12$^{o}$ towards the south;
- maximum height of the panels of 2.3 metres from the ground;
- stainless steel bracket ;
- foundation: screwed or driven piles capable of resisting all combinations of loads such as the weight of the structure, the rings, the winds;
- solar cables behind the panels which are connected to the junction boxes
- junction boxes connected to the inverters by solar cables buried in trenches;
- fibre optics for communications between the control system and the sensors in the cabinets;
- delivery station on the site of the 33 kV power station for connection to the 33 kV transmission line which will belong to SONABEL;
- 11 power blocks for inverters, electrical applications and oil transformers (the latter being located outside the container but within the power block);
- auxiliary transformers to electrify buildings;
- earthing and protection of inverters, transformers and the solar field ;
- digital control (CCN): monitoring system with remote access;
- mesh fence with 2 rows of barbed wire;
- 33 kV line of about 7.8 km from the PV plant delivery station to SONABEL's Wona station;
- drilling of a well with a pumping station and a 6m PVC tank$^{3}$ .

### *2.3.3 Environmental and social considerations of the solar power plant*

Solar energy production has little negative impact on the environment considering the following elements

- The silicon used in the panels is a non-toxic material;
- The production of electricity does not cause any noise, nor any emission of polluting gases and atmospheric pollution (GHG); PV requires very little water consumption, only for washing the panels, and a dry wash will be privileged to help preserve water resources. The selected site offers favourable

conditions for the creation of autonomous water points for the power plant without having to draw water from the hydraulic works of the surrounding villages; the material is recyclable and even reusable in certain cases;

- the production of energy through PV does not generate noise pollution;
- the risk of explosion or fire is very low;
- no problem for the health of the workers (in terms of electric and electromagnetic fields) since the voltage produced remains low and the currents direct at the modules;
- The construction is based on simple works such as laying concrete foundations, installing poles and panels (at low height), laying buried cables and installing inverters in protected buildings. The risk is that of electric shock, but health and safety measures are put in place;
- the site is confined to a fenced area and guarded by guards, with risks of intrusion for the surrounding population;
- the water requirements of the plant will be relatively low.

# 3 DESCRIPTION OF THE INITIAL STATE OF THE ENVIRONMENT

As part of the updating of biophysical and human data. Three zones of influence were defined, taking into account the administrative division and the radii of the inventories. These zones are defined as follows:

## 3.1 Area of influence of the project

### *3.1.1 Area of direct influence*

This area will be the site of the solar power plant, where the activities of infrastructure construction, solar power plant equipment and tree felling will be carried out. The environment of the site is currently occupied by fields and agroforestry parks with rainfed crops, fallow land and plant species. During the field trip, we were able to observe the effective felling of trees located in the project's right-of-way following the issuance of a felling permit by the Boucle du Mouhoun Regional Directorate for Ecological Transition and the Environment on the basis of the environmental feasibility opinion the project had. The issuance of the aforementioned cutting permit was also the reason for the compensation of all PAPs following the loss of land, crops and trees.

Figure 1Right of way of the solar power plant site

Source: IPEAD, 2021

### *3.1.2 Local influence area*

This zone concerns the village of Zina in the commune of Kona. Located 72 km from Dédougou, the capital of the province and of the Mouhoun region, the commune of Kona covers an area of 605.175 km², i.e. 9.06% of the provincial area, and includes 17 localities. The description of the environment of the project site will be done in this area.

### *3.1.3 Regional influence area,*

It concerns the Boucle du Mouhoun region. This area will be considered if data on the biophysical and human environment are not available for the direct and local influence areas.

## 3.2 Physical environment

### *3.2.1 Relief*

The relief of the rural commune of Kona is made up of a vast plateau dissected by rivers. The summits are armoured hillocks, located in the south-eastern part. The commune is dotted with hills or small elevations towards Lah, Nana, Blé, Dangouna, Soungoulé and Yankoro. There are also many low-lying areas in Zina and other localities.

### *3.2.2 Soil resources*

The territory of the Kona municipality is located on three main soil types (BUNASOL). These are :

- **the less developed soils,** which cover an area of 151.09 km2 , i.e. 24.96% of the commune, are found in the form of patches scattered throughout the commune, particularly in the north, centre and south. This type of soil is also found in the village of Zina. These soils are suitable for growing millet and groundnuts, but more suitable for grazing cattle;
- **The mull soils,** which belong to the group of brown eutrophic soils, are found mainly in the south-eastern part of the commune (Nana, Blé, Soungoulé, Yankoro). They cover an area of 23.54 $km^2$ , or only 3.89% of the commune. They are easily exploited for agricultural purposes and are suitable for a wide range of crops such as maize, cotton, sorghum and fruit trees.
- **sesquioxide soils,** which are soils with very extensive alteration of primary minerals, cover 432.07 $km^2$ , or 71.17% of the commune's territory. These soils are generally suitable for growing millet, sorghum, groundnuts, maize and cotton.

### *3.2.3 Climate and climate change*

The rural commune of Kona, like all the communes of the Mouhoun loop region, is located in the Sudanian climatic zone with isohyets ranging from 700 to 1000 mm. It is characterised by two (2) main seasons:

- **a rainy season** from June to October. Rainfall is usually concentrated between July and August but in recent years and with climate change, significant isohyets are recorded from August to September. The prevailing wind at this time is the monsoon with average temperatures around 28°C.
- **a dry season** from November to May with high temperatures sometimes exceeding 40°C. The harmattan is the dominant wind during this period. A long dry season generally from November to May, with high temperatures sometimes exceeding 40°C. The harmattan is the dominant wind during this period.

Table 3 : Water level in relation to the year and the number of days

| Years | Water height (mm) | Number of days |
|---|---|---|
| 2015 | 976 | 53 |
| 2016 | 860 | 44 |
| 2017 | 974 | 50 |
| 2018 | 857 | 61 |
| 2019 | 846 | 57 |

Source: ZATA Kona, February 2020

### *3.2.4 Hydrography*

The commune of Kona is crossed by a rather diffuse hydrographic network made up of shallow streams attached to the lower watershed of the Mouhoun River. Generally speaking, these streams are areal and dry up as soon as the dry season sets in. The hydrographic network includes temporary rivers such as the Konzié, Karouko and Niagan. Only the main town of the commune (Kona) has a bouli. This bouli, which is used for market gardening and watering, is currently damaged by high water pressure. Groundwater is collected by means of wells and boreholes. In addition to the watercourses, the commune has small lowlands that can be developed in its northern, eastern and southern parts, notably in Goulo, Tâ, Sanflé, Toton, Tyouré, Nana and Zina.

## 3.3 Biological environment

### *3.3.1 Vegetation*

The commune of Kona belongs to the Sudanian phytogeographical domain, which is characterised by a shrubby to woody savannah with gallery forests along the rivers. Thus, the very varied vegetation is dense and is favourable to the creation of protected areas and the development of forestry potential. However, there are climatic hazards and significant pressure on plant resources (uncontrolled clearing, bush fires, overgrazing, demographic pressure).

The natural formations are dominated by the following species: *Vitellaria paradoxa (shea), Parkia biglobosa (cowpea)*, *Lannea microcarpa...*). In the shrub layer, we find a fairly dense and varied herbaceous carpet. This very varied and dense vegetation is favourable to the creation of protected areas and the development of forestry potential.

Table 4 : List of plant species on the site of the solar power plant

| N° | SPECIES | FAMILY | BIOLOGICAL FORM | FREQUENCY |
|---|---|---|---|---|
| 1 | *Acacia dudgeonii* | Fabaceae-Mimosoideae | a | ++ |
| 2 | *Acacia macrostachya* | Fabaceae-Mimosoideae | a | ++ |
| 3 | *Acacia seyal* | Fabaceae-Mimosoideae | a | ++ |
| 4 | *Albizia chevalieri* | Fabaceae-Mimosoideae | a | + |
| 5 | *Annona senegalensis* | Annonaceae | a | +++ |
| 6 | *Anogeissus leiocarpa* | Combretaceae | A | ++ |

| N° | SPECIES | FAMILY | BIOLOGICAL FORM | FREQUENCY |
|---|---|---|---|---|
| 7 | *Balanites aegyptiaca* | Balanitaceae | a | ++ |
| 8 | *Bombax costatum* | Bomabacaceae | A | ++ |
| 9 | *Boswellia dalzielii* | Burseraceae | A | ++ |
| 10 | *Burkea africana* | Fabaceae-Caesalpinioideae | A | ++ |
| 11 | *Capparis corymbosa* | Capparaceae | L | ++ |
| 13 | *Combretum adenogonum* | Combretaceae | a | +++ |
| 12 | *Combretum collinum* | Combretaceae | a | +++ |
| 14 | *Combretum glutinosum* | Combretaceae | a | +++ |
| 15 | *Combretum molle* | Combretaceae | a | +++ |
| 16 | *Combretum nigricans* | Combretaceae | a | +++ |
| 17 | *Daniellia oliveri* | Fabaceae-Caesalpinioideae | A | ++ |
| 18 | *Detarium microcarpum* | Fabaceae-Caesalpinioideae | a | ++ |
| 19 | *Dichrostachys cinerea* | Fabaceae-Mimosoideae | a | ++ |
| 20 | *Entada africana* | Fabaceae-Mimosoideae | a | ++ |
| 21 | *Feretia apodanthera* | Rubiaceae | a | +++ |
| 22 | *Fluaegga virosa* | Euphorbiaceae | a | +++ |
| 23 | *Gardenia aqualla* | Rubiaceae | a | ++ |
| 24 | *Gardenia erubescens* | Rubiaceae | a | +++ |
| 25 | *Gardenia ternifolia* | Rubiaceae | a | ++ |
| 26 | *Grewia lasiodiscus* | Tiliaceae | a | +++ |
| 27 | *Guiera senegalensis* | Combretaceae | a | +++ |
| 28 | *Hymenocardia acida* | Hymenocardiaceae | a | ++ |
| 29 | *Lannea microcarpa* | Anacardiaceae | A | +++ |
| 30 | *Lannea velutina* | Anacardiaceae | a | ++ |
| 31 | *Parinari curatellifolia* | Chrysobalanaceae | a | ++ |
| 32 | *Parkia biglobosa* | Fabaceae-Mimosoideae | A | ++ |
| 33 | *Pavetta crassipes* | Rubiaceae | a | + |
| 34 | *Pericopsis laxiflora* | Fabaceae | a | ++ |
| 35 | *Pseudocedrela kotschyi* | Meliaceae | A | ++ |
| 36 | *Pteliopsis suberosa* | Combretaceae | a | ++ |
| 37 | *Pterocarpus erinaceus* | Fabaceae | A | ++ |
| 39 | *Saba senegalensis* | Apocynaceae | L | +++ |
| 40 | *Sclerocarya birrea* | Anacardiaceae | A | ++ |
| 41 | *Sterculia sitigera* | Sterculiaceae | A | ++ |
| 38 | *Stereospermum kunthianum* | Bignoniaceae | a | ++ |
| 42 | *Strychnos innocua* | Loganiaceae | a | ++ |
| 43 | *Strychnos spinosa* | Fabaceae-Loganiaceae | a | ++ |
| 44 | *Tamarindus indica* | Fabaceae-Caesalpiniaceae | A | ++ |
| 45 | *Terminalia avicennioides* | Combretaceae | a | +++ |
| 46 | *Vitellaria paradoxa* | Sapotaceae | A | +++ |
| 47 | *Vitex simplicifolia* | Labiatae | a | ++ |
| 48 | *Xeminia americana* | Olacaceae | a | +++ |
| 35 | *Pseudocedrela kotschyi* | Meliaceae | A | ++ |
| 36 | *Pteliopsis suberosa* | Combretaceae | a | ++ |
| 37 | *Pterocarpus erinaceus* | Fabaceae | A | ++ |
| 48 | *Xeminia americana* | Olacaceae | a | +++ |

Source: Field data, IPEAD 2022

**Note:** There are approximately 2,290 trees on the entire 74 hectare site, or 777.29 $m^3$ of woody material. Within the 37 hectare right-of-way area of the solar plant, there are approximately 850 trees and shrubs that will need to be removed. In addition, there will be losses of wild fruit trees (*Vitellaria paradoxa, Lannea microcarpa, Detarium microcarpum, Parkia biglobosa, Balanites aegyptiaca, Gardenia erubescens, Diospyros mespiliformis* and *Sclerocarya birrea).* The table below lists the species of utility value to the communities that will be affected in the farmer-owned agricultural plots.

**Table 5** : Status of species of utility value that will be affected by the construction works

| ENDANGERED SPECIES | NAME IN DIOULA | USUAL NAME | NUMBER OF FEET AFFECTED |
|---|---|---|---|
| *Vitellaria paradoxa* | Sii yiri | Shea | 160 |
| *Lannea microcarpa* | N'pekoun yiri | Grape | 90 |
| *Balanites aegyptiaca* | Zinginè yiri | Desert date palm | 28 |
| *Sclerocarya birrea* | Kouna yiri | African plum | 25 |
| *Parkia biglobosa* | Nèré yiri | Néré | 17 |
| *Tamarindus indica* | Tomi yiri | Tamarind tree | 11 |
| *Bombax costatum* | Boumboun yiri | Kapokier | 04 |
| *Saba senegalensis* | Zamba yiri | Liane | 02 |

Source: Field data, IPEAD 2022

### *3.3.2 Wildlife*

Diverse wildlife resources include small game such as monkeys, hares, partridges, wild guinea fowl, rats and turtle doves

Climatic hazards and various anthropic actions (anarchic clearing, bush fires, overgrazing, demographic pressure) have degraded the biotope of the fauna, which has led to the reduction and disappearance of certain animal species in the commune.

### *3.3.3 Spatial occupation of the municipality*

The space is organised according to the activities that are carried out and above all according to the resources available. Thus, the space in the commune of Kona is structured as follows:

Table 6 : Spatial distribution of land use units

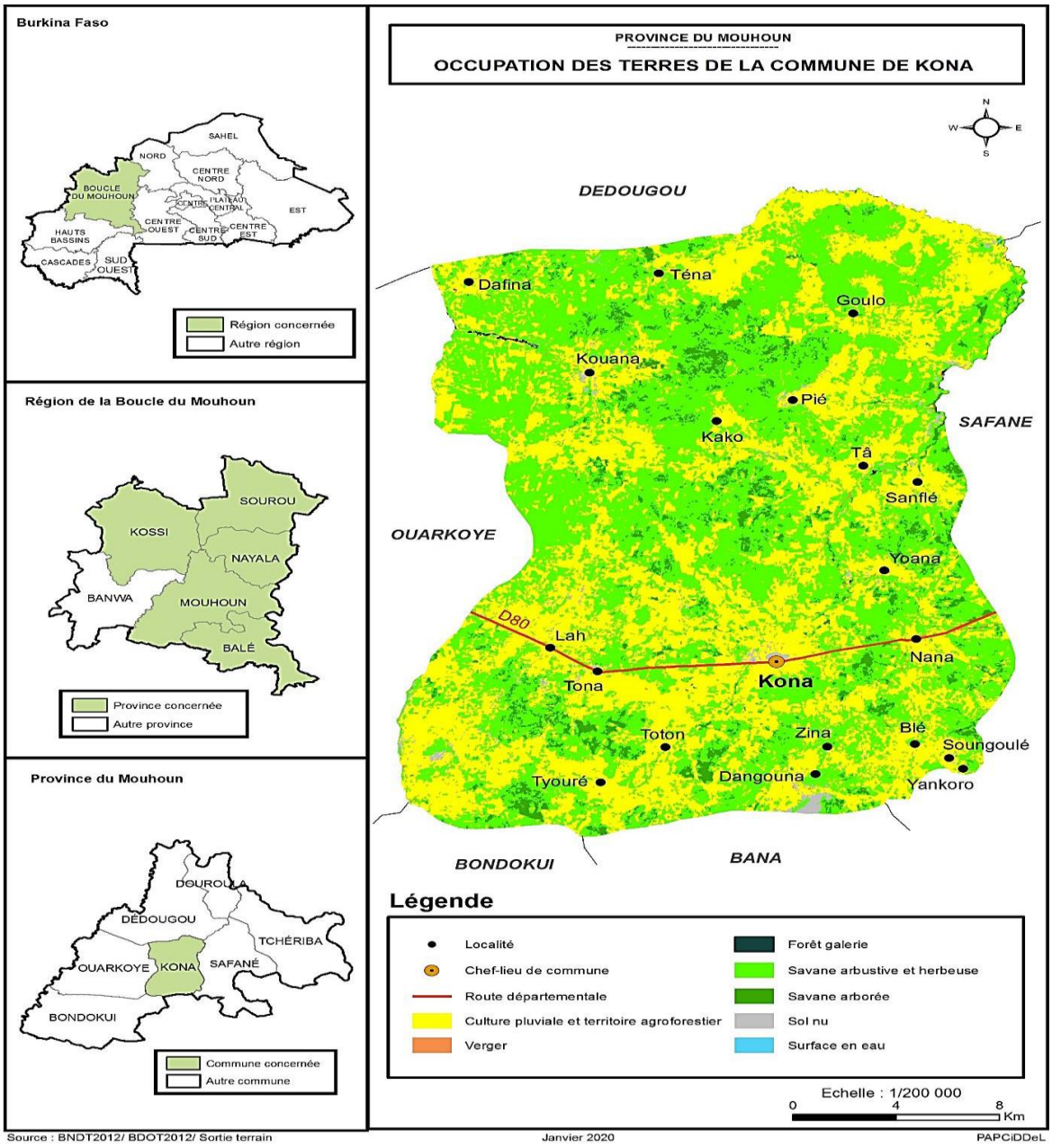
| Units | Area ($Km^2$) | % |
|---|---|---|
| Rainfed agriculture and agroforestry land | 265,172521 | 43,66 |
| Gallery forest | 0,285741 | 0,05 |
| Wooded savannah | 28,288594 | 4,66 |
| Shrubby and grassy savannah | 306,898833 | 50,53 |
| Bare soil (eroded, bare, armour, etc.) dune and sand | 5,734932 | 0,94 |
| Water surface | 0,034282 | 0,01 |

| | | |
|---|---|---|
| Orchard | 0,884786 | 0,15 |
| **Total** | **607,299689** | 100,00 |

Source: BDOT 2012

The analysis of this table confirms the BUNASOL data mentioned in the paragraph "Soil resources". Indeed, 43.66% of the land is suitable for rainfed crops and agroforestry and 50.53% of the land is shrub and grassland. Bare soils, which fortunately occupy only 0.94%, the rest of the land (even unoccupied) are favourable for human activities. Thus, the bare soils require recovery and enrichment actions (subsoiling, bunds, grass strips, reforestation, etc.).

Map 1 Land use in the commune of Kona



## 3.4 Human environment

### *3.4.1 Demographics*

The site of the solar power plant is located in an uninhabited area without any buildings. At its eastern end, the road is located nearby. The site is located more than 1 km from the village of Zina, which has a population of approximately 1,690 (2015 census).

According to the results of the 2006 General Census of Population and Housing (RGPH), the commune of Kona had 3,494 households with a total population of 19,606 inhabitants, 51.72% of whom were women and 50.2% men. According to the 2019 RGPH, the population is estimated at 28,321 inhabitants. In 2024 (at the horizon of the plan), the population of the commune will be 30,311 inhabitants.

The PAPs identified in the solar power plant area come from four (4) villages: Yona with three (3) people, Kona with 11 people, Zina with six (6) people and Blé with one (1) person. Thus, a total of 21 PAPs were identified at the solar power plant. All these PAPs have been compensated.

### *3.4.2 Social organisation*

The traditional socio-political organisation sees three orders of power coexist: traditional power, the deconcentrated administrative power held by the prefect and the decentralised power exercised by the Municipal Council.

There are mainly 4 ethnic groups in the commune, in numerical order: the Marka, the Bwabas, the Mossis and the Peulhs. Islam is the dominant religion, followed by Christianity. Traditional religion (ancestor worship) is the least widespread religion officially, but in reality, the populations live a religious syncretism, because almost all the natives submit to certain rites of ancestral religions.

### *3.4.3 Economic activities*

The economic activities of the population of Kona are essentially agro-sylvo-pastoral production, handicrafts and small-scale trade.

- **Agriculture**

Agriculture is one of the main activities in the commune. It is highly dependent on rainfall. The commune of Kona has relatively good rainfall. It employs more than 90% of the working population and the main crops are of two types: cereal crops (sorghum, maize, millet, rice) and cash crops (groundnuts, cotton, sesame, cowpeas, voandzou, soya).

- **Breeding**

Livestock farming is the second most important socio-economic activity of the commune's population after agriculture. Two (02) main systems predominate, namely

- the traditional extensive transhumant system marked by cyclical migrations in search of pasture and water. It is based on the exploitation of natural rangelands and is the most important livestock system in terms of numbers. The shrinking of pastoral areas as a result of pressure on the land

and the difficulty of accessing pastoral resources (pasture and water) in the rainy season due to the obstruction of access tracks;

- the traditional extensive sedentary system, which is characterised by livestock farming in association with agriculture or agro-pastoralism, most often with a herd of cattle, small ruminants, donkeys, pigs, horses and poultry. The donkeys are mainly used to transport equipment and materials. Pig farming is mainly the preserve of Bwaba and Marka women. It is primarily an economic activity. Poultry farming is practiced by all ethnic groups. It has social, economic and cultural importance.

Other small-scale livestock systems include semi-intensive and intensive systems such as cattle, sheep and pig fattening units as well as draught animals

- **Forestry / environment**

The main silvicultural activities are nursery for the production of seedlings and reforestation for reforestation or to satisfy the need for wood and cash. These reforestations are carried out using endogenous and exogenous species. According to the report (2019) of the reforestation campaign in the commune of Kona, 15.5 ha of exogenous species were planted (Kona high school, Kona village forest, Dangouna, Zina) and 16.5 ha of endogenous species were planted (Kona, Blé, Dangouna, Zina). Collectively and individually, the number of ha reforested amounts to 20.5 ha and 11.5 ha respectively. Fruit tree plantations are mainly mango, guava and cashew.

Table 7Actions taken to improve the environmental situation and strategies

| **Locality** | **Type of achievement** | **Area** |
|---|---|---|
| Kona | Village forest | 10 ha |
| Sanflé | Grove | 1.5 ha |
| Pié | Village forest | 05 ha |

- **Handicrafts**

The crafts are organised around basketry, weaving, pottery, blacksmithing, carpentry and sewing. There are also butchers, restaurant owners, and processors of harvested and agricultural products. Although it provides substantial income to the population, the handicraft sector faces a number of difficulties such as the low level of organisation and equipment of the craftsmen, the lack of training and the absence of a vocational training centre. In order for this sector to be more profitable, it is necessary to make it more dynamic by supporting the structuring of craftsmen, supporting the acquisition of processing equipment and setting up a vocational training centre. The revitalisation of the craft industry could contribute to food security by raising the level of income of the population, and to the fight against the lack of jobs in the dry season.

- **Trade**

The municipality of Kona has a variety of small-scale economic units, which indicates a relatively sluggish local economy. Furthermore, these economic units are dominated by the trade in shops, grain shops, millers and retail. In terms of infrastructure, the commune has a small-scale market infrastructure. There are five markets: a communal market in Kona and four other markets in the villages of Pié, Kouana, Lah and Nana. Apart from these markets, the population also visits the markets in neighbouring communes and localities such as Wona, Safané and Ouarkoye.

- **School infrastructure**

The commune of Kona has a Basic Education District. This CEB comprises a total of 24 schools, all of which are functional and spread over the various villages. One of them is in the village of Zina. The commune of Kona has a total of 4 post-primary schools (Kona, Dangouna, Pié, Lah), 2 secondary schools including the departmental high school and one public school.

- **Health infrastructure**

The commune of Kona has five health facilities. These are the CSPSs of Kona, Kouana, Dangouna, Lah and Pié. In addition, there is only one hospitalization room (in Kona) and one pharmaceutical warehouse (in Lah). Of the CSPSs mentioned above, all five are functional. The community has a total of 17 qualified health workers for 13 nursing units.

- **Water infrastructure**

The commune of Kona has 125 water points divided into 76 boreholes (12 of which are non-functional), 5 AEPS (1 of which is non-functional) and 4 standpipes. The drinking water coverage rate is relatively satisfactory. Including one (01) functional borehole and one (01) non-functional in Zina.

- **Communication**

The commune of Kona is covered by the fixed telephone and mobile telephone networks (Moov, Telecel, Orange). This coverage is not uniform but generally allows for good communication. The commune has access to local radio stations in Dédougou and to Radio Television Burkina.

- **Roads and transport**

The commune of Kona is not very open. There is only one major road, the departmental road (D80) which links Safané to Ouarkoye and crosses Kona from East to West, and the rural track from the national road N°10 to Kari which crosses it from North to South. In the rainy season, these two tracks are difficult to use. Other tracks link the villages to the main town of the commune, but they are impassable in winter. As a result, the transport sector remains poorly developed. No public transport company uses these roads regularly, which hinders the development of the commune.

6.9. Development actors

- **Decentralised services**

The administrative services present in the commune are the prefecture and the town hall. Most of the technical services are under the authority of a Provincial Directorate based in Dédougou. These include the departmental services of Agriculture, Livestock, Environment and the deconcentrated health and education services.

- **Mining company**

SEMAFO BF S.A. was granted a 112.5 km2 Kona exploration permit by the Burkinabe government by ministerial decree No. 02/040/MCE/SG/DGMGC/DG of 31 May 2001, located in the vicinity of the village of Dangouna. In March 2007, the Mana project received its mining permit from the Burkinabe government by decree N2007-144/PRES/PM/MCE/MFB/MEDEV/MECV. A mining convention was signed between the Burkinabe party and SEMAFO to govern the terms and conditions relating to taxation, employment, property and mining guarantees, and environmental protection. In May 2006, construction of the mine was officially launched and in March 2008, the first gold pour was achieved. The mining project covers the communes of Bana and Yaho in the Balés province, as well as Kona in the Mouhoun province.

The houses that were impacted in the mining perimeter have been rebuilt. The mining company recruits its unskilled staff locally. Accessibility to the commune has improved significantly thanks to the tracks built by the company, which also maintains these tracks, which it needs to facilitate the transport of personnel and products.

- **Société burkinabè des fibres textiles**

SOFITEX is a limited company comprising the Burkinabe State, private companies and the National Union of Cotton Producers. Its missions are to

- purchase, transport and ginning of seed cotton ;
- marketing of fibre and seed ;
- supply of agricultural inputs to farmers ;
- to assist in the development of cotton and associated crops through technical support, services and participation in the financing of necessary research and development measures;
- direct promotion of textile fibres.

- **Farmers' associations and organisations**

The socio-professional associations and groups that operate in the commune work in the areas of social infrastructure, training, agricultural equipment, rural credit and women's IGAs. There are several cotton producers' groups (GPCs) and village development associations in the commune.

# 4 ANALYSIS OF VARIANTS

The aim here is to describe the technically and financially feasible alternatives to the solar project .

In this project, two alternatives were analysed: the type of solar power plant and the choice of site, while the technical alternatives were the panel technology**, the** foundation and panel support technology and the cleaning technology.

## 4.1 Description and analysis of project variants and alternatives

## 4.2 Variant 1: Type of plant solar

- **Concentrated solar power plant**

A concentrated solar power plant (or concentrated solar thermal power plant, or CSP) is a power plant that concentrates the Sun's rays using mirrors in order to heat a heat-transfer fluid, which generally allows electricity to be produced. This type of power plant allows the power plant to operate for several hours after sunset by storing the fluid in a tank. There are different types of power plants depending on the shape of the mirrors (flat or curved) and the location of the heat transfer fluid (point or linear).

The solar potential of Burkina Faso can be efficiently exploited by solar thermal technologies (CSP). The main advantage of this technological solution is the coupling with heat storage systems (e.g. molten salt, concrete) which can be used as a base load energy source. The problem is that CSP technology is very underdeveloped compared to the current installed capacity.

- **Photovoltaic solar power plant**

A solar photovoltaic power plant is a technical device for producing electricity by means of interconnected (series and parallel) solar photovoltaic (PV) modules and uses inverters to be connected to the grid.

Photovoltaic power plants often operate without storage and only produce energy during the day. The main advantage of photovoltaic power plants is that the technology is better known and improved and has seen a significant drop in prices in recent years. Furthermore, AMEA has experience in the construction and management of photovoltaic power plants, as it operates similar projects in Africa and elsewhere. This justifies the choice of a solar photovoltaic plant in this project.

Table 8 Comparative analysis of the two types of solar power plants

| **Comparison criteria** | **Concentrated solar power plant** | **Photovoltaic solar power plant** |
|---|---|---|
| Energy storage : | YES | NO (YES with batteries) |
| Rational use of the resource : | YES | YES |
| Direct Normal Irradiance (DNI): | Achievable if DNI greater than 2000 kWh/$m^2$ /year (in Burkina Faso the DNI is less than 1700 kWh/$m^2$ /year) | Achievable even if the DNI is below 1700 kWh/$m^2$ /year |
| Continuous availability of energy: | YES | NO (YES with batteries) |
| Cost : | 0.14 and $0.36/kWh | 0.17 and 0.25 $/kWh |
| Experience of AMEA : | No | Yes |
| Performance : | Approximately 25%. | 16 à 24% |
| Number of times used before replacement : | Lifetime between 25 and 40 years. | Estimated life span of 25 years. |
| Existing recycling opportunities for each of the technologies (environmental gains) : | YES<br>No GHG emissions | YES<br>No GHG emissions |
| Social cost and impact on human health : | Job creation<br>No known impact on human health | Job creation<br>No known impact on human health |

Source: IPEAD research, 2021

### *4.2.1 Alternative 1: Panel technology*

There are currently 3 main types of photovoltaic panels, which are differentiated by the type of cells they contain. All cells are produced from silicon, but the different manufacturing methods give them very different characteristics, particularly in terms of productivity:

- **Amorphous cells**

They are produced from a "silicon gas", which is sprayed onto glass, flexible plastic or metal by a vacuum vaporisation process. The cell is very dark grey. This is the cell used in calculators and so-called "solar watches", because this type of cell is cheap and the technology can be used on many different substrates, including flexible substrates. The problem is that its efficiency is 2 to 3 times lower than monocrystalline cells.

- **Monocrystalline cells**

They are made from a single block of molten silicon, so they are very "pure". They offer the best efficiency (between 13 and 17%), but are also more expensive to produce and therefore to sell. These cells are generally octagonal and have a uniform dark colour (navy blue or grey). These cells are the most efficient, so they make it possible to create panels that are very efficient: those that produce the most energy with the least surface area.

- **Polycrystalline cells**

They are made from a block of crystallised silicon in the form of multiple crystals. The different orientations of the crystals can be seen at close range. They have an efficiency of 11-15%, but are cheaper to produce than monocrystalline cells.

Crystalline panels were preferred to thin film panels because crystalline panels have a higher efficiency at low temperatures and more data is available due to their longer use. Thin film panels perform better at higher temperatures and degrade more slowly over time than crystalline panels, however their higher cost does not compensate for the performance benefits. The promoters considered that crystalline panels are more suitable for the sub-project and the Sudano-Sahelian context.

The choice of mono or poly crystalline technology has not yet been decided. The difference in efficiency between these two technologies is relatively small but the cost of monocrystalline panels is higher. A cost-benefit analysis will be carried out at the detailed design stage to ensure that the most optimal solution is selected.

According to PV Cycle, the government agency in charge of recycling solar panels, it is possible to recycle 100% of crystalline silicon modules, the majority of the global photovoltaic market. Appropriate infrastructures have been created: Veolia, for example, inaugurated its first solar panel recycling plant in France in July 2018 and envisages a recycling rate of 98%.

### *4.2.2 Alternative 2: Foundations and panel supports*

The choice of foundations and panel supports has a direct implication on the cost of the plant installation and operation, its productivity and the environmental and social impacts of the sub-project.

Mobile supports, compared to fixed supports, are equipped with a motorisation allowing them to follow the path of the sun to optimise their exposure and therefore their yield. They require a higher investment and maintenance for a higher productivity that can reach 30 to 40%. Mobile arrays have a higher surface utilisation rate (m2/kWp) and the motors consume energy during operation (about 0.5% of the annual production), but the ground shading is lower than that of fixed panels. In addition, mobile supports cause less soil erosion (rainfall). The noise generated by the motors of the mobile supports is exclusively diurnal and considered to have no impact on the environment. For these reasons, the sub-project opted for mobile supports.

The foundations that support the panels also play an important environmental role because of the degree of soil sealing they generate. For example, foundations with light structures (battered steel piles) will result in much less soil sealing than heavier structures (concrete footings for example). Considering the environmental impacts of each of these structures, the sub-project opts for the solution that minimises the environmental impact by using driven steel piles.

### *4.2.3 Alternative 3: Cleaning the solar panels*

Two cleaning options were considered for the sub-project, mechanical cleaning with a water injector and manual cleaning using water from the on-site borehole. The mechanical option has the advantage of reducing the water consumption of the project but has a higher operating and maintenance cost. The manual option has a slightly higher environmental impact while providing additional low-skilled employment opportunities.

The module manufacturers recommend the following cleaning solutions:

- cleaning with water only (osmosis water and without any additional products) to avoid greasing or marking the module. Avoid hard water and bleach;
- cleaning with a water + sodium percarbonate solution;

Avoid high pressure, avoid steam cleaning (high temperature is not recommended),

Light cloth with weak detergent + water solution.

The first solution (cleaning with osmosis water) will be preferable for the site. However, it should be noted that the cleaning of the dirt on the modules is mostly due to dust. For example, at the power plant in the central region, cleaning is carried out by staff using a tractor with a telescopic arm to which is attached a circular brush made of rotating synthetic fibre and a hose through which water is injected onto the panels. The modules are cleaned during the dry season from October to May, every day from 6-11 am and 2-5

pm. The choice between these two cleaning techniques has not yet been made at the NIES development stage.

### 4.3 Variant 2: site selection

AMEA chose the site in the village of Zina, hence the name "ZINA SOLAR", because of its distance from the houses and the fact that the company has been granted a long lease by the government for the site. This location also allows the plant to be connected to the Wona substation, thus limiting the costs associated with the connection (which then affects the cost of production per kWh), and the extent of the environmental and social impacts. The site was also chosen because of its accessibility, its geographical position and the absence of housing.

### 4.4 Selection of the project variant and alternative

The analysis of these variants and alternatives led to the choice of the variant and alternative for the implementation of the solar power plant in Zina.

# 5 IMPACT OF THE PROJECT ON THE DIFFERENT AREAS OF THE ENVIRONMENT

The impacts generated by the solar power plant project on the different components of the environment are taken into account through two main steps: the identification and analysis of the environmental and social impacts and the assessment of the relative importance of the identified impacts.

## 5.1 Methodology for identifying impacts

Impacts are identified by comparing the components of the receiving environment with the activities of each phase of the solar power plant project. The most frequently used method is the Luna Leopold matrix (1971). This is an interrelationship matrix, linking the impact-causing project activities with the components of the project environment. Each interrelationship identified represents a likely impact of a sub-project activity on a component of the environment.

### *5.1.1 Identification of sources of impacts*

These are the project activities that may cause impacts (positive or negative) on the various components of the physical and biological environment. Depending on the project's implementation phases, these impact-causing activities are described below.

- **Preparatory phase**

In the preparatory phase, the activities that cause impacts are

- installation of the life base ;
- site preparation ;
- deforestation and clearing of undergrowth ;
- cleaning and clearing of rights of way ;
- access road openings.

Some activities, such as land acquisition and compensation, were taken into account and carried out in the previous study.

- **Construction phase**

During the construction phase, the following activities will have an impact:

- civil engineering works ;
- assembly and installation of equipment ;
- testing and commissioning of the plant ;
- waste management.

- **Operational phase**

The impacts come from the implementation of the following activities:

- operation and daily monitoring of the plant ;
- preventive maintenance ;

- management of sanitation facilities and works ;
- curative maintenance.

- **Closure and rehabilitation phase**

The activities in this phase will be carried out as follows: two stages:

Closure and rehabilitation of the site base: the following activities are planned:

- de-installation of equipment and removal of machinery;
- sorting and disposal of waste produced on the site;
- site rehabilitation.

Closure and rehabilitation of the power plant site: The solar power plant is planned to operate for approximately 25 years. At the end of the operating period, the plant can be closed down and rehabilitated. The following activities will therefore be necessary:

- decommissioning of the plant's facilities;
- recycling/upgrading of solar modules ;
- waste disposal and site restoration ;
- handing over the used land to the authorities ;
- recycling of components (solar panels)
- destruction and recovery of materials;
- closure of access roads;
- restoration of the site and access roads.

### *5.1.2 Identification of impact receptors*

The identification of positive or negative impacts due to the implementation of the project is based on the analysis of the effects resulting from the interactions between an affected environment and the different facilities or activities implemented within the framework of the project. The analysis allows the establishment of a relationship between the sources of the impacts or activities of the sub-project and the components of the different environments that could be affected. In this respect, the receptors for this project are listed in the following table:

Table 9 : Environmental components likely to be affected by the project

| Environment | Receivers |
|---|---|
| **Biophysics** | - the relief<br>- soil resources<br>- air **;**<br>- Climate and climate change<br>- the sound environment ;<br>- surface water and groundwater;<br>- vegetation/ wildlife and its habitat |
| **Socio-economic** | - health and safety ;<br>- employment ;<br>- socio-economic activities;<br>- the living conditions of the population;<br>- cultural and archaeological heritage (monuments, sacred sites, etc.);<br>- land (agricultural land, housing, etc.);<br>- social cohesion ;<br>- vulnerable people (women, girls, widows, children, people living with a disability, etc.) |

**Source:** IPEAD, field data 2022

Table 10 : Interaction matrix of impact sources and impact receptors of the solar power plant construction project

| Phases | Designation | Biophysical environments | | | | | | Socio-economic environment | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Impact receptors / Sources of impacts | Air | Sound environment | Surface water and underground | Floors | Vegetation/ Fauna and habitat | Relief (Landscape and morphology) | Health and safety | Employment | Activities socio-economic | Cultural heritage and archaeological | Land | Living conditions of the populations | Social cohesion | Vulnerable persons |
| Preparatory | site preparation | N | N | N | N | N | N | N | P | P | O | N | N | N | N |
| | deforestation and clearing of undergrowth ; | O | O | O | O | N | O | O | P | P | O | O | O | O | O |
| | cleaning and clearing of rights of way ; | O | O | O | O | N | O | N | P | P | O | O | P | P | P |
| | access road openings. | N | N | N | N | N | N | N | P | P | O | O | P | P | P |
| | Installation of the life base | N | N | N | N | N | N | N | P | P | O | O | P | P | P |
| Construction | Site preparation | N | N | N | N | N | N | N | P | P | O | O | O | O | O |
| | Assembly and installation of equipment | N | N | N | N | N | N | N | P | P | O | O | O | O | O |
| | Testing and commissioning of the plant | N | N | N | N | N | N | N | P | P | O | O | O | O | O |
| | Waste management | N | N | N | N | N | N | N | P | P | O | O | N | N | N |
| Operation | Operation and daily monitoring of the plant | N | N | O | O | O | O | O | P | P | O | O | O | O | O |
| | Preventive maintenance | N | O | N | N | O | N | O | P | P | O | O | P | O | O |
| | management of sanitation facilities and works ; | O | O | O | O | O | N | O | O | O | O | O | O | O | O |
| | curative maintenance. | O | O | O | O | O | O | P | P | P | P | O | P | P | P |
| Closure and rehabilitation | Closure and remediation of the base camp site | N | N | O | P | P | P | N | P | O | O | O | P | O | O |
| | Closure and rehabilitation of the plant site at the end of its useful life | N | N | O | P | P | P | N | P | O | O | O | P | O | O |

Legend - Y: Negligible, P: Positive, N: Negative. Source: IPEAD mission January 2022 for the elaboration of the NIES of the solar power plant

- **Results of impact identification**

The potential impacts of the project are shown in the following table:

Table 11Potential impacts of the project

| Components of the environment | Potential impacts |
|---|---|
| Air | Degradation of air quality |
| Sound environment | Vibration and noise |
| Surface water and groundwater | Surface and groundwater pollution<br>Reduction of surface water quantity<br>Disruption of natural surface water flow |
| Floors | Modification and weakening of soil structure and texture<br>Soil pollution |
| Landscape, vegetation / wildlife and its habitat | Destruction of trees and shrubs<br>Loss of wildlife habitat<br>Disturbance of wildlife tranquillity<br>Changes to the natural landscape |
| Health and safety | Increased respiratory infections (for company employees working on site);<br>Increase in STI/AIDS and VCT-19 prevalence rates<br>Increase in unwanted pregnancies<br>Traffic accidents, work accidents, incidents on construction sites for both workers and members of the surrounding communities. |
| Employment | Creation of permanent and temporary posts |
| Socio-economic activities | Development of economic activities |
| Business opportunities and tax revenues | Business opportunities for domestic companies and increased tax revenues |
| Living conditions | Improvement of living conditions<br>Improving access to basic social services |
| Land | Loss of arable land, trees and other livelihoods |
| Cultural and archaeological heritage (monuments, sacred sites, etc.) | Desecration of places of worship and cultural/sacred objects<br>Loss of cultural objects |
| Social cohesion | Disruption of social cohesion (Social conflicts) |
| Vulnerable persons | Improving the situation of vulnerable people |

Source: IPEAD, 2022

## 5.2 Impact assessment methodology

It aims to determine the degree of importance of the impacts in the disturbance of the environment. The method used consists of determining, through a combination of well-defined criteria, the importance (absolute or relative) of the impact on the socio-economic and biophysical environment.

The relative importance of the impact, whether positive or negative, is determined by its intensity, extent, duration, but also by the value placed on the affected component. The relative importance of the impact is in fact proportional to these four specific criteria and will be qualified as weak, medium or strong. The absolute significance is determined by combining the criteria of intensity, extent and duration. It is classified as minor, medium or major.

Table 12 Fecteau grid

| Intensity | Scope | Duration | Absolute importance |
|---|---|---|---|
| Strong (Fo) | Regional (R) | Permanent (Long or L) | Strong or Major (Ma) |
| | | Temporary (Medium Mo) | Strong or Major (Ma) |
| | | Momentary (Short or C) | Strong or Major (Ma) |
| | Local (L) | Permanent (Long or L) | Strong or Major (Ma) |
| | | Temporary (Medium Mo) | Strong or Major (Ma) |
| | | Momentary (Short or C) | Average (MB) |
| | Punctual (P) | Permanent (Long or L) | Strong or Major (Ma) |
| | | Temporary (Medium Mo) | Average (MB) |
| | | Momentary (Short or C) | Average (MB) |
| Average (M) | Regional | Permanent (Long or L) | Strong or Major (Ma) |
| | | Temporary (Medium Mo) | Strong or Major (Ma) |
| | | Momentary (Short or C) | Average (MB) |
| | Local | Permanent (Long or L) | Strong or Major (Ma) |
| | | Temporary (Medium Mo) | Average (MB) |
| | | Momentary (Short or C) | Average (MB) |
| | One-off | Permanent (Long or L) | Average (MB) |
| | | Temporary (Medium Mo) | Average (MB) |
| | | Momentary (Short or C) | Low or Minor |
| Low (F) | Regional | Permanent (Long or L) | Strong or Major (Ma) |
| | | Temporary (Medium Mo) | Average (MB) |
| | | Momentary (Short or C) | Average (MB) |
| | Local | Permanent (Long or L) | Average (MB) |
| | | Temporary (Medium Mo) | Average (MB) |
| | | Momentary (Short or C) | Low or Minor |
| | One-off | Permanent (Long or L) | Average (MB) |
| | | Temporary (Medium Mo) | Low or Minor |
| | | Momentary (Short or C) | Low or Minor |

Source: Fecteau Mars grid, 1997

### *5.2.1 Impact assessment steps*

The assessment of the relative significance of impacts involves four steps:

**Step 1**: Establish the list of impact-source activities and determine the environmental components likely to be affected by them;

**Step 2:** Assess the intensity of the disturbance imposed on each component and determine the duration and extent of the effects generated by each activity;

**Step 3**: After characterising the impact according to the criteria of intensity, duration and extent, the Fecteau matrix is used to determine the absolute significance of impacts. This matrix is based on the following principles:

- all the criteria used have the same weight;

- if two criteria have the same level of severity, the importance rating corresponding to that level is given, regardless of the severity level of the third criterion;
- if the values of the three criteria are different, the average importance rating is given.

The resulting matrix of these rules includes both major and minor importance ratings. The advantage of this arguable arrangement of criteria is that it is transparent and avoids distortions in favour of minor or major impacts. Thus absolute significance, which is qualified as :

- **minor**: when damage is observed but does not affect the receiving environment. The impact is not very significant, but should still be reduced by adequate mitigation or compensation measures;
- **medium**: when there is partial degradation of the receiving environment. The impact is noticeable and undesirable. It is strongly recommended that mitigation or compensation measures are implemented;
- **major**: in case of degradation of the receiving environment. The potential impact is unacceptable. Mitigation or compensation measures must be implemented.

Other parameters for characterising the impact are: reversibility, occurrence, value of the affected component and cumulative nature. The situation is of concern when the impact is irreversible, certain, cumulative and the affected component is highly valued (or of high value).

The environmental or social measure is proposed according to materiality. After application of this measure, a residual impact may remain. This is considered in terms of the effectiveness of the proposed environmental measure. All the residual impacts will allow the overall assessment of the project on the environment. Overall, the final assessment of the project's effects on the environment will be made on the basis of the significance of the residual impacts.

**Step 4**: Record the results of the significance assessment in an impact fiche which presents the details of the assessment. Each sheet presents a justified assessment of the impacts, a factual description, proposed mitigation measures and monitoring and follow-up measures if required.

### *5.2.2 Impact assessment criteria*

- **The intensity of the impact**

It reflects the extent of the changes observed in the affected component.

- **strong**: the activity significantly affects the integrity of the component or its use and compromises its sustainability. This means that the activity significantly alters or enhances one or more environmental components, calling into question their integrity or significantly diminishing their use, characteristic or quality;
- **medium**: the activity significantly affects the integrity of the component or its use, but does not compromise its sustainability;

- **low**: the activity has little effect on the integrity of the component or its use, i.e. the activity alters or improves one or two environmental elements in a barely perceptible way, without significantly modifying their use, their characteristic or their quality.

- **The duration of the impact**

It refers to the period during which the effects of an intervention on the environment are felt. The following variants can be distinguished:

- **long**: the duration is long when the disturbance goes beyond 5 years and continues even after the end of the sub-project;
- **medium**: the duration is medium when the disturbance continues after the end of the activity and can reach about 5 years;
- **short or temporary**: the impact is limited to the construction period of the sub-project or less. This means that the disturbance is well circumscribed in time and stops with the end of the activity causing the impact.

- **The extent of the impact**

It reflects the scope of the impact.

- regional: the impact extends over the municipality;
- local: the impact extends to the villages or districts surrounding the project;
- one-off: the impact extends over the site's footprint up to 500 metres from the site, or affects only a few people.

### 5.3 Environmental and social impact assessment and analysis

As well as the identification, assessment and analysis of impacts will be done in the different phases of the Zina solar power plant construction project.

#### *5.3.1 During the pre-construction or site preparation phase*

During the preparation phase, which will last approximately two months, the activities that will have an impact on the biophysical and socio-economic environment are the site preparation operations, deforestation and brush clearing, cleaning and excavation of the rights of way, the installation of the base camp and the opening of the access roads, which will affect the biophysical and socio-economic environment.

- **Impact on the physical environment**

**Impact on air quality and noise environment**

During the preparation phase, atmospheric emissions will mainly be linked to dust generated by the various activities such as site preparation operations, clearing and scrubbing, cleaning and excavation of the rights of way, installation of the life base and the opening of access roads and the passage of vehicles

on unsealed roads. Given the configuration of the site, these emissions will be limited. The engines of the vehicles and construction equipment will also generate harmful gases such as carbon dioxide (CO2), sulphur dioxide (SO2), nitrogen oxides (NOx) and carbon monoxide (CO). The impact of dust emissions will be accentuated by wind action.

Noise emissions from project preparation activities will mainly come from trucks, tree felling and construction equipment. These noises will be more noticeable at night if the work continues. No significant noise-generating activities are planned between 6 p.m. in the evening and 7 a.m. in the morning, except in the case of a major imperative related to the planning of the preparation phase. These nuisances will continue at the construction sites and at the aggregate removal sites. On the other hand, they will be occasional on the access road. There are health risks for communities and employees such as hearing problems.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Installation of the life base ;<br>Deforestation and Brushwood Clearance ;<br>Right-of-way clean-up and clearing ;<br>Access road openings. | Degradation of air quality | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: medium | **Minor** |
| | Vibration and noise | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: medium | **Minor** |

**Impact on the relief and geomorphology of the soil**

During the preparation phase, tree felling activities, the establishment of the base camp, the opening of roads and the movement of machinery will lead to soil compaction and partial sealing of the soil. Soils exposed as a result of felling and clearing activities will be subject to wind and water erosion. Soil pollution is likely to occur as a result of accidental hydrocarbon spills following a possible technical failure or accident involving site machinery. These works will also generate solid and liquid waste.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Installation of the life base ;<br>Deforestation and Brushwood Clearance ;<br>Right-of-way clean-up and removal ;<br>Access road openings. | Changes in the physical and chemical properties of soils | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: medium | **Minor** |
| | Soil pollution | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: medium | **Minor** |

**Impact on surface and groundwater**

The preparatory phase activities will not require water abstraction. However, deforestation activities will increase the runoff coefficient with soil leaching that may lead to changes in surface water turbidity. The maintenance activities of the machines and the construction of the base camp and the opening of the access roads may also lead to pollution of surface water due to the spillage of hydrocarbons and chemical products (paint). Groundwater will not be negatively impacted as the depth of the water table is between 90m and 120m. In addition, the soil in the area has a low permeability.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Installation of the life base ;<br>Deforestation and Brushwood Clearance ;<br>Right-of-way clean-up and clearing ;<br>Access road openings. | change in surface water turbidity surface water pollution | Nature: negative impact<br>Intensity: low<br>Scope: local<br>Duration: medium | **Average** |
| | Groundwater pollution | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: medium | **Minor** |

**Impact on climate change**

The project area, like the rest of the country, is experiencing disturbances linked to climate change: extremely violent winds, torrential rains, long and recurrent droughts, extreme temperatures, etc.

The climatic issues related to this power plant construction project are mainly the occurrence of strong winds, temperature increases, thunderstorms, lightning strikes, hail, etc. These climatic events can have impacts and present risks for the power plant facilities: the risk of flooding, the risk of flooding, the risk of flooding, etc. These climatic events can have impacts and present risks for the power plant facilities:

- high temperatures can lead to a decrease in the efficiency of the photovoltaic panels;
- wind can cause dust to settle and increase the frequency of cleaning the panels or carry and drop particles that can break the panels;
- torrential rain, lightning, hail and strong winds can destroy the supports and plates.

This may result in a disruption of the electricity supply, with consequent disruptions to the operation of government and technical services, basic social services, socio-economic activities and security services.

**Impact on the biological environment**

**Impact on the landscape and vegetation**

During the preparatory works, the landscape and vegetation will be particularly affected. The following impacts will be noted*:*

- All tree, shrub and herb vegetation will be cleared from the project area, particularly from the 37-hectare photovoltaic panel installation area. Approximately 850 trees and shrubs have already been

felled. The quantitative impact on the vegetation cover will be significant. As trees act as carbon sequestration sinks, the impact will be even greater;

- Some species such as shea (*Vitellaria paradoxa*) and cowpea (*Parkia biglobosa*) have a strong environmental and social value. These species and many varieties of trees, shrubs and herbs produce edible fruit, provide leaves or bark for use in medicines and as timber (construction, furniture);
- the fraudulent or abusive exploitation of plant resources (especially green wood) by site personnel is likely to increase the significance of the impact on vegetation;

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Installation of the life base ;<br>Deforestation and Brushwood Clearance ;<br>Right-of-way clean-up and removal ;<br>Access road openings. | Destruction of vegetation and loss of rare, vulnerable or threatened species | Nature: negative impact<br>Intensity: Medium<br>Scope: one-off<br>Duration: long | **Average** |

**Impact on wildlife and wildlife habitat**

The preparatory activities that will lead to the destruction of vegetation on the site will result in the disturbance of wildlife, the destruction of its habitat and the reduction of space for microfauna.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Installation of the life base ;<br>Deforestation and Brushwood Clearance ;<br>Right-of-way clean-up and removal ;<br>Access road openings. | Destruction of habitats and reduction of space for microfauna.<br>disturbance of wildlife tranquillity | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: long | **Minor** |

- **Impact on the human environment**

**Impact on demography and habitat.**

The preparatory activities may have impacts in terms of the flow of potential job seekers into the village of Zina, which may constitute a possibility of population increase. The workers of the company executing the works will be housed in a living base. However, the subcontractors' staff will be housed off-site, which will contribute to increased pressure on housing in the project area.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Installation of the life base ;<br>Deforestation and Brushwood Clearance ;<br>Right-of-way clean-up and removal ;<br>Access road openings. | Demographic and human habitat pressure | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: long | **Minor** |

**Impact on land management and loss of habitat and property**

Preparatory work on the site had resulted in the acquisition of 74 ha of land. This resulted in the loss of agricultural land. The loss of land generally affects 21 PAPs, who own/operate 16 fields with a total area of 63.74 ha;

The loss of this land contributes to the reduction of the landowners' portions of the land. There are no built-up areas on the site. Compensation operations for PAPs were carried out during the 2015 environmental study. The compensation covered loss of land, loss of trees.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Installation of the life base ;<br>Deforestation and Brushwood Clearance ;<br>Right-of-way clean-up and removal ;<br>Access road openings. | Loss of 16 agricultural fields | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: long | **Minor** |

**Impact on community health and safety and on workers**

The preparatory activities would have an impact on the security of the community as the work may constitute acts of aggression on the part of the community. In addition, the work will limit the population's access to certain medicinal plants and may be a source of accidents. Pressure on the local health centre due to the presence of workers. For the workers, this impact will be low because the ZINA SOLAIRE project has an occupational and environmental health and safety team that deals with the issue of health and safety at work.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| iInstallation of the life base ;<br>Deforestation and Brushwood Clearance ;<br>Right-of-way clean-up and removal ;<br>Access road openings. | Health and safety impact on communities and workers | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: long | **Minor** |

**Impact on cultural and archaeological heritage (monuments, sacred sites, etc.)**

No cultural heritage sites are present on the site of . However, preparatory activities may result in archaeological materials . In addition, the presence of workers can lead to sources of desecration of the locality's prohibitions.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Installation of the life base ;<br>Deforestation and Brushwood Clearance ;<br>Right-of-way clean-up and removal ;<br>Access road openings. | Desecration of the locality's prohibitions<br>Archaeological discovery | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: long | **Minor** |

**Impact on socio-economic and livelihood activities**

- **Local employment**

In the preparatory phase, the work will require a significant amount of manpower. This is an employment opportunity for the young people of the commune. This impact is a positive impact for young people.

- **Local economy and other activities**

The implementation of the project, especially in the installation phase, will contribute to increased tax revenues for the municipality and the state through income tax and entry fees for items. Also, the recruitment of companies, subcontractors and employees will generate benefits for the state through the collection of taxes.

The direct and indirect jobs created will also be sources of tax collection: withholding tax for service providers and the Single Tax on Salaries (IUTS) for employees.

- **Public infrastructure**

There is no public infrastructure on the site of the plant. No impact is expected. Furthermore, the tracks used by the works will be rehabilitated, so no impact is expected.

- **Living conditions, social cohesion and vulnerable people**

During the preparatory phase, risks to the health, social cohesion and safety of workers, neighbouring populations and the safety of property will be observed. The use of construction equipment, excavation work for the construction of the living quarters, tree felling, the opening of access roads and the transport of equipment and materials, as well as the failure to follow safety instructions, will expose workers and local populations to the risk of physical injury if certain precautions are not taken.

Similarly, the presence of workers on the site will also lead to changes in the lifestyle of the local population.

Conflicts could arise as a result of a possible failure to respect local customs and traditions. Practices such as adultery, rape, theft, assault, failure to recruit local people, especially for unskilled jobs, and nepotism during recruitment could be sources of disruption to the existing social organisation.

The cohabitation between the local population and the company's staff in charge of the works is likely to encourage GBV and ECV: rape, unwanted pregnancies, harassment, all kinds of abuse, negligence, exploitation, etc. This violence can also be observed among the company's staff. This violence can also be observed among the company's staff.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Installation of the life base ;<br>Site preparation ;<br>Deforestation and Brushwood Clearance ;<br>Right-of-way clean-up and removal ;<br>Machine traffic ;<br>Access road openings. | Creation of temporary jobs<br>Compensation for losses of affected property<br>Business opportunities and payment of taxes | Nature: positive impact<br>Intensity: medium<br>Scope: one-off<br>Duration: long | **Minor** |

### *5.3.2 During the construction and operation phase*

The construction and operation phase will be carried out through the following activities: civil works, assembly and installation of equipment, testing and commissioning of the plant, waste management, operation and daily monitoring of the plant, preventive and curative maintenance and management of equipment and wastewater treatment facilities.

- **Impact on the physical environment**

**Impact on air quality and the noise environment**

The construction works will have a one-off impact on air quality, in particular through the raising of dust in the construction areas, and through emissions from the exhaust of diesel engines of vehicles and construction machinery. During the operational phase, air emissions will be mainly related to the temporary and limited operation of the back-up generator, the mismanagement of solid and liquid waste and hydrocarbons, and the movement of personnel to the plant. These emissions will be very limited and therefore negligible.

The sound environment will be modified by the noise of the trucks and the generator. This noise will be more noticeable at night if the work continues. No significant noise-generating activities are planned between 6 p.m. in the evening and 7 a.m. in the morning, except in the case of a major imperative linked to the planning of the construction phase. These nuisances will continue at the construction sites and at the aggregate removal sites. On the other hand, they will be occasional on the access road.

Noise and dust will not affect the population as the site is uninhabited and located more than one kilometre from dwellings. However, in exceptional circumstances, harmattan winds can carry dust to residential areas.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Civil works ;<br>Assembly and installation of equipment;<br>Solid and liquid waste management.<br>Operation and daily monitoring of the plant ;<br>Preventive and corrective maintenance<br>Management of sanitation facilities and works | Degradation of air quality and changes to the microclimate | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: long | **Minor** |
| | Alteration of the quality of the sound environment and vibrations | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: long | **Minor** |

**Impact on the relief and geomorphology of the soil**

During the construction and operation phase, the repeated passage of machinery and vehicles is likely to result in soil compaction, partial sealing and structural changes. Excavation work can lead to changes in the physical (density, depth, structure, etc.) and chemical (fertility) properties of the soil. During these phases, soil pollution can occur if chemicals or poor management of hydrocarbons during construction and installation work, waste produced especially in the life base and the construction and public works sector, and water used to clean the plates and for drainage works.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Civil works ;<br>Assembly and installation of equipment;<br>Solid and liquid waste management.<br>Operation and daily monitoring of the plant ;<br>Preventive and corrective maintenance ;<br>Management of sanitation facilities and works ; | Soil pollution | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: long | **Minor** |
| | Partial soil sealing | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: long | **Minor** |
| | Changes in the physical and chemical properties of soils | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: long | **Minor** |

**Impact on surface and groundwater**

The construction of the solar power plant does not require the withdrawal of large quantities of water. Therefore, during the construction phase, there should be no significant effects on surface water quantities. Wastewater from the base camp and the accidental discharge of waste oil or paint could be drained into the watercourses (river) and affect the quality of surface water. On the other hand, during the operation phase, groundwater withdrawals may reach a large quantity if rational use measures are not taken. There will also be a production of solid waste such as aluminium and copper cable off-cuts, liquid waste (panel washing wastewater, domestic wastewater), fuel and lubricants from vehicles and maintenance equipment that could pollute the soil and water.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Civil works ;<br>Assembly and installation of equipment;<br>Solid and liquid waste management.<br>Operation and daily monitoring of the plant ;<br>Preventive and corrective maintenance ;<br>Management of sanitation facilities and works ; | Deterioration of surface water quality | Nature: negative impact<br>Intensity: medium<br>Scope: local<br>Duration: long | **Average** |
| | Groundwater contamination and depletion | Nature: negative impact<br>Intensity: medium<br>Scope: local<br>Duration: long | **Average** |

**Impact on climate change**

The project, during its preparation phase, may have negative effects on the climate. Indeed, the implementation of the power plant will require the clearing/deforestation of the sub-project site. This deforestation will limit the carbon sequestration capacity and contribute to climate change. Also, poor solid waste management during construction and operation (uncontrolled incineration) will produce greenhouse gases ($CO_2$ , NOx, ...).

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Civil works ;<br>Assembly and installation of equipment;<br>Solid and liquid waste management.<br>Operation and daily monitoring of the plant ;<br>Preventive and corrective maintenance ;<br>Management of sanitation facilities and works ; | Release of greenhouse gases | Nature: negative impact<br>Intensity: low<br>Scope: local<br>Duration: long | Minor |
| | Non-sequestration of CO2 | Nature: negative impact<br>Intensity: low<br>Scope: local<br>Duration: long | minor |

- **Impact on the biological environment**

**Impact on the landscape and vegetation**

During these construction and operation phases, apart from the plant species that were felled during the preparatory phase, species impact may occur as additional aggregate storage areas have to be defined or other opening routes have to be created. Other cases of felling may occur if control is not observed with regard to workers and the population.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Civil works ;<br>Assembly and installation of equipment;<br>Solid and liquid waste management.<br>Operation and daily monitoring of the plant ;<br>Preventive and corrective maintenance ;<br>Management of sanitation facilities and works ; | Loss of plant species and microflora | Nature: negative impact<br>Intensity: low<br>Scope: local<br>Duration: long | **Minor** |

**Impact on wildlife and wildlife habitat**

During the construction and operation phase, wildlife will be impacted by the presence of workers. This presence can lead to the hunting of animals and the disturbance of wildlife, resulting in the loss of wildlife habitat.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Civil works ;<br>Assembly and installation of equipment;<br>Solid and liquid waste management.<br>Operation and daily monitoring of the plant<br>Preventive and corrective maintenance ;<br>Management of sanitation facilities and works ; | Loss of animal species and microfauna | Nature: negative impact<br>Intensity: low<br>Scope: local<br>Duration: long | **Minor** |

- **Impact on the human environment**

**Impact on demography and habitat.**

Construction and operation activities will involve the presence of workers from the construction company and subcontractors. The presence of these workers, especially during the construction phase, may increase the presence of young people and pressure on housing in the village of Zina or the commune of Kona.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Civil works ;<br>Assembly and installation of equipment;<br>Solid and liquid waste management.<br>Operation and daily monitoring of the plant<br>Preventive and corrective maintenance ;<br>Management of sanitation facilities and works ; | Demographic pressure and on human habitats | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: long | **Minor** |

**Impact on land management and loss of habitat and property**

Construction and operation will take place on the right-of-way of the solar power plant site. These activities will have no impact on the land, as the developer has obtained a lease from the government. With regard to the loss of habitat and property, an assessment of the property has been carried out and the PAPs have been compensated.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Civil works ;<br>Assembly and installation of equipment;<br>Solid and liquid waste management.<br>Daily operation and monitoring of the plant ;<br>Preventive and corrective maintenance ;<br>Management of sanitation facilities and works ; | Loss of agricultural land and fields | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: long | **Minor** |

**Impact on community health and safety and on workers**

During the construction phase, as with any construction project, there will be risks to the health and safety of workers, neighbouring populations and property. The use of construction equipment, excavation work for the installation of panel supports, electrical cabling, tree felling, opening of trenches and the transport of equipment and materials, as well as failure to follow safety instructions, will expose workers and local populations to the risk of personal injury if certain precautions are not taken.

During the operational phase, the maintenance and servicing of equipment will also generate risks of accidents and incidents.

The risks of using children on construction sites exist and it will be necessary to raise awareness among both communities and companies of the need to respect codes of good conduct in the field of employment.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Civil works ;<br>Assembly and installation of equipment;<br>Solid and liquid waste management.<br>Operation and daily monitoring of the plant<br>Preventive and corrective maintenance ;<br>Management of sanitation facilities and works ; | Health and safety impact on communities and workers | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: long | **Minor** |

**Impact on cultural and archaeological heritage (monuments, sacred sites, etc.)**

The construction and operation of the plant may result in the incidental discovery of archaeological sites and/or artefacts, burials and/or sacred sites. Incidental finds will be subject to appropriate measures as recommended by international good practice.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Civil works ;<br>Assembly and installation of equipment;<br>Solid and liquid waste management.<br>Operation and daily monitoring of the plant ;<br>Preventive and corrective maintenance ;<br>Management of sanitation facilities and works ; | Desecration of the locality's prohibitions | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: long | **Minor** |

**Impact on socio-economic activities and livelihoods**

Local employment

During the construction phase, the work will require a large workforce. This is an employment opportunity for the young people of the commune. This impact is a positive impact for young people.

Local economy and other activities

The major positive impact is the accessibility and availability of electrical energy for the local population. The access of the populations to electricity will have positive effects on the living conditions of the populations (health, education, quality of life...).

The construction of the solar power plant will increase the availability of energy in the Boucle du Mouhoun region and contribute to the connection of a significant number of households to the electricity grid. It will also inject a new dynamic into the life of the local community and improve their living conditions in a sustainable way through the development of the local formal and informal economy.

Public infrastructure

During the construction phase, especially in the operational phase, the solar power plant will be a source of increased security for public infrastructure.

Living conditions, social cohesion and vulnerable people

Conflicts could arise as a result of a possible failure to respect local customs and traditions. Practices such as adultery, rape, theft, assault, failure to recruit local people, especially for unskilled jobs, and nepotism during recruitment could be sources of disruption to the existing social organisation.

The cohabitation between the local population and the company's staff in charge of the works is likely to encourage GBV and ECV: rape, harassment, all kinds of abuse, negligence, exploitation, etc. This kind of violence can also be observed among the company's staff. Among the IDPs, there is a significant number of children who could also be subject to exploitation and abuse because of their situation.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Civil works ;<br>Assembly and installation of equipment;<br>Solid and liquid waste management.<br>Operation and daily monitoring of the plant ;<br>Preventive and corrective maintenance ;<br>Management of sanitation facilities and works ; | Creation of temporary jobs<br>Compensation for losses of affected property<br>Business opportunities and payment of taxes | Nature: positive impact<br>Intensity: medium<br>Scope: local<br>Duration: long | **Average** |

### *5.3.3 During the dismantling and closure phase*

The dismantling and closure phase will concern the construction site and the solar power plant. The following activities will be carried out on the one hand for the construction site and on the other hand for the solar power plant site.

The closure and rehabilitation of the construction site will involve activities such as the dismantling of equipment and removal of machinery, the sorting and disposal of waste produced on the site and the restoration of the site. As for the activities at the power plant site, they will concern the dismantling of the power plant installations, the recycling/upgrading of the solar modules, the evacuation of the waste and the restoration of the site, the handing over of the used land to the authorities, the recycling of the

components (solar panels), the destruction and upgrading of the materials, the closure of the access roads and the restoration of the site and the access roads.

- **Impact on the physical environment**

**Impact on air quality and noise environment**

The dismantling and closure works will have a one-off impact on air quality, in particular through the raising of dust in the work areas and through emissions from the exhaust of vehicles and site machinery. This impact will mainly affect site personnel exposed to noise effects and likely to be affected by dust;

Noise from continuously operating machinery (e.g. generator) could be significant, while noise from circulating vehicles remains semi-permanent and spatially limited. This machinery noise will cause an alteration in the quality of the sound environment and a certain nuisance for the site personnel in particular.

Noise and dust will not affect the population as the site is uninhabited and located more than one kilometre from dwellings. However, in exceptional circumstances, harmattan winds could carry dust generated by the works to residential areas.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Dismantling of equipment and removal of machinery,<br>Sorting and disposal of waste produced on the site and the restoration of the site (plant and site base);<br>Decommissioning of plant facilities ;<br>Recycling/recovery of solar modules, destruction and recovery of materials, closure of access roads | Degradation of air quality and changes to the microclimate | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: long | **Minor** |
| | Alteration of the quality of the sound environment and vibrations | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: long | **Minor** |

**Impact on the relief and geomorphology of the soil**

During the dismantling and closure phase, the repeated passage of machinery and vehicles is likely to result in soil compaction, partial sealing and structural changes. Excavation work can lead to changes in the physical (density, depth, structure, etc.) and chemical (fertility) properties of the soil. During this phase, soil pollution can occur if the equipment used or the machinery is not of good quality or poorly maintained (hydrocarbon leaks), or if demolition waste is poorly managed (construction). At the end of dismantling, disturbed areas must be rehabilitated and vegetated to mitigate any negative impact.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Dismantling of equipment and removal of machinery, | Soil pollution | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: long | **Minor** |

| | | | |
|---|---|---|---|
| Sorting and disposal of waste produced on the site and the restoration of the site (plant and site base);<br>Decommissioning of plant facilities ;<br>Recycling/recovery of solar modules, destruction and recovery of materials, closure of access roads | Partial soil sealing | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: long | **Minor** |
| | Changes in the physical and chemical properties of soils | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: long | **Minor** |

**Impact on surface and groundwater**

The dismantling and closure works of the solar power plant do not require the withdrawal of water. Therefore, during the dismantling phase, there may be an impact on surface water due to the water used for watering the soil to mitigate dust lifting. Pollution may occur when emptying the septic tanks of the living base. In addition, there is also the management of demolition waste and used oil from vehicles and work equipment (generators, jackhammers, etc.). As for groundwater pollution, the impact is negligible because the water table is at a depth of between 90 and 120 m and the soil is impermeable.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Dismantling of equipment and removal of machinery,<br>Sorting and disposal of waste produced on the site and the restoration of the site (plant and site base);<br>Decommissioning of plant facilities ;<br>Recycling/recovery of solar modules, destruction and recovery of materials, closure of access roads | Deterioration of surface water quality | Nature: negative impact<br>Intensity: low<br>Scope: local<br>Duration: short | **Minor** |
| | Groundwater contamination and depletion | Nature: negative impact<br>Intensity: low<br>Scope: local<br>Duration: short | **Minor** |

- **Impact on the biological environment**

**Impact on the landscape and vegetation**

During the dismantling and closure phase, the works should not lead to the destruction of any plant species. The space that was occupied by the solar panels will be freed up. This space must be restored by planting trees. Felling may occur if control is not observed with regard to workers and the population.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Dismantling of equipment and removal of machinery,<br>Sorting and disposal of waste produced on the site and the restoration of the site (plant and site base);<br>Decommissioning of plant facilities ;<br>Recycling/recovery of solar modules, destruction and recovery of materials, closure of access roads | Re-vegetation of the power plant site | Nature: positive impact<br>Intensity: high<br>Scope: one-off<br>Duration: long | **Average** |

**Impact on wildlife and wildlife habitat**

During the dismantling and closure phase of the solar power plant, the work will have an impact on the microfauna that was re-established during the operational phase. But this disturbance will be short-lived. The restoration work will allow this microfauna and certain animals to return to the project site.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Dismantling of equipment and removal of machinery,<br>Sorting and disposal of waste produced on the site and the restoration of the site (plant and site base);<br>Decommissioning of plant facilities ;<br>Recycling/recovery of solar modules, destruction and recovery of materials, closure of access roads | Loss of animal species and microfauna | Nature: negative impact<br>Intensity: low<br>Scope: one-off<br>Duration: short | **Minor** |
| | Recolonisation of fauna | Nature: positive impact<br>Intensity: low<br>Scope: local<br>Duration: long | **Average** |

- **Impact on the human environment**

**Impact on demography and habitat.**

The dismantling and closure activities will not have an impact in terms of the inflow of potential job seekers into the project area of the solar power plant. The work in this phase does not require a large number of workers. Thus, the workers will be housed in the living quarters by the ZINA SOLAR project.

**Impact on land management and loss of habitat and property**

The decommissioning and closure of the solar power plant will allow the land to be returned to the PAPs. The land will be rehabilitated to allow for farming. Support will be provided to PAPs for a better use of the land.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Dismantling of equipment and removal of machinery,<br>Sorting and disposal of waste produced on the site and the restoration of the site (plant and site base);<br>Decommissioning of plant facilities ;<br>Recycling/recovery of solar modules, destruction and recovery of materials, closure of access roads | Revaluation of reclaimed agricultural land | Nature: positive impact<br>Intensity: low<br>Scope: local<br>Duration: long | **Average** |

**Impact on community health and safety and on workers**

The decommissioning and closure activities of the solar power plant would have an impact on the safety of the community as the work may constitute acts of inconvenience to the community. With regard to workers, the ZINA SOLAR project has an Occupational and Environmental Health and Safety team that deals with occupational health and safety issues.

**Impact on socio-economic activities and livelihoods**

Local employment

During the dismantling and closure of the solar power plant, the work will not require a large workforce. This is a very small employment opportunity for the young people of the communities affected. This impact is a positive but very small impact on young people.

Local economy and other activities

The dismantling and closure of the solar power plant will result in a loss of tax revenue for the municipalities and the state through income tax and entry fees. Also, this phase will be the stage of termination of service of companies, subcontractors and employees who were generating profits for the state through the collection of taxes.

The direct and indirect jobs created that served as sources of tax collection will no longer be effective: withholding tax for service providers and the Single Tax on Salaries (IUTS) for employees.

The major negative impact is the decrease in the amount of electrical energy for the local population. The lack of access to electricity will have negative effects on the living conditions of the population (health, education, quality of life, etc.).

Public infrastructure

The decommissioning and closure of the solar power plant will not have an impact on the destruction of public infrastructure, but will have an impact in terms of the service provided due to the reduction in the quantity of electricity, which will result in load shedding.

Living conditions, social cohesion and vulnerable people

During the dismantling and closure phase of the solar power plant, there will be risks to the health, social cohesion and safety of workers, neighbouring populations and the safety of property. The closure of the solar power plant may lead to a lack of electricity supply in the localities served by the solar power plant. This shortfall may hinder a number of activities that improve the living conditions and livelihoods of communities in the project areas. The loss of the solar power plant will have a negative impact insofar as the energy was used to carry out activities to support vulnerable people.

The cohabitation between the local population and the company's staff in charge of the works is likely to encourage GBV and ECV: rape, harassment, all kinds of abuse, negligence, exploitation, etc. This kind of violence can also be observed among the company's staff. Among the IDPs, there is a significant number of children who could also be subject to exploitation and abuse because of their situation.

| Source of impact | Impact | Criterion | Materiality |
|---|---|---|---|
| Dismantling of equipment and removal of machinery,<br>Sorting and disposal of waste produced on the site and the | Loss of temporary and permanent jobs | Nature: negative impact<br>Intensity: medium<br>Scope: one-off | **Average** |

| | | | |
|---|---|---|---|
| restoration of the site (plant and site base);<br>Decommissioning of plant facilities ;<br>Recycling/recovery of solar modules, destruction and recovery of materials, closure of access roads | Loss of business opportunities and payment of taxes<br>Loss of energy | Duration: long | |

## 5.4 Proposal of mitigation, compensation and enhancement measures for impacts

This section is devoted to the formulation of mitigation, compensation and enhancement measures for the potential impacts identified and assessed in the previous sections. Mitigation measures are actions that aim to prevent or reduce the significance of a negative impact on the environment. This is done in order to allow a better integration of the project in the receiving environment and to maximise the benefits. Compensation measures aim to offset the effect of an impact that cannot be mitigated. Finally, the measures to improve the positive impacts concern the measures to be taken to enable the population to improve their living environment and standard of living. These measures are described according to the three main phases of the project: preparatory, construction and operation.

### *5.4.1 Preparation, construction, operation and dismantling and closure phase*

The measures will be presented according to the different receiving environments: physical, biological and human

**Measures for the protection of the physical environment**

The measures will be presented according to the different components of this environment. These are: air quality and noise environment, relief and geomorphology of the soil, surface and groundwater and climate change.

- **Air quality and noise environment**
  - comply with the various standards on ambient air quality and on the discharge of emissions from facilities and logistics in accordance with national regulations and WHO standards;
  - watering the traffic lanes on and around the site at least twice a day;
  - providing workers with appropriate work equipment (PPE)
  - Minimise work during high temperatures and thermal inversions;
  - carry out mechanical tillage after watering the soil or after rain;
  - adapting work periods to the local context where possible;
  - install mufflers on the engines of generators and trucks and adjust the orientation of the exhaust;
  - choice of low-noise equipment.

- **Relief and soil geomorphology**
  - planting to reduce soil erosion;

- awareness and training of workers handling chemicals (hydrocarbons, lubricants, hydraulic binders, bitumen, etc.) to minimise accidental spills on the ground
- Set up a systematic system for the recovery of engine oil and its proper storage;
- set up a system for the regular collection and removal of waste and its disposal at an authorised landfill;
- carry out regular inspections of machinery to avoid accidental spills of toxic or hydrocarbon products;
- sign contracts with approved waste management service providers;
- Establish an adequate effluent management system to avoid deliberate or accidental spills.

- **Surface and groundwater**
  - minimise the pressure on surface waters used by communities;
  - make payments of the surface water abstraction tax (SWAT) for surface water abstractions for the execution of the works;
  - implement an adequate effluent management system to avoid deliberate or accidental spills;
  - Establish an adequate effluent management system for the base camp to avoid any deliberate or accidental spills;
  - direct runoff and drainage water to bypass areas where soils are susceptible to erosion and infiltration and apply mitigation measures to avoid soil contamination;
  - ensure the maintenance and washing of machinery and vehicles at the sites provided for this purpose;
  - implement anti-erosion measures (gabions, stone barriers);
  - to set up groundwater protection areas in accordance with the regulations

- **climate change**
  - comply with technical building standards;
  - respecting the limits of deforestation ;
  - carry out compensatory reforestation.

**Measures for the protection of the biological environment**

The measures will be presented according to the different components of this environment. These are: the landscape and vegetation and the fauna and its habitat.

- **Landscape and vegetation**
  - minimise the number of trees to be felled during the works;
  - to accompany local reforestation initiatives by supporting village groups, local associations, non-governmental organisations (NGOs), etc. in their environmental activities;

- Carry out and maintain compensatory planting on the site and in community locations (schools, health centres, communal forests, etc.);
- support PAPs in the management of compensatory plantings.

- **Wildlife and its habitat**
  - prohibit the hunting of animal species on the site;
  - help restore wildlife habitats on sites and access routes;
  - contribute to limiting the degradation of surface water quality, which in turn will limit the loss of wildlife (terrestrial and aquatic) and domestic animals.

**Measures for the protection of the human environment**

The measures will be presented according to the different components of this environment. These are: demography and habitat, land management and loss of habitat and property, health and safety of communities and workers, cultural and archaeological heritage (monuments, sacred sites, etc.) and socio-economic activities and livelihoods.

- **Demography and housing and social cohesion**
  - provide housing in the base for subcontractors' workers to avoid pressure on the village habitat;
  - to provide adequate health care equipment within the site to avoid pressure on the local health centre:
  - communicate effectively with communities and involve their local authorities;
  - encourage the recruitment of local workers;
  - raising workers' awareness of the customs and habits of the environment.
- **Land management and loss of habitat and property**
  - to accompany the PAPs receiving compensation in order to manage their compensation properly;
  - Establish a framework for exchange with PAPs to take their concerns into account;
- **Health and safety of communities and workers**
  - setting up an in situ health unit to provide first aid in case of accidents or illnesses before transfer to a reference health centre
  - Strengthen the capacity of health centres with health care products and materials;
  - implement a programme to combat STIs, HIV/AIDS and unwanted pregnancies for site staff, the local population and the general public
  - set up a system of user awareness signs.
  - Conducting disease awareness sessions (STIs and HIV, COVID 19).
- **Cultural and archaeological heritage (monuments, sacred sites, etc.)**
  - set up a preventive archaeology procedure to avoid the destruction of potential remains.

- Establish an incidental findings procedure and require subcontractors to comply with this procedure as part of their contract.
- make all workers aware of the content of the stop procedure in case of a threat to an archaeological or culturally important site.

- **Socio-economic activities and livelihoods**
  - Include a clause on the employment of local labour and the use of labour-intensive techniques for certain works in the companies' specifications;
  - inform communities of employment opportunities as they arise, and of the need for goods and services that can be provided locally;
  - encourage local employment by security subcontractors and inform them of local specificities and validate their methods and rules to avoid conflicts with local actors.
  - Raising awareness among local people about the possibilities of developing local entrepreneurship initiatives, in particular catering and the sale of food and basic necessities.

# 6 RISK ANALYSIS

The assessment methodology is based on the International Finance Corporation (IFC) General EHS Guidelines: Environment - Hazardous Materials Management (Environmental, Health and Safety Guidelines, 30 April 2007) and the US Environmental Protection Agency (US EPA) Title 40 CFR parts 68, 112 and 355.

More specifically, the methodology used for hazard and risk assessment is Preliminary Risk Analysis (PRA), which is based on hazard identification and risk estimation (HAZID).

The risk assessment is used to plan preventive actions during the implementation works, taking into account the priorities. The methodology used consists mainly of three steps:

- identification of risk situations related to the construction and operation of the plant;
- the estimation for each hazardous situation of the severity of the potential damage and the frequency of exposure;
- prioritisation of risks to determine the priorities of the action plan.

## 6.1 Risk identification and assessment

The identification of risks was based on feedback (occupational accidents and illnesses) from electrical infrastructure worksites and site visits. The stakeholder consultation campaign was also a means of identifying and assessing the potential risks of the project on the biophysical and human environment of the area. The risks identified are as follows:

- risk of hearing damage for local residents and site personnel;
- risks of contamination of surface water and groundwater ;
- risks of accidents and incidents at work and occupational diseases related to the handling of machinery ;
- risks of falling on the same level and when working at height;
- risks of developing gender-based violence (GBV) ;
- EAS/HS risks;
- risk of social conflict ;
- risks of transmission of sexual diseases (STI/HIV/AIDS) ;
- risks of spreading COVID-19;
- risks of damage to the health, safety and hygiene of workers and the surrounding population;
- risks of deterioration of archaeological remains ;
- risk of fire and electric shock ;
- risks of destruction of facilities and disruption of energy production due to the effects of climate change;
- risks of proliferation of waste electrical and electronic equipment (WEEE) ;
- vandalism of the park, theft.

For risk assessment, a scoring system has been adopted. This scoring is done in order to define the important risks and prioritise prevention actions. The criteria that were taken into account in this assessment are: the frequency of the task to be performed that contains the risk and the severity of the accident/incident.

### 6.2 Presentation of the risk assessment grid

The estimation of risk consists of considering two factors for each hazardous situation: the frequency of exposure to the hazard and the severity of the potential damage. The frequency levels can range from low to very frequent and the severity levels from low to very severe.

Table 13Levels of factors in the risk assessment grid

| **Probability scale (P)** | | **Gravity scale (G)** | |
|---|---|---|---|
| **Score** | **Meaning** | **Score** | **Meaning** |
| **P1** = Very unlikely | Once every 10 years, | G1 = low | Reversible accident or illness without time off work |
| **P2** = Unlikely | Once a year, | G2 = average | Reversible accident or illness with time off work |
| **P3** = Likely | Once a month, | G3 = severe | Accident or illness with partial permanent disability |
| **P4** = Very likely | Once a week or more, | G4 = very severe | Accident or fatal illness |

Source: IPEAD 2022 Mission

The risk is evaluated by the formula: R (risk) = G (severity) x P (probability), a "criticality matrix" is established and makes it possible to see the acceptable and unacceptable risks, but also the prioritisation of actions, which go from 1 to 3. Crossing frequency and severity gives the level of priority

Table 14Risk assessment grid

| | **Probability** | | | |
|---|---|---|---|---|
| **Gravity** | P1 | P2 | P3 | P4 |
| G4 | 4 | 8 | 12 | 16 |
| G3 | 3 | 6 | 9 | 12 |
| G2 | 2 | 4 | 6 | 8 |
| G1 | 1 | 2 | 3 | 4 |

Source: IPEAD 2022 Mission

Table 15 : Meaning of the colours in the risk assessment grid

| Colour code | Priority level | Meaning of the colours |
|---|---|---|
| | Priority 1 | While the red colour represents an unacceptably high risk that requires one of the highest priority actions |
| | Priority 2 | The colour yellow indicates a high risk. In this case the priority for action is 2 |
| | Priority 3 | A very limited risk will have a green colour. In this case the priority for action is third order |

Source: IPEAD 2022 Mission

### 6.3 Analysis of the environmental and social risks of the project

Among the risk situations linked to the project, the present study has identified risks of hearing disorders for local residents and site personnel, surface and groundwater pollution, accidents and work-related incidents and occupational illnesses linked to the handling of machinery, falls from the ground during work at height, the development of gender-based violence (GBV), EAS/HS, social conflicts, the spread of COVID-19 and STIs, and the risk of accidents to workers and the neighbouring population, the proliferation of WEEE, fire and electrocution, the destruction of installations and the disruption of energy production due to the effects of climate change, and security (vandalism of the park, theft, terrorist attack). The risks of fire and electrocution, the spread of COVID-19, the development of gender-based violence (GBV), EAS/HS, accidents and incidents at work and occupational diseases are assessed as high and will require the implementation of priority actions. The summary of the results of the analysis of the identified risks is recorded in Table 15.

Table 16 : Summary of the environmental and social risk assessment

| Component | Risks | Description and analysis | Risk assessment before prevention | | |
|---|---|---|---|---|---|
| | | | Probability | Gravity | Level of risk |
| Sound environment | Risk of hearing impairment for local residents and construction workers | The main risks arising from the implementation of the project stem from the traffic flow of the trucks, their speed and the noise generated. With regard to noise, the World Health Organisation suggests a maximum peak level of 45 dB(a) at night in a bedroom. During the day, a maximum level of 55 dB(a) is proposed outside. The outdoor level may be exceeded occasionally when trucks are passing by | 2 | 2 | **4** |
| Surface and groundwater | Surface and groundwater contamination | The supply, storage and distribution of hydrocarbons could lead to accidental spills and discharges of waste oil from the operation of machinery. The discharge of these wastes would contribute to soil pollution and, through the phenomenon of run-off/infiltration, to surface and ground water, the consumption of which could lead to illnesses | 2 | 2 | **4** |
| Health and safety | Occupational accidents and incidents and occupational diseases related to the handling of machinery | During the preparatory and construction phases, there will be risks of accidents related to the movement of construction equipment, the transport of personnel and the movement of people. Occupational illnesses due to physical effort or repetitive movements and bad posture, etc., may also occur. These risks of accidents and occupational diseases are linked to handling activities. However, they could also be caused by the movement of mobile machinery (collision, skidding), by the load being handled (falling objects, tipping over), or by the poor handling of work tools. Illnesses can also be caused by inhalation of various building site dusts. | 3 | 3 | **9** |
| | Falls on the ground and when working at height | Free falls of people or objects could occur during work at height (raising walls, setting up scaffolding, fixing electricity poles, etc.). Falls on the same level and falls from heights are respectively the second and third most common causes of work accidents in the construction industry | 3 | 3 | **9** |
| Health and safety | Spread of COVID-19 and communicable diseases (STI AIDS) | The power plant construction project will be carried out with the COVID 19 pandemic. Indeed, during the preparatory, construction and operation phases, there will be a large influx of people, including company personnel, members of control missions, | 4 | 4 | **16** |

| Component | Risks | Description and analysis | Risk assessment before prevention | | |
|---|---|---|---|---|---|
| | | | Probability | Gravity | Level of risk |
| | | suppliers and other service providers, and local workers. All these people are exposed to COVID-19 and the mixing with the local population could lead to an aggravating situation. The presence of these personnel can lead to the proliferation of sexual diseases (STI-AIDS) | | | |
| | Deterioration of the health, safety and hygiene of workers and the surrounding population | During the preparation, construction and operation phase, poor waste management could lead to a deterioration in health and safety and thus in the short to medium term to occupational diseases. Also the intense work without rest could lead to health problems. | 2 | 2 | **4** |
| | Risk of fire and electric shock | This is a serious risk of burns or injury to people as a result of fire or electrocution. They can lead to material and physical damage (to staff during network and cabin maintenance activities) or even to the beneficiary population. These dangerous situations may well be encountered in the work area and among new subscribers; indeed, ignorance of the risks associated with electricity may lead to electrocution of unwary users, and failure to follow safety instructions may lead to this phenomenon among workers during line maintenance. | 4 | 4 | **16** |
| VBG | Increase in gender-based violence (GBV) | During the construction phase, the sub-project could lead to an influx of workers into the area. This influx of workers from various backgrounds could lead to deviant behaviour (sexual harassment, violence against children etc.). | 3 | 3 | **9** |
| Human | Risk of social conflicts | The arrival of the personnel of the contracting companies will certainly contribute enormously to the animation of the social life of the localities concerned by the Project, but it is also likely to generate conflicts and real upheavals in the existing social relationships. Indeed, the staff, having relatively large financial means at their disposal, could voluntarily or involuntarily disrupt the pre-existing social order in the villages adjacent to the project site and cause the dislocation of certain social links (families, households, traditional, etc.). Such situations could be a source of conflict and/or confrontation that could threaten social cohesion and peace. Furthermore, social conflicts could possibly arise as a result of the non-recruitment of young people | 2 | 2 | **4** |

| Component | Risks | Description and analysis | Risk assessment before prevention | | |
|---|---|---|---|---|---|
| | | | Probability | Gravity | Level of risk |
| | | in the localities concerned or the non-respect of local customs and habits (acts of adultery, non-respect of prohibitions, theft, etc.). Behaviour that defies local mores and customs (acts of adultery, unwanted pregnancies, theft, non-respect of prohibitions, etc.) attributable to site personnel can lead to conflicts and block the progress of work. The same applies to gender-based violence, in particular sexual and moral harassment, sexual abuse, attempted rape and rape of young girls, widows and minors, not forgetting the use of prostitutes. | | | |
| Archaeological remains | Deterioration of archaeological remains | No sacred sites were identified at the time of land acquisition. However, it is possible that cultural property may be discovered during excavation activities. Incidental discoveries will be subject to appropriate measures as recommended by international good practice. | 2 | 2 | **4** |
| Operation of services and security | Risk of destruction of facilities and disruption of energy production due to climate change effects | Climate change events such as increased temperature, increased wind speed, thunderstorms, lightning, hail, etc., can pose risks to the plant's facilities:<br>high temperatures can lead to a decrease in the efficiency of the photovoltaic panels;<br>winds can cause dust to settle and increase the frequency of cleaning;<br>torrential rain, lightning, hail and strong winds can destroy the supports and plates.<br>This may result in a disruption of the electricity supply, with consequent disruptions to the operation of government and technical services, basic social services, socio-economic activities and security services. | 4 | 2 | **8** |
| Climate | Risk of proliferation of WEEE | During construction and operation, project activities will generate waste electrical and electronic equipment (WEEE) and hazardous industrial waste (HIW). If not managed under a controlled system, these wastes can be misused or proliferate in nature with negative impacts on the environment and health. The environmental damage is most harmful during the final disposal of these wastes, as the toxic substances are discharged directly onto the soil, which can contaminate it and contaminate water. When burned, WEEE and IEDs contribute to polluting the ambient air and form polluting ash heaps and substances that contribute to the production of greenhouse | 2 | 4 | **8** |

| Component | Risks | Description and analysis | Risk assessment before prevention | | |
|---|---|---|---|---|---|
| | | | Probability | Gravity | Level of risk |
| | | gases in the atmosphere. The implementation of hazardous waste management systems will clean up the environment of the area and thus protect the biophysical environment and the climate. | | | |
| Safety and security of facilities | Park vandalism, theft, terrorist attack | During the operating phase, the plant's facilities may be destroyed, which could be due to<br>the attraction of the equipment for a certain group of people who are looking for solar panels in a fraudulent way.<br>the failure to meet the expectations of the population with regard to the sub-project, which could lead to movements of discontented crowds, with the power station being the target of their anger. | 2 | 4 | **8** |

Source: IPEAD 2022 Mission

## 6.4 Environmental and social risk management measures

Environmental and social risk management measures have been proposed. These measures take into account the potential risks of the project. The table above presents the different measures observed.

Table 17 : Environmental and social risk management measures

| Components | Risks | Description and analysis | Risk management measures |
|---|---|---|---|
| **Sound environment** | **Risk of hearing impairment for local residents and construction workers** | The main risks arising from the implementation of the project stem from the traffic flow of the trucks, their speed and the noise generated. With regard to noise, the World Health Organisation suggests a maximum peak level of 45 dB(a) at night in a bedroom. During the day, a maximum level of 55 dB(a) is proposed outside. The outdoor level may be exceeded occasionally when trucks are passing by | - Implementation of an accident prevention and safety plan :<br>- inform users and local populations of the safety instructions for the site;<br>- install signage inside and outside the site<br>- ensure that drivers are properly trained;<br>- carry out proper maintenance and regular testing to reduce the possibility of brake failure;<br>- Equip all machines with a protective structure associated with a safety belt to keep the driver safe in the event of a rollover, a reversing display and warning system, ergonomic access, adapted cabs and protection against falling objects;<br>- establish internal regulations and post safety instructions on the site; |
| **Surface and groundwater** | **Surface and groundwater contamination** | The supply, storage and distribution of hydrocarbons could lead to accidental spills and discharges of waste oil from the operation of machinery. The | Implementation of measures to reduce surface and groundwater contamination : |

| Components | Risks | Description and analysis | Risk management measures |
|---|---|---|---|
| | | discharge of these wastes would contribute to soil pollution and, through the phenomenon of run-off/infiltration, to surface and ground water, the consumption of which could lead to illnesses | - prepare and implement a construction waste management and disposal plan;<br>- carrying out IEC towards workers and local populations;<br>- set up storage and retention bins for waste; |
| **Health and safety** | **Occupational accidents and incidents and occupational diseases related to the handling of machinery** | During the preparatory and construction phases, there will be risks of accidents related to the movement of construction equipment, the transport of personnel and the movement of people. Occupational illnesses due to physical effort or repetitive movements and bad posture, etc., may also occur. These risks of accidents and occupational diseases are linked to handling activities. However, they could also be caused by the movement of mobile machinery (collision, skidding), by the load being handled (falling objects, tipping over), or by the poor handling of work tools. Illnesses can also be caused by inhalation of various construction site dusts. | Implementation of an Occupational Injury and Illness Prevention Plan :<br>- ensure that drivers are properly trained;<br>- carry out proper maintenance and regular testing to reduce the possibility of brake failure;<br>- Equip the machines with a protective structure associated with a safety belt that holds the driver in place in the event of a rollover, a display and reversing warning system, ergonomic access, adapted cabs and protection against falling objects;<br>- Establish internal regulations and post safety instructions on the site;<br>- train staff in workplace safety ;<br>- Establish procedure sheets for the use of machines ;<br>- ensure that personal protective equipment (PPE) is worn: helmets, safety boots, appropriate gloves etc. |
| | **Falls on the ground and when working at height** | Free falls of people or objects could occur during work at height (raising walls, setting up scaffolding, fixing electricity poles, etc.). Falls on the same level and falls from heights are respectively the second and third most common causes of work accidents in the construction industry | |

| Components | Risks | Description and analysis | Risk management measures |
|---|---|---|---|
| **Health and safety** | **Spread of COVID-19 and communicable diseases (STI AIDS)** | The power plant construction project will be carried out with the COVID 19 pandemic. Indeed, during the preparatory, construction and operation phases, there will be a large influx of people, including company personnel, members of control missions, suppliers and other service providers, and the local workforce. All these people are exposed to COVID-19 and the mixing with the local population could lead to an aggravating situation. The presence of these personnel can lead to the proliferation of sexual diseases (STI-AIDS) | Risks of COVID-19 contamination:<br>- Develop a COVID19 pandemic influenza prevention plan to address risks and sources of exposure, transmission routes;<br>- raise awareness among workers and local populations about the fight against COVID19 ;<br>- Wear medical masks or other locally made masks;<br>- apply social distancing throughout the sub-project area<br>- confine people contaminated with COVID-19;<br>- observe the barrier measures ;<br>- develop and implement company procedures for worker protection and infection control.<br>- ensure that women are able to obtain information on how to prevent and respond to the epidemic in an understandable way<br>- developing targeted strategies for women's economic empowerment or exploring |

| Components | Risks | Description and analysis | Risk management measures |
|---|---|---|---|
| | **Deterioration of the health, safety and hygiene of workers and the surrounding population** | During the preparation, construction and operation phase, poor waste management could lead to a deterioration in health and safety and thus in the short to medium term to occupational diseases. Also the intense work without rest could lead to health problems. | Implementation of a special health, safety and hygiene plan for workers and the surrounding population:<br>- Use approved products in the maintenance of green spaces and premises;<br>- raise awareness of the ways in which dangerous products are used and stored;<br>- ensure proper waste management (sorting, storage and disposal ;<br>- respecting working time and avoiding intense mental work<br>- Equipping facilities with fire extinguishers and training staff in their use |
| | **Risk of fire and electric shock** | This is a serious risk of burns or injury to people as a result of fire or electrocution. They can lead to material and physical damage (to staff during network and cabin maintenance activities) or even to the beneficiary population. These dangerous situations may well be encountered in the work area and among new subscribers; indeed, ignorance of the risks associated with electricity may lead to electrocution of unwary users, and failure to follow safety instructions may lead to this phenomenon among workers during line maintenance. | Implementation of a fire and electrocution risk reduction plan :<br>- to raise awareness of the risks of electrocution due to misuse or incorrect household connections;<br>- Develop and distribute awareness-raising manuals on good practice in the use of electricity; |

| Components | Risks | Description and analysis | Risk management measures |
|---|---|---|---|
| | | | - require the wearing of appropriate PPE during maintenance work on the electricity network;<br>- train staff in fire extinguishing. |
| **VBG** | **Increase in gender-based violence (GBV)** | During the construction phase, the sub-project could lead to an influx of workers into the area. This influx of workers from various backgrounds could lead to deviant behaviour (sexual harassment, violence against children etc.). | Implementation of a risk reduction plan on GBV :<br>- raise awareness of GBV among workers<br>- avoiding the employment of minors on the site |
| **Human** | **Risk of social conflicts** | The arrival of the personnel of the contracting companies will certainly contribute enormously to the animation of the social life of the localities concerned by the Project, but it is also likely to generate conflicts and real upheavals in the existing social relationships. Indeed, the staff, having relatively large financial means at their disposal, could voluntarily or involuntarily disrupt the pre-existing social order in the village adjacent to the project site and cause the dislocation of certain social ties (families, households, traditional, etc.). Such situations could be a source of conflict and/or confrontation that could threaten social cohesion and peace. Furthermore, social conflicts could possibly arise as a result of the non-recruitment of young people in the localities concerned or the non-respect of local customs and habits (acts of adultery, unwanted pregnancies, non-respect of prohibitions, theft, etc.). Behaviour that defies local customs and mores (adultery, theft, failure to respect | Implementation of a risk reduction plan on social conflicts :<br>- prioritise the recruitment of local labour for unskilled work<br>- fencing off the site of the solar power plant so that it can be better monitored<br>- compensate for felled trees through reforestation<br>- raise awareness<br>- set up the consultation and complaints management framework<br>- raise awareness against unwanted pregnancies |

| Components | Risks | Description and analysis | Risk management measures |
|---|---|---|---|
| | | prohibitions, etc.) attributable to site personnel can lead to conflicts and block the progress of work. The same applies to gender-based violence, in particular sexual and moral harassment, sexual abuse, attempted rape and rape of young girls, widows and minors, not to mention the use of prostitutes. | |
| **Archaeological remains** | **Deterioration of archaeological remains** | No sacred sites were identified at the time of land acquisition. However, it is possible that cultural property may be discovered during excavation activities. Incidental discoveries will be subject to appropriate measures as recommended by international good practice. | Implementation of a safeguarding plan for religious property :<br>- stop the work immediately and inform the services in charge of culture and the local authorities if cultural or archaeological remains are discovered;<br>- to accompany the location and protection of the remains discovered on the sub-project site;<br>- inform staff in advance of what to do in the event of an accidental discovery of remains. |
| **Operation of services and security** | **Risk of destruction of facilities and disruption of energy production due to climate change effects** | Climate change events such as increased temperature, increased wind speed, thunderstorms, lightning, hail, etc., can pose risks to the plant's facilities:<br>high temperatures can lead to a decrease in the efficiency of the photovoltaic panels;<br>winds can cause dust to settle and increase the frequency of cleaning;<br>torrential rain, lightning, hail and strong winds can destroy the supports and plates. | - take into account wind speeds and heavy rainfall when designing the supports for the plates;<br>- take into account the deficit in the management of energy distribution in the event of a temperature rise;<br>- provide a back-up unit to cover the energy deficit;<br>- Provide sufficient water for cleaning the solar panels (0.10 litres per square metre of panel). |

| Components | Risks | Description and analysis | Risk management measures |
|---|---|---|---|
| | | This may result in a disruption of the electricity supply, with consequent disruptions to the operation of government and technical services, basic social services, socio-economic activities and security services. | - maintain a strong collaboration with the weather service to have up-to-date data;<br>- landscaping around the power plant (to create a microclimate, provide a windbreak and mitigate dust);<br>- install a lightning protection system |
| **Climate** | **Risk of proliferation of WEEE** | During construction and operation, project activities will generate waste electrical and electronic equipment (WEEE) and hazardous industrial waste (HIW). If not managed under a controlled system, these wastes can be misused or proliferate in nature with negative impacts on the environment and health. The environmental damage is most harmful during the final disposal of these wastes, as the toxic substances are discharged directly onto the soil, which can contaminate it and contaminate water. When burned, WEEE and IEDs contribute to polluting the ambient air and form polluting ash heaps and substances that contribute to the production of greenhouse gases in the atmosphere. The implementation of hazardous waste management systems will clean up the environment of the area and thus protect the biophysical environment and the climate. | - Store in a container and evacuate (Europe or elsewhere) at the end of the construction period for<br>- Store in a dedicated area and recycle<br>- Selective storage on site to avoid leakage of oils and hydrocarbons into the soil, surface or ground water. Send to a specialised disposal facility, or recycling if available;<br>- Conducting an IEC campaign on hazardous waste for the population and workers |
| **Safety and security of facilities** | **Park vandalism, theft, terrorist attack** | During the operating phase, the plant's facilities may be destroyed, which could be due to | - build the fence of the power plant according to the ODA (minimum height 2m with barbed wire);<br>- install surveillance cameras ; |

| Components | Risks | Description and analysis | Risk management measures |
|---|---|---|---|
| | | The attraction of the equipment for a certain group of people in search of solar panels in a fraudulent manner.<br>The failure to meet the expectations of the population with regard to the sub-project could lead to movements of discontented crowds, with the power station being the target of their anger. | - collaborate with the defence and security forces ;<br>- working with the city council ;<br>- raise awareness of the protection of facilities |

Source: IPEAD 2022 data

# 7 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The objective of this ESMP is to ensure that the project complies with Burkina Faso's national legislation and the International Finance Corporation's international standards for environmental and social management. The ESMP describes the following programmes:

- programme for the implementation of mitigation, compensation and enhancement measures for impacts and risks ;
- environmental monitoring and follow-up programme ;
- capacity building programme ;
- cost estimates for the various ESMP programmes.

## 7.1 Programme for the implementation of mitigation, compensation and enhancement measures for impacts and risks ;

This section presents the monitoring and performance indicators, the implementing actors and the costs of the programme for the implementation of mitigation, compensation and remediation measures for impacts and risks;

The table above shows the implementation programme for the mitigation and compensation measures.

Table 18 : Implementation programme for impact mitigation and compensation measures

| Project phases | Environmental component affected | Potential impacts | Mitigation or compensation measures | Performance monitoring indicators | Responsibility | | | Timetable for implementation | Costs (FCFA) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Execution | Monitoring | Follow-up | | |
| **In environmental terms** | | | | | | | | | |
| **Preparation and construction** | Landscape and topography | Changes in landscape and morphology | Implementation of a Borrow Site Operation and Maintenance Plan | 100% of the degraded areas have been rehabilitated;<br><br>80% of the plants planted have reached a height of 1.5m | Contracting company | Business environment expert | AMEA POWER ZINA SOLAR - ANEVE | During the works | Included in the company's contract costs |
| | Air | Degradation of air quality | Implementation of a plan to reduce dust and gas emissions | Number of times the platform and access road are watered per day | Contracting company | Business environment expert | AMEA POWER ZINA SOLAR - ANEVE, DRE Town Hall | During construction | 6 920 000 |
| | Sound environment | Noise pollution | Implementation of a plan to reduce or eliminate noise pollution | 100% of workers are equipped and wear PPE including ear muffs<br>100% of the equipment on site is in good condition. | Contracting company | Business environment expert | AMEA POWER, ZINA SOLAR, ANEVE, DRE, Town Hall | During construction | 1230 000 |
| | Surface and subterranean water | Water pollution and water quantity reduction. | Implementation of a Surface and Groundwater Protection Plan | 100% of the storage and retention bins have been installed<br>100% of solid and liquid waste is collected and transferred to the city's landfill for recycling | Contracting company | Business environment expert | AMEA POWER, ZINA SOLAR - ANEVE, DRE Town Hall | During the construction works | Included in the company's contract costs |

| Project phases | Environmental component affected | Potential impacts | Mitigation or compensation measures | Performance monitoring indicators | Responsibility | | | Timetable for implementation | Costs (FCFA) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Execution | Monitoring | Follow-up | | |
| | Soils | Pollution, modification and weakening of soil structure and texture | Implementation of a Soil Protection Plan | 100% of degraded areas are restored | Contracting company | Business environment expert | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE Town Hall | During the works | 1 500 000 |
| **Preparation and construction** | Vegetation | Loss of trees | Reforestation to compensate for felled trees on the project site and borrow areas | 100% of the felled trees were compensated<br>80% of the plants planted have reached a height of 1.5m | Contracting company | Business environment expert | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE Town Hall | During the works | 3 012 500 |
| | Wildlife | Disturbance of wildlife tranquillity / destruction of wildlife habitat | Implementation of a plan for the restoration and protection of natural wildlife habitats | 100% of identified stakeholders are reached by IEC (Information Education Communication) actions | Contracting company | Business environment expert | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE Town Hall | During the works | 805 000 |
| **Operation** | Soil, air and noise | Waste generation and air pollution | Implementation of a waste management plan | 100% of the WEEE and IDW produced is sorted.<br>The WEEE and WID treatment sites are identified;<br>A transfer protocol to the treatment sites is established. | ZINA SOLAR | Environmental expert | - AMEAPOWER,<br>- ANEVE, DRE Town Hall | During operation | Included in the cost of operation |

| Project phases | Environmental component affected | Potential impacts | Mitigation or compensation measures | Performance monitoring indicators | Responsibility | | | Timetable for implementation | Costs (FCFA) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Execution | Monitoring | Follow-up | | |
| | Groundwater Floors | Water quantity reduction, water and soil pollution. | Implementation of a plan to reduce water consumption | Level of water consumption | ZINA SOLAR | Environmental expert | - AMEA POWER,<br>- ANEVE, DRE Town Hall | During operation | Included in the cost of operation |
| | Vegetation | Degradation of spared natural plant species and impact on landscaping | Maintain spared plant species;<br>Implementing the landscape plan | State of the landscaping and the appearance of the natural vegetation | ZINA SOLAR | Environmental expert | - AMEA POWER<br>- ANEVE, DRE | During operation | Included in the cost of operation |
| | Wildlife | Recolonisation of the site by fauna and microfauna | Prohibit poaching in the site;<br>Avoiding practices that disturb wildlife | Presence of fauna and microfauna | ZINA SOLAR | Environmental expert | | | Included in the cost of operation |
| **Closure and dismantling** | Landscape and topography | of the solar panel site<br>and landscape change | restoration of the construction site and the site of the solar power plant | 100% of the land rehabilitated | Contracting company | Environmental expert of the contracting company | - AMEA POWER<br>- ZINA SOLAR<br>- ANEVE, DRE Town Hall | End of operation | Included in the construction cost |
| | Soil<br>Water<br>Air<br>noise | Deterioration of soil, water and air quality | Development and implementation of a Closure and Rehabilitation Plan at the end of the works and at the end of the plant's life | Existence of a closure and decommissioning plan<br><br>100% of registered complaints are dealt with | Contracting company | Business environment expert | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE Town Hall | End of operation | Included in the cost of the work |

| Project phases | Environmental component affected | Potential impacts | Mitigation or compensation measures | Performance monitoring indicators | Responsibility | | | Timetable for implementation | Costs (FCFA) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Execution | Monitoring | Follow-up | | |
| | Vegetation | Degradation of the construction site and the solar panel site and modification of the landscape | Reforestation following dismantling works and restoration of degraded areas | 100% of the power plant site and the construction site have been reforested and rehabilitated and 80% of the plants planted have reached a height of 1.5m | Contracting company | Business environment expert | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE Town Hall | End of operation | Included in the cost of the work |
| | Wildlife | Disturbance of wildlife tranquillity / destruction of wildlife habitat | Implementation of a plan for the restoration and protection of natural wildlife habitats | Presence of small fauna and avifauna in the area | Project | Business environment expert | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE Town Hall | End of operation | Included in the cost of the company's contract |
| **Total 1** | | | | | | | | | |
| **On a human level** | | | | | | | | | |
| **Preparation/construction/operation** | Land | Loss of arable land and other land resources | Implementation of the compensation plan for Project Affected Persons Implementation of the MGP | 100% of PAPs were compensated | Contracting company | Business environment expert Monitoring actors | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE Town Hall PAPs' representatives and Chair of the DVC | Before the work | Included in the PRME |
| | Public health and safety | Damage to human health | Implementation of a safety plan | 100% of the access roads to the plant | Company | | - AMEA POWER,<br>- ZINA SOLAR | During the works | 862 500 |

| Project phases | Environmental component affected | Potential impacts | Mitigation or compensation measures | Performance monitoring indicators | Responsibility | | | Timetable for implementation | Costs (FCFA) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Execution | Monitoring | Follow-up | | |
| | | and safety of workers and the general public | for the execution of the work | site have traffic signs and speed bumps.<br>100<br>100% of workers wear PPE | | Business environment expert | - ANEVE, DRE Town Hall | | |
| | Social cohesion | Disruption of social cohesion | Implementation of a local recruitment plan | At least 25% of unskilled workers are from the region<br>Customary obligations have been met | Company | Business environment expert | - AMEA POWER,<br>- ZINA SOLAR<br>- DRE, Town Hall DRFPTPS | During the works | Included in the cost of the work |
| | Cultural and archaeological heritage | Destruction or disturbance of cultural and archaeological heritage | Implementation of a safeguarding plan for religious property | The remains discovered are protected | Company | Business environment expert | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE Town Hall<br>DVC and customary leaders | During the works | Included in the cost of the work |
| **Preparation/construction/operation** | Vulnerable persons | Deterioration of the situation of vulnerable people | Implementation of a plan for the protection of vulnerable persons | Number of temporary signs at work sites.<br>Number of awareness campaigns carried out. | Project | Business environment expert | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE Town Hall, DVC | During the works | Included in the cost of the work |
| | Workers and local communities | EAS/HS claims | Compliance with the code of conduct<br>Implementation of the MGP | Number of EAS/HS claims processed | Project | Corporate social expert | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE<br>- Town Hall Social action | During the works | Included in the cost of the work |

| Project phases | Environmental component affected | Potential impacts | Mitigation or compensation measures | Performance monitoring indicators | Responsibility | | | Timetable for implementation | Costs (FCFA) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Execution | Monitoring | Follow-up | | |
| Dismantling and closure | Land | Revaluations of lost arable land and other land resources | Implementation of the PAPs' land transfer plan | 100% of the land has been handed over | Project | Environmental expert of the contracting company | - ZINA SOLAR<br>- ANEVE, DRE<br>- Town Hall<br>PAPs' representatives and DVC chairpersons | End of operation | 862 500 |
| | Public health and safety | Damage to human health, safety of workers and the general public | Implementation of a health and safety diagnostic plan | Number of sick people and number of attacks in the project area | Project | Environmental expert of the contracting company | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE<br>- Town Hall | End of operation | |
| | Social cohesion<br>Vulnerable persons<br>Workers and local communities | Disruption of social cohesion<br>Deterioration of the situation of vulnerable people<br>Allegations of EAS/HS | Implementation of an awareness-raising plan on living together and protecting vulnerable people | Number of awareness-raising activities carried out<br>No aggression against vulnerable people | Project | Environmental expert of the contracting company | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE<br>- Town Hall | End of operation | |
| **Total 1** | | | | | | | | | **15 192 500** |

The table above shows the implementation programme for the mitigation and compensation measures.

**Table 19 :** Environmental and social risk implementation programme

| Project phase | Environmental component | Risks | Preventive measures | Responsibilities | | Costs (FCFA) |
|---|---|---|---|---|---|---|
| | | | | Monitoring | Follow-up | |
| PREPARATORY/CONSTRUCTION | Sound environment | Risk of accidents to staff and local residents due to machine movements | Implementation of an accident prevention and safety plan :<br>- inform users and local populations of the safety instructions for the site;<br>- install signage inside and outside the site<br>- ensure that drivers are properly trained;<br>- carry out proper maintenance and regular testing to reduce the possibility of brake failure;<br>- Equip all machines with a protective structure associated with a safety belt that holds the driver in place in the event of a rollover, a reversing display and signalling system, ergonomic access, adapted cabs and protection against falling objects;<br>- Establish internal regulations and post safety instructions on the site; | Contracting company | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE | Included in the cost of the work |
| | Surface and groundwater | Surface and groundwater contamination | Implementation of measures to reduce surface and groundwater contamination :<br>- prepare and implement a construction waste management and disposal plan;<br>- carrying out IEC towards workers and local populations;<br>- set up storage and retention bins for waste; | Contracting company | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE | Included in the cost of the work |

| Project phase | Environmental component | Risks | Preventive measures | Responsibilities | | Costs (FCFA) |
|---|---|---|---|---|---|---|
| | | | | Monitoring | Follow-up | |
| PREPARATORY/CONSTRUCTION | Health and safety | Occupational accidents and incidents and occupational diseases related to the handling of machinery | Implementation of an Occupational Injury and Illness Prevention Plan :<br>- ensure that drivers are properly trained;<br>- carry out proper maintenance and regular testing to reduce the possibility of brake failure;<br>- Equip the machines with a protective structure associated with a safety belt that holds the driver in place in the event of a rollover, a display and reversing warning system, ergonomic access, adapted cabs and protection against falling objects;<br>- establish internal regulations and post safety instructions on the site;<br>- train staff in workplace safety;<br>- Establish procedure sheets for the use of machines ;<br>- ensure that personal protective equipment (PPE) is worn: helmets, safety boots, appropriate gloves etc. | Contracting company | - AMEA POWER<br>- ZINA SOLAR<br>- ANEVE, DRE Regional Labour Directorate | Included in the cost of the work |
| PREPARATORY/CONSTRUCTION | Security | Falls on the ground and when working at height | Implementation of measures to reduce falls from the ground and during work at height :<br>Collective protection :<br>- organise storage (reserved spaces, storage methods adapted to the objects, width of aisles compatible with the handling equipment used).<br>- Use appropriate ladders for work at height;<br>- limit storage heights;<br>- mark out risk areas;<br>- backfill the excavations ;<br>- properly secure the loads being handled;<br>- raise awareness of safety measures among site personnel.<br>- wear personal protection<br>- Wear personal protective equipment (Harnett, safety shoes, helmets, etc.) | Contracting company | -AMEA POWER,<br>-ZINA SOLAR<br>-ANEVE, DRE Regional Labour Directorate | Included in the cost of the work |

| Project phase | Environmental component | Risks | Preventive measures | Responsibilities | | Costs (FCFA) |
|---|---|---|---|---|---|---|
| | | | | Monitoring | Follow-up | |
| PREPARATORY/CONSTRUCTION | Vulnerable persons | Increase in gender-based violence (GBV) | Implementation of measures to reduce gender-based violence (GBV) :<br>- take into account the aspects of GBV/ASR/HS when developing environmental and social contractual clauses;<br>- train workers on GBV/ASR/HS (including code of conduct, house rules, case management, PMM, etc.);<br>- Have workers sign the Code of Conduct before they are hired on site;<br>- identify and train community sensitizers to inform the community about GBV risks;<br>- Raise awareness in the community about GBV/ASA/HS risks and HIV - Ensure wide dissemination of job offers to ensure equal opportunities for all applicants;<br>- Provide separate male and female toilets and changing rooms that can be locked from the inside;<br>- raise awareness of gender-based violence among company staff, monitoring missions and the community;<br>Primary and secondary health care facilities may be called upon to manage the number of GBV survivors and only refer to tertiary hospitals when higher level care is needed. GBV referral pathways should be updated to reflect these health facilities;<br>- Promote the provision of psychosocial support for women and girl survivors of GBV;<br>Measures to ease the workload of primary health care facilities should prioritise access to sexual and reproductive health services, including pre- and post-natal care. | Contracting company<br>CSO | -AMEA POWER,<br>-ZINA SOLAR<br>-ANEVE, DRE Action sociale, Service de la santé,<br>Customary<br>Religious | Included in the cost of the work |

| Project phase | Environmental component | Risks | Preventive measures | Responsibilities | | Costs (FCFA) |
|---|---|---|---|---|---|---|
| | | | | Monitoring | Follow-up | |
| PREPARATORY/CONSTRUCTION | Social cohesion | Risk of social conflict | Implementation of a plan to reduce the risk of social conflict :<br>- solicit the support of administrative (Governors, Prefects), communal (Mayors, Councillors), village (CVD) and customary (Village Chiefs/Land Heads) authorities, youth and women's associations, as well as non-governmental organisations (NGOs), etc., to sensitise company employees on the habits and customs of the project areas;<br>- recruiting the majority of unskilled labour locally, especially in Kona.<br>- to develop and disseminate a code of conduct to combat sexual harassment and abuse and to raise awareness among site personnel of the penalties provided for in the laws in force;<br>- Develop and implement an action plan to combat GBV and violence against children at the worksite level;<br>- prohibit any recruitment of underage children (under 16 years of age) on construction sites and make employers aware of the penalties provided for by the law in force | Contracting company<br>Prefect<br>Traditional authorities<br>CSO | -AMEA POWER,<br>-ZINA SOLAR<br>-ANEVE<br>-DRE, DRFPTPS | Included in the cost of the work |
| PREPARATORY/CONSTRUCTION | Public health and safety | Contamination of COVID-19 | Implementation of a plan to prevent and reduce the risks of COVID-19 contamination:<br>- Develop a COVID19 pandemic influenza prevention plan to address risks and sources of exposure, transmission routes;<br>- raise awareness among workers and local populations on the fight against COVID19 ;<br>- Wear medical masks or other locally made masks;<br>- apply social distancing throughout the sub-project area<br>- confine people contaminated with COVID-19;<br>- observe the barrier measures ;<br>- development and implementation by companies of worker protection and infection control procedures.<br>- ensure that women are able to obtain information on how to prevent and respond to the epidemic in an understandable way<br>- developing targeted strategies for women's economic empowerment or exploring | Town Hall<br>Contracting company<br>Health service | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE | Included in the cost of the work |
| PREPARATORY/ CONSTRUCTIO | Public health and safety | Deterioration of the health, safety and hygiene of workers | Implementation of a special health, safety and hygiene plan for workers and the surrounding population: | Town Hall<br>Contracting company | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE | |

| Project phase | Environmental component | Risks | Preventive measures | Responsibilities | | Costs (FCFA) |
|---|---|---|---|---|---|---|
| | | | | Monitoring | Follow-up | |
| | | and the surrounding population | - Use approved products in the maintenance of green spaces and premises;<br>- raise awareness of the ways in which dangerous products are used and stored;<br>- ensure proper waste management (sorting, storage and disposal ;<br>- respecting working time and avoiding intense mental work<br>- Equipping facilities with fire extinguishers and training staff in their use | Health service | | Included in the cost of the work |
| | Archaeological and cultural remains | Risk of damage to archaeological remains | Implementation of a safeguarding plan for religious property :<br>- stop the work immediately and inform the services in charge of culture and the local authorities if cultural or archaeological remains are discovered;<br>- to accompany the location and protection of the remains discovered on the sub-project site;<br>- inform staff in advance of what to do in the event of an accidental discovery of remains. | Town Hall<br>MDC<br>Contracting company<br>Traditional authorities | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE<br>- DRE | |
| OPERATIONS | Health and safety | Risk of fire and electric shock | Implementation of a fire and electrocution risk reduction plan :<br>- to raise awareness of the risks of electrocution due to misuse or incorrect household connections;<br>- Develop and distribute awareness-raising manuals on good practice in the use of electricity;<br>- require the wearing of appropriate PPE during maintenance work on the electricity network;<br>- train staff in fire extinguishing. | ZINA SOLAR<br>Town Hall<br>Fire Brigade | - AMEA POWER<br>- ANEVE<br>- DRE | Project management budget |
| | Operation of services and security | Risk of destruction of facilities and disruption of energy production due to climate change effects | - take into account wind speeds and heavy rainfall when designing the supports for the plates;<br>- take into account the deficit in the management of energy distribution in the event of a temperature rise;<br>- provide a back-up unit to cover the energy deficit;<br>- Provide sufficient water for cleaning the solar panels (0.10 litres per square metre of panel). | ZINA SOLAR and safety of the Contracting Company | - AMEA POWER<br>- ANEVE, DRE<br>- Meteorological Directorate General | Project management budget |

| Project phase | Environmental component | Risks | Preventive measures | Responsibilities | | Costs (FCFA) |
|---|---|---|---|---|---|---|
| | | | | Monitoring | Follow-up | |
| | | | - maintain a strong collaboration with the weather service to have up-to-date data;<br>- landscaping around the power plant (to create a microclimate, provide a windbreak and mitigate dust);<br>- install a lightning protection system. | | | |
| OPERATIONS | Climate | Risk of proliferation of WEEE | - storage in a container and evacuation (Europe or elsewhere) at the end of the work for<br>- storage in a dedicated area and recycling<br>- Selective storage on site to avoid leakage of oils and hydrocarbons into the soil, surface or ground water. Send to a specialised disposal facility, or recycling if available;<br>IEC campaign on hazardous waste for populations and workers | ZINA SOLAR | - AMEA POWER<br>- ANEVE<br>- DRE Town hall | Project management budget |
| | Facility security | Park vandalism, theft, terrorist attack | - build the fence of the power plant according to the ODA (minimum height 2m with barbed wire);<br>- install surveillance cameras ;<br>- collaborate with the defence and security forces ;<br>- work with the city council.<br>- raise awareness of the protection of facilities | ZINA SOLAR<br>Ministry of Defence security expert | - AMEA POWER;<br>- ANEVE, DRE,<br>- Town Hall<br>- Gendarmerie | Project management budget |
| DISMANTLING AND CLOSING | Sound environment | Risk of accidents to staff and local residents due to machine movements | Implementation of an accident prevention and safety plan :<br>- inform users and local populations of the safety instructions for the dismantling work on the site;<br>- install signage inside and outside the site | Contracting company | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE | Included in the cost of the work |
| | Surface water and groundwater | Surface and groundwater contamination | Implementation of measures to reduce surface and groundwater contamination :<br>- prepare and implement a construction waste management and disposal plan;<br>- sign a contract for the removal of waste by an approved service provider | Contracting company | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE | Included in the cost of the work |
| | Health and safety | Occupational accidents and incidents and occupational diseases related to | Implementation of an Occupational Injury and Illness Prevention Plan<br>Implementation of measures to reduce falls from the ground and during work at height | Contracting company | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE | 862 500 |

| Project phase | Environmental component | Risks | Preventive measures | Responsibilities | | Costs (FCFA) |
|---|---|---|---|---|---|---|
| | | | | Monitoring | Follow-up | |
| | | the handling of machinery ;<br>Falls on the ground and when working at height | | | | |
| | Vulnerable persons | Increase in gender-based violence (GBV) | Implementation of measures to reduce gender-based violence (GBV) :<br>- take into account the aspects of GBV/ASR/HS when developing environmental and social contractual clauses;<br>- train workers on GBV/ASR/HS (including code of conduct, house rules, case management, PMM, etc.) | Contracting company | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE<br>- Social action | Included in the cost of the work |
| | Social cohesion | Risk of social conflict | Implementation of a plan to reduce the risk of social conflict :<br>solicit the support of administrative (Governors, Prefects), communal (Mayors, Councillors), village (CVD) and customary (Village Chiefs/Land Heads) authorities, youth and women's associations, as well as non-governmental organisations (NGOs), etc., to sensitise company employees on the habits and customs of the project areas; | Contracting company | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE<br>- Social action | Included in the cost of the work |
| | Public health and safety | Contamination of COVID-19 | Implementation of a plan to prevent and reduce the risks of COVID-19 contamination:<br>- Develop a COVID19 pandemic influenza prevention plan to address risks and sources of exposure, transmission routes;<br>- raise awareness among workers and local populations about the fight against COVID19. | Contracting company | - AMEA POWER,<br>- ZINA SOLAR<br>- ANEVE, DRE<br>- Social action | Included in the cost of the work |
| Total 2 | | | | | | **862 500** |

## 7.2 Environmental and social monitoring and follow-up programme

### *7.2.1 Environmental monitoring programme and social*

The objective of environmental and social monitoring is to ensure that the promoter meets its commitments and obligations to take the environment into account and to apply the measures envisaged in the NIES and the IFC standards. It also aims to ensure that mitigation and enhancement measures are implemented, that they are achieving their intended results; or if they prove inadequate, that they can be modified, discontinued or replaced. Environmental and social monitoring should be carried out by the main contractor. The project manager must ensure that environmental and safety aspects are recorded in the site reports and the provisional acceptance reports.

During the construction phase, the consulting engineer in charge of the supervision of the works on site will have to take on the services of an environmental manager whose main tasks will be to :

- Enforce all standard and special mitigation measures for the sub-project;
- remind contractors of their environmental and social obligations and ensure that these are met during the construction period;
- prepare environmental monitoring reports throughout the works;
- inspect the work and request appropriate corrective action where necessary;
- draft the final report of the environmental and social monitoring programme.

In addition, the consulting engineer will be able to act as an interface between the local population and the contractors in case of complaints. The environmental and social monitoring programme is shown in Table 19.

Table 20 : Environmental and social monitoring programme

| Middle element | Aspect to be monitored | Purpose | Means of control | Periodicity of control | Quality level to be maintained | Responsibility | Costs in FCFA |
|---|---|---|---|---|---|---|---|
| **Construction phase** | | | | | | | |
| Biophysical and socio-economic | Application of environmental and safety instructions on the site | Apply environmental and safety instructions on the site | Site visit and consultation with environmental experts | Weekly | Minimise the impact on the environment, the health and safety of site personnel and local residents | Company HSE manager | **1 000 000** |
| **Construction phase** | | | | | | | |
| Landscapes and ground topography | Existence of bare areas, gullies, etc. induced by the project<br>Storage of topsoil | Limiting physical damage to the soil<br>Limit erosive processes and reduce trampling | Visual observation | Weekly | Minimal loss of soil, reduction of any trampling and damage to the soil | Company HSE manager | **800 000** |
| Noise and air quality | Existence of silencers in noisy equipment and presence of earplugs for workers<br>Watered traffic routes | Limiting noise pollution<br>Limiting air pollution | Visual observation | Weekly | Compliance with safety regulations on noise and air quality | Company HSE manager | |
| Water quality | Check the management of waste and liquid discharges | Prevent, limit or avoid the production of waste and liquid discharges, direct or accidental | Visual observation of operations.<br>Document control.<br>Authorisation management<br>Recording of waste and discharges | Daily | Compliance with the legislation in force. | Company HSE manager | |
| Vegetation and fauna | Existence of compensatory reforestation and landscaping<br>Existence of fauna and microfauna | Limit the impact of tree loss and ensure a microclimate on the site | Visual observation of operations.<br>Document control | quarterly | Respect for the protection of plant and animal species | Company HSE manager | |

| Middle element | Aspect to be monitored | Purpose | Means of control | Periodicity of control | Quality level to be maintained | Responsibility | Costs in FCFA |
|---|---|---|---|---|---|---|---|
| Public health and safety | Compliance with safety and health provisions | Prevent and avoid accidents | Visual observation maintenance of a claims register | Daily | Zero accidents and zero claims. | Company HSE manager | |
| Socio-economic environment | Perception of local residents prior to the development of the sub-project. Respect for the employment of local labour<br>Compliance with CNSS affiliation<br>Respect for the application of the minimum wage for the payment of workers on the site, including service providers and suppliers | Enforce the project's PMM<br><br>Compliance with national employment legislation | Communication with local authorities and local populations;<br>Hired lists<br>Payment slip for workers' contributions to the CNSS<br>Employment contracts or payment statements of employees and contractors | Fortnightly, and at every incident. | Fluid communication | Corporate Social Responsibility | **700 000** |
| Socio-economic environment | Setting up a local monitoring and social support committee | Achieving better integration and social management of the sub-project | Minutes of the Local Monitoring Committee | Monthly | Strong involvement of the population | Corporate Social Responsibility | |
| Operational phase | | | | | | | |
| Water and soil quality | Water and soil pollution | Prevent, limit or avoid the production of waste and liquid discharges, direct or accidental | Visual observation of operations.<br>Document control.<br>Authorisation management<br>Recording of waste and discharges | Weekly | Compliance with the legislation in force. | HSE Manager of ZINA Solaire | Included in the operating costs |
| Vegetation and fauna | Presence of compensatory planting, landscaping | Preserve plant and animal species | Visual observation of operations.<br>Control | Quarterly | Respect for the protection of plant and animal species | HSE Manager of ZINA SOLAIRE | |

| Middle element | Aspect to be monitored | Purpose | Means of control | Periodicity of control | Quality level to be maintained | Responsibility | Costs in FCFA |
|---|---|---|---|---|---|---|---|
| Public health and safety | Compliance with health and safety regulations | Prevent and avoid accidents, illnesses, STIs/AIDS risks and SIAs/HS | Health and safety diagnosis | Monthly | Zero accidents and zero claims and illness. | Social Manager of ZINA SOLAIRE | Included in the operating costs |
| Socio-economic environment | Gender-based discrimination and vulnerable groups | Anticipating, preventing and avoiding discrimination based on gender and vulnerable groups | Awareness-raising report on gender-based discrimination and vulnerable groups | During construction | Zero discrimination | Social Manager of ZINA SOLAIRE | Included in the operating costs |
| Closure and decommissioning phase | | | | | | | |
| Landscapes and ground topography | Existence of bare areas, gullies, etc. induced by the project<br>Storage of topsoil | Limiting physical damage to the soil<br>Limit erosive processes and reduce trampling | Visual observation | Weekly | Minimal loss of soil, reduction of any trampling and damage to the soil | Company HSE manager | **800 000** |
| Noise and air quality | Existence of silencers in noisy equipment and presence of earplugs for workers<br>Watered traffic routes | Limiting noise pollution<br>Limiting air pollution | Visual observation | Weekly | Compliance with safety regulations on noise and air quality | Company HSE manager | |
| Water quality | Check the management of waste and liquid discharges | Prevent, limit or avoid the production of waste and liquid discharges, direct or accidental | Visual observation of operations.<br>Document control.<br>Authorisation management<br>Recording of waste and discharges | Daily | Compliance with the legislation in force. | Company HSE manager | |
| Public health and safety | Compliance with safety and health provisions | Prevent and avoid accidents | Visual observation maintenance of a claims register | Daily | Zero accidents and zero claims. | Company HSE manager | **700 000** |

| Middle element | Aspect to be monitored | Purpose | Means of control | Periodicity of control | Quality level to be maintained | Responsibility | Costs in FCFA |
|---|---|---|---|---|---|---|---|
| Socio-economic environment | Perception of local residents during the operation of the project.<br>Respect for the employment of local labour<br>Compliance with CNSS affiliation<br>Respect for the application of the minimum wage for the payment of workers on the site, including service providers and suppliers | Enforce the project's PMM<br><br>Compliance with national employment legislation | Communication with local authorities and local populations;<br>Hired lists<br>Payment slip for workers' contributions to the CNSS<br>Employment contracts or payment statements of employees and contractors | Fortnightly, and at every incident. | Fluid communication | Corporate Social Responsibility | |
| Socio-economic environment | Setting up a local monitoring and social support committee | Avoiding problems in returning the site to the PAPs | Minutes of the Local Monitoring Committee | Monthly | Strong involvement of the population | Corporate Social Responsibility | |
| **TOTAL3** | | | | | | | **4 000 000** |

### *7.2.2 Environmental monitoring programme and social*

Environmental and social monitoring is dedicated to monitoring the predicted impacts. It makes it possible to verify the accuracy of the predictions and measure the actual impacts of the subproject and to assess the effectiveness of the proposed mitigation and compensation measures. Monitoring can lead the proponent to react promptly to the failure of a mitigation measure or to any new disturbance of the environment by implementing more appropriate measures or new measures for unforeseen impacts. The environmental and social monitoring programme uses environmental and social indicators to verify compliance with applicable national standards and IFC environmental and social sustainability standards. The monitoring programme will address the impacts of greatest concern to the sub-project.

Table 20 presents the environmental and social monitoring programme.

Table 21 : Environmental and social monitoring programme

| Environmental and social aspects | Monitoring indicators | Monitoring methods and devices | Follow-up officers | Responsible for control | Periodicals | Cost FCFA |
|---|---|---|---|---|---|---|
| **Preparatory/construction phase** | | | | | | |
| Air quality | Particulate matter (PM10, PM5 and PM2.5), CO2, NOx, VOCs and heavy metals | Verification of the implementation of dust mitigation measures<br>Conduct air quality measurement campaigns at sensitive receptors in the vicinity of each site | Company in charge of the works | AMEA POWER, ZINA SOLAR and ANEVE | Monthly | 500 000 |
| Noise | Noise measurements | Verification of the implementation of noise control measures<br>Conduct noise measurement campaigns at sensitive receptors in the vicinity of each site | Company in charge of the works | AMEA POWER, ZINA SOLAR and ANEVE | Monthly | 500 000 |
| Vegetation | Survival rate of planted trees | Verification of reforestation success rates | Company in charge of the works | AMEAPOWER, ZINA SOLAR and ANEVE and DRE | Each year | 500 000 |
| Public health and safety | No. of people infected with COVID- 19 and other diseases<br>Number of accidents at work | Checking incident and accident reports | Company in charge of the works | AMEA POWER, ZINA SOLAR and ANEVE | | 500 000 |
| Socio-economic environment | Number of jobs created in the locality<br>Number of IGAs created<br>Provisions in the PRME | Audit of local employment and PRME recruitment reports | Company in charge of the works | AMEA POWER, ZINA SOLAR and ANEVE | | 500 000 |
| **Operating phase** | | | | | | |
| Water resources | Surface water quality | Checking the quality of surface water | ZINA SOLAR | AMEA POWER, | monthly | |

| Environmental and social aspects | Monitoring indicators | Monitoring methods and devices | Follow-up officers | Responsible for control | Periodicals | Cost FCFA |
|---|---|---|---|---|---|---|
| | | | | and ANEVE | | |
| Waste management | Presence of waste management facilities | Checking the waste management system | ZINA SOLAR | AMEA POWER, and ANEVE | monthly | Included in the cost of operation |
| Public health and safety | Number of people infected | Verification of barrier measures and means of prevention of other diseases (STI and HIV) | ZINA SOLAR | AMEA POWER, and ANEVE | Daily | |
| Socio-economic environment | Living standards of the PAPs | PRME Implementation Report | ZINA SOLAR | AMEA POWER, and ANEVE | monthly | |
| **Closure and decommissioning phase** | | | | | | |
| Air quality, Noise | Particulate matter and heavy metal content | Verification of the implementation of dust and noise mitigation measures<br>Conduct air quality and noise measurement campaigns at sensitive receptors in the vicinity of each site | Company in charge of the works | AMEA POWER, ZINA SOLAR and ANEVE | Monthly | 5 00 000 |
| Floors | Amount of contaminated land | Rate of remediation of contaminated land | Company in charge of the works | AMEA POWER, ZINA SOLAR and ANEVE | Monthly | **300 000** |
| Vegetation | Survival rate of reforested plants at the power plant site | Verification of reforestation success rates | Company in charge of the works | AMEA POWER, ZINA SOLAR and ANEVE | Each year | **500 000** |
| Public health and safety | Number of people infected | Verification of barrier measures | Company in charge of the works | AMEA POWER, ZINA SOLAR and ANEVE | Daily | **700 000** |
| Socio-economic environment | Return of land to PAPs<br>Number of land used for agriculture or livestock | Checking the remediation report | Company in charge of the works | AMEA POWER, ZINA SOLAR and ANEVE | Monthly | |
| Total4 | | | | | | **4 000 000** |

## 7.3 Capacity building programme

In order to ensure effective and timely implementation of the project's environmental and social measures, this ESMP provides a detailed description of the measures:

- institutional arrangements ;
- the entity responsible for carrying out the mitigation and monitoring measures (including operation, supervision, implementation, monitoring, corrective action, financing, reporting and staff training).

In order to strengthen the environmental and social management capacities of the project implementing structures, the ESMP recommends

- the creation or strengthening of the entities concerned,
- Staff training and any additional measures that may be required to support the implementation of mitigation measures; this training will cover the following topics: the IFC's environmental sustainability standards and the World Bank's environmental and social framework, gender mainstreaming, environmental and social monitoring, risk prevention and disaster management.
- any other recommendations from the Environmental and Social Impact Assessment.

### *7.3.1 Training of the actors on the site*

All site personnel should receive general training on health, safety and environmental issues, with emphasis on the responsibility of each employee. The training will focus on the following elements: health risks related to certain site activities; first aid in case of accidents; emergency response procedures, STIs and HIV/AIDS/COVID 19, risks and consequences of GBV/ASW/HS, code of conduct and sanctions related to GBV incidents, functioning of the MGP-VBG/EAS/HS, response to survivors of such incidents, and waste management.

A detailed programme of such training should be defined in a training and awareness plan to be implemented by the company in charge of the works.

The health and safety training programme to reduce the risks associated with project operations shall include as a minimum

- a summary of the legal, regulatory, local, national and other policies that apply to the project and the site;
- training in occupational risk assessment, safety procedures and information sources (safety data sheets, etc.);
- an emergency evacuation plan ;
- firefighting and emergency response procedures; health and safety risks associated with certain tasks; and
- first aid.

Contractors, subcontractors and consultants working on the project will be required to adhere to all safety and environmental policies and procedures included in the CAD and the technical specifications for the work for the duration of their involvement in the work.

**Table 22 :** Capacity Building Programme

| Sub-project phase | Target audience | Actions | Implementer and Monitoring | Cost of implementation (FCFA) |
|---|---|---|---|---|
| Studies | Administrative authorities, local elected officials,<br>Local associations (nature conservation, environmental Residents, ...)<br>Local communities<br>Inhabitants,<br>Local economic actors (farmers, traders, etc.) | - inform the public about the solar power plant project<br>- inform about the duration of the work public awareness meeting<br>- raise awareness of acts of vandalism | - AMEA POWER<br>- ZINA SOLAR<br>- COMPANY | **500 000** |
| Work | Staff Company<br>Subcontractors<br>Local authorities and populations<br>Administrative authorities<br>Network managers, local councillors. | - Training and awareness-raising on occupational risk assessment, safety procedures and information sources (safety cards, etc.) and on the emergency evacuation plan;<br>- training and awareness-raising on firefighting and emergency response procedures<br>- training and awareness of health and safety risks associated with certain tasks and first aid for accident victims;<br>- Inform - Educate and Communicate (IEC) on STI/HIV/AIDS and COVID 19 ;<br>- training and IEC on gender-based violence (GBV) ;<br>- IEC on the appropriate provisions envisaged for the information of road users<br>- training and IEC on the monitoring and complaints handling system for local populations | - AMEA POWER<br>- ZINA SOLAR<br>- COMPANY | **1 000 000** |

| Sub-project phase | Target audience | Actions | Implementer and Monitoring | Cost of implementation (FCFA) |
|---|---|---|---|---|
| | | - produce an advertorial on the project and disseminate it to the public<br>- managing waste | | |
| Monitoring and control of works, marketing Social | Project Monitoring Committee | inform on the progress of the work and the implementation of the ESMP | - AMEA POWER<br>- ZINA SOLAR<br>- COMPANY | **500 000** |
| | NGOs and Associations | training in Citizen Engagement (roles and responsibilities) in the case of monitoring the implementation of the ESMP | - AMEA POWER<br>- ZINA SOLAR<br>- COMPANY | **600 000** |
| **TOTAL** | | | | **2 600 000** |

## 7.4 Management plan for waste generated at the plant

### *7.4.1 Solid waste management*

During the works, for any removal of solid waste, the works company will ensure that the structure or company that removes the waste has an approval issued by the competent authorities. It will ensure that there is no pollution of the environment during the removal of this waste.

After these various checks, the works company will have a waste tracking form filled in by the removal facility before the waste is transferred. The waste tracking form must contain the following useful information:

- the name of the collection facility ;
- the type of waste to be removed;
- the quantity of waste ;
- the destination of the waste ;
- the date of removal of the waste ;
- the name and signature of the person responsible for the management of the co-location or treatment facility.

### *7.4.2 Non-hazardous waste management*

During the construction and operation phases of the plant, non-hazardous waste may be produced. It consists of office waste (paper, cardboard, packaging), household waste (food scraps, plastic bottles, cans), green waste (leaves, stalks, grass clippings), textile fragments (rags, used clothing, jute bags). This waste will be sorted and stored in specific bins.

Rubbish bins will be provided for the storage of waste. Rubbish bins will also be placed in and around the sub-project area. All this waste will be removed and transported to the communal grouping station by an approved structure. The removal operations of the common waste will be carried out under the supervision of the sub-project and the commune.

### *7.4.3 Inert waste management*

Inert waste (rubble, gravel or sand) produced during the construction phase will be used for the development of the site.

### *7.4.4 Management of special waste (WEEE and WID)*

Electrical and electronic waste (modules, cables, ink cartridges, batteries) and hazardous industrial waste (HIW) such as paint cans, chemical containers, chemical product remains, hydrocarbon leaks, etc., will be stored according to their nature in bins with compartments, on retention tanks and protected from the weather. They will then be removed by a structure approved by the municipality for transfer to treatment sites (in Europe or in the sub-region).

### *7.4.5 Rainwater management*

A stormwater drainage system is planned, consisting mainly of nozzles of varying sizes with an average slope that takes into account the topography of the site. This system will be equipped with capping and closure devices for the traffic areas used by pedestrians and vehicles. This will ensure the safety of pedestrians and People with Reduced Mobility (PRM). These gutters must be regularly cleaned to avoid any overflow of water during the main rainy season.

## 7.5 Estimated cost of implementing the ESMP

The cost of implementing the various ESMP programmes can be estimated at **26,655,000** CFA **francs.** The table shows the summary budget for the ESMP. The table below shows the details of the costs per component and per activity.

**Table 23Overall cost of the ESMP**

| **ESMP programmes** | **Cost in FCFA** |
|---|---|
| Programme for the implementation of mitigation, enhancement and compensation measures for environmental and social impacts and risks | 16 055 000 |
| Environmental and social monitoring and follow-up programme | 8000 000 |
| Capacity building programme | 2 600 000 |
| **Overall cost of the ESMP** | **26 655 000** |

# 8 CLOSURE AND REHABILITATION PLAN (CPR)

A solar power plant has an average lifespan of 25 years. At the end of its life, it must be dismantled and the site restored. The restoration of the site will consist of returning the land to a state as close as possible to the initial state before the project was implemented.

## 8.1 Objective

The closure and rehabilitation plan aims to return the project site to a similar state as before the project intervention.

### *8.1.1 Specific objectives*

The specific objectives of the closure and rehabilitation plan are

- to rehabilitate the soil of the site bases at the end of the works;
- dismantle all installations (photovoltaic modules, inverters, cables, supports, support foundations, premises, etc.);
- draw up a protocol for site clearance and management of the various components of the dismantled plant (photovoltaic modules, inverters, cables, supports, etc.).

### *8.1.2 Rehabilitation of the construction site*

The closure and rehabilitation of the base will record the presence of heavy equipment and machinery on the site. It will consist of the de-installation of the equipment and its reallocation to other company sites. The various wastes produced on these sites will be sorted and recycled or destroyed. An anti-erosion development (CES/DRS) will be carried out in order to recover the soil and the site will be revegetated.

## 8.2 Decommissioning of the plant's facilities

This process is described in Table 23

Table 24:Decommissioning process of a solar power plant

| Equipment | Elements | Type of fixing | Dismantling method |
|---|---|---|---|
| Generation, transformation and delivery of electricity | Modules | Placed on the metal structure with clips | Unscrewing the clips |
| | Inverters | Standing on the ground without a foundation | Removal by crane |
| | Delivery station | Placed on the ground without foundation | Removal by crane |
| Supports | Metal frame | Attached to the wooden beam | Unscrewing |
| | Wooden beam | Fixed on piles | Unbolting |
| Anchoring | Piles in the ground | Anchored in the ground | Grubbing up |
| | Piles in a concrete structure | Anchored in the ground | Ripping out and leaving concrete in place |
| | Concrete studs | Laying on the ground | Picking up of studs |
| Electrical cables | Cables | Buried in the ground in a trench | Re-opening of trenches and removal of cables |

| Equipment | Elements | Type of fixing | Dismantling method |
|---|---|---|---|
| Security | Cameras and detectors | Attached to posts | Unscrewing and dismantling of components |
| | Breeze block fence | To be considered according to the future use of the site: either rehabilitation to the original or reuse for the installation of a future public utility infrastructure | |
| Traffic | Tracks | To be considered according to the future use of the site: either rehabilitated to its original state or reused for agricultural or other purposes | |

### *8.2.1 Recycling/upgrading of solar modules*

The photovoltaic panels will be dismantled with particular attention to the following points, after mechanical separation of cables, junction boxes and metal frames, the recycling of crystalline silicon modules can follow two routes:

- heat treatment, which eliminates the encapsulating polymer by burning it and thus separates the various elements of the photovoltaic module (cells, glass and metals: aluminium, copper and silver);
- chemical treatment, which consists of crushing the entire module and then extracting secondary materials in fractions, using different methods. Once separated from the modules, the cells are chemically treated to remove the metal contacts and the anti-reflection layer.

These recycled chips are then :

- integrated into the cell manufacturing process and used for the manufacture of new modules, if they have been recovered in their integrity;
- or melted down and integrated into the silicon ingot manufacturing process.

It is therefore important, in view of this information, to mobilise the entire sector to improve the process of separating the various components (known as "deencapsulation").

The foundations that support the panel supports also play an important environmental role because of the degree of soil sealing they create. The panel supports will be removed and the foundations destroyed. The foundation debris will be removed from the site and dumped at a suitable site. The metal supports will be integrated into a recycling circuit.

The landscaping and planting carried out as part of the landscape integration of the site will be left in place. The same applies to the access roads and the fence, which can still be used in the event of the installation of other public utility infrastructures on the site.

### *8.2.2 Rehabilitation of the power plant site*

After dismantling, the contaminated soil will have to be stripped and the waste transferred to a treatment site. The holes left by the foundations of the supports will be filled and tamped. At the end of the site clearance, a report will be produced. It will include (but not be limited to) the following items:

- geo-referencing of the site;
- the start and end dates of the occupation ;
- photos before, during and after the operation;
- comments on the site rehabilitation operations and the environmental impacts of the operations.

A new inspection of the site may be carried out at least one year after the end of the operations to validate the correct application and reliability of the rehabilitation measures.

## 8.3 Closure and rehabilitation programme

Table 25Closure and rehabilitation programme

| Measures | Activities | Location | Period | Responsible for |
|---|---|---|---|---|
| Rehabilitation of the site base | De-installation of equipment | Construction site base | At the end of the work | - ZINA SOLAR<br>- Company<br>- DRE<br>- Town Hall |
| | Management of the waste produced | | | |
| | Revegetation and landscaping of CES/DRS structures | | | |
| Dismantling of facilities and fate of materials | Mechanical separation of plant components | Power plant site right-of-way | At the end of the plant's life (approximately 25 years) | - ZINA SOLAR<br>- Company<br>- DRE<br>- Town Hall |
| | Sorting and recycling of plant components | | | |
| | Extraction and recycling of panel supports | | | |
| | Filling of foundation holes and cable trenches | | | |
| Rehabilitation of the power plant site | Implementation of a site clean-up protocol | | | |

# 9 ARRANGEMENTS FOR PUBLIC CONSULTATION AND PARTICIPATION

The solar power plant construction project has incorporated the issue of stakeholder participation and consultation. In the process of integrating the project with the population, a monitoring committee for the livelihoods restoration plan has been set up. This committee includes the promoter's representative, the community relations officer, the administrative and decentralised authorities (prefects and mayors) of the communes and departments of Kona and Bana, the deconcentrated technical services of the Environment and Livestock, the customary authorities, the CVDs, the women's associations, the PAPs and the representative of the vulnerable people of the communes concerned. As a reminder, the 2014 Notice had identified 21 PAPs whose property was identified and compensated. The project continues to communicate with stakeholders and the population through its social staff, namely the social specialist and the CLOs.

## 9.1 Purpose of the consultation

The consultation process took into account: (i) the views of both the female and male populations, where necessary in the case of separate forums or meetings, and (ii) the differing concerns and priorities of men and women with regard to impacts, mitigation mechanisms and benefits, as appropriate.

## 9.2 Consultation process and synthesis of concerns

As part of the NIES update, a public consultation was carried out from Friday 4 to Wednesday 9 February 2022 for all stakeholders to ensure a good understanding of the issues, positive and negative impacts and environmental risks and the various mitigation and compensation measures of the project.

This consultation and participation process has resulted in a more in-depth exchange of views and information, as well as organised and iterative consultations, which result in AMEA Power taking into account the views of affected communities in its decision-making process on issues that directly affect them, such as proposed mitigation measures, sharing of benefits and opportunities generated, and enforcement issues.

During these exchanges the following concerns were listed and are recorded in the table below.

Table 26 : Summary of concerns from the public consultation

| STAKEHOLDERS | CONCERNS | RESULTS AND RECOMMENDATIONS |
|---|---|---|
| **Representatives of PAPs and CVDs in the commune of Kona (Kona, Zina, Blé and Dangouna)** | - problem of disseminating information on the procedure for recruiting local labour to the population ;<br>- slow implementation of IGAs for women; | - to respect the commitments made to the population and to ensure that they are respected by the service providers;<br>- review the dissemination of information on the procedure for recruiting local labour;<br>- Involve PAPs' representatives in the process of recruiting local labour;<br>- consider the initial inventory of trees on the line;<br>- recruit neutral and non-political community workers.<br>- implementation of compensatory planting within the village forest. |
| **Representatives of PAPs and CVDs from the commune of Bana (Wona, Somona and Yona)** | - problem of disseminating information on the local labour recruitment process to the population<br>- waiting for the implementation of the IGAs promised to women;<br>- Waiting for the trees on the line to be felled;<br>- confusion between the Bobo-Dédougou interconnection line and the 33 kv Wona-Zina line;<br>- high cost of electrical energy. | - explain to the population the difference between the two power line projects in the area (Bobo-Dédougou interconnection line and the 33 KV Wona-Zina line);<br>- make solar panels available to PAPs;<br>- respect the commitments made to the population and ensure that they are respected by the service providers. |
| **Prefect of Kona Department** | Slow implementation of project activities | Participation in the Monitoring Committee ; |
| **Kona Department of Agriculture and Environment Services** | Failure to carry out IGAs such as :<br>- implementation of anti-erosion devices ;<br>- creation of market gardens;<br>- construction of manure pits ; | Compensatory planting in the village forest; |

Sources: Field data, IPEAD 2022

The following images illustrate the meetings within the framework of the consultation

**Photo 2 :** Meeting with representatives of the KONA PAPs

**Photo 1 :** Meeting with PAPs representatives

**Photo 4** Field visit with the PAPs

**Photo 3** Planting of eucalyptus camaldulensis donated by ZINA SOLAIRE for reforestation

## CONCLUSION

This ESIA was carried out in accordance with the environmental and social sustainability standards of the International Finance Corporation (IFC) and the national legislation in force in Burkina Faso, as well as the international environmental conventions ratified by the country. It identified and assessed the potential impacts associated with the construction of the solar power plant and carried out an analysis of the potential risks.

It should be noted that the significance of the main negative impacts that have been identified is estimated to be low or minor during the construction period and during the operation of the solar power plant. The positive impacts are considered to be of major importance for ZINA Solaire and for the population. Indeed, the construction of the solar power plant will allow ZINA Solaire to supply energy to SONABEL in order to improve the quality of the electricity it provides to its customers in the Boucle du Mouhoun and Hauts Bassins regions and the surrounding areas.

Taking into account these considerations and all the analysis of impacts and risks previously presented, it is recommended to implement the mitigation measures proposed in the ESMP for a good development and acceptance of the project.

The analysis of the biophysical and socio-economic environment of the project area and the public consultations revealed a number of key environmental and social issues and challenges that will require attention during the implementation of the works:

- protection of the soil against erosion ;
- preservation of water quality ;
- good waste management ;
- preservation of vegetation ;
- preservation of health (STI/HIV and COVID-19) and the living environment;
- the safety of workers and local populations;
- respect for customs and traditions;
- the humanitarian and security crisis.

The project raises a lot of hope in the communities concerned. It is seen as a first step towards electrification and development. However, the current enthusiasm of the stakeholders should not obscure the fact that the trust gained will need to be reinforced throughout the implementation of the sub-project.

Based on the results obtained, it can be stated that if the ESMP measures are effectively implemented, they will be sufficiently effective to mitigate the identified negative impacts. Therefore, the project is environmentally and socio-economically feasible.

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