MINISTRY OF ENERGY

NAKURU COUNTY
COUNTY OF UNLIMITED OPPORTUNITIES

COUNTY ENERGY PLAN

NAKURU

2022-2027

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County Vision

A secure, cohesive, and industrialized County

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County Mission

To formulate citizen-oriented policies, promote sustainable socio-economic and technological development.

Nakuru County has set ambitious targets to increase access to clean cooking solutions to 70% by 2027, and to achieve universal access by 2030.

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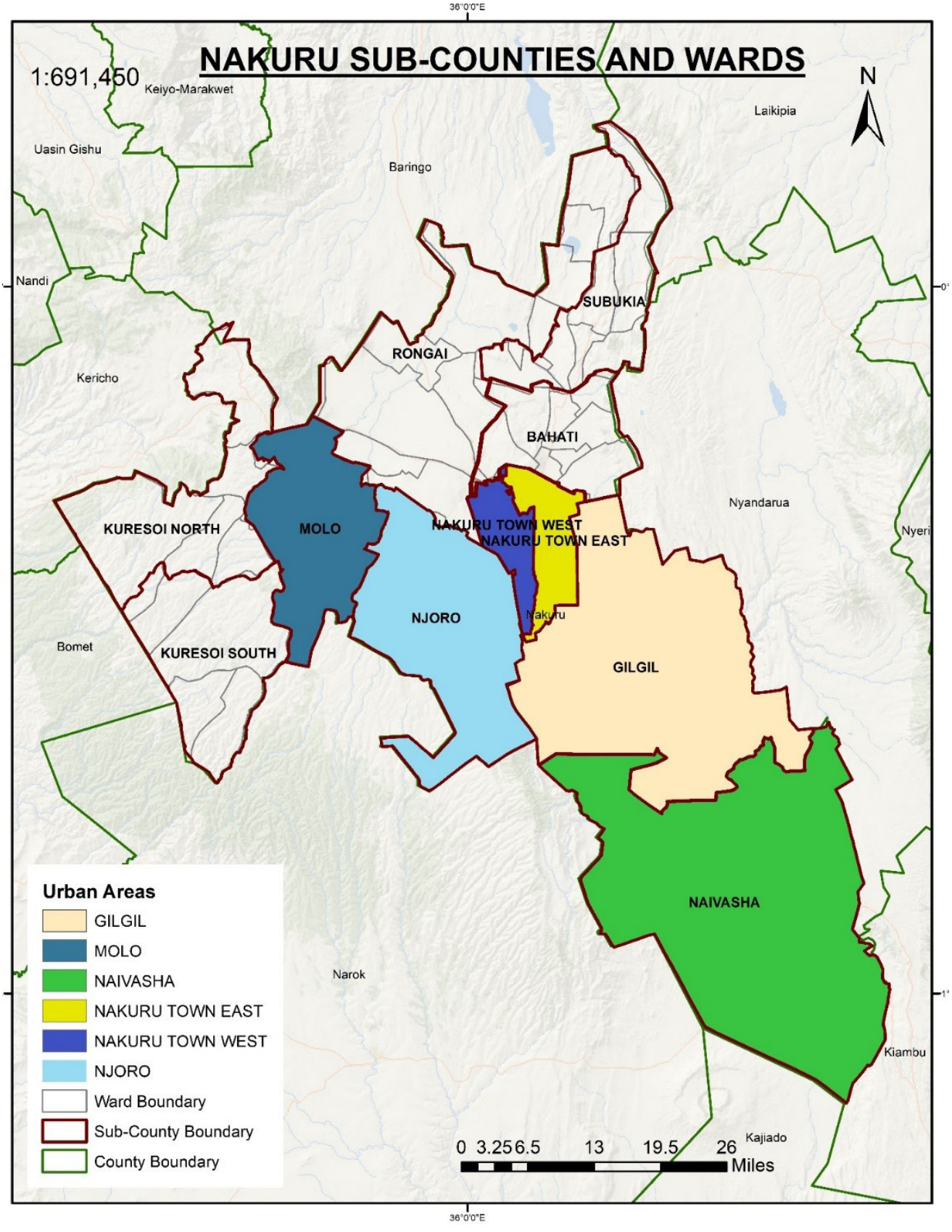
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MOLO
NAKURU TOWN WEST
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NJORO
Nakuru
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KURESOI SOUTH
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Foreword

The Constitution of Kenya (2010) established 47 counties and instituted a framework that, for the first time in the history of the country, devolves some energy planning and administrative functions to the sub-national level (the County Governments). This is expected to lead to a more equitable sharing of resources, heightened participation in energy planning at the sub-national level, and targeted investments, particularly in areas that have been historically neglected. Nakuru County is therefore proud to launch this County Energy Plan (CEP) for the period 2022-2027. This Plan is the outcome of many months of consultations with relevant stakeholders representing the county government, national government, development partners, state agencies, and non-governmental actors. As a critical component of the Sustainable Energy Access and Climate Action Plan (SEACAP), this plan provides a roadmap for energy development in the County.

Nakuru County is committed to playing its role as delegated in the Constitution of Kenya (2010) and the Energy Act (2019). Since joining the Covenant of Mayors in Sub-Saharan Africa initiative in 2020, the County is also committed to energy and climate action at the local level. The completion and inauguration of this Plan is part of that commitment. From the baseline survey carried out in preparation for this plan, Nakuru County is firmly on course to achieving universal access to electricity by 2027. This can be credited to the ambitious public sector grid extension efforts made in the last ten years through national programmes such as the Last Mile Connectivity Project (LMCP) and innovative private sector initiatives to promote the use of solar PV based standalone solutions. However, three (3) out of every five (5) homes still use traditional forms of cooking energy including firewood and charcoal.

The limited access to modern cooking solutions is especially acute in rural areas. We have set ambitious targets to increase access to clean cooking solutions to 70% by 2027, and to achieve universal access by 2030. This will be achieved through a combination of technologies, including liquified petroleum gas (LPG), bioethanol, biomass briquettes, and electricity. On the energy efficiency front, we have committed to retrofitting all streetlights with LED bulbs by the year 2025 among other plans. Despite relatively high electricity access rates, consumption at the household level remains very low. This deprives the consumers of the potential benefits of using electricity as a tool for economic empowerment. One of our focus areas will be the establishment of productive use value chains, and enable households to acquire productive electric appliances.

To implement this Plan, a County Energy Planning Committee (CEPC), of which I will be the patron, will be established according to the Integrated National Energy Planning (INEP) framework. This committee will establish a Secretariat responsible for the management of specific tasks, as outlined in this Plan. The CEPC will periodically review this plan and update it accordingly. We invite other partners from the private sector, national government, and non-governmental organizations to walk with us on this journey.

HE Lee Kinyanjui
Governor, Nakuru County.

Preface

This County Energy Plan (CEP) has been prepared in fulfilment of the requirements of the Energy Act (2019) and the Constitution of Kenya (2010). Following the promulgation of the Constitution of Kenya (2010), some energy planning functions previously led by the central government were devolved to the newly created counties. Among those functions include energy planning, energy regulation and licensing, and energy development. The rationale for the devolution of energy functions is the realization that different counties are endowed differently with energy resources and are at different stages of development. To ensure that local county-specific circumstances are factored in the planning process, sub-national level planning is imperative.

Nakuru County is thus pleased to have attained this critical milestone of developing a comprehensive County Energy Plan that both addresses the needs of the County and offers a 5-year implementation roadmap. The Department of Energy, Water, Environment and Natural Resources has played the lead role in this process. Developing this plan involved extensive consultations with various stakeholders and background research facilitated by EED Advisory with the support from GIZ in context of the Covenant of Mayors in Sub- Saharan Africa (COM-SSA) initiative. To ensure that the outcome was aligned with the realities and priorities on the ground, primary data collection was carried out in all the eleven sub-counties covering households, enterprises, and social institutions including educational and health institutions. Key Informant Interviews (KIIs) with sectoral stakeholders and technical experts, and workshops with County directorates formed part of this extensive process. The review and planning process was done through gender-lens and considered the current and impending impacts of climate change. We are therefore confident that the contents of this Plan represent the aspirations of the residents of Nakuru County and the County government.

This plan has been launched at an opportune time when the County is reviewing the County Integrated Development Plan (CIDP) 2018-2022. Given the transcending nature of energy, we hope to engender the programs and activities outlined in this plan in the CIDP. The proposals of this plan are multi-layered: there are policy and institutional recommendations that will be accomplished through institutional review and legislation, while others are administrative. All this will be implemented by the Secretariat entrusted with oversight from the County Energy Planning Committee (CEPC) with guidance from the office of the Governor. The County government will allocate substantial funding to the implementation of this and mobilize the rest from development partners. Once again, we call upon our partners to join us in this undertaking..

Eng. Festus Ng`eno
CEC—Energy, Water, Environment
and Natural Resources

Acknowledgement

Nakuru County is a signatory of the Covenant of Mayors in Sub-Saharan Africa (CoM SSA), an initiative of sub-national governments taking ambitious climate and energy action. In this context, we are grateful to the CoM SSA program, funded by the European Union and the German Federal Ministry of Economic Cooperation and Development (BMZ). Special acknowledgement goes to the CoM SSA team in Kenya, led by Mr Abel Omanga and Ms Kruti Munot of GIZ.

This work would not have been complete without the invaluable contribution of technical experts from ICLEI Africa and EED Advisory. The ICLEI Africa team was led by Ms Carine Buma while EED Advisory`s team included Mr Murefu Barasa, Mr Daniel Wanjohi, Ms Ruth Gichuhi, and Eng. James Muchiri. We also extend our gratitude to all the stakeholders who offered their expert opinion and comments on this process including Eng. Jonathan Mbutu (REREC), Eng. Henry Odede (KETRACO), Mr Jechoniah Kitala (Practical Action), Dr Ed Brown and Dr Sarah Wykes (MECS), Mr Tom Maruti (MoE), Ms Jackline Nyabuti (Davis and Shirtliff, Nakuru), Marcello Antinucci (GOPA Intec) and Dr. Joanes Atela (Africa Centre for Technology Studies)

Many thanks also go to the various Directors from the County Government for participating in the workshops and offering valuable suggestions that have enriched this document. These include Mr Fredrick Ojwang (Director, Agriculture), Mr Cyrus Kahiga (Director, Economic Planning), Ms Millicent Yugi (Director, Education), Ms Elizabeth Kisto (Director, Health), Ms Dorcas Njeri (Director, Trade), and Ms Mary Gitongu (Director, Veterinary Services).

Finally, special thanks to the staff of the Nakuru County Department of Energy, Water, Environment and Natural Resources led by Eng Festus Ng`eno (County Executive Member), Mr Muriithi Kiogora (Chief Officer) and Ms Grace Karanja (Director).

List of Abbreviations

AECID	Spanish Agency for International Development Cooperation
AFD	French Development Agency
APR	Annual Progress Report
BAU	Business as Usual
BMZ	German Federal Ministry for Economic Cooperation and Development
CAPI	Computer Aided Personal Interview
CCAK	Clean Cooking Association of Kenya
CCF	Clean Cooking Fund
CEP	County Energy Plan
CEPC	County Energy Planning Committee
CGN	County Government of Nakuru
CIDP	County Integrated Development Plan
CIMES	County Integrated Monitoring Evaluation System
COM-SSA	Covenant of Mayors in Sub-Saharan Africa
EPRA	Energy and Petroleum Regulatory Authority
GDC	Geothermal Development Company
GDP	Gross Domestic Product
GFW	Global Forest Watch
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GJ	Gigajoule
HAP	Household air pollution
ICT	Information Communication Technology
IEA	International Energy Agency
IEBC	Independent Electoral and Boundaries Commission
INEP	Integrated National Energy Planning
IRENA	International Renewable Energy Agency
KenGen	Kenya Electricity Generating Company
KEREA	Kenya Renewable Energy Association
KES	Kenya Shillings
KETRACO	Kenya Electricity Transmission Company
kHA	Kilohectares
KII	Key Informant Interview
KNBS	Kenya National Bureau of Statistics
KNES	Kenya National Electrification Strategy
KPLC	Kenya Power and Lighting Company
kWh	kilowatt hour
LCPDP	Least Cost Power Development Plan
LEAP	Low Emissions Analysis Platform
LED	Light Emitting Diode
LMCP	Last Mile Connectivity Program
LPG	Liquified Petroleum Gas
M&E	Monitoring and Evaluation
MECS	Modern Energy Cooking Solutions
MoE	Ministry of Energy
MoU	Memorandum of Understanding
MT/Mton	Megatons
MTR	Mid-term Review
MW	Megawatt
MWh	Megawatt hour
NAWASCO	Nakuru Water and Sanitation Company
NGO	Non-governmental Organization
NMT	Non-motorised Transport
PV	Photovoltaic
RBF	Results Based Financing
REREC	Rural Electrification and Renewable Energy Corporation
SDG	Sustainable Development Goal
SEACAP	Sustainable Energy Access and Climate Action Plan
SEforAll	Sustainable Energy for All
SEI	Stockholm Environment Institute
SEP	Slum Electrification Project
SHS	Solar Home System
TSOF	Three-Stone Open Fire

Executive Summary

Introduction

Anchored on the legislative and governance reforms based on the Constitution of Kenya (2010) and the Energy Act (2019), the County Government of Nakuru has developed this County Energy Plan (CEP) as part of the Integrated National Energy Plan (INEP) framework. To ensure that the planning process is data-driven and aligns with the realities on the ground and prevailing opportunities, data was collected through various representative surveys: household survey (n[1] = 420), education institutions survey (n = 130), health centre survey (n = 197), and enterprises survey (n = 384); Key Informant Interviews (KII); extensive data and literature review; and working sessions with various stakeholders. In addition, to this, the Plan employs the Low Emission Analysis Platform (LEAP) integrated modelling tool developed by the Stockholm Environment Institute (SEI) to assess three future energy access scenarios – business as usual scenario, UN SDG 7 (universal access to energy) scenario, and a high growth economic scenario. This analysis uses these scenarios - which are conceptualized story lines of how the energy system may evolve, to create and evaluate alternative future outcomes, prepare the County leadership for extreme outcomes, and also to guide them on measures required to achieve desired outcomes.

Household Energy Access

This Plan finds that 90.7% of households in Nakuru have access to electricity. Of these, about 61.0% of households reported connection to the national grid, 2.9% have access through a mini-grid connection, and 26.9% have access through standalone solar PV systems. Traditional biomass sources (firewood and charcoal) are the main source of energy for cooking with 69.1% for all households reporting use. LPG is the second most used source of cooking energy at 29.3%, with other sources such as paraffin and biogas accounting for less than 2.0%.

Educational Institutions - Energy Access

89.2% of educational institutions had access to electricity. According to the survey findings, the electrification rates across the sub-counties varied significantly. At 55%, the rate in Kuresoi South is notably lower than the rest of the sub-counties, while the sub-counties of Naivasha, Nakuru East, Nakuru North and Bahati report universal electrification. Educational institutions commonly use four main sources of energy: firewood, charcoal, LPG, and briquettes. At least 90.7% of all the educational institutions reported using firewood, 10% use charcoal, 19.2% use LPG and 0.8% use briquettes as part of their cooking stack.

1 n represents the sample size

Health Institutions - Energy Access

Near universal access to electricity (98.5%) was recorded for health institutions across the county. Only 3 out of the sample size of 194 centres interviewed did not have electricity. Except for the sub-counties of Naivasha (96.9%), Kuresoi South (92.3%) and Kuresoi North (90.0%), the remaining 8 sub-counties report a 100% electrification rate based on the sampled respondents.

Commercial Enterprises – Energy Access

The formal commercial enterprises interviewed were grouped into five categories: hospitality, general trade, ICT services, general services, and other services. The Plan finds that these users have attained near-universal access to electricity at 97.9%. Due to the wide variation of type and focus, energy consumption differs greatly across and within the five categories. There are significant opportunities to further improve productivity through the introduction of productive use of energy (PUE) appliances.

Summary of the Plan (2022-2027)

Guided by the baseline information and anchored on national legislation, the Nakuru County CEP provides a planning and implementation framework that will facilitate greater coordination between and among the key actors promoting access to energy. These include the sub-national government, the national government, development agencies, and the private sector. Nakuru County aims to attain universal access to electricity by 2027 using both on-grid and off-grid solutions, and modern clean cooking solutions by 2030. The CEP vision is founded on the strength of strategic partnership with the national government, private sector, development partners, and bilateral and multilateral donors. Through a programmatic approach delivered utilizing four interrelated components: i) access to energy for cooking and heating; ii) access to electricity; iii) promoting sustainable transportation, and iv) cross-cutting issues, this CEP aims to achieve the goal of improved access to clean, affordable, and reliable energy by 2027. These components are further divided into 12 programs (abbreviated as PG). The estimated implementation budget is KES 2.29 billion spread over 5 years from private sector investments, national government's contribution, sub-national government resources, support from development agencies and climate finance. The figure below provides a summary of this Plan.

90.7%

of households in Nakuru have access to electricity.

89.2%

of educational institutions had access to electricity

The Plan finds that these users have attained near-universal access to electricity at

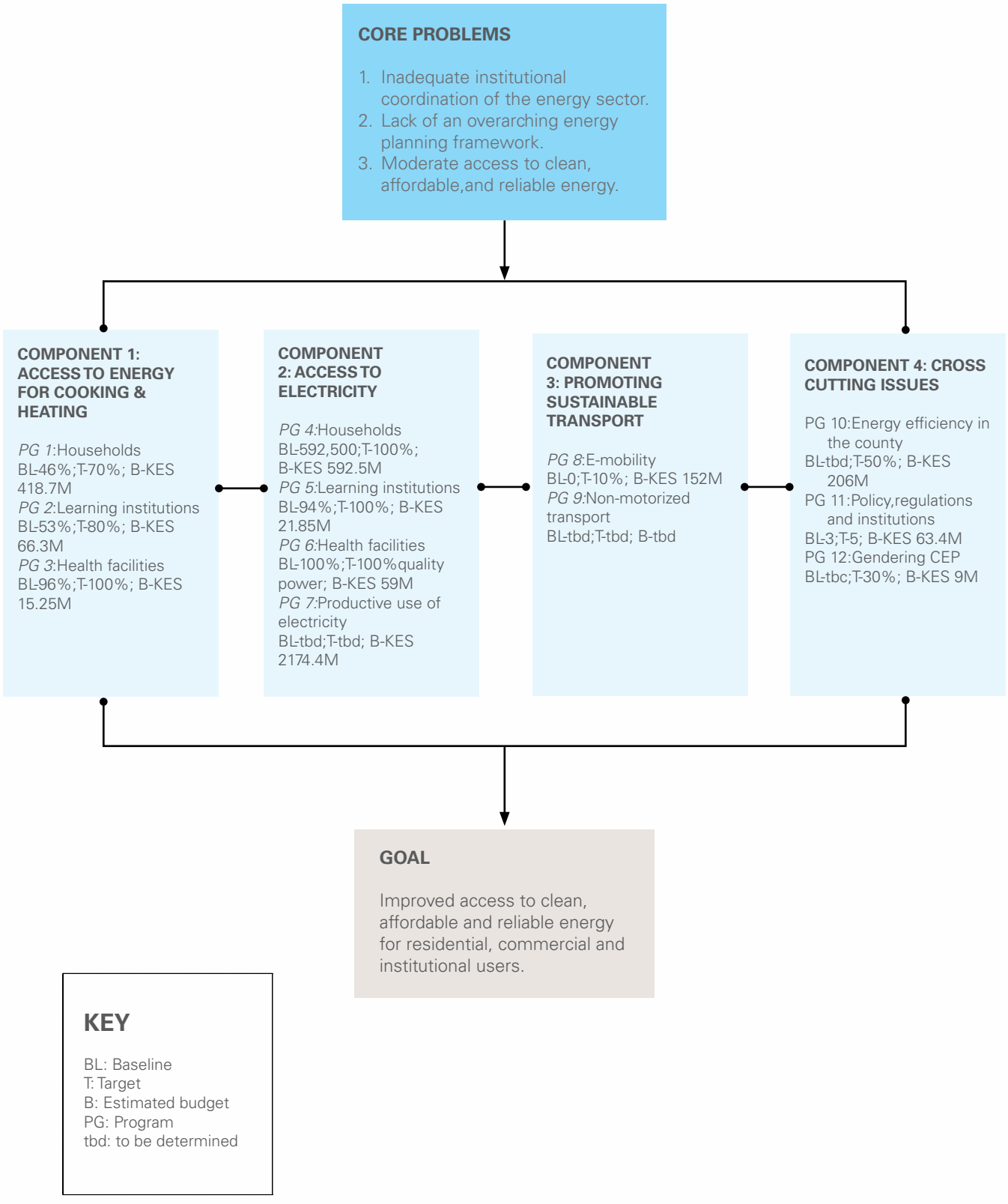
97.9%

Near universal access to electricity

98.5%

was recorded for health institutions across the county

Figure 1: Summary of the Nakuru County Energy Plan (CEP)



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Introduction

1.1 Background

1.1.1 Rationale

The Constitution of Kenya (2010) established 47 counties and instituted a framework that, for the first time in the history of the country, devolves some energy planning and administrative functions to the sub-national level. This is expected to lead to a more equitable sharing of resources, heightened participation in energy planning at the sub-national level, and targeted investments, particularly in areas that have been historically neglected. These diverse functions devolved to the county governments are enumerated in chapter 11 and the fourth schedule of the Constitution. The Energy Act (2019) builds on the provisions of the Constitution and provides details of this new structure under sections 5, 193, 194, 196, 199, 222, and the fifth schedule. Section 5, sub-section 3 states that "each County Government shall develop and submit a country energy plan to the Cabinet Secretary in respect of its energy requirements."

The national government, in close cooperation with the county governments, is required to ensure the provision of sustainable, affordable, reliable, and demand-driven energy services for all citizens. Besides the development of the County Energy Plan, the role of county governments includes guiding the exploitation and use of renewable energy resources through appropriate strategy and planning for efficient delivery of energy services to domestic, institutional, and commercial and industrial users. It is in line with these legislative and institutional changes that the County government of Nakuru, through its Department of Water, Energy, Environment and Natural Resources and with the support of the *Deutsche Gesellschaft für Internationale Zusammenarbeit* (GIZ), has developed this County Energy Plan (CEP).

Nakuru County hosts major centres of trade, industry, agriculture, tourism, electricity production, education, and health care. Its headquarters, Nakuru city, has been consistently ranked as one of the fastest-growing cities in East and Central Africa. With an estimated population of 2.2 million,[2] the County covers an area of 7498 km^2 and includes the iconic Great Rift Valley lakes: Lake Elementeita, Lake Naivasha, and Lake Nakuru. Given the prevailing national population growth, the energy demand is set to increase significantly. The County Government of Nakuru has ambitious socio-economic development plans outlined in the County Integrated Development Plan 2018-2022 (CIDP) that aligns with the national Medium-Term Plan (2018-2022) and the Governor's manifesto.

The provision of affordable, sustainable, and reliable energy is central to the success of these plans. On-grid and off-grid electricity are the main sources of energy for lighting, while firewood and charcoal contribute significantly to thermal applications including cooking.[3] According to the 2019 national census, 50% of all households are connected to the national electricity grid infrastructure, although there are major concerns with the quality of supply.[4] The high demand for firewood and charcoal has put a strain on the limited biomass resources, including forests. On the other hand, opportunities including the prospects of promoting electric-supported transportation (e-mobility), non-motorized transportation, direct use of geothermal, among others, require a systematic review of the energy sector in the County. This CEP provides the County's position and aspiration within the national energy planning framework, as well as outlining investment opportunities in the energy sector.

2 KNBS. (2019). Kenya Population and Housing Census Vol. II: Distribution of population by socio-economic characteristics. Kenya National Bureau of Statistics

3 CGN. (2018). Nakuru County Integrated Development Plan (2018-2022), County Government of Nakuru.

4 KNBS. (2019). Kenya Population and Housing Census Vol. II: Distribution of population by socio-economic characteristics. Kenya National Bureau of Statistics

County covers an area of **7,498 km**

Population of **2.2 million**

Nakuru County hosts major centres of trade, industry, agriculture, tourism, electricity production, education, and health care.

1.1.2 Objectives

The overall goal of this CEP is to ensure the provision of affordable, sustainable, and reliable energy in Nakuru County for residential, institutional, and commercial users. The working definition of energy in this context includes mechanical, thermal, and electric applications covering all productive sectors and social service provision. This goal is supported by the following CEP objectives:

i) Provide a medium-term planning framework for advancing affordable, sustainable, and reliable energy provision within the County.

ii) Ensure proactive compliance with the provisions of the National Constitution (2010) and the Energy Act (2019) on energy planning and administration.

iii) Address the challenges and capture opportunities in the energy sector at the County level.

In addition to the inclusive and extensive consultations, the development of this CEP involved assessing and mapping the energy resource potential in the County; analysing the current and projected energy demand; assessing the current energy efficiency and conservation measure; and proposing an implementation and financing plan, in line with the draft Integrated National Energy Planning (INEP) framework. This CEP is organized into six chapters as described below:

Chapter 1: The rest of this chapter offers a snapshot of Nakuru County, including its geographic and demographic details, and describes the methodology followed in developing the Energy.

Chapter 2: Provides an inventory of available primary energy resources in the County and an analysis of the exploitability of these resources.

Chapter 3: Quantifies current energy use by households, institutions, and businesses, including fuel (biomass and fossil fuel) consumption, number of electrified and non-electrified households and institutions, and productive uses of energy among other uses.

Chapter 4: This is a projection of the energy growth and demand under various scenarios. For Nakuru County three scenarios were considered, namely i) business as usual; ii) SDG 7; and iii) high economic growth scenario.

Chapter 5: Provides the actual plan, the estimated budget and the various projects and programs under implementation.

Chapter 6: This is the implementation framework, including a monitoring and evaluation procedure.

1.2 County Overview

1.2.1 Geographic description

The County covers an area of approximately 7,498 Km² and is located between Longitudes 35.41 ° East or 35 ° 24' 36" East and 36.6 °East or 36 °36' 0" East and Latitude 0.23 ° North or 0 ° 13' 48" North and 1.16 ° South or 1° 9`36" South. It is situated in Rift Valley and borders seven counties: Laikipia to the north-east, Kericho to the West, Narok to the south-west, Kajiado to the South, Baringo to the North, Nyandarua to the East and Bomet to the West[5]. The County headquarters is Nakuru City. The County is administratively and politically divided into 11 sub-counties, 11 constituencies, 55 wards, 121 locations and 265 sub-locations[6] as shown in Table 2 , Table 3 and Figure 2 below.

Table 1: Nakuru Administrative Units (IEBC 2015)

Sub-County	Area (km²)	No of Locations	No of Sub-Locations
Molo	478.79	14	30
Njoro	713.3	20	43
Naivasha	1685.8	12	20
Gilgil	1348.4	8	15
Kuresoi South	559.7	11	24
Kuresoi North	572.3	9	23
Subukia	390.71	10	24
Rongai	1049.1	18	37
Bahati	375.4	12	28
Nakuru West	251	4	12
Nakuru East	74.3	3	9
Total	**7498.8 km²**	**121**	**265**

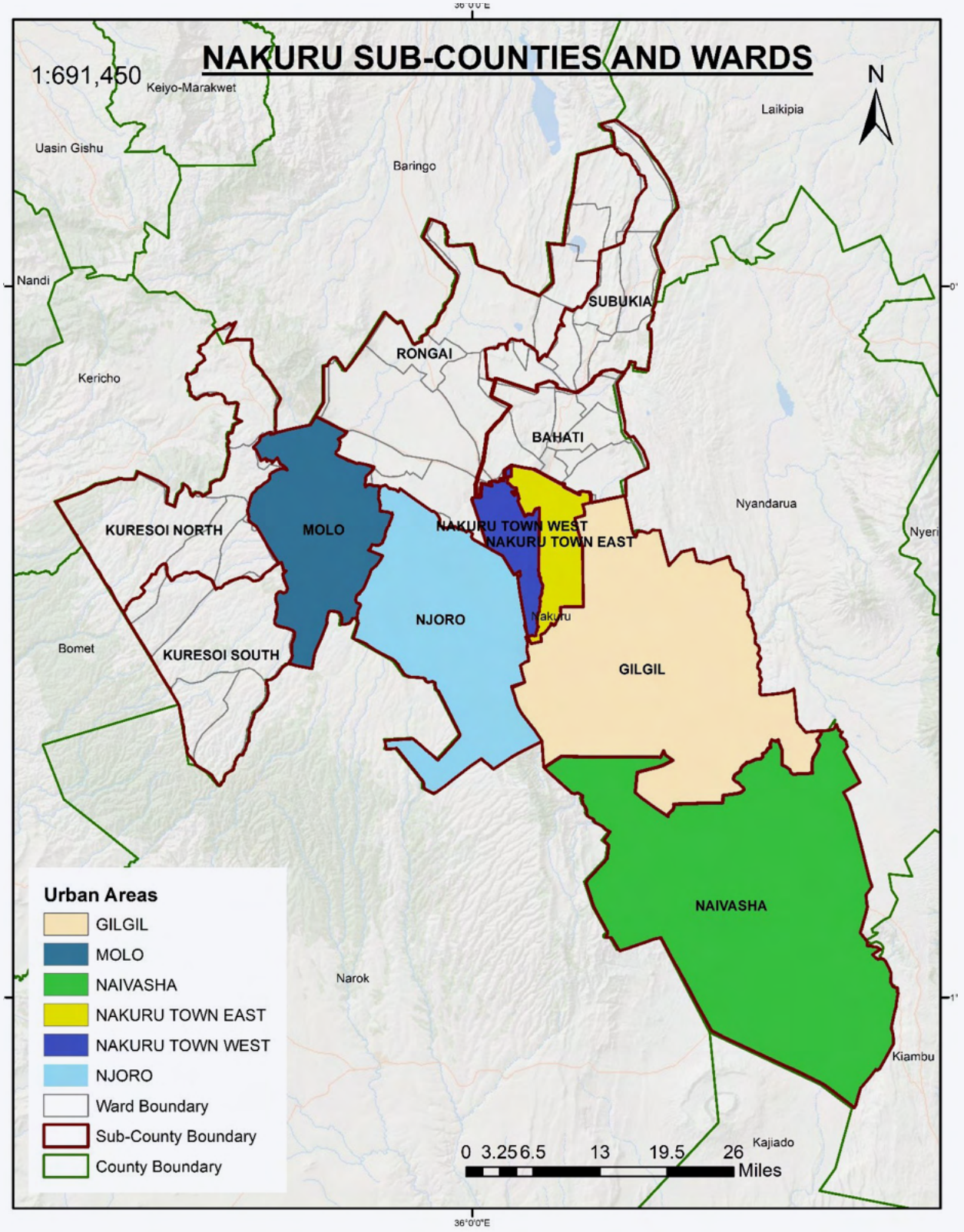
Table 2: Nakuru Political Units (Source: IEBC 2015)

Constituency	No of Wards	Area (km²)	Wards
Molo	4	478.79	Mariashoni, Elburgon, Turi, Molo
Njoro	6	713.3	Mau Narok, Mauche, Kihingo, Nessuit, Lare, Njoro
Naivasha	8	1685.8	Biashara, Hells Gate, Lake View, Maiella, Mai Mahiu, Olkaria, Naivasha East, Viwandani
Gilgil	5	1348.4	Gilgil, Elementaita, Mbaruk/Eburu, Malewa West, Murindati
Kuresoi South	4	559.7	Amalo, Keringet, Kiptagich, Tinet
Kuresoi North	4	572.3	Kiptororo, Nyota, Sirikwa, Kamara
Subukia	3	390.71	Subukia, Waseges, Kabazi
Rongai	5	1049.1	Menengai West, Soin, Visoi, Mosop, Solai
Bahati	5	375.4	Dundori, Kabatini, Kiamaina, Lanet/Umoja, Bahati
Nakuru Town West	6	251	Barut, London, Kaptembwo, Kapkures, Rhonda, Shaabab
Nakuru Town East	5	74.3	Biashara, Kivumbini, Flamingo, Menengai, Nakuru East
TOTAL	**55**	**7498.8 km²**	

5 CGN. (2018). *Nakuru County Integrated Development Plan (23018-2022)*, County Government of Nakuru.

6 KNBS. (2019). Distribution of Population by Administrative Units, *Kenya Population and Housing Census: Vol. II*, Kenya National Bureau of Statistics

Figure 2: A map of the sub-counties and wards in Nakuru County (Source: ESRI)



The Mau escarpment covering the western part of the County, the Great Rift Valley, Ol-Doinyo Eburru Volcano, Akira Plains and Menengai Crater are the major topographical features. The County boasts an elaborate drainage and relief system with various inland lakes on the floor of the Rift Valley, into which nearly all the permanent rivers and streams in the County drain. These rivers include River Njoro and Makalia which drain into Lake Nakuru; River Malewa which drains into Lake Naivasha; and Molo River which drains into Lake Baringo, among others. The topographical features provide an interesting niche for research as well as great tourist attraction sites. The topography in Naivasha and Gilgil Sub-Counties is characterized by mountain ranges and savannah vegetation that supports various species of wildlife. The County's soil pattern presents a complex distribution of three main classifications that have been influenced by climatic conditions, volcanic activities, and the underlying rock type.[7]

The climate of Nakuru County is strongly influenced by altitude and physical features. There are four broad climatic zones, as shown in Figure 1 below.

Zone 1

has lowest mean annual amount of rainfall of about 500-800mm per annum. This zone is predominantly experienced in Gilgil and Naivasha sub-counties.

Zone 2

occupies most parts of Nakuru County with a general elevation of between 900m and 1800m above mean sea level (amsl).

Zone 3

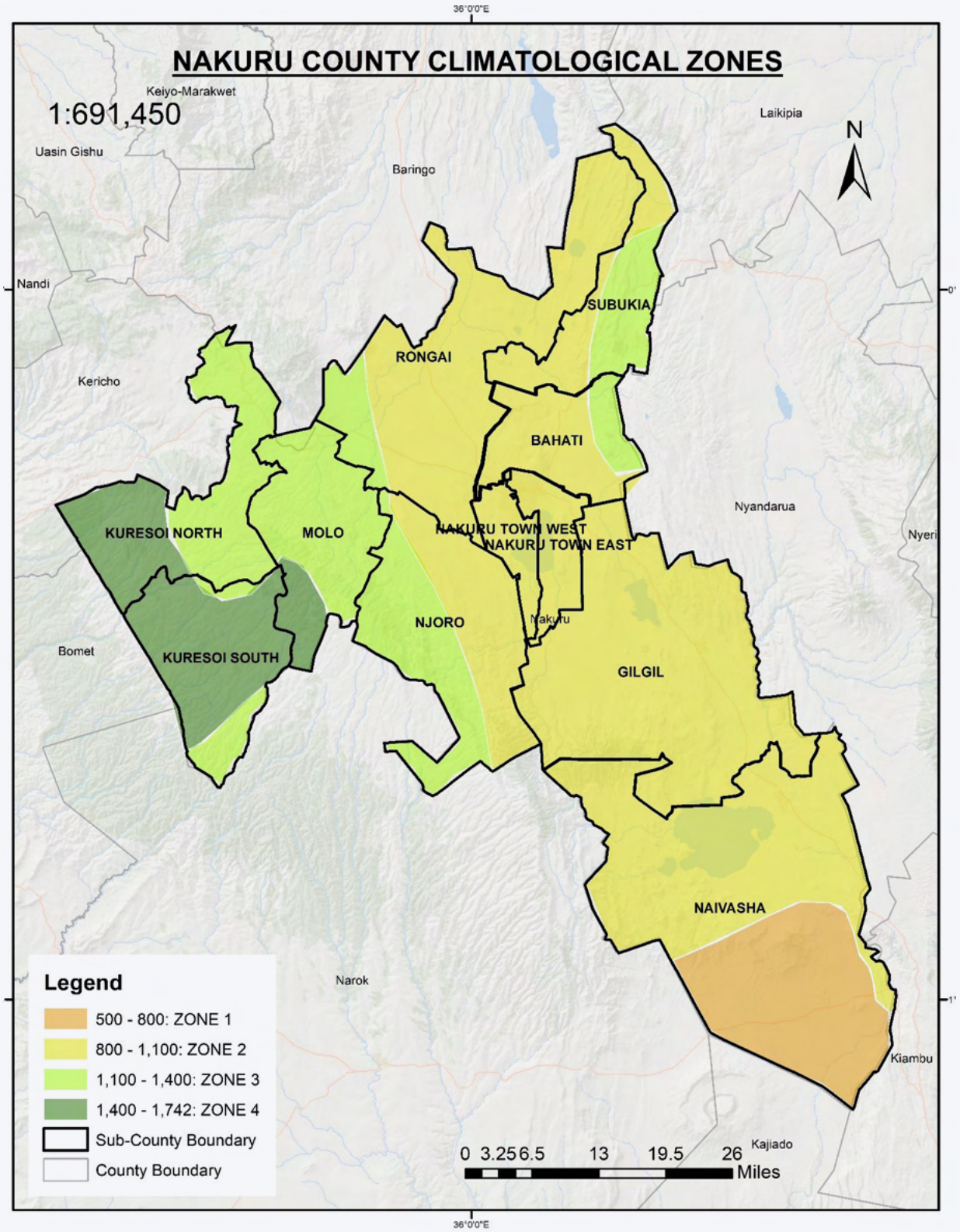
receives rainfall of between 1100 and 1400 mm per annum and covers areas with an altitude of between 1800-2300m above sea level. This zone covers much of the sub-counties of Kuresoi North, Molo, Njoro, Subukia and Bahati and are very suitable for agricultural activities.

Zone 4

covers areas with an altitude between 2300m and 2700m above mean sea level (amsl), receiving rainfall of over 1400mm per annum. This zone covers Mau Escarpment that is parts of both sub-counties of Kuresoi North and South.

7 CGN. (2018). Nakuru County Integrated Development Plan (2018-2022), County Government of Nakuru

Figure 3: Climatological zones of Nakuru County (Source: ESRI)



1.2.2 Demographic description

Nakuru County is the third-most populous County in Kenya after Nairobi County and Kiambu County. The population growth rate is approximately 3% per year and as of 2019, the population of Nakuru County stood at 2.2 million persons.[8] Slightly more than half (54%) of the people in Nakuru live in rural areas, while 46% live in urban areas.[9] Nakuru Town East and Nakuru Town West Constituencies are most densely populated, with 2,764 and 840 persons respectively per km^2. The high population density in both Nakuru Town West and East sub-counties is mainly attributed to the fact that the old Nakuru town district was also the Rift Valley Provincial Headquarters, which is a pull factor for migration.

On the other hand, despite Rongai, Naivasha and Gilgil Constituencies having the largest areas of land, they have the least population densities—202, 181 and 171 persons per km^2 respectively—in the year 2019. This may be attributed to unfavourable weather conditions. Gilgil constituency has the lowest population density, attributed to the semi-arid nature in the parts which include Elementaita and the Lake Elementaita water body and a few large-scale private ranches. The County is cosmopolitan, drawing its population from different ethnicities and nationalities. Settlement patterns are influenced by the availability of natural resources, soil fertility and rainfall, pasture, infrastructure, economic opportunities, proximity to urban areas and security. The dominant communities include the Kikuyu and the Kalenjin. Other communities present in the County include Luo, Luhya, Maasai, Kamba and Meru, among others.[10]

The County's Gross Domestic Product (GDP) for 2019 was estimated at KES 613 billion, accounting for 6.9% of Kenya's GDP. About 29.1% of the population lives under the poverty line of US$ 2 a day, which is slightly below the national poverty level of 36.1%.[3] The County's growing economy is largely based on natural resource sectors such as agriculture, forestry, fishing, wildlife and quarrying, with Agriculture accounting for approximately 60% of total economic activity. The main economic activities within Nakuru County are agribusiness, financial services, geothermal power generation and tourism.[4] Thus, Nakuru's economy is founded on ecosystems and their provision of 'services', such as a stable climate, fresh water, soil, and wildlife, among others.

Important industries such as tourism, forestry, agricultural production and cut flowers rely on a healthy natural resource base for their continued operation. The County is also known for its landscapes and associated biodiversity. The ecological zones of Nakuru County comprise of the Mau Escarpment, where most of the forests are located. The escarpment is also the source of the Njoro River that drains into Lake Nakuru. The forests in Nakuru are Menengai, Kiptunga, Bahati, Eburru, Likia, Sururu, Baraget, Mariashoni, Logoman, Molo, Saino, Teret, Nessuit and Dundori. They provide ecological services as well as socio-economic development.[11]

Nakuru Town East and Nakuru Town West Constituencies are most densely populated, with **2,764** and **840** persons respectively per km^2

The County's Gross Domestic Product (GDP) for 2019 was estimated at

KES 613

billion, accounting for 6.9% of Kenya's GDP.

29.1%

of the population lives under the poverty line of US$ 2 a day

8 KNBS.(2019). Distribution of Population by Administrative Unit, 2019 Kenya Population and Housing Census: Vol. II. http://www.knbs.or.ke

9 KNBS. (2019). Distribution of Population by Administrative Units, 2019 Kenya Population and Housing Census: Vol. II. http://www.knbs.or.ke

10 CGN. (2018). Nakuru County Integrated Development Plan (2018-2022), County Government of Nakuru.

11 IEBC. (2015). Independent Electoral and Boundaries Commission.

1.3 Electricity

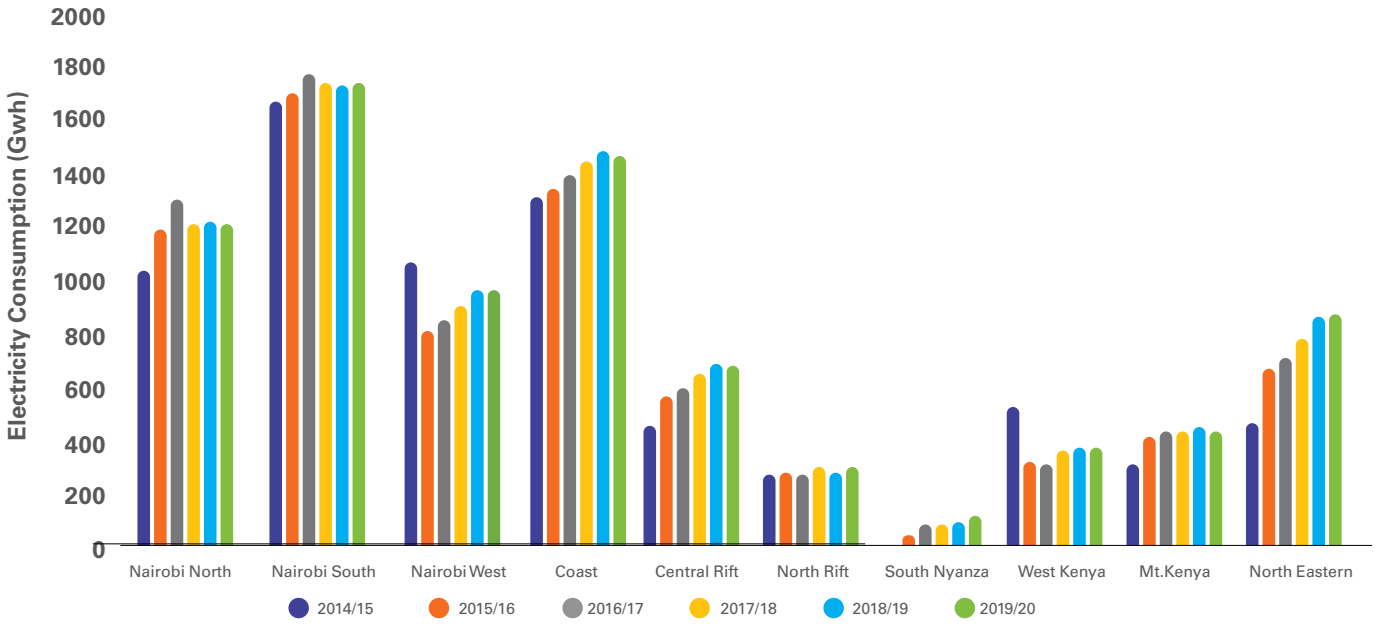
1.3.1 National Electricity Supply

Over the last decade, the electricity sector in Kenya has gone through a major expansion phase driven by government policy, with much of the activity focusing on increased generation and expansion of the household electrification rate. Several large-scale projects in the sector, such as the Last Mile Connectivity Project (LMCP), Slum Electrification Project (SEP), the Kenya Electrification Expansion Project, and the Kenya Electrification Modernisation Program, have contributed heavily to this rapid growth. Kenya's generation capacity is more than double the 2008 capacity, which was 1,310MW and the electrification rate has grown from 19% in 2010 to approximately 85% in 2020. The current capacity, which stands at 2,984 MW, is largely from renewable sources, mostly hydro, geothermal, and more recently wind and solar. Kenya still has a significant proportion of diesel-based thermal power plants (720 MW) but they are used mostly to provide voltage support and other grid-related services.

The uptake of solar energy has been driven by plummeting hardware costs internationally. A significant number of Kenyans use off-grid solar, though the total installed capacity of off-grid solar is unknown. Due to the low cost of solar energy many commercial and industrial customers have installed captive solar to mitigate the high electricity tariffs levied by the utility. The total capacity of commercial and industrial solar installed nationally is not well known, but it has risen quite fast recently, and it is expected to grow as the cost of solar PV hardware continues to decline globally. Generation has historically been dominated by state-owned hydropower, being as high as 47% of the generation mix early in the last decade. This reliance on hydropower has for a long time negatively affected electricity supply due to vulnerabilities in power generation in periods of drought or reduced hydrology.

While electricity generation capacity has nearly doubled over the last decade, consumption has grown marginally and plateaued in some regions and sectors. The national consumption by year and region is shown in Figure 4 below.

Figure 4: Regional Electricity Consumption (Source: EPRA)



12 Government of Kenya, Least Cost Power Development Plan, 2017-2037
13 IEA. (2020). SDG7: Data and Projections. IEA. Paris https://www.iea.org/reports/sdg7-data-and-projections.
14 EPRA. (2021). Energy and Petroleum Statistics Report, 2021, Energy and Petroleum Regulatory Authority.
15 EPRA. (2021). Energy and Petroleum Statistics Report, 2021, Energy and Petroleum Regulatory Authority.

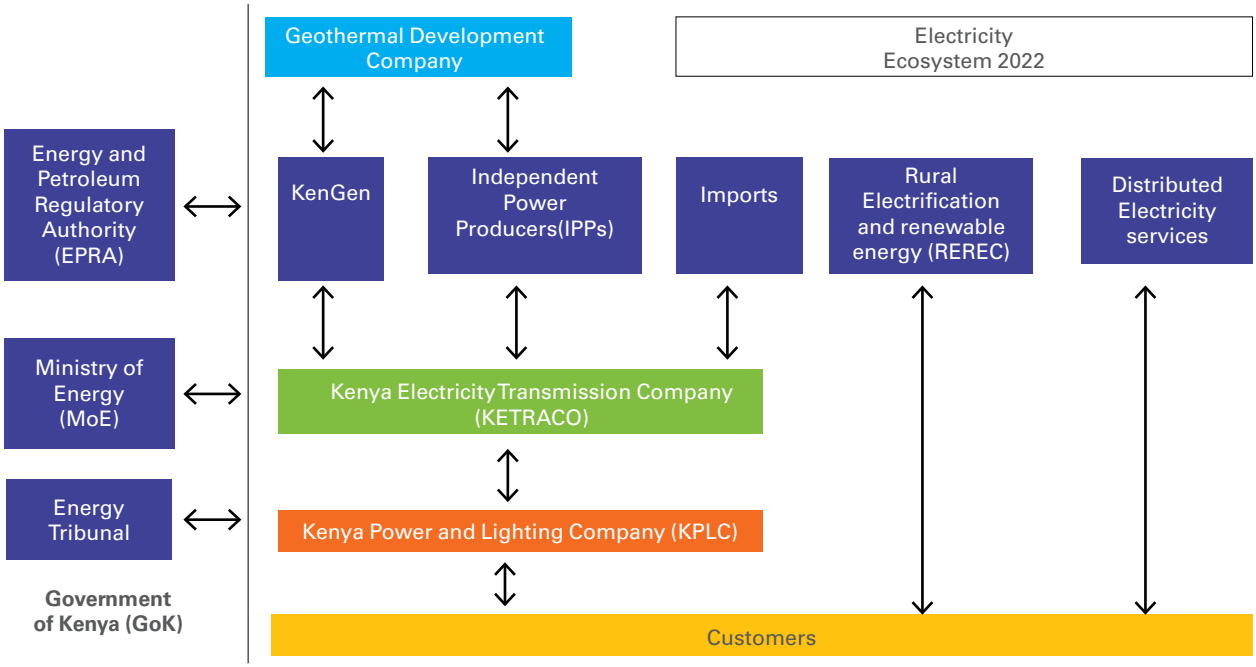
Kenya's electrification rate has grown from **19%** in 2010 to approximately **85%** in 2020. The current capacity stands at

2,984 MW

and is largely from renewable sources

The key actors in the electricity sector have evolved from a largely government-owned and operated vertically integrated utility, to many state-public companies; a regulatory body and private developers. While these reforms are laudable and have contributed largely to increased electricity access, significant challenges abound. Concerns of power quality, high tariffs and inequality in electricity access still plague the sector. KenGen, the semi-private legacy electricity generator, generates almost two-thirds of the electricity consumed in Kenya.[17]

Figure 5: Power Sector Ecosystem in 2022.



1.3.2 Nakuru electricity supply infrastructure

Nakuru County is home to Nakuru city, one of just four cities in the Republic of Kenya. It is highly developed compared to other counties, with a dense network of electricity delivery infrastructure. This is evidenced by the high rates of electrification reported from the survey. That said, it should be noted that the infrastructure is not evenly or uniformly distributed across all the sub-counties. Urban sub-counties like Nakuru East and Nakuru West have a dense network of distribution lines compared to more rural counties like Kuresoi North and South. This section will map out the transmission and distribution lines that straddle the County.

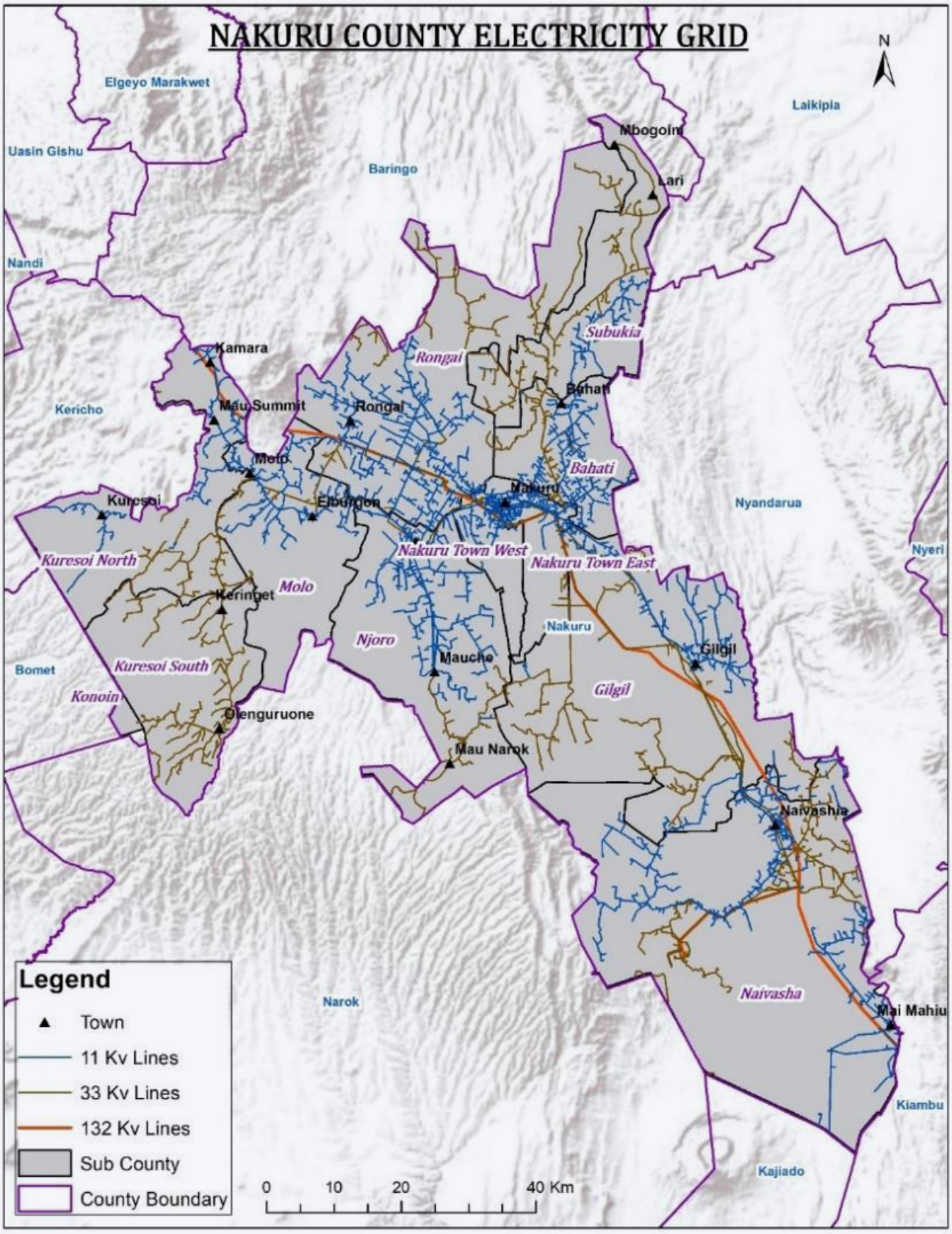
Nakuru County has around 2224 km of 11 kV distribution line which is around 5% of the entire 11 kV network in the country. This is quite impressive compared to most of the other 47 counties. The list of existing infrastructure can be seen in the table below.

Nakuru County has around **2224 km** of **11 kV** distribution line which is around **5%** of the entire **11 kV** network in the country

Table 3: National and County Electricity Infrastructure (Source: WB/KPLC/KETRACO)

	132 kV (km)	33 kV (km)	11 kV (km)
National (Kenya)	3372	35703	40616
Nakuru County	559	1743	2224

Figure 6: Grid Infrastructure Distribution in Nakuru County (Source: WB/KPLC/KETRACO)



1.4 Methodology

1.4.1 Secondary Data Review

The CEP development process covered an in-depth review of national and sub-national policies, laws and plans, national census data, County-level databases, geospatial resources among others. Additionally, we reviewed the current benchmarks in energy planning across other countries and counties to understand national and international best practices. Table 5 below detail some of the existing policy documents and legislation that were reviewed in the preparation of this plan.

Table 4: A Sample of Documents Reviewed

No	Legislations	Functions
1	Kenya Constitution and Vision 2030	The Kenya Vision 2030 identifies energy as one of the infrastructure enablers of its social-economic pillar.
2	The County Governments Act, 2012	Requires the counties to protect and develop natural resources in a manner that aligns national and county government policies.
3	The Energy Act No. 1, 2019	Consolidates the laws relating to energy and provides for national and county government functions in relation to energy.
4	National Environment management and coordination Act 2015	Provides for the legal and institutional framework for the management of the environment and for the matters connected therewith and incidental thereto.
5	Sustainable Energy for All (SEforAll)	Outlines how Kenya will achieve the SE4All goal of 100% universal access to modern energy services, as well as increase the rate of energy efficiency and the share of renewable energy in the energy mix, to 80%, by 2030.
6	Kenya National Electrification Strategy (KNES)	Recognizes the key role played by off-grid options, mini-grids and stand-alone solar systems that complement grid extension and intensification.
7	The Climate Change Act 2016	Seeks to provide the legal and institutional framework for mitigation and adaption to the effects of climate change; to facilitate and enhance response to climate change; and to provide guidance and measures for achieving low carbon climate-resilient development.

1.4.2 Primary Data Collection

Primary data collection was carried out at the household, institution, and business levels to understand the status of energy access, consumption, and efficiency. 420 households, 197 health facilities, 128 learning institutions and 384 commercial enterprises across the eleven sub-counties were surveyed. Businesses and institutions were surveyed from the 22nd of November 2021 to 4th December 2021 using trained data collection experts drawn from the County government and from EED Advisory. Computer Aided Personal Interviews (CAPI) tools were employed. The household survey was carried out by Africa Center for Technology Studies (ACTS) as part of the SEACAP process while the institutions and businesses survey were carried out by EED Advisory.

Additionally, eleven (11) key informants drawn from government agencies, private sector, non-governmental organizations, and other development partners were interviewed in October, November, and December. The County Energy Plan (CEP) development is a consultative process, and as such, virtual and in-person meetings and workshops were held with representatives from the County government. The first of such was a data validation workshop which was held online on the 20th of January 2022. A subsequent target setting workshop was held physically in Nakuru on the 21st of January 2022 with representation from different County directorates, including Education, Health, Trade, Economic Planning, Veterinary Services, and Energy, Environment and Natural Resources. To cap it, another target validation workshop was held virtually on the 4th of February 2022 with good representation from the County directorates. The inputs and suggestions from these engagements have been incorporated into the Energy Plan.

Table 5: Summary of the Primary Data Collection Activities

Survey		Key Informant Interview (KII)		Workshop	
Entity	**Quantity**	**Entity**	**Quantity**	**Entity**	**Quantity**
Households	420	Ministry of Energy	2	Nakuru County Directorates (Data Validation Workshop)	1
Health Facilities	197	KETRACO	1		
		REREC	1		
Enterprises	384	Practical Action	2	Nakuru County Directors (Target Setting Workshop)	1
		Modern Energy Cooking Services (MECS)	1		
Learning Institutions	128	Davis and Shirtliff	1	Nakuru County Directors (Targets Follow-up)	1
		Department of Energy (Nakuru County)	1		

1.4.3 Energy Demand Modeling

The Low Emissions Analysis Platform (LEAP) is a full-fledged systems optimization model for long-run energy planning. This linear optimization model determines all combinations of energy carrier usage and technology activity, which minimizes the total cost of the system within given constraints. Energy demand modeling can be carried out using two main techniques—optimization and simulation. Optimization energy models are used when demand can be met by various energy resources and system planners need to determine the best supply mix to meet demand. The optimal supply is based on certain constraints such as availability and capacity limits, with the main constraint being resource cost. The main objective of optimization models is to meet supply at the least cost. Simulation tools on the other hand are used to project demand based on certain scenarios such as favourable policy and economic growth. The simulation builds upon known parameters, past data and relationships between energy demand and factors influencing it with a consistent set of assumptions.

For Nakuru County, modeling was done by defining scenarios and setting constraints for each technology or energy source. Scenarios were simulated based on both known variables, including the present energy consumption, current population, and energy access targets among others, and unknown variables such as growth rates (economic and demographics) and impacts of technological advancement. The three scenarios which are later described in detail in this report include:

i) business as usual

ii) SDG 7 and

iii) high economic growth scenario.

The results of each of these scenarios per sector as well as the County level are presented later in this report. The aim of this activity is not to prescribe the best option, but to offer guidelines on the expected demand and growth should the County adopt any.

Energy Resource Assessment

2.1 Solar Energy

2.1.1 Common Technology Options

The sun`s energy can either be in form of heat or light. Both heat and light are harnessed using various technologies for various uses. Heat, or thermal energy, can be harnessed directly using plates or collectors and used for diverse applications, including heating water, drying agricultural products, among others. Solar thermal technologies are widely used today in residential households to heat water, thus saving consumers electricity bills. Several industries or hotels with high demand for hot water are also installing solar collectors instead of using electric heaters.

Solar energy—light from the sun—can be converted to electricity using solar photovoltaic (PV) panels. Solar PV is the most popular and dominant use of solar energy today. Historically, solar PV was installed mostly for domestic use due to cost, but over the last few decades prices of solar PV have plummeted appreciably, allowing solar PV to compete with legacy energy sources like hydro and coal at the grid level. Solar photovoltaic (PV) technology is today helping many off-grid households in Nakuru County, and Kenya at large, to access electricity.

Most households use what is widely regarded as solar home systems (SHSs)—a combination of a solar panel, battery, inverter, and a few appliances. Many industrial and commercial enterprises have lately turned to solar to cut on the electricity bills. A significant number of flower farms in Naivasha and Njoro have installed solar systems recently. Menengai Oil company also inaugurated their 1 MW solar system at their facility in Nakuru. Other applications of solar energy include solar hybrid mini-grids and utility scale plants, as shown in Figure 7 below.

Figure 7: Garissa Solar Utility-Scale Solar Project (Source: REREC, 2022)

2.1.2 Solar Resource Assessment

Kenya receives approximately 4-6kWh/km^2/day[18] of solar radiation per day. Nakuru County receives solar radiation of around 6kWh/km^2/day[19]. What this means is that the County receives approximately six full sun hours daily out of 24 hours. As discussed above solar energy can be harnessed in various forms, and the exact potential can only be determined after considering the amount of space available for installation. Sub-counties like Gilgil and Naivasha may be more suited for utility scale plants given the expansive land, while other sub-counties like Nakuru East and West may be suited for commercial and industrial solar systems, given the concentration of industries.

Naivasha is home to many horticultural production farms, which have increasingly embraced commercial and industrial scale. The same phenomenon is replicated in the sub-county of Njoro, which also hosts a significant number of flower farms. In sub-counties with low levels of electricity access, and towns where the grid is quite far, mini-grids can be deployed effectively and in a cost-efficient manner. The images below show the solar irradiation in the County, and the suitability of various locations for harnessing solar energy. From the images, it can be seen that Rongai sub-County has the highest potential for solar energy. In 2020, President Kenyatta announced plans to construct a solar plant in Kabarak which is in Rongai sub-County.[20]

Kenya receives approximately **4-6kWh/km^2/day** of solar radiation per day. Nakuru County receives solar radiation of around **6kWh/km^2/day**

18 MoE. (2008). Solar and Wind Resource Assessment, Kenya County Report.

19 ibid

20 Metropol TV. (2020). Solar energy plant to be constructed in Kabarak to complete Moi`s dream. https://metropoltv.co.ke/2020/02/12/solar-energy-plant-to-be-installed-in-kabarak-to-complete-mois-dream/

Figure 8: Nakuru`s solar irradiance map (Sources: SolarGIS, ESRI, GEBCO, NOAA, NGDC)

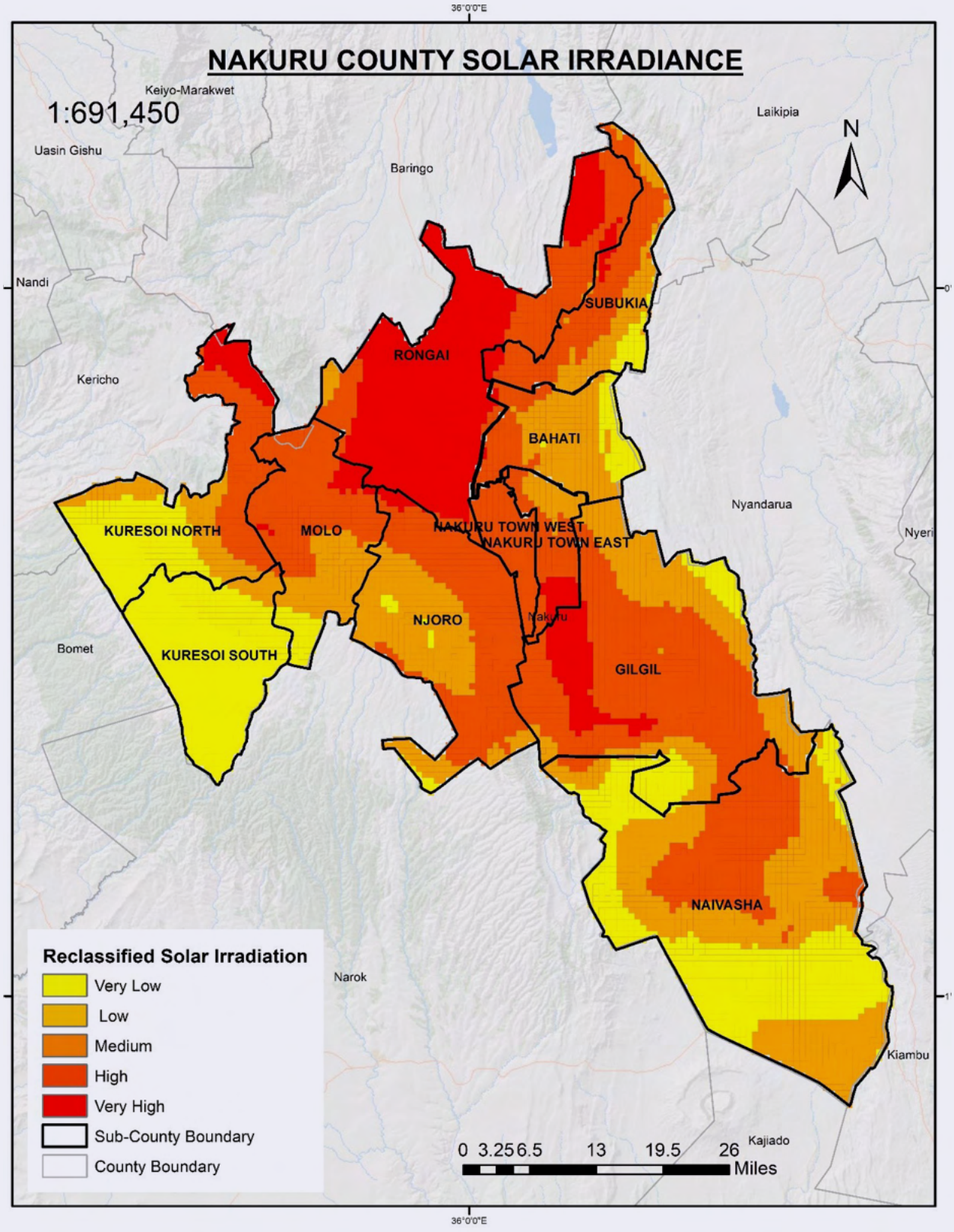
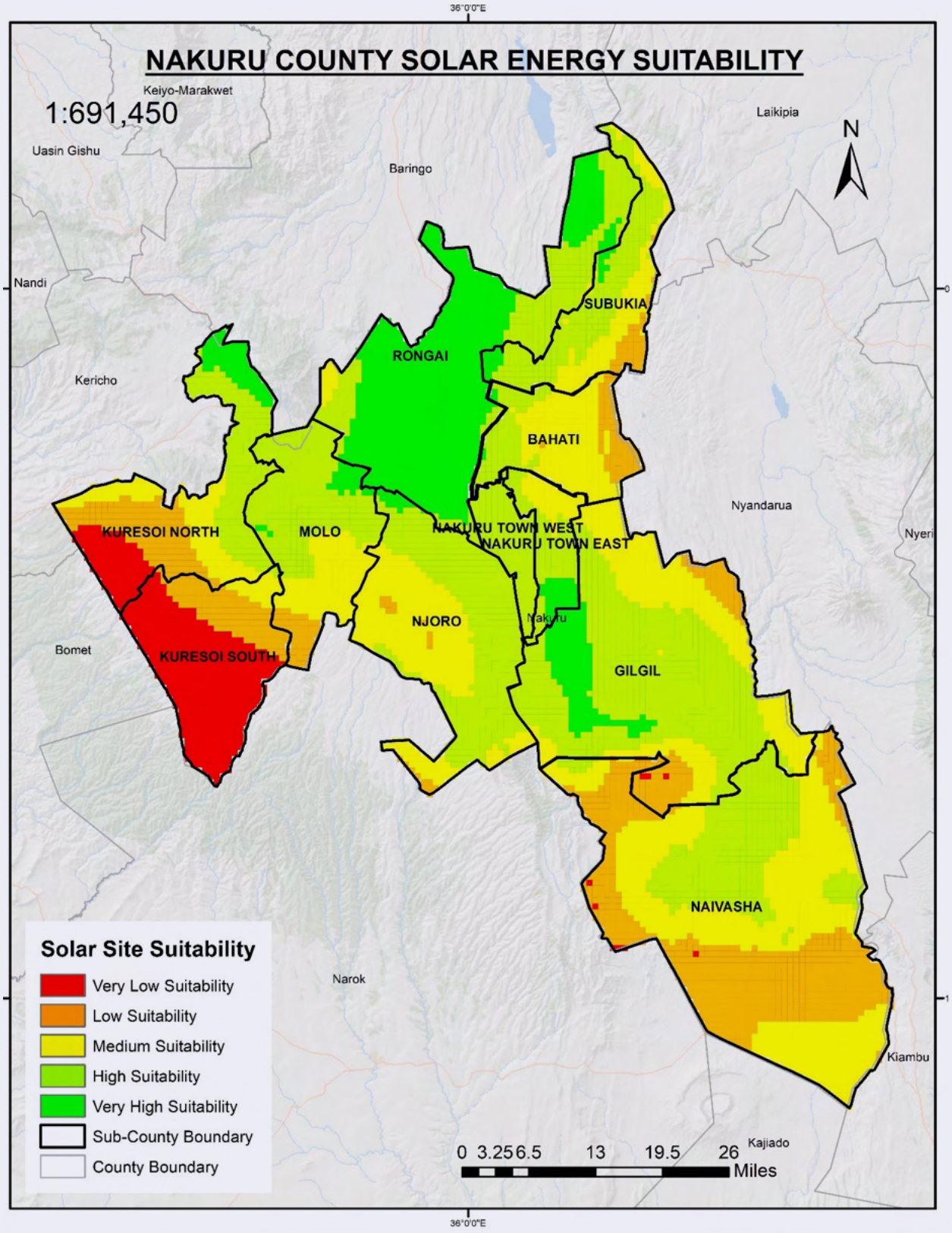
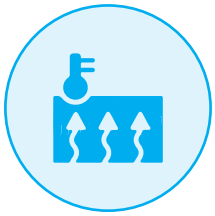


Figure 9: Nakuru Solar Energy Suitability Map (Sources: SolarGIS, ESRI, GEBCO, NOAA, NGDC)





2.2 Geothermal Energy

2.2.1 Common Technology Options

Geothermal energy is heat within the earth formed from decay of radioactive particles in the earth's core.[21] This heat, heats water that seeps into the earth's crust and converts it to steam. Steam is then harnessed by drilling and used to generate electricity or used directly for thermal applications like grain drying. Geothermal energy for electricity production is the dominant form of geothermal technology employed. After a well is drilled and the quality of the steam is authenticated, steam from different wells is gathered to a central location using cladded pipes. It is used to drive a turbine or turbines connected to an electric generator, and electricity is produced by electromagnetism.

A geothermal powerplant is run by steam from hundreds of wells, drilled over a period of many months and sometime even years. To benefit from geothermal energy while wells are still being drilled, KenGen invented the wellhead technology. A wellhead is a mini-powerplant constructed at on each well before gathering steam from these wells to a single powerplant. Through this innovation, KenGen can take advantage of the idle time between drilling wells and constructing a powerplant and piping system. KenGen has so far installed 14 wellheads with a total generation capacity of 75.6 MW.[22]

Kenya's geothermal capacity is estimated to be about **7,000 MW-10,000 MW**, of which **863 MW** has been installed

Drilling a geothermal well is often a risky and expensive affair. In many instances, a well can yield steam that does not meet the quality required for electricity generation. Inasmuch as this steam is not ideal for electricity generation, it contains considerable thermal/heat energy. This heat energy trapped in low quality steam can be channelled to several applications. This direct utilization of steam from a geothermal well without necessarily using it to generate electricity is what is referred to as Direct Use geothermal. Both KenGen and Geothermal Development Company have elaborate Direct Use geothermal sections devoted to development of Direct Use geothermal applications. To date, both companies have built demonstration projects in Ol karia and Menengai to showcase some of the uses of Direct Use geothermal, like heating greenhouses, heating fish ponds, drying cereals, and pasteurizing milk, among others.

2.2.2 Geothermal Resource Assessment

Nakuru County is the leading geothermal producer, not just in Kenya, but also in Africa. Kenya ranks seventh globally in geothermal energy production.[23] Kenya's geothermal capacity is estimated to be about 7,000 MW-10,000 MW,[24] of which 863 MW has been installed.[25] Most of these resources are found within the Great Rift Valley of Kenya. Geothermal exploration began in Kenya around the 1980s but development did not progress as rapidly. The first geothermal power plant in Kenya was commissioned in 1981. The 15 MW plant is today part of three turbines which cumulatively make up Olkaria 1.

22 EIA. (20210). Geothermal Explained, International Energy Administration. https://www.eia.gov/energyexplained/geothermal/

23 KenGen. (2021). 75.6 MW Well head units, Kenya Electricity Generating Company. https://www.kengen.co.ke/index.php/geothermal-plant/75-6-mw-geothermal-well-head-units.html

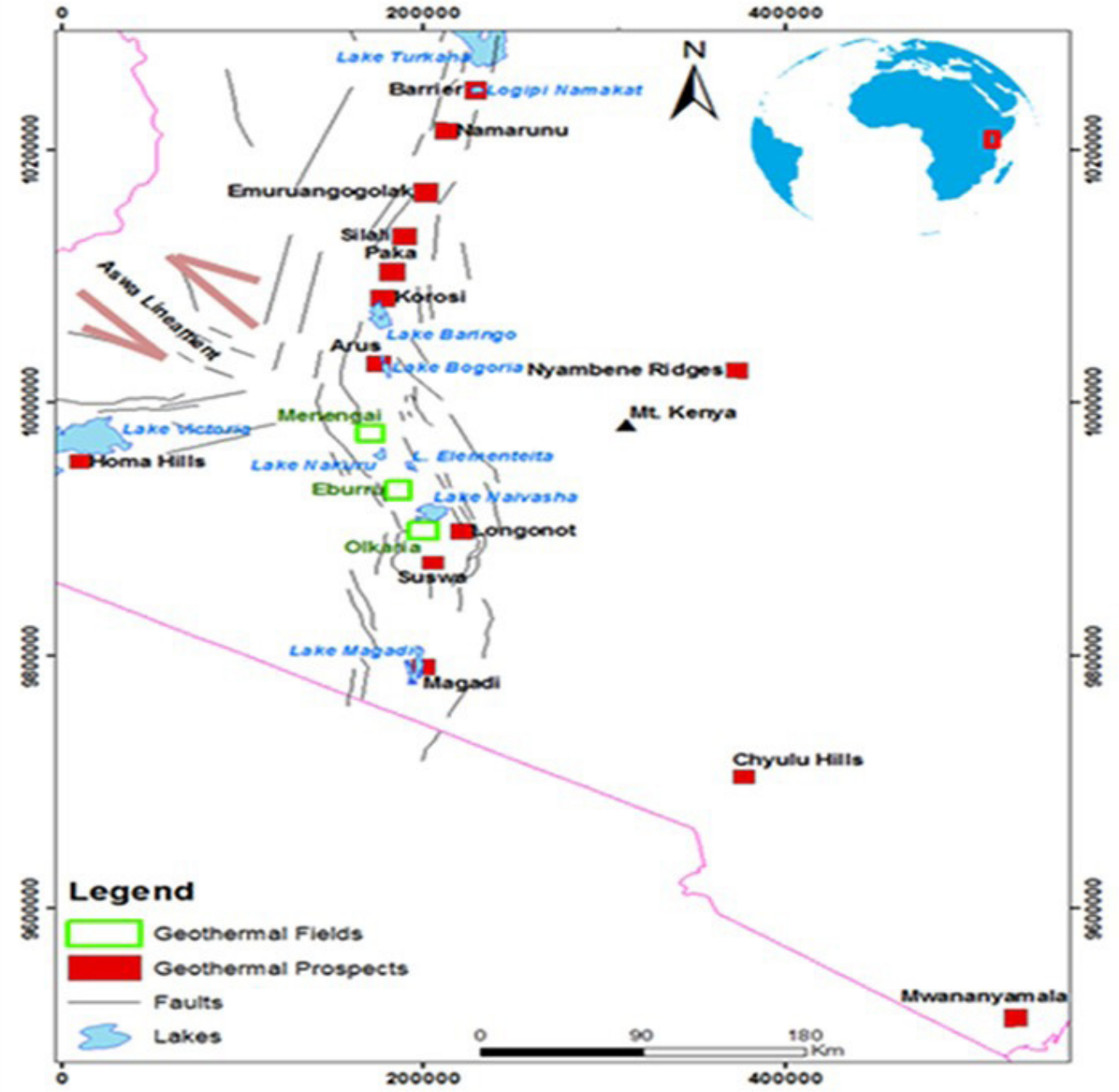
24 EPRA. (2021). Energy and Petroleum Statistics, 2021, Energy and Petroleum Regulatory Authority.

25 EPRA. (2021). Geothermal in Kenya, Energy and Petroleum Regulatory Authority. https://renewableenergy.go.ke/technologies/geothermal-energy/#:~:text=Geothermal%20resources%20in%20Kenya%20are,spread%20over%2014%20prospective%20sites.

26 EPRA. (2021). Energy and Petroleum Statistics, 2021, Energy and Petroleum Regulatory Authority.

To date, all the geothermal installed in the Kenyan grid is from Naivasha sub-County of Nakuru County, in Olkaria. Kenya electricity Generating Company (KenGen) has been the lead developer of geothermal energy in Kenya, but in order to fast-track the development of geothermal, a special-purpose state agency, Geothermal Development Company, was established in 2008. The role of this new entity was to develop steam fields in the geothermal belt and partner with independent power producers for power generation.

Figure 10: Map Showing Geothermal Resource in Kenya (Source: KenGen, 2022)



Majority of the geothermal capacity installed in Kenya is by KenGen and is drawn from Olkaria region of Naivasha. This region has a geothermal potential of around 2000 MW, of which 863 MW have been exploited and connected to the grid.[26] The list of geothermal power plants in Kenya is as shown below:

Table 6: List of Geothermal Power Plants in Kenya[27,28]

#	Owner/ Operator	Name	Capacity	Year(s) Commissioned
1	KenGen	Olkaria I	45 MW	1981, 1982, 1985
2	KenGen	Olkaria II	105 MW	2003, 2010
3	KenGen	Olkaria I Unit 4&5	280 MW	2014, 2015
4	KenGen	Olkaria V	165.4 MW	2019
5	KenGen	Olkaria Wellheads generators	81 MW	2012
6	KenGen	Eburru Wellhead	2.44 MW	2012
7	Ormat	Olkaria III	139 MW	2000, 2009, 2014,2016

Geothermal Development Company (GDC) drilled its initial wells in Olkaria around 2009, but after 2010 they have been actively developing the Menengai steam field. Menengai geothermal field has a potential of 1600 MW of geothermal,[29] of which about 456 MW is expected to be generated once it is successfully exploited in five phases.[30] The company will operate a steam sales business model where it will sell steam to independent power producers (IPPs) for electricity generation. By 2019, 47 wells had been drilled with an estimated geothermal potential of 169 MW.[31] Instructively, no power plant has been built and none of these has been connected to the grid. A schedule of the development stages for Menengai is as shown below:

Table 7: Menengai Powerplants Development Stages

#	Phase	Capacity	Independent Power Producers (IPPs)
1	Phase I	105 MW	Quantum Power East Africa (35 MW) Sosian Energy (35 MW) Ormat Power (35 MW)
2	Phase II	60 MW	Undisclosed
3	Phase III, IV,V	N/A	N/A

26 EPRA. (2021). Energy and Petroleum Statistics Report, 2021, Energy and Petroleum Regulatory Authority.

27 KenGen. (2022). Geothermal installed capacity, Kenya Electricity Generating Company. https://www.kengen.co.ke/index.php/business/power-generation/geothermal.html

28 Ormat. (2016). Press Release, Ormat Technologies. https://investor.ormat.com/news-events/news/news-details/2016/Ormat-Announces-Commercial-Operation-of-Plant-4-in-Olkaria-III-in-Kenya-Expanding-Complex-Capacity-to-Nearly-140-MW/default.aspx

29 GDC. (2021). Geothermal resource potential, Geothermal Development Company.

30 ibid

31 ibid

32 ibid

2.3 Wind Energy

2.3.1 Common Technology Options

Wind energy is energy in motion. Moving air contains kinetic energy which can be harnessed using turbines or vanes to generate electricity or run other mechanical equipment. Windvanes convert wind energy—moving air—into rotational energy which can be used mechanically in several applications such as water pumping.

Alternatively, wind energy can be used to produce electricity using wind turbines. A wind turbine consists of specially engineered blades, a rotor erected to the required height, and an electric generator connected to the blades by means of a shaft. Once air in motion meets the blades, the kinetic energy causes the blades to rotate, thus rotating the shaft coupled to it. The shaft is connected to a generator on the other end, and as it rotates, electricity is produced by means of electromagnetism. The quantity of electricity generated is dependent on the wind speed and size of the blades.

A single wind turbine can have an average of 1.6 MW electric energy capacity.[33] A wind farm is made of an array of wind turbines connected to one output. Windfarms can be built on land (onshore wind) or in shallow open waters like oceans and seas (offshore wind) where wind speed is relatively high.

A single wind turbine can have an average of **1.6 MW** electric energy capacity.

2.3.2 Wind Resource Assessment

The installed capacity for wind in Kenya stands at 435 MW[34] the bulk of which comes from Lake Turkana Wind Power Project (310 MW), the biggest wind farm in Africa. The windfarm, which was commissioned in 2018, is built in Loiyangalani area in the wider Marsabit County, which is one of the highest wind potential areas nationally. The first wind power plant to be commissioned in Kenya was the 25 MW Ngong Wind Power Project, owned and operated by KenGen. The latest addition to the grid is Kipeto`s 100 MW in Kajiado County, which was commissioned in 2021. Several wind farms have been proposed but these are at different development stages. The most popular sites for wind power development in Kenya include the regions around Meru and some parts of Lamu.

To understand the potential of wind energy in Kenya, a comprehensive wind resource assessment was carried out by WinDForce in 2013. Assessing wind resource involves measuring wind speeds at various heights, mostly 60m, 80m and 100m. Based on this data—wind speeds at the assessed height—the wind is categorized according to class. For wind to be categorized as ideal for power production using mainstream wind turbines, the wind should have a minimum speed of 6 m/s at the assessed height. WinDForce estimated the potential area for wind energy and categorized it based on that. At 100m the Eastern region of Marsabit showed the greatest potential, with wind speeds of approximately 9.7 m/s.[35]

33 IRENA. (2021. Wind Energy, International Renewable Energy Agency. https://www.irena.org/wind
34 EPRA. (2021). Energy and Petroleum Statistics, 2021, Energy and Petroleum Regulatory Authority.
35 EPRA. (2021). Wind prospectus in Kenya, Energy and Petroleum Regulatory Authority.

WinDForce estimated that in Nakuru alone we have 29,286 m^2 of area,[36] with wind speeds averaging 6.52 m/s, which is Category IV wind speed. A breakdown of the potential area for wind energy nationally at 100m is as shown in Table 9 below. The potential for wind in Nakuru County and suitable sites for wind energy generation was estimated using GIS. The outcome of that exercise is in Figure 11 and Figure 12 below. While there are some locations with Nakuru County that show some potential for wind generation, compared to other parts of the county like Marsabit with excellent windspeeds, it is highly unlikely many large-scale wind energy investors will be drawn to Nakuru. Also, given the high potential for geothermal and solar in the County, these two—geothermal and solar—appear to be the most ideal and economically viable.

Table 8: Wind Resource Potential Area at 100m (Source: EPRA)

Wind Speed (m/s)	Potential Area (SQ. M)	Category
2 - 2.5	7	Not Suitable
2.5 – 3	435	
3 – 3.5	1007	
3.5 – 4	1643	
4 – 4.5	6932	
4.5 – 5	20794	
5 – 5.5	56435	
5.5 – 6	78782	
6 – 6.5	107410	Class IV
6.5 – 7	142352	Class III
7 – 7.5	146363	
7.5 – 8	21318	Class II
8 – 8.5	6910	
8.5 – 9	2586	Class I
9 – 9.5	238	

Figure 11: Wind Speeds for Nakuru County (Source: WindAtlas, ESRI, GEBCO, NOAA)

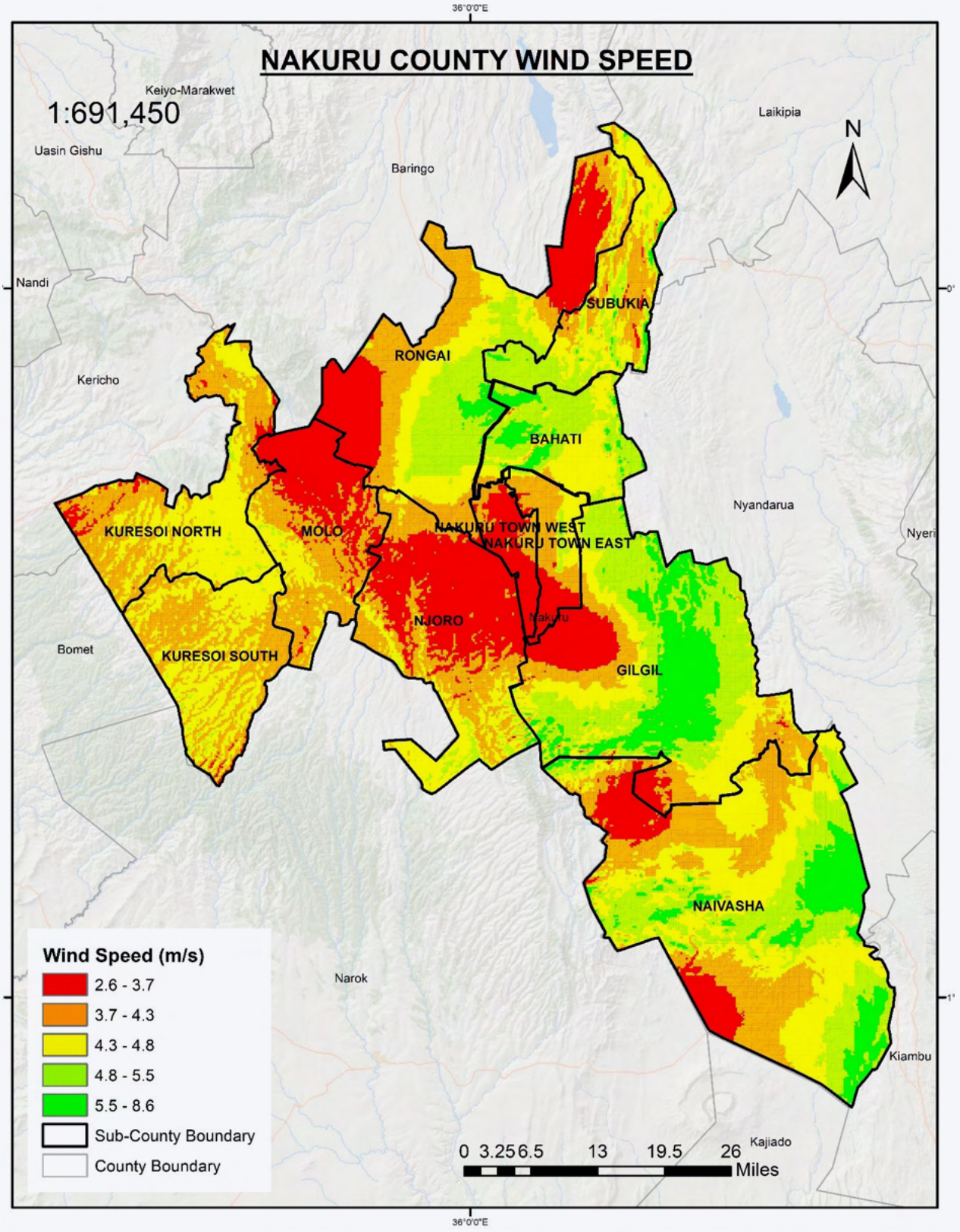
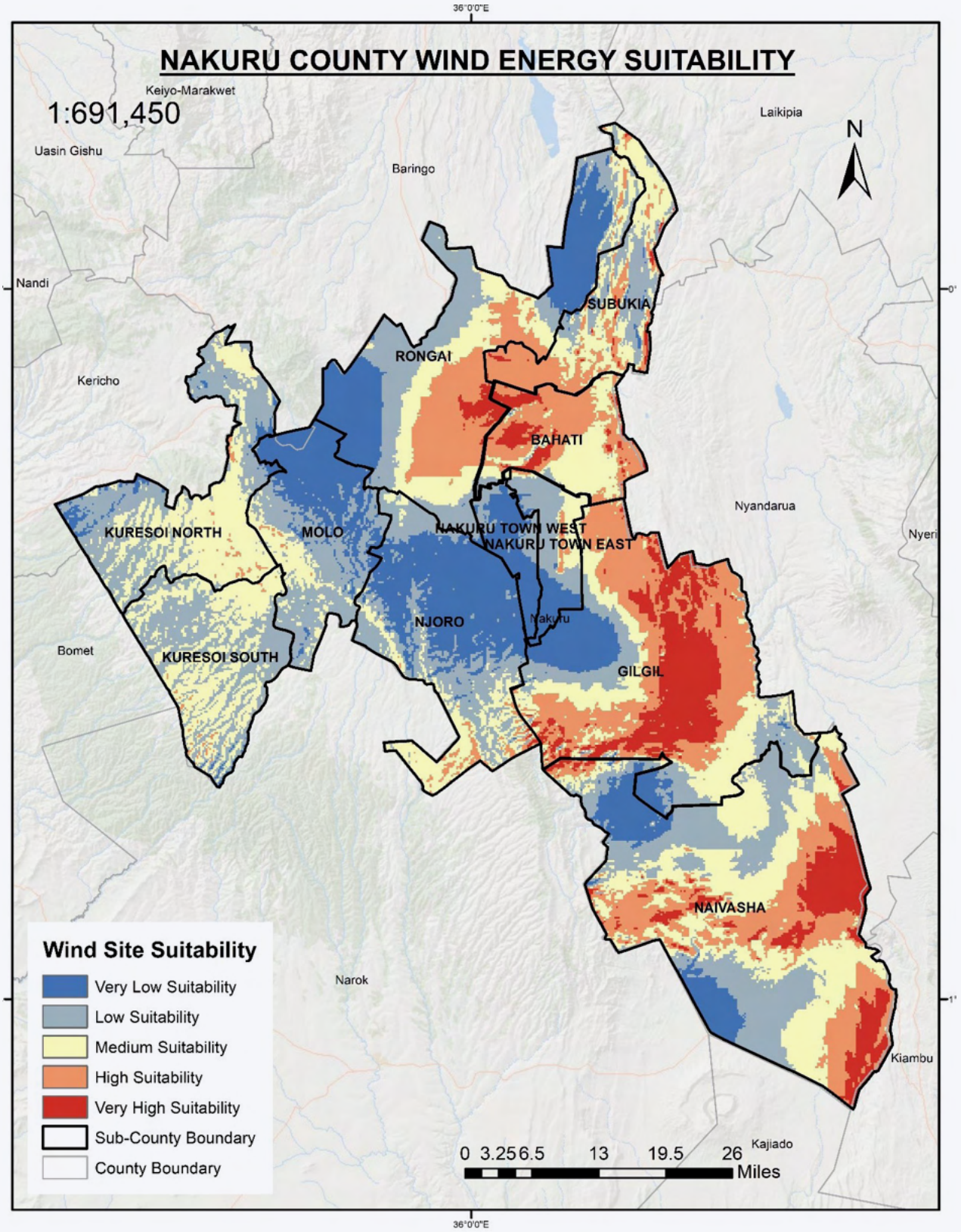


Figure 12: Wind Energy Suitability Map for Nakuru (Source: WindAtlas, ESRI, GEBCO, NOAA)



2.4 Bioenergy

2.4.1 Common Technology Types

Bioenergy refers to energy derived from living plant and animal matter and their metabolic by-products.[37] Bioenergy can be categorized based on:

i) final use (heating, electricity generation, transport fuel);

ii) its physical nature (solid, liquid, gas);

iii) technology of conversion before/during use (traditional, improved, and modern).

Several conversion routes and technologies transform raw biomass into final energy products (heat, electricity, transport, or cooking fuel), as shown below. The primary classes of conversion routes are:

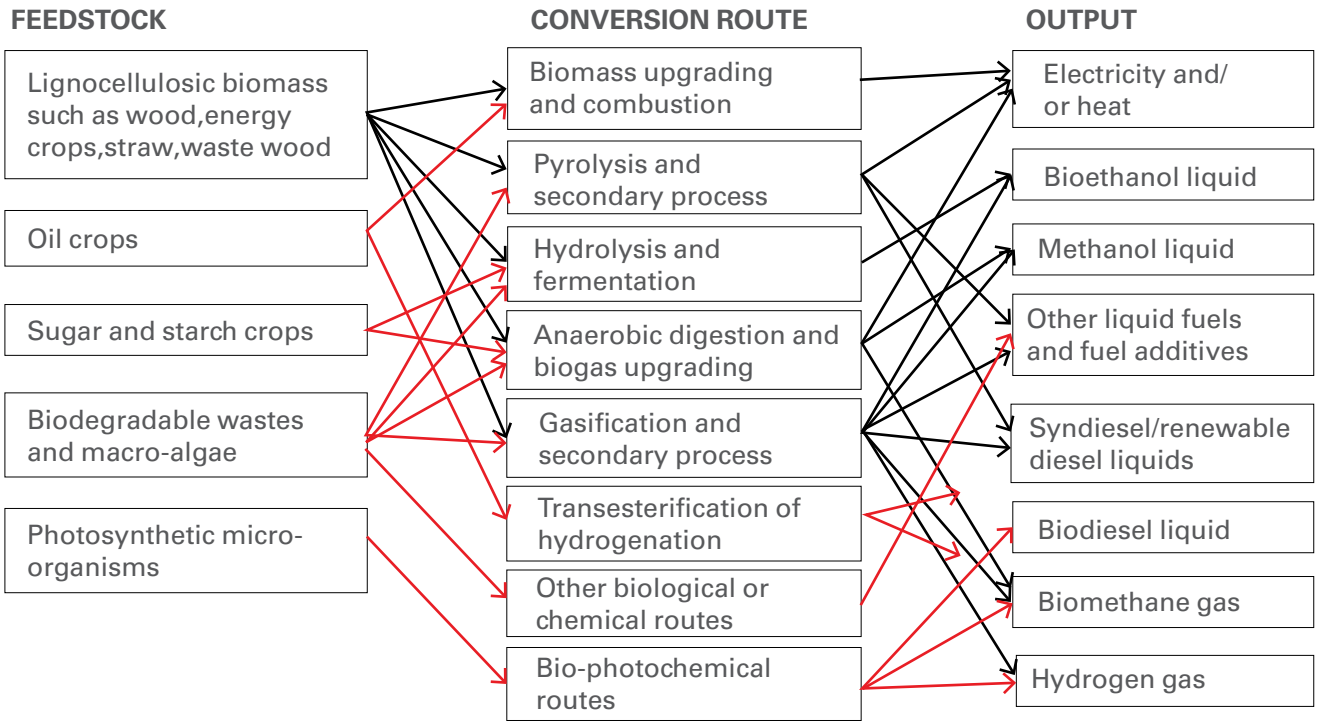
i) thermochemical conversion (combustion, gasification, pyrolysis, and torrefaction);

ii) physiochemical conversion (oil extraction and transesterification);

iii) biological conversion (fermentation, anaerobic digestion); and

iv)bio-photochemical route.[38]

Figure 13: Biomass Conversion routes (Source:IEA)



Note: Black arrows indicate potential conversion routes for woody biomass.

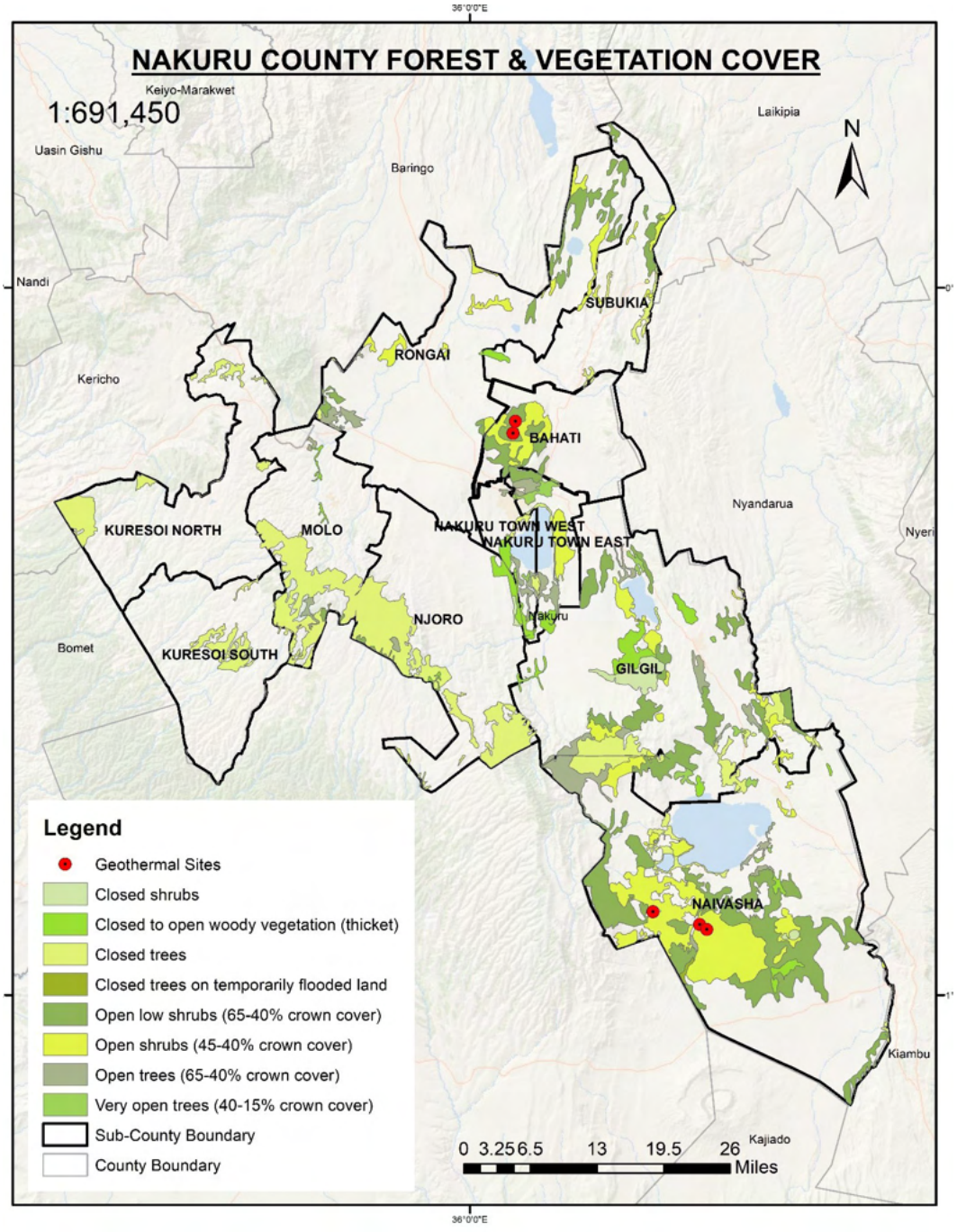
37 Lee, S., & Shah, Y. T. (2012). Biofuels and bioenergy: Processes and technologies. CRC Press.

38 IEA. (2009). Bioenergy–a sustainable and reliable energy source. International Energy Agency Bioenergy, Paris, France.

2.4.2 Bioenergy Resource Assessment

According to the Global Forest Watch (GFW), Nakuru County had 91.2 kHa of natural forest in 2010,[39] accounting for 14% of its total landmass.[40] In 2021, it lost 152ha of natural forest, equivalent to 85.6kt of CO_2 emissions. This loss can be attributed to deforestation to meet the growing County energy needs, especially cooking needs, as well as agricultural expansion. With this background, there is need to transition sectors that are heavy firewood and charcoal consumers. A map of forests and vegetation cover across the County is shown below.

Figure 14: A Map of Forests and Vegetation Cover in Nakuru County (Source: ESRI, GEBCO, NOAA)



39 GFW. (2021). Status of Forests in Nakuru, Global Forests Watch.
40 ibid


©shutterstock.com
Nakuru County had
91.2 kHa
of natural forest in
2010,accounting
for 14% of its total
landmass.

Using the 2019 population and housing census and the cooking sector study data, we find that the average total annual residential fuelwood (0.80Mton), charcoal (0.24Mton), and crop residue (0.21Mton) demand for Nakuru County is as shown in the table below. Apart from households, the second-highest consumer of bioenergy is cottage industries. Cottage industries use bioenergy primarily for brick making, tobacco curing, fish smoking, and bakeries. Other bioenergy consumers segments are:

i) institutions (schools, hospitals, prisons);

ii) restaurants, hotels, and cottages; and

iii) industries operating biomass-fired boilers (e.g., Menengai Industries and Njoro canning).

Table 9: Nakuru County Average Annual Bioenergy Demand (Source: MoE)

Fuel	Urban	Rural	Total
	Average (Mton/yr)	Average (Mton/yr)	Average (Mton/yr)
Fuelwood	0.37	0.43	0.80
Charcoal	0.11	0.13	0.24
Crop residue	0.08	0.13	0.21
Total	**0.56**	**0.69**	**1.25**

The primary bioenergy sources in Nakuru County are woodlots cultivated by smallholder farmers, gazetted forests (illegal logging), private forests, community forests and supplies from other counties, e.g., Narok. Approximately 34% of biomass consumed in Nakuru County is non-renewable, meaning that harvesting outstrips regrowth.[41] An analysis undertaken in 2012 showed that Nakuru County was a net firewood consuming county; hence, it faces a significant firewood deficit potential, as shown below. Overall, the County had a net deficit of 55,350m^3 of firewood and 289,533m^3 of charcoal. This is because it has large population densities, with natural forests that are not for bioenergy production[42]

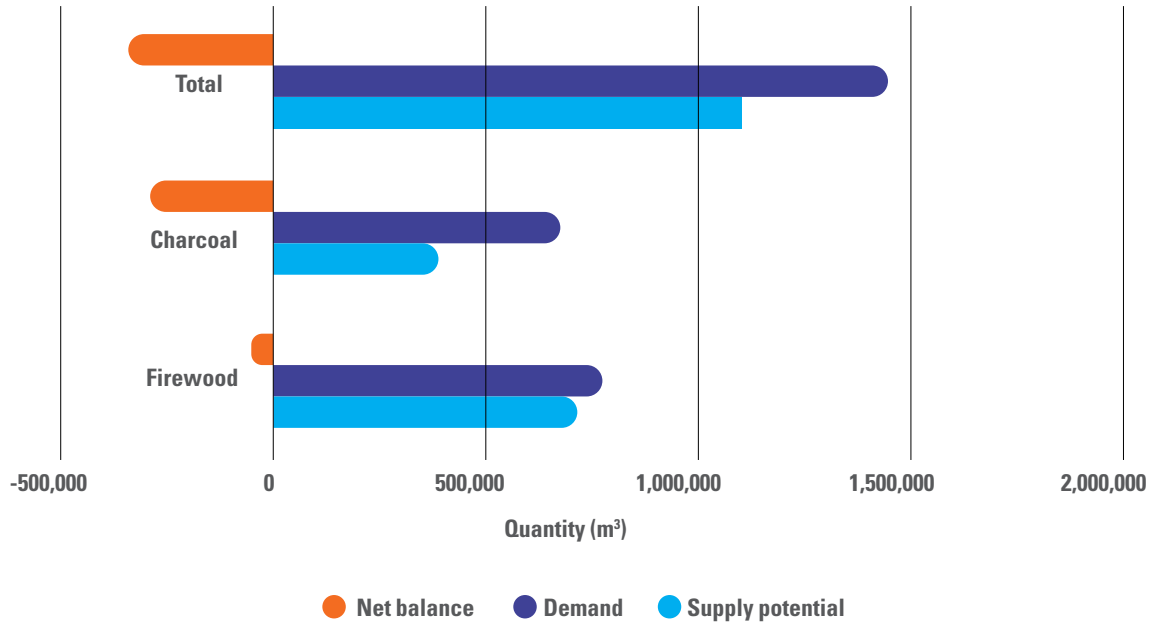
34%

of biomass consumed in Nakuru County is non-renewable, meaning that harvesting outstrips regrowth

41 MoE. (2019). Kenya Household Cooking Sector Study: Assessment of the supply and demand of cooking solutions at the household level, Ministry of Energy Kenya.

42 Walneys Consultancy Services. (2013). Analysis of supply and demand of wood products in Kenya. Ministry of Environment, Water and Natural Resources.

Figure 15: Nakuru County Net Balance of Fuelwood (Source: Walneys Consultancy Services (2013)



Nakuru County is an agricultural County. Most households and institutions own animals and practice some form of crop production agriculture. Biogas seems to be an ideal alternative form of fuel if the conditions are right. Technical and financial constraints which have often limited its adoption can be easily surmounted with good partnerships between the County government and the private sector. Subsidies in form of grants or interest-free credit facilities can be explored to fast-track its adoption. Many private sector players have improved on the technology significantly, reducing the cost and construction materials. A mapping of biogas resource by tracking all livestock owned within the County is needed.

Briquettes made from human waste have a higher calorific value **(4000kcal/kg)**, making them a perfect, sustainable, and cost-effective replacement to firewood

Briquettes made from human waste have a higher calorific value (4000kcal/kg) compared to dried firewood (3000kcal/kg)[43] , making them a perfect, sustainable, and cost-effective replacement to firewood. Given the supply of faecal matter and the underdeveloped sanitation in most towns in the County, converting the sludge into an alternative fuel seems to be the ideal way of addressing cooking energy needs, sanitation, and industrialization. It is worth noting that the two water utilities in Nakuru—Nakuru and Naivasha water and sanitation companies—have explored this idea. The Nakuru Water and Sanitation Services Company (NAWASCO), through one of its subsidiaries, produces carbonized bio-briquettes from faecal sludge blended with sawdust at a ratio of 50:50 using molasses as a binder.[44] There is adequate feedstock because the NAWASCO plant collects 2,000 cubic meters of sludge daily, and utilizes only 100 cubic meters per day.[45]

43 Sanivation. (2020). Superlogs Overview, Sanivation. https://static1.squarespace.com/static/5ea141689c03680a5cc5dbac/t/5eb3c19cb4bca56e3c1cc737/1588838828505/SuperLogs_Sanivation_overview_2020+final.pdf
44 Lafeber, C., et al. (2018). Nakuru county sanitation programme (NCSP) TEAM. 52.
45 EED Advisory. (2020). Urban briquette making pilot. https://eedadvisory.com/reports/external-reports/

NAWASCO uses sawdust from saw millers in Nakuru County, such as Biashara sawmills and Timsales. In general, Nakuru County produces approximately 21,900 tonnes of sawdust and 64,700 tonnes of off cuts annually.[46] The bio-briquettes have a calorific value of 18.8MJ/kg, higher than the recommended 17.5MJ/kg.[47] The company produces 15 tonnes of briquettes per month and sells them at 30 shillings per kilogram.

Private firms, like Sanivation which operates from Naivasha, have also registered great success with human-waste briquettes. Economically the briquettes are relatively cheap compared to purchased charcoal and firewood, especially for institutions. The technology is simple and can be deployed across many small towns.

46 Intelligent Energy Europe. (2016). Assessment of sustainable lignocellulosic biomass potentials from Kenya for export to the European Union 2015-2030. https://www.biotrade2020plus.eu/

47 Nyaanga, D. M., et al. (2018). Faecal matter-saw dust composite briquette and pellet fuels: Production and characteristics

Status of Energy Access

3.1 Overview of Energy Access

This chapter provides an overview of energy access in Nakuru County. The assessment is based on data collected through various representative surveys: household survey (n = 420), education institutions survey (n = 130), health centre survey (n = 197), and enterprises survey (n = 384). These are further divided into sub-classes as shown in Table 11 below. The surveys were administered through Computer Aided Personal Interview (CAPI) using the SurveyCTO application

Table 10: Groups of Survey Respondents and Sample Sizes (n)

#	Respondent	Classification	No.
1	Households	Urban & rural	420
2	Education Institutions	Public	83
		Private	33
3	Health Facilities	Public	55
		Private	131
		Other	8
4	Enterprises*	Hospitality	75
		General trade	129
		ICT services	36
		General services	22
		Other services	111

*Enterprises were classified into five categories namely, hospitality, general trade, ICT services, general services, and other services. Hospitality enterprises are involved in food production and sales, including accommodation. These include hotels, restaurants, lodges etc. General trade businesses include shops, kiosks, supermarkets, etc. ICT services include MPESA shops, cyber cafes, etc. Under general services, businesses that offer professional services both formally and informally were considered. These include transport and logistics, welding, garage, etc. All other services, including beauty shops, barbers, tailoring shops, etc were classified under other services.

Based on the sample averages this CEP presents the average rate of access to on-grid and off-grid electricity, annual energy consumption, aggregate (GJ/year); annual energy consumption, per respondent group (GJ/year); and annual energy consumption, per source (GJ/year), as shown in Table 11. The total energy consumption is determined through aggregating the average consumption of thermal and electric energy per user type with the reported number of users across the County. The total number of users for education facilities, health centres and enterprises was provided by the County, and the access rates to the energy sources was determined from the survey data.

The total number of households was obtained from the National Census data of 2019 and multiplied by the growth rate to establish the household number in 2021. For example, the reported average consumption of electricity per education institution is 558.7 kWh per month. This average is multiplied by the total number of schools (1602 schools in Nakuru County) with access to electricity in the County (89% of 1602 schools). The latter amounts to 9,583,702 kWh per year. Then using conversion factors, the kWh is converted to its MJ or GJ equivalent.

Table 11: Summary of Access to Grid Electricity and Total Annual Energy Consumption (TBD)

#	Estimate	Households	Education Institutions	Health Institutions	Enterprises
1	Access to grid electricity (%)	61	89	99	98
2	Annual total energy consumption (GJ/year)	2,554,673	1,884,492	534,666	40,602,036
3	Annual total energy consumption from electric sources (GJ/year)	766,402	51,904	40,458	12,180,611
4	Annual total energy consumption from thermal sources (GJ/year)	1,788,271	1,832,688	494,208	28,421,425

3.2 Energy Access: Households

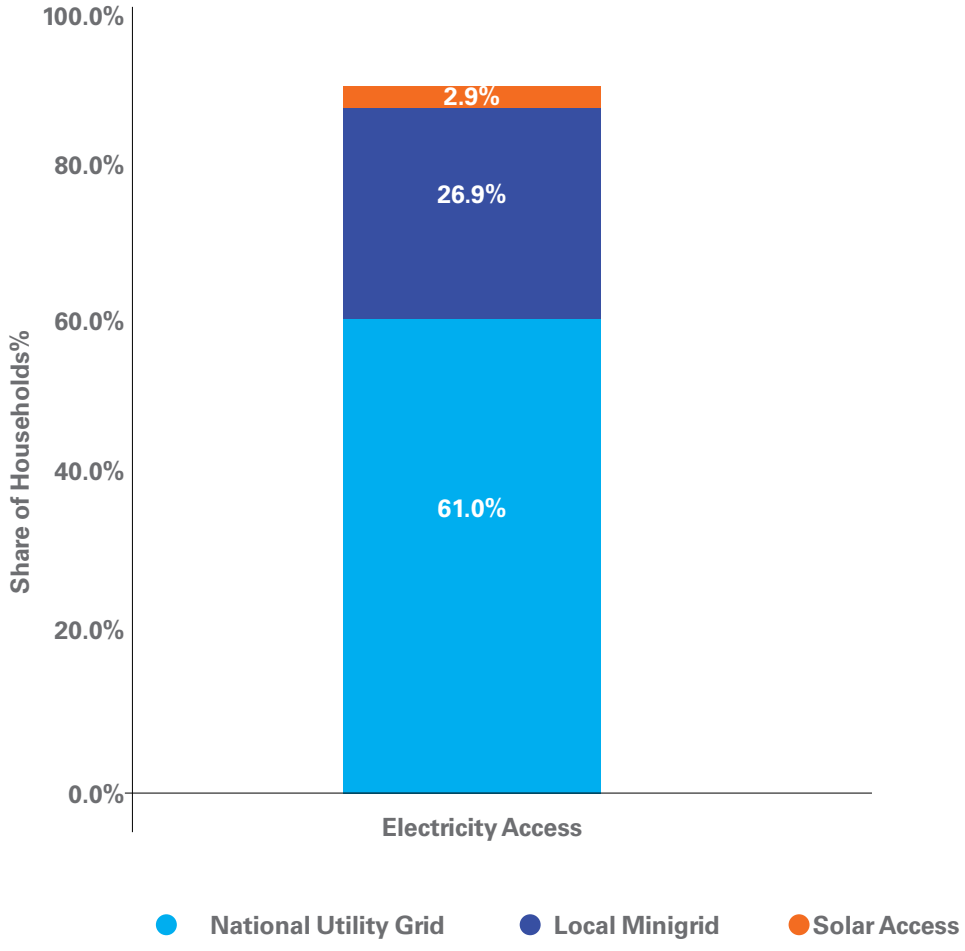
3.2.1 Electric Energy

Combining both on-grid and off-grid energy applications, this survey estimated that 91% of households in Nakuru have access to electric energy. 61% of households report having a connection to the national grid, 3% to a mini-grid connection and 27% reported owning at least one type of solar PV system.

The grid connectivity rate is comparable to the Kenya National Population Census (2019) which reported an access rate of 64%. About 13% of households with access to electricity through the national grid and mini grids also reported using solar energy. The Census reports 15% of households using solar PV as their source of lighting, while this CEP notes that 27% of households own at least one type of solar PV system. Households that own a solar PV product do not necessarily also have it as their main source of lighting.

This survey estimated that **91%** of households in Nakuru have access to electric energy

Figure 16: Household Electricity Access



Although only 61% of respondents reported having a connection to the main national grid, 88% mentioned the presence of electricity infrastructure within their general area. This is an important metric that characterises the potential to quickly connect additional households to the national grid.

Such household have been classified as being under-grid, with this definition explaining a situation where a potential user is within connecting range but not connected.[48] Of those with electricity within their area, the information was further disaggregated into utilization; that is, did the respondents use electricity within the household? About 27.4% of those respondents reported not using electricity for various reasons, as highlighted in the figure below.

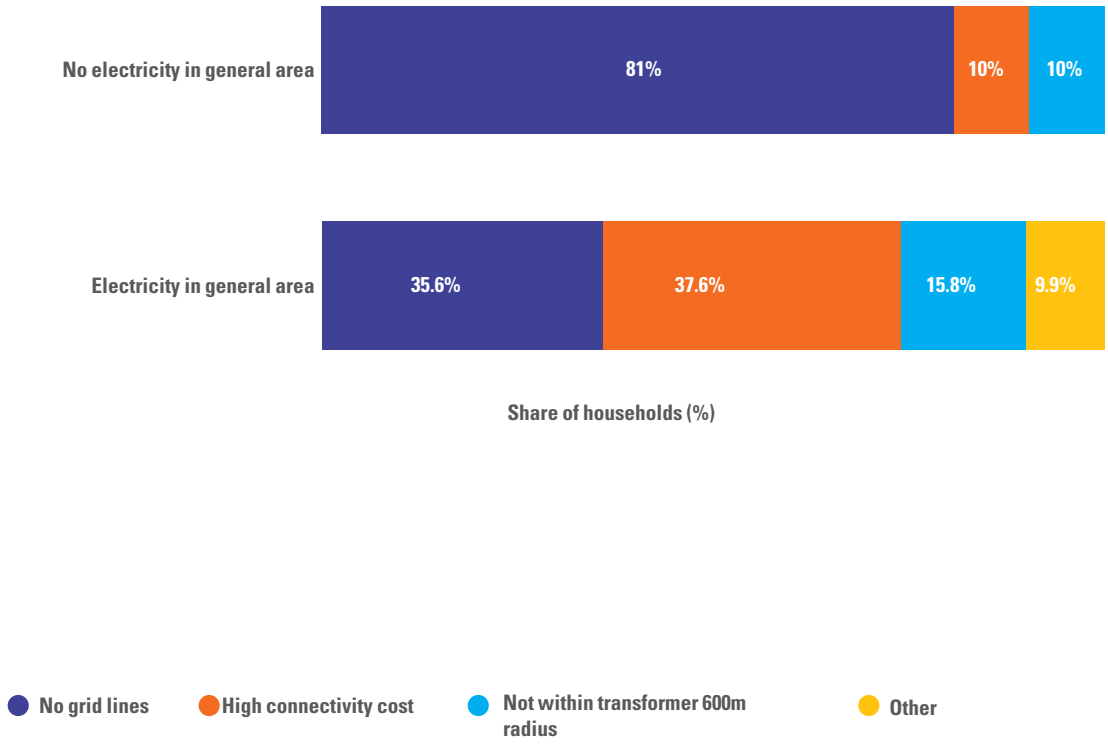
61%

of respondents reported having a connection to the main national

88%

mentioned the presence of electricity infrastructure within their general area

Figure 17: Share of Households with Electricity Within their General area



48 Lee, K., Brewer, E., Christiano, C., Meyo, F., Miguel, E., Podolsky, M., Rosa, J., and Wolfram, C. (2016). Electrification for "Under Grid" households in Rural Kenya. Development Engineering, Vol 1 (26 – 35). https://doi.org/10.1016/j.deveng.2015.12.001

The primary reasons stated for not using electricity were:

i) high connectivity rates (38%); and

ii) the lack of grid lines (36%).

16% of the households specified that they were not within a 600m radius to the closest transformer. The remaining 10% had applied to get connected and were awaiting installation. In comparison, households that did not have electricity within the general area provided one main reason for not using electricity in their homes—the lack of grid lines (81%), followed by high connectivity costs (10%), and households not within 600m radius of transformer (10%). All the respondents without electricity in their households expressed a willingness to use electricity in their homes.

From this survey, 64% of the respondents with access to electricity also use it for lighting daily. Of these, 41% report using electricity because it's affordable/cheap, 34% use because its easily available and 15% use it because it is easy to use. Of the total respondents, 27% report using solar systems, presumably for lighting. It should be noted that the latter do not have access to electricity through the grid or mini grids. About 9% of all respondents reported using paraffin for lighting. According to the National Census Data (2019), 64% households reported using electricity as their main source of lighting, 14.5% reported using solar systems, 10% reported using paraffin powered lamps and the remaining 11.7% reported using torches, candles, or batteries.

3.2.2 Thermal Energy (including cooking)

This survey observed that firewood and charcoal are the main source of energy for cooking at the household level at 69%. LPG use is noted to be the second most used fuel at 29%, with other sources such as paraffin and biogas accounting for less than 2%. Overall, there is a slight variation with the figure estimations from the National Census Data. The primary cooking fuel was woodfuel, reported at a lower aggregate of 64%. The gas stove use remains the same, reported at 30%. A shift is also noted for paraffin, as 5% less households are noted to use it in this survey compared to the census data. The increase in fuelwood noted in this survey is likely because of the pandemic's effect on incomes and the ability of households to purchase paraffin.

A total of 277,941 households in Nakuru (46%) report using the three-stone open fire as their primary cooking stove/method of cooking, followed by the gas stove which is used by 175,283 households (29%). It is also worth highlighting that 112,528 households (19%) use the traditional jiko which utilizes charcoal, and 22,793 households (4%) use energy saving jikos.

Figure 18: Primary Cooking Stove

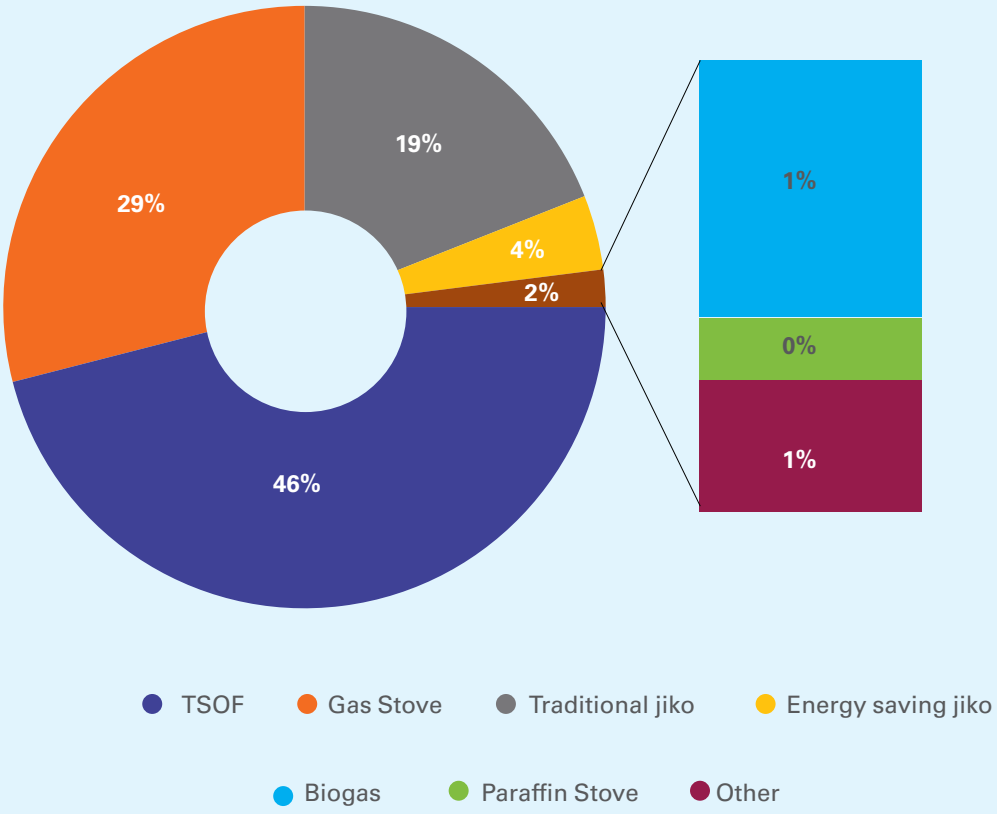


Figure 19: A Three-stone open fire (TSOF) stove (Source: Shutterstock)

Figure 20: A tradition metallic jiko (Source: Shutterstock)

Figure 21: A modern industrially manufactured jiko (Source: Shutterstock)

Typically, households cook with more than one cooking solution in a practice known as stacking. The respondents were asked to also describe their secondary cooking stove where this was applicable. Secondary cooking stoves used by the respondents are listed in Table 12 below. For TSOF primary users, these households use the traditional jiko (53%) and gas (19%) as their main secondary cookstoves. Primary users of LPG utilize the traditional jiko (63%) and other cookstoves (21%) such as the electric stove, biogas and paraffin stoves as the two main secondary cookstoves. Primary users of Traditional jikos use TSOF (37%) and LPG (37%) as their main secondary stoves. Essentially, 41.9% of all households use fuelwood as both their primary and secondary cooking stove.

41.9%
of all households use fuelwood as both their primary and secondary cooking stove.

Table 12: Household Secondary Cookstove Classified According to the Primary Cookstove

No	Primary Cook Stove	Secondary Cook Stove				
		TSOF	LPG	Traditional Jiko	Energy Saving Jiko	Other
1	TSOF	13%	19%	53%	3%	11%
2	LPG	2%	6%	63%	7%	21%
3	Traditional Jiko	37%	37%	6%	0%	20%
4	Energy Saving Jiko	25%	63%	13%	0%	0%

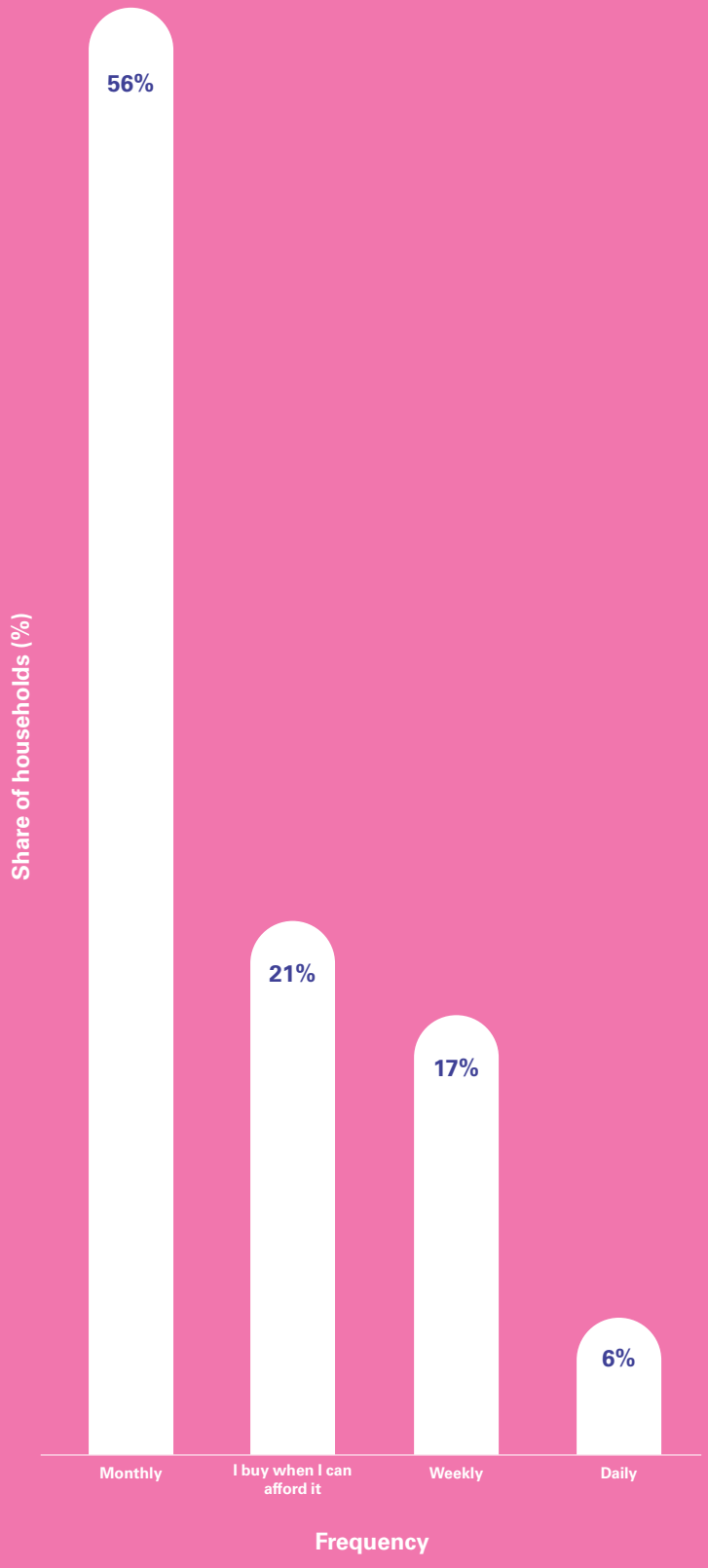
3.2.3 Purchase and Consumption of Household Energy

As regards accessing firewood, 53% of all respondents reported collecting firewood for either their primary or secondary cookstove, while 15% exclusively purchase firewood. When asked about which cleaner cookstove these respondents would like to transition to, 50% preferred transition to LPG, followed by biogas (30%). Households using LPG reporting spending KES 1,198 per month and an average of KES 393 for households using paraffin.

Pre-paid electricity is the dominant mode of electricity sales and purchases among households, with most (56%) indicating that they purchase monthly.

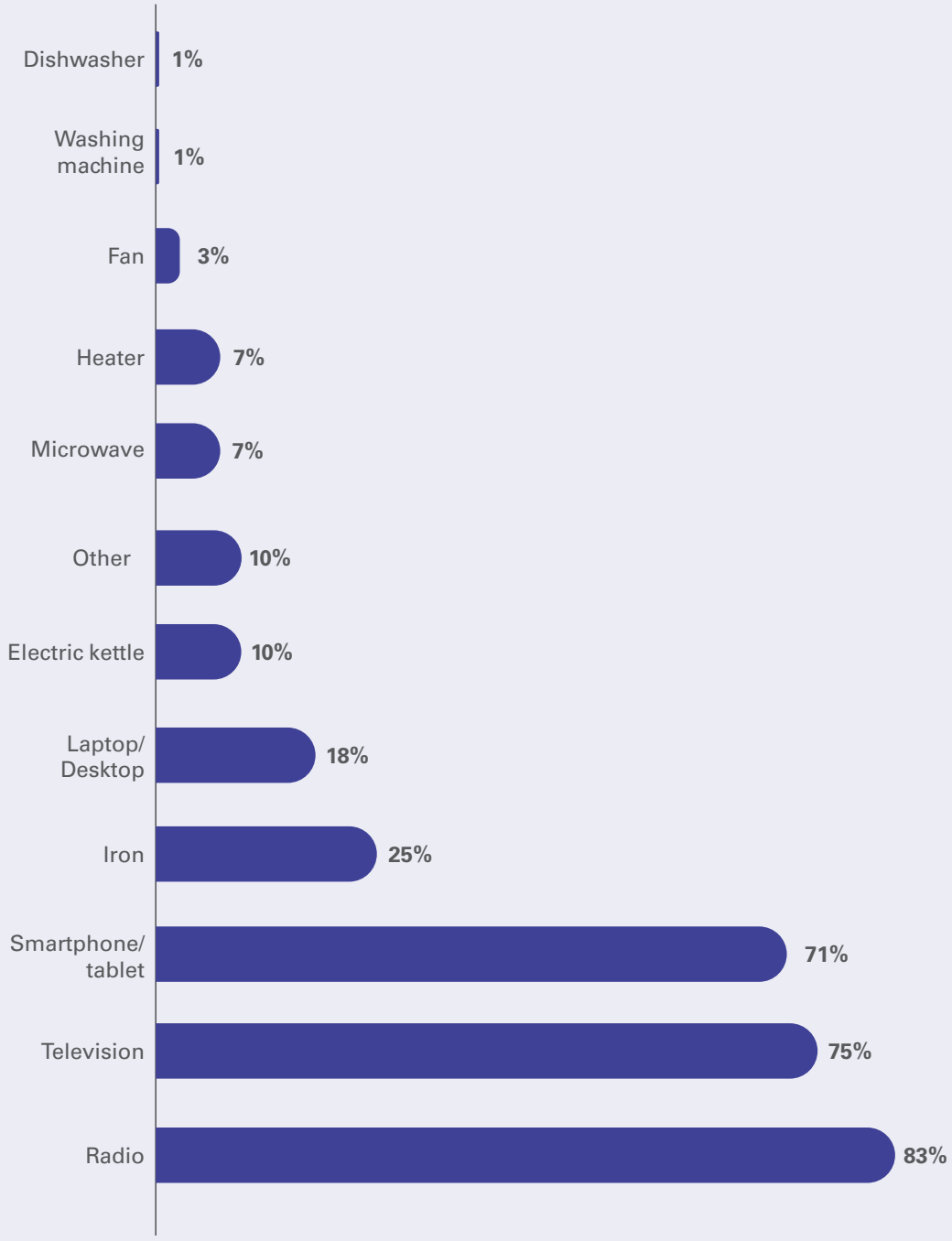
Households using LPG reported spending
KES 1,198
per month and an average of
KES 393
for households using paraffin.

Figure 22: Frequency of Electricity Bill Payments



The most common electrical appliance in the households is the radio (83%) followed closely by a TV (75%) and a mobile phone/tablet (71%).

Figure 23: Appliances found in Households



Electrical Appliances ownership (%)

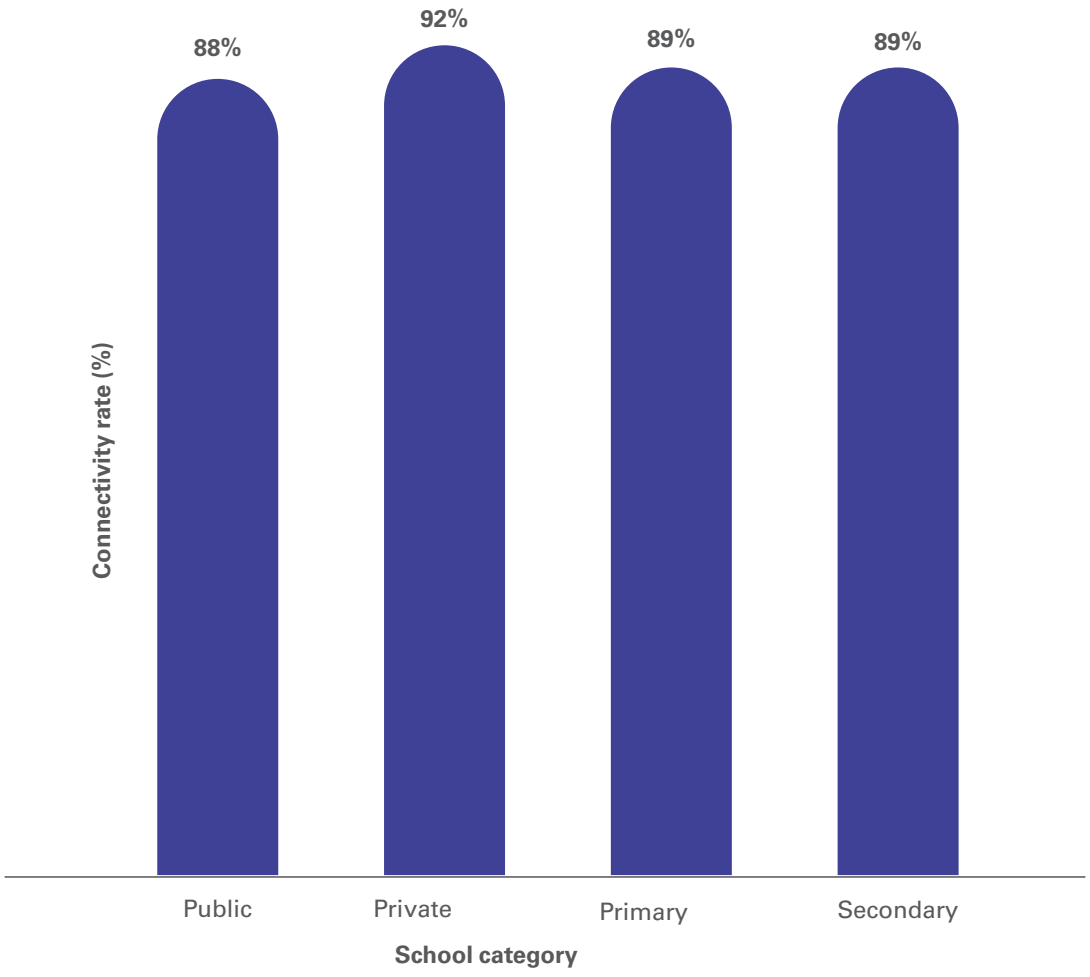
3.3 Energy Access: **Education Facilities**

3.3.1 Electric Energy

Out of a total of 130 schools interviewed during the survey, 89% had access to electricity. According to the survey findings, the electrification rates across the sub-counties varied significantly. The rate in Kuresoi South is notably lower than the rest of the sub-counties at 55%, while the counties of Naivasha, Nakuru East, Nakuru North and Bahati report 100% electrification for all schools.

The electrification rate across private and public schools is also noted to be comparable, at 88.3% and 91.7% respectively. When analysed according to the level of education as indicated in the figure below, electrification across the education tiers is comparable, ranging from 88.9% (primary), 89.2% (secondary), 100.0% (tertiary and the mixed primary and secondary schools).

Figure 24: Access to Electricity Based on the Levels of Education



The average cost of connection to the grid is

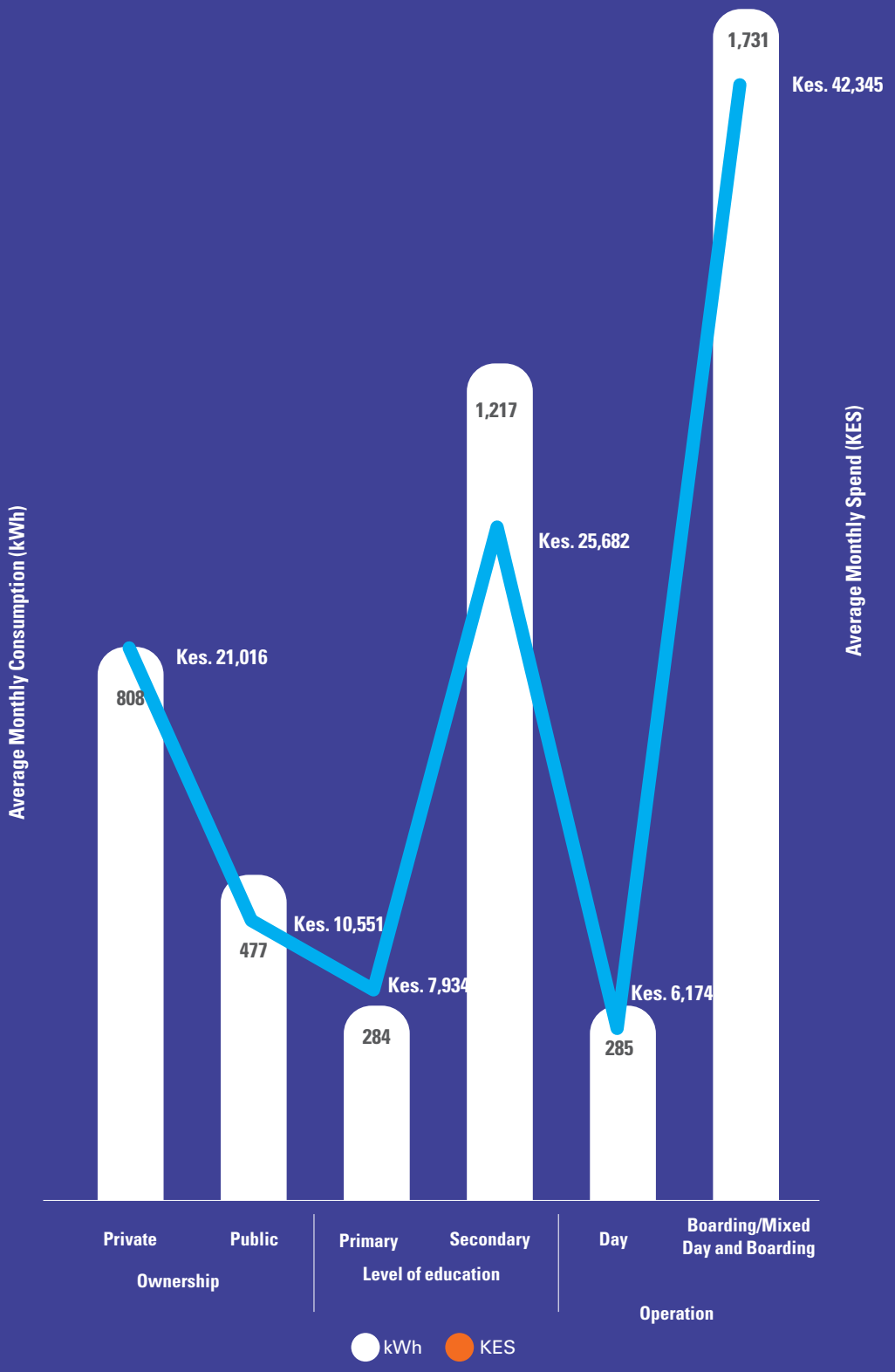
KES 49,202

With regards to energy systems, every school with electricity reported having a connection to the national grid. About 7% of these schools also utilize solar energy for electricity and 8.5% also have a generator. 58.6% of the schools, mostly public-owned, financed the grid connection through government support, 37.9% report financing through cash. Less than 4% financed their connection either through a donation, grants, or loans. The average cost of connection to the grid is KES 49,202.

The average monthly electricity consumption for the educational facilities is 558.7 kWh. Of course, the consumption is expected to vary depending on the type of institution, the number of students, the hours of operation (e.g., day vs. boarding schools) and ownership. Private schools report a higher consumption rate of 808 kWh at an average spend of KES 21,016 compared to public schools' 477 kWh at a spend of KES 10,551. The public schools have an average student count of 589 and 14 classrooms. At least 90.3% of the public schools were day schools and the remaining 10% have a boarding option. In comparison, private schools had an average student count of 370 students and 15 classrooms, with 50% being day schools and the rest having a boarding option.

The consumption of electricity across the type of institution, that is, either primary or secondary schools, varied significantly. Primary schools have an average consumption of 285 kWh per month at a spend of KES 7,934, and Secondary schools consume 1,217 kWh at a spend of KES 25,682. The variation is explained by the boarding component of the secondary schools. This is further evident from the average consumption rate of the day schools at 285 kWh spending on average KES 6,174, and boarding/mixed boarding schools that have an average consumption of 1,731 kWh, spending KES 42,345. Institutions that own and operate generators spend approximately KES 9, 590 per month on fuel.

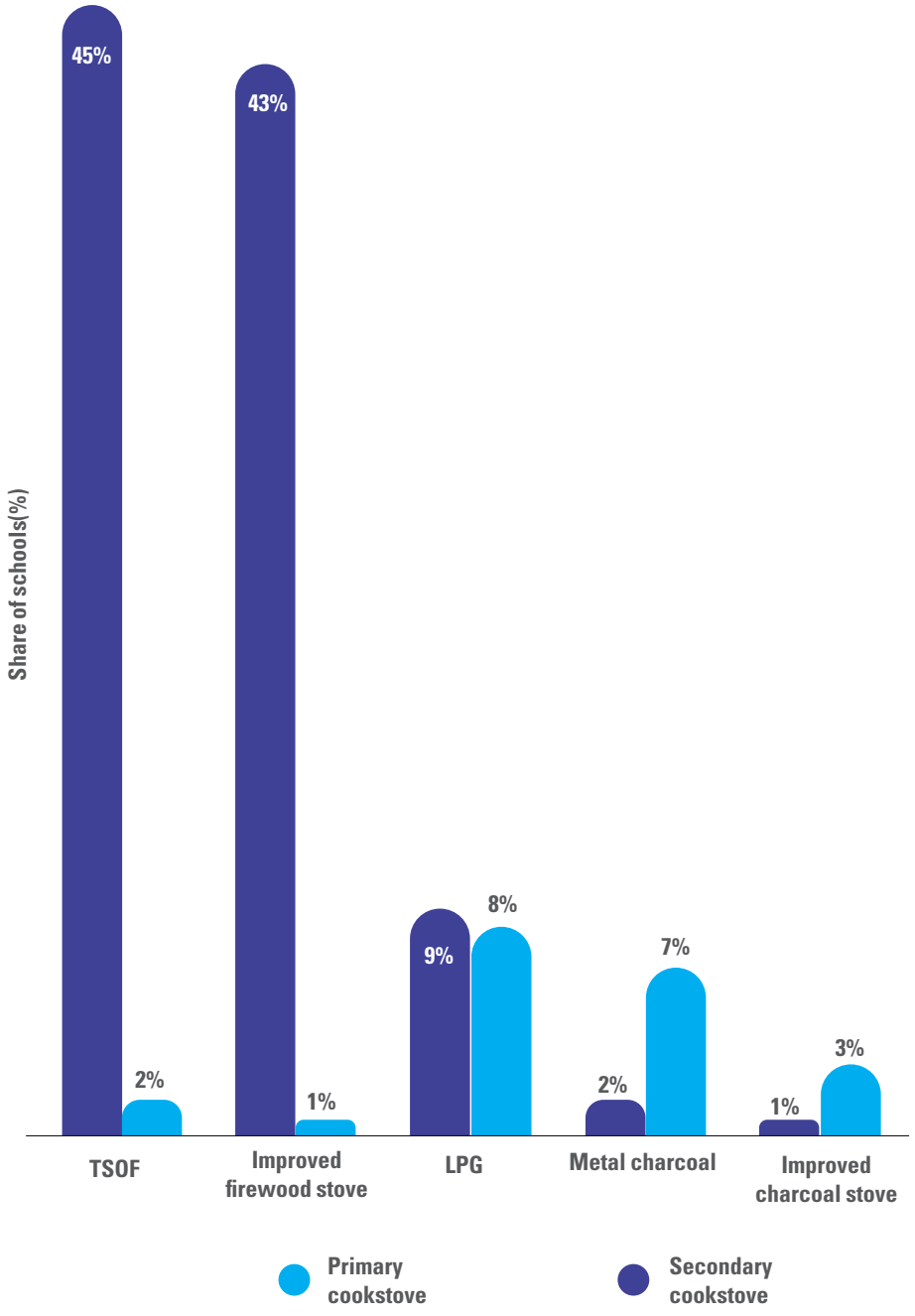
Figure 25: Average Monthly Consumption of Electricity (kWh)



3.3.2 Thermal Energy (including Cooking)

Education institutions use four main sources of energy: firewood, charcoal, LPG, and briquettes. It's noted that some schools use more than one source of energy for cooking. Factoring this in, at least 90.7% of all the schools report using firewood, 10% use charcoal, 19% use LPG and 0.8% use briquettes. The distinction between the primary and secondary fuel used is further deduced by considering the primary cookstoves, as shown in the figure below.

Figure 26: Primary and Secondary Cookstove use for Nakuru County Educational Institutions



About 45% use the three-stone open fire, 43% use improved firewood stoves and 9% use LPG stoves as their primary cookstoves and therefore, their primary fuels. The use of charcoal stoves as a primary stove account for about 3%. From the survey findings, it was also evident that 21% of the schools interviewed have a secondary cookstove. Interestingly, LPG is the main secondary cookstove, accounting for 8% of all the schools, followed by the traditional or ordinary charcoal stoves, accounting for 7% and 3%. Subsequently, charcoal is the main secondary fuel used by at least 10% of all the schools.

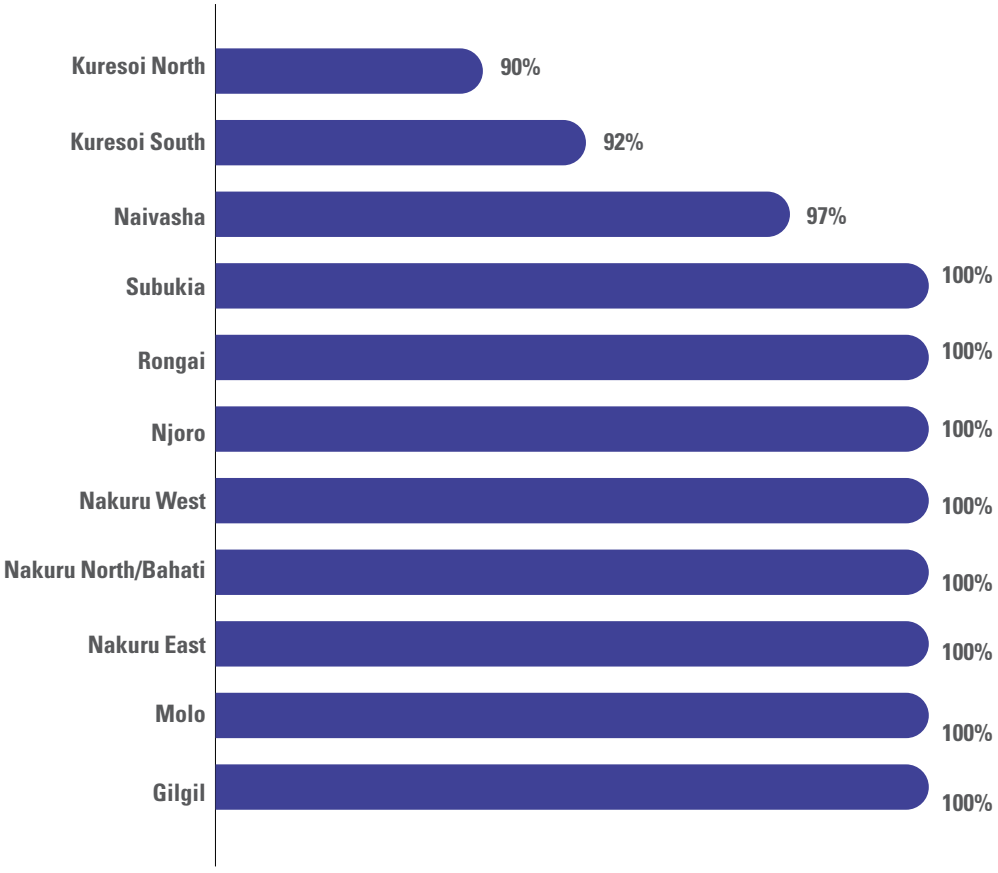
For firewood stoves, a school in Nakuru County uses an average of 48.2t of firewood per year. This is almost four times the amount of charcoal used for the charcoal stoves, at 13.1t per school per year.

3.4 Energy Access: **Health Facilities**

3.4.1 Electric Energy

From the survey findings, the electrification rate for health centres is 98.5%. Only 3 out of 194 centres indicated not being connected to the grid. The centres are government owned. Overall, it should be noted that there's no statistically significant difference in the electrification rates across private, public, religious or NGO affiliated health centres. Electrification rates across the sub-counties for health centres is as indicated in the figure below. Except for the sub-counties of Naivasha (96.9%), Kuresoi South (92.3%) and Kuresoi North (90.0%), the remaining 8 sub-counties report 100 electrification rate for health centres.

Figure 27: Electrification Rate of Health Centres (%) across Sub-Counties in Nakuru.



The average cost of a grid connection for health centres is KES 35,836

All the health centres are connected to the grid (100%), with 10.6% also reporting access to generators. Less than 4% also use solar energy systems, including solar home and solar lighting systems. The average cost of a grid connection for health centres is KES 35,836. The average electricity consumption per facility per month is 1,015 kWh. Further broken down into institution based on ownership, the consumption is 2335 kWh for public hospitals at average spend of KES 35,054 and 504 kWh at an average spend of KES 11,388.40 for private hospitals. The public hospitals have a bed capacity of 16 patients, while that of private hospitals is 8 beds.

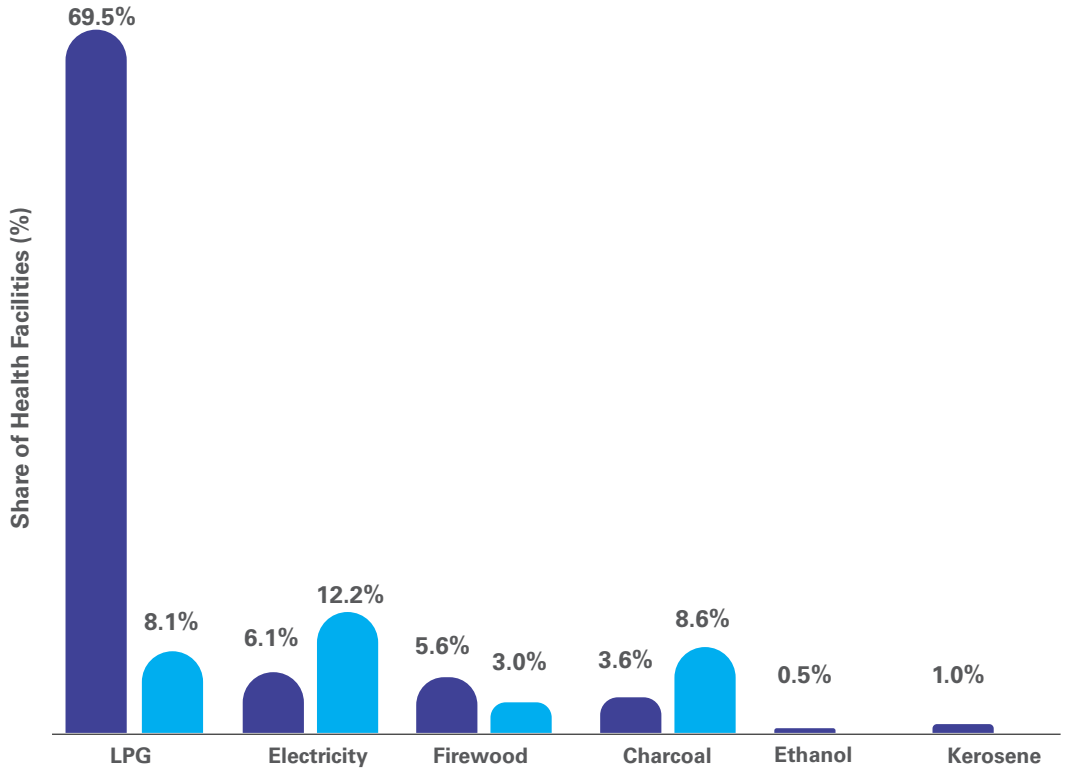
3.4.2 Thermal Energy (Including Cooking)

Health institutions use electricity, LPG, firewood, charcoal, ethanol, and kerosene for cooking. LPG is the primary cooking fuel, used by 69.5% of the health facilities, followed by electric stoves at 6.1%. Fuelwood as the primary fuel only accounts for 9.2%. Similarly, the main cookstove is LPG (69.5%), electricity (6.1%), firewood (5.6%), charcoal (3.6%), ethanol (0.5%) and kerosene (1.0%).

About 32% of health facilities also have a second fuel and second stove as indicated in the figure below. Electricity is the main second fuel of choice used by 12% of the health facilities, followed by charcoal at 8.6%. Notably, only 5.6% of the institutions use firewood and 3.6% use charcoal as the primary source of energy for cooking.

The average quantity of firewood used per week is 36.4t per facility per year, at a spend of KES 84,900. The average quantity of charcoal used is 1.1t per facility per year, at a spend of KES 34,647.

Figure 28: Primary and Secondary Fuels used in Health Facilities



3.5 Energy Access: **Enterprises**

3.5.1 Electricity Access

97.9% of the businesses interviewed are connected to the grid. Enterprises were classified into five categories, namely hospitality, general trade, ICT services, general services, and other services. Hospitality enterprises are involved in food production and sales, including accommodation. These include hotels, restaurants, lodges, etc. General trade businesses include shops, kiosks, supermarkets, etc. ICT services include MPESA shops, cyber cafes, etc. Under general services, businesses that offer professional services, both formally and informally, were considered. These include transport and logistics, welding shops, garages, etc. All other services including beauty shops, barbers, tailoring shops, etc were classified under other services. As indicated, there was no significant discrepancy in the rate of electrification across the five categories; the discrepancy was in consumption. The sources of electricity are shown below. The average cost of grid connection is KES 36,500.

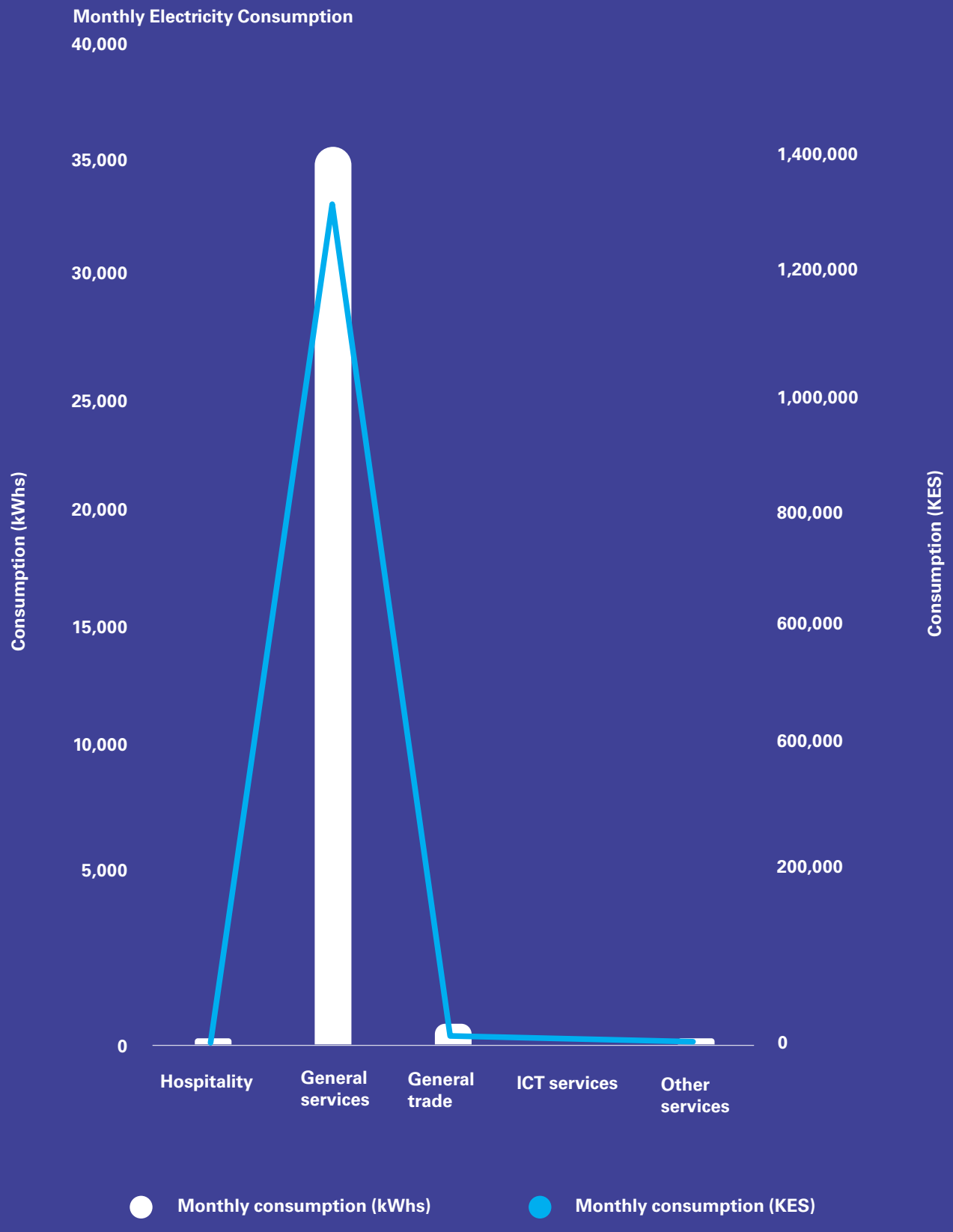
97.9%
of the businesses interviewed are connected to the grid.

Table 13: Electricity Access and Consumption Across Enterprises

#	Estimate	Hospitality	General trade	General services	ICT services	Other services
1	Access to grid electricity (%)	99	96	96	100	97
2	Annual total electricity consumption (kWh/year)	7620	11364	432780	3348	6984
3	Annual total energy consumption from electric sources (GJ/year)	27	41	1558	12	25

The electricity consumption from the national grid per year varies depending on the type of business. General services businesses reported utilizing 32,500 kWh per month/ per business, while ICT businesses reported consumption of 1,565 kWh per month/ per business.

Figure 29: Average Monthly Electricity Consumption per Type of Business

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Modeling Energy Demand and Growth

4.1 Definitions, Data Sources and Key Assumptions

Energy systems modeling provides a systematic evaluation of technical, socio-economic, political, and environmental factors that could influence future energy demand and growth. This does not give a forecast of the future but provides insights to policy and decision makers on the potential impacts of key decisions and trends. This CEP employs the Low Emission Analysis Platform (LEAP) integrated modeling tool developed by the Stockholm Environment Institute (SEI). This analysis uses scenarios, which are conceptualized story lines of how the energy system may evolve, to create and evaluate alternative future outcomes, to prepare the County leadership for extreme outcomes, but also to guide them on measures required to achieve desired outcomes.

The scenarios selected for this analysis are described below:

- **Business as Usual Scenario:** This scenario assumes that the status quo will be maintained. The rate of change across factors that influence energy demand and growth in the past, including population growth, urbanization, economic growth, and political influence will remain relatively unchanged. Also, it assumes that there will be no deliberate efforts to rapidly expand energy access or stimulate demand.

- **United Nations Sustainable Development Goals 7 (SDG 7) Scenario:** The United Nations Sustainable Development Goal 7 (SDG #7) is the aspirational goal of achieving universal access to energy—electricity and clean coking energy—by 2030. Part of this aim is to increase the share of electricity drawn from renewable sources and double the energy efficiency of all electrical devices. For this case, a pathway to the attainment of SDG 7 by 2027 for electricity and clean cooking by 2030 within Nakuru County was modeled.

- **High Economic Growth Scenario:** The underlying assumption in this scenario is that Nakuru County will experience above average economic growth, superseding the past, current, and generally expected rates. For Nakuru, a consistent GDP growth of 12% was assumed, which is achievable but higher than the national and County average. Nakuru town was elevated to city status and there are plans to rapidly expand agricultural production, local manufacturing, service provision, tourism, the horticulture industry among others.

Population data from the Kenya National Bureau of Statistics (KNBS) was instrumental in modeling household energy demand. According to the County government records, there are approximately 38,765 registered businesses in the County, classified as shown below. This data was used to model energy demand across all commercial enterprises. For learning institutions, the data was obtained from the County as well, while the consumption trends were taken from the survey carried out.

Table 14: Classification of Business Enterprises by Function (Source: CG of Nakuru)

Business Type	Percentage Share
General Trade	34%
Hospitality	20%
ICT	10%
General Services	6%
Others	30%
Total	**100%**

Table 15: Classification and Number of Learning Institutions (Source: CG of Nakuru)

Institution	Total number	Number of Students/Catering Capacity
Primary (Public)	681	435,819
Primary (Private)	396	
High School (public)	294	93,235
High School (private)	101	16,790

The following guidelines and assumptions were considered during the modeling stage:

- The domestic sector power consumption was simulated based on the LCPDP 2021-2030 annual specific consumption/capita data: 327.96kWh and 78.39kWh for urban households and rural households respectively.
- The data for the small commercial, large commercial & Industrial data was obtained from Kenya Power Nakuru County Office.
- The projection for the domestic sector under the baseline scenario was done with an annual increase of 4 % as of 2021.
- The average annual growth rate of electricity consumption for the commercial and industrial sector is taken as 4.5% from base year to 2021, after which the projection is based on a coefficient derived from the relationship between the historical annual GDP Growth rate and the annual electricity growth rate.
- The GDP growth rate was taken as 6%, 10%, and 12% for the baseline, SDG 7, and High Economic Growth scenarios, respectively.

4.2 Summary of all the Scenarios Combined

The modeling results are presented in various forms. The aggregated modeling results for all the sectors—households, institutions, and commercial enterprises—are detailed in this section, across both energy access indicators for the three scenarios assumed. Later, disaggregated results for each sector and scenario will be presented.

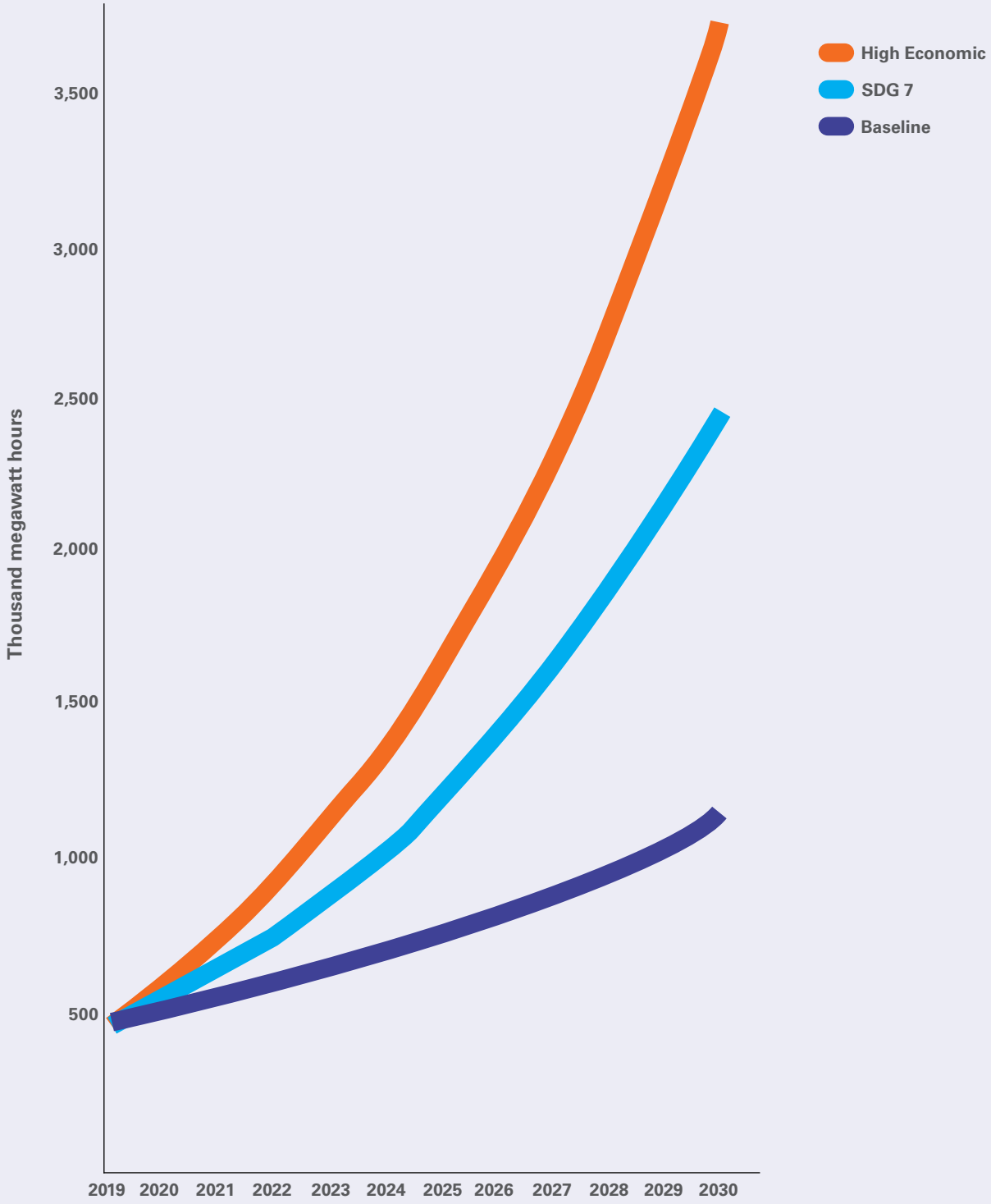
4.2.1 Electricity

As expected, electricity demand will be highest under the high economic growth scenario, followed by SDG 7. The business as usual will have the lowest demand, given that it is the least ambitious scenario. Instructively, this demand will be generated mainly by increased consumption rather than increasing electrification rates, which are already high. This will require individual households, the government, and the utility to stimulate demand for electricity for the already connected. At the assumed growth rate of 12%, total electricity demand will be more than 3 times by 2030 under the high growth scenario, relative to the business-as-usual scenario.

Table 16: Summary of Projected Electricity Demand (2019-2030)

Scenario	Demand base year -2019 (MWh)	Projected demand 2027 (MWh)	Projected demand 2030 (MWh)
Baseline	477,000	907,610	1,158,150
SDG 7	477,000	1,644,410	2,477,530
High Economic	477,000	2,368,800	3,766,600

Figure 30: Projected Electricity Demand for the County under the Three Scenarios



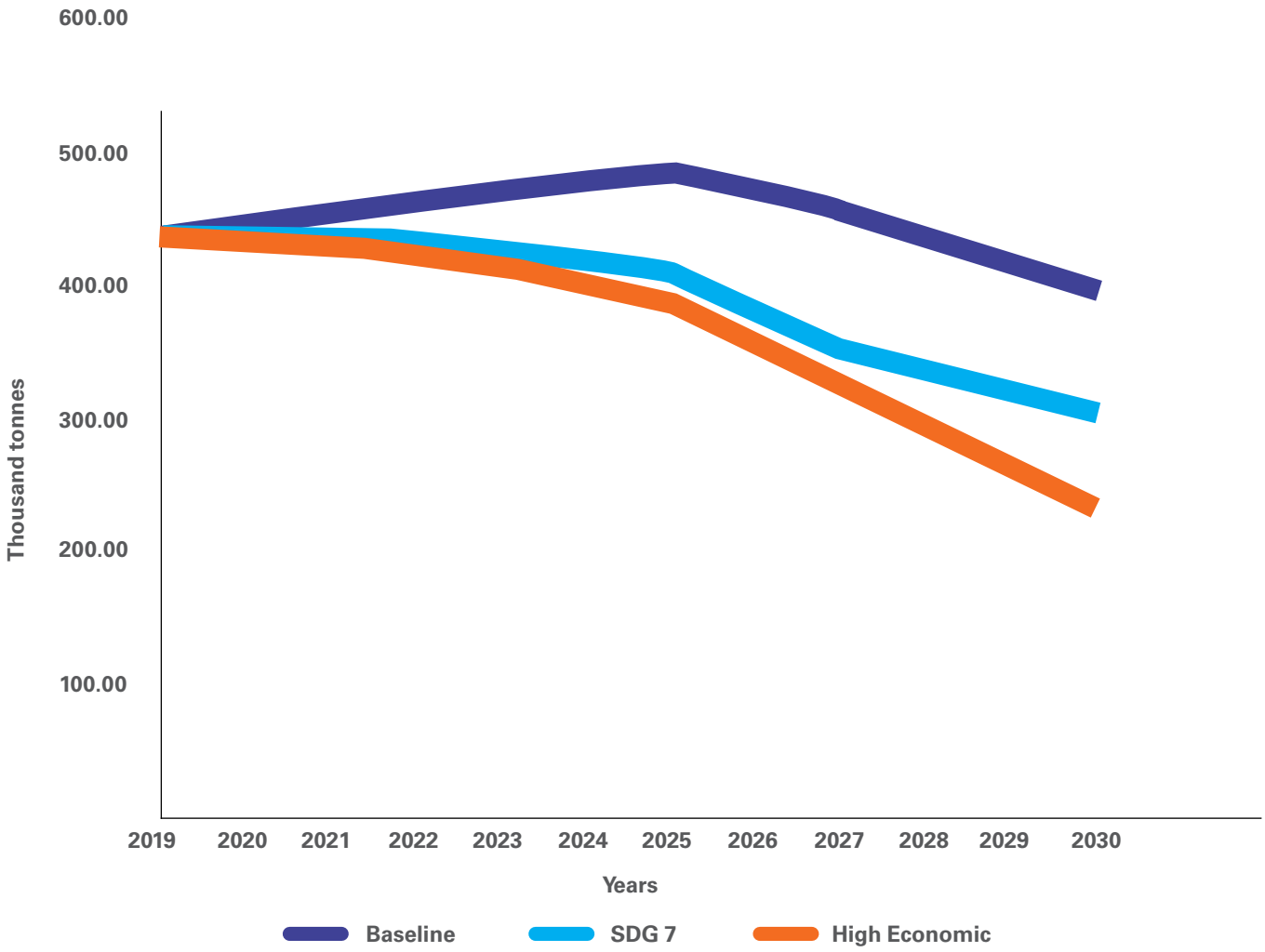
4.2.2 Wood Fuel

Consumption of wood fuel is expected to decrease significantly under the high-growth scenario. There will be a marginal decline in consumption of wood fuel under the business-as-usual scenario, which is expected. The decline for fuel under high growth is predicated on the fact that as GDP grows, the standards of living increase leading to adoption of higher tier cooking technologies like electricity and LPG.

Table 17: Projected Demand for Wood Fuel (2019-2030)

Scenario	Demand base year -2019 (MT)	Projected demand 2027 (MT)	Projected demand 2030 (MT)
Baseline	437,580	456,780	397,740
SDG 7	437,580	353,600	305,890
High Economic	437,580	324,000	233,840

Figure 31: Projected Growth in Wood Fuel Demand under the Three Scenarios



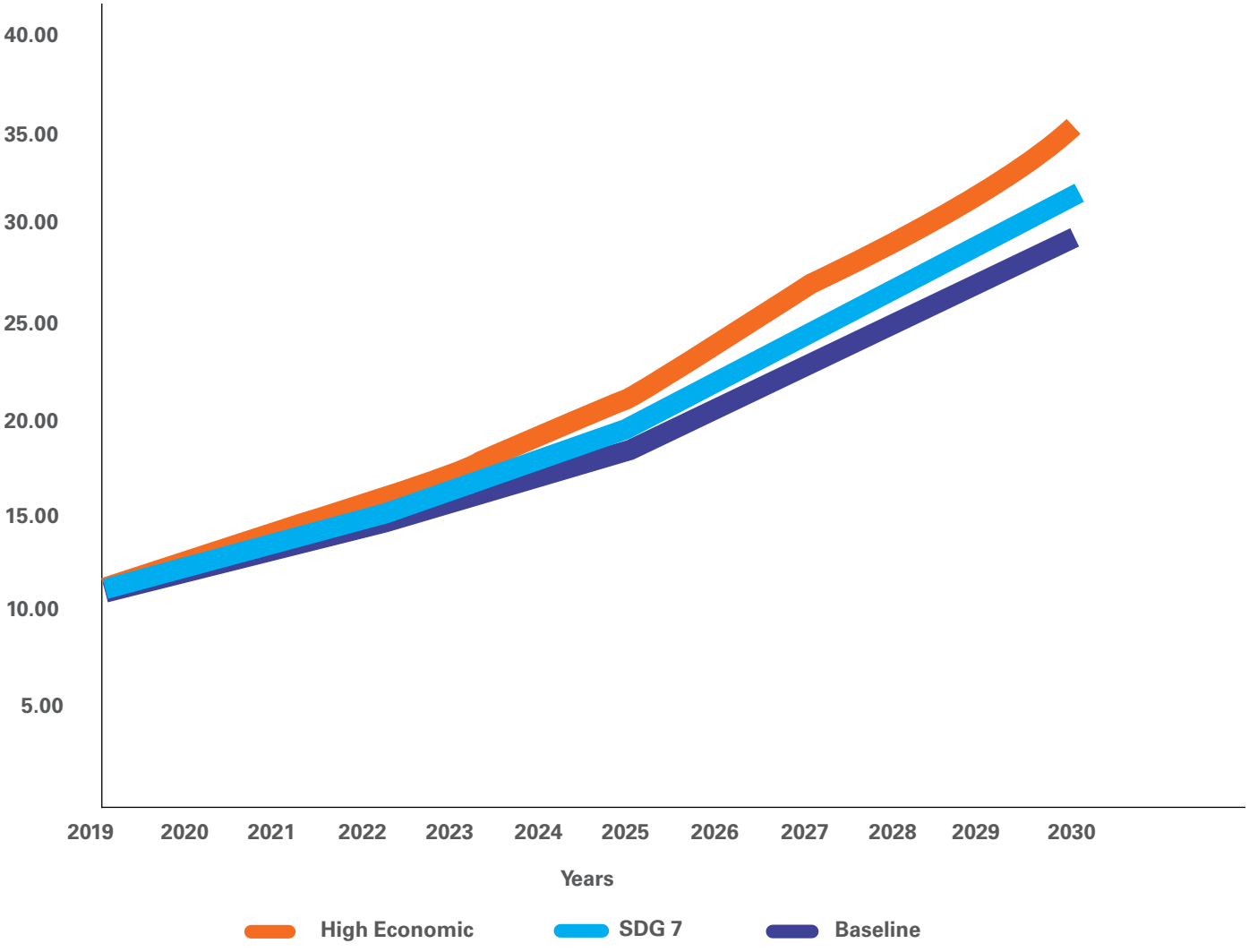
4.2.3 Liquefied Petroleum Gas (LPG) Fuel

The use of LPG is expected to grow substantially across all sectors. This is because LPG is increasingly proving to be a reliable source of cooking energy, even among the low-income population. LPG is expected to displace traditional fuels like kerosene and charcoal in the long run. The near-uniform growth in LPG demand across all scenarios is due to the fact that even in the present circumstances LPG is competitive to commercial charcoal, which indicates that even without major interventions, residents will prefer LPG over commercial charcoal.

Table 18: Projected Growth in LPG Demand

Scenario	Demand base year -2019 (MT)	Projected demand 2027 (MT)	Projected demand 2030 (MT)
Baseline	11,100	23,180	29,550
SDG 7	11,100	24,810	31,910
High Economic	11,100	27,120	35,150

Figure 32: Projected Demand in LPG under the Three Scenarios



4.2.4 Implications of all Scenarios

- The high-growth scenario, being the most ambitious, will deal the biggest blow to environmentally polluting fuels like wood and kerosene. Equally, this will require more investment and effort.
- The realization of any of the scenarios will require collaboration between the County government, the national government, utilities, Consumers, private sector and development partners
- Whichever option the County settles for, LPG demand will grow exponentially and there is a need to focus on LPG value chains across the County, including regulation, storage, distribution, and sale.
- Given that wood and charcoal will still be cooking fuels for the foreseeable future, sustainable harnessing and use of these resources should be encouraged.

4.3 Business as Usual Scenario

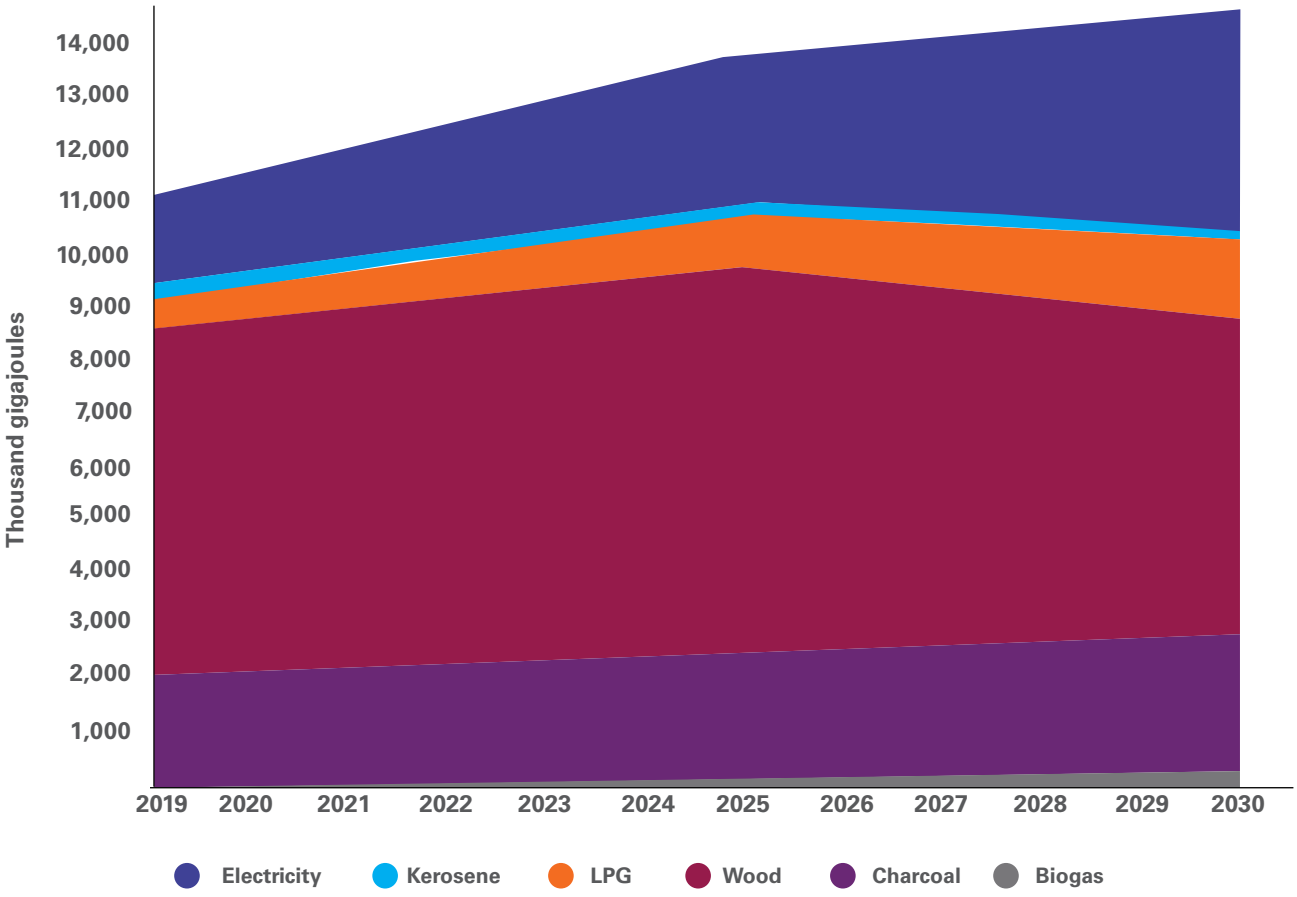
As earlier discussed, the following assumptions were made under the business-as-usual scenario.

- GDP Growth rate is taken as an average of 6% as from 2022. [49]
- Under this scenario, there are no targets for achieving universal access and it is highly likely that universal access will not be met by 2030.

4.3.1 Cooking Fuels

An aggregation of all fuels used for cooking purposes is presented below. Charcoal and wood will still form a significant portion of all cooking fuels in the interim before their use declines in the long term. Electricity and LPG are poised to grow gradually as traditional biomass-based fuels decline.

Figure 33: Projected Demand in Cooking Fuels under BAU Scenario



49 Based on the projected GDP growth as per the 2022 Budget Policy statement (BPS)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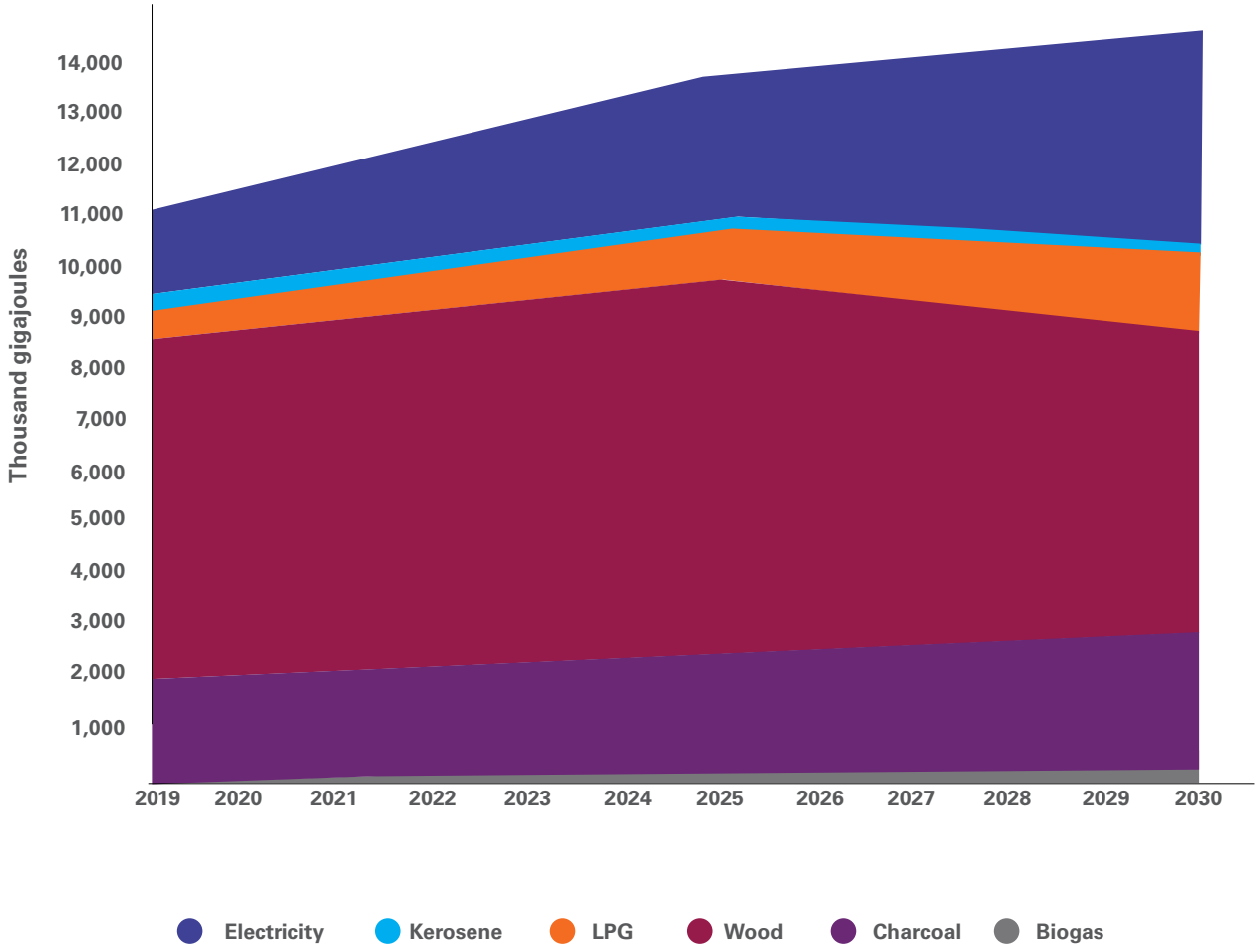
4.3.2 Biomass Demand

The consumption of wood fuel is expected to continue in the household sector, especially rural households, due to the high fuel availability. However, as the households transition from using the three-stone open fire (with an annual consumption of 1232kg/hh) to the improved wood cookstoves (784kg/hh), the total tonnage consumed eventually reduces by the year 2030. The total purchased biomass for use in schools and hotels remains at almost 10% of the total consumed biomass by all sectors.

Table 19: Projected Biomass Demand under BAU Scenario

Branch	Base year (2019) Metric Tonnes	2027 Metric Tonnes	2030 Metric Tonnes
Household	388,110	402,210	342,690
Schools	42,440	46,890	47,100
Hotel Industry	7,030	7,690	7,940
Total	437,580	456,780	397,740



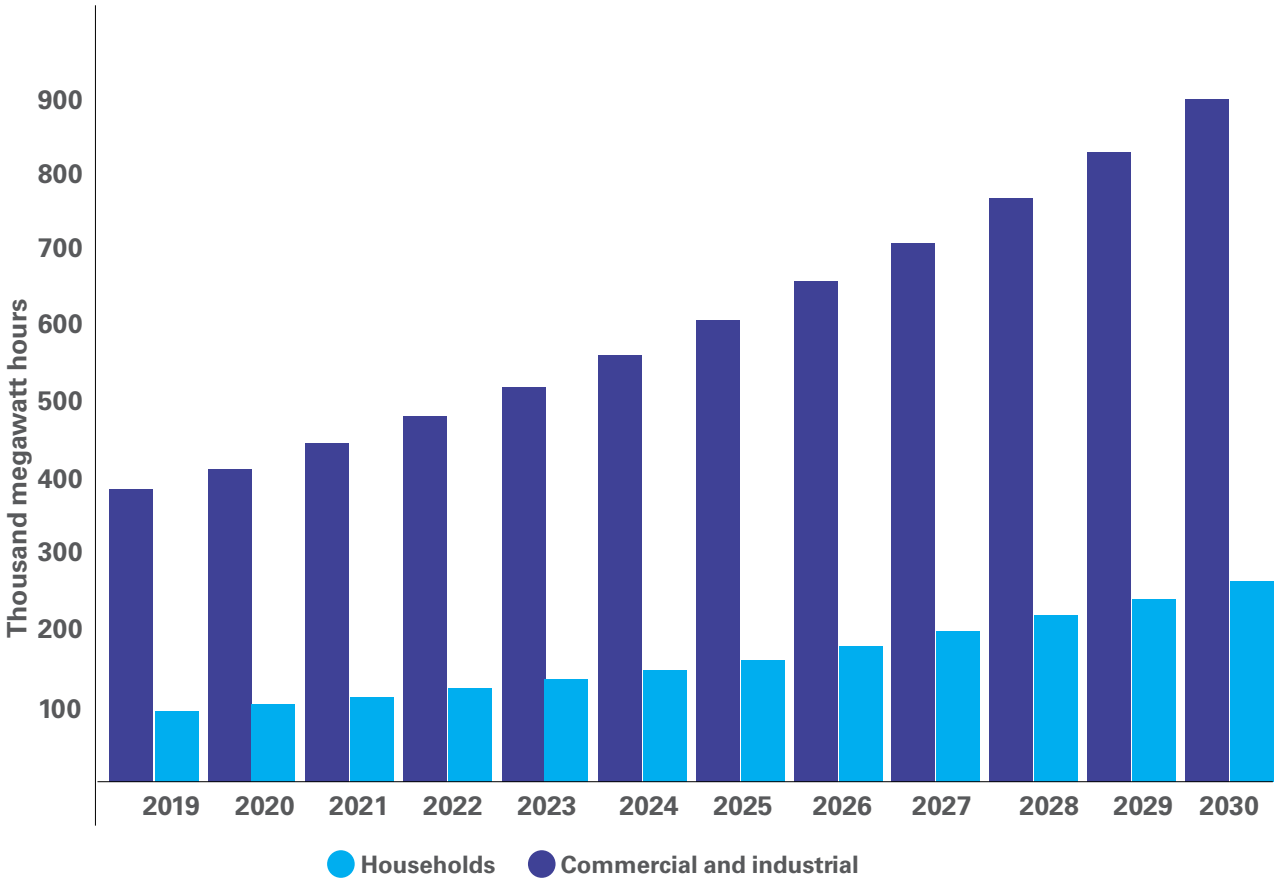
4.3.3 Electricity Demand

The electricity demand for the commercial and industrial sector is expected to dominate throughout the projection window. This is because, from the baseline consumption, this sector accounts for 81% of all electricity consumed across the County. There are no indications that this will stop being the case in the foreseeable future. The breakdown of the demand is given in the table below.

Table 20: Projected Electricity Demand under BAU Scenario

Sector	Units (HH/ Connection)	Base year Consumption 2019 (MWh)	Consumption by 2027 (MWh)	Consumption 2030 (MWh)
Domestic (Households)	616,046	92,096	198,929	262,429
Small Commercial	25,364[50]	89,243	164,262	207,613
Large Commercial & Industrial	306	293,756	544,424	688,106

Figure 34: Projected Electricity Demand (2019-2030)



50 Based on the Nakuru County Statistical Abstract 2015

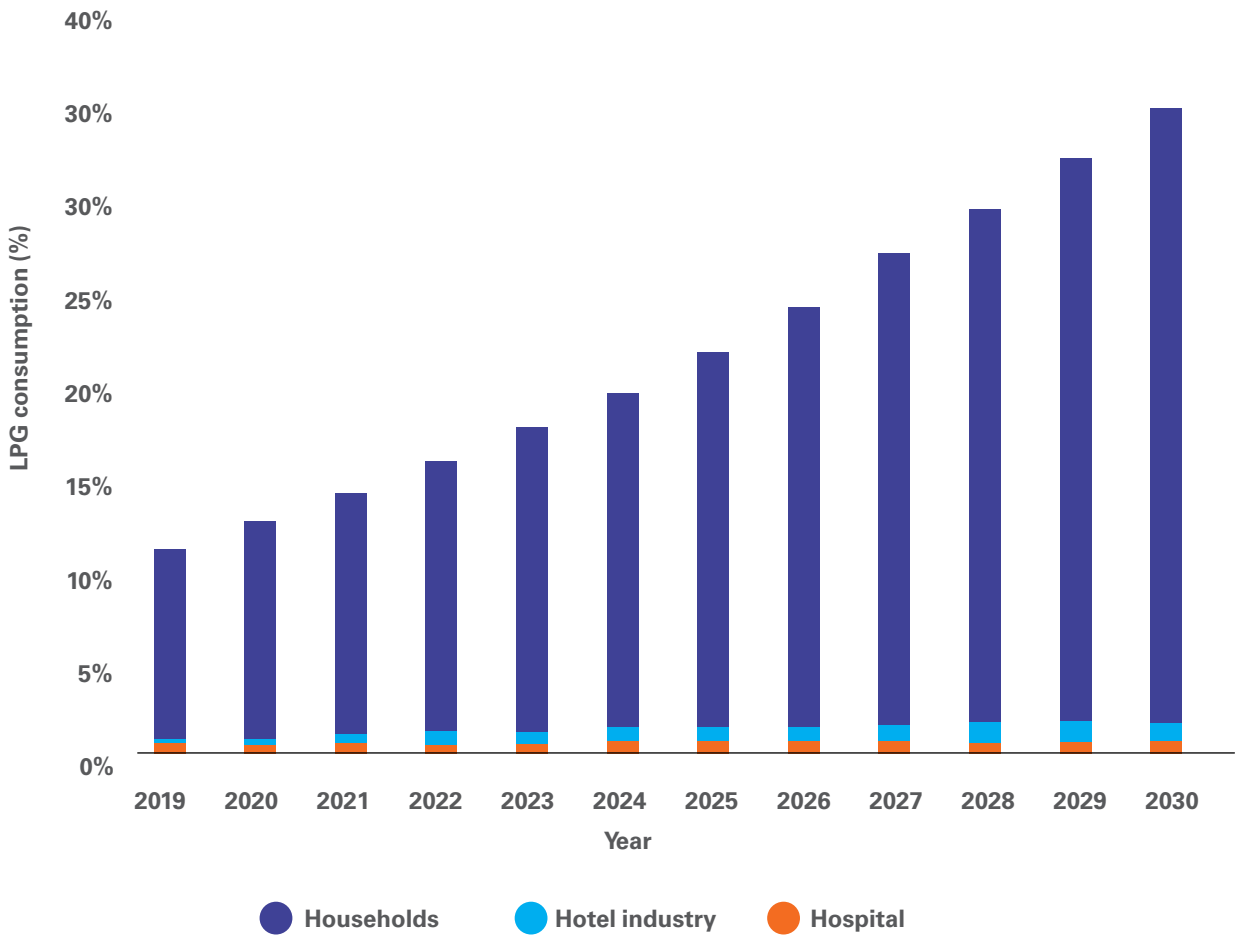
4.3.4 LPG Demand

The consumption of LPG in the hospitals and hotel industry remains below 10% across the projection window. This is due to their numbers compared to households. Schools have also not really embraced LPG as a cooking fuel, though this is expected to change. The greatest consumption sector is expected to be the household sector. The breakdown is given in the table below.

Table 21: Projected LPG Demand under BAU Scenario

Branch	Base year (2019) Metric Tonnes	2027 Metric Tonnes	2030 Metric Tonnes
Household	10,400	22,255	28,475
Hospitals	327	381	457
Hotel Industry	371	540	615
Total	**11,098**	**23,175**	**29,547**

Figure 35: Share of Projected Electricity Demand under BAU Scenario



4.3.5 Implications of BAU Scenario

- The prevalent use of traditional biomass sources for cooking, primarily charcoal and firewood, persists with implications on household air pollution (HAP), GHG emissions, and negative environmental impacts.
- Per capital electricity consumption remains ultra-low, limiting the potential for productive uses which support socio-economic development.
- The use of LPG for cooking increases significantly with positive impacts on household cooking but exposes the County and the country in general to global geopolitical forces that influence price.
- Biogas use will increase, primarily driven by uptake in rural areas, but will remain a marginal source of cooking.

4.4 SDG 7 Scenario

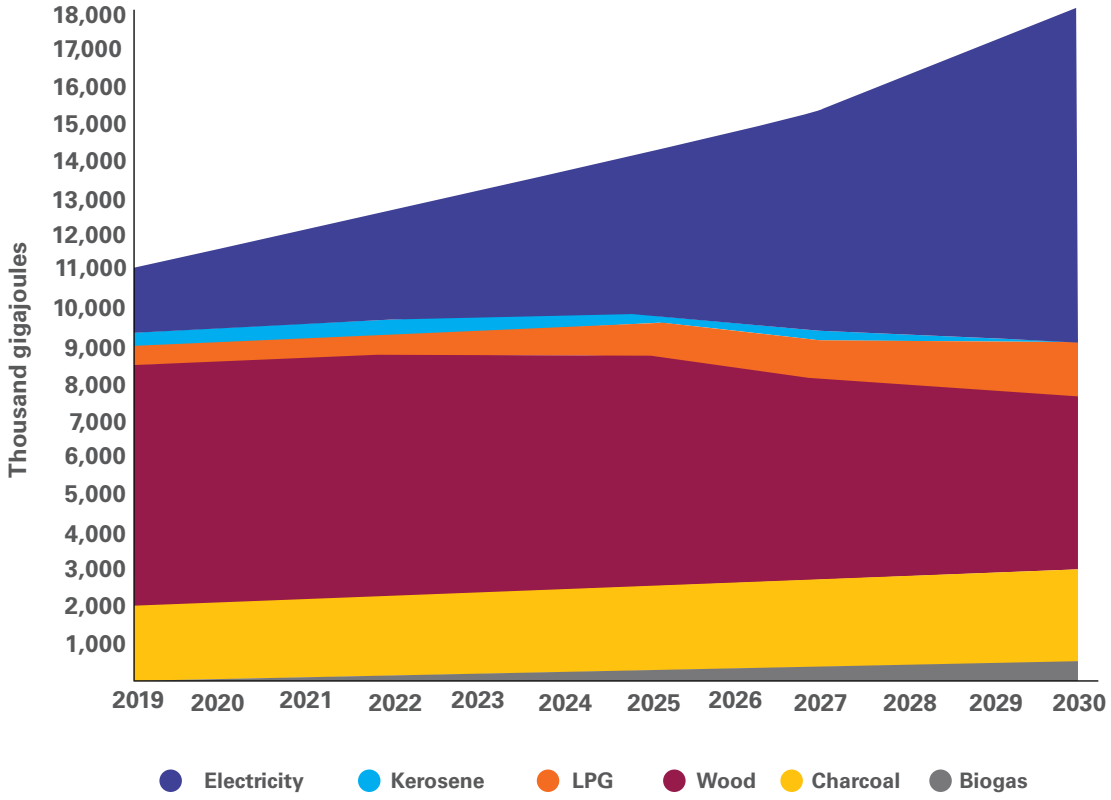
Under this scenario, the following assumptions are made.

- This scenario represents the reference scenario, which would result in the achievement of SDG 7.
- GDP growth rate is taken as 10%[51]
- Under this scenario, it is expected that 100% of the population transition to clean cooking by 2030 as well.

4.4.1 Cooking Fuels Demand

Demand for cooking fuel is expected to grow commensurately with population and as the population transitions to clean(er) cooking fuels. From this scenario, the proportion of clean fuels demand increases quite rapidly compared to the business as usual scenario. This is because the assumed GDP growth is higher than the baseline scenario, and equally the targets are higher. Electricity use will be several magnitudes higher than it is today. By 2030, there will be no use of kerosene as a cooking fuel and the use of LPG will be double the baseline figures.

Figure 36: Demand for Cooking Fuels under SDG 7 Scenario



51 Projection based on the Vision 2030 blueprint

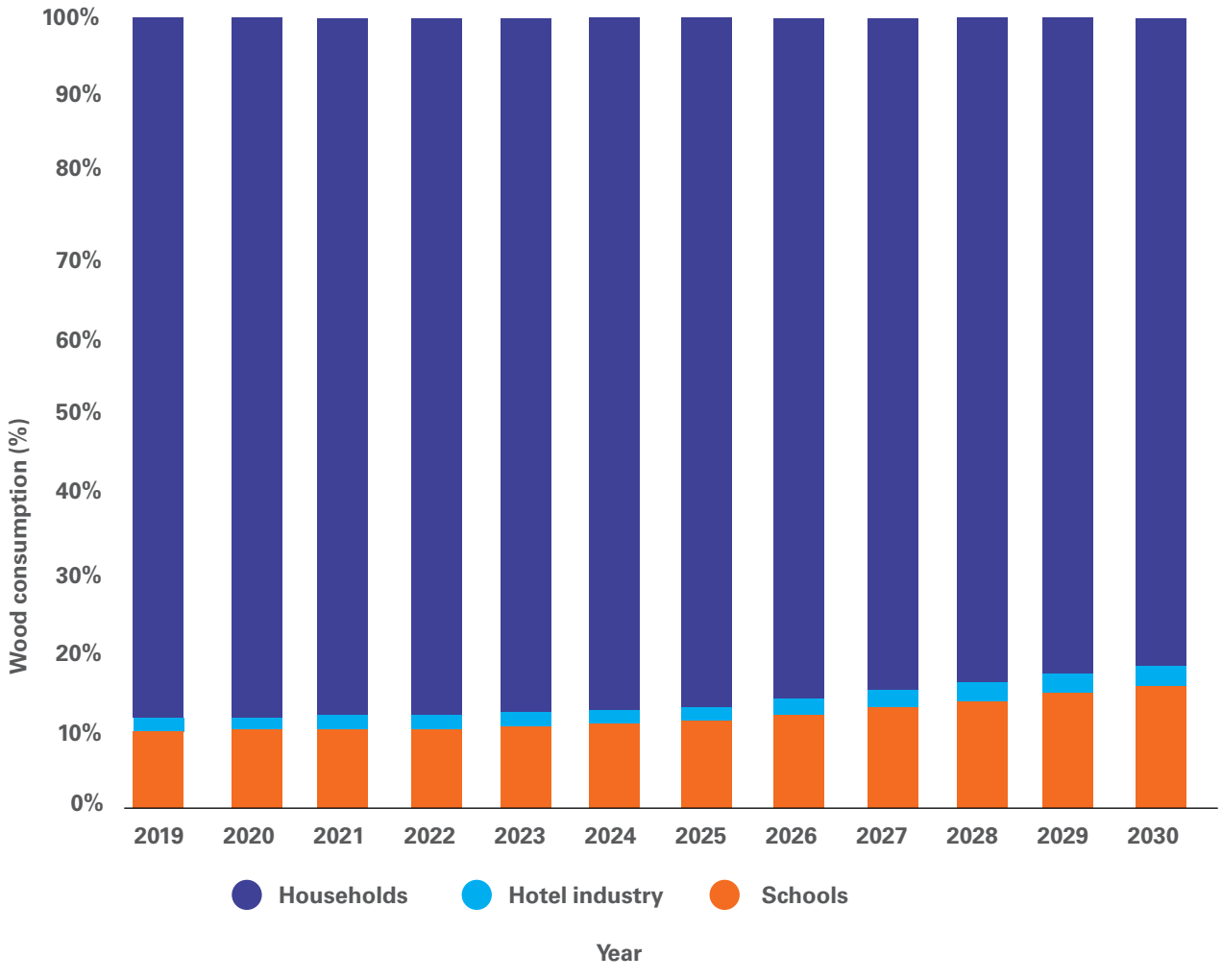
4.4.2 Biomass Demand

Under SDG 7, the share of household sector total consumption of firewood reduces, as households continue to embrace clean(er) cooking alternatives through to 2030. However, rural households are expected to continue using firewood as a main source of fuel, but mostly with improved cookstoves.

Table 22: Projected Demand of Biomass under SDG 7 Scenario

Branch	Base year (2019) Metric Tonnes	2027 Metric Tonnes	2030 Metric Tonnes
Household	388,110	301,032	250,844
Schools	42,440	44,876	47,103
Hotel Industry	7,030	7,691	7,944
Total	437,580	353,599	305,892

Figure 37: Share of Biomass Demand under SDG 7 Scenario



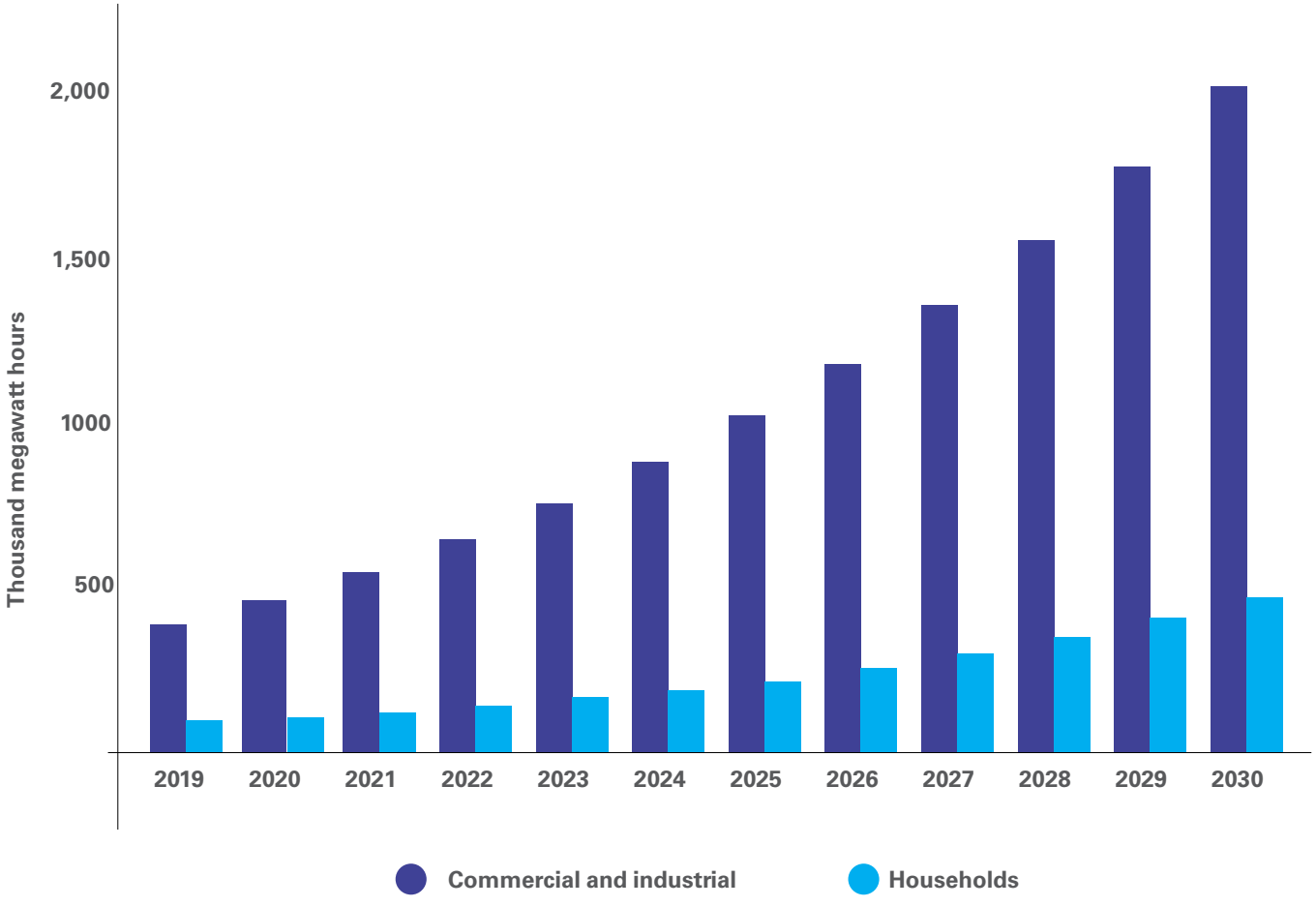
4.4.3 Electricity Demand

Nearly 80% of electricity demand will come from large commercial enterprises (70%) and small and medium enterprises (10%). The remaining 20% will be generated by households. For this to be actualized significant industrialization is envisaged.

Table 23: Projected Electricity Demand across Different Sectors under SDG 7 Scenario

Sector	Units (HH/ Connection)	Base year Consumption 2019 (MWh)	Consumption by 2027(MWh)	Consumption 2030(MWh)
Domestic (Households)	616,046	92,096	296,003	462,050
Small Commercial	25,364	89,243	210,064	295,215
Large Commercial & Industrial	306	293,756	1,138,341	1,720,264

Figure 38: Growth in Electricity Demand under SDG 7 Scenario



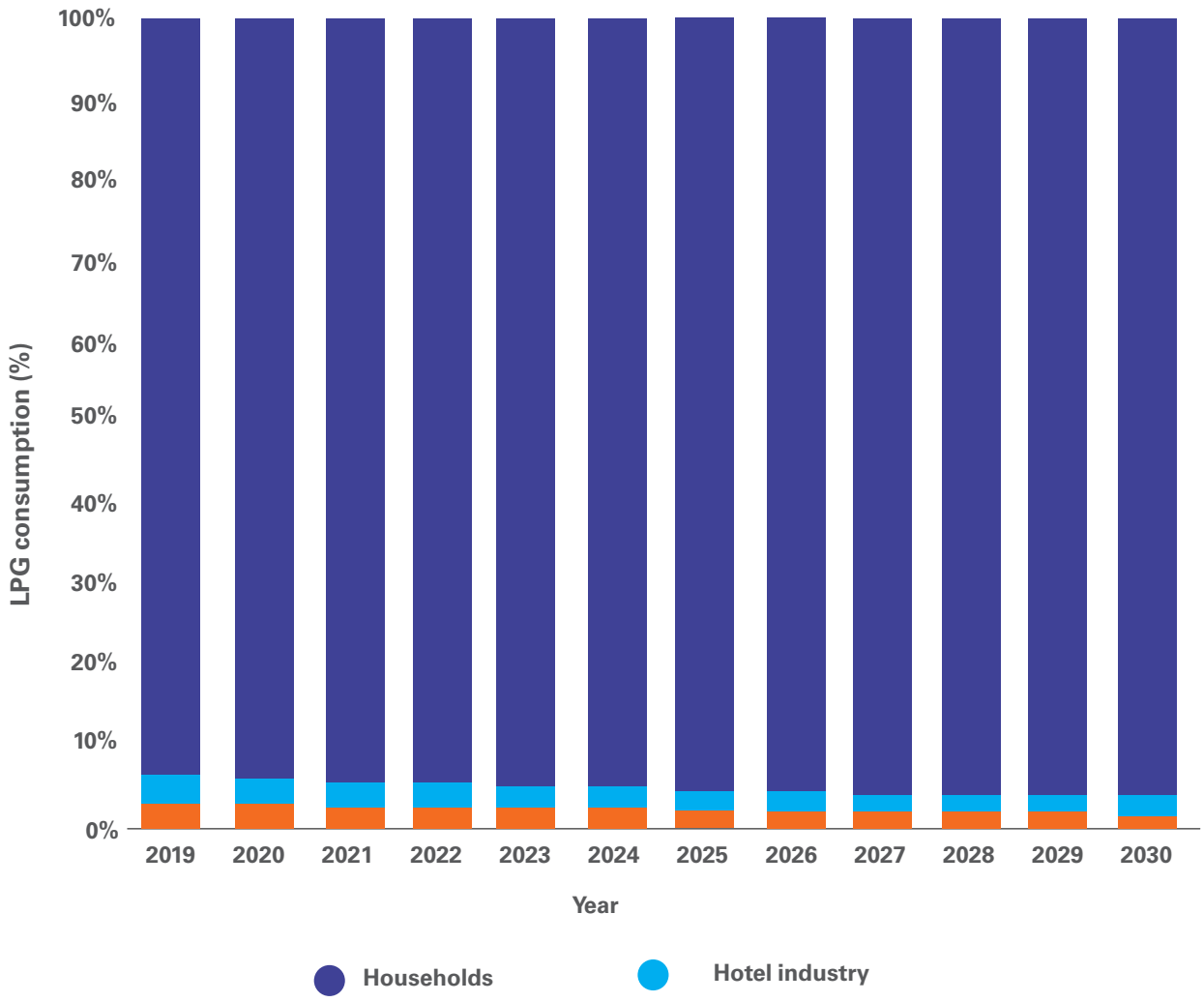
4.4.4 LPG Demand

The consumption of LPG is expected to grow rapidly at the household level. Majority of hospitals use LPG already, so the growth here will be marginal.

Table 24: Projected LPG Demand under SDG 7 Scenario

Branch	Base year (2019) Metric Tonnes	2027 Metric Tonnes	2030 Metric Tonnes
Household	10,400	23,703	30,682
Hospitals	327	457	457
Hotel Industry	371	645	769
Total	**11,098**	**24,805**	**31,908**

Figure 39: Share of LPG Demand across Different Sectors under SDG 7 Scenario



4.4.5 Implications for SDG 7 Scenario

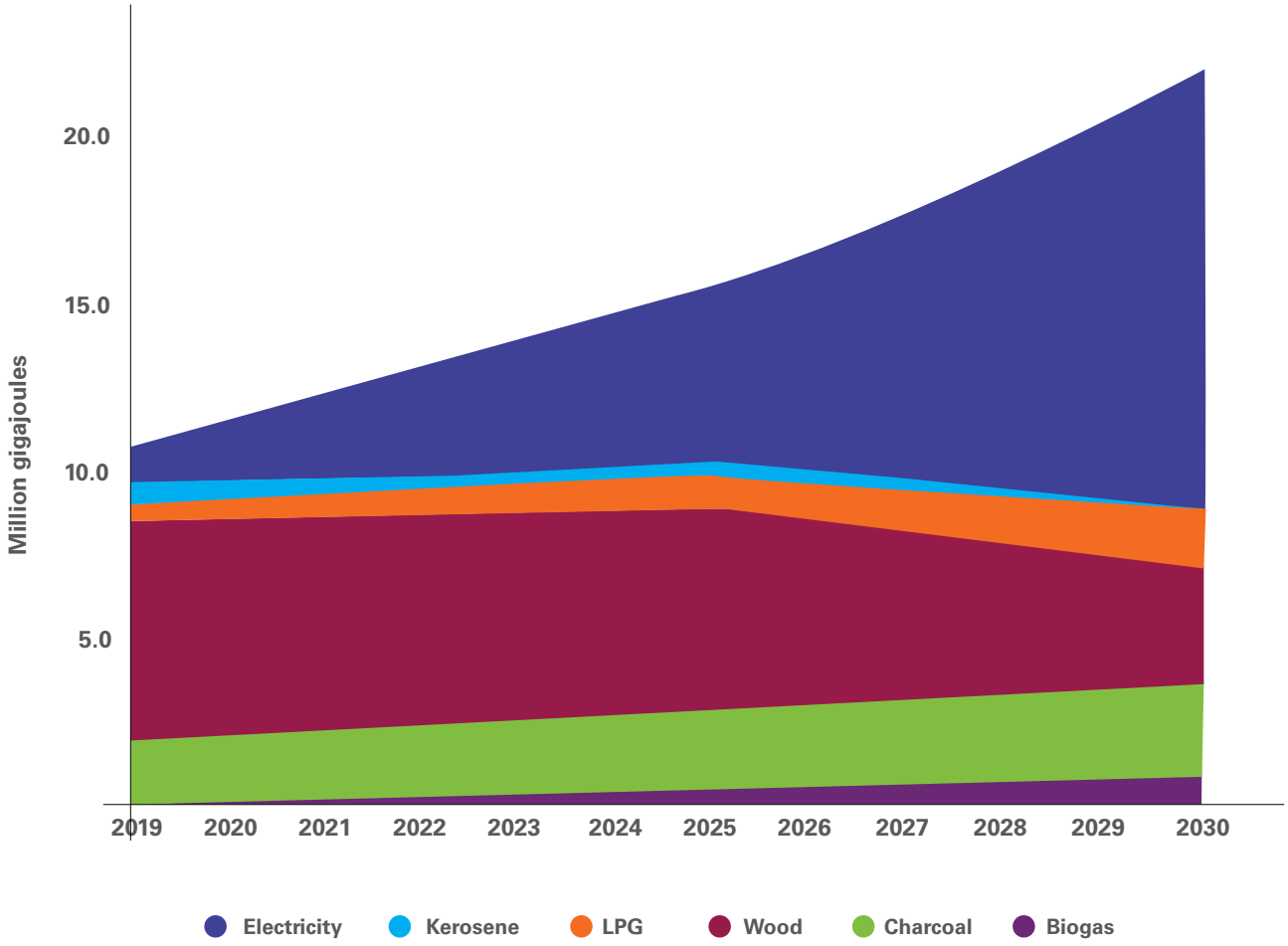
- Increased use of electricity as a cooking fuel will lead to an increase in demand for electric cookers. This is an opportunity for the County government to collaborate with manufacturers, especially manufacturers specializing in electricity-efficient stoves
- The adoption of electricity as a cooking fuel will be predicated largely on increased electricity quality and cost-friendly tariffs. The County will have to actively lobby the utility to improve electricity quality, as this can deter many households from switching.
- Charcoal and wood will still contribute a sizeable share of cooking fuels. This is an opportunity for energy-efficient and cleaner industrially manufactured charcoal and wood stoves.

4.5 High Growth Scenario

Under the high economic growth scenario, GDP growth rate is taken as 12%. It is expected that 100% of the population will transition to clean cooking by 2030.

4.5.1 Cooking Fuels Growth

Figure 40: Projected Cooking Fuels Demand under High Growth Scenario



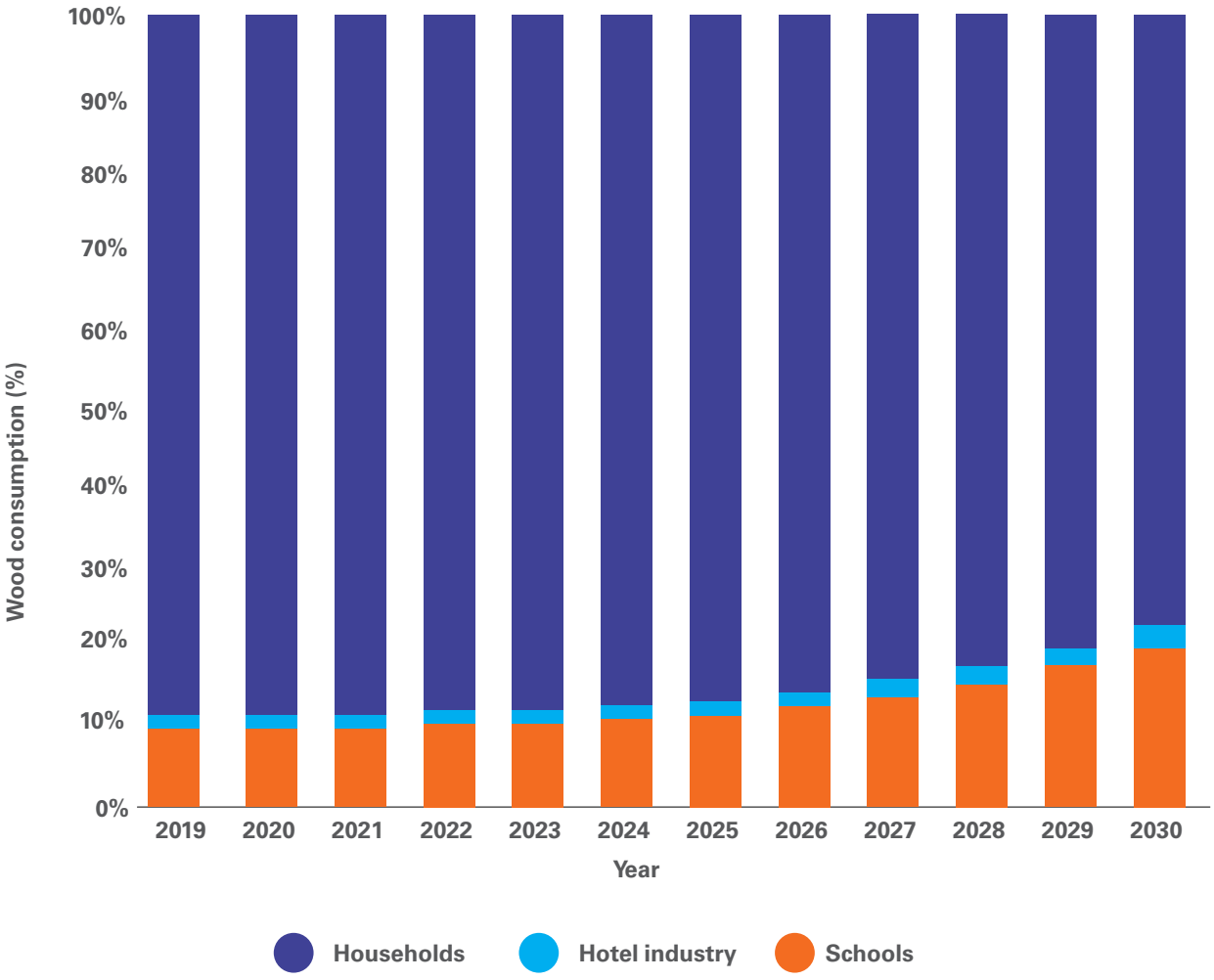
4.5.2 Biomass Demand

As the living standards in the high economic scenario improve, most households would be expected to move to high tier cooking solutions, so the consumption of wood reduces drastically in this scenario, including in the rural households as seen in the figure below.

Table 25: Projected Biomass Demand under High Growth Scenario

Branch	Base year (2019) Metric Tonnes	2027 Metric Tonnes	2030 Metric Tonnes
Household	388,110	272,785	180,783
Schools	42,440	44,876	47,104
Hotel Industry	7,030	6,330	5,959
Total	**437,580**	**323,991**	**233,846**

Figure 41: Share of Biomass Demand across Different Sectors under High Growth Scenario



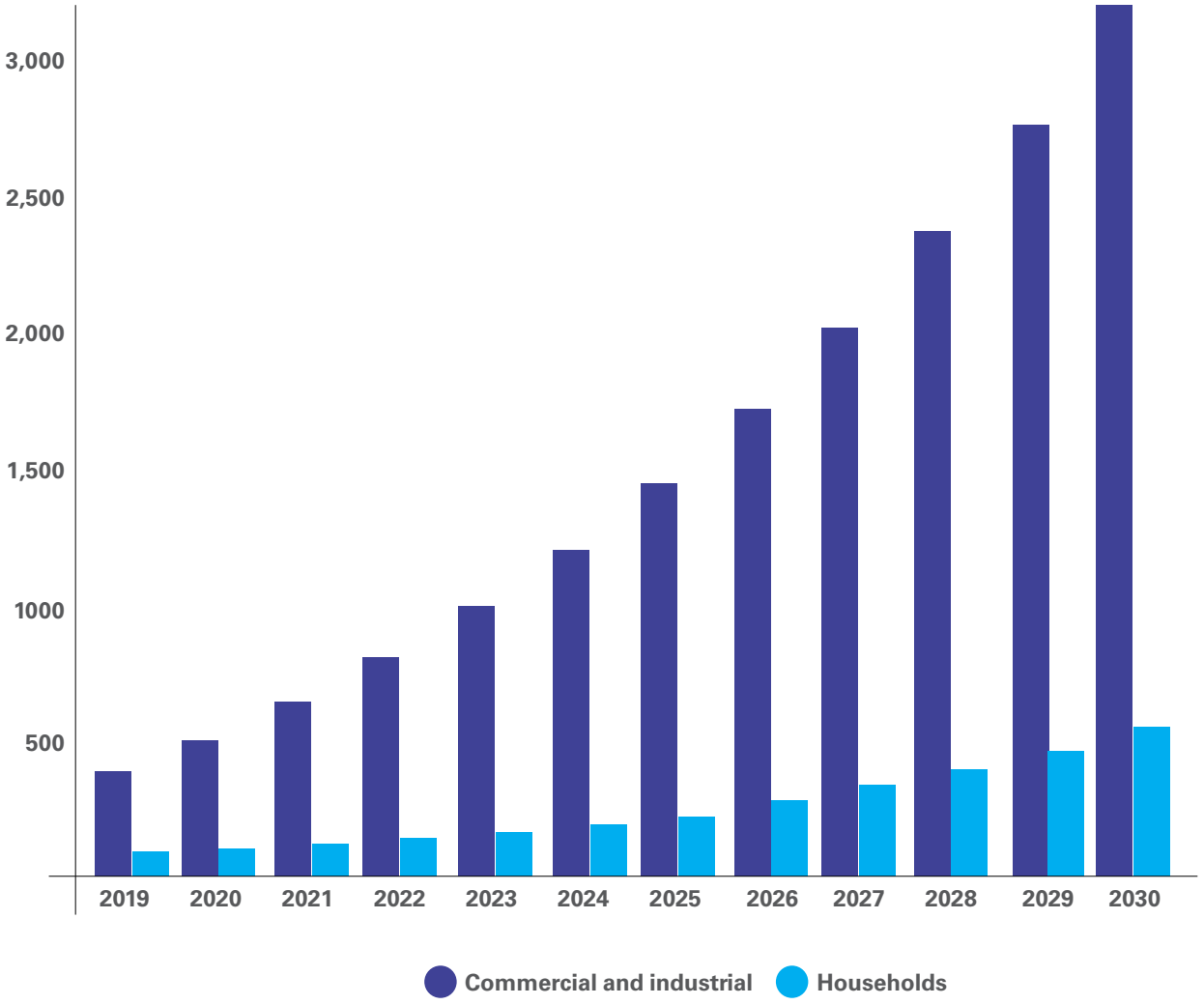
4.5.3 Electricity Demand

Very high growth in electricity demand is registered under this scenario, unsurprisingly. It is expected that electricity demand for households will grow more than fivefold the baseline figures for 2019 by 2030, and nearly tenfold for large commercial enterprises during the same period.

Table 26: Share of Electricity Demand under High Growth Scenario

Sector	Units (HH/ Connection)	Base year Consumption 2019 (MWh)	Consumption by 2027(MWh)	Consumption 2030 (MWh)
Domestic (Households)	616,046	92,096	335,794	553,276
Small Commercial	25,364	89,243	234,748	346,213
Large Commercial & Industrial	306	293,756	1,798,248	2,867,107

Figure 42: Projected Electricity Demand across Different Sectors under High Growth Scenario



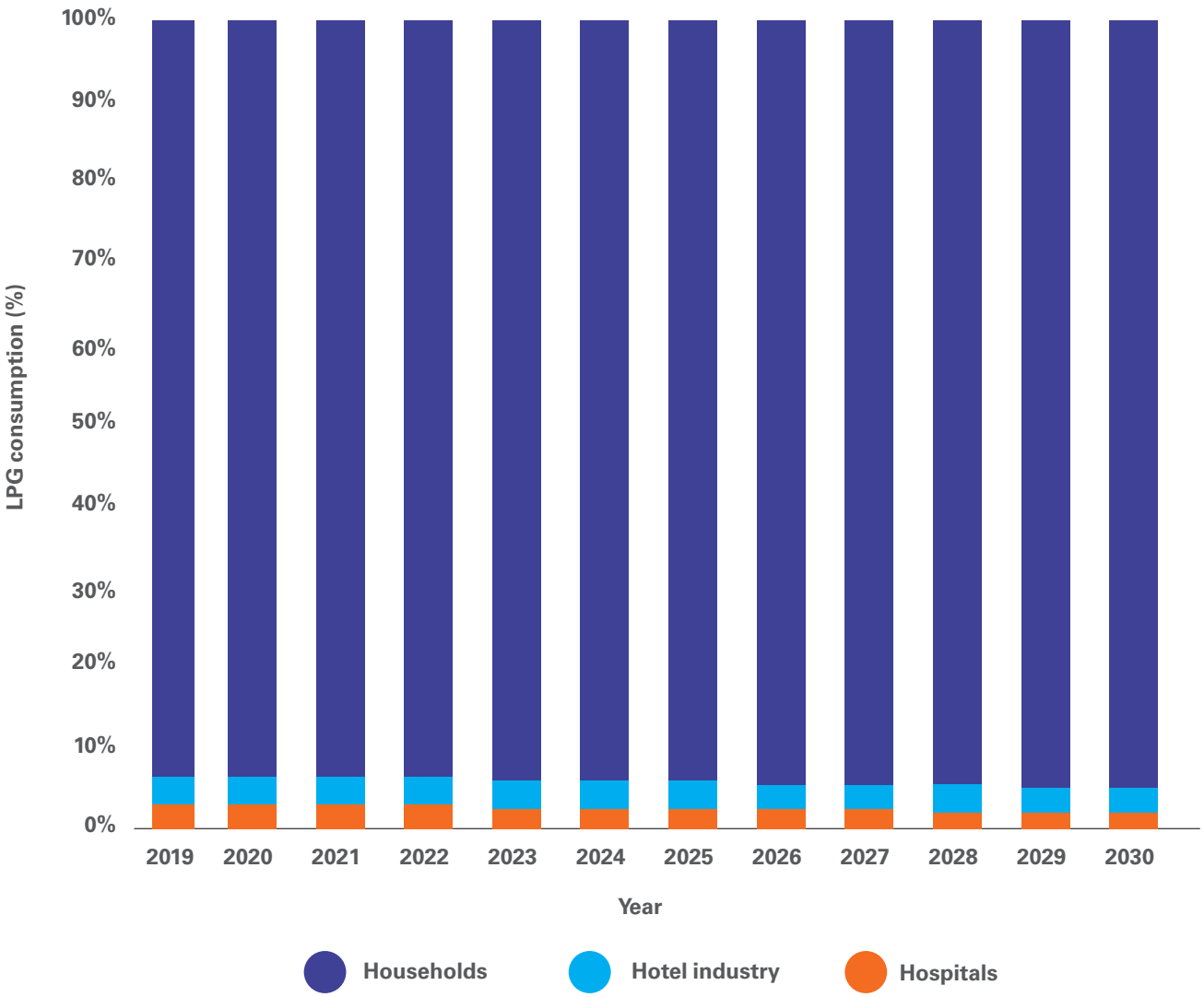
4.5.4 LPG Demand

The demand for LPG in the high economic scenario triples from the base year's demand, as shown in the table below. This is due to an increase in the purchasing power of consumers owing to significant economic growth. It is expected that demand for LPG will mostly be by individual households.

Table 27: LPG use Growth under High Growth Scenario

Branch	Base year (2019) Metric Tonnes	2027 Metric Tonnes	2030 Metric Tonnes
Household	10,400	25,651	33,467
Hospitals	327	609	609
Hotel Industry	371	856	1,076
Total	**11,098**	**27,116**	**35,152**

Figure 43: Projected LPG use Growth across Different Sectors under High Growth Scenario



4.5.5 Implications for High growth Scenario

- Following an increase in LPG demand, the County should increase its capacity for LPG regulation to protect consumers from exploitation. This can be done through collaboration with independent bodies like the Energy and Petroleum Regulatory Authority (EPRA).

- As demand for electricity increases for commercial and industrial enterprises, it is necessary to address quality and tariffs concerns, lest all of them turn to self-generation.

- To balance demand and supply of electricity, it will be necessary to focus on non-electric forms of energy like solar thermal, especially for schools, hotels, and industries.

4.6 Link between CEP and Modelling Simulations

- The CEP target of clean cooking by 2030 is not reached by the BAU scenario: some improvements are met but a significant gap remains. This means that an additional public policy effort is necessary to complement the market drivers considered in this scenario. The CEP Programs 1, 2 and 3 are addressed to fill this gap. The situation is improved in the other two scenarios, as the accelerated GDP increase deploys stronger trends to abandon the traditional cooking technologies. Nevertheless, some gaps may remain in rural areas, and the probability of these high rates of annual GDP increase (10 and 12%) are questionable.

- The CEP target of an increase of household electricity access from 91% to 100% (universal access) by 2027 is highly likely that will not be met in the BAU scenario. So will be for educational buildings, having 94% electricity access in 2019. The necessary public policy effort is shown by the CEP Programs 4 and 5. The SDG 7 scenario shows a 5-fold increase of household consumption in the period 2019-2030 (compared to 2.8 times for the BAU scenario), that may suggest reaching the universal access target by 2030.

- The CEP baseline and target values for public buildings are not available yet, as the statistical inquiry performed on enterprises could not afford this aspect. Defining these values will be an initial and high priority task for the CEP Secretariat. The GDP growth produces in all scenarios a rapid industrialization process; therefore, the Program 7 supports cleaner and more efficient ways of decentralized power generation in large commercial and industrial enterprises. A similar approach is foreseen by Program 6 for a better quality of the power service in health facilities (less supply interruptions).

- The CEP Secretariat will monitor the evolution of the energy consumption by end-users and energy sources in the County, to monitor how the GDP trends and the Government policies influence the energy balance. The possible impact of the CEP programs on the annual energy consumption by energy source will be assessed, evidencing how the consumption deviates respect to the BAU scenario, that will be updated regularly adapting the demographic and GDP input values. This process will help fix energy consumption targets by end-use, target values difficult to assess in this phase.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Projects and Programs

5.1 Overview of the CEP

Guided by the baseline information and anchored on national legislation, the Nakuru County CEP provides a planning and implementation framework that will facilitate greater coordination between and among the key actors promoting access to energy. These include the sub-national government, the national government, development agencies, and the private sector. Nakuru County aims to attain universal access to electricity by 2027 using both on-grid and off-grid solutions, and to modern clean cooking solutions by 2030. The CEP vision is founded on the strength of strategic partnership with the national government, private sector, development partners, and the bilateral and multilateral donors. As such, efforts will be put in place to make the operating environment conducive to attracting investment.

This CEP identifies three core problems:

- inadequate institutional coordination of the energy sector;
- lack of an overarching energy planning framework; and
- moderate access to clean, affordable, and reliable energy.

Through a programmatic approach delivered utilizing four interrelated components:

i) access to energy for cooking and heating;

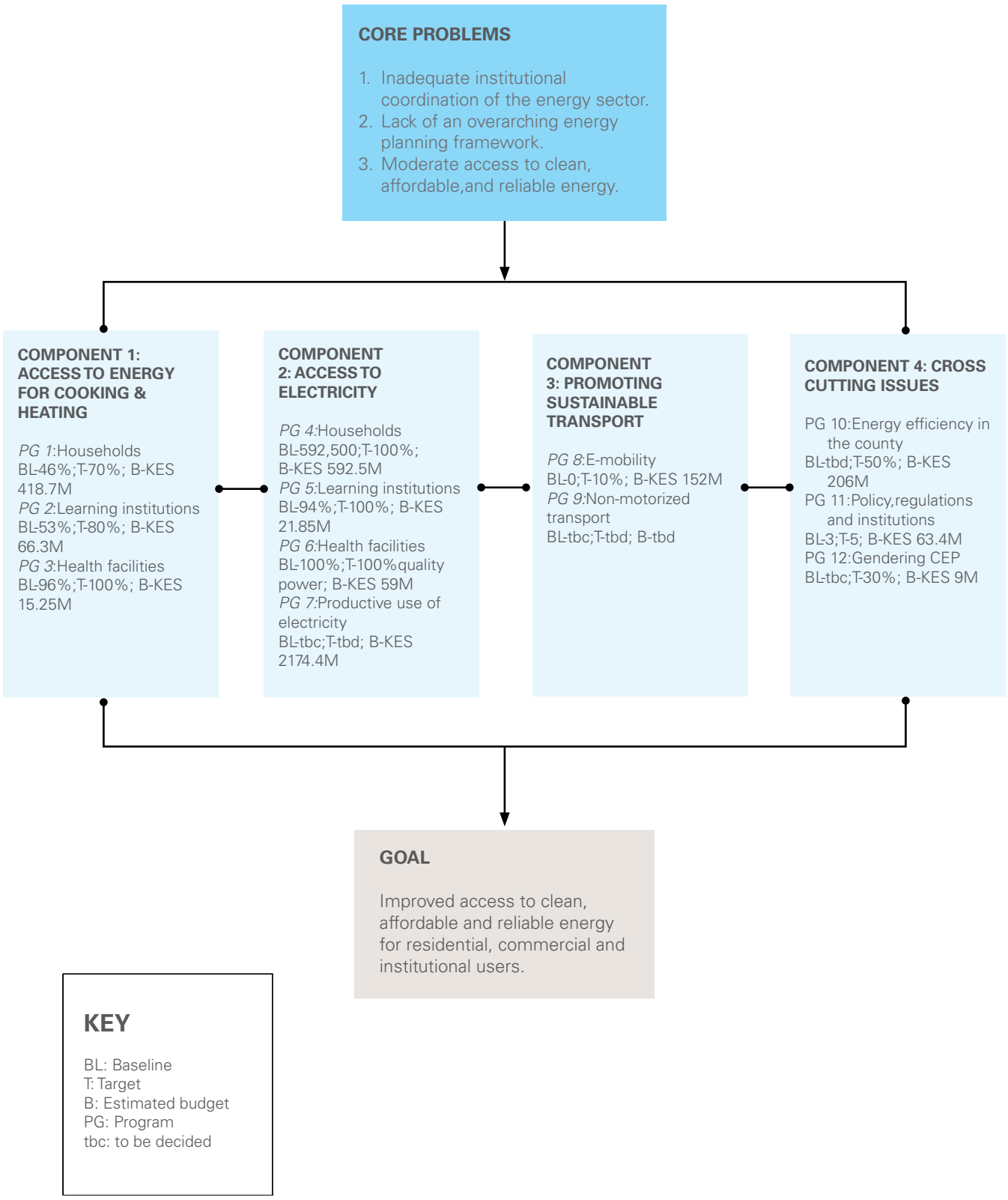
ii) access to electricity;

iii) promoting sustainable transportation; and

iv) cross-cutting issues,

this CEP aims to achieve the goal of improved access to clean, affordable, and reliable energy by 2027, as shown in Figure 44 below. These components are further divided into 12 programs (abbreviated as PG). The estimated implementation budget is KES 2.29 billion spread over 5 years, as will be discussed in chapter 6. This includes private sector investments, value of national government's contribution, sub-national government resources, support from development agencies and climate finance, in-kind and in cash. Creating an enabling environment that will attract private sector investments and improve collaborations between development agencies and the County government will be key to crowding in these resources.

Figure 44: CEP Programmatic Interventions



5.2 Components of the CEP

5.2.1 Component 1: Energy Access – Cooking and Heating

Table 28: Program 1--Accelerating Cleaner Cooking Solutions for Households

Program 1: Intervention area - Accelerating cleaner and more efficient energy for cooking in households **Baseline: 46% of the County population have access to cleaner cooking solutions** **Target: 70% access to cleaner cooking by 2027 and 100% by the year 2030**					
Outputs	**Activities**	**Progress Indicators**	**Responsibility**	**Timeline (Indicative start-date)**	**Actions under other county plans**
Partnership established with cooking energy providers and development partners	Mapping of active cooking solution providers and development partners	A detailed list of clean cooking service providers active in Nakuru and those planning to enter the County	Energy department	2022/2023 -Q2	Directorate of environment, energy and natural resource- County government plan to map county energy stakeholders
	Consultative forums on the County clean cooking vision and opportunities	Two consultative forums held	Energy department/ Consultant	2022/2023- Q3	
	MoU with partners on clean cooking solutions	At least five MOU signed with partners	Energy department	2022/2023 -Q4	Directorate of environment, energy and natural resource- County government plan promotion of home biogas use in partnership with Amiran Kenya
Awareness creation on the benefits of improved cooking solutions undertaken	Desk survey on appropriate awareness creation approaches considering, rural-urban dynamics, and different socio-economic groups	Awareness creation campaign strategy	Energy department/ Public health department/ Gender department/ Consultant	2022/2023 – Q4	Nakuru county clean energy policy, draft 2016-County government to launch awareness programmes through media and public forums to promote clean fuels and clean cooking
	Recruit a marketing firm	Marketing firm identified and contracted		2023/2024 – Q1	
	Awareness creation rollout	Series of campaigns rolled out in all the sub-counties		2023/2024 -Q 2, Q4 2024/2025 – Q2, Q4	Directorate of environment, energy and natural resource- County government planned to do county wide continuous awareness creation of clean/green energy solution adoption

	Establish and mainstream clean cooking energy week annually	Gazettement of the energy week and annual roll-out	Energy department/ Health department/ Agriculture department / Service providers/ Gender department/ Development partners	2022/2023 -Q4 2023/2024 -Q4 2024/2025 -Q4 2025/2026 -Q4 2026/2027 -Q4	
A Clean Cooking Fund created (a- Residential needs)	Develop clean cooking fund strategy focusing on residential users	Guidelines and a strategy developed	Energy department/ Gender department/ Environment department/ Economic planning	2022/2023 - Q4	Directorate of environment, energy and natural resource- County government was developing Nakuru County Energy Strategy and plan in 2018/19
	The County government allocate a budget for clean cooking	Nakuru County allocates a seed fund toward CCF	Energy department/ Treasury/ Planning department	2022/2023 -Q1	County Integrated Development Plan-County government planned to promote renewable sources and targeting 9700 new households to be using renewable energy by 2022
	Mobilize financial resources to strengthen the CCF	Fund equivalent to the County allocation mobilized	Energy department/ Health department/ Gender department	2022/2023 -Q4	Nakuru county clean energy policy, draft 2016-County government to collaborate with the national government to establish a consolidated energy fund to pool financial resources to provide capital funding for energy projects
Dissemination of clean cooking energy solution mix accelerated – ethanol, biogas, pellets	Design a consumer financing facility and Result Based Financing (RBF)	A functional consumer financing and RBF facility ready for roll-out	Gender department/ Energy department/ Private sector/ Financial institutions/ Development partners	2022/2023-Q3-onward	Nakuru county clean energy policy, draft 2016-County government to partner with financial institutions to give credit to households who are not able to pay for energy efficient appliances upfront
	Roll out consumer financing through – Merry-go-round, Saccos, pay-go, etc	Increased uptake of clean cooking solutions through developed consumer finance	Gender department/ Energy department/ Private sector/ Financial institutions/ Development partners	2023/2024 -Q3	Nakuru county clean energy policy, draft 2016-County government to support public private partnership in the energy sector

	Roll out RBF cookstoves facility to enhance the uptake of clean cooking solutions	New and innovative clean cooking solutions are readily available and accessible to consumers	Energy department/ Private sector/ Trade department/ Development partners/ Financial institutions	2023/2024 -Q3	
	Strengthen the role of the Clean Cooking Association of Kenya (CCAK) at the County level	CCAK County chapter activated through the signing of an MoU with the County	Energy department/ Development partners/ CCAK	2023/2024-Q3	

Table 29: Program 2—Accelerating Cleaner Cooking Energy for Learning Institutions

Program 2: Intervention area - Accelerating cleaner energy for cooking in learning institutions **Baseline: 53% of the County learning institutions have access to cleaner cooking solutions** **Target: 80% access to cleaner cooking solutions by 2027 and 100% by the year 2030**					
Outputs	**Activities**	**Progress Indicators**	**Responsibility**	**Timeline (indicative start date)**	**Actions under other county plans**
All schools without clean and efficient cooking solutions mapped out	Convene the County school heads forum	An annual head of schools event held	Education department/ Energy department	2022/2023 – Q4	
	Commission a County-level audit of all public schools and determine those that do not have access to clean cooking solutions	All schools without access to improved institutional stoves mapped out		2022/2023 – Q4	
A Clean Cooking Fund created (b - Institutional needs)	Develop a clean cooking fund strategy focusing on institutional users	Roll out of institutional stoves financing	Financial institutions/ Education department/ Energy department	2023/2024 -Q2	
	Develop or adopt guidelines for institutional stoves providers	Institutional stoves providers guidelines developed	Energy department/ Energy research institutions/ Development partners	2022/2023 -Q4	

	Develop a register of certified institutional stoves installers in the County	Online register of certified institutional stove installer developed	Energy department/ Development partners	2022/2023-Q3 onward	
	Roll-out institutional stove program	Number of institutional stoves installed	Energy department/ Development partners/ Education department	2023/2024 -Q3	Nakuru county clean energy policy, draft 2016-County government to promote and enhance fuel-switch from wood fuel to other cleaner sources (LPG, biogas) for cooking

Table 30: Program 3--Accelerating Clean(er) Cooking Solutions for Health Facilities

Program 3: Intervention area - Health facilities access to clean energy for cooking **Baseline: 96% of the health facilities have access to cleaner cooking solutions** **Target: 100% access to clean cooking solutions by 2027**					
Outputs	**Activities**	**Progress indicators**	**Responsibility**	**Timeline (Indicative start date)**	**Actions in other county plans**
Public health institutions without clean cooking solutions mapped	Map out all health institutions without access to clean cooking solutions	Number of health facilities without access to clean energy for cooking mapped out	Health department/ Energy department	2022/2023 – Q4	
	Undertake energy need assessment	Need assessment done	Health department/ Energy department	2022/2023 – Q4	
	Adapt the CCF to finance health institutions	CCF activated for health institutions	Energy department/ Treasury/ Development partners	2023/2024 -Q1	
All health institutions fitted with clean cooking solutions	Mobilize development partners for technical and financial support	Amount of funds mobilized	Energy department/ Health department/ Development partners	2022/2023 – Q4	
	Clean energy for cooking roll-out	Number of health facilities fitted with clean cooking solutions	Development partners/ Treasury/ Health department/ Energy department	2022/2023 – Q1	Nakuru county clean energy policy, draft 2016-County government to promote and enhance fuel-switch from wood fuel to other cleaner sources (LPG, biogas) for cooking

5.2.2 Component 2: Energy Access – Electricity

Table 31: Program 4--Household Lighting Electricity Access

Program 4: Intervention area - Household energy for lighting **Baseline: 90% of the County population has access to electricity** **Target: 100% access to electricity by 2027**					
Outputs	**Activities**	**Progress indicators**	**Responsibility**	**Timeline (Indicative start date)**	**Actions in other county plans**
All households in Kuresoi North and South, Rongai and Nakuru North connected with electricity	Map areas that are planned for grid extension in the next five years in liaison with KPLC	Grid extension plan for the next five years shared with the County	KPLC/Energy department	2022/2023 -Q2	
	Last-mile connection activated	Number of households connected as per the agreed plan	KPLC/Energy department	2022/2023 -Q4	
	Develop a database of certified solar PV products, service providers, and solar technicians	A functional online database of solar service providers and products sellers in place	KEREA/ Energy department/ Consultant/ EPRA	2022/2023-Q2 onward	
	Vet all solar products marketed in the County to ensure they are quality certified	Registration of solar products sellers and types in the County Market surveillance & monitoring	Kenya Bureau of Standards/ Energy department/ Development partners	2022/2023 -Q3 onward	
	Promote Solar Home Systems (SHS) and solar lanterns in areas outside the marked zones for electrification by KPLC	60% of households marked for off-grid solar in the target area connected by year 3; 40% done in the next 2 years	Development partners/ Service providers/ Energy department/ Financial institutions	2022/2023 -Q4 onward	Nakuru county clean energy policy, draft 2016-County government to promote electricity generation from solar energy for off-grip application

Table 32: Program 5--Institutional Appliances

Program 5:	**Intervention area - Institutions of learning energy for lighting and powering appliances**				
Baseline:	**94% of the institution of learning have access to electricity**				
Target:	**100% access to electricity by 2027**				
Outputs	**Activities**	**Progress indicators**	**Responsibility**	**Timeline (Indicative start date)**	**Actions under other county plans**
All institutions of learning without power mapped out	Identify all institutions without power: location and proximity to grid	All learning institutions without electricity mapped out	Energy department/ Development partners/ Education department	2022/2023 -Q4	
	KPLC shares its institutional electrification plans for the next five years	County on-grid extension plans by KPLC shared	KPLC/ Energy department	2022/2023 -Q4	Nakuru county clean energy policy, draft 2016-County government to map out priority areas for the on-grid and off-grid county energy solutions
All institutions connected to power— either grid power or off-grid solutions	Design a model for off-grid electrification	Off-grid electrification model designed	Energy department/ Treasury/ Development partners/ Financial institutions	2022/2023-Q3	
	Mobilize financial resources to boost the off-grid electrification solutions,	Amount of funds mobilized against the target	Development partners/ Treasury/ Energy department	2022/2025 – Q3	
	Connect institutions with electricity	Number of institutions connected to electricity	Development partners/ Energy department/ Education department	2023/2024 – Q2 onward	

Table 33: Program 6--Health Facilities Appliances

Program 6: Intervention area - Health facilities energy for lighting and powering appliances **Baseline: 100% access to electricity** **Target: Enhance the quality and uninterrupted access to energy for lighting and powering appliances by 2027**					
Outputs	**Activities**	**Progress indicators**	**Responsibility**	**Timeline (Indicative start date)**	**Actions in other county plans**
Energy need assessment undertaken	Identify the main challenges for power supply interruption	Need assessment report	KPLC/ Energy department/ Health department	2022/2023 – Q4	
	Develop a tailor-made solution for each facility	Tailor-made solutions roll-out	Energy department/ Health department/ Development partners	2023/2024 -Q2	Nakuru county clean energy policy, draft 2016-County government to work with KPLC and REA to promote development on-grid and off-grid energy solutions
Funds raised to support setting up of backup solutions	The County government allocate a budget to enhance power in health facilities	Amount of funds allocated	Health department/ Energy department/ Development partners	2022/2024 – Q3	
	Mobilization of financial resources from partners	Amount of funds mobilized	Development partners/ Treasury/ Health department/ Energy department	2022/2024-Q2	
Uninterrupted power supply	Install power backup solutions for the facilities without back-up	Backup power systems installed	Energy department/ Health department/ Development partners	2023/2024 – Q1	

Table 34: Program 7--Productive Uses of Energy

Program 7: Intervention area - Productive use of energy[52] **Baseline: To be determined (TBD)** **Target: TBD**					
Outputs	**Activities**	**Progress indicators**	**Responsibility**	**Timeline (Indicative start date)**	**Actions under other county plans**
Milk coolers supplied with adequate power in all milk-producing sub-counties	Undertake energy need assessment for milk coolers in the County	Need assessment report	Agriculture department/ Energy department	2022/2023 -Q2	County Integrated Development Plan -County government planned to install 31 milk coolers between 2018-2022
	Install power and power backup systems for the milk coolers	Number of milk coolers installed with power and backup system	Agriculture department/ Trade department/ Development partners/ Financial institutions	2022/2023-Q4	
Operational egg incubators hybridized (solar and grid)	Undertake energy need assessment for incubators in the County	Need assessment report	Agriculture department/ Energy department	2022/2023-Q3	
	Set up demo incubators powered by an off-grid solar solution	11 demo incubators set up in all sub-counties with low access to electricity	Agriculture department/ Energy department	2023/2024-Q1	
Fish-cold chains established in all the relevant fish landing and markets	Energy need assessment for fish cold rooms in the County	Need assessment report	Fisheries department/ Energy department	2022/2023-Q4	
	Install fish chillers/cold rooms in fish landing and markets	Number of installed fish chiller/cold rooms	Fisheries department/ Agriculture department/ Trade department/ Development partners	2023/2024-Q2	County Integrated Development Plan -County government planned to construct 1 modern fresh fish auction/facility with cold storage in 2018-solar powered

52 A baseline was not undertaken during the field survey and it is expected that upon the setting up of the Coordinating secretariat, the office in conjunction with the relevant departments will be able to agree on the baseline and targets when the need assessment will be happening. This applies to all the intervention areas that did not have a baseline.

Potatoes cold storage facilities in sub-counties producing potatoes established	Energy need assessment for potato cold chain	Need assessment report	Agriculture department	2023/2024-Q2	
	Identify and develop a strategic partnership with the private sector to develop cold chains and processing	Strategic partner identified	Agriculture department/ Energy department	2023/2024-Q2	
	Set up potato cold storage facilities in the sub-counties	Potatoes cold storage facilities in the sub-counties	Agriculture department/ Trade department/ Private sector/ Development partners	2023/2024-Q2	County Integrated Development Plan -County government planned to construct fresh produce cold stores 1 in 2018 and 1 in 2020

5.2.3 Sustainable Transport

Table 35: Program 8--E-mobility

Program 8:	**Intervention area - Support the uptake of e-mobility based transportation**				
Baseline:	**0**				
Target:	**10%**				
Outputs	**Activities**	**Progress indicators**	**Responsibility**	**Timeline (Indicative start date)**	**Actions under other county plans**
E-mobility for 2 and 3 wheelers rolled out	Design an e-mobility pilot project	E-mobility pilot launched	Transport department/ Energy department	2022/2023—Q4	
	Set-up an e-mobility charging station	Charging stations established in Nakuru town	Transport department	2023/2024—Q2	
	Create and incentive to purchase electric 2 and 3 wheelers	A finance scheme established between the County and the private sector	Transport department/ Finance institution/ Development partner	2023/2024—Q2	Nakuru county clean energy policy, draft 2016-County government to promote energy efficiency awareness to transport stakeholders

	Research on retrofitting existing diesel and petrol 2 and 3 wheelers	Partnership with a research institution established	Research institution/ Transport department/ Energy department	2023/2024—Q4	
E-mobility policy and strategy for 2 and 3 wheelers developed	Stakeholders' consultation	Number of e-mobility forums held	Transport department/ Energy department/ Physical Planning department	2024/2025—Q2	
	Establish a technical committee on e-mobility	Technical committee gazette by CEC for Energy	Transport department	2024/2024—Q2	
	Develop e-mobility strategy for 2 and 3 wheelers	e-mobility policy and strategy developed	Transport department/ Development partners/ Private sector	2026/2027—Q1 2026/2027—Q4	
Develop e-mobility infrastructures including charging stations in strategic locations	Create awareness on the benefits, opportunities for the e-mobility	Number of people aware of the benefits of e-mobility	Energy department/ Roads department/ KPLC	2022/2024-Q4 onward	County Integrated Development Plan -County government planned to construct 30 motorable bridges every year between 2018-2022
	Develop a carbon project on e-mobility	Strategic partnership established with carbon developers	Transport department	2024/2025 Q1 onward	
	Engage private sector to sell and provide maintenance for 2&3 electric wheelers	MoU signed with a private sector	Transport department	2025/2026 -Q4	

Table 36: Program 9—Non-Motorised Transport (NMT)

Program 9: Intervention area - Non-Motorised Transport (NMT) **Baseline: 5 km** **Target: 50 km**					
Outputs	**Activities**	**Progress indicators**	**Responsibility**	**Timeline (Indicative start date)**	**Actions under other county plans**
Organized NMT paths constructed	Construct NMT paths and crossings in the County	Number of kilometres of NMT paths built	Transport department/ Energy department/ Physical planning department	2022/2023-Q2	Nakuru county clean energy policy, draft 2016-County government to establish an integral systems of bicycle routes connecting major urban areas and public spaces
	Install streetlights along the NMT paths	Number of streetlights mounted	Transport department/ Energy department/ Physical planning department	2022/2023 -Q4	County Integrated Development Plan -County government planned to install 600 streetlights every year between 2018 and 2022
	Establish parking spaces for bicycles	Number of secure and dedicated bicycle parking bays established	Transport department/ Physical planning department	2023/2024-Q2	
Awareness creation on the benefits of walking and cycling	Mass awareness campaign on the health benefits of walking/ cycling	Number of people walking/cycling to work and other places	Public health department/ Transport department/ Development partners/ Sports department	2023/2024-Q2 onward	Nakuru county clean energy policy, draft 2016-County government to plan and conduct public awareness campaigns to promote alternative modes of transport
	Establish and mainstream a walking/ cycling day every month	First, walking/cycling week held	Public health department/ Roads department/ Transport department/ Development partners/ Sports department	2023/2024-Q4 onward	

5.2.4 Component 4: Cross-cutting issues

Table 37: Program 10--Energy Efficiency

Program 10: Intervention area - Enhancing energy efficiency in the County **Baseline: TBD** **Target: 50% reduction of streetlights bill from the existing infrastructure**					
Outputs	**Activities**	**Progress indicators**	**Responsibility**	**Timeline (Indicative start date)**	**Actions under other county plans**
50% of all streetlights retrofitted with solar power	Map out the streetlights that need to be retrofitted with solar and areas that need streetlights in the County	Need assessment report			
	Installation of solar street lighting	Number of streetlights retrofitted Number of new streetlights installed	Energy department/ Roads department/Transport department	2022/2024-Q2 onward	County Integrated Development Plan -County government planned to install solar powered and LED streetlights between 2018-2022
All grid-connected streetlights retrofitted with LED lights	Replace conventional streetlights with LED lights	Number of streetlights replaced with LED	Energy department/ Roads department/ Transport department/KPLC	2022/2024-Q2	
A streetlight rapid response desk established	Establish a streetlight rapid response desk to handle streetlight issues	Response time to streetlights O&M reduce by half	Energy department	2022/2023-Q1	
	Automate lightings in public places	Number of public places with automated lighting systems	Energy department/ Roads department/ KPLC	2023/2024-Q4	
All public buildings adopt energy efficiency measures	Sensitize and educate the government staff on practices of energy efficiency measures	% Change in electricity bill from public buildings	Energy department/ Public works department	2022/2023-Q2 onward	
All new public buildings adopt the green-building guidelines	Gazette the green-building guidelines	Green building guidelines gazetted	Physical Planning department/ Construction department	2022/2024-Q2 onwards	
	Train the physical planning on the best practices in green building	Number of public buildings adopting the green-building guidelines	Physical Planning department	2023/2024 -Q2 onward	

Table 38: Program 11--Policy and Regulation

Program 11: Intervention area - Policy, regulations, and institutions **Baseline: 0** **Target: 1 policy developed, 3 energy centres established and 2 coordinating institutions**					
Outputs	**Activities**	**Progress indicators**	**Responsibility**	**Timeline (Indicative start date)**	**Actions under other county plans**
County energy biomass policy developed	Hold consultative forums	Number of consultative forums held	Energy department/ Climate change department/ Environment department/ Development partners/ Private sector/ Energy department/ Forest department	2023/2024-Q1	
	Establish thematic working groups: charcoal, biogas, pellets & briquettes	Number of functional working groups in place		2023/2024-Q1 onwards	
	Develop the County biomass policy	County biomass energy policy developed		2023/2024-Q4	Nakuru county clean energy policy, draft 2016-County government to formulate and implement a county strategy for coordinating subsistence and commercial biomass production
Three energy centres and Innovation Hubs established	Identify the site for the energy centres	Land and paperwork for energy centres establishment finalized	Energy department/ ICT department/ Research institution/ Development partners	2023/2024-Q1	Nakuru county clean energy policy, draft 2016-County government to establish county energy centre
	Develop the operational plan for the energy centres	Operational plan developed		2023/2024-Q2	
	Gazette the energy centres	Energy centres gazetted by the County	Energy department	2023/2024-Q4	
	Identify and engage strategic partners to co-run the centres	At least three MoUs signed with strategic partners	Energy department	2024/2025-Q1	
	Equip the energy centres	All requisite equipment purchased	Energy department/ Development partner/ Private sector	2024/2025 – Q2 onward	
County Energy Planning Committee (CEPC) established	Consultation forums for the members as per the energy regulations	Members identified and co-opted to the CEPC	Energy department	2022/2023-Q2	
	Gazettement of the CEPC	CEPC gazetted	Energy department	2022/2023-Q2	

CEP secretariat established	Publish the functions of the CEP	The operational guidelines of the CEP completed	Energy department	2022/2023-Q2	
	Gazette the CEP	CEP gazetted	Energy department	2022/2023-Q2	
	Recruit the CEP secretariat core team	CEP secretariat operational	Energy department	2022/2023-Q3	

Table 39: Program 12--Gender Component

Program 12: Intervention area - Gendering the CEP **Baseline: TBD** **Target: Gendering all the CEP programs**					
Outputs	**Activities**	**Progress indicators**	**Responsibility**	**Timeline (Indicative start date)**	**Actions under other county plans**
Gender integrated into the CEP implementation	Undertake a gender needs assessment	Needs assessment report	Energy department Gender department	2023/2024-Q1	
	Customize the gender policy in energy - Kenya	County gender white paper in energy developed		2023/2024-Q2	Nakuru county clean energy policy, draft 2016-County government to ensure equitable participation in formulation and implementation of energy interventions
	Engender the CEP through training and integration of women in the implementation process	More women being involved in decision making, especially in the clean cooking energy sector	Energy department/ Gender department	2023/2024-Q2onward	Nakuru county clean energy policy, draft 2016-County government to promote awareness on gender issues pertaining to men and women's social roles in the energy sector
Leveraging GHG abatement potential of interventions	Mainstream estimation of the GHG abatement of all energy sector interventions	tCO2 avoided or reduced Number of carbon projects developed Amount of carbon finance leverage	Energy department/ Gender department	2023/2024-Q2onward	

Implementation, Monitoring, and Evaluation

6.1 Implementation: **Institutional Setting**

The success of County Energy Plan (CEP) implementation is premised on the strength of partnership with all the relevant stakeholders, both government and non-government entities. Hence it is expected that Nakuru County will be required to cultivate a strong relationship with partners in the private sector, local and international development partners, national government, and bilateral and multi-lateral energy agencies, as well as strengthen the enabling environment for the partners to work and realize the shared goals and aspirations of the CEP.

To have an effective implementation framework of the CEP, it is proposed that a coordinating secretariat be established which will be tasked with the management of the day-to-day work of the CEP. It will be headed by a Focal Point Officer (FPO) supported by a core staff, as shown in the figure below. The secretariat will ensure dedicated attention to the implementations of CEP in the County. As this is a new institutional arrangement, and as recommended by the draft INEP framework, the secretariat will need to be legally backed by sub-national legislation.

It is proposed that a County Energy Planning Committee (CEPC) be established to provide policy and strategic guidance and support the CEP Secretariat in line with the energy regulations. Members of the CEPC will consist of:

(i) Chief Officer responsible for Energy, who shall be the Secretary of the Committee;

(ii) Representative of the County Commissioner;

(iii) County Executive Committee Member responsible for Finance and Planning;

(iv) Chief Officer responsible for Economic Planning;

(v) Chief Officer responsible for Finance;

(vi) County Executive Committee Member responsible for Lands, Housing, Physical Planning and Urban development;

(vii) County Executive Committee Member(s) responsible for Water, Environment and Natural Resources;

(viii) a representative from Kenya Power and Lighting Company;

(ix) a representative from Rural Electrification and Renewable Energy Corporation;

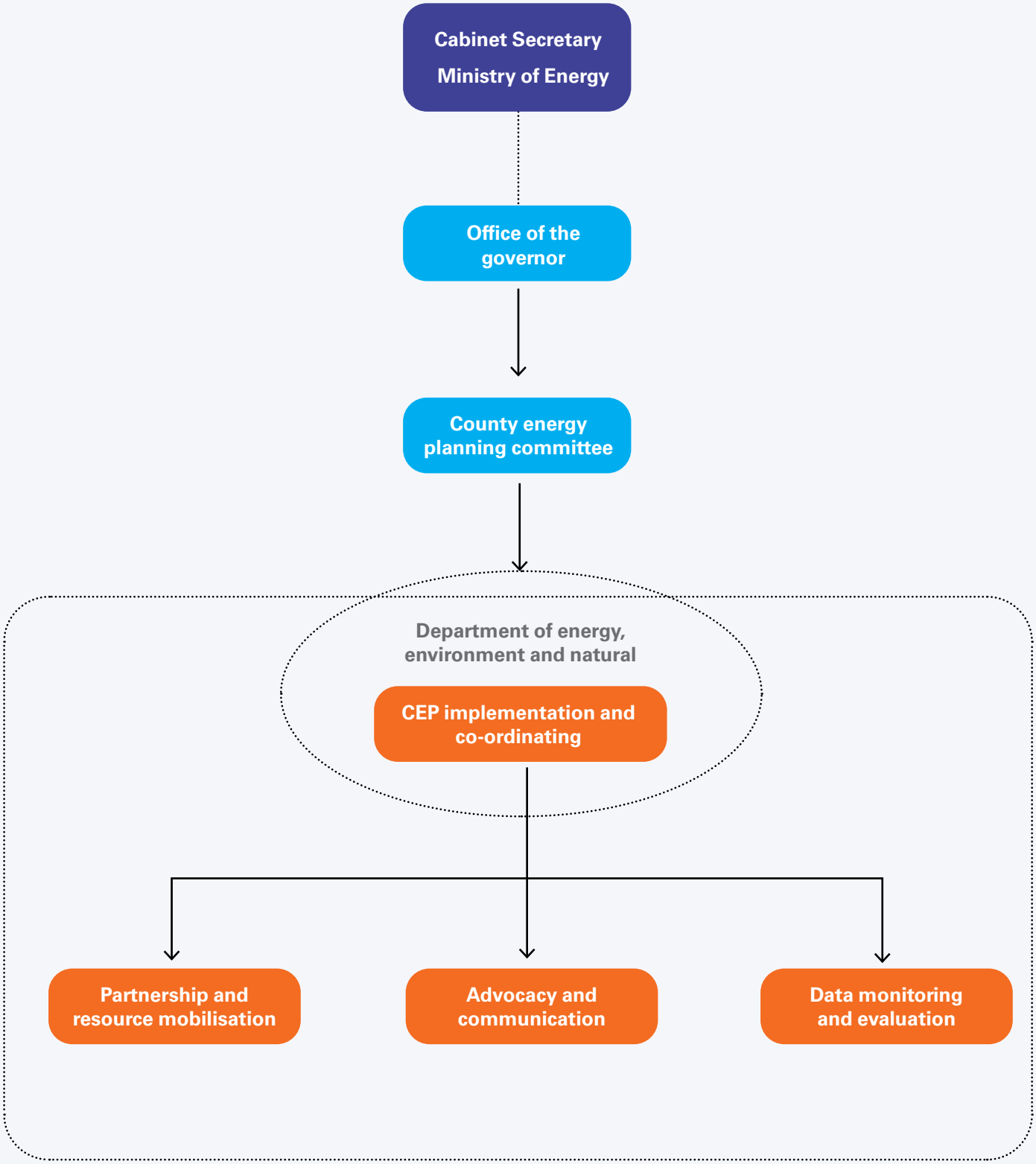
(x) Kenya Forest Service County Representative;

(xi) Technical County Officer(s) responsible for Coal, Renewable Energy and Electricity.[53]

The chair of the committee will be the County Executive Committee Member responsible for the energy docket. The committee will meet at least three times a year, or as may be agreed, to review progress, approve work plans and budgets, and provide strategic guidance. The figure below shows the proposed structure of the CEP secretariat and its position in the Nakuru County Government. Incomplete targets or estimates denoted by (TBD) will be completed by the CEP Secretariat after further deliberations in collaborations with the CEPC.

53 Ministry of Energy. (2021). Draft Energy (Integrated National Energy Plan) Regulations. Government of Kenya

Figure 45: Implementation and Coordination Structure



The CEP office will be headed by an FPO reporting to the CEPC, whose mandate is to undertake the following functions:

- Development of the CEP.
- Annual planning.
- Monitoring and evaluation.
- Updating CEP every three years.
- Capacity gaps identification and guiding on the necessary capacity building.

6.1.1 Focal Point Office (FPO)

The functions of the FPO will be:

- To oversee the implementation of the CEP as per the approved plans.
- To identify opportunities in the CEP and coordinate with the national government and affiliate institutions, the County departments, and non-governmental entities, including the private sector, development partners, and NGOs for their implementation.
- Overseeing resource mobilization, partnership, and monitoring and evaluation.
- Act as a linkage between the CEPC and the CEP.
- The FPO will be supported by three inter-linked offices to discharge its mandate effectively, namely: partnership and resource mobilization, advocacy and monitoring, and evaluation.

6.1.2 Partnership & Resource Mobilization Office

The partnership and resource mobilization office will be responsible for the following:

- Strengthening County partnerships with the private sector, donors, and national government departments; arranging and holding partnership meetings; delivering administrative aspects of the partnership plans; reviewing and appraising partnerships; and working with partners to deliver effective processes e.g., information sharing, assessment, and referral processes.
- Sourcing information from partners and providing partners with reciprocal information from the County.
- Monitoring the existing partnerships; helping prepare regular and ad-hoc reports for both internal and external circulation by ensuring continuous improvement of internal monitoring and evaluation systems for partnerships, so that any potential problems are identified and dealt with at an early stage.
- Acting as a link between the CEP team and other departments to ensure that all the departments are kept abreast of all the CEP interventions where they are required, and that issues relating to the departments are taken into consideration.
- Networking, updating, and liaising with key in-country and international donors.
- Advising program and program quality teams, finance, and working groups on relevant donor requirements/compliance, potential funding opportunities, changes in donor priorities; ensuring quality grant management for all funded projects under the CEP.
- Identifying opportunities for meaningful collaboration within and across the country.
- Securing partners' buy-ins and discuss parameters to be observed to derive maximum benefit from all partnerships.

6.1.3 Advocacy and Communications Office

Due to the devolved nature of the energy sector between the national government and the County, there is a need for an officer to advocate Nakuru CEP issues to the national government, partners, and the donors. The advocacy officer will:

- Lead the CEP advocacy agenda to the national government for intervention, e.g., rural electrification.
- Communicate the strategic objectives of the CEP to the other departments, partners, and the national government.
- Maintain thorough knowledge of the needs of the CEP, potential opportunities, as well as an understanding of how it impacts other sectors in the County and at the national level.

6.1.4 Data, Monitoring and Evaluation Office

The office will be responsible for:

- Leading the collection, organizing, and updating the energy related data regularly
- Act as a link between the energy docket and the county planning department on matters related to energy data and updating the county statistical abstract
- Developing the overall framework for project M&E, for example, mid-term project review, impact assessment, final evaluation, and will develop a project Performance Monitoring Plan with relevant data collection systems.
- Development and revision of the Project Work Plan, and keeping it updated in accordance with project activities and timeframes.
- Reviewing the quality of existing data in the project subject areas, the data collection methods, and the degree to which it will provide good baseline statistics for impact evaluation.
- Developing baseline data for each project component and for all project indicators that do not have a baseline.
- Collecting data regularly to measure achievement against the performance indicators
- Working with collaborating partners to review their existing approaches and management information systems and harmonizing them where possible.
- Supporting project progress reporting, project mid-term review, and final evaluation.
- Identifying areas where technical support to project partners is required and organizing refresher training on M&E for them as required.
- Maintaining and administering the M&E database; analyze and aggregating findings.
- Identifying lessons learned and developing case studies to capture qualitative outputs of the project.
- Providing advice to the implementing partners on improving project performance using M&E findings.

6.2 Detailed Work Plan

Table 40: Detailed Workplan of Programs and Initiatives

		From Financial Year 2022/2023 to 2027/2028																			
Program 1: Accelerating cleaner and more efficient energy for cooking in households		**Yr 1**				**Yr 2**				**Yr 3**				**Yr 4**				**Yr 5**			
Output	**Activities**	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**	**Q12**	**Q13**	**Q14**	**Q15**	**Q16**	**Q17**	**Q18**	**Q19**	**Q20**
Partnership established with cooking energy providers and development partners	Mapping of active cooking solution providers and development partners																				
	Consultative forums on the County clean cooking vision and opportunities																				
	MoU with partners on clean cooking solutions																				
Awareness creation on the benefits of improved cooking solutions undertaken	Desk survey on appropriate awareness creation approaches considering rural-urban dynamics and different socio-economic groups																				
	Recruit a marketing firm																				

	Awareness creation rollout																				
	Establish and mainstream clean cooking energy week annually																				
A Clean Cooking Fund (CCF) created	Develop clean cooking fund strategy																				
	The County government allocate a budget for clean cooking																				
	Mobilize financial resources to strengthen the CCF																				
Dissemination of clean cooking energy solution mix accelerated – ethanol, biogas, pellets	Design a consumer financing facility and a Result Based Financing (RBF)																				
	Roll out consumer financing through: Merry-go-round, Saccos, pay-go, etc																				
	Roll out RBF cookstoves facility to enhance the uptake of clean cooking solutions																				

	Strengthen the role of the Clean Cooking Association of Kenya (CCAK) at the County level																				
Program 2: Accelerating cleaner and more efficient energy in learning institutions																					
All schools without clean and efficient cooking solutions mapped out	Convene the County school heads forum																				
	Map out the cooking solutions used, school population, etc																				
Creation of Clean Cooking Fund (Integrate with the CCF to have a common fund	Adapt the clean cooking fund to fit the institutions of the learning cycle																				
	Develop guidelines for institutional stoves providers – e.g., warranty																				
	Develop a register of certified institutional stove installers in the County																				
	Roll-out institutional stove program																				

Program 3: Health facilities access to clean energy for cooking																				
Public health institutions without clean cooking solutions mapped	Map out all health institutions without access to clean cooking solutions																			
	Undertake energy need assessment																			
	Adapt the CCF to finance health institutions																			
All health institutions fitted with clean cooking solutions	Mobilize development partners for technical and financial support																			
	Clean energy for cooking roll-out																			
Program 4: Household energy for lighting																				
All HH in Kuresoi North and South, Rongai and Nakuru North connected with electricity	In liaison with KPLC, map areas that are planned for grid extension in the next five years																			
	Last-mile connection activated																			

	Develop a database of certified solar PV products, service providers, and technicians																				
	Vet all solar products marketed in the County to ensure they are quality certified																				
	Promote Solar Home Systems (SHS) and solar lanterns in areas outside the marked zones for electrification by KPLC in partnership with solar PV providers																				
Program 5: Institutions of learning energy for lighting and powering appliances																					
All institutions of learning without power mapped out	Map out all institutions without electricity: location and proximity to grid																				
	KPLC shares its institutional electrification plans for the next five years																				

All institutions connected to power – either – grid power or off-grid solutions	A model for off-grid electrification designed																				
	Mobilize financial resources to boost the off-grid electrification solutions,																				
	Connect institutions with electricity																				
Program 6: Health facilities energy for lighting and powering appliances																					
Energy need assessment undertaken	Identify the main challenges for power supply interruption																				
	Develop a tailor-made solution for each facility																				
Funds raised to support setting up a power backup solution	The County government allocate a budget to enhance power in health facilities																				
	Mobilize financial resources to boost power backup solutions for health facilities (to match County allocation)																				

Uninterrupted power supply	Install power backup solutions for health facilities																			
Program 7: Productive use of energy																				
Milk coolers supplied with adequate power in all milk-producing sub-counties	Undertake energy need assessment for milk coolers in the County																			
	Install power and power backup systems for the milk coolers																			
Operational egg incubators hybridized (solar and grid)	Undertake energy need assessment for incubators in the County																			
	Set up demo incubators powered by an off-grid solar solution																			
Fish-cold chains established in all the relevant fish landing and markets	Energy need assessment for fish cold rooms in the County																			
	Install fish chillers/cold rooms in fish landing and markets																			

Potatoes cold storage facilities in sub-counties producing potatoes established	Energy need assessment for potato cold chain																				
	Identify and develop a strategic partnership with the private sector to develop cold chains and processing																				
	Set up potatoes' cold storage facilities in the sub-counties																				
Program 8: E-mobility																					
E-mobility pilot for 2&3 wheelers rolled out	Design an e-mobility pilot project																				
	Set up charging stations																				
	Create an incentive to attract buyers of 2&3 electric wheelers																				
	Research on retrofitting the petrol 2&3 electric wheelers																				
E-mobility policy & strategy for 2&3 electric wheelers developed	Stakeholders' consultations																				

	Establish a technical committee on e-mobility																			
	Develop an e-mobility policy & strategy for electric 2&3 wheelers																			
Develop e-mobility infrastructure, including charging stations in strategic locations	Create awareness on the benefits, opportunities for e-mobility																			
	Develop a carbon project on e-mobility																			
	Engage private sector to sell and provide maintenance for 2&3 electric wheelers																			
Program 9: Non-Motorised Transport (NMT)																				
Organized NMT paths constructed	Construct NMT paths and crossings in the County																			
	Install streetlights along the NMT paths																			
	Establish parking spaces for bicycles																			

Awareness creation on the benefits of walking and cycling	Create awareness on the health benefits of walking/cycling																				
	Establish and mainstream a walking/cycling day every month																				
Program 10: Enhancing energy efficiency in the county																					
50% of all streetlights retrofitted with solar power	Map out the streetlights that need to be retrofitted with solar and areas that need streetlights in the County																				
	Install solar street lighting installation																				
All grid-connected streetlights retrofitted with LED lights	Replace conventional streetlights with LED lights																				
A streetlight rapid response desk established	Establish a streetlight rapid response desk to handle streetlight issues																				
	Automate lightings in public places																				

All public buildings adopt energy efficiency measures	Sensitize and educate the government staff on practices of energy efficiency measures																				
All new public buildings adopt the green-building guidelines	Gazette the green-building guidelines																				
	Train the physical planning on the best practices in green building																				
Program 11: Policy, regulations, and institutions																					
County biomass policy developed	Hold consultative forums																				
	Establish thematic working groups: charcoal, biogas, pellets & briquettes																				
	Develop a County biomass policy																				
3 energy centres and Innovation Hubs established	Identify the site for the energy centres																				
	Develop the operational plan for the energy centres																				
	Gazette the energy centres																				

	Identify and engage strategic partners to co-run the centres																				
	Equip the energy centres																				
County Energy Planning Committee (CEPC) established	Consultation forums for the members as per the energy regulations																				
	Gazettement of the CEPC																				
CEP secretariat established	Publish the functions of the CEP																				
	Gazette the CEP																				
	Recruit the CEP secretariat core team																				
Program 12: Gendering the CEP																					
Gender integrated into the CEP implementation	Undertake a gender need assessment																				
	Customize the gender policy in energy -Kenya																				
	Engender the CEP through training and integration of women in the implementation process																				

6.3 Detailed Budget

Table 41: Budget breakdown

										KES (000)
Program 1: Accelerating cleaner and more efficient energy for cooking in households						**From Financial year 2022/2023 to 2027**				
Output	**Activities**	**# of units**	**Unit name**	**Unit cost**	**Total**	**Yr 1**	**Yr 2**	**Yr 3**	**Yr 4**	**Yr 5**
Partnership established with cooking energy providers and development partners	Mapping of active cooking solution providers and development partners	1	Study	200	200	200	-	-	-	-
	Consultative forums on the County clean cooking vision and opportunities	2	Workshops	1,500	3,000	3,000	-	-	-	-
Awareness creation on the benefits of improved cooking solutions undertaken	Desk survey on appropriate awareness creation approaches considering, rural-urban dynamics, and different socio-economic groups	1	Consultant	5,000	5,000	5,000	-	-	-	-
	Recruit a marketing firm	1	Marketing firm	500	500	500				
	Awareness creation rollout	5	Financial years	1,000	5,000	1,000	1,000	1,000	1,000	1,000
	Establish and mainstream clean cooking energy week annually	5	Financial years	5,000	25,000	5,000	5,000	5,000	5,000	5,000
A Clean Cooking Fund (CCF) created (for household, schools & health facilities)	Develop clean cooking fund strategy	1	Consultant	5,000	5,000	5,000	-	-	-	-
	County government allocate budget for clean cooking	3	Financial years	50,000	150,000	50,000	50,000	50,000	-	-
	Mobilize financial resources to strengthen the CCF	2	Financial years	5,000	10,000	5,000	5,000	-	-	-

Dissemination of clean cooking energy solution mix accelerated – ethanol, biogas, pellets	Design a consumer financing facility and Result based financing	1	Consultant	5,000	5,000	5,000	-	-	-	-
	Roll out consumer financing through: Merry-go-round, Saccos, pay-go, etc	1	Financing scheme	100,000	100,000	-	25,000	25,000	25,000	25,000
	Roll out RBF cookstoves facility to enhance the uptake of clean cooking solutions	1	Financing scheme	100,000	100,000	-	50,000	50,000	-	-
	Strengthen the role of the Clean Cooking Association of Kenya (CCAK) at the County level	2	Financial years	5,000	10,000	5,000	5,000	-	-	-
		Subtotal			**418,700**	**84,700**	**141,000**	**131,000**	**31,000**	**31,000**
Program 2: Accelerating cleaner and more efficient energy for cooking in learning institution										
All schools without clean and efficient cooking solutions mapped out	Convene the County school heads forum	5	Annual forums	1,000	5,000	1,000	1,000	1,000	1,000	1,000
	Map out the cooking solutions used, school population, etc	1	Study	5,000	5,000	5,000	-	-	-	-
Creation of Clean Cooking Fund (Integrate with the CCF to have a common fund	Adapt the clean cooking fund to fit the institutions learning cycle	1	Study	1	500	500	-	-	-	-
	Develop guidelines for institutional stoves providers – e.g., warranty	1	Study	500	500	500	-	-	-	-
	Develop a register of certified institutional stoves installers in the County	1	Study	300	300	300	-	-	-	-
	Roll out institutional stove program	11	Number of sub-counties	5,000	55,000		13,750	13,750	13,750	13,750
		Subtotal			**66,300**	**7,300**	**14,750**	**14,750**	**14,750**	**14,750**

Program 3: Health facilities access to clean energy for cooking										
Public health institutions without clean cooking solutions mapped	Map out all health institutions without access to clean cooking solutions	1	Study	500	500	500	-	-	-	-
	Undertake energy need assessment	1	Study	2,000	2,000	2,000	-	-	-	-
	Adapt the CCF to finance health institutions	1	Study	250	250	250		-	-	-
All health institutions fitted with clean cooking solutions	Mobilize development partners for technical and financial support	5	Annual cycle	300	1,500	300	300	300	300	300
	Clean energy for cooking roll-out	11	Number of sub-counties	1,000	11,000	2,200	2,200	2,200	2,200	2,200
		Subtotal			**15,250**	**5,250**	**2,500**	**2,500**	**2,500**	**2,500**
Program 4: Household energy for lighting										
All households in Kuresoi North and South, Rongai and Nakuru North connected with electricity	Map areas that are planned for grid extension in the next five years in liaison with KPLC	1	Study	500	500	500	-	-	-	-
	Last-mile connection activated	37,800	# of households	15	567,000	113,400	113,400	113,400	113,400	113,400
	Develop and manage a database of certified solar PV products, service providers in the County & solar technicians	5	Financial years	2,000	10,000	2,000	2,000	2,000	2,000	2,000
	Vet all solar products marketed in the County to ensure they are quality certified	2	Number of times	2,500	5,000	2,500	-	2,500	-	-
	Promote Solar Home Systems (SHS) and solar lanterns in areas outside the marked zones for electrification by KPLC with solar PV providers	5	Financial years	2,000	10,000	2,000	2,000	2,000	2,000	2,000
		Subtotal			**592,500**	**120,400**	**117,400**	**119,900**	**117,400**	**117,400**

Program 5: Institutions of learning energy for lighting and powering appliances										
All institutions of learning without power mapped out	Identify all institutions without power: location and proximity to grid	1	Study	3,000	3,000	3,000	-	-	-	-
	KPLC shares its institutional electrification plans for the next five years	1	Frequency	200	200	200	-	-	-	-
All institutions connected to power – either – grid power or off-grid solutions	Design a model for off-grid electrification	1	Study	3,000	3,000	-	3,000	-	-	-
	Mobilize financial resources to boost the off-grid electrification solutions,	1	Number of rounds	5,000	5,000	1,000	1,000	1,000	1,000	1,000
	Connect institutions with electricity	213	Number of institutions	50	10,650	2,130	2,130	2,130	2,130	2,130
		Subtotal			**21,850**	**6,330**	**6,130**	**3,130**	**3,130**	**3,130**
Program 6: Health facilities energy for lighting and powering appliances										
Energy need assessment undertaken	Identify the main challenges for power supply interruption	1	Study	2,000	2,000	2,000	-	-	-	-
	Develop a tailor-made solution for each facility	1	Study	4,000	4,000		4,000	-	-	-
Funds raised to support setting up of backup solutions	County government allocate budget to enhance power in health facilities	5	Financial years	10,000	50,000	-	10,000	10,000	20,000	10,000
	Mobilization of financial resources to set up a power backup solution for health facilities (to match County allocation)	3	Number of rounds	1,000	3,000	1,000	1,000	1,000		
Uninterrupted power supply	Install power backup solutions for health facilities	11	Sub counties	5,000	55,000	-	11,000	11,000	22,000	11,000
		Subtotal			**59,000**	**3,000**	**15,000**	**11,000**	**20,000**	**10,000**

Program 7: Productive use of energy										
Milk coolers supplied with adequate power in all milk-producing sub-counties	Undertake energy need assessment for milk coolers in the County	1	Study	5,000	5,000	5,000	-	-	-	-
	Install power and power backup systems for milk coolers	22	Number of installations in 11 counties	1,000	22,000	-	4,400	4,400	8,800	4,400
Operational egg incubators hybridized (solar and grid)	Undertake energy need assessment for incubators in the County	1	Study	2,000	2,000	2,000	-	-	-	-
	Installing solar PV on all incubators as a power back-up both for existing and the planned ones	1,000	Number of incubators	50	50,000	10,000	10,000	10,000	10,000	10,000
Fish-cold chains established in all the relevant fish landing and markets	Energy need assessment for fish cold rooms in the County	1	Study	3,000	3,000	3,000	-	-	-	-
	Install fish chillers/cold rooms in fish landing and markets	6	Lakes and markets	5,000	30,000	-	7,500	7,500	7,500	7,500
Potatoes cold storage facilities in sub-counties producing potatoes established	Energy need assessment for potato cold chain and processing	1	study	6,000	6,000	3,000	3,000	-	-	-
	Identify and develop strategic partnership with private sector to develop the cold chain and processing (PPP)	1	Financial year	1,000	1,000	-	1,000	-	-	-
	Set up potatoes' cold storage facilities in the sub-counties	2	# of facilities	25,000	50,000	-	-	25,000	25,000	-
		Subtotal			**169,000**	**23,000**	**25,900**	**46,900**	**51,300**	**21,900**

Program 8: E-mobility										
E-mobility pilot for 2 & 3 wheelers rolled out	Design an e-mobility pilot project	1	Study	30,000	30,000	30,000	-	-	-	-
	Set-up e-mobility charging stations	5	stations	2,000	10,000	-	10,000	-	-	-
	Create incentive to purchase 2 & 3 electric wheelers	2	Financial years	12,500	25,000	-	12,500	12,500	-	-
	Research on retrofitting the petrol 2&3 electric wheelers in partnership with private sector	2	Financial years	25,000	50,000	-	-	25,000	25,000	-
E-mobility policy & strategy for 2&3 electric wheelers developed	Stakeholders' consultations	2	Workshop	500	1,000	-	-	-	500	500
	Establish a technical committee on e-mobility	4	Financial years	3,000	12,000		3,000	3,000	3,000	3,000
	Develop an e-mobility policy & strategy for electric 2&3 wheelers	1	Document	6,000	6,000	-	-	-	-	6,000
Develop e-mobility infrastructure including charging stations in strategic locations	Create awareness on the benefits, opportunities for the e-mobility	1	Sessions	10,000	10,000	-	-	-	5,000	5,000
	Develop a carbon project on e-mobility	1	Study	5,000	5,000	-	-	2,500	2,500	-
	Engage private sector to sell and provide maintenance for 2&3 electric wheelers	3	Cycles	1,000	3,000	-	-	1,000	1,000	1,000
		Subtotal			**152,000**	**30,000**	**5,500**	**44,000**	**37,000**	**15,500**
Program 9: Non-Motorised Transport (NMT)										
Organized NMT paths constructed	Construct NMT paths and crossings in the County	50	Length in kilometres	5,800	290,000		72,500	72,500	72,500	72,500
	Install streetlights along the NMT paths	1000	Number of streetlights	50	50,000		12,500	12,500	12,500	12,500

	Establish parking spaces for bicycles (pilot)	20	Bicycles packing racks	200	4,000				2,000	2,000
Awareness creation on the benefits of walking and cycling	Mass awareness campaign on the health benefits of walking/ cycling	1	Awareness campaign	5,000	5,000		5,000			
	Establish and mainstream a walking/cycling day every month	36	Number of walking days	500	18,000			6,000	6,000	6,000
		Subtotal			**367,000**		**90,000**	**91,000**	**93,000**	**93,000**
Program 10: Enhancing energy efficiency in the county										
50% of all streetlights retrofitted with solar power	Map out the streetlights that need to be retrofitted with solar and areas that need streetlights in the County	1	Study	5,000	5,000	-	5,000	-	-	-
	Install solar street lighting	1000	Number of streetlights	50	50,000	-	25,000	25,000	-	-
All grid-connected streetlights retrofitted with LED lights	Replace conventional streetlights with LED lights	500	Number of streetlights	15	7,500	-	3,750	3,750		
A streetlight rapid response desk established	Establish a streetlight rapid response desk to handle streetlight issues	5	Financial years	25,000	125,000	25,000	25,000	25,000	25,000	25,000
	Automate lighting in public places	1	Lumpsum	10,000	10,000	-	-	10,000	-	-
All public buildings adopt energy efficiency measures	Sensitize and educate the government staff on practices of energy efficiency measures	5	Financial years	1,000	5,000	1,000	1,000	1,000	1,000	1,000

All new public buildings adopt the green-building guidelines	Gazette the green building guidelines	1	Lumpsum	2,000	2,000	-	-	2,000	-	-
	Train the physical planning on the best practices in green building	3	Cycles	500	1,500	-	500	500	500	-
		Subtotal		**43,565**	**206,000**	**26,000**	**60,250**	**67,250**	**26,500**	**26,000**
Program 11: Policy, regulations, and institutions										
County biomass policy developed	Hold consultative forums	4	Workshops	500	2,000	1,000	500	500	-	-
	Establish thematic working groups: charcoal, biogas, pellets & briquettes	4	Meetings	500	2,000	-	500	500	500	500
	Develop a county biomass policy	1	Document	3,000	3,000	-	-	-	3,000	-
3 energy centres and Innovation Hubs established	Identify the site for the energy centres	1	Financial allocation	2,000	2,000	1,000	1,000	-	-	-
	Develop the operational plan for the energy centres	1	Study	3,000	3,000	-	-	3,000	-	-
	Gazette the energy centres	1	Document	5,000	5,000	-	-	5,000	-	-
	Identify and engage strategic partners to co-run the centres	2	Rounds	1,000	2,000	-	1,000	1,000		-
	Equip the energy centres	2	Financial years	20,000	40,000	-	-	-	20,000	20,000
County Energy Planning Committee (CEPC) established	Consultation forums for the members as per the energy regulations	3	Meetings	500	1,500	1,500	-	-	-	-
	Gazettement of the CEPC	1	Document	300	300	300	-	-	-	-
CEP secretariat established	Publish the functions of the CEP	1	Document	300	300	300	-	-	-	-
	Gazette the CEP	1	Document	300	300	300	-	-	-	-

	Recruit the CEP secretariat core team	1	Session	2,000	2,000	2,000	-	-	-	-
		Subtotal			**63,400**	**6,400**	**3,000**	**10,000**	**23,500**	**20,500**
Program 12: Gendering the CEP										
Gender integrated into the CEP implementation	Undertake a gender needs assessment	1	Study	2,000	2,000	2,000	-	-	-	-
	Customize the gender policy in energy -Kenya	1	Study	1,000	1,000	1,000	-	-	-	-
	Engender the CEP through training and integration of women in the implementation process	4	Financial years	1500	6,000		1,500	1,500	1,500	1,500
		Subtotal			**9,000**	**3,000**	**1,500**	**1,500**	**1,500**	**1,500**
Monitoring and Evaluation (cross-cutting across all programs)	Undertake baseline assessment on programs without	1	Consultant	4,000	4,000	4,000	-	-	-	-
	Develop indicators	1	Consultant	1,000	1,000	-	-	-	-	-
	Progress monitoring		Internal M&E	-	-	-	-	-	-	-
	Mid-term and end-term	2	mid-term & end term	6,000	12,000	-	-	6,000	-	6,000
	Documentation of lesson learnt and dissemination	1	Lumpsum	2,000	2,000	-	-	1,000	-	1,000
		Subtotal			**19,000**	**4,000**	**-**	**7,000**	**-**	**7,000**
		Grand total			**2,159,000**	**319,380**	**502,930**	**549,930**	**421,580**	**364,180**

6.4 CEP Secretariat Budget

Table 42: Secretariat Budget

	Descriptions	Number of units	Unit name	Unit cost KES (000)	Total KES (000)
1	Focal point officer	60	Months	500	30,000
2	Partnership and fundraising officer	60	Months	400	24,000
3	Advocacy and communication officer	60	Months	400	24,000
4	Monitoring and evaluation officer	60	Months	400	24,000
5	Administration Manager	60	Months	300	18,000
6	Office supplies	60	Months	100	6,000
7	Office equipment	5	Years	1,000	5,000
8	ICT	1	Lumpsum	5,000	5,000
	TOTAL				**131,000**

6.5 Summary of the Budget

Table 43: Budget Summary

	Program description	Budget KES (000)
PG1	Accelerating cleaner and more efficient energy for cooking in households	418,700
PG2	Accelerating cleaner and more efficient energy for cooking in learning institutions	66,300
PG3	Health facilities access to clean energy for cooking	15,250
PG4	Household energy for lighting	592,500
PG5	Institutions of learning energy for lighting and powering appliances	21,850
PG6	Health facilities energy for lighting and powering appliances	59,000
PG7	Productive use of energy	169,000
PG8	E-mobiity	152,000
PG9	Non-Motorised Transport (NMT)	-
PG10	Enhancing energy efficiency in the county	206,000
PG11	Policy, regulations, and institutions	63,400
PG12	Gendering the CEP	9,000
	Monitoring and Evaluation	19,000
	Program subtotals	2,159,000
	CEP Secretariat totals	131,000
	Grand CEP Budget	2,290,000

6.6 Monitoring and Evaluation

The M&E system will follow the guidelines set by the County Integrated Monitoring Evaluation System (CIMES) which aims to ensure the information on projects and programs being implemented at the County level is available on a timely basis for policy decision making. Since the CEP is premised on strong partnership, the CIMES will serve as a vehicle for enhancing accountability that will result in strong working relationships between the County governments, national government, private sector, civil society, and development partners.

A detailed schedule of the CEP Monitoring and Evaluation framework has been developed, as shown in Table 44 below. As there are areas where baseline information was not available, the CEP Secretariat, in consultation with the implementing partners and stakeholders will be expected to undertake the baseline for such. The Secretariat will be expected to draw a work plan guided by the master CEP work plan and M&E framework that will be ratified by the County Energy Planning Committee (CEPC). The schedule will include: (i) annual work plan and budget; (ii) day to day monitoring; (iii) reporting plan; (iv) mid-term and end-term M&E plan; (v) timeframes for the CEPC meetings and any other need as may be approved by the CEPC. It is noteworthy that projects and programs within the CEP are bound to start at different times in the financial year as the implementation is partnership driven. Therefore, it is expected that upon signing an agreement with the CEP secretariat, the project will be activated in the M&E system. This will enhance accountability and harmonization of all the initiatives taking place in the County toward the realization of the CEP goals. The following are the core components of the CEP M&E system.

6.6.1 Day to Day Monitoring

Day-to-day monitoring of implementation progress will be the responsibility of the Secretariat based on the annual work plan and its indicators. The Secretariat will inform the CEPC of any delays or difficulties faced during implementation so that appropriate and timely support or corrective measures can be taken.

6.6.2 Quarterly monitoring

Periodic monitoring of implementation progress will be at two levels. The first level is through the CEPC meetings. The CEP Secretariat will report to the CEPC during their quarterly meetings. The CEP implementation progress report will be a core agenda item in all the meetings of the CEPC during which the chairperson of the CEPC will report. The CEPC will in turn report to the Governor on the progress of the CEP. This report will include the progress, emerging opportunities, resource mobilization, challenges, and how they are being addressed. This will allow all the parties to take stock and troubleshoot any problems pertaining to the implementation process on time.

6.6.3 Annual Monitoring

The CEP Secretariat will prepare an Annual Progress Report (APR) to be submitted to the CEPC. The APR will highlight progress against the target, any policy issues, and recommendations for the decision of the CEPC. Separate reviews of each CEP component may also be conducted where necessary since the projects will be on a rolling basis.

6.6.4 Mid-term Review

A Mid-Term Review (MTR) will take place at the implementation mid-point of the CEP, which is essentially after two and a half years. It will focus on the degree to which the CEP planned activities are on target, identifying areas that need improvement to realize the goal and any deviation from the plan that needs to be corrected. Beyond this progress review, the MTR will also assess the CEP activities against the following evaluation criteria: relevance, design, efficiency, effectiveness, and potential for sustainability. It is strongly recommended that the MTR be carried out by an independent external party to ensure objectivity. According to the Energy Act (2019), the CEP is supposed to be updated every three years, hence this will form an opportunity to update the CEP informed by evidence and realities from its execution.

6.6.5 End-term evaluation

An End-Term Evaluation will be undertaken and will assess whether the CEP has achieved its goals, draws conclusions, distills lessons learned, and builds knowledge for the second generation of the CEP. As mentioned under the MTR, the end-term evaluation will apply the same evaluation criteria: design, relevance, efficiency, effectiveness, impact, and sustainability. It is also recommended that the end-term evaluation be carried out by an independent external party.

Both the Mid-Term Review, the End-Term Evaluation will be guided by CIMES. As discussed above, they will use recognized evaluation criteria around relevance, design, efficiency, effectiveness, eventual impact, and long-term sustainability and will serve two purposes. Firstly, it will inform the CEP performance against the plan and will bring out observations and lessons to take forward. Secondly, the observations and lessons learned will inform the medium to the longer-term knowledge base for future energy plans. On completion and consolidation of the evaluation, it will be shared with the County Assembly and other government institutions, as well as the public through the County website.

Table 44: CEP Monitoring and Evaluation Framework

Programs	Outputs	Performance indicators	Baseline		Mid-term target	End-term target (cumulative)	Means of verification
			Value	Year			
Program 1: Accelerating cleaner and more efficient energy for cooking in households	Partnership established with cooking energy providers and development partners	5 signed up strategic partnership	0	2022	3	5	Signed MoUs, interviews with strategic partners
	Awareness creation on the benefits of improved cooking solutions undertaken	5 Countywide awareness campaigns	0	2022	3	5	Awareness campaign reports; Field interviews
	A Clean Cooking Fund (CCF) to cover households, schools, and health facilities	A functional Clean Cooking Fund	0	2022	1	1	Establishing documents; the number of cookstoves rolled through the fund
		300 million raised for the CCF	0	2022	150 million	150 million	Bank accounts statements
	Dissemination of clean cooking energy solution mix accelerated – ethanol, biogas, pellets	24% increase in the number of HH using cleaner cooking solutions	46%	2022	>10%	24%	Field survey; sales report

Program 2: Accelerating cleaner and more efficient energy for cooking in learning institutions	All schools without clean and efficient cooking solutions mapped out	Energy for cooking need assessment report	0	2022	1	1	Need assessment report
	Install institutional cookstoves	27% increase in number of schools installed with cleaner institutional stoves	53%	2022	>10%	27%	Field survey; stoves installation records
Program 3: Health facilities access to clean energy for cooking	Public health institutions without clean cooking solutions mapped	Energy needs assessment report	0	2022	1	1	Report
	All health institutions fitted with clean cooking solutions	4% of health institutions fitted with clean cooking solutions	96%	2022	>4%	4%	Field survey
Program 4: Household energy for lighting	All HH in Kuresoi North and South, Rongai and Nakuru North connected with electricity	100% of HH connected with electricity	33% Average	2022	>60%	100%	Field verification; connection reports
Program 5: Institutions of learning energy for lighting and powering appliances	All institutions of learning without power mapped out	Energy needs assessment report	0	2022	1	1	Report
	All institutions connected to power: either grid power or off-grid solutions	6% connected to electricity	94%	2022	>4%	6%	Field survey; connection reports
Program 6: Health facilities energy for lighting and powering appliances	Energy needs assessment undertaken	Energy needs assessment report	0%	2022	1	1%	Report

	Uninterrupted power supply	% of blackouts in health facilities reduced	tbd	2022	<60%	100%	Interviews with health personnel management
	Funds raised to support setting up a power backup solutions	100 million raised	0	2022	50 million	100 million	Account statements
Program 7: Productive use of energy	Energy needs assessment report for milk coolers and egg incubators	Need assessment report	0	2022	2	2	Energy needs assessment report
	Milk coolers supplied with adequate power in all milk-producing sub-counties	# of milk coolers with backup power	tbd	2022	50%	100%	Field survey; Installation reports
	Operational egg incubators hybridized (solar and grid)	# of egg incubators hybridized	tbd	2022	50%	100%	Field survey; Installation reports
	Fish-cold chains established in all the relevant fish landing and markets	6 fish cold chain established	0	2022	3	6	Site verification
	Potatoes cold storage facilities in sub-counties producing potatoes established	2 potatoes cold chain established	0	2022	1	2	Site verification
Program 8: E-mobility	E-mobility pilot for 2 & 3 wheelers rolled out	100, 2&3 wheelers operating	0	2022	50	100	List of registered with the pilot
	E-mobility policy & strategy for 2&3 electric wheelers developed	1 policy on e-mobility done	0	2022	0	1	Report
		1 strategy on e-mobility done	0	2022	0	1	Report

	Charging, and maintenance infrastructure established in strategic locations e.g., petrol stations for the electric vehicles	10 e-mobility charging infrastructures done	0	2022	5	10	Site verification
Program 9: Non-Motorised Transport (NMT)	Number of kilometers of NMT paths constructed	50 kilometers of NMT	tbd	2022	20	50	Site verification
	Awareness creation on the benefits of walking and cycling	% of the population using NMT	tbd	2022	>10%	>20%	Field survey
Program 10: Enhancing energy efficiency in the county	Streetlights retrofitted with solar power	50% of all streetlights	tbd	2022	20%	50%	site verifications; retrofitting records
	All grid-connected streetlights retrofitted with LED lights	100% retrofitted	tbd	2022	50%	100%	site verification; retrofitting records
	A streetlight rapid response desk established	A functional response desk	0	2022	1	1	Office verification
	All public buildings adopt energy efficiency measures	# of public buildings	tbd	2022	50%	100%	Field survey; Design records
	All new public buildings adopt the green-building guidelines	# of new public buildings	tbd	2022	50%	100%	Field survey; Design records
Program 11: Policy, regulations, and institutions	County biomass energy policy developed	1 biomass energy policy	0	2022	1	1	Policy document
	Energy centres and Innovation Hubs established	3 energy centres	0	2022	1	3	Site verification

	County Energy Planning Committee (CEPC) established	Functional CEPC	0	2022	1	1	Gazette notice; Minutes of meetings
	CEP secretariat established	Functional CEP secretariat	0	2022	1	1	Office verification
Program 12: Gendering the CEP	Gender need assessment	Gender needs assessment report	0	2022	1	1	Report
	Gender integrated into the CEP implementation	Integration of gender in all 11 programs	0	2022	6	11	Program audit

Annexes

Annex 1: **Household Questionnaire**

DEMOGRAPHIC INFORMATION

1. Gender of the respondent

   Male Female Prefer not to tell Transgender.

2. Education level?

   Pre-school Primary Secondary Tertiary

3. Age of the respondent

   18-24 years 25-34 years 35-44 years 45-54 years 55-64 years <65 years

A. HOUSEHOLD INCOME

4. Please select all relevant sources of income for your household

   Formal Employment Casual employment (Kibarua) Own Business Farming Other

5. How much is your household income per month (KShs)?

   Less than 5000 6000-15000 16000-25000 26000-35000 36000-45000

   46000-55000 56000-65000 66000-75000 75000+

6. Who is the main earner in the household?

   Father Mother Child Grand-child Non-relative Other

B. COOKING OPTIONS

7. What is the Primary cooking method used by the household?

   Electric stove Gas stove Paraffn Stove Energy Saving jiko (Jiko Okoa)

   Jiko (Traditional jiko) 3-stone fireside Briquette Biogas Other

8. What is the secondary type cooking method do you use in the household?

   Electric stove Gas stove Paraffn Stove Energy Saving jiko Jiko (Traditional jiko)

   3-stone fireside Briquette Biogas Other

9. If you had a choice, what will be your preferred method of cooking?

   Electric stove Gas stove Paraffn Stove Energy Saving jiko (Jiko Okoa)

   Jiko (Traditional jiko) 3-stone fireside Briquette Biogas

10. Are you willing to transition to the use of cleaner cooking stoves for cooking?

    Yes No I do not Know

11. Which clean cooking options are you willing to transition to?

    Solar stoves Biogas stoves LPG stoves Electric stoves Other

12. How much are you willing to pay to transition to a cleaner means of cooking (operation costs)?

    Nothing Less than my current fuel cost Same as my current fuel cost

    More than my current fuel cost Up to double my current fuel cost I don't know

13. Does your household collect firewood for cooking (or making fire)

    Yes No

14. How often do you collect firewood?

    Daily Several days in week Weekly Bi-weekly Monthly

15. Does your household buy firewood for cooking (or making fire)

    Yes No

16. How far do you travel to get your firewood (km)

17. How much do you spend in buying firewood per month

18. How long does it take you when you got out to fetch firewood

    Less than 1 hour 1-2 hours 3-5 hours 6 hours or more

19. How often do you buy firewood (wood to be used for cooking)

    Daily 2 times a week 3 times a week At least once every week

    Once every month Once a while Never

C. ACCESS TO ELECTRICITY

20. Is electricity universally available in your area?

    Yes No I don't know

21. Do you use electricity in your house?

    Yes No

22. Why you are not connected?

    The connection is fee expensive Gridlines are not available near to my area

    The household does not like electricity

23. Are you willing to use electricity

    Yes No

24. Do you use electricity for cooking?

    Yes No

25. How often do you use electricity for cooking?

    Daily 3-4 times a week Twice a week once time a week

    Once time a month Not often I don't know

26. Why do you use electricity for cooking?

    It is affordable/cheap It is easily availablee It is easy to use It is safer

27. Do you use electricity for lighting?

    Yes No

28. How often do you use electricity for lighting?

    Daily 3-4 times a week Twice a week once time a month Not often

29. Why do you use electricity for lighting?

    It is affordable/cheap It is easily availablee It is easy to use It is safer

30. Do you use electricity for heating?

    Yes No

31. How often do you use electricity for heating?

    Daily 3-4 times a week Twice a week once time a week

    once time a month Not often

32. Why do you use electricity for heating?

    It is affordable/ cheap It is easily available It is easy to use It is safer

33. Do you use electricity for cooling?

    Yes No

34. How often do you use electricity for cooling?

    Daily 3-4 times a week Twice a week once time a month

    Not often I don't know

35. Why do you use electricity for cooling?

    It is affordable/cheap It is easily available It is easy to use It is safer

36. Where do you get your electricity supply?

    National utility grid Own Renewable energy generation Local mini-grid

    Diesel generator Gas generator

37. How is your household connected to electricity?

Own-meter Shared meter Extension cord from another source Own system

38. How do you pay for electricity?

Pre-paid meter Postpaid I pay a private person I get it free

I don't know

39. Have you ever stayed without electricity due to load shedding or technical faults from your electricity supplier?

Yes No

40. What amount of electricity do you get in a month for free (amount in units or kWhs)?

41. How often do you buy electricity?

Daily Weekly Monthly I buy when I can afford it I don't know

42. Is it the same amount every time?

Yes No

43. Have you ever been without electricity because you did not buy enough?

Yes No I can't remember

44. What determines how much electricity you buy?

How much I can a ord How much I need Other I don't know

45. Has the electricity supply ever been suspended because the household did not pay the bill?

Yes No I don't know

46. On average, how much money do you spend on electricity in a month (amount in local currency)?

USE OF GAS IN THE HOUSEHOLD

47. Is gas (LPG) energy for cooking universally available in your area?

Yes No

48. Do you use gas (LPG) in your household?

Yes No

49. Which other type of gas do you use?

Biogas Natural gas other

50. Why don't you use gas?

The household does not like gas It is too expensive Household can't afford gas appliances

Gas is not available in my area I don't know

51. Are you willing to use gas?

Yes No

52. What do you use gas for?

Cooking Lighting Heating Cooling Other

53. Why do you prefer to use gas?

It is affordable/cheap It is easily available It is easy to use It is safer

54. How often do you use gas?

Occasionally Not often I don't know Daily

55. Where do you usually buy your gas?

Petrol station Local shop vendor Other

56. How often do you buy gas?

Daily Weekly Monthly I buy when I can afford

57. On average how much money do you spend in a month on gas?

USE OF PARAFFIN IN THE HOUSEHOLD

58. Is paraffin available in your area?

Yes No I don't know

59. Do you use paraffin in your household?

Yes No

60. Why don't you use paraffin?

Too expensive It smells It's dangerous I don't have paraffn appliances

it's not available in my area I don't know what it is Other

61. Are you willing to use paraffin in your household?

Yes No I don't know

62. What do you use paraffin for?

Cooking Heating Lighting

63. How much do you buy each time (Amount in liters)?

64. What determines how much paraffin you buy?

How much I can afford How much I need Size of the container

65. How often do you buy paraffin?

Daily Weekly Monthly I buy when I can afford it Other

66. Have you ever been without paraffin because you did not buy enough?

    Yes No

67. Besides money issues, have you ever not had paraffin in the household?

    Yes No

68. On average, how much money does the household spend a month on buying paraffin (Kshs)?

A. Enabling Support

69. What support do you receive from other agencies towards electricity/cooking energy access?

70. What are the main challenges you face in accessing energy for lighting (electricity) and cooking?

71. Which other source of energy do you use?

    Solar Panel Wind Other

Annex 2: **Learning Institutions Questionnaire**

ENUMERATOR'S NAME:	MOBILE TEL. #:

SECTION A: CONTRIBUTOR'S DETAILS

1	**Contributor's details:**		
	a) Name:		
	b) Gender: ☐ Male (1) ☐ Female (2)		f) Mobile Tel #:
	c) Sub-county:		g) Location:
	d) Ward		h) Nearest Electrified Town:
	e) Division:		i) Nearest Market Center:
	j) GPS Coordinates	a. Latitude |__|__| ° |__|__|.|__|__|__| 's	a. Longitude |__|__|° |__|__|.|__|__|__| 'e
2	**Describe the Institution:**		
	a) State the tenure of the premises		
	☐ Owner: Purchased (1)	☐ Owner: Constructed (2)	☐ Owner: Inherited (3)
	☐ Rented (4)	☐ Open air/ Public space (5)	☐ Itinerant/ Roadside (6)

b) Select the type of institution below:

	Description	Unit	Number		
1	Primary School	Classrooms:			
2	Secondary School	Classrooms:			
3	Tertiary Institutions	Classrooms:			

c) How many people are employed at the institution (both teaching and non-teaching staff)

d) How many students attend this facility per day on average when the facility is open?

e) State whether the institution is private or public	a) Private (1)	b) public (2)

SECTION B: ENERGY SYSTEMS AND USE

1 Which of the following energy sources do you use?

Type	Total Capacity	Year of installation	Financing Loan (1) Donation (2) Cash (3) Grant (4) Government (5)
a) Grid electricity (1)			
b) Solar (2) - Wp			
c) Generator (3) - kVA			
d) Wind (4) - Wp			
e) Biogas (5) - m3			
f) Batteries (6) - Ah			

2 Please indicate your average energy consumption cost per month:

Source	# of Units	Average KES/Month
a) Grid Electricity (1) kWh		
b) Local mini grid (2) kWh		
c) Generator – Fuel (3)		
d) Motorbike – Fuel (4)		
e) Vehicle – Fuel (5)		
f) Recharging batteries (6)		
g) Charcoal (7)		
h) Kerosene (8)		
i) Firewood (9)		
j) LPG (10)		
k) Ethanol (11)		
l) Briquettes (12)		

3 Which of the following devices do you currently have or plan to buy in the next 6 months?

Device	Yes (1)	No (2)	Number	Number of hours used per day if yes
a) Incandescent Light Bulb				
b) Fluorescent Tube				
c) Compact Fluorescent Light (CFL) Bulb				
d) LED Light Bulb				
e) Television				
f) Computer				
g) Printer				
h) Internet modem/router				
i) Fans				
j) Air Conditioning				
k) Electric space heaters				
l) Refrigeration				
m) Drinking Water Coolers				
n) Mobile Phone Charger				
o) Electric Water Pump				
p) Science Kit (Multimeters etc.)				
q) Projector				
r) Smart Board				
s) Audio-Visual System				
t) Other				

4 Which of these appliances do you plan to buy in the next 6 months?

Device	Yes (1)	No (2)	Number
a) Incandescent Light Bulb			
b) Fluorescent Tube			
c) Compact Fluorescent Light (CFL) Bulb			
d) LED Light Bulb			
e) Television			
f) Computer			
g) Printer			
h) Internet modem/router			
i) Fans			
j) Air Conditioning			
k) Electric space heaters			
l) Refrigeration			
m) Drinking Water Coolers			
n) Mobile Phone Charger			
o) Electric Water Pump			
p) Science Kit (Multimeters etc.)			
q) Projector			
r) Smart Board			
s) Audio-Visual System			
t) Other (specify)			
u) Other (specify)			
v) Other (specify)			

5 a) Are you connected to the Kenya Power grid? ☐ Yes (1) ☐ No (2)

b) If NO, why are you not connected?

☐ Distance to the grid (1)	☐ High cost of connection (2)	☐ Have alternative sources (3)
☐ Do not know how to connect (4)	☐ Using non-electric applications (5)	☐ Other (6)

c) If NO, list other equipment that you would be using if you were connected?

SECTION C: ENERGY EFFICIENCY AND CONSERVATION

1. Do you feel that you spend more energy than you should? ☐ Yes (1) ☐ No (2)

2. Which of these methods describes how to reduce energy consumption at your facility?

Energy efficiency method	Awareness		
	Yes (1)	No (2)	N/A(3)
a) Switching off appliances when not in use (1)			
b) Measuring/monitoring consumption of energy use (2)			
c) Use of energy efficient equipment (3)			
d) Use of improved cook stoves (4)			
e) Saving and re-using unused fuels (e.g., charcoal blocks) (5)			
f) Using natural cooling or heating (open air heating) (6)			
g) Other:			

3. Which of these methods do you apply to reduce energy consumption at your facility?

Energy efficiency method	Practice		
	Yes (1)	No (2)	N/A (3)
a) Switching off appliances when not in use (1)			
b) Measuring/monitoring consumption of energy use (2)			
c) Use of energy efficient equipment (3)			
d) Use of improved cook stoves (4)			
e) Saving and re-using unused fuels (e.g., charcoal blocks) (5)			
f) Using natural cooling or heating (open air heating) (6)			
Other:			

4. What is/are the reason/s that limit your ability to practice energy conservation? (Tick all that apply)

☐ Cost of equipment (1) ☐ Behavioral (2) ☐ Accessibility (3) ☐ Awareness/Knowledge (4)

☐ Other_____ (7)

SECTION D: PROBLEMS AND CHALLENGES

1. What are the main problems you face in energy access?

☐ Distance to the grid (1)	☐ High cost of connecting to the grid (2)
☐ High cost of energy products in general (3)	☐ Limited options of energy sources (4)
☐ Quality of energy available e.g., KP or fuels (5)	☐ Lack of awareness on alternative sources (6)
☐ High cost of improved cookstoves	☐ High cost of clean cooking fuels (8)
☐ Other (9)	

2. How can the county government assist in alleviating these problems?

☐ Subsidize connection to the grid (1)	☐ Subsidize energy products/devices (2)
☐ Facilitate the provision of finance e.g., loans (3)	☐ Raise awareness on alternatives (4)
☐ Enforce regulations to ensure better quality (5)	☐ Other (6)
☐ Other (7)	☐ Other (8)

Annex 3: **Health Facilities Questionnaire**

ENUMERATOR'S NAME:	MOBILE TEL. #:

SECTION A: CONTRIBUTOR'S DETAILS

1	**Respondents' details:**		
	a) Name:		
	b) Position held at the facility		
	c) Gender: ☐ Male (1) ☐ Female (2)	f) Mobile Tel #:	
	d) Sub-county:	g) Location:	
	e) Ward	h) Nearest Electrified Town:	
	f) Division:	i) Nearest Market Center:	
	j) GPS Coordinates of health facility	a. Latitude |__|__|° |__|__|.|__|__|__| 's	b. Longitude |__|__|° |__|__|.|__|__|__| 'e
2	**Description of the health facility:**		
	a) State the tenure of the premises		
	☐ Owner: Purchased (1)	☐ Owner: Constructed (2)	☐ Owner: Inherited (3)
	☐ Rented (4)	☐ Open air/ Public space (5)	☐ Itinerant/ Roadside (6)
	b) What type of health facility is this		
	☐ Public government facility (1)	☐ Private facility (2)	☐ Religious group affiliated (3)
	☐ NGO affiliated (4)	☐ Other_(specify)_(4)	
	c) How many people are employed at the facility?		
	d) How many patients' beds does the facility have?		

SECTION B: ENERGY SYSTEMS AND USE

1 What is the primary source of electricity for the facility?

Type	Total Capacity	Year of installation	Financing Loan (1) Donation (2) Cash (3) Grant (4)
National grid (1)			
Generator (2) - kVA			
Mini grid (3)			
Solar home system (4)			
Solar lighting system (5)			
Batteries (6)			
Solar lantern (7)			

2. What types of fuels are used for cooking at the facility?

Type	Units	Average Quantity per week
Firewood (1)		
Charcoal (2)		
LPG (3)		
Electricity (4)		
Briquettes (5)		
Ethanol (6)		

3 Please indicate your average energy consumption cost per month:

Source	# of Units	Average KES/Month
Grid Electricity (1)		
Generator – Fuel (2)		
Motorbike – Fuel (3)		
Vehicle – Fuel (4)		
Recharging batteries (5)		
Charcoal (6)		
Kerosene (7)		
Firewood (8)		
LPG (9)		
Ethanol (10)		
Briquettes (11)		

4 Which of the following devices do you currently have or plan to buy in the next 6 months?

Device	Yes (1)	No (2)	Number	Number of hours used per day
Incandescent Light Bulb				
Fluorescent Tube				
Compact Fluorescent Light (CFL) Bulb				
Flashlight (dry-cell battery_				
LED Light Bulb				
Television				
Projector				
Computer				
Printer				
Photocopier				
Internet modem/router				
Fans				
Air Conditioning				
Electric space heaters				
Refrigeration				
Drinking Water Coolers				
Mobile money agents/kiosks				
Mobile Phone Charging kiosks				
Water Pump				
Water Tank				
Sterilizer				
X-Ray Machines				
Microscope				
Centrifuge .				
Refrigerator for vaccination				
Solar fridge				
Ultrasound				
Nebulizer and PulseOximeter				
ECG machine				
Blood glucose monitor				

Device	Yes (1)	No (2)	Number	Number of hours used per day
Suction apparatus, Anesthesia				
Operation Theatre				
Oxygen Concentrator				
Blood Banks				
Maternity Ward				
TB Machine				
Document Scanner				
Accessories (stabilizer, inverters)				
Bench-top autoclave				
Semi-automatic bench-top autoclave 20 - 100 L				
Vertical autoclave				
Device for measuring albumin by electrophoresis,				
Semi-automatic hematology device				
Rhesuscope				
Hematocrit centrifuge				
Electric centrifuges				
Biochemical apparatus				
Complete hemacytometer				
Lovibond-type hemoglobinometer				
Binocular microscope / electric microscopes				
Spectrophotometer				
Serological water bath				
Vibrating agitators				
Kline oscillating agitators				
Electric stove				
Fridge Freezer				
X-ray viewer				
Gynecological lamp				
Benchtop autoclave				
Decontamination tank				
Pressure cooker with adapted stove				

5	Is the capacity of the primary source of electricity sufficient to run simultaneously all electrical appliances needed in the facility?	a) Yes (1)	b) No (2)

6	Are you connected to the Kenya Power grid? ☐ Yes (1) ☐ No (2)		
	If NO, why are you not connected?		
	☐ Distance to the grid (1)	☐ High cost of connection (2)	☐ Have alternative sources (3)
	☐ Do not know how to connect (4)	☐ Using non-electric applications (5)	☐ Other (6)
	If NO, list other equipment that you would be using if you were connected?		

SECTION C: ENERGY EFFICIENCY AND CONSERVATION

1. Do you feel that you spend more energy than you should? ☐ Yes (1) ☐ No (2)

2. Which of these methods describes how energy consumption can be reduced at your facility?

Energy efficiency method	Awareness		
	Yes (1)	No (2)	N/A(3)
a) Switching off appliances when not in use (1)			
b) Measuring/monitoring consumption of energy use (2)			
c) Use of energy efficient equipment (3)			
d) Use of improved cook stoves (4)			
e) Saving and re-using unused fuels (e.g., charcoal blocks) (5)			
f) Using natural cooling or heating (open air heating) (6)			
Other:			

3. Which of these methods do you apply to reduce energy consumption at your facility?

Energy efficiency method	Practice		
	Yes (1)	**No (2)**	**N/A(3)**
a) Switching off appliances when not in use (1)			
b) Measuring/monitoring consumption of energy use (2)			
c) Use of energy efficient equipment (3)			
d) Use of improved cook stoves (4)			
e) Saving and re-using unused fuels (e.g., charcoal blocks) (5)			
f) Using natural cooling or heating (open air heating) (6)			
Other:			

4. What is/are the reason/s that limit your ability to practice energy conservation? (Tick all that apply)

☐ Cost of equipment (1) ☐ Behavioral (2) ☐ Accessibility (3) ☐ Awareness/Knowledge (4)

☐ Other_____ (7)

SECTION D: PROBLEMS AND CHALLENGES

1. What are the main problems you face in energy access?

☐ Distance to the grid (1)	☐ High cost of connecting to the grid (2)
☐ High cost of energy products in general (3)	☐ Limited options of energy sources (4)
☐ Quality of energy available e.g., KP or fuels (5)	☐ Lack of awareness on alternative sources (6)
☐ High cost of improved cookstoves	☐ High cost of clean cooking fuels (8)
☐ Other (9)	

2. How can the county government assist in alleviating these problems?

☐ Subsidize connection to the grid (1)	☐ Subsidize energy products/devices (2)
☐ Facilitate the provision of finance e.g., loans (3)	☐ Raise awareness on alternatives (4)
☐ Enforce regulations to ensure better quality (5)	☐ Other (6)
☐ Other (7)	☐ Other (8)

Annex 4: **Businesses Questionnaire**

ENUMERATOR'S NAME:	MOBILE TEL. #:

SECTION A: CONTRIBUTOR'S DETAILS

1	**Contributor's details:**		
	a) Name:		
	b) Gender: ☐ Male (1) ☐ Female (2)	f) Mobile Tel #:	
	c) Sub-county:	g) Location:	
	d) Ward	h) Nearest Electrified Town:	
	e) Division:	i) Nearest Market:	
	j) GPS Coordinates	a.Latitude |__|__|° |__|__|.|__|__|__| 's	b.Longitude |__|__|° |__|__|.|__|__|__| 'e
2	**Describe the business:**		
	a) State the tenure of the premises		
	☐ Owner: Purchased (1)	☐ Owner: Constructed (2)	☐ Owner: Inherited (3)
	☐ Rented (4)	☐ Open air/ Public space (5)	☐ Itinerant/ Roadside (6)

b) Select the type of business below:

	Description Description	PT- Part time FT – Full time		Main products sold	Days in operation per week
		PT	FT		
1	General Trade				
1.1	Large trader (>10 employees)				
1.2	Medium trader (6-10 employees)				
1.3	Small trader (3-5 employees)				
1.4	Micro trader (1-2 employees)				
1.5	Other				
2	Food, Beverage & Accommodation				
2.1	Bar/Club				
2.2	Restaurant				
2.3	Hotel/Guest houses				
2.4	Tented camps				
2.5	Other:				
3	ICT				
3.1	Photocopying + printing only				
3.2	Photocopying + printing + cyber café				
3.3	Cyber café only				
3.4	Video/TV hall only				
3.5	Other:				
	Other Services				
4.1	Beauty + grooming (barber, salon etc.)				
4.2	Bicycle repair				

4.3	Garage (motorbikes and cars)				
4.4	Welding				
4.5	Technical (e.g. electrician, plumbing etc.)				
4.6	Tailoring/Embroidery				
4.7	Banks and Micro-Finance Institutions				
4.8	Industries				
4.9	Flower farms				
4.10	Other:				

SECTION B: ENERGY SYSTEMS AND USE

1 Which of the following energy sources do you use?

Type	Total Capacity/ quantity	Year of installation	Financing Loan (1) Donation (2) Cash (3) Grant (4)
a) Solar (1) - Wp			
b) Generator (2) - kVA			
c) Wind (3) - Wp			
d) Biogas (4) - m3			
e) Batteries (5) - Ah			
f) Geothermal steam (6) m^3			
g) LPG (7) kg			
h) Firewood (8) kg			
i) Charcoal (9) kg /bags			
j) Ethanol (10) L			
k) briquettes (11) kg			
l) other (12)			

2 Please indicate your average energy consumption cost per month:

Source	# of Units	Average KES/Month
m) Grid Electricity (1)		
n) Generator – Fuel (2)		
o) Motobike – Fuel (3		
p) Vehicle – Fuel (4)		
q) Recharging batteries (5)		
r) Charcoal (6)		
s) Kerosene (7)		
t) Firewood (8)		
u) LPG (9)		
u) LPG (9)		
w) Geothermal steam (11)		
x) Briquettes (12)		

3 Which of the following appliances do you currently have or desire to have?

Device	Yes (1)	No (2)	Number	Capacity (watts)	Hours used per day
u) Television only (1)					
v) DVD/Decoder (2)					
w) Electric sewing machine (3)					
x) Welding machines (4)					
ay) Fridge (5)					
z) Electric boilers (6)					
aa) Air Conditioner (7)					
bb) Instant Shower (8)					
cc) Computer (9)					
dd) Printers (10)					
ee) Hair drier (11)					
ff) Hair trimmer (12)					
gg) Boiler (13)					
hh) Other (14)					
ii) Other (15) (list all appliances and heavy machinery for industries)					

4 a) Are you connected to the Kenya Power grid? ☐ Yes (1) ☐ No (2) ☐ Applied but not connected (3)

b) If NO, why are not connected?

☐ Distance to the grid (1)	☐ High cost of connection (2)	☐ Alternative sources (3)
☐ Do not know how to connect (4)	☐ Using non-electric applications (5)	☐ Other (6)

c) If NO, list other equipment that you would be using if you were connected?

SECTION C: ENERGY EFFICIENCY AND CONSERVATION

1. Do you feel that you spend more energy than you should? ☐Yes (1) ☐ No (2)

2. Which of the methods listed below illustrates how your business/company can reduce consumption of energy?

Energy efficiency method	Awareness			Practice		
	Yes (1)	No (2)	N/A (3)	Yes (1)	No (2)	N/A (3)
a) Switching off appliances when not in use (1)						
b) Measuring/monitoring consumption of energy use (2)						
c) Use of energy efficient equipment (3)						
d) Use of improved cook stoves (4)						
e) Saving and re-using unused fuels (e.g. charcoal blocks) (5)						
f) Using natural cooling or heating (open air heating) (6)						
g) Other:						

3. Which of the methods listed below does your business/company apply to reduce consumption of energy?

Energy efficiency method	Practice		
	Yes (1)	No (2)	N/A (3)
h) Switching off appliances when not in use (1)			
i) Measuring/monitoring consumption of energy use (2)			
j) Use of energy efficient equipment (3)			
k) Use of improved cook stoves (4)			
l) Saving and re-using unused fuels (e.g. charcoal blocks) (5)			
m) Using natural cooling or heating (open air heating) (6)			
n) Other:			

3. What is/are the reason/s that limit your ability to practice? (Tick all that apply)

☐ Cost of equipment (1) ☐ Behavioral (2) ☐ Accessibility (3) ☐ Awareness/Knowledge (4)

☐ Other_____ (7)

4.	Has your company undertaken an energy audit in the last three years (for large commercial and industrial businesses)	Yes (1)	No (2)
5.	If yes (4) above would you be willing to share the energy audit for this study	Yes (1)	No (2)

SECTION D: PROBLEMS AND CHALLENGES		
1	What are the main problems you face in energy access?	
	☐ Distance to the grid (1)	☐ High cost of connecting to the grid (2)
	☐ High cost of energy products in general (3)	☐ Limited options of energy sources (4)
	☐ Quality of energy available e.g. KP or fuels (5)	☐ Lack of awareness on alternative sources (6)
	☐ Other (7)	☐ Other (8)
2	How can the county government assist in alleviating these problems?	
	☐ Subsidize connection to the grid (1)	☐ Subsidize energy products/devices (2)
	☐ Facilitate the provision of finance e.g. loans (3)	☐ Raise awareness on alternatives (4)
	☐ Enforce regulations to ensure better quality (5)	☐ Other (6)
	☐ Other (7)	☐ Other (8)

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