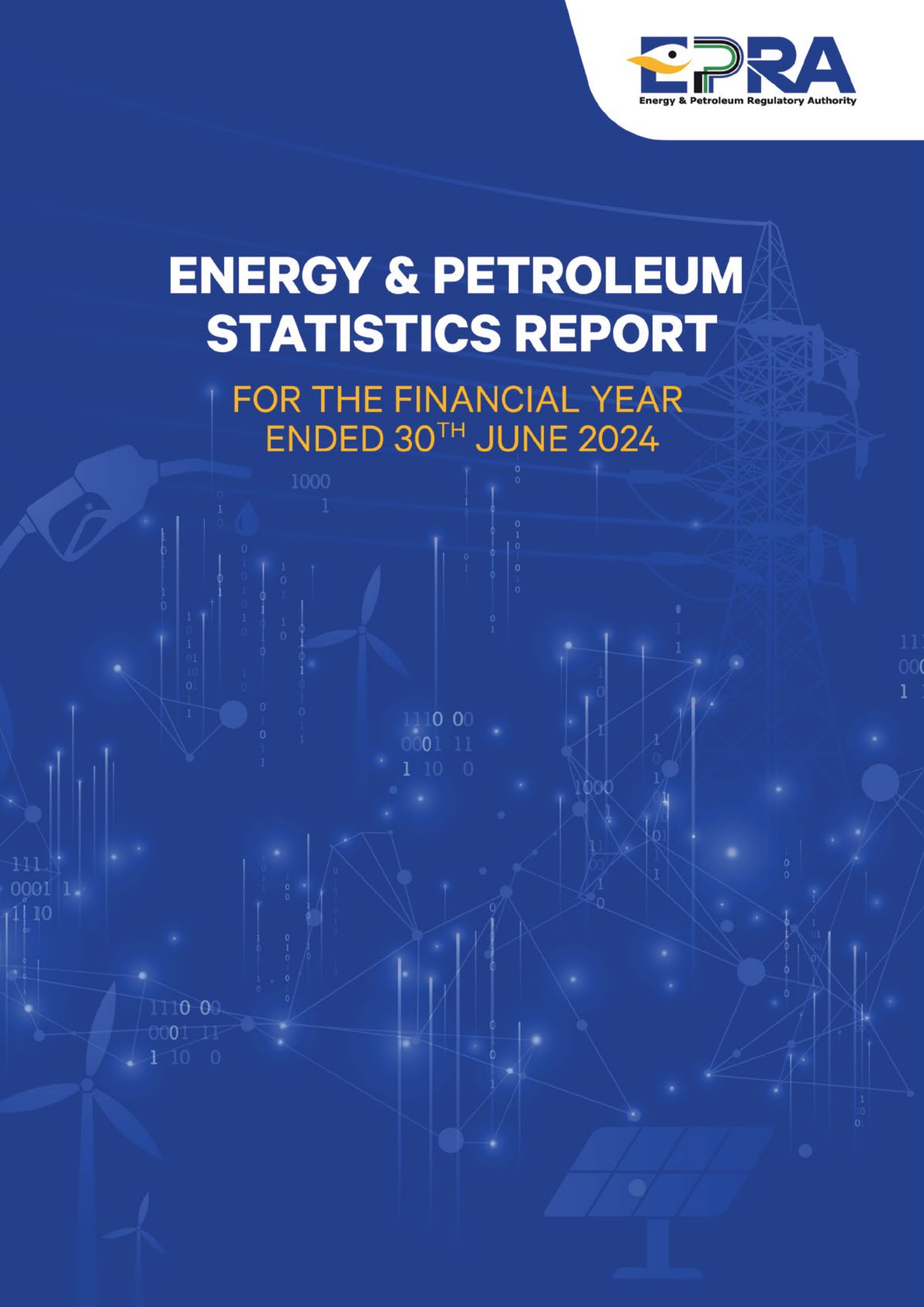
Energy & Petroleum Regulatory Authority

ENERGY & PETROLEUM STATISTICS REPORT

FOR THE FINANCIAL YEAR ENDED 30TH JUNE 2024



About this report

This report provides key statistics on the performance of the electricity, petroleum, and renewable energy subsectors during the financial year 2023/2024. It also highlights the performance of emerging technologies such as e-mobility and green hydrogen, concluding with a future outlook.

For further information or to provide feedback, please contact EPRA through statistics@epra.go.ke.

ACKNOWLEDGEMENTS

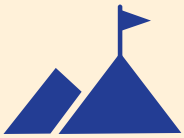
This report has been compiled by the EPRA Statistics Committee, comprised of the individuals listed below.

1. Njoki Karanja
2. Newtone Munyolo
3. Ronald Ketter
4. Moses Akuno
5. Allan Wairimu
6. Lee Okombe
7. Peter Kirukmet
8. Hassid Okumu
9. Gladys Njoroge
10. Ruth Rono
11. Kenneth Bullut
12. Ian Bett
13. Allan Gisanga

The team expresses gratitude to the Director General, Director Economic Regulation and Strategy, the Senior Management team, and all staff members for their invaluable support, which made the preparation of this report possible.

WHO WE ARE

The Energy and Petroleum Regulatory Authority (EPRA) is established under the Energy Act, 2019 as the regulatory agency responsible for economic and technical regulation of the electricity, renewable energy, petroleum and coal sectors.



Our Mission

To facilitate sustainability in the energy and petroleum sectors through regulation for improved livelihoods.

Our Vision

A leading energy and petroleum regulator.

Our Rallying Call

Quality Energy, Quality Life.

Our Core Values

Integrity

Responsiveness

Accountability

Innovativeness

Professionalism

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ABBREVIATIONS AND ACRONYMS

AGO	Automotive Gas Oil (Diesel)
CBK	Central Bank of Kenya
DWT	Dead Weight Tonnage
EPRA	Energy and Petroleum Regulatory Authority
EREA	Energy Regulators Association of East Africa
FDP	Field Development Plan (FDP)
FEC	Fuel Energy Cost
FERFA	Foreign Exchange Rate Fluctuation Adjustment
GDP	Gross Domestic Product
GVA	Gross Value Added (GVA)
GWh	Giga-Watt hour
HHI	Herfidahl Hirschman Index
IK	Illuminating Kerosene
IPP	Independent Power Producer
KETRACO	Kenya Electricity Transmission Company
KPC	Kenya Pipeline Company
KRA	Kenya Revenue Authority
LPG	Liquefied Petroleum Gas
LTWP	Lake Turkana Wind Power
MWh	Mega-Watt hour
NDCs	Nationally Determined Contributions
NGAO	National Government Administrative Officers
NOCK	National Oil Corporation of Kenya
NSC	Network Service Contract
OMCs	Oil Marketing Companies
OTS	Open Tender System
PMS	Premium Motor Spirit (Super petrol)
PPA	Power Purchase Agreement
TOE	Tonne of Oil Equivalent
WHRC	Waste Heat Recovery Cycle

DIRECTOR GENERAL'S FOREWORD

At the Authority, we are dedicated to fostering an innovative and dynamic environment within the energy and petroleum sectors. Our role in the technical and economic regulation of these sectors is essential for unlocking opportunities and driving sustainable growth for all stakeholders.

In today's world, data serves as a critical tool for informed decision-making. This report offers comprehensive insights into key performance metrics and recent developments, equipping stakeholders with the necessary information to navigate this evolving landscape.

The past year has been particularly dynamic. Among several notable developments, the stabilization of the Kenyan shilling against the dollar reduced volatility in electricity and petroleum prices, offering much-needed relief to consumers and businesses alike while alleviating inflationary pressures from high energy costs.

Captive power generation has seen significant growth among commercial and industrial consumers, thanks to its cost-effectiveness, ease of setup, and supportive government policies. Currently, captive power has a capacity of 532.6 MW, representing 14.88% of our total installed capacity, with solar PV leading the way, closely followed by biomass.

Another game-changing initiative is the gazetting of the Energy (Net Metering) Regulations, 2024 in June. This allows individuals and companies generating renewable energy to receive credits for excess energy generated and supplied to the national grid. Not only does this provide credits to offset energy bills, but it also stimulates innovation in renewable energy generation.

Kenya is well-positioned to capitalize on the emerging green hydrogen economy, supported by our abundant renewable resources. The commissioning of the first green hydrogen plant in Morendat, Nakuru County, in November 2023 marks a significant milestone. To further bolster this sector, the Authority published the Kenya Green Hydrogen and Its Derivatives Guidelines in May 2024, establishing a robust regulatory framework designed to encourage innovation and growth.

In the petroleum sector, we have witnessed a surge in demand for Liquefied Petroleum Gas (LPG), largely driven by the zero-rating of taxes through the Finance Act of 2023, resulting in lower prices for consumers.

These highlights offer just a glimpse into our progress. I encourage you to explore this report for deeper insights and a comprehensive understanding of our achievements and future opportunities.

I would like to extend my heartfelt thanks to the Board for their strategic direction and to the dedicated EPRA staff for their tireless efforts in executing our mandate. Special recognition is due to the Statistics Report Committee for their diligent work in compiling this report. Lastly, a sincere thank you to our stakeholders, your support is crucial to the continued growth and success of our industry.

Daniel Kiptoo Bargoria, O.G.W, M.B.S.
Director General

MESSAGE BY THE DIRECTOR, ECONOMIC REGULATION AND STRATEGY

Over the past four years, we have been dedicated to producing insightful bi-annual and annual statistics reports, highlighting our commitment to delivering comprehensive energy and petroleum statistics. Each edition not only showcases our progress but also captures the dynamic nature of our evolving sectors.

This year is no exception. This report presents key metrics that provide an overview of sector performance. Beyond highlighting achievements, it also addresses challenges and identifies opportunities for advancing the industry.

Our industry can leverage these statistics to drive strategic initiatives and foster collaboration. As we navigate the complexities of energy transition and evolving customer demands, we hope that this report will empower you to make informed decisions that benefit both the industry and the broader economy.

Notably, during the review year, the Authority launched its strategic plan for 2023/2024 to 2027/2028, aimed at better addressing emerging stakeholder needs. Among the strategic goals outlined in this plan is the enhancement of efficient, evidence-based decision-making in the industry through research, innovation, and data management. As a result, you can expect to see more of these valuable reports in the future.

I encourage all readers to engage with the insights and statistics presented here. We welcome your feedback and thoughts, please reach out to us via email statistics@epra.go.ke.

Together, let's build a more sustainable and resilient energy future.

Dr. John M. Mutua, PhD
Director, Economic Regulation and Strategy

THE YEAR AT A GLANCE

13,684.63 GWh
energy generated

79.89%
renewable energy installed capacity

2,177.13 MW
peak demand

Ksh. 1.838 billion
TOU savings

360,594 MT
LPG Consumption

The Energy (Net Metering) Regulations, 2024
gazetted in June

Green Hydrogen
Kenya's Green Hydrogen and Its Derivatives Guidelines published in May 2024

OVERVIEW OF SECTOR PERFORMANCE

Analyzing the country's macroeconomic landscape is essential for understanding the dynamics that influence the performance of the energy and petroleum sectors.

The country experienced an improvement in economic performance, with the real Gross Domestic Product (GDP) expanding by 5.6% up from 4.9% in 2022. Nominal GDP increased from KSh. 13,489.6 billion in 2022 to KSh. 15,108.8 billion in 2023 with the GDP per capita increasing from KSh. 266,473 in 2022 to KSh. 293,229 in 2023. The economy also experienced an increase in the volume of trade by 7.1% from Ksh. 3,363.9 billion in 2022 to Ksh. 3,619.9 billion in 2023 characterized by an increase in the total imports bill by 4.9% and total exports earnings by 15.4%.

Other factors that impacted the energy sector include volatility of foreign currencies and inflation. The US Dollar, which is the main trading currency, appreciated against the Kenya Shilling during the year under review trading at a high of 159.69 in January 2024 and the lowest at 129.36 in June 2024. The economic performance was also impacted by the inflation rate which recorded an annual average rate of 7.7%. Figure 1.1 shows the trend of the Kenyan Shilling performance against the US Dollar.

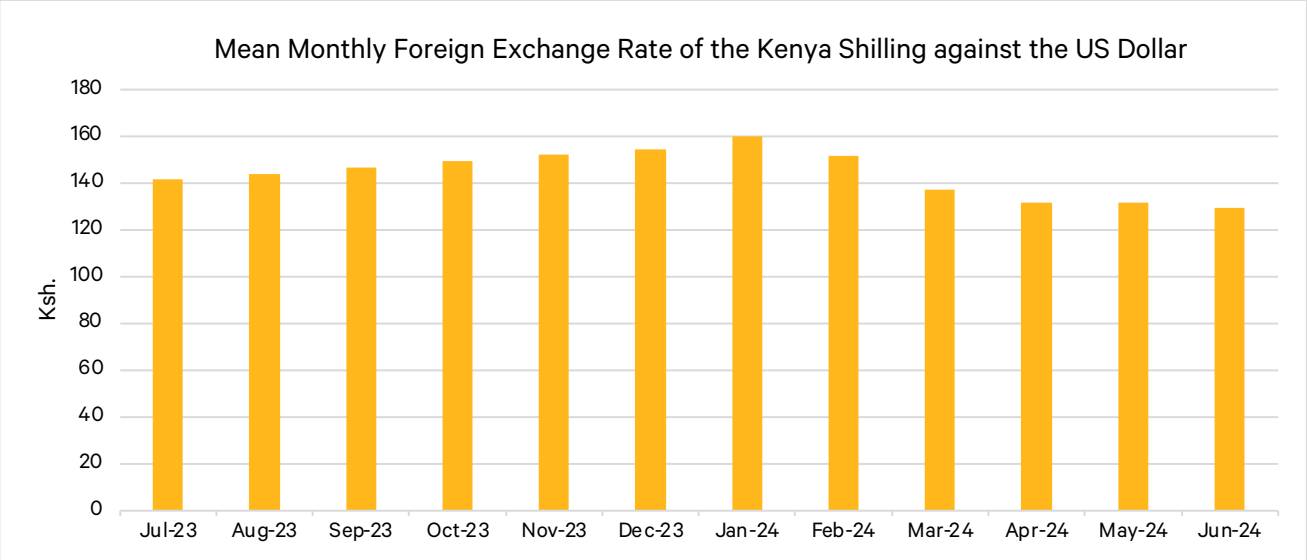


Figure 1.1: A trend of the Kenya Shilling performance against the US Dollar

Source: Central Bank of Kenya (CBK)

In the electricity supply sector, real Gross Value Added (GVA) grew by 2.9% in 2023, down from 5.7% in 2022. This growth was primarily due to an increase in total electricity generation by 3.4% to 13,423.6 GWh. Figure 1.2 illustrates the trend in GDP and electricity generation as at December 2023.

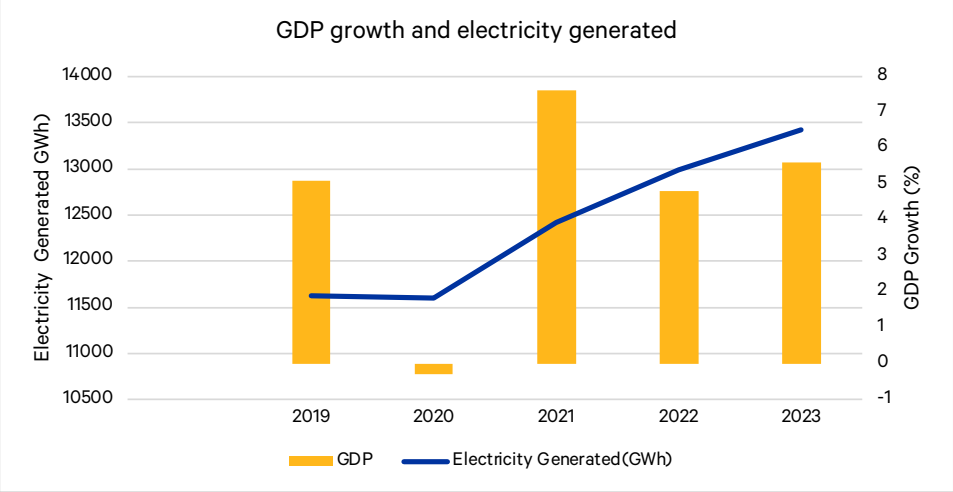


Figure 1.2: A graphical comparison of GDP growth and electricity generation

As shown in Figure 1.2, electricity demand has been on an upward trajectory, with a decline in 2020 due to the effects of the Covid-19 pandemic. Additionally, per capita electricity consumption has also been rising, as illustrated in Figure 1.3.

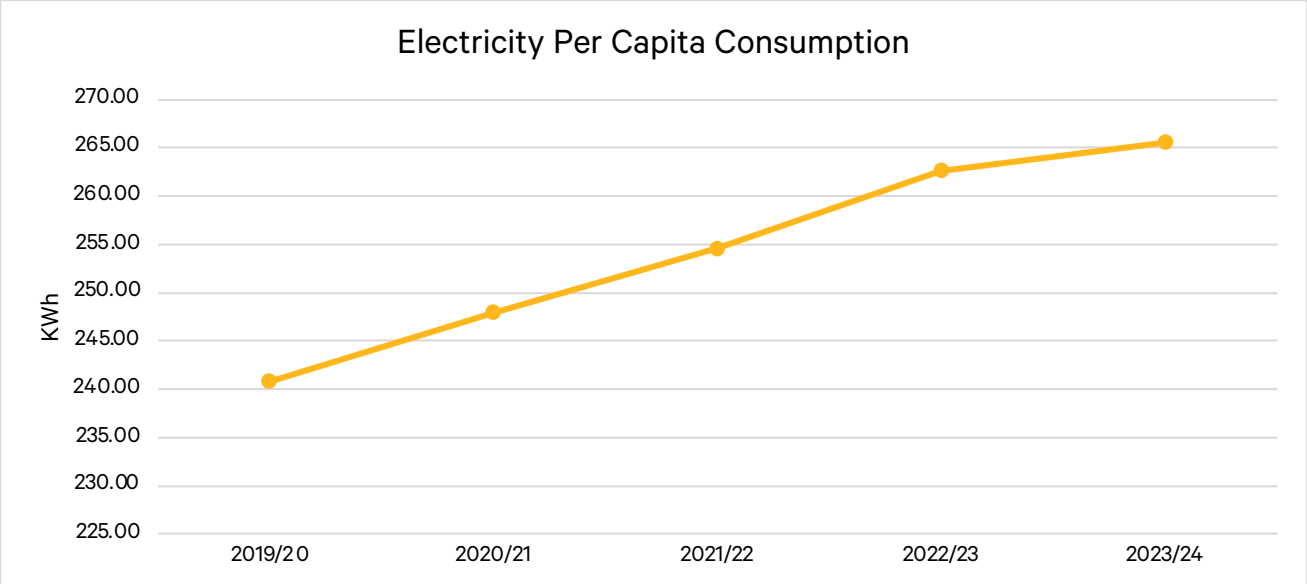


Figure 1.3: A trend of electricity per capita consumption from the financial year 2019/2020

During the review period, the supply of petroleum products totaled 9,059,597.15 m³, reflecting a decrease of 2% . Additionally, domestic petroleum consumption dropped by 2.1%, from 5,576,147.01 m³ to 5,460,436.82 m³ compared to the previous financial year.

ELECTRICITY SUB-SECTOR

This section summarizes the performance of various segments of the electricity supply chain, including generation, transmission, and distribution. It also addresses electricity pricing systems, market analysis, and greenhouse gas emissions. Additionally, this section provides an analysis of Kenya's electricity sector performance in comparison to other East African countries.

2.1 Electricity Supply and Demand

2.1.1 Installed Capacity

Installed capacity refers to the combined maximum power generation capacity of a country's power plants. Table 2.1 shows the country's total installed capacity as at June 2024, which comprises grid connected, captive and off grid generation units.

Table 2.1: Installed, effective and captive power capacity as at 30th June 2024

Technology	Interconnected Capacity (MW)		Captive Capacity (MW)	Off grid Capacity	Total Installed Capacity	% Total Installed
	Installed	Effective				
Hydro	839.3	810.4	33.0	0.1	872.4	24.38%
Geothermal	940.0	841.1	3.7		943.7	26.37%
Thermal	572.8	562.4	21.3	42.0	636.1	17.78%
Wind	435.5	425.5	-	0.6	436.1	12.19%
Solar	210.3	210.3	229.2	3.4	442.9	12.38%
Bioenergy	2.0	2.0	161.8		163.8	4.58%
Imports	200.0	200.0	-		200.0	
WHRC	-	-	83.5		83.5	2.33%
Total	**3,199.9**	**3,051.7**	**532.6**	**46.0**	**3,778.5**	**100.00%**

Geothermal energy accounts for the largest portion of Kenya's installed capacity, at 26.37%. Hydro and thermal power follow, with 24.38% and 17.78% respectively. Solar photovoltaic systems and wind generation contribute 12.38% and 12.19% to the total installed capacity.

During the review period, Kenya's interconnected capacity decreased by 73.5 MW, bringing the total to 3,199.9 MW, due to the expiration of the Power Purchase Agreement for the Kipevu 1 power plant. No new grid-connected power generation plants were commissioned during this period. However, the Sossian geothermal power plant began full commercial operations in October 2023, strengthening power supply and improving reliability in the Central Rift region.

Captive power capacity as at June 2024 was 532.6 MW, making up 14.88% of the country's installed capacity. Captive power generation remains attractive to commercial and industrial consumers due to its cost-effectiveness, ease of setup, and supportive government policies. Captive solar PV and bioenergy capacities increased to 229.2 MW and 161.8 MW, respectively.

2.1.2 Energy Generated

Energy generated refers to the total gross electrical energy that was generated and delivered to the national grid by the various power producers. During the review period, 13,684.63 GWh of electrical energy was generated as compared to 13,289.63 GWh of electrical energy that was generated in the year ended June 2023. This represents an increase of 2.98%.

The highest monthly electrical energy generated was 1,180 GWh in March. The lowest amounts were recorded in December and February, with each of these months generating 1,110 GWh.

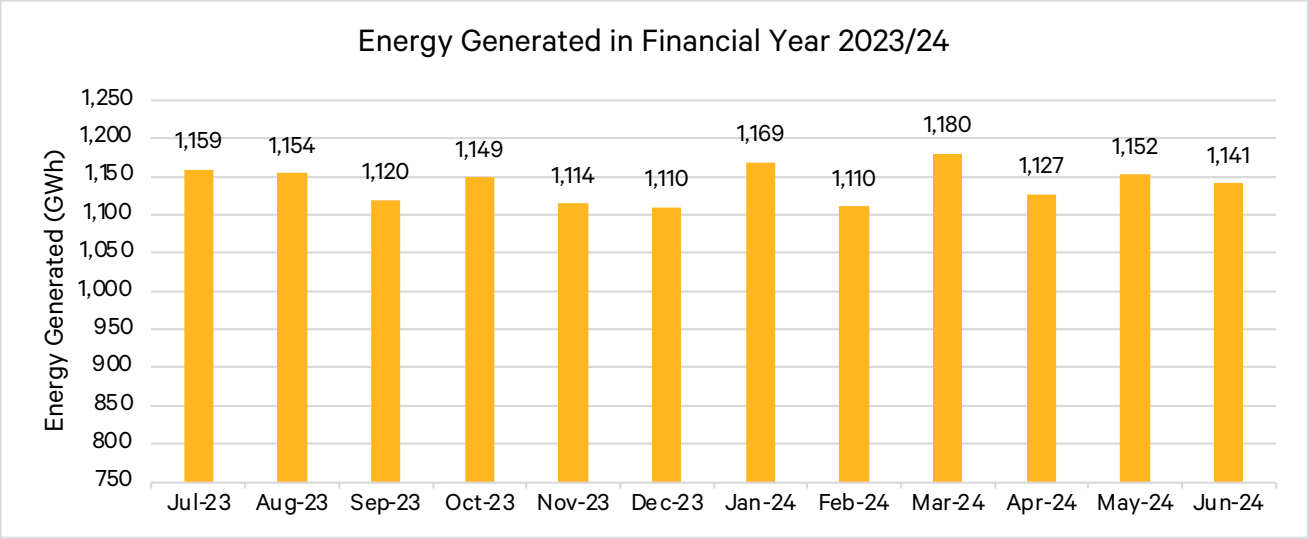


Figure 2.1: A trend in monthly electricity generation in the financial year 2023/2024

Geothermal energy remained the leading source of electrical power in the country, generating 5,707.71 GWh, which accounted for 41.7% of the total electrical energy produced for the year ending June 2024. This represents a decrease of 328 GWh from the 6,035.00 GWh generated in the previous year, when geothermal energy accounted for 45.4% of the total. The reduction is partly due to the decommissioning of the 45 MW Olkaria I power plant and an increase in hydro generation and electricity imports during the period.

Hydro energy contributed 24.7% of the total electrical energy generated, producing 3,377.58 GWh. This marks an increase of 808.4 GWh compared to the 2,569.18 GWh generated in the previous financial year, when hydro energy accounted for 19.3% of total generation. The rise is attributed to improved hydrology, driven by heavy rains in October-December 2023 and March-May 2024.

Wind energy's share of the generation mix decreased to 13.1%, down from 16.6% in the previous year. Gross wind generation fell by 403 GWh, from 2,201.72 GWh in the previous year to 1,798.59 GWh. This decline is attributed to lower wind speeds, which were a direct consequence of the prolonged rainy seasons.

Electricity imports rose significantly to 1,199.80 GWh, accounting for 8.8% of total energy, up from 644.07 GWh and 4.86% of gross energy in the previous year.

Thermal generation declined to 8.2% of the total energy generated in the year ending June 2024, compared to 10.52% the previous year. In absolute terms, thermal generation decreased by 268.38 GWh, from 1,395.49 GWh in the year ending June 2023 to 1,127.11 GWh in the year ending June 2024. This decline is attributed to a shift towards prioritizing renewable energy sources over thermal power. Figure 2.2 illustrates the energy generation mix by source.

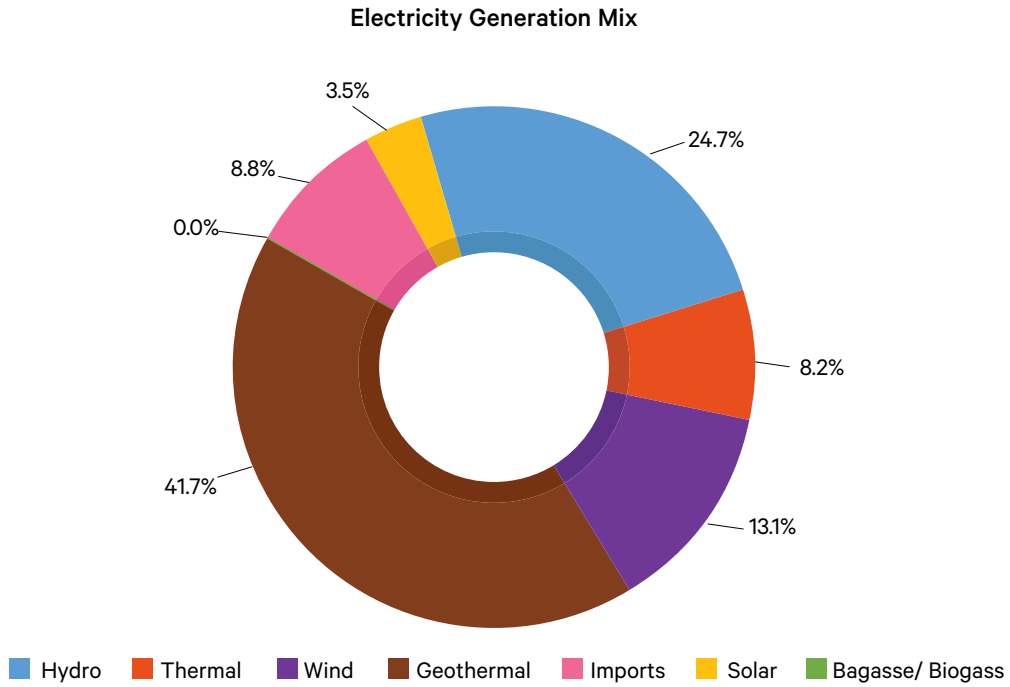


Figure 2.2: Electricity generation mix by source during the financial year 2023/2024

2.1.3 Peak demand

Peak demand is the highest power requirement in the power system at any given time. It occurs between 1930hrs-2030hrs. The peak demand for the year under review was 2,177.13 MW which was recorded on 21st February 2024. This was a slight improvement from the peak demand of 2,149 MW recorded in the previous year. Monthly peak demands in the second half of the period under review were consistently above 2,170MW with the exception of the month of January 2024 which recorded a peak demand of 2,160MW. The trend in the monthly peak demand is presented in figure 2.3.

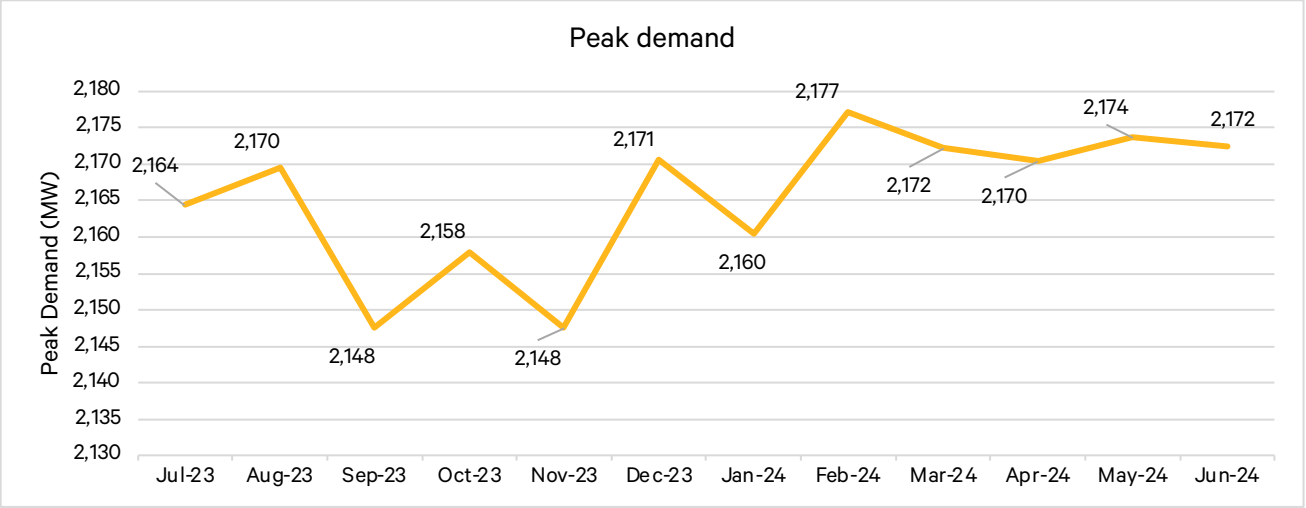


Figure 2.3: A trend in the monthly peak demand in the financial year 2023/2024

The growth in peak demand from 2014/2015 to 2023/2024 is illustrated in figure 2.4.

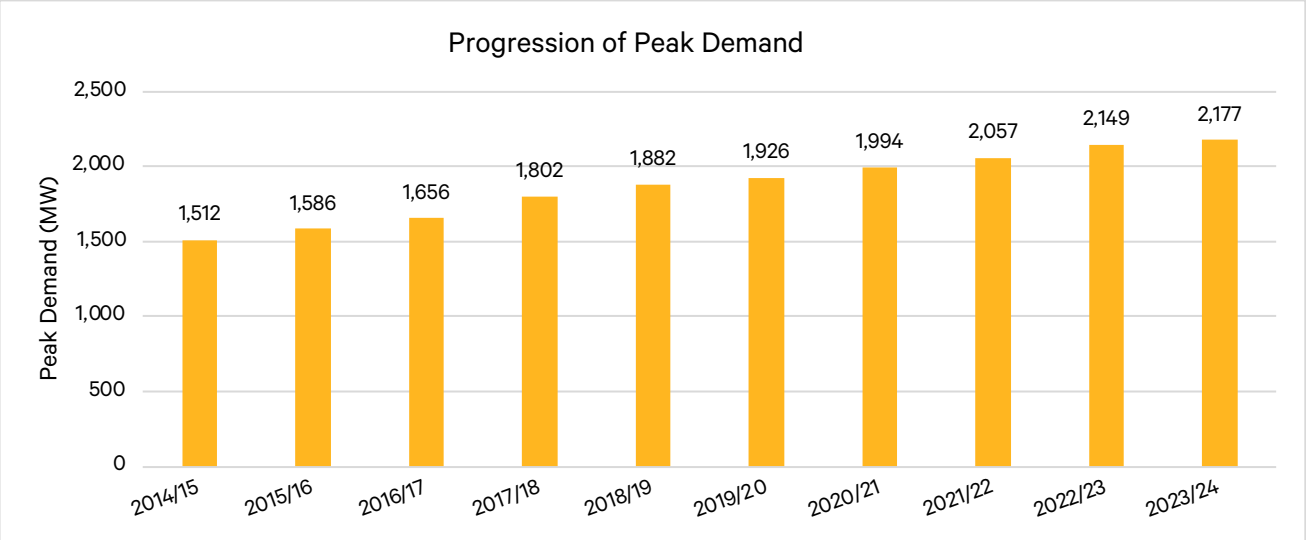


Figure 2.4 : A trend in the peak demand from 2014/2015 to 2023/2024

2.1.4 Electricity Access

The cumulative number of grid-connected customers stood at 9,659,877 as at June 2024 representing a 4.86% growth from 9,212,581 customers in June 2023. Figure 2.5 presents the trend in new customer connections and cumulative customers numbers from the financial year 2018/2019 to 2023/2024.

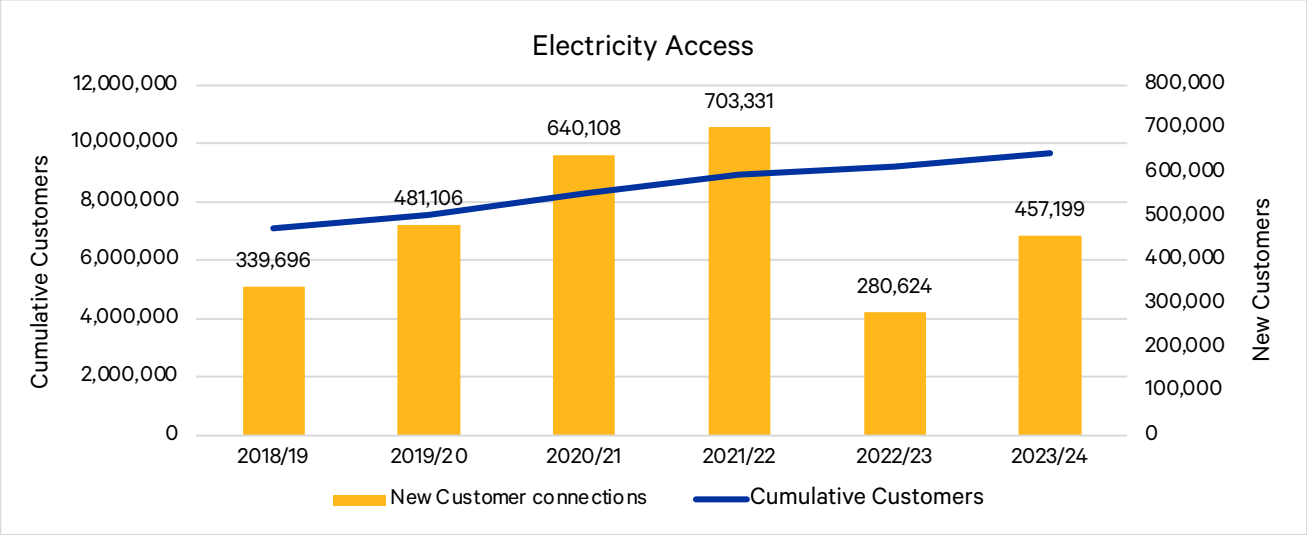


Figure 2.5: The trend in new customer connections and cumulative customers from 2018/2019 to 2023/2024

2.1.5 Electricity consumption by category

Large commercial and industrial consumers are the major users of electrical energy. In the year ending June 2024, this category consumed 5,431.74 GWh, accounting for 51.86% of the country's total consumption. These consumers are supplied at medium and high voltage or at low voltage with monthly usage exceeding 15,000 kWh. Customers in this category comprise; large and medium industries, factories, high-rise buildings, warehouses, and public infrastructure such as airports, ports, and railway stations.

Domestic customers followed, consuming 3,220.78 GWh, which represents 30.76% of total energy consumption. Small commercial enterprises used 1,715.54 GWh, accounting for 16.38% of overall electrical consumption.

Street lighting accounted for 103.6 GWh, or 0.99% of total energy consumption. Electric mobility, a recently introduced category aimed at promoting electric vehicle adoption, consumed 1.26 GWh, constituting 0.01% of the total energy consumption. Table 2.2 and figure 2.6 provide a summary of energy consumption by each customer category.

Table 2.2: A summary of energy consumption by each customer category during the financial year 2023/2024

Customer category	Energy consumption (GWh)	Percentage
Industrial	5,431.74	51.86%
Domestic	3,220.78	30.76%
Electric Mobility	1.26	0.01%
Small commercial (SMEs)	1,715.54	16.38%
Street lighting	103.6	0.99%
Total	**10,472.92**	**100.00%**

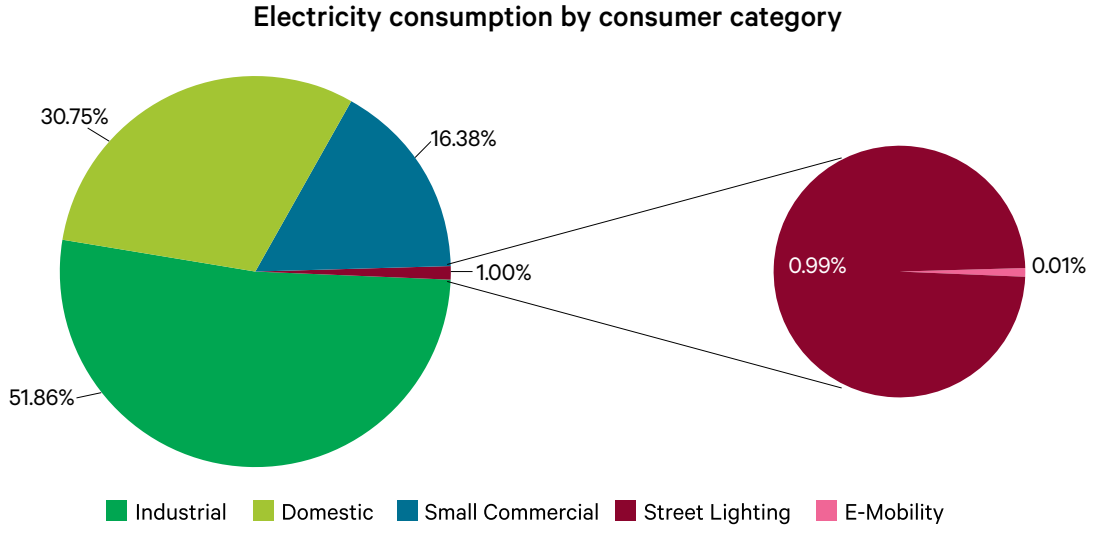


Figure 2.6: A visual representation of energy consumption by each customer category during the financial year 2023/2024

2.1.6 Energy consumption by region

Nairobi region emerged as the leading consumer of electrical energy, utilizing 4,571.78 GWh, marking the highest consumption nationwide. This constituted 43.7% of the country's total energy consumption. The region, which includes Kiambu, Kajiado, Machakos and Makueni counties, stands out with its dense concentration of large and medium industries, micro and small enterprises.

The Coast region ranked second in energy consumption, utilizing 1,916.68 GWh, which constituted 18.3% of the country's total energy consumption. The Rift region accounted for 13.67% of the total consumption, utilizing 1,431.23 GWh, followed by North-Eastern and Mt. Kenya regions contributing 10.7% and 6.5% to the overall consumption respectively. The North Eastern region in this case, covers Garissa, Wajir, Mandera, Marsabit, Kitui, Thika and parts of Machakos. West Kenya and South Nyanza regions reported the lowest consumption percentages, representing 5.31% and 1.92% of the total consumption, respectively.

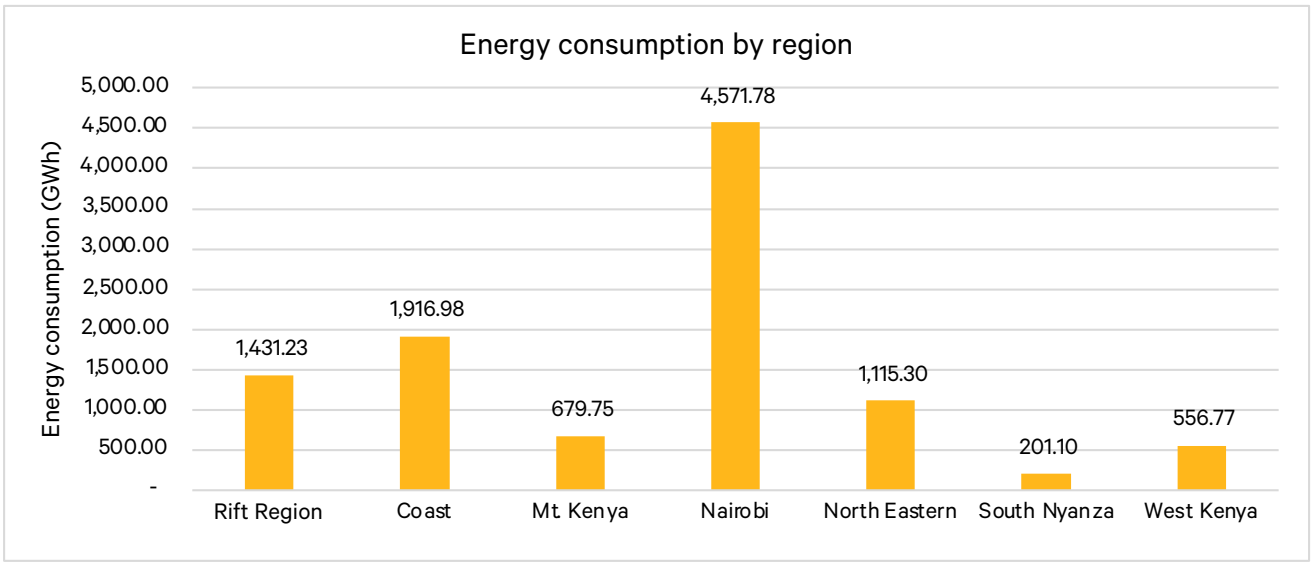


Figure 2.7: Energy Consumption based on KPLC region categorisation for the year ending June 2024

2.1.7 Energy Curtailment

Energy curtailment is inherent to power systems where the output of certain plants is reduced in periods of low demand. This is primarily done to maintain system frequency. Demand is lowest between 0000hrs and 0500hrs. Curtailment mainly affects geothermal power plants which mostly operate as base load plants. Wind plants are only affected by curtailment when they meet their contracted annual generation thresholds.

In the review period, 812.8 GWh of energy was curtailed which is 5.9% of total energy generated. This is an increase from the 495.43 GWh of energy curtailed in the year ended June 2023. The increase in energy curtailment can be attributed to improved hydro generation as a result of the heavy rains and increased electricity imports in the period under review. Figure 2.8 illustrates the trend in energy curtailment since the financial year 2020/ 2021.

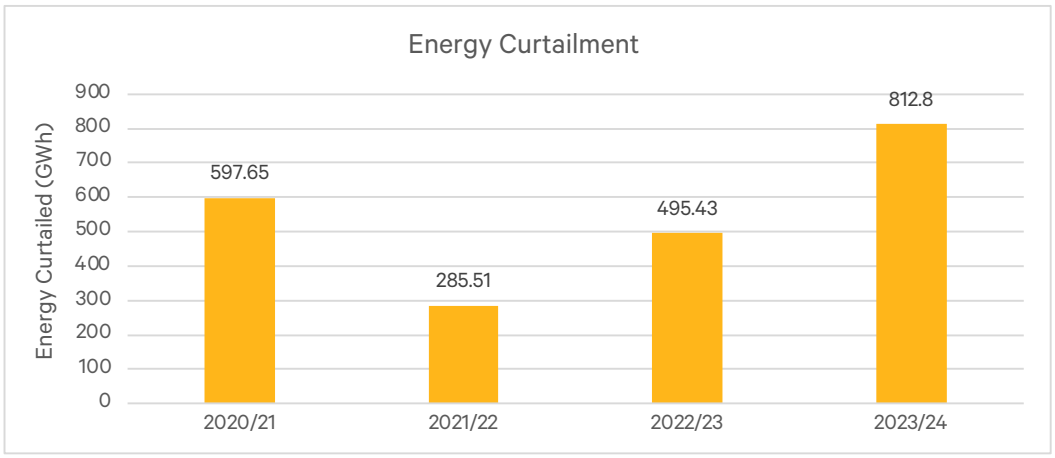


Figure 2.8: A trend of energy curtailed from the financial year 2020/2021 to 2023/2024

Figure 2.9 illustrates the monthly energy curtailment during the year under review. The bulk of the curtailment was done in the second half of the review period which accounts for 70% of total curtailment done. In contrast, the first half of the review year accounted for only 30%.

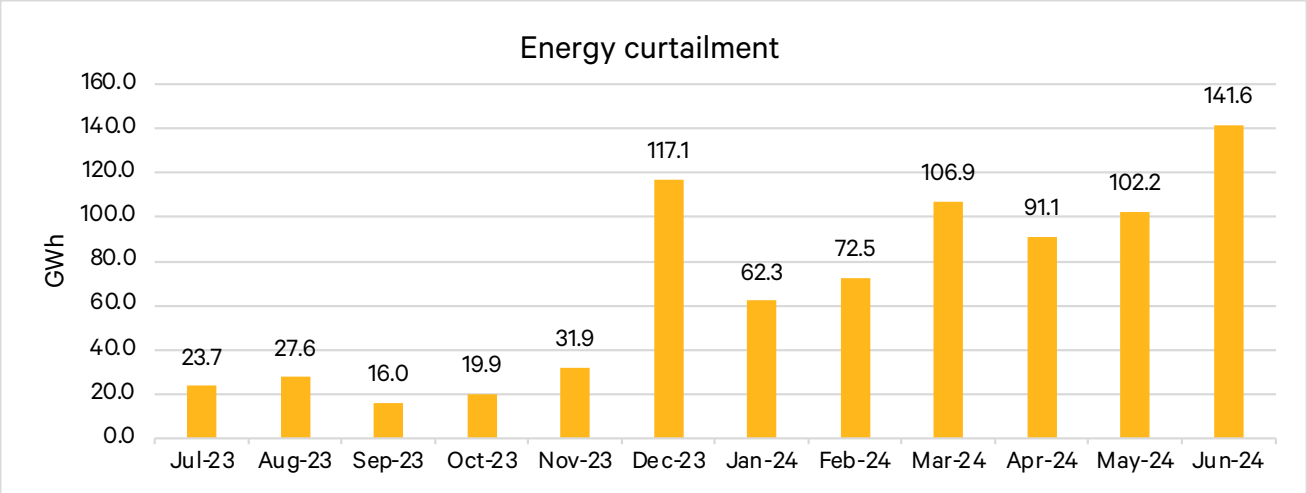


Figure 2.9: A trend of monthly energy curtailment in the financial year 2023/2024

2.1.8 Electricity Transmission Infrastructure

Electricity transmission refers to the transfer of power in bulk from its point of generation to receiving substations. This function is done by KETRACO and KPLC using high voltage transmission lines operating at voltages of 132kV, 220kV, 400kV and 500kV.

In the period under review, KETRACO commissioned the 94km Isinya-Namanga 132kV transmission line and the 68km Turkwel-Ortum 220kV transmission line adding a total of 162km to their transmission network. The latter is part of the Turkwel-Ortum-Kitale 220kV transmission project.

2.1.9 Minigrids

Minigrids assume a pivotal role in advancing Kenya's objective of achieving universal electricity access. KPLC operates offgrid distribution networks in far flung areas of the country that are beyond the reach of the national grid. These networks are found in Marsabit, Turkana, Wajir, Mandera and Garissa Counties. The offgrid networks are powered by diesel generators, with some having solar generation integrated, and serve customers within a 30km radius of the respective power plants. The total installed off-grid generating capacity as at June 2024 was 27.867MW.

With an installed capacity of 4.5MW, Wajir town is the largest offgrid distribution undertaking operated by KPLC. Other towns with significant capacities are Mandera, Marsabit, Moyale and Habaswein. These five (5) towns account for 46.02% of total off-grid installed capacity. Table 2.3 shows installed capacities of KPLC operated offgrid sites in the country.

Table 2.3: Installed capacity in KPLC operated offgrid sites

Station	Installed Capacity (MW)	Station	Installed Capacity (MW)
Wajir	4.5	North Horr	0.584
Mandera	2.1	Lokori	0.56
Marsabit	2.9	Daadab	0.784
Lodwar	0.46	Faza island	1.508
Merti	0.25	Lokitaung	0.584
Elwak	0.965	Kiunga	0.184
Habaswein	1.88	Banisa	0.184
Baragoi	0.62	Kakuma	1.2
Mfangano	0.65	Kotulo	0.396
Eldas	0.76	Karmorliban	0.184
Takaba	0.78	Khorondile	0.37
Rhamu	0.68	Sololo	0.7
Lokichoggio	1.06	Maikona	0.32
Laisamis	0.64	Lokiriama	0.4
Moyale	1.452	Hulugo	0.212
TOTAL 27.867			

The private sector has also developed several minigrids in offgrid areas. During the review period, the Authority granted tariff approvals for four (4) sites owned by Renewvia Energy Kenya Limited.

2.1.10 System Losses

System losses encompass the electrical energy lost during transmission and distribution, comprising both technical losses and commercial losses. Technical losses are proportionate to the effectiveness of the transmission and distribution network, while commercial losses are caused by factors such as power supply to illegal connections and meter tampering.

In the review period, total system losses, comprising both technical and commercial, accounted for 23.47% of the energy purchased, an average that exceeds the 18.5% benchmark set by the Authority for financial year 2023/24. The financial losses arising from the difference between the allowed benchmark losses and actual losses are absorbed by the utility. Table 2.4 provides a detailed summary of monthly system losses as a factor of energy purchased by KPLC from power producers and energy sold to consumers.

Table 2.4: A summary of system losses during the financial year 2023/2024

Month	Total Energy purchased (GWh)	Total Energy Sales (GWh)	Total system losses
Jul-23	1,158.855	881.0062	23.73%
Aug-23	1,154.216	885.1724	23.33%
Sep-23	1,119.774	874.3496	22.72%
Oct-23	1,148.642	877.4838	22.90%
Nov-23	1,114.283	859.4333	22.85%
Dec-23	1,109.523	828.3412	23.19%
Jan-24	1,168.734	881.3668	23.36%
Feb-24	1,110.442	854.0089	23.29%
Mar-24	1,180.381	878.9306	23.51%
Apr-24	1,126.69	883.0172	23.29%
May-24	1,152.37	892.4264	23.19%
Jun-24	1,140.932	877.3799	23.16%
Total	**13,684.84**	**10,472.92**	

2.1.11 Electricity Reliability Indices

Reliability indices are metrics that measure the reliability of a power system. They give a measure of how often power supply is interrupted and for how long the interruption lasts. These indices are the Customer Average Interruption Duration Index (CAIDI), System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI).

a) Customer Average Interruption Duration Index (CAIDI)

This index measures the average outage duration that any given customer would experience. It gives an indicator of how long it takes for power to be restored after a sustained interruption. It only includes customers who actually experienced an interruption in its calculation. Figure 2.10 illustrates the monthly CAIDI trend during the financial year 2023/2024.

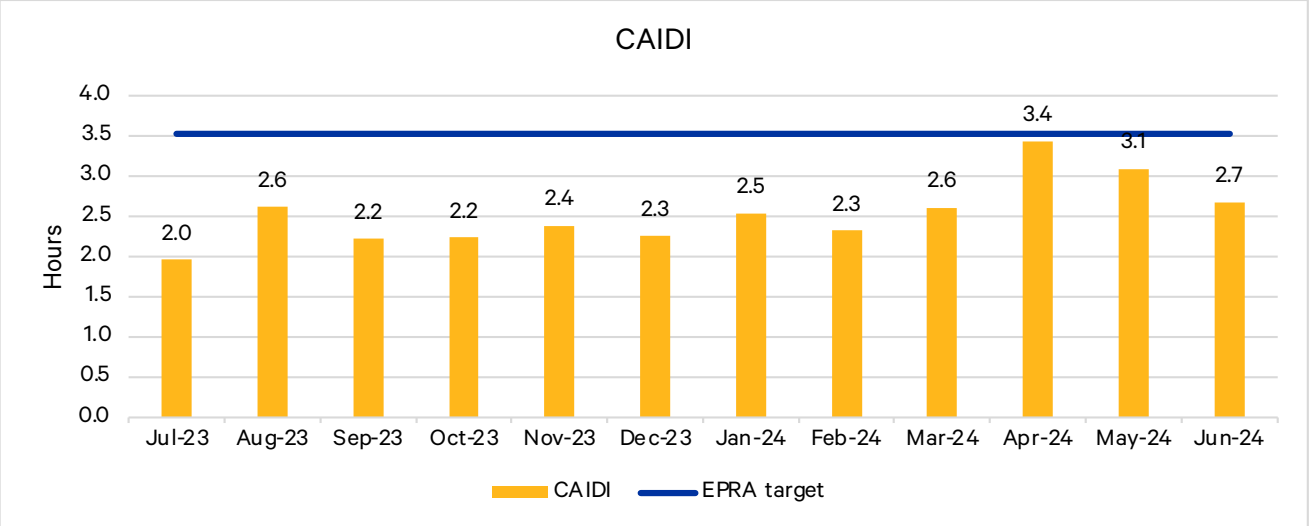


Figure 2.10: The monthly CAIDI trend during the financial year 2023/2024

The CAIDI averaged 2.53hrs per month as compared to 2.25 hours per month in the previous financial year. This was within the EPRA set target of 3.53 hours per customer for the Financial Year 2023/2024 in the 4th tariff control period. The longest outage was 3.43 hours per customer recorded in April 2024, while the shortest outage per customer was recorded in July 2023 at 1.97 hours.

b) System Average Interruption Duration Index (SAIDI)

SAIDI is a measure of the total duration of interruptions a customer would experience in a given period and is measured in units of time (minutes, hours) per month or year.

It describes how long, on average, each customer connected to a power system experiences outages. This average includes even those who did not experience any outage.

The SAIDI for the period under review averaged 10.14 hours per month. This is an increase from the 8.37 hours per customer recorded in the year ended June 2023. This exceeded the EPRA target of 5.00 hours per customer stipulated in the 2023/2024 tariff control period. The longest outage averaged 17.29 hours per customer in April 2024 while the shortest outage per customer averaged 5.53 hours as illustrated in figure 2.11.

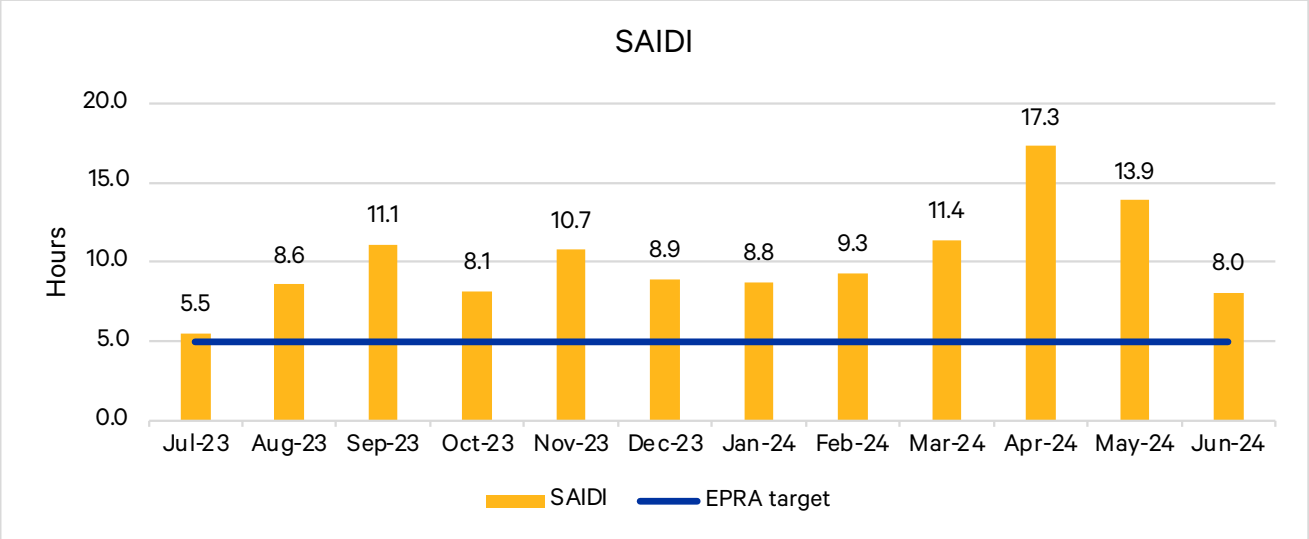


Figure 2.11: The monthly SAIDI trend during the financial year 2023/2024

c) System Average Interruption Frequency Index (SAIFI)

SAIFI refers to the average number of interruptions that any given customer experiences.

The SAIFI for the year ended June 2024 was 3.96 interruptions per customer as compared to 3.75 interruptions per customer in the year ended June 2023. This exceeded EPRA's target of 2.15 interruptions per customer for the 2023/2024 tariff control period. Interruptions were most frequent in April 2024, with 5.03 interruptions per customer while July 2023 had the least number of outages at 2.81 per customer as shown in figure 2.12.

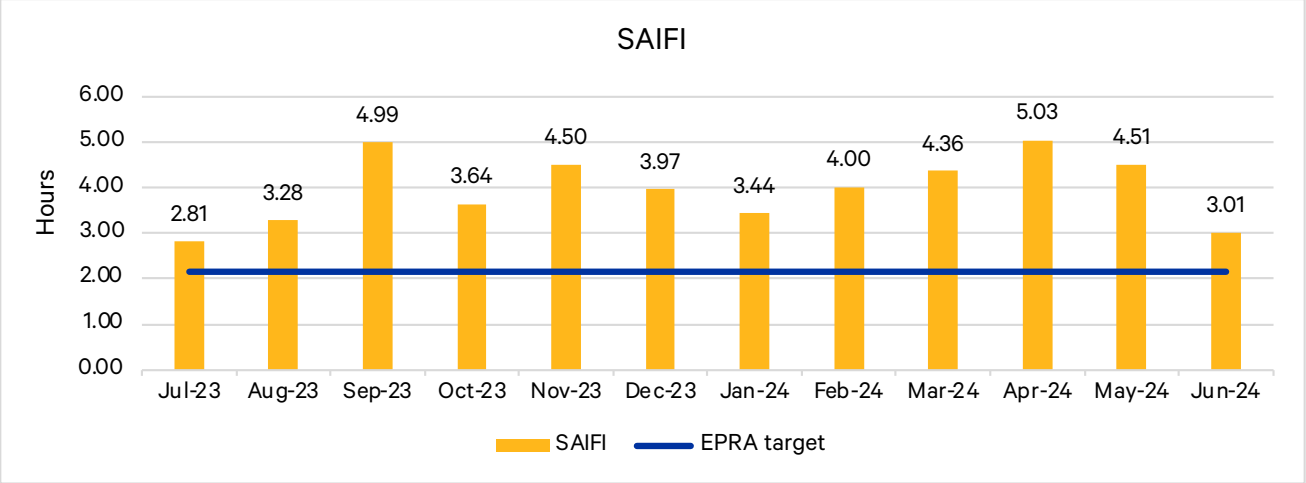


Figure 2.12: The monthly SAIFI trend during the financial year 2023/2024

Overall, the reliability indices for the financial year 2023/2024 were lower compared to the previous year. This decline can be attributed partly to several national blackouts that occurred in August, November, and December 2023, as well as in March 2024. Additionally, the floods in April 2024 damaged power transmission and distribution infrastructure, further impacting reliability.

2.2 Electricity Pricing

Electricity prices are set with the aim of ensuring that power utilities generate sufficient revenue to cover the costs of generating, transmitting, and distributing electricity while maintaining system reliability and sustainability. The pricing system is reflective of the cost of power generation, transmission, distribution, retail, taxes and levies.

2.2.1 Power Purchase Agreements (PPAs)

A Power Purchase Agreement (PPA) is a contract between power generators and the off taker that defines the terms for selling electricity, including the amount of power and its cost. PPAs are essential for providing long-term price stability by locking in a fixed electricity price for the duration of the contract. This stability benefits both generators and consumers by reducing the risks associated with market price fluctuations. During the period under review, the Authority approved the following renegotiated contracts;

1. A power purchase agreement between DWA Estate Limited and KPLC for a 1.14 MW Biomass Power Plant and;
2. A power purchase agreement between Marco Borero Limited and KPLC for a 1.5MW Solar Power plant.

2.2.2 Base Electricity Tariff

The Authority approved the Retail Electricity Tariff for the fourth Tariff Control Period spanning from 2022/23 to 2025/26 in March 2023 with an effective date of 1st April 2023. This tariff approval set the stage for adjustments in electricity pricing aimed at ensuring a balance between cost recovery and consumer affordability. As part of these adjustments, the base tariff for the financial year 2023/2024 reflects minor tariff variations across different customer categories compared to the applicable tariff for the period April 2023 to June 2023. The applicable base tariff for the period under review is presented in table 2.5.

Table 2.5: Approved electricity retail tariffs for the financial year 2023/2024

Customer category	Voltage at connection	Energy Limit (kWh/month)	Base Tariff (2022/2023)	Base Tariff (2023/2024)	Demand Charge/ KVA(Ksh.)
Domestic	240 Volts/415 Volts	0-30	12.22	12.24	0
		30-100	16.30	16.58	0
		>100	20.97	20.58	0
Small Commercial	240 Volts/415 Volts	0-30	12.22	12.24	0
		30-100	16.40	16.36	0
		>100	20.18	20.00	0
Electric Mobility	240 Volts/415 Volts	=<15000	16.00	16.00	0
Commercial/Industrial	415 V (CI 1)	>15000	14.70	14.50	1,100
	11KV (CI 2)	No Limit	13.24	13.08	700
	33 KV (CI 3)	No Limit	12.66	12.52	370
	66 KV (CI 4)	No Limit	12.40	12.26	300
	132 KV (CI 5)	No Limit	12.12	11.98	300
	220 KV (CI 6)	No Limit	10	10	200
	SEZ- CI 7	No Limit	10	10	200
Street Lighting	240 Volts/415 Volts	No Limit	9.22	9.24	0

Small Commercial customers (consuming above 100 kWh per month), E-Mobility customers and the Commercial and Industrial customers have off-peak Time of Use (TOU) tariff, where they are charged discounted 50% of their base energy tariff on attaining their consumption thresholds.

2.2.3 Pass-through costs

In addition to the base tariffs outlined in the previous section, the Authority also approves monthly pass-through costs that are passed to consumers by the utility provider in response to fluctuations in specific cost components. These pass-through costs account for variations in the Fuel Energy Charge (FEC), Foreign Exchange Rate Fluctuation Adjustments (FERFA), Inflation Adjustments, and the contributions to the Water Resources Authority (WRA).

The FEC reflects the cost of fuel used in electricity generation by thermal power plants. In the period under review, FEC was highest in November 2023 at 5.74 Ksh./kWh and lowest at 3.26 Ksh./kWh in April 2024.

FERFA fluctuated throughout the period under review with January 2024 recording the highest value of +6.4634Ksh./kWh. This is attributed to the depreciation of the local currency during the period and the large volume of foreign currency payments made by both KPLC and KenGen towards settling their foreign currency denominated financial obligations.

The inflation adjustment cost is reviewed every six months to account for changes in economic conditions and ensure that electricity prices reflect the current cost of living and inflationary pressures. From June to December 2023, the applicable inflation adjustment cost was 0.23 Ksh./kWh which increased to 0.33 Ksh./kWh during the second half of the financial year..

WRA levy fluctuated over the period with the highest recorded in May 2024 at +0.0196Ksh./kWh and lowest in November 2023 at +0.01096Ksh./kWh. The fluctuations in WRA levy reflects patterns in hydro generation over the period under review. A summary of the applicable pass-through costs is presented in table 2.6.

Table 2.6: A summary of pass-through costs during the financial year 2023/2024

Month	FEC (Ksh./Kwh)	Forex Adj. (Ksh./Kwh)	Inflation Adj. (Ksh./Kwh)	WRA Levy (Ksh./Kwh)
Jul-23	4.02	1.75	0.23	0.0146
Aug-23	4.46	1.71	0.23	0.0148
Sep-23	4.16	1.38	0.23	0.0138
Oct-23	4.94	2.05	0.23	0.0136
Nov-23	5.74	0.80	0.23	0.01096
Dec-23	3.98	3.17	0.23	0.0158
Jan-24	4.33	6.46	0.33	0.01512
Feb-24	4.14	3.22	0.33	0.0133
Mar-24	3.64	3.68	0.33	0.0145
Apr-24	3.26	1.99	0.33	0.0151
May-24	3.52	0.97	0.33	0.0196
Jun-24	3.59	1.76	0.33	0.0183

2.2.4 Evolution of the overall electricity tariff

The overall retail tariff consists of the base tariff, pass-through costs, taxes, and levies. During the review period, electricity prices varied, primarily due to changes in the monthly pass-through costs. Prices peaked in January 2024 and were lowest in May 2024. Figure 2.13 illustrates the trend in electricity prices across various customer categories during this period.

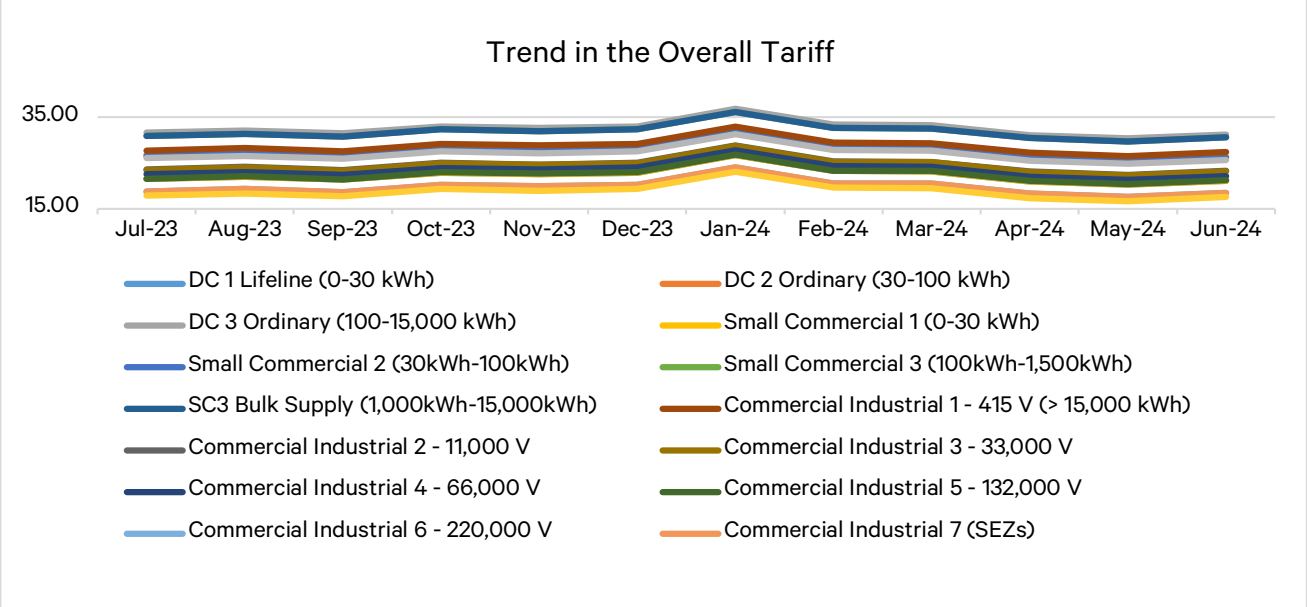


Figure 2.13: A trend in the overall tariff across customer categories for the financial year 2023/2024

2.2.5 Time of Use (TOU) Tariff

In December 2017, the TOU tariff was introduced for the commercial industrial customers to promote industrial growth in line with the country's development goals. Further, in April 2023 the Authority introduced the TOU tariff for the small commercial customer categories and e-mobility tariff customers. The TOU tariff provides a 50% discount on the energy charge rates during the off-peak periods (2200hrs to 0600hrs during weekdays, 1400hrs to 0800hrs Saturdays and the whole day on Sundays and during public holidays) on premises that electricity consumption thresholds are met.

The TOU beneficiaries saved a total of Ksh. 1.838 billion during the review period. Table 2.7 shows the total monthly savings made by the beneficiaries.

Table 2.7: Performance of the TOU tariff scheme during the financial year 2023/2024

Description	Unit of measure	Customers in Tariff	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24
			No. of Customers Benefited											
SC3	No.	4,736	584	1,224	1,228	1,500	1,119	1,204	1,308	908	1,453	1,109	1,167	1,217
EM	No.	30										21	20	26
CI-1	No.	3,277	965	757	828	1,187	764	919	1,075	594	1,048	637	702	641
CI-2	No.	539	189	147	184	242	183	175	230	103	222	146	157	140
CI-3	No.	86	40	20	28	32	19	22	39	22	29	23	28	27
CI-4	No.	47	24	17	20	22	15	17	17	15	16	11	13	7
CI-5	No.	50	10	2	3	6	2	4	5	3	6	5	3	2
Total	**No.**	**8,765**	**1,812**	**2,167**	**2,291**	**2,989**	**2,102**	**2,341**	**2,674**	**1,645**	**2,774**	**1,952**	**2,090**	**2,060**
Savings By customers	Kshs 'M		204.4	99.0	153.3	197.0	117.7	175.9	210.9	80.6	151.8	143.4	158.3	146.0
Total Increase in Sales (Low Rate)	GWh		26.7	11.4	17.9	24.2	14.0	22.8	24.4	9.2	18.9	17.5	19.2	18.3
Increase in demand	MW		70.6	32.3	50.6	62.7	40.8	56.0	67.4	25.5	52.2	48.1	52.7	49.5

Table 2.8 shows a summary of TOU subscribers and corresponding savings from the financial year 2021/2022 to 2023/2024 and the corresponding savings.

Table 2.8. A comparison of TOU subscribers from the financial year 2021/2022 to 2023/2024

Item	Description	Unit of measure	Customers in Tariff	2021/22	2022/23	2023/24
A	**Total No. Of customers benefited by tariff category**			**Average No. of Beneficiaries**		
	SC3	No	4,736	0	495	1,168
	EM	No.	30	0	0	22
	CI-1	No	3,277	1,211	1,091	843
	CI-2	No	539	216	197	177
	CI-3	No	86	27	34	27
	CI-4	No	47	19	16	16
	CI-5	No	50	9	10	4
	Total	No	8,765	1,482	1,431	2,241
B	Savings By Customers	Kshs 'M (VAT Inclusive)		1,575	1,417	1,838
C	Total Increase in Sales (Low Rate)	GWh		270	255	225

2.3 Market share and competition analysis

The market share within the electricity sector is determined by the proportion of electricity generated by each company. During the period under review, KenGen was the leading contributor, accounting for 62% of the total energy generated in the country. Other notable companies with substantial market shares included Lake Turkana Wind Power (LTWP) with (10%), Imports (9%) and Orpower (6%). A summary of the market shares within the electricity sector is depicted in figure 2.14 and table 2.9.

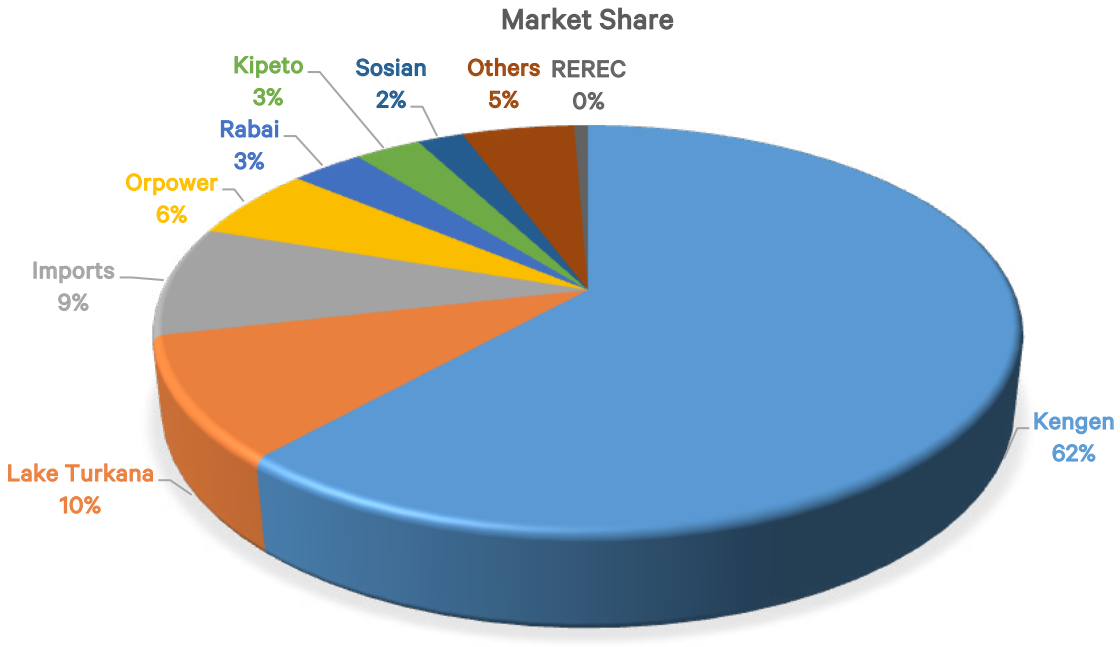


Figure 2.14: A graphical representation of the electricity market share during the financial year 2023/2024

Table 2.9: A summary of the electricity sector market share from the financial year 2021/2022 to 2023/2024

COMPANY	2023/2024		2022/2023		2021/2022	
	GWh	% Share	GWh	% Share	GWh	% Share
Kengen	8,383.5	61.66%	8,026.86	60.74%	7,921.02	62.91%
Lake Turkana Wind Power	1,325.88	9.75%	1,678.32	12.70%	1,572.83	12.49%
Imports	1,196.06	8.80%	644.07	4.87%	337.5	2.68%
Orpower	793.5	5.84%	939.23	7.11%	975.8	7.75%
Rabai Power	440.62	3.24%	446.01	3.38%	501.77	3.98%
Kipeto Energy PLC	404.44	2.97%	466.1	3.53%	425.88	3.38%
Sosian Menengai Geothermal	281.6	2.07%	6.17	0.05%	0	0.00%
Thika Power	120.6	0.89%	194.38	1.47%	210.97	1.68%
Alten Kenya Solar Farm	100.27	0.74%	79.17	0.60%	0	0.00%
Malindi SolarGroup	98.7	0.73%	98.91	0.75%	53.64	0.43%
CEDATE	95.52	0.70%	93.85	0.71%	88.11	0.70%
SELENKEI SOLAR FARM	94.47	0.69%	85.74	0.65%	88.56	0.70%
REREC	84.3	0.62%	85.86	0.65%	82.38	0.65%
GILF POWER	53.01	0.39%	170.42	1.29%	81.45	0.65%
IBERAFRICA (52.5MW)	37.85	0.28%	115.52	0.87%	85.77	0.68%
TRIUMPH POWER	25.56	0.19%	35.11	0.27%	69.5	0.55%
REGEN-TEREM	22.88	0.17%	20.32	0.15%	15.43	0.12%
NORTH MATHIYA SHP (METUMI)	16.99	0.12%	14.48	0.11%	9.91	0.08%
GURA	13.89	0.10%	11.1	0.08%	19.6	0.16%
KIANTHUMBI SMALL HYDRO	3.22	0.02%	1.46	0.01%	2	0.02%
GIKIRA SMALL HYDRO POWER STATION	1.55	0.01%	0.99	0.01%	0.89	0.01%
CHANIA	1.18	0.01%	0.25	0.00%	0.56	0.00%
IMENTI TEA FACTORY CO. LTD	0.11	0.00%	0.25	0.00%	0.15	0.00%
BIOJOULE BIOGAS POWER PLANT	0.11	0.00%	0.21	0.00%	0.38	0.00%
STRATHMORE	0.08	0.00%	0.08	0.00%	0.05	0.00%
KIPEVU II (Tsavo)		0.00%		0.00%	47.76	0.38%
Total	**13,595.89**		**13,214.86**		**12,591.91**	

The Herfindahl Hirschman Index (HHI) analyzes competition by measuring the concentration of firms in a market thereby giving insight on the state of competition. It is calculated by squaring the market shares of all firms in the market and summing the squares as follows;

$$HHI = \sum_{i=1}^{K} (MS_i)^2$$

Where MS_i represents the market share of the ith firm and k represents the total number of firms in the market.

A market with a HHI of less than 0.1 is considered competitive, a HHI of 0.15 to 0.25 is moderately concentrated, and a HHI of 0.25 or greater is highly concentrated.

The average HHI for electricity generation during the year under review stood at 0.404, indicating a slight decrease in competition compared to 0.396 recorded in the financial year 2022/2023. This figure remains significantly above the Authority's benchmark of 0.1.

The HHI for the electricity sector has been decreasing over the years indicating improved competition. This is attributed to entry of new players in the generation market particularly the Independent Power Producers (IPPs). Figure 2.15 shows the HHI trend in electricity generation over a five year period.

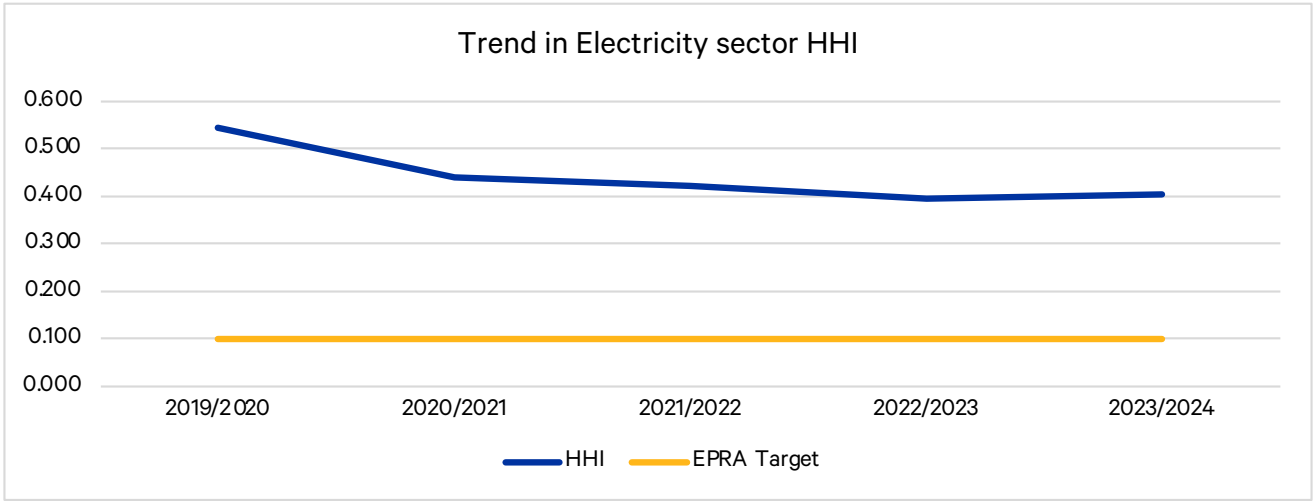


Figure 2.15: HHI trend for electricity generation from the financial year 2019/2020 to 2023/2024

2.4 Greenhouse Gas Emissions

As a party to the Paris Agreement, Kenya has committed through its updated Nationally Determined Contributions (NDCs) to reduce greenhouse gas emissions by 32% by 2030 compared to a business-as-usual scenario. This commitment involves implementing various adaptation and mitigation strategies. In the energy sector, following commitments made at the 28th United Nations Conference of the Parties (COP 28), Kenya has further pledged to increase renewable energy generation to 100% by 2030 and to double the rate of energy efficiency improvements. These initiatives have led to a reduction in emissions within the electricity sub-sector.

During the review period, carbon dioxide emissions from electricity generation were estimated at 652,285.12 tCO2, a decrease of 29.6% from 845,256.51 tCO2 the previous year. The grid emission factor for the review period was 0.04789 tCO2/MWh, representing a 34% reduction from the previous year's grid emission factor of 0.06397 tCO2/MWh.

This reduction in CO2 emissions is primarily due to a 21% decrease in grid thermal generation, which fell from 1,320,000 MWh to 1,042,031 MWh during the review period. Emissions have been on a downward trend since the 2021/2022 financial year, as illustrated in figure 2.16.

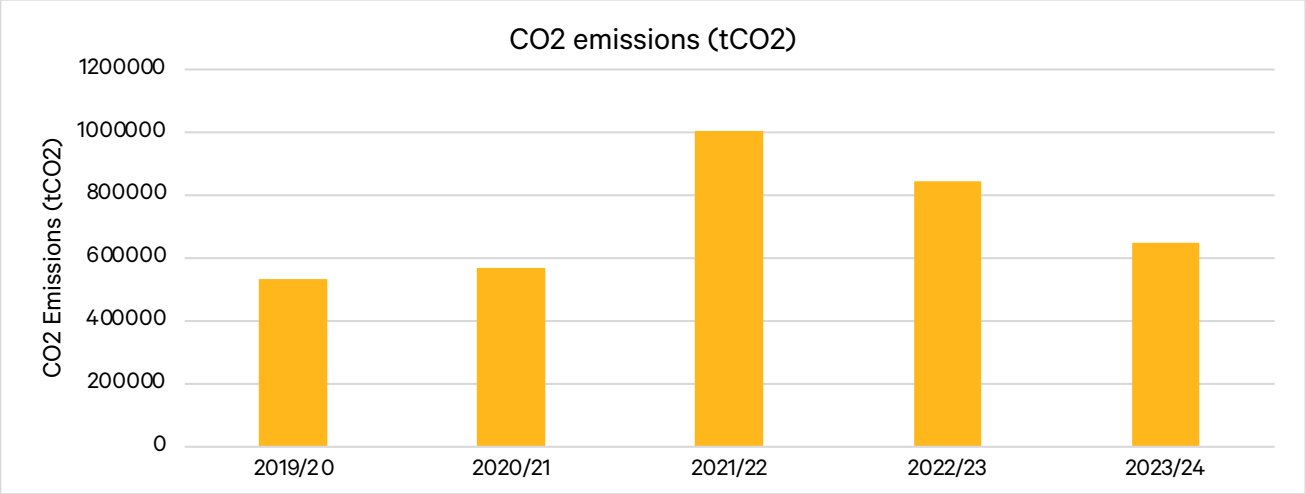


Figure 2.16: A trend in CO2 emissions from electricity generation from the financial year 2019/2020 to 2023/2024

2.5 Electricity sector performance in the East African Community (EAC)

2.5.1 Installed capacity

The installed capacity in the sampled EAC countries increased by 1,673.9 MW from 6,957.8 MW in June 2023 to 8,631.7 MW in June 2024, representing a growth of 24.06%. Uganda recorded the highest increase, adding 820.2 MW to its grid, while Tanzania added 547.4 MW. Uganda's growth can be attributed to the commissioning of the 600 MW Karuma Hydroelectric Dam, while Tanzania's expansion is linked to the phased commissioning of the 2,120 MW Julius Nyerere Hydroelectric Power Project. These developments reinforce the role of renewable energy in the EAC region's generation mix. Rwanda's installed capacity grew by 143.4 MW, while Kenya's and Burundi's capacities increased by 115.7 MW and 47.5 MW, respectively.

Uganda boasts the highest share of renewables in its installed capacity, with renewables accounting for 88%. Kenya follows at 79.89% and Burundi ranks third at 78%. In contrast, Tanzania (45%) and Rwanda (43%) have less than 50% of their generation mix from renewables due to significant natural gas and methane generation in both countries.

With an installed capacity of 3,199.9 MW, Kenya has the highest capacity in the region, followed by Tanzania at 2,435.27 MW and Uganda at 2,430.27 MW. Table 2.10 below shows the growth in installed capacities since 2018.

Table 2.10: A summary of the installed capacity in selected EAC states

	Dec -2018	Dec -2019	Dec -2020	Dec -2021	Dec -2022	Jun-23	Jun-24
Burundi	91.36	91.36	98.86	113.86	112.377	112.377	159.82
Kenya	2,351	2,712	2,840	2,984	3,121	3,084.65	3,199.9
Rwanda	221.95	225.5	238.352	263.052	263.052	263.052	406.4
Tanzania	1,543.20	1,627.71	1,626.80	1,634.25	1,849.20	1,887.85	2,435.27
Uganda	984	1,252.6	1,269.1	1,365.2	1,401.96	1,609.85	2,430.27
Total (MW)	**5,191.51**	**5,909.17**	**6,073.11**	**6,360.36**	**6,747.59**	**6,957.78**	**8,631.66**

Source: EREA

2.5.2 Peak demand

Peak demand in the EAC region increased by 429 MW, a rise from 4,730.66 MW in June 2023 to 5,159.61 MW in June 2024. Kenya leads with the highest peak demand at 2,177 MW, followed by Tanzania at 1,645.23 MW and Uganda at 1,033.38 MW. Table 2.11 below shows the progression of peak demands for select EAC states.

Table 2.11: A summary of the peak demand in selected EAC states

	Dec-2018	Dec-2019	Dec-2020	Dec-2021	Dec-2022	Dec-2023	Jun-24
Burundi	65.2	65.2	65.2	65.2	65.2	65.2	70
Kenya	1,802	1,882	1,926	1,994	2,149	2,149	2,177
Rwanda	138.71	146.91	154.79	170.66	170.66	170.66	234
Tanzania	1,045.70	1,116.58	1,151.66	1,201.02	1,354.61	1,482.8	1,645.23
Uganda	645.4	723.8	736.7	794	843	863	1,033.38
Total (MW)	**3,697.01**	**3,934.49**	**4,034.35**	**4,224.88**	**4,582.47**	**4,730.66**	**5,159.61**

Source: EREA

2.5.3 System losses

System losses in the sampled EAC region decreased across all countries in 2023 as compared to 2022. Tanzania boasts the most efficient network in the region, with system losses at 14.57%. Rwanda ranks second at 16.9%. Burundi recorded losses of 18.3%, and Kenya reported the highest at 23.2%. Table 2.12 below illustrates the progression of system losses at the end of the calendar year.

Table 2.12: System losses in selected EAC states

	2018	2019	2020	2021	2022	2023
Kenya	21	23.69	24.46	24.1	24.75	23.2
Rwanda	19.72	19.08	19.55	18.73	18.73	16.9
Tanzania	14.72	16.23	15.3	15.16	15.43	14.57
Uganda	20.4	20	21.3	22.1	23.8	20.6
Burundi	30	24	22	20	28	18.3

Source: EREA

RENEWABLE ENERGY

This chapter analyses the renewable energy sub-sector, detailing the installed capacity and performance of each renewable energy resource, throughout the year.

3.1. Installed capacity

The installed capacity of renewable energy sources as at June 2024 was 2,859.4 MW, accounting for 79.89% of Kenya's total installed capacity. This consists of 2,427.1 MW of interconnected renewable energy capacity and 427.7 MW of captive renewable energy capacity. In the period under review there were increases in captive solar PV plants, bringing the installed captive capacity to 229.2 MW, and in captive bioenergy, reaching 161.8 MW. Table 3.1 provides a breakdown of the country's installed renewable energy capacity by technology as of June 2024.

Table 3.1: Installed renewable energy capacity as at June 2024

Technology	Interconnected Capacity (MW)		Captive Capacity (MW)	Offgrid Capacity	Total Installed Capacity	% Total Installed
	Installed	Effective				
Hydro	839.3	810.4	33.0	0.1	872.4	24.38%
Geothermal	940.0	841.1	3.7		943.7	26.37%
Wind	435.5	425.5	-	0.6	436.1	12.19%
Solar	210.3	210.3	229.2	3.4	442.9	12.38%
Bioenergy	2.0	2.0	161.8		163.8	4.58%
Total	**2427.1**	**2289.3**	**427.7**	**4.0**	**2858.9**	**79.89%**

During the review period, 83.00% of the energy supplied to Kenya's national grid came from renewable sources. Thermal plants contributed 8.24%, while 8.77% was imported from neighboring Ethiopia and Uganda, where over 90% of the generation comes from hydro sources. Geothermal energy remained the largest contributor, meeting 41.71% of Kenya's total electricity demand. Hydro and wind generation followed, providing 24.68% and 13.14% respectively. Utility-scale solar generation contributed 3.46% to the country's electricity supply. The renewable energy contribution to the generation mix is illustrated in figure 3.1.

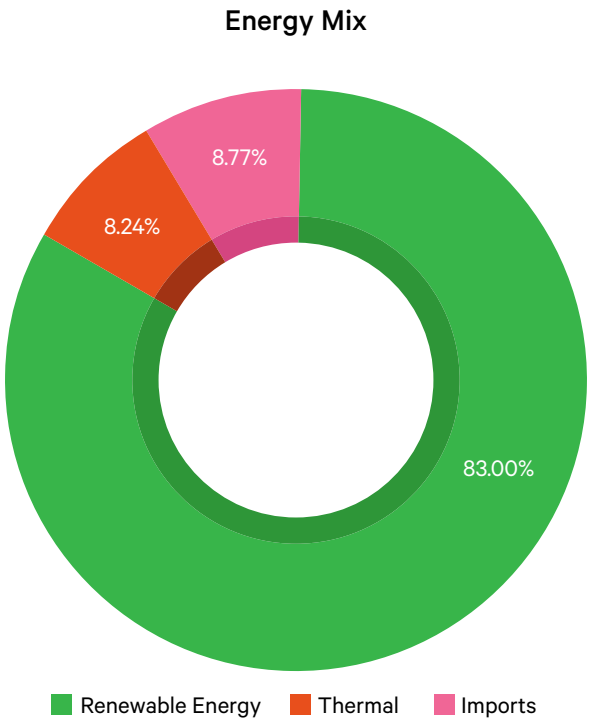


Figure 3.1: Renewable energy contribution to Kenya's energy mix

3.2 Geothermal Development

As of June 2024, Kenya's installed geothermal capacity was 943.7 MW. During the review period, 5,707.71 GWh of energy was generated from geothermal sources, accounting for 41.71% of the energy supplied to the interconnected grid. Monthly geothermal energy generation during this period is depicted in Figure 3.2. The peak generation occurred in August 2023, with 522.92 GWh, while the lowest generation was in June 2024, with 416.81 GWh.

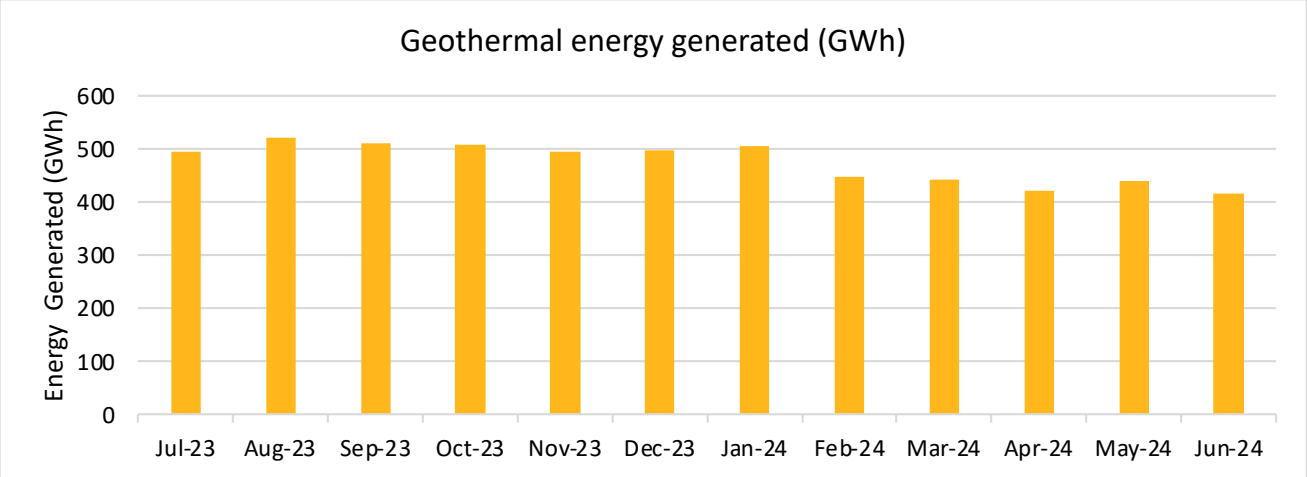


Figure 3.2: Monthly geothermal energy generated during the financial year 2023/2024

Geothermal energy generation declined in the second half of the review period due to improved hydro generation and increased energy imports.

A trend of the geothermal energy generated between 2018 and 2024 is provided in figure 3.3. The geothermal energy generation in the period under review decreased by 5.42% from 6,035.00 GWh in the previous financial year.

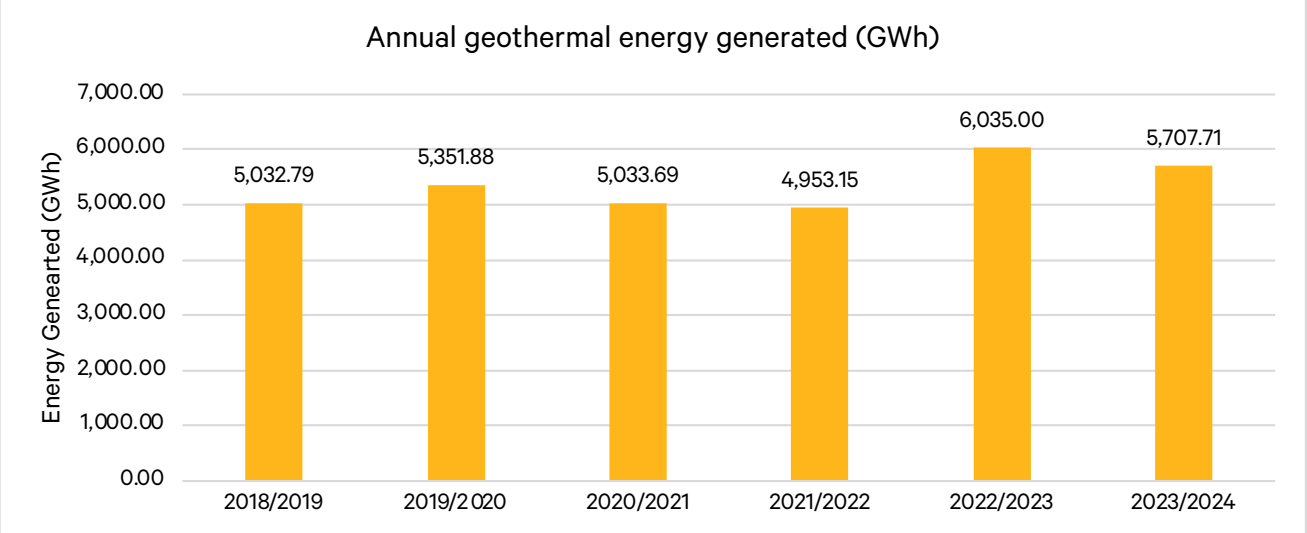


Figure 3.3: A trend of geothermal energy generated from the financial year 2018/2019 to 2023/2024

3.3 Hydro

As of June 2024, the total installed hydro capacity was 872.4 MW, consisting of 839.3 MW of interconnected capacity, 33 MW of captive capacity and 0.1 MW of offgrid capacity. During the review period, interconnected hydropower plants produced 3,377.58 GWh, representing 24.68% of the total energy generated. Figure 3.4 illustrates the monthly energy generation from hydropower plants over the review period. Energy generation from hydro resources closely reflects rainfall patterns. April had the highest hydro energy production at 362.38 GWh, while October recorded the lowest at 205.28 GWh.

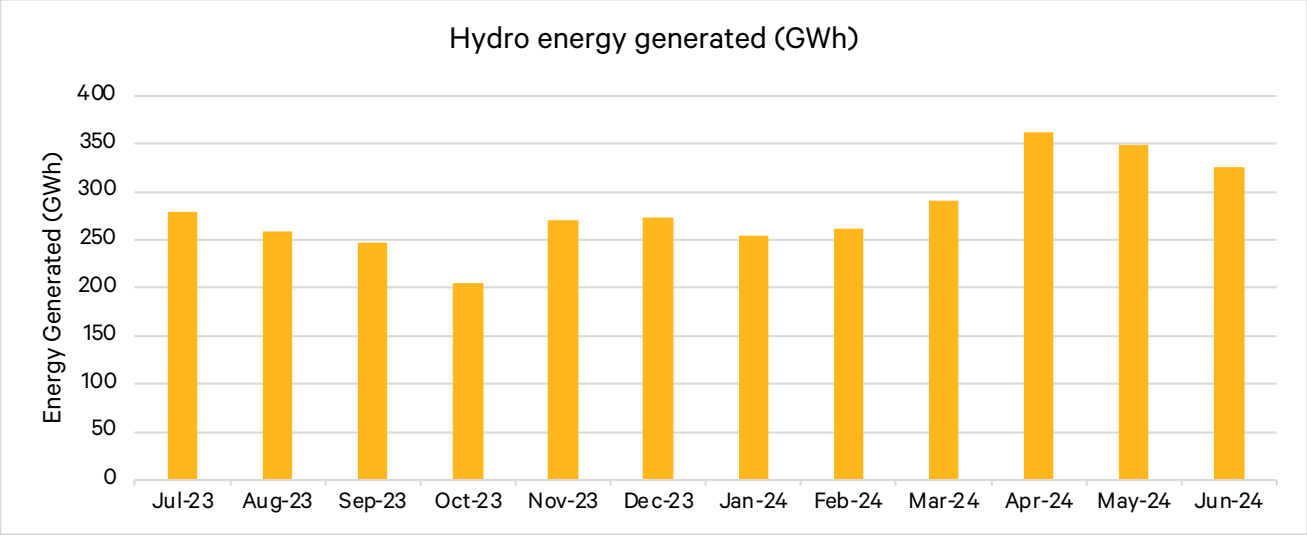


Figure 3.4: Monthly energy generation from hydropower plants during the financial year 2023/2024

Hydropower generation shows a positive correlation with inflows into Sondu Miriu and dam levels for Turkwel and Masinga. For Turkwel, the average end-of-month dam level was 1,133.79 meters above sea level (m.a.s.l.), compared to a Minimum Operating Level (MOL) of 1,105 m.a.s.l. and a Full Supply Level (FSL) of 1,150 m.a.s.l. This represents a decrease from the previous review period, during which the end-of-month dam level was 1,136.80 m.a.s.l. The lowest dam level of 1,130.47 m.a.s.l. was recorded in March 2024, as shown in Figure 3.5. Turkwel experienced record-low end-of-month dam levels from July 2023 to March 2024, but conditions improved in the final three months of the review period.

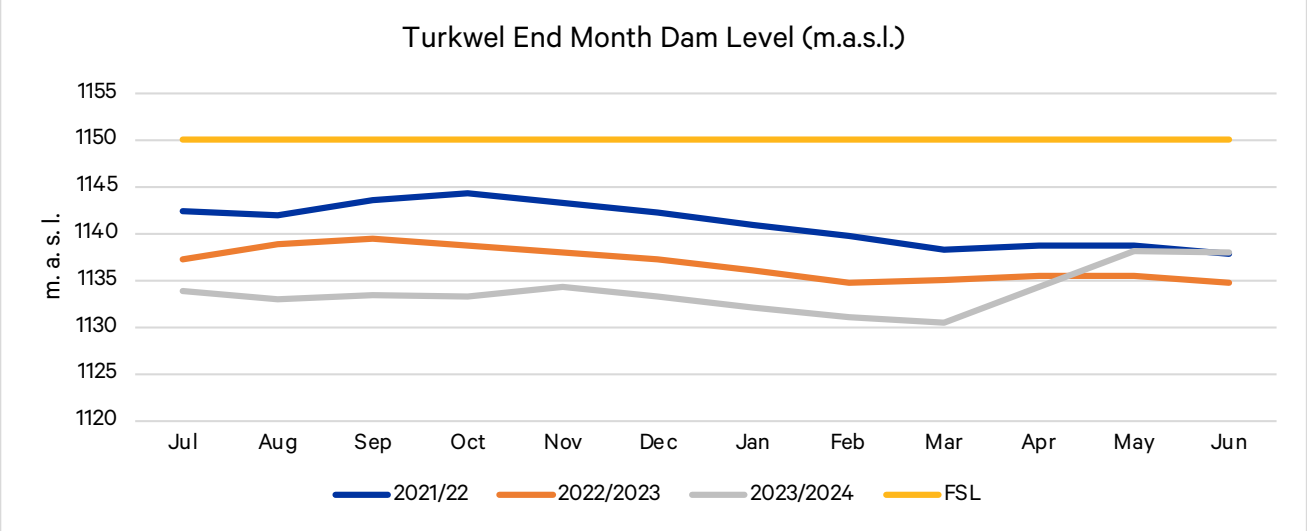


Figure 3.5: Monthly Turkwel dam levels for the financial year 2021/2022 to 2023/2024

The Masinga Dam had an average end-of-month level of 1,049.99 meters above sea level (m.a.s.l.), compared to a Full Supply Level (FSL) of 1,056.5 m.a.s.l. and a Minimum Operating Level (MOL) of 1,035 m.a.s.l. This represents an increase from the previous review period, where the average end-of-month level was 1,040.21 m.a.s.l. The lowest dam level during the review period was recorded in October 2023 at 1,036.88 m.a.s.l. From January to June 2024, Masinga Dam levels were consistently close to or above the FSL. In the last three months of the review period, the dam was spilling, a result attributed to high rainfall.

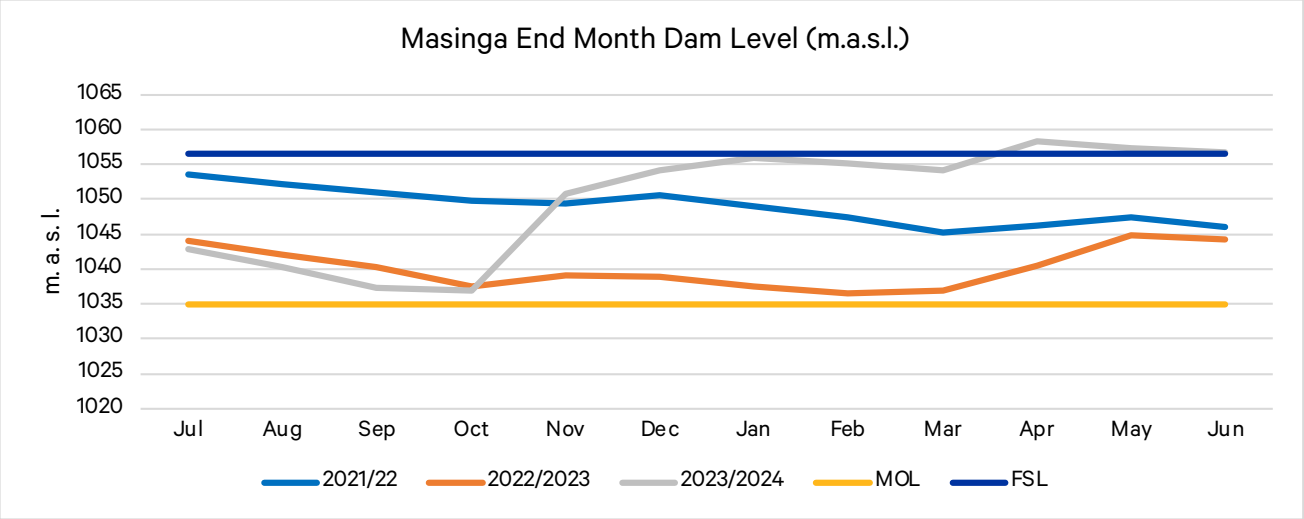


Figure 3.6: Monthly Masinga dam levels for the financial year 2021/2022 to 2023/2024

In the period under review, there was a significant increase in hydro energy generation, by 31.47% from 2,569.18 GWh to 3,377.58 GWh. This is attributed to better hydrology in November 2023 to June 2024. Figure 3.7 illustrates the hydro energy generation from the financial year 2018/2019 to 2023/2024.

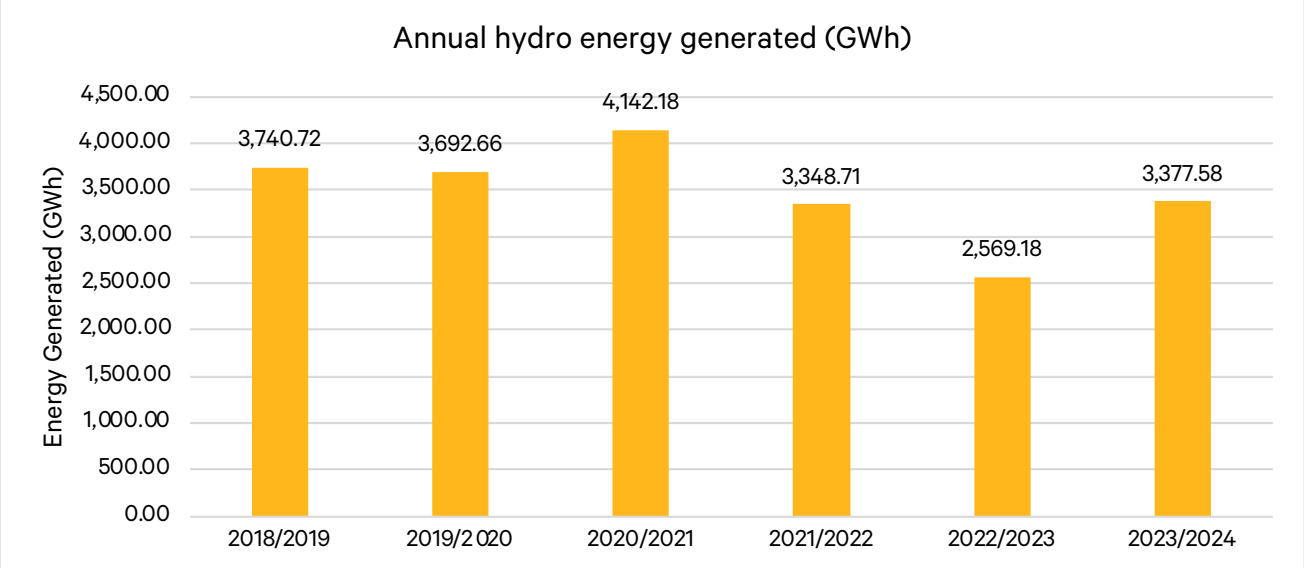


Figure 3.7: A trajectory of hydro energy generation from 2018 to 2024

3.4 Wind Energy

As of June 2024, Kenya's installed wind capacity was 436.1 MW. Figure 3.8 illustrates the monthly wind energy generation during the review period. The highest wind energy output was recorded in March 2024, at 198.722 GWh, while the lowest was in April 2024, at 82.96 GWh. The lower output in April is attributed to reduced wind resources due to heavy rainfall during that period. The variations in wind generation are linked to fluctuations in wind resource patterns and energy curtailment.

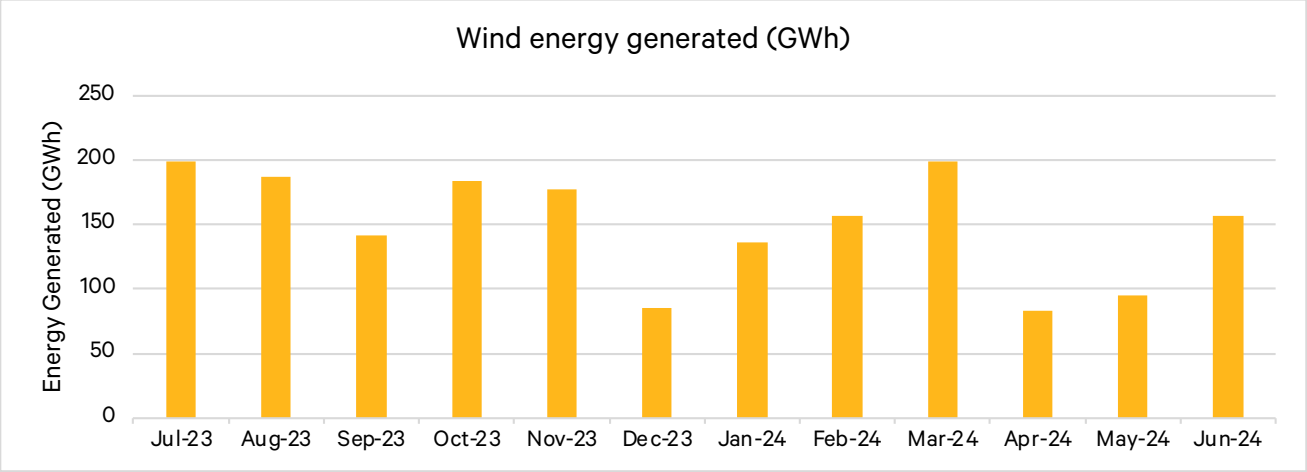


Figure 3.8: Monthly wind energy generation during the Review period

Wind energy contributed 1,798.58 GWh to the interconnected grid during the period under review, constituting 13.14 % of the country's total electricity mix. The wind energy generated decreased by 18.31% from 2,201.72 GWh in the previous review period to 1,798.59 GWh. The annual wind energy generation trend between 2018/19 and 2023/24 is provided in figure 3.9.

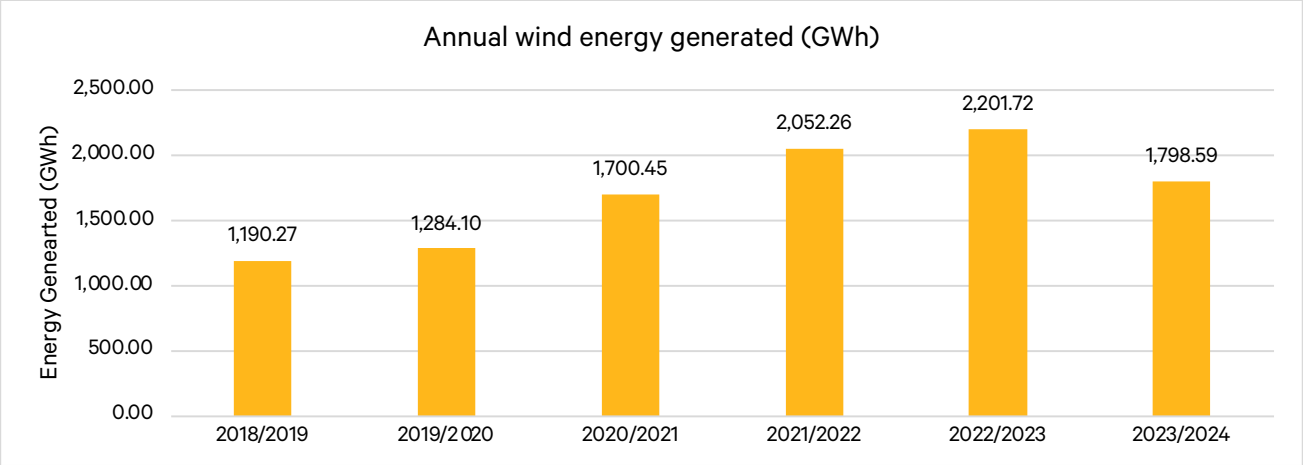


Figure 3.9: The annual wind energy generation trend from the financial year 2018/2019 to 2023/2024

3.5 Solar

As of June 2024, Kenya's solar installed capacity was 442.9 MW, comprising 210.3 MW of utility scale capacity, 229.24 MW of captive capacity and 3.39 MW of off grid capacity. The monthly energy generation from interconnected solar photovoltaic plants is displayed in figure 3.10. The highest solar energy generation occurred in December 2023, at 44.443 GWh, while the lowest was recorded in November 2023, at 35.691 GWh. These fluctuations in energy generation are attributed to variations in solar insolation.

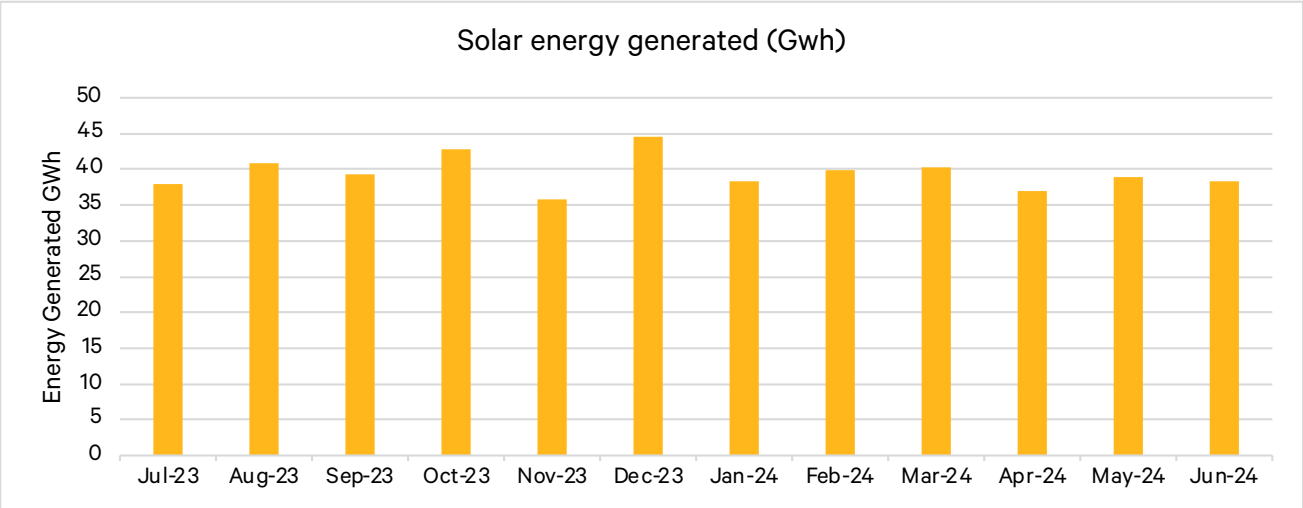


Figure 3.10: Monthly solar energy generation during the financial year 2023/2024

The energy generated from interconnected solar PV systems increased by 6.68% from 443.95 GWh in the previous review period to 473.62 GWh in the period under review. This is attributed to increased solar insolation. A trend in the annual solar energy generation between 2018 and 2024 is provided in figure 3.11.

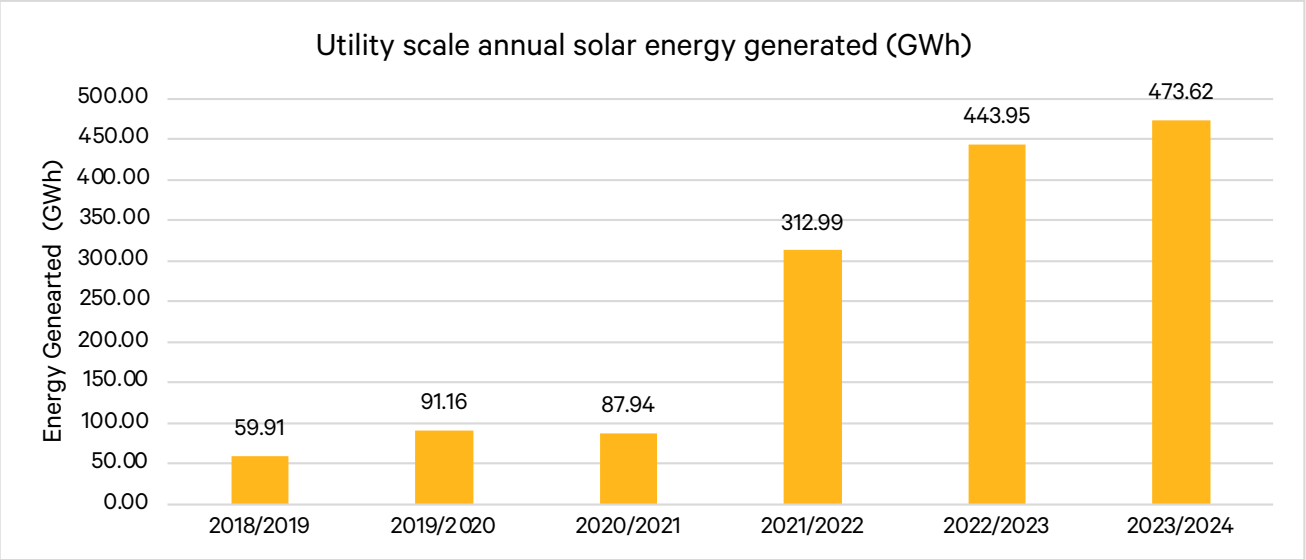


Figure 3.11: A trend in the annual solar energy generation between the financial year 2018/2019 and 2023/2024

Solar photovoltaic systems have the highest contribution to the country's captive generation capacity at 229.238 MW, which accounts for 43.04 % of the total captive capacity. The preference for this technology can be attributed to several factors, including the ease of setup, advantageous solar insolation levels in many regions of Kenya, cost-effectiveness in terms of energy production, and supportive government policies.

Figure 3.12 shows energy generation from 195 captive solar PV installations with a combined capacity of 59.113 MW between 2021 and 2024. During the financial year under review, these installations generated a total of 49.74 GWh.

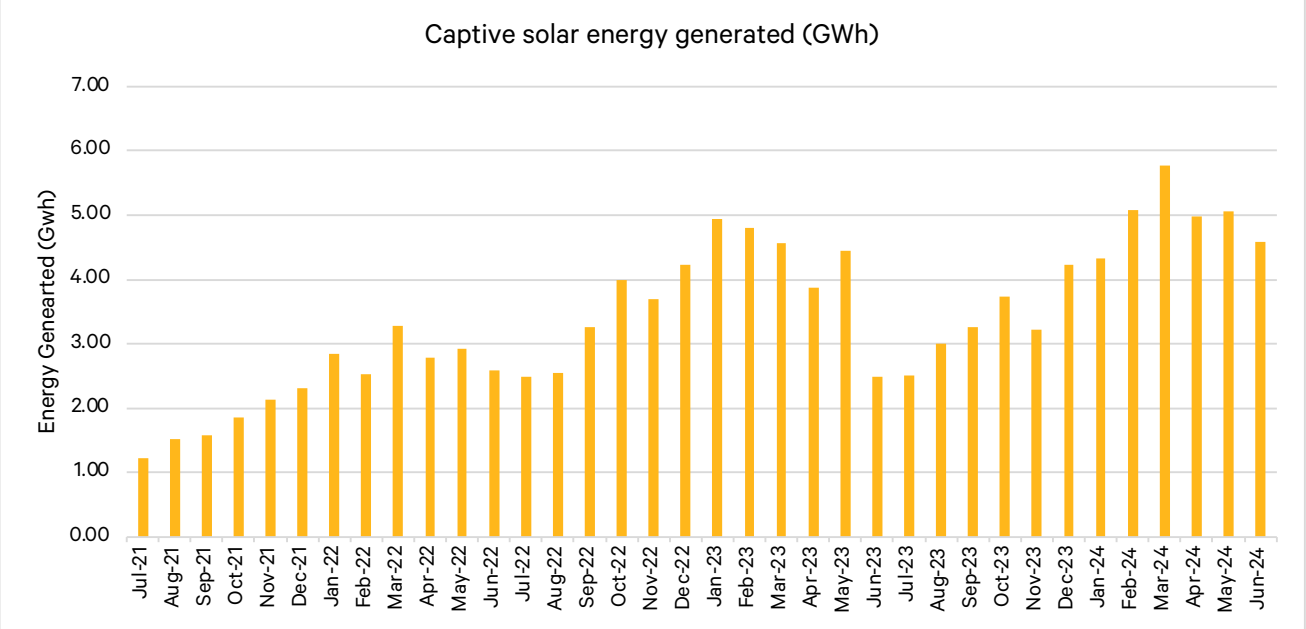


Figure 3.12: Captive solar energy generation from the financial year 2021/2022 to 2023/2024

The market share of captive solar players by energy generated during the review period is shown in figure 3.13. Key players in the sector include CP Solar Resources Limited, Equator Energy Kenya Limited, Ecoligo Limited, and Ariya Finergy Holdings Limited.

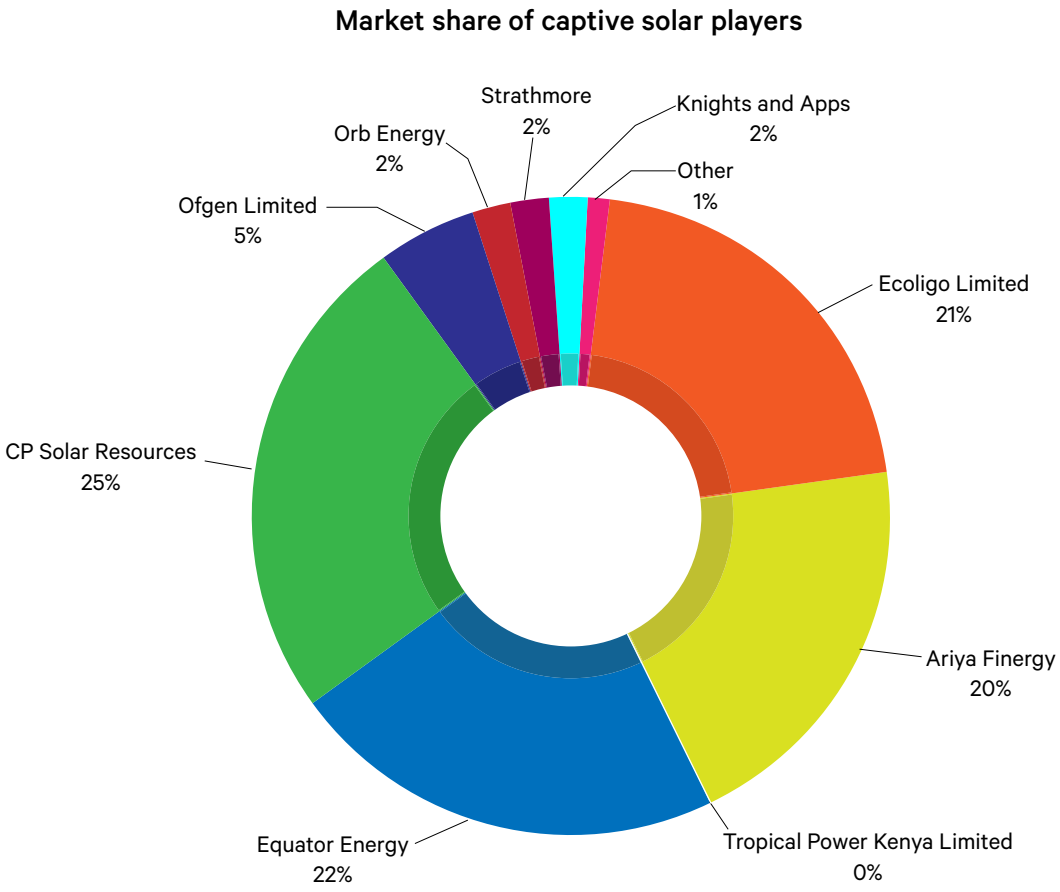


Figure 3:13: Market share of captive solar players as at 30th June 2024

During this period, the Authority approved 18 captive power purchase agreements with a total combined capacity of 29.006 MW, as detailed in Table 3.2.

Table 3.2: Captive power purchase agreements approved during the financial year 2023/2024

No.	Applicant	Technology	Capacity	Location
1.	Equator Energy Kenya Limited	Solar PV	1400 kWp	Saj Ceramics Limited
2.	Equator Energy Kenya Limited	Solar PV	2200 kWp	Milly Glass Works Limited
3.	Ecoligo Limited	Solar PV	100 kWp	DL Koisagat Tea Estates
4.	Ecoligo Limited	Solar PV	450 kWp	Mogogosiek Tea Factory
5.	Ecoligo Limited	Solar PV	82 kWp	Summit Fibers limited
6.	Ariya Finergy Ltd	Solar PV	550 kWp	Isuzu East Africa Limited
7.	Crossboundary Energy Kenya Ltd	Solar PV	680 kWp	Maisha Packaging Company Limited
8.	Ecoligo Limited	Solar PV	300 kWp	Quality Meat Packers Limited
9.	Farmdo Energy Kenya Ltd	Solar PV	220 kWp	PJ Dave Flora Limited
10.	Gridx Africa Development Ltd	Solar PV	320 kWp	Muthu Keekorok Management Limited
11.	Ofgen Ltd	Solar PV	200 kWp	Tropikal Brands Limited
12.	Ecoligo Limited	Solar PV	5000 MW	Abyssinia Iron and Steel Limited
13.	Ecoligo Limited	Solar PV	2800 kWp	Abyssinia Iron and Steel Limited
14.	Ecoligo Limited	Solar PV	1000 kWp	Devyani (Daima) Limited
15.	Gusii Tea Solar Company Limited	Solar PV	519 kWp	Kebirigo Tea Factory Company Limited
16.	Gusii Tea Solar Company Limited	Solar PV	685 kWp	Sanganyi Tea Factory Company Limited
17.	Gridx Africa Development Ltd	Solar PV	2500 kWp	Mabati Rolling Mills Limited
18.	Equator Energy Kenya Limited	Solar PV	10000 kWp	Mombasa Cement Limited

3.6 Bioenergy

Bioenergy refers to sustainable energy derived from organic matter and can take various forms such as firewood, biochar, briquettes, bagasse, biogas, syngas, bioethanol, and biodiesel. In Kenya, these diverse forms of bioenergy find applications in open-fire cooking, improved cook stoves, industrial biomass boilers, furnaces, internal combustion engines, lighting lamps, and electricity generation. Notably, bioenergy constitutes the most substantial portion of final energy consumption in Kenya.

As of June 2024, the installed bioenergy electricity generation capacity was 163.8 MW, comprising 161.8 MW of captive capacity and 2MW of grid-interconnected capacity. Table 3.3 provides the list of bioenergy projects and their respective capacities.

Table 3.3: A list of bioenergy projects as at 31st June 2024

S/No.	Facility	Capacity (MW)	Technology
1.	Bidco	2.1	Biomass
2.	Kwale International Sugar Company Limited	18.0	Biomass
3.	Butali Sugar Mills Limited	11.0	Bagasse
4.	Chemelil Sugar Company Limited	3.0	Bagasse
5.	South Nyanza Sugar Company	8.7	Bagasse
6.	DWA Estates Limited	1.4	Biomass
7.	Nzoia Sugar Co. Limited	7.0	Bagasse
8.	Pwani Oil Products Limited	1.5	Biomass
9.	Biojoule Kenya Limited	2.0	Biogas
10.	Transmara Sugar Company Limited	12.0	Bagasse
11.	James Finlay (Kenya) Limited	0.18	Biogas
12.	West Kenya Sugar Company Limited	21.0	Bagasse
13.	Sukari Industries Limited	8.5	Bagasse
14.	Kibos Sugar and Allied Industries	23.5	Bagasse
15.	Cummins	8.4	Biomass
16.	Muhoroni Sugar Company	3.0	Bagasse
17.	Mumias Sugar Company	10.0	Bagasse
18.	Busia Sugar Industry Limited	6.0	Bagasse
19.	West Valley Sugar Company	3.0	Bagasse
20.	Olepito Sugar Factory	1.5	Bagasse
21.	West Kenya Naitiri Sugar Company	12.0	Bagasse
Total		**163.8**	

Kenya has experienced a notable increase in the adoption of bioethanol as a clean cooking fuel, as demonstrated in figure 3.14.

In August 2022, the Authority issued biofuels guidelines outlining approval requirements for biofuels businesses in Kenya. These guidelines are designed to promote the safe use of biofuels and encourage adherence to relevant Standards in all aspects, including production, transportation, exportation, storage, packaging, and sale of bioethanol.

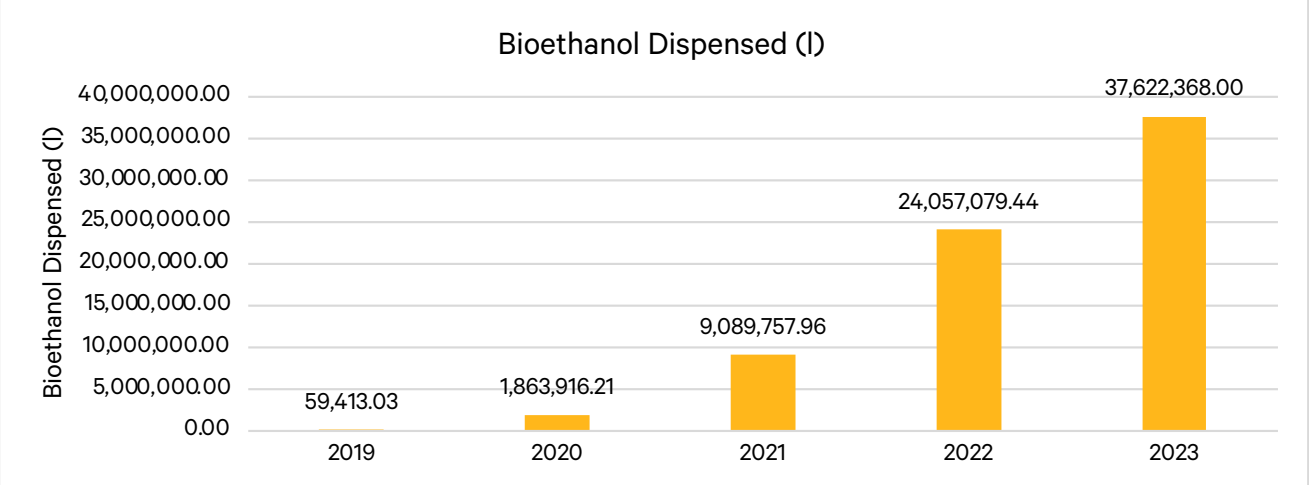


Figure 3.14: A trend in bioethanol consumption from 2019 to 2023

OTHER ENERGY SOURCES

This chapter outlines energy sources that play a key role in our energy landscape, despite their limited contribution to the electricity mix.

4.1 Electricity imports

Kenya has a 200 MW electricity supply agreement with Ethiopia Electricity Power Company (EEP) and has energy exchange contracts with Uganda Electricity Transmission Company Limited (UETCL). These contracts allow Kenya to import additional energy from its neighbors while increasing the interconnected grid's reliability. During the review period, Kenya imported 1,199.80 GWh of electricity, which constituted 8.77% of the country's energy mix. The highest import occurred in January 2024, totaling 142.25 GWh. Figure 4.1 illustrates the monthly energy imports for the period. The increase from December 2023 is attributed to the commencement of full commercial operations under the power purchase agreement between KPLC and EEP, which began on 1st December 2023.

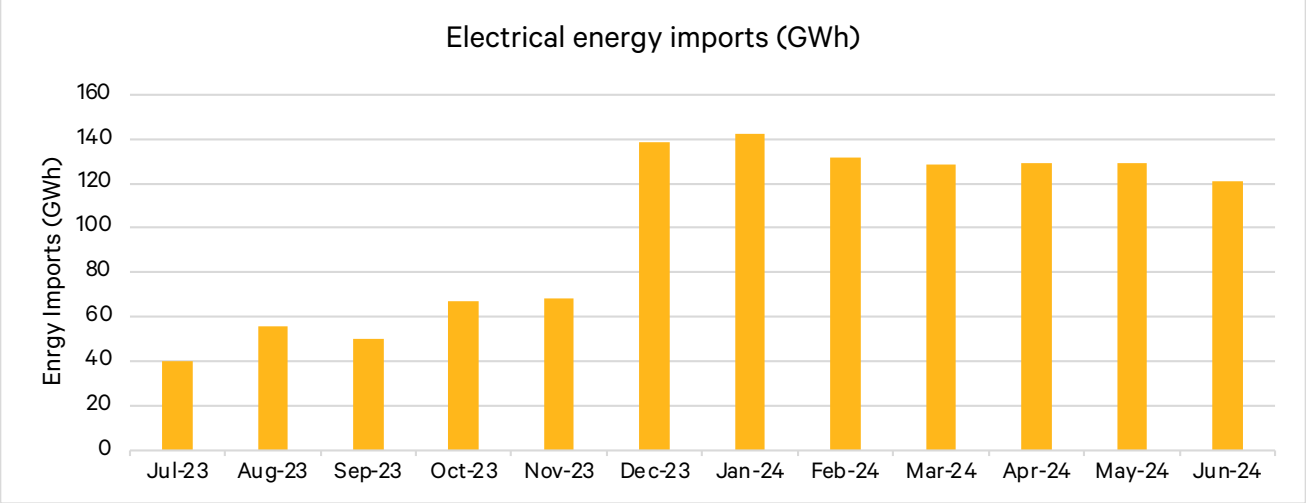


Figure 4.1: Monthly electrical energy imports during the financial year 2023/2024

Figure 4.2 shows the trend of energy imports from 2018 to 2024. During the review period, electricity imports rose by 86.28%, increasing from 644.07 GWh in the previous financial year to 1,199.80 GWh.

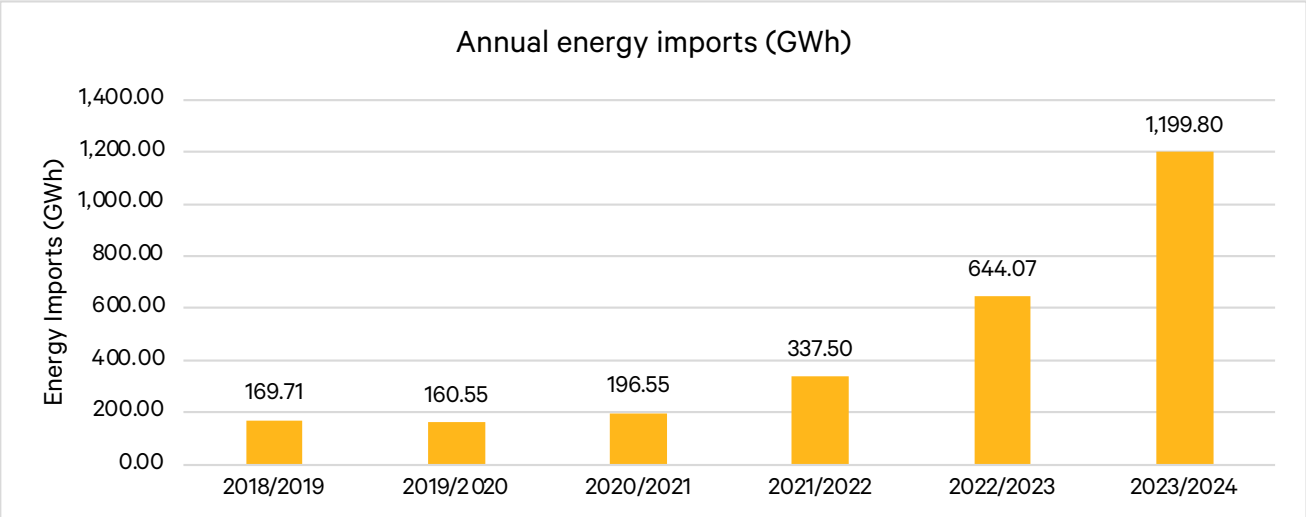


Figure 4.2: Electrical energy imports from the financial year 2018/19 and 2023/2024

4.2 Thermal energy

Kenya has an installed thermal capacity of 636.1 MW, comprising 512.8 MW from medium-speed diesel and 60 MW from gas turbines, 21.3 MW of captive capacity and 42 MW of off grid capacity. These thermal energy resources are used to meet peak demand, support voltage stability, and address the intermittency of variable renewable energy sources. During the review period, 1,127.11 GWh of energy was generated from thermal sources, accounting for 8.24% of Kenya's total energy demand. As shown on figure 4.3, the highest thermal energy generation occurred in October 2023, at 140.57 GWh. This figure declined after November 2023 due to improved hydro conditions and increased electricity imports.

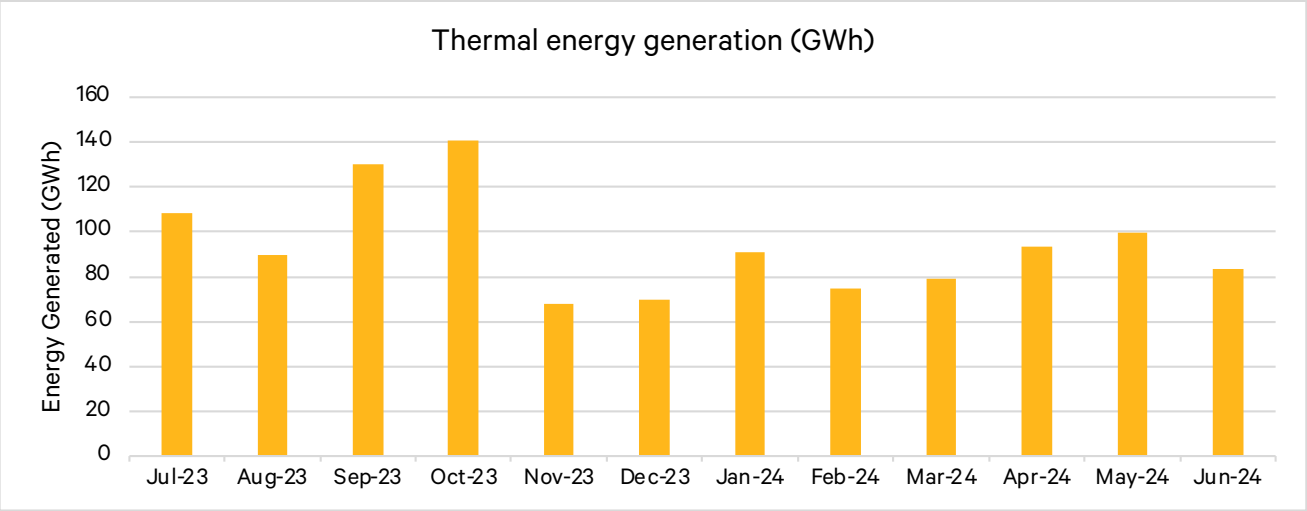


Figure 4.3: Monthly thermal energy generation during the financial year 2023/2024

The generation of thermal energy has been declining, as illustrated in figure 4.5. During the review period, thermal energy production fell by 19.23%, decreasing from 1,395.49 GWh in the previous year to 1,127.11 GWh.

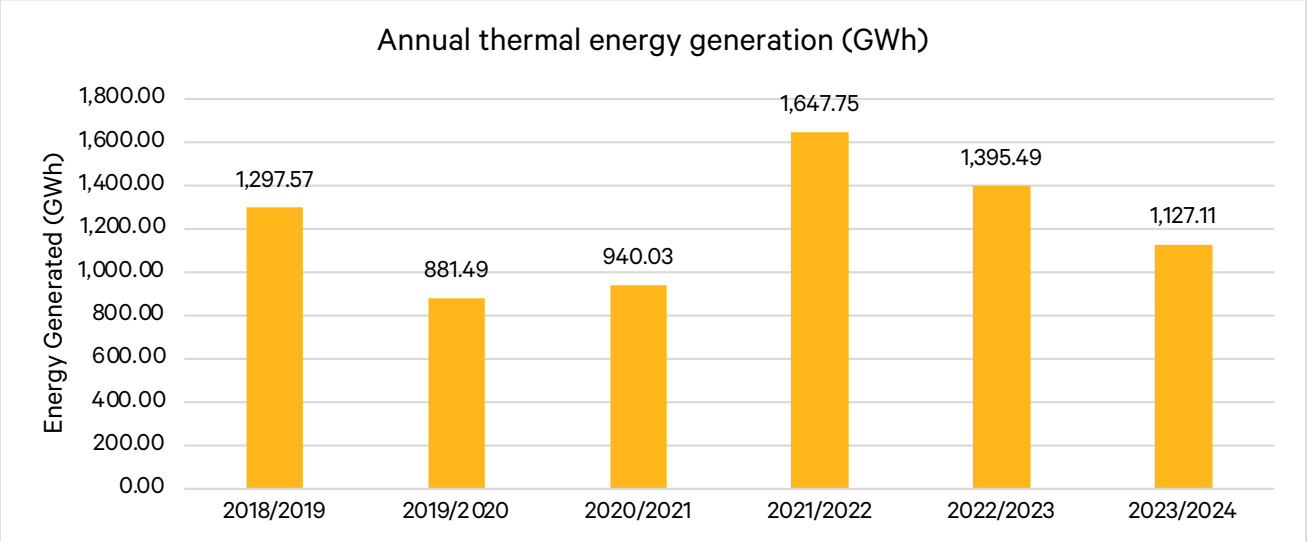


Figure 4.5: A trend in the thermal energy generated from the financial year 2018/2019 to 2023/2024

4.3 Coal

Coal is a black or brownish-black readily combustible sedimentary deposit that has a composition of more than 50% by weight and more than 70% by volume of carbonaceous material. It is formed from plant remains that have been compacted, hardened, chemically altered, and metamorphosed by heat and pressure over geologic time. The first documented occurrence of coal deposits in the country dates back to 1940's in the Mui Basin, Kitui while serious exploration efforts began in the late 2000s. In the course of prospecting for other minerals, coal was discovered in Kwale, Kilifi, Garissa, and Taita Taveta counties. From studies, prospective coal deposits may be found in Tana River, Tharaka Nithi, Machakos, Makueni, Isiolo, Marsabit and Baringo counties. The country has delineated thirty-one (31) coal blocks for coal exploration. The Kitui basin is matured in terms of exploration and has had 62 exploratory wells drilled that confirmed the existence of coal.

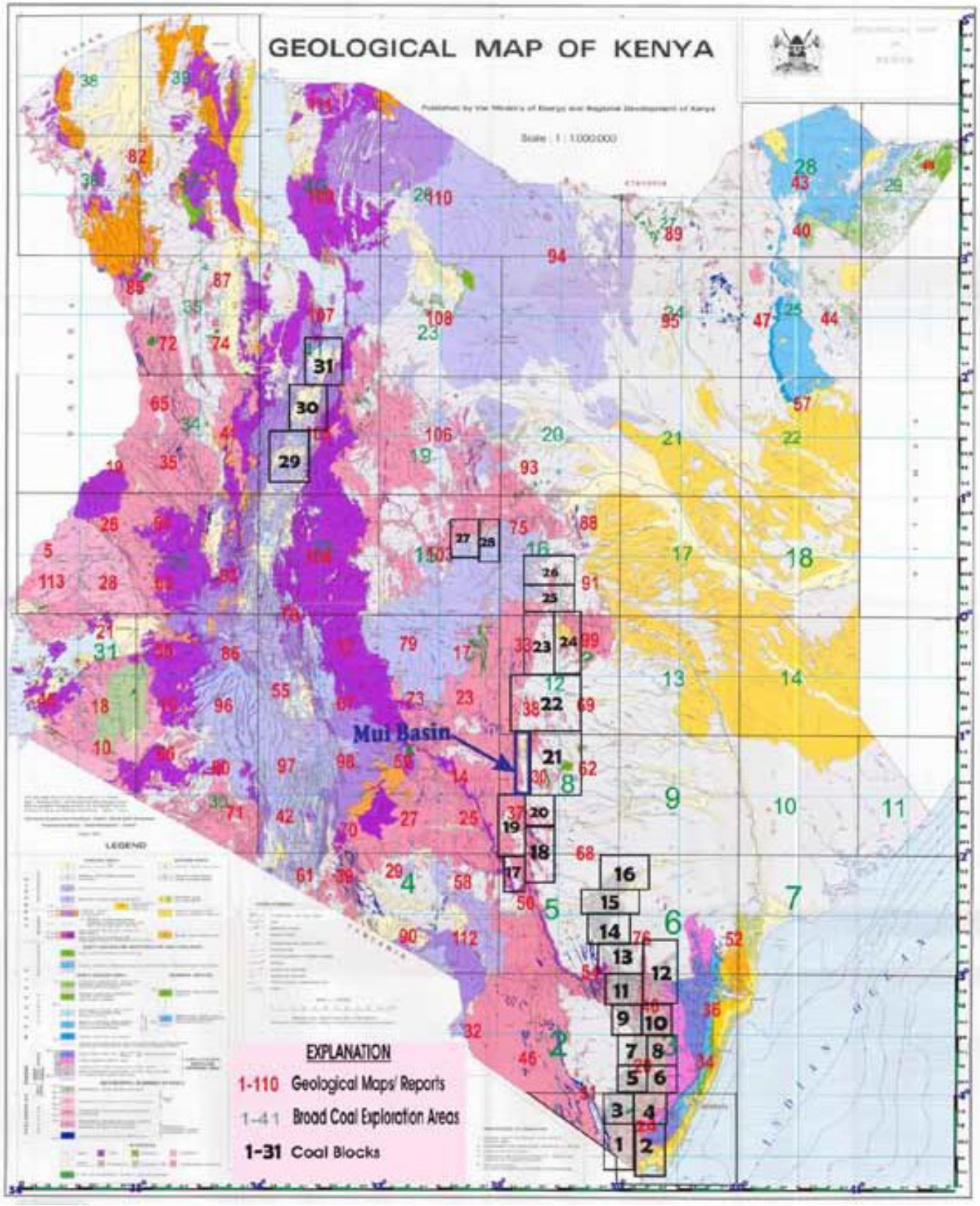


Figure 4.6: A map of coal exploration blocks in Kenya

Kenya is currently a net importer of coal which is primarily used in high-heat industrial processes and cogeneration notably, steelmaking, and manufacturing industries majorly cement and ceramic.

ENERGY EFFICIENCY

Promoting energy efficiency and conservation is instrumental in reducing both financial and environmental burdens associated with energy consumption. The Authority has instituted two key regulations to foster energy efficiency: the Energy (Energy Management) Regulations, 2012 and the Energy (Appliances' Energy Performance and Labelling) Regulations, 2016.

The Energy (Energy Management) Regulations primarily target commercial and industrial facilities with an energy consumption threshold of at least 180,000 kWh of thermal and electrical energy. These regulations mandate designated facilities to conduct energy audits and implement the recommended measures arising from these audits. In the period under review, a total of 284 facilities underwent energy audits, comprising 98 small, 124 medium, and 62 large energy consumers. These audits projected substantial energy savings amounting to 459.46 GWh from the implementation of recommended energy conservation measures.

The Energy (Appliances' Energy Performance and Labelling) Regulations, 2016 have a primary focus on improving the energy efficiency of electrical appliances. These regulations mandate that both imported and locally manufactured refrigerators, non-ducted air conditioners, fluorescent lamps, and motors undergo testing to verify compliance with the relevant Kenyan Standard. Importers or manufacturers of these regulated appliances are eligible to receive a registration certificate upon demonstrating their compliance with these regulations. During the period under review, the Authority issued registration certificates for 197 refrigerator models and 82 Air conditioner models.

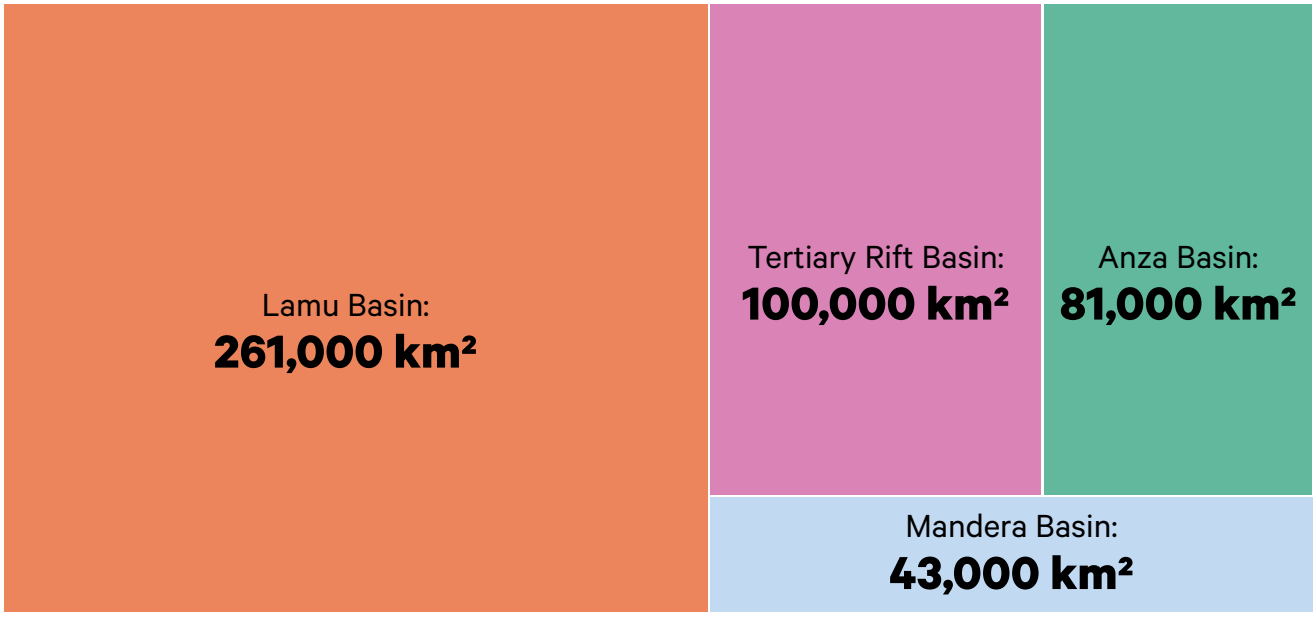
PETROLEUM SUB-SECTOR

This section summarizes the performance of the upstream, midstream, and downstream petroleum segments, covering factors such as supply, domestic consumption, pipeline transport logistics, pricing, and competition.

6.1. Upstream Subsector

Upstream petroleum operations encompass all activities related to the exploration, development, production, separation and treatment, storage, and transportation of petroleum up to the agreed delivery point. In Kenya, exploration activities are ongoing both onshore and offshore.

To date, ninety-four (94) exploration wells have been drilled by various oil exploration companies across four sedimentary basins. These basins cover a total surface area of 485,000 km² and are divided as follows:



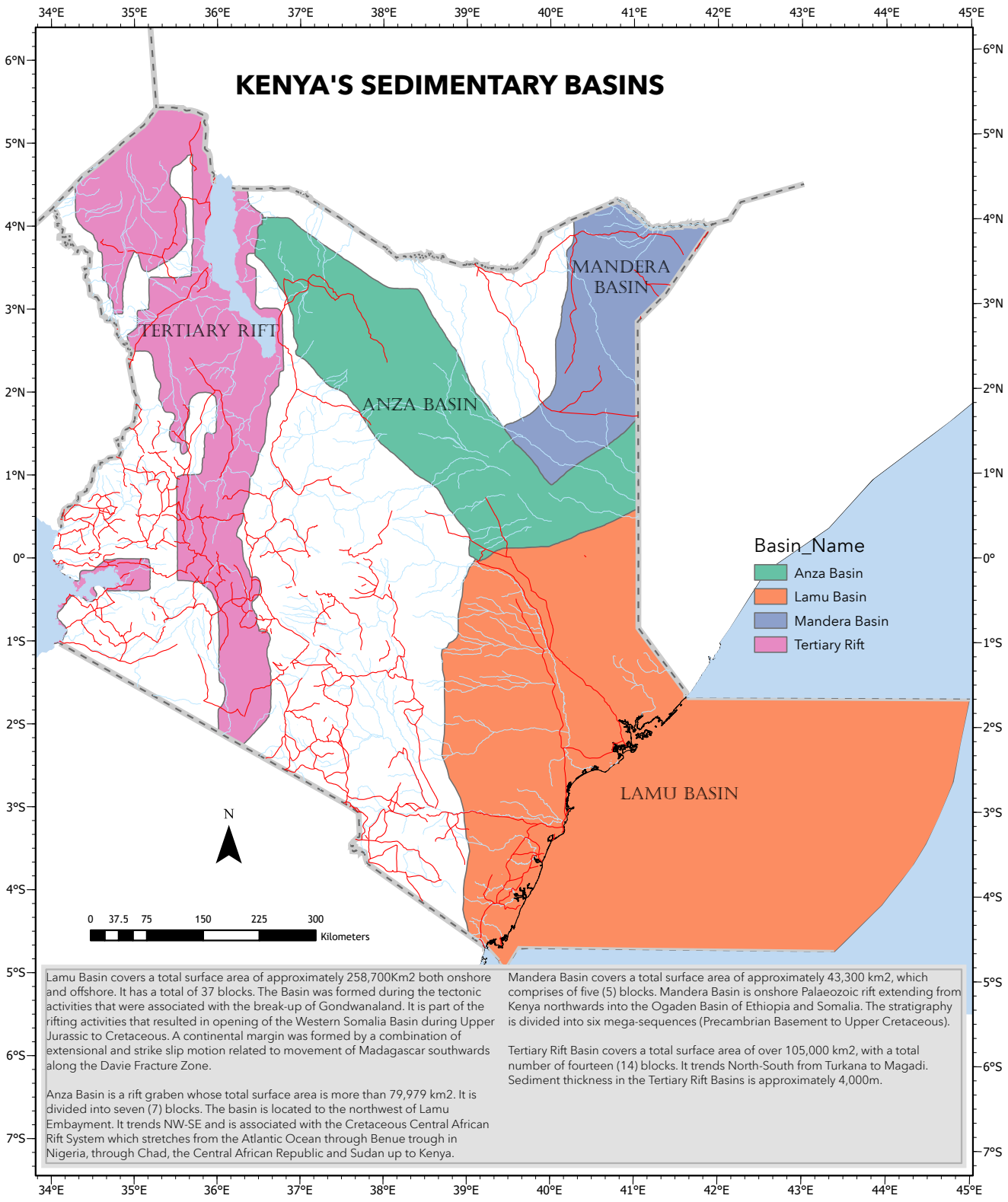


Figure 6.1: A map of sedimentary basins

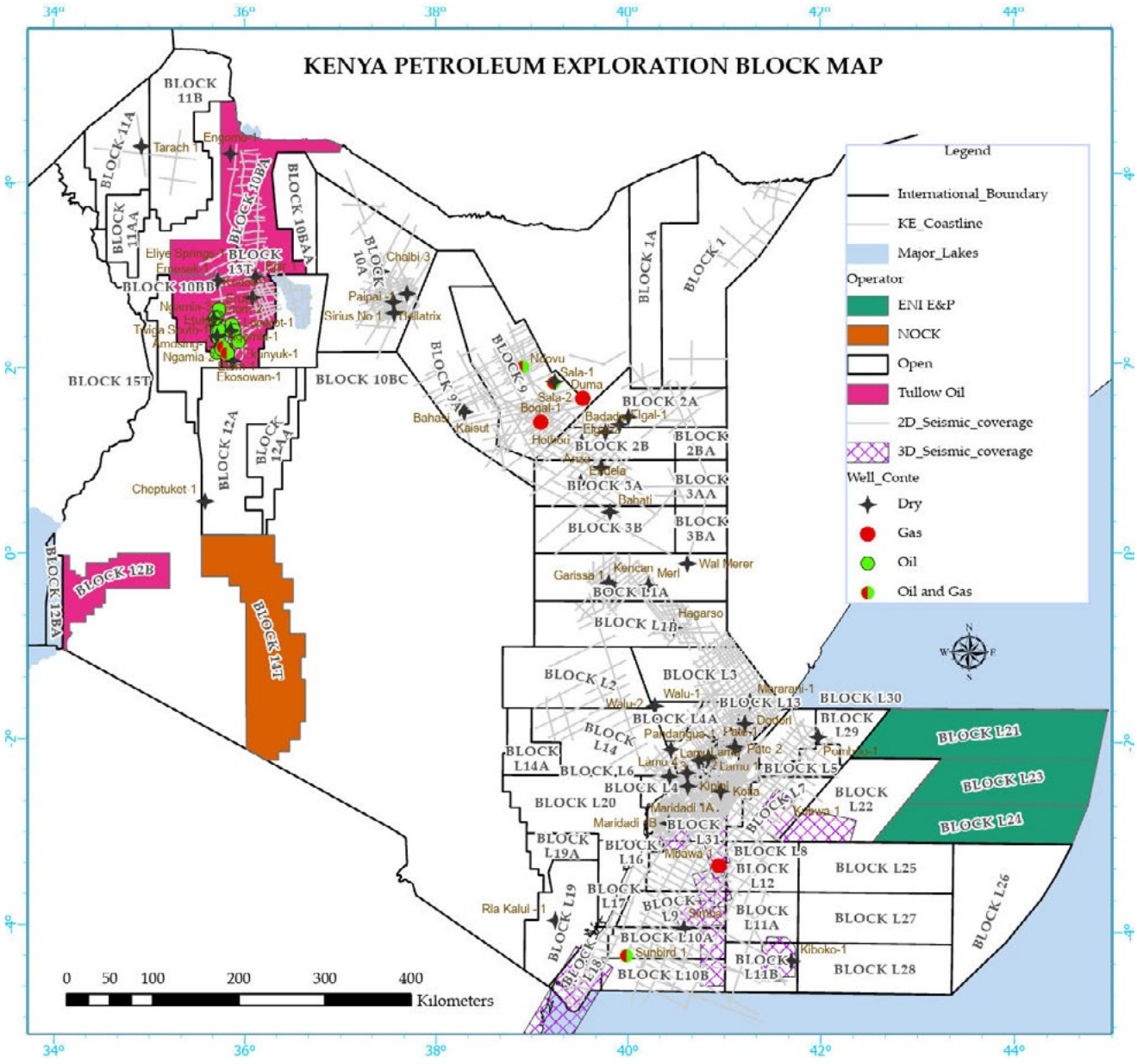


Figure 6.2: Map of petroleum exploration blocks

The Kenyan government is currently evaluating the Final Field Development Plan (FDP) submitted by Tullow Oil. This comprehensive FDP outlines a strategic roadmap for the development of resources within Block 10BB and 13T license areas, as well as additional appraisal and exploration activities aimed at optimizing resource extraction within the designated development zone.

The development strategy revolves around a well-structured, phased infrastructure-driven approach, commencing with the most sizable and technically advanced reservoirs. In order to achieve the production of first oil and support the initial production plateau, the Ngamia, Amosing, Twiga, and Ekales fields, collectively referred to as "NEAT," will be developed within the first five years of the production period.

The development aims to tap into a discovered Stock-Tank-Oil-Initially-in-Place ("STOIIP") range spanning from 1,620 to 4,573 million barrels and anticipates the recovery of an estimated 240 to 971 million barrels of contingent resources over the course of the 25-year contract period.

6.2 Midstream and downstream subsector

6.2.1 Petroleum supply

Kenya is a net importer of petroleum products, a process that is coordinated by the Ministry of Energy and Petroleum. Petroleum products imported into the country are primarily received through the Kipevu Oil Terminal (KOT) I and Kipevu Oil Terminal (KOT) II jetties. KOT I handles vessels with a capacity of up to 85,000 DWT, whereas KOT II can accommodate vessels of up to 120,000 DWT. The two jetties are connected to key receiving terminals: Kipevu Oil Storage Facility (KOSF), Vitol Tank Terminal International Kenya (VTTI), and Kenya Petroleum Refineries Limited (KPRL). Additionally, the Shimanzi Oil Terminal (SOT) handles slightly smaller vessels with a capacity of up to 18,000 DWT.

The imported products are stored in bulk storage facilities within the port for distribution through the pipeline or road. Table 6.1 shows the capacity of bulk storage facilities within the port of Mombasa.

Table 6.1: Capacity of bulk storage facilities within the Mombasa port

No.	Name of Facility	Capacity (Cubic meters)	Location
1.	Kenya Pipeline Company Limited	326,230	Kipevu
2.	Kenya Petroleum Refineries Limited	264,438	Changamwe
3.	GAPCO Kenya Limited	105,000	Shimanzi
4.	VTTI Kenya Limited	111,057	Kipevu
5.	Vivo Energy Kenya Limited	100,000	Shimanzi
6.	Kenya Petroleum Refineries Limited (Port reitz)	100,000	Kipevu
7.	Mbaraki Bulk Terminal Limited	36,000	Mbaraki
8.	Total Energies Marketing PLC (MJT)	44,460	Shimanzi
9.	Ola Energy Kenya Limited	42,200	Shimanzi
Total Capacity		**1,129,385**	

During the financial year under review, 9,059,597.15 cubic meters were imported, representing a 2.10% decline from the previous year. This decrease is attributed to a reduction in domestic demand. Figure 6.3 presents a trend of imported volumes from financial year 2020/2021 to 2023/2024.

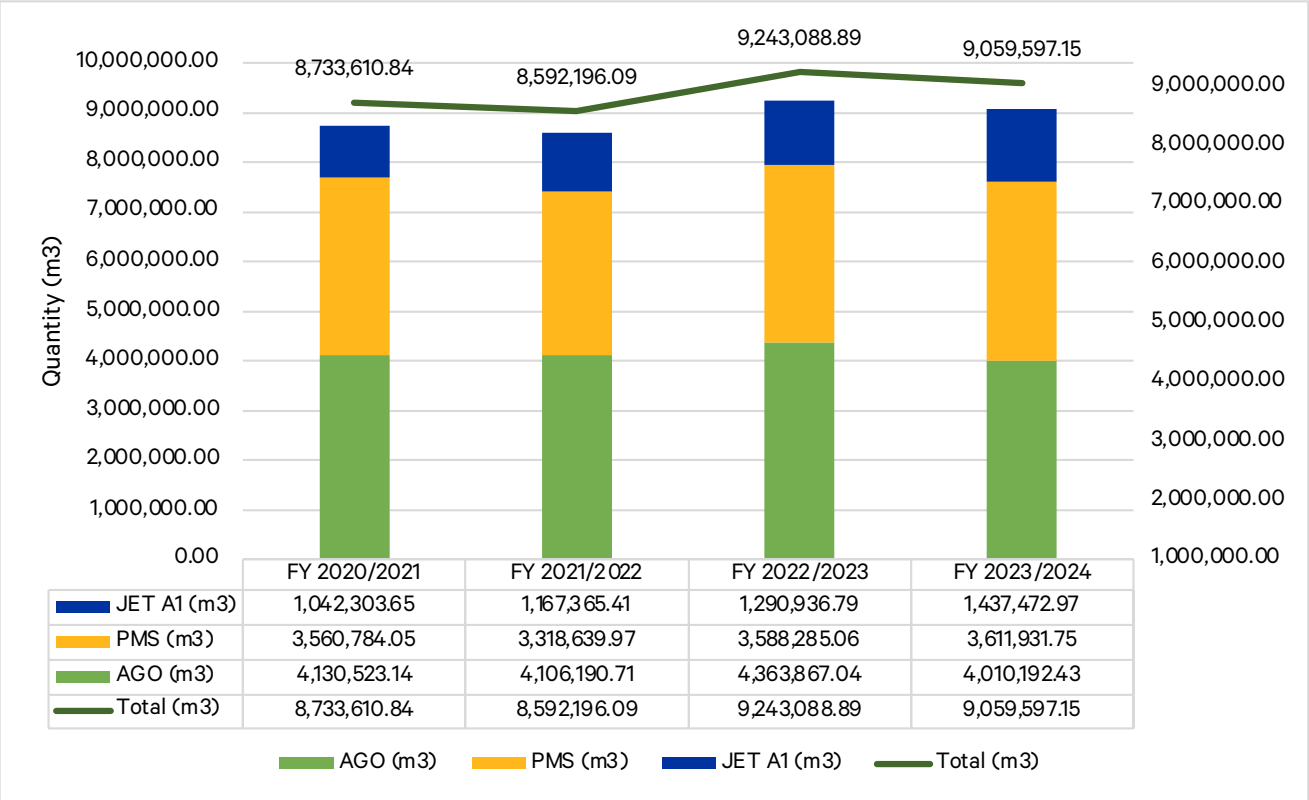


Figure 6.3: A trend of import volumes from the financial year 2020/2021 to 2023/2024

Overall, the share of volumes designated for domestic market consumption accounted for 55.01% of the total import volume. The monthly trends in imports is shown in figure 6.4.

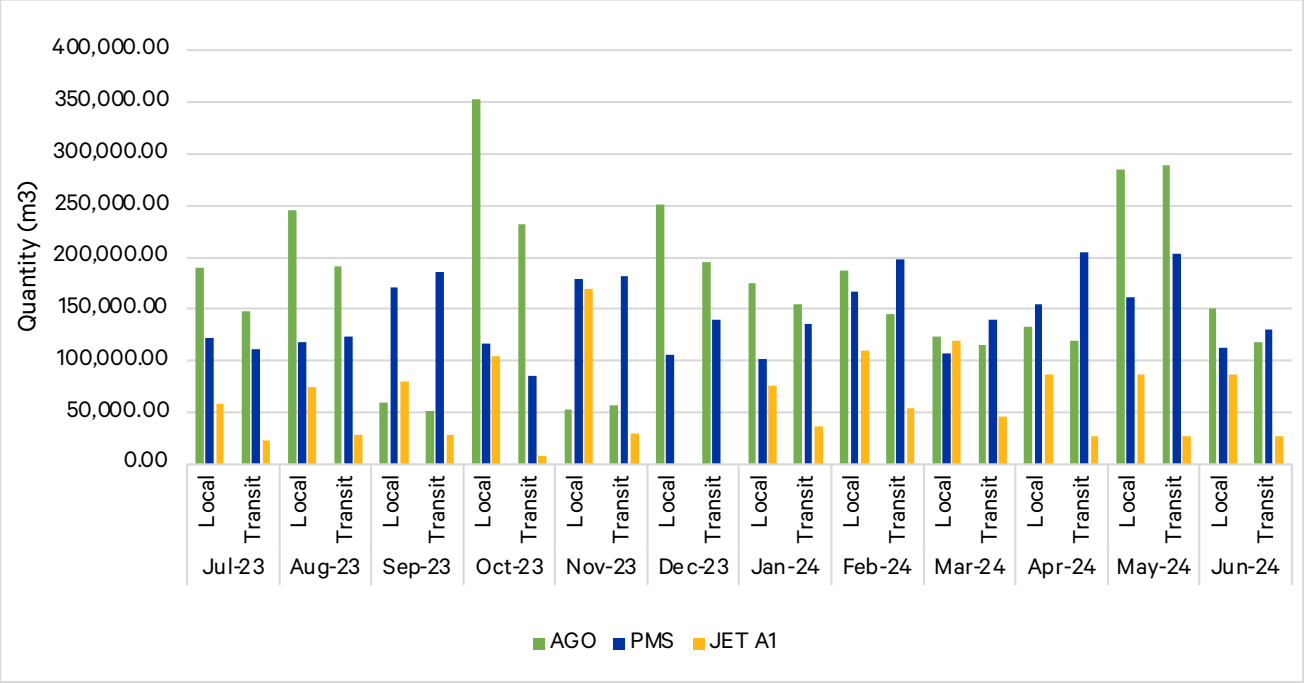


Figure 6.4: Monthly trend in imports during the financial year 2023/2024

6.2.2 Petroleum demand

6.2.2.1 Domestic Petroleum Consumption

Domestic demand for petroleum products decreased by 2.10%, totaling 5,460,436.82 cubic meters compared to the previous financial year. Figure 6.5 shows the trajectory of demand during the year under review while 6.6 shows the demand from the financial year 2020/2021 to 2023/2024.

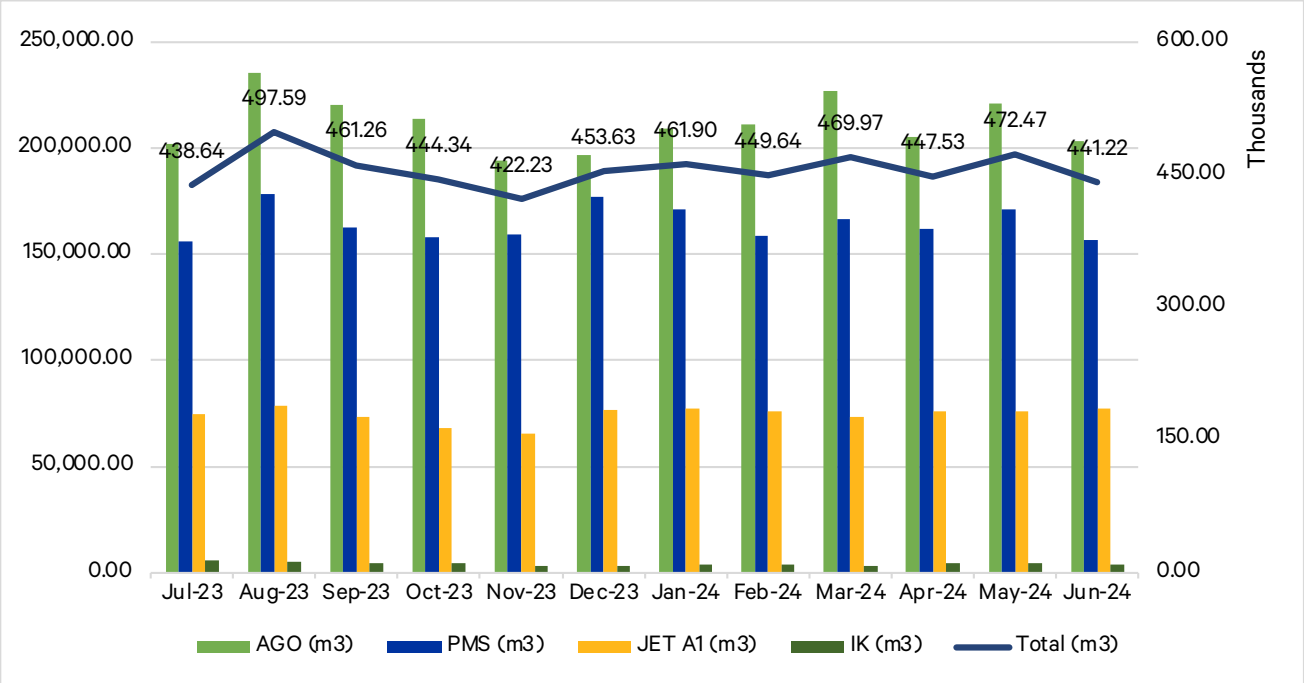


Figure 6.5: Monthly trend in the consumption of petroleum products during the financial year 2023/2024

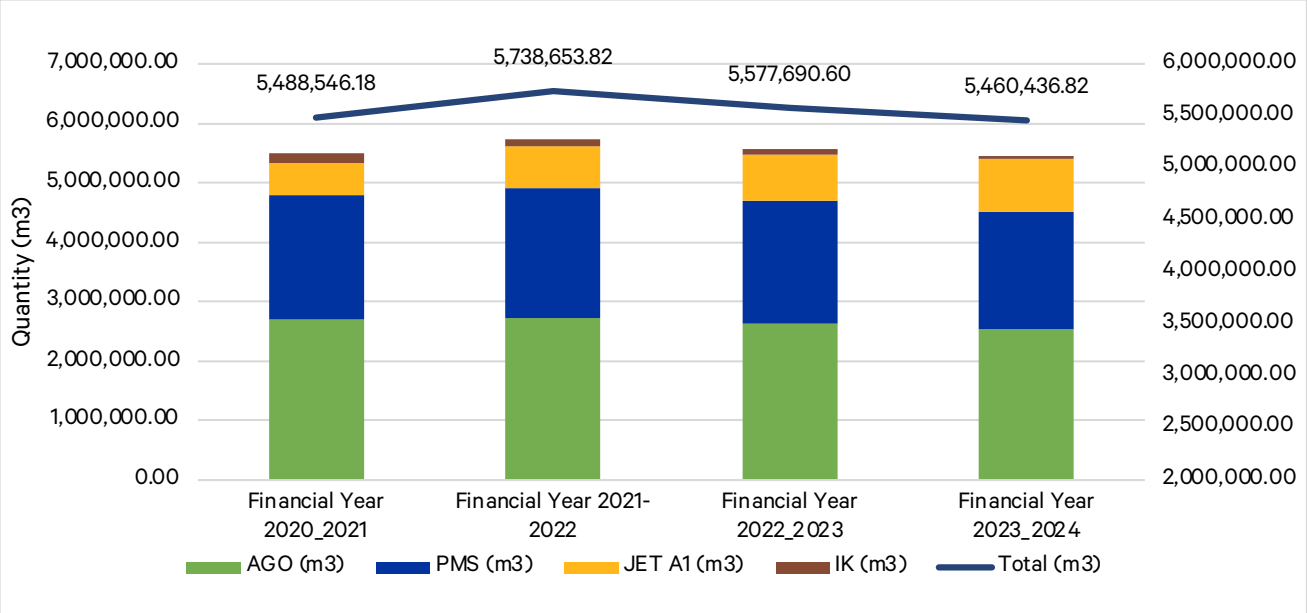


Figure 6.6: A trend of petroleum demand from the financial year 2020/2021 to 2023/2024

6.2.2.2 Pipeline Throughput

Imported petroleum products are primarily stored and distributed by the Kenya Pipeline Company (KPC) to bulk storage facilities within the country. Table 6.2 shows the pipeline infrastructure and design flow rates.

Table 6.2: Pipeline infrastructure and design flow rates

Pipeline	Pipeline Diameter (Inches)	Pipeline length (km)	Flow rate (m3/hr)
Nairobi – Sinendet – Eldoret pipeline (Line 2)	8/6	325	220
Sinendet – Kisumu pipeline (Line 3)	6	121	140
Nairobi – Eldoret pipeline (Line 4)	14	325	311
Mombasa – Nairobi pipeline (Line 5)	20	450	1,300
Sinendet – Kisumu pipeline (Line 6)	10	121	280

The overall pipeline throughput statistics for the period under review are indicated in Figure 6.7.

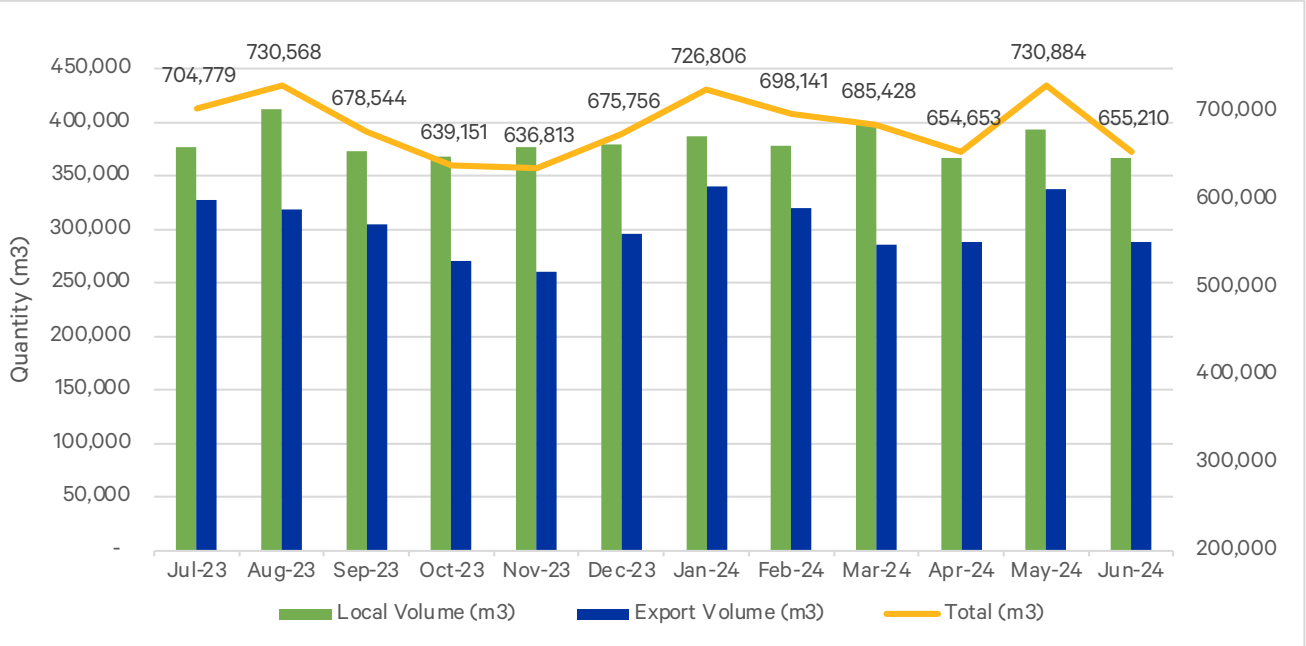


Figure 6.7: Monthly pipeline throughput from during the financial year 2023/2024

Figure 6.8 shows the pipeline throughput from the financial year 2021/2022 to 2023/2024.

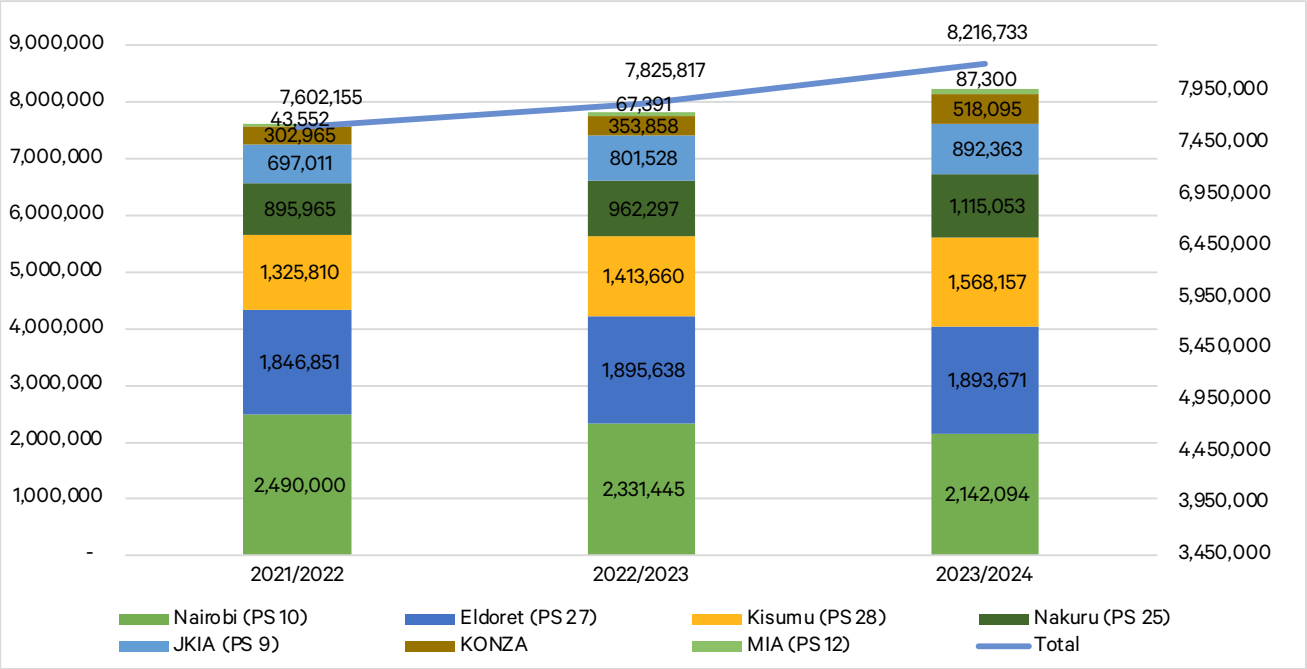


Figure 6.8: A trend of pipeline throughput from the financial year 2021/2022 to 2023/2024

As noted in figure 6.8, throughput increased due to higher volumes directed towards the export market, as evidenced by increased volumes in the Kisumu, Nakuru, and Konza depots. Additionally, there was a rise in throughput of JET fuel at both the Mombasa International Airport (MIA) and the Jomo Kenyatta International Airport (JKIA). However, throughput decreased at the Eldoret and Nairobi depots.

6.2.3 Petroleum Prices

6.2.3.1 International crude oil prices

International crude oil prices are influenced by demand and supply, geopolitics and other market forces. Murban Crude Oil recorded a minimum price of 75.59$/Bbl in August 2023 and a peak price of 93.92 $/Bbl in December 2023.

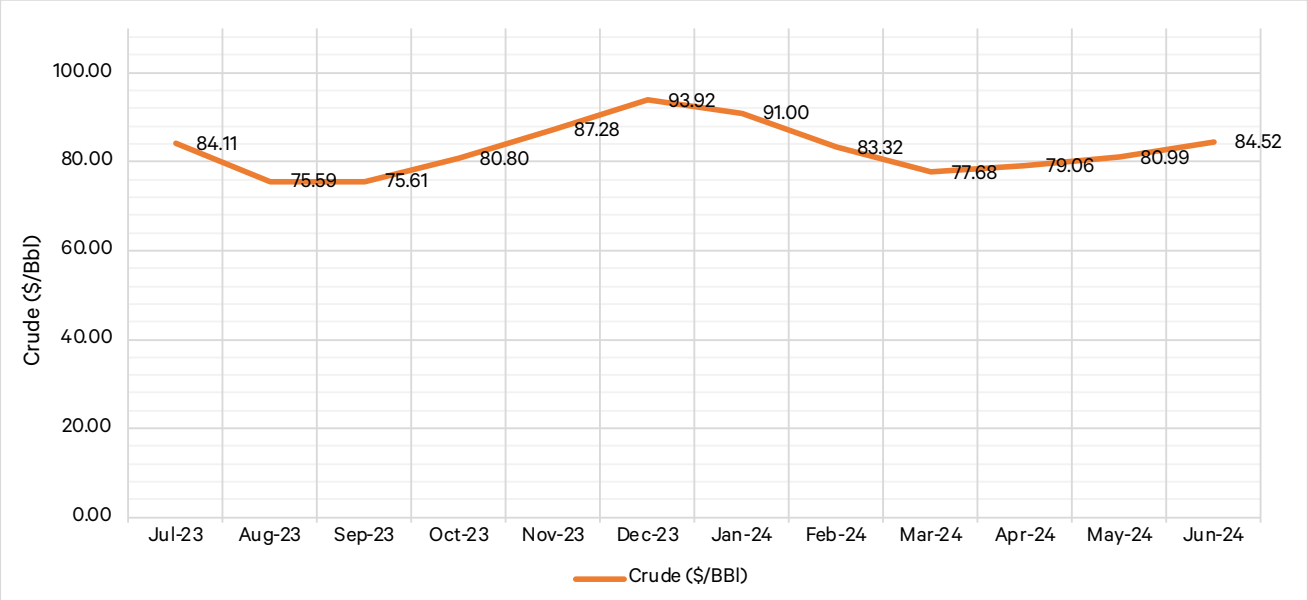


Figure 6.9: A trend in Murban Crude oil prices during the financial year 2023-2024

6.2.3.2 Local Retail Petroleum Prices

Fuel prices in Kenya are determined by factors such as landed costs, distribution costs, taxes and levies, demurrage costs and margins accrued by Oil Marketing Companies (OMCs). The Authority computes these costs and publishes monthly prices for super petrol (PMS), Diesel (AGO) and Illuminating Kerosene (IK) on the 14th day of every month. Figure 6.10 shows the trend of the Nairobi pump prices for the period July 2023 to June 2024.

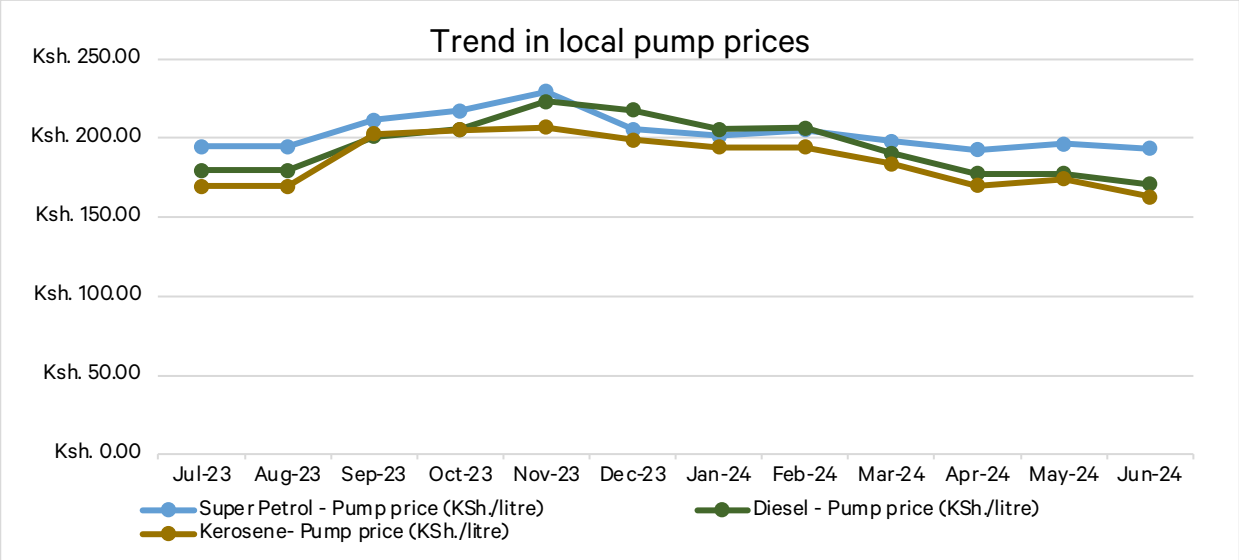


Figure 6.10: A trend in the local petroleum pump prices during the financial year 2023/2024 with Nairobi used as an example

6.2.4 Competition in the Petroleum Sector

There were 140 registered Oil-Marketing Companies (OMCs) as at June 2024. These companies market petroleum products; Diesel, Petrol and Dual Purpose Kerosene.

Table 6.3 presents the market shares of the OMCs during the review period.

Table 6.3: A summary of OMCs market share as at June 2023

OMC	Local sales volume for imported products (m3)	% Share
Vivo Energy Kenya Limited	1,215,150.75	22.24%
Rubis Energy Kenya Plc	850,194.85	15.56%
TotalEnergies Marketing Kenya Plc	822,808.79	15.06%
Ola Energy Kenya Limited	324,154.00	5.93%
Be Energy Limited	241,791.22	4.43%
Galana Energies Limited	147,921.27	2.71%
Stabex International Ltd	130,792.21	2.39%
Oryx Energies Kenya Limited	127,531.40	2.33%
Lake Oil Limited	118,569.99	2.17%
Tosha Petroleum (Kenya) Limited	118,503.00	2.17%
Petro Oil Kenya Limited	112,218.00	2.05%
Hass Petroleum Kenya Limited	108,725.00	1.99%
Gapco Kenya Limited	89,271.50	1.63%
Dalbit Petroleum Limited	81,841.68	1.50%
Astrol Petroleum Company Limited	66,632.93	1.22%
Gulf Energy Holdings Limited	62,345.44	1.14%
Lexo Energy Kenya Limited	56,169.45	1.03%
Sahara Energy Limited	54,101.33	0.99%
Towba Petroleum Company Limited	52,049.82	0.95%
Green Wells Energies Limited	49,033.20	0.90%
Aftah Petroleum(K)Ltd	47,201.86	0.86%
Fossil Supplies Limited	44,584.00	0.82%
Luqman Petroleum Limited	33,973.09	0.62%
Ramji Haribhai Devani Limited	33,002.00	0.60%
Riva Petroleum Dealers Limited	30,888.65	0.57%
East African Gasoil Limited	26,192.71	0.48%
Trinity Energy (K) Limited	25,400.75	0.46%
Zacosia Trading Limited	25,214.60	0.46%
Others	367,601.76	6.70%

The HHI for the downstream petroleum subsector stood at 0.1079, a slight increase from the previous financial year's figure of 0.1037,

signifying increased dominance of the top three players controlling approximately 52% of the market. The Authority continues to monitor competition within the sector to promote equity and fairness.

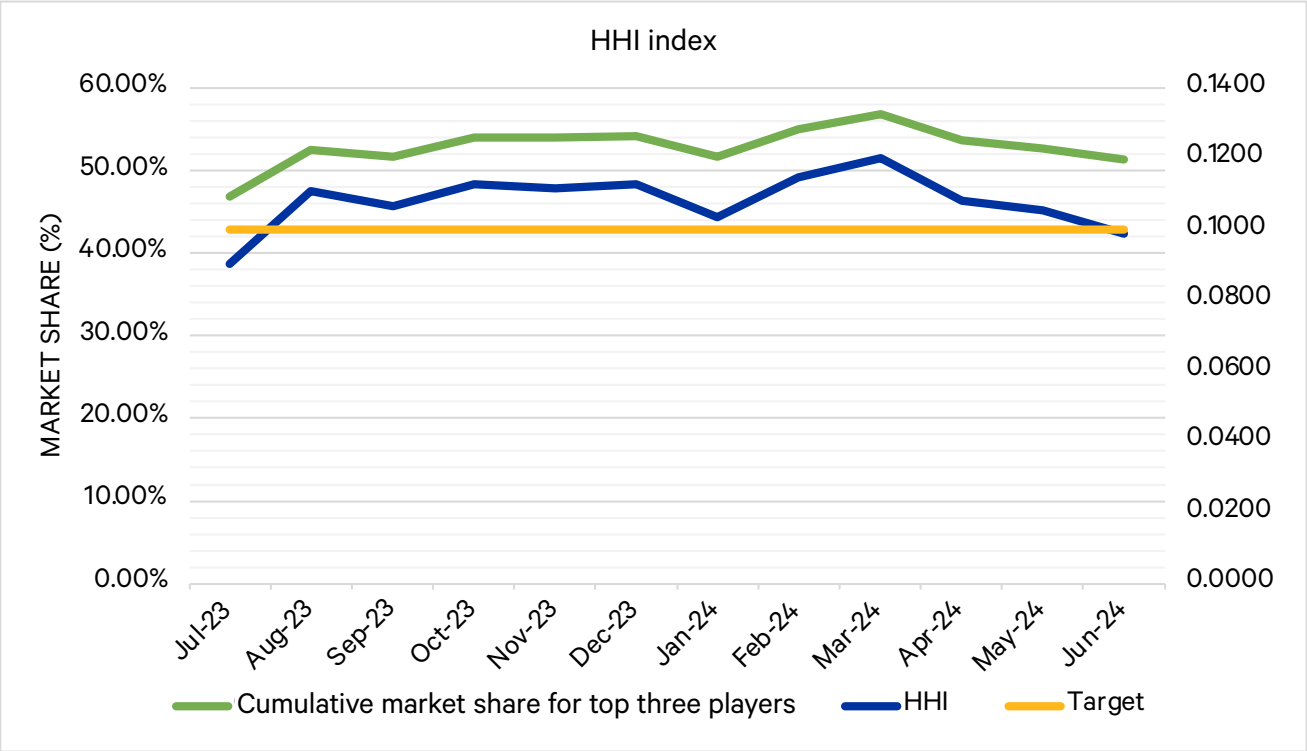


Figure 6.11: A trend in HHI index for downstream petroleum during the financial year 2023/2024

6.3 Liquefied Petroleum Gas (LPG)

6.3.1 LPG Supply

LPG is imported into the country primarily through the Mombasa port and via border points at Namanga, Oloitokitok, Taveta, and Lunga Lunga from Tanzania. Figure 6.12 illustrates the distribution of imports by route.

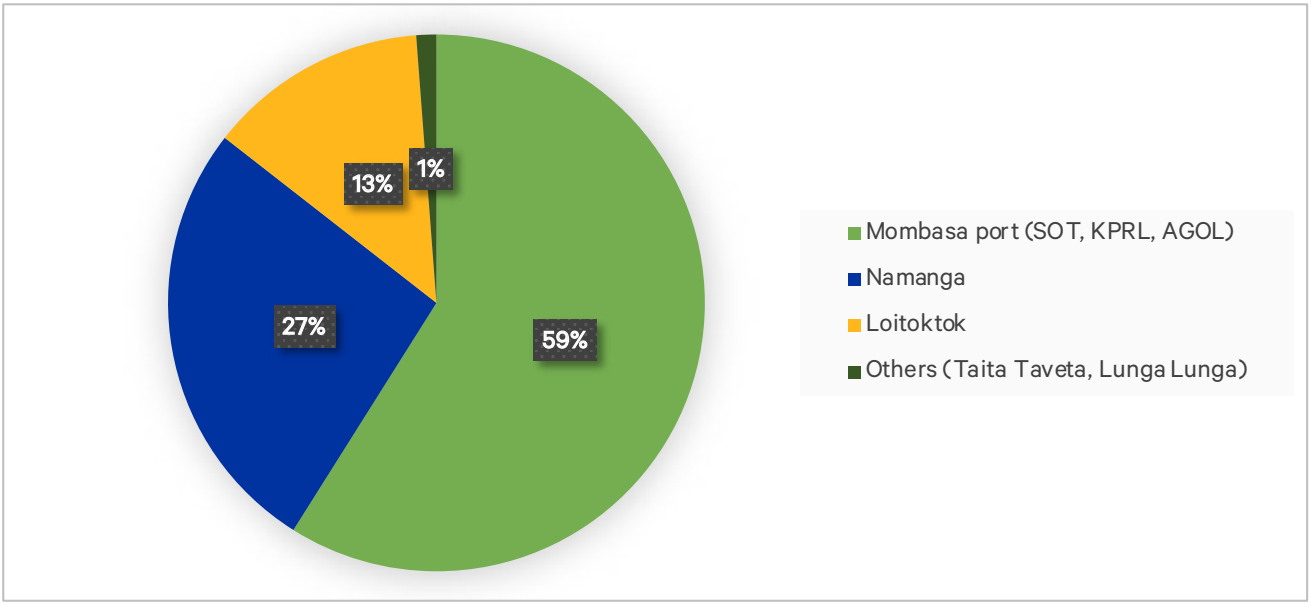


Figure 6.12: LPG imports distribution routes as at June 2024

There are two (2) jetties, Shimanzi Oil Terminal (SOT) and the African Gas and Oil Company Limited (AGOL), which are used to receive LPG into bulk storage facilities within Mombasa. AGOL has the largest bulk storage capacity of 25,000 metric tonnes (Mt). SOT connects to 5 LPG bulk storage facilities as indicated in table 6.4.

Table 6.4: Bulk LPG storage facilities connected to the SOT

No.	Facility	Capacity (metric tons)	Location
1.	Kenya Petroleum Refineries Limited	1,195	Changamwe
2.	Vivo Energy Kenya Limited	50	Shimanzi
3.	Hashi Energy Limited	400	Changamwe
4.	Total Energies Marketing Kenya PLC	240	Changamwe
5.	OLA Energy Kenya Limited	450	Shimanzi
	Total Capacity	**2,335**	

The total LPG import receiving infrastructure capacity within Mombasa currently stands at approximately 27,335 Mt.

There are 134 LPG bulk storage and filling plants distributed in various parts of the country as indicated in Table 6.5.

Table 6.5: Bulk LPG storage and filling facilities in the hinterland

No.	Region	Combined Capacity (metric tons)	No. of Facilities
1.	Nairobi	3,203	44
2.	Rift valley	1,026	24
3.	Central	1,008	28
4.	Coast	665	13
5.	Eastern	441	14
6.	Nyanza	387	7
7.	North Eastern	108	4
8.	Western	104	5
	Total	**6,942**	**134**

6.3.2 LPG demand

Demand for Liquefied Petroleum Gas (LPG) recorded an increase in 2023 to 360,594Mt from 333,830Mt in 2022. The increase can be attributed to government policy to promote use of clean energy such as zero rating taxes on LPG through the Finance Act of 2023, which led to reduction in the price of the commodity.

The trend in the consumption of LPG is illustrated in the figure 6.13.

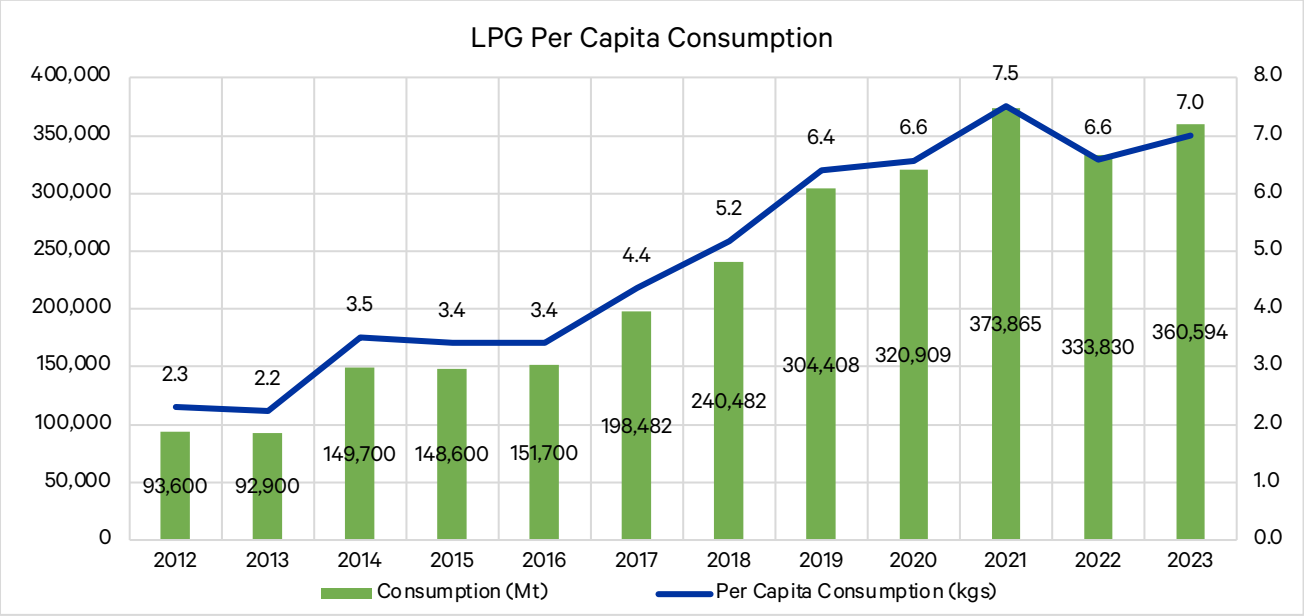


Figure 6.13: A trend in the consumption of LPG and per capita consumption of LPG since 2012

Figure 6.14 shows the monthly trend in LPG consumption.

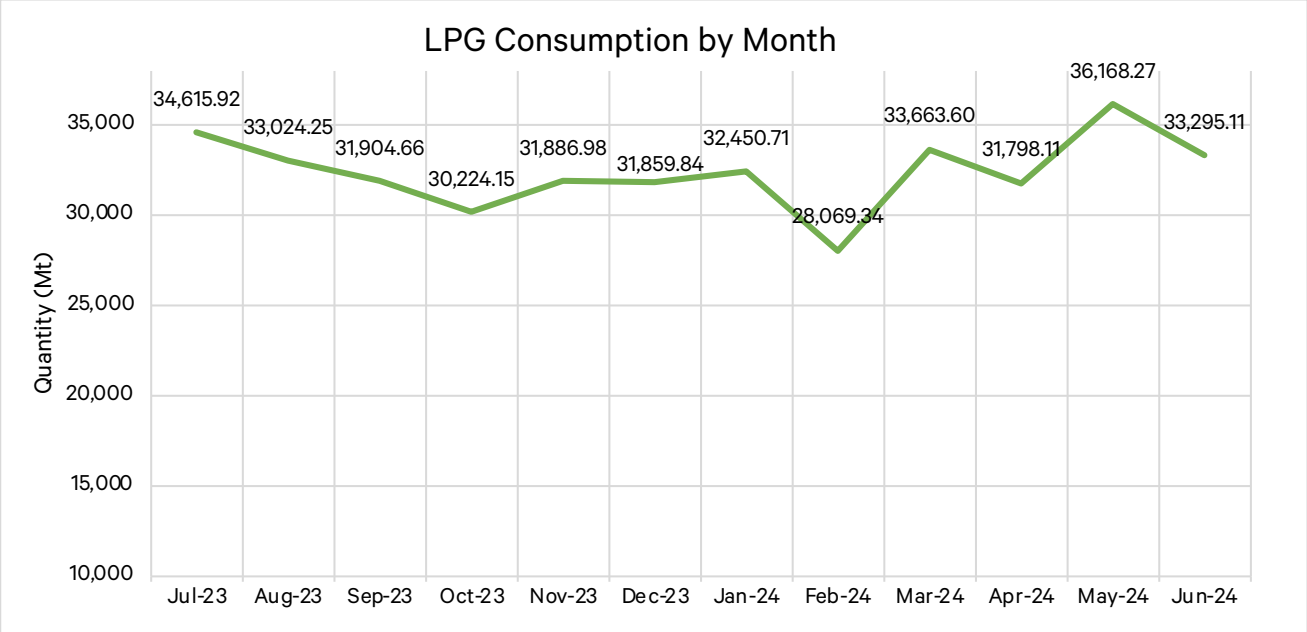


Figure 6.14: Monthly LPG consumption trend during the financial year 2023/2024

KENYA'S ENERGY BALANCE

7.1 Structure of the Energy Balance for Kenya

Energy balance is a method used to track the flow of energy within a geographical area in a given period usually one year. The structure of the energy balance provides an overview of how energy is produced, transformed, distributed, and consumed within the country. It outlines the quantities of electricity generated, biomass produced, petroleum products and coal imported, energy lost and consumption by different sectors. To compare the energy flow of the different fuels, a common accounting unit, Tonne of Oil Equivalent (TOE) is used.

7.2 Total Primary Energy Production

In 2023, the country's total primary energy production was 18,229.70 Ktoe, an increase from 18,117.75 Ktoe in 2022. The majority of this energy was derived from biomass and various renewable sources, including hydro, geothermal, solar, wind, and bagasse. Biomass dominated the energy mix, accounting for 94.7% of the total indigenous energy production. The remaining 5.3% was contributed by renewable energy sources. Figure 7.1 illustrates the contribution of each primary energy source.

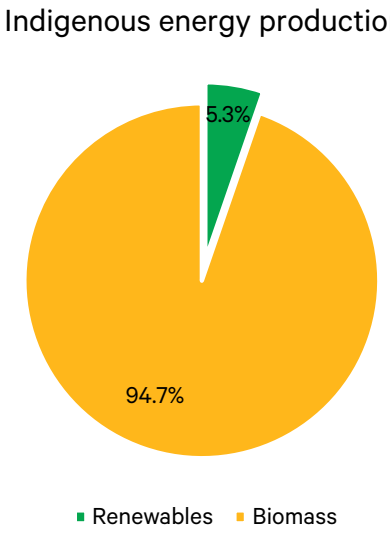


Figure 7.1: Total primary energy production in Kenya

Figure 7.2 presents a trend of the country's indigenous energy production from 2021 to 2023.

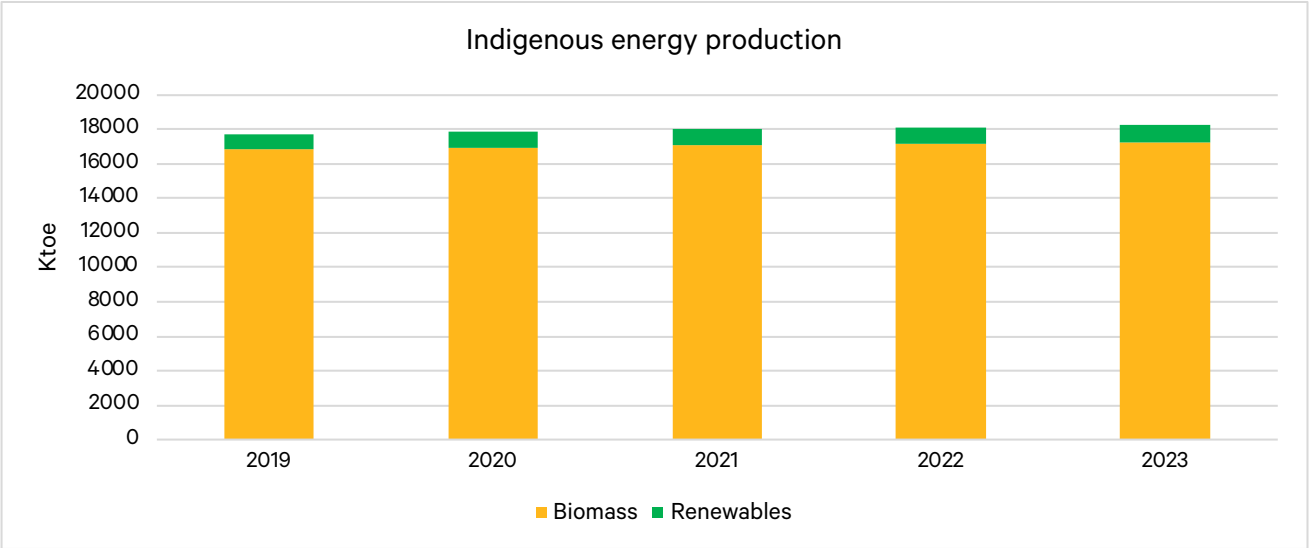


Figure 7.2: A summary of the indigenous energy production from 2021 to 2023

7.3 Total Energy Supply

The total energy supply in the country comprises of both primary supply and imports which stood at 23,710.16 Ktoe in 2023, a slight decline by 1.65% from 24,107.70 Ktoe in 2022. Of the total energy supply, 71.3% was from biomass and waste, 20.8% from petroleum products, 3.7% from coal and coke and 4.2% from renewable electricity sources. Figure 7.3 show the contribution of each energy source to the total energy supply in the country.

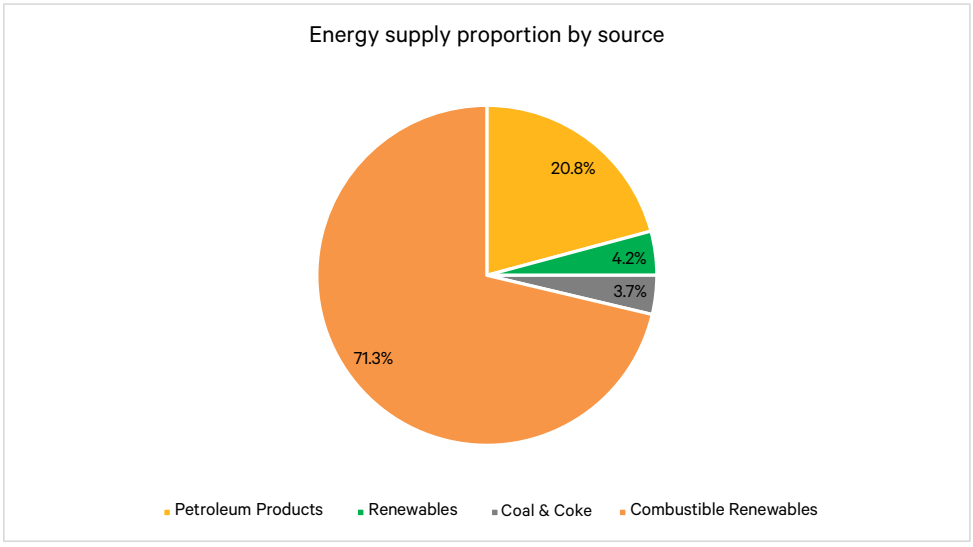


Figure 7.3: Contribution of energy sources to the total energy supply in 2023

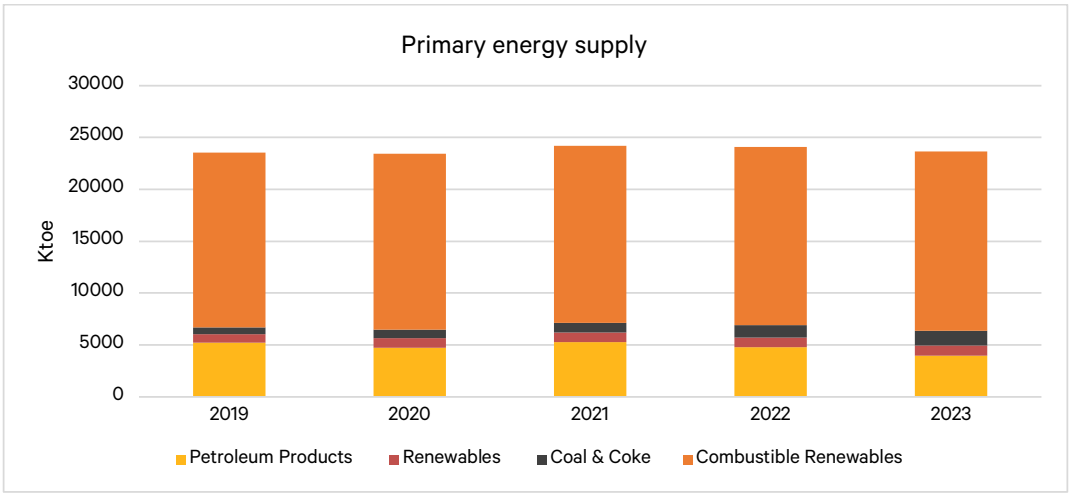


Figure 7.4: Primary energy supply from 2019 to 2023

7.4 Final energy consumption

The final energy consumption increased at an average annual growth rate of 0.3% from 17,756.99 Ktoe in 2019 to 18,015.18 Ktoe in 2023. Between 2022 and 2023, the final energy consumption increased by 534.66Ktoe, from 17,480.52 Ktoe in 2022 to 18,015.18Ktoe in 2023 representing an increase of 3.1%. Figure 7.5 presents the trend in the total final energy consumption from 2019 to 2023.

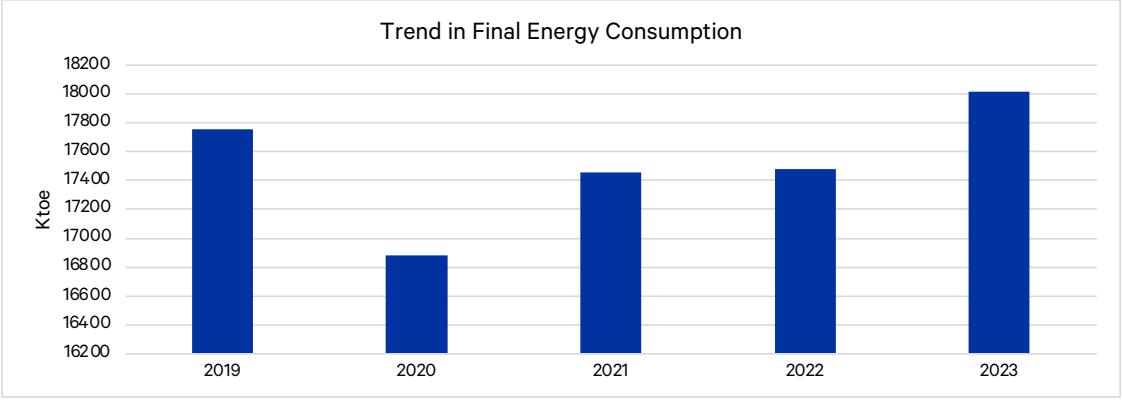


Figure 7.5: A trend in final energy consumption from 2019 to 2023

Notably, the residential sector accounted for a significant portion, representing 69% of the energy consumed within the country. The transport and industrial sectors followed with 18% and 8% consumption respectively, while the other sectors contributed to the remaining 5%. Figure 7.6 presents the final energy consumption by sectors.

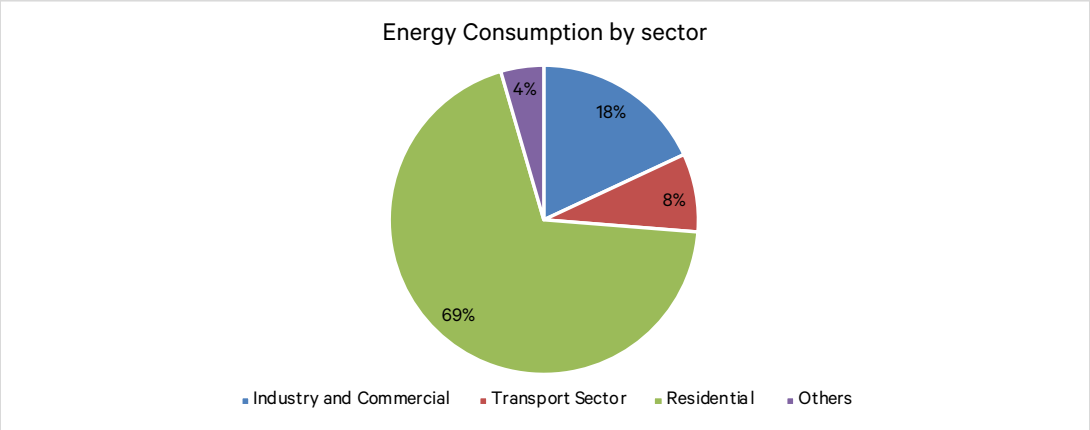


Figure 7.6: Final energy consumption by sector in 2023

An overall analysis of the energy balance shows that the total indigenous production, primary energy supply and total final energy consumption have generally been increasing with the exception of the year 2020 which recorded a decline due to the impact of the COVID-19 pandemic and the year 2023 which recoded a small decline in final energy supply. This overall increase can be attributed to both population growth and the expansion of the economy. Figure 7.7 shows the trend of the total indigenous production, total energy supply and total energy consumption in the country from 2009 and 2023.

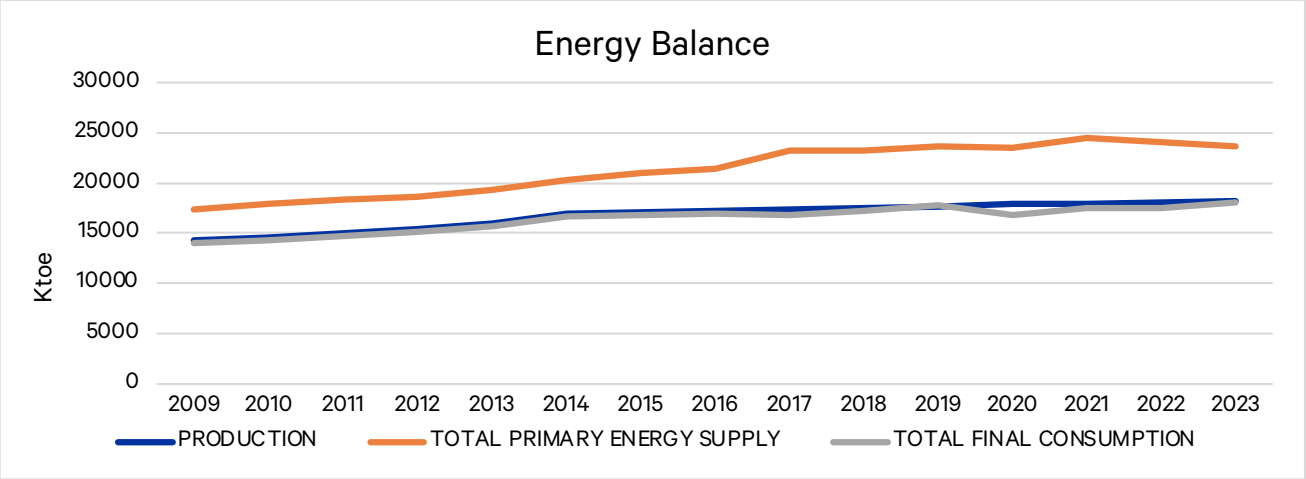


Figure 7.7: A trend in the energy balance from 2009 to 2023

CONSUMER PROTECTION

The Authority's mandate in consumer protection focuses on promoting end-user welfare in relation to the provision of energy and petroleum products and services. This chapter discusses the Authority's consumer protection activities, which include licensing, fuel quality monitoring, LPG compliance monitoring, investigation of accidents and incidents, as well as public education and advocacy.

8.1 Licensing

8.1.1 Petroleum and LPG licensing

The Authority grants licenses, permits or certificates to any persons intending to undertake the importation, exportation, bulk storage or transportation of petroleum products. Table 8.1 summarizes the licenses issued in the financial year under review.

Table 8.1: A summary of Petroleum and LPG licenses issued in the financial year 2023/2024

Type of licence	No. of licences issued
Driver certification	9,254
Transport of petroleum products(Except LPG) by Road	2,037
Export and wholesale of petroleum products(Except LPG)	1,136
Retail of LPG in cylinders	883
Retail of petroleum products (except LPG)	660
Transport of LPG in cylinders	290
Transport of LPG in bulk by road	239
Storage & wholesale of LPG in cylinders	215
Import, export and wholesale of petroleum products (Except LPG)	151
Transport of Jet-A1	128
Storage & filling of LPG in cylinders	114
Import, export and wholesale of LPG in bulk	57
Export & wholesale of Jet-A1	50
Export and wholesale of LPG in bulk	40
Storage of petroleum products(Except LPG)	40
Import, export and wholesale of Fuel Oil	17
Import, export and wholesale of Bitumen	16
Bunkering of petroleum products (Except LPG)	14
Storage & filling of LPG in bulk	6
Storage of LPG in bulk	4
Import of lubricants	3
Reticulation of LPG	1
Retail of LPG in cylinders via smart meters	1
Total	**15,356**

The permits for the construction of petroleum facilities issued during the review period are detailed in Table 8.2.

Table 8.2: Number of petroleum and gas permits issued during the financial year 2023/2024

Permit Category	Permits issued
Petroleum retail dispensing station	57
LPG storage and filling facility	23
LPG storage depot	1
Pipeline	2
Fuel consumer site	2
Autogas dispensing station	9
LPG reticulation system	1
Total	**95**

8.1.2 Electrical and Renewable Energy Licensing

The Authority is responsible for licensing individuals and contractors engaged in electrical and solar photovoltaic system projects. The licensing process serves the critical purpose of ensuring that those involved in these activities possess the necessary competence, thus enhancing the functionality and safety of installations. Moreover, it guarantees that products and services conform to the required standards.

During the year under review, 479 electrical workers and 442 electrical contractors were licensed. Table 8.3 shows comparisons in the number of licences issued from the financial year 2021/2022 to 2023/2024 for each category.

Table 8.3: A comparison of electrical workers' certificates and contractors' licences issued from the financial year 2021/2022 to 2023/2024

Licence Class	Number of Issued Electrical Workers' Certificates			Number of Issued Electrical Contractors' Licences		
	FY2023/24	FY2022/23	FY2021/22	FY2023/24	FY2022/23	FY2021/22
C2	242	205	325	161	195	107
C1	141	171	202	128	152	124
B	49	36	79	73	41	43
A1	41	52	52	73	52	46
A2	6	5	9	7	6	4
Total	**479**	**469**	**667**	**442**	**446**	**324**

The cumulative number of issued electrical contractor licences and electrical worker certificates as at 30th June 2024 was 3,570 and 7,329 respectively. Figure 8.1 shows the growth in the number of electrical worker and contractor licensees.

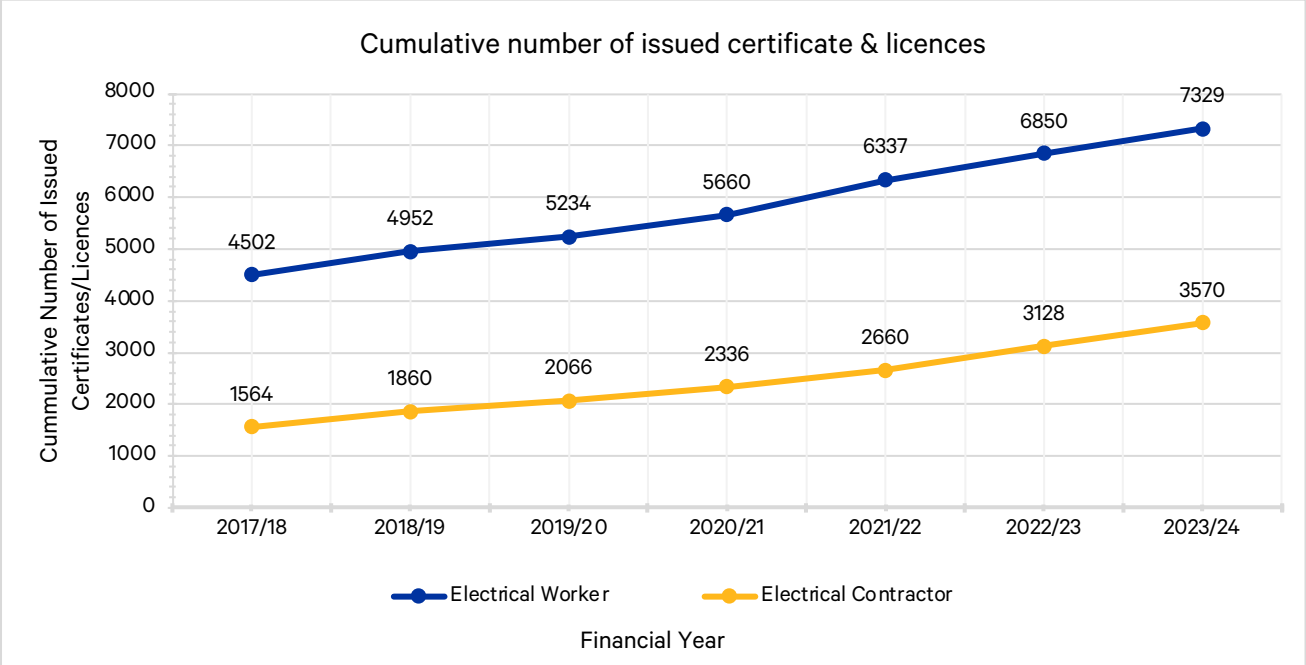


Figure 8.1: Trend in the electrical worker and contractor licences issued from the financial year 2017/2018 to 2023/2024

Additionally, licenses were granted to 154 solar PV technicians, 355 solar PV contractors/manufacturers and importers. Figure 8.2 shows the cumulative number of licenses issued between the financial year 2018/2019 and 2023/2024.

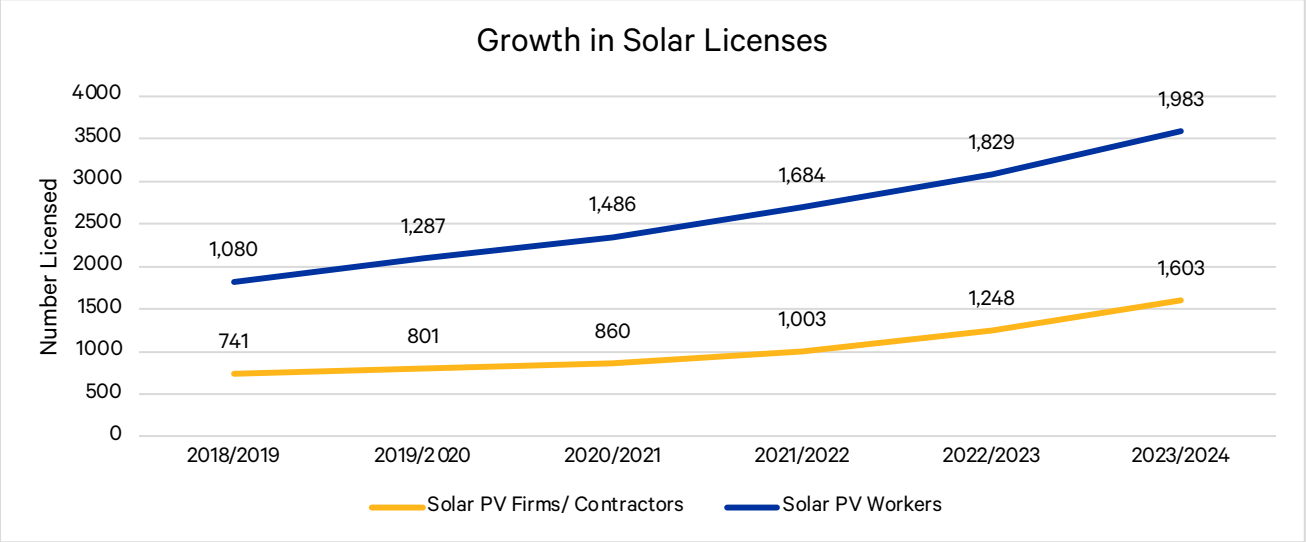


Figure 8.2: Cumulative number of solar PV technicians and company licenses issued between the financial year 2018/2019 and 2023/2024.

8.1.3 Electrical appliances certification and energy efficiency

The Energy (Appliances' Energy Performance and Labelling) Regulations, 2016 primarily aim to enhance the energy efficiency of electrical appliances. These regulations require that both imported and locally manufactured refrigerators, non-ducted air conditioners, fluorescent lamps, and motors undergo testing to ensure compliance with the relevant standards.

Importers and manufacturers of these regulated appliances can obtain a registration certificate by demonstrating compliance with the regulations. It's important to note that a registration certificate for a specific appliance model remains valid until the associated standard is revised.

In the 2023/2024 financial year, the Authority processed registration certificates for 82 air conditioner models and 197 household refrigerator models. Market compliance surveillance confirmed that all retailers were compliant.

The Energy (Energy Management) Regulations, 2012 provide for the designation of energy-consuming facilities. The Authority published this designation, setting the threshold at an annual energy consumption of 180,000 kWh. Designated facilities are required to conduct energy audits every three years. To support these audits, the Authority licenses energy auditors and energy audit firms. During the review period, the Authority issued 7 energy auditor licenses and 5 energy audit firm licenses.

8.2 Fuel Quality Compliance

The Authority monitors the quality of fuel for local consumption and export through a process known as Fuel Marking. The process entails adding small amounts of a distinct identifier (referred to as the marker), commonly a bio-chemical liquid, to fuel products in order to identify the presence of fuel adulterants or fuels intended for export.

Overall, the total volume of all export products and domestic kerosene marked across all loading facilities increased by 11.7%, rising to 3,609,915,872 liters compared to 3,230,659,914 liters marked in the previous financial year. Of this, export/duty-free motor fuels accounted for 3,561,548,557 liters (98.7%), while domestic kerosene accounted for 48,367,315 liters (1.3.%).

Export volume marked during the financial grew by 13.5% compared to the previous financial year. The significant growth of export volumes was attributed to factors such as distinctive logistic cost efficiencies on the Kenya transit corridor, robust infrastructure and a robust fuel marking and monitoring program which guarantees product integrity.

The domestic kerosene volumes marked declined by 48.2%. The significant decline was attributed to the reduced demand for industrial and domestic use, as more consumers are transitioning to alternative fuels, the ongoing imposition of the anti-adulteration levy, EPRA's monitoring of kerosene released from all terminals and a robust fuel marking and monitoring technology that effectively detects fraud.

During the period under review, the Authority conducted 27,174 sample tests in 5,946 petroleum sites across the country. When selecting sample sites, the Authority takes into account various factors, including the need for nationwide coverage, intelligence gathered through surveillance efforts, and feedback from the public. Of the tested sites, 5,867, representing 98.67% of the stations, were found to be compliant. However, seventy-nine (79) sites, or 1.33%, were deemed non-compliant, and appropriate penalties were imposed in accordance with relevant legislation.

Additionally, the Authority received 85 complaints regarding fuel quality. Tests were conducted at the affected sites, and the complaints were resolved.

8.3 LPG Compliance

The Authority performs routine compliance inspections at LPG facilities to assess their adherence to regulatory requirements, operational safety standards, maintenance of plant and equipment, emergency preparedness, and risk management.

During the review period, the Authority conducted 108 bulk inspections of LPG road tankers, achieving an average compliance level of 80.50%. Additionally, it carried out 1,680 inspections at wholesale and retail sites, with an average compliance level of 52.45%, and inspected 2 LPG cylinder manufacturing and revalidation plants, which had an average compliance of 73.05%. The Authority also performed 66 audits and 66 re-evaluation inspections of LPG storage and filling facilities across the country.

The Authority is committed to enhancing compliance levels through public education, advocacy and enforcement at these facilities.

8.4 Accident and Incident Investigation

The Authority is mandated under the Energy Act, 2019 to undertake investigation of accidents within the Energy and Petroleum Sector.

8.4.1 Petroleum & Gas Accident and Incidents

Figure 8.3 provides a graphical representation of the accidents/incidence occurrence over the last 6 financial years.

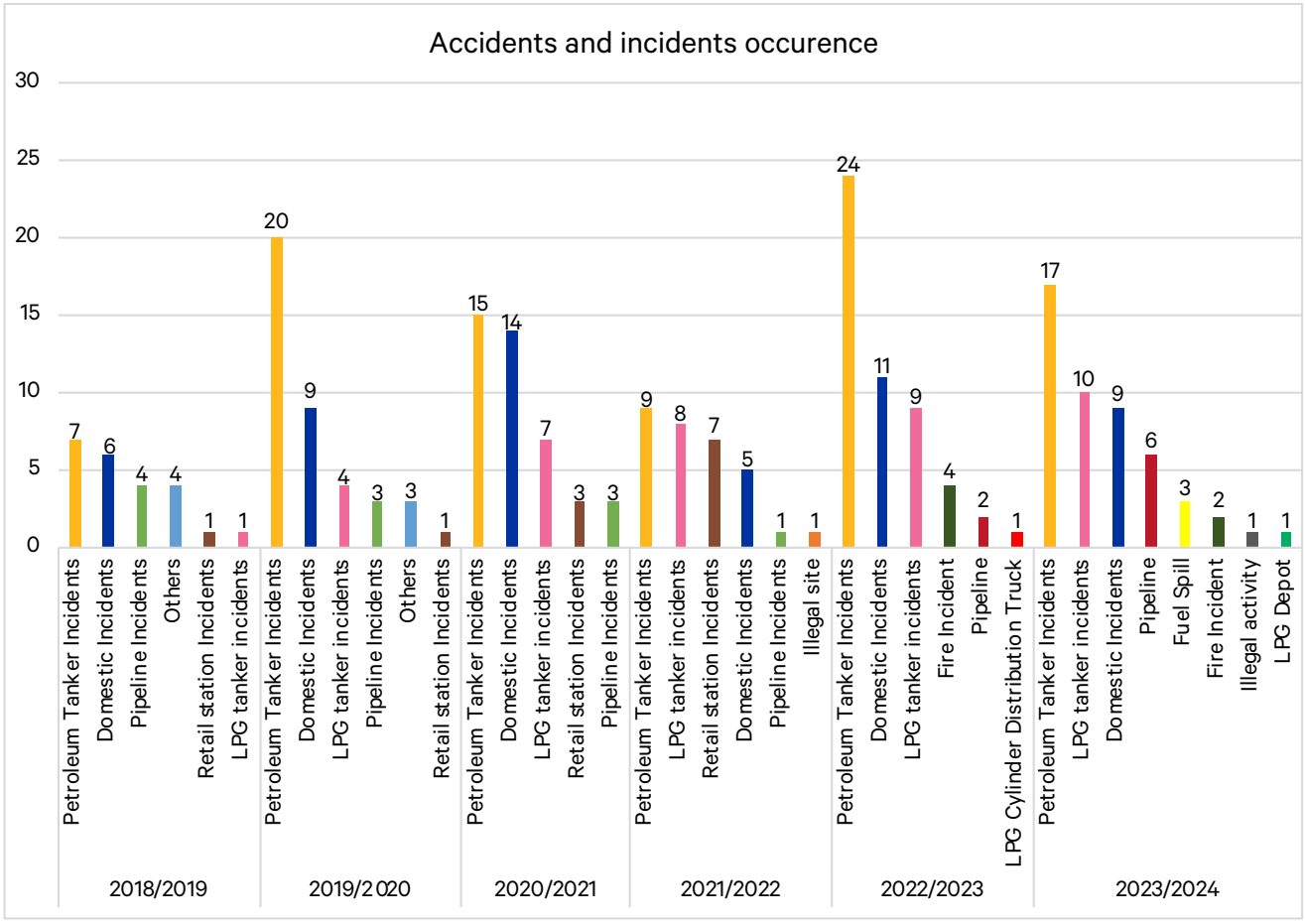


Figure 8.3: Accidents occurrence and root causes

From the graph above, petroleum tanker accidents continue to be the leading category of accidents in the petroleum and LPG sector. The primary causes of tanker incidents have been identified as follows:

1. Driver fatigue and lack of concentration;
2. Insufficient defensive driving skills;
3. Inadequate vehicle maintenance;
4. Road indiscipline, including over speeding and freewheeling; and
5. Absence of a comprehensive journey plan that defines approved driving times, identifies hazardous areas, and designates approved rest stops.

8.4.2 Electricity accident and incidents

The Authority investigates accidents reported by the utilities. During the review period, 153 accidents were reported up from 116 reported in the previous financial year. The accidents resulted in 98 human fatalities, 61 human injuries and 16 animal deaths.

Figure 8.4 displays the top root causes of accidents reported during the financial year.

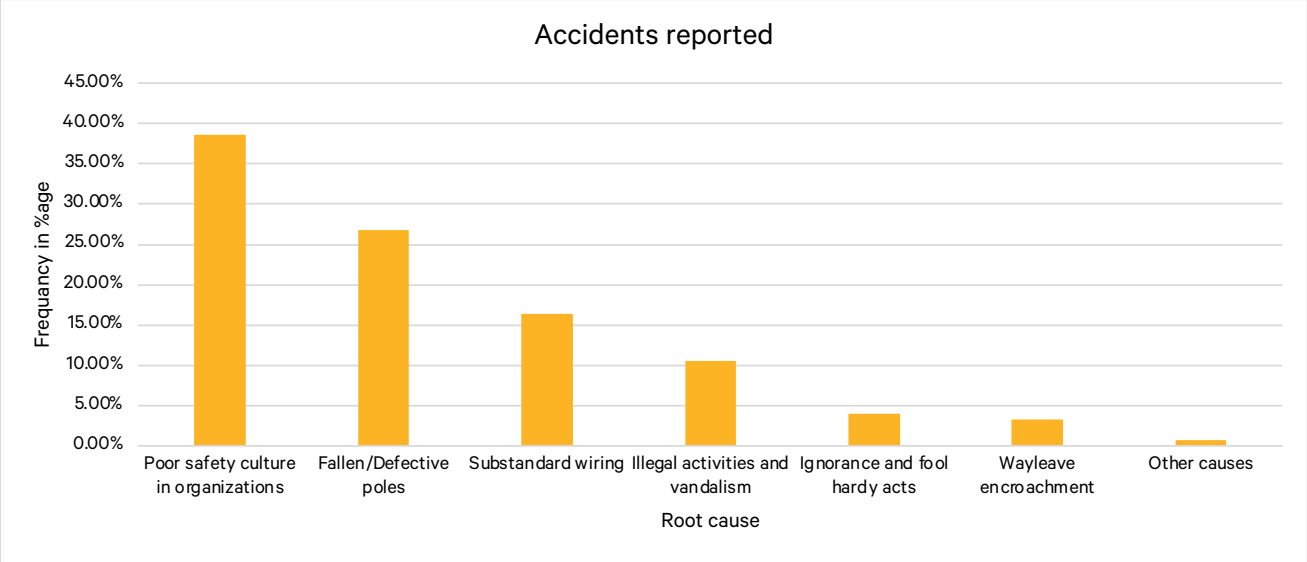


Figure 8.4: Electrical accidences root causes

From the accident investigations conducted, the top three (3) causes were poor safety culture in organizations at 38.56%, defective or fallen power lines at 26.80%, and substandard customer wiring at 16.34%. These causes accounted for over 80% of all accidents.

8.5 Public education and advocacy

The Authority conducted public education and advocacy campaigns through national broadcasting platforms and grassroots initiatives to enhance awareness of energy matters. Table 8.4 below provides a breakdown of the public education and advocacy programs implemented during the period.

Table 8.4: Public education and advocacy programs

No	Type of Forum	Number of grassroots forums	Region	No. of people reached
1	Public awareness engagements	55	All EPRA regions	Approx. 1,024
2	Bodaboda riders engagements	15	All EPRA regions	Approx. 381
3	Electricity and Solar PV contractors and licenses	11	All EPRA regions	257
4	Petroleum and LPG licensees	14	All EPRA regions	516
5	National Government Administration Officers (NGAO) and Security & Intelligence Committees	26	Six counties, 21 Sub-counties	1,033
6	County government Trade, fire and enforcement staff education and awareness	3	Three counties	88
7	Church forums	2	Kisumu and Kakamega counties	Approx. 1,040
8	Women groups forums	1	Kakamega	35
9	Public prosecutors	1	Nairobi	94
10	Radio outreaches	2	National and Kisumu region (Radio citizen and Radio lake Victoria)	Over 1 million

To raise awareness of energy and petroleum matters among key enforcement agencies in the sector, the Authority developed a comprehensive capacity-building and sensitization program targeting National Government Administrative Officers (NGAO) and security intelligence committees. A total of 1,033 officers from Kiambu, Kisumu, Kakamega, Machakos, Kilifi, and Mombasa counties were trained on safety and compliance in the energy and petroleum sectors.

Additionally, the Authority sensitized 94 prosecutors from the Office of the Director of Public Prosecutions (ODPP) in the Nairobi Region, aiming to enhance the efficiency, effectiveness, and timely handling of energy and petroleum cases.

EMERGING TRENDS

9.1 Electric Mobility

Electric mobility is gaining prominence in Kenya due to supportive government policies, lower operating costs, increased awareness, and heightened environmental consciousness. The Ministry of Energy and Petroleum has implemented various policies to promote electric mobility, including the Kenya National Energy Efficiency and Conservation Strategy (2020), which aims to achieve a 5% annual increase in electric vehicle imports. Additionally, Kenya signed the COP26 declaration to accelerate the transition to 100% zero-emission cars.

Through the Fourth Medium Term Plan (2023-2027) of Vision 2030, the Government of Kenya has established strategies to develop e-mobility, notably the creation and implementation of an e-mobility policy, the establishment of charging infrastructure, and the promotion of electric motorcycle (boda boda) manufacturing.

To encourage the uptake of electric mobility, the Authority implemented an e-mobility tariff of Ksh. 16 per kWh effective April 2023. During the review period, electric mobility consumed 1.26 GWh of electricity. Consumption has been on an upward trajectory, with April 2024 recording the highest usage at 291,216 kWh, while July 2023 saw the lowest at 29,097 kWh. The highest consumption occurred in Nairobi, followed by the Coast region, whereas the least consumption was recorded in the South Nyanza region.

In order to accelerate the adoption of electric vehicles and guarantee the establishment of safe, reliable, accessible, and affordable charging infrastructure, the Authority released the Electric Vehicle Charging & Battery Swapping Infrastructure Guidelines in September 2023. These guidelines provide a concise summary of essential considerations for setting, designing, installing, and operating electric vehicle charging points and stations.

As of December 2023, 2,694 electric vehicles (EVs) were registered, bringing the cumulative number of registered EVs to 3,753. The increase in registered EVs may be attributed to government initiatives such as the introduction of the special e-mobility tariff, reduced excise duty on electric vehicles from 20% to 10%, Value Added Tax (VAT) exemption on fully electric cars and development of charging infrastructure.

9.2 Green Hydrogen

Green hydrogen is recognized as a promising alternative for decarbonizing the transport, agriculture and energy sectors. In September 2023, Kenya unveiled its Green Hydrogen Strategy and Road Map during the Africa Climate Summit. This strategic initiative aims to capitalize on the country's abundant renewable energy resources to create demand for diverse applications of green hydrogen. The strategy focuses on four key pillars; improved balance of payments, food security and resilience, green industrialization and decarbonization and investments in the country. It is geared towards achieving various impact targets notably, at least $1 billion direct investments by 2030,at least 25,000 direct jobs created between 2028-2032,at least 250,000 CO2 tonnes avoided per year by 2030 and production of green shipping fuels by 2030.

In November 2023, Kenya commissioned its first green hydrogen plant in Morendat, Nakuru County. The facility comprises a 2.1 MWp solar PV installation with 780 kWh lithium ion storage supplying a 1 MW alkaline electrolyzer. The facility produces one ton of green ammonia per day.

In May 2024, the Authority published the Kenya Green Hydrogen and Its Derivatives Guidelines, which provide a regulatory framework for green hydrogen. These guidelines outline the sustainability criteria for green hydrogen, as well as regulations on land and water use, and requirements for the approval of expressions of interest and feasibility studies.

(L-R)Sebastian Groth, Ambassador of the Federal Republic of Germany to Kenya, Jennifer Morgan, State Secretary and Special Envoy for International Climate Action, the German Federal Foreign Office, Daniel Kiptoo, Director General, Energy and Petroleum Regulatory Authority, Davis Chirchir, Cabinet Secretary, Energy & Petroleum, and Alex Wachira, Principal Secretary, State Department of Energy during the launch of the guidelines on Green Hydrogen and its Derivatives.

As part of implementing the Green Hydrogen Strategy and Roadmap, the Ministry of Energy and Petroleum has established the secretariat and the Program Coordination Committee (PCC). These entities will be responsible for advancing the green hydrogen program in Kenya through the review and approval of expressions of interest, as well as initiatives focused on awareness creation and capacity building. To date, several expressions of interest for developing green hydrogen in Kenya have been received and are at various stages of review.

9.3 Auto gas

The Autogas market is a rapidly growing alternative fuel sector that offers an environmentally friendly alternative fuel for vehicles. The growing demand for cleaner, more sustainable transportation options, coupled with government incentives by zero rating taxes on LPG is propelling the Autogas market forward.

The Authority is establishing a regulatory framework to ensure safety in Autogas operations. There are an estimated 15,000 converted vehicles and seventeen (17) operational Autogas stations in the country.

FUTURE OUTLOOK

As Kenya navigates the complexities of a rapidly changing global energy landscape, the future of its energy sector presents both challenges and opportunities. With a growing population and increasing energy demands, the country is poised to leverage on technology and its abundant renewable resources; solar, wind, and geothermal energy, to foster sustainable growth. Government instruments, initiatives, and the commitment to increase access, reflect a clear ambition to not only meet domestic needs but also position Kenya as a regional energy hub. It is therefore crucial to address the infrastructure gaps and to create an enabling environment for investment in order to realize this vision.

The future of Kenya's petroleum industry looks promising, with several key decisions and infrastructure projects underway:

1. **COSSOP Study:** The ongoing study for the LPG and petroleum sectors seeks to provide insights into the true costs of goods and services across the supply chain. This review is expected to spur investment in the petroleum sector and develop a pricing model for LPG; including the implementation of an Open Tender System (OTS). These measures are anticipated to lower LPG prices and improve planning for LPG infrastructure projects.
2. **LPG Growth Strategy:** Launched in August 2023, this strategy aims to boost LPG consumption by enhancing its use in institutions, distributing subsidized LPG cylinders, and reforming the regulatory framework to improve safety in the LPG sector. It is projected that LPG consumption will continue to increase from the 7.0 kg per capita recorded in 2023.
3. **Northern Corridor:** Despite a drop in domestic petroleum product demand, there has been an increase in transportation through the Northern Corridor. This underscores the cost-effectiveness and efficiency of the corridor. With Uganda consolidating its petroleum needs through this route, further increases in petroleum transportation via the Northern Corridor are anticipated.
4. **Infrastructure:** KPC envisions optimizing KPRL assets to scale up supply chain and distribution efficiencies in mid and downstream petroleum through enhanced storage capacity to serve the hinterland, as well as regional demand. In addition, KPC will facilitate the establishment of a super-sized regional import receipt terminal for breaking bulk refined petroleum products. This terminal will be enhanced into a regional trading hub. Beyond storage terminals, there are plans to extend the Western Kenya pipeline loop to the Malaba border post, and eventually connect to Kampala, Uganda and Kigali, Rwanda. The pivotal Eastern segment of the pipeline network will see expansion beyond the year 2031, when the demand from local and regional economies is projected to outstrip the supply network.

Developments that are expected to shape the electricity sector include:

1. **Tariff review:** The Authority plans to finalize the review of the Time of Use (TOU) tariff framework to enhance its adoption and utilization. Key changes anticipated in the tariff review, is the update of the E-Mobility tariff to remove the consumption limit of 15,000 units per month, addressing challenges faced by E-Mobility customers who exceed this threshold and face additional demand charges under Commercial & Industrial tariffs.
2. **Regulatory framework:** The following regulations are being developed to improve market access, competition, and transparency in the electricity sector:
   - **Electricity Market, Bulk Supply, and Open Access Regulations 2024:** To facilitate electricity trading, enhance consumer choices, and promote competition and Public-Private Partnerships in electricity transmission and distribution.
   - **Energy (Electricity Tariffs) Regulations 2024:** To establish frameworks for determining electricity tariffs for generation, transmission, distribution, and retail, including processes, eligible costs, and review frequencies.
   - **Energy (Regulated Accounts) Regulations 2024:** To provide a reporting framework for licensees' regulated operations, including profit & loss statements, balance sheets, and cash flow statements. The aim is to assess tariff adequacy for regulated businesses while excluding unregulated activities.

These regulations are expected to be implemented in the financial year 2024/2025.

Consumer protection and enforcement are top priorities for the Authority. The Authority is focused on strengthening partnerships and collaborations with county governments, which are key stakeholders with designated mandates under both the Energy Act 2019 and the Petroleum Act 2019. These partnerships will enhance the licensing of retail petroleum and LPG sites, as well as the designation of parking areas for petroleum and LPG tankers.

The Authority through public education and advocacy initiatives seeks to achieve increased levels of awareness on energy regulatory issues, safety and compliance among the public, consumers and licensees. The Authority plans to develop an advocacy framework that will influence sector policies and behavior change toward uptake of clean energy and energy efficient practices. Public education and awareness initiatives target to reach all counties, increasing awareness from the current 23% which represents 11 counties that have been covered countrywide.

1. **Head office**
   Energy and Petroleum Regulatory Authority
   Eagle Africa Centre, Longonot Rd, Upperhill
   P.O. Box 42681-00100 GPO, Nairobi
   Telephone: +254 709 336 000/ / +254 020 284 7000
   Email: info@epra.go.ke or statistics@epra.go.ke
   Website: www.epra.go.ke

2. **North Rift Region – Eldoret**
   7th Floor, Eldoret Daima Towers
   P.O. Box 6950-30100, Eldoret.
   Tel: +254 709 336 527 / +254 020 284 7527

3. **Central Region - Nyeri**
   4th Floor, KDS Centre, Kimathi Way
   P.O. Box 1670-10100, Nyeri
   TEL: +254 709 336 552 / +254 020 284 7552

4. **Coast Region - Mombasa**
   3rd floor, Kilindini Plaza Building, Moi Avenue
   P.O. Box 83315-80100, Mombasa.
   Tel: +254 709 336 577 / +254 020 284 7577

5. **Nyanza & Western Region - Kisumu**
   2nd floor, Lake Basin Mall
   P.O. Box 7540-40100, Kisumu.
   Tel: +254 709 336 501 / +254 020 284 7501

6. **North Rift Region – Lodwar**
   Former WFP Office, Along Lodwar Airport Road,
   P.O. Box 447 – 30500, Lodwar.
   +254 709 336 652 / +254 020 284 7652

7. **North Eastern Region – Isiolo**
   BarsalingaTowers, 2nd Floor Along Isiolo Moyale Road.
   P.O. Box 55 – 60300, Isiolo.
   +254 709 336 626 / +254 020 284 7626

8. **South Rift Region – Nakuru**
   Jennifer Riria Hub, Kipchoge Road, Opposite Bontana Hotel
   P.O. Box 785 – 20100, Nakuru
   +254 709 336 601 / +254 020 284 7601

www.epra.go.ke EPRA Kenya @EPRA_Ke Energy & Petroleum Regulatory Authority

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