



ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED 60MW WIND ENERGY FARM IN KAJIADO COUNTY.

Prepared For:

National Cement Company Limited (NCCL)

CERTIFICATE OF DECLARATION AND DOCUMENT AUTHENTICATION

This Environmental and Social Impact Assessment Study Report has been prepared in accordance with Environmental Management and Coordination Act (EMCA), 1999 (Amendment 2015) and the Environmental (Impact Assessment and Audit) Regulations, 2003 (Revised 2019).

PROPONENTS:

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Signature  Date: 02ND April 2026

NEMA EXPERTS

LEAD EXPERT

NEWTON KARURI

REGISTRATION NUMBER - 7117



Signature  Date: 05 April 2026

Do hereby certify that this report was prepared based on the information provided by the proponent, neighbors as well as that collected from other primary and secondary sources and on the best understanding and interpretation of the facts by the Environmental assessors. It is issued without any prejudice.

This report has been prepared and reviewed by a team of experts and has been approved by the following professionals.

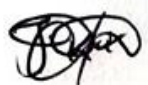
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Table 1: Team of Experts

ABBREVIATIONS AND ACRONYMS

ESIA- Environmental and Social Impacts Assessment

EMCA-Environment Management and Coordination Act, 1999

EIA – Environmental Impacts Assessment

MEIK- Member of Environment Institute of Kenya

NCCL – National Cement Company Limited

NEMA – National Environment Management Authority

MW – Megawatts

GE – General Electric

WTGs – Wind Turbine Generators

LCPPD – Least Cost Power Development Plan

ESMP – Environmental and Social Management Plan

EPRA – Energy and Petroleum Regulatory Authority

OSHA – Occupational Safety and Health Act, 2007

KWS – Kenya Wildlife Services

KFS -Kenya Forest Services

SGR – Standard Gauge Railway

SEP – Stakeholders Engagement Plan

PPEs – Personal Protective Equipments

KETRACO -Kenya Electricity Transmission Company Limited

ESHS-MS - Environmental, Social, Health and Safety Management System

ASAL – Arid and Semi-arid Lands

GIIP – Good International Industry Practice

IFC – International Finance Corporation

EHS – Environmental Health and Safety

KPLC – Kenya Power and Lighting Company

EPC – Engineering, Procurement and Construction

WT – Wind Turbine

IEC – Internal Electrical Collection

AOI – Area of Influence

WTG – Wind Turbine Generator

ISS – Integrated Safeguards System

WRA – Water Resource Authority

KCC – Kenya Civil Aviation Authority

NGOs – Non-governmental Organizations

CBOs – Community-Based Organization

NTS – Non-technical Summary

GRM – Grievance Redress Mechanism

DFIs – Development Finance Institutions

AfDB – African Development Bank

OS – Operational Safeguards

CLO – Community Liaison Officer

TBT – Tool Box Talks

OHSP – Occupational Health and Safety Plan

EXECUTIVE SUMMARY

The proposed Project involves the development of a **60 MW commercial wind energy facility** by **National Cement Company Limited (NCCL)** in **Kajiado County, Kenya**, approximately **33 km west of Nairobi**. The Project will be implemented within an area of approximately **50 hectares** of generally flat terrain with gentle undulations sloping from north to south.

Administratively, the Project site falls within **Kajiado County** and is accessed via the **Kimuka-Suswa Road**, which connects to the **Kaplong-Narok-Maai Road**, a key regional transport corridor that has contributed to increased development pressure in the area. The Project site is also located adjacent to the **Standard Gauge Railway (SGR) corridor**, providing additional regional infrastructure context.

The surrounding area is **scarcely populated**, with land use predominantly characterized by **pastoralism**. However, recent field observations indicate **emerging land subdivision trends**, with several parcels subdivided into **50 × 100 residential plots** and increasing establishment of **resort and hospitality developments**, signaling gradual transformation of land use driven by improved road connectivity. Access to basic amenities such as **grid electricity, sewerage systems, and telecommunications infrastructure** remains limited across much of the Project area.

The proposed wind farm will comprise **thirty-eight (38) GE 1.6–82.5 Wind Turbine Generators (WTGs)**, each with a **rated capacity of 1.6 MW**, resulting in a combined installed capacity of approximately **60 MW**. Each turbine will have a **hub height of 80 m**, a **rotor diameter of 82.5 m**, and a **maximum tip height of approximately 121.25 m**, with an anticipated **design life of 20 years**.

Electricity generated by the Project will be evacuated via a **220 kV transmission line** connecting the wind farm to the **Kimuka Substation**, located approximately **8 km east of the Project site**. The transmission line will be developed in accordance with **Kenya Power and Lighting Company (KPLC) wayleave standards**, requiring a **60 m wide wayleave** along a length of approximately **2,430 m**, translating to a total wayleave area of approximately **36 acres**.

The Project will also include the development of a **33/220 kV plant substation**, occupying approximately **8 acres**, comprising a **step-up transformer yard (approximately 4 acres)** and an **open storage yard (approximately 5 acres)**. Individual WTG platforms will occupy areas of approximately **120 m × 120 m**, with **inter-turbine spacing ranging between 400 m and 885 m**, connected through internal access roads and underground or overhead electrical infrastructure. Existing access roads will be **upgraded** to facilitate transportation of turbine components and construction materials. The Project footprint represents a **small proportion of the overall Project area**, as wind energy developments are spatially extensive but physically disturb limited land, allowing for **continued compatible land uses**, such as grazing, during the operational phase.

Electricity generation from wind energy is inherently **low-emission during operation** and contributes to national and global efforts to **reduce greenhouse gas emissions**, diversify energy supply, and improve energy security. In Kenya, the Project aligns with national objectives under the **Energy Act, 2019**, the **National Climate Change Action Plan**, and Kenya's commitment to increasing the share of **renewable energy** in the national power mix.

Baseline ecological assessments indicate that the Project area is dominated by **natural shrub vegetation** with **minimal wildlife presence**. Site observations recorded **low-flying common bird species**, with no evidence of migratory corridors or sensitive avifauna habitats within the Project footprint. The nearest existing wind energy facility, the **KenGen Ngong Wind Power Station**, is located approximately **17 km from the Project site**, and therefore cumulative impacts are expected to be limited and manageable.

This Environmental and Social Impact Assessment (ESIA) Study has been prepared to identify, evaluate, and propose mitigation measures for potential **environmental and social impacts** associated with the planning, construction, operation, and eventual decommissioning of the Project. The study has been undertaken in accordance with the **Environmental Management and Coordination Act (EMCA), Cap 387**, the

Environmental (Impact Assessment and Audit) Regulations, 2019, and other relevant national legislation and international good practice.

ESIA Study Team and Expertise

The ESIA Study Report has been undertaken by a multidisciplinary team led by a Project Director and supported by Project and Research Managers with the following responsibilities:

Project Director: Overall leadership, appointment of team members, approval of methodologies, and final decision-making.

Project Manager: Coordination of field studies, stakeholder engagement, and integration of environmental management measures.

Research Manager: Oversight of data collection, analysis, interpretation, and compilation of study outputs.

The Spatial Design Solutions consultants team, led by Lead Environmental Expert, Newton Gitonga Karuri, is a NEMA-registered ESIA/EA Firm of Experts, has been contracted by National Cement Company Limited (NCCL), the registered owner of Title Number listed below to carry out an Environmental and Social Impact Assessment (ESIA) Study Report.

S/NO	L.R NO.	SIZE (HA)
1	KDJ/EWUASO KEDONG/9854	2,83
2	KJD/NTASHART/35582	2,84
3	KJD/NTASHART/35580	3,64
4	KJD/NTASHART/35803	3,63
5	KJD/EWUASO KEDONG/9856	3,27
6	KAJIADO/NTASHART/26630	1,9
7	KAJIADO/NTASHART/30083	1,2
8	KAJIADO/NTASHART/35114	2,42
9	KAJIADO/NTASHART/35120	2,42

10	KAJIADO/NTASHART/35121	1,46
11	KAJIADO/NTASHART/35392	3,22
12	KAJIADO/NTASHART/35110	2,92
13	KAJIADO/NTASHART/35108	1,29
14	KAJIADO/NTASHART/35123	3,83
15	KAJIADO/NTASHART/35125	4,15
16	KAJIADO/NTASHART/35394	3,64
17	KAJIADO/NTASHART/35112	1,21
18	KAJIADO/NTASHART/1508	2,73
19	KAJIADO/NTASHART/35115	5,02
	TOTAL	53,62

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Photo 6: The scattered drought resistant shrubs in the project area

CHAPTER 1: INTRODUCTION

1.1 Background

The energy sector is a critical driver of Kenya's socio-economic development and underpins industrial growth, rural electrification, and improved livelihoods. Kenya has made deliberate efforts to diversify its energy mix and reduce reliance on fossil fuels through the promotion of renewable energy sources, particularly geothermal, wind, and solar power. These efforts are aligned with national development frameworks including *Vision 2030*, the *Least Cost Power Development Plan (LCPDP)*, the *Energy Act, 2019*, and Kenya's commitments under global climate change mitigation instruments. Wind energy has emerged as a strategic component of Kenya's renewable energy portfolio due to the country's favorable wind regimes, especially in arid and semi-arid lands (ASALs). Development of wind power projects contributes to energy security, reduction of greenhouse gas emissions, and socio-economic benefits such as employment creation, infrastructure improvement, and community development. In line with these national objectives, the Proponent intends to develop a utility-scale wind power project (hereafter referred to as "the Project"). The Project will consist of multiple wind turbine generators (WTGs), associated electrical infrastructure, access roads, and a substation to evacuate power to the national grid. The Project is designed to operate over a design life of approximately 20 years and will adopt proven wind turbine technology suitable for the local climatic and wind conditions. This Environmental and Social Impact Assessment (ESIA) has been prepared to assess the potential environmental and social impacts associated with the proposed wind farm during the construction, operation, and decommissioning phases, and to propose appropriate mitigation and management measures in compliance with Kenyan regulatory requirements and Good International Industry Practice (GIIP).

1.2 Project Location and Components

The proposed wind farm will be developed within a predominantly pastoral landscape characterized by open grazing land used by local communities for livestock rearing, mainly cattle, goats, and sheep. Settlement patterns within the wider Project area reflect Maasai cultural practices, where homesteads are grouped by family units and separated by relatively long distances. Housing structures are a blend of traditional and semi-permanent forms, commonly constructed using mud and sticks with grass or iron sheet roofing, while a limited number are built using stone. Water supply is primarily through rainwater harvesting, with storage in tanks.

The Project will comprise the following key components:

Wind Turbine Generators (WTGs): Each WTG platform will occupy an area of approximately 120 m by 120 m. The spacing between turbines will range from approximately 400 m to 885 m, depending on layout optimization and wind flow considerations.

Wind Turbine Technology: The Project will utilize GE 1.6-82.5 wind turbines with a rated capacity of 1.6 MW per turbine. The turbines have a rotor diameter of 82.5 m, a hub height of 80 m, and a maximum tip height of approximately 121.25 m. The turbines are designed for IEC Class IIB wind conditions and have a design life of 20 years.

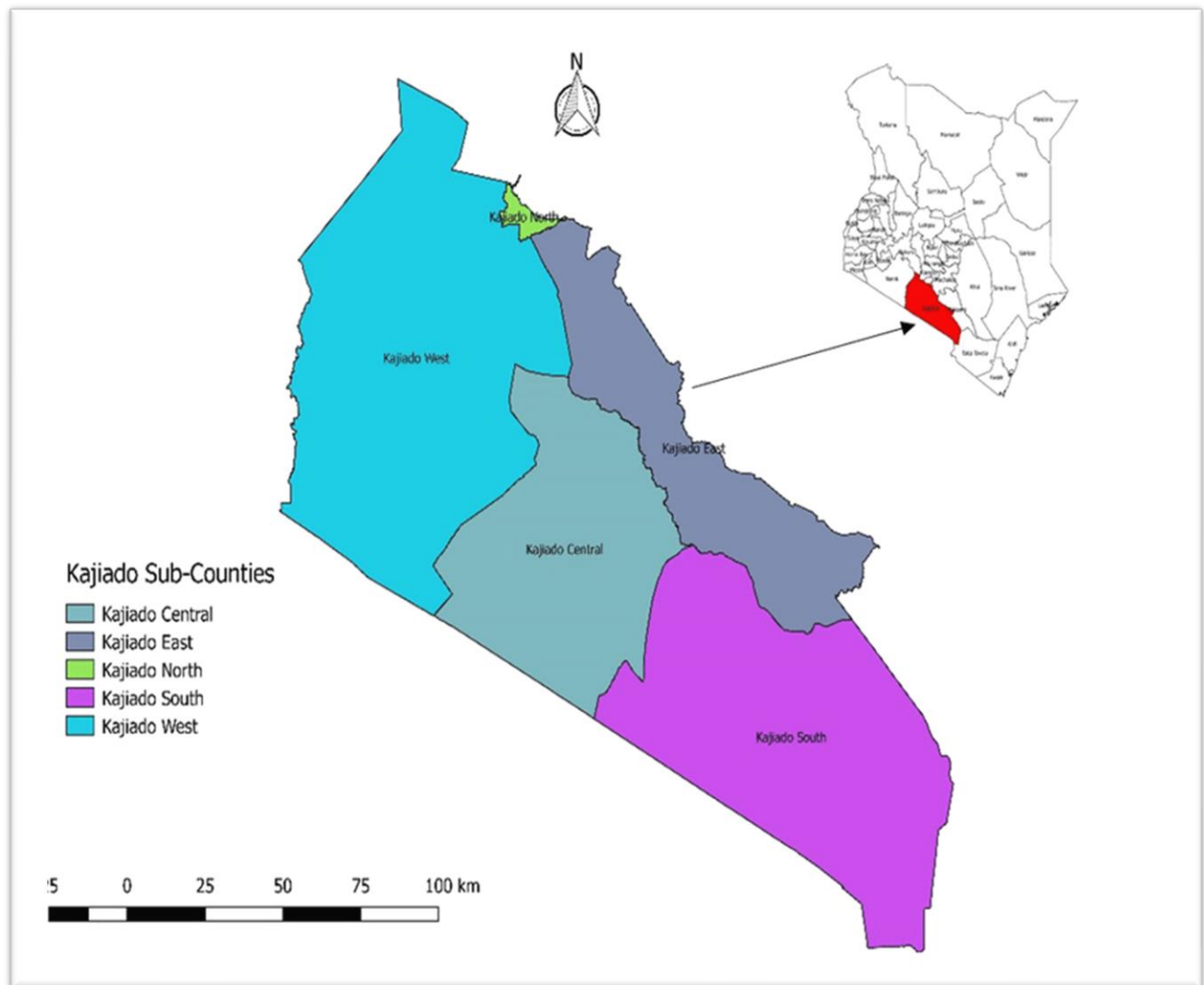
Internal Electrical Network: A 33 kV collection system will connect individual turbines and evacuate power to the Project substation.

Substation and Associated Facilities: A 33/220 kV plant substation will be developed, occupying approximately 8 acres. Additional land will be allocated for a step-up transformer pull-up area (approximately 4 acres) and open storage (approximately 5 acres).

Transmission Line: A 220 kV transmission line will connect the Project substation to the national grid. The total length of the transmission line is approximately 2,430 m. In accordance with Kenya Power and Lighting Company (KPLC) standards, a wayleave of

60 m will be maintained, resulting in an estimated wayleave area of approximately 36 acres.

Access Roads: Existing roads within and leading to the Project site will be upgraded to accommodate the transportation of turbine components, construction equipment, and operational vehicles.



Map1: Location of Kajiado County on the Map of Kenya

1.3 Environmental and Social Impact Assessment

The proposed wind farm is subject to the provisions of the *Environmental Management and Coordination Act (EMCA)*, 1999 and the *Environmental (Impact Assessment and Audit) Regulations*, 2003 (as amended). Under these regulations, wind energy projects of this nature and scale require a full Environmental and Social Impact Assessment to be undertaken and approved by the National Environment Management Authority (NEMA) prior to commencement of construction activities.

In addition to national legal requirements, the Proponent intends to implement the Project in line with Good International Industry Practice (GIIP). Where applicable, this includes alignment with the International Finance Corporation (IFC) Performance Standards, the World Bank Group Environmental, Health and Safety (EHS) Guidelines for Wind Energy, and other relevant international safeguards frameworks, particularly where international financing is anticipated.

This ESIA identifies baseline environmental and social conditions within the Project area, evaluates potential impacts, and proposes mitigation, monitoring, and management measures to ensure that adverse impacts are avoided, minimized, or adequately managed, while enhancing positive impacts.

1.4 Document Structure

This ESIA report is structured as follows:

Executive Summary: A non-technical overview of the Project, key findings, anticipated impacts and proposed mitigation measures, ESIA study team and expertise

Chapter 1 – Introduction: Background to the Project, Project description, ESIA objectives, and document structure.

Chapter 2 – Project Description: Detailed description of Project components, activities, and implementation phases.

Chapter 3 – ESIA Approach and Methodology: Methodology adopted for baseline studies, impact identification, and assessment.

Chapter 4 – Stakeholder Engagement and Public Participation: Summary of stakeholder consultations and key issues raised.

Chapter 5 – Policy, Legal and Institutional Framework: Applicable national legislation, policies, and international standards.

Chapter 6 – Analysis of Alternatives: Consideration of Project alternatives, including the no-project option.

Chapter 7 – Existing Environmental and Social Baseline Conditions: Description of the physical, biological, and socio-economic environment.

Chapter 8 – Impact Assessment and Mitigation Measures: Assessment of potential impacts and proposed mitigation measures.

Chapter 9 – Assessment of cumulative impacts on the basis of; regional development context, assessment of cumulative environmental and social impacts and the overall cumulative impacts evaluation.

Chapter 10 – Environmental and Social Management Plan (ESMP): Framework for implementation, monitoring and reporting of mitigation measures.

Conclusions and Recommendations

References; list of the areas of consultation for the project.

Annexes; Approved TOR of the project, site photographs, location maps, layout drawing, transmission line route maps, public consultation records, minutes of the stakeholders meeting & its attendance lists, tools of consultations such as questionnaires,

1.5 Key Involved Entities

The key entities involved in the planning, implementation, and regulation of the Project include:

The Proponent: Responsible for the development, financing, construction, and operation of the wind farm.

National Environment Management Authority (NEMA): The regulatory authority responsible for review and approval of the ESIA and issuance of the environmental licence.

Kenya Power and Lighting Company (KPLC): Responsible for grid interconnection requirements and transmission line wayleave standards.

Energy and Petroleum Regulatory Authority (EPRA): Responsible for energy sector regulation and licensing.

Engineering, Procurement and Construction (EPC) Contractor: To be appointed by the Proponent to undertake detailed design and construction works.

Project Operator: Responsible for operation and maintenance of the wind farm during the operational phase.

ESIA Consultant: Responsible for preparation of the ESIA study in accordance with Kenyan regulations and GIIP.

CHAPTER 2: PROJECT DESCRIPTION

2.1 Introduction

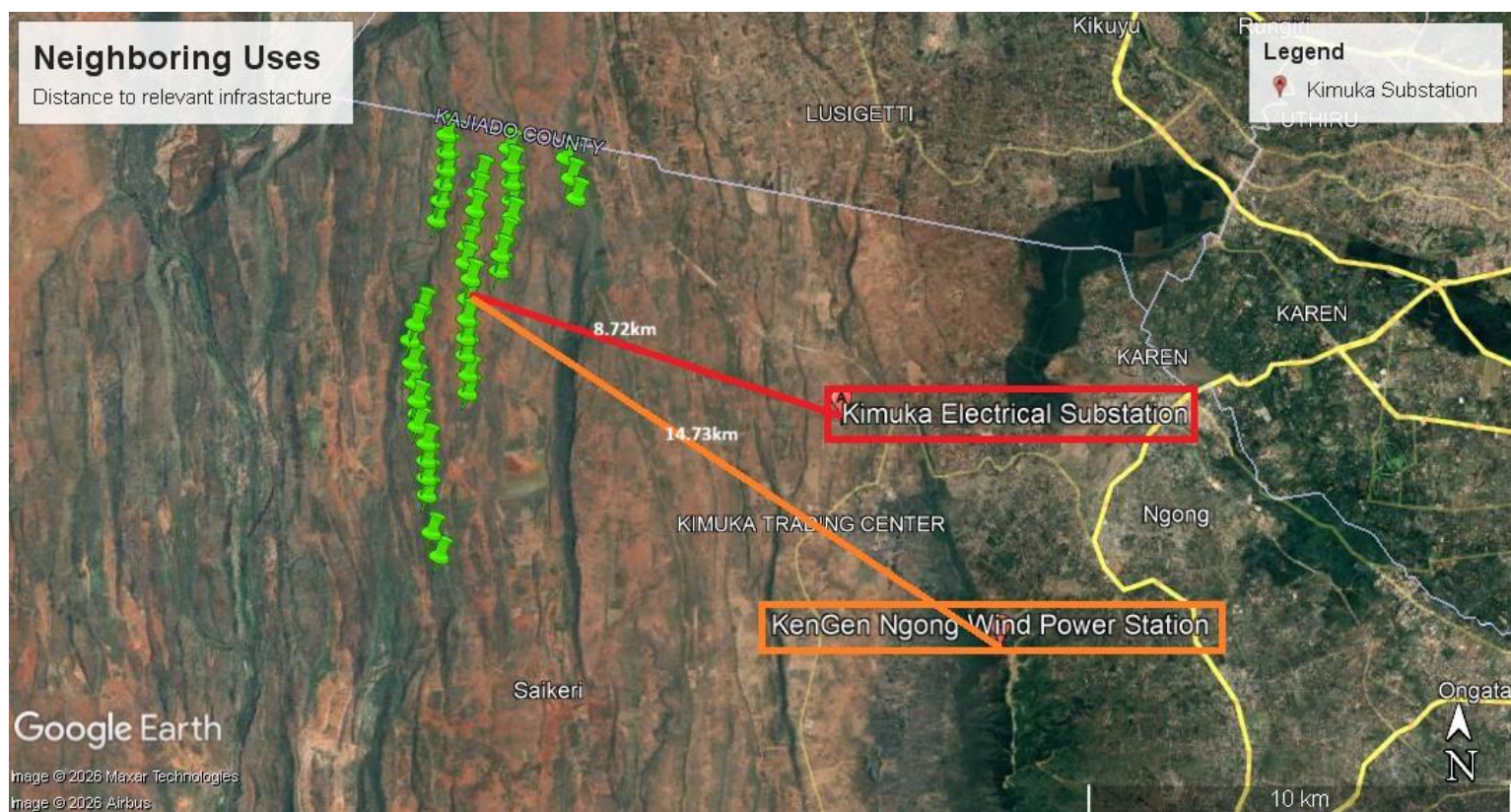
This chapter provides a detailed description of the proposed wind farm project, including its location, scale, components, design specifications, associated infrastructure and supporting facilities. The description is intended to provide a clear understanding of the project for environmental, social, and regulatory assessment purposes in line with the Environmental Management and Coordination Act (EMCA), Cap 387, and the Environmental (Impact Assessment and Audit) Regulations, 2003.

The proposed project involves the development of a utility-scale wind power facility comprising thirty-eight (38) wind turbine generators (WTGs), associated electrical infrastructure, internal access roads, a step-up substation and a 220 kV transmission line to evacuate generated power to the national grid.

2.2 Project Location and Setting

The proposed wind farm project is located within a predominantly pastoral landscape characterized by open rangelands used for livestock grazing. The surrounding land use is largely extensive pastoralism, with scattered homesteads arranged according to family groupings in line with Maasai cultural practices. Settlement density is low, with significant distances between homesteads.

The nearest comparable development is the KenGen Wind Power Farm, located approximately 17 km from the project site, which has become both an energy generation facility and a local attraction for hiking, nature walks, and turbine sightseeing. A similar indirect socio-economic benefit is anticipated for the proposed project.



Map 2: Distance to Kimuka Sub Station and Kengen Ngong Wind Power Station

Kajiado Wind Farm WTG Locations				
Sr. No.	Logintude	Latitude	Elevation in mtrs	WTG ID
1	36,545837	-1,281842	1859,2	WT-1
2	36,534286	-1,294297	1805	WT-6
3	36,54689	-1,286158	1867,8	WT-2
4	36,547991	-1,290312	1881,7	WT-3
5	36,533801	-1,279853	1835	WT-4
6	36,53426	-1,283469	1825	WT-5
7	36,534288	-1,28708	1828,7	WT-7
8	36,534289	-1,2907	1819,5	WT-8
9	36,525706	-1,307148	1770	WT-9
10	36,524921	-1,311243	1750	WT-10
11	36,52476	-1,31551	1719,7	WT-11
12	36,524553	-1,319439	1710,1	WT-12
13	36,52448	-1,323037	1705	WT-13
14	36,525015	-1,327177	1697,7	WT-14
15	36,520712	-1,276979	1876,1	WT-15
16	36,520709	-1,280597	1855	WT-16

17	36,520705	-1,284212	1870,1	WT-17
18	36,520122	-1,287334	1855	WT-18
19	36,519396	-1,290685	1812,6	WT-19
20	36,518503	-1,294723	1738	WT-20
21	36,51556	-1,313071	1768,2	WT-21
22	36,514088	-1,316524	1757,3	WT-22
23	36,512951	-1,319905	1735,7	WT-23
24	36,513281	-1,324758	1716,4	WT-24
25	36,513678	-1,328726	1712,6	WT-25
26	36,514262	-1,332569	1699,8	WT-26
27	36,532872	-1,298451	1786,8	WT-27
28	36,51442	-1,335361	1683,5	WT-28
29	36,531915	-1,302095	1764,7	WT-29
30	36,514332	-1,337984	1670,6	WT-30
31	36,531636	-1,305389	1741,8	WT-31
32	36,51625	-1,341601	1701,4	WT-32
33	36,516246	-1,345217	1683,2	WT-33
34	36,524869	-1,330968	1690	WT-34
35	36,516242	-1,348832	1662	WT-35
36	36,516239	-1,352448	1655	WT-36
37	36,517114	-1,360407	1596,9	WT-37
38	36,518769	-1,365334	1628,3	WT-38
39	36,52703	-1,289068	1778,8	WT-20A
40	36,526663	-1,292778	1776,4	WT-19A
41	36,524557	-1,303675	1767,5	WT-18A
42	36,524919	-1,300155	1770,5	WT-17A
43	36,526118	-1,2964	1780	WT-16A
44	36,527865	-1,285463	1783,6	WT-15A

Table 3: Coordinates for the Turbines

2.3 Project Proponent

The project is being developed by the Proponent with the objective of generating renewable energy from wind resources and contributing to Kenya's clean energy mix, in line with national energy and climate change policies.

2.4 Project Components

The proposed wind farm development will comprise the following main components:

- Wind Turbine Generators (WTGs)

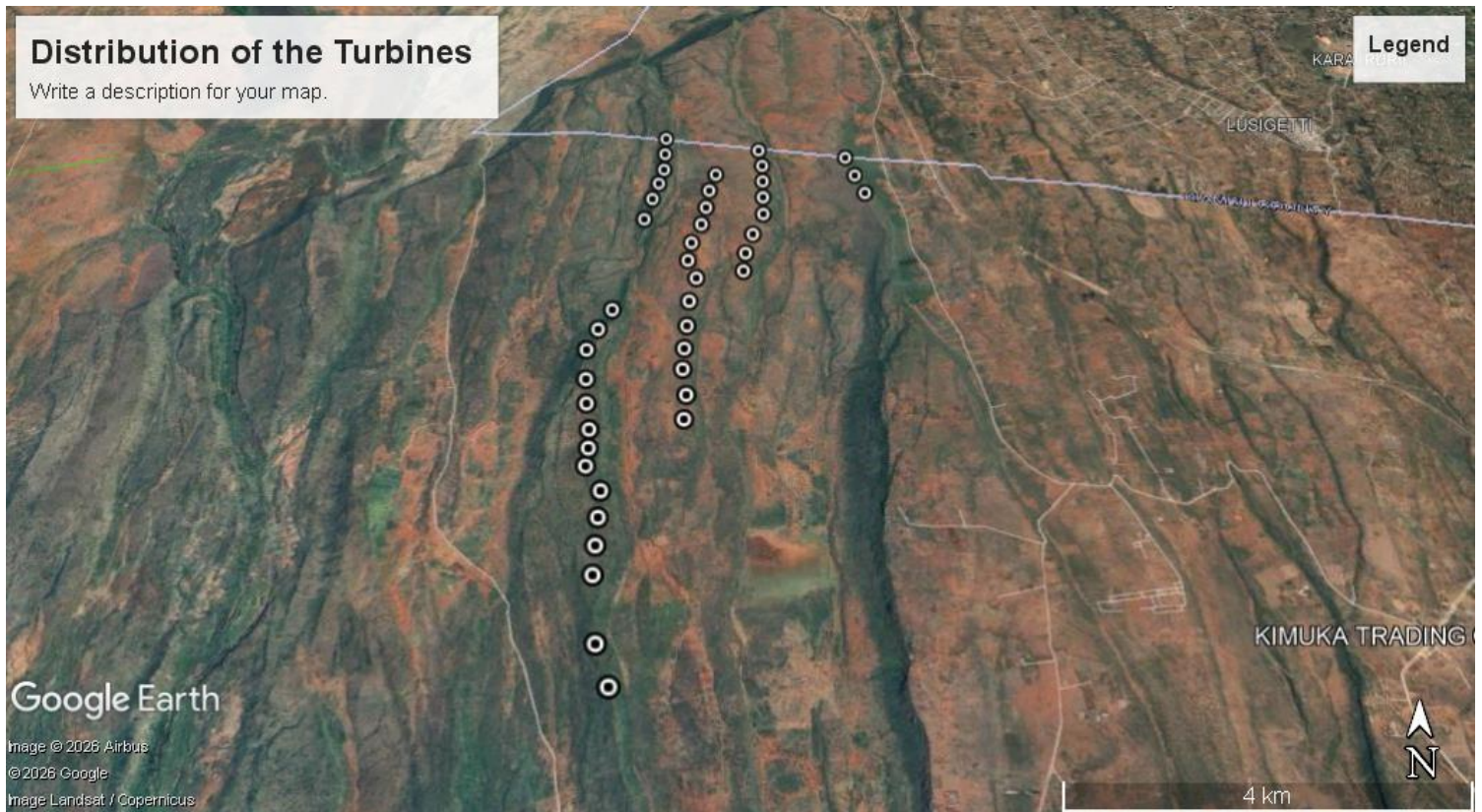
- Turbine platforms and foundations
- Internal access roads (including upgrades of existing roads)
- Underground and overhead electrical cabling
- 33/220 kV step-up substation and associated facilities
- 220 kV transmission line and wayleave
- Construction support areas and temporary storage yards

2.5 Wind Turbine Generators (WTGs)

2.5.1 Number and Layout of Turbines

The project will consist of thirty-eight (38) wind turbine generators, designated WT-1 to WT-38. These turbines represent the final approved turbine layout for the project. Any previously considered alternative turbine identifiers, including WT-15A to WT-20A, are not part of the final project design.

Each turbine will be installed on a platform measuring approximately 120 m by 120 m. The distance between adjacent turbines will range between approximately 400 m and 885 m, allowing for optimal wind capture efficiency and safe turbine operation.



Map 3: Turbine Distribution

2.5.2 Turbine Specifications

The proposed turbines are GE 1.6–82.5 wind turbine generators with the following specifications:

- Rated Power: 1.6 MW per turbine
- Rotor Diameter: 82.5 m
- Hub Height: 80 m (three-section tubular steel tower)
- Maximum Tip Height: 121.25 m
- Cut-in Wind Speed: 3.5 m/s
- Cut-out Wind Speed:
 - 25 m/s over a 600-second interval
 - 28 m/s over a 30-second interval

- 30 m/s over a 3-second interval
- Operational Temperature Range: -15°C to +40°C
- Survival Temperature Range: -20°C to +50°C
- IEC Classification: IIB (with reduced gust)
- Design Life: 20 years

2.6 Electrical Infrastructure

2.6.1 Internal Electrical Collection System

Electricity generated by each turbine will be collected via an internal medium-voltage (33 kV) electrical network. This network will consist of underground and/or overhead cabling connecting the turbines to the project substation.

2.6.2 Substation Facilities

A 33/220 kV step-up substation will be constructed to transform power from the turbine collection voltage to transmission voltage. The substation facilities will occupy approximately:

- 4 acres for the step-up transformer and associated electrical equipment
- 5 acres for open storage and auxiliary facilities

The total substation-related land requirement will therefore be approximately 9 acres.

2.7 Transmission Line and Wayleave

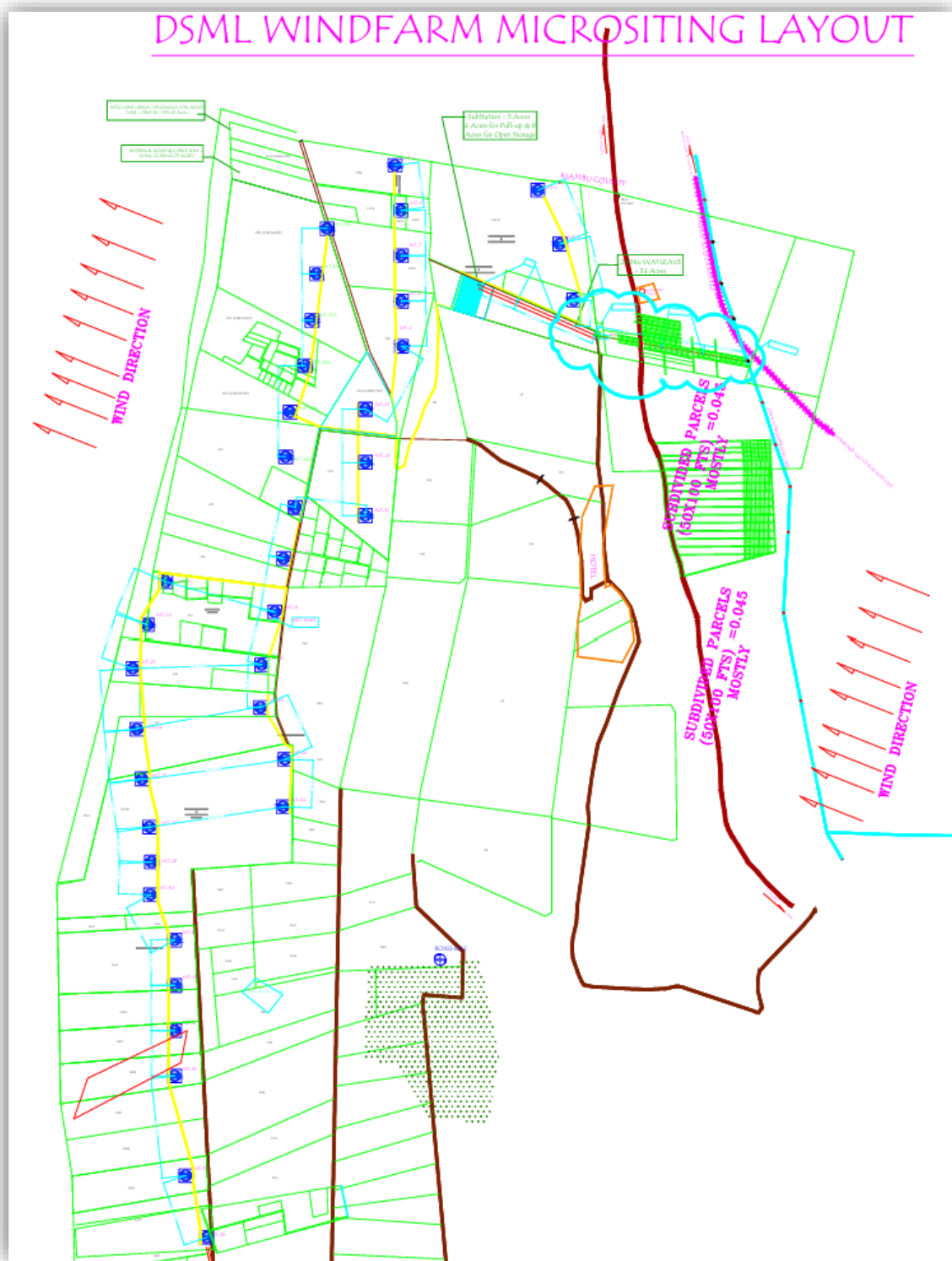
Electricity from the substation will be evacuated through a 220 kV transmission line connecting the project to the national grid. The transmission line will have a total length of approximately 2,430 m.

In accordance with Kenya Power and Lighting Company (KPLC) standards, the 220 kV transmission line will require a wayleave width of 60 m. This results in an estimated wayleave area of approximately 36 acres. The wayleave will be kept clear of permanent structures and incompatible land uses throughout the operational life of the project.

2.8 Access Roads and Transportation

Existing access roads within and leading to the project site will be upgraded where necessary to facilitate the transportation of turbine components, construction equipment, and materials. Road upgrades will include widening, strengthening, and surface improvements to accommodate oversized and heavy loads during the construction phase.

Internal access roads will be constructed to connect turbine locations, the substation, and other project facilities. These roads will be designed to minimize land disturbance while ensuring safe and efficient access for construction, operation, and maintenance activities.



Map 4: Road Layout at the Project Site

2.9 Construction Activities

Key construction activities for the proposed wind farm will include:

- Site clearance limited to turbine platforms, road alignments, and infrastructure footprints
- Excavation and construction of turbine foundations
- Erection of turbine towers, nacelles, and rotor blades
- Installation of electrical cabling and substations
- Construction and upgrading of access roads
- Installation of the transmission line and associated structures

Construction activities will be undertaken in phases to minimize environmental disturbance and allow for effective environmental management.

2.10 Operation and Maintenance

During the operational phase, the wind farm will operate as a renewable energy generation facility with minimal on-site staffing. Routine activities will include turbine monitoring, periodic maintenance, inspection of electrical infrastructure, and upkeep of access roads and the substation.

Livestock grazing and other compatible land uses are expected to continue within the project area during operation, except within restricted safety zones around turbines and electrical infrastructure.

2.11 Project Lifespan and Decommissioning

The expected operational lifespan of the wind farm is approximately 20 years, consistent with the design life of the turbines. At the end of the project life, the Proponent will undertake decommissioning activities, which may include removal of turbines, electrical equipment, and associated infrastructure, or repowering subject to regulatory approvals at that time.

Decommissioning will be carried out in accordance with applicable environmental regulations and best practice guidelines to ensure site rehabilitation and safe post-project land use.

CHAPTER 3: ESIA APPROACH AND METHODOLOGY

3.1 Introduction

This chapter describes the approach and methodology adopted in undertaking the Environmental and Social Impact Assessment (ESIA) for the proposed 60 MW Kajiado Wind Farm Project by National Cement Company Limited (NCCL). The methodology was guided by the requirements of the Environmental Management and Coordination Act (EMCA), Cap 387, the Environmental (Impact Assessment and Audit) Regulations, 2003 (as amended), relevant sectoral legislation, and international good practice for wind energy developments.

Specifically, this chapter outlines the following;

- The approach to analysis of project alternatives;
- The approach to stakeholder engagement and public participation;
- The approach to defining the spatial and temporal scope of the ESIA study;
- The methodology for establishing baseline environmental and social conditions;
- The methodology used to identify and assess potential environmental and social impacts, including determination of significance, development of mitigation measures, and assessment of residual impacts;
- The approach to assessment of cumulative impacts; and
- The approach used in development of the Environmental and Social Management Plan (ESMP).

3.2 Analysis of Alternatives

The analysis of alternatives is a key requirement under Regulation 18 of the Environmental (Impact Assessment and Audit) Regulations, 2003, and is also consistent with international good practice for ESIA studies. The purpose of this analysis is to demonstrate that reasonable alternatives were considered during project planning and to justify the preferred project option from environmental, technical, social, and economic perspectives.

The analysis of alternatives for the proposed wind farm is presented in detail in **Chapter 6** of this ESIA and considers the following:

- Alternative project sites;
- Alternative technologies and turbine configurations;
- Alternative project layouts and designs; and
- The “no project” (no-action) alternative.

The preferred alternative was selected based on wind resource availability, land suitability, minimal environmental and social sensitivity, proximity to grid infrastructure (Kimuka Substation) and technical feasibility.

3.3 Stakeholder Engagement and Public Participation

Stakeholder engagement and public participation are integral components of the ESIA process and were undertaken in accordance with the requirements of EMCA Cap 387, the Environmental (Impact Assessment and Audit) Regulations, 2003, and the principles of meaningful stakeholder engagement.

Stakeholder engagement for the Project included consultations with relevant national and county government institutions, local administration, landowners, pastoralist communities within the project area, and other interested and affected parties.

Engagement methods included site meetings, key informant interviews, public barazas, focused discussions, and formal correspondence.

Details of the stakeholder engagement process, issues raised and how these concerns have been addressed are provided in **Chapter 4: Public Participation and Stakeholder Engagement**. Future engagement activities, including disclosure of ESIA findings and continued consultation during construction and operation phases, are also outlined in that chapter.

3.4 Delineation of Study Boundaries and Scope of Assessment

3.4.1 Area of Influence (AOI)

The Area of Influence (AOI) for the ESIA represents the geographical area within which the proposed wind farm may cause direct, indirect, or cumulative environmental and social impacts. The AOI includes the physical footprint of the Project and surrounding areas where project-related effects could reasonably occur.

For this ESIA, the core AOI includes:

- The wind turbine generator (WTG) platforms;
- Internal access roads and upgraded public roads;
- The 33/220 kV project substation;
- The 220 kV transmission line and associated wayleave; and
- Temporary construction areas such as laydown and storage areas.

For certain thematic aspects – such as noise, shadow flicker, visual and landscape character, biodiversity (including avifauna and bats), socio-economic conditions, and infrastructure – the AOI extends beyond the immediate project footprint. The thematic AOI for each discipline has been defined on a case-by-case basis and is clearly described within the relevant chapters of this ESIA.

3.4.2 Temporal Scope of the Assessment

The ESIA considers potential environmental and social impacts across the full life cycle of the Project, comprising the following phases:

- Planning and Construction Phase;
- Operation and Maintenance Phase; and
- Decommissioning Phase.

Planning and Construction Phase: This phase includes detailed design, transportation of turbine components, upgrading of access roads, construction of WTG foundations, erection of turbines, construction of the substation, installation of the transmission line, and associated ancillary works.

Operation and Maintenance Phase: This phase includes routine operation of the wind turbines, periodic maintenance activities and operation of the substation and transmission infrastructure over the project design life.

Decommissioning Phase: At the end of the project life, decommissioning activities may include dismantling of turbines, removal of above-ground infrastructure and site restoration. Impacts during this phase are expected to be similar in nature to construction-related impacts and are therefore addressed using comparable mitigation measures.

3.5 Establishment of Environmental and Social Baseline Conditions

Baseline environmental and social conditions within the AOI were established to provide a reference against which potential project impacts were assessed. The baseline assessment involved identifying key environmental and social receptors, determining their sensitivity, and understanding existing conditions in the absence of the Project.

Baseline data collection was undertaken using the following approaches:

- Desk-based review of existing literature, maps and policy documents;
- Review of data from relevant government institutions and agencies;
- Site visits and field observations; and
- Specialist surveys where applicable.

Baseline conditions for environmental and social aspects – including land use, physical environment, biodiversity, socio-economic conditions, infrastructure, and cultural considerations – are described in detail in **Chapter 7** of this ESIA.

3.6 Impact Assessment Methodology

3.6.1 Identification and Assessment of Impacts

Potential environmental and social impacts were identified by comparing project activities with baseline conditions for each project phase. Both beneficial and adverse impacts were considered. Where possible, impacts were quantified; where

quantification was not feasible, qualitative assessment based on professional judgement and available information was applied.

3.6.2 Sensitivity of Receptors

The sensitivity of environmental and social receptors was determined based on their importance, resilience, and capacity to absorb change. Receptor sensitivity was categorized as:

- **High sensitivity:** Receptors with low resilience where impacts may cause permanent or long-term change;
- **Medium sensitivity:** Receptors with moderate resilience and capacity to adapt to change; and
- **Low sensitivity:** Receptors that are resilient and adaptable to change.

3.6.3 Magnitude and Nature of Impacts

Impact magnitude reflects the scale and intensity of change relative to baseline conditions and applicable standards. Magnitude was classified as high, medium, or low, considering factors such as:

- Type (positive or negative);
- Nature (direct or indirect);
- Duration (short-term, medium-term, or long-term);
- Reversibility (reversible or irreversible).

3.6.4 Determination of Significance

Impact significance was determined by combining receptor sensitivity with impact magnitude using a structured evaluation matrix. Impacts were categorized as:

- Major significance;
- Moderate significance;
- Minor significance; or
- Not significant.

Professional judgement was applied to ensure that context-specific factors were adequately considered.

3.7 Mitigation Measures and Residual Impacts

For each identified adverse impact, appropriate mitigation measures were developed following the mitigation hierarchy of avoidance, minimization, management, and, where necessary, compensation. After application of mitigation measures, residual impacts were reassessed to determine their remaining significance.

3.8 Assessment of Cumulative Impacts

Cumulative impact assessment considered the combined effects of the proposed wind farm together with other existing or reasonably foreseeable developments in the surrounding area, including infrastructure projects and other wind energy developments. The cumulative impact assessment is presented in **Chapter 9** of this ESIA.

3.9 Development of the Environmental and Social Management Plan (ESMP)

Based on the findings of the impact assessment, an Environmental and Social Management Plan (ESMP) was developed to outline mitigation, monitoring, and institutional responsibilities for managing project-related impacts. The ESMP provides a practical framework for implementation during construction, operation, and decommissioning phases and is presented in **Chapter 10** of this ESIA.

CHAPTER 4: STAKEHOLDER CONSULTATION AND ENGAGEMENT

Stakeholder consultation and engagement is a core component of the Environmental and Social Impact Assessment (ESIA) process and a statutory requirement under the Environmental Management and Coordination Act (EMCA), Cap 387, and the Environmental (Impact Assessment and Audit) Regulations, 2003 (as amended). It is also consistent with international best practices, including the IFC Performance Standards, the African Development Bank (AfDB) Integrated Safeguards System (ISS), and the EBRD Performance Requirements.

National Cement Company Ltd (NCCL) is committed to undertaking a *transparent, inclusive, and culturally appropriate stakeholder engagement process* with all individuals and institutions that may be directly or indirectly affected by the proposed 60 MW Wind Farm Project in Kajiado County.

Stakeholder engagement for the Project was initiated during the ESIA scoping and baseline studies and will continue throughout the project lifecycle, including construction, operation, and decommissioning phases.

For the purposes of this ESIA, stakeholders are defined as individuals, groups, or institutions that may be affected by, have an interest in, or have the ability to influence the Project, either positively or negatively, including vulnerable and marginalized groups.

4.1 Objectives of Stakeholder Engagement

The objectives of stakeholder consultation and engagement for the Project are to:

- Ensure compliance with Kenyan legal and regulatory requirements for public participation;

- Inform stakeholders about the proposed project, including its scope, activities, benefits, and potential impacts;
- Identify and document stakeholder concerns, expectations, and perceptions;
- Integrate stakeholder views into project planning, impact assessment, and mitigation measures;
- Promote local acceptance and ownership of the Project; and
- Establish a framework for ongoing engagement and grievance redress throughout the project lifecycle.

4.2 Legal and Policy Framework

4.2.1 National Legal Framework

Stakeholder engagement for the Project is guided by the following key legal and policy instruments:

- The Constitution of Kenya (2010), particularly Article 10 and Article 69 on public participation and environmental management;
- Environmental Management and Coordination Act (EMCA), Cap 387;
- Environmental (Impact Assessment and Audit) Regulations, 2003 (as amended);
- County Governments Act, 2012;
- Land Act, 2012 and Land Registration Act, 2012;
- Energy Act, 2019.

In accordance with EMCA and the EIA Regulations, the Project is classified as a *high-risk development*, requiring a full ESIA study and mandatory public participation.

4.2.2 International Best Practice Requirements

The stakeholder engagement process also aligns with:

- IFC Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts;
- AfDB Integrated Safeguards System (ISS), including OS1 and OS5;
- EBRD Performance Requirement 10: Information Disclosure and Stakeholder Engagement.

4.3 Stakeholder Identification and Analysis

Stakeholder identification was undertaken based on the Project's area of influence, land use patterns, and socio-economic context. The Project area is characterized by sparsely populated pastoral land, emerging residential developments, and growing tourism-related activities.

4.3.1 Directly and Indirectly Affected Stakeholders

- Local pastoralist communities (primarily Maasai households);
- Landowners and plot owners within and adjacent to the Project area;
- Residents of emerging residential developments;
- Operators and employees of nearby resorts and tourism facilities;
- Livestock owners utilizing surrounding land for grazing.

4.3.2 Vulnerable and Marginalized Groups

The following groups were identified as potentially vulnerable:

- Pastoralist households dependent on natural resources;
- Women, whose participation may be limited by cultural norms;
- Elderly persons;
- Persons with disabilities.

Engagement approaches were designed to be **inclusive, culturally appropriate, and accessible** to these groups.

4.3.3 Institutional and Government Stakeholders

- National Environment Management Authority (NEMA);
- Ministry of Energy and Petroleum;
- Kenya Electricity Transmission Company (KETRACO);
- Kenya Power and Lighting Company (KPLC);
- Kajiado County Government (Environment, Lands, Physical Planning, Roads);
- Water Resources Authority (WRA);
- Kenya Wildlife Service (KWS);
- Kenya Civil Aviation Authority (KCAA);
- Kenya Railways Corporation;
- Local administration (County Commissioner, Chiefs, Assistant Chiefs).

4.3.4 Other Stakeholders

- NGOs and CBOs;
- Academic and research institutions;
- Media houses;
- Project contractors and workforce.

4.4 Stakeholder Engagement Methodology

Public participation for the Project was undertaken in accordance with EMCA requirements using a **multi-method approach** to ensure inclusivity and effectiveness.

4.4.1 Public Participation Meetings (Barazas)

Public meetings were held within the project area with support from local administration, including chiefs and village elders.

During these meetings:

- The ESIA team presented the project scope, expected benefits, potential impacts, and mitigation measures;
- Stakeholders were given an open platform to ask questions, raise concerns, and provide feedback.



Photo 1: Public Participation Barazas at the Project Site

4.4.2 Direct Interviews

Direct interviews were conducted with key stakeholders, including:

- Local community members;
- Landowners and pastoralists;
- Local leaders and government representatives.

These engagements provided deeper insights into *land use patterns, grazing practices, cultural considerations, and community expectations*.

4.4.3 Questionnaire Administration

Structured questionnaires (stakeholder comment sheets) were administered to residents within and around the project area to capture:

- Levels of awareness of the project;
- Perceived benefits and concerns;
- Community attitudes and expectations.

4.4.4 On-site Notices

Public notices were placed at strategic locations within the project area to:

- Inform stakeholders about the proposed development;
- Provide details of consultation meetings;
- Invite submission of comments.

This ensured transparency and inclusivity, even for stakeholders unable to attend meetings.

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED CONSTRUCTION AND INSTALLATION OF WIND TURBINES AND ASSOCIATED FACILITIES IN SAIKERI LOCATION, KAJIADO COUNTY

National Cement Company Limited is developing wind turbines and associated facilities in Saikeri location, Kajiado County. The process requires broad stakeholder engagement involving neighbouring communities, organizations and individuals who may be affected by or have interest in the proposed development. In accordance with the guidelines of the Environmental and Coordination Act 1999, we invite the interested parties to attend the public participation meeting scheduled as follows:

Venue	Date of engagement	Time
Ormeroi	26.03.2026	9am-1pm
Emugurr Osinyai	27.03.2026	9am-1pm

The main purpose of these meetings is to inform the public and stakeholders about National Cement Company Limited's intention to develop the proposed wind turbines, explain the scope of the project, collect views, inputs and concerns of the stakeholders. Your participation will be important to ensure stakeholder issues are well understood and considered. We shall highly appreciate your attendance and participation.

For: National Cement Company Limited

MANUFACTURERS OF QUALITY PPC AND OPC CEMENT 32.SN, 42.SN AND SIMBA PAVING BLOCKS

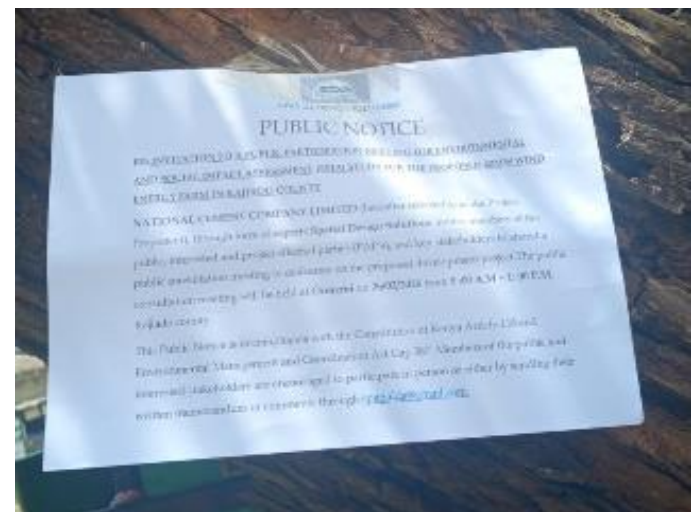


Photo 2: On-Site and ads on the dailies for Stakeholders Meeting

4.5 Stakeholder Consultation Outcomes

4.5.1 Key Issues Raised

The consultation process revealed several key concerns:

- Potential loss or restriction of grazing land;
- Noise from wind turbines;
- Visual impacts on the landscape;
- Potential impacts on wildlife, particularly birds;

- Land ownership and compensation concerns;
- Temporary disruptions during construction (traffic, access).

4.5.2 Positive Feedback

Stakeholders expressed general support for the Project, highlighting:

- Employment opportunities during construction and operation;
- Improvement of local infrastructure, especially access roads;
- Increased local economic activity;
- Contribution to clean and renewable energy generation.

4.5.3 Key Observations

- The project area is sparsely populated with dispersed settlements;
- Limited access to electricity, sewerage, and communication infrastructure;
- Communities rely on pastoralism and rainwater harvesting;
- Increasing land subdivision and development trends are evident.

4.6 Future Stakeholder Engagement Plan

Stakeholder engagement will continue throughout the project lifecycle as follows:

4.6.1 Public Participation and Disclosure

- Public consultation meetings will continue in collaboration with county government and local administration;
- ESIA reports and Non-Technical Summary (NTS) will be disclosed as required by NEMA;
- Stakeholders will be informed through public notices and local forums.

4.6.2 Ongoing Engagement

- Regular engagement with community leaders and representatives;
- Continuous information sharing during construction (traffic, safety, noise);
- Engagement with landowners along access roads and transmission corridors.

4.7 Grievance Redress Mechanism (GRM)

A project-level Grievance Redress Mechanism (GRM) will be established to:

- Provide stakeholders with a formal avenue to raise concerns or complaints;
- Ensure grievances are received, documented, and addressed in a timely manner;
- Promote transparency, accountability, and trust.

The GRM will be *accessible, culturally appropriate, and responsive*, with clear procedures for resolution and feedback.

4.8 Documentation and Evidence of Consultation

All stakeholder engagement activities have been documented. Supporting evidence to be included in the ESIA annexes comprises:

- Attendance registers;
- Photographs of public meetings;
- Copies of questionnaires and completed comment sheets;
- Public notices;
- Records of stakeholder feedback.

Stakeholder consultation and engagement for the proposed 60 MW Wind Farm Project has been conducted in accordance with national legal requirements and international best practices. The process has been inclusive and participatory, enabling stakeholders to express their views and contribute to the ESIA process.

The feedback received has been incorporated into project design, impact assessment, and mitigation planning. Engagement will continue throughout the project lifecycle to ensure that stakeholder concerns are effectively addressed and that the Project maintains social acceptability and sustainability.

CHAPTER 5: POLICY, LEGAL AND REGULATORY FRAMEWORK

5.1 Introduction

This chapter outlines and explains the policy, legal and regulatory framework applicable to the proposed 60 MW Kajiado Wind Farm Project by National Cement Company Limited (NCCL). The framework provides the basis upon which the Project has been planned, assessed, and will be implemented to ensure compliance with Kenyan law and alignment with international best practice for large-scale renewable energy developments.

Given the scale of the Project, its spatial footprint, and its potential environmental and social interactions, the ESIA has been undertaken in accordance with national legislation and with reference to international environmental and social safeguard standards commonly applied by development finance institutions (DFIs). These frameworks are relevant in guiding risk identification, mitigation, stakeholder engagement, biodiversity conservation, land access, occupational health and safety, and community protection.

5.2 National Policy and Legal Framework (Kenya)

5.2.1 Constitution of Kenya (2010)

The Constitution of Kenya provides the overarching legal foundation for environmental protection, sustainable development, and public participation. Article 42 guarantees every person the right to a clean and healthy environment, while Article 69 obligates the State and project proponents to ensure sustainable exploitation, utilization, management, and conservation of the environment.

For this Project, the Constitution underpins the requirement to:

- Undertake a comprehensive ESIA prior to project implementation;
- Involve affected communities through meaningful public participation; and
- Prevent environmental degradation while promoting sustainable energy development.

The principles of public participation, transparency, and accountability under Article 10 are particularly relevant given the presence of pastoralist communities and emerging residential developments within the Project area.

5.2.2 Environmental Management and Coordination Act (EMCA), Cap 387

EMCA is Kenya's principal framework law governing environmental management and protection. It establishes the National Environment Management Authority (NEMA) as the regulatory body responsible for reviewing and approving environmental impact assessments.

Under the Environmental (Impact Assessment and Audit) Regulations, 2003 (as amended), wind energy projects of this scale are classified as high-risk developments requiring a full Environmental and Social Impact Assessment (ESIA).

For the proposed Kajiado Wind Farm, EMCA is relevant in:

- Mandating the preparation and approval of this ESIA prior to construction;
- Requiring identification, assessment, and mitigation of environmental and social impacts;
- Providing for environmental monitoring and audits during project implementation; and
- Ensuring continued regulatory oversight throughout the project lifecycle.

5.2.3 Environmental (Impact Assessment and Audit) Regulations, 2003 (as amended)

These Regulations operationalize EMCA and provide procedural guidance on how ESIA studies should be conducted. They specify requirements for scoping, stakeholder consultation, impact assessment, reporting and decision-making.

In relation to this Project, the Regulations require:

- Disclosure of project information to affected stakeholders;
- Public participation through consultations and documentation of stakeholder concerns;

- Submission of an ESIA Study Report to NEMA for review; and
- Implementation of mitigation and monitoring measures through an Environmental and Social Management Plan (ESMP).

5.2.4 Energy Act, 2019

The Energy Act, 2019 provides the legal framework for the generation, transmission, distribution, and supply of electrical energy in Kenya. It promotes renewable energy development as part of national energy security and climate change mitigation efforts.

The relevance of the Energy Act to this Project includes:

- Licensing of power generation facilities by the Energy and Petroleum Regulatory Authority (EPRA);
- Compliance with technical and safety standards for electricity generation and transmission;
- Coordination with Kenya Power and Lighting Company (KPLC) and relevant grid operators for interconnection at the Kimuka Substation.

5.2.5 Physical and Land Use Planning Act, 2019 (PLUPA)

The Physical and Land Use Planning Act governs land use planning and development control in Kenya. Under PLUPA, utility infrastructure such as wind farms falls under strategic or public utility land use.

For this Project, PLUPA is relevant in:

- Ensuring compatibility of the wind farm with surrounding land uses, including pastoralism, emerging residential developments, and tourism activities;
- Guiding approval of development plans by Kajiado County Government;
- Managing potential land use conflicts arising from subdivision and sale of plots within the Project area.

5.2.6 Land Act, 2012 and Land Registration Act, 2012

These Acts govern land ownership, acquisition, registration, and use in Kenya. They are particularly relevant given that the Project involves multiple parcels of land under private ownership.

Their relevance includes:

- Securing legal land access agreements for turbine sites, access roads, substation, and transmission line wayleaves;
- Protecting landowners' rights and ensuring lawful compensation where applicable;
- Preventing involuntary displacement through proper planning and engagement.

5.2.7 Occupational Safety and Health Act (OSHA), 2007

OSHA provides the legal framework for ensuring safe and healthy working conditions. Given the construction and operation of tall structures and heavy equipment, this Act is particularly relevant.

The Act applies to:

- Construction-phase activities such as foundation works, turbine erection, and transmission line installation;
- Operational health and safety for maintenance personnel;
- Implementation of safety procedures, training, and provision of personal protective equipment (PPE).

5.3 International Best Practice and Lender Safeguard Frameworks

5.3.1 IFC Performance Standards (2012)

The IFC Performance Standards provide an internationally recognized framework for managing environmental and social risks in large infrastructure projects. Although not legally binding in Kenya, they are widely adopted by lenders and provide benchmarks for good international industry practice.

PS1 – Assessment and Management of Environmental and Social Risks and Impacts

is central to this ESIA, as it requires systematic identification, mitigation, monitoring, and stakeholder engagement throughout the project lifecycle.

PS2 – Labour and Working Conditions is relevant due to the anticipated construction workforce and ongoing operational staff, ensuring fair treatment, occupational safety, and compliance with labour laws.

PS3 – Resource Efficiency and Pollution Prevention supports the Project's renewable energy objectives while guiding management of waste, emissions and material used during construction and operation.

PS4 – Community Health, Safety and Security addresses risks related to construction traffic, turbine safety, transmission lines, and interaction with pastoralist livelihoods.

PS5 – Land Acquisition and Involuntary Resettlement is relevant in ensuring that land access arrangements do not result in physical or economic displacement without appropriate mitigation.

PS6 – Biodiversity Conservation is particularly relevant given the presence of birds, bats, and natural shrubland vegetation within the Project area.

PS8 – Cultural Heritage provides procedures for chance finds, should any archaeological or cultural resources be encountered.

5.3.2 IFC Environmental, Health and Safety (EHS) Guidelines

The IFC EHS Guidelines provide technical guidance on managing project-specific risks.

The **IFC EHS Guidelines for Wind Energy (2015)** are directly applicable and address issues such as:

- Noise emissions
- Shadow flicker
- Impacts on birds and bats
- Aviation safety and turbine marking
- Blade throw and public safety
- Visual and landscape impacts

- Transportation of abnormal loads.

The **IFC EHS Guidelines for Electric Power Transmission and Distribution (2007)** are relevant to the 220 kV transmission line connecting the Project to the Kimuka Substation, particularly regarding wayleaves, electromagnetic fields, and community safety.

5.3.3 EBRD Environmental and Social Policy (2019)

The EBRD classifies large-scale wind energy projects as Category A due to their potential for significant environmental and social impacts. The associated Performance Requirements reinforce many IFC principles while emphasizing EU environmental standards.

The policy is relevant in strengthening requirements on biodiversity protection, stakeholder engagement, land acquisition, and cumulative impact assessment.

5.3.4 African Development Bank (AfDB) Integrated Safeguards System (ISS)

The AfDB ISS provides a structured approach to managing environmental and social risks, with particular emphasis on community consultation, biodiversity conservation, and climate resilience.

Operational Safeguards OS1 (Environmental and Social Assessment), OS3 (Biodiversity), and OS5 (Labour Conditions) are especially relevant to this Project.

5.4 Applicability to the Proposed Kajiado Wind Farm

Collectively, the national and international frameworks outlined above ensure that the proposed 60 MW Kajiado Wind Farm is:

- Environmentally sustainable and compliant with Kenyan law;
- Socially responsible and respectful of pastoralist livelihoods and land tenure systems;
- Designed and operated in accordance with international good practice for wind energy projects; and
- Aligned with Kenya's renewable energy and climate change objectives.

These frameworks guide the impact assessment, mitigation measures, monitoring programs, and stakeholder engagement strategies presented in subsequent chapters of this ESIA.

CHAPTER 6: ANALYSIS OF ALTERNATIVES

6.1 Introduction

The analysis of alternatives is a core requirement of an Environmental and Social Impact Assessment (ESIA) as prescribed under the Environmental Management and Coordination Act (EMCA), Cap 387, and the Environmental (Impact Assessment and Audit) Regulations, 2003. This chapter evaluates feasible alternatives to the proposed wind farm project, including site selection, technology options, design considerations, and the no-project alternative. The objective is to demonstrate that the proposed project represents the most environmentally, socially, technically, and economically viable option.

6.2 Site Selection Alternatives

6.2.1 Initial Site Consideration – Kwale County

The initial site for the proposed wind energy project was identified within an area of approximately **157.38 hectares in Kananga Sub-County, Kwale County**, located about 6 km from Samburu Town along the Nairobi–Mombasa Highway. The area lies approximately 18 km east of Marikana Town and towards the western side of Samburu Village. The locality is predominantly inhabited by the indigenous Duruma community, whose livelihoods are largely based on subsistence agriculture, livestock keeping, and utilization of natural resources.

The site was initially considered due to its apparent availability of land, proximity to existing transport infrastructure, and minimal settlement density within the immediate project footprint. Preliminary environmental and ecological assessments were therefore undertaken to establish the site's suitability for wind power development.

6.2.2 Environmental and Ecological Suitability of the Initial Site

Transect surveys and vantage point observations were conducted to assess avifaunal presence and potential risks associated with wind turbine installation. The surveys

indicated that only a limited number of bird species were likely to breed within the project footprint, primarily **small-bodied passerines**, which are generally regarded as having a low risk of collision with wind turbines.

Several **raptor** the **species** were recorded within wider area, albeit in very low numbers. Raptors are internationally recognized as being more vulnerable to turbine collision due to their soaring flight behavior. Notably, **Augur Buzzards** and **Tawny Eagles** were observed intermittently during the survey period, though their population density was considered low.

Additional reference was made to avifaunal studies undertaken in comparable industrial landscapes, including assessments conducted at **Devki Steel Mills Limited**, which provided broader contextual understanding of bird species composition, migratory status, conservation importance, and vulnerability to wind farm developments. These studies highlighted that raptors represent the most sensitive group requiring focused monitoring, while medium-sized species may present moderate risk. Evidence of breeding activity for a limited number of species, including the **Kori Bustard**, was also recorded.



Photo 3: Augur Buzzards and Tawny Eagles types of birds observed over the survey period

It is noted that vantage point observations are inherently limited to daylight hours and periods of adequate visibility, and therefore may not fully capture nocturnal or low-visibility movements. This limitation was acknowledged during the assessment process.

6.2.3 Wind Resource Constraints and Site Abandonment

Despite the ecological impacts at the Kwale County site being assessed as potentially manageable through mitigation and monitoring, subsequent detailed wind resource assessments revealed that wind speeds and prevailing wind patterns were insufficient to sustain a technically and economically viable wind energy project. The wind regime did not meet the minimum thresholds required for efficient turbine operation, long-term energy yield, and financial feasibility.

Given that adequate and consistent wind resource availability is a fundamental requirement for wind power projects, this limitation was considered critical.

Consequently, the Kwale County site was *abandoned as a viable option*, demonstrating the proponent's commitment to evidence-based planning and technical due diligence.

6.2.4 Selected Site Alternative – Kajiado County

Following the rejection of the initial site, alternative locations with proven wind potential were evaluated, leading to the selection of the current project site in *Kajiado County*. The selected site benefits from:

- Documented and sustained wind regimes suitable for utility-scale wind energy generation;
- Relatively sparse settlement patterns, reducing potential land use conflicts;
- Compatibility with existing land uses, primarily extensive grazing;
- Availability of multiple land parcels whose combined area can accommodate turbine foundations, access roads, internal cabling, and ancillary infrastructure;
- Feasibility of implementing environmental and social mitigation measures.

Based on these considerations, the Kajiado County site was identified as the most suitable alternative for the proposed project.

6.3 Technology Alternatives

6.3.1 Renewable Energy Technology Alternatives

Kenya has adopted an energy diversification strategy emphasizing increased reliance on renewable energy sources, as articulated in the *Least Cost Power Development Plan (LCPDP)* and national climate change commitments. Renewable energy alternatives suitable within the Kenyan context include wind, solar (photovoltaic and concentrated solar power), geothermal, and hydropower.

Solar energy projects are widely implemented in Kenya due to high solar irradiation levels; however, the land area required to generate equivalent capacity compared to wind energy is significantly larger. Additionally, the selected project site demonstrates superior wind resource potential relative to solar energy yield.

Geothermal energy development is geographically constrained to the Rift Valley region and is therefore not feasible at the proposed site. Hydropower development is similarly limited by hydrological and topographical requirements and is not applicable in the project area.

Given the site-specific resource availability, wind energy represents the most appropriate and efficient renewable energy technology for the proposed location.

6.3.2 Conventional Thermal Power Plants

Conventional thermal power generation using fossil fuels was considered as an alternative; however, such developments are associated with significant adverse environmental impacts, including high greenhouse gas emissions, air pollution, and water consumption. Furthermore, thermal power plants are inconsistent with Kenya's commitment to low-carbon development and climate change mitigation.

Consequently, conventional thermal power generation was deemed environmentally unsustainable and incompatible with national energy policy objectives.

6.4 Design Alternatives

Design alternatives focused on turbine layout, spacing, access road alignment, and auxiliary infrastructure placement. The final design was informed by detailed wind modeling, topographical analysis, land ownership patterns, and environmental sensitivity considerations.

Key design principles adopted include:

- Optimization of turbine spacing to maximize energy yield while minimizing wake effects;
- Avoidance of environmentally sensitive features where identified;
- Use of underground cabling for internal electrical connections to reduce visual intrusion and ecological disturbance;
- Alignment of access roads along existing tracks where feasible to minimize land disturbance.

These measures ensure that the final design balances energy efficiency with environmental and social safeguards.

6.5 No-Project Alternative

The no-project alternative assumes that the proposed wind farm is not developed and that the project site remains under its current land use, characterized primarily by open grazing and undeveloped land.

Under this scenario, project-related environmental and social impacts would be avoided. However, the positive impacts associated with renewable energy development would also not be realized. These include contributions to national energy security, reduction of greenhouse gas emissions, local employment creation, infrastructure improvement and alignment with Kenya's renewable energy and climate change objectives.

Considering that the anticipated negative impacts of the proposed project are largely site-specific, moderate and manageable through implementation of the Environmental

and Social Management Plan (ESMP), the no-project alternative is not considered preferable.

6.6 Preferred Alternative

Based on the analysis presented above, the preferred alternative is the implementation of the wind energy project at the selected Kajiado County site using modern wind turbine technology and environmentally responsive design. This option offers the most balanced outcome in terms of technical feasibility, environmental sustainability, social acceptability and economic viability.

CHAPTER 7: EXISTING PHYSICAL, BIOLOGICAL AND SOCIAL ENVIRONMENT

7.1 Introduction

This chapter describes the existing environmental and social conditions in and around the proposed Kajiado Wind Farm Project area. It draws on field assessments, climate and hydrology databases, land use information, biodiversity surveys, and socio-economic context for the region. The aim is to establish a robust baseline for subsequent assessment of potential impacts and mitigation measures.

7.2 Landscape, Topography and Visual Environment

7.2.1 Landscape Character

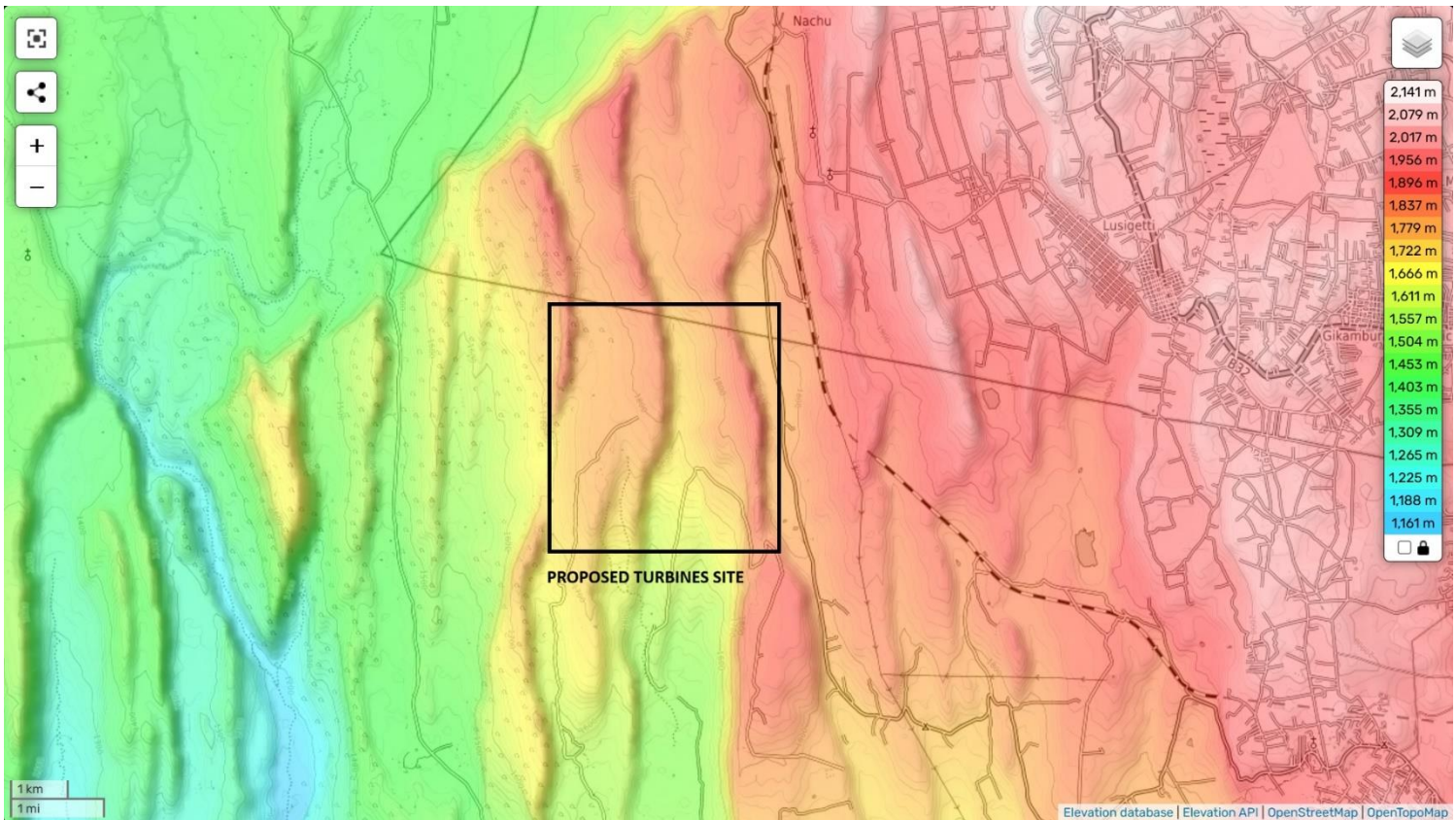
The Project lies in **semi-arid southern Kenya** dominated by open rangelands typical of the **Arid and Semi-Arid Lands (ASALs)**. The landform consists of gently undulating plains interspersed with **three distinct ridges**, which have been selected as the preferred locations for turbine siting due to their elevation and wind exposure. The region's visual character is expansive with wide horizons, large open skies, and minimal dense vegetation, offering a largely **natural to semi-natural visual environment** with low settlement density.

Vegetation cover is generally sparse, largely consisting of grasslands and shrublands dominated by **Acacia spp.** and other drought-tolerant shrubs, interspersed with patches of bare ground and occasional rocky outcrops. The ridgelines rise gently above the plains and provide the most prominent features in the local topography.

7.2.2 Terrain and Physical Features

- **Ridges and Plains:** The Project area consists of a series of low ridges rising above expansive plains. Elevations across turbine locations range from about 1,655 m to 1,881 m above sea level, indicating gentle relief with gradual slope changes.

- **Surface Drainage:** Shallow drainage lines and ephemeral gullies occur across the site, indicating surface runoff during heavy rainfall episodes. These features are not permanent watercourses but reflect occasional high-energy events from storm runoff, typical of ASAL environments.



Map 5: Terrain of Proposed site in Kajiado

7.2.3 Visual Receptors

Receptors within the 10 km radius include:

- **Dispersed pastoral homesteads (manyattas) and livestock corridors**, often constructed of traditional materials and scattered across the rangeland.



Photo 4: A pastoral homestead within proposed site

- **Access tracks and community roads**, used by pastoralists and occasional motorized traffic.



Photo 5: Access tracks observed

- **Scattered eco-tourism lodges and camps** that capitalize on the scenic semi-arid landscape.



Photo 6: An eco-tourism park observed near site

The open landscape means turbines may be visible from distant vantage points under clear visibility conditions, but there are **no dense urban settlements** or significant built heritage sites in immediate proximity. Visual sensitivity is therefore assessed as **low to moderate**, heavily influenced by cultural familiarity with expansive landscapes.

7.3 Land Use and Tenure

7.3.1 Baseline Methodology

Land use analysis combined field land surveys, review of cadastral maps, and consultations with local county officials, community leaders, and pastoralists.

7.3.2 Formal Land Use

The Project area falls largely outside formal urban development zones and is not subject to intensive agricultural or industrial use. Kajiado County's land use is overwhelmingly characterized by **extensive rangelands supporting livestock grazing and wildlife habitat**. According to the County Spatial Plan, over 90 % of the land is under natural

forage used for **extensive livestock production** with very limited formal crop agriculture due to low and erratic rainfall typical of ASAL conditions.

Land ownership in the region is predominantly under **registered private titles** and group ranches that have historically supported pastoralism. The Project has secured access agreements with landowners for turbine installations and associated infrastructure.

7.3.3 Customary Land Use and Pastoralism

Pastoralist Maasai communities predominate in the area, relying on **mobile livestock grazing** as a primary livelihood. Livestock movements are influenced by rainfall variability and pasture availability, with livestock including cattle, goats, sheep and donkeys. Pastoralism reflects long-standing customary land use practices that focus on extensive grazing across large tracts of land.

Water pans and shallow troughs are used seasonally for livestock watering, but no significant perennial rivers traverse the Project footprint. Intermittent surface water bodies and seasonal pans serve both pastoral and wildlife needs during brief rainy periods.



Photo 7: Livestock grazing and a water pan for their use in the area.

7.4 Geology, Soils and Topography

7.4.1 Geological Setting

The Project area lies on stable basement terrain typical of the Kenya Craton, with underlying Precambrian metamorphic and igneous rocks overlain by shallow soils and colluvial deposits. Bedrock at ridge locations provides suitable support for turbine foundations, subject to detailed geotechnical investigation as part of design and construction planning.

7.4.2 Soils

Soils in the site area are primarily **shallow, coarse textured, and low in organic matter**, common in semi-arid environments. These include **Ferrasols and Cambisols** in some areas supporting grazing and wildlife habitat. The soils exhibit **moderate to high susceptibility to wind and gully erosion** when protective vegetation cover is sparse.



Photo 8: The soil type in the area that is susceptible to wind and gully erosion

Table 1: Soil Characteristics

Soil Type	Location/Description	Characteristics / Suitability
Ferrasols	Shallow ridge soils	Low fertility, coarse texture, moderate erosion risk
Cambisols	Lower slopes and valleys	Sandy to loamy, low organic matter, moderate water retention
Colluvial Soils	Foot of ridges, minor ephemeral drainage	Stony, supports foundation stability with excavation

Table 4: Soil Characteristics at the Project site

7.5 Hydrology

7.5.1 Surface Hydrology

There are **no permanent rivers or perennial surface water bodies** within the Project footprint. Surface drainage is dominated by ephemeral channels and shallow depressions that temporarily capture stormwater during the rainy seasons. Local hydrological dynamics are driven by seasonal rainfall patterns, with flash floods occurring during intense rainfall events that can generate rapid runoff and shallow flow across the plains.

7.5.2 Groundwater

Groundwater resources in much of Kajiado are limited and vary spatially. Access is typically through **boreholes and drilled wells** located outside the Project area and used by local communities and livestock. Borehole depths vary widely and water quality ranges from brackish to moderately saline, reflecting semi-arid recharge conditions and limited aquifer connectivity.

The Project will avoid impacts on existing boreholes and shall ensure adequate setbacks for turbine foundations and access roads relative to identified water points.

7.6 Climate

Kajiado County's climate is characteristic of **semi-arid to arid zones**, with high temperatures, low and highly variable rainfall, and considerable seasonal fluctuation.

7.6.1 Temperature

Average annual temperatures in the region typically range from about **18 °C to 30 °C**, with warmer periods from November to April and relatively cooler conditions between June and August.

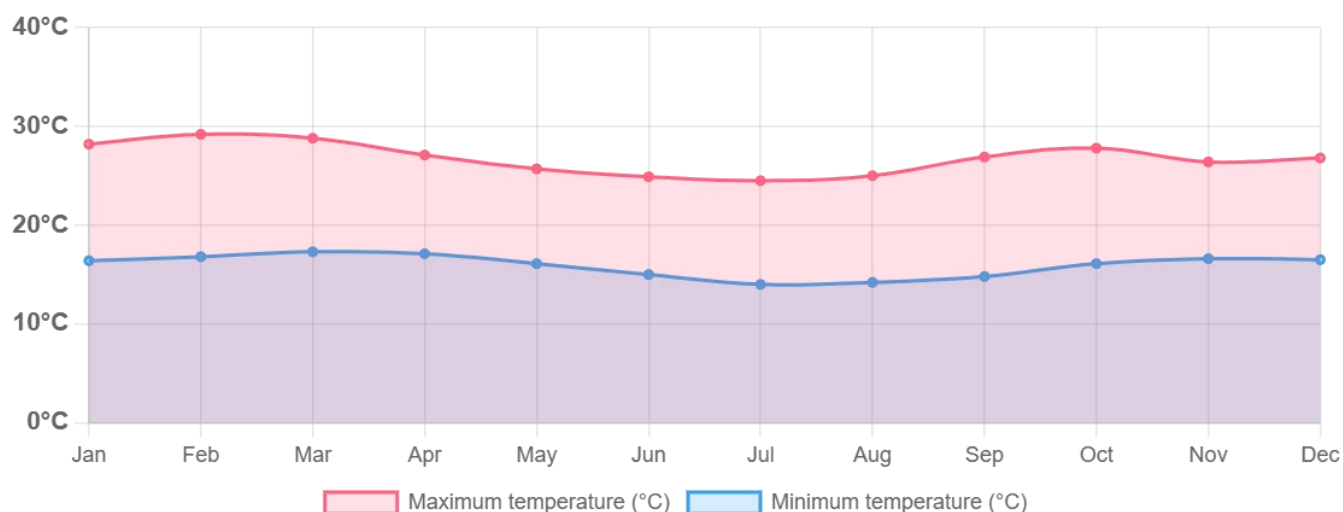


Diagram 1: An illustration of the average maximum day and minimum night temperatures in Kajiado by month:

7.6.2 Rainfall

Annual precipitation in Kajiado generally falls between **300 mm and 800 mm**, with rainfall occurring in **bimodal patterns** – the “long rains” (March–May) and “short rains” (October–December). However, rainfall is highly unreliable and spatially variable, contributing to frequent drought conditions

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Nov	Oct	Dec	Year
Record high °C (°F)	30.0 (86.0)	31.0 (87.8)	30.0 (86.0)	29.0 (84.2)	26.0 (78.8)	26.0 (78.8)	27.0 (80.6)	28.0 (82.4)	28.0 (82.4)	29.0 (84.2)	27.0 (80.6)	27.0 (80.6)	31.0 (87.8)
Average high °C (°F)	24.41 (75.94)	25.77 (78.39)	25.77 (78.39)	23.91 (75.04)	22.66 (72.79)	22.33 (72.19)	22.43 (72.37)	23.1 (73.58)	24.61 (76.3)	25.17 (77.31)	23.36 (74.05)	23.16 (73.69)	23.89 (75.0)

Daily mean °C (°F)	20.86 (69.55)	21.68 (71.02)	22.12 (71.82)	20.91 (69.64)	19.65 (67.37)	19.02 (66.24)	18.73 (65.71)	19.33 (66.79)	20.76 (69.37)	21.94 (71.49)	20.81 (69.46)	20.34 (68.61)	20.51 (68.92)
Average low °C (°F)	15.6 (60.08)	16.4 (61.52)	17.53 (63.55)	17.23 (63.01)	15.7 (60.26)	14.27 (57.69)	13.67 (56.61)	14.45 (58.01)	15.82 (60.48)	17.41 (63.34)	17.19 (62.94)	16.28 (61.3)	15.96 (60.73)
Record low °C (°F)	11.0 (51.8)	12.0 (53.6)	13.0 (55.4)	9.0 (48.2)	10.0 (50.0)	9.0 (48.2)	9.0 (48.2)	10.0 (50.0)	11.0 (51.8)	13.0 (55.4)	7.0 (44.6)	9.0 (48.2)	7.0 (44.6)
Avg precipitation mm (inches)	112.97 (4.45)	92.87 (3.66)	142.0 (5.59)	204.5 (8.05)	100.0 (3.94)	36.91 (1.45)	22.23 (0.88)	22.57 (0.89)	23.77 (0.94)	72.5 (2.86)	201.4 (7.93)	165.6 (6.52)	96.67 (3.81)
Avg precipitation days (≥ 1.0 mm)	12.73	12.18	18.36	24.27	21.18	10.73	6.91	7.0	6.36	14.64	25.27	21.18	15.07
Avg relative humidity (%)	73.34	69.47	71.72	82.18	82.92	77.39	72.28	68.5	65.75	67.16	80.49	82.26	74.45
Mean monthly sunshine hours	11.24	11.18	10.99	10.73	10.9	11.13	11.03	11.28	11.27	11.41	10.78	11.16	11.09

Table 5: Illustration of the rainfall pattern in Kajiado county

7.6.3 Wind Climate

The Project's ridges benefit from relatively consistent wind regimes compared to surrounding plains, which is a key reason for siting wind turbines on elevated terrain. Meteorological data from nearby stations indicate average winds consistent with Class.

Wind	Max	Average	Min
Wind	14.0kmh 8.7mph	11.1kmh 6.9mph	5.0kmh 3.11mph
Gust Wind	18.0kmh 11.18mph	14.13kmh 8.78mph	7.0kmh 4.35mph

Table 6: Metrological data showing wind climate of the project area

3–4 wind power potential typical of elevated parts of Kajiado, with prevailing winds generally from the northwest to northeast.

Seasonal dust storms (local *Kusi* winds) can occur, particularly in dry months.

7.6.4 Climate Variability and Risk

The region is highly susceptible to **drought and climate variability**, with trends toward increased temperatures, longer dry spells and unreliable rainfall. Such climatic conditions influence pastoral livelihoods, water availability and ecosystem dynamics.

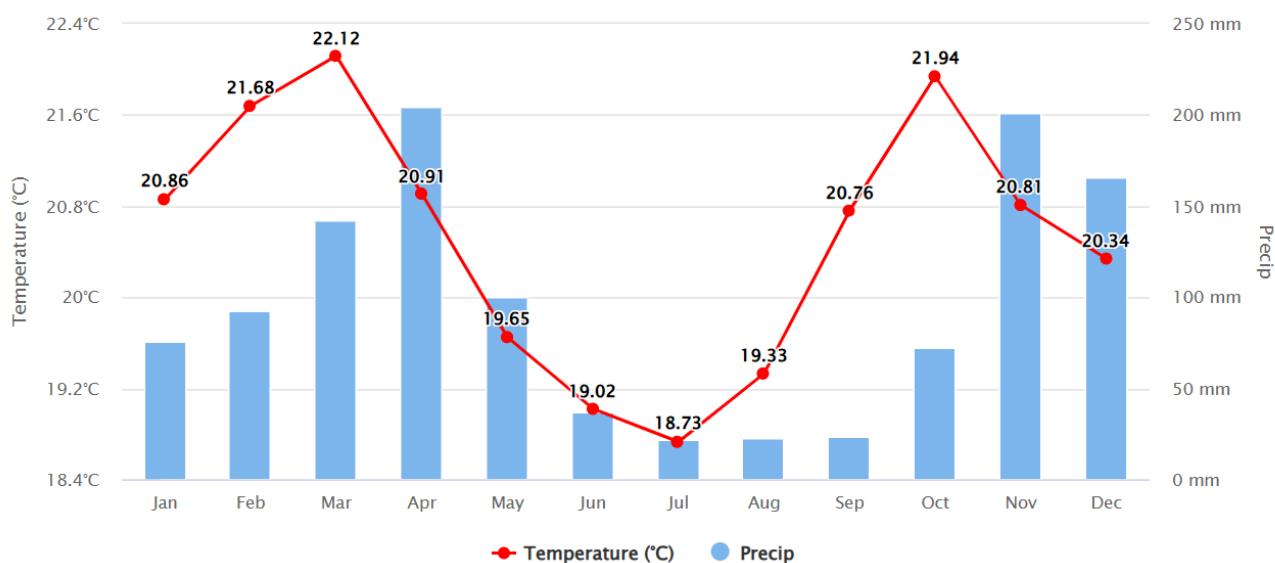


Diagram 2: An illustration of the climate variability and risk of Kajiado county

Parameter	Value / Range	Notes
Annual Rainfall	300–800 mm	Highly variable, bimodal (Mar–May, Oct–Dec)
Average Temperature	18–30 °C	Warmest Nov–Apr, coolest Jun–Aug
Relative Humidity	40–65 %	Lower in dry months
Wind Speed (average)	5–7 m/s at ridge level	Suitable for Class 3–4 wind turbines
Prevailing Wind Direction	NW–NE	Supports optimal turbine orientation
Climate Risk	Drought, flash floods	Semi-arid environment

Table 7: Climate Summary – Kajiado County

7.7 Biological Environment

7.7.1 Flora

Vegetation in the Project area is typical of ASAL savannah and scrubland systems, dominated by:

- Acacia spp.
- Drought-tolerant shrubs and grasses
- Sparse understorey of herbaceous species on plains and ridges

The low vegetation cover reflects limited moisture availability and extensive grazing pressure. No plant taxa with national or international conservation concern have been identified in the immediate Project footprint.



Photo 9: The Acacia type of plant species in the project area

7.7.2 Fauna

Faunal assemblages include:

- **Avifauna:** A mix of resident and migratory birds, including raptors, (discussed in chapter 6) and passerines observed during field surveys. Local migration patterns indicate intermittent use of the landscape during seasonal movements.
- **Reptiles:** Species adapted to semi-arid environments such as agamas and other small lizards.
- **Mammals:** Small mammals and occasional sightings of larger species such as **jackals or foxes**; larger wildlife movements occur in broader Kajiado landscapes, especially toward Amboseli and Maasai Mara ecosystems.



Photo 10: Superb Starling bird in the area and their nests

Wildlife populations have generally declined over recent decades due to landscape fragmentation, drought and human pressures. However, there are some few cases of hyenas attacking livestock especially at night.

Category	Representative Species / Groups	Notes
Trees/Shrubs	Acacia spp., Commiphora spp., Grewia spp.	Drought-tolerant, sparse cover
Grasses	Themeda triandra, Cenchrus ciliaris	Pasture species for livestock
Birds	Bateleur eagle, Superb Starling Bird,	Mix of resident and migratory
Mammals	Jackal, hyrax, small rodents	Larger wildlife moves through broader rangelands
Reptiles	Agama lizards, skinks	Typical of semi-arid areas

Conservation Status	No nationally endangered species observed onsite	Wildlife exists mostly in low densities
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Table 8: Flora and Fauna

7.8 Socio-Economic and Cultural Environment

7.8.1 Population and Settlement

The Project area is sparsely populated, with low population densities in southern parts of Kajiado. Settlements are generally small pastoral communities, with many households engaged in livestock keeping and associated pastoral livelihoods.

The current trends however show an upcoming suburban settlement characterized by single-dwelling housing units. The area is undergoing parcel subdivision to fit for small housing units.

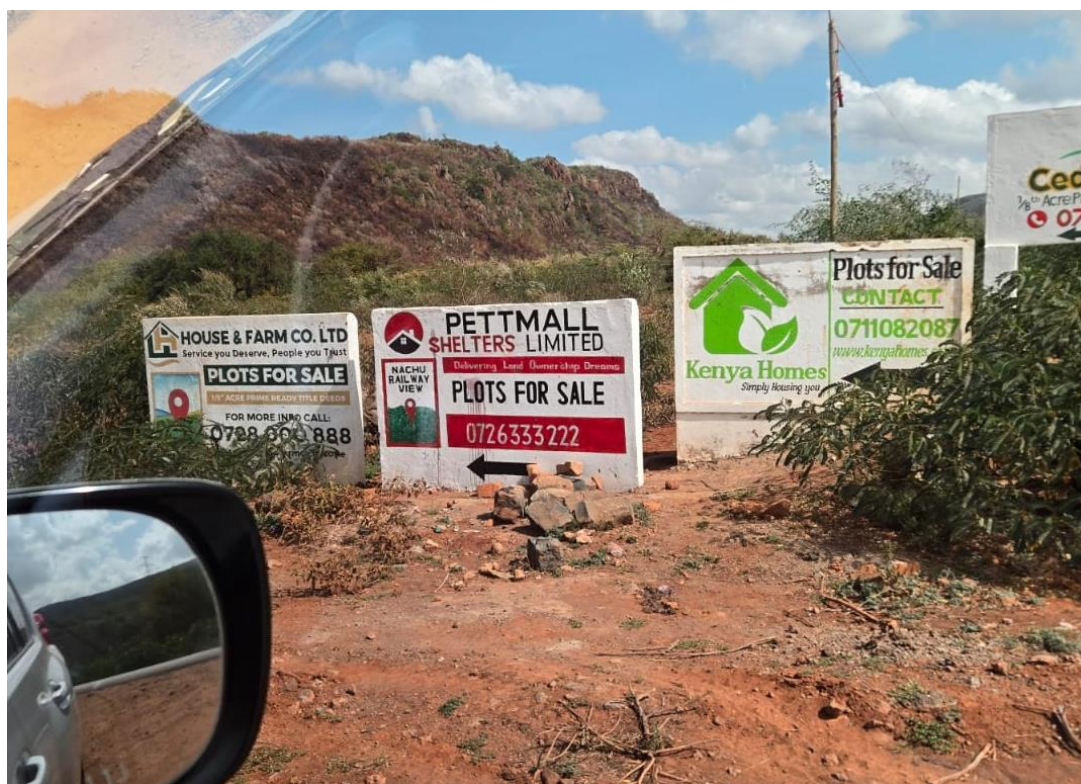


Photo 11: Real Estate Company ads for plots in the proposed area

7.8.2 Economic Activities

- **Pastoralism:** Primary economic activity, with livestock representing a major asset for local households. Pastoralists utilize extensive grazing lands and seasonal water sources.
- **Small-scale horticulture/agriculture:** Limited to areas with better soil moisture.
- **Eco-tourism:** Scattered lodges and camp facilities attract visitors to semi-arid landscapes and wildlife areas, though tourism is limited compared to major national parks.

Feature	Description / Value	Notes
Dominant Land Use	Pastoralism / Livestock grazing	Maasai pastoral communities
Settlement Type	Scattered homesteads (manyattas)	Low-density
Livestock	Cattle, goats, sheep and donkeys	Primary livelihood source
Agriculture	Limited, small-scale horticulture	Dependent on rainfall and water pans
Cultural Significance	Maasai traditions and communal land use	Community decisions via elders
Infrastructure	Minor roads, livestock tracks	Access for construction requires upgrades
Population Density	Sparse, ~10–30 people/km ²	Reflects semi-arid low-density environment

Table 9: Socio-Economic Features

7.8.3 Cultural Context

The Maasai cultural identity is strong and tied to pastoralism, livestock wealth, and customary social structures. Cultural norms emphasize communal land use, livestock mobility, and traditional decision-making through elders and community leaders.



Photo 12: A Maasai herds boy

7.9 Summary of Baseline Conditions

The existing environment within the Project area is a **low-density, semi-arid pastoral landscape** characterized by:

- Gently rolling ridges with high wind potential
- Sparse vegetation and low soil organic content
- Limited surface water and highly variable rainfall
- Pastoralist Maasai communities as the primary land users
- Biodiversity typical of ASAL ecosystems with limited conservation concern species locally



Photo 13: The scattered drought resistant shrubs in the project area

CHAPTER 8: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

8.1 Overview of Strategic Environmental and Economic Impacts

This Chapter presents an assessment of the anticipated environmental and social impacts associated with the proposed **60 MW Kajiado Wind Farm Project** to be developed by **National Cement Company Limited (NCCL)**. The assessment is structured to align with the methodology and layout applied in the reference Cairo Wind Power ESIA, while being fully contextualized to the Kenyan regulatory, environmental, and socio-economic setting.

The impact assessment covers impacts arising during the **construction, operation** and where applicable, **decommissioning** phases of the Project. Impacts are described qualitatively where site-specific quantitative baseline data is unavailable, in accordance with standard ESIA practice and without introduction of speculative or assumed data.

8.1.1 Governmental Vision for the Energy Sector

The proposed wind power project is aligned with the Government of Kenya's strategic objectives for increasing renewable energy generation, diversifying the national energy mix, and enhancing long-term energy security. Kenya's energy policy framework emphasizes the expansion of clean and renewable energy sources to meet growing demand while reducing greenhouse gas emissions.

The development of a utility-scale wind energy facility in Kajiado County supports national goals related to climate change mitigation, promotion of private sector participation in energy generation and regional infrastructure development. The Project contributes additional renewable capacity to the national grid and complements existing wind energy developments in the wider Kajiado-Ngong region.

8.1.2 Energy Security

The Project's installed capacity of approximately **60 MW**, generated through **38 wind turbine generators**, will contribute to strengthening Kenya's electricity supply

reliability. Wind energy provides a non-fossil fuel-based source of power that reduces dependence on hydropower during drought periods and on thermal generation during peak demand.

Connection of the Project to the national grid via the **Kimuka Substation**, located approximately 8 km east of the site, will facilitate integration of the generated power into the existing transmission network and support grid stability within the Nairobi metropolitan and adjacent regions.

8.1.3 Environmental Benefits

The Project is expected to result in positive environmental impacts at a strategic level through the displacement of electricity that would otherwise be generated from fossil fuel-based sources. This contributes to the reduction of greenhouse gas emissions and air pollutants at the national level.

The utilization of wind as a renewable resource does not involve fuel extraction, combustion, or water consumption during operation, thereby minimizing long-term environmental footprint compared to conventional power generation technologies.

8.2 Landscape and Visual Impacts

8.2.1 Potential Impacts during the Construction Phase

During the construction phase, temporary visual impacts are expected as a result of site clearance, earthworks, construction of turbine foundations, establishment of WTG platforms (approximately 120 m by 120 m each), access road upgrades and installation of transmission infrastructure.

The presence of construction equipment, material storage areas and increased vehicular activity may alter the visual character of the landscape temporarily. These impacts are expected to be localized and reversible upon completion of construction activities.

8.2.2 Potential Impacts during the Operation Phase

During operation, the wind turbine generators, with hub heights of approximately **80 m** and tip heights of **121.25 m**, will constitute prominent vertical elements within the landscape. Given the generally flat to gently undulating terrain and the open rangeland character of the area, the turbines will be visible from various viewpoints.

The surrounding area is currently sparsely populated, with emerging residential developments and resort facilities. While the turbines will introduce a new visual element, the presence of existing large-scale infrastructure such as the Standard Gauge Railway (SGR) corridor and other wind energy facilities in the broader region moderates the overall magnitude of visual change.

8.3 Land Use

8.3.1 Potential Impacts during the Planning, Construction, and Operation Phases

The Project area is characterized by semi-arid rangeland traditionally used for pastoralism, alongside increasing subdivision of land into smaller residential plots and the establishment of resort developments. The development of the wind farm will result in partial and localized land take for turbine foundations, internal access roads, substations and transmission wayleaves.

Land use impacts are expected to be moderate and largely compatible with existing pastoral land use, as livestock grazing can continue around turbine installations with minimal restriction. Permanent land take will be limited to infrastructure footprints, while the majority of the Project area will remain accessible.

8.4 Geology, Hydrology, and Hydrogeology

8.4.1 Potential Impacts from Flood Risks on the Project Site

The Project site is located within an area of gently sloping terrain, generally draining from north to south. No permanent surface water bodies were observed within the immediate Project footprint during site reconnaissance.

Potential flood-related impacts are expected to be low, provided that appropriate surface drainage measures are incorporated into the design of access roads, turbine platforms and substation areas.

8.4.2 Potential Impacts from Improper Management of Waste Streams during Construction

Construction activities will generate solid and liquid waste streams including excavated materials, packaging waste and domestic waste from construction personnel. Improper handling or disposal of these wastes could result in localized soil and water contamination.

These impacts are preventable through implementation of standard waste management practices and adherence to applicable Kenyan environmental regulations.

8.4.3 Potential Impacts from Erosion and Runoff during the Construction Phase

Ground disturbance associated with excavation and earthworks may increase the risk of soil erosion, particularly during periods of intense rainfall. Erosion impacts are expected to be localized and temporary, provided that erosion control measures are implemented during construction.

8.5 Biodiversity

8.5.1 Potential Impacts during the Construction Phase

The Project area supports natural vegetation dominated by shrubs typical of semi-arid rangelands. Construction activities will result in localized vegetation clearance within turbine platform areas, access roads, and other infrastructure footprints.

Faunal diversity within the Project area is limited. No sensitive habitats or protected areas were identified within the immediate Project footprint during site visits. Disturbance to fauna during construction is expected to be temporary and localized.

8.5.2 Potential Impacts during the Operation Phase

Potential operational impacts include collision risk for avifauna. Observations during site reconnaissance indicated the presence of a limited number of low-flying bird species. No significant bird migration corridors or high-density avifaunal habitats were identified at the Project site.

Based on current observations, the risk of significant impacts to bird populations is expected to be low. Detailed monitoring and adaptive management measures may be implemented as part of operational environmental management where required.

8.6 Greenhouse Gas (GHG) Emissions Assessment

This section presents an assessment of potential greenhouse gas (GHG) emissions associated with the proposed project across its entire lifecycle, including pre-construction, construction, operation, and decommissioning phases. The objective of the assessment is to identify key emission sources, characterize the nature and magnitude of emissions, and evaluate the overall climate impact of the project.

GHG emissions from the project are primarily linked to fuel combustion from construction machinery, transportation of materials and components, and limited auxiliary energy use during operation. In addition, indirect emissions are anticipated from the production of construction materials, particularly cement used in turbine foundations. These emissions are largely short-term and confined to the construction phase, after which the project's operational emissions are expected to be minimal.

Importantly, as a renewable energy development, the project will generate clean electricity and displace fossil fuel-based power generation within the national grid. This results in significant avoided GHG emissions over the project's operational lifespan,

contributing positively to climate change mitigation and supporting national and global low-carbon development objectives.

The table below provides a consolidated summary of identified GHG emission sources, their characteristics, estimated magnitudes, and the overall climate impact of the project.

8.6.1 Consolidated Greenhouse Gas (GHG) Emissions and Climate Impact Summary

Project Phase	Activity / Source	Emission Pathway	Primary GHGs	Estimated Magnitude	Duration / Frequency	Significance (Pre-Mitigation)	Key Remarks
Pre-Construction	Site surveys and geotechnical investigations	Fuel combustion from vehicles and drilling equipment	CO ₂ , CH ₄ , N ₂ O	Low	Short-term	Minor	Limited to initial site investigations and access activities
Construction	Earthworks (excavation, grading, foundations)	Operation of heavy construction machinery	CO ₂ , CH ₄ , N ₂ O	Medium	Continuous (~24 months)	Moderate	Includes excavators, graders, cranes, batching plants
	Transport of turbines and materials	Fuel combustion from heavy-duty trucks	CO ₂ , CH ₄ , N ₂ O	Medium-High	Intermittent (multiple trips)	Moderate	Long-haul and local transport of oversized components

	Concrete production (foundations)	Indirect emissions from cement manufacturing	CO ₂	High (one-time)	One-off per foundation	Moderate	Major embodied carbon source in construction phase
	Workforce logistics and site operations	Diesel generators and vehicles	CO ₂	Low-Medium	Intermittent	Minor	Power supply for camps and site offices
Construction Phase Total	Combined sources	—	CO ₂ , CH ₄ , N ₂ O	Moderate (short-term)	Temporary	Not Significant (after mitigation)	Emissions are non-recurring and limited to construction period
Operation	Maintenance activities	Service vehicle fuel use	CO ₂	Low		Minor	Routine inspections and servicing
	Auxiliary power use	Grid electricity / standby generators	CO ₂	Low	Continuous	Minor	Control systems, substations, lighting
	Standby diesel generators	Emergency fuel combustion	CO ₂	Very Low	Rare	Negligible	Used only during outages
Operational Phase Total	Combined sources	—	CO ₂	Very Low	Long-term	Not Significant	Minimal emissions relative to energy

							generate d
Decommissioning	Dismantling and site restoration	Machinery operation and transport	CO ₂ , CH ₄ , N ₂ O	Low-Medium	Short-term	Minor	Temporary emissions during end-of-life phase
Climate Benefit (Positive Impact)	Wind power generation (60 MW capacity)	Displacement of fossil-fuel-based grid electricity	Avoided CO ₂ emissions	High (thousands tCO ₂ e/year)	Continuous (25 years)	Major Positive Impact	Strong contribution to national low-carbon development and climate change mitigation

Table 10: Greenhouse Gas (GHG) Emissions and Climate Impact Summary

- Construction-related emissions are *temporary and moderate*, largely driven by machinery, transport, and cement use.
- Operational emissions are *negligible to very low*, consistent with renewable energy projects.
- The project delivers a *net positive climate impact, with significant avoided emissions* over its 25-year lifespan.
- Overall, the project aligns strongly with *Kenya's climate change mitigation and green energy goals*.

8.7 Climate Change Risk and Vulnerability Assessment

This section evaluates the potential risks posed by climate change to the proposed project, as well as the project's vulnerability to current and future climatic conditions.

The assessment considers how climate-related factors such as temperature variability, extreme weather events, changing rainfall patterns, and wind regime variability may affect the design, construction, operation, and long-term performance of the wind farm.

The analysis focuses on identifying key climate hazards relevant to the project area, assessing the sensitivity of project components to these hazards, and determining the level of risk based on the likelihood and potential consequences. Particular attention is given to infrastructure resilience, including turbine stability, access roads, drainage systems, and electrical components, as well as occupational health and safety considerations for workers under extreme weather conditions.

In addition, the assessment highlights the adaptive capacity of the project by outlining design considerations and management measures that can enhance resilience to climate variability and change. These may include engineering design standards, site planning measures, and operational protocols aimed at minimizing climate-related disruptions and ensuring long-term sustainability.

The table below presents a consolidated summary of identified climate risks, their potential impacts on the project, and corresponding mitigation and adaptation measures to enhance project resilience.

8.7.1 Consolidated Climate Change Risk, Vulnerability, and Adaptation Framework

Climate Hazard / Risk	Observed / Projected Trend	Project Component Affected	Likelihood	Severity	Risk Rating (Pre-Mitigation)	Adaptation / Mitigation Measures	Responsible Party	Residual Impact (Post-Mitigation)
Increased temperatures / Heat stress	Increasing	Construction workforce; equipment performance	High	Medium	Moderate	Work scheduling (avoid peak heat hours); provision of PPE; worker hydration and rest plans	EPC Contractor	Low (Minor)
Prolonged drought / Water scarcity	Increasing frequency	Construction activities; water supply for works	High	Medium	Moderate	Water efficiency measures; sourcing from licensed suppliers; water conservation practices	Developer / EPC Contractor	Low (Minor)
Intense rainfall / Flooding and erosion	Episodic but increasing	Access roads; turbine foundations; drainage systems	Medium	Medium	Moderate	Climate-resilient drainage design; erosion control structures; proper site grading	EPC Contractor	Low (Minor)
Strong wind variability / Extreme gusts	Seasonal variability	Turbine structures and operational safety	Low	High	Moderate	Use of turbines certified for site-specific wind classes; adherence to international design standards	Turbine Supplier	Low (Minor)

Dust storms / Dust accumulation	Common in ASAL regions	Turbine blades; machinery; air quality	Medium	Low	Minor	Regular blade cleaning; routine maintenance; dust suppression during construction	O&M Contractor / EPC Contractor	Negligible
Construction-related GHG emissions	Temporary (construction phase)	Overall project carbon footprint	Medium	Medium	Moderate	Efficient machinery use; optimized transport logistics; GHG monitoring and reporting	EPC Contractor / Developer	Minor
Operational GHG emissions	Continuous but minimal	Auxiliary systems; maintenance activities	Low	Low	Minor	Use of efficient systems; minimal reliance on diesel generators	O&M Contractor	Negligible
Climate change mitigation contribution	Long-term positive impact	National grid / energy sector	—	—	Major Positive Impact	Renewable wind energy generation; fossil fuel displacement; energy-efficient turbine technology	Developer	Strongly Positive
Climate governance and compliance	Regulatory requirement	Project planning and implementation	—	—	Positive	Integration into ESIA and ESMP; GHG monitoring (MRV); alignment with Climate Change Act, 2016 (Sections 15 & 19)	Developer	Fully Compliant
Overall Climate	—	Entire project lifecycle	—	—	Moderate (Pre-	Integrated adaptation and	All Parties	Low

Vulnerability					Mitigation)	resilience measures across all phases		
Overall Climate Resilience	—	Entire project lifecycle	—	—	—	Robust design, planning, and operational controls	All Parties	High
Net Climate Contribution	—	National and global climate system	—	—	—	Displacement of fossil fuel-based electricity; contribution to NDC targets	Developer	Strongly Positive

Table 11: Climate Change Risk, Vulnerability, and Adaptation Framework

8.7.1 Overall Impact Significance and Cumulative Effects Summary

Category	Aspect	Assessment	Significance
Construction Phase	Environmental impacts	Localized, temporary impacts (vegetation loss, dust, noise, soil disturbance) effectively mitigated	Low to Moderate (Temporary)
	Social impacts	Employment benefits with manageable disruptions (traffic, access)	Low to Moderate
Operation Phase	Environmental impacts	Minimal adverse impacts; strong positive contribution through clean energy generation	Low Adverse / High Positive
	Social impacts	Long-term benefits in energy supply, employment, and land-use compatibility	Moderate Positive
Decommissioning Phase	Environmental impacts	Short-term, reversible impacts with proper rehabilitation	Low
	Social impacts	Limited negative impacts (job loss) mitigated through planning	Low

Cumulative Impacts	Wind energy developments	No significant cumulative adverse impacts (e.g., proximity to Ngong Wind Farm)	Not Significant
	Infrastructure (SGR, roads)	Combined visual and land-use changes manageable	Low
	Land use change	Compatible with ongoing subdivision and development trends	Low
Overall Project Impact	Environmental & Social	Impacts largely localized, manageable, and reversible; benefits outweigh adverse effects	Acceptable
Net Project Outcome	Climate & Development	Significant positive contribution to renewable energy and national development goals	Strongly Positive

Table 13: Overall Impact Significance and Cumulative Effects Summary

CHAPTER 9: ASSESSMENT OF CUMULATIVE IMPACTS

9.1 Introduction

This Chapter presents an assessment of **cumulative environmental and social impacts** associated with the proposed **60 MW Kajiado Wind Farm Project (38 WTGs)** developed by National Cement Company Limited (NCCL). The assessment considers the combined effects of the Project together with other existing and reasonably foreseeable developments within the wider Kajiado–Kimuka–Suswa area.

The approach and structure of this Chapter are adapted from the cumulative impact assessment framework applied in the reference Egypt (Cairo) wind power ESIA.

However, all conclusions are contextualized to **Kenyan conditions, Kajiado County**, and the specific characteristics of the proposed Project.

Cumulative impacts are assessed by examining the interaction between the Project and:

- Existing and planned wind energy developments (including KenGen Ngong Wind Power Station);
- Linear infrastructure such as the Standard Gauge Railway (SGR) and regional road networks;
- Ongoing land subdivision, residential development, and resort establishment;
- Pastoral land use and associated socio-economic activities.

9.2 Regional Development Context

The proposed wind farm is located approximately **33 km west of Nairobi** and lies within a region undergoing gradual transformation driven by improved road connectivity, particularly the **Kimuka–Suswa Road** and its linkage to the **Kaplong–Narok–Maai Road**. While the area remains sparsely populated and largely pastoral in character, land subdivision into smaller residential plots and the emergence of resort developments indicate increasing development pressure.

The nearest large-scale wind energy facility is the **KenGen Ngong Wind Power Station**, located approximately **17 km from the Project site**. No other utility-scale wind farms are currently operational within the immediate vicinity of the Project area.

9.3 Basis of the Cumulative Impact Assessment

The cumulative impact assessment is informed by:

- Findings from the Project-specific ESIA baseline studies and site reconnaissance;
- Review of existing infrastructure and land use within the Project's zone of influence;
- Professional judgment based on comparable wind energy developments in semi-arid rangeland settings;
- Kenyan environmental management principles, including the precautionary approach and sustainable development.

Assessment of Cumulative Environmental and Social Impacts

E&S Attribute	Outcomes of Regional / Strategic Context Assessment	Project-Specific ESIA Findings	Additional Requirements / Management Measures
Landscape and Visual	The wider Kajiado–Ngong region already accommodates large-scale infrastructure including wind turbines, transmission lines, roads, and the SGR corridor. Sensitive visual receptors are limited due to low population density.	The Project will introduce 38 WTGs with hub heights of 80 m, resulting in a noticeable but acceptable alteration of the landscape.	Consistent turbine design and layout; stakeholder engagement with nearby landowners and resort developments.

Land Use	Land is predominantly semi-arid rangeland used for pastoralism, with increasing subdivision for residential and commercial use.	Wind farm land take is localized and largely compatible with continued grazing activities.	Maintain access corridors for livestock; compensate for permanent land take where applicable.
Geology, Hydrology and Hydrogeology	No regionally significant surface water bodies; groundwater use is limited and localized.	No direct abstraction of groundwater is proposed for operation. Impacts expected to be negligible.	Maintain safe distances from existing boreholes and water points; proper stormwater management.
Biodiversity (Terrestrial)	Vegetation is dominated by shrubs typical of semi-arid ecosystems with limited faunal diversity.	Localized vegetation clearance only; no critical habitats identified.	Site-specific mitigation, rehabilitation of disturbed areas, and monitoring.
Birds (Avifauna)	The region is not identified as a major internationally recognized bird migration bottleneck, though local bird movement occurs.	Site visits recorded limited low-flying bird activity; no sensitive species observed.	Implement bird monitoring during early operation and apply adaptive management if needed.

Archaeology and Cultural Heritage	The wider Kajiado landscape contains scattered cultural and heritage features, though none are formally recorded within the Project footprint.	No archaeological or cultural heritage sites identified during site reconnaissance.	Apply the Chance Finds Procedure and liaise with relevant authorities if discoveries occur.
Air Quality	Regional air quality is generally good due to low industrial activity.	Temporary dust generation during construction only.	Dust suppression measures during construction; routine monitoring.
Noise	Ambient noise levels are low due to absence of major noise sources.	Operational turbine noise expected to remain localized due to low receptor density.	Maintain setbacks from residences; regular turbine maintenance.
Infrastructure and Utilities	Existing road and rail infrastructure supports regional development. Electricity access remains limited locally.	Road upgrades required for construction; power exported to the national grid via Kimuka Substation.	Traffic management during construction; coordination with utility providers.
Occupational Health and Safety	Regional risks typical of construction and energy projects.	Construction and operation introduce occupational risks to workers.	Compliance with Kenyan OSHA requirements and international best practice.

Socio-Economics	Low population density; pastoral livelihoods dominate. Development is gradually increasing.	Project will generate short-term construction jobs and limited long-term operational employment.	Prioritize local employment; continuous stakeholder engagement.
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Table 14: Assessment of Cumulative Environmental and Social Impacts

9.4 Overall Cumulative Impact Evaluation

The cumulative impacts associated with the proposed Kajiado Wind Farm Project, when considered alongside existing and reasonably foreseeable developments in the region, are assessed as **low to moderate and manageable**. Positive cumulative effects include contribution to renewable energy generation, regional infrastructure development, and limited employment creation.

Potential adverse cumulative impacts related to landscape change, land use transformation, and localized ecological disturbance are not expected to exceed acceptable thresholds, provided that mitigation and management measures outlined in this ESIA and the Environmental Management Plan are fully implemented.

The proposed 60 MW Kajiado Wind Farm Project is not anticipated to result in significant adverse cumulative environmental or social impacts. The Project is compatible with existing land uses and infrastructure within the area and aligns with national and county-level objectives for renewable energy development and sustainable land management.

CHAPTER 10. PUBLIC PARTICIPATION

10.1 Methodology

Public participation for the proposed wind energy farm project in Kajiado County was undertaken in accordance with the Environmental Management and Coordination Act (EMCA) requirements. The objective was to inform stakeholders about the project and obtain their views, concerns, and recommendations.

A combination of methods was employed by the ESIA team to ensure effective and inclusive stakeholder engagement. These included public participation meetings, direct interviews, questionnaire administration, and the placement of on-site notices inviting members of the public to attend and participate in the consultation process. The approach ensured that all affected and interested parties were given an opportunity to express their opinions regarding the proposed development.

10.1.1 Public Participation Meetings

Public participation meetings (barazas) were organized within the project area in Kajiado County with the assistance of local administration, including the area chief and village elders. The meetings brought together community members, local leaders, and other stakeholders.

During these meetings, the ESIA team presented details of the proposed wind farm project, including its objectives, expected benefits, potential environmental and social impacts, and proposed mitigation measures. Stakeholders were given an open forum to ask questions, raise concerns, and provide feedback.

10.1.2 Direct Interviews

Direct interviews were conducted with key stakeholders, including local community members, landowners, pastoralists, local leaders, and government representatives. These interviews provided deeper insights into site-specific concerns such as land use, grazing patterns, cultural considerations, and expectations from the project.

The informal nature of these engagements encouraged stakeholders to freely express their views, enabling the ESIA team to capture diverse perspectives regarding the proposed wind farm.

10.1.3 Questionnaire Administration

Structured questionnaires (stakeholder comment sheets) were administered to residents within and around the project area. The questionnaires were designed to capture public perception of the project, awareness levels, anticipated benefits, and potential concerns. The responses collected formed an important basis for assessing community attitudes toward the project and identifying key issues that require attention in the project design and implementation phases.

10.1.4 On-site Notices

Public notices were placed at strategic locations within the project area and its environs to inform stakeholders about the proposed project and invite them to participate in the consultation process. These notices included details of the project, dates and venues of public meetings, and contact information for submitting comments.

This approach ensured transparency and allowed stakeholders who may not have attended the meetings to still provide their input.

10.2 Stakeholders' Comments

The consultation process revealed a generally positive attitude towards the proposed wind energy project, with stakeholders acknowledging its potential to contribute to renewable energy generation and socio-economic development in the area.

Positive Feedback:

- Creation of employment opportunities during construction and operation phases
- Improvement of local infrastructure such as access roads
- Increased economic activities within the area
- Contribution to clean and sustainable energy production

Concerns Raised:

- Potential loss of grazing land for pastoral communities
- Noise from wind turbines
- Visual impact on the landscape
- Possible effects on wildlife, particularly birds
- Land ownership and compensation issues
- Disruptions during construction activities

All concerns raised by stakeholders were adequately addressed in the Environmental and Social Management Plan (ESMP), with appropriate mitigation measures proposed to minimize negative impacts and enhance project benefits.

10.3 Documentation and Evidence

Evidence of the public participation process, including attendance registers, photographs of meetings, copies of questionnaires, filled stakeholder comment sheets, and copies of public notices, will be annexed to this ESIA report.

CHAPTER 11: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

This Chapter presents the Environmental and Social Management Plan (ESMP) for the proposed 60 MW Wind Energy Project in Kajiado County. The ESMP provides a comprehensive framework for the implementation of mitigation measures, monitoring programmes, and institutional arrangements necessary to manage the environmental, social, health and safety (ESHS) risks and impacts identified in the ESIA.

The ESMP translates the impact assessment findings into *practical, measurable and enforceable actions* to be implemented throughout the Project lifecycle, including planning, construction, operation and decommissioning phases.

The ESMP has been developed in accordance with:

- The Environmental Management and Coordination Act (EMCA), Cap 387
- Environmental (Impact Assessment and Audit) Regulations, 2019
- Occupational Safety and Health Act (OSHA), 2007
- Energy Act, 2019
- Applicable County Government by-laws
- International best practices, including *IFC Performance Standards and World Bank EHS Guidelines*

The primary objectives of the ESMP are to:

- Ensure compliance with applicable legal and regulatory requirements
- Prevent, minimize or mitigate adverse environmental and social impacts
- Enhance positive project outcomes
- Provide a framework for monitoring and continuous improvement
- Assign clear responsibilities for ESMP implementation

11.1 Institutional Framework and Procedural Arrangements

Effective ESMP implementation will be achieved through a well-defined institutional framework supported by clear reporting lines, accountability mechanisms and coordination among all Project stakeholders.

11.1.1 Roles and Responsibilities

The successful implementation of the ESMP and the broader Environmental, Social, Health and Safety Management System (ESHS-MS) will be anchored on:

- Clearly defined roles, responsibilities and authority
- Adequate staffing and resource allocation
- Effective supervision, monitoring and reporting

Roles and Responsibilities of Entities Involved in ESMP Implementation

Project Role	Entity	Key Responsibilities	Staffing Requirements
Project Developer	NCCL	Overall ESMP compliance; financing; oversight of contractors; stakeholder engagement; grievance redress	HSSE Manager; Community Liaison Officer (CLO); Environmental Officer
EPC Contractor	To be appointed	Implementation of ESMP during construction; compliance with ESHS-MS; reporting; incident management	Full-time HSE Manager; HSE Officers (1:50 workers); Environmental Officer
Project Operator	To be appointed	ESMP implementation during operation; monitoring; maintenance of mitigation measures	Full-time EHS Manager; Technician-level safety staff
Regulators	NEMA, County Government, DOSHS	Licensing, compliance monitoring, audits, enforcement	Not applicable

Community Representatives	Local leaders	Stakeholder engagement; grievance feedback	Not applicable
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Table 15: Roles and Responsibilities of Entities Involved in ESMP Implementation

11.1.2 Training and Capacity Building

A structured *Environmental, Health, Safety and Social Training Programme* shall be implemented to ensure competency of all personnel.

Additional requirements:

- Induction training mandatory before site access
- Periodic refresher training
- Specialized certification for high-risk tasks
- Community awareness programs (safety around turbines, transmission lines)

11.1.3 Inspection, Monitoring and Environmental Audits

To ensure compliance:

- Daily inspections will focus on operational risks
- Weekly inspections will evaluate broader environmental performance
- Quarterly internal audits and *annual external environmental audits*

Monitoring results shall be documented and used for corrective action and continuous improvement.

11.1.4 Meetings, Reporting and Documentation

Additional improvements:

- Maintain *ESHS Registers* (incidents, waste, complaints, inspections)
- Submit *Annual Environmental Audit Reports to NEMA*
- Maintain *Grievance Redress Mechanism (GRM)* with documented resolution timelines

11.2 Environmental, Social, Health and Safety Management System (ESHS-MS)

All Project stakeholders shall implement a *Project-specific ESHS Management System* aligned with the ESMP.

Key Components

- Risk Assessment and Hazard Identification Procedures
- Permit-to-Work System (PTW)
- Emergency Preparedness and Response (including fire, turbine failure, electrical hazards)

11.2.1 Environmental, Social, Health and Safety Management System Table

Environmental/Social Aspect	Potential Impact	Mitigation Measures	Monitoring	Frequency	Responsibility
Land Acquisition	Displacement / conflicts	Fair compensation; stakeholder engagement; GRM	Compensation records	Continuous	Developer
Soil & Erosion	Soil degradation	Erosion control; drainage; rehabilitation	Site inspections	Weekly	Contractor
Air Quality	Dust emissions	Water spraying; speed control	Visual inspection	Daily	Contractor
Noise	Construction noise	Daytime work; equipment maintenance	Complaint's log	Continuous	Contractor
Waste Management	Improper disposal	Waste segregation; licensed disposal	Waste manifests	Monthly	Contractor
Biodiversity	Habitat disturbance	Minimize clearing; restoration	Inspections	Weekly	Contractor
Traffic	Accidents, congestion	Traffic Management Plan; signage	Incident records	Continuous	Contractor
Community Health & Safety	Injuries to public	Site fencing; awareness; signage	Incident reports	Continuous	Contractor

Cultural Heritage	Damage to artifacts	Chance Find Procedure	Incident records	As needed	Contractor
Occupational Health & Safety	Worker injuries	PPE; training; supervision	Incident reports	Continuous	Contractor

Table 16: Environmental, Social, Health and Safety Management System

- Incident Investigation and Corrective Action Procedures
- Community Health and Safety Plan
- Biodiversity Management Plan (important for wind projects)

11.3 ESMP for Planning and Construction Phase

Critical Impacts

- Traffic and road safety risks
- Community health and safety
- Cultural heritage
- Water resource management

Table 20: ESMP – Planning and Construction Phase

11.4 ESMP for Operation Phase

Key Considerations

- Shadow flicker
- Electromagnetic interference
- Long-term biodiversity monitoring

11.4: ESMP – Operation Phase

Aspect	Impact	Mitigation	Monitoring	Frequency	Responsibility
Noise	Turbine noise	Setbacks; maintenance	Noise monitoring	Periodic	Operator
Biodiversity	Bird/bat collisions	Monitoring; adaptive management	Survey reports	Quarterly	Operator
Shadow Flicker	Nuisance to receptors	Proper siting; shutdown protocols	Complaints	As needed	Operator

Waste	Oil, maintenance waste	Licensed disposal	Waste records	Monthly	Operator
Public Safety	Unauthorized access	Fencing; signage	Inspections	Continuous	Operator
OHS	Maintenance risks	PTW system; PPE	Safety audits	Quarterly	Operator
Socio-economic	Employment	Local hiring	Employment records	Continuous	Developer
Air Quality	Dust emissions	Water spraying; speed limits; covered trucks	Visual inspection	Daily	Contractor
Soil & Erosion	Soil erosion and compaction	Drainage control; re-vegetation	Site inspections	Weekly	EPC Contractor
Land Use	Conflicts with pastoral use	Stakeholder engagement; maintain access routes	Engagement records	Continuous	Developer / EPC
Landscape & Visual	Temporary visual intrusion	Good housekeeping; orderly storage; removal of idle equipment	Visual inspections	Daily / Weekly	EPC Contractor

Table 17: ESMP for the Operation Phase

11.5 Decommissioning Phase ESMP

At the end of the Project life a *Decommissioning Plan* shall be implemented.

Key Measures

- Dismantling and removal of turbines and infrastructure
- Recycling of turbine components where feasible
- Disposal of hazardous materials through licensed handlers
- Site restoration and revegetation
- Consultation with stakeholders on future land use

11.6 ESMP IMPLEMENTATION BUDGET

An adequate budget is essential to ensure effective implementation of the Environmental and Social Management Plan (ESMP). The Project Proponent, National Cement Company Limited (NCCL), shall allocate sufficient financial resources to support all environmental, social, health, and safety (ESHS) mitigation, monitoring, and management measures throughout the Project lifecycle.

The ESMP budget covers:

- Environmental monitoring and audits
- Training and capacity building
- Waste management
- Community engagement and grievance management
- Occupational health and safety
- Rehabilitation and restoration measures

11.6.1 ESMP Budget Estimate (Construction Phase)

No.	ESMP Component	Activity Description	Estimated Cost (KES)
1	Environmental Monitoring	Air, noise, soil, biodiversity monitoring	2,500,000

2	Waste Management	Waste collection, segregation, transport, disposal	1,800,000
3	Occupational Health & Safety (OHS)	PPE, signage, first aid, safety equipment	3,000,000
4	Training & Capacity Building	Induction, specialized training, toolbox talks	1,200,000
5	Community Engagement	Meetings, consultations, awareness programs	1,000,000
6	Grievance Redress Mechanism	GRM setup, documentation, resolution processes	600,000
7	Traffic Management	Road signage, traffic marshals, safety measures	1,500,000
8	Rehabilitation & Restoration	Re-vegetation, landscaping, erosion control	2,000,000
9	Emergency Preparedness	Fire equipment, emergency drills, response systems	1,200,000
10	Environmental Audits	Annual environmental audits and compliance reporting	800,000

Subtotal (Construction Phase): KES 15,600,000

Table 18: ESMP Budget Estimate for the Construction Phase

11.6.2 ESMP Budget Estimate (Operation Phase – Annual)

No.	ESMP Component	Activity Description	Estimated Annual Cost (KES)
1	Environmental Monitoring	Noise, biodiversity (bird/bat monitoring), air quality	1,500,000

2	Waste Management	Handling of oils, lubricants, general waste	1,000,000
3	Occupational Health & Safety	PPE, training, safety audits	1,200,000
4	Community Engagement	Ongoing consultations, CSR activities	800,000
5	Grievance Management	Maintenance of GRM system	400,000
6	Emergency Preparedness	Equipment maintenance and drills	600,000
7	Environmental Audits	Annual audits and reporting to NEMA	500,000

Subtotal (Operation Phase – Annual): KES 6,000,000

Table 19: ESMP Budget Estimate for the Operation Phase – Annual

11.6.3 Decommissioning Phase Budget (Indicative)

No.	Activity	Estimated Cost (KES)
1	Dismantling of Turbines and Infrastructure	10,000,000
2	Waste Disposal and Recycling	3,000,000
3	Site Rehabilitation and Restoration	4,000,000
4	Environmental Monitoring (Post-Decommissioning)	1,500,000

Subtotal (Decommissioning Phase): KES 18,500,000

Table 20: Decommissioning Phase Budget

11.6.4 Total ESMP Budget Summary

Phase	Cost (KES)
Construction Phase	15,600,000

Operation Phase (Annual)	6,000,000
Decommissioning Phase	18,500,000

Total: KES 40,100,000

Table 21: Total ESMP Budget Summary

11.6.5 Budget Justification and Commitment

The Project Proponent commits to:

- Providing adequate financial resources for ESMP implementation
- Reviewing and updating the ESMP budget periodically
- Ensuring funds are ring-fenced for environmental and social management
- Complying with all regulatory requirements, including annual environmental audits

11.7 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP) SUMMARY TABLE

Project Phase	Environmental / Social Impact	Proposed Mitigation Measures	Monitoring Indicators	Responsibility	Frequency	Estimated Cost (KES)
Pre-Construction	Land acquisition conflicts	Ensure fair compensation in line with Land Act; stakeholder engagement and grievance redress mechanism	Number of grievances resolved; compensation records	Proponent, County Govt, Valuer	Once / Continuous	5,000,000
	Loss of vegetation	Minimize site clearing; mark areas to be cleared; replant	Area cleared vs restored; number of trees planted	Contractor, Environmental Officer	Once / Quarterly	1,500,000

		indigenous species				
	Community dissatisfaction	Conduct public participation and awareness programs	Attendance records; stakeholder feedback	Proponent, ESIA Expert	Continuous	800,000
	Disruption of land use	Proper planning and zoning compliance	Approved plans; compliance reports	Physical Planner, County Govt	Once	500,000
Construction Phase	Soil erosion and land degradation	Implement erosion control (gabions, terracing, drainage channels)	Presence of erosion features; drainage effectiveness	Contractor, Environmental Officer	Monthly	2,500,000

	Air pollution (dust emissions)	Regular water sprinkling; cover trucks; enforce speed limits	Dust levels; complaints from community	Contractor	Daily	1,200,000
	Noise pollution	Limit working hours; use well- maintained machinery; provide PPE	Noise levels (dB); worker complaints	Contractor	Weekly	800,000
	Waste generation (solid & hazardous)	Waste segregation; licensed disposal; recycling	Waste records; disposal certificates	Contractor, NEMA Licensed Waste Handler	Weekly	1,500,000

	Occupational health & safety risks	Provide PPE; safety training; enforce safety protocols	Accident records; PPE usage	Contractor, Safety Officer	Daily	2,000,000
	Traffic congestion & accidents	Implement Traffic Management Plan; signage; traffic marshals	Traffic flow; accident reports	Contractor, Traffic Police	Daily	1,000,000
	Water pollution	Proper storage of fuels; spill prevention; sanitation facilities	Water quality tests; spill incidents	Contractor	Monthly	900,000
	Impacts on fauna (birds & wildlife)	Avoid sensitive habitats;	Wildlife sightings;	Environmental Officer	Monthly	700,000

		schedule works; awareness training	incident reports			
	Employment conflicts	Prioritize local labour; transparent recruitment	Employment records; complaints	Contractor, Proponent	Continuous	500,000
Operation Phase	Bird and bat collisions	Install bird diverters; turbine siting optimization; monitoring programs	Number of bird/bat fatalities	Proponent, Environmental Expert	Quarterly	2,500,000
	Noise from turbines	Maintain turbines; ensure setback distances	Noise level measurements	Proponent	Quarterly	1,000,000

	Visual impact	Proper landscape integration; community engagement	Community feedback	Proponent	Annually	500,000
	Waste (maintenance waste)	Proper disposal; recycling of parts	Waste records	Proponent	Monthly	600,000
	Oil leaks & contamination	Routine maintenance; spill kits	Spill records; soil condition	Proponent	Monthly	800,000
	Occupational health & safety	Regular training; PPE; emergency preparedness	Incident reports	Proponent	Continuous	1,200,000
	Community health & safety	Awareness programs; restricted	Incident reports	Proponent	Continuous	700,000

		access to turbines				
Decommissioning Phase	Land degradation	Site restoration; backfilling; landscaping	Land restoration reports	Contractor, Proponent	Once	3,000,000
	Waste generation	Proper dismantling; recycling; licensed disposal	Waste disposal records	Contractor	Continuous	2,000,000
	Loss of livelihoods	Compensation; alternative livelihood programs	Beneficiary reports	Proponent	Once	2,500,000
	Visual scarring	Restore site to original condition	Site inspection reports	Environmental Officer	Once	

Table 22: (ESMP) Summary

CHAPTER 12. CONCLUSIONS AND RECOMMENDATIONS

12.1 Conclusions

The Environmental and Social Impact Assessment (ESIA) for the proposed 60 MW Wind Energy Project located in Kajiado County has been conducted in accordance with the Environmental Management and Coordination Act (EMCA), 1999 (Revised 2015), the Environmental (Impact Assessment and Audit) Regulations, 2003 and relevant international best practice standards including IFC Performance Standards and World Bank Group Environmental, Health and Safety (EHS) Guidelines.

The assessment confirms that the project site is generally suitable for wind energy development due to its favorable wind regime, open terrain, and low population density. The project aligns with **Kenya's Vision 2030**, national renewable energy policies, and global climate change mitigation objectives by contributing clean, renewable energy to the national grid and reducing greenhouse gas emissions.

Potential **positive impacts** identified include:

- Increased renewable energy generation capacity and improved energy security;
- Reduction in greenhouse gas emissions compared to fossil fuel alternatives;
- Employment creation during construction and operation phases;
- Local economic stimulation through procurement of goods and services;
- Improvement of local infrastructure such as access roads.

The ESIA also identified **potential adverse environmental and social impacts**, particularly during the construction phase, including:

- Temporary land disturbance and soil erosion;
- Noise and dust emissions from construction activities;
- Occupational health and safety risks;
- Impacts on avifauna and bats due to turbine operation;
- Visual and landscape impacts;
- Potential land use conflicts and community concerns related to access and livelihoods.

However, the study concludes that these impacts are largely **site-specific, manageable, reversible and of moderate to low significance**, provided that the recommended mitigation and enhancement measures are fully implemented.

Public and stakeholder consultations indicated **general support for the project**, with concerns mainly related to land access, employment opportunities, community benefits, noise, and safety. These concerns have been adequately addressed through project design measures and the proposed Environmental and Social Management Plan (ESMP).

Overall, the ESIA concludes that the proposed 60 MW wind energy project in Kajiado is **environmentally and socially acceptable** and that the **benefits significantly outweigh the anticipated adverse impacts**, subject to effective implementation of mitigation measures and continuous monitoring.

12.2 Recommendations

Based on the findings of this ESIA, the following recommendations are made to ensure environmentally sound and socially responsible implementation of the project:

11.2.1 Environmental Management

- The proponent shall implement the **Environmental and Social Management Plan (ESMP)** in full, ensuring adequate budgetary allocation and assignment of responsibilities.
- Soil erosion control measures, including proper drainage design, revegetation and controlled excavation, should be applied especially during the rainy season.
- Dust suppression measures such as regular water spraying and covering of transported materials shall be enforced during construction.
- Noise control measures should be implemented including equipment maintenance and restricted working hours near sensitive receptors.

12.2.2 Biodiversity and Avifauna Protection

- A **Bird and Bat Monitoring Programme** shall be implemented throughout construction and operation phases.
- Turbine micro-siting should avoid known bird migration routes and sensitive habitats.
- Operational mitigation measures such as turbine curtailment during peak migration periods should be considered where necessary.

12.2.3 Occupational Health and Safety (OHS)

- The proponent shall develop and implement a comprehensive Occupational Health and Safety Management Plan in compliance with the Occupational Safety and Health Act (OSHA), 2007.
- All workers shall receive appropriate training, personal protective equipment (PPE) and emergency response guidance.
- Traffic management plans shall be implemented to reduce accident risks associated with construction vehicles.

12.2.4 Social Management and Community Engagement

- Continued stakeholder engagement should be maintained through the project lifecycle in line with the Stakeholder Engagement Plan (SEP).
- Priority should be given to local employment and capacity building where feasible.
- A functional Grievance Redress Mechanism (GRM) shall be maintained to address community concerns promptly and transparently.
- Community development initiatives should be implemented in consultation with local leadership and aligned with community priorities.

12.2.5 Land Access and Livelihoods

- Land access agreements shall be clearly documented and fairly implemented.

- Any economic displacement shall be addressed through appropriate compensation and livelihood restoration measures in line with national legislation and international best practice.

12.2.6 Monitoring, Reporting, and Compliance

- Environmental and social monitoring shall be conducted as outlined in the ESMP.
- Regular compliance audits and reporting shall be submitted to **NEMA** and other relevant authorities.
- Adaptive management approaches should be applied to address unforeseen impacts.

12.2.7 Overall Recommendation

It is recommended that the proposed 60 MW Wind Energy Project in Kajiado County be approved for implementation, subject to:

- Issuance of an **EIA License by NEMA**; and
- Full implementation of the proposed mitigation, monitoring and enhancement measures outlined in the ESIA and ESMP.

13. REFERENCES

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10. The Physical and Land Use Planning Act (PLUPA), 2019
11. Environmental Management and Coordination Act (EMCA), 1999
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15. Land Act, 2012 and Land Registration Act, 2012;
16. International Finance Corporation EHS Guidelines for Wind Energy (2015)
17. IFC EHS Guidelines for Electric Power Transmission and Distribution (2007)
18. EBRD Environmental and Social Policy (2019)
19. IFC Performance Standards (2012)
20. IFC EHS Guidelines for Electric Power Transmission and Distribution (2007)

14. ANNEXES

List of stakeholders' meeting attendance

People and institutions consulted during the study process

Minutes of the stakeholders' meeting

The approved TOR of the proposed project

Photos of the flora and fauna found in the project area during the study process