DJERMAYA SOLAR

DJERMAYA SOLAR – POWER TRANSMISSION LINE

ENVIRONMENTAL AND SOCIAL IMPACT NOTICE

INTERIM REPORT - REV4

ARTELIA EAU & ENVIRONNEMENT
Dptmt Risques, Société
& Environnement
Immeuble Le First
2, avenue Lacassagne
69 425 LYON Cedex 03 - FRANCE
Tel.: +33 (0)4 37 65 38 00
Fax: +33 (0)4 37 65 38 01

DATE: JANVIER 2020 REF: 8512192

QUALITY CONTROL SHEETE

Project Description	
Project Name	Power Line Transfer - Environmental and Social Impact Notice
Project Number	8512192
Client	CONSORTIUM DJERMAYA SOLAR
Location	Djermaya, Tchad
Document Type	Assessment Report
Document Name	8512192 Djermaya Solar NIES Tline V3

Etude réalisée par ARTELIA Eau et Environnement – Branche Environnement - RSE			
	Name	Date	Visa
Drafter	Julien AULNER	05/27/2019	
Drafter	Karima BROCHE	05/13/2019	
Drafter	Loréa BIBES	05/24/2019	
Modified by	Julien AULNER	01/08/2020	
Approved by	Christop DERRIEN	01/08/2020	

List of revisions			
Document #	Version #	Date	Description
3	V0	05/31/2019	8512192 Djermaya Solar NIES Tline V0-rev2
3	V1	06/06/2019	8512192 Djermaya Solar NIES Tline V1
3	V2	06/21/2019	8512192 Djermaya Solar NIES Tline V2
3	V3	08/27/2019	8512192 Djermaya Solar NIES Tline V3
3	V4	08/08/2020	8512192 Djermaya Solar NIES Tline V4

Distribution List			
N° Document	N° Version	Format/number of copies	Recipient
3	V0	word/pdf	Consortium Djermaya
3	V1	word/pdf	Consortium Djermaya
3	V2	word/pdf	Consortium Djermaya
3	V3	word/pdf	Consortium Djermaya
3	V4	word/pdf	Consortium Djermaya

ARTELIA E&E – BRANCHE ENVIRONNEMENT - RSE
Immeuble Le First – 2, avenue Lacassagne 69425 LYON – Cedex 03 – France Tel/Fax: +33 (0) 4 37 64 38 00 (1)

TABLE OF CONTENTS

List of Tables

List of Figures

ACRONYMS

AADL	Aldwych Africa Development Limited
AFD	French Development Agency
Aldwych	Aldwych International Limited
ANADER	National Rural Development Support Agency
BARPI	Industrial Risks and Pollution Analysis Bureau (France)
CEDAW	Convention on the Elimination of All Forms of Discrimination against Women
CILSS	Permanent Inter-State Committee for Drought Control in the Sahel
CIRA-SA	Consulting Engineering and Applied Research
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CIW	Common Industrial Waste
CMS	Conservation of Migratory Species
COD	Chemical Oxygen Demand
COHV	Halogenated Volatile Organic Compounds
CR	Critically Endangered
DBO5	Biological Oxygen Demand at 5 days
DD	Data Deficient
DGAC	French Civil Aviation Authority
DGE	Directorate General of the Environment
DRA	Detailed Risk Analysis
EDD	Hazard Analysis
EHS	Environment Health and Safety
EIA	Environmental Impact Assessment
EIN	Environmental Impact Notice
EN	Endangered
EPC	Engineering Procurement Construction
ESIA	Environmental and Social Impact Assessment
ESIN	Environmental and Social Impact Notice
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
EW	Extinct In the Wild
EX	Extinct
FAA	Federal Aviation Administration
FNE	National Environment Fund
FPIC	Free, Prior and Informed Consent
GHG	Greenhouse Gas
GIIP	Good International Industrial Practices
GW	Green Waste
HCNE	High National Committee for the Environment
HIW	Hazardous Industrial Waste

HPP	Human-powered Pump
HSE	Health, Safety, Environment
HTA	Medium Voltage (voltage levels between 1,000 V and 50,000 V
ICP	Informed Consultation and Participation
ICPE	Facilities Classified for Environmental Protection
IFC	International Finance Corporation
InfraCo Africa	InfraCo Africa Limited
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producer
IRENA	International Renewable Energy Agency
IW	Inert Waste
LC	Least Concern
LCBC	Lake Chad Basin Commission
LRP	Livelihoods Restoration Plan
MEDDE	Ministry of Ecology, Sustainable Development and Energy (France)
NHW	Non-Hazardous Waste
NR	Not rated
NR	National Road
NT	Near Threatened
ODS	Ozone Depleting Substances
ONCFS	National Hunting and Wildlife Agency
PAHs	Polycyclic Aromatic Hydrocarbons
PASST2	Health Sector Support Project (Phase 2)
PIR	Compensation and Resettlement Plan
PPE	Personal Protective Equipment
PPP	Public Private Partnership
PRA	Preliminary Risk Analysis
PS	Performance Standards
PSST	Occupational Health and Safety
RAIA	Analysis, Research and Information on Accidents (France)
RAP	Resettlement Action Plan
SGAT	Solar Glare Analysis Tool
SLG	Local Management Body
SNE	National Electricity Company
THC	Total Hydrocarbon Content
TOE	Tonne of Oil Equivalent
ToR	Terms of Reference
UICN	International Union for Conservation of Nature
UNFCCC	United Nations Framework Convention on Climate Change
VOC	Volatile Organic Compound
VU	Vulnerable
WEEE	Waste Electrical and Electronic Equipment

XAF	CFA franc (Central African financial cooperation franc)

1. INTRODUCTION AND BACKGROUND

1.1. BACKGROUND

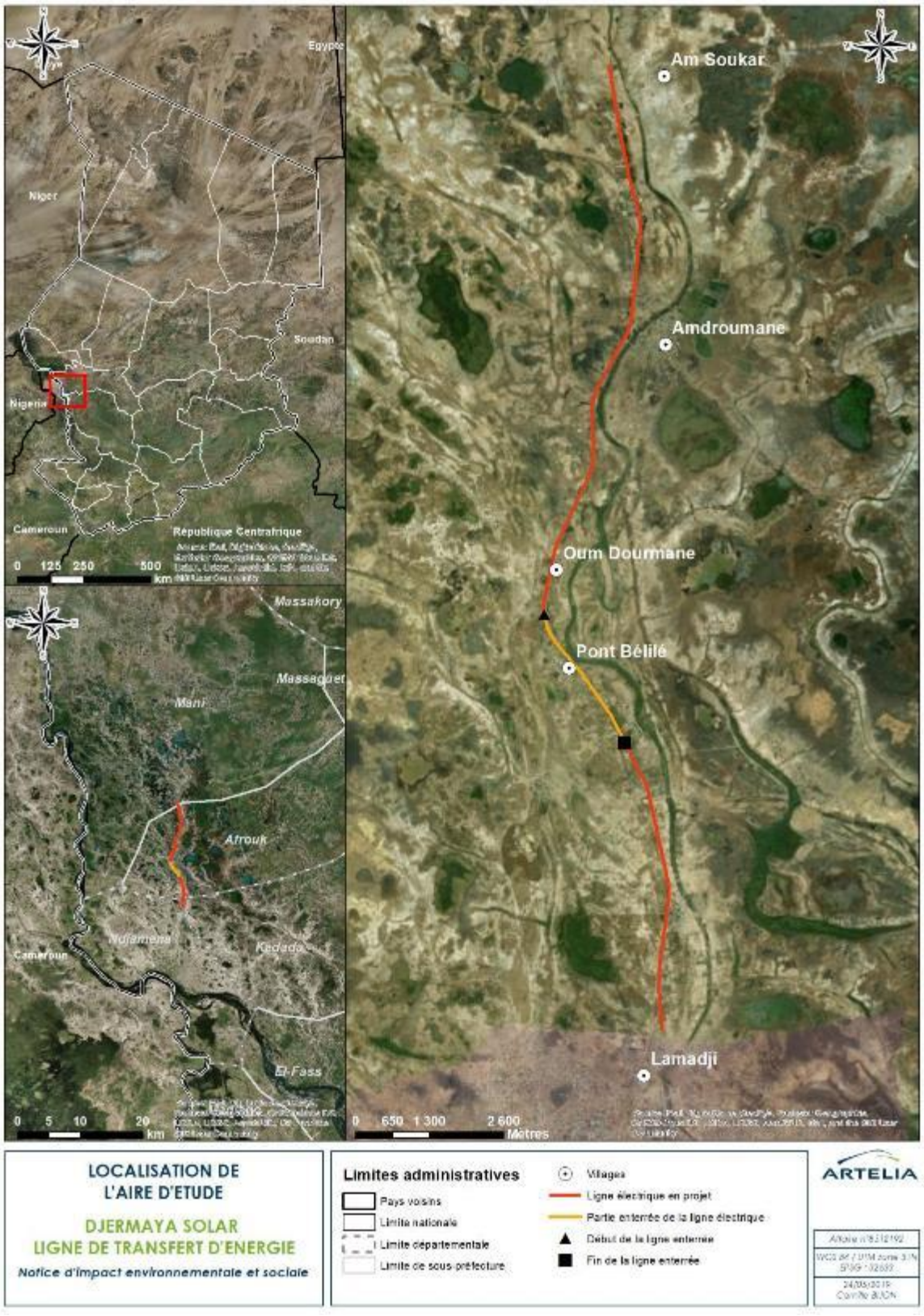
Chad is experiencing difficulties in supplying and accessing electrical energy, which is holding back its economic development. Ninety-six and a half percent (96.5%) of the energy consumed nationwide (source: *Schéma Directeur de l'Energie* - Energy Sector Master Plan) is produced from wood fuels, which has serious environmental consequences, especially on Chad's forest resources and air quality.

In addition, Chad boasts considerable natural resources, including considerable solar energy potential that could be used to develop sustainable electricity production systems, reduce deforestation and improve the country's energy performance.

With this in mind, Djermaya Solar (a consortium formed by Smart Energies International SA and Aldwych Africa Development Limited (AADL)[1]) is planning to install and operate, near N'Djamena, a 32 MWc photovoltaic power plant, which will be supplemented later by a second phase with a 28 MWp capacity) on a 100 ha site that will host both phases of the project.

To evacuate the energy produced by the future solar power plant, an additional medium voltage (33 kV) power line construction project is being developed by Djermaya Solar. This project is described in this document. This power line, a piece of infrastructure associated with the solar power plant project, will be fully owned and operated by the National Electricity Company (SNE) once completed. The line, approximately 17.5 km long, will connect the future Djermaya solar photovoltaic power plant to an existing substation located in the locality of Lamadji, Chad. The future power line will generally go along the nearby national road connecting the city of N'Djamena to=093gtrz the Djermaya refinery (see Fig.1 below).

[1] ALDA has been contracted by InfraCo Africa Limited to develop projects in sub-Saharan Africa. ALDA is a subsidiary of Aldwych International Limited



Source: Djermaya Solar / ARTELIA

Figure 1 - Location of the Transmission line Project

1.2. DJERMAYA SOLAR

Djermaya Solar is a consortium comprising Smart Energies International S.A. and Aldwych Africa Development Limited (AADL). It was formed to develop, finance, build and operate the future Djermaya photovoltaic power plant (a public-private partnership (PPP) as well as the power evacuation line, which is the subject of this impact notice.

- SMART ENERGIES INTERNATIONAL:

Smart Energies International is a French developer specialized in renewable energies and photovoltaic energy in particular. Smart Energies International develops, builds, finances and operates solar energy projects in emerging countries.

The Smart Energies group, founded in 1936, is an independent power producer managing about 100 production sites, mainly solar, in France. Smart Energies also owns and manages hydroelectric and methanization assets, as well as assets in Italy and Germany. Smart Energies, through its subsidiary Smart Energies International, is developing several energy production projects on the African continent and in the Middle East.

- AADL:

ALDA is a subsidiary of Aldwych International Limited (Aldwych). Aldwych develops, builds, owns, operates and invests in power generation, transmission and distribution facilities in sub-Saharan Africa. Aldwych has been selected by InfraCo Africa Limited (InfraCo Africa) to develop projects in sub-Saharan Africa.

1.3. AUTHORS

ARTELIA	**Artelia Eau et Environnement** **Le First Part Dieu – 2, avenue Lacassagne** **69425 Lyon Cedex 03 — France**

Artelia is one of the largest independent European engineering, project management and consultancy groups, formed from the merger of Coteba and Sogreah in March 2010. It now employs nearly 5,000 professionals in 200 countries. The group has the technical and logistical capacity to carry out a very large number of studies while mobilizing multidisciplinary teams throughout the world.

The group conducts its assignments in nine areas of expertise: building construction, water, energy, environment, industrial facilities, maritime, multi-site projects, transport and cities. ARTELIA works for both private clients (industrialists, especially in the energy sector, developers, engineering firms, investors, construction companies, banks and insurance companies, etc.) and public clients (ministries, local authorities, public institutions, etc.). Finally, the Artelia Group is internationally recognized by numerous institutions such as the World Bank, the Global Environment Facility, the European Union, the Asian Development Bank, the French Development Agency, etc.

Artelia has conducted numerous environmental and social studies for various clients (Energy Caraïbes, EDF, Groupe MATIERE, Photowatt, BP Solar, Séchilienne-Sidec, Green Solar, Akuo Energy, Austral Energy, TANESCO, Casino etc.) under photovoltaic power plant construction projects. It has also conducted due diligence audits for companies such as Société Générale, Poweo, Crédit Mutuel, etc.

The International CSR Department in charge of this study draws on solid experience in Africa, which includes various dam projects in Cameroon (Nachtigal project), Mali (Kénié and Felou dam projects), Gabon and the Democratic Republic of Congo (Grand Inga project), along with interconnection projects, especially in Chad, Cameroon and Nigeria, and solar power plants in Tunisia and Tanzania, etc.

2. LEGAL, REGULATORY AND INSTITUTIONAL FRAMEWORK

2.1. ESIN PROCEDURE AND PROCESS

In Chad, E&S studies must meet the requirements of Act No. 14/PR/98 of August 17, 1998 outlining general environmental protection principles. Article 80 of this law stipulates that "when developments, facilities or projects are likely to adversely affect the environment because of their size or their impact on the natural environment, the administration may require the petitioner or the project owner to conduct a pre-project impact study to assess their compatibility with environmental protection requirements". It also complies with Decree No. 630/PR/PM/MERH/2010 of August 4, 2010 on the regulation of environmental impact assessments and Order No. 039/PR/PM/MERH/SG/DGE/DEELCPN/2012 of November 29, 2012 on general guidelines for conducting an environmental impact assessment.

Chadian regulations classify projects into three categories - A, B and C -, i.e. from the most to the least impacting. The decree establishing the respective categories has not yet been published. However, considering the very limited scope of the expected impacts of this medium voltage (MV) line, a **category B** classification is proposed for the power line project.

In addition, based on the criteria outlined by Act No. 14/PR/2008 and confirmed by the Chadian authorities, vegetation clearing induced by the project does not exceed 5 hectares (area of vegetation cover removed by the project estimated at 1.1 hectares, see Chapter 5.2.1). Therefore, the surface area cleared does not compromise the project's category B classification under Chadian regulations.

Category B is subject to an EIN (environmental impact notice) which is the subject of this study. The content and procedure to be followed for an EIN are defined in Order No. 039/PR/PM/MERH/SG/DGE/DEELCPN/2012. The content of an EIN is presented in a form and consists of six (6) sections presented below. This form can be supplemented with a specific report to adequately present all the required information.

Table 1 - Contents of an Environmental Impact Notice

CONTENTS OF AN ENVIRONMENTAL IMPACT NOTICE
Part 1: General Information
Part 2: Description of the Facility, Structure or Project
Part 3: Description of the Receiving Environment
Part 4: Mitigation Plan and Measures
Part 5: Monitoring and Follow-up Activities
Part 6: Signature and Date

2.2. INSTITUTIONAL, LEGAL AND REGULATORY FRAMEWORK

2.2.1. Institutional Framework

- The National Assembly

The National Assembly is a legislative body, responsible for passing laws. Its mandate includes ruling on environmental issues. It sets the rules for the protection of the environment and the conservation of natural resources, in accordance with Article 127 of the Chadian Constitution of 2018, presented in Section 2.2.2.

- The High National Committee for the Environment (HCNE)

Established by Decree No. 822/PR/MET/95 of October 20, 1995, the HCNE's mandate is to promote, harmonize and monitor the implementation of environmental protection policies and strategies to ensure sustainable development in Chad. It is an inter-ministerial body chaired by the Prime Minister. Article 3 of the decree defines the members of the HCNE who include:

- The minister of Production, Irrigation and Agricultural Equipment.
- The minister of Livestock and Animal Productions.
- The minister of Mines, Industrial and Business Development and the Promotion of the Private Sector.
- The minister of Petroleum and Energy.
- The minister of Infrastructure, Transport and Desenclavement.
- The minister of National Education and Civic Promotion.
- The minister of Economy and Development Planning.
- The minister of Territorial Administration.
- The minister of Communication, and Government spokesperson.
- The minister of Women, Early Childhood Protection and National Solidarity.
- The minister of the Civil Service, Labor and Social Dialogue.
- The minister Delegate to the Office of the President of the Republic, responsible for National Defense, Public Security, Veterans and War Victims.

The specific role entrusted to the HCNE are as follows:

- effectively implement the recommendations of the Sovereign National Conference on Environment and Development;
- effectively implement the recommendations and Agenda 21 resulting from the United Nations Conference on Environment and Development in Rio de Janeiro in June 1992;
- ensure that environmental and development issues are effectively integrated;

- guide sustainable development policies and ensure they are effectively implemented;
- make trade-offs between conflicting development and environmental protection priorities;
- define the procedures for the implementation and the functioning of a National Environment Fund (FNE) to promote environmental protection operations;
- mobilize institutional and social partners to promote the protection and improvement of the environment.

- The Government

The main ministries collaborating at the central level with the Ministry of the Environment in environmental management are listed below.

- Ministry in charge of the Environment

The Ministry in charge of the environment is responsible for developing and implementing the government's environment policy.

- Ministry of Economy and Planning

According to Decree No. 331/PR/PM/02 of July 26, 2002, the Ministry of Planning, Development and Cooperation participates in the preparation and organization of the Donors' Round Tables on the development of Chad and other consultations.

- Ministry of Water

This ministry is responsible for the design, coordination, implementation and monitoring of the government's water policy.

- Ministry of Agriculture

This ministry is responsible for the design, coordination, monitoring, and implementation of the government's agricultural policy.

- Ministry of Livestock

This ministry in responsible for implementing the country's livestock development policy.

- Ministry of Mines and Energy

The Ministry of Mines and Energy implements the government's energy and mining development policy.

- Ministry of Social Action and Family

The family policy defined by the government is carried out through the development and implementation, in collaboration with the technical ministries concerned, of education and training programs for women in urban and rural areas.

- Ministry of Tourism Development

The government's tourism policy consists in establishing an inventory of the country's tourism potential to ensure its development as a national industry, promoting national tourism resources, in particular national parks and wildlife reserves and hunting areas, in collaboration with the minister of Environment, and encouraging and supporting private initiatives in the tourism and hospitality sectors.

- Ministry of Land Management, Urban Planning and Housing

This ministry is involved in rural land use planning for improved management purposes and also in the development and implementation of land legislation in collaboration with ministries working to reduce wildlife habitats through population migration and crop expansion.

- Ministry of Territorial Administration

This ministry is involved due to the involvement of local and territorial authorities (communes, region...) which are under its authority.

- Ministry of Public Health

This ministry is responsible for the design, coordination, implementation and monitoring of the government's public health policy.

- The Ministry of Environment, Water and Fisheries is organized as defined by Decree No. 1153/PR/PM/MEEP/2019. It includes the following departments:
- a General Inspectorate
- a Central administration
- decentralized services.
- bodies under its supervision (such as the National Water Fund, the Special Fund for the Environment, the National Agency for the Great Green Wall, the Agency for Domestic Energy and the Environment, etc.)..

The central administration is itself broken down into:

- a General Secretariat.
- a DGE.
- a General Directorate for Administration, Planning and Monitoring; and
- the following Technical Departments:
    - Technical General Directorate for the Environment and Sustainable Development:
    - Directorate for Environmental Assessments and Pollution and Nuisance Control.
    - Directorate of Environmental Education and Climate Change Control.
    - Directorate General for Forestry, Wildlife and Fishing Resources:
    - Forestry and Desertification Control Directorate
    - Directorate of Wildlife Conservation and Protected Areas.
    - Directorate of Fisheries and Aquaculture Development.

- General Technical Directorate of Hydraulics and Sanitation:
- Drinking Water Supply Branch.
- Sanitation Department.
- Directorate of Pastoral Hydraulics.
- General Technical Directorate of Water Resources:
- Directorate of Water Resources.
- Waterworks Operation Monitoring Department.
- Directorate of Studies, Planning, Monitoring and Evaluation of Information Technology.
- Legal Affairs and Litigation Department.
- Human Resources and Material Directorate.

- Decentralized State services

Most ministries have set up regional delegations and departmental services. The deconcentrated technical services play an important role with urban and rural populations within the framework of sustainable environmental management.

Thus, as part of efforts to monitor the management and control of forest resources, the Ministry of Environment and Water has established regional environmental delegations corresponding to the country's 23 regions, forest inspectorates, wildlife conservation sectors, and fisheries sectors and sub-sectors.

- Local Authorities

According to the Constitution, the decentralized territorial communities (rural communities, communes, departments, provinces) are responsible for environmental protection with the support of the public authorities. As part of the implementation of the decentralization process in the country, support for local development has been provided through specific capacity building programs to enable rural communities to manage their territories themselves (establishment of local management bodies - SLGs).

2.2.2. Regulatory Instruments

The legislative and regulatory instruments governing environmental management in Chad are as follows:

- The constitution enacted on May 04, 2018;
- Acts No. 23, 24 and 25 of July 22, 1967 which respectively govern the status of state property, the system of land ownership and customary rights, the limitations of land rights, and their implementing decrees n° 186, 187, 188 of August 01, 1967;
- Act No. 038/PR/96 of December 11, 1996 on the Labor Code;
- Act No.14/PR/98 of August 17, 1998 outlining general principles on environmental protection;
- Act No. 16/PR/99 of August 18, 1999 on the Water Code, including provisions on the management of fluvial, lacustrine or underground waters and the exploitation of hydraulic works;
- Act No.14/PR/2008 of June 10, 2008 on forests, wildlife and halieutic resources;
- Act No. 006/PR/2010 of 2010 relating to urban planning;

- Decree No. 2002-540 of April 18, 2002 relating to waste classification;
- Decree No. 904/PR/PM/MERH/2009 of August 6, 2009 on environmental pollution and nuisance regulation through various titles:
  (i) Title II on environmental protection; (ii) Title III on waste; (iii) Title IV on liquid and gaseous effluents; (iv) Title V on noxious or hazardous substances;
- Decree No. 630/PR/PM/MERH/2010 of August 04, 2010 on the regulation of environmental impact assessments;
- Decree No. 378/PR/PM/MAE/2014 of June 05, 2014 on the promotion of environmental education;
- Decree No. 380/PR/PM/MERH/2014 of June 5, 2014, establishing the terms for applying the wildlife regime and presenting lists A and B of protected species in Chad;
- Decree No. 579/PR/PM/MAE/2014 establishing the procedures for managing the forest domain;
- Decree No. 1472/PR/PM/MEEP/2018 on the organization of the Ministry of the Environment;

- Order No. 039/PR/PM/MERH/SG/DGE/DEELCPN/2012 of November 29, 2012 on general guidelines for conducting an environmental impact assessment;
- Order No. 041/MERH/SG/CACETALDE/2013 of July 9, 2013 regulating public consultations on environmental impact assessments.

2.2.3. International Conventions and Regulations

Chad has signed and/or ratified a number of international conventions, agreements and regulations relating to environmental management and protection. Signing an international instrument is a preliminary approval, unlike ratification or accession, which implies that the country agrees to be legally bound by the provisions of the instrument. The table below lists the conventions, agreements and regulations concerning Chad:

Table 2 - List of International Conventions, Treaties and Regulations

NAME OF THE CONVENTION, TREATY, REGULATION	STATUS	SIGNATURE DATE	RATIFICATION	EFFECTIVE DATE
Convention establishing the Lake Chad Basin Commission (LCBC), bringing together four countries bordering Lake Chad (Chad, Cameroon, Nigeria and Niger), CAR and Libya	Chad is a founding member along with Cameroon, Nigeria and Niger	05/22/1964	05/22/1964	05/22/1964
African Convention on the Conservation of Nature and Natural Resources;	Algiers, 09/15/1968; revised by the Conference of the African Union in Maputo on 07/11/2003	12/06/2004	01/20/2015	07/23/2016

NAME OF THE CONVENTION, TREATY, REGULATION	STATUS	SIGNATURE DATE	RATIFICATION	EFFECTIVE DATE
Convention establishing the Inter-State Committee for Drought Control in the Sahel (CILSS);	Adopted in Ouagadougou, 09/12/1973, Amended in Banjul, 21/12/1977	12/30/1975	12/30/1975	12/30/1975
Agreement on the common regulation of fauna and flora between Cameroon, Niger, Nigeria and Chad;	Chad is a founding member along with Cameroon, Nigeria and Niger	12/03/1977	12/15/1977	12/03/1977
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES Washington);	Accession order signed on 02/08/1988	03/03/1973 in Washington Amended in Bonn, 06/22//1979 and Gaborone 04/30/ 1983	02/02/1989	07/01/1975
Convention on the Conservation of Migratory Species of Wild Animals (CMS);	Adopted in Bonn on 06/23/1979	06/23/1979	06/011997	09/01/1997
Agreement on cooperation and consultation between the Central African States on the conservation of wildlife;	Adhered to the agreement on 08/02/1988	04/16/1983	08/02/1988	04/16/1983
International Plant Protection Convention;	Adopted in Rome on 12/06/1951 and revised on 11/17/1997(FAO)	12/06/1951	03/15/2004	03/15/2004
International Code of Conduct on the Distribution and Use of Pesticides;	Adopted in 1985, amended in 1989, revised in 2002 and 2013	11/28/1985	01/06/2013	June 2013 (FAO)
Convention on Wetlands (RAMSAR); Convention on Wetlands of International Importance	Adopted on 02/02/1971 in Ramsar, Iran and Accession in 1990	02/02/1971	07/13/1990	10/13/1990
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 within Africa;	Adopted in Mali, on 01/30/1991	01/27/1992	05/31/2013	08/29/2013
United Nations Framework Convention on Climate Change (UNFCCC);	Adopted in Rio de Janeiro, 1992	06/12/1992	07/07/1994	03/21/1994
Convention on Biological Diversity;	Adopted in Rio de Janeiro, 1992	06/07/1992	04/30/1993	12/29/1993
Vienna Convention on Substances that Deplete the Ozone Layer (ODS);	Adopted on 03/22/1985	03/22/1985	05/18/1989	09/22/1988
Montreal Protocol on the Protection of the Ozone Layer;	Adopted on 09/16/1987	09/16/1987	06/07/1994	01/01/1989
United Nations Convention to Combat Desertification;	Adopted on 07/17/1994 in Paris	10/15/1994 in Paris	09/27/1996	12/26/1996
Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade;	Adopted in Rotterdam, on 09/10/1998	11/11/1998 in Rotterdam	03/10/2004	06/08/2004

NAME OF THE CONVENTION, TREATY, REGULATION	STATUS	SIGNATURE DATE	RATIFICATION	EFFECTIVE DATE
Stockholm Convention on Persistent Organic Pollutants (POPs);	Adopted in Stockholm, on 05/22/2001	05/16/2002	03/10/2004	04/17/2004
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal;	Adopted in Basel, on 03/22/1989	03/22/1989	03/10/2004	07/08/2004
Minamata Convention on Mercury	Adopted in Kumamoto on 10/10/2013	09/25/2014	09/24/2015	08/16/2017

2.3. INTERNATIONAL STANDARDS

2.3.1. African Development Bank (AfDB) Standards

For AfDB, E&S studies must specifically address AfDB's Integrated Safeguard System Policies and Guidelines (ISS, 2013):

- Operational Safeguard #1: Environmental and Social Assessment;
- Operational Safeguard #2: Involuntary Resettlement - Land Acquisition, Relocation and Compensation;
- Operational Safeguard #3: Biodiversity and Ecosystem Services;
- Operational Safeguard #4: Pollution Prevention and Control, Hazardous Materials and Resource Efficiency;
- Operational Safeguard #5: Working Conditions, Health and Safety.

The AfDB recognizes three project categories from 1 to 3 based on the magnitude of potential environmental and social impacts. Rural electrification projects as well as small-scale power transmission projects are in Category 2, provided that a RAP is not required or limited only to an abbreviated RAP to less than 200 people. Under AfDB's guidance notes, since this power transmission project is small-scale (<110 kV) and does not physically displace any population, it is classified as Category 2.

For the E&S assessment, the following documents should be used as references:

- Integrated Backup System Guidelines. Volume 1: General guidance for the implementation of Operational Safeguards 1. (AfDB, 2015).
- Integrated Backup System Guidelines. Volume 2: Guidelines on safeguards. (AfDB, 2015).
- Integrated Safeguarding System Guidelines. Volume 3: Sector Fact Sheets. (AfDB, 2015).
- Safeguards and Sustainability Series. Volume 1-Publication 4: Environmental and Social Assessment Procedures (ESAP). (AfDB, 2015).

2.3.2. IFC Performance Standards

The IFC standards applicable to the project consist mainly of Performance Standards (PS) as well as environmental, health and safety guidelines for electricity transmission and distribution (IFC, 2007).

These PSs are as follows:

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

Where there is a difference between national regulations and the IFC international standards, the more stringent values will be adopted by the project.

The power line project, considered independently, would likely be classified as a Category B project under the IFC (2012) standards, i.e., as a project with limited potential adverse social or environmental impacts that are specific to the project site, largely reversible, and readily managed through mitigation measures. The project as a whole (line and solar plant) is classified as Category A, i.e., as a project with significant environmental and social impacts that are diverse, irreversible or unprecedented.

2.3.3. EHS Guidelines

The Environmental, Health and Safety (EHS) Guidelines (World Bank Group EHS guidelines, 2007) are technical reference documents that provide examples of good practice. Adherence to these guidelines helps to meet the criteria set forth in PS 3 for resource efficiency and pollution prevention. The general EHS guidelines provide general recommendations that can be applied to a variety of projects.

The Environmental, Health and Safety Guidelines for Electricity Transmission and Distribution (IFC, 2007) are applicable to this project due to the alteration of terrestrial habitat during the construction phase of the electricity distribution structure. Measures recommended to prevent and control adverse environmental effects will be incorporated into this impact notice.

2.3.4. International Labour Organization Standards Standards

The International Labour Organization Standards was established in 1919 and became a specialized agency of the United Nations in 1946. International labor standards are the minimum core social standards agreed upon by all actors in the global economy. There are currently 189 conventions and 203 recommendations.

Eight conventions are termed “fundamental” and deal with issues considered fundamental principles and rights at work:

- Freedom of Association and Protection of the Right to Organize Convention, 1948 (No. 87).
- Right to Organize and Collective Bargaining Convention, 1949 (No. 98).

- Forced Labor Convention, 1930 (No. 29).
- Abolition of Forced Labor Convention, 1957 (No. 105).
- Minimum Age Convention, 1973 (No. 138).
- Worst Forms of Child Labor Convention, 1999 (No. 182).
- Equal Remuneration Convention, 1951 (No. 100).
- Discrimination (Employment and Occupation) Convention, 1958 (No. 111).

The main themes covered by ILO conventions and recommendations are freedom of association, collective bargaining, forced labor, child labor, equal opportunity and treatment, tripartite consultations, labor administration, labor inspection, employment policy, employment promotion vocational guidance and training, employment security, social policy, wages, working time, occupational safety and health, social security, maternity protection, as well as taking into account the specificities of certain types of workers (domestic workers, migrants, seafarers, indigenous and tribal peoples, etc.).).

For the implementation of the Project, the relevant ILO conventions and recommendations will be enforced when more binding than national labor laws and at least the eight core conventions.

2.4. SUMMARY OF THE MAIN LAWS AND STANDARDS APPLIED TO THE PROJECT

THEMES	*NATIONAL LEGISLATION*	*INTERNATIONAL STANDARDS - PERFORMANCE STANDARDS - IFC*	*INTERNATIONAL STANDARDS - OPERATIONAL SAFEGUARDS - AfBD*	*MODALITIES OF TAKING INTO ACCOUNT BY THE PROJECT*
MANAGEMENT AND PROTECTION OF THE ENVIRONMENT				
General principles on environmental protection	May 04, 2018 Constitution; Act No. 14/PR/98 of 17/08/1998 outlining general environmental protection principles.	PS 1 on the assessment and management of environmental and social risks and impacts PS 8 on cultural heritage	OS 1: Environmental and social assessments. OS 3: Biodiversity, renewable resources and ecosystem services.	Completion of an ESIN that assesses the project's impact on the environment Conduction of an ESMP (line and solar power plant) to recommend impact mitigation measures
Environmental impact assessments	Decree No. 630/PR/PM/MERH/2010 on the regulation of EIA; Order No. 039/PR/PM/MERH/SG/DGE/DEEELCPN/2012 on general EIA guidelines; Order No. 041/MERH/SG/CACETALDE/2013 regulating public EIA consultations.	PS 1 on the assessment and management of environmental and social risks and impacts	OS 1: Environmental and social assessments. OS 2: Involuntary resettlement: land acquisition, displacement and compensation. OS 3: Biodiversity, renewable resources and ecosystem services.	Completion of an ESIN that assesses the project's impact on the environment Completion of an ESMP (line and solar power plant) to recommend impact mitigation measures
Protection, exploitation and management of natural resources	Act No. 14/PR/2008 on forests, wildlife and halieutic resources; Act No. 16/PR/99 on the Water Code; Decree No. 380/PR/PM/MERH/2014 establishing the procedures for applying the wildlife regime Decree No. 579/PR/PM/MAE/2014 establishing the procedures for the management of the forest domain	PS 3 rational use of resources and pollution prevention; PS 6 on biodiversity conservation, sustainable management of living natural resources and ecosystem services.	OS 2: Involuntary resettlement: land acquisition, displacement and compensation OS 3: Biodiversity, renewable resources and ecosystem services. SO4: Pollution prevention and control, hazardous materials and efficient use of resources.	The ESIN focuses on assessing resource consumption, pollution risks, and the conservation of biodiversity and ecosystem systems. The ESMP (line and solar power plant) proposes alternatives and measures for protecting resources and fighting against all forms of pollution

Management of waste, liquid and gaseous effluents, noxious or dangerous substances, auditory and olfactory nuisances	Act No. 14/PR/98 outlining general environmental protection principles; Decree n°904/PR/PM/MERH/2009 on environmental pollution and nuisance regulation.	PS 3 on the rational use of resources and pollution prevention: Consumption of natural resources GHG Waste and Pesticide Management; PS 4 on community health, safety and security	OS 1: Environmental and social assessments. OS 3: Biodiversity, renewable resources and ecosystem services. SO4: Pollution prevention and control, hazardous materials and efficient use of resources.	The ESIN focuses on assessing resource consumption, pollution risks, and biodiversity conservation The ESMP (line and solar power plant) proposes alternatives and measures for the protection of resources and the fight against all forms of pollution
TOWN PLANNING AND LAND USE				
Land use and urban planning	Act 67-23 and its implementing decree No. 186 on the status of state-owned property; Act 67-24 and its implementing decree No. 187 land ownership and customary rights; Act 67-25 and its enforcement decree No. 188 of August 1, 1967 on the limitations of land rights Act N°006/PR/2010 on urban planning	PS 5 on land acquisition and involuntary resettlement through a Resettlement Action Plan and/or Livelihoods Restoration Plan; PS 8 on cultural heritage	OS 1: Environmental and social assessments. OS 2: Involuntary resettlement: land acquisition, displacement and compensation OS 3: Biodiversity, renewable resources and ecosystem services.	A Livelihood Restoration Plan (LRP) is drafted to take into account the temporary displacement of economic activities related to the construction of the line. This document covers the activities of the line and the solar power plant.
WORKING CONDITIONS				
General provisions and fundamental rights	Act No. 038/PR/96 on the Labor Code	Comply with PS 2 on labor and working conditions requiring that a safe and healthy working environment be provided for workers. Compliance with ILO conventions and recommendations	OS 1: Environmental and social assessments. OS 2: Involuntary resettlement: land acquisition, displacement and compensation OS 5: working conditions, health and safety	The social impact of the project is assessed in the ESIN. The ESMP calls for measures to respect working conditions and workers.

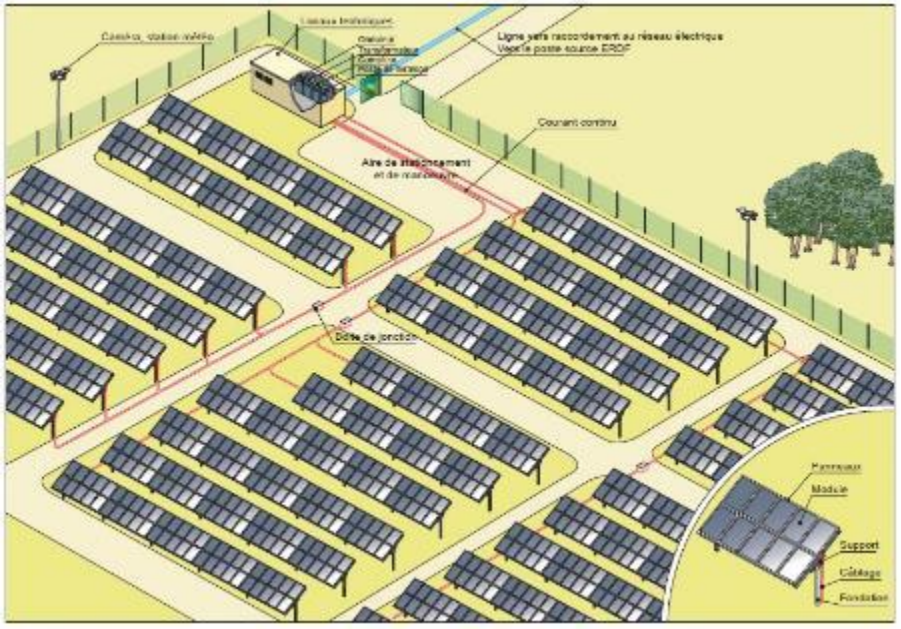
3. RESENTATION OF THE PROJECT FRAMEWORK

3.1. DJERMAYA SOLAR POWER PLANT

The Djermaya Solar project is located about 30 km north of N'Djamena (Chad) on a 100-ha site adjacent to a north-south road, and about 7 km southwest of the country's main oil refinery in the town of Djermaya.

The power plant will consist mainly of a set of photovoltaic panels laid out to capture the maximum amount of solar radiation, associated with a network of transformers/inverters and cables to distribute the electricity produced within the grid. Fig.2 below shows a summary of these elements.

Djermaya Solar's photovoltaic park will be equipped with poly-crystalline modules mounted on a system of solar trackers, which allows the modules to follow the path of the sun throughout the day and thus obtain a better operating yield.



SOURCE: (French Ministry of Ecology, 2011)

Figure 2 - Schematic diagram of a photovoltaic park

Source: ARTELIA

Figure 3 - Example of a Ground-Mounted Solar Power Plant with a Single-Axis Tracker

Source: ARTELIA

Figure 4 - The solar Power Plant Project Area

Table 3 - Coordinates of the Plot of Land Hosting the Solar Power Plant

LONGITUDE	LATITUDE
12°22'10.13 "N	15° 2'3.06 "E
12°22'7.85 "N	15° 2'28.53 "E
12°21'25.89 "N	15° 2'24.68 "E
12°21'28.04 "N	15° 1'59.21 "E

WGS84 (in decimal degrees and in degrees, minutes, and seconds)

In the first phase, the plant will include approximately 100,000 solar modules (about 25ha of panels) that will generate a peak power of 32 MWp. This energy will be made available to the National Electricity Company (SNE) and will be redistributed throughout the Chadian network. The project could be completed by a second tranche of 28 MWp, bringing the total power of the plant to 60 MWp. This second tranche will be developed on the same site.

The construction time of the solar power plant will take approximately one year.

3.2. DESCRIPTION OF THE POWER LINE

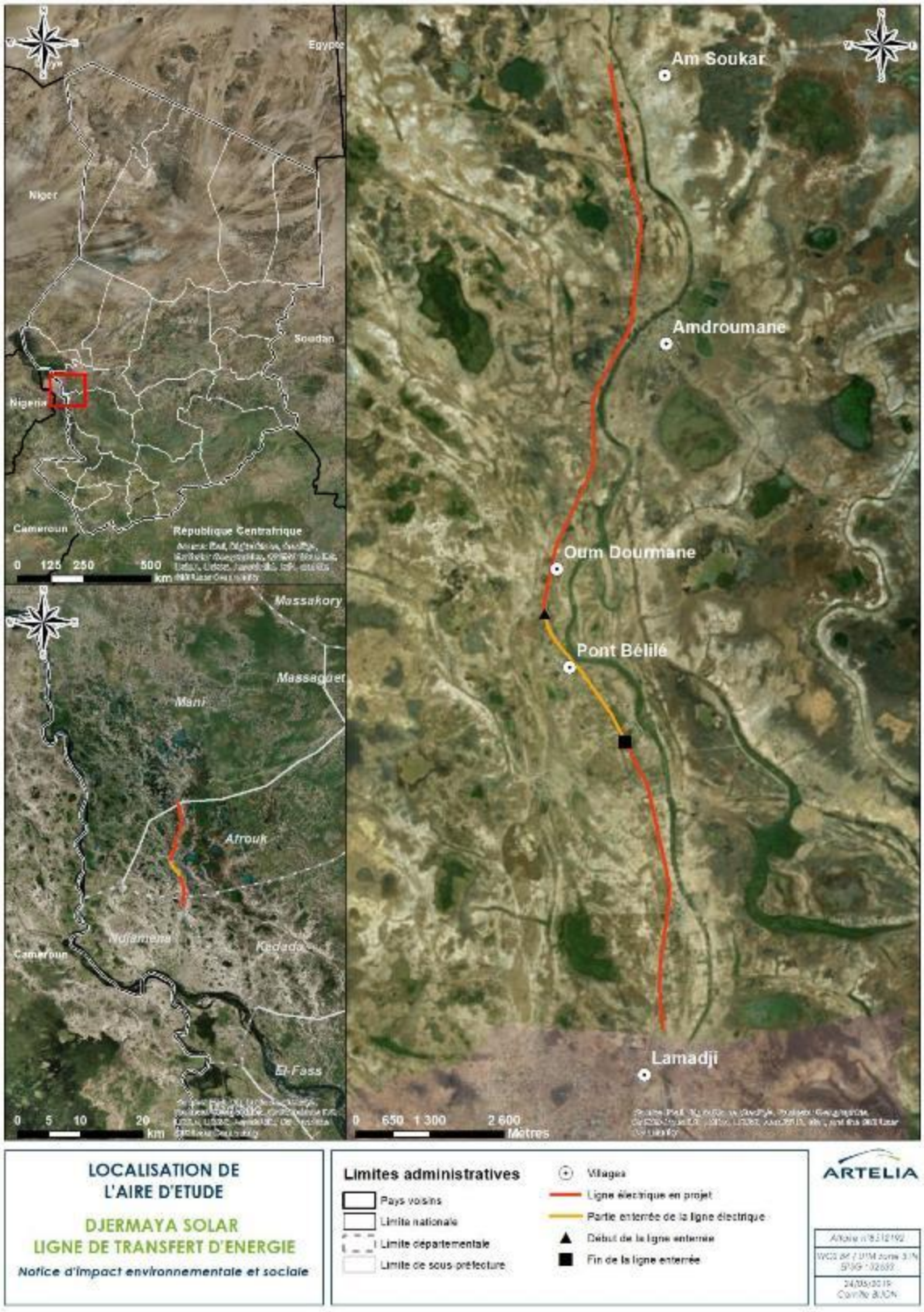
The energy evacuation line, which is the subject of this impact notice, will consist of the line itself and the associated transformer stations, located at the photovoltaic power plant and the Lamadji substation, the latter already being in operation.

3.2.1. Presentation of the Line

The design of the connection line of the Djermaya solar power plant is yet to be finalized and will be specified by the project developer at the time of the detailed design phase.

The project involves the installation of a 17.5 km long 33kV line, with conductors with a 360 mm^2 diameter. The line is a "double-circuit" line, which means it includes two sets of three power cables (three-phase overhead line).

The location of the facility is shown in the figure below.

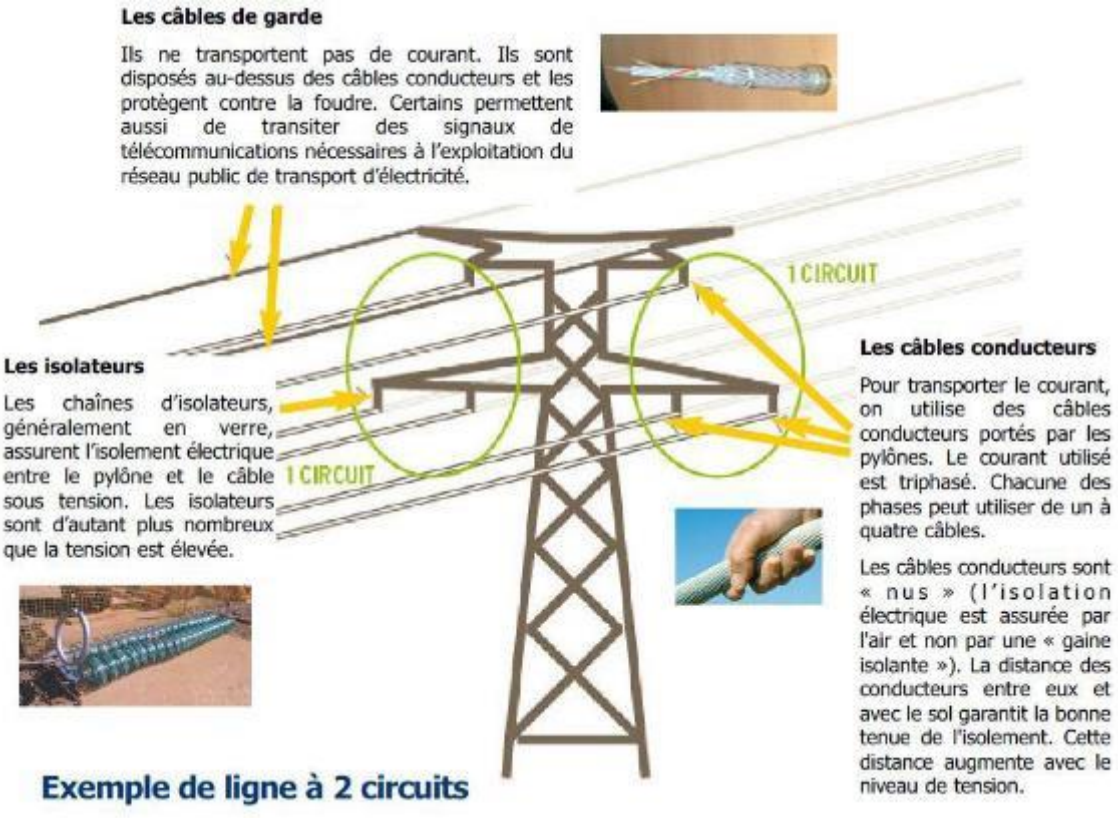


Source: Djermaya Solar / ARTELIA

Figure 5 - Location of the Power Line

For most of the route, the overhead line will run parallel to the N'Djamena-Abeche road, which it will follow at a distance of about 22 m west of its centerline.

An overhead line is composed of towers, conductor cables, guard cables and insulators. The pylons support the overhead cables through which the electric current flows.Their role is to maintain the cables at a minimum safe distance from the ground and surrounding obstacles, to protect the safety of people and installations located in the vicinity of the lines.



Source:RTE

Figure 6 - Main Components of a Power Line

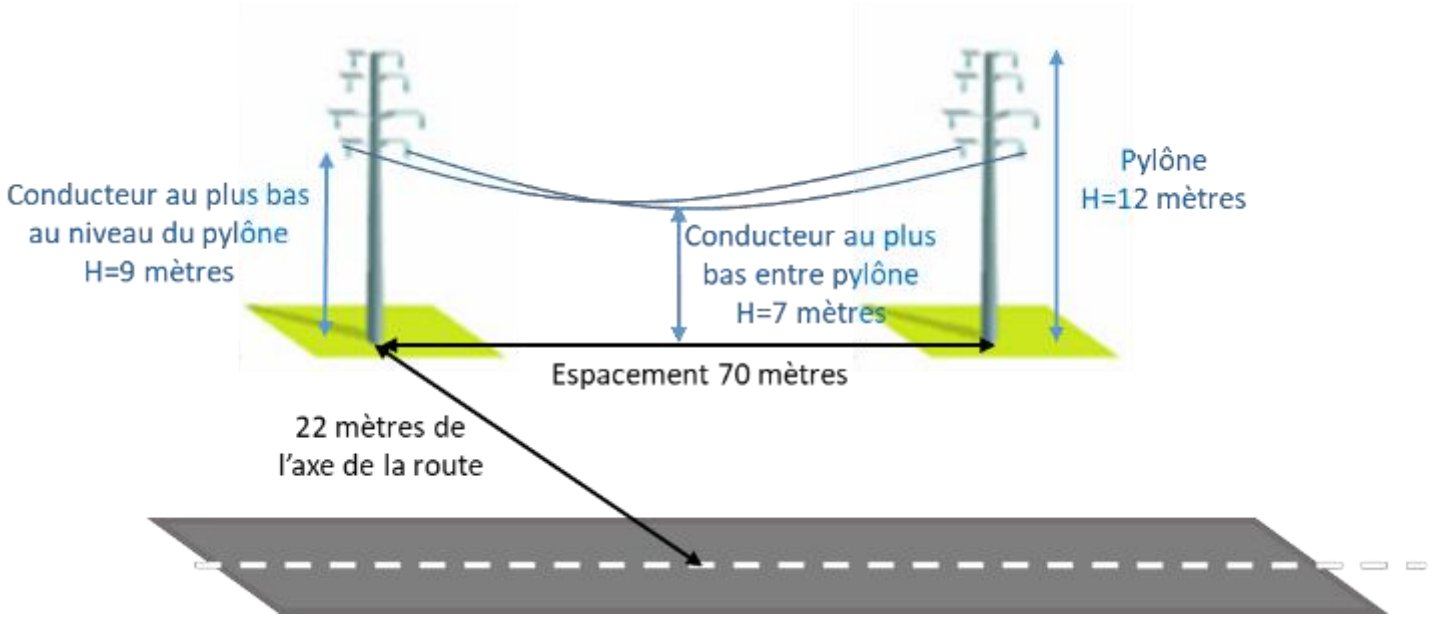
The line will be equipped with a guard cable (grounding cable), located above the conductors, to ensure both lines are protected against lightning. This will contain one or more fiber optic cables to allow communication and information exchange between the power plant and the network manager (SCADA system - *Supervisory, Control and Data Acquisition*). This is called OPGW (optical ground wire) or composite fiber optic cable.

The line will be supported by prefabricated metal pylons, spaced at 70-meter intervals. A total of 220 pylons should be installed. The height of the pylons will be approximately 12 meters, and their diameter at ground level will be 50 centimeters. The foundations of the pylons will be made of reinforced concrete and buried at a depth of about two meters.

The conductors and the guard cable will be installed on the pylons at heights between 9 and 12 m. The minimum height of the conductors from the ground should be about 7 m. At the level of the towers, the cables will be supported by glass insulators.

Just before the Lamadji substation, the line will cross the road and an 11kV cable, then will continue underground to the perimeter of the substation.

The diagram below summarizes the principles applied to the implementation of the line and the photo gives an example of a similar installation.



Source: ARTELIA

Figure 7- Line Layout Diagram

Source: Djermaya Solar

Figure 8 - Typical example of towers that can be used for the 33kV line

In the village of Pont Bélilé (or Pombélilé), the line will be buried at a distance of one to two meters from the edge of the road, over a length of up to about 2.25 km. This is to avoid any lasting physical displacement of buildings (businesses or homes - this is described in more detail in chapter 3.7)

Another option is being considered for the last kilometer south of the village of Pont Bélilé. On this stretch, the line could once again become overhead and run along the perimeter walls of the properties

However, this would require a deviation from the 22 m distance from the centerline of the road agreed upon with the SNE and the Chadian authorities. In this option, 5 pylons would have to be placed at a distance of between 21 m and about 15 m from the centerline of the road to maintain a minimum distance from the perimeter wall at this location. The feasibility of this option is being discussed with the authorities and will be confirmed when the authorities formally return on the subject. The selection of this option does not affect the measures recommended in this study.

The cable will be installed within a 1.2- to 1.5-meter deep trench that would accommodate the following configuration (from the bottom of the trench to the surface):

- 75 to 100 mm of sand;
- Cable;
- 75 to 100 mm of sand;
- Layer of protective bricks;
- Backfill from all sources;
- Topsoil layer.

3.2.2. Presentation of the Stations

At the ends of the line there are electrical substations that allow the electricity to be routed and controlled remotely. At the power plant level, the substation is designed to inject the energy produced by the photovoltaic power plant into the power line. At the Lamadji substation, the new substations will be used to inject and distribute the energy produced by the power plant to the N'Djamena network.

Substations are also used to respond to an incident by cutting power to a line and diverting it to another destination.

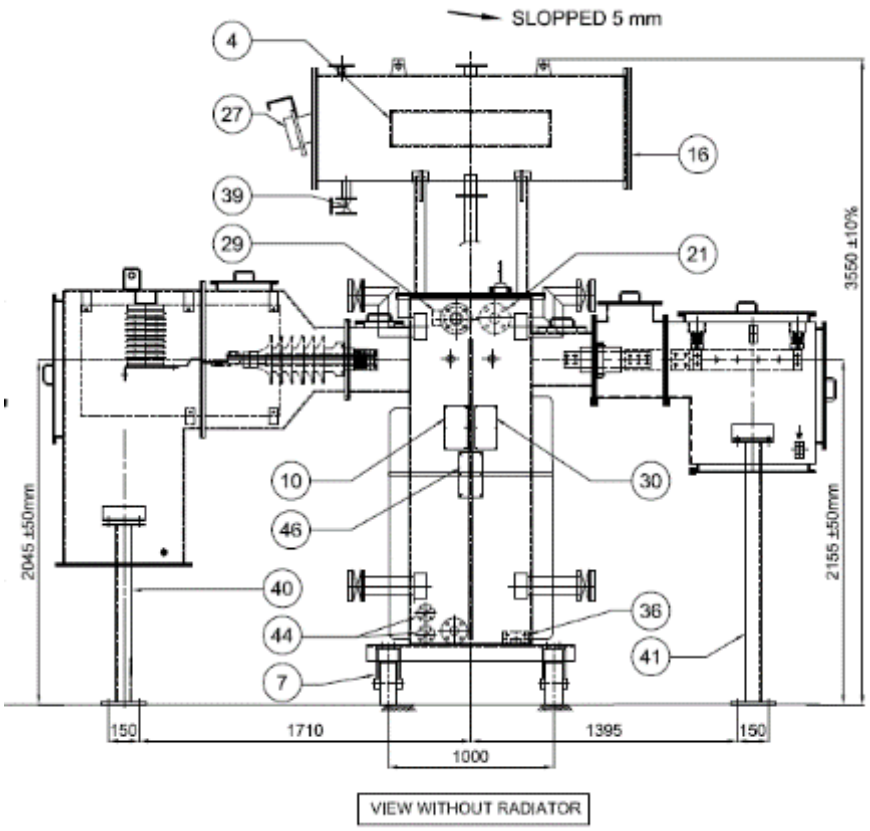
Within each substation, there are control buildings, metal structures and several electrical installations (transformers, circuit breakers, disconnectors, etc.) that contribute to the proper functioning of the network.

3.2.2.1. Stations of the Photovoltaic Plant

Two substations are planned on the site of the solar power plant. One of them will be transferred to SNE during the operation phase. Thus, no additional space will be used for the installation of these substations in addition to the space required by the solar power plant.

These two facilities will be located in separate buildings. Access to the SNE substation will be through a separate entrance from the power plant to allow access to SNE operators at all times.

The drawings below show the projected configuration of the transformer planned to be located at the solar plant site.



Source: Djermaya Solar

Figure 9 - Preliminary design of the solar power plant's transformer

Table 4 - Characteristics of the solar power plant's transformer

Features	
Transformer type	Oil
Weight	Approx. 10 tons
Height	Approx. 3.5 meters
Length	Approx. 3.5 meters
Width	Approx. 1.7 meter
Oil amount	2,000 liters / 1,800 kg
Power	2,700 kVA
Voltage	33 kV

It is also planned to install batteries at the substation of the power plant. Ownership and operation of this system, which would be an integral part of the grid interconnection, will be transferred to SNE upon commissioning. This system will be located next to the solar power plant and connected to the SNE substation at the 33 kV busbar.

The facility consists of a rack-mounted battery assembly located in a 40-foot container or dedicated building. The storages are protected against leakage and fire. The photos below show examples of similar systems for photovoltaic power plants.

Source ARTELIA

Figure 10- Example of a battery backup system

What is advantageous about this type of backup system is that it stabilizes the amount of energy introduced into the 33 kV line from the solar power plant to the Lamadji substation, reducing the need for a spinning reserve or the installation of a hot-start generator.

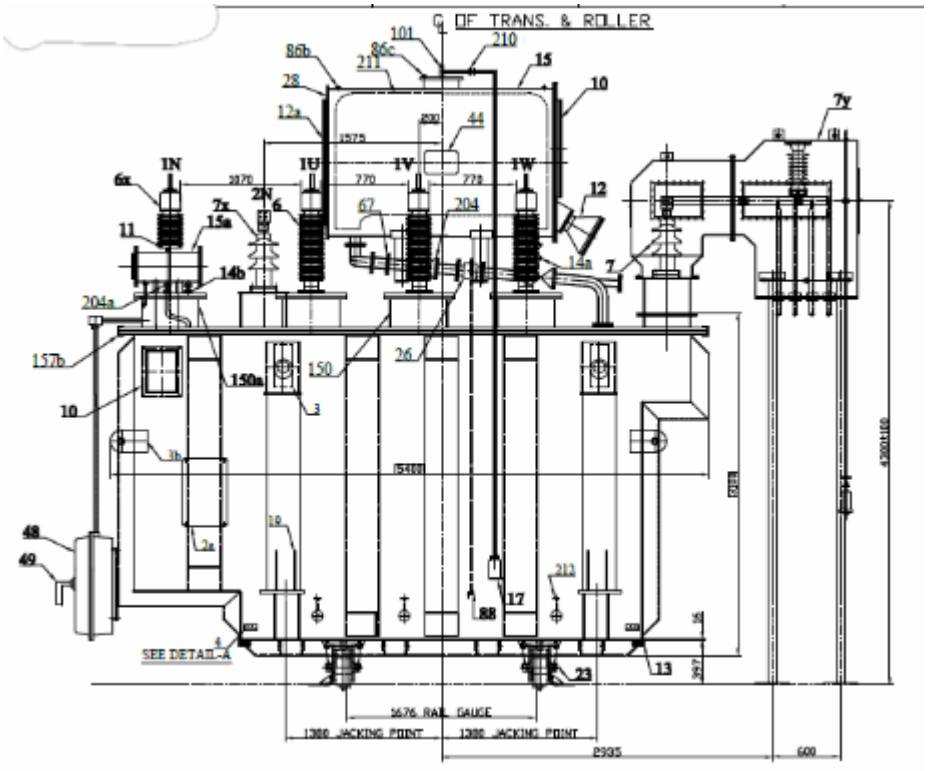
Thus this 4 MW system reduces the solar start-up time from about 16 MW to about 1.5 MW, hence an improvement by a factor of 10. The capacity to be installed is being discussed and will be confirmed at a later stage.

3.2.2.2. Lamadji Stations

Two 33/90 25MVA step-up transformers will be installed so that AC power can be injected into the N'Djamena 90 kV network. These new installations will be located within the existing perimeter of the Lamadji site owned by SNE.

They will be located northeast of the substation, and will be aligned with the two existing 66/90 kV transformers. The transformer breakers will be designed for a load current of at least 630A. The existing 90kV busbar will be extended to accommodate the future transformer substation for an eventual phase 2 of the Djermaya Solar project. This entire set of equipment will be transferred to SNE after commissioning.

Figure 11 - Satellite view of the SNE's Lamadji station; yellow dotted line: area dedicated to two future transformers



Source: Djermaya Solar

Figure 12- Preliminary design of a transformer for the Lamadji substation

Table 5 - Characteristics of the Lamadji substation transformer

Features	
Transformer type	Oil
Weight	Approx. 60 tons
Height	Approx. 4.7 meters
Length	Approx. 7 meters
Width	Approx. 3 meters
Oil amount	20,000 liters / 18,000 kg
Power	25 MVA
Voltage	**33** 90 kV

3.3. DESCRIPTION OF THE WORK PHASE

3.3.1. Construction of the line

The line will be built by the company in charge of building the power plant or its subcontractor. The material necessary for the construction of the line will be stored on the site of the power plant. The work will be carried out by small teams (10 to 30 people in all, depending on the progress rate required) working in mobile construction sites and in specialized workshops: a “foundations” team, a “tower installation” team and a “cable pulling” team.

These teams will operate successively at specific work sites. The works will begin with the staking operation, the purpose of which is to mark out the route of the line on the ground and define the exact location of the pylons. Next will be preparatory operations, which include clearing the right-of-way for the pylons and the line’s route, and preparing access roads (deforestation, pruning, topping). Given the location of the line close to the road and the absence of nearby forests, this access preparation work will be very limited.

For this type of project, the pylons will be erected one after the other and the lines will be installed by a specialized team on a given section. The following sequence is anticipated:

- Digging of the foundation (2 m deep and at least 50 cm in diameter, i.e. 0.8m²) using a mechanical shovel or by hand (the most likely option);
- Installation of reinforcement and pouring of the concrete foundation;
- Pylon assembly;
- Lifting, installation of the tower and bolting.

Once all the pylons are in place in a given section, the structure is first "dressed" with insulators. The cables are then unwound: a pulling cable is unrolled from tower to tower, which is then used to pull the cables. The cables are unwound in sections of about 2 to 3 km. The new cable reels are brought in by truck and laid in the line axis before the first tower. A reel is then placed on a trestle where it can rotate freely when the motorized winch placed on the other side of the second stop starts pulling. The cables are unwound using the technique known as "mechanical tension" by the winch: they are held in the air, without contact with the ground between two pylons, so as not to disturb activities under the overhung areas, while maintaining good safety conditions..

We always start by pulling the guard wire placed at the top of the tower that will hold the towers together. The guide wire is placed on the pulleys attached to the towers up to the winch. For phase pulling, the pulley are attached to the end of the insulator chains on each tower. When turning, the winch calls the pulling cable, which pulls the electric cable. After pulling all the cables, the spans are adjusted to respect the ground clearance and the verticality of the route chains, then the conductors are fixed in the clamps. The work progresses section by section.

3.3.2. Installation of the buried cable

The buried section of the power line will be located in the village of Pont Bélilé to limit the relocation of existing facilities.

The work will begin with the digging of a one-meter deep trench placed one to two meters away from the road over a length that could reach approximately 2.25 km. The trench will be dug by excavator or by hand. The footprint of these works is in the order of two to three meters wide.

The bottom of the trench will then be covered with a 10cm layer of sand and the cable will be installed along its entire length. A second 10cm thick layer of sand will be used to cover the cable, which will then be protected by a layer of crushed bricks. The trench will then be backfilled with a layer of topsoil and compacted.

Source: Djermaya Solar (example of another similar project, no operation having started for this project)

Figure 13 - Example of cable installation work

3.3.3. Construction of the stations

The construction of the solar power plant will begin with the clearing of the right-of-way, the creation of access roads and grading/earthworks. The foundations of the platform that will host the transformers will be prepared in reinforced concrete and the equipment can be installed and connected. At the same time, the technical premises will be set up nearby to house ancillary installations (SCADA, control room, battery rooms, etc.).

At the Lamadji substation, the transformers will be installed within the existing enclosure, without extending it. The works will include the preparation of foundations, the installation of the equipment, the extension of the existing busbars and the connection of the installations. Only the traffic of machines and trucks necessary to transport the equipment will be seen from outside the substation.

3.4. DESCRIPTION OF THE OPERATION PHASE

The operating phase will be carried out by SNE, to whom ownership of the facilities will be transferred on completion of the project. The operating activities will mainly consist of diagnostic/monitoring operations and maintenance missions. In the event of damage, appropriate resources will be deployed on a case-by-case basis to repair the structures concerned as soon as possible.

Inspections are conducted at regular intervals (typically every two to three years) and include:

- On-foot visits to assess the condition of the structures (pylons, cables, insulators, signage), to verify the safety distances from the ground and obstacles and to check the immediate environment of the structure (vegetation, erosion, buildings, roads ...);
- So-called "ascending" visits of the pylons during which operators climb the pylon and carry out a more in-depth inspection of the structure and the cable attachments.

Maintenance tasks include vegetation management (cutting back vegetation that could damage the line), pylons (anti-corrosion treatment), replacement of defective structural elements or insulators, installation of cable fittings when damaged, etc...

Similarly, the substations will be regularly inspected and maintained.

3.5. DESCRIPTION OF THE DECOMMISSIONING PHASE

The Djermaya solar power plant has a planned life span of 25 years. Beyond that, if the ageing of the modules allows it, the installations will be transferred to SNE which will be able to continue its operation.

The 33 kV power line and associated transformers will be operated for at least the life of the plant and will then either be reassigned for grid use or dismantled for recycling. The lifespan of a power line is generally longer than the planned operating period of the plant (40 years and sometimes beyond). For transformers, their lifespan is very dependent on operating and maintenance conditions but is of the same order of magnitude (30 to 40 years).

The following operations are anticipated for the decommissioning of the line:

- Installation of safety signs and traffic management where necessary;
- Unhooking the cables which are rewound to facilitate their transport;
- Decommissioning of the pylons and storage of various components (pylons, angles, insulators, etc.);

- Demolition of the concrete foundation blocks to a depth of one meter and backfilling of the excavations with rubble and topsoil;
- Evacuation of components by specialized companies for recycling.

The materials resulting from the decommissioning of the line are easily recyclable (copper, scrap metal). Decommissioning will progress by one to several kilometers per day (depending on the size of the teams).

When it comes to decommissioning transformers, the equipment is generally de-oiled and then removed by crane and taken to a waste treatment center.

The installations are then cleaned and dismantled to recycle all the recoverable components (mainly scrap metal and copper). Some of the equipment will have to be taken in charge in a hazardous waste treatment center, especially the dielectric oils.

The ancillary equipment is also dismantled, and the slabs are broken up with a jackhammer and disposed of as inert waste. Excavations are backfilled with excavated materials and topsoil.

3.6. IDENTIFICATION OF THE MAIN IMPACT SOURCES

The following table presents the impact factors identified for the power line creation project.

Table 6 - Project Impact Factors

PROJECT PHASE	IMPACT FACTOR
WORKS	Physical right-of-way: Construction activities will generate a temporary physical right-of-way along the route of the line and the buried cable, with consequences for the environment and local communities (temporary disruption of economic activities).
	Employment opportunities on the site: The site will require the recruitment of a maximum of 10 to 30 people, with unskilled to skilled job profiles. Employees and potential subcontractors' personnel will be exposed to risks on the construction sites (electrical risk, work at height, trench risk, fall from the ground, etc.). These risks will be managed through a management plan Health, Safety and Environmental standards drawn up by the project manager, contractually required of subcontractors and subject to regular monitoring by the project manager.
	Civil works: Civil works activities will involve very limited earth reworking. Brush clearing operations will take place along the entire route. Excavations, especially for the buried cable, may encourage erosion, especially during the rainy season, and the transport of fines by runoff to the surrounding environment.
	Traffic: Equipment, material and machinery will be brought in by road, which will have a temporary impact on local traffic on the RN.
	Consumption of resources: Civil engineering activities consume raw materials (metal, sand, concrete...) and various products to carry out the work and operate the equipment (gasoline, oil...).
	Liquid discharges: Civil engineering activities lead to the discharge of various liquid effluents during the works (e.g.: washing water for machines, sanitary effluents).
	Waste generation: Civil engineering activities (clearing brush, preparation of tower foundations...) lead to the production of waste (inert waste...) as do the assembly and installation activities of the towers and the line (packaging waste, offcuts). The presence of the workers will generate limited household waste.

PROJECT PHASE	IMPACT FACTOR
	Atmospheric emissions and noise: Overall, the operation of equipment and vehicle traffic lead to the production of atmospheric emissions (GHG, dust) and noise.
	Accidental situation: A bad management of the works can lead to the appearance of a degraded mode likely to impact people and the environment: spill of dangerous materials, fire, individual accident
OPERATION	Physical footprint: The permanent presence of the pylons, the line and the transformers generate a physical footprint on the ground and in the air and therefore possible consequences on the landscape, biodiversity (especially birdlife) and human activities.
	Electricity transmission: the line allows the transmission of electrical energy from the solar plant to the public grid.
	Waste generation: The production of waste associated with the operation of the line will be very limited, apart from the waste linked to the maintenance work on the vegetation, which can be recovered. Maintenance activities will lead to the production of some hazardous waste (electrical and electronic waste, transformer oil, etc.). No permanent employees are expected during the operation phase.
	Accidental situation: the transport installations can lead to the appearance of a dangerous situation in the event of an accident: electrocution / fire

3.7. ANALYSIS OF VARIANTS AND RATIONALE FOR THE PROJECT VARIANT CHOSEN

3.7.1. Route Variation

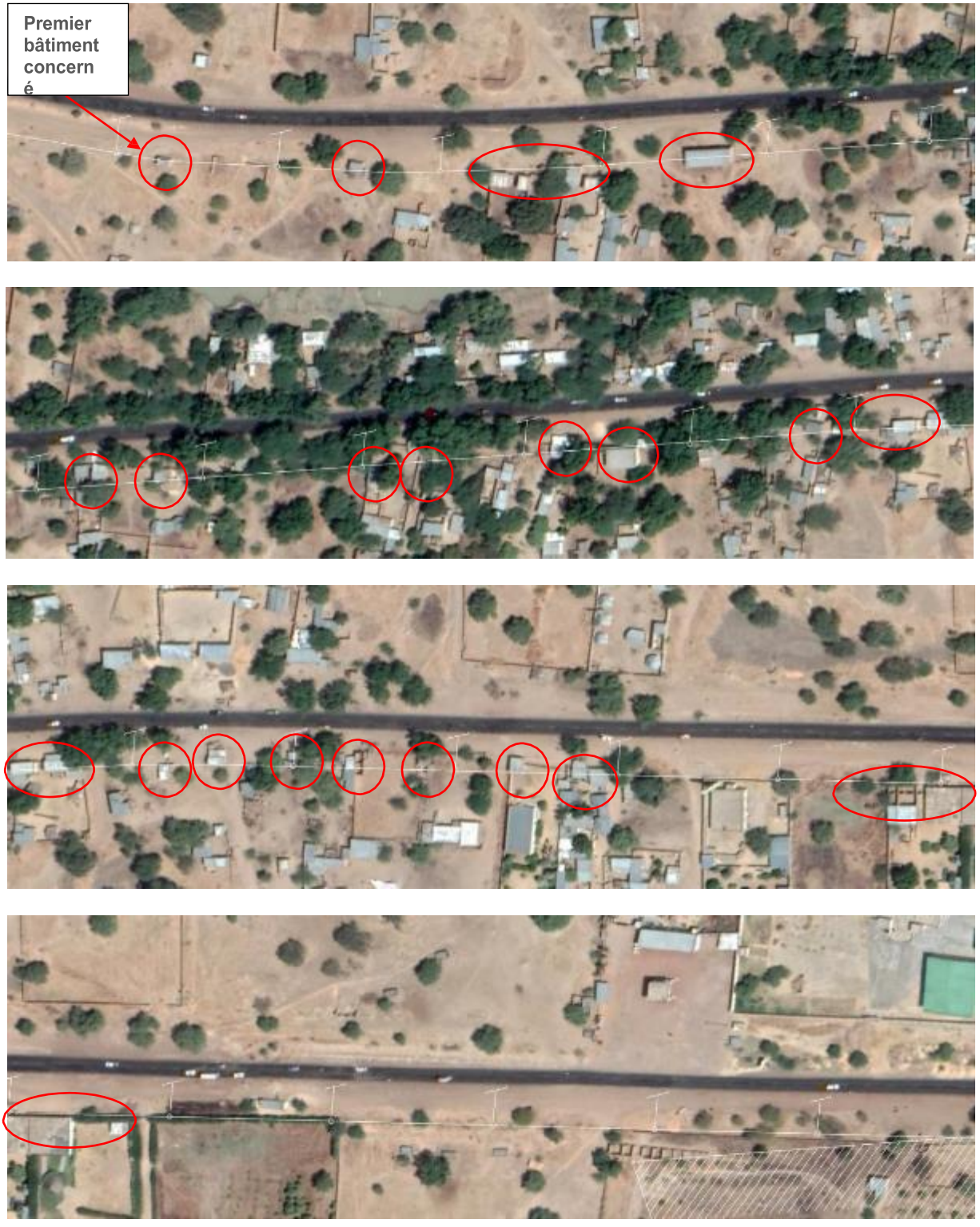
The preferred route of the line is parallel to the paved N'Djamena-Abeche national road on the west side. The pylons will be located for the overhead part at 22 m from the axis of the road. The use of the easement zone of the road linking N'Djamena to Abéché has been proposed by SNE. In accordance with the measures recommended by the IFC guidelines on electricity transmission, the decision to follow the existing national road route reduces the impact on habitats and avoids the creation of access roads. Thus, no other route alternatives were considered as this was done early in the project design.

3.7.2. Overhead Line Along the Entire Route

The selection of the line's route is based on the fact that, in accordance with Chadian urban planning regulations, no building or structure may occupy a space located less than 25 meters from the centerline of the road. The route of the transmission line was defined within this space, in coordination with the Société Nationale d'Electricité (SNE). In Chad, the State owns all land that is not legally recognized in writing as belonging to a natural or legal person, public or private. Thus, no land acquisition or lasting interference with socio-economic activities is anticipated in the context of this project.

However, preliminary surveys, carried out by geotechnical and topographical firm Lagemont, which is in charge of staking the road, have shown that a significant number of houses, businesses and places of worship are located within the easement. Some buildings visibly bear a cross indicating that they encroach on the public domain (marking made outside the framework of the project). On the other hand, the mosque, at the southern exit of the village, is in the process of moving its perimeter walls to integrate its building into the legal boundaries.

The figure and table below show the location of the facilities that would have been affected by the relocation if the line had crossed the village of Pont Bélilé overhead. The distance involved is potentially 2.25 km.


Premier
bâtiment
concern
é

Source:ARTELIA

Figure 14 - Location of buildings at 22m from the roadside at Pont Bélilé

Table 7 - Identification of facilities within 22m of the roadside at Pont Bélilé

Number of houses	Number of inhabitants	Number of concrete buildings	Number of buildings with other materials	Businesses
38	274	18	20	34

It should be noted that the regulations establishing the easement zone have evolved over time. This was clarified by the Director of Urban Planning who was interviewed during the preparation of this notice. According to him, in the 1950s-1960s, the easement was 10 m wide on each side of the road. In the 1980s, it was 10 m to the east and 20 m to the west. The current 25 m-distance on each side of the road dates back to the late 1990s. The village of Pont Bélilé existed before the road was built, and successive changes in the width of the easement have not always been documented and have not clearly differentiated between illegal and historical occupants. According to the Director of Urban Planning, any physical or economic displacement in this area is likely to be complex and legally sensitive in the absence of reliable data.

The field visit conducted to collect socio-economic data confirmed this information. The history of the village of Pont Bélilé seems to show that the original inhabitants initially resided in the village of Mogo. Some of them left to build the central hospital in N'Djamena in 1944. They were later involved in the reconstruction of a bridge washed away by floods in 1945, hence the name of the village, and then settled there. Elders explain that they worked on the road construction site in 1943.

4. DESCRIPTION OF THE NATURAL AND HUMAN ENVIRONMENT

4.1. LOCATION AND STUDY AREA

This chapter provides a detailed description of the physical, natural and human environment likely to be affected by the construction of the power line project.

The project study area is defined as the area likely to be directly or indirectly affected by the proposed facilities.

It is important to note that this study area varies according to the component considered (societal or environmental). It is therefore defined more precisely in the various section of the study.

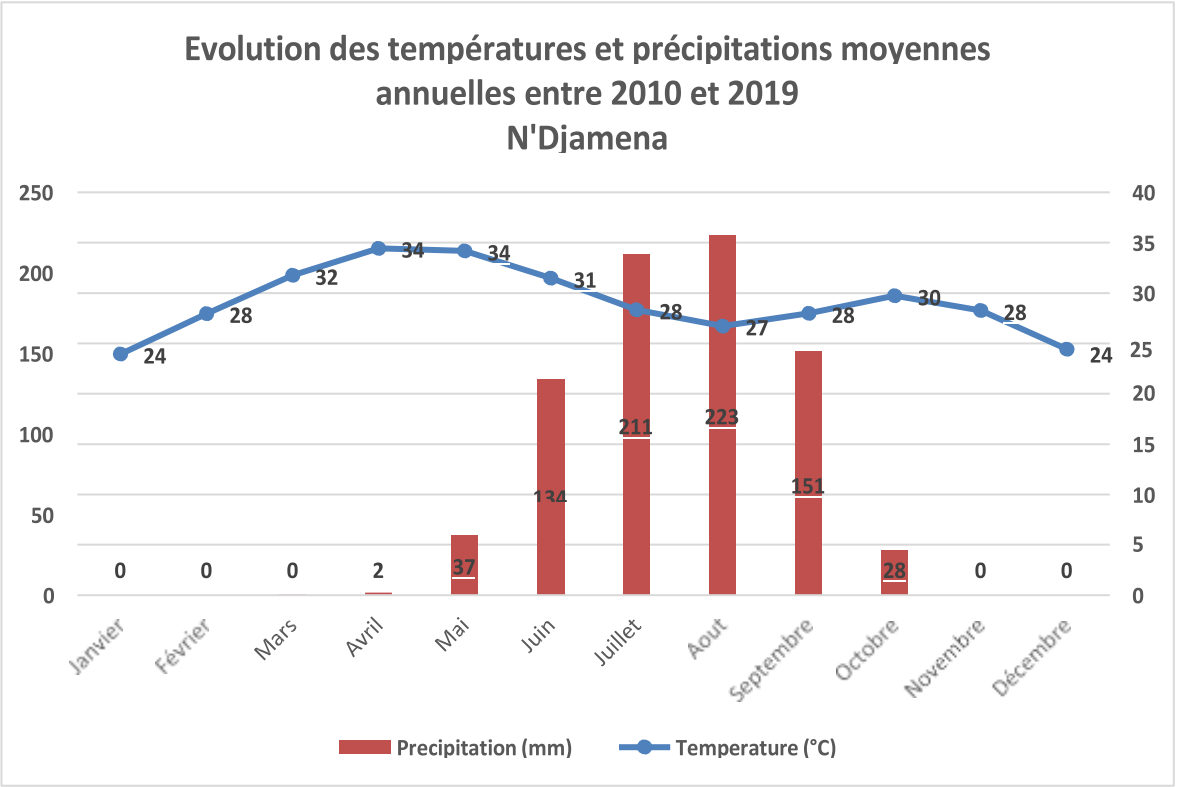
4.2. PHYSICAL ENVIRONMENT

4.2.1. Climatology

4.2.1.1. CLIMATIC CONDITIONS

The project is located in the Sahelian strip of Chad, which covers 38% of the country's surface area. Rainfall is concentrated from June to September (rainy season) with an annual average of 787.4 mm of rain.

Average temperatures range from 24°C in the coldest month (January) to 34.4°C in the hottest month (April). There is also a cooler period during the rainy season (July - September).



Source: en.tutiempo.net/climate

Figure 15 – Trends in average annual temperatures and precipitations between 2010 and 2019 **at the** *N'Djamena station*

4.2.1.2. SUNSHINE

The Djermaya region has a solar potential that is highly suitable for the development of solar photovoltaic energy. The territory in which the route of the line is located receives a global horizontal irradiance (GHI) of 2,193 kWh/m²/year which corresponds to an intensity value of about 6 kWh/m²/d (Ministry of Economy, 2013).

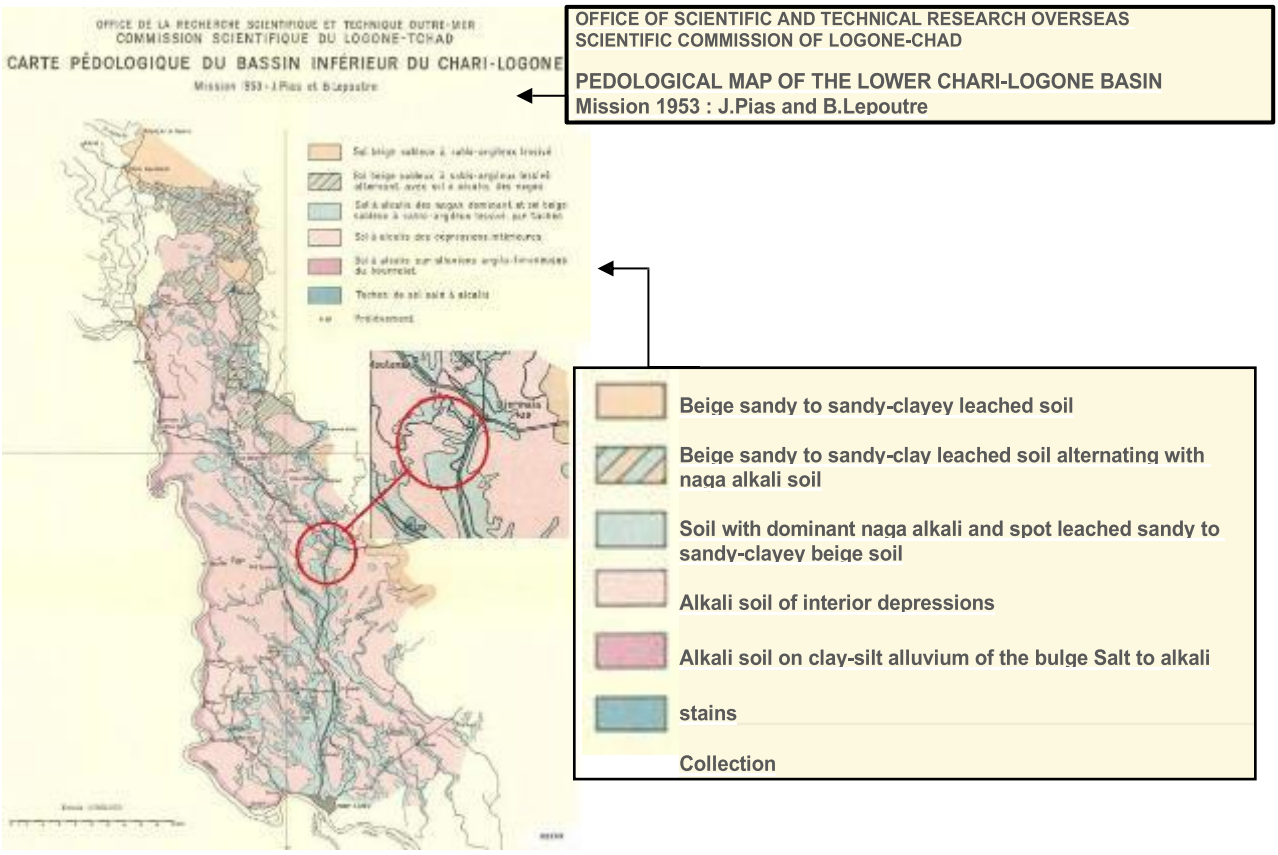
4.2.2. Geology and Soils

The study area has alkaline soils on clayey-silty alluvium but also some localized patches of saline alkaline soils, as can be seen on the map presented in 0. These soils have high pH ranging between 8 and 10, an absorbent complex higher than 15% and high compactness.

The last sedimentations present on the upper layers are complex as can be seen on the following well, observed near N'Djamena:

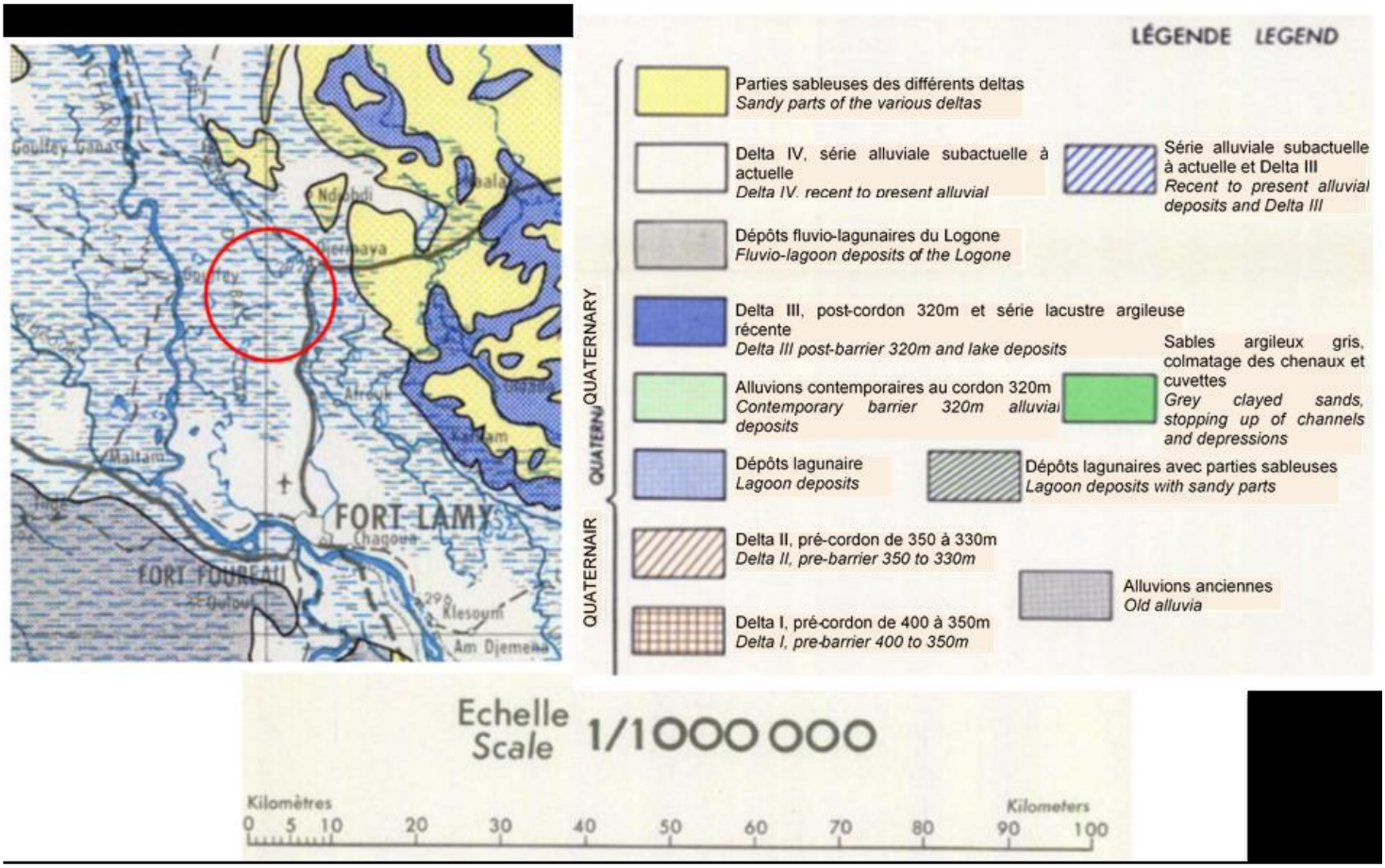
- 0- 80 cm: black clay;
- 80 - 160 cm: mottled sand, rusty, very compact;
- 160-260 cm: grey clay, with rusty spots;
- 260-270 cm: white sand;
- 270-340 cm: black clay, compact (Pias, 1970).

These soils are not particularly permeable and can cause water to accumulate on the surface (flooding, formation of water bodies and ponds) but also runoff and soil erosion.



Source Unesco

Figure 16 - Soil map of the Djermaya region



Source: UNESCO

Figure 17- Geological map of the Djermaya region

The soils in the study area are of sedimentary origin, of a clayey-silty nature; they are compact and poor in nutrients. These soils are not very permeable and can cause both the accumulation of water on the surface (formation of water bodies and ponds often temporary) but also runoff and soil erosion.

4.2.3. Relief and Topography

Chad's terrain is relatively rugged, with alternating plains and mountains. The study area has a relatively flat topography: the difference in elevation is 6 m between the lowest point (292 m) and the highest (298).

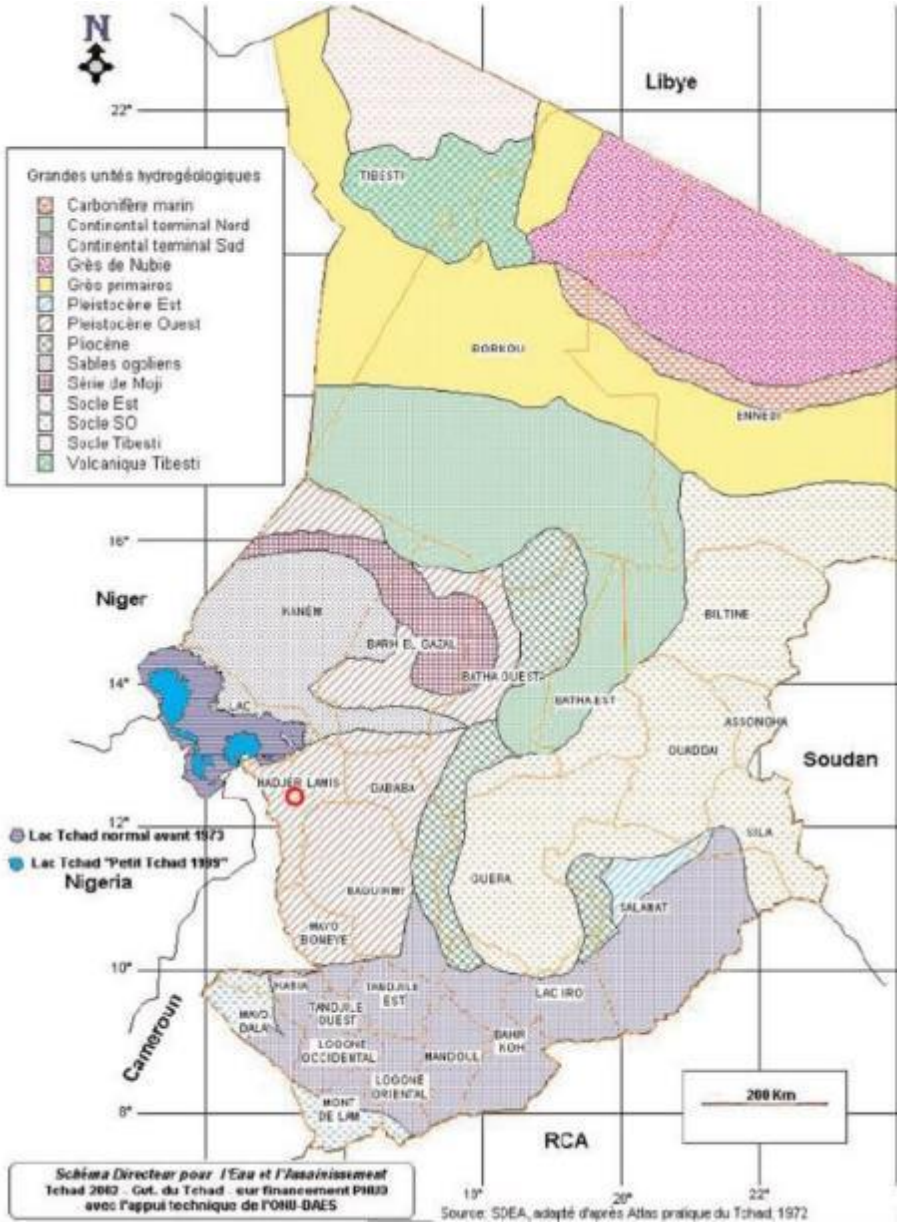
The route of the line has a flat topography.

4.2.4. Hydrogeology

Chad's groundwater resources amount to approximately 500 billion cubic meters[2] . These resources are present in vast sedimentary formations where there are aquifers in the form of unconfined groundwaters or deep captive to semi-captive groundwaters. These various groups are presented in Fig.18.

[2] Source: Anon., 2016

The study area is located in the West Pleistocene hydrogeological unit (Fig.18), which is underlain by Middle Pliocene sandy formations and covers 235,000 km². The characteristics of the aquifer are not uniform. In the Chari-Baguirmi, the hydrogeological unit of the study area, the sands can appear as a homogeneous unit of 40 to 70 meters in thickness, but most often, fluvial sedimentation has given way to episodes of lacustrine or limnic sedimentation, as is the case in the area to be covered by the solar power plant project.



Source: HCNE-MEEPNUDD-DAES, 2003

Figure 18- Map of the major hydrogeological complexes of Chad

Transmissivity values range from 95 m²/day to 600 m²/day and permeability values from 3 m/day to 56 m/day. The specific flow values vary between 2 m^3/h/m and 9 m^3/h/m. In N'Djamena, the storage coefficient (S) was estimated between 4 x10-4 and 1 x10-3.

The flow rates of the boreholes used for village water supply in the study area vary from 7 m^3/h to 40 m^3/h (HCNE-MEEPNUD-DAES, 2003).

The following table presents a summary of the characteristics of the aquifer present in the study area.

Table 8 - Summary table of the aquifer in the study area

Aquifère	Unité hydrog	Localisation	Superficie (km²)	Lithologie	Épaisseur (m)	Autres caractéristiques	Paramètres hydrauliques	Chimie	Piézométrie	Recharge	Décharge	Observations
Pliocène moyen	Système multicouches, centre nord (zone sahélienne)	Chari-Baguirmi central	30 000	Sables fluviatiles lenticulaires intercalés dans argiles pliocènes	Épaisseur des lentilles 10-20 m	Captif	T : < 8.0 m²/j ; S : 0,003 ; Qs : 0,7-10 m³/h/m	RS : 0,2-0,5 g/l, localement, jq 1,5 g/l	Vers dépression à l'est de N'Djaména	Infiltration pluies au sud, Lac Tchad, du Plioc. inf.	Exfiltration, exploitation, écoulement souterrain vers NE	Baisse niveau ~1m/an, impact par exploitation de N'Djaména

The Pleistocene free aquifer may be a serious concern, given the lens-like nature of the sandy layers and their hydraulic interconnection with the upper formations.

According to the study conducted by the engineering firm Hydratec (Hydratec, 2016), borings conducted at the power plant project site did not reveal the presence of groundwater within the first 10 meters of depth.

4.2.5. Hydrology

After a period of drought in the 1970s and 1980s, Lake Chad has lost both its surface area and its volume. Its river system is reduced to the Chari (1200km and 83% of water supply) and Logone (1000km) rivers, which have their sources in the Central African Republic and Cameroon.

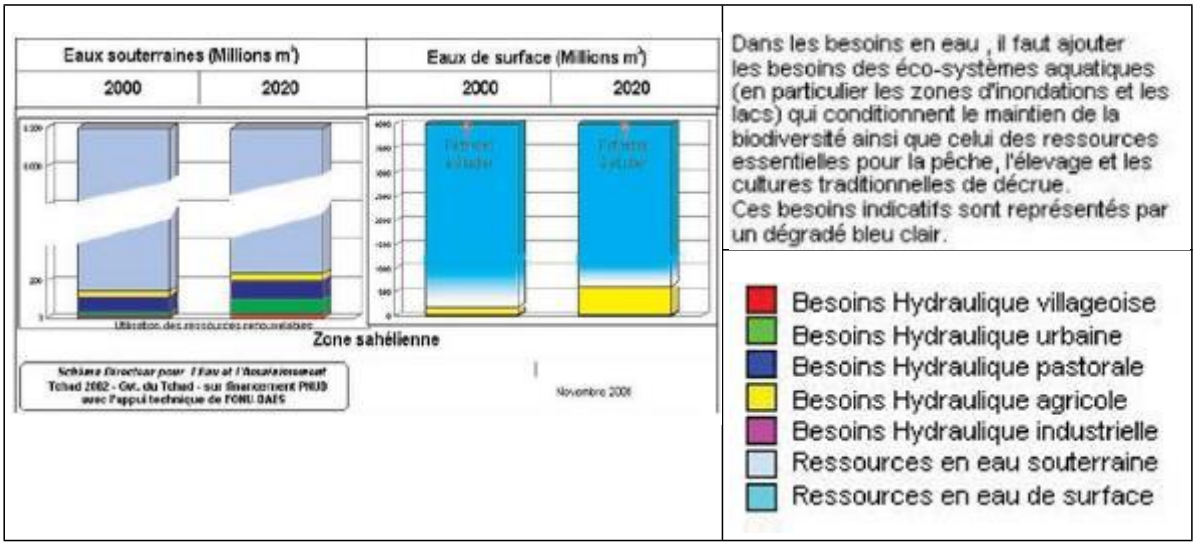


Figure 19- Summary of water needs and resources in the Sahelian strip

The river system in the vicinity of the study area is characterized by the Chari and its tributaries (Fig.20). The Chari River drains a watershed of 650,000 km² and has a flow rate that fluctuates significantly with seasonality.

The Lake Chad basin is an endoreic system, i.e., without any outlet to the sea, which has the particularity of causing the level of the rivers to vary according to climatic changes, much more strongly than a marine level. In addition, the flat topography of the basin explains that variations in elevation cause the surface of the lake to vary widely. The Chari, which flows through an ancient sandy delta, is better entrenched in its bed than the other rivers, and therefore less subject to overflow.

A ditch, watered during the rainy season and dry the rest of the year, is located east of the road linking the capital N'Djamena to the village of Djermaya. This temporary flow is located more than 50m from the road. It joins the Chari on its right bank, about 20 km downstream from the solar power plant site. Along its length, this flow does not systematically have a marked minor bed. It is thus punctually possible to observe areas of very localized overflows which persist nevertheless east of the road and thus without interference with the layout of the line.

Source: Hydratec, 2016

Figure 20 - Hydrographic network in the vicinity of the project

In the study area, there is a very high variability of water resources depending on seasonality and precipitation.

This wide range of water resources has a significant effect on the landscape, land use by local populations, but also in terms of attractiveness and habitat potential for flora and fauna.

4.2.6. Biogeographical Context

4.2.6.1. LOCATION OF THE STUDY AREA IN THE REGIONAL CONTEXT

The study area is located in the Sahelian strip, in the transition zone with the Sudanese strip south of the country. The Chari River flows west of the line at a distance of about 15 km.

When we look at the biogeographic context in which the study area is integrated, we observe the presence of:

- The Chari River and its tributaries that structure the territory and influence the various plant formations found in the area.
- A network of stagnant water points, of varying size, some of which remain partially in water throughout the year. This network of depressions is found continuously in the watershed of the main rivers that structure the territory.
- Drier areas occupied mainly by sparsely vegetated soils.

Intense rainfall during the rainy season recharges these depressions, which then become pools and facilitate the return of the vegetation cover over much of the territory.

Once the rainy season is over, these ponds gradually dry up until they disappear completely in the dry season for some.

The vegetation is totally dependent on the rains and changes with the seasons.

The right-of-way corridor of the proposed power line is part of an overall anthropized context along the N'Djamena-Abeche national road. It cuts across several villages and meets various zones where traditional human activities of breeding and cultivation are organized.

4.2.6.2. LANDSCAPE OF THE STUDY AREA

The landscape along the route of the line changes significantly with the seasons, due to variations in vegetation cover.

The project is located in an open, flat savannah environment, which means that it can be seen from a close distance. However, the vegetation masking effect (isolated trees and shrubs along the road) limits the visibility of the future line in the wider landscape.

As previously mentioned, the route of the future line will follow that of the nearby national road. The route crosses the following villages: Lamadji, Pont Bélilé, Oum Dourmane, Amdourminé and Am Soukar. In the village of Pont Bélilé, the line will be buried over a distance of up to 2.25km.

4.3. BIOLOGICAL ENVIRONMENT

4.3.1. Context of Biodiversity in Chad

4.3.1.1. BIOCLIMATIC ZONING OF CHAD AND THE STUDY AREA

The study area is part of the Sahelian bioclimatic strip. There are mainly two types of vegetation, tree species and bushy grassy species. The presence of floral and faunal biodiversity is directly related to the presence of water.

4.3.1.2. PROTECTED NATURAL AREAS

There are 19 protected natural areas and 10 classified forests in Chad:

- 3 national parks (492 520 ha)
- 7 wildlife reserves (11 153 310 ha)
- 1 biosphere reserve (195,000 ha)
- 7 hunting areas (2,531,400 ha)
- 1 pilot community hunting area (40,000 ha)

In addition, there are six RAMSAR sites in the country. These are wetlands of international importance, both from an environmental and societal point of view. They are likely to be home to sensitive species and play an important role as high conservation value ecosystems. Finally, Chad is home to other important bird conservation areas: the IBAs (International Bird Areas). They are part of an international program to identify the most favorable wild bird conservation areas.

The study area is not affected by any protected natural areas. The closest identified areas are the following sites (Fig.21):

- Cameroonian part of Lake Chad (Cameroon), RAMSAR site No. 1903: located at the nearest 70km from the Project.
- The Flooded Plain of Waza Logone (Cameroon), RAMSAR site No. 1609: located at the closest 15km from the Project.
- Mandelia Wildlife Reserve (Chad): located at the closest 55km from the Project.

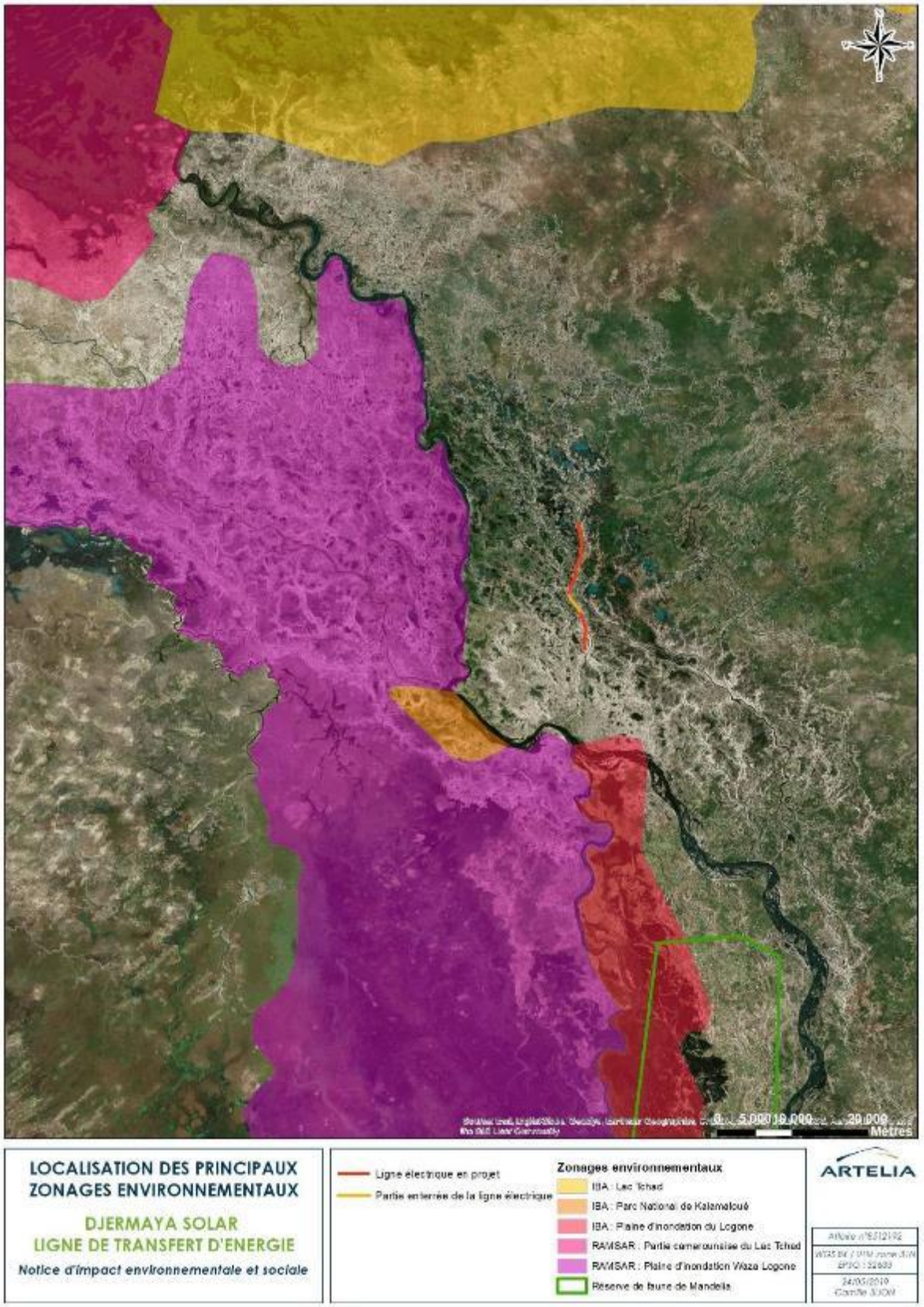


Figure 21 - Map of protected natural areas closest to the project

No natural areas protected by law or recognized by international institutions are affected by the project. The closest areas are not in the study area.

4.3.1.3. STATE OF THE CHADIAN FLORA

The presence of flora is extremely related to the nature of the soils, the type of relief, the presence of water and the climate of the area under consideration (see Fig.22).

The Sahel strip has sandy tropical ferruginous soils that are poor in organic matter, while the vegetation is characterized by:

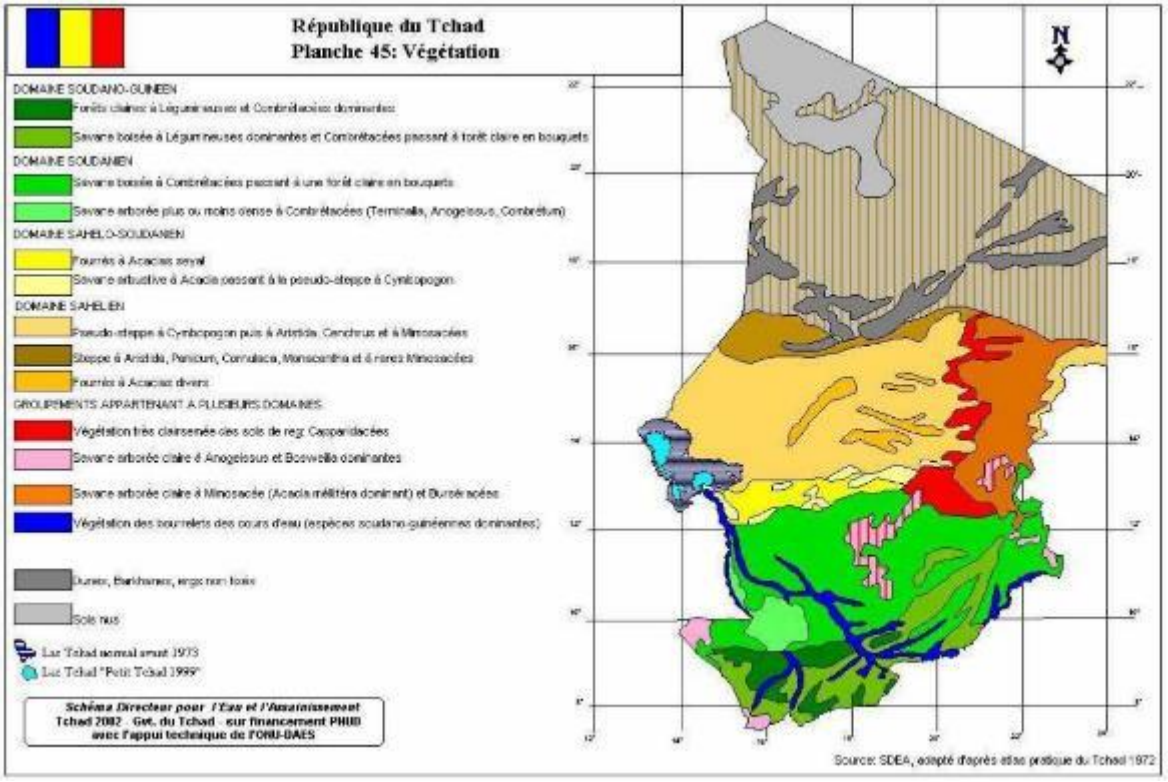
- a shrubby savanna occupying the southern part and dominated by Acacia and Balanites with a herbaceous carpet composed of Antropogon, depending on the type of soil present.
- a steppe (or pseudo-steppe), located in the northern part and characterized by very open woody formations, the grassy carpet dominated by Aristidae.

Chad also has considerable forest resources, which occupy 44.71% of the national territory. These forests are totally dependent on the water resources available. The stratification of the climate (from the arid north to the humid south) leads to the following types of forests[3]:

- Clear forest formations;
- Productive mixed formations;
- Unproductive mixed formations: tree savannas belonging to the Sahelian domain, whose gross volume on bark hardly exceeds 20m^3/ha and whose dominant height does not exceed 7 m.

The following map shows the type of vegetation according to the various bioclimatic zones. According to this map, the project study area, located in the Sahelo-Sudanian transition zone, should therefore be covered mainly by acacia seyal thicket formations and acacia shrub savannahs that transition to the Cymbopogon pseudo-steppe.

[3] Anon., 2016



Source: SDEA

Figure 22 - The various types of vegetation in Chad by bioclimatic zone

The 6th National Report on Biodiversity in Chad estimates the number of threatened species at 11, while the International Union for Conservation of Nature (IUCN) red list mentions only 6. The number of endemic and threatened plant species is most likely underestimated due to the lack of available scientific data. For the purpose of this study, data were extracted from the database. This 2019 IUCN data was used to conduct the analysis (Table 9-).

Table 9 - Level of flora extinction risk in Chad

CATEGORY	TOTAL	DD	LC	NT	VU	IN	CR	EW	EX
Plants	351	7	335	2	4	3	0	0	0

DD	Insufficient data	LC	Least Concern	NT	Near Threatened	VU	Vulnerable
IN	At risk	CR	Critically Endangered	EW	Extinct in the wild	EX	Off

Based on the bibliographic data presented above, the study area is occupied by mixed vegetation of Acacia thickets and shrubby savannahs that have evolved into pseudo-steppe. No threatened species are impacted by the project.

4.3.1.4. STATE OF THE CHADIAN FAUNA

According to the 6th National Report on Biodiversity in Chad (6th National Report on Biodiversity. CHAD, 2018), Chad's wildlife diversity would include 722 species of animals (wild and domestic) and 878 wild species according to the IUCN, not including the insect group which seems to have a richer specific diversity.

The most studied and known fauna is composed of mammals, birds, reptiles and fish. There are currently 131 known large mammals species, 532 known species of birds of which 354 are residents, 117 palearctic migrants, and 260 Afro-tropical migrants, as well as 177 species of fish.

The following data was extracted from the IUCN databases (Tabl.10- and Tabl.11-) about threatened species:

Table 10 - Level of wildlife extinction risk in Chad

CATEGORY	TOTAL	DD	LC	NT	VU	IN	CR	EW	EX
Animals	878	12	808	22	19	6	10	1	0

Table 11 - Risk level by species group

THREATENED SPECIES								
Mammals	Birds	Reptiles	Amphibian	Fish	Mollusks	Other invertebrate	Mushrooms and protists	Total
15	13	2	0	1	4	0	0	35

There are 35 threatened species and one extinct species in the wild. These various include 15 species of mammals, 4 species of birds as well as Nile crocodiles and varans that are fully protected nationwide.

Mammals

The patrimonial interest of the known Chadian fauna is essentially related to large mammals.

In the Sahelo-Sudanian strip, there are species such as: giraffes, buffaloes, elephants, hartebeests, damalisques, red-fronted gazelles, cobes and cobes defassa, great kudu, derby elands, antelopes, probably the last populations of lions in the Sahelian countries, cheetahs, wild dogs.

Spotted hyenas, leopards, jackals, ratels, civets, Gambian mongooses and other genets; primates (patas, baboons, cercopithecines and other galagos), rodents (porcupines, hares, squirrels, rats, etc.) are also present.

Chad has a large number of elephants distributed mainly in several protected areas. The Lamentin (*Trichechus senegalensis*) is characteristic of the Binder-Léré Wildlife Reserve. The pangolin (order Pholidotes) is also present *(6th National Report on Biodiversity. CHAD, 2018)*.

Avifauna

Chad has a very high bird diversity, 516 different species according to BirdLife International, including 401 terrestrial species and 115 aquatic species. These 516 species include 215 migratory. No endemic species are present in Chad. 13 species are threatened, or 3% of the total number of species presented in the following table (Table12).

Table 12 - Threatened species, birdlife (source: IUCN)

SPECIES	COMMON NAME	CATEGORY
Gyps rueppelli	Rüppell's Vulture	CR

Vanellus gregarius	Sociable Lapwing	CR
Trigonoceps occipitalis	White-headed Vulture	*Gyps*
africanus	African vulture	CR
Necrosyrtes monachus	Scavenger vulture	CR
Neophron percnopterus	Percnopterus	EN
Torgos tracheliotos	Turkey Vulture	EN
Marmaronetta angustirostris	Marbled Duck	VU
Balearica pavonina	Crowned Crane	VU
Streptopelia turtur	Turtle Dove	VU
Polemaetus bellicosus	Martial Eagle	VU
Sagittarius serpentarius	Sagittarius Messenger	VU

Reptiles

Nile Crocodiles (*Crocodilus niloticus*), Nile Varans (*Varanus niloticus*), and the *Python seba* are found in Chad (6th National Biodiversity Report. CHAD, 2018). According to the IUCN there are also long-snouted crocodiles (*Mecistops catphractus*) classified as "critically endangered". The IUCN red list mentions 3 species of turtles in Chad presented in the following table (Tabl.13-):

Table 13 - Threatened species, reptiles (source: IUCN)

SPECIES	COMMON NAME	CATEGORY
Geochelone sulcata	Crested turtle	VU
Cyclanerbis senegalensis	Senegal Trionyx	VU
Cyclanerbis elegans	Nubian trionyx	

Frogs

The IUCN lists eight species of amphibians in Chad. They are all species of the order Anura, presented in the following table (Table14):

Table 14 - Threatened species, amphibians (source: IUCN)

SPECIES	COMMON NAME	CATEGORY
Ptychadena bibroni	Broad-banded Grass Frog	LC
Ptychadena oxyrhynchu	South African sharp-nosed frog	
Ptychadena trinodis	Dakar Grassland Frog	LC
Sclerophrys maculata*	Hallowell's toad	LC
Sclerophrys regularis (or Amietophrynus) regularis)*	Common African Toad	LC
Sclerophrys steindachneri*	Steindachner's toad	LC
Sclerophrys xeros*	Sub-Saharan toad	LC

Chad's wildlife includes large mammals such as hippos, giraffes and elephants, as well as a large number of bird species thanks to the various wetlands found throughout the country.

With respect to plants, the lack of scientific knowledge makes the conservation work difficult. However, we note that according to the IUCN, the critically endangered species include 4 species of vultures, 1 species of wader, 2 species of cattle, 1 species of crocodile, 1 species of rhinoceros and 1 species of mollusk.

4.3.1.5. THREATS TO BIOLOGICAL DIVERSITY

The main threats to biological diversity in Chad are as follows:

- **Bush fires:** weaken vegetation making it vulnerable during the annual dry period. This slows down natural soil restoration and fallow land fertility.
- **Rangeland pressure**: Due to the concentration of livestock around easily accessible wells, some areas may experience some loosening of their soil surface layer as a result of heavy trampling by livestock. This makes the soil more vulnerable to erosion and impoverishes soil for agriculture.
- **Deforestation**: The main deforestation is the abusive cutting for the supply of firewood to the populations.
- **Extensive logging and shortened fallow periods**: the overexploitation of land and failure to return nutrients taken by livestock leads to a decline in soil fertility.
- **Increased poaching** and insecurity associated with armed conflicts that are detrimental to large fauna;
- **A lack of policies and regulations** regarding the management and protection of the environment and wildlife.
- **A ack of scientific knowledge and data** on species present in the territory and their conservation status.
- Invasive species represent a real risk for biodiversity, especially aquatic plant species (freshwater hyacinth, water fern, etc.). This plant invasion represents a serious obstacle to the multiple functions that rivers and lakes play and negatively affects the life of the populations: decrease of the fishermen's earnings, reduction of the exploited spaces (rice cultivation), invasion of the fodder areas feeding the animals.

Chad's biological diversity is subject to heavy pressure from various anthropic activities that have direct or indirect impacts.

With environmental regulations still being developed and armed conflicts in the country, it is not always possible to actively address these threats.

4.3.2. Field Surveys

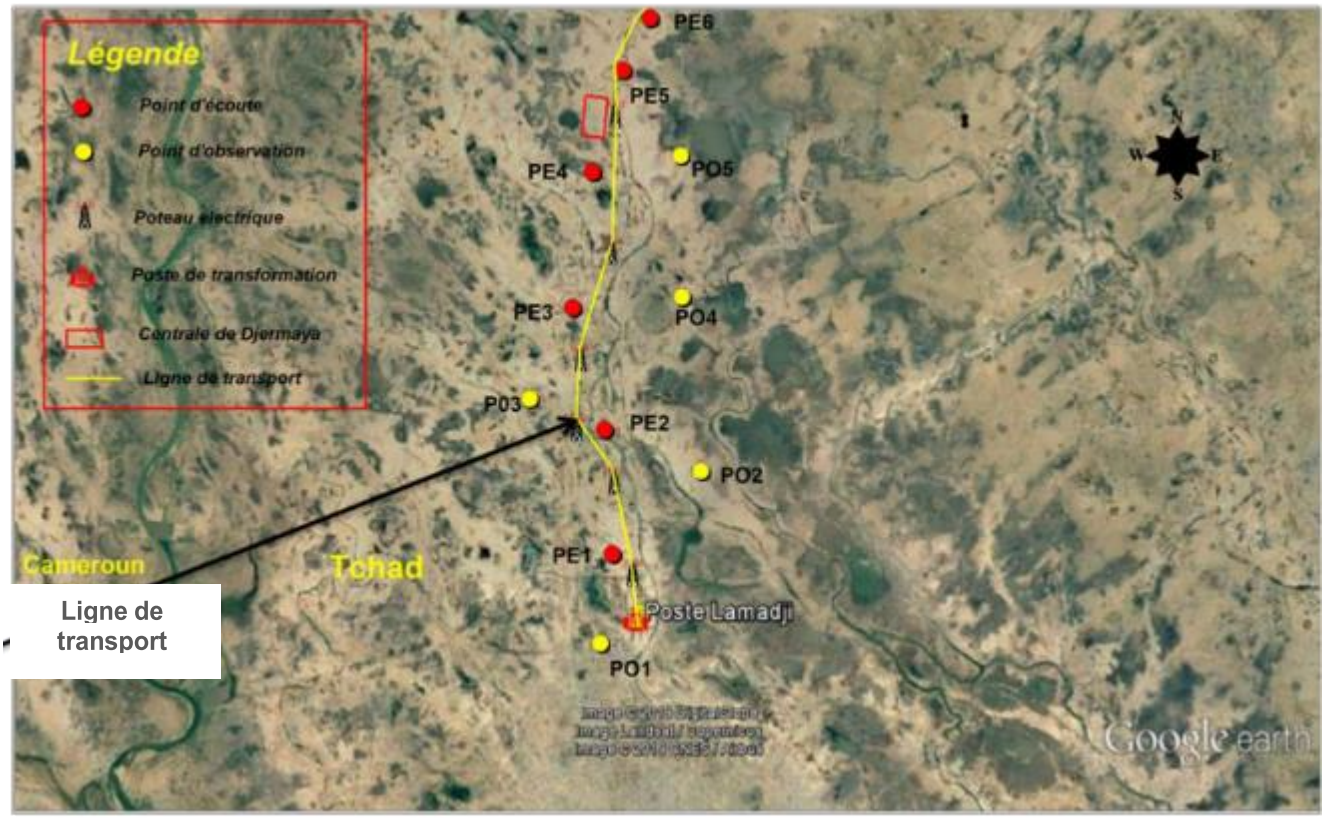
4.3.2.1. METHODOLOGY SELECTED

To understand the ecological issues associated with fauna and flora within the project's right-of-way, a field campaign was conducted in April 2019. The objectives of this campaign were as follows:

- Identify plant species along the route of the line;
- Conduct a survey of animal species in the study area, especially avifauna;

- Identify actual and potential threats to wildlife, plants and their habitats caused by the construction of the power line.

With respect to avifauna, an observation and listening campaign points was conducted (Fig.23).



Source: ARTELIA

Figure 23 - Location of bird observation and listening points

Other fauna and flora species were identified during a walk along the route of the line. A participatory approach (interviews with inhabitants) was also implemented to better identify the types of birds present and existing threats in the area.

The following paragraphs provided a summary of the field survey.

4.3.2.2. NATURAL HABITATS AND FLORA

The strict right-of-way of the project is concerned with meadow and pasture open environments, agricultural plots, remains of old buildings (foundations), huts, etc. The habitats can be qualified as modified and are subject to anthropic pressure marked by cultivation and breeding activities. The characterization of the natural habitats crossed is presented below (see Table15). During the rainy season, these habitats are systematically flooded.

All the vegetation formations (consisting of planted trees) encountered near the route of the future line project are modified, homogeneous and highly anthropized habitats. They are generally characterized by the presence of camels, donkeys, sheep, etc. They also serve as transit areas for nomads between the capital Ndjamena and the north of the country.

The wooded savannahs of the Lamadji urban forest border the project; all other savannahs are located far from the road. Trails cross these wooded savannahs to serve the surrounding villages. Therefore, the habitats encountered are of little conservation concern.

Some isolated trees are located on the future route of the line. They will be either pruned (26%) or cut down (74%).

Table 15 - Tree vegetation identified in the study area

 Nomadic forest of Lamadji	Habitat characterized by the presence of *Acacia nilotica* (50%) and *Azadirachta indica* (Neemiers) (50%).
 Habitat surveyed in Afrouk	Habitat dominated by *Acacia nilotica*, and surrounded by a few Neemier, *Balanites aegyptiaca* (soap tree) and *Acacia ehrenbergiana* trees.
 Forest of Pont Bélilé	Outside the village: forest dominated by 95% by *Acacia nilotica*.
 Village of Pont Bélilé	Interior of the village: habitat with a strong vegetation of Neemiers lining the road and dotted with a few soap trees.
 Ancient nomadic forest of Mbourtani	Ancient nomadic forest. Habitat characterized by *Balanites aegyptiaca* (soap trees) and some *Acacia nilotica*.

Forest of Amdourminé (no photo)	**Habitat periodically flooded characterized by**

Photos taken from April 15 to 19, 2019

The botanical inventories in the field allowed us to determine 11 species, 8 of which were identified and divided into 6 families, as shown in the table below (Table16):

Table 16 - List of plant species inventoried

ENGLISH NAME	*SCIENTIFIC NAME*	*FAMILY*	*IUCN (2019)*	*ECONOMIC IMPORTANCE, FOOD AND MEDICINAL*
Calotrope	*Calotropis procera*	Asclepiadaceae	NE	Leaves used as a deworming agent, cough and filariasis treatment
Egyptian balsam	*Balanites aegyptiaca*	Balanitaceae	NE	Used for the fight against erosion, fruit used against rheumatism
Tamat	*Acacia ehrenbergiana*	Mimosaceae	LC	A plant with anti-inflammatory and diuretic properties, marketed as gum arabic
Gum arabic tree / gonakié	*Acacia nilotica/ Acacia arabica*	Mimosaceae	LC	Roots used to treat dental caries and ENT infections
African Baobab	*Andansonia digitata*	Bombaceae	NE	Treatment of malaria with the roots, treatment of inflammations of the digestive tract. Bark to heal wounds, sap to heal tooth decay, etc.
Neem tree	*Azadirachta indica*	Meliaceae	NE	The oils extracted from the seeds are used to treat of itchy skin, etc.
Mesquite	*Prosopis juliflora*	Mimosaceae	NE	Antiseptic and healing (ulcerated wounds)
Gum arabic	*Acacia qourmaensis*	Mimosaceae	NE	Treatment of cough with roots, etc. The leaves are used as fodder for sheep, camels, etc.
	Indeterminate 1,2,3	N/A	NE	

Floristic surveys yielded the following plant species (0):

DD	Insufficient data		Least Concern	NT	Near Threatened	VU	Vulnerable
IN	At risk		Critically Endangered	EW	Extinct in the wild	EX	Off
NE	Not Evaluated						

The most common species are acacia, neem and desert date palm.

Calotropis procera, Family: Asclepiadaceae

Acacia ehrenbergiana, Family: Fabaceae

Undetermined

Andansonia digitata, Family: Bombaceae (village Am dourminé)

Balanites aegyptiaca (commonly called:soap tree), Family: Balanitaceae

Azadirachta indica (Neemier), Family: Meliaceae

Prosopis juliflora, Family: Mimosaceae

Photos taken from April 15 to 19, 2019

Figure 24 - Illustrations of the inventoried plant species

The field surveys reveal numerous vegetation areas, dominated by *Acacia nilotica*, with only about 100 trees impacted by the project (to be cut down or pruned for the construction site). None of the plant species are classified as threatened according to the IUCN.

4.3.2.3. WILDLIFE

Only two classes of animals were recorded in the field, namely avifauna and herpetofauna.

The fauna inventories in the field identified 4 bird species (Table17) and 2 reptile species (Table. 18 -). None of the species is classified as threatened according to the IUCN red list.

Table 17 - List of bird species inventoried

ENGLISH NAME	NAME SCIENTIFIC	FAMILY	IUCN (2019)	MIGRATORS	HABITAT
Cattle heron	*Bubulcus ibis*	Ardeidae	LC	Yes	Open enviro
Stork	*Ciconia ciconia*	Ciconiidae	LC		Aquatic and dry environm
Black-headed Lapwing	*Vanellus tectus*	Charadriida e	LC	No	Dry grasses
Pied Crow	*Corvus albus*	Corvidae	LC		Anthropiz ed environm

Table 18 - List of inventoried reptile species

ENGLISH NAME	SCIENTIFIC NAME	FAMILY	IUCN (2019)	HABITAT
Rainbow Agama	*Agama agama*	Agamidae	LC	Tree and soil of the village
Mabuya	*Trachylepis quinquetaeniata*	Scincidae	NE	Urbanized environment, soil with dry grassy vegetation

Black-headed Lapwing, *Vanellus tectus*

Trachylepis quinquetaeniata

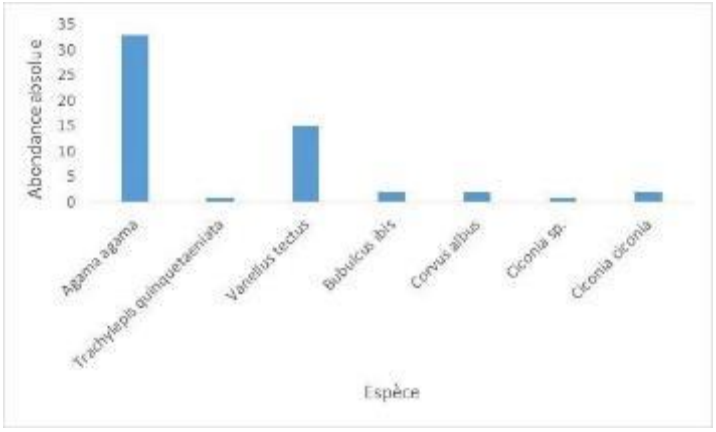
Agama agama (male)

Agama agama (female)

Source: ARTELIA - photos taken from April 15 to 19, 2019

Figure 25 - Illustrations of the inventoried fauna species

Table 19 - Abundance of inventoried fauna species



Source: ARTELIA

According to local residents, several species of birds, including migratory ones, stay in the villages near the study area to establish their living, breeding and resting areas.

The villagers also pointed to cases of electrocution or bird collisions related to existing lines (parallel to the route of the proposed line). These accidents occur mainly between August and September.

The study area has a poor fauna context: only 6 reptilian and avian species have been identified. Birds are frequently electrocuted on existing power lines parallel to the proposed route.

4.4. HUMAN ENVIRONMENT

4.4.1. Methodology

The study of the human environment hosting the power line project was conducted firstly, from the impact study of the solar power plant located in the immediate vicinity, and secondly, by means of a field survey carried out to complete the available socio-economic data. It focused on the human groups along the route of the line.

The objectives of the field survey were twofold:

1. Collect socio-economic data from local stakeholders in the study area, focusing specifically on the following:
   - Administrative organization and governance;
   - Demographics;
   - Land use and economic activities;
   - Access to public services.

   The data was collected using participatory socio-economic survey methods (individual interviews with resource persons, group discussions, participatory visual observation, etc.) in the main localities identified as being part of the direct influence zone along the power line. There are four of them, located on the map below (Am Soukar, Oum Dourmane, Pont Bélilé and Lamadji). The results are integrated into the socio-economic profile of the area.
2. Inform stakeholders about the project (nature, potential impacts) and take stock of their potential concerns and expectations.

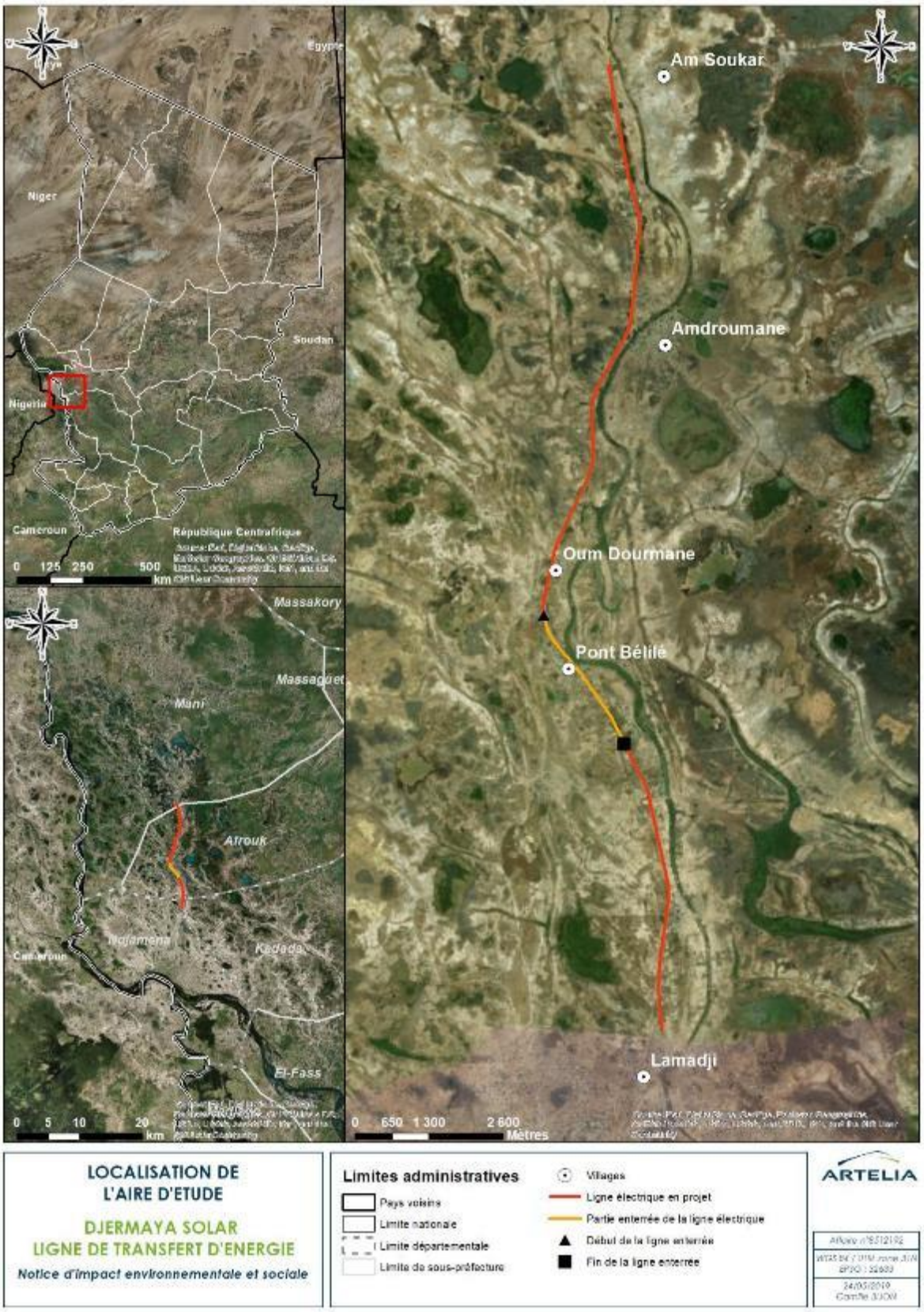


Figure 26 - Location of the project and surrounding areas

This information process, in addition to consultations, took the form of public meetings in four villages that present important issues (such as Pont-Bélilé) or are close to the site of the future power plant (Am Soukar), or are located at the end of the line (Lamadji).

This survey took place from April 9 to 13, 2019. It involved a societal expert fluent in French and Arabic, as well as a local consultant fluent in French and local dialects. All data collected in the field has been integrated into this impact notice. A specific section of the report is dedicated to the summary of the consultation (see 4.4.3.4).

4.4.2. Line's route and land use in Pont-Bélilé

As discussed in section 3.7 on the analysis of alternatives, the preferred route for the line is parallel to the paved N'Djamena-Abeche national road along its western side. The pylons will be located, for the overhead section, 22 m from the road axis within the road's easement zone. In addition, part of the line at Pont-Bélilé will be buried over a distance of up to 2.25 km, 1 or 2 m from the edge of the road, to avoid impacting built-up structures in this area (right-of-way of 2 to 3 m wide during the construction phase only). However, since economic activities close to the road are likely to be temporarily impacted during the construction phase, these activities were identified conducted during the survey associated with this impact notice. It should be noted that, apart from the village of Pont-Bélilé, no other economic activities have been identified along the route of the line.

A walking tour in Pont-Bélilé along the road (west side) towards N'Djamena was conducted over 2.25 km on April 12, 2019 after the public meeting in Oum Doumrane to identify the commercial facilities likely to be impacted by the power line burial works. It should be noted that the majority of businesses are concentrated towards the central part of the village, which is more wooded area.

Since this took place on a Friday and at an hour close to the prayer time, some shops or stalls were closed or empty. In this case, we asked passers-by what they were selling. On the other hand, several other shops, often run by women[4], were open. We explained the purpose of our visit and the photos we were taking.

Most of the merchants interviewed live just behind their shops/stalls or a little further into the village. Most of these merchants had heard about the line project at the public meeting held the day before in front of the village chief's house, adjacent to the road.

This raised some questions about the impact of the construction site on businesses:

- Were the businesses to be moved or closed?
- Could the construction site prevent customers from accessing their stalls?
- How long would the work last?

The problems with the easement area are known. Two merchants asked if our visit was related to a road widening project.

Overall, the 18 merchants likely to be temporarily moved a few meters during the construction period, because of their location in relation to the line's passage, did not seem to have a problem with that.

[4] Women are not required to perform the Friday collective prayer at the mosque

As shown in the table in Appendix 2, the majority of elements close to the roadside and therefore likely to be impacted during the construction of the line are mobile because they consist of stalls and tables. The elements classified as fixed, (except houses, the mosque and some businesses far from the road that are not in the right of way of the cable site), are not necessarily important constructions. The fixed elements identified are the butcher's stalls that are at the edge of the road. The wooden supports of the meat stalls are just embedded in the ground, while the cooking hearth is built of masonry bricks. The three cooking stoves that will be dismantled and rebuilt later will have to be compensated for. The meat racks and mobile stalls will be moved.

- A butcher's shop (business #9) has a cooking pit 2.5 m from the roadway;
- Another (business #13) has a cooking pit locaterd 4 m from the roadside;
- Finally, a third (Business 24, Fig.27) has a cooking hearth, 3.5 m from the pavement.

Source: ARTELIA - 04/12/2019

Figure 27 - Example of a butcher's shop, Business # 24

It should be noted that the facilities to be relocated are located within the northernmost 1.25 km of the route. The selection of option to cross the village of Pont-Bélilé will not influence the number of businesses temporarily impacted.

On the other hand, in Pont-Bélilé, where population density near the road is the most notable, problems related to road safety are reported. Vehicles, especially heavy trucks, drive too fast and do not slow down when crossing the village (Fig. 28). There are speed bumps but they are insufficient. Accidents with pedestrians are frequent according to the population.

Source: ARTELIA - 04/11/2019

Figure 28 – A Heavy truck crossing Belilé Bridge at high speed

4.4.3. Socio-Economic Profile

Overall, the data collected in the study area, although not systematic, suggest some characteristics that indicate a certain state of vulnerability:

- High dependence on land as a means of livelihood;
- Health and material situation very dependent on the agricultural calendar and rain-fed agriculture;
- Agricultural season limited in time and dependent on rainfall;
- Limited or difficult access to irrigation;
- Relatively limited or insufficient access to basic infrastructure (health, education, water, energy);
- Low level of education, high level of illiteracy, especially prevalent among women;
- No or limited access to support organizations, etc.

4.4.3.1. GOVERNANCE AND POPULATION

Three of the four localities included in this consultation (Am Soukar, Pont Bélilé and Oum Dourmane) belong to the same administrative district as the future solar power plant, namely the province of Hadjer Lamis.

These rural areas near the capital are in a process of progressive peri-urbanization. For example, some of the civil servants (teachers, nurses) working in Pont Bélilé or Oum Dourmane live in N'Djamena and make a daily round trip. The area also attracts people from N'Djamena who are looking for land to cultivate or homes at a relatively more affordable price.

The village of Lamadji is another example. It was integrated into the 10th district of the capital N'Djamena in 2005, and is one of the 11 districts that make up this district.

Villages in the study area are all headed by a hereditary chief. The village chiefs are assisted by a village council composed of dignitaries, elders and religious leaders (imams). These authorities are responsible for making consensus-based decisions on behalf of the community. They are involved in mediation and local conflict resolution.

According to the village chiefs interviewed, the population of the various localities is as follows

- Am Soukar: 102 inhabitants.
- Pont Bélilé: 3,750 inhabitants, most of the inhabitants live on the west side of the road.
- Oum Dourmane: 2,500 inhabitants. Like the inhabitants of Pont Bélilé, this human grouping has existed for more than a hundred years[5].
- Lamadji: the figure of 4,000 inhabitants has been put forward, but it actually refers to voters, so the population is probably larger.

While in most villages, the ethnic groups settled were initially mostly Chadian Arabs, today there is greater ethnic diversity (presence of Sara, Wadin, Gouran, Boulala, etc.).

Nomadic populations

There is a permanent camp of Arab camel nomads in the town of Lamadji. Other camps appear in October and March during the dry season, when herders flee the drought in northern Chad for less difficult living and breeding conditions near the capital. All along the road between Lamadji and Am Soukar, there are intermittent encampments of nomads, mostly to the east of the road. An interview with the head of the Lamadji camp[6], who oversees 200 camps belonging to the same group, indicates that while some groups are temporarily settled, such as those north of the Lamadji post, other groups, such as his own (located at the northern exit of Lamadji), are quasi-sedentary. The youngest and most able-bodied people lead the herds to the pastures. In the rainy season, the camel herds are driven further east to graze and avoid epidemics, parasites and insect proliferation due to the humidity and favored by the tall grass in the pastures.

This sedentary group practices agriculture during the rainy season as well as goat rearing for self-consumption and marketing (at the roadside) of surplus milk production. The main difficulties mentioned are the relative scarcity of grazing areas and their low capacity. The grazing area is gradually being reduced in favor of the expansion of cultivated areas, which leads to recurrent conflicts between herders and farmers. The lack of water and boreholes for pastoral purposes is also reported, although this camp has a borehole used to supply men and animals, donated by a visiting Saudi.

[5] The chief, a descendant of the founders who used to live in a village called Mogo, located 3 km away. A dispute forced some of them to come and settle here, which explains the toponymy, because they were told "if you want to leave, go to Amdourman (in Khartoum)" i.e. go as far as possible!

[6] Interview conducted on April 10, 2019 with the representative of Arab nomads in the area, Mr. Djibrine Anour.

Nomads near the Lamadji post (temporary camp)

Chief of the nomads (permanent camp Lamadji exit)

Source: ARTELIA - 10/04/2019

Figure 29 - Nomadic camps

4.4.3.2. ECONOMIC ACTIVITIES

The economic activities reported during the consultations are based primarily on agriculture, with rain-fed food crops dominating between late April and late September. The main crops are okra, beans, cucumbers, onions, white sorghum, corn, etc. Few cash crops were mentioned, with the exception of peanuts. Production is partially self-consumed and sold on local weekly markets such as those in Djermaya or N'Djamena. Farmers are therefore highly dependent on rainfall, which can be deficient in certain years and impact their activity. Difficulties in accessing irrigation hamper the extension of the production period and the diversification of crops. A few wealthier people have access to a borehole and a pump for irrigation, but they complain about the price of fuel and use it as a supplement to rainwater; although some have land, they only cultivate part of it due to the lack of water and inputs. Investors from N'Djamena, with greater resources, may have greater recourse to irrigation.

Straddling the dry and rainy seasons, three months are particularly critical for villagers: May, June and July. This period, known as the "lean season," is the most difficult of the year for farmers because their reserves are exhausted and new crops are not yet available.

Extensive livestock farming is also practiced as a complement to agriculture. It is a source of protein (milk, eggs, etc.), savings and additional income for households, which also plays a social role. The main animals are goats, sheep and, to a lesser extent, cattle, as the cost of raising them is higher. Some villagers are essentially stockbreeders and have larger herds. In Lamadji, poultry farming was interrupted due to an avian epidemic. Grazing is the system

the most common form of feeding. To compensate for the lack of fodder, those who can buy hay or collect the by-products of their crops (corn, sorghum). Water sources consist of seasonal or permanent pools and seasonal streams. The dry season, with the reduction in the quantity and quality of pasture, as well as the reduction in available water, makes livestock vulnerable.

In Pont Bélilé and Lamadji, other professions were mentioned to a lesser extent, such as shopkeepers, drivers, and even civil servants (see the professions mentioned in the consultation).

With the exception of Lamadji, where there is no women's self-help group, women are generally organized in associations and cultivate land near the villages. They market their products to generate income and contribute to the group. In addition, some women, such as those in Lamadji, work on gum arabic farms in the surrounding area. Some women also cultivate the land individually.

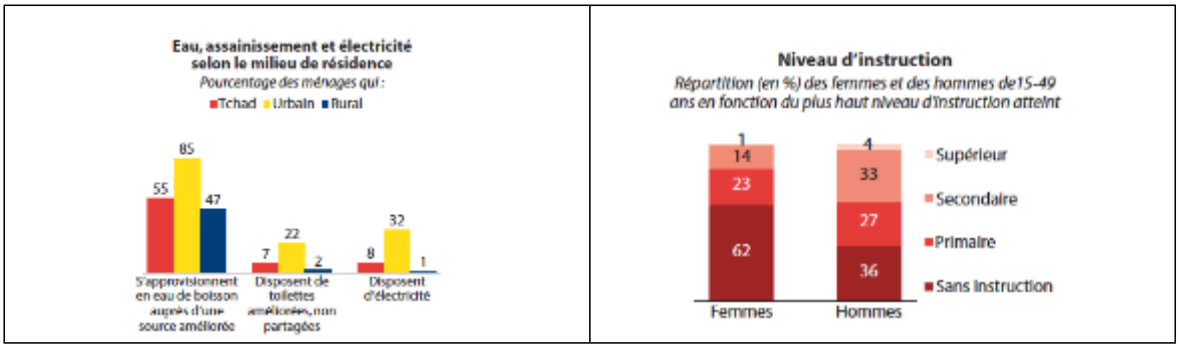
In Oum Dourmane, for example, women say they are able to secure food for themselves but that things would improve for them and their families if they could also cultivate during the dry season, which is longer than the rainy season. For example, they would like to develop market gardening but do not have the means to irrigate.

These women's groups, when they exist as in Pont Bélilé, operate slowly. Active members are decreasing due to a lack of prospects and women lack the experience and means to diversify their income-generating activities.

Mutual aid practices exist between families, but there are no institutions of solidarity or initiatives that successfully carry out collective projects. It should be noted, however, that in villages such as Pont Bélilé or Oum Dourmane, the provision of drinking water or the construction of classrooms has often been through a collective effort pending government intervention.

4.4.3.3. ACCESS TO BASIC SERVICES

Overall, the villages are poorly equipped with basic infrastructure or infrastructure considered inadequate or insufficient in relation to needs. The level of education and literacy is low, especially for women. This is consistent with the results of the third Multiple Indicator Cluster Survey (MICS 2014-2015)[7]. During consultations for the project, the population expressed high expectations around these issues, especially access to water, electricity and education.



Source: MICS 2014-2015

Figure 30 - Educational level and access to other services

[7] Chad Demographic and Health Survey (DHS-MICS) 2014-2015

4.4.3.3.1. Access to Education

Three of the four local areas visited have a school. The children of Am Soukar, where the solar power plant will be located, must go to the Djermaya school, which is a larger locality.

Overall, education needs are inadequately covered[8]. This can be seen in overcrowded classes, especially at the primary level, the very basic or unfinished aspect of certain infrastructures, the absence or inadequacy of furniture, the lack of teaching materials, the absence of drinking water and toilets. There are also apparently economic and cultural barriers to girls' education.

This is reflected in the low level of education of the population, among both the older and newer generations. In the three villages, for example, there has never been a teacher born in the area. The level of illiteracy is high according to our interlocutors, especially among women.[9] One teacher estimated that the level of education in the village is low. One teacher estimated that the level of illiteracy (Arabic/French) is over 60% in the village of Pont Bélilé.[10]

In Pont Bélilé

The village has a three-classroom school built by the State in the late 1990s. A school built by the inhabitants a few years earlier was destroyed during a rainy season. An extension to the school was started by the state, but construction has stopped due to lack of funds. The parents have built a shed to reduce congestion in classrooms. The available space is shared between the school children in the morning and the college students in the afternoon.

The primary school operates with two grades per class. There are 770 students, only 30% of whom are girls, according to the teacher we met. The school has 10 Arabic and French-speaking teachers, most of whom come from N'Djamena. Their salaries are paid for by the State. However, parents must pay for supplies because the national education system does not provide the school with an operating budget to cover this type of expenses.

Overall, the main difficulties mentioned are a lack of material, textbooks, overcrowded classes in primary school, the absence or insufficiency of chairs and tables, including for teachers. The school is equipped with a drinking water well, offered by an Islamic association, but which does not function because the pump was stolen on the day it was unveiled. The toilets, whose doors were torn off, are not usable either.

Teachers report inadequate enrollment and high attrition rates, especially among girls, some of whom are not enrolled or are enrolled late. Among those who are enrolled, only a small proportion manage to complete the primary cycle. Few of them reach the secondary level.[11] The history-geography teacher said he had three girls in his senior class of 20 students. In his second-grade class, there were two girls out of a group of 15, but one of them finally dropped out to get married. Overall, the reasons given for the low enrollment and school dropout rate among young girls are economic and socio-cultural.

---

[8] According to the 2014-2015 MICS report, only 51% of primary school age children in Chad attend elementary school. Only one-fifth of secondary school age children attend secondary school.

[9] Generally, the women involved in the consultation could not write their names on the attendance sheets and had difficulty signing

[10] According to the 2014-2015 MICS, 62% of women and 36% of men in Chad have no education. One in five women (22%) is literate, compared to 54% of men. There are, of course, regional disparities. In Hadjer Lamis province, only 4.6% of women are literate compared to 58% in N'Djamena, for example.

[11] According to the 2014-2015 MICS survey, the gender parity index for elementary school attendance is 0.83% in Hadjar Lamis (0.90 in N'Djamena) and it drops seriously for the secondary level. It is only 0.17 in Hadjar Lamis (0.75 in N'Djamena).

Academic performance also appears to be poor. According to the high school teacher, out of 50 senior students last year, only 10% would have passed the *baccalauréat*. And those who did so did not necessarily go on to higher education.

A classroom built by parents - Pont Bélilé

A classroom in the old public school

An elementary school outing

A new unfinished public school

Toilets without doors

An unfinished toilets in the new school

Source: ARTELIA - 04/11/2019

Figure 31 - School infrastructure in Pont Bélilé

In Oum Dourmane

The village has an elementary school built in 2017, with 3 two-level classrooms and accommodating 360 students, half of whom would be girls. The school has 4 teachers (1 Arabic teacher for 1 hour a day and 3 French teachers) who all live in N'Djamena. The children who go on to secondary school (less than 30% of the total) go to Pont-Bélilé. Only a very small proportion of girls go to secondary school.

The classrooms were financed by the parents. They are quite basic and have no furniture. The classrooms are overcrowded, especially in the lower grades (80 students in the first-grade class, which also has kindergarten-aged children). The Grade 5/Grade 6 teacher has a class of 28 students, of whom only 15 were present on the day of the visit[12]. Attendance is a problem according to him, as children may be asked by their parents to do chores and a lack of interest in studies is developing. According to the teacher, the number of students is inversely proportional to the level of education, which indicates that the school is losing students, especially girls.[13] The school does not have toilets and the terminal is not equipped with the necessary equipment. The school has no toilets and the water point, built by the heath clinic project for the school, is blocked to prevent children from playing with it[14]. The village hopes that the government will build a school.

Class of CM1-CM2- Oum Dourmane

Class of CE1-CE2- Oum Dourmane

[12] This teacher also looked after the Grade 3 and Grade 4 pupils whose teacher was absent.

[13] This year, for example, among fifth graders, three girls reportedly dropped out of school to get married.

[14] But no alternative solution, such as the provision of water jars, has been put in place. The teacher says that children go home to drink at recess.

Grade 1 and Grade 2 class (primary school)

School outing

Koranic school (khalwa)

Unused water point

Source: ARTELIA - 04/12/2019

Figure 32 - School infrastructure in Oum Dourmane

In Lamadji

There is a public school in a house donated by a local resident, which reportedly has 500 students, only 10% of whom are girls. According to the information provided during the discussion with the women, most of the girls attend only the Koranic school, while the boys also attend the public school; other children attend private schools. For secondary education, some go to high schools in other neighborhoods (Roula, Hodjaj).

	
A Koranic school	A Koranic school - Lamadji

SOURCE: ARTELIA - 13/04/2019

Figure 33 - School infrastructure in Lamadji

4.4.3.3.2. Access to Health

In the study area, two of the four localities have a health center, but they only partially meet the needs of the population. This is attributed to insalubrity, a lack of equipment and medicines, the obsolescence of some equipment, the absence of a doctor, the cost, and the distance.

The main diseases cited by the health center and by the villagers show a high prevalence of malaria, especially during the rainy season. Contagious infectious diseases such as typhoid and meningitis were reported, as well as water-borne diseases, especially among children, and childhood diseases such as measles and whooping cough (a sign of insufficient vaccination), as well as respiratory diseases. In Oum Dourmane, a nurse mentioned cases of child malnutrition.[15]

In Oum Dourmane:

The village has a health clinic, which appears to serve the 25 surrounding villages. The building is newly constructed (2017) and was established through a Qatari donation[16]. It is accessible every day at certain times. It provides basic health care, sells medicines, and can perform some basic tests (using reagents in kits) but these are no longer available since the Qatari funding stopped. Although it has a general consultation room, a prenatal consultation room, a treatment room, a laboratory and a pharmacy, the heath clinic does not have a doctor. The paramedical staff consists of two nurses, a midwife and a laboratory technician, all of whom come from N'Djamena. The salaries of the staff are paid by the state, consultations are free of charge but patients must pay for tests, medicines and medical equipment.

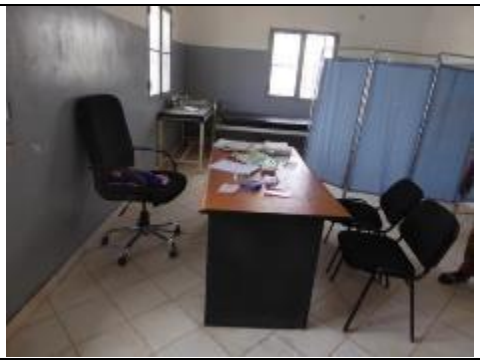
The facility has a borehole powered by solar panels and a water tower, but the building's power supply is no longer working, which is affecting deleivery.

Some of the problems are related to a lack of medical care and the storage of certain medicines. According to the inhabitants, the absence of a doctor and paramedical staff, as well as the lack of medicines and care materials, are

[15] According to the 2014-2015 MICS report, 40% of children under age 5 in Chad are stunted, 43% in Hadjar Lamis and 45% in Chari Barguimi province. Height-for-age is generally indicative of the quality of the environment and, in general, the level of socio-economic development of a population

[16] The village has a large and very active khalwa that welcomes children from different parts of Chad. This would have helped attract the Qatari grant.

the main problems.

	
A heath clinic	A prenatal consultation room
	
A consultation room	A laboratory

SOURCE: Photographs from Artelia field mission - 04/12/2019

Figure 34 - Heath clinic in Oum Dourmane

In Pont Bélilé, the residents said they travel to N'Djamena for treatment. Mutual aid can be organized to finance the travel of those who cannit afford it. The center of Oum Dourmane, although less than 2 km away, has never been mentioned as a possible destination for treatment. Nevertheless, the absence of doctors and the lack of medicines may explain this disaffection.

In Lamadji, the villagers have a private health center (fees are charged[17]), set up by a local resident, with a water source but no electricity. The generator does not work, so it is not possible to store medicines in good conditions. The center has four health aides (2 nurses and 2 assistants) who can provide very basic care, and also sells some medicines. Residents can also go to a general practitioner in another neighborhood, 5 km away, with the central hospital in N'Djamena being the main alternative.

[17] F 500 with a treatment record booklet and F 300 without a booklet. As a comparison, consultation (by a doctor) at the hospital with a booklet costs F 5000).

A private heath clinic -Lamadji

SOURCE: Photographs from Artelia field mission - 13/04/2019

Figure 35 – A private clinic in Lamadji

4.4.3.3.3. Access to Water

In the study area, water is supplied mainly by human-powered boreholes found in most villages:

- In Am Soukar there is a manual water pump (with a borehole at a depth of 45 m), in an intermediate state, but which works all year round.
- In Pont Bélilé, the village has four boreholes, installed thanks to village self-financing or donations. There is a small water tower[18] by photovoltaic panels, also financed by the population. Two fountains are supplied in this way, only one of which is working. The other boreholes are equipped with manual pumps.

[18] Water is only available from 10 am. From 1pm-2pm there is no more water

It is mainly women[19] and children who are responsible for fetching water. The inhabitants complain that, with the exception of one borehole, the other installations do not provide good quality water (color, odor, high mineral content[20]) and, in addition, in insufficient quantity to cover their needs.

- In Oum Dourmane, there are 8 hand-pumped boreholes, but villagers complain about their dilapidation, the quality of the water and the insufficient quantity of water available.
- In Lamadji, there are several boreholes equipped with hand pumps. They were financed by the inhabitants or thanks to charitable donations. The inhabitants complain about the quantity of water available, which is considered insufficient (low flow rate) even if the quality is considered good.

Water hydrant at Pont Bélilé

Hand pump in Pont Bélilé

Water hydrant at Pont Bélilé (east side of the village)

Solar panels supplying the water tower

[19] When asked, an old woman said that it takes her more than 30' to fetch water and that she has to do it 4 to 5 times a day.

[20] They complain of fluorosis or kidney disease, which they attribute to the quality of the water.

Bollard out of order-Lamadji

Water hydrant-Lamadji

Water tower of the heath clinic - Oum Dourmane

Water point-Oum Dourmane

SOURCE: Photographs from Artelia field mission - 04/12/2019

Figure 36 - Access to water

4.4.3.3.4. Access to Energy

Access to energy is one of the main problems mentioned by residents in all the localities visited.[21] In Am Soukar and Oum Dourmane, although a high-voltage line passes near the study area, the villages in this area have no electricity connection.

In contrast, in Pont Bélilé and Lamadji it is possible to connect to existing lines[22], but the cost of connection seems to be prohibitive for most inhabitants. The eastern part of the village (less populated) has a few street lights. In Lamadji as well, according to the head of the neighborhood, only 4 or 5 families have access to electricity; the inhabitants use battery lamps for lighting.

For cooking, households mainly use biomass (wood, charcoal or dried dung) as fuel. Access to gas is very limited because the supply is limited and the price is too high for most inhabitants. As tree cutting is forbidden, villagers limit themselves to collecting dead wood or, when they can afford it, buying it at the market.

[21] According to 2014-2015 MICS survey data, less than one in ten (8%) Chadian households have electricity.
[22] The transformer at Pont Bélilé was down when we visited

	
Power line in Lamadji	Low voltage line at Pont Bélilé

SOURCE: Photographs from Artelia field mission - April 11 and 13, 2019

Figure 37 - Electrical distribution

4.4.3.4. GENDER ISSUES

The status of women in Chad is complex, subject to the influences of customary law, the Muslim religion, modern law inherited from France (the colonizing country until 1960) and also international law.

Both customary law and Islam are traditionally opposed to equality between men and women. Women are generally dedicated to functions such as childbearing, child rearing and home maintenance. Her freedom of opinion and participation in decision-making processes are not encouraged.

Despite the integration of provisions promoting gender equality into the constitution (Articles 13 and 14) and the Chadian civil code (inherited from the colonial period) and the government's efforts to encourage this equality (notably through adherence to international conventions such as the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) and the implementation of dedicated public policies), the status of women in Chad remains deeply unequal. A report on the implementation of CEDAW in the country emphasizes that the challenges to changing attitudes and the status of women are

- The permanence of unequal conceptions in customary law that continue to apply in many provinces of the country (exclusion of women from inheritance, lack of land rights, dependence on the spouse for decision-making);
- Women's perception of their own status and role;
- Their poor knowledge of their rights.

In the study area, women's activities are centered on household maintenance and market gardening. Most women cultivate their own market garden plots. The land is put under cultivation after authorization from the village chief. The money generated by the sale of agricultural products belongs to the women, who use it to support the household.

when an expense needs to be made. Men are still responsible for major household expenses (health, education, home furnishings, etc.).

Marriages are arranged by the parents and involve the payment of a dowry, which may, for example, consist of 2 million CFA francs, 3 oxen, and 3 suitcases of clothing. Women are married at a very young age, sometimes as young as 12/13, and can have up to 10 children. Men practice polygamy (up to 4 wives) without the consent of their previous wives, leading to households with up to 40 children. Separation of a woman from her husband is possible, but cases are rare. After a separation, a woman must wait 3 months before she can get back together. Domestic violence is rare, as is alcohol consumption by spouses.

As in the rest of the country, the situation of women in the study area is unequal due to the persistence of customary law: they are excluded from village decision-making processes, and although they attend public meetings, they do not actively participate unless they are asked to. However, women do not perceive this inequality and feel relatively empowered.

4.5. PUBLIC CONSULTATION

4.5.1. Framework of the consultation

4.5.1.1. NATIONAL LEGISLATION

Chadian legislation on impact studies and public consultation stipulates that the Ministry of the Environment is responsible for making impact studies known to the public by posting it within three months of submitting the complete file to its services. The Ministry must also collect the opinions of local populations and other stakeholders concerned by the project during a 45-day open consultation. During this consultation, any person interested in the project may request access to the impact study and submit an opinion noted in a register opened for this purpose.

Chadian legislation is therefore relatively limited in terms of consultation, as it leaves it to the affected populations to inform themselves about the project at the end of the impact study process. International good practice recommends that project owners organize their own public information and consultation by inviting those potentially affected by the project to information meetings organized by them. Consultation and information must cover the life cycle of the project.

4.5.1.2. IFC REQUIREMENTS

PS 1, *Environmental and Social Risk and Impact Assessment and Management*, includes specific requirements for stakeholder engagement in projects, including external communication and grievance management (paragraphs 25-36). Standard No. 1 focuses on the following aspects:

- Ensure that people who may be affected by or have an interest in the Project are involved as stakeholders, with particular attention to vulnerable and/or disadvantaged groups.
- Manage external communication to reach relevant stakeholders and facilitate dialogue between the Project and these stakeholders.

- Tailor stakeholder engagement to the specificities of the Project and the affected communities, ensuring that a locally tailored and effective information and consultation approach is implemented.

- Disseminate relevant information about the Project to help stakeholders understand the risks, impacts, and opportunities associated with it. This includes issues related to the purpose, nature, scale, and duration of the Project, the potential environmental and social impacts associated with the Project, as well as the proposed mitigation measures, the stakeholder engagement process, and the Project's complaint and grievance management mechanism.

- Ensure that a dual process of information and consultation is conducted early in the planning phase of the Project with all relevant stakeholders, that it is conducted in a culturally appropriate manner, free of intimidation or coercion, that it is properly documented, that stakeholders are able to express their views, and that these views are effectively taken into account by the Project

International good practice therefore recommends being proactive in informing those affected and stakeholders of projects for which impact studies are conducted.

4.5.2. Consultation/information process

The information and consultation of stakeholders took the form of individual interviews with government departments, four public meetings, additional interviews with women, generally followed by a visit to the villages.

4.5.2.1. CONSULTATION AND INFORMATION ACTIVITIES IN THE PREPARATION OF THE IMPACT NOTICE

The table below (Table- 20-) summarizes all consultation and outreach activities conducted (their type, nature and number of people involved) during ARTELIA's field mission between April 9 and 13, 2019.

Table 20 - Consultation activities

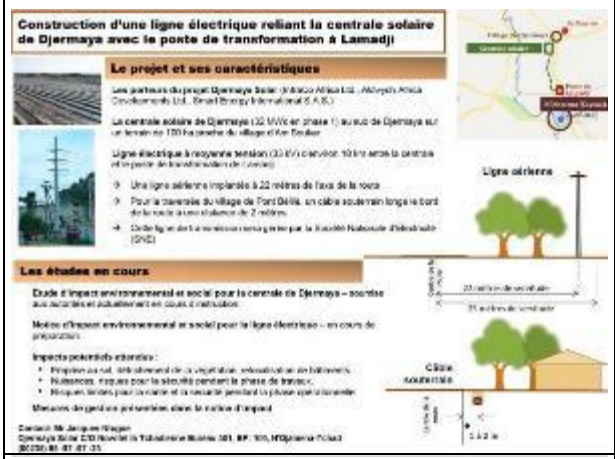
DATE	NATURE OF THE ACTIVITY AND PERSONS OR INSTITUTION MET
04/09/2019	Interview with Mr. Houlé DJONKAMLA, Director General (Ministry of Economy and Development Planning, General Directorate of the Ministry)
	Interview with Mr. Abderaman Mahamat ABDERAMAN, Director of Environment at the Directorate of Environmental Assessments and the Fight against Pollution and Nuisances (Ministry of Environment and Fisheries)
	Interview with Mr. ALAINA Yacoub Possey, Director General of Urban Planning and Habitat (Ministry of Land Management, Urban Planning and Habitat).
04/10/2019	Public information meeting in Am Soukar (38 participants including 0 women)
	Discussion with representatives of the women's group (8 women)
	Discussion with the chief of the nomads (at the northern entrance of Lamadji)
04/11/2019	Public information meeting in Pont Bélilé (59 participants, including 36 women)
	Discussion with representatives of the women's group in Pont Bélilé
	Visit of the village and social infrastructures
/04/12/2019	Public information meeting in Oum Dourmane (31 participants including 2 women)

DATE	NATURE OF THE ACTIVITY AND PERSONS OR INSTITUTION MET
	Interview with 3 women
	Visit of the village and social infrastructures
	Visit along the road to Pont Bélilé
04/13/2019	Public information meeting in Lamadji (18 participants)
	Interview with 3 women
	Visit of the village and social infrastructures

The public meetings held in Am Soukar, Pont-Bélilé, Oum Dourmane and Lamadji were organized with the help of their respective village chiefs or the neighborhood chief for Lamadji (part of a district of N'Djamena).

These sessions were attended by a total of 161 people: 110 men (village chiefs and notables, elders, youth) and 51 women (married women, young girls). An attendance list was signed (see Appendix 3) and minutes were taken at each consultation meeting (see Appendix 4). The presence of women was relatively low, with the exception of Pont-Bélilé, where their number was even higher than that of men. There, they spoke more readily[23] even though their participation was low compared to their numbers. Overall, the actual participation of women in the meetings, when they were present, was lower despite our requests. It was therefore decided to organize specific meetings to discuss with them after each public meeting. In Am Soukar, the women's representatives we met after the public meeting, which was exclusively male, told us that there could have been more of them, but that they had not been informed by the men of the meeting.

An A0 poster was prepared in French by ARTELIA (see photo below and in Appendix 4). It was used as a basis for discussion and one or more copies in A4 format were circulated among the audience and left with the village chief. The option presented during these meetings was that of burying the line for 2.25 km. If the other option were to be chosen, a new information/consultation meeting would be organized in the village of Pont-Bélilé by the project leader.



Taken on 10/04/2019

Presentation poster of the line | Presentation of public meeting in Am Soukar

SOURCE: Photographs from the Artelia field mission

Figure 38 - Information support

[23] The fact that some of them are shopkeepers is probably not unrelated to this public speaking ability

The presentation was generally made in French with a translation into local Arabic. In Lamadji, the presentation was made in classical Arabic because several members of the audience understood it.[24] However, the presentation, questions and answers were still translated into dialectal Arabic to ensure consistency. However, the presentation and questions and answers were still translated into dialectal Arabic to ensure consistency of understanding.

Minutes were taken at the end of each meeting to increase transparency. These minutes were shared with the assembly and the village chief to validate their content and ensure that the level of understanding was shared. It summarizes the main questions/topics discussed and the answers/commitments expressed by the project sponsor. When the women did not participate in the public meeting, the minutes were shared with them during the meeting held in their presence following the public meeting (see Appendix3 for attendance lists and meeting minutes and Appendix4 for meeting minutes).

Generally, the end of the public meeting was devoted to collecting information on the socio-economic situation of the village. This was followed by a tour of the village and its main infrastructure, guided by members of the village, which provided an opportunity to discuss with them and with some of the actors met (teachers, health workers) about the socio-economic situation of the village and its inhabitants.

However, the information on the socio-economic situation of the village of Am Soukar used in this report comes from the information collected as part of the ESIA and LRP for the Djermaya solar power plant project. The level of information collected was deemed sufficient for the purposes of this impact notice.

4.5.2.2. MAIN EXPECTATIONS, PERCEPTIONS OF THE POWER LINE PROJECT

4.5.2.2.1. Results of the consultation in Am Soukar

In Am Soukar, where the population has already been informed several times about the solar power plant project, the technical aspects of the power line did not seem to raise many questions or particular concerns. On the other hand, a large part of the questions and interrogations concerned the solar power plant.

- The first concern was the expression of a weariness with regard to the consultation without seeing it lead to concrete achievements (in reference to the meetings organized in the framework of the LRP and the ESIA).
- They expressed concern about the identification of land included in the perimeter of the power plant and to be compensated.

25

[24] The meeting was held in the khalwa (Koranic school) near the home of the neighborhood chief who also manages the school.

Public meeting Am Soukar

Discussion on the identification of parcels for the power plant site

Discussion with members of the women's group in Am Soukar

Source: ARTELIA - 10/04/2019

Figure 39 - Public information meeting in Am Soukar

- The other main issue was access to electricity. The villagers do not understand that the presence of the power plant in the future could not translate into access to electricity for individuals, especially since they expect to suffer the impacts of the construction site. This issue was also raised with regard to the power line.
- The issue of employment was also raised. The villagers expect to have a share of the employment granted in priority to the youth of the village.

The main concerns expressed by the representatives of the women's group, met after the public meeting, are the following

- Like the men, they are worried that they will not see any concrete progress in the project or any benefits for the village,
- They are especially interested in knowing if the project can help them develop income-generating activities. They mentioned the example of women in another village (Djermaya) who had access to training to learn how to make soap that they could sell.[25]

[25] They were reportedly approached by an organization that came to the village to listen to their grievances. The organization promised to help them learn how to make cheese from cow's milk, which is available mainly during the rainy season

- Their other main concern, like the men, is access to electricity.

Table 21 - Verbatim of the public meeting in Am Soukar

Verbatim
• *"There have been several meetings organized in the past with us but we still don't see anything coming" Participant* • *"Years go by, we are told things but we don't see anything concrete. We don't see anything coming" Participant* • *"The farmers have been waiting for 4 years for their compensation and they have stopped farming on these plots" Village chief* • *"The project has forbidden us to exploit the plots but without compensating us" Village chief* • *"What is most important for us is to have access to electricity and water. Participant* • *"First, before we talk about water and school, we need the offsets." Participant* • *"Since the beginning, there has been a lot of talk, everyone comes to do their job and leaves. The electricity will go to N'Djamena and we will have nothing." Participant* • *"When the project arrived, we thought it will bring good things. Now we understand that people have to be patient and that those who want to cultivate their plot can do so. We didn't know that" Participant* • *"The plant is an opportunity for us if work was given to our children and if we could have help to develop activities to have income" Representative of the women's group* • *"Can we get electricity?" Representative of the women's group*
Project responses to questions and expectations

- They were told that compensation is a right for those who are eligible, that the project will clarify the situation regarding the census, ensure that it is comprehensive and that all eligible people are included.
- An explanation was given concerning the project schedule and the fact that authorizations were being requested (administrative, environmental, etc.) as well as the search for financing. The project will not be able to start concretely without these prerequisites which take time.
- Furthermore, it was made clear to them that those entitled to compensation would receive it before the construction site started.
- It was also explained to them, with the agreement of a representative of the developer present at the meeting, that if construction in the parcels of the solar plant site was indeed

Although it was not possible, it was not excluded that they could, while waiting for the land to be fenced in, cultivate the land during the rainy season, especially since these are short crops (vegetables: okra, beans, cucumbers, etc.) that can grow and be harvested in 2-3 months. They were also told that they would be informed in advance when this access to the land would no longer be possible.

- Regarding access to electricity, it was specified that the project would reinforce Chad's electricity production, but the decision to connect is the exclusive responsibility of the SNE. However, it was explained to them that within the framework of the project, it was possible that a solution for access to electricity via solar kits, for example, could be considered and that the promoter would forward these requests to the SNE.

- Concerning the desired actions in response to basic needs or the creation of income-generating activities, especially for women, this will be done by the promoter within the framework of the LRP, in agreement with the actors and through actions that meet their priorities.

4.5.2.2.2. Results of the consultation in Pont-Bélilé

- The first questions in Pont-Bélilé focused on the local impact of the project and what it could bring to the villagers. Could it help them meet social needs that are currently poorly covered (education, water, health)?

- Stakeholders also asked whether the preference for the underground route to avoid relocating them was a desire not to compensate for them.

- The women asked if they could benefit from income-generating activities that would target the village women's group that needs to be revitalized.

- The issue of access to electricity was also central to the expectations expressed. The villagers find it difficult to accept that power lines pass near their homes without them having access to electricity. They refer to an 11 or 15 kV line that already crosses the village.

- Questions were also asked about access to employment during the construction period, especially for the buried part of the line that will cross the village.

- They asked about the nuisance of the construction site (dust and how it would be managed).

- Traders, especially women, expressed concern about the effect of the construction on their businesses. They mentioned the possibility of disruptions or even closure during the work.

Table 22 - Verbatim of public meeting in Pont Bélilé

Verbatim
• ***"Solar energy is good. It is cheaper and less polluting than producing electricity with generators, but if we do not have access to this electricity it is not fair. We are part of the people and the people have the right to electricity. Participant***
• ***"You're going to bury the line and then the project will be over and we still won't have electricity. Can you talk to SNE about that? Participant***
• ***"With the NES, we have no guarantee, they will not listen to us. Participant***

- *"We would like you to make things easier for us by asking you to install a transformer so that we have electricity. Participant*
- *"The village is more than 100 years old and we have nothing. We want development for the village. We want you to relay this request to the authorities. Participant*
- *"There are lots of projects that have passed, we were promised but we have nothing". Participant*
- *"We understand what you want to do, we don't have a problem with it, but we want the workers to come from the village. Participant*
- *"This project will bring us benefits, we don't care about the dust". Participant*
- *"My dealership is less than 3 meters from the tarmac, will I be affected? Shopkeeper*
- *"We are installed here, we have stores all along the road, are we going to have to close during the works? Shopkeeper*
- *"An NGO taught us how to make soap but we cannot afford to buy the ingredients to produce and sell it. Participant*

Public meeting in Pont-Bélilé

SOURCE: Photographs from Artelia field mission - 04/11/2019

Figure 40 - Public information meeting at Pont Bélilé

Project responses to questions and expectations

- The responses given to the concerns/expectations regarding access to electricity were, firstly, to explain that it was not the mission of the project to distribute electricity, as this was the responsibility of the SNE. On the other hand, the project would essentially increase the capacity of electricity production (between 9am and 5pm). SNE is the owner of the networks in general and of this line in particular and is the only one able to decide on distribution.

- Participants said they understood this but that if they went directly to SNE, they would not be heard. They asked if the project could relay this expectation to the SNE.

- Regarding employment, the consultant explained, under the control of the project representative, that the project would try as much as possible to promote local employment but that the villagers had to be aware that this would represent very few jobs and that the work would be temporary and would not last longer than 1 or 2 months.

- Regarding the nuisance, it was explained that the 1 to 1.5 m trenches will be covered quickly after the line is buried and that measures will be taken to ensure that customers can access the business during the work.

- It was announced that a visit along the road will be carried out following the public meeting to identify the businesses that are too close to the road and that will probably have to be moved temporarily a few meters from the road to facilitate the cohabitation between the construction site and the current commercial activities. They were told that they will be informed in advance about these arrangements when the date of the construction site is defined. This visit was finally carried out the next day at the beginning of the afternoon.

- Regarding the other expectations (income-generating activities for women, meeting social needs), it was specified, with the agreement of the project representative, that the project first needed to understand a little better what their situation was, their problems and needs, and that this study would contribute to this. It was not excluded that actions would be carried out to help them on certain subjects. Their attention was also drawn to the fact that they had to be aware that these potential punctual aids will not be able to solve all the problems and that the project could not substitute itself for the State.

4.5.2.2.3. Results of the consultation in Oum Dourmane

The main questions asked during the consultation were:

- Does the created line only serve Lamadji? Is it possible to connect to it?

- What is the nature of the electricity produced and does the fact that the source is solar change the nature of the electricity produced?

- Could the poles that are going to be installed be equipped with bulbs to improve the street lighting on the road? This was one of their main requests.

- Is the developer conducting this project on his own or has he been mandated by the state?

- Access to employment related to the project was also requested.

- Help has been requested for the school (books, school furniture).

The concerns of the women gathered at the public meeting were as follows:

- The women are concerned about the lack of economic activity. Apart from the rainy season when they cultivate the land (corn, cucumbers, okra), some of them do a little trading. They would like to obtain assistance to undertake income-generating activities and especially to be able to extend the growing season through small-scale irrigation.

- They would also like help for the school (books, supplies) and medicines for the health center.
- Access to electricity was also a concern for them.

Table 23 - Verbatim of public meeting in Oum Dourmane

Verbatim
• *"Is there a transformer planned with this line and can we get electricity? Participant* • *"Will it allow us to have electricity in the village? Participant* • *"For us, the most important thing is that from the entrance to the village to the exit there are even a few dozen streetlights. Participant* • *"Will this project allow the poorest people to have electricity? Will it cost less? Participant* • *"Are you going to employ people from the village. We have people who are capable of working. Village chief* • *"Can we get help for the school. The children don't have books, the classrooms don't have furniture. Participant* • *"Can the project help us to get irrigation." Participant*
 
Public meeting in Oum Dourmane

SOURCE: Photographs from Artelia field mission - 04/12/2019

Figure 41 - Public information meeting in Oum Dourmane

Project responses to questions and expectations

- A simplified answer on the technique of solar energy production was given. It was also explained that the nature of the source did not change the nature of the electricity but that the production period was limited to the time of sunshine.

- It was explained that the objective of the project was to increase the capacity of electricity production through the solar power plant and that once this electricity was injected into the electrical network, the SNE was the only decision-maker regarding distribution.
- Regarding the street lighting along the road, it was explained that installing bulbs on a 33kv line was not really possible.
- It was also specified that this project was done in the framework of a partnership between the State and the private sector. The private company designs the plant, finds the financing, builds it, operates it and the SNE buys the electricity produced, which pays the developer.
- Some had heard of solar projects that addressed the needs of the poorest and lit small villages independently of the SNE grid. It was explained that this project was not of this nature and that its main objective was to reinforce the capacity of the existing network and that the distribution remained the responsibility of SNE.
- Regarding employment, it was explained that firstly, the overhead part of the line required a certain technicality because it requires operations at height and lifting, and secondly, it will not mobilize a large team and will be done over a short period. Concerning the buried part at Pont-Bélilé, if manual digging were preferred (the most likely option), the inhabitants of Pont-Bélilé expect to be given priority as the line passes through their village. This seemed legitimate to the audience. Again, it was pointed out that this operation would not require much manpower and would be temporary.

4.5.2.2.4. Results of the consultation in Lamadji

- The first question concerned access to electricity. It was asked if this project would allow villagers to have electricity in their homes at a lower cost, or even for free.
- Participants asked if the line would impact people and if they would be compensated.
- Several questions were asked about the arrival of the 33kv line at the Lamadji substation and whether road traffic would be cut off during the work.
- It was also asked if this project would provide work for the locals.
- The women, who were met separately, asked for assistance in accessing irrigation so that they could produce even during the dry season.

Table 24 - Verbatim of the public meeting in Lamadji

Verbatim
• ***"Today, if we go to the SNE, it costs a lot to have electricity, at least 500,000 francs. With your project, will it cost us less? Participant***
• ***"Instead of giving this electricity to SNE, why don't you give it directly to the population and make it cheaper for us? Participant***
• ***"There is land but you can only produce when there is water. If we had irrigation we could grow more crops and over a longer period of time. Woman farmer***

	
Discussion with some women	Public meeting

SOURCE: Photographs from Artelia field mission - 13/04/2019

Figure 42 - Public information meeting in Lamadji

Project responses to questions and expectations

- It was clarified that the project was not intended to distribute electricity but to reinforce the capacity of the existing network, especially in the 9am-5pm time slot in connection with the sunshine period.
- Regarding impacts, it was explained that the line passes 22 meters from the axis of the road, which is located in the public domain (road easement zone) and that the only place that posed a problem was Pont-Bélilé because homes and businesses were located in this easement. Therefore, the preferred solution, to avoid the displacement of any house or business, is to bury the line at 1 or 2 m from the asphalt over a length of about 2 km.
- Regarding the impact on the road, a diagram, complementary to the poster, locating the road, the existing power lines and the Lamadji substation was used to explain the passage of the overhead line from the west side to the east side of the road where the Lamadji substation is located. It was also specified that during this passage, measures will be taken to avoid disrupting traffic.

Concerning the spin-offs in terms of employment, it was explained that a project of this size and of this nature was little generator of direct employment. It will mobilize a small specialized team, which will move along the road (mobile site). And for the part at Pont Bélilé, where the line will be buried, the trench will probably be dug manually so that some laborers can be temporarily hired. It was also specified that this type of work site was of limited duration (1 or 2 months maximum).

4.6. SUMMARY OF THE SENSITIVITY OF THE NATURAL AND HUMAN ENVIRONMENT

The analysis of the initial state of the study area allowed us to evaluate the intrinsic sensitivity of the various components of the natural and human environment of the project.

To carry out this evaluation, the following two concepts are defined:

- Issue: criterion or theme attached to all or part of a territory which, given its current or foreseeable state, is of value with regard to environmental, heritage, cultural, aesthetic, monetary or technical concerns.
- Sensitivity: risk of degradation of the value of an environmental issue as a result of the project. In the present methodology, four levels of sensitivity have been distinguished to classify the environmental and societal issues with regard to the project: nil/negligible, low, moderate and high.

The tables below present the environmental and societal issues whose sensitivity has been assessed using the following grid:

Table 25 - Environmental and Societal Sensitivity Assessment Classes

(4) Strong	High sensitivity to the creation of a power line. ● the parameters of the environment with which the project will have a direct and/or permanent interaction leading to a degradation or an improvement of their condition; ● the parameters of the environment requiring a particular technical control;
(3) Moderate	Moderate sensitivity to the creation of a power line. ● environmental parameters of particular sensitivity with which the project will only have an indirect and/or temporary interaction leading to a degradation or improvement of their condition ● the parameters of the environment requiring some technical adaptations
(2) Low	Low sensitivity to the creation of a power line. ● parameters of the environment with which the project will have an indirect and/or temporary interaction that does not result in a change or improvement in their condition
(1) Negligible	Negligible to no sensitivity to the creation of a power line.

Table 26 - Summary of the sensitivities of the receiving environment in relation to the project

ENVIRONMENTAL THEME		ISSUES	SENSITIVITY
PHYSICAL ENVIRONMENT			
Climate		The study area is located in a Sahelian bioclimatic strip characterized by a rainy season from June to September and a dry period from November to May. Rainfall can cause the appearance of flooded areas and favors vegetation. The region is also affected by climate change (reduced water supply, desertification) and has a very carbon-intensive energy supply (oil-fired power plants, firewood etc.).	Low
Soils and basements		The soils in the study area are of sedimentary origin, of a compact clay-silt nature and poor in nutrients. They are therefore vulnerable to erosion. In addition, in case of precipitations, they can lead to the formation of water bodies and runoff.	Low
Relief / topography		The route of the line has a flat topography.	Negligible
Groundwater		The route of the line is located in an area with relatively large aquiferous sandy formations covered by episodes of lacustrine or limnic sedimentation making the soil locally more or less impermeable. The sensitivity is relatively low.	Low
Surface water		There is a very high variability of water resources depending on the seasonality and volume of rainfall. This high amplitude has a notable effect on the landscape, land use by local populations, and also in terms of attractiveness and habitat potential for plant and animal species. Within the study corridor, no watercourses or ponds are crossed. The closest watercourse is the ditch along the road to the east, which is only seasonally wet.	Negligible
NATURAL ENVIRONMENT			
Biological environment	Protected area	No natural areas protected by law or recognized at the international level are directly affected by the project.	Negligible
	Habitats	The habitats of the area are modified by human activities and offer little potential for flora and fauna, especially due to the proximity of the study corridor to the road and villages.	Low
	Wildlife	The study area is part of a poor fauna context: only six reptilian and avian species have been observed. Nevertheless, the route of the line, due to its proximity to Lake Chad (Ramsar site) and the surrounding wetlands, is sensitive for avifauna, especially migratory.	Moderate
LANDSCAPE			
Landscape		The route of the line is located in a semi-desert plain, crossing several villages and areas of shrubby savannah to be planted. Power lines already exist and run parallel to the project, so the landscape issue is reduced.	Negligible
NUISANCE			
Air quality		Air quality is degraded by the nearby road and by atmospheric emissions from the Djermaya refinery located 7 km northeast of the plant site. However, it will not be affected by the creation of the power line.	Low
Sound environment		Given the location of the study area in a rural and in some places urbanized environment, noise sources are a priori low. Nevertheless, the proximity of the road to the east places the route of the line in the area affected by traffic noise.	Low

ENVIRONMENTAL THEME	ISSUES	SENSITIVITY
RISKS		
Technological risks	The linear right-of-way is located along a road with high traffic volume. In addition, the project area of the photovoltaic power plant is destined to become the industrial hub of the region. The road along the evacuation line has many characteristics that favor the occurrence of accidents. Therefore, the road risk is a real issue, especially with the industrialization of the territory.	Moderate
Natural hazards	The areas near the route are potentially subject to flooding due to heavy rainfall during the rainy season, combined with the impermeability of the soil, preventing the infiltration of rainwater. Nevertheless, the roadside areas where the line works will take place are only slightly affected by this risk.	Low
HUMAN ENVIRONMENT		
Population	The route of the line crosses rural and urbanized areas (desert zones, dwellings, commercial facilities) and nomadic camps (dry season). The inhabitants live in 4 moderate-sized villages (about 10,400 inhabitants). Moderate vulnerability status of households in the study area.	Moderate
Land	The route of the line is located within the easement of the state-owned road. Some built assets and businesses are located within the project right-of-way.	Low
Economic activities and livelihoods	The inhabitants of the study area are mainly agro-pastoralists. These activities are based on the exploitation of arable land and especially perennial or seasonal water points. These water points allow for the watering of herds, but also for the development of irrigation networks to practice market gardening in the dry season. In the study area, commercial activities are present in the various villages crossed. On the other hand, on the route of the line and the cable, very few activities have been noted: for the fixed installations, there are three small butcher shops equipped with barbecues and meat stalls in the village of Pont-Bélilé, as well as a forest warden's hut to the south of the power plant site. For the mobile elements, there are 15 stalls in the village of Pont-Bélilé. The expectations in terms of employment are high.	Moderate
Exploitation of natural resources	Several types of natural resources are exploited in the study area, but to a very limited extent due to the low forest cover (implying low production of wood products) and the very limited seasonal production of herbaceous products with low diversity, caused by strong anthropic pressure.	Low
Nomadic populations	Nomadic populations set up their camps in Lamadji (about 200, some temporary, others almost sedentary) in the study area, for periods of several months (dry season) before migrating to other grazing areas. The future line's right-of-way does not interfere with the areas directly used by these nomadic populations.	Low
Migratory movements	Migration movements in the study area are relatively limited, with youth migration to the capital (in search of employment) and the occasional presence of migrants transiting to and from N'Djamena. During the construction of the refinery, Djermaya attracted economic migrants, but these flows have been limited since the refinery became operational.	Low
Cultural heritage	There is no evidence of archaeological heritage in the study area. There are no sacred or heritage sites within the line's right-of-way	Low

ENVIRONMENTAL THEME	ISSUES	SENSITIVITY
Health and safety	Water-borne diseases, primarily malaria, are very present in the area studied. Only one health center operates in Djermaya, but it suffers from a lack of resources and medical staff. It is relatively far from some of the villages in the study area, which limits its access for the poorest households. Each village has one or more water points that are unreliable (broken pumps, insufficient flow) and under increasing demographic pressure.	Moderate
Public Infrastructures	In the study area, three of the four localities visited have a school. Educational needs are insufficiently covered (overcrowded classrooms, very basic or unfinished infrastructure, lack of or inadequate furniture, lack of teaching materials, lack of drinking water and toilets). There are also economic and cultural barriers to girls' education. Generally speaking, access to basic infrastructure (health, education, water, energy) is limited or insufficient	Moderate
Road access	The route of the line runs along the national road linking Djermaya to the capital. As a result, the road accesses are usable, but all the more dangerous for the users during the construction phase.	Moderate

5. IMPACT ANALYSIS

5.1. IMPACT ASSESSMENT METHODOLOGY

The assessment of the potential impacts of the project on the environment follows three steps:

- The first step is to establish the impact factors from the project description (see § 3.6) and to estimate the sensitivity of the environment from the description of the initial state (see § 4.6).

Impact factors are identified for each phase of the project, namely: (i) the construction phase, (ii) the operation phase. The risk of accidents is also considered as an impact factor.

The sensitivity of the environment is qualitatively noted on 4 levels from negligible to strong.

- The second step consists in establishing an environmental and societal risk analysis by estimating the potential impact (gross, i.e. without mitigation measures) of each impact factor on each sensitive component of the environment. The characterization of the impact is carried out according to the methodology presented in this paragraph.

This approach is based on a rating of the impacts according to various factors (intensity of the impact and sensitivity of the receiving environment) as well as on expert opinion. This method allows for a semi-quantitative evaluation of the impacts, but also for nuancing the evaluation. The results are first presented in the form of a text describing the origin and consequences of the potential impact. In a second step, a summary table summarizes all these potential impacts to visualize the issues at stake in a global and rapid manner (see § 5.3).

- The third step consists in establishing the measures to be taken to reduce, support and compensate for the potential impact, which make it possible to estimate the residual impact of all the impact factors on each sensitive component of the environment. The same rating system is used as for the potential impacts.

Methodological limitation. The ability to accurately analyze the impacts of a project on the natural environment should be kept modest. We believe that a final classification of the impact into 4 categories (i) no impact, (ii) minor impact, (iii) moderate impact, and (iv) major impact, represents the maximum realistic. Our experience has also shown that a classification for the same ESIA by various experts results in significantly different impact classifications, especially for potential impacts that imply implementation of the project without special precautions. The sensitivity and experience of the experts influence the rating even if the main issues and measures emerge in the end.

5.1.1. Intensity of the impact

The prospective analysis of the likely impacts of the project on the facility site and in the immediate vicinity of the project is classified according to the methodology detailed below. Impact is defined by its intensity (I) which combines the following elements:

- Persistence (P), which shows the duration of the impact (short-term or long-term);
- Severity (G), which expresses qualitatively and/or quantitatively the effects generated by the impact;

- Extent (E), which represents the geographic extent of the impact.

Impact intensity is the average of persistence, severity and extent.

$$I = (P+G+E) / 3$$

The result is rounded to the nearest number. If the gravity is zero, the intensity is zero.

Table 27 - General principles for rating intensity

PERSISTENCE OF IMPACT (P)	Score
Permanent effect: impact with irreversible damage.	4
Long-term effect: impact with long-term reversible effects (3-10 years).	3
Medium-term effect: impact with reversible effects in the medium term (3 years).	2
Short-term effect: impact with reversible effects in the short term (a few months).	1
GRAVITY OF THE IMPACT (G)	Score
Major: high consumption of raw materials (or moderate consumption of scarce raw materials), water, energy or fuel. Significant pollution of air, water and land resources by toxic, non-biodegradable and environmentally damaging substances. Physical and/or economic displacement of populations. Loss of non-displaceable and/or irreplaceable cultural heritage or of great historical/archaeological/symbolic/community value. Potentially serious damage to human health (communities or workers). Significant unsorted and untreated waste generation and high noise emissions. Significant changes to the ecosystem. High disturbance to landscape or heritage.	4
Moderate: moderate consumption of raw materials (or low consumption of scarce raw materials), water, energy or fuel. Low air pollution, limited impact on water or land resources by non-biodegradable substances. Moderate damage to community and worker health and safety. Loss of movable and/or replaceable cultural heritage. Significant waste generation with separation and treatment, and noise emissions above regulatory thresholds. Changes to the ecosystem, landscape or heritage.	3
Minor: low consumption of raw materials, water, energy and fuel. Acceptable air pollution, low pollution of water or land resources by biodegradable substances. Low waste production with separation or treatment. Low risks to community and worker health and safety. Acceptable noise emissions. Acceptable changes to the ecosystem, landscape. Loss of low value cultural heritage.	2
Negligible: no consumption of raw materials. Use of alternative energies. No atmospheric emissions or discharge of polluted liquids. No production of special waste. Noise emissions equivalent to the environment. Minimal changes to the ecosystem and landscape. No disturbance to cultural heritage. Minor changes to local communities.	1
No impact	0
EXTENT OF IMPACT (E)	Score
Global scope: consequences with widespread impact and areas indirectly affected (e.g., relocation of waste disposal) or directly affected (e.g., air pollution and its influence on climate change). Consequences have an impact on the global environment	4
Regional scope: consequences that may affect other regions of Chad.	3
Local scope: consequences limited to the area near the project.	2
One-time extent: consequences limited to the perimeter of the project and the area directly around the project.	1

5.1.2. Impact ranking: severity

The severity (S) of the impact is classified by taking into account the intensity (I) of the impact and the sensitivity of the receiving environment (Se) (see § 4.6) using the matrix below. It is important to keep in mind that an intensity estimated at level 4 is classified as a "major" severity, regardless of the sensitivity of the environment.

Table 28 - Severity of impact

SEVERITY (S)		IMPACT INTENSITY (I)				
		0	1	2	3	4
SENSITIVITY (SE)	(1) NEGLIGEABLE	No impact	Negligible impact	Negligible impact	Minor impact	Major impact
	(2) LOW	No impact	Negligible impact	Minor impact	Moderate impact	Major impact
	(3) MODERATE	No impact	Minor impact	Moderate impact	Moderate impact	Major impact
	(4) STRONG	No impact	Minor impact	Moderate impact	Major impact	Major impact

The assessment of potential impacts is therefore based on expert opinions that take into account qualitative, quantitative and semi-quantitative aspects. Finally, the potential impact can be grouped into two categories:

- Negative impact: impact generating pollution and negative environmental or societal effects (see severity ranking (S) in the table above). It can be:
  - No impact (blank);
  - Negligible (blue): impact is low enough that no mitigation measures are required;
  - Minor (yellow): the impact is low, but measures, in particular good environmental and social practices, must be mentioned;
  - Moderate (orange): impact that requires avoidance and mitigation measures to become acceptable;
  - Major (red): this impact concerns very sensitive environmental and social targets or those whose intensity is very high and requiring specific measures.
- Positive impact: impact that benefits the environment or that can benefit community development.

5.1.3. Definition of mitigation measures and determination of residual impacts

Once the potential impact is assessed, avoidance and mitigation measures are proposed. There are

different types of measures:

- Avoidance and mitigation measures for potential impacts observed during the construction and operation (these measures will be implemented through the policy frameworks described in the Line's ESMP).

- Avoidance and mitigation measures for potential impacts specific to the project. These measures are included during the project design phase.
- The implementation of these measures will have the effect of reducing the intensity and therefore the severity of the impact. The impacts will thus become residual impacts. If they are negligible or minor, no compensation measures will be necessary.
- Compensation measures are used when a residual impact is considered significant. Compensation measures are only implemented when avoidance or mitigation measures cannot be implemented or are deemed insufficient.
- It should be noted that follow-up measures may be recommended to verify predicted environmental impacts or to evaluate the effectiveness of planned mitigation measures over time.

Before describing the detailed analysis of potential and residual impacts, a general presentation of the issues is given below. This presentation, made in two matrices, each dedicated to a specific phase of the project, allows a quick visualization of the potential impacts foreseen according to the elements of the project and the affected environment, before detailing the origin and consequences of the impact.

5.2. IMPACT SIGNIFICANCE ASSESSMENT

5.2.1. Impacts and measures associated with the construction phase

5.2.1.1. IMPACTS AND MEASURES ON THE PHYSICAL ENVIRONMENT

5.2.1.1.1. Climate impacts and measures

The greenhouse gases (GHG) emitted during the work phase will come from the exhaust gases of the few work machines and transport vehicles required for the operations. The exact number of machines is not known at this time and will depend on the sequencing of the work that will be defined by the contractor in charge of the work (and in particular the number of teams working in parallel). However, these GHG emissions are not likely to modify the overall impact on the climate given the duration of the work site (approximately 2 to 3 months). In addition, these emissions will be largely inferior to those coming from the vehicles circulating on the road located near the project.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
2	1	2	1	1	Negligible	1	2	1	1	Negligible

To minimize GHG emissions as much as possible during the construction phase, an atmospheric discharge management plan will be implemented. This plan will aim to optimize travel induced by the project and set up a monitoring of fuel consumption. It will also provide that all vehicles and machinery used for the project will, in accordance with the legislation in force, be subject to periodic monitoring of air pollutant emissions (CO2, CO, NOx, SOx, particles and HC).

5.2.1.1.2. Impacts and measures on the soil and subsoil

Generally speaking, the soils are flat with little relief. The risk of erosion and landslides is low. The use of polluting materials and products presents a risk of accidental spillage and therefore of soil and subsoil pollution (a phenomenon increased in the rainy season by surface runoff). Nevertheless, the quantities used are small for the line (only the products contained in the tanks of the transport and construction machines (fuel, lubricants) could be the subject of an accidental spill). The substations that will be installed contain dielectric oils in larger quantities (20 tons in all) but the filling operation is occasional.

Cutting vegetation and burying the underground line could lead to a loss/destruction of topsoil. Topsoil is the surface layer of the soil, containing the main elements necessary for plant growth (humus, micro-organisms, fungi). The loss of this soil would correspond to a degradation of the soil by surface erosion.

The surface of soil reworked by the project is relatively small, about 2,481 m² (220 pylons of 0.8 m² surface, i.e. 176 m², 110 trees to be cut with an average ground surface of 0.5 m² and a trench of 2,250 m long and one meter wide). The line being parallel to the road, no access is planned.

To limit the risks of erosion, the trenching work will be carried out in the dry season (the precise schedule of the work site has not yet been established at the time of writing).

To preserve the topsoil layer during excavation operations, the first 20 - 30 centimeters of soil will be excavated and then stored separately for later reuse. This area can be located in the immediate vicinity of the work, especially when creating trenches for the burial of the line, where it is advisable to put the topsoil on one side and the alluvial material on the other so as not to mix these layers. It is advisable not to dig trenches during the rainy season.

A hazardous materials management plan will be put in place. Anti-pollution kits (e.g.: absorbent, containment socks) will be made available to contain any spillage of products. An intervention procedure in case of accidental pollution will be put in place. The maintenance and the refuelling of the vehicles will be carried out on the site of the solar power station or at a specialist (garage, service station). In case of presence of hazardous materials (machine maintenance products, fuel etc.), those will be stored on covered retentions, correctly dimensioned in the base of construction site of the power station; it is not however planned to store fuel in important quantity on the construction site (no service station on the construction site).

No wild deposit of waste will be made on the building site. The waste will be either gathered on the site of the solar power plant for regrouping or sent directly to an approved treatment or recycling center. A waste management plan will be prepared by the project manager during the detailed engineering phase and implemented.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
2	3	2	1	2	Minor	2	1	1	1	Minor

5.2.1.1.3. Impacts and measures on topography

The topography along the route is relatively flat. The general relief will not be impacted. No measures are required.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
1	1	1	1	1	Negligible	1	1	1	1	Negligible

5.2.1.1.4. Impacts and measures on groundwater

The water needs of the construction site will mainly come from the preparation of the concrete and the cleaning of the equipment. Considering the dimensions of the foundations (diameter: 50cm and depth: 2m) we can estimate the need for concrete at about 86m^3 for the whole line, i.e. a water requirement of about 15m3 (considering a dosage of 175l of water/m^3). The quantities needed to wash the tools are estimated at 5m3. The water for the construction of the line and the stations will be taken at the base of the solar power plant (where a well will be drilled to ensure the water needs of the project), in limited quantity (a hundred liters is sufficient for a team per day) and spread out in time. The impact on the water resource in the area is negligible.

The risks of groundwater pollution during the construction of a power line are low. They may be impacted indirectly following a spill of products on the ground and then infiltration through the subsoil (see 5.2.1.1.2).

Nevertheless, as previously stated, the clay soils are not very permeable and do not favor infiltration. In addition, the small quantity of hazardous products used limits very strongly the risk of significant contamination of the soil and therefore of infiltration into the groundwater (the risk of spillage is mainly linked to the fuel and lubricant/hydraulic fluid tanks of the machines (a few dozen to five hundred liters at most).

The measures proposed to reduce and avoid impacts on soil and subsoil are also valid for avoiding and reducing impacts on groundwater.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
2	3	2	2	2	Minor	1	1	1	1	Negligible

5.2.1.1.5. Impacts and measures on surface water

The construction phase is likely to have an impact on surface waters if toxic and polluting materials are drained into the watercourse in the event of accidental spills of chemicals or poor management of wastewater from the concrete preparation facilities.

The measures proposed to reduce and avoid the impacts on the soil and subsoil (cf0) are also valid to avoid and reduce the impacts on surface water.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
1	2	2	2	2	Negligible	2	2	1	2	Negligible

5.2.1.2. IMPACTS AND MEASURES ON THE BIOLOGICAL ENVIRONMENT

5.2.1.2.1. Impacts and measures on habitats and flora

In accordance with the measures recommended by the IFC transmission guidelines, the line's route follows the existing public highway to reduce impacts on habitats. No new access is expected to be required.

The only significant impact on "natural" habitats and on ecosystem services to the population is tree cutting along the line. An evaluation of the wooded area, the number and type of trees impacted by the project was conducted by analyzing satellite images and during the field campaign.

The impacted wooded area is thus limited to 10,730 m² or approximately 1.1 ha. The results of the evaluation of the impacted species are presented in the table below. The maps in the geographical atlas presented in Appendix5 show the location of the trees impacted on the route.

Table 29 - Identification of trees to be cut and pruned

Scientific name	Number of specimens	To cut	To be pruned
Acacia nilotica	2	2	0
Andansonia digitata	1	1	0
Calotropis procera	1	1	0
Acacia ehrenbergiana	52	26	26
Azadichta indica	5	5	0
Prosopis juliflora	29	29	0
Acacia gourmaensis	2	1	1
Balanites aegyptiaca	39	28	11
Undetermined	18	17	1
Totals	149	110	39

The impacted trees will be subject to compensation. A one-for-one minimum replacement rate is recommended, i.e., the replanting of 1.1 hectares of trees. The replanted trees will be local species and preferably the species that were removed to maintain ecosystem services. The selection of species and the location of replanting areas will be made in consultation with the affected villagers and customary authorities. The surface approach has been favored in view of the mainly shrubby character of the species present. The details of the replanting plan will be consolidated according to the feedback from the consultations with the local residents and the elements available (the age and size of the plants available to define the surface density of replanting). The objective is to achieve neutrality between the cleared area and the replanted area (no loss of biodiversity, no loss of ecosystem services).

In addition, the cut trees will be made available to residents for their firewood needs.

For the record, no protected or endangered species of flora have been identified in the area and the habitats present are considered degraded/modified by human activities.

The measures planned to reduce the impact on the flora and natural habitats, grouped together in the biodiversity action plan, are as follows

- Respecting the right-of-way and marking trees to be cut down or preserved
- Delimitation of zones of prohibition to the machines or sensitive as the nomadic forest of Lamadji;
- Opening of rights-of-way and earthworks in the dry season to minimize impacts on biodiversity;

- Prohibition of the use of phytosanitary products for the clearing of brush along the route (mechanical or manual clearing only);
- Whenever possible, trees located near but not on the line's route will be pruned rather than felled to limit impact.
- The replanting sites will be defined in agreement with the customary authorities of the villages crossed and the administrative and technical services in charge of forests. The cut trees will be compensated by replanting an equivalent area (at least 1.1 ha of local species to be distributed along the route). The species used will be local species, adapted to the area and chosen in consultation with the populations and customary authorities. Preferably, species belonging to the Mimosaceae family will be used.
- Provision of cut wood resources to the population

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
2	2	3	2	2	Minor	2	2	1	2	Minor

5.2.1.2.2. Impacts and measures on wildlife

The project is located along a national road and crosses several villages, therefore areas already heavily reworked by human activities. The installation of the line will cause a disturbance of the fauna, caused by the passage of the machines and the intervening parties on the building site, in particular because of the noise generated and the clearing work.

The period of reproduction and rearing of young (especially for the avifauna) is the most critical and generally occurs when the vegetation and natural habitats are most conducive to meeting the ecological requirements of the various groups (in terms of food, shelter for example), namely during and/or at the end of the rainy season in the study area (July to October).

The measures planned to reduce the impact on wildlife, grouped within the Biodiversity Action Plan, are as follows:

- Clearing should be carried out during the dry season and outside the breeding and rearing periods of juvenile birdlife. Optimally, clearing is recommended between November and June;
- Delimitation and respect of the rights of way to avoid the divagation of the machines of work towards the sensitive zones and in particular the nomadic forest of Lamadji;

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
2	3	3	2	3	Moderate	2	2	2	2	Minor

5.2.1.3. IMPACTS ON THE LANDSCAPE, AIR QUALITY, SOUNDSCAPE AND WASTE PRODUCTION, AND ASSOCIATED MEASURES

5.2.1.3.1. Impacts on the Landscape, and Associated Measures

The impact on the landscape is low due to the existence of a power line on the other side of the road and the fact that the areas crossed are heavily modified by human activities. The landscape integration of a second line is therefore easier in this space already largely anthropized.

Nevertheless, keeping the site and its surroundings clean (regular waste disposal) will limit the impact on the landscape.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
1	1	2	2	1	Negligible	1	1	2	1	Negligible

5.2.1.3.2. Air quality impacts and measures

Atmospheric emissions are linked to the operation of thermal engines (machines, electric generators: CO_2, CO, SOx, NOx, particles and HC) but also to the dust released by the passage of machines and excavation work (impact directly linked to the dryness of the soil and the wind - the problem of dust is naturally present in the project area, especially during the harmattan period). However, the severity of these emissions remains limited due to the short duration of the work site and the limited length of the power line to be installed and the trench.

To reduce the impacts the following measures will be implemented:

- Tarpaulin covering of the piles of earth and trucks transporting powdered materials, limiting the flight of materials;
- Limitation of the speed of the machines on the building site and its surroundings (30 km/h);
- Dampening of the surroundings of the construction site in dry and windy weather to limit dust emissions;
- Regular technical controls and maintenance of the construction equipment. These operations will be traced within a maintenance book available within each machine or vehicle.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
2	1	3	2	2	Minor	1	1	2	1	Negligible

5.2.1.3.3. Impacts and measures on the soundscape

Noise pollution is related to the operation of thermal engines (machines, electric generators) and concerns the workers and particularly the local population. The impact will be limited due to the small size of the construction sites and the short duration of the construction activities (a few hours on a given site, then moving the mobile site).

Measures to limit the impact are as follows:

- Optimization of daytime work to limit night-time noise pollution (no night work planned to date);
- Provision of personal protective equipment to workers (ear plugs);
- Compliance with the IFC standard in inhabited areas: 55 dB (A) during the day and 45 dB (A) at night.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
1	1	3	2	2	Negligible	1	2	2	2	Negligible

5.2.1.3.4. Impacts and measures on waste generation

The production of waste will be limited at the source and will favor local recovery and recycling channels. The evacuation of waste will be done daily to leave a clean environment and to limit visual pollution.

Waste management will be carried out in accordance with the waste management plan presented in the Monitoring and Follow-up Program and Environmental and Social Management Plan (ESMP).

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
2	3	1	2	2	Minor	1	1	2	1	Negligible

5.2.1.4. IMPACT ON THE HUMAN ENVIRONMENT, AND ASSOCIATED MEASURES

5.2.1.4.1. Impacts on the Physical Movement of People and Associated Measures

Overall, the study of the physical right-of-way of the route, based on the analysis of satellite images, the staking campaign, and field surveys (social and environmental team), shows that the line's passage corridor, 22 m from the axis of the road in the road's easement zone, will not impact any buildings or economic activities, with the exception of the passage through the village of Pont-Bélilé. A point identified on satellite images under the line south of the power plant site was found to be a hut used by forest rangers. After preliminary consultation, the forest rangers have no problem with the hut being moved a few meters. The relocation will be carried out by the construction workers, or by the forest rangers in exchange for compensation.

Source: Djermaya Solar - 27/04/2019

Figure 43 - Hut on the route of the overhead line

At Pont-Bélilé, running the line overhead would have required the displacement of several dozen people and would have been complicated from a legal point of view, given the evolution over time of the regulations relating to the easement zone (see § 3.7.2). The adoption of the 2.25 km or 1.25 km buried line solution with an adaptation of the distance between the line and the road for 1 km will avoid this impact.

The impact in terms of physical and economic travel is negligible.

In fact, some fixed or mobile installations will have to be moved 1 or 3 meters because they are too close to the road (see section 4.4.3.3) and therefore to the trenching zone set at 1 or 2 meters from the edge of the road[26]. This displacement of a few meters is easy to organize and will not overly impact activities. Some of the people concerned, whom we were able to interview, do not see any disadvantage in this, especially since it will be over a short distance and for a limited period of time (duration of the mobile worksite, i.e. a few days at a given point). However, it will be necessary that the people concerned be informed in advance of the beginning of the work site and that punctual help be offered to them to move their installations and stalls before the beginning of the work site and after its end. Customer access to the stalls and businesses must be maintained. The terms of the assistance to be granted (relocation by project employees or compensation calculated, for example, on a common basis for all persons concerned if the relocation is carried out by the shopkeeper) will be defined amicably and on a case-by-case basis with the persons concerned.

In addition, three businesses whose fixed elements will probably have to be moved and rebuilt will have to be compensated. These are the three butcher's shops (shop no. 9 with a masonry cooking pit at 2.5 m from the roadway, shop no. 24 with a masonry cooking pit at 3.5 m from the roadway and shop no. 13 with a masonry cooking pit at 4 m from the roadway). The new location will be chosen in consultation with the merchants concerned, as the available space in the direct vicinity of the current locations does not pose a problem.

It should be remembered that the option chosen in the end (burying the line over 2.25 or 1.25 km) has no consequence on the number of Parts Affected by the Project concerned, as these are located on the section that will be underground in both cases.

In addition, the trenches will be dug gradually over a few dozen meters. The burial of the line and the filling of the trenches will be done rapidly. Access to the shops and businesses from the road should therefore not be a problem. Nevertheless, these work site conditions will have to be re-explained to the merchants before the start of the work.

The complaint management system put in place for the Djermaya solar power plant (see ESIA report November 2018) will have to deal with any complaints related to the construction of the line, especially in Pont-Bélilé.

SEN	*P*	*G*	*E*	*I*	*GROSS SEVERITY*	*P*	*G*	*E*	*I*	*RESIDUAL SEVERITY*
2	1	2	1	2	Minor	1	1	1	1	Negligible

5.2.1.4.2. Impacts and measures on nomadic camps

Nomadic camps are found along the road, more to the east of the road than to the west where the proposed power line will pass. These camps are generally temporary, during the dry season, and their exact location may vary from year to year. In contrast, a permanent camp of the chief of these nomads is located at the entrance to Lamadji. It is located at a distance from the road and will not be impacted by the passage of the line.

[26] The width for this type of work site is 3 to 4m (1m for the storage of topsoil, 1m for the trench, 1m for the storage of all the material and 1m for the preparation of the ducts before the installation).

Nevertheless, when the work schedule is more precise, the promoter will ensure that temporary nomadic camps will not be set up near the pylon installation sites and will inform the chief of the nomads of the upcoming work and its schedule.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
2	1	1	1	1	Negligible	1	1	1	1	Negligible

The residual impact on nomadic herding populations is therefore considered to be short-term, negligible in severity, and localized to the project corridor. The severity of the impact is negligible.

5.2.1.4.3. Nuisances associated with the construction site

Apart from the impact on road traffic to secure the work (occasional displacement of pole installation teams, cable pulling, passage to the Lamadji substation, etc.), the work site will not create any major nuisance and it will be of short duration. The teams mobilized for the mobile line installation site will comprise fewer than ten people in total, and there will be no accommodation at the base camp.

- For the Pont Bélilé crossing, nuisances to local residents are possible (dust, noise) but if the work is manual, the noise impact will be low;
- In addition, some poles could be erected near the perimeter walls of certain properties (option under study).

However, some measures are necessary

- The mobile stalls along the road in Pont-Bélilé will be moved away from the trenches so as not to be impacted by the dust. 15 mobile stalls (see Appendix2) are likely to be affected (this figure is likely to vary according to the season) in addition to the three butcher's shops;
- If necessary, accesses will be provided above the trench at Pont-Bélilé to allow pedestrian passage and ensure continuity of commercial activities during the short duration of the mobile work site at a given point.
- The workers will be made aware of the E&S issues of the project and in particular of the respect of the local communities, t h e prohibition to throw away waste outside the garbage cans provided for this purpose, the prohibition to take wildlife, etc.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
1	1	1	1	1	Negligible	1	1	1	1	Negligible

5.2.1.4.4. Impacts and measures on the safety of local residents

The safety of project residents may be adversely affected by the following factors:

- Risk of road accidents between a project vehicle and a resident or other road user
- Risk of people falling in trenches, which will not exceed 1m to 1.50m in depth at Pont-Bélilé.

The risks of violence between workers and communities as well as the risks of violence against women are considered negligible, as the operation of installing a tower is very short (a few hours) and the teams of cutters are small. Furthermore, there are no plans to use security forces to protect workers on mobile sites, and the risk of disproportionate use of force is also considered negligible.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
3	1	3	1	2	Moderate	1	1	1	1	Minor

The impact on the safety of local residents during the construction phase is therefore considered to be short-term, moderate in severity and local in scope. The severity of the impact is negligible after the implementation of the following measures:

- Implementation of a Traffic Management and Road Safety Plan: Training of drivers to drive safely / traffic plan indicating routes, schedules, and driving rules.
- Signage of the works and definition of a safety perimeter. If necessary, during particular operations (cable pulling over the road...) adaptations will be necessary such as the implementation of an alternating traffic in view of the narrowness of the road and its bad conditions in some places.
- For the Pont-Bélilé passage, the trenches must be marked and protected by construction barriers. If necessary, a guard will be present every night.

5.2.1.4.5. Impacts and measures on worker safety

On power line sites, the risks incurred by workers typically observed are mainly traumatic accidents caused by unsafe working conditions (fall from height, trench work, manual work) or road accidents. On the other hand, the electrical risk is present for the specialized workers who will perform this type of work.

At this time, there are no plans to use armed guards to prevent the risk of aggression or terrorist attacks. The security situation in the area will be reassessed prior to the start of construction and on an ongoing basis.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
3	1	4	2	3	Moderate	1	2	2	2	Minor

The impact on worker safety during the construction phase is therefore considered to be short-term, potentially major in severity and local in scope. The impact has a moderate and then minor severity after the implementation of a Worker Health and Safety Plan (WHSP) covering in broad outline the following safety aspects: identification of risky tasks, wearing of Personal Protective Equipment (PPE), awareness and training of personnel on work risks and postures to avoid accidents,

- Measures to secure the work site to avoid collisions with vehicles
- A system for handling emergencies and first aid.

5.2.1.4.6. Impacts and measures on local employment

The nature of the work associated with this short-term project does not allow for the creation of many jobs. The work site will be mobile and will only require a few people to work simultaneously, including technicians trained in network installation operations[27]. The underground section at Pont-Bélilé, if the trenching work is manual, will create a few more low-skilled jobs, but only about ten over a short period of time.

Given the project's low labor requirements, employment is an expectation of the villagers that will be difficult to meet and will need to be managed to avoid dissension. During the consultation, organized as part of the preparation of this impact notice, information was given on the limited and very temporary nature of the direct employment generated by the project as well as the need to employ workers skilled in the installation of electrical networks. Expectations are particularly high in Pont-Bélilé, and the promoter has committed itself during this consultation to favor local employment as much as possible, especially for the digging of the trenches. The companies in charge of the works and their subcontractors will be contractually notified of this requirement and a plan for maximizing local employment will be prepared by the service provider in charge of detailed engineering, procurement and construction.

The small number of jobs generated is likely to create tensions between those who will be recruited and those who will not. To reduce this risk, this subject should be addressed during the public presentation of the impact notice to explain the recruitment system to be put in place. For example, a list of candidates who meet the site's criteria could be drawn up and recruited in a transparent manner, by lottery; this practice should avoid suspicions of favoritism. This type of process should be public, transparent, and organized in conjunction with local employment authorities. The number of positions that can be assigned to local residents will be maximized in consultation between Djermaya Solar and the company in charge of the work. For this purpose a local recruitment plan will be developed (see § 6.5.56.5.4.).

Even if the level of employment is low, the Contractor and all its subcontractors will be required to recruit, manage the workforce, and provide working conditions in accordance with Chadian national regulations (and in particular Act No. 038/PR/96 of December 11, 1996 on the Labor Code) and international standards[28] (elimination of forced labor, abolition of child labor, etc.). In particular, they must have each worker sign a written employment contract, which will be archived and may be audited by the Employer.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
3	1	1	1	1	Negligible	1	1	1	1	Negligible

During the consultation, many expectations were expressed regarding the socio-economic benefits for the population, especially in terms of income-generating activities (IGA) for women, actions targeting access to water and energy, and education. Within the framework of the construction of the photovoltaic power plant, an action plan is considered targeting the people impacted by the acquisition of land, and actions to support community development as well. No promises were made during the consultation for this line project. Nevertheless, the promoter was open to the possibility of punctual support for certain projects, especially at Pont-Bélilé.

[27] In particular to hoist, fix and adjust the cable and its accessories according to the temperature, the distance between the posts and the staking plan data.

[28] These standards are defined in several international declarations and conventions by the International Labour Organization Standards (ILO) and the United Nations.

For the sake of consistency and to help build trust between the project and its stakeholders, it is recommended that the beneficiaries of the community development actions that the project plans to implement for the photovoltaic power plant be extended to the villages consulted for the power line, and particularly to Pont-Bélilé, while remaining proportional to the issues encountered by each project (power plant/line).

5.2.1.4.7. Impacts and measures on cultural heritage

The study area has not been the subject of any archaeological investigation to date. While no community sacred sites have been identified within the future line's right-of-way, a mosque has been identified and avoided in the design of the project (building already being relocated before the project, no impact).

However, civil engineering work requiring soil excavation may reveal artifacts of potential interest to Chadian heritage.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
1	1	2	2	2	Minor	1	1	2	1	Negligible

The impact on the archaeological heritage potentially present during the construction phase is therefore considered to be a short-term effect, of minor severity and local extent. The severity of the gross impact is minor and becomes negligible after the implementation of measures.

It is necessary to set up a procedure of preventive archaeology of limited scope, to be deployed during the activities involving ground works (digging of various trenches, excavations).

5.2.1.4.8. Impacts and measures on public infrastructure

No public infrastructure (roads, schools, health centers, water points) are located within the project right-of-way. There is therefore no impact in terms of displacement of public infrastructure. It should be remembered that the personnel required to operate the mobile site for the installation of the pylons and the construction of the line are limited to a few people.

5.2.1.5. IMPACTS AND MEASURES ON NATURAL AND TECHNOLOGICAL RISKS

5.2.1.5.1. Impacts and measures on natural risks

There is a risk of flooding during rainy periods in the study area overall, due to the low permeability of the soil, but it is reduced in the vicinity of the road (the temporary pools are far from the road). In addition, this risk is not modified by the activities of the work phase.

The project does not increase the risk of increased drought that Chad is currently experiencing, and will result in only a small consumption of water resources (about 20m3 over the entire construction period).

The impact on natural risks during the construction phase is therefore considered to be nil.

5.2.1.5.2. Impacts and measures on technological risks

During the construction phase, the risks for the personnel are related to the work of electrical installations and the start of fire.

The electrical risk exists during the connection and assembly of the various electrical components (after powering up). There are three types of fire outbreaks:

- Short-circuit on a construction machine (measure: machines equipped with fire extinguishers and subject to periodic maintenance);
- Electrical short circuit during assembly/energization of the line (measures: use of class II connectors, non-flame propagating; presence of fire extinguishers; obligation to use qualified and authorized personnel, wearing PPE, test procedure and energization);

The gross impact is considered to be major with a long-term effect, potentially of major and local severity, the residual impact being reduced to a "moderate" level thanks to the prevention and protection measures adopted. In addition, a Health & Safety management plan will be developed by the company in charge of the work, and will include, among other things, an intervention procedure in the event of a fire and a medical evacuation flow chart in the event of serious injury.

SEN	*P*	*G*	*E*	*I*	*GROSS SEVERITY*	*P*	*G*	*E*	*I*	*RESIDUAL SEVERITY*
3	3	3	2	3	Moderate	3	2	2	2	Moderate

5.2.2. Impacts and measures associated with the operation phase

5.2.2.1. IMPACTS AND MEASURES ON THE PHYSICAL ENVIRONMENT

5.2.2.1.1. Climate and air quality impacts and measures

No GHG emissions are generated by the operation of the power line.

GHG emissions from the operation of the line will come from vehicles transporting maintenance personnel. Due to the low maintenance required to operate a line, these emissions will be minimal (with an anticipated line inspection only every two to three years).

In addition, the implementation of a distribution network of electrical energy produced from solar energy will eventually lead to the elimination of energy practices that consume natural resources and pollute, such as generators or charcoal. The emission of GHG from these practices will be eliminated. For a more precise analysis of the GHGs avoided by the project, please refer to the environmental and social impact study of the solar power plant project.

The operation of the facilities will therefore have a positive impact on climate change and the production of greenhouse gases.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
-	-	-	-	-	Positive	-	-	-	-	Positive

5.2.2.1.2. Impacts and measures on the soil and subsoil

The line corridor will have to be maintained to limit the regrowth of trees that could cause damage to the installations. The only risk of soil and subsoil pollution is related to the potential use of pesticides, which could impact the quality of the soil and affect nearby crops. Wherever possible, the maintenance of the corridor under the line will be carried out using mechanical or manual means.

If pesticide use cannot be avoided, it will be necessary to:

- Do not use pesticides in categories 1a, 1b and II of the WHO Guidelines for the Classification of Pesticides and those in Annexes A and B of the Stockholm Convention.
- Use only pesticides that are licensed, registered, and approved by the appropriate authority and in accordance with the UN Food and Agriculture Organization (FAO) International Code of Conduct on the Distribution and Use of Pesticides.
- Train staff in the application of pesticides (limited and reasonable use) and ensure that they receive the necessary certificates and/or training.

In addition, the low frequency of maintenance operations is not likely to pose a significant risk in terms of pollution. Maintenance and in particular the replacement of dielectric fluids in transformers will be carried out by professionals. In addition, the transformers will be located on a retention tank to contain any accidental spillage of dielectric fluids.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
2	3	3	2	3	Moderate	2	2	2	2	Minor

5.2.2.1.3. Impacts and measures on topography

Once the construction is completed, the operation of the new structures will not change the elevation of the area. The impact is therefore nil.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
-	-	-	-	-	Null	-	-	-	-	Null

5.2.2.1.4. Impacts and measures on groundwater

As stated in the previous sections, the risks of groundwater contamination are relatively low in the study area due to the presence of a low-permeability surface horizon. No significant disruption of subsurface flows is anticipated at the level of the line or substations, and the low level of soil sealing induced by the project will allow the underlying aquifer to recharge during rainy periods.

Concerning the risk of pollution due to the use of pesticides during the maintenance of the line's vegetated areas, see previous paragraph 5.2.2.1.2.

Therefore, it can be considered that the impact on groundwater is negligible to nil.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
-	-	-	-	-	Null	-	-	-	-	Null

5.2.2.1.5. Impacts and measures on surface water

The only risk to surface water during the operation phase of the line would be accidental pollution by hazardous products during vegetation maintenance. This point is dealt with in the previous paragraph 5.2.2.1.2.

It can be considered that the impact on surface water will be minor to negligible for the operation phase.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
2	2	3	2	2	Minor	2	1	1	1	Negligible

5.2.2.2. IMPACTS AND MEASURES ON THE BIOLOGICAL ENVIRONMENT

5.2.2.2.1. Impacts and measures on habitats and flora

Within the line right-of-way, periodic maintenance of the vegetation will be carried out by SNE agents. This will locally affect the spontaneous development of the vegetation. However, this impact will be offset in the long term by the program to compensate for the tree vegetation during the construction phase. The right-of-way surface is not very large and is located in an already anthropized area, in the immediate vicinity of a busy road. The impact on habitats and flora will thus be limited.

Within the framework of the solar power plant, an ecological follow-up will be set up at the beginning of the exploitation to check the good recovery of the plantations carried out and the effective reappropriation of the site by the local flora. This ecological follow-up will integrate the line of evacuation of energy and the follow-up of the plantations carried out as compensation. The follow-up is recommended carries at least over a period of 2 years in wet season.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
2	1	3	2	2	Minor	1	2	1	1	Negligible

5.2.2.2.2. Impacts and measures on wildlife

In the operational phase, the main environmental risk is that of collision of avifauna with the line and electrocution, especially for migratory avifauna. The rights-of-way and the presence of the supports and lines do not present any impact on terrestrial fauna.

For avifauna, the risk of collision is greater for HV lines than for MV/LV lines such as those to be installed in this project; conversely, the risk of electrocution is greater for MV lines than for HV lines. No specific migration route (i.e. precisely located) is known in the study area. It is therefore considered in this study a diffuse migration route.

The danger of electrocution concerns mainly medium and large birds because of their ability to touch:

- Either two conductors at the same time: it is the electrocution between phases;
- Either a conductor and a conductive element connected to the ground: it is the electrocution between a phase and a ground connected to the ground.

The risk of electrocution is also a function of the type of armament (pole head) and the position of the pole in the landscape, depending on its attractiveness (e.g., hunting post).

The danger of impact exists when birds fly at the height of the conductor sheets. Many factors influence the flight height of a bird: the species, the type of activity (hunting, displacement, migration...), the attractiveness of the environment, the weather conditions (temperature and wind strength), the topographic configuration, the height of the vegetation cover, etc... Overall, collisions occur mainly at the level of the guard wire.

In addition, the interviews conducted during the fauna & flora field campaign in April 2019 showed that the existing lines induced avian mortality, especially during the migration period.

The project leader will study in detail the opportunity to put in place devices to reduce the risks of collision and electrocution. For this purpose, a marking of the line will be carried out by an adapted means (see below). Other strategies may be adopted in coordination between the project owner and the project manager:

- Neutralization: insulation device for bare conductors under tension. A plastic sheath placed on the wire at the level of the support prevents a perched bird from being electrocuted.
- Deterrence: In this case, the aim is to prevent the bird from landing on the dangerous weapon. For this purpose, vertical rods forming combs or forks are placed on the top of the post.

- Incentive: a perch is installed on the pole to encourage the bird to come and land on it rather than on the dangerous parts of the armament. This also provides observation posts for raptors. This strategy can also lead to the installation of secure nests at the top of some pylons if it is adapted. Depending on the species present, for example the jabiru or marabou, nesting supports can be installed at the top of some supports to compensate for the felled trees.
- Visualization: the lines can be equipped with visualization beacons to prevent collisions (different devices exist: anchored spirals, aeronautical balls, glass disc, spiral or oscillating beacon of the "Firefly" type).

The strategy adopted will be established on the basis of a dedicated technical and economic study to be carried out in the pre-construction phase, at the time of the detailed design of the line.

In all the cases, a follow-up of avian mortality at the beginning of the exploitation will be taken in charge by the person in charge of the ecological follow-up of the solar power plant project. This follow-up will allow to define the real impact level, to choose if necessary complementary measures to the marking already retained, in particular among those mentioned above, and to evaluate the effectiveness of these measures. The monitoring is recommended at least over a period of 2 years in wet season.

Therefore, the impact can be considered minor.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
3	2	3	4	3	Moderate	2	2	2	2	Minor

5.2.2.3. IMPACTS AND MEASURES ON THE LANDSCAPE, AIR QUALITY, SOUNDSCAPE AND WASTE PRODUCTION

5.2.2.3.1. Impacts and measures on the landscape

The impact on the landscape is low due to the existence of a power line on the other side of the road and a high voltage power line to the west. In addition, the areas crossed are already heavily altered by human activities. The landscape impact of the proposed transmission line is therefore low.

At the level of the stations, the landscape impact will also be limited. for the station of the power plant, the installations will be integrated into the site of the solar power plant in general and will bring only few landscape modifications. At the level of the Lamadji substation, the installations will not involve any particular extension of the existing site. The impact will thus be negligible to nil.

Therefore, the overall impact can be considered negligible.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
1	1	2	2	1	Negligible	1	1	2	1	Negligible

5.2.2.3.2. Impacts and measures on the soundscape

Noise emissions caused by the operation of the line are relatively low (humming / crackling accentuated in wet periods) in terms of acoustic power. The most important consequences will be related to maintenance work in the villages. In view of the low frequency of interventions required by a power line, it can be considered that the impact is negligible.

In the vicinity of the substations, a regular humming/screaming noise can also be perceived near the transformers. This noise is the result of the corona effect: electrical discharges produced in the surrounding air. This phenomenon is sometimes visible at night (especially by animals). This noise should not be disturbing given the absence of housing in the immediate vicinity of the substations. In addition, this phenomenon has no consequences on health. Here also the impact can be considered as negligible.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
1	1	3	2	2	Negligible	1	2	2	2	Negligible

5.2.2.3.3. Impacts and measures on waste generation

The operation of the power line and substations should not generate significant waste. Some maintenance waste is to be expected (used transformer oil, gaskets, cable or insulator scrap) in limited quantities and spread over time. Analyses will also be carried out at regular intervals to guide maintenance activities (analysis of dissolved gases, dielectric strength, water content, acidity index, furan content).

The impact can be considered negligible.

The management of maintenance waste will be carried out in accordance with the SNE waste management plan. The waste will be collected and treated according to the good practices in force.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
1	2	3	2	2	Minor	2	1	1	1	Negligible

5.2.2.4. IMPACT AND MEASURES ON THE HUMAN ENVIRONMENT

The line corridor will need to be maintained. The line and poles should be inspected approximately every three years and the vegetation around and under the line should be maintained every three years to limit the growth of trees that could damage the facilities. The disturbance caused by these inspections is negligible given their low frequency. The immediate proximity of the line to the national road explains why no access roads to the infrastructure were created for maintenance purposes.

Maintenance of vegetation will be conducted if possible only by mechanical or manual means (see 5.2.2.1.2).

The impacts of this phase are therefore negligible.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
2	1	1	1	1	Negligible	1	1	1	1	Negligible

5.2.2.5. IMPACTS AND MEASURES ON NATURAL AND TECHNOLOGICAL RISKS

5.2.2.5.1. Impacts and measures on natural risks

There is a risk of flooding in the study area overall, but this risk is low in the vicinity of the road (the temporary ponds are far from the road). In addition, this risk is not modified by the presence of the installation.

New installations (lines and substations), present a risk of attracting lightning, especially due to the presence of high metallic elements and live elements. The consequences of a lightning strike on these installations are varied and include: short-circuit, network failure due to overvoltage, cable fall, fire...

The installations will be protected against the risk of lightning: the electric line will be equipped with a guard cable and all the poles will be connected to the ground. The transformers will be equipped with lightning protection in accordance with international standards.

The residual impacts of the project on natural hazard are negative, long-term, negligible, and local. The severity of the impact is moderate.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
3	4	3	3	3	Moderate	3	1	2	1	Moderate

5.2.2.5.2. Impacts and measures on technological risks

A. Impacts and measures on the electrical/fire risk

During the operating phase, there is a risk of electrocution if the line comes into contact with conductive material. The people working on the line are trained and authorized.

For local residents, electrocution is possible in the event of an accident (falling cable) or if someone climbs the tower. In the event of a component of the line falling, the consequences could be significant for the infrastructures located below or could trigger a fire.

First of all, the facilities will be sized and built to withstand the most extreme conditions. In addition, no housing or infrastructure will be located under the line. In addition, explanatory signs at the bottom of each support will remind people of the danger of electrocution (with sufficiently explicit sketches) to ward off any adventure. Information on the risks associated with the line will also be provided during the construction phase as part of the public consultations.

Therefore, it is possible to consider that the impact on the electrical/fire risk is moderate to minor.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
3	4	3	3	3	Moderate	3	1	1	1	Minor

B. Impacts and measures on road risk

The frequency of personnel intervention on the line during the operation phase is very low (approximately every 3 years) for inspection and maintenance of vegetation. No significant road impacts are expected.

The presence of power poles can create a collision risk for road users. However, the distance between the power line and the national road (22 m from the centerline of the road) is sufficient to reduce this risk to an acceptable level.

Therefore, it can be considered that the impact on road risk is negligible.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
3	1	2	1	1	Minor	1	2	1	1	Minor

C. Electromagnetic risk

According to the IFC[29] "Despite public and scientific concern about the potential for adverse health effects from exposure to electromagnetic fields (not only from high-voltage power lines and substations, but also from electrical appliances used in daily life), there is no empirical evidence of adverse health consequences[30]. However, while the evidence for adverse effects is not strong, it is sufficient to be of some concern.[31]

The following preventive measures will be adopted by the project:

- Compliance with the reference values established for the population by the International Commission on Non-Ionizing Radiation Protection ICNIRP[32]. These guidelines provide sufficient protection against known health effects and against those that may occur when touching a charged object in an external electric field. For a 50 Hz line:
  - Electric field limit: 5 kV/m;
  - Magnetic field limit: 100 µT.
- Establishment of a line height for dwellings to meet these reference values.

SEN	P	G	E	I	GROSS SEVERITY	P	G	E	I	RESIDUAL SEVERITY
3	3	1	1	2	Minor	2	1	1	1	Negligible

5.3. SUMMARY OF IMPACTS AND MITIGATION MEASURES

The table below presents a summary of the impact analysis.

[29] IFC, Environmental, Health and Safety (EHS) Guidelines. ELECTRICITY TRANSMISSION AND DISTRIBUTION (2007)

[30] International Commission on Non-Ionizing Radiation Protection (ICNIRP) (2001); International Agency for Research on Cancer (2002); National Institute of Health, USA (2002); Advisory Group to the Radiation Protection Board, UK (2001); and National Institute of Environmental Health Sciences, USA (1999))

[31] National Institute of Environmental Health Sciences, USA (200

[32] ICNIRP guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz - 100 kHz), (2010).

Table 30 - Summary table of impact analysis

Environmental target	Sensitivity (Sen)	Persistence (P)	Gravity (G)	Scope (E)	Intensity (I)	Gross Severity (SB)	Summary of proposed mitigation measures	P	G	E	I	Residual Severity (SR)
Construction phase												
Climate	2	1	2	1	1	Negligible	To minimize GHG emissions as much as possible during the construction phase, an atmospheric discharge management plan will be implemented. This plan will aim to optimize travel induced by the project and set up a monitoring of fuel consumption. It will also provide that all vehicles and machines that will be used for the project will be, in accordance with the legislation in force, subject to periodic control, especially with regard to pollutant emissions (CO2, CO, NOx, SOx, dust and HC).	1	2	1	1	Negligible
Soil and subsoil	2	3	3	2	3	Moderate	To preserve the topsoil layer during excavation operations, the first 20 - 30 centimeters of soil will be excavated and then stored separately for later reuse. This storage area can be located in the immediate vicinity of the work, especially in the case of trenching, where it is advisable to put the topsoil on one side and the alluvial material on the other, so as not to mix these layers. It is advised not to dig trenches during the rainy season. A management plan for hazardous products will be put in place for the site. Anti-pollution kits (e.g.: absorbent, containment socks) will be made available to contain any spillage of products, and a procedure for intervention in the event of accidental pollution will be drawn up. In case of presence of hazardous materials (maintenance products for the machines, fuel etc.), these will be stored on covered retentions correctly dimensioned in the construction site of the power plant; No wild deposit of waste will be made on the construction site. A waste management plan will be prepared and implemented;	2	2	1	2	Minor
Topography	1	1	1	1	1	Negligible	No action required	1	1	1	1	Negligible
Groundwater	2	3	2	2	2	Minor	The measures proposed to reduce and avoid impacts on soil and subsoil are also valid for avoiding and reducing impacts on groundwater.	1	1	1	1	Negligible
Surface water	1	2	2	2	2	Negligible	The measures proposed to reduce and avoid the impacts on the soil, subsoil are also valid to avoid and reduce the impacts on surface water.	1	2	1	1	Negligible
Habitats and flora	2	2	3	2	2	Minor	Biodiversity Action Plan; Respecting the right-of-way and marking trees to be cut or pruned; Delimitation of the zones of prohibition of machines and sensitive as the nomadic forest of Lamadji; Opening of rights-of-way and earthworks in the dry season to minimize impacts on biodiversity; Prohibition of the use of phytosanitary products for brush cutting along the route (mechanical or manual brush cutting only) Whenever possible, trees located near but not on the line's route will be pruned rather than cut down to limit impact. Replanting sites will be defined in agreement with the customary authorities of the villages crossed and the administrative and technical services in charge of forests. The cut trees will be compensated by replanting an equivalent area (at least 1.1 ha of local species to be distributed along the route). The species used will be local species, adapted to the area and chosen in consultation with the populations and customary authorities. Preferably, species belonging to the Mimosaceae family will be used. Provision of cut wood resources for the population.	3	2	1	2	Minor
Wildlife	2	3	3	3	3	Moderate	Biodiversity Action Plan Clearing should be carried out during the dry season and outside the breeding and rearing periods of juvenile birdlife. Optimally, clearing is recommended between November and June. Delineate and respect the rights-of-way to avoid the movement of machines towards sensitive areas; Conduct ecological monitoring of the implementation of measures during the construction phase and the effectiveness of post-construction measures	2	2	3	2	Minor
Landscape	1	1	2	2	1	Negligible	Keeping the site and its surroundings clean (daily waste disposal)	1	1	2	1	Negligible

Environmental target	Sensitivity (Sen)	Persistence (P)	Gravity (G)	Scope (E)	Intensity (I)	Gross Severity (SB)	Summary of proposed mitigation measures	P	G	E	I	Residual Severity (SR)
Air quality	2	1	3	2	2	Minor	Tarpaulin covering of the piles of earth and trucks transporting powdered materials to limit the flight of materials. Limitation of the speed of the machines on the building site and its surroundings (30 km/h); Wetting of the surroundings of the construction site in dry and windy weather to limit dust emissions; Regular technical controls and maintenance of the construction equipment. These operations will be traced within a maintenance book available within each machine or vehicle.	1	1	2	1	Negligible
Acoustic atmosphere	1	1	3	2	2	Negligible	Provision of personal protective equipment to workers (ear plugs). Compliance with the IFC standard in inhabited areas: 55 dB (A) during the day and 45 dB (A) at night (optimization of daytime work to avoid night-time noise pollution)	1	2	2	2	Negligible
Waste generation	2	3	1	2	2	Minor	Limiting waste production at the source and favouring local recovery and recycling channels; Daily waste evacuation; Waste management will be carried out in accordance with the waste management plan	1	1	2	1	Negligible
Physical or economic movement of people	2	1	2	1	2	Minor	Informing the people concerned in advance of the start of the work. Proposal of help for the relocation of their installations and stalls before the beginning of the construction site and after its end (18 stalls including the 3 butcher's shops) as well as for the ranger's hut. Compensation for the three cooking stoves to be rebuilt and the businesses to be moved and rebuilt (3 businesses). Gradual digging of the trenches to maintain access to the stalls and businesses from the road (modalities to be explained to the merchants before the beginning of the work). Extension of the complaint management process set up for the solar power plant to the residents of the line project to handle any complaints related to the construction site, especially in Pont-Bélilé	1	1	1	1	Negligible
Nomadic camps	2	1	1	1	1	Negligible	Verification of nomadic camp sites as soon as the work schedule is set. Discussions with the nomadic leader to inform him of the upcoming work and the associated schedule.	1	1	1	1	Negligible
Nuisances related to the construction site	1	1	1	1	1	Negligible	The stalls will be set back from the trenches to avoid being impacted by dust. Water will be used to suppress dust if necessary. A regular technical control of the machines of building site will have to be carried out. The work will be carried out only during daytime hours (8am-6pm). If necessary, accesses will be built above the trench at Pont-Bélilé to allow pedestrian passage The workers will be made aware of the E&S issues of the project and in particular of the respect of the local communities.	1	1	1	1	Negligible
Safety of the residents of the construction site	3	1	3	1	2	Moderate	Implementation of a Traffic Management and Road Safety Plan: Training of drivers to drive safely / traffic plan indicating routes, schedules, and driving rules. Management of road risks with a signposting of the works and the definition of a safety perimeter. If necessary, during specific operations (pulling a cable over the road, etc.), adaptations are to be planned, such as the implementation of alternating traffic in view of the narrowness of the road and the poor conditions in some places. At Pont-Bélilé, trenches will be marked and protected by construction site barriers. If necessary, a guard will be present every night	1	1	1	1	Minor
Worker safety	3	1	4	2	3	Moderate	Identification of risky tasks, wearing of Personal Protective Equipment (PPE), sensitization and training of personnel on work risks and postures to be adopted to avoid accidents. Site security measures to avoid collisions with vehicles. Emergency and first aid system.	1	2	2	2	Minor
Local employment	3	1	1	1	1	Negligible	Employment of local people for the digging of the trenches (commitment of the client during the consultation of the NIE, to the extent possible), employment of people for unskilled work (clearing, handling, etc.). The number of jobs that can be assigned to people living in the area will be maximized in consultation between Djermaya Solar and the company in charge of the work. For this, a local recruitment plan will be developed. Public presentation of the impact notice addressing the low number of jobs generated (reducing the risk of tension between those hired and not hired) For example, creating a list of people who meet the criteria of the work site and organizing a draw to designate the people to be recruited in a transparent manner and thus avoid accusations of favoritism. Compliance with current labor regulations and ILO conventions.	1	1	1	1	Negligible
Cultural heritage	1	1	2	2	2	Minor	Establishment of a preventive archaeology procedure of limited scope, to be deployed during activities involving ground works (digging of various trenches, excavations	1	1	1	1	Negligible

Environmental target	Sensitivity (Sen)	Persistence (P)	Gravity (G)	Scope (E)	Intensity (I)	Gross Severity (SB)	Summary of proposed mitigation measures	P	G	E	I	Residual Severity (SR)
Public Infrastructures	-	-	-	-	-	Null	-	-	-	-	-	Null
Natural hazards	-	-	-	-	-	Null	-	-	-	-	-	Null
Electrical/fire hazard	3	3	3	2	3	Moderate	Construction equipment equipped with fire extinguishers, subject to periodic maintenance. Use of class II connectors, non-flame propagating; Presence of fire extinguishers; Obligation to use qualified and authorized personnel (electrical work), wearing PPE.	3	2	2	2	Moderate
Operation phase												
Climate and air quality	-	-	-	-	-	Positive	-	-	-	-	-	Positive
Soil and subsoil	2	3	3	2	3	Moderate	Wherever possible, maintenance of the corridor under the line will be done by mechanical or manual means. If pesticide use cannot be avoided, it will be necessary to: Do not use pesticides in categories 1a, 1b and II of the WHO Guidelines for the Classification of Pesticides and those in Annexes A and B of the Stockholm Convention. Use only pesticides that are licensed, registered, and approved by the appropriate authority and in accordance with the UN Food and Agriculture Organization (FAO) International Code of Conduct on the Distribution and Use of Pesticides. Train staff in the application of pesticides and ensure that they receive the necessary certification and/or training. Maintenance and in particular the replacement of dielectric fluids in transformers will be carried out by professionals. The transformers will also be equipped with a retention system to contain any accidental spill.	2	2	2	2	Minor
Topography	-	-	-	-	-	Null	-	-	-	-	-	Null
Groundwater	-	-	-	-	-	Null	-	-	-	-	-	Null
Surface water	2	2	3	2	2	Minor	The proposed mitigation measures are the same as those stated in the paragraph on soils and subsoil (see 5.2.2.1.2).	2	1	1	1	Negligible
Habitats and flora	2	1	3	2	2	Minor	Setting up an ecological monitoring at the beginning of the exploitation to verify the good recovery of the plantations carried out and the effective reappropriation of the site by the local flora. The follow-up is recommended at least over a period of 2 years in wet season.	1	2	1	1	Negligible
Wildlife	3	2	3	4	3	Moderate	Implement a marking of the line. Carry out a study on the technical and economic feasibility of installing devices to reduce the risks of collision and electrocution (see 5.2.1.2.2) Set up a monitoring of avian mortality at the beginning of the operation to verify the absence of impacts. This monitoring will allow to define the real impact level and to define, if necessary, complementary measures. The monitoring is recommended at least over a period of 2 years in wet season.	2	2	3	2	Minor
Landscape	1	1	2	2	1	Negligible	No action required	1	1	2	1	Negligible
Acoustic atmosphere	1	1	3	2	2	Negligible	No action required	1	2	2	2	Negligible
Waste generation	1	2	3	2	2	Minor	The management of maintenance waste will be carried out within the framework of the SNE waste management plan. The waste will be collected and treated according to the good practices in force.	2	1	1	1	Negligible
Population	2	1	1	1	1	Negligible	No measures to be taken except for electrical and fire hazards	1	1	1	1	Negligible
Natural hazards	3	4	3	3	3	Moderate	Protection of the installations against the risk of lightning (line protected by a guard cable and metallic poles connected to the earth, transformers equipped with a lightning protection).	3	1	2	1	Moderate
Electrical/fire hazards	3	4	3	3	3	Moderate	Put a sign at the bottom of each rack indicating the danger of electrocution (with sufficiently explicit sketches) to ward off any adventure. Sensitization to be planned during public meeting on the electrical and fire risks within the villages located along the energy evacuation line.	3	1	1	1	Minor
Road risk	3	1	2	1	1	Minor		1	2	1	1	Minor

Environmental target	Sensitivity (Sen)	Persistence (P)	Gravity (G)	Scope (E)	Intensity (I)	Gross Severity (SB)	Summary of proposed mitigation measures	P	G	E	I	Residual Severity (SR)
Electromagnetic risk	3	3	1	1	2	Minor	- Compliance with the reference values established for the population by the International Commission on Non-Ionizing Radiation Protection - Establishment of a line height for dwellings to meet these reference values.	2	1	1	1	Negligible

5.4. CUMULATIVE IMPACTS

5.4.1. Methodology

The methodology used for the cumulative impact analysis is based on the IFC guide: *Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets*. It follows the main steps of the approach presented in this guide, namely:

1. Determine the spatial and temporal boundaries of the analysis.
2. Identify the environmental and social components of value.
3. Identify all projects that may influence these components.
4. Determine the initial state of these components.
5. Assess cumulative impacts and their significance to the components.
6. Develop and implement strategies, plans and procedures to manage cumulative impacts.

Cumulative impacts essentially mean assessing whether similar impacts between different existing or future projects present synergistic or antagonistic effects (non-linear effects) or whether they are simply additive. If the effects are merely additive, then the measures implemented on a project-by-project basis are deemed to be necessary and sufficient. On the other hand, if synergistic effects are to be suspected, such as a threshold effect, then the measures developed specifically for each project considered individually may be insufficient. Additional cross-cutting measures can then be proposed if the contribution of the project is significant.

5.4.2. Temporal and spatial limits

The proposed construction of the line is an 18km long linear structure. The analysis covers the area surrounding the project in a corridor one kilometer wide (500 m on either side of the road). The projects taken into consideration are those that are known, confirmed and planned in the short or medium term (2 to 10 years), but in any case they are mostly major and/or structuring and significant for the analysis. Thus, the numerous minor projects that will necessarily be developed in the near future due to the urban activities of the area are not taken into account (such as individual constructions, the establishment of a gas station or the opening of a small shop or workshop for example).

5.4.3. Environmental and social components of value

Regarding the physical, natural and human environments, the following components have a particular value that requires consideration in the cumulative impact analysis.

Table 31 - Environmental and social components of value

Environm	Environmental and social component
Physics	▪ Air quality ▪ Soil quality ▪ Surface water quality ▪ Groundwater Quality
Biological	▪ Terrestrial Biodiversity
Human	▪ Landscape ▪ Habitat ▪ Economic activities and livelihoods ▪ Social and organizational dynamics ▪ Health and safety ▪ Nomadic population

5.4.4. Projects selected for analysis

The power line project is integrated along the road linking N'Djamena to the Djermaya refinery. Several power lines are already present along this road: on the east side of the road, symmetrically to the project, there is an 11kV line. Further west is a 66kV line connecting the Djermaya refinery to the Lamadji substation. In addition to the solar power plant project itself, the most significant project in the vicinity of the future line is the project to widen the road into a 2x3 lane expressway to connect N'Djamena to the future Djermaya airport. This road widening project is linked to the airport project and is likely to be carried out by the same developer. The Djermaya international airport project has been under study for more than 10 years (project initially carried by the Chinese company CAMCE). A facility by the Turkish company Summa is currently being discussed with the Chadian President[33]. This project will probably not be carried out at the same time as the new rail line construction project.

[33] https://www.alwihdainfo.com/Tchad-l-aeroport-international-de-Djermaya-pourrait-enfin-voir-le- day_a71506.html

5.4.5. Cumulative Impact Analysis

Table 32 - Cumulative Impact Matrix

Components	Air quality	Soil quality	Groundwater Quality	Surface Water Quality	Biodiversity	Landscape	Habitat	Economic activities and livelihoods	Social and organizational dynamics	Health and safety	Nomadic population
Existing or planned activities											
Existing power lines	N	N	N	N	Fa	Fa	N	N	N	Fa	N
Road widening project related to the airport of Djermaya	If	N	N	Fa	Fa	Fa	If	If	If	If	Im
Djermaya Solar Project	N	N	N	N	Fa	Fa	N	N	N	N	Fa
Djermaya Solar power plant connection line project	N	N	N	N	Fa	Fa	N	N	N	Fa	N
Synthesis											
No. of impacting projects	1	0	0	1	4	4	1	1	1	3	2
Type of interaction	Add	-	Add Syn	Add Syn	Add Syn	Add Syn	-	Add	Syn	Syn	Add
Significance of cumulative impacts	Fa	-	N	Fa	Fa	Fa	If	Fa	If	If	Im
Influence of the power plant connection line project Djermaya Solar	N	N	N	N	Fa	Fa	N	N	N	Fa	N
Additional measures	N	N	N	N	N	N	N	N	N	N	N

Impact: Positive: Po; No impact: N; Low: Fa; Significant: Si; Important: Im;

Interaction Simple additive: Add; Synergy: Syn; Antagonist: Ant

Additional measures: Yes: Y; No: N

5.4.6. Analysis of the contributions of the line project

The analysis focuses on the contributions of the proposed connector line to the overall impacts in the area.

Concerning biodiversity, according to the field surveys carried out (cf. § 4.3.2.3), the residents of the road report cases of bird deaths linked to the existing lines. These accidents occur mainly between August and September. Since the existing lines run parallel to the current route, the installation of the new line will necessarily increase these risks of collision and electrocution for birds. The measures proposed in chapter 5.2.2.2.2 will make it possible to reduce this risk (monitoring of avian mortality induced by the new line project and marking of the guard cable). The cumulative impact on avifauna is therefore expected to be low and will be monitored elsewhere. The road widening project (still under study) will also have an impact on the movement of terrestrial and avian fauna by reinforcing the pre-existing barrier effect. This effect is cumulative with those of the existing and planned lines.

From a landscape point of view, the proposed line is integrated into an already anthropized area, marked by the presence of existing lines, villages, various developments along the road and the agropastoral component of the areas outside the villages. In this context, the cumulative impact of the new line is relatively negligible.

Finally, from the point of view of safety, the proposed line will make a small contribution to increasing the accidental electrical risk (electrocution and fire) already present with the existing lines. This contribution is low. The road widening project would significantly increase the already high road risk on this route.

The project's contribution to impacts in the project area is low. No additional measures are recommended.

6. MONITORING AND FOLLOW-UP PROGRAM AND ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

6.1. OBJECTIVE OF THE ESMP

The purpose of this Environmental and Social Impact Notice is to identify and evaluate the impacts of the project for the evacuation of energy produced by the Djermaya solar power plant on the natural and human environment. The elements resulting from the analysis conducted show that the expected impacts are relatively limited.

The ESMP aims to set a framework for the implementation of the planned impact reduction measures, especially during the construction phase, to briefly describe the plans to be prepared, the planning and operational responsibilities, the monitoring procedures and the anticipated budget.

The ESMP of the line is in line with the ESMP defined for the solar power plant, a general contractor being in charge of the construction of all these installations and infrastructures. During the design, pre-construction and construction phases, a single ESMP will be developed by Djermaya Solar and its general contractor, grouping together the actions to be carried out for the line and the solar power plant.

The ESMP will be detailed by Djermaya Solar and the selected subcontractors during the design phase of the project, so that it is fully operational before the start of construction (design and pre-construction). The ESMP, as an integral part of the HSES management system, will be reviewed and revised as appropriate during the project, in a continuous improvement process.

6.2. HEALTH-SAFETY-ENVIRONMENT-SOCIAL (HSE) MANAGEMENT

Djermaya Solar is responsible for organizing the project's Health-Safety-Environment-Social management during the construction phase only, with SNE then becoming the owner and operator of the facilities.

- During the construction phase, Djermaya Solar shall select a prime contractor on the basis of its ability to conduct construction operations in accordance with this ESMP. Djermaya also has a role in controlling the HSES aspects of the operations of the selected contractor. The selected contractor will carry out the construction of the power plant and the line.

- During the operating phase, Djermaya Solar will ensure that ecological monitoring of the replanting operations carried out to compensate for the clearing caused and the consequences of the operation of the line on avifauna is put in place. This monitoring will be carried out over a period of 2 years and may require the implementation of corrective actions aimed, for example, at the installation of additional protection on the line (cf. § 6.11.1.3).

- In the operational phase, SNE must integrate the line and the substations into the network. The facilities will be managed according to an environmental and social monitoring program including

inspection, maintenance and scheduled maintenance operations in accordance with its internal maintenance policy for its facilities.

Responsibilities are thus divided in the pre-construction and construction phases between the Djermaya Solar construction manager and his delegate for these aspects, and the HSES manager. Their role is to coordinate and monitor the proper implementation of this ESMP in coordination with the Health-Safety-Environment-Social Manager (HSSEM) of the project manager. The measures recommended by this study will be integrated into the prime contractor's contract to make their implementation binding.

Djermaya Solar's project team will also ensure relations with the central environmental authorities (Ministries), local administrations and communities for all aspects related to the line (stakeholder engagement / complaints management).

During the operation phase, the HSES Manager will ensure the planning and implementation of rehabilitation measures and the monitoring of avian mortality by an independent expert.

In the operational phase, the management of HSES aspects will be the primary responsibility of the SNE Operations District Manager and his operational teams. Community relations will be managed by the Customer and Public Relations Department, which is common to the entire SNE.

The government will be responsible for administrative oversight and technical control of the implementation of the ESMP. This task will be carried out primarily by the authorities in charge of the environmental police, as well as by civil protection agents, hygiene inspectors or services for classified establishments, or any other structure designated to carry out monitoring of the Djermaya Solar project. The monitoring will include compliance with national legislation and compliance with the measures of the ESMP.

6.3. ENVIRONMENTAL AND SOCIAL INFORMATION AND AWARENESS PLAN

An information and awareness plan concerning the environmental and social management procedures will be prepared by Djermaya Solar and its subcontractors for the construction phase. It will present the content of the ESMP concerning them and will aim at training the employees in its application.

The first training given to employees will cover the HSES organization of the project and the basics of environmental and social management procedures. This HSES induction will be presented to each employee taking into account their involvement in the organization of the environmental and social management system. This training will cover methods to reduce the impacts presented in the ESMP, their roles and responsibilities, waste management, pollution prevention, health and safety aspects of their work, including aspects related to traffic, lifting, working at heights, risks related to trench work and methods for managing emergency situations (accident, fire, etc.). The training will also cover respect for and relations with local communities, especially women.

These themes will then be developed periodically during the daily team meetings (Tool box meeting).

In the operational phase, HSES training will be provided at a more general level to SNE employees.

6.4. ENVIRONMENTAL AND SOCIAL MONITORING AND SURVEILLANCE PROGRAM

6.4.1. Application of the measures recommended in the ESIN

The purpose of monitoring is to verify that the environmental and social safeguards applicable to the project are being applied. Therefore, a regular supervision of the protection measures implemented during the project will be put in place.

Monitoring aims to establish a correlation between the activities and their environmental and social consequences by quantitatively measuring the associated parameters to provide information on impacts related to the project's activities and to propose compensatory measures if necessary.

For an environmental point of view, the program to be carried out will allow make it possible track and monitor the impact of atmospheric emissions as well as various pollution sources. It will define the various measurement methods, parameters, measurement points and frequency. The results will be recorded, stored and made available to the supervisory authority.

Monitoring activities will be defined by Djermaya Solar and will include the following:

- Quantities consumed monthly for the following products: water, and significant consumables (fuel, concrete, paper, chemicals, etc.);
- Amount of waste generated, as well as its storage and disposal route;
- Air quality (dust) in and around the work areas;
- Construction noise emissions;
- Monitoring of the flora and fauna environment of the study area, in particular avifauna: the effectiveness of the collision and electrocution risk prevention measures put in place for avifauna will be evaluated over a period of at least two years to detect any negative evolution linked to the implementation of the power line. The evolution of the compensation areas for the cut trees and the good recovery of the vegetation along the route of the line will also be recorded.

For its social part, the program that will be conducted will allow the follow-up and monitoring of the associated management plan and will include:

- Monitoring the implementation schedule of the stakeholder engagement plan;
- Review of the Complaint Management Process;
- Local Recruitment Plan Review;
- Follow-up of the relocation assistance of the facilities located along the line.

The monitoring program should highlight any non-compliance with the objectives and recommendations of the ESMP, and these should be promptly communicated to line managers to ensure that corrective action is taken.

6.4.2. Definition of activities, indicators and monitoring periods

Various parameters will be monitored as listed in the following paragraphs. Fauna and flora will be continuously monitored, as well as other parameters associated with the project.

Given the short duration of the construction site for the line and the transformers, the proposed frequency is monthly. This frequency can be adapted according to the first results.

6.4.2.1. WASTE TRACKING

The waste management plan provides recommendations for waste tracking and control during the various phases of the project, including storage, treatment and disposal. Tracking of waste generation and disposal is presented in the waste management plan.

6.4.2.2. MONITORING OF NOISE EMISSION COMPLIANCE

Noise values from the work site must not exceed the limits presented in the following table nor result in an increase of 3dB in ambient levels at the reception area closest to the work site (notion of emergence).

Table 33 - Noise limit values at the nearest reception point

	One-hour L_{Aeq} (dBA)	
Type of receiver	Daytime (7am-10pm)	Night time (10pm-7am)
Residential, institutional, educational	55	45
Industrial, commercial	70	70

6.4.2.3. AIR QUALITY COMPLIANCE MONITORING

Air quality will be monitored during the construction phase, especially during the dry season, to control dust levels related to operations or climatic conditions. The frequency of monitoring will be adapted according to the time of year and the results of previous analyses. The air quality values used for the project are the WHO values:

- Particulate matter PM2.5: 10 µg/m^3 annual average / 25 µg/m^3 24-hour average.
- Particulate Matter PM10: 20 µg/m^3 annual average / 50 µg/m_3 24-hour average

In the event of this being exceeded, collective (watering) or individual (dust mask) protection measures will be put in place.

6.4.2.4. FOLLOW-UP OF SOCIAL MANAGEMENT ACTIONS

The monitoring of social management actions will include the following indicators:

- The number of consultations and meetings conducted as part of the stakeholder engagement plan, the percentage of progress on the plan, and the level of compliance with the schedule;
- The number of complaints recorded in the complaint management system, differentiating between those from local residents and those from site employees, the types of grievances, the percentage of treatment and the degree of satisfaction. The proper functioning of the mechanism will be tested by conducting monthly interviews with the village chiefs concerned.
- The number of local people working on the project (in value and percentage), the type of positions held, the number of women (in value and percentage) employed.
- The smooth running and satisfaction of the people impacted by a displacement of infrastructure (ranger's hut and the three butcher shops and their cooking stoves)

6.4.3. Environmental and Social Monitoring Dissemination and Communication Tools

During the construction phase, an environmental and social monitoring report will be issued at least once a month. It will be accompanied by an action plan to remedy any non-compliance identified during the monitoring.

6.5. SOCIAL MANAGEMENT PLAN

The Social Management Plan contains a number of thematic plans and procedures to be implemented by the Employer or its subcontractors.

6.5.1. Stakeholder Engagement Plan

The stakeholder engagement plan developed for the solar plant will need to be completed to include the line's stakeholders. The different stakeholders are the people or groups directly or indirectly affected by the project (whether they are neighbors of the line or not), as well as those who have an interest in the project or who have the capacity to influence it (positively or negatively). They fall into three categories: authorities, private sector and civil society.

Within the framework of the project of the line it will be a question in particular of adding the customary authorities, the inhabitants, the tradesmen and farmers as well as the NGOs present within the villages crossed by the work (Oum Dourmane, Pont-Bélilé and Lamadji - Am Soukar being already taken into account in the PEPP of the power station project).

Djermaya Solar will have to implement, during the phases of pre-construction, construction and at the launch of the operation of the line, activities of information, dialogue and engagement with its stakeholders in accordance with the recommendations of the IFC and the AfDB.

Information and dialogue activities will vary in intensity depending on the phase of the project:

- During the pre-construction and construction phases, regular and frequent communication and dialogue must be established, primarily with local authorities and communities living near the project.
- At the start of the operation phase, a communication will be made to inform about the energization of the line and the potentially associated risks.

These activities shall be:

- Culturally appropriate (e.g., respecting days of rest, religious holidays, local customs such as the importance of greeting the village chief when visiting, ensuring that women receive information)
- Adapted to the educational level of the local population (oral communication rather than written communication).
- Conducted in the local language when necessary, with the intervention of a translator who respects the principles of neutrality, non-coercion and fidelity in the transcribed words.

Communication should be as transparent as possible and the information disseminated should be substantiated, with a level of detail sufficient to allow communities to easily understand the project and the issues it represents for them.

Women's participation should be mandatory at every meeting and their opinions should be solicited by the HSES Manager in charge of community relations. If necessary, the HSES Manager will organize women-only meetings.

Each engagement activity (public meeting, one-on-one interview, etc.) should be recorded in a database to ensure effective tracking of the activities conducted and to ensure that commitments made are kept by all parties.

The recommended *minimum* activities to be implemented are presented in the table below, broken down by phase and target audience.

The responsibility for the implementation of the PEPP is that of the HSES Manager of Djermaya Solar who will be recruited during the pre-construction and construction phase. He will be in charge of community relations. This manager will be able to rely on the village chiefs as a relay of information to be disseminated. The project leader will have to implement a strict counterparty policy towards these village leaders to minimize ethical risks.

Table 34 - Stakeholder Engagement Plan

ACTION	*TARGET*	*INFORMATION DISSEMINATED*	*COMMUNICATION MEDIA/DISSEMINATION MEANS*	*SCHEDULE/FREQUENCY*
PRE-CONSTRUCTION AND CONSTRUCTION PHASE				
Presentation of the ESIN	Village chiefs of the study area concerned by the ESIN	Presentation of ESIN findings: ▪ main E&S impacts identified ▪ proposed management measures to avoid, reduce or compensate for them ▪ complaint management mechanism in place	Individual meeting with each village chief Paper support (poster for example) Minutes of the meeting with signature of the participants	Prior to and during the validation process of the ESIN by the Ministry of the environment
	Local communities in the study area affected by the ESIN		Public meeting with communities (if needed, meeting with women only) Paper support (poster for example) Minutes of the meeting with signature of the participants	
	Local communities in the study area affected by the ESIN		Public meeting with those affected by the LRP Paper medium (e.g. poster) Minutes (PV) of the meeting with signature of the participants	
Presentation of the ESIN findings	Prefect and/or Deputy Prefect	▪ Main E&S impacts identified ▪ Measures proposed to avoid, reduce or compensate them ▪ Claims management mechanism in place	Individual meeting	Prior to and during the validation process of the ESIN by the Ministry of the environment

ACTION	*TARGET*	*INFORMATION DISSEMINATED*	*COMMUNICATION MEDIA/DISSEMINATION MEANS*	*SCHEDULE/FREQUENCY*
Information on the launch and progress of the works	Village leaders and communities affected by the work	▪ Nature of the work carried out ▪ Schedule of work to be done ▪ Points of vigilance that communities must take into account (increased road traffic, temporary nuisances, etc.) ▪ Local recruitment procedure in Pont-Bélilé ▪ Ongoing claims and their processing	Public meeting with the communities concerned (if necessary, meetings with certain socio-demographic (women) or socio-professional groups only).	Every month during the construction phase
Road safety awareness campaign road safety	Residents of villages of Am Soukar, Oum Dourmane, Pont Bélilé and Lamadji	▪ Road risk prevention information	Session awareness of the populations concerned	Every month during the construction phase
OPERATIONS				
General information on power line hazards	Village leaders and local communities	▪ Electrical hazards ▪ Reaction in case of an accident ▪ Maintenance and inspection activities ▪ Answers to community questions ▪ Follow-up of complaints	Public meeting (if needed, additional meeting with women only)	At the start of the operation phase

6.5.2. Claims Management Mechanism

During the pre-construction and construction phase of the power line, Djermaya Solar will set up a system to respond to any questions or complaints from the people and communities living along the route of the line. This mechanism will also be accessible to the workers and employees of the construction site through the opening of a dedicated register.

The deployment of this mechanism will have to be done by the HSES Manager, also in charge of community relations. He/she will ensure that the mechanism is quickly operational, and will collect complaints at regular intervals, record them and ensure their processing, in coordination with the other Djermaya Solar entities potentially responsible for the complaint. He will have to make sure that the mechanism is in conformity with the following requirements and good practices:

- Prompt: A claim should be processed within a reasonable time. The response time to a claim should be as short as possible (less than 30 days);
- Accessible: the mechanism must be easily accessible to all people affected by the project (close to the study area, available every working day of the week, etc.);
- Culturally appropriate: the mechanism must take into account local particularities (language spoken, level of literacy, easily accessible to women, etc.).;
- Free of charge: access to the mechanism must not involve unreasonable expenses (e.g. for transportation to the place of submission of the claim).;
- Anonymous: the identity of complainants must be preserved in all circumstances outside the person(s) in charge of managing the mechanism;
- Allowing for legal recourse: a person who has submitted a complaint to the company must still be able to go to court if necessary.

The proposed mechanism is based on the steps presented in the following sections.

6.5.2.1. FORMULATION OF THE CLAIM

A complaint may be submitted individually or collectively (by a community, clan, organization, etc.). When a claim is submitted collectively, the submitting institution will have to be represented by a single person, who will be the privileged interlocutor of the HSES Manager.

To guarantee access to the complaints mechanism to all populations affected by its activities, Djermaya Solar shall provide several channels for the formulation of complaints:

- Verbal complaint to the HSES Manager: Any person may make a verbal complaint when the HSES Manager is present on the site and in the villages of the study area. In this case, the HSES Manager will fill out a complaint form directly with the complainant, signed by the latter.
- Verbal complaint to another person involved in the project (site manager, worker, etc.): when a complaint is addressed to a person other than the HSES Manager, the person receiving the complaint must inform the complainant of the various means available to him/her to express his/her complaint. He or she should not make any commitments or attempt to provide answers or solutions to the complaint. He/she shall note the name and telephone number of the complainant and refer the matter to the HSES Manager.

- Telephone call to the HSES Manager: The HSES Manager will provide a telephone number to the village authorities, the population and the site workers to allow them to express their complaint directly and verbally. After each call, the Manager will have to fill in the complaint form by collecting all the required data. To limit the cost of the call for the complainant, the HSES Manager shall offer to call the complainant back immediately. This measure ensures that the complaint handling mechanism is free of charge.

- Verbal or written complaint to the village chief: The HSES Manager will provide communities with a register, in the form of an A4 notebook containing the columns necessary to record the complaint (name and surname of the complainant, address, telephone number, date, subject of the complaint, etc.). This register will be available at the office of the village chief. It will allow people to come directly to register their complaint in writing and illiterate people to have their grievances written by the village chief. The HSES Manager will check the register once a week and visit the complainant to fill out a complaint form with him/her.

- Similarly, the HSES Manager will make a complaints log available to workers on the job site throughout the duration of the work, and will come in to pick up the log at regular intervals.

- Letter addressed to Djermaya Solar: any person will be able to address a letter to Djermaya Solar to formulate a complaint in its respect. This letter must include the elements identifying the complainant as well as the reason for the complaint, except if the complainant wishes to remain anonymous.

As a result, the HSES Manager will:

- Provide village leaders with a single telephone number for complaints and a physical registry.

- Provide the site manager with a physical logbook for recording workers' complaints.

- Train the site manager and village leaders in receiving, recording and transmitting complaints.

- To inform the personnel of Djermaya Solar on the treatment of the complaints which they must implement.

- Inform local communities about the existence and operation of the procedure.

- It will also need to ensure that women can access the mechanism directly, without having to ask their spouses, by informing them about it in meetings held with women only.

6.5.2.2. REGISTRATION OF THE CLAIM

All complaints must be recorded on a complaint form. In the event of the form not being filled out directly by or with the complainant (letter, complaint recorded in the village register, telephone call), the HSES Manager will complete the form and assign a reference to the complaint. This action must be taken within 48 hours of receiving the complaint.

Each complaint must be categorized according to its theme (health, safety, environment, nuisance, employment, compensation, communication/information) and its severity (noted, for example, on 4 levels: minor, average, serious, major).

Each claim should be recorded in a database (preferably an Excel file) that captures the information contained in the claim form, reports the category and severity of the claim, and indicates the status of the claim (in progress, closed, etc.) to facilitate tracking. Recording should be done on a daily basis.

6.5.2.3. SETTLEMENT OF MINOR TO MEDIUM SEVERITY CLAIMS

If a complaint is deemed minor to moderate, the HSES Manager will prepare a written response and present it in person to the complainant. The HSES Manager will explain the contents of the document verbally to ensure that the complainant understands the response.

The HSES Manager shall then complete the originally opened Claim Form with the response and have the complainant sign it acknowledging that the Claim has been closed. The Manager then records the act of closing the claim in the claims database.

6.5.2.4. SETTLEMENT OF CLAIMS OF SERIOUS TO MAJOR SEVERITY

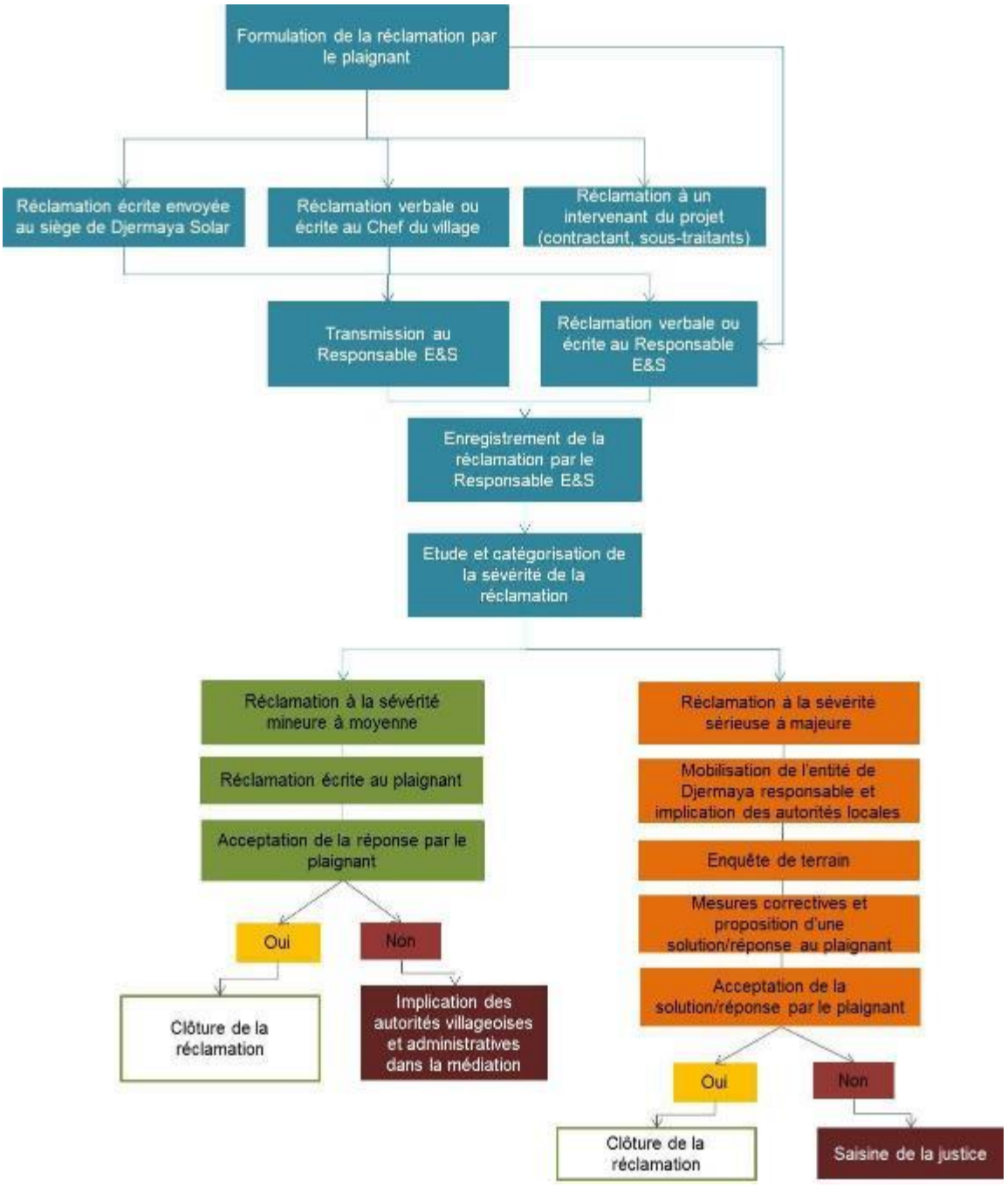
Serious to major claims require special attention, which can lead - if not handled well enough - to significant repercussions on the project (blockades and demonstrations).

The steps to be implemented for effective resolution of these claims are as follows:

- Internal involvement of the entity responsible for the claim: the person in charge of the department that caused the damage and that gave rise to the claim must be informed of the claim and involved in the verification, compensation and resolution process.
- Involvement of the village chief and local administrative authorities (sub-prefect or prefect): These authorities should be informed of the claim through an information note with a copy of the signed claim form. They (or the relevant technical services) should be invited to participate in the verification and resolution of the claim.
- Organization of a field investigation: A field investigation is imperative to verify the origin of the claim. This investigation must take place as soon as possible, especially if scientific analysis is required. It brings together the HSES manager, the head of the technical entity, the village chief and, if necessary, a representative of the administrative authority
- If no scientific analysis is required, the administrative authority issues a recommendation in terms of compensation (financial or in kind) and/or corrective action. The authority's representative then explains the proposed solution to the various stakeholders with reference to the results of its investigation.
- If additional scientific analysis is required, it is implemented and a second visit is scheduled to communicate the results and present the proposed solution.
- Resolution of the complaint: If the recommended action(s) satisfy the complainant and all stakeholders, they are implemented as soon as possible. The entity that caused the damage that gave rise to the complaint ensures that the technical corrective measures are implemented. The HSES Manager is responsible for the implementation of the measures under his responsibility (payment of financial compensation, etc.) and monitors the implementation of the technical corrective measures. He/she ensures that the complaint closure is recorded and that the complainant signs the complaint form.

- Recourse to the courts: in the event of disagreement with the proposed measures, the complainant may bring his or her complaint before the competent courts.

The diagram below shows the claims management process from formulation to resolution of a claim.



Source: ARTELIA

Figure 44 - Schematic diagram of the claims management mechanism

6.5.2.5. CLAIMS FOLLOW-UP

During monthly meetings with village leaders during the pre-construction and construction phases of the Stakeholder Engagement Plan, the HSES Manager will report on the number of complaints filed and processed, the issues addressed by these complaints, and the measures implemented to respond to proven complaints.

Internally, he/she will organize meetings with his/her hierarchy to follow up on complaints and feedback to improve the management of unforeseen impacts and avoid new complaints.

6.5.3. Preventive archaeology procedure

An Incidental Finds Procedure will need to be implemented. The purpose of this procedure is to protect any archaeological discoveries that may be made during excavation activities related to the site.

The steps in this procedure are as follows:

- Stopping work in case of accidental discovery and securing the discovered sites.
- The study and treatment of finds (excavation, storage for conservation or exhibition, etc.) according to their value. The intervention of an archaeologist may be required to analyze the objects.
- Awareness of all workers of the contents of the shutdown procedure in the event of a threat to an archaeological or culturally significant site (information on the type of materials potentially present, instructions to follow in the event of a discovery, etc.).

The deployment of this procedure shall be ensured by the Owner. The subcontractors involved on the site will have to comply with it.

6.5.4. Livelihoods Restoration Plan (LRP)

A livelihood restoration plan has been developed as part of the impact assessment for the solar power plant project and covers the actions that will be implemented by the project to compensate for the loss of undeveloped bare land, the loss of agricultural and grazing areas, and the impacts on the people who use this land.

This plan has been updated to incorporate the management of trips related to the line project, namely:

- Relocation by project workers of the ranger's hut along the route of the line or provision of monetary compensation for performing this task.
- The relocation of mobile stalls along the route of the buried portion of the line.
- Reconstruction by project workers of the three brick cooking stoves and meat racks or provision of monetary compensation for the completion of this task.

These actions will be carried out during the construction phase before the actual work is carried out.

6.5.5. Local recruitment plan

The local recruitment plan must allow for the employment of people from the affected communities during the construction phase. This plan shall be developed by Djermaya Solar and shall contain at least the following measures

- Identification of jobs to be filled on the site in areas requiring basic skills (digging the cable trench, manual clearing, handling) that can more easily coincide with the skills of local populations.
- Communication of the types and number of positions available to the residents of Pont-Bélilé
- Organization of a public meeting to assign positions to qualified candidates, e.g., by lottery

All measures should be taken to ensure transparency in the recruitment process.

Subcontractors shall comply with the Recruitment Plan developed by the Employer.

6.6. WORKERS' HEALTH AND SAFETY PLAN

The worker health and safety plan defines the procedures and practices for dealing with issues related to the physical safety of workers. Proper compliance with this plan and its recommendations should help avoid material and physical accidents on the line and substation sites.

The HSES Manager is responsible for managing the proper implementation of this plan. His/her objectives are:

- Zero accidents;
- Meet legal regulatory requirements;
- Train and inform the staff on safety instructions and good practices;
- Continuously improve the effectiveness of the security system.

All employees will be trained in safety instructions and good occupational health and safety practices before working on the site. This training will be provided by the HSES Manager and must be understandable to all employees (appropriate training in Arabic, English, French). The HSES Manager must be able to provide the authorities with proof that all persons present on the site have received the training.

The training sessions will take place in groups and the health and safety instructions will also be recalled during the site meetings as well as the safety points during the work. A report including the following points will have to be written before each training:

- Name(s) of person(s) trained with signature;
- Date, duration and location of training;
- Type of training.

At the end of the training, each employee should be able to identify and evaluate the risks he/she faces in the performance of his/her work and to know the good practices and safety instructions.

The HSES Manager will conduct a risk assessment prior to any activity and provide training accordingly. Specialized training will be provided for each type of activity (e.g., working at heights, trench work, lifting work, electrical hazards, handling of products and chemicals, etc.). The HSES Manager will ensure that all employees have completed the Health and Safety Plan training as well as the specialized training to which they are attached. If not, untrained personnel will not be allowed to work on the site.

Particular attention will be paid to the training of employees performing electrical work and their level of qualification for the position. A clearance system will be set up by the contractor in charge of the work.

In addition, the HSES Manager shall ensure that:

- Workers are informed of the risks involved and are able to manage them;
- Personnel are sufficiently qualified and use PPE appropriately;
- In the event of an incident or accident, a sufficient number of workers are qualified to provide first aid;
- The activities comply with the legislation and standards in force relating to health and safety at work;
- Workplace accidents and near misses are reported regularly and processed for corrective and preventive action.

6.7. AIR RELEASE MANAGEMENT PLAN

6.7.1. Vehicles

In this area, the first measure is the requirement of conformity of the machines used on the site as well as good maintenance.

To reduce the carbon footprint of the site, the following solutions are recommended:

- Encourage public transportation,
- Search for supply channels for nearby materials,
- Set up waste management channels in the vicinity,
- To ensure a good adjustment of the thermal engines (machines, generator, ...) and a planned maintenance;
- Set up a fuel consumption monitoring system.

Each work machine and motor vehicle (for the transport of personnel and goods) will be provided with a maintenance booklet in which will be recorded the checks carried out and the defects noted at the end of each statutory check. This booklet will have to be available for each motorized equipment. It will specify the controls and their frequency and will record any adjustment or maintenance operation carried out.

6.7.2. Dust

The emission of dust linked to the road traffic as well as to the deposition of sludge on the road by the trucks leaving the construction site will have to be limited and in particular near the dwellings. It will be a question of imposing when necessary a regular watering of the roadways and wheels of the trucks and/or with raw water in case of nuisance for the workers or the populations. All loads of fine materials that may generate dust during transport will be covered with a tarpaulin. At the level of material storage, watering will be recommended for materials generating dust, especially during windy periods.

Measures will be implemented to reduce the resulting dust emissions on the site and along the access roads:

- Machine and vehicle maintenance;
- Covering of trucks transporting powdered materials;
- Tarpaulin or watering of storage areas for powdered materials;
- Limiting traffic speed to 30 km/h on work areas to reduce dust.

6.8. WASTE MANAGEMENT PLAN

6.8.1. Purpose of the Waste Management Plan

The waste management plan establishes procedures for the collection, storage and disposal of waste. The objective of the waste management plan is to ensure that waste management is conducted in accordance with good practices defined by IFC, the AfDB and Chadian legislation to prevent any impact on the environment. The waste management plan requires maintaining an up-to-date inventory of waste, classified by type, as well as the volumes generated and their disposal routes for each project activity.

It is important to emphasize that the subcontractors that Djermaya Solar has in charge of the works are responsible for the effective implementation of the good practices of the waste management plan. The general principle is that the producer of the waste is responsible for it until its final disposal. Each subcontractor will be required to develop a waste management plan for its activities in accordance with the recommendations in this document. The waste management plans of the subcontractors will be validated by Djermaya Solar.

The objectives of the waste management plan are:

- Minimize the amount of solid waste generated by judicious selection of raw and recycled materials where possible;
- Treat and dispose of waste to minimize its impact on the environment;
- Promote awareness and application of waste management procedures for operators.

During operations, no solid waste will be left or buried in the natural environment. The waste produced during the construction of the line or the substations will either be sent directly to a treatment center or regrouped on the site of the solar power plant in a specific storage area before evacuation and treatment in accordance with the waste management plan.

Information is provided to all employees to increase awareness of the waste management plan and the importance of reducing the amount of waste produced.

The waste management plan includes measures for monitoring waste, allowing traceability of production (recording of volumes generated), type, and final treatment for each activity.

6.8.2. Waste identification

Decree N°904 PR/PM/MERH of 2009 on the regulation of pollution and environmental nuisances defines the waste classification system.

As mentioned in Title 3, Chadian regulations define specific hazard classes for waste:

- Household waste:
  - Toxic: these are the remains of harmful, explosive, corrosive, irritant and flammable products used in the home, in DIY or gardening activities or, overall, in domestic activities and which are harmful to human health and the environment.
  - Simple: as opposed to toxic household waste, these are packaging, paper and cardboard, organic materials, peelings, wood; electrical and electronic waste; ferrous and non-ferrous metals; rubbers, biodegradable plastics and tires; feathers and down; textiles, glass...
- Organic waste: this is waste produced by the catering industry, the food industry, animal husbandry and animal excrement.
- Green waste; it includes green space residues from pruning and tree trimming, grass clippings, dead leaves...
- Industrial waste: there are 2 categories:
  - Non-hazardous industrial waste: waste from companies and businesses that can be treated in the same facilities as ordinary household waste.
  - Special industrial waste: waste that cannot be assimilated to household waste and which, because of its toxic or dangerous nature, requires a specific disposal route. This category also includes waste from oil exploitation and refining activities.
- Waste from sanitation activities: they can be of urban, agricultural, commercial or industrial origin and include:
  - Sludge from wastewater treatment plants.
  - Sewage sludge.
  - Emptying materials (from septic tanks, cesspools and grease traps).
- Biomedical waste: is waste from hospitals, clinics, laboratories or any other healthcare activity.
- Radioactive waste.

The waste generated during the construction phase is limited and will mainly be packaging of the various parts to be assembled (cables, insulator, pylon etc.) or construction materials (concrete). This waste will be assimilated to simple household waste.

To facilitate effective waste monitoring, the following actions will be undertaken:

- Properly label waste containers according to the practices described in this chapter to allow for sorting;
- Conduct inspections/audits of work areas to validate the absence of waste and disseminate audit reports;
- Develop and monitor actions resulting from audits;
- Supervise subcontractors involved in waste handling, transportation and disposal.

6.8.3. Waste collection and handling

The waste generated on the mobile construction sites of the line will be collected as regularly as possible and bagged for return each evening by the construction crew. The waste will then be sorted on the site of the solar power plant or sent directly to a treatment center.

The waste produced on the transformer station sites will be sorted at the source in a dedicated area and will be evacuated regularly and at least at the end of the site. To enable efficient waste sorting, suitable collection containers will be distributed at strategic locations, close to where the waste is produced. Food waste will be stored in a protected area to limit access to animals. A second container that is impervious to the stored products will be used for the storage of liquid waste. Absorbent kits will be available near each liquid hazardous waste storage (absorbent, towel).

Incompatible hazardous wastes will be stored in a manner that prevents accidents (sufficient space between containers or physical separation such as walls or partitions). Waste storage areas will allow inspection between containers to monitor for leaks or spills.

The purpose of each waste container will be clearly marked (color icon and text), to facilitate efficient sorting. The pictogram will be explicit and the text (waste designation) will be multilingual (for example Arabic, French, English). For hazardous waste, the hazard pictogram will be present on the container to inform about the HSE risks associated with the waste. All sources of flame (including cigarettes) are prohibited near flammable products. Appropriate fire fighting equipment and “No Smoking” logos will be available and visible in the area.

The waste container shall have the following characteristics:

- Be waterproof and leak-proof, and made from materials with low flammability;
- Avoid flying particles or spilling of materials. Dumpsters exposed to heavy rain and/or wind shall be covered and placed under cover;
- Stand stably on the ground, easy to move, safe for users;
- To allow safe handling for the operators;
- For hazardous waste, the containers must be chemically resistant to the products they contain and may be sealed to reduce the risk;
- The waste containers are adapted to the waste handling equipment

- Be placed near work sites in sufficient numbers to avoid waste spills and reduce collection frequency.

The storage time depends on the available storage capacity and the transportation to the treatment center (2-3 days for food waste and a few weeks for inert waste).

6.8.4. Waste processing and disposal method

The strategy used for waste management is based on the following principles (in order of priority):

- Reduce;
- Reuse;
- Recycle;
- Recover.

The implementation of these principles will result in a reduction in the amount of residual waste that is disposed of. The consequences of this plan are:

- Waste sorting to maximize reuse and recycling;
- Where necessary, secure and controlled storage of residual waste;
- Disposal of residual waste.

Waste can be disposed of in a variety of ways, as defined by legislation and opportunities. Methods with the lowest impact on people and the environment should be prioritized. Employee training in waste separation is critical to the implementation of waste management.

The following is a list of best practices for waste disposal and management:

- Food waste can be a source of infection due to the breakdown of organic matter. In addition, this waste, if not properly disposed of, can attract animals and insects. Food and household waste should be disposed of regularly.
- Paper, cardboard and plastic will be sorted. The materials of low quality will be evacuated for destruction and those of good quality will be recycled by approved companies.
- Used oils will be collected and stored in watertight containers protected from rainwater and under retention before being recycled or eliminated in a suitable treatment center.
- The tires will be sent to an authorized subcontractor for recycling.
- Chemicals and paint residues will be stored in waterproof containers (preferably their original containers). All these products will be stored in an area protected from rainwater and equipped with a retention tank before being disposed of.
- Any medical waste generated will be stored in appropriate containers (e.g. specific needle box) and disposed of in an approved center.

- Used batteries will be sorted and sent to an authorized disposal center for recycling.
- The metal waste will be sorted and a storage area will be defined. Each storage area will be set aside to store only one type of metal. Any contaminated metal waste will be cleaned before storage.

6.8.5. Waste transfer and transportation

Waste transport vehicles will be adapted to the type of waste they carry. All shipments of hazardous or non-hazardous waste will comply with Chadian legislation regarding the transport of hazardous materials and will use a waste manifest for each transport operation. If no model is specified by Chadian legislation, a model based on good practice will be adopted. The waste manifest shall contain at least the following information

- Name and identification number of material(s);
- Physical state (i.e. solid, liquid, gas or a combination of one or more states);
- Quantity (e.g. kilograms or liters, number of containers);
- Date sent, date transported and date received;
- Registration of the sender, receiver and carrier.

To ensure waste traceability, a waste registration book will be kept. It will record each waste transfer chronologically and will show the date of the transfer, the type of waste and the quantity. Transportation means the final disposal route and the intended treatment method.

The transport of waste to the disposal site can be done by the operator himself or by a specialized company. The person responsible for the waste management will have to check the quality and reliability of the service provided (reference, etc.).

The following items are mandatory:

- Personnel working with the waste will be aware of the nature of the waste and the potential impact it may have;
- The waste slip will be properly completed and audits will be conducted;
- For industrial wastes, a follow-up sheet, reporting the nature, the dangerous characteristics and the actions to be taken in case of accident is provided to the driver responsible for the transport;
- The company receiving the waste will provide certificates of disposal;
- In accordance with the required frequency, a report will be sent to the HSE department (monthly, quarterly, semi-annually). It will report the type and quantity of waste produced, the disposal strategy adopted for each type of waste and the cost of waste management.

6.9. HAZARDOUS MATERIALS MANAGEMENT PLAN

6.11.1. Objectives

The use of hazardous materials is planned to be limited during the construction phase only for the needs of the site (machine maintenance, painting, etc.). During the operation phase, hazardous products may be used for maintenance (replacement of dielectric oil, paint, etc.) in a limited manner and spread out over time.

A chemical management program will be established by the contractor in charge of the work to detail the measures planned to minimize the risks of pollution. The program will be applicable to all site activities involving the handling, storage and use of products classified as hazardous. The information to be presented in such a program will cover the following aspects:

- Registration and follow-up procedure for any hazardous product, including in particular the reference of the Material Safety Data Sheet (MSDS);
- Procedure for identifying less hazardous alternatives;
- Handling and storage conditions, including product compatibility;
- Emergency Spill Procedure;
- Conditions of final treatment of the residues or recycling.

6.11.2. Storage

The chemicals will be stored within the base of construction located on the site of the solar power plant in a closed container implanted on a waterproof zone in a retention of a capacity at least equal to the volume of the biggest container or to the half of the volume of the whole of the containers (if this volume is more important). The retention capacity can be created using prefabricated containers intended for this purpose, by using transportable retention or by creating a dedicated waterproof area (concrete zone or waterproofed with a tarpaulin). No hazardous product storage will be located in a potentially floodable area. The storage site will be equipped with a recovery pit, absorbents and fire extinguishers. Standard signs will warn of the hazards associated with the stored products.

Material Safety Data Sheets will be available on site and from the HSE manager of the company concerned. Chemical storage facilities will be regularly inspected for leaks or container damage.

All the possible activities of handling of the hazardous materials and in particular the unloading or the unloading of the containers will be carried out on a tight area and under adapted safety conditions.

The hazardous materials used in the framework of the mobile work sites will be stored in the vehicles and transported in good conditions (stowage, adapted quantities).

6.11.3. Spill Preparedness and Response

An anti-pollution directive will be put in place to define the procedures for responding to leaks or accidental spills of liquid products. This directive will include a description of the organization planned in the event of a response and the workstations of the key people. A

Specific training on the activities to be developed in the event of an emergency response will be given to all employees involved at any stage of the procedure.

Spills of less than 200 liters can be managed locally by the HSE manager and the teams. For larger spills (which is very unlikely for this project), it will be necessary to involve a higher level of management. The local authorities and departments to be notified in the event of an emergency at the local and regional level will be identified and informed of the response procedure in place.

Spilled products will be recovered in the best conditions and stored in watertight containers before being evacuated according to the waste management plan.

6.10. TRAFFIC MANAGEMENT AND ROAD SAFETY PLAN

Construction activities for the power line and transformer stations may generate additional traffic and accident risks. It is necessary to establish a safety plan dedicated to the project in collaboration with the administrative authorities, the local communities and the main towns crossed.

This plan will cover the following:

- The establishment of a traffic plan that defines pre-established routes (roads used and schedules) according to the characteristics of the roads (proximity to built-up areas, crops, wildlife present, etc.) and the already high level of traffic due to the presence of the refinery. Drivers will be trained in the traffic plan and its proper implementation will be demonstrated by the contractor in charge of the work.
- Dangerous areas will be marked with appropriate signs, especially at the access to the plant site and mobile work areas. In case of heavy traffic, an employee will be in charge of regulating the traffic in the dangerous areas.
- Drivers will receive specific training in safe driving, compliance with speed limits (particularly in the vicinity of built-up areas, homes or in the presence of animals), risks related to alcohol and drugs, load stability rules (securing) and vehicle maintenance. The correct application of these principles will have to be controlled during the construction phase by the service provider in charge of the construction operations. Vehicles will be systematically equipped with a fire extinguisher and a first aid kit.

The contractor in charge of the construction will have to report on the volume of traffic generated, on the respect of the transport plan (training of the drivers, routes, etc.), on the possible accidents and the way they were managed, on the possible complaints for transport-related nuisances.

6.11. BIODIVERSITY ACTION PLAN

6.11.1. During the construction phase

6.11.1.1. LAND CLEARING OPERATIONS

Various measures will be implemented during the clearing operations to limit their impact:

- The clearing operations will be carried out outside of the reproduction and nesting periods to limit the impacts on the fauna. The clearing is recommended between November and June.
- The clearing will be limited to its strict minimum, by proceeding beforehand to a delimitation of the zones to be cleared materialized on the ground by the marking of the trees located immediately outside or a marking using colored stakes.
- Information and sensitization of the workers recruited for these operations will be necessary.
- Poaching, fishing and hunting on or near the areas to be cleared and the consumption of bushmeat will have to be prohibited and penalties will have to be imposed on all offenders.
- A reforestation plan will be implemented as soon as work begins. The areas to be reforested will be discussed with the village chiefs concerned and the administrative and technical services in charge of forests. Species similar to those present will be used. A one-for-one replacement rate is recommended (1.1 hectares of tree vegetation to be replaced - for species selection see inventory of flora along the route in § 5.2.1.2.1). The details of the replanting plan will be consolidated according to the feedback from the consultations and the elements available (the age and size of the available plants to define the replanting area density). In addition to the planting activities, the program will describe the maintenance and protection activities of the compensation areas. Species selected will be local to maintain ecosystem services

6.11.1.2. NUISANCE ON WIDLIFE

Construction activities in the area, which generate noise pollution (use of machinery, human presence), associated with land clearing operations, will lead to the disturbance and potential displacement of terrestrial wildlife. To reduce impacts, as much as possible, it is recommended that work be carried out outside of the breeding and nesting periods (from November to June).
The protection of biodiversity requires:

- Absolute prohibition to hunt and to bring weapons and traps on the site;
- The ban on eating bushmeat;
- Prohibition on collecting wood or non-timber products;
- Prohibition of fires in wooded areas that are not organized as part of construction activities;
- Prohibition of holding products from endangered species;
- The prohibition of unplanned introductions of animal or plant species or the spread of invasive species;

Penalties will have to be imposed on all offenders.

Employee awareness of biodiversity protection should also be provided.

An ecological follow-up will be set up to verify the implementation of the measures during the construction phase and the effectiveness of the post-construction measures.

6.11.1.3. AVIFAUNA PROTECTION MEASURES

The project leader will study in detail the opportunity to put in place devices to reduce the risks of collision and electrocution. For this purpose, a marking of the line will be carried out by an adapted means (see example below). Other strategies may be adopted in coordination between the project owner and the project manager:

- Neutralization: insulation device for bare conductors under tension. A plastic sheath placed on the wire at the level of the support prevents a perched bird from being electrocuted.
- Deterrence: In this case, the aim is to prevent the bird from landing on the dangerous weapon. For this purpose, vertical rods forming combs or forks are placed on the top of the post.
- Incentive: a perch is installed on the pole to encourage the bird to land on it rather than on the dangerous parts of the armament. This also provides observation posts for raptors. This strategy can also lead to the installation of secure nests at the top of some pylons if it is suitable. Depending on the species present, e.g. jabiru or marabou, nesting supports can be installed at the top of some supports to compensate for the felled trees.
- Visualization: lines can be equipped with visualization beacons to prevent collisions (different devices exist: anchored spirals, aeronautical balls, glass discs, spirals or oscillating beacons “Firefly”).

The strategy adopted will be established on the basis of a dedicated technical and economic study in the pre-construction phase, at the time of the detailed design of the line.

In all cases, a follow-up of avian mortality at the beginning of the exploitation will be taken in charge by the person in charge of the ecological follow-up of the solar power plant. This monitoring will allow to define the real impact level and to define, if necessary, complementary measures. The monitoring is recommended at least over a period of 2 years in wet season.

Installation of a protection system on medium

Artificial nest for storks on a BT support

Installation of a visualization spiral

Visualization beacon

*Figure 45 - **Example of bird protection devices***

6.11.2. In the operation phase

Maintenance of vegetation along the route of the line will be carried out preferably using mechanical or manual methods.

If pesticide use cannot be avoided, it will be necessary to:

- Do not use pesticides in categories 1a, 1b and II of the WHO Guidelines for the Classification of Pesticides and those in Annexes A and B of the Stockholm Convention.
- Use only pesticides that are licensed, registered, and approved by the appropriate authority and in accordance with the UN Food and Agriculture Organization (FAO) International Code of Conduct on the Distribution and Use of Pesticides.
- Train staff in the application of pesticides (including limiting the amount used to what is necessary) and ensure that they receive the necessary certification and/or training.

6.11.3. Ecological monitoring of the effectiveness of the management measures

Ecological monitoring will be carried out at the start of the operational phase over a two-year period to verify the application of the management measures proposed in the ESIA and the ESMP as well as the effectiveness of these measures. This monitoring will be carried out by an independent expert at regular intervals and the data recorded in a monitoring report before being transmitted to Djermaya Solar.

For the power line, monitoring will focus on the monitoring of compensatory plantings and monitoring of avian mortality related to the line. the line's route is not far from important Ramsar areas (Lake Chad, Logone floodplains, etc.) of particular interest to waterfowl and migratory birds. The monitoring will include:

- Identification and counting of species found dead under the lines. Photographing and collecting the remains will allow us to finalize the identifications for the litigious cases;
- The monitoring will be carried out by the independent expert recruited for the solar power plant construction project and will take place over a minimum of two years. For this purpose, the expert will identify local relays (teachers, village chiefs, notables sensitive to the protection of the environment, etc.).

of biodiversity...) to photograph and count dead birds under the lines outside of his visits and to contact him if necessary.

- In the event of mortality of species classified according to the IUCN VU, EN or CR or of significant mortality, the expert's evaluation will make it possible to recommend whether or not it is necessary to install additional protective devices on the supports or the line in the places requiring it (see the possible measures presented in § 5.2.2.2).

6.12. ENVIRONMENTAL & SOCIAL AUDIT PROGRAM

Djermaya Solar's environmental team will be responsible for conducting internal audits on good environmental practices. The persons will be selected from within the company or from external companies (external audits) and should have advanced knowledge of the operations carried out, as well as the requirements of the HSES management system. The auditors will be responsible for preparing reports on the environmental & social activities to the management of Djermaya Solar.

Audits will be conducted during each phase of the overall project: mobilization phase with audit of the contractor's HSES management system and facilities, execution phase (monitoring and audit of HSES performance indicators) or at the end of a phase (construction or decommissioning) to assess site restoration or the condition of the facilities

Within the framework of this project, the auditor will carry out the operational evaluation of the environmental and social procedures, regulations and the achievement of the objectives of the ESMP for all phases (construction, operation, decommissioning.). The environmental audit program will be required to:

- The identification of gaps between the normative and regulatory requirements identified;
- Evaluation of the effectiveness of the implementation of preventive and corrective actions;
- The use of audit results in the context of continuous improvement. The environmental

audit should include the following points:

- A complete review of records to ensure that they are filed, organized and complete;
- A site inspection to ensure that facilities are compliant, that previously identified non-conformities are being addressed, that safety rules are being applied, that storage facilities are in compliance with the stakeholder engagement plan, the social management plan, and the grievance management procedure;
- A program review to ensure that inspection follow-up is documented;
- An interview with the different thematic leaders.

Several audits may be carried out, especially during the construction phase:

- Initial audit: validation of the proper application of the environmental and social procedures defined in this ESMP;
- regular audit: quarterly audit of the contractor's employees in charge of the work and its subcontractors. The purpose is to verify that the monitoring, control and intervention plans

on site are carried out in accordance with the recommendations defined by the various environmental and social plans.

6.12.1. Waste management audit

The audit shall examine the implementation of:

- Storage and disposal methods (including control of subcontractors and disposal companies);
- Recording of waste produced (type, volume, weight, hazard identification, etc.);
- Waste tracking and documentation associated with waste storage and disposal;
- Recycling alternatives.

The audit will verify that waste management is carried out in accordance with the waste management plan. In case of identification of shortcomings or deviations, corrective measures will have to be undertaken and documented.

6.12.2. Health and safety audit

The audit will verify the good understanding of the health and safety system and its good application by all persons present on the site. The evaluation will cover the relative aspects:

- To the organization of the site;
- To occupational hazards;
- To the safety of the different workstations.

Compliance with regulatory requirements will be assessed by the HSES Manager internally; he/she may also request the support of an external consultant to provide an outside view and expertise of the practices carried out on the site. In the event of non-compliance, corrective actions will have to be taken such as, for example, the organization of new training and awareness-raising sessions for personnel, the posting of instructions and good practices to be respected, and the implementation of technical devices. These actions are the responsibility of the HSES Manager of Djermaya Solar.

6.13. COST ESTIMATE OF HSES MEASURES

The HSES management costs for the power line and transformers construction project are presented phase by phase in the table below.

Table 35 - Estimated costs of HSES measures

Theme	Key Mitigation Measures	Cost/surcharge Euros - FCFA (XAF)	Manager
Pre-work and work phase			
HSES management	Hiring the HSES Manager	Already taken into account in the construction project of the plant	Djermaya Solar
	Hiring of an HSE manager	Already taken into account in the construction project of the plant	Company in charge of the work
Environmental Monitoring Program	Noise analysis / Dust analysis	3 k€ - 1.9 MFCFA	Company in charge of the work
Worker health and safety plan	PPE equipment for workers	3 k€ - 1.9 MFCFA	Company in charge of the work
Waste Management Plan	Setting up waste area / Waste disposal	5 k€ - 3.3 MFCFA	Company in charge of the work
Hazardous Materials Management Plan	Establishment of a dedicated storage area	2 k€ - 1.3 MFCFA	Company in charge of the work
Compensation for trees on the route	Replanting of 1.1 hectares of vegetation	40 k€ - 19.7 MFCFA	Company in charge of the work
Compensation and support for travel (LRP)	Provision for compensation and support	1 k€ - 0.7 MFCFA	Company in charge of the work
Protection of wildlife during the construction phase	Follow-up of the construction site by an expert ecologist	Already taken into account in the construction project of the plant	Company in charge of the work
Protection of birdlife	Installation of line marking devices	10 k€ - 6.6 MFCFA	Company in charge of the work
Community Health and Safety	Road safety training	3 k€ - 1.9 MFCFA	Djermaya Solar
Total		67 k€ - 43.9 MFCFA	
Operation phase (annual budget)			
Biodiversity monitoring (at least 2 years)	Monitoring of avian mortality / compensation area	5 k€ - 3.3 MFCFA	Djermaya Solar
Total		5 k€ - 3.3 MFCFA	

Monitoring the implementation of the ESMP is an activity of the Ministry of the Environment, Water and Fisheries through the Directorate of Environmental Assessments and the Fight against Pollution and Nuisance.

7. BIBLIOGRAPHY

(2018). *6ème Rapport National sur la Biodiversité. TCHAD.*
HCNE-MEEPNUD-DAES. (2003). *Schéma Directeur de l'Eau et de l'Assainissement du Tchad.*
Hydratec. (2016). *Etude hydrologique et hydraulique dans le cadre du projet DJERMAYA SOLAR.*
IUCN. (s.d.). *Red list*. Consulté le Octobre 18, 2016, sur http://www.iucnredlist.org/ Ministère de l'Economie, d. P. (2013). *Plan National de Développement (PND) 2013 - 2015.*
Ministère Français de l'Écologie, d. D. (2011). *Installations photovoltaïques au sol : Guide de l'étude d'impact.*
Pias. (1970). Les formations sédimentaires tertiaires et quaternaires de la cuvette tchadienne et les sols qui en dérivent.
(1999). *Stratégie nationale et plan d'action de la diversité biologique du Tchad.*
(2016). *Stratégie nationale et plan d'actions sur la diversité biologique 2ème édition .*
Terrasol. (2016). *Centrale Photovoltaïque de Djermaya - Rapport d'études géotechniques.*

Enquête démographique et de santé et à indicateurs multiples au Tchad (EDS- MICS) 2014-2015

ICNIRP guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz – 100 kHz), (2010)

Arbonnier M., 2009. Arbres, arbustes et lianes des zones sèches d'Afrique de l'Ouest. Nouvelle édition/3ième édition. MNHN, Muséum national d'histoire naturelle, France. 573 p.

Bara G. et Schoonmaker K., 1991. Introduction à la méthode accélérée de recherche participative (MARP): quelques notes pour appuyer une formation pratique.75 p.

Blondel J., Ferry C. et Frochot B., 1970. La méthode des indices ponctuels d'abondance (I.P.A) ou des relevés d'avifaune par "stations d'écoute". Alauda, 38: 55-71.

Borrow N. et Demey R., 2004.Field guide to the Birds of Western Africa. 511 p. Cordonnier P., 1976. Etude du cycle annuel des avifaunes par la méthode des « points d'écoutes ». Alauda, 44(2): 169-180.

Dorst J., 1963. Les techniques d'échantillonnage dans l'étude des populations d'oiseaux. Muséum National d'Histoire Naturelle, Paris. 23 p.

FAO et DIPA, 1998. Programme pour le développement intégré des Pêches artisanales en Afrique de l'ouest: La MARP dans les Communautés de Pêche (Un guide pour les agents de terrain). Rapport Technique N° 128. 146 p.

Lammerink P., Marc et Wolffers, 1998. Approches participatives pour un développement durable: Exemple d'Afrique, d'Amérique Latine et d'Asie. Livre. Institut Panafricain pour le Développement et Editions Karthala 1998. ISBN: 2- 86537-831-4. Boulevard Arago 75013 Paris / France. 209 p.

Letouzey, 1985. Notice de la carte phytogéographique du Cameroun au 1/500000. Miaud C., 2005. Méthodes d'inventaire et d'identification des Amphibiens. Commande n°04018.Mission Ecologie du Milieu Agence de l'Eau Artois- Picardie200, rue Marceline Centre Tertiaire de l'Arsenal BP 818, 59508 DOUAI Cedex. Université de Savoie, UFR CISM, 73 376 La Bourget du Lac, France. 21 p. Okezie Akobundu L. et Agyakwa C. W., 1992. Guide des adventices d'Afrique de l'Ouest. Institut International d'agriculture (IITA). 521 p.

Trape J-F., Trape S., Chirio L., 2012. Lézards, crocodiles, tortues d'Afrique occidental et du Sahara. Edition IRD. Marseille/France. 505p.

White L. et Edwards A., 2000. Conservation des forêts pluviales Africaines: manuel des méthodes de recherche. Livre, WCS. 444 p.

Yapp W.B., 1956. The theory of line transects. Bird Study, 3: 93-104.

Webographie

https://www.iucnredlist.org/search chad&source=bl&ots=YLg4sFiSW0&sig=dDe_CdOQZ5vcoSMMiZEJ9sdiGOw&hl=fr&sa=X&ved=

http://www.oiseaux.net. http://www.cites.org

www.oiseauxdutchad.net

http://www.oiseaux.net/aves/cameroun.alpha.html

oOo

ANNEX 1

Terms of reference

DJERMAYA SOLAR

PROJECT OF PHOTOVOLTAIC POWER STATION OF DJERMAYA

TDRATIONFORTHEREALISATIONOFANIMPACTNOTICEONEVIRONMENTFORCONSTRUCTIONANDEXPLOITATIONOFANENVIRONMENTLINERGICATIONLINEONANDTHEEXPLOITATIONOFAMOYERGIENTENSIONEVACUATIONLINE(33 KV)

ARTELIA EAU & ENVIRONNEMENT
Risks - Society - Environment Unit
Le First Building
2, avenue Lacassagne
69 425 LYON Cedex 03 - FRANCE
Tel: +33 (0)4 37 65 38 00
Fax: +33 (0)4 37 65 38 01

DATE: JUNE 2019 REF: 851 2192

SUMMARY

1. PURPOSE OF THE DOCUMENT

Aldwych Africa Developments Limited (AADL), on behalf of the Djermaya Solar Project Development Team (the "Sponsors"), is requesting an Environmental and Social Impact Assessment (ESIA) and Environmental and Social Management Plan (ESMP) for a proposed medium voltage (33 kV) power line connecting the proposed Djermaya solar PV plant to an existing substation in the town of Lamadji, Chad.

These Terms of Reference (ToR) detail the technical methodology to be used by the consultant in preparing the Environmental Impact Notice.

2. BACKGROUND AND DESCRIPTION OF THE PROJECT

The Djermaya Solar project is located about 30 km north of N'Djamena, Chad, on 100 ha of land adjacent to a north-south road and about 7 km southwest of the country's main oil refinery in the town of Djermaya. The electricity from the new 32 MWp solar power plant will be evacuated via a 33 kV overhead transmission line of about 17.5 km that will follow the national road southward to the Lamadji substation.

The present ToR of the NIE/ESMP required here concerns only the 33 kV connection line project. the photovoltaic power plant is also subject to an environmental and social assessment process (ESIA) according to Chadian regulations and in compliance with IFC/AfDB performance standards to obtain international financing. The ESIA for this project is currently under review by the Chadian authorities.

The overhead line will be parallel to the road axis at about 22 meters. The line will be supported by pylons, spaced about 70 meters apart. When the line reaches the Lamadji substation, it will cross the road and then run underground to the perimeter of the substation to avoid an existing high voltage overhead line. When passing through the village of Pombélilé (or Pont Bélilé), an underground solution was preferred to avoid any risk of physical displacement. A project is currently being studied to transform the current road into a highway.

3. REGULATORY CONTEXT AND STANDARDS TO BE CONSIDERED IN THE COMPLETION OF THE ESIN

The private investors will build the line, the transformers and the associated equipment. The entire infrastructure will then be transferred to the Société Nationale d'Électricité (SNE) as soon as it enters commercial service.

Funding for the project will come from the European Union. Nevertheless, the infrastructure is considered to be infrastructure associated with the solar power project funded by the project's international donors. Social and environmental issues will therefore have to comply with (i) Chadian regulations, (ii) European regulations and (iii) IFC/AfDB standards which have been chosen as a reference for

The realization of the ESIA of the solar power plant project to meet the requirements of the main donors of the project, namely the AfDB (African Development Bank) and Proparco (Promotion and Participation for Economic Cooperation, a subsidiary of the French Development Agency).

The environmental and social assessment must therefore satisfy:

- To Chadian regulations.

  In Chad, E&S studies must meet the requirements of Act No. 14/PR/98 of August 17, 1998 outlining general environmental protection principles, which stipulates in Article 80 that "when developments, works or projects are likely, because of their size or their impact on the natural environment, to harm the environment, the administration may require the petitioner or a project owner to carry out a prior impact study to assess their compatibility with environmental protection requirements. It also complies with Decree No. 630/PR/PM/MERH/2010 of August 4, 2010 on the regulation of environmental impact assessments and Order No. 039/PR/PM/MERH/SG/DGE/DEELCPN/2012 of November 29, 2012 on general environmental impact assessment guidelines. The regulations subdivide projects into 3 categories A, B and C, from the most impacting to the least impacting. The decree establishing the different categories has not yet been published, however, given the very limited extent of the expected impacts for medium voltage (MV) lines, a category B classification remains the most likely in the case of the project. Category A is subject to an EIA (environmental impact assessment) while category B is subject to an NIE (environmental impact notice), the respective contents of which are defined in Order No. 039/PR/PM/MERH/SG/DGE/DEELCPN/2012.

- For IFC, E&S studies should specifically meet the following Performance Standards (PS) (International Finance Corporation (IFC), 2012):
  - PS 1: Environmental and Social Risk and Impact Assessment and Management;
  - PS 2: Workforce and Working Conditions;
  - PS 3: Resource efficiency and pollution prevention;
  - PS 4: Community Health, Safety and Security;
  - PS 5: Land Acquisition and Involuntary Resettlement;
  - PS 6: Biodiversity conservation and sustainable management of living natural resources;
  - PS 7: Indigenous Peoples;
  - PS 8: Cultural Heritage.

The project is expected to have very limited environmental and social risks and/or impacts, for which the preparation of a full-scale ESIA is not required by host country environmental assessment laws and regulations. In such cases, IFC requests that environmental and social assessments be conducted that are narrow in scope and smaller in scale than a full-scale ESIA, and that are specific to the potential environmental and social risks and/or impacts identified as being associated with the project. The implementation of targeted impact assessments is thus anticipated for the Djermaya project.

- For AfDB, E&S studies must specifically address the policies and guidelines of AfDB's Integrated Safeguards System (ISS, 2013) through primarily the following 3 operational safeguards:

- Operational Safeguard 1: Environmental and Social Assessment;
- Operational Safeguard 2: Involuntary Resettlement - Land Acquisition, Displacement and Compensation;
- Operational Safeguard 3: Biodiversity and Ecosystem Services;

The AfDB recognizes three project categories from 1 to 3 based on the magnitude of potential environmental and social impacts. Rural electrification projects as well as small-scale power transmission projects are in category 2, provided that a RAP is not required or limited only to an abbreviated RAP to less than 200 people. According to AfDB's guidance notes, this small-scale (<110 kV) power transmission project with no physical population displacement is Category 2. This type of project requires the completion of a simplified impact assessment and an appropriate Environmental and Social Management Plan (ESMP).

For the E&S assessment, the consultant shall refer to the following documents

- African Development Bank Integrated Safeguards System. Policy Statement and Operational Safeguards. (AfDB, 2013), Integrated Safeguards System Guidelines (Volume 1-3 - AfDB 2015);
- Environmental and Social Sustainability Performance Standards (IFC 2012) and associated guidance notes;
- Environmental, Health and Safety Guidelines for Electricity Transmission and Distribution. (IFC, 2007).

4. PROJECT DESCRIPTION

4.1. TRANSMISSION LINE

This is a 17.5 km long, double trunk line with a conductor diameter of 360 mm^2. The line will be equipped with a shielded wire to ensure lightning protection of both lines and will contain one or more fiber optic cables (OPGW) for communication.

The principle of the route is based on the fact that, in accordance with Chadian urban planning regulations, no building or structure may occupy a space located less than 25 meters from the centerline of the road. The route of the transmission line was defined within this space, in coordination with the Société Nationale d'Electricité (SNE). In Chad, the State owns all land that is not legally recognized in writing as belonging to a natural or legal person, public or private. Thus, no land acquisition is anticipated in the context of this project. However, preliminary surveys have shown that in Pombélilé there are a significant number of houses, stores and places of worship that violate this boundary. The route has therefore been optimized to avoid the physical displacement of stakeholders with a section of the line that will be buried (see figure below).

Djermaya Solar

Situation actuelle à Pombelilé

A Les voies publiques comprennent toutes les terres situées à moins de **25 mètres** de l'axe central de la route.

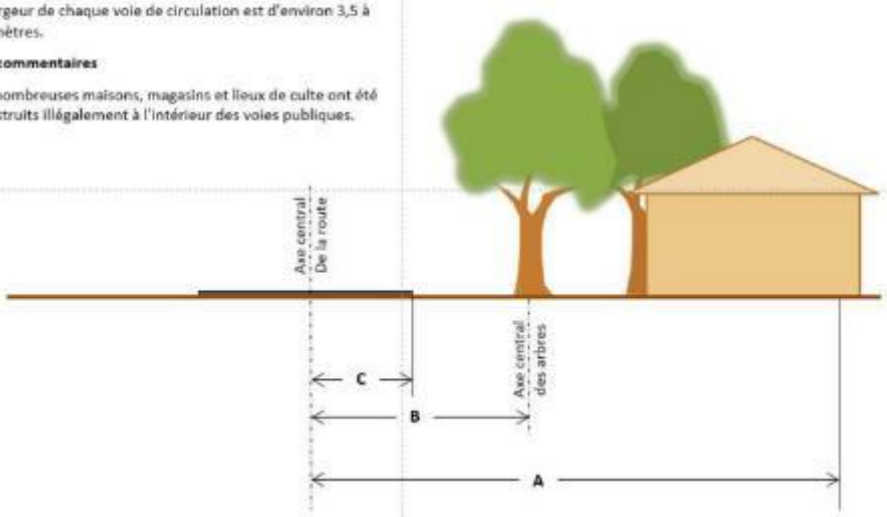
B Les grands arbres fournissant l'ombre nécessaire en été sont situés à seulement **4 / 8 mètres** du bord de l'autoroute et à travers tout le village.

C La largeur de chaque voie de circulation est d'environ 3,5 à 4,0 mètres.

Autres commentaires

- De nombreuses maisons, magasins et lieux de culte ont été construits illégalement à l'intérieur des voies publiques.

View Looking South



Djermaya Solar

Solution 'C' – Câbles souterrains (en bord de route)

E Distance normale de **6 mètres** entre l'axe central du tracé des câbles souterrains et le bord de la route. Ce qui permettra d'élargir la route à l'avenir.

F Une distance autorisée de **2 mètres** compte tenu des circonstances particulières (pour éviter l'abattage d'arbres), notons que les câbles devraient être acheminés par un conduit et avoir des points d'entrée appropriés en cas d'élargissement futur de la route.

Autres commentaires

- L'urbanisation a cité les distances « E » et « F » pour le projet Djermaya, et dans les deux cas la profondeur serait de **1 mètre**.
- La SNE a indiqué que la distance « F » pourrait être d'**1 mètre** seulement (au lieu de 2 mètres), faisant toutefois état d'une préoccupation concernant le passage des câbles dans les conduits de peur qu'ils ne puissent supporter le poids de la circulation routière si la route était élargie (aucune objection cependant si la conception peut résister au poids des véhicules et ajoutant que la profondeur pourrait devoir être portée à 1,5 mètre).

La solution « C » est la seule qui rencontre l'approbation de l'Urbanisation et de la SNE

Vue vers le Sud

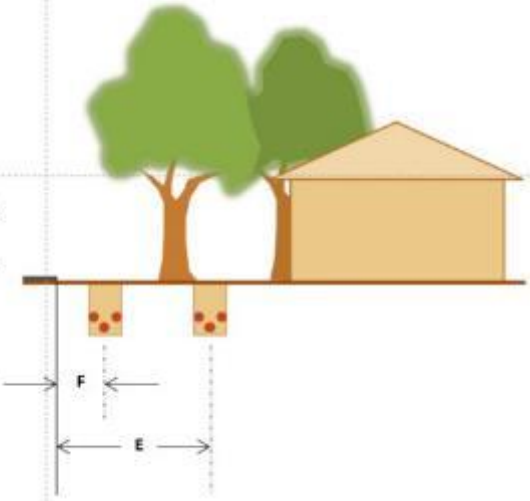


Fig. 1: Optimization of the route in Pombélilé

Fig. 2: Principle behind the route of the line

Fig. 3: Typical example of towers that can be used for the 33kV line

4.2. LAMADJI STATION

Two 33/90 25MVA step-up transformers will be installed so that AC power can be injected into the 90 kV circuit of N'Djamena. They will be located on the east side of the substation, in line with the two existing 66/90 kV transformers. The transformer circuit breakers will be designed for a load current of at least 630A. For a possible phase 2 of the Djermaya Solar project, the existing 90kV busbar will be extended to accommodate the future transformer substation. All this equipment will be transferred to SNE after commissioning.

Fig. 4: Aerial view of Lamadji post

4.3. GENERAL APPROACH / EXPECTED IMPACT LEVEL

The main objectives of this mandae are as follows:

- Review the existing Chadian legal and institutional framework related to the project, including international conventions to which Chad is a signatory;
- Describe donor performance standards (limited to IFC and AfDB) and situate the project within the classification systems of these standards;
- Collect and compile basic information about the proposed Lamadji transmission line and substation to describe and justify the project;
- Identify and analyze alternative options for the proposed project and argue the benefits of the final solution;
- Collect primary data to describe the initial state of the project site through (i) a community participatory process, (ii) study site surveys, and (iii) a literature review of available data;
- Evaluate the potential and residual negative impacts of the project and propose avoidance, reduction and if necessary compensation measures;
- Design an ESMP to (i) plan the implementation of mitigation measures, (ii) describe responsibilities for implementation, (iii) describe measure performance indicators and monitoring tools, and (iv) establish the ESMP budget;

The general approach is to establish documentation that is acceptable to the Chadian authorities and international donors. IFC and/or AfDB standards should be used as a reference both in the structure of the report and in the means of investigation and consultation. In the event of significant discrepancies between Chadian regulations and IFC/AfDB standards, the most comprehensive approach will be used. The consultant will nevertheless have to take into account the fact that the nature of the project, the importance of the works and the current sensitivity of the environment are very limited, which requires an environmental assessment proportionate to these issues.

In fact, the construction work for a medium-voltage power line, such as the one planned for this project, is fairly modest in scope, especially since the line runs along the entire length of the existing road and the terrain in the project area is not very pronounced, which facilitates access and limits the scope of the work to be done. The impacts of the work are scattered over a small linear area and are, at a given location, of short duration. The impact of the construction activities can be considered as the juxtaposition of the impacts generated by the small successive worksites for the creation of the pylon foundations and their installation. The construction site progresses progressively and concludes with the cable installation phase (cable pulling phase), also of limited duration. The installation phase of the underground parts, involving the creation of trenches, 1 to 1.5 m deep, should also be of short duration and can be easily managed by conventional prevention measures.

Once installed, the power lines require reduced maintenance activities. Outside of accidental situations, the expected impacts are common and similar to those of other MV lines already present along the route.

The expected impacts of the project are therefore limited in time and space.

The selection of location for the power line has minimized the impact on the environment and on local residents. For example, the route along the road avoids the main impacts on the natural environment as well as the opening of access for the installation and maintenance of the pylons. Also,

burying the line at certain sections reduces the right-of-way on existing buildings, whether legal or not.

Considering firstly that once built, the power line and the associated transformer stations will be transferred to SNE, which will operate them, and secondly, that the expected impacts are limited, the approach considered is to identify all the environmental and social impacts, whether temporary or permanent, during the study and to deal with them at the construction stage.

The report should be consistent in terms of effort and detail with the project issues, i.e., the most important risks should be described and argued in greater detail than the lesser risks, whether in the analysis of the initial state, the analysis of impacts or the description of measures.

4.4. ENVIRONMENTAL DATA COLLECTION (PHYSICAL AND NATURAL ENVIRONMENT)

According to the IFC, "the establishment and maintenance of transmission line rights-of-way, specifically those that cross forested areas, can result in the alteration and disruption of terrestrial habitat, including adverse effects on avian species and increased risk of forest fires. However, as this is a 33 kV line on a roadside, the potential risks to the biophysical environment are very limited. However, special attention will be paid to:

- To fire hazards related to vegetation;
- The presence or not of giraffes or other large mammals in the project area;
- Potential areas classified for the preservation of biodiversity crossed by the project;
- To the risks of collision and electrocution of birds and bats, especially in the case of migration corridors or nearby resting areas;
- Risks related to electromagnetic fields;
- Risks related to soil and water pollution during the works.

The data collected for the initial state must be sufficiently detailed to allow an analysis of the impacts of the project and to compare the post-project situation with the pre-project situation. The data collected will be:

- Of various kinds:
    - Bibliographic and cartographic data from research and/or from sponsors, authorities,;
    - From field interviews and/or affected stakeholders or resource stakeholders on particular topics;
    - From field observations collected by an expert in local fauna and flora during a tour of the route;
- From different themes, for example, climate, geology, soils, relief, hydrology, hydrogeology, land use, protected areas, flora, fauna and more broadly ecosystems and biodiversity.

Particular attention will be paid to species protected by Chadian regulations, threatened species (IUCN Red List), species with limited distribution, and areas classified for nature protection, whether national or international, in particular

IBAs (Birdlife for avifauna) and RAMSAR sites. At this stage and in view of the data already acquired during the preparation of the ESIA for the solar power plant, no particular biodiversity problems are anticipated along the route of the line, which runs along a major traffic artery and through several villages. This point will nevertheless be confirmed during the field visit. If necessary, the consultant will also be able to rely on the documentation of the habitats of the IFC PS6 and will use the concepts of modified habitats, natural habitats and critical/essential habitats to describe the biological context of the project.

4.5. COMPANY DATA COLLECTION

The collection of societal data will be done through a literature review and a field visit to collect information about the project study area (power line and Lamadji substation). In particular, the following information will be collected:

- Administrative organization and governance;
- Demographics;
- Land use and economic activities;
- Access to public services.

The collection of this data will be done using participatory socio-economic survey methods (individual interviews with resource persons, focus group discussions, participant visual observation, etc.) in the main localities identified as being part of the project's impact zone, of which there are seven, located on the map below.

Fig. 5: Main towns along the route of the line

4.6. STAKEHOLDER CONSULTATIONS

Stakeholder consultation will be conducted individually for the following stakeholders at the national level:

- Planning Department;
- Ministry of Planning;
- National Electricity Company (SNE).

At the local level, the following representatives will be consulted:

- Village chiefs and traditional authorities;
- Prefects of the departments in the study area.

The consultations will take the form of semi-structured interviews during which the consultant will present the main features of the project, collect the opinions and views of the participants and answer the questions and concerns raised by them.

4.7. PUBLIC CONSULTATIONS

Public information and consultation meetings will be held in the main communities in the project's impact zone during the field surveys required to collect societal data. All residents along the line's route will be invited to the nearest meeting by word of mouth and by posting.

It is planned to hold four public consultations on the entire route, grouping the meetings for the closest villages (grouping villages 3 and 5 with the meeting in Pombélilé and grouping village 2 with the meeting in Lamadji).

During these meetings, the consultant will present the main characteristics of the project, the anticipated impacts and the classic measures implemented for this type of project, will collect the opinions of the participants and will answer the questions and fears raised by them.

Minutes of the public meetings should be taken in situ by the consultant and signed by the local authorities in charge. An attendance list signed by the participants should also be made available.

4.8. STUDY CONTENT

There is no significant difference between the chaptering of an ESIA and an EIS in the case of the Chadian regulatory context or the content of a Category 1 and Category 2 ESIA if one considers the IFC and AfDB guidelines. The difference lies in the level of detail in each chapter that allows for the assessment of potential and residual impacts and in the level of detail in the description of avoidance, mitigation and compensation measures, which is necessarily more limited and easier to implement for Category 2 projects or those requiring an EIS.

The proposed outline for the NIE report is as follows:

- Non-technical summary
- Introduction and background
- Legal, regulatory and institutional framework

- Presentation of the project framework
- Analysis of alternatives and justification for project selection
- Description of the natural and human environment
- Public Consultations
- Analysis of the environmental and social impacts, temporary or permanent, of the chosen variant and associated impact reduction measures
- Technological risks, safety measures and emergency plan
- Monitoring and Follow-up Program and Environmental and Social Management Plan (ESMP) including a description of the measures for monitoring, reducing and compensating for environmental and social impacts as well as an estimate of the costs of their implementation.

The report will be accompanied by the maps and graphics necessary for its understanding and will also include a glossary, a bibliography and appendices as needed. The report will be proportionate to the issues at stake in accordance with IFC/AfDB guidelines.

4.9. CALENDAR

The projected schedule is as follows:

Task	Milestone
Mobilization and kick-off telephone meeting	T0 plus one week
Environmental field investigation	T0 plus 3 to 5 weeks
Stakeholder consultation	T0 plus 3 to 5 weeks
Submission of the NIE/ESMP draft report	T0 plus 8 weeks
Feedback from sponsors and funders	8 days after submission of comments
Submission of the report to the authorities	-
Potential public consultation depending on the opinion of the authority (see Order N°041 MERH SG CACETALDE - 2013 - articles 4 and 5)	Depending on the opinion of the Authority.
Responses to any comments from the authorities	8 days after submission of comments

APPENDIX 2

Identification of businesses that may be impacted by the Pont Bélilé underground line

	Nature of the activity/structure	Distance from the roadside		Photos
		Fixed element	Mobile element	
1	House	22 m		
2	Stand		0,5 m	
3	House	20 m		
4	Airtel stand (hut)	5 m		 
5	Cahute (store, grocery store)	4,5 m		
6	Vulcanizer	20 m		

	Nature of the activity/structure	Distance from the roadside		Photos
		Fixed element	Mobile element	
7	Fuel sales stand		1,5 m	
8	Store	8 m	2 m (Stands selling shoe polish, fuel, bread)	
9	Butchery	Display 0,5 m Fireplace, 2.5 m	Table at 2.3 m	 
10	Grocery store (closed at prayer time)	3,8 m	Spread 2,5 m	

	Nature of the activity/structure	Distance from the roadside		Photos
		Fixed element	Mobile element	
11	Table and compressor for tires		3, 20 m	
12	Power supply (fridge not working)	10,20 m		
13	Butchery stall	Display 2 m Table 4 m	Fireplace 4 m	

	Nature of the activity/structure	Distance from the roadside		Photos
		Fixed element	Mobile element	
14	Stand (chili, sauces)		4 m	Daughter of the cook below  
15	Stand for products and ready-made meals		5 m	Cooks and sells food, lives next door. She is afraid of eviction and asks if the construction site will prevent customers from accessing her stall.   

	Nature of the activity/structure	Distance from the roadside		Photos
		Fixed element	Mobile element	
16	Store (cigarettes, telephone repair)	5 m		
17	Mobile stand (cigarettes)		4 m	
18	Stand selling onions, millet, curd, drinks, etc.		4 m	
19	Stand (curdled milk, millet, corn, chili, peppers, garlic, salt, dried tomatoes, etc)		4,20 m	 

	Nature of the activity/structure	Distance from the roadside		Photos
		Fixed element	Mobile element	
20	Stand (tomatoes, cucumbers, bread)		4 m	 
21	2 stores	10,50 m		
22	Telephone booth (red)	22 m		
23	Cigarette stand		1,5 m	

	Nature of the activity/structure	Distance from the roadside		Photos
		Fixed element	Mobile element	
24	Butchery (Idriss Oumar)	Display 0,5 m Fireplace, 3.5 m	Table 3,5 m	  
25	Al Jazira Restaurant		7 m	
26	Cahute sells wood + air pump	8,5 m		
27	Stand selling fruit, doughnuts		1,5 m + hut (stores bread) at 4 m	

	Nature of the activity/structure	Distance from the roadside		Photos
		Fixed element	Mobile element	
28	Al Afiya Restaurant	6 m		
29	Stand (cigarettes, candy, bread, gasoline)		3 m	A night guard at Foraco (drilling), he does not see any inconvenience in temporarily moving his stand. 
30	Store (vegetables, groceries, bread, water, etc.)	10 m	Table 4m	  

	Nature of the activity/structure	Distance from the roadside		Photos
		Fixed element	Mobile element	
31	Mosque	20 m		 Work to move the mosque away from the easement area by moving its perimeter wall.

SOURCE: Photographs from the Artelia field mission

APPENDIX 3

Meeting Attendance Lists

APPENDIX 4

Minutes of Meetings

Public Consultation Report

DATE	APRIL 10, 2019	CONSULTANT'S NAME	Karima BROCHE
VILLAGE	UM SOUKAR	MUNICIPALITY, DEPARTMENT, REGION	HADJAR LAMIS
NUMBER OF PARTICIPANTS		OF WHICH 38	MEN: 30 WOMEN:8
DURATION	3 HOURS	PUBLIC MEETING: 3 HOURS FOCUS GROUP WOMEN: 1 HOUR	

Methodology

- The meeting was organized by contacting the village chief. As he had been approached several times before, he was familiar with the project. A poster was prepared in a large format (see Appendix 4). It was presented in French and translated into local Arabic. Three people from the project and the consultant spoke local Arabic. The consultant in charge spoke more classical Arabic, which was only partially understood

Participants and meeting dynamics

- Despite our request, the public meeting was held in the presence of men only.
- Those challenging the census attracted much of the attention during the discussion.

Women's participation

- A meeting was organized immediately afterwards with women to compensate for their absence during the public meeting. There were 8 women members and representatives of the women's group

Summary of exchanges

Overall, the questions asked and concerns expressed were related to the solar farm and not the power line, which did not raise any specific concerns

Some expressed their weariness at not seeing the project come to fruition despite previous consultations

An explanation was given on the planning of the project and the fact that the authorizations (administrative, environmental, etc.) were in the process of being requested as well as the financing and that this explained why they did not see anything coming for the moment because it took time.

Several interventions and concerns expressed were related to the census done in the context of the solar power plant

- There was a first census where the people concerned were present on their plot of land in the company of the village chief and they signed the census document, but they have still not received any compensation
- The 2nd census was conducted (Editor's note: as part of the preparation of the LRP) on their lifestyles, their needs, but they saw nothing coming
- Finally, others question the completeness of the census following the change in the configuration of the land from square to rectangular.

The client committed himself firstly to clarify the situation concerning the census. On the other hand, it was made clear to them that the construction site would not start until the people entitled to compensation were actually compensated.

They were also told that offsets are a right for those who are eligible and that the project will verify that the census is complete.

They would also have stopped all cultivation on the plot following this census. They would have understood that the date

The deadline meant that they had to stop all construction or cultivation and that they would be compensated very quickly. Some people say they paid fees to the land registry to mark out their plots. They say they paid for these plots or inherited them.

It was explained to them, with the agreement of a representative of the client present at the meeting, that construction was not possible inside the plant's grounds, but that they could, until the land was fenced off, cultivate the land during the rainy season, especially since it is a short crop. They were also told that they would be informed in advance when this access to the land would no longer be possible.

Still concerning the land of the power plant, the question was raised whether the presidential decree (or order) that granted the 100 ha takes into account the change in the current land configuration

Some of the participants, whose parcels have not been surveyed, say that they will only agree to have their parcel surveyed if they are told beforehand what price their land will be valued at. They say that the land has increased in value since then and the price that has been given to those that have already been surveyed will not necessarily be sufficient and that they want to discuss this.

Another question concerned access to electricity. They do not understand that there can be a power plant nearby, which produces electricity, and that they will suffer the impacts of the construction site without having access to electricity. This issue was also raised in connection with the power line.

It was explained to them on this subject that the project came to reinforce the production of electricity the decision of connection is more of the competence of the SNE than of the project but it was explained to them that within the framework of the project, it was possible that a solution of access to electricity via for example solar kits could be considered and that in addition they will go up this request of access expressed to the SNE

The question of employment was also raised and they expect to have a share of the employment granted in priority to the youth of the village

It was also specified that if there were actions to be carried out to meet the needs expressed in socio-economic matters, this would be done by the company in agreement with you and with the actions that would meet your priorities.

Verbatim

- *"There have been several meetings organized in the past with us but we still don't see anything coming" Participant*
- *"Years go by, we are told things but we don't see anything concrete. We don't see anything coming" Participant*
- *"The farmers have been waiting for 4 years for their compensation and they have stopped farming on these plots.*
- *"The project has forbidden us to exploit the plots but without compensating us" Village chief*
- *"What is most important for us is to have access to electricity and water. Participant*
- *"First, before we talk about water and school, we need the offsets." Participant*
- *"Since the beginning, there has been a lot of talk, everyone comes to do their job and leaves. The electricity will go to N'Djamena and we will have nothing." Participant*
- *"When the project arrived, we thought it will bring good things. Now we understand that people have to be patient and that those who want to cultivate their plot can do so. We didn't know that" Participant*

For more transparency, a report was drawn up at the end of the meeting to summarize the main topics discussed and to materialize the commitments and answers expressed by the client. This summary was explained to the village chief who cannot read French. He agreed that it was faithful to the content of the discussion. Then this summary was read and translated to all the people present to ensure that the level of understanding was shared.

Women's concerns

First, as for the men, the power line project was explained to them, using the same poster presented to the men. They also saw a picture of a solar power plant. There were 8 women. They said that they could have been more if the men had informed them about the meeting.

In particular, there were women members of a group of 37 women. They grow and market together (mainly cucumbers, okra, beans). Since the socio-economic data had already been collected during the ESIA of the plant and during the development of the LRP, it was decided not to ask them

specific questions about their lifestyle (access to school, water, etc.).

The main concerns expressed in relation to the project

- Could the project help them access income-generating activities? They don't really have an idea of what they could do but they mentioned the example of women in another village (Djermaya) who had access to training to learn how to make soap.
- Just like the men, they are worried about not seeing anything coming from the project
- They perceive the presence of the plant as an opportunity if it creates jobs and supports them in income-generating activities
- It was also explained to them that the work that will be created by the central will be temporary during the construction phase and that some jobs will be technical. However, some activities that do not require technical skills could be filled by people from the surrounding villages.
- Their other concern, as for the homes, was access to electricity

The minutes of the meeting with the men were presented to them at this time to inform them about what was expressed by the men and the explanations and commitments expressed by the project

- *"The plant is an opportunity for us if work was given to our children and if we could have help to develop activities to have income" Representative of the women's group*
- *"Can we get electricity? Representative of the women's group*

Men's concerns

See above as the meeting was not mixed but separate

Photos

Public Consultation Report

DATE	04/11/2019	CONSULTANT'S NAME	Karima BROCHE
VILLAGE	BELILE BRIDGE	MUNICIPALITY, DEPARTMENT, REGION	HADJAR LAMIS
NUMBER OF PARTICIPANTS	59	INCLUDING	MEN: 23 WOMEN: 36
DURATION	2 H 30		

Methodology

The village chief was contacted by phone a few days before the meeting. The day before the meeting, the team went to speak with the village chief, confirming his arrival for the next day and specifying the objective and the various actions desired (public meeting, visit to the village, focus group with the women and identification of the businesses and facilities on the west side of the road through which the line will pass)

A visual aid (poster, see Appendix 4) was prepared in large format. It was presented in French and simultaneously translated into Chadian Arabic. Three people from the project and the consultant spoke local Arabic. The consultant in charge of the mission spoke more classical Arabic which is partially understood if the people have not had enough schooling. The A4 format support was left with the village chief.

Participants and meeting dynamics

Those who spoke were of all ages. The younger ones were often more vocal about the potential impact of the project on their village.

Women were present in large numbers but participated relatively less compared to their numbers.

Women's participation

In this meeting, women were present and their participation was encouraged, but generally only the older ones spoke, as well as some representatives of the trade profession installed along the road in Pont Bélilé. A small meeting was organized afterwards to discuss with some of them in small committee.

Summary of exchanges

The first questions focused on the local impact of the project: what they could gain from it. Could the project help them cover social needs (education, water, health)?

The issue of access to electricity was central to the expectations expressed. They do not understand that power lines pass near their homes but they do not have access to them. They refer to an 11 or 15 kv line that crosses the *village.*

One of the participants said *"solar energy is better, it is cheaper and less polluting than generating electricity with generators but if we do not have access to this electricity it is not fair, we are part of the people and the people have the right to electricity".*

Questions were also raised about access to unskilled employment at the time of construction for the buried track

The response to these two concerns/expectations was to explain that it was not the capacity of the project to distribute electricity, as this is the responsibility of the SNE. The project would essentially be able to increase the electrical capacity (between 9am and 5pm). SNE is the owner of the networks and the only one able to decide on the distribution

Participants said they understood this but that if they went directly to the SNE, they would not be heard. They asked if the project could relay this expectation to the SNE.

They asked for explanations about the nuisance of the construction site (dust and how it was managed)

Some merchants also asked if they had to close during the work

The project explained that it would try to promote local employment as much as possible, but that they had to be aware that this would not represent a lot of people and that it would not last more than 1 or 2 months.

Regarding the other expectations (IGAs for women, meeting social needs), the project said that they first needed to understand a little better what their problems and needs were and that it was not excluded that actions would be taken to help them. Their attention was also drawn to the fact that the project could not replace the state and that these potential aids would not cover everything.

To increase transparency, at the end of the public meeting, a meeting report was prepared to summarize the main issues discussed and to document the project's responses to their concerns/expectations. This summary was shared with the village chief and the chef de carré who agreed that it was representative of the concerns expressed. This summary was then read and translated to all those present to ensure that the level of understanding was shared.

Verbatim

Solar energy is good. It is cheaper and less polluting than producing electricity with generators but if we do not have access to this electricity it is not fair. We are part of the people and the people have the right to electricity" participant

You're going to bury the line and then the project will be over and we still won't have electricity. Can you talk about this with the SNE?

With the SNE, we have no guarantee, they won't listen to us".

We would like you to make things easier for us by asking you to install a transformer so that we can have electricity.

The village is more than 100 years old and we have nothing. We want development for the village. We want you to relay this request to the authorities.

There are a lot of projects that have passed, we were promised but we have nothing" participant

We understand what you want to do, we have no problem with it, but we want the manpower to come from the village.

This project will bring us benefits, we don't care about the dust" a participant

My concession is less than 3 meters from the tar, will I be affected?

We are installed here, we have stores all along the road, will we have to close during the works?

"An NGO taught us how to make soaps but we can't afford to buy the ingredients to produce and sell." Participant

Before leaving to visit the village guided by some inhabitants, questions were asked about the origin of the village and the history of their presence in relation to the road and the easement zone.

Women's concerns

The women essentially expressed the need to obtain assistance for the women's group and support for developing income-generating activities. Their group would need to be reactivated. Several members had withdrawn from the group due to lack of opportunities.

Access to employment for the village's youth was also discussed.

There were many women who have a business along the road and asked if their business will be disrupted or if they will have to close during the construction.

They were told that it would not be necessary to close the businesses and that their activities could be carried out normally, that precautions would be taken so that the construction site would disturb them as little as possible. We also informed them that a part of the visit of the village was going to be devoted to the businesses located on the west side of the road so that we could identify more precisely if there are, for example, stalls that will have to be moved one or two meters to avoid the construction site. This walk along the road was finally done the next day in the early afternoon.

Men’s concerns
- Access to electricity - Access to employment for young people during the project - Aid to improve the daily life of the village (water, education, health)
Photos

Public Consultation Report

DATE	APRIL 12, 2019	CONSULTANT'S NAME	Karima BROCHE
VILLAGE	OUM DOURMANE	MUNICIPALITY, DEPARTMENT, REGION	HADJAR LAMIS
NUMBER OF PARTICIPANTS	31	INCLUDING	MEN: 28 WOMEN: 3
DURATION	1H30		

Methodology

Two days before, the team went to identify the village chief and meet with him to set up an appointment. He was busy organizing a religious ceremony at the Koranic school. We obtained his contact information and contacted him later in the day to explain the purpose of the visit and to request the organization of the public meeting

A visual aid (poster see annex) was prepared in large format. It was presented in French with simultaneous translation into Chadian Arabic. Two people from the project and the consultant spoke local Arabic. The A4 format support was left with the village chief.

Participants and meeting dynamics

The meeting was mainly attended by men.

Women's participation

The women were not very present and did not express themselves publicly. At the end of the meeting, we discussed with them live

Summary of exchanges

The first question was whether the line created would only serve Lamadji and whether it was possible to connect to it. Would it allow them to have electricity in the village?

A question was asked about the nature of the electricity produced if the fact that the source is solar, changes the nature of the electricity. A simplified answer on the technique of production of the solar energy was given and that the nature of the source did not modify the nature of the electricity but that the period of production was limited to the hourly range of sunshine.

It was explained that the objective of the project was to increase the capacity of electricity production at the solar power plant and that once the electricity was injected into the power line, the SNE was the only decision-maker regarding the distribution

Several stakeholders asked if it was possible that the poles that were going to be installed could also be fitted with bulbs to improve the street lighting on the road. It was answered that installing bulbs on a 33kv line was not really possible. This remains one of their main requests.

There was also an expectation of employment. It was explained that on the overhead part of the line,

- This required a certain technicality because there are lifting operations
- This will not mobilize a large team.

Regarding the buried section in Belilé, if manual digging is preferred, we explained that the people of Belilé want their residents to have priority because it will cross the middle of the village. This seemed to be considered a legitimate expectation. It was also explained that this will not require much manpower and that it will be temporary.

It was asked whether the company was carrying out this project on its own or whether it was mandated by the State. It was explained that this project was done within the framework of a partnership between the State and the private company. The private company, designed the

plant, found the financing, built it, had it produced and the SNE bought the electricity produced, which paid the company.

Some have heard of solar projects that address the needs of the poorest and are aimed at lighting small villages. It was explained that this project was not of that nature and that its main objective was to reinforce the capacity of the existing network and that the distribution remained the responsibility of SNE.

To increase transparency, at the end of the public meeting, a meeting report was prepared to summarize the main issues discussed and to document the project's responses to their concerns/expectations. This summary was shared with the village chief who agreed that it was representative of the concerns expressed. The minutes were then read and translated to all those present to ensure that the level of understanding was shared.

A visit of the village guided by some inhabitants was made at the end of the meeting to collect some socio-economic data.

Verbatim

"Is there a transformer planned with this line and can we get electricity?" participant

Will it allow us to have electricity in the village?

For us, the most important thing is that from the entrance to the village to the exit, there are even a few dozen streetlights.

Will this project allow the poorest people to have electricity? Will it cost less?" participant

Are you going to employ people from the village? We have people who are capable of working.

Can we get help for the school. The kids don't have books, the classrooms don't have furniture?" Participant

"Can the project help us get irrigation?" Participant

Women's concerns

- The women are concerned about the lack of activity. Apart from the rainy season when they cultivate the land (corn, cucumbers, etc.) some of them do a little trading.
- They would like to be helped to create income-generating activities and especially to be able to extend the growing season through small-scale irrigation. They would like to produce market garden products but lack water. They say that they are able to feed themselves but that things would improve for them and their families if they could grow crops even during the dry season.
- They would like help for the school and medicines for the health center and help to develop irrigation.
- Lack of electricity is a concern

These words were collected on the sidelines of the public meeting.

Men's concerns

- Access to electricity
- Use of power line poles to install street lighting along the road.
- Access to employment in connection with the project
- Help for the school: supplies, books, etc.

Photos

Public Consultation Report

DATE	APRIL 13, 2019	CONSULTANT'S NAME	Karima BROCHE
VILLAGE	LAMADJI	MUNICIPALITY, DEPARTMENT, REGION	XTH DISTRICT OF N'DJAMENA
NUMBER OF PARTICIPANTS	18	INCLUDING	MEN: 15 WOMEN: 3
DURATION	1H30		

Methodology

The Chief of the district was contacted a few days before to organize the meeting.

A visual aid (poster, see Appendix 4) in A4 format was distributed in several copies because it was difficult to glue the A0 version and the wind did not allow it to be held in place. It was presented in Arabic (several participants knew classical Arabic) and French and was simultaneously translated into Chadian Arabic. Two people from the project and consultant sides spoke local Arabic. A diagram of the line extension was also shown to visualize the part of the Lamadji substation that will receive the new transformers.

Participants and meeting dynamics

The audience being almost exclusively male

Women's participation

Only one woman was present and she did not speak. We joined her after the meeting to discuss with her and two other women

Summary of exchanges

The first question concerned access to electricity. It was asked if this project would allow them to have electricity in their homes at a lower cost or even free.

We explained that the project was not intended to distribute electricity but to reinforce the capacity of the existing network, especially in the 9am to 5pm time slot in relation to the sunshine period.

They asked if people would be affected and compensated for passing the line. We explained that the line passed 22 meters from the axis of the road which is in the public domain (road easement zone) and that the only place where there was a problem was Pont Bélilé because houses or businesses were very close to the road and that for that reason, in order not to have to move people, the decision to bury the line at 1 or 2 meters from the asphalt was preferred.

Several questions were asked about the arrival of the 33kv line at the Lamadji substation and whether the road would be cut off for the work. A diagram, complementary to the poster, showing the road, the other power lines and the Lamadji substation was used to explain the passage of the overhead line from the west side to the east side of the road where the Lamadji substation is located. It was also stated that during this passage, measures will be taken to avoid disrupting traffic.

It was also asked if this project would create work for the locals. It was explained that a project of this size would not create much work. It will require a small crew, trained in the lifting work for the poles. And for the part of Pont Belilé where the line will be buried, while the digging will probably be done manually and some people from Pont Belilé will be hired. This kind of work is also temporary (1 or 2 months maximum).

To increase transparency, at the end of the public meeting, a meeting summary was prepared to summarize the main topics discussed and to materialize the answers given by the project to their concerns/expectations. This summary was shared with the ward manager and the square manager who agreed that it was representative of the concerns expressed. The minutes were then read and translated to all those present to ensure that the level of understanding was shared.

A short visit of the neighborhood, guided by some inhabitants, was made after the meeting to collect some socio-economic data

Verbatim

Today, if we go to the SNE, it costs a lot to have electricity, at least 500,000 francs. Will your project make it cheaper for us?

Instead of giving this electricity to SNE, why don't you give it directly to the population so that it costs us less?

There is land but we can only produce when there is water. If we had irrigation, we could grow more crops and over a longer period of time.

Women's concerns

- Have water for irrigation
- Have access to electricity

Men's concerns

- Access to electricity at a more affordable cost
- Employment related to the site
- Impacts on road traffic related to the work for the passage of the line from the west side to the east side where the Lamadji transformer station is located.

Photos

APPENDIX 5

Cartographic Atlas