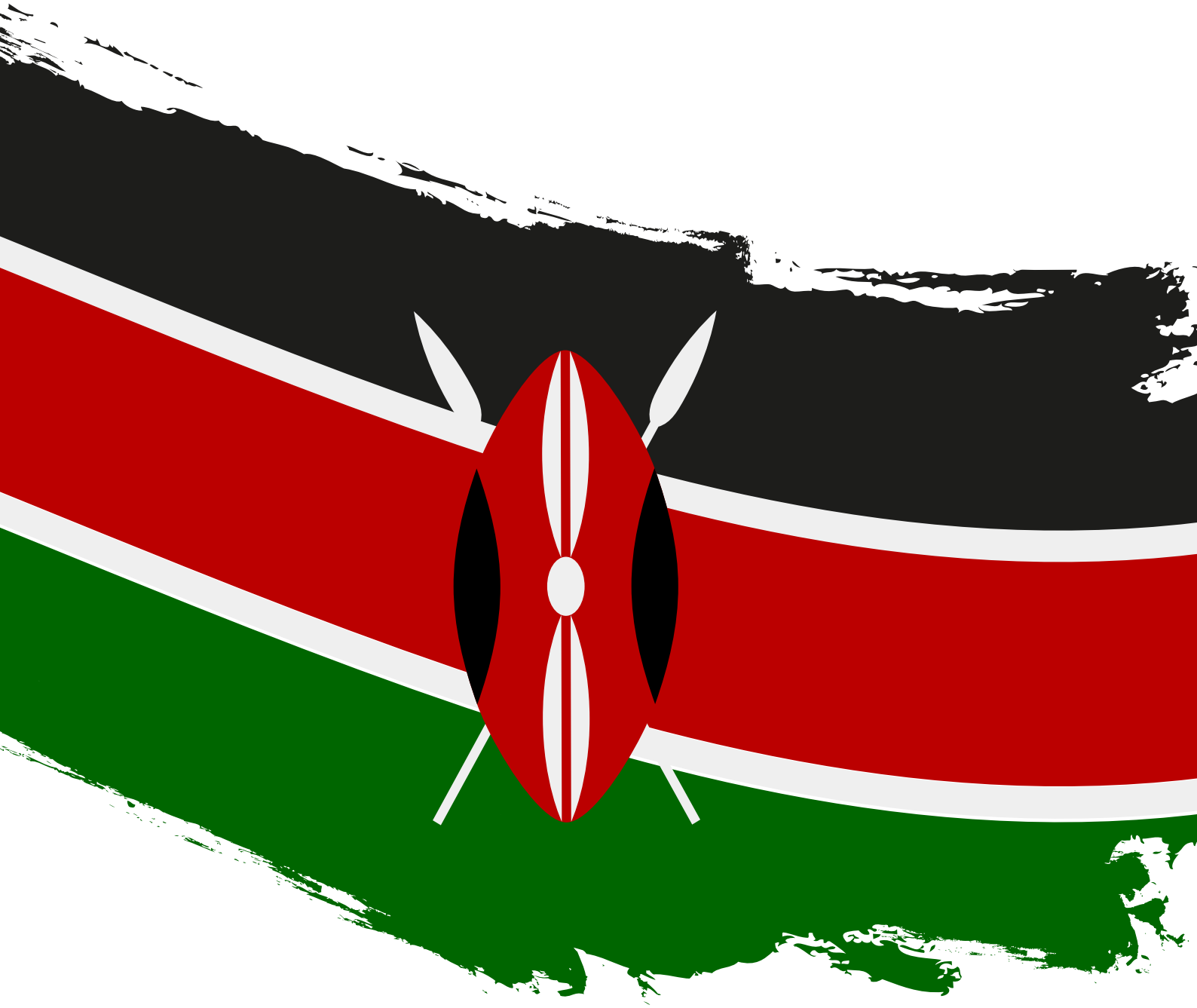

Kenya 2024

Energy Policy Review

International Energy Agency

INTERNATIONAL ENERGY AGENCY

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Foreword

Welcoming Kenya into the IEA family as an Association Country in June 2023 was a milestone in our longstanding engagement on energy issues in Africa. This was a profoundly important step. Kenya has proven itself a regional and global leader on key energy topics, making the country's voice an integral one in the broader IEA family.

Since then, co-operation between Kenya and the IEA has gone from strength to strength. Kenya hosted the IEA's 9th Annual Global Conference on Energy Efficiency in Nairobi in May 2024, and has played a key role in elevating the crucial issue of universal clean cooking access in Africa, helping the IEA spearhead a far-reaching collaborative effort to propel this pressing challenge towards the top of the global energy agenda.

Kenya has shown outstanding leadership in Africa on a range of issues, from universal energy access to the development of renewable energy, especially geothermal, and energy innovation. I congratulate Kenya for the impressive progress it has made over the past two decades in improving access to electricity, reaching an access rate of 75%, one of the highest in sub-Saharan Africa. This illustrates Kenya's commitment to reaching its energy development goals. The IEA looks forward to continuing our strong partnership with Kenya as it continues to drive progress in its energy sector.

Much of Kenya's ongoing work will be facilitated by the updated "Kenya National Energy Policy". This builds on the bedrock of policies and programmes, expertise and institutions that Kenya has at its disposal to help the country reach its energy goals. I hope that this IEA in-depth review, developed in close collaboration with the Ministry of Energy and Petroleum, will play a meaningful part in that journey.

This report aims to support Kenya's efforts on universal access to modern energy, continued development of renewables, and improved energy efficiency, as it works towards achieving its Vision 2030 goals. At the Africa Climate Summit in Nairobi, His Excellency President Ruto and I called for a 'New Energy Pact for Africa,' one that would deepen collaboration between African countries and its international partners. I trust this in-depth review will serve as a tool to inspire further co-operation and help Kenya reach its energy and climate goals.

Dr Fatih Birol

Executive Director

International Energy Agency

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Executive summary

Kenya has put in place significant energy policies and strategies, and with strong institutions and ambitious targets, the country is well-positioned to reach its energy goals and continue its economic growth and development.

As the largest economy in Eastern Africa and a regional leader in energy development, Kenya has made remarkable progress in increasing the rate of access to electricity among its population, putting the country on track to reach universal access to electricity by 2030. Kenya has set an ambitious target in its Vision 2030 of becoming a newly industrialising middle-income country with a high quality of life by 2030. A strong emphasis is put on infrastructure development, including for energy. Kenya's high renewable energy potential and skilled workforce position the country well for sustainable energy development.

Bioenergy, mainly traditional biomass used for cooking, accounts for nearly two-thirds of total energy supply. Geothermal, solar, wind and hydropower are increasingly prominent in the mix, mainly used for electricity generation. Imported oil completes the energy supply and is mostly concentrated in the transport sector. Energy production, supply and consumption has been driven up by strong economic and population growth in the past decade.

The Ministry of Energy and Petroleum oversees Kenya's energy sector, supported by various semi-autonomous governmental agencies. The sector operates under the Energy Act of 2019 and the National Energy Policy, mandated to be updated every five years. Despite strong policies, the regulatory environment remains complex. Co-ordination and alignment with other government entities and sectors remain critical for effective implementation of Kenya's ambitious plans. Furthermore, while Kenya has improved coverage, quality and timeliness of energy balances and data, there is need for more structured and accessible energy data.

A diverse electricity mix with strong renewable generation

Kenya is well-positioned to maintain its role as a regional leader in renewable power generation, with geothermal presenting great potential as Kenya targets 100% renewable electricity generation and universal electricity access by 2030.

Kenya has a diverse electricity mix, with nearly 90% of generation from renewable sources, including geothermal (47%), hydro (21%), wind (16%) and solar (4%) in

2023. The country is one of the lowest-cost geothermal power developers in the world and is home to the Lake Turkana Wind Project, the largest wind farm in Africa.

The power sector has around 3.3 GW of installed generation capacity, of which 950 MW is from geothermal, over 800 MW from hydropower and almost 800 MW from wind and solar combined. The remaining capacity comes from oil, mostly in the form of diesel generators (nearly 700 MW) and bioenergy. The recent addition of geothermal (around 750 MW geothermal capacity additions in the last decade) and variable renewable capacity has supplemented existing large-scale hydropower projects.

Kenya aims to scale up biomass co-generation by 2030, focusing on industrial waste and bioethanol for clean cooking. Biogas production from municipal and livestock waste also holds promise, with about 21 000 digesters currently in operation.

Historically, progress in renewable generation was guided by a feed-in tariff programme, which since 2021 has been evolving into an auction scheme under the Renewable Energy Auction Policy to attract investment in larger projects.

The increase in variable renewable energy capacity leads to the need for energy storage systems, which can provide grid services and stability. Kenya's electricity grid shares interconnections with Ethiopia, Tanzania and Uganda, and additional interconnectors with other East African countries can further support the exchange of power for balancing and supply.

Increased competition to expand power generation and grid infrastructure

Addressing grid losses, increasing competition, and ensuring investment in infrastructure will be key for Kenya's sustainable growth and universal access to electricity.

The electricity sector is state-led but open to independent players. In 2024, Kenya introduced regulations to open transmission and distribution networks to private investment, fostering competition and efficiency.

Kenya's electricity networks face substantial losses, estimated at 23% in 2023, due to technical failures, theft, and billing anomalies, causing frequent outages. Efforts to curb these losses and improve system efficiency, such as smart management systems, are being considered.

The Integrated National Energy Plan will play a critical role in aligning electricity sector planning with national energy goals, including the expansion of power generation and grid infrastructure.

The Energy Act of 2019 envisions a structure with an independent system operator and open access for new transmission and distribution licensees.

A regional leader in electricity access

Kenya is a leader in East Africa for expanding electricity access, increasing the rate from 37% in 2013 to 79% in 2023. The country is on track to achieve universal access by 2030, and urban electrification has already reached 100%. However, affordability of electricity remains a challenge.

The Last Mile Connectivity Project (LMCP), launched in 2015, cut the number of people without access to electricity in rural areas by almost half, from 20 million to 11 million. The project prioritises households within 600 meters of existing transformers and includes a gender component to promote women's participation. The project aims to provide electricity to an additional 280 000 households in 2024 and 2025. Kenya has also utilised off-grid solutions, mainly solar-powered mini-grids in remote areas, to expand access. These are used by one in five households. Kenya is the largest and most mature market for solar off-grid solutions globally, and accounts for almost 74% of solar home system sales in East Africa in 2023.

Affordability remains a major challenge, with Kenya's electricity prices among the highest in Africa, driven by inflation, the removal of subsidies, and a depreciated currency driving up inflation. In the meantime, Kenya has a vibrant innovation scene and is a regional hub for start-ups, especially in relation to energy access, which can help provide affordable options to households. The regulator introduced new tariff structures in 2023 aim to lower the cost of electricity for low-income households, representing about 70% of customers.

Ensuring affordability for all fuels for greater uptake of clean cooking solutions in rural areas

Kenya has made substantial progress in increasing the clean cooking access rate from only 10% in 2013 to 31% in 2023, but 69% of households, mainly concentrated in rural areas, still rely on polluting fuels. The burden is most acute on women and children, who are exposed to indoor air pollution, and deprived of pursuing education or paid work by the time it takes to collect fuelwood.

Firewood remains the primary cooking fuel in Kenya for half of the population, followed by liquefied petroleum gas (LPG), charcoal and kerosene, with significant disparities between urban and rural households. The newly launched Kenya

National Cooking Transition Strategy (KNCTS) provides a clear, integrated roadmap to reach universal access by 2028. The KNCTS envisions that by 2050, half of Kenyan households will use LPG for cooking. To make this happen, the government is removing the value-added tax (VAT) on LPG and directing all public institutions to transition to the fuel by 2025. The KNCTS also foresees that 30% will use bioethanol, partially relying on local production, and 10% will use electricity. However, the lack of affordable electric stoves and lack of access to reliable electricity hinder the uptake of electric cooking. The remaining 10% of households will use biogas and other low emission or clean burning sustainable biomass. However, VAT on improved cookstoves remains one of the highest in the region.

Affordability of cleaner fuels remains a major challenge, often leading households to revert to biomass. Soaring fuel prices in the last few years have led to a decrease in incentives and financial support for clean cooking solutions for households.

Like much of the rest of the world, adherence to traditional cooking methods, as well as the lack of awareness of alternative cooking solutions, further hinders clean cooking uptake, which the government is tackling through awareness campaigns and transitioning of public institutions.

Ensuring fuel supply and price stability is essential for the sustained use of clean cooking solutions. For long-term stability, clean cooking needs to be integrated into broader energy planning, linking it with economic growth and electricity supply strategies.

Investing in ensuring energy security to support growth in energy demand

Kenya's growing demand in the buildings and transport sectors is making the country heavily reliant on imported oil products, leading to efforts to reduce its dependency.

To address the growing oil consumption, Kenya is focusing on efforts to limit dependence on oil product imports through energy efficiency measures, electrification of the transport sector and the promotion of biofuels, including plans to develop sustainable aviation fuels. The government also aims to develop local manufacturing of EV parts and is examining ways to establish domestic value chains for this purpose.

Kenya experiences frequent power outages, which can be addressed by strengthening and expanding the existing grid and supporting additional domestic electricity supply. Enhancing resilience of the electricity infrastructure to cyber threats and climate change is critical for strengthening Kenya's energy security.

Kenya currently has no mining sites for critical minerals, but geological surveys have indicated potential reserves of minerals (such as copper, fluorspar, graphite, manganese, niobium and zinc) needed for clean technology manufacturing. The promotion of local processing of the minerals could benefit Kenya's industry sector, economic growth and energy security.

Sustained progress in energy efficiency in all sectors

The buildings and transport sectors, which are heavily reliant on bioenergy and oil products, drive Kenya's energy consumption with efficiency efforts required in these sectors. Kenya's overall energy intensity has decreased by 14% from 2010 to 2023.

The 2020 National Energy Efficiency and Conservation Strategy sets ambitious targets for energy efficiency improvements including increasing the annual rate of energy efficiency improvements from 0.2% to 3% by 2025.

The buildings sector, which accounts for two-thirds of total final consumption, is largely dependent on biomass. In addition to clean cooking solutions that are helping households move away from traditional biomass, the government introduced the 2024 National Building Code to promote sustainable building practices in all buildings. Kenya has also implemented minimum energy performance standards (MEPS) for appliances, but enforcement is lacking, and the market remains dominated by lower-efficiency models.

The transport sector represents 22% of Kenya's total final consumption (2023), primarily accounted for by petroleum products. Most vehicles in Kenya are imported as second-hand, including heavy duty vehicles and trucks. The electric vehicle (EV) market in Kenya is currently very small. However, the government aims to increase the use of EVs through incentives such as the introduction of an e-mobility tariff, reducing the excise duty on EVs and developing charging infrastructure. To improve the fuel economy standards and labelling for vehicles, the government aims to restrict the age of imported second-hand vehicles from eight to five years and implement vehicle emissions inspections.

Industry accounts for a small proportion of total energy consumption, at 12% in 2023, and has experienced slow growth. Coal (43%) and oil (17%) account for the biggest energy consumption in the sector. Efficiency efforts in the industry sector have focus on audits, capacity building, and trainings for energy efficiency professionals.

Ambitious goals for greenhouse gas emissions reduction need finance, capacity building and technical expertise

While Kenya's contribution to global greenhouse gas emissions (GHGs) is minor, the country faces significant threats from climate change.

Policies, including the submission of Kenya's updated Nationally Determined Contribution (NDC) in 2020, aim to reduce GHG emissions by 32% by 2030, with the energy sector to contribute 45% of these reductions. Kenya's GHG emissions reached 21.2 Mt CO_2-eq in 2021, an increase from 14 Mt CO_2-eq in 2010, with 52% of the emissions attributed to the transport sector.

Achievement of Kenya's GHG emissions target in the NDC is conditional on almost 80% of the required funding coming from international sources. Kenya launched its Long-Term Low Emission Development Strategy (LT-LEDS) in 2023, aiming to achieve a net-zero emission economy by 2050, but implementation remains challenging due to data, finance and human resource needs.

Kenya has issued over 50 million credits via the Clean Development Mechanism and Voluntary Carbon Market standards. Through the National Policy on Climate Finance, Kenya aims to establish a Climate Change Fund, the largest in Africa, and enhance carbon markets. Furthermore, a number of innovative initiatives exist, including direct air capture technology powered by geothermal energy, which aims to be operational in the near term.

Kenya has integrated climate resilience into its national development plans through policies such as the National Climate Change Action Plan 2023-2027, LT-LEDS 2022-2050 and Climate Change Act (Amendment 2023), as climate change poses a threat to the country's transport, telecommunications and water supply infrastructure, as well as energy assets. The hydropower sector is particularly vulnerable, as Kenya has experienced numerous floods and droughts over the past decade.

An attractive investment environment with room to mobilise greater levels of private capital

Kenya's energy sector has become an attractive destination for international public and private capital. Public investment, especially in grids and rural electrification, has been crucial in driving the sector's growth. However, the government is increasingly relying on development finance institutions (DFIs) and private investment to fund key projects due to limited fiscal space.

Kenya's attractive policy environment for investors, along with strong growth, a large, skilled workforce and developed tech and fintech infrastructure, has made

Nairobi a hub for innovators and start-ups. However, private investors still face a series of both actual and perceived risks, which limit their involvement to the more established sectors where these risks are considered lower, such as power generation and electricity access, and pushes up the cost of capital. DFIs therefore continue to play a key role in both derisking private capital and in funding areas such as grids, clean cooking and end-use sectors.

The government has an Energy Transition and Investment Plan 2023-2050 (ETIP), which can provide investors with a clear sense of the focus areas. The ETIP estimates a need for USD 600 billion in investments to 2050, with the power and transport sectors accounting for nearly 90%. To support the implementation of the ETIP, the government could develop roadmaps and clarify priorities where private sector investment is needed. Furthermore, clarification around fiscal incentives for solar products and clean cooking solutions are necessary to stimulate greater private sector investment and ensure affordable energy access.

Over the longer term, there is significant scope for the role of Kenya's domestic financial sector to take on a larger role in the energy sector. Kenya has one of the most developed financial markets on the continent, with relatively well-capitalised commercial banks and a growing pool of institutional investor capital. In recent years, efforts have been made to blend local commercial bank capital with financing from DFIs in order to extend tenors and reduce the cost of capital. Meanwhile, on the institutional side, green bonds are being explored – with the issuance of clean cooking bonds in 2023 – as well as the creation of a local currency guarantee scheme. These developments should allow for a growth in local currency financing, which is particularly important for the growth of locally-owned energy businesses.

1. General energy policy

Country overview

The Republic of Kenya (hereafter "Kenya") is a country in East Africa that borders Ethiopia, Somalia, South Sudan, the United Republic of Tanzania and Uganda. The capital city, Nairobi, is located in the south-central part of the country and is where most of the economic activity takes place. Inland territories in the central and south-western parts of the country towards the border of Uganda and Lake Victoria are the most populated, as well as around the coastal city of Mombasa, Kenya's second-largest city. Kenya formally became independent from the United Kingdom in 1963 and joined as a member of the Commonwealth the same year.

The population of Kenya reached 55 million in 2023, with a growth rate of 2% per year. The median age in Kenya is 19.6, with 37% of total population under 14. The population is ethnically diverse, and the official languages are Swahili and English.

Kenya's Human Development Index score is relatively low, ranking 146th out of 193 countries. Out of the whole population, almost 8% live in extreme poverty (less than USD 2.15 a day) and more than one-third live in overall poverty with a lack of accessibility to adequate food and other basic expenses. One factor of food insecurity is climate change in arid and semi-arid regions, which comprises 80% of the country's land.

In 2023, Kenya had a gross domestic product (GDP) of USD 107.4 billion and a GDP per capita equal to USD 1 950. In 2023, Kenya's GDP by sector was: services (tourism, finance, retail) at 55%, agriculture at 22%, and industry at 17%. A significant portion of Kenya's economy is informal, and is estimated to be equivalent to as much as 25-30% of the country's official GDP.

Kenya's total exports surged to USD 7.8 billion in 2023, a 56% increase from 2020, while total imports reached USD 20.3 billion, growing by 59% from 2020. Petroleum products were by far the first imported product by value, accounting for USD 4.7 billion in 2023, followed by machinery at USD 2.2 billion.

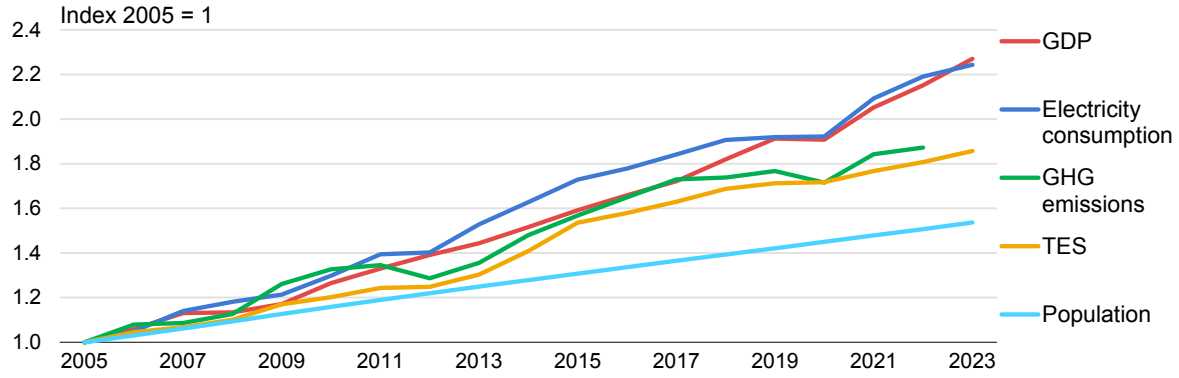
Growing energy demand

In the past decade, Kenya's economic and population growth drove up energy production, supply and consumption (Figure 1.1). Electricity consumption has increased significantly, from 6.6 terawatts hour (TWh) in 2012 to 10.5 TWh in

2023. The country's domestic energy production covers a significant share of total energy supply at 80% in 2022, mainly thanks to the use of domestic bioenergy and geothermal sources.

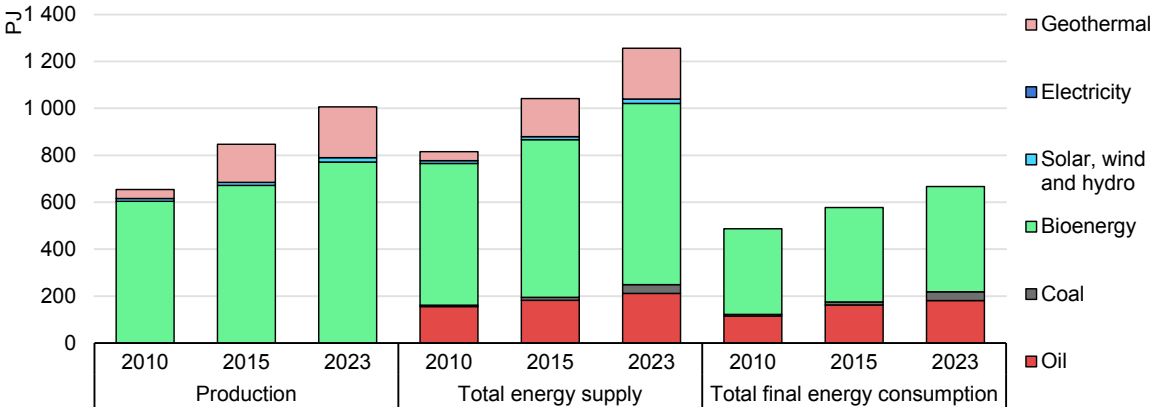
Kenya's energy system is dominated by renewable energy, with two-thirds of total energy supply covered by bioenergy and an increasing share of geothermal, solar, wind and hydro. Imported oil and coal complete Kenya's energy supply (Figure 1.2).

Figure 1.1 Trends of GDP, population and key indicators in Kenya, 2005-2023



Notes: GHG = greenhouse gas; TES = total energy supply. Greenhouse gas emissions only available until 2022.
Source: IEA (2024), World Energy Balances (database).

Figure 1.2 Energy production, total energy supply and total final energy consumption by fuel in Kenya, 2010-2023

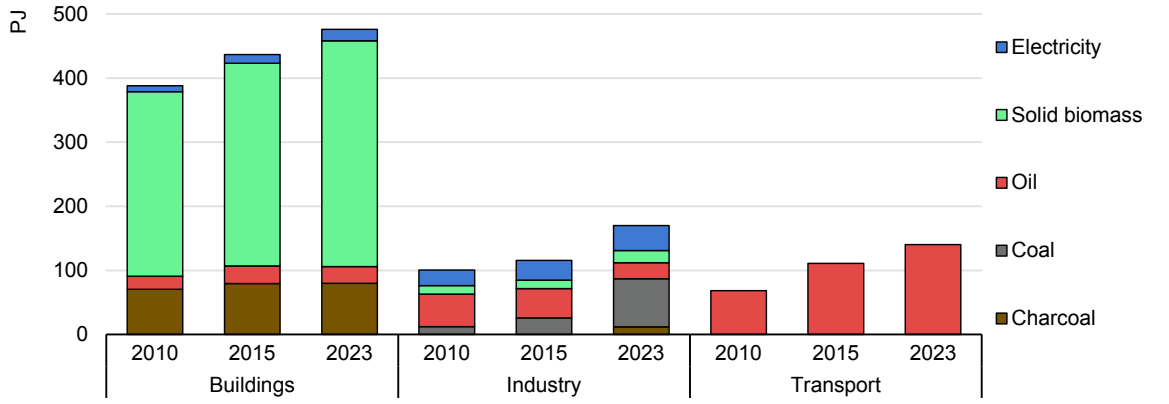


Note: PJ = petajoule.
Source: IEA (2024), World Energy Balances (database).

Energy demand has increased since 2010 especially from the transport and buildings sectors, with the industry sector also growing but at a slower pace. The buildings sector is responsible for the highest share of energy demand (68% in 2023), followed by transport (20%) then industry (12%).

Bioenergy is used mainly in buildings, either directly as firewood or transformed into charcoal. The transport sector relies exclusively on oil, while Kenya's industry sector has a diversified energy mix, made up of coal, electricity and oil (Figure 1.3).

Figure 1.3 Energy demand by sector and fuel in Kenya, 2010-2023



Source: IEA (2024), World Energy Balances (database).

Governance and policy frameworks

Kenya has strong economic growth, but still requires reforms to end poverty and reduce foreign debt

As the largest economy in East Africa, Kenya has undergone significant political and economic reforms over the past decade, fostering sustainable economic growth, social development and political stability. Kenya's economic growth slowed to 4.8 % in 2022 from 7.6% in 2021 due to drought, rising commodity prices and global financial conditions. In 2023, Kenya's GDP growth rose to 5.6%, but is expected to slow down again in 2024. In September 2022, Kenya experienced its highest inflation rate in five years at 9.2%, exacerbated by a decline in agricultural production due to climate change. Underlying social crises of poverty and inequalities remain a challenge in Kenya. The country has experienced drastically increasing commodity prices of food, fuel and electricity, with the price level being 6.9% higher in January 2024 than in January 2023. Further, Kenya's domestic and foreign debt has reached USD 80 billion, representing approximately 70% of its GDP.

The National Tax Policy of 2023 was created as part of the Kenyan government's efforts to enhance predictability and transparency in tax policies and is aligned with the Fourth Medium-Term Plan (2023-2027) of Vision 2030. To support the Policy, the Kenyan government proposed the Finance Bill 2024, aimed at changing the taxation system by increasing several existing taxes and introducing new ones to increase the government budget by USD 2.7 billion to minimise budget deficits and new borrowing. The bill included a 16% tax on bread and a 25% tax on cooking oil, as well as an eco-levy on environmentally harmful goods such as mobile phones, plastic and diapers. The president withdrew the bill in June 2024 after mass protests erupted, mainly led by unemployed youth (the youth unemployment rate was more than 12% in 2021, compared to the national unemployment rate of 5.7%), that on some occasions resulted in violence.

Governance and overarching policy frameworks

The Ministry of Energy and Petroleum is tasked with developing and implementing policies to create an enabling environment for the efficient operation and growth of Kenya's energy sector. It determines strategic directions to facilitate sector growth while providing a long-term vision for all stakeholders. It promotes the development of hydropower, geothermal and renewable energy; oversees the rural electrification programme; and provides guidance on energy regulation, security and energy efficiency.

Under the Ministry of Energy and Petroleum, several semi-autonomous governmental agencies operate: Kenya Electricity Transmission Company (KETRACO), Kenya Power and Lighting Company (KPLC), the Energy and Petroleum Regulatory Authority (EPRA), the Rural Electrification and Renewable Energy Corporation (REREC), and the Geothermal Development Company (GDC). The Kenya Electricity Generating Company (KenGen), the leading power generation company in Kenya, has 70% government ownership and 30% private shareholder ownership.

EPRA was established under Section 9 of the Energy Act and is responsible for energy sector regulation, including regulating the generation, trade, transmission, distribution, supply and use of electricity, including renewables. EPRA oversees demand forecasting and system planning, maintains data and statistics, and determines tariffs and tariff structures.

While KenGen is responsible for the generation of electricity, KETRACO plays a critical role in distribution and supply. KETRACO manages the national power grid and the underlying power networks, ensuring that electricity is efficiently distributed to households, businesses and industrial customers across the country. While KETRACO operates and manages the high-voltage network (132 kilovolts [kV] and above), KPLC is the system operator that operates and

maintains the medium- and low-voltage distribution network. Retail electricity distribution and system operation within the country is the primary purview of KPLC.

Kenya's overarching law, the Constitution of Kenya of 2010, establishes that the national government is responsible for the protection of the environment and natural resources, as well as energy policy including electricity and gas reticulation and energy regulation. Kenya has undertaken considerable efforts to address its core national development objectives as reflected in its Vision 2030 (unveiled in 2008), which aims to transform Kenya into a newly industrialising middle-income country with a high quality of life by 2030 in a clean and secure environment. Vision 2030 strongly emphasises infrastructure development, including for energy. The development of Vision 2030 involved extensive stakeholder dialogue among government bodies, private enterprises and civil society and is broadly considered to be a consensus for the country's future.

Progress is best demonstrated through advances in electricity access rates, which reached 79% in 2023, while simultaneously achieving nearly 90% of electricity generation via renewable energy sources in the same year. The prioritisation of renewable energy technologies for growth is reflective of the government's commitment to the Paris Agreement and the principals set out in Kenya's Climate Change Act from 2016, which was revised in 2023.

The five-year review of the 2018 National Energy Policy provides an opportunity for growth in the energy sector

Kenya has a number of energy policies, roadmaps and strategies that have been conceived to provide an enabling environment for growth, centring around the foundational Energy Act of 2019. The Act establishes the energy sector entities and regulates production, supply and use of energy. It also establishes EPRA. The Energy Act further calls for updating the National Energy Policy of 2018 every five years to ensure the overarching policy can adapt and respond to changing technologies, global trends and policies. The 2023 mandated review is being carried out through a consultative process, engaging stakeholders across 11 thematic areas, with completion expected in late 2024 or early 2025. This required five-year update involved diverse stakeholders and ensures a comprehensive and timely policy that aligns with national, regional and global trends in the energy and related sectors.

The National Energy Policy provides a comprehensive overview of the state of the energy sector and provides recommendations for various sub-themes. The policy recommendations in the 2018 document cover topics such as coal, renewable energy (including geothermal and hydro), electricity, energy efficiency and conservation, land, environment, health and safety, energy services, energy

financing, energy pricing, and socio-economic issues. The ongoing review process in 2024, which also includes participation from the public, comes at an opportune time and will address changes in the energy landscape, in particular within access, security and resilience, economic competitiveness, energy efficiency, geopolitics, and technological innovation.

Kenya's significant number of energy-related laws, strategies, regulations, policies and programmes underscore the country's strong focus on energy policy. However, the multitude of laws and policies may also present challenges. In some cases, for instance, no clear and detailed implementation plans exist.

Due to the cross-sectoral nature of energy policies and planning, effective co-ordination and consultation are essential for coherent, efficient and successful execution. Kenya's wide array of energy-related policies and plans and the vibrancy of its energy sector means that co-ordination and alignment among the various cabinet ministries and semi-autonomous governmental agencies, whose activities affect different aspects of government policy on energy, is a critical factor for successful energy sector development. In addition to the Ministry of Energy and Petroleum and all its subsidiary units, effective policy making for the energy sector requires close co-ordination with the Office of the Presidency and the ministries responsible for transport, agriculture, climate and environment, trade, industry, rural development, housing, and other relevant portfolios. This highlights the necessity of having an integrated approach that leads to effective prioritisation, prevents redundancy, simplifies procedures, and improves monitoring and implementation.

Involving non-governmental stakeholders, such as the private sector, is crucial when developing a new strategy or policy to ensure a comprehensive and contextually relevant plan. The IEA commends Kenya for consulting with non-governmental stakeholders when drafting government strategies, policies and plans, most recently and notably in the new Kenya National Cooking Transition Strategy 2024. Despite this, non-governmental stakeholders report inefficient and unstructured communication with ministries, and sense a lack of co-ordination and harmonisation. Fluid communication and co-operation between departments and with other stakeholders could increase the efficiency with which Kenya reaches its ambitious development goals.

Further, in the absence of allocated budgetary resources, implementation schedules and administrative accountability, progress may fall short of stated goals and targets. The ongoing preparations for the National Energy Policy review and the government's Integrated National Energy Plan aim to tackle these challenges and offer a clearer framework for the implementation of Kenya's energy objectives.

High renewable energy potential and a skilled workforce make Kenya attractive for green industry

Kenya's high renewable energy potential means the country is well placed to attract green industry. Industrial growth and investment, co-ordinated among both the Kenyan government and the private sector, can spur domestic economic growth, create valuable employment and skills, and expand the market share of low-carbon industrial products and manufactured goods. This potential has been recognised through international programmes such as the African Green Industrialisation Initiative launched by the Kenyan president at COP28 in Dubai and aimed at scaling up green industries across the continent.

Kenya boasts a skilled workforce across the energy and related sectors, particularly engineering technicians, electrical engineering technicians and geologists. The focus on skills and technical certifications within its labour force will need to grow at a pace that matches the expanding reach of the energy network, particularly in rural areas. Technical and vocational education and training will need to cater to the skill requirements of emerging technologies such as hydrogen production. Capacity-building programmes such as the IEA energy efficiency training week or other similar capacity training programmes, may be able to assist with further institutional skills requirements.

Employment in the energy sector is gender-informed and public utilities have targets for female participation in the sector. The Constitution of 2010 mandates that no one gender should make up greater than two-thirds of the composition of public committees. Much progress has been made in the last ten years, and women now occupy at large senior positions such as management positions and on boards.

Further, Kenya has a people-centred, inclusive approach to energy for development, with clear steps taken to advance rural electrification rates, working closely with community leaders and administrative counties. This includes the introduction of targeted subsidies, such as the domestic lifeline tariff.

Statistics and data

In the area of energy data and statistics, the Ministry of Energy and Petroleum and the Kenya National Bureau of Statistics (KNBS) are the main sources of data used at the IEA. KNBS is the official statistical agency for the government of Kenya and was established by an act of parliament – the Statistics Act, 2006 No. 4 – as a semi-autonomous government agency under the Ministry of State for Planning, National Development and Vision 2030. The legal framework for data is embedded in the Energy Act of 2019, which establishes the energy sector entities and regulates the production, supply and use of energy.

KNBS includes statistics on firewood and charcoal in its economic surveys, although the data fluctuate considerably. The significant increase observed following the years 2019/20 can be attributed to the energy crisis in 2021 and the subsequent increase in energy prices, but all in all it would be good to understand the underlying data collection or estimation methodologies, given national relevance.

In recent years, Kenya has improved the coverage, quality and timeliness of energy balances and related data, but the quality of the data could be significantly improved for all fuels and sectors. Key areas for improvement could include a focus on aligning electricity data originating from various sources and further disaggregating demand-side data for all sectors across different fuels. Given that responsibility for compiling energy statistics is divided between several institutions, enhanced communication between these institutions needs to be a high priority.

Currently, energy statistics for Kenya are available through reports on different institutions' websites such as EPRA, KPLC and KNBS. Furthermore, there is no structured database containing all national energy supply and demand data that are publicly accessible for users to make full or customised data extractions. Access to and dissemination of national energy statistics can be improved by having a publicly accessible online platform with a schedule of data releases and user-friendly formats (infographics, spreadsheets, csv).

There currently appears to be limited metadata available. Such metadata would be extremely valuable for understanding data trends and ensuring transparency and robustness in data-collection methods.

Recommendations

To reach its objectives, the government of Kenya could consider:

- Developing clear, prioritised and well-co-ordinated implementation plans to deliver on Kenya's overall strategy for modernising its energy sector, including the availability of a skilled workforce.
- Enhancing inter-ministerial co-ordination to promote effective development of Kenya's energy sector.
- Maintaining and improving the timeliness, completeness and accuracy of national energy data, especially for demand-side data, including by aligning collection and reporting methodologies.
- Modernising the national energy statistics system by establishing a data dashboard, including upgrading the data management infrastructure through a centralised data repository.

2. Electricity

Overview

Kenya has abundant renewable energy resources, with wind, solar, geothermal and hydro accounting for nearly 90% of generation. Furthermore, it is one of the lowest-cost geothermal power developers in the world. As a result of its sustained electrification efforts, electricity access has risen to 79% from 37% over the past decade. However, Kenya's electricity sector has experienced low growth over the last two decades despite an aggressive electrification programme.

The power sector has roughly 3.3 gigawatts (GW) of installed generation capacity and is dominated by renewable sources, which account for 80% of capacity. Geothermal is the largest source of electricity generation followed by hydro, wind, oil and solar photovoltaics (PV). Kenya has made notable progress in recent years in diversifying its sources of electricity by increasing generation from geothermal, wind and solar PV and decreasing its reliance on hydro, which is prone to variability with fluctuations of water availability.

Guiding policies

The Ministry of Energy and Petroleum published the National Energy Policy in 2018. Its objective is to ensure an affordable, competitive, sustainable and reliable supply of energy at the least cost to meet national and county development needs while protecting and conserving the environment. It identifies the key challenges facing the electricity sector and outlines the policies and strategies needed to overcome them in the short, medium and long term.

A new Energy Act was developed and gazetted on 31 March 2019. It amended the Energy Act of 2006, consolidated the laws relating to energy, and delineated the functions of the national and devolved levels of government concerning energy. It redefined the mandate of energy-dedicated public authorities, regulated the development of renewable energy sources, and established a framework for electricity supply and consumption. The Energy Act also established EPRA as the successor to the Energy Regulatory Commission.

The Power Generation and Transmission Master Plan, published in 2015 by the Ministry of Energy and Petroleum, sets out the country's long-term plan for key elements of the power sector for the period 2015-35. The Plan identifies suitable expansion pathways for the Kenyan power system in line with defined planning criteria and frameworks.

The Kenya National Electrification Strategy is a roadmap for achieving universal access to electricity, a cornerstone of the country's development agenda. It sets out a strategy to achieve electricity access for all households and businesses in Kenya over the shortest possible timetable and at an acceptable quality of service.

In January 2021, the Ministry of Energy and Petroleum published its Renewable Energy Auction Policy (REAP), which outlines the approach for renewable energy procurement in Kenya by means of competitive auctions. Later in the same year, EPRA published several benchmark tariffs to be reviewed annually and applied to all wind and solar projects (regardless of capacity), as well as small hydro, biomass and biogas projects greater than 20 megawatts (MW), pursuant to the REAP.

The Feed-in Tariff Policy (2021) is a revision of the 2012 Feed-in Tariff Policy with substantial changes introduced to align with the Energy Act of 2019 and other changes since the previous Act. The new policy limits feed-in tariffs to small-scale biomass, biogas and small hydro projects (up to 20 MW). All solar and wind power projects, as well as other renewable energy projects larger than 20 MW, will be procured under the REAP, which provides that EPRA may run a competitive process before awarding a generation licence under the Energy Act.

Published in 2021 by the Ministry of Energy and Petroleum, the Updated Least Cost Power Development Plan (LCPDP): Study Period 2020-2040, is intended to guide power policy and investment decisions in the country. Following this, the Ministry published a ten-year LCPDP for the period 2021-30, derived from the longer-term LCPDP. The update is intended to make long-term planning assumptions more predictable, given the greater certainty in planning for a 10-year period compared to a 20-year one. The objective of the LCPDP is to ensure that the demand-supply balance is not skewed too heavily towards supply to avoid stranded generation investments and resulting higher system costs. The Plan also focuses on system requirements for the integration of renewable energy technologies and provides guidance on affordable tariffs.

The National Climate Change Framework Policy and National Climate Change Action Plan also have implications for the electricity sector, notably in terms of energy infrastructure resilience.

Governance and market oversight

Kenya has made significant progress in modernising its electricity sector. The power sector governance framework has evolved continuously since the 1990s to reflect changing market fundamentals, support the development of new technologies and ensure a reliable electricity supply for its growing economy. The government adopted policy and regulatory reforms to attract new investments,

improve competition and gradually open the market to private investment. This process culminated in the adoption of the Energy Act in 2019, which liberalised electricity supply.

The key agencies involved in managing and regulating the electricity sector include the Ministry of Energy and Petroleum, EPRA, KPLC, KenGen, GDC, KETRACO and REREC (see Chapter 1).

The Ministry of Energy and Petroleum promotes the development of renewable energy; oversees the rural electrification programme; and provides guidance on energy regulation, security and energy efficiency.

EPRA regulates the generation, trade, transmission, distribution, supply and use of electricity as well as overseeing demand forecasting and system planning and determining tariffs.

Following enactment of the Energy Act of 2019, REREC was mandated to lead Kenya's clean energy programmes and implement rural electrification projects. The Renewable Energy Resource Advisory Committee is an inter-ministerial committee that advises the Minister for Energy on the criteria for the allocation of renewable resources, licensing of renewable energy resource areas, management of water resources, development of dams and reservoirs for power generation, and the management and development of renewable energy sources.

The purpose of the Energy and Petroleum Tribunal is to resolve disputes arising from licences issued or declined by EPRA. The Public-Private Partnerships Directorate is mandated to facilitate the implementation of the Public-Private Partnership Programme and Projects in Kenya.

The electricity sector is largely state-dominated but there are some independent players in the generation market. KenGen, the largest power producer in Kenya, produces power from hydro, geothermal, thermal and wind sources, selling power to customers on a wholesale basis. Several independent power producers (IPPs) supply power to the grid, and approximately 30% of power generation comes from generation assets operated by IPPs.

The Kenya Power and Lighting Company (Kenya Power) owns and operates most of the electricity distribution assets in Kenya. The government owns slightly over half of the company with the remainder listed on the Nairobi Securities Exchange. KETRACO is a state-owned entity that owns, operates and maintains the high-voltage electricity transmission grid and regional power interconnectors. Following the adoption of the Energy Act of 2019, KETRACO was designated as the transmission system operator.

GDC is a fully government-owned company charged with developing steam fields and selling geothermal steam for electricity generation to KenGen and other stakeholders.

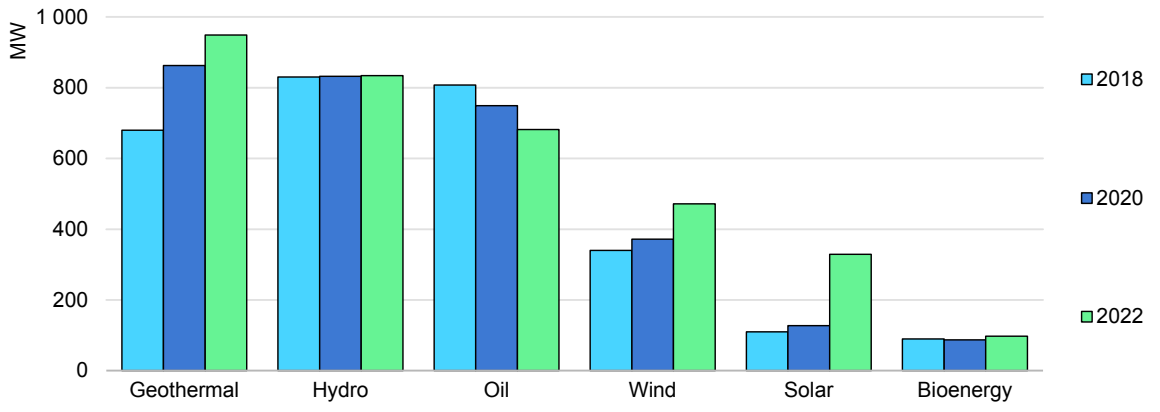
Electricity supply and demand

Electricity capacity

At around 3.3 GW, the total generating capacity of the Kenyan power system is relatively small compared to its population. Geothermal is the largest source of capacity with 950 MW, followed by hydro, which accounts for around 830 MW; oil at around 680 MW; wind with 470 MW; and solar PV with 330 MW (Figure 2.1). As mentioned above, in the case of solar, wind and small hydro additions, Kenya's plan is to transition from a system based on feed-in tariffs to an auction scheme. While the initial auctions have yet to be announced, firm pricing structures coupled with a reliable schedule would accelerate expansion.

Hydropower, traditionally the largest source of electricity, has remained stagnant over the past decade. The largest resources can be found along the Tana River to the north of Nairobi and on the Turkwel River in the west of the country. Kenya has ample wind resources and the highest wind speeds can be found in the north-west of the country around Lake Turkana where Kenya hosts Africa's largest wind farm. The 310 MW plant can supply up to 10% of Kenya's peak electricity demand. Other large plants can be found at Kipeto and Ngong.

Figure 2.1 . Electricity generating capacity in Kenya, 2018-2022



Source: IEA (2024), Electricity Information (database).

Geothermal energy is heat derived from the sub-surface of the earth. Depending on its characteristics, geothermal energy can be used for local or district heating and cooling purposes or can be harnessed to generate carbon-free electricity if

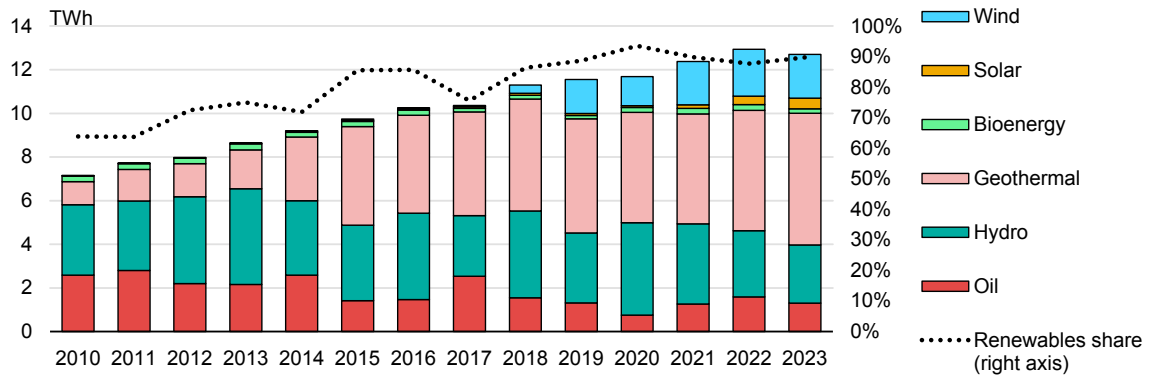
the temperature is adequate. The Great Rift Valley in Kenya is a rich resource of geothermal energy, and the country first initiated the development of geothermal power generation in this region in the 1970s. To date, the bulk of geothermal projects have been developed in the Olkaria area in the Hell's Gate National Park. Smaller projects have been developed in Menengai about 100 kilometres (km) to the north of Olkaria.

Electricity generation output

Total electricity demand in 2022 was around 13 300 gigawatt hours (GWh). KenGen delivered around 8 000 GWh, independent power producers around 4 500 GWh, and the remainder came from small rural producers and REREC-owned Garissa Solar Power Plant. Electricity generation output is dominated by renewables, which accounted for almost 90% of electricity generation in 2022. Electricity production has increased significantly over the past decade, largely the result of significant growth in geothermal energy capacity. The share of electricity generation from geothermal sources increased from 15% electricity output (1.1 terawatt hours [TWh]) in 2010 to 47% (5.5 TWh) in 2023. Hydropower is the next largest source of electricity supply, accounting for around 21% (3 TWh) of generation in 2023 (Figure 2.2).

The share of hydropower in generation output in 2010 was 45% but the volume remained flat as total output increased. In recent years, the share of wind energy has grown significantly, from 5% in 2018 to 17% in 2022. Solar PV contributed for around 3% of electricity generation in 2022, more than double that of the previous year thanks to the commissioning of several new projects.

Figure 2.2 Electricity generation by source in Kenya, 2010-2023



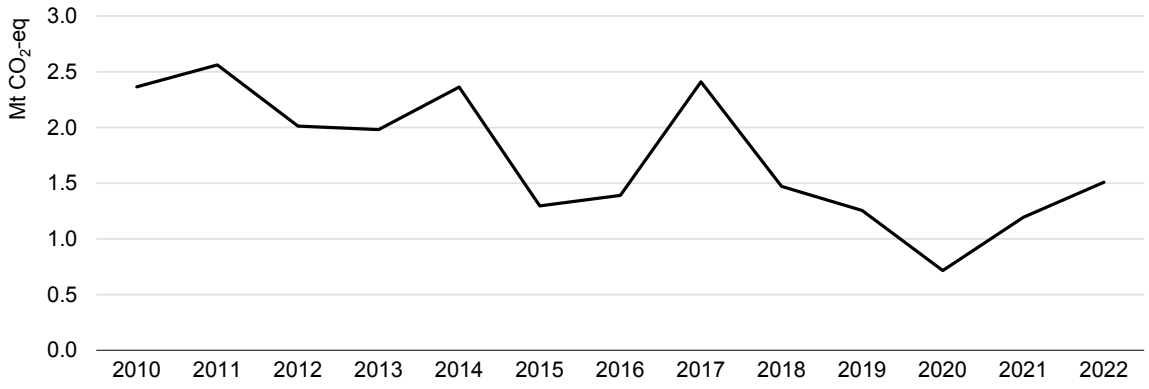
Source: IEA (2024), World Energy Balances (database).

Given the high share of renewables in the generation mix, the carbon intensity of the power sector is low, albeit somewhat dependent on the share of hydropower

available. For instance, when hydropower resources are low, oil capacity may run, leading to an increase in GHG emissions from the power sector. This effect can be observed by the sharp increase in GHG emissions from the power sector in 2017, following severe droughts in 2016 that decreased hydropower generation (Figure 2.3).

Nonetheless, recent trends in wind and solar PV capacity additions suggest that emissions from the sector are likely to decline in the coming years if capacity expansion can meet demand for electricity. Conversely, Kenya's legacy feed-in tariff programme spurred multiple new solar PV and wind project announcements, but power purchase agreement (PPA) renegotiations, in part related to cost concerns, and land-rights issues led to project cancellations.

Figure 2.3 Greenhouse gas emissions from the Kenyan power sector, 2010-2022



Source: IEA (2024), World Energy Balances (database).

The increasing share of variable renewables is seen by both government and the private sector as a future challenge for system operations, and work is underway to improve dispatch models, system services and storage options (including ancillary services, regional interconnections, battery storage, etc.).

Networks

Following the adoption of the Electric Power Act of 1997, Kenya embarked on a series of reforms that led to the unbundling of generation from transmission and distribution services in the electricity market. As a result, KenGen took on power generation functions while Kenya Power assumed control of most transmission and distribution services. This marked the beginning of Kenya's path toward opening the electricity market and introducing competition in power generation. The size of the transmission network (400 kV, 220 kV and 132 kV) is approximately 6 300 km, of which around 3 900 km is owned by Kenya Power and 2 400 km is owned by KETRACO.

In 2024, Kenya introduced regulatory changes to end the existing monopolies in transmission and distribution held by KETRACO and Kenya Power, respectively. The Energy (Electricity Market, Bulk Supply and Open Access) Regulations 2024 provide open access to the transmission and distribution systems for privately owned distribution companies at a tariff. While implementation of these rules is at an early stage, they fail to address problems such as the allocation of existing fixed contracts entered into by the current sole off-taker, whose costs would be spread over a smaller customer base should wholesale or retail competition enter the market without this (and other problems) being addressed. Ideally, this move would increase competition, efficiency and reliability and improve the quality of service within the electricity market while attracting investment in generation, transmission, distribution and retail supply. With planned interconnections of Kenya's electricity network with Tanzania and other Eastern Africa Power Pool (EAPP) countries, which is set to commence trading as early as 2025, as well as the strengthening of the interconnection with Uganda through the Nile Equatorial Lakes Countries Electric Grids Interconnection Project, the government views these regulatory changes as having the potential to boost market and supply options for both power generation and large consumers. Kenya could access Southern Africa Power Pool via Tanzania once the Kenya-Tanzania and Tanzania-Zambia interconnections are completed.

While KPLC oversaw a large grid expansion programme, which resulted in the growth of customer connections, the country also has a growing number of off-grid and mini-grid systems, led by solar home systems and solar-powered mini-grids. Almost one in five Kenyans accesses electricity through off-grid connections and Kenya has the highest share of households that access electricity through solar home systems globally.

Power sector planning has historically been done in an independent manner but will now have to be co-ordinated with the Integrated National Energy Plan, which covers all energy sectors. For the Integrated National Energy Plan to be successful, there will need to be an increased level of co-ordination for demand forecasting as well as assessments for either electrification of other sectors (e.g. industry, transportation, agriculture, etc.) or policies around demand stimulation for electricity. Stakeholder consultation is an important factor to ensure that power sector infrastructure is balanced with future demand projections.

The Generation and Transmission Master Plan is the main implementation plan for the power sector. One of the main inputs comes from the LCPDP, which is developed by public entities and publicly owned companies and based on power sector modelling.

Clarity on future electricity demand and energy generation will be important to project the need for grid expansion and financing and drive sector development.

In this regard, the three scenarios of low, medium and high in the LCPDP medium-case scenario is well grounded in reasonable assumptions and can be used to plan future investment in power generation, transmission and distribution.

Kenya's electricity grid shares interconnections with Ethiopia, Tanzania and Uganda. The Kenya-Ethiopia connection has a technical potential of 2 000 MW but imports on the line are limited to 300 MW pending completion of ongoing reinforcements of the Kenya network expected for 2026. The installed capacity, coupled with the import agreements, is sufficient to meet Kenya's present electricity demand. For example, construction of the Kenya-Tanzania Interconnector, a 96-km, 400 kV double circuit line between Isinya and Namanga is underway. Funded by the African Development Bank and the Kenyan government, the line is expected to facilitate power exchange between Ethiopia, Kenya, Tanzania, the EAPP and Egypt and Sudan in the north.

Growing interconnections between countries in East Africa support the exchange of power for balancing and supply. The EAPP has been under development for several years and seems to be reaching maturity in a form where it could become active in a few years with day-ahead market trading expected as early as 2025.

Network losses

Many electricity systems in Africa face extremely high network losses, which averaged 15% across the continent in 2020 – almost twice the global average of 8%. These losses result from underinvestment and ageing infrastructure, though other factors such as overgrown vegetation (especially in remote areas), natural disasters, vandalism and theft contribute. In 2023, losses on Kenya's power system were estimated to be as high as 23%, about half of which were technical losses arising from leakages within the transmission and distribution lines. The remaining losses were attributed to power theft and billing and collection anomalies.

These losses, alongside taxes and the cost of power generation, affect the final cost of electricity, highlighting a potential to increase efficiencies that would translate into lower costs. To reduce system losses, the government could consider embedding measures to reduce power system losses and improve system efficiency in the overall strategy for delivering universal access to electricity. This could include applying smart solutions to power system management to identify and respond to system-loss hotspots at the county or individual distribution transformer level.

In addition to high levels of system losses, the average frequency and duration of power outages in Kenya is above global averages. On average, customers experienced around 45 unplanned outages in the year to June 2023, increasing from 29 (2020/21) and 38 (2021/22), with individual outages lasting on average

nearly 5 hours. To address this problem, the national regulator, EPRA, recently proposed limits to the System Average Interruption Frequency Indicator (SAIFI) – the number of times an average customer is hit by a blackout – at 20 per year.

Further, the regulator proposed a limit of 80 hours for total time an individual customer experiences an outage in one year. EPRA already established performance indicators, including a System Average Interruption Duration Index (SAIDI), a SAIFI and a Customer Average Interruption Duration Index, for the next four years, when it approves retail tariffs. It would be beneficial to combine actions to reduce the frequency and duration of power outages with reforms to the flexibility/ancillary services market that would attract other service providers to invest in energy storage, demand-side response and other technologies such as static synchronous compensators to manage grid frequency stability and the piloting of battery energy storage in several regions.

Kenya also experiences episodes of vandalism, which weakens infrastructure. In the 2022/23 financial year, Kenya Power reported a 46% increase in cases of transformer vandalism, with 242 transformers impacted compared to 165 in the previous year. Low reliability of the electricity system hampers further electrification and could be a major obstacle for the adoption of new technologies for clean cooking and e-mobility.

Technical codes

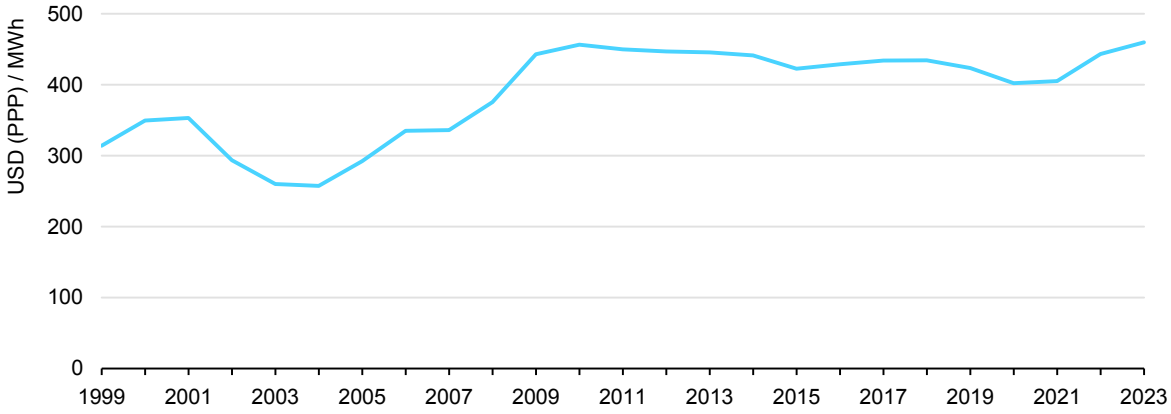
The Kenya National Transmission Grid Code is the primary technical code for the transmission system, setting out the technical regulations for connecting to and using the system. Furthermore, the code has been developed considering the EAPP and East African Community Interconnection Code (EAPP IC). As a member of the EAPP, Kenya adheres to the requirements imposed on EAPP member countries, which also apply to users of the Kenya National Transmission System.

Retail market and energy prices

The adoption of the Energy Act of 2019 marked out the future structure of the electricity sector with an independent system operator as well as envisaging new transmission and distribution licensees and open access to both the transmission and distribution systems. The law introduced a licensing regime for traders and retailers and broadened the concept of an eligible consumer who can purchase power from the source of their choice. This provision enables competition between generators and retailers to supply clients at both the wholesale and retail levels. The Act sets out the future structure of the electricity sector. The process has not been completed and it will be important to clarify roles and responsibilities in the power sector as to when the system operation is transferred and how investment

in grid expansion will be financed. It is also important to highlight that what is envisaged in the Act has not yet been pursued and that several significant hurdles remain to making it a reality. Instead, the Act is only likely to be realised gradually and slowly over time and one could argue that the decision makers' cautious approach is warranted.

Figure 2.4 Electricity prices in Kenya, 1999-2023



Source: IEA (2024), Energy Prices (database).

The current market is a single buyer model, with generators entering into a PPA with the single buyer, KPLC. There is currently no market for services for system operations, but EPRA has released draft Energy Regulations for Electricity Market, Bulk Supply and Open Access. To ensure confidence in the regulations and future electricity markets, there is a need for greater stakeholder consultation, as several elements of these draft rules require further elaboration and refinement.

EPRA is responsible for determining electricity tariffs in Kenya. The Schedule of Tariffs 2022/23-2025/26 established the cost items incorporated into the retail tariff charged by KPLC, and took effect from 1 April 2023. EPRA declared a 4% reduction in electricity bills for 6.3 million domestic customers who consume less than 30 kilowatt hours (kWh), accounting for more than 70% of domestic customers. EPRA also provides for certain tariff adjustments, including regular pass through of foreign exchange and inflation changes, which are added to the end-user tariff (see Chapter 4).

Recommendations

To reach its objectives, the government of Kenya could consider:

- Assigning clear roles and responsibilities in the power sector (as mandated by the Energy Act of 2019) before implementing new market structures. This can support the many developments in the power sector and enhance power system operations.
- Strengthening the reliability of the transmission and distribution grids to reduce power outages and mobilising the capital necessary to upgrade the medium- and low-voltage network.
- Harmonising planning approaches and tools for power sector modelling to ensure improved optimisation of energy supply and demand-side projections.

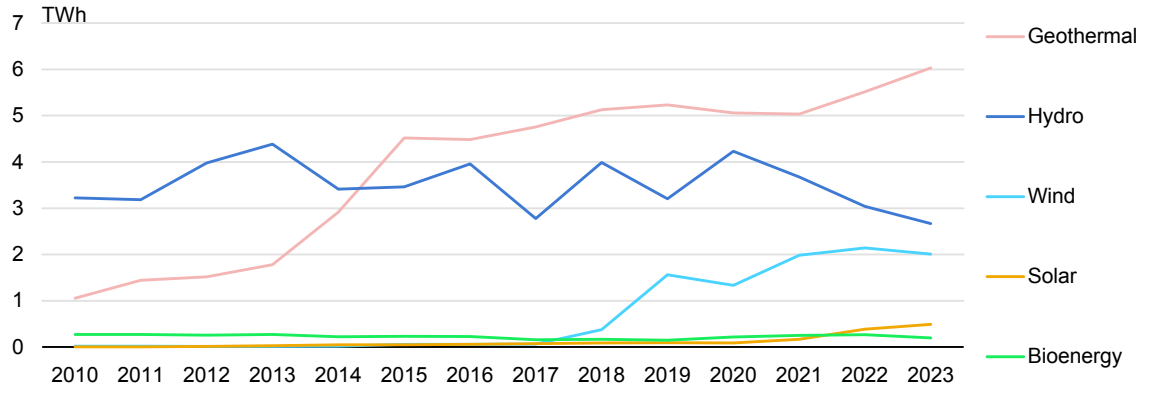
3. Renewable energy

Renewable generation

Renewable energy already provides the vast majority of Kenya's electricity

Renewable energy accounted for nearly 80% of Kenya's total energy supply in 2022, with traditional biomass accounting for 62%, mostly for cooking. Renewable electricity accounted for the remaining 18%. Kenya currently has over 2.6 GW of installed renewable energy generation capacity accounting for nearly 90% of power generation in 2023. Geothermal power (47%) provided the highest share of renewable electricity, followed by hydropower, wind and solar PV (Figure 3.1). Kenya has abundant resources, including untapped potential for additional geothermal resources. The country has a 2030 target for 100% of power generation from renewable energy and 100% access to electricity by 2030.

Figure 3.1 Renewable energy generation by source in Kenya, 2010-2023



Source: IEA (2024), World Energy Balances (database).

A strong policy framework has set the groundwork for the continued development of renewable energy

Several policies are guiding Kenya towards its 100% renewable generation goal. They include: the Energy Act of 2019, the Bioenergy Strategy 2020, the Renewable Energy Auctions Policy, the Feed-in Tariffs Policy on Renewable Energy Resources and the Energy (Net-Metering) Regulations 2024.

The Energy Act of 2019 set the framework for the development of additional policies, including the Renewable Energy Auctions Policy and the Feed-in Tariffs (FIT) Policy on Renewable Energy Resources. In addition to outlining the establishment of resource maps and inventory, it splits renewable resources into two groups, the first being biomass, biodiesel, bioethanol, charcoal, fuelwood, solar, wind, tidal waves, hydropower, biogas and municipal waste and the second geothermal resources.

The Act gives the EPRA broad regulatory authority over areas including, but not limited to, paperwork and forms, fees and royalties, qualifications, geothermal development, ecological impacts of projects, licensing, energy pricing, and the management of all renewable resources.

In addition to the Energy Act of 2019, the LCPDP provides a ten-year overview for power system growth, including demand-supply projections and levelised costs of energy. The LCPDP provides a roadmap for the expansion of the power system and includes four key areas: 1) load forecast; 2) generation plan; 3) ancillary services requirements; and 4) tariff evolution. The currently publicly available LCPDP is for 2020-30 and updates country-level conditions post Covid-19 while taking into account various additional inputs, such as the Revised IPP/PPA Taskforce Report 2020, the Sustainability Report for KPLC, the revised project list and external feedback.

Abundant geothermal resources allow for both geothermal for power and direct uses

Geothermal capacity holds the highest share of both capacity and generation for renewable energy, with 950 MW of installed capacity (2022). The power stations located in the Great Rift Valley are primarily owned and operated by KenGen, with the largest complex being the Olkaria Geothermal Project. Independent power producers have also built successful installations in the country. The Kenyan government has identified 14 additional areas for development, which has an estimated potential of 7-10 GW.

The Energy Act assigns all undeveloped geothermal resources to the national government, which can grant exploration licences for up to two years (with the possibility of renewal). Licences for power production can be assigned for up to 30 years, with the power producer retaining the right to use the post-generation water. The Act creates a framework for the cost of geothermal energy and outlines royalties for the resource extracted: 2.5% for the first ten years and 2-5% for the remaining years of the licence. Finally, the Act creates a framework for the industrial or commercial use (direct utilisation) of geothermal resources.

In addition to geothermal for power, Kenya has identified the direct use of geothermal for uses in agriculture, industry, fisheries and tourism. GDC has a pilot demonstration programme for milk pasteurisation, aquaculture, greenhouses, laundry facilities and grain drying. In 2023, GDC entered into a 25-year agreement to provide steam for cement production, including power uses (a 4 MW plant) and heat for drying. Additional uses for geothermal by-products could include cooling and tea drying. Currently, there is no specific policy supporting the direct use of geothermal energy.

The development of large-scale hydropower has slowed, but small-scale hydropower can increase electrification

Kenya has around 830 MW of installed hydropower capacity, with large-scale projects typically owned by KenGen, including the country's largest dam, the Gitaru Power Station (225 MW). Two additional large dams, the Thwake Multipurpose Dam (33 MW) and the Grand High Falls Dam (500 MW), are being pursued by the government.

The country also has numerous small hydropower installations, with many of the plants owned and operated by the Kenya Tea Development Agency and located within the tea-growing counties in Kenya. In addition to grid connected small hydropower plants, there are numerous installations, which are not grid connected, which provide power to communities or businesses. Aiding the development of small-scale hydropower is the FIT Policy on Renewable Energy Resources Generated Electricity (small hydro, biomass and biogas), which was originally introduced in 2008, with revisions in 2010, 2012 and finally 2021. The current iteration of the Policy is for biomass, biogas and small hydropower plants under 20 MW and sets a ceiling capacity (10% of total system capacity) for the programme.

The Policy outlines standard PPA terms, including contract length and a framework for the development of pricing, including fixed and adjustable costs operation and maintenance costs, which are indexed to the consumer price index. In addition, the policy outlines roles and responsibilities for EPRA for PPA contract review and general payment terms for the off-taker. All projects participating in the FIT programme require a PPA.

Reaching 100% renewable energy in power generation will require additional variable renewable energy

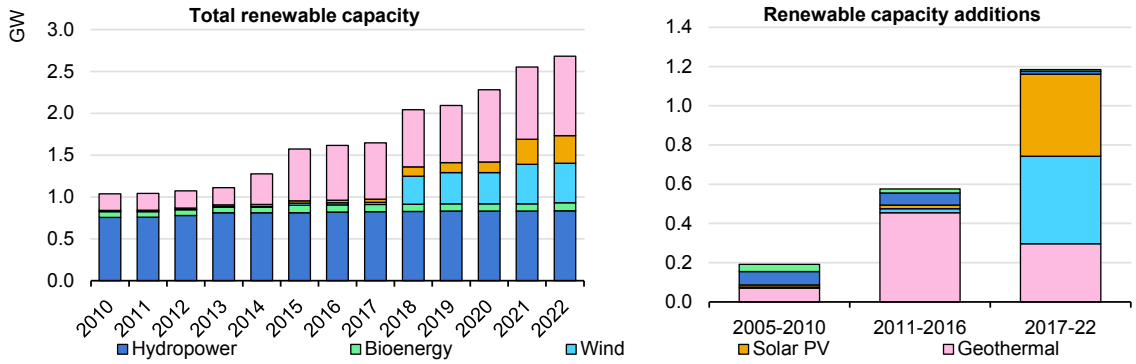
Solar PV and wind power currently total almost 800 MW of installed capacity combined. Grid-connected solar PV makes up the majority of the installed solar PV capacity, but there is also a substantial amount of off-grid solar PV. For wind, the Lake Turkana Wind Power Project (310.5 MW) accounts for nearly two-thirds

of total wind capacity. It is the largest wind power project in Africa, with construction being completed in 2017 and connection to the national grid occurring in 2018. The majority of this capacity was sourced via a FIT, with development done by KenGen and IPPs.

Prior to the FIT, Kenya relied heavily on run-of-river hydropower for the majority of its domestic power generation. However, following a drought in the mid-2010s, the FIT system sourced quick-start heavy fuel oil generators to help meet supply gaps. This has been changed to a new procurement method: the Renewable Energy Auctions Policy, introduced in 2021. The new auction system was introduced, in part, to replace those generators.

New variable renewable energy (and any renewable energy projects above 20 MW) will be governed by the auction system that is technology-neutral with key considerations being price, location and financial viability for the developer. The programme consists of two stages: 1) prequalification; and 2) a technical and financial evaluation. Bids are evaluated by price, with projects being awarded from lowest bid until the auction volume is achieved. In the new auction programme, developers are responsible for obtaining a grid connection study, land rights and interconnection cost. The policy transfers those projects which were awarded a FIT in the previous FIT programme, to the new auction scheme.

Figure 3.2 Total renewable energy capacity and renewable energy capacity additions in Kenya



Source: IEA (2024), World Energy Balances (database).

Development challenges include land-rights issues, which have previously led to project delays and cancellations. Land rights are managed at the county level, independent from federal programmes for renewable procurement. In addition, new development of renewable capacity has been on hold, as projects previously awarded a FIT are transferred to the auction programme.

To manage the variability of solar PV and wind systems, installations might need to be paired with energy storage systems for grid reliability. In addition to the storage requirement for renewable projects, the country is currently piloting a 100 megawatt hour (MWh) battery storage system through loans from the World Bank and the Green Climate Fund. Kenya currently has a draft market regulation, which would include an ancillary services market, under review.

Distributed energy resources are currently active and can increase electrification, but could impact demand

Small-scale installations or solar PV can be roughly split into two segments: 1) embedded generation that may or may not be connected to the grid given the system size (systems above a certain size must register as a generator); and 2) off-grid systems, such as mini-grids, pay-as-you-go (PAYGo) or solar home systems. Kenya is major market for third-party solar kits.

In 2024, the government passed a net metering programme. The programme has a maximum system size of 1 MW with the total capacity capped at 100 MW over the first five years from the start of the programme. The regulation outlines timelines for approvals, costs and associated responsibilities, standardised system agreements and the net metering credit rate of 50% of the exported power.

Off-grid systems and programmes were previously overseen by the Rural Electrification Authority, which was transitioned to the Rural Electrification and Renewable Energy Corporation in the Energy Act of 2019. Kenya is the strongest market in East Africa for PAYGo solar PV systems, accounting for nearly 60% of the region's market share. In addition to PAYGo systems, Kenya also has a large number of solar home systems.

However, demand is a current barrier to an additional increase of renewable energy capacity in Kenya. The current high amount of installed renewable capacity indicates that an increase in renewable capacity would need to be matched by an increase in demand. The country does have agreements for regional imports of electricity, for example a 400 MW agreement with Ethiopia for hydropower, which could potentially be replaced by domestic generation. However, the length of the contract, 27 years, indicates replacing this capacity with domestic generation may be challenging.

The new Electricity Regulations (2024) would allow for the development of renewable energy projects which would be directly contracted with a consumer, which could help spur additional development. However, the decoupling of the electricity market could create additional market concerns, such as system balancing and decreased demand for the incumbent utility, Kenya Power.

Incentives and mandates could be used to spur Kenya's abundant bioenergy potential

Traditional biomass products are the primary use of bioenergy in Kenya, mainly for cooking, though there are currently programmes in place to encourage the use of clean cooking fuels and equipment (see Chapter 5). The country's Bioenergy Strategy 2020 outlines best practices for bioenergy use worldwide and identifies sources and uses of bioenergy in Kenya. The strategy includes an overview of options for the optimisation of Kenya's bioenergy potential, though many of these measures have yet to be implemented.

The primary biomass fuels are woody biomass, crop residue and animal waste, while significant amounts are also derived from government or communal forests. Industry also uses biomass for thermal processes. While biomass for power generation and heat represents a small portion of the overall power generation mix in Kenya, the country has a target of 600 MW of biomass co-generation by 2030. In addition, the government sees potential in industrial waste as a fuel for biomass co-generation.

Kenya has an estimated 21 000 biogas digesters throughout the country, producing an estimated 29-131 MW of installed power generation capacity. The government has identified biogas as having high potential for cost and labour savings while also reducing the use of fuelwood and charcoal use in households. Potential feedstocks for biogas plants are municipal and livestock waste.

Outside of power generation, bioenergy for cooking and heating (including traditional biomass) accounts for a substantial portion of Kenya's total energy consumption. The use of biofuels in Kenya is mostly focused on cooking, as the country is seeking to adopt clean cooking practices. Bioethanol is an alternative clean fuel for cookstoves and has a growing market share owing to private sector participation. Most of the bioethanol is imported, though the government plans to build two new bioethanol production facilities using molasses and cassava feedstocks.

Noticeably, biofuels have not been used for transportation. The Energy Act of 2019 empowers the Cabinet Secretary to promote the development and use of biofuels, and the bioenergy strategy mentions a potential 2% blend of biodiesel with traditional diesel fuel and 10% ethanol-gasoline blend. However, there is currently no specific legislation for blending of biofuels in transport fuels. Currently, the country's feedstocks (vegetable oil from the processing of castor, croton and cottonseeds) are exported for the processing of biofuel products.

Kenya has a national biogas programme – the Kenya National Domestic Biogas Programme – which is aligned with the African Biogas Partnership Programme.

The Programme promotes the installation of small-scale biodigesters across the country to help reduce the dependence on fuel wood and charcoal.

A major barrier to the uptake of biofuels is the absence of regulations and blending mandates to create a domestic market for feedstocks and production. There is currently a programme to send feedstocks for production in Europe, only to be re-imported for use by Kenya Airways. In addition, Eni has recently received a grant from the International Finance Corporation and the Italian Climate Fund to expand the production and processing of biofuels from oilseeds.

Green hydrogen has the potential increase domestic fertiliser production through policy incentives

Kenya has released a Green Hydrogen Strategy and Roadmap for green hydrogen production. The guidelines outline a two-phase roadmap for the production of green hydrogen. The first phase (2023-27) focuses on increasing domestic demand to replace 20% of imported ammonia-based fertiliser and 100% of imported methanol. The second phase (2028-32) will focus on both domestic production and regional and global exports. For domestic use, this second phase aims to replace 50% of ammonia-based fertiliser imports and decarbonise the transportation and power generation sectors.

The guidelines set definitions for the type of power plant used for green hydrogen production: a captive plant, grid-connected plant or a wheeling plant. Each of these types has its own specific criteria, with additional criteria set out for land and water use. Crucially, the roadmap establishes a one-stop shop to support developers on guidelines and incentives. The document also provides the necessary documentation and timelines for developers when creating a proposal for a green hydrogen project in Kenya, along with the expected amount of time it will take the government to review these documents.

The document includes incentives for green hydrogen production, which include: a ten-year tax holiday, a value-added tax exemption on raw materials and machinery, a single operation licence, exemption from stamp duty, a fixed corporate tax rate after the tax exemption expires, 100% investment depreciation, and no currency exchange controls. Finally, the roadmap establishes special economic zones with additional incentives.

Recommendations

To reach its objectives, the government of Kenya could consider:

- Ensuring that the framework for renewable energy auctions is consistent with the Least-Cost Power Development Plan and explicitly details additional government

and regulatory requirements, and including total capacity, an indicative timeline, bidding criteria and grid capacity information for priority areas for development.

- Advancing consultation with all major stakeholders to promote direct uses of geothermal resources such as agriculture, cooling, manufacturing and/or renewable hydrogen for energy storage.
- Fostering the development of a market for cooking and transport biofuels by, for example, use of domestic feedstocks and blending mandates for transport.

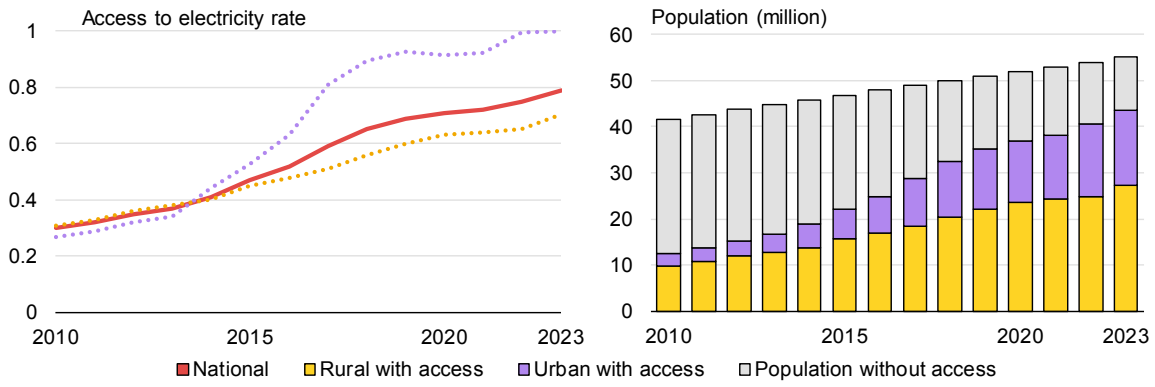
4. Access to electricity

Increasing access to electricity

Rapid increase in access to electricity has made Kenya a regional leader

Kenya has made considerable progress in increasing access to electricity.[1] Access has more than doubled over the past decade, from 37% in 2013 to 79% in 2023, making it the country with the highest electricity access rate in East Africa (Figure 4.1). Kenya is on track to provide electricity to its entire population by 2030, in line with national plans and Sustainable Development Goal (SDG) 7 targets.

Figure 4.1 Access to electricity in Kenya, 2010-2023



Source: IEA (2024), Access to Electricity.

Although Kenya has a high national electricity access rate compared to the sub-Saharan African[2] rate of 50%, there are strong disparities between the rates in urban and rural areas. In 2023, 100% of the urban population had access to electricity. However, the population in Kenya is largely rural, with only about one-third living in urban areas. Access rates have climbed from 30% in 2010 to 70% in 2023 in rural areas, providing roughly 15 million people with access. There

[1] The IEA defines access to electricity as a household receiving enough electricity to power at least a minimum level of services that is capable of growing over time. The IEA minimum level of services is defined as the "basic bundle", which includes more than one light, phone charging and a radio, broadly equivalent to a range of 50-75 kWh per household per year, depending on efficiency levels. In the case of off-grid solar, the IEA considers in the access definition solar home systems of 10 watt-peaks and above. See the IEA Guidebook for Improved Electricity Access Statistics.

[2] Sub-Saharan Africa includes all African countries excluding the North African countries Algeria, Egypt, Libya, Morocco and Tunisia. In this report, South Africa is included in sub-Saharan Africa.

remain around 11 million people living in rural areas who lack access to electricity services. Kenya's priority now is to focus on the most remote populations in rural areas while still investing in increasing the level and quality of services provided by electricity for the people that already have access.

The government of Kenya has developed a comprehensive and clear set of strategies, policies and plans to achieve universal access to electricity and 100% renewable power by 2030, notably Kenya Vision 2030, which aims to transform Kenya into a newly industrialising, middle-income country; the Kenya National Electrification Strategy; the Energy Act; and the Rural Electrification Programme. Electricity demand in Kenya grew by 15% from 2018 to 2022 as GDP expanded over the same period by about 18%, with a record-high peak demand of almost 2 100 MW in June 2022. The government focused measures on demand stimulation to promote greater electricity consumption and utilisation of grid networks, with a significant emphasis on electrifying transport.

It is critical that electricity access plans are aligned with a broader vision of socio-economic development to ensure broader long-term results.

The Last Mile Connectivity Project has successfully connected millions to the grid

Much of Kenya's recent progress on electricity access can be attributed to the country's National Electrification Strategy, launched in 2018 with the goal of achieving universal access to electricity by 2022. From 2018 to 2023, the access rate increased from 65% to 79%, and the urban access rate of nearly 100% was also achieved during this period. This expansion was achieved despite global setbacks from Covid-19 and the global energy crisis, underscoring the success of the Kenya National Electrification Strategy.

The main approach underpinning the drive towards universal electricity access is the Last Mile Connectivity Project (LMCP). Launched in 2015, the Project aimed to maximise utilisation of existing distribution transformers across 47 counties to their maximum capacity through extension of the low-voltage network to reach around 1.2 million people. In support of electricity access plans, all public facilities and households located within a radius of 600 metres from an existing transformer were prioritised for connection. In addition to providing increased electricity access, new transformer installations on existing grid networks to promote households' electricity connection have been undertaken. This approach has led to significant improvements in access to electricity for households in rural areas, halving the number of people without access to electricity in rural areas from 20 million in 2015 to around 11 million today.

Between July and December 2023, Kenya Power added more than 250 000 households to its consumer base thanks to the LMCP, bringing its cumulative grid-connected consumer base to almost 9.5 million at the end of 2023. However, as the majority of these households are in rural areas, they use significantly lower amounts of electricity than their urban counterparts, usually only for limited lighting and to charge phones. The programme, therefore, did not boost Kenya Power's power sales. More demand and productive uses stimulation activities could boost electricity use and increase the sales of the electricity provider while at the same time catalysing economic growth and in the long term addressing the affordability issue.

In May 2024, the government announced that it had secured funding for the fourth round of the LMCP, providing electricity to an additional 280 000 households across 32 counties, excluding Nairobi and Mombasa. This phase of the project is expected to be completed within 18 months.

The LMCP has a built-in gender component where gender was taken into account from the start, including capacity building for Kenya Power staff and gender mainstreaming workshops. The programme envisions that at least 30% of the job opportunities that are created in the construction phases of the project will target women. Further, the Project will provide access to electricity for low-consumption last-mile connections where more than one-third of households are headed by women. Providing access to electricity can contribute to closing gender disparities and facilitate women's economic empowerment in relation to education, paid work and healthcare.

Before kicking off the LMCP, Kenya focused on rural electrification in public institutions, with the Government's Digital Learning Programme (2013-2016) aiming to electrify all public schools. The national grids were extended to schools, while solar PVs were installed at those schools where the grid was inaccessible. The programme provided a network across the country that helped further connect households in the vicinity of the connected schools. The programme is still ongoing with REREC.

In 2010, the access rate in urban areas was only 27%, less than in rural areas. This was largely due to the informal settlements in the cities, such as Kibera in Nairobi, Africa's most populous slum. Through using a community-based approach in its informal settlements programme, Kenya Power managed to go from 5 000 households to over 150 000 households connected to electricity in just one year, from May 2014 to May 2015. Through collaboration with World Bank supported programmes such as the Kenya Informal Settlements Improvement Project and the Global Partnership on Output-Based Aid, the access rates in urban informal settlements helped drastically improve the urban access rate to nearly 100% in 2023.

Other electrification programmes include the Rural Electrification Programme under Vision 2030 and the Transmission Network Improvement Project, which aims to improve power transfer capacity to address system gaps and enhance universal electricity access. In addition, Phase 1 of the World Bank's Kenya GREEN Programme (2024-2028) makes available roughly USD 100 million in support of KPLC's aim to connect 1.6 million additional on-grid customers by June 2028.

Off-grid and mini-grid solutions help provide important access to otherwise hard-to-reach populations

Solar home systems are a helpful transitional measure to reach universal access to electricity, as they can reach remote populations with difficulties to access the national grid. Even in areas with extensive low-voltage networks such as in the Central Region, the cost of providing connections is high due to the need to run lines to scattered households in dispersed settlements. Kenya is the largest and most mature market for solar off-grid solutions globally, surpassing India in 2019, and accounting for 74% of solar home system sales in East Africa in 2023, though in recent years there have been lower levels of investor attention.

The government removed the import duties and VAT on solar PV products in 2021 to make solar energy more affordable to households and businesses. However, import duties still remain on solar PV parts, leading local companies to report having to pay import duty and VAT on individual parts for domestic assembly or repairs.

The Kenya Off-Grid Solar Access Project (KOSAP) is a five-year initiative started in 2018[3] by the World Bank and Kenya's Ministry of Energy and Petroleum whose aim is to enhance energy access in underserved Kenyan counties with the goal of promoting solar technology use, largely through a distributed model. The project targets the 14 out of 47 counties in the country the government defines as marginalised and aims to provide energy access via solar technology. The component objectives of KOSAP include the construction of 157 mini-grids through public-private partnership (PPP); the sale of 250 000 solar home systems and 150 000 clean cooking solutions; and the installation of stand-alone solar PV systems with water pumps in 473 community facilities.

As of February 2023, the Kenyan government had deployed 62 fully operational mini-grids and had 28 additional ones under construction as part of its electrification efforts. The private sector is also involved, with more than 50 private mini-grids in operation and around 150 under development.

[3] The project end date was extended to 2025 to accommodate disruptions related to the global pandemic.

The 2021-2030 LCPDP highlights Kenya's intention to develop solar PV mini-grids to improve rural electrification. With this in mind, EPRA developed the Energy (Mini-Grid) Regulations 2021 to provide clear regulatory guidelines for mini-grid development. The Regulations apply to those wishing to develop a mini-grid project with an installed capacity of up to 1 MW. They include requiring a Mini-Grid Construction Permit from EPRA as well as a licence to operate the generation and distribution infrastructure.

Challenges to electricity access

Rising electricity prices continue to hinder affordable electricity access

Affordability remains one of the biggest challenges to achieving universal access to electricity in Kenya. Despite having a high share of low-cost renewable energy, including geothermal, which represents 90% of the country's power generation, electricity end-user prices in Kenya remain some of the highest on the continent, at 0.256 USD/kWh as of September 2023 (compared to 0.191 USD/kWh in Rwanda, 0.190 USD/kWh in South Africa, 0.173 USD/kWh in Uganda and 0.058 USD/kWh in the Democratic Republic of the Congo).

Kenya has experienced high inflation in recent years leading to increased cost of living, especially for the poorest households. According to KNBS, the general price level was 6.9% higher in January 2024 than in January 2023; 10.6% higher for transport; 9.7% higher for housing, water, electricity, gas and other fuels; and 7.9% higher for food. Prices for electricity skyrocketed in 2023 compared to the previous year, with an increase of almost 70% for 50 kWh and almost 50% for 200 kWh between August 2022 and August 2023, both due to increased tariffs and increased global fuel prices, as well as to improve cost recovery and the financial health of KPLC. In 2024, prices have dropped slightly from month to month, but this does not come close to bringing them down to 2022 levels.

Price increases on electricity can be attributed to new tariffs and the removal of electricity subsidies. It can also partly be attributed the weakening of the Kenyan shilling to the US dollar, as well as to global trends with increasing costs attributable to the Covid-19 pandemic and heightened geopolitical tensions in Eastern Europe and the Middle East, which have disrupted international trade. Conflict has also impacted global fuel and commodity prices, which has had a limited impact on Kenyan electricity tariffs. In January 2022, the government introduced a 15% subsidy to reduce the price of electricity for households but the subsidy was not extended beyond its expiration in December 2022. New electricity tariffs were introduced in April 2023, increasing the end-user bill by 19% for customers consuming 30-100 kWh and by 14% for those consuming more than

100 kWh compared to the tariffs from 2018. For low-income households, a new tariff ("lifeline tariff") reduced the end-user bill by 4% compared to 2018 tariffs. The tariffs were amended after the commissioning of several new power plants to ensure financial viability and sustainability for KPLC, and to allow for system expansion. The new tariffs rebalance the electricity costs, with low-income households paying less for electricity and middle- and high-income households paying a greater share of the cost. The band for the lifeline tariff was also raised several times: its current band of 0-30 kWh per month benefits about 6 million households, or more than 70% of electricity consumers.

Improving quality of connections and tracking access through community participation

Data collection on access to electricity remains a challenge due to difficulties in reaching and tracking rural communities and methodologies used when defining and tracking access. Further, data on factors such as reliability and quality of connections at the household level are not collected widely. Closing the access gap and reaching universal access to electricity in Kenya requires greater scaling, which today is hindered by traditional planning and customer acquisition approaches. Today, this often relies on workers going village to village to assess the current electrification and energy needs at the community level.

Timely data on access to electricity is essential for tracking progress towards universal electrifications and for policy makers to plan electrification campaigns. The IEA has developed a Guidebook for Improved Electricity Access Statistics, which provides a foundation for how to improve methodologies using readily available supply-side data from electric utilities, mini-grid operators and off-grid system distributors to track access to electricity trends, which can be a tool used by governments to achieve their access goals in time.

Kenya has implemented programmes for promoting greater community involvement and ownership of connections. However, these programmes lack regulatory frameworks for integration into projects. The Guide to Community Engagement for Power Projects in Kenya, developed by the government and USAID in 2018, provides useful guidelines and tools for increased community participation in electricity projects. Further actions, such as training community representatives to participate in local power system monitoring and maintenance, could provide significant benefits for tracking quality of connections.

Kenya is actively enhancing its data collection on electricity provision, as well as for monitoring overall connection quality and broader power system health. Kenya Power has set out plans to install smart meters or advanced sensors at 1 300 distribution feeders, 73 000 distribution transformers and 600 000 large consumers across the country. This is part of efforts to improve overall system

monitoring and bring in additional revenue. As of February 2024, Kenya Power had installed 67 000 new smart meters, which has increased the company's annual sales by KES 347 million (Kenyan shilling, approximately USD 2.6 million) by saving on operating expenses and commercial costs. By December 2024, Kenya Power plans to have installed smart meters for all big electricity users, small and medium-sized enterprises, and customers who consume over 200 kWh on advanced metering infrastructure.

At the household level, more granular data on broader productive uses of electricity, such as for lighting, mobile phones, appliances and electric cooking (e-cooking), is limited. However, there is potential for improvement through the rollout of smart meters and application of other tools such as geographic information systems.

Recommendations

To reach its objectives, the government of Kenya could consider:

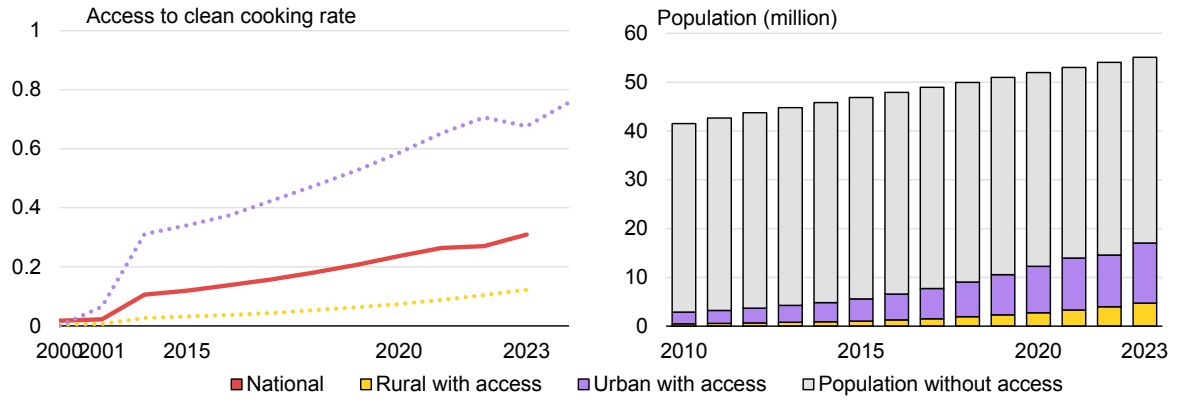
- Reinforcing national policy frameworks that deliver access to electricity and promote affordability (including affordability of connection), while balancing cost recovery and utility financial sustainability alongside long-term power reliability, quality and durability considerations.
- Setting out a least-cost pathway for the delivery of universal access to electricity by 2030 that clarifies the roles and responsibilities of national and county-level government; sets guidelines for on- and off-grid solutions; and aims to increase levels of energy services and productive uses.
- Strengthening electricity demand data collection and monitoring at the national and county levels.
- Promoting inclusivity of electricity access projects within local communities. This could include delivering capacity-building programmes for power system monitoring.

5. Access to clean cooking

Kenya is a regional champion in clean cooking access, but efforts are still needed to transition away from biomass

Kenya is a regional champion of clean cooking[1] access and has made great progress in increasing the access rate from only 10% in 2013 to 31% in 2023 (76% urban, 12% rural), putting it ahead of its neighbouring countries and other East African countries as well as of the sub-Saharan African average of 22%. Despite this progress, around three-quarters of Kenyan households still rely on traditional biomass such as firewood or charcoal, and kerosene for cooking. Further, the number of people without access remained almost stable between 2010 and 2023 at around 40 million, as high population growth has outpaced the clean cooking rate (Figure 5.1).

Figure 5.1. Access to clean cooking in Kenya, 2010-2023



Source: IEA (2024), Access to Clean Cooking.

The Kenyan government's ambition is to reach universal access to clean cooking by 2028. Several strategies on biomass and clean cooking support this goal, such as the Bioenergy Strategy 2020. The government, in May 2024, released the

[1] Clean cooking is defined as cooking solutions that release less harmful pollutants, and which are more efficient and environmentally sustainable than traditional cooking options that use solid biomass (e.g. a three-stone fire), coal or kerosene. For more information, see: the IEA website. The IEA SDG 7.1 indicators for clean cooking are defined as households primarily cooking with clean fuels, including liquefied petroleum gas (LPG), electric cooking, ethanol, biogas and improved biomass cookstoves of ISO Tier > 3. However, official SDG 7 indicators exclude all solid biofuels (wood, charcoal, etc.) from access to clean cooking due to gaps in data gathering on improved biomass cookstoves.

Kenya National Cooking Transition Strategy (KNCTS). The Strategy is much welcomed by ministries, private stakeholders and the international community, as well as the IEA.

The KNCTS lays out the pathways to reach universal access to clean cooking by 2028 and to contribute to the Nationally Determined Contribution (NDC) target to reduce their GHG emissions by 32% by 2030. The Strategy's objectives include: establishing a baseline scenario of Kenya's cooking sector, including looking at the current energy mix for cooking, barriers to uptake, the enabling environment and opportunities; assessing gender dimensions in Kenya's cooking sector; determining the appropriate cooking fuel mix to reach universal access by 2028; and developing a roadmap to reach this goal.

Kenya has also developed the Kenya National Electric Cooking Strategy, which feeds into the KNCTS. It focuses on how energy-efficient electric cooking strategies can be scaled up in Kenya to minimise the risks associated with the use of biomass for cooking, improving environmental sustainability and stimulating electricity demand growth.

Kenya has for many years had several strategies and policies related to clean cooking; however, implementation plans have been lacking and there have been low and inconsistent budget allocations to clean cooking at the national level, which has hindered the scaling up of clean fuels. Strategies such as the Kenya Ethanol Cooking Masterplan, the Bioenergy Strategy, the National Growth LPG Strategy and the Electric Cooking Strategy (draft) have lacked coherence and co-ordination, making implementation and budgeting difficult. The new KNCTS provides harmonisation to the clean cooking sector in Kenya and an improved enabling environment to develop the sector. It also provides a clear integrated roadmap covering all fuels, including budget allocations and time frames, on how to reach its goal of universal access to clean cooking by 2028.

Cooking solutions by fuel

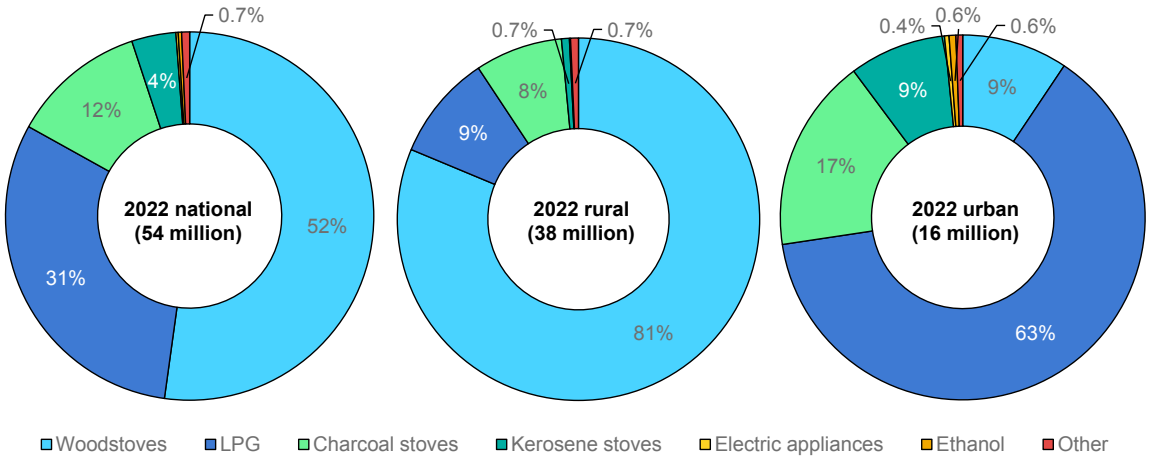
Three-stone open fires remain the most common cooking solution

According to the Kenya Demographic and Health Survey of 2022, the three-stone open fire[2] has historically been and remains the most used fuelwood-based cooking option in the country, with 49% of households using this solution as their

[2] Traditional cooking set-up where the cooking vessel is placed near open flame to limit heat loss.

primary solution in 2022. The KNCTS finds that nationally, 52% of the population uses firewood as their main cooking fuel, with the number being as high as 81% in rural areas (Figure 5.2).

Figure 5.2. Primary cooking technology in Kenya, 2022



Source: IEA analysis based on data from Kenya National Cooking Transition Strategy.

Improved cookstoves[3] is a valid transitional solution towards clean cooking as they allow more efficient use of fuel, limited release of smoke and have higher safety standards. They are generally the cheapest and most practical means of providing improved cooking solutions to households, as they do not require switching fuels or developing new infrastructure. The use of improved cookstoves is rapidly growing, with more than 4 million improved cookstoves manufactured in Kenya sold since 2014. Import duties on improved cookstoves remain high, at 35%, compared to the common East African Community (EAC) import duty of 10% applied in the other EAC countries. The higher import duty on imported clean cookstoves is an effort to promote local manufacturing.

The government has implemented the World Bank Multi-Tier Framework for Cooking to identify what stoves meet certain standards as a way to ensure deployed stoves are providing the expected results and can be classified as clean cooking. The Kenya Industrial Research and Development Institute, Dedan Kimathi University of Technology Centre for Energy Studies, the University of Nairobi and Strathmore University have established testing laboratories for quality testing of improved cookstoves. There are also proposals to establish regional testing laboratories for cookstoves in energy centres across the country.

[3] Intermediate and advanced improved biomass cook stoves (ISO tier ≥ 3). It excludes basic improved stoves (ISO tier 0-2).

More than 50% of Kenyan households use more than one device for cooking and one in six use three or more. This is referred to as fuel stacking. This means that the number of each stove type sold in Kenya may be significantly higher than the number of households actually using the stove as their primary fuel. Some households may use several types of cooking devices for different meals or even for different parts of a single meal.

Continued demand for charcoal fuels illegal logging

Around 12% of households use a type of charcoal cookstove as their primary cookstove appliance, and in urban areas, more than 80% of households use charcoal as their primary or secondary source for cooking. The mean annual charcoal consumption from households in Kenya is almost 400 kg per year.

Rapid increase in charcoal demand due to high prices of cleaner alternatives has led to a widened supply-demand gap, resulting in unsustainable charcoal demand and deforestation. To address these challenges, the government established the Forest (Charcoal) Rules in 2009 to regulate the production, transportation and marketing of charcoal by requiring producers to formally register and receive a certificate. To further prevent deforestation and biodiversity loss, the government imposed a national ban on logging (and therefore charcoal production) in 2017. Despite the ban, illegal logging continues, fuelled by corruption and a lack of enforcement and of monitoring capacities of the forest land.

In July 2023, the logging ban was lifted, and the government said there will be responsible forest management where firewood and charcoal production in certain forests can be sustained and new jobs can be created. Despite these efforts, households continue to use large amounts of charcoal due to the lack of affordability of cleaner solutions. This continuation of high demand continues to sustain the illegal logging and charcoal trades.

Kenya is scaling up the use of LPG and bioethanol to achieve access to clean cooking goals

From 1999 to 2022, the number of households using LPG for cooking increased more than threefold, with the proportion rising from around 9% in 1999 to 31% in 2022 (63% urban and 9% rural). LPG is, therefore, the most common fuel among those considered to have access to clean cooking. However, due to fuel stacking, there may be a large number of households that use LPG only occasionally and in combination with other more polluting fuels such as firewood or charcoal.

In the KNCTS, to reach universal access to clean cooking by 2028, Kenya foresees 50% of households using LPG for cooking (up from 35% as previously foreseen). The government has shown support for the use of LPG for cooking, for

instance by removing the 16% VAT in 2023 to stimulate its use. The government also introduced LPG market regulations by standardising cylinders to work with any LPG provider. The government aims to use LPG as a transitional fuel, targeting for it to be phased out completely by 2050 in line with its net zero emissions goal. However, all LPG is currently imported and there are limited plans to start domestic production, which exposes the country to increased risk in currency fluctuations and cost of supply. In late 2023, the Kenya Pipeline Company acquired an old, closed refinery in Mombasa that previously stored oil-based products to consider developing LPG storage (see Chapter 6).

The government's Clean Cooking Energy Compact of 2021 aims to transition public schools and institutions away from biomass, providing an opportunity for children to positively impact their family's cooking practices. The government's LPG Strategy aims for all schools to use LPG for cooking, and the president of Kenya has directed all public institutions to transition to LPG for cooking by 2025. While these are worthwhile measures, they do not address the problem of biomass use in households, and there is a risk that households and institutions will revert to biomass if the LPG price surges, or the VAT regime become less favourable. The VAT on LPG has been introduced and removed several times, making the market less predictable. A 16% VAT was reintroduced in Kenya in July 2021, causing many households to switch back to biomass. The restoration of the VAT removal for LPG sales through the Finance Act of 2023 is a welcome measure, but should the government decide to reinstall the VAT it should be accompanied by schemes to protect the welfare of the poorest households through income support or subsidy.

The use of bioethanol for cooking is growing at a fast pace in Kenya, especially in urban areas, but still accounts for less than 1% of cooking fuels. Most bioethanol is imported. The government is looking at increasing domestic production and is planning on building two new bioethanol production facilities (see Chapter 3).

In addition to the 50% LPG target, the KNCTS foresees that by 2028, 30% of households will be using bioethanol, 10% will be using electricity, 3% will be using biogas, and 7% will be using low emissions or clean burning sustainable biomass stoves such as those using briquettes or pellets. The IEA commends the diversity of clean cooking solutions being championed in Kenya. However, the number of households currently using bioethanol for cooking is small at less than 1%. Reaching 30% by 2028 will require a rapid increase in investments in supply and distribution infrastructure and subsidies to ensure that bioethanol is an attractive option for households. The sustainability of bioethanol supply must also be a consideration to avoid undue competition over land used for crops and food production, deforestation and biodiversity loss, impact on water use, and emissions related to production (see Chapter 6).

There is currently no widespread use of bioethanol for transportation in Kenya. However, there have been discussions to turn an inactive refinery in Mombasa into a bio-refinery, potentially producing biofuels for cooking, transport and heating (see Chapter 6). With increased production of biofuels, the potential competition of bioethanol in the cooking and transportation sectors must be considered when expanding the biofuels sector.

Although about 25% of households in Kenya own at least one electric cooking appliance, only 3.5% of these are considered complete cooking solutions, such as electric pressure cookers, induction cookers, rice cookers and electric hobs. The remaining 21.5% are task-specific appliances such as electric kettles, water heaters and microwaves, which does not fall under the definition of clean cooking technologies. Despite this, only 0.2% of households use electricity as their primary source for cooking. This is largely attributed to the high cost of such stoves, cost of electricity and unreliability of the electricity provided.

Achieving universal access to clean cooking by 2028 will require scaling up access to solutions such as LPG, electricity, biogas, bioethanol and improved biomass cookstoves. This implies efforts including investing in supply- and distribution infrastructure for clean cooking fuels and stoves and establishing and reinforcing policies for implementing the KNCTS roadmaps including targeted affordability measures and incentives.

Challenges to access to clean cooking

Cooking with biomass disproportionately affects women and children, and is a major CO_2-emitter

With around three-quarters of Kenyan households still relying on traditional solid biomass (such as firewood) and kerosene for cooking, a large part of the population, especially women and children, are exposed to unnecessary health risks. This is estimated to cost the economy KES 5.7 trillion (USD 39 billion) each year in negative climate and health impacts. Further, cooking with polluting fuels is estimated to contribute to the death of over 23 000 Kenyans every year due to exposure to indoor air pollution.

In sub-Saharan Africa, women in households without cleaner fuels spend an average of five hours each day collecting firewood and cooking their meals. This not only impacts their health significantly but also deprives them of opportunities like access to education, economic activities, which could give them financial independence. Transitioning from cooking on a traditional open fire to using an improved cookstove could reduce their daily cooking time by one hour, improving both economic opportunities and health.

The National Climate Change Action Plan 2018-2022 notes that improving biomass cooking efficiency and increasing the update of clean cookstoves is an important measure to reach the NDCs' emissions reduction targets.

Regulations, cultural awareness, data collection and affordability are challenges to scaling up clean cooking

The role of the private sector in the clean cooking market is growing rapidly, giving consumers options to choose their preferred clean cooking fuel, including LPG, bioethanol, e-cooking, biodigesters and other improved cookstoves. The VAT on LPG was removed in July 2023, making the fuel more affordable to consumers and investors. However, VAT on imported clean cookstoves remains at 16% in Kenya, in addition to a 35% import duty, as an effort to protect and promote local manufacturing. Uncertainties regarding VAT exemptions as well as a lack of a transparent regulatory framework may disincentivise foreign private investment in the cooking sector in Kenya (see Chapter 9).

Providing affordable stoves is not enough to ensure that households continue using clean cooking solutions in the long term. The lack of affordable fuel for a cleaner burning stove technology can lead many to revert back to biomass. The government is considering establishing a clean cooking electricity tariff utilising digital tracking of electricity usage that is separately metered to ensure more households can afford e-cooking solutions. This initiative could contribute to greater uptake of electric cooking appliances on the Kenyan market, as well as to the financial viability of the power sector through demand stimulation. The current electricity tariffs include a customer band for those consuming 30-100 kWh/month. Although this is not referred to as an "e-cooking tariff", it was introduced partly to promote the uptake of e-cooking, as it targets the typical consumption range for the low-income households that might consider cooking with electric stoves.

To ensure the sustainable development of clean cooking, it should be part of integrated energy planning strategy that targets long-term economic growth so that people can sustain the cost of clean cooking fuels in the long term. This requires Kenya to incorporate planning for electricity supply with clean cooking and other development goals, and that the creation of new businesses and productive uses are supported and stimulated in tandem. Kenya has made great strides in helping households and institutions access clean cookstoves through various programmes, as well as introducing some incentives for cleaner cooking fuels. However, ensuring supply and price stability for such fuels is key for ensuring clean cooking solutions households can afford and sustain over the long term. Cultural barriers and lower awareness of alternative options for cooking also play a role in hindering the switch from cooking with traditional fuels, such as coal, charcoal or firewood, to less polluting solutions such as LPG or e-cooking. Preferences in food taste and methods of cooking leave many hesitant to make

the switch, and limited access to information on the potential benefits of switching can further limit willingness. The Behaviour Change Communication Strategy is one government approach to address these challenges. Mama Doing Good, an organisation that implements programmes for the Office of the First Lady of Kenya, also works to promote the adoption of clean and efficient cooking options. Transitioning of public institutions to clean cooking can further contribute to bolstering awareness of cooking with clean fuels.

Tracking access to clean cooking is complex and further contributes to the challenges of scaling up access. The Kenya Institute of Public Policy Research and Analysis collects statistics on households and submits them to KNBS. However, household statistics vary between national and county level. The 2022 Kenya Demographic and Health Survey contains the latest and most comprehensive tracking of access across households in Kenya.

Recommendations

To reach its objectives, the government of Kenya could consider:

- Developing an implementation action plan for faster uptake of clean cooking solutions that takes a multi-stakeholder approach; setting out a robust monitoring and evaluation framework for tracking progress against the targets in the KNCTS, with clearly defined roles and responsibilities.
- Embedding energy efficiency in regulations governing the clean cooking sector, including minimum energy performance standards, labelling and testing capacity in co-operation, where appropriate, with neighbouring countries.
- Developing an investment plan for the KNCTS which outlines the most appropriate clean cooking technology given geospatial and socio-economic conditions, relative costing of those technologies, and steps to access finance for clean cooking from different sources, including development finance institutions, private sources, public sources, etc.
- Developing a stable fiscal incentive regime that emphasises affordability for the end user, clearly linked to the number of households gaining access, and is aligned across clean cooking fuels and technologies listed in the KNCTS.

6. Energy security

Kenya's progress in developing an innovative and clean energy sector is having a positive impact on strengthening the country's energy security. A wide range of renewable energy sources provides secure domestic supply of electricity, covering almost the entire generation mix and demand, reducing Kenya's dependence on imported fossil fuels for its electricity supply.

A significant proportion of its energy supply, particularly fossil fuels, is imported. Kenya's energy imports consist mainly of oil products (88% of total energy imports in 2022), as the country has no oil production and no active oil refinery. Other energy imports include coal (11%) and electricity (0.4%).

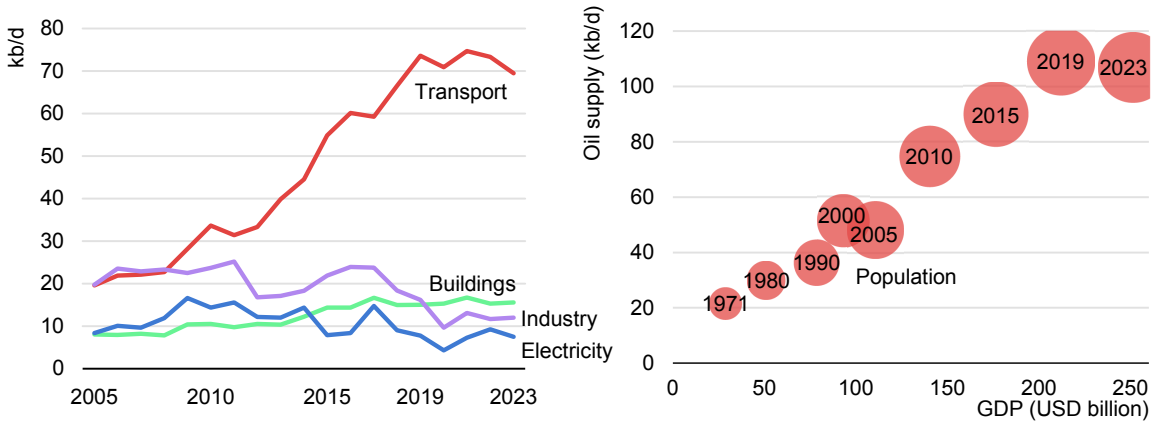
Liquid fuels

Oil product imports meet domestic demand

Oil consumption in Kenya is growing and is expected to continue to do so. From 2005 to 2023, oil consumption in Kenya more than doubled, driven mainly by growing gasoline and diesel consumption in the transport sector, but also by increasing household consumption of LPG (Figure 6.1).

Despite some signs of decoupling between GDP growth and oil supply, economic development and population growth are expected to further contribute to increased oil demand in the coming years. It is, therefore, important to ensure that a reliable and diversified oil supply can adequately meet growing demand. At the same time, efforts to limit oil consumption through energy efficiency measures, the electrification of transport and the promotion of biofuels would help to reduce dependence on imports of oil products.

Figure 6.1 Oil demand by sector in Kenya, 2005-2023, and correlation with GDP and population, 1971-2023



Note: kb/d = thousand barrels per day.
Source: IEA (2024), World Energy Balances (database).

Kenya does not produce crude oil but reserves have been identified in the South Lokichar Basin in the Turkana region. International oil companies had plans to start oil production in the early 2010s, and to construct a pipeline from the production site to Lamu, where a refinery could be built.

In 2020, preliminary production wells successfully completed two years of exploration. EPRA is reviewing a field development plan that uses data gathered from the preliminary wells and aims to produce first oil in 2028 and up to 120 kb/d by 2030. An outcome is expected by the end of 2024. Once the review of the field development plan is complete, the government expects to take an informed decision on whether to allow commercial oil production.

At COP28 in the United Arab Emirates, Kenya joined the Beyond Oil and Gas Alliance, and received funding to plan for a just, managed and orderly transition away from oil.

In the past, Kenya produced oil products at a refinery owned by Kenya Petroleum Refineries Limited (KPRL) in Mombasa. KPRL operated the only refinery in East Africa, but it ceased operations in 2013 owing to a lack of profitability. In late 2023, the complex was acquired by the Kenya Pipeline Company, which uses it to store oil products, including the development of LPG storage. There may be potential to convert the facility to produce biofuels (see next section).

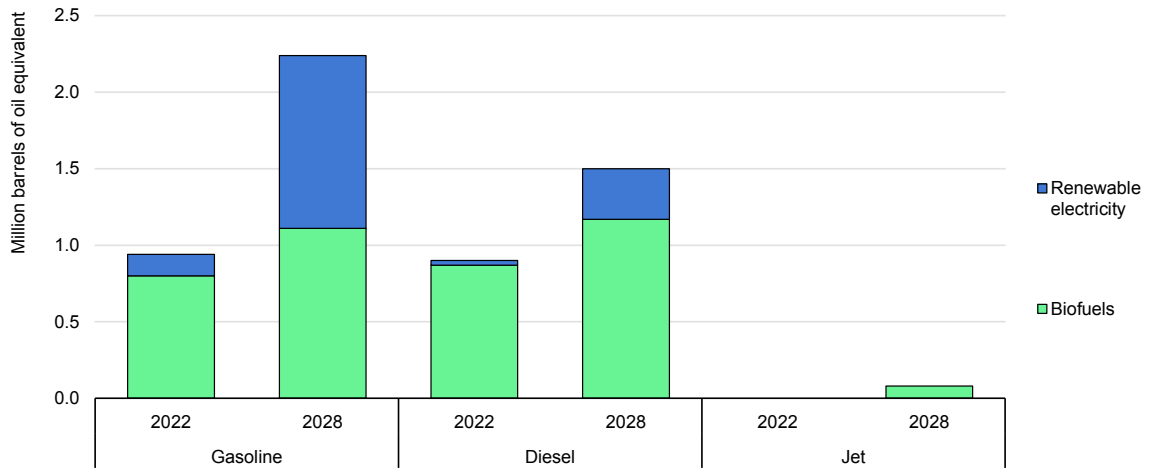
As a result of the refinery closure, all oil products are imported from overseas through the port of Mombasa, which acts as a hub for the region. Oil imports come mainly from the United Arab Emirates, followed by Saudi Arabia, Malaysia and India. Some oil products are used domestically; others are re-exported to East African countries.

The ability to quickly respond to oil supply disruptions is a critical element of oil security. Solutions to ensure short-term oil security include the development of sufficient emergency oil stocks that can be quickly released in case of need, along with demand-restraint measures aimed to limit oil demand. The government has prepared a draft regulation on the establishment and maintenance of emergency oil stocks equivalent to 15 days of consumption, including the establishment of a Petroleum Strategic Stocks Management Committee. The IEA welcomes this measure and encourages the government to implement the regulation and to prepare a manual with guidelines and procedures for the implementation of emergency measures.

Clean fuels adoption, electrification and efficiency can reduce demand for oil products

Alternative energy sources for the transport sector and improved fuel economy can break the link between economic growth and oil consumption and help limit the country's dependence on oil product imports (Figure 6.2). On a global scale, biofuels and electricity are set to reduce oil demand in the transport sector by almost 9% of projected demand in 2028. Fuel economy standards – regulations on the average fuel consumption of new or imported vehicles – can also make a significant contribution to reducing oil consumption. Alternative energy sources and energy efficiency measures also help reduce emissions, and support Kenya's target of not increasing transport emissions by more than 6.34 Mt CO_2-eq compared to 2015.

Figure 6.2 Biofuels and renewable electricity avoided oil demand in transport, world, 2022-2028



Source: IEA (2023), Renewables 2023.

The number of electric vehicles in Kenya is low (1.6% of new vehicle registrations in 2023, compared to 18% globally), although being slightly higher than the African average of nearly 1%. However, the government has plans to increase the use of EVs, and annual registration of EVs increased significantly, from 475 in 2022 to 2 694 in 2023. The Draft E-Mobility Policy aims to develop infrastructure for EVs and improve fiscal and non-fiscal measures for consumers (see Chapter 7). The document also includes plans to introduce measures to support local manufacture of EV parts, including local battery manufacturing, recycling and reuse.

The IEA commends Kenya for its plans to expand the use of EVs, which can make a significant contribution to reducing oil demand in transport. The IEA encourages the government to support the development of charging points and infrastructure to increase the electrification of transport. Targeted support for the electrification of public transport should continue, as the introduction of electric buses, for example, has recently gained momentum.

In addition to the expansion of EVs, the use of biofuels can provide an alternative energy source for the sector while creating jobs and contributing to GDP growth. Bioethanol is currently used for clean cooking (see Chapter 5), partly from domestic production – using cassava and sugar cane feedstocks – and partly from imports.

Kenya currently produces some feedstocks for the production of transport biofuels. These are mainly non-edible seeds not in competition with the food chain or forests. They are grown on degraded lands identified jointly with local institutions and with smart agriculture techniques, such as cover cropping and intercropping. Seeds are processed in some plants in the country, operated by the Italian multinational energy company, Eni: a plant in Makueni County has a capacity of 15 000 tonnes (t) per year of vegetable oil. Another plant in Mombasa has a production capacity of 55 000 t/year. A recent investment of EUR 210 million backed by the International Finance Corporation and the Italian Climate Fund contributes to increase the production of oil seeds to 200 000 t/year by 2026 and support up to 200 000 local farmers by providing inputs, tools and training.

Kenya is also at the forefront of the adoption of sustainable aviation fuel (SAF). Kenya Airways in 2023 became the first African airline to operate a long-haul commercial flight from Africa to Europe blending SAF with kerosene, using Eni Biojet SAF produced from renewable raw material. Kenya Airways has committed to comply with EU regulation to use a proportion of SAF on all flights departing from European airports by 2025.

However, there is no widespread use of transport biofuels in the country. Blending mandates for biofuels in transport or heating fuels provide a strong incentive to increase biofuel production, helping to limit the growth of oil use in transport and

decarbonise the national energy mix. Biofuel production can use agricultural by-products as feedstocks, providing new income streams for the agricultural sector, creating jobs and contributing to national economic growth.

The Bioenergy Strategy 2020-2027 proposed the introduction of blending mandates for heating and transport, but these have not been implemented. Finalisation of the regulation would create market incentives for local production of biofuels in the country and reduce the risks associated with reliance on imports of fossil fuels and biofuels, for both cooking and transport, including the depreciation of the Kenyan shilling and exposing oil prices to international geopolitical risks.

The currently inactive infrastructure at the Mombasa refinery presents an opportunity to develop a bio-refinery to produce biofuels using feedstocks from Kenya and the region, potentially producing biofuels for clean cooking, transport and heating. The refinery is currently managed by the government, which has received offers by private companies for converting it to a bio-refinery. A local bio-refinery could also enable domestic production of SAF, which Kenya Airways has committed to using and currently imports. The production of SAF also provides an opportunity for Kenya to use hydrogen produced from excess renewable electricity from the grid.

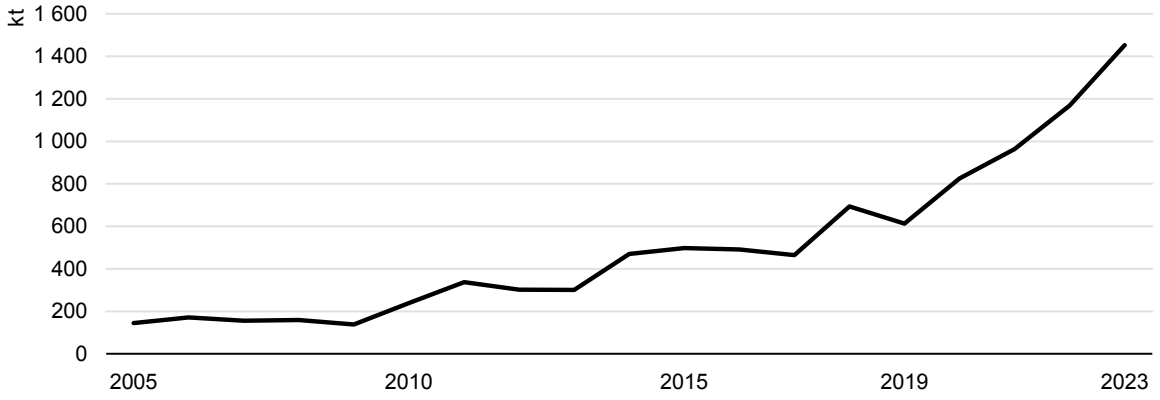
An additional challenge for the government is to strike a delicate balance between the advantages of increasing domestic consumption of biofuels and sustainability criteria. The use of domestic by-products that do not affect land/water use and are not in competition with land crops and food should be prioritised. The import of biofuels adds emissions for their transportation, as well as concerns on security of supply, and increasing the use of land for domestic production of biofuels that are not by-products of other agricultural process can compete with food security, cause deforestation and have impacts on biodiversity.

Coal and critical minerals

Geological resources need careful management to protect communities and the environment

Coal use in Kenya increased from less than 0.5 million tonnes (Mt) in 2015 to almost 1.5 Mt in 2023 (Figure 6.3). Coal is used in industry, with growing demand from the cement, iron, steel and chemicals sectors. All coal is imported, as the country does not have any domestic production. Some sources indicate potential coal deposits in Kenya (Mui Basin in Kitui Country), but to date no coal mining has occurred.

Figure 6.3 Coal demand in Kenya, 2005-2023



Note: kt = kilotonne.
Source: IEA (2024), World Energy Balances (database).

The energy transition to clean technologies in Kenya and across the globe will require new raw materials that are critical for clean technology manufacturing. Existing geological surveys indicate that the country has the potential to produce a wide range of critical minerals (such as copper, fluorspar, graphite, manganese, niobium, zinc) and rare earth elements. The Mining Act of 2016 opened the mining sector to more players and established the Directorate of Geological Surveys under the Ministry of Petroleum and Mines, responsible for collecting Kenya's geological data. In October 2023, the Kenyan parliament proposed revamping the Mining Act of 2016 to promote transparency, efficiency and sustainability in Kenya's mining sector.

Any mining activities in the country should follow strict environmental, social and governance standards to ensure that workers and communities are protected from environmental and social harm and that projects supporting energy transitions are people-centred and inclusive. Various initiatives, such as the Initiative for Responsible Mining Assurance, provide guidance and audits to support improved practices at the top of the supply chain of materials supporting the energy transition. Additionally, when harnessing its natural critical mineral resources, it would be beneficial for Kenya to also promote local processing of these materials.

Electricity security

Reliability and resilience of energy infrastructure is key to energy security

As the country electrifies, it needs to ensure electricity security, which is defined as the ability of the electricity system to ensure uninterrupted availability of electricity by preventing and quickly recovering from disturbances and contingencies.

An average Kenyan consumer frequently experiences long power outages. According to EPRA, the SAIFI – the number of times an average customer experiences a blackout – increased from 26 in 2020 to 48 in 2023 (the global median is around 2.5). The SAIDI – the average duration of power outages – was more than 100 hours/year in 2023 (the global median is around 3). EPRA proposed in March 2024 regulations to limit SAIFI to 20 per year and SAIDI to 80 hours per year.

To reduce the frequency and duration of power outages in the short term, the government could consider supporting KPLC in addressing the reliability of distribution transformers, which have been identified as weak points leading to power outages. For the longer term, EPRA could aim to set targets to further reduce unplanned blackouts each year, total unplanned outages and maximum duration per outage. Accompanying measures to achieve these targets, such as specific reinforcements to the electricity grid, should also be clearly identified. Also, it would be beneficial to combine actions to reduce the frequency and duration of power outages with reforms to the flexibility/ancillary services market that would attract investment in energy storage, demand-side response and other technologies (see Chapter 2).

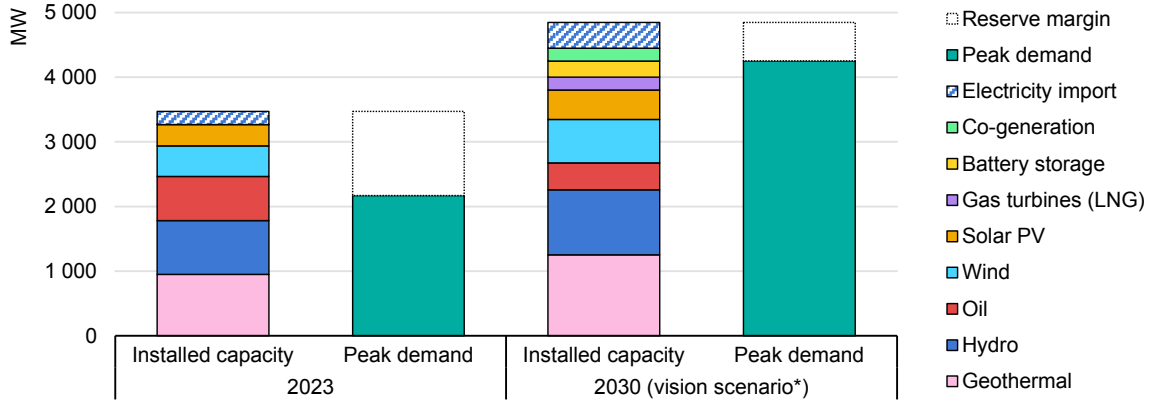
Ensuring adequate supply of electricity at any given moment is fundamental for avoiding electricity disruption. The system peak demand averaged 2 057 MW in 2022, above the average available domestic capacity of 2 035 MW, which increases the country's reliance on its interconnections with Ethiopia, Tanzania and Uganda. While trade with Tanzania and Uganda is bi-directional, Kenyan imports from Ethiopia have increased to reach 0.9 TWh in 2023, which is more than 6% of domestic electricity demand.

Integration of the regional electricity market helps to stabilise the electricity system, but reliance on electricity imports from Ethiopia highlights the shortfall in domestic generating capacity. Looking ahead, electricity demand is set to continue to increase at an average of almost 6% per year from 2024 to 2026. The 2021-2030 LCPDP projects a 50% increase of both domestic generation and import capacity from 2023 to 2030, while peak demand is projected to double in

the same time frame. This would lead to halving the reserve margin based on firm capacity – the difference between installed capacity and peak demand – from 47% of peak demand in 2023 to 14% in 2030, increasing the risk of electricity generation shortfall (Figure 6.4).

Moreover, the electricity mix in 2030 is expected to have a higher share of variable renewable generation, which is associated with higher loss of load expectation. To ensure security of electricity supply, the government of Kenya could consider including low loss of load expectation requirements in its electricity planning exercise. At the same time, growth of electricity generation and demand should go hand-in-hand with adequate investment in the electricity grid for building new lines or upgrading existing equipment.

Figure 6.4 Electricity capacity and peak demand in Kenya, 2023 and 2030 scenario



* The vision scenario is based on the development patterns highly driven by Vision 2030 growth projections and the implementation of flagship projects.

Note: LNG = liquefied natural gas.

Source: IEA based on Kenya (2024), Least Cost Power Development Plan 2021-2030.

The quality of equipment in the grid affects its reliability. While there are effective standards that utilities may comply with, no minimum energy performance standards have been adopted for distribution transformers in Kenya. The adoption of a nationwide mandatory minimum energy performance standard (MEPS) for distribution transformers would help increase the reliability of the system. In addition, close monitoring of the status of the grid would allow prompt response to disruptions and equipment failure, minimising the time of power loss. This could be done with digital devices or by training local technicians.

The energy and electricity infrastructure's resilience to cyber, physical and other threats should also be monitored. The Communication Authority of Kenya is tasked to monitor cybersecurity. In 2023, it reported a record high of 860 million incidents, including interrupting power supply. Increasing the level of awareness of the need for cyber resilience in the energy sector, encouraging risk identification

and exchange of information on vulnerabilities and actual incidents, and adapting regulations to a fast-evolving digital environment would help Kenya protect against cyber threats.

Climate change is also a threat to Kenya's energy security. Recurring droughts, erratic rainfall patterns and floods are already affecting the Kenyan energy system. In the next decades, climate change is expected to increase significantly and affect electricity consumption for cooling, decrease the efficiency of electricity generation and the safety of transmission. Increasing probability of floods and draughts is also threatening the resilience of the energy system, affecting the electricity grid, hydropower plants and availability of biomass. The IEA commends Kenya for publishing a National Adaptation Plan 2015-2030 in 2015, addressing threats to the energy system stemming from climate change.

Recommendations

To reach its objectives, the government of Kenya could consider:

- Increasing the resilience of the energy sector, taking concrete actions to mitigate cyber, physical and other threats, for example by addressing the reliability of distribution transformers.
- Ensuring that sustainable technologies and responsible practices are adopted and that local communities are engaged when energy or mineral extraction projects are developed in the country.

7. Energy efficiency

The majority of Kenya's energy consumption is in the buildings and transport sectors, primarily reliant on bioenergy and oil products

Kenya has a relatively low energy intensity compared to other countries in the East African region at just over 3 000 megajoules per thousand 2015 USD, the second lowest among the eight countries of the EAC. Overall energy intensity has decreased by 14% from 2010 to 2023.

Although accounting for just over 5% of total energy consumption, electricity consumption has increased significantly, almost doubling from around 5.8 TWh in 2010 to around 10.5 TWh in 2023. Electricity consumption per capita in Kenya increased by 30% over the same period to nearly 0.2 MWh/capita, compared to a global average of 3.4 MWh/capita. Per capita consumption in 2023 was more than three times below the average for the continent of over 0.6 MWh/capita.

The government of Kenya has policies and strategies for accelerating energy efficiency progress in support of its climate change and energy access goals

Kenya is aiming to place energy efficiency at the centre of its policy action, as efficient use of energy would support the country's goal to provide a secure supply of energy to everyone. The Kenyan government has set out a series of energy efficiency policies and strategies, providing a clear direction for improvements across key sectors.

The main guiding document for energy efficiency policy and implementation in Kenya is the National Energy Efficiency and Conservation Strategy (NEECS), released by the Ministry of Energy and Petroleum in 2020, which was produced under provisions set out in the Energy Act of 2019. The Energy Act is set for review in 2024. The NEECS includes situational analysis and quantitative targets for five thematic sectors: households, buildings, industry and agriculture, transport, and power utilities. It sets economy-wide targets for energy efficiency, including:

- Increasing the annual rate of energy efficiency improvements from 0.2% per annum (2019) to 3% per annum by 2025, in support of achieving SDG 7.
- Ensuring energy efficiency contributes to Kenya's NDC through increasing annual emission reductions from energy supply and consumption to 7.6 Mt CO_2-eq by 2025, up from 6.9 Mt CO_2-eq in 2015.

The National Cooling Action Plan for Kenya, released in 2022, is a five-year plan (2023-27) that aims to support access to sustainable and energy-efficient cooling for all Kenyans. Aligned with Kenya's climate commitments, the plan sets out actions to:

- accelerate the market transition to high-efficiency cooling appliances and equipment
- transition the cooling sector away from high global warming potential refrigerants
- increase access to agricultural cold chain solutions.

The Draft National E-Mobility Policy, introduced in March 2024, sets goals to create an enabling environment for the growth and adoption of EVs in Kenya. The draft policy sets goals to:

- develop an integrated and comprehensive policy, legal and regulatory framework to promote the adoption of e-mobility
- improve fiscal and non-fiscal measures to accelerate EV adoption
- reduce over-reliance on the road maintenance levy collected on petrol and diesel fuel.

Kenya has also shown leadership at the regional and international level to promote greater action on energy efficiency. On 21-22 May 2024, the Ministry of Energy and Petroleum co-hosted with the IEA the 9th Annual Global Conference on Energy Efficiency in Nairobi. The conference attracted over 550 participants from 67 countries, with 30 governments officially represented, over 40 senior business leaders and more than 26 000 online viewers. The success of the conference and strong leadership from Kenya highlighted a commitment to drive energy efficiency progress both domestically and at a regional level, in particular across sectors, including clean cooking, buildings, electric mobility and industry.

Buildings

The buildings sector is Kenya's largest energy consumer, primarily reliant on bioenergy, with more stringent enforcement of energy efficiency measures needed to address future growth

The buildings sector is the dominant energy-consuming sector in Kenya, accounting for just over two-thirds of total final energy consumption. Consumption in the sector increased by 23% from 2010 to 2023. In 2023, bioenergy accounted for over 90% of total final consumption in the buildings sector, with remaining consumption from oil products (5.5%) and electricity (3.8%). Electricity consumption in the sector has doubled since 2010 and that from oil increased by

28%. Bioenergy has been the primary driver of overall growth in residential energy consumption over the past three decades (1990-2023), doubling over this period and accounting for almost 92% of total growth in residential energy consumption.

Public buildings represent a significant portion of the energy demand within this sector. KPLC estimates that there are over 20 000 public buildings in Kenya with annual energy consumption of 700 GWh (around 10% of Kenya's total annual energy consumption), with energy costs of USD 120 million. Over the next few years, energy consumption will continue to grow as the residential and commercial buildings sectors expand, with total building stock expected to increase by over 25% between 2018 and 2025. A shift to more efficient sources of energy and investment in efficient buildings has been limited by a range of factors, including consumer perceptions of high costs for more efficient buildings, limited financing and lack of mandatory regulations for energy efficiency in buildings.

The NEECS sets out objectives to improve the energy efficiency of buildings, including through the establishment of a mandatory building energy code. There are also aims to introduce MEPS and increase the share of energy efficiency compliant building stock from 0% to 10% in new buildings, supported by incentives for green finance.

In February 2024, the Ministry for Lands, Public Works, Housing and Urban Development published its National Building Code 2024, which is expected to become effective in 2025, pending parliamentary approval. The national building code was last updated in 2022 to include provisions for sustainable building practices. The 2024 revision includes plans to introduce elements in the building code related to e-mobility and charging infrastructure, as well as broader aims to improve skills and qualifications in the buildings sector. To date, however, a mandatory building code has not yet been adopted.

In commercial building, over the past decade the government has also placed a growing focus on promoting best practice for energy management. In 2021, EPRA published updated Energy Management Regulations which highlighted that only 43% of the facilities covered by the regulation had carried out energy audits between 2012 and 2020. The regulation requires mandatory energy audits for every owner of a designated (industrial, commercial and institutional) facility with an annual energy consumption of more than 180 000 kWh, the development of energy management plans aiming to achieve at least 50% of the recommended energy savings within three years of submission, and more stringent reporting and disclosure requirements.

The NEECS also sets objectives for promotion of energy services companies (ESCOs) for energy efficient upgrades and the renovation of existing public buildings, aiming for five established ESCOs by 2025 from a baseline of zero in 2019. In 2021 the Kenyan government, in partnership with the African

Development Bank, launched a process for establishing a utility-run super ESCO under KPLC. The super ESCO is not yet active but would focus on key areas including energy studies and audits, establishing energy performance contracts, and mobilising broader financing for energy efficiency projects and programmes.

Appliances

Kenya has introduced measures to improve appliance efficiency, but the market remains dominated by lower-efficiency models

Electricity consumption from appliances and cooling systems in Kenya could increase significantly as the country makes progress towards universal electrification targets. The effects of climate change are projected to accelerate demand for household cooling appliances as a result of increased frequency of hot weather conditions. According to the National Cooling Action Plan, energy demand from residential refrigerating appliances and room air conditioning alone could reach approximately 7% to 13% of the projected total electricity demand in Kenya by 2030.

Kenya has introduced measures aimed at improving appliance efficiency, and currently has MEPS covering six appliance types: motors, air conditioners, refrigerators, compact fluorescent lamps, magnetic ballasts, and fluorescent lamps. In 2016, requirements were introduced for the first time for use of energy efficiency labels on selected electrical appliances manufactured, imported, distributed and sold for use in Kenya, as well as stipulating the testing requirements prior to labels being issued by the regulator.

The Kenya Label, introduced by EPRA, is a labelling scheme that tags the highest performing appliance with five stars and the lowest with one star, providing consumers with information to decide on what they want to buy. The label includes information on average annual energy consumption, manufacturer and licence number, and follows a standard format across different appliance types. Currently air conditioners, refrigerators/freezers, induction motors and fluorescent lamps are the only appliances on the market with a Kenya Energy Label. Since 2021, the regulator has maintained an extensive registry of appliances meeting MEPS covering four key categories: refrigerators, air conditioners, motors and fluorescent lamps.

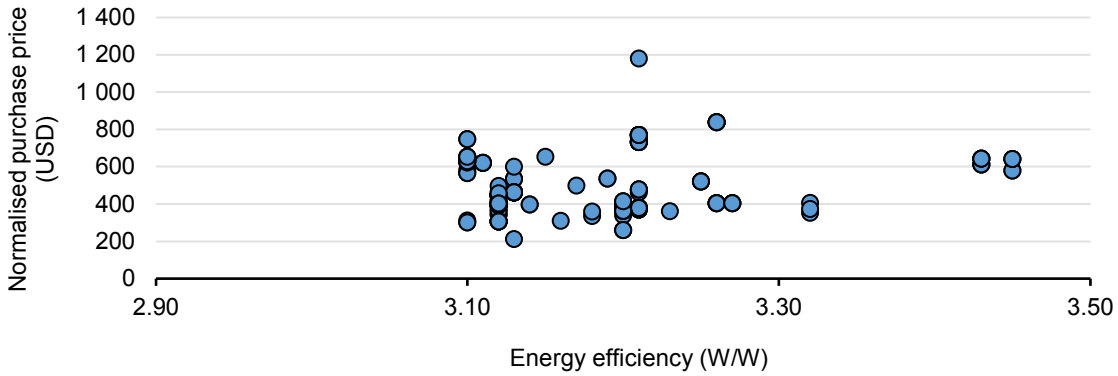
Under the NEECS, the government plans to expand the coverage of MEPS to include televisions, computers, cookers and light-emitting diodes (LEDs). It also aims to scale up testing facilities, improve energy efficiency labelling and reduce electricity consumption from lighting. Since their introduction in 2016, the

government of Kenya has revised MEPS for room air conditioners and domestic refrigerators twice, in 2019 and 2020, and aims to further revise these in 2025. The government is also aiming to accelerate harmonisation of MEPS with other countries in the East Africa region through partnering with the East African Centre of Excellency for Renewable Energy and Energy Efficiency.

Despite measures introduced to promote appliance energy efficiency, the majority of models available on the market are of lower-efficiency classes. According to IEA analysis, the majority of refrigerators on the market are of the lowest efficiency class 1 Star (63%), followed by 2 Star (30%). The share of 3-5 Star models is minimal. As an import-only market for air conditioners and domestic refrigerators, Kenya is exposed to issues of dumping and imports of second-hand appliances. Import of these appliances results in increased energy bills, higher energy demand and strain on grids as cumulative use increases. For refrigerators, a majority of models on the market are imported from the People's Republic of China followed by Thailand and India.

It is not necessarily the case, however, that more efficient appliance models in Kenya result in a higher purchase price. Analysis of the market in Kenya indicates that for USD 300, consumers could purchase an air-conditioning unit that is more than twice as efficient as low-efficiency alternatives (Figure 7.1). The limited or lack of availability of higher efficiency models, however, reduces opportunities for consumers to obtain them, therefore missing out on the longer-term energy savings potential. In addition, limited competition in the market results in limited availabilities and products, with a range of efficiencies being available for the same price, reducing the ability for increased product efficiency to be reflected accurately in final consumer prices.

Figure 7.1 Normalised purchase price versus energy efficiency rating in Kenya (wall-mounted split type), 2023



Notes: The normalised purchase price represents the air-conditioner price normalised with a cooling capacity of 12 000 British thermal units (BTU) per hour. The cooling capacity of air conditioners used in this analysis ranges from 9 000 BTU/hour to 35 000 BTU/hour.

Source: IEA original Kenya air conditioning market analysis.

Transport

Kenya's transport fleet is primarily made up of internal combustion engines, with the dynamic electric-mobility market in its nascent stages of growth

The transport sector accounted for around 20% of Kenya's total final energy consumption in 2023, and is the primary user of petroleum products, consuming over three-quarters of all oil products. It is also the fastest growing sector in terms of final energy consumption over the past decade, doubling from 2010 to 2023. Energy consumption in the transport sector was dominated by diesel (54%) and gasoline (45%) in 2023, with a minimal proportion of electricity consumption.

As of 2022, Kenya had around 4.6 million vehicles, with petrol and diesel vehicles accounting for the large majority and an estimated 3 753 EVs at the end of 2023, up from only 1059 the year before. Primarily an importing country, 72% of energy consumption in the Kenyan transport sector is based on imported fossil fuels and 85% of all imported vehicles into Kenya are second hand. The country is exposed to the issue of dumping of often inefficient and second-hand vehicles, including heavy duty vehicles and trucks.

Under the NEECS, actions for the transport sector focus on two main areas: 1) improving the fuel economy of Kenya's fleet of light duty vehicles from 7.5 litres (L)/100 km (2019) to 6.5 L/100 km (2025), and increasing the share of EVs from 0% to 5% in total vehicle imports. Globally, the average fuel economy of light duty vehicles was 6.9 litres gasoline equivalent per 100 km (Lge/100 km) in 2022. The government is also aiming to initiate fuel economy standards and labelling for vehicles, restrict the age of imported second-hand vehicles from eight to five years, and implement vehicle emissions inspections.

The Draft E-mobility Policy, introduced in March 2024, includes objectives to develop supporting infrastructure for EVs, improve fiscal and non-fiscal measures for consumers, and scale up socio-economic measures. In line with this, EPRA set out EV charging and battery swapping infrastructure guidelines, which aim to increase accessibility, promote affordable tariffs and generate new employment opportunities. EPRA has also granted approval for a special e-mobility tariff within the electric mobility category for EV charging, reduced the excise duty on EVs from 20% to 10%, and made EVs exempt from VAT.

Electric mobility is also seen as a strategic sector for promoting demand stimulation, as around 40% of installed energy generation capacity is unutilised. It is estimated that daily curtailed energy could be utilised to support an additional 7 000 electric buses and 200 000 electric motorcycles on the road. In the public transport sector, Kenya also aims to electrify its public bus fleet by 2027. The local

start-up BasiGo has developed its model E9 Kubwa, a locally assembled electric bus, with aims to deliver 1 000 over the next three years.

In May 2024, during a visit of President Ruto to the United States, the US International Development Finance Corporation announced a USD 10 million direct loan to BasiGo to facilitate procurement of buses and batteries for sale in Kenya, as well as USD 10 million to the Kenyan company Roam Electric, which supports assembly and production of electric motorcycles.

Industry

Industry accounts for a small proportion of overall energy consumption, with energy efficiency efforts primarily focused on expanding audits, compliance and training.

Growth in industry and manufacturing has been limited over the past few decades due to factors including high energy costs, globalisation and regional competition. These factors have increased competition of domestically produced goods with imported products and limited investment in domestic manufacturing. Industry accounted for around 12% of total energy consumption in 2023, a lower share than the global average (28%), growing by 70% since 2010.

Over half of energy consumption in industry comes from fossil fuels, mainly led by coal (43%) and oil (17%) while electricity consumption accounts for 23%. Large and medium-sized enterprises (commercial and industrial consumers) account for over 50% of total national electricity consumption. The manufacturing sector accounts for around 12% of fuel consumption, the second-largest after transport (86%).

Despite slower than anticipated growth in industry, overall value added by the sector has shown significant growth in the last two decades, from USD 1.9 billion in 2000 to over USD 20 billion in 2022. Manufacturing is now included as a key policy focus under Kenya's "Buy Kenya-Build Kenya" initiative and the Kenya Association of Manufacturers, working closely with the Ministry of Trade, Investment and Industry, has developed a plan dubbed "Kenya Manufacturing 20by30". This is a plan to increase the manufacturing sector's contribution to GDP from 7.2% in 2022 to 20% by 2030.

The NEECS set out plans to improve industrial competitiveness and energy efficiency, including increasing the coverage of audits, training and capacity building for licensed audit professionals, promoting captive power use, and establishing energy efficiency benchmarks. There are approximately

4 000 entities designated for energy efficiency audits due to annual electricity consumption over 120 000 kWh, of which 1 800 had undergone audits by 2019. The NEECS set a target to deliver the remaining 2 200 audits by 2025 with an expected budget of nearly USD 32 million.

Other measures for promoting energy efficiency include aims to establish a trading market for green and white certificates based around energy performance targets and training of energy professionals in the ESCO market. To expand awareness of industry and commercial energy efficiency and promote best practices, the Kenya Association of Manufacturers in collaboration with the Kenyan government established its Centre for Energy Efficiency and Conservation in 2006. The Centre supports programmes to help companies identify energy wastage and savings potential and offers subsided energy auditing services.

Recommendations

To reach its objectives, the government of Kenya could consider:

- Enhancing the long-term capacity of relevant departments at the national and county level to implement, enforce and monitor energy efficiency regulations and standards.
- Embedding energy efficiency principles and approaches in the country's plans for promoting demand stimulation, universal access to electricity and clean cooking.
- Setting out a clear roadmap for the implementation of mandatory building energy codes and minimum energy performance standards for appliances and communicating this roadmap to stakeholders. Co-operation and alignment in regional forums on building and appliances regulations enables lower market entrance barriers and lower cost to consumers.
- Providing support to the ESCO market that can increase confidence and attract investment, in addition to expanding public procurement programmes under the established super ESCO.
- Co-ordinating with customs to collect data on appliance and vehicle imports, which can inform strategies for addressing imports of low efficiency and second-hand models.

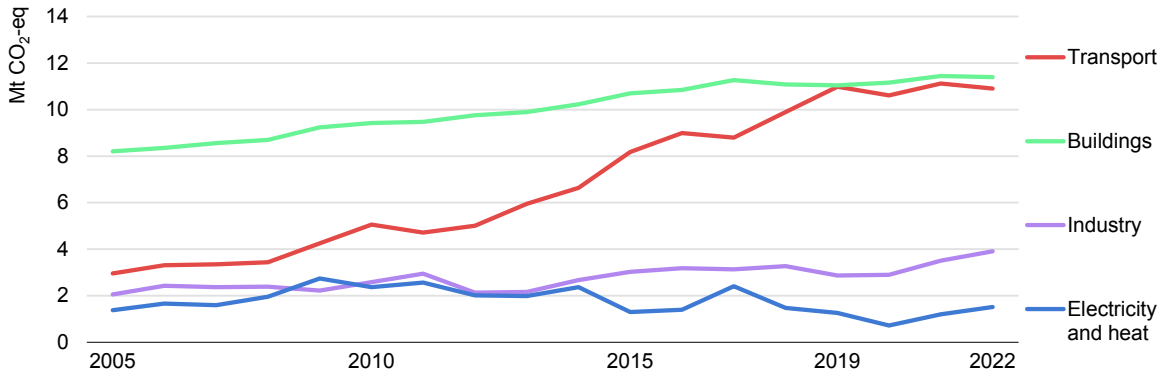
8. Energy and climate

Like the rest of the African continent, Kenya's contribution to global climate change is very minor, accounting for a fraction of global energy-related CO_2 emissions today, with emissions per capita among the lowest in the region. In contrast, the country faces significant threats from changing climate systems. Mindful of its commitments and the imperative to address climate change, Kenya is actively taking steps to confront the challenges ahead. Notable among these actions was the adoption of the Kenya National Adaptation Plan (NAP) 2015-2030 in 2015, the submission of its updated NDC in December 2020, and the adoption of the Climate Change (Amendment) Act in September 2023.

Emissions profile

In 2022, Kenya's energy-related GHG emissions were 28 Mt CO_2-eq. This compares to 25 Mt CO_2-eq in 2020 and 20 Mt CO_2-eq in 2010. The main contributors to energy-related GHG emissions are buildings and transport, which accounted for 41% and 39% of the total emissions in 2022, respectively (Figure 8.1).

Figure 8.1 Greenhouse gas emissions by sector in Kenya, 2005-2022



Source: IEA (2024), Greenhouse Gas Emissions from Energy (database).

Transport is a key driver of emissions in the economy, most notably the expansion in road transport use over the past decade. The transport sector is a major consumer of petroleum products, accounting for almost three-quarters of all petroleum products imported into the country. By 2020, Kenya had around 4.6 million vehicles, with petrol and diesel vehicles accounting for 98% of the national fleet. The National Energy Efficiency and Conservation Strategy established targets for CO_2 emissions reductions, as well as for improving fleet

fuel economy, increasing e-mobility and improving public transport systems. Nonetheless, the emissions intensity of the economy remains low and at 77 grammes of carbon dioxide (g CO_2)/USD is well below the IEA average of 184 g CO_2/USD. Likewise, with emissions of 96 g CO_2/USD, the power sector is a low emitter, especially compared to the IEA average of 320 g CO_2/USD.

Nationally Determined Contributions

In December 2020, Kenya submitted its updated NDC to the United Nations Framework Convention on Climate Change. Kenya aims to reduce GHG emissions by 32% by 2030 relative to the business-as-usual scenario of 143 Mt CO_2-eq in line with its sustainable development agenda and national circumstances. Around 45% of the emissions reductions are expected to come from the energy sector, most notably from increased electricity generation and energy efficiency, with 21% of the mitigation cost coming from domestic sources and 79% of the mitigation cost subject to international support.

Climate strategies and policies

Long-term low-emission development strategies (LT-LEDS) are crucial frameworks that guide countries in aligning their developmental goals with the Paris Agreement's objective to limit global warming to well below 2°C. In September 2023, Kenya announced its LT-LEDS, with the goal of steering Kenya towards a net zero emissions future by 2050. Kenya's submission brings the global total to 68 countries, even though the majority of LT-LEDS have been developed by high- or middle-income nations. One reason for this is that developing an LT-LEDS is very complex, requiring extensive data alongside an in-depth analysis and understanding of climate action in diverse socio-economic contexts. All this demands financial resources and human resources with specific capacities. The IEA welcomes the announcement of Kenya's LT-LEDS and suggests the country develop the human and technical capacity necessary for the realisation of its strategy.

The National Policy on Climate Finance outlines Kenya's legal and policy framework for climate financing and identifies the role of climate finance in key economic sectors. It aims to support climate actions in energy and transport as well as in sectors such as agriculture, forestry, trade and tourism. It describes the policy interventions the Kenyan government intends to make with respect to climate financing, including establishing a national Climate Change Fund, identifying climate financing sources, creating a national system for tracking them, enhancing Kenya's carbon-trading system and exploring the possibility of green bonds.

The Kenya NAP 2015-2030, finalised in 2015, is a strategic framework addressing climate change impacts and promoting adaptation measures in Kenya. It builds upon the foundation established by the National Climate Change Action Plan and aligns with the Constitution of Kenya and Vision 2030. The NAP aims to integrate climate resilience into Kenya's development plans by proposing macro-level adaptation actions across sectors. Its main objectives include integrating adaptation into national- and county-level planning processes while enhancing the resilience of public and private sector investment. According to the first review of the NAP in 2022, many initiatives have been implemented in the agriculture and livestock sectors, such as increasing crop productivity by increasing area under irrigation by 4 933 hectares in June 2020.

The Kenya Climate Change Adaptation Programme, administered by Tana and Athi Rivers Development Authority, contributes to various sectors such as agriculture, energy and water management. While focusing on enhancing resilience to climate change, its objectives also include improving food security and water management systems in response to climate change.

Kenya is a major producer of tea, coffee, fresh fruit and dairy products. Farmers, who are used to rain-fed farming systems, are being pushed into dryer, more marginal areas where they become increasingly vulnerable to drought and the unpredictability of weather patterns resulting from climate change. Under the Integrated Programme funded by the Adaptation Fund, five projects aimed at enhancing climate resilience and food security are being implemented in selected counties. These projects include establishing milk cooling and processing plants in Kajiado County and constructing check dams for water management in Makueni County. Although the national government allocated KES 700 million for the expansion of a milk cooling plant in December 2023, with 10% completion, there is no update on the Wanduli Check Dam in Makueni County since its completion.

Climate risks and infrastructure resilience

Climate change poses major threats to Kenya's transport, telecommunications and water supply infrastructure, as well as energy assets. Infrastructure damage can result from extreme weather events, as well as forced migration, political instability, famine, declining labour productivity, poor sanitation and deterioration in public health. All of these have implications for the ease, cost and viability of clean energy transitions, as well as progress in meeting the SDGs.

In Kenya, regardless of the emissions scenario, temperatures are projected to rise, with a high-emission scenario indicating rapid temperature increases by mid-century. Increased heat and extreme weather conditions will have significant implications for the country, including more frequent and intense rainfall events in some regions and decreased rainfall in arid zones. These changes will impact the

resilience of energy-system infrastructure, affecting hydropower generation potential, solar PV output and network capacities.

Kenya faces a wide range of natural and human-induced hazards, such as droughts, floods, landslides, human and animal disease, pests, earthquakes, and urban and forest fires, that can impact on the welfare of the population and their access to basics services such as energy and telecommunications. In the first quarter of 2024, intense rainfall affected several regions in Kenya, including the coastal area, central areas including Nairobi, the Western Highlands, Rift Valley, Lake Victoria Basin, the south-eastern lowlands and some north-eastern regions. Over 55 000 households were displaced and almost 300 lives lost. Many of the hazards are associated with the country's diverse geo-climatic and socio-economic conditions. While the population contends with these hazards, especially droughts and floods, their magnitude, frequency and impacts have become more severe. This is aggravated by climate change and human-induced factors that has resulted in more areas being affected. Mindful of the risks the country faces, the government has developed and implemented several policies to manage emergencies and emerging crises.

The National Disaster Response Plan, for example, outlines principles, procedures, roles and responsibilities for disaster response in Kenya. It addresses various hazards, including droughts, floods, landslides and fires, and provides guidance for effective disaster management. The National Policy for Disaster Management recognises the role of climate change in increasing Kenya's vulnerability to disasters. It aims to institutionalise mechanisms for addressing disasters and associated vulnerabilities, with a focus on climate change resilience. The Climate Risk Management Framework for Kenya seeks to harmonise climate-change and disaster-risk policies. It identifies priority areas for government intervention and outlines strategies for programme co-ordination and implementation.

The role of carbon markets

Carbon markets can lower the cost of reducing GHG emissions. Expanding and linking markets internationally can drive down the cost of achieving emission reduction targets, helping to stimulate the needed investments. While the Climate Act represents a major step towards reforming the operation of carbon markets in Kenya, enabling regulations have not been published. To strengthen the operation of the carbon market, the final set of regulations could mandate the disclosure of carbon credits purchase and use (by volume, type and project) by all companies active in Kenya; support the creation of an advance market purchase-commitment coalition of different actors for high-quality credits (e.g. clean cookstoves and direct air capture and storage); and allow the development of guidelines for high-quality carbon credits generation.

While Kenya estimates a need for over USD 17 billion to support its mitigation actions up to 2030, it intends to mobilise domestic resources to cover 21% of the budget, with the remaining 79% reliant on international support. One avenue for attracting financial assistance is through voluntary carbon markets. Kenya has leveraged existing market mechanisms, issuing over 50 million carbon credits via the Clean Development Mechanism (CDM) and Voluntary Carbon Market standards. With the largest CDM portfolio in Eastern Africa, Kenya also hosts a substantial Voluntary Carbon Market portfolio as well.

The Climate Change (Amendment) Act aims to regulate carbon projects and trading in Kenya, imposing various requirements on stakeholders in the carbon market. It signifies the government's commitment to mitigating the adverse effects of climate change and establishes the National Climate Change Council, the regulatory body in charge of Kenya's national climate change co-ordination framework.

Under Article 6 of the Paris Agreement, countries can voluntarily co-operate to achieve emission reduction targets outlined in their NDCs. Kenya intends to utilise voluntary co-operation under Article 6, with plans to develop domestic legislation and institutional frameworks governing engagement in market mechanisms. Many Kenyan CDM activities may be eligible for transition, pending the availability of the transition process under the Article 6.4 Supervisory Body (the entity tasked with developing and supervising the requirements and processes needed to operationalise Article 6.4).

Innovative financing and technology initiatives in Kenya

In December 2023, the European Investment Bank and the Central Bank of Kenya launched an initiative to strengthen domestic financial institutions' commitment to financing climate-related investment and enable commercial banks to mobilise climate finance that will support the transition to a net zero economy while strengthening the climate resilience of the financial systems. The initiative will tackle barriers that hold back engagement by commercial banks and will enable the Central Bank of Kenya to incorporate climate risk into its regulatory framework. The scheme increases the impact of climate-related investment by developing a green taxonomy for the financial sector that supports scaling up green investment aligned with the goals of the 2015 Paris Agreement.

In January 2024, the African Development Bank and the United Kingdom announced the selection of the Transmission Network Improvement Project in Kenya as a beneficiary project under the Room to Run Sovereign transaction. This means that up to USD 59 million of the USD 116 million total project cost corresponding to the climate mitigation component of the loan was made possible by means of the additional capital mobilised by the UK government's guarantee.

The funding will contribute to addressing transmission network capacity limitations, improving the reliability and quality of electricity supply, and reducing high power system losses. It will also support the extension and reinforcement of the national electricity grid system and the Last Mile Connectivity Program.

Direct air capture (DAC) technologies extract CO_2 directly from the atmosphere, for CO_2 storage or utilisation. Twenty-seven DAC plants have been commissioned to date worldwide. In Naivasha, Kenya, Project Hummingbird is deploying 100 machines, making it the world's second-largest DAC pilot. The project is developed by Octavia Carbon and Cella Mineral Storage and is largely powered by geothermal energy. Kenya's geological conditions and geothermal energy potential make it an ideal location for scaling up the project since DAC projects can operate with minimal net emissions, aided by waste heat from geothermal plants. This initiative aims to store mineralised carbon deep underground, positioning Kenya as a promising destination for DAC deployment in East Africa.

The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) is a global market-based measure operated by the International Civil Aviation Organization to reduce emissions from international aviation while minimising market distortion and respecting the special circumstances and respective capabilities of the International Civil Aviation Organization member states. Kenya participates in CORSIA through the Kenya Civil Aviation Authority. Meanwhile, Kenya Airways has been engaged in carbon offsetting programmes since 2011 in collaboration with CORSIA and Astral Aviation. Kenya Airways is also a voluntary participant in CORSIA pilot phases, monitoring, reporting and verifying the emissions from its international flights since 2019 and is participating in the first offsetting phase in 2024.

Recommendations

To reach its objectives, the government of Kenya could consider:

- Developing the human capacity and skill sets necessary to develop plans to implement the Long-Term Low-Emission Development Strategy.
- Transposing into law the necessary enabling regulations for the Climate Change (Amendment) Act as soon as possible.
- Preparing a detailed climate risk and impact assessment for the energy sector, which will inform the energy-planning framework, and factoring climate resilience assessments into energy infrastructure decision making.

9. Energy investment

Kenya is one of the largest economies in Africa and since 2014 has been ranked as a lower middle-income country based on its per capita income level. GDP growth has been strong, generally more than 5% over the last decade (except for 2020, owing to the Covid-19 pandemic). The country has been effective at attracting international public and private capital, and has a growing domestic financial ecosystem that is likely to become increasingly active in the energy sector.

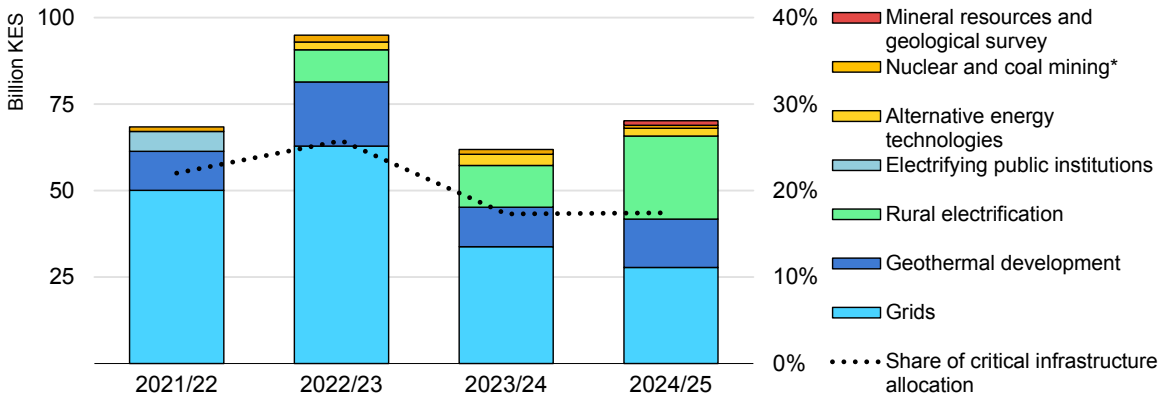
Current investment patterns

Public spending acts as the bedrock for energy investments, particularly in grids and rural electrification

The government is facing multiple financial pressures, particularly efforts to keep the cost of living down for the population following a period of high inflation and rising global interest rates combined with growing debt service payments. Kenya has taken on significant public debt and in 2023, according to the National Treasury, the country's public debt-to-GDP ratio stood at 70% (compared to the International Monetary Fund's recommended threshold of 50% for developing countries). The debt service-to-revenue ratio stood at 58.8% (compared to the International Monetary Fund's recommendation of 30%). This limits the government's ability to take on new debt to fund infrastructure projects while also further limiting the fiscal space of the public utilities.

Despite this, public spending on the energy sector has been relatively consistent over the last five years, with a spike in FY2022/23 (Figure 9.1). Historically, government spending on energy has focused on maintaining and expanding the grid networks, making up 65% of energy spending between FY2021-24, but plans for FY2024/25 see rural electrification accounting for roughly the same share as grids. Both areas are complex for private sector investment, either due to a lack of prior experience (transmission grids) or to high risk of non-payment from the end users (rural electrification). These are, therefore, important focus areas for government spending going forward.

Figure 9.1 Government spending on the energy sector by focus area in Kenya, 2021-2025



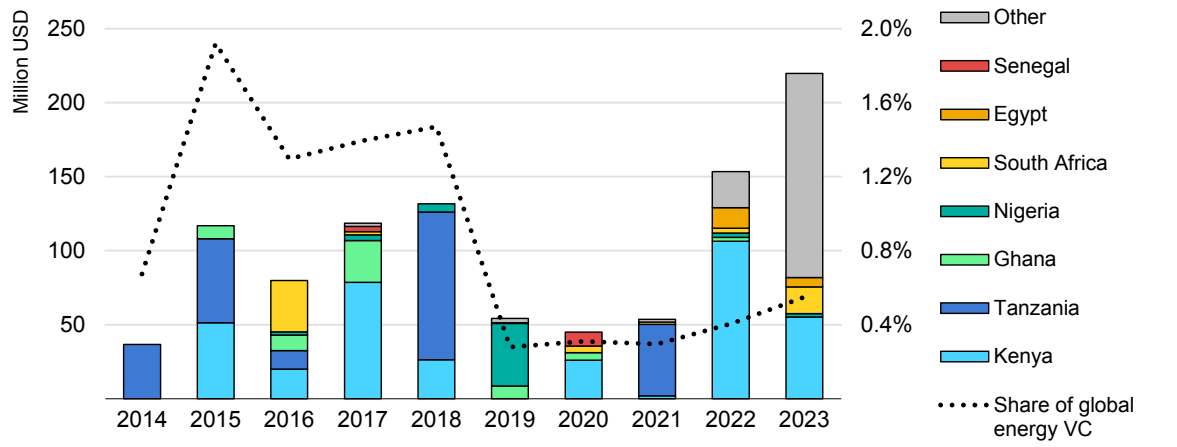
*Coal mining not included in the 2024/25 budget.
Source: Government of Kenya, The National Treasury and Economic Planning.

Kenya remains an attractive destination for private investment, but local entrepreneurs struggle to access financing

Kenya presents an attractive policy environment for investors, with foreign investors receiving the same treatment as local investors. Given its strong growth and position as the entry point for trade into inland East African countries, including Rwanda and Uganda, Kenya is home to the regional hubs for many multinationals. The large skilled workforce and developed tech and fintech infrastructure have also made Nairobi a hub for innovations and start-ups, including in relation to energy access.

Venture capital and private equity make up the largest sources of private capital flows into Africa, and Kenya has been one of the major markets for this type of capital (Figure 9.2). Over the last ten years, Kenya has attracted over USD 350 million in venture capital into energy projects. However, private capital from abroad is still more readily available for foreign-owned or expat-founded businesses. For example, in 2021, the World Resources Institute published a study on impact investing in energy companies in Kenya and found that 69% of investment went to expat-founded businesses. This leaves locally owned companies with less access to international private capital, relying primarily on local commercial banks (see section below). This can be complicated for highly price-sensitive areas like energy access, where it is important to have the cheapest capital possible, which involves grants or concessional funding from sources like development finance institutions (DFIs) or impact investors.

Figure 9.2 Energy-related venture capital investments in Africa, by country, 2014-2023



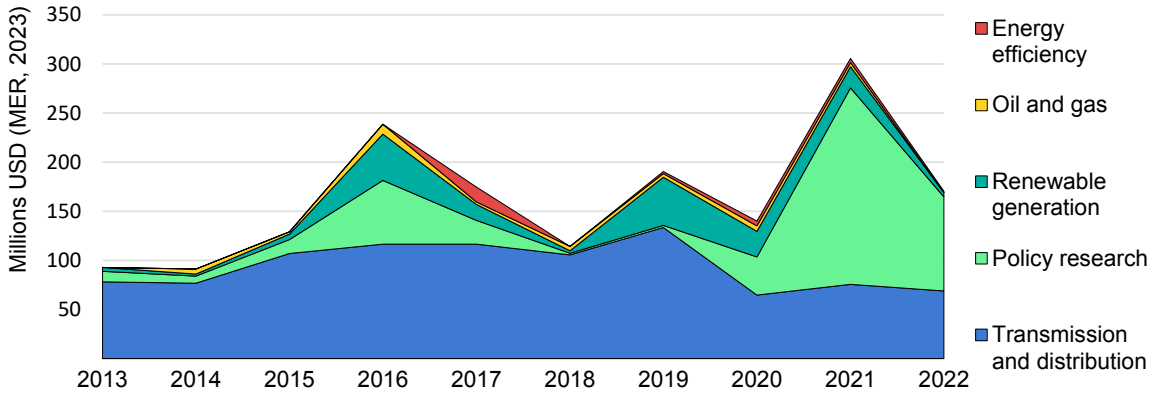
Note: VC = venture capital.
Source: Cleantech Group (2024).

Development finance institutions play an important role in direct project financing, as well as derisking for private sector investments

Over the last ten years, DFIs have disbursed roughly USD 1.6 billion in energy-related projects in Kenya, demonstrating the combination of a willingness on the part of the Kenyan government to partner with donors and the presence of a solid pipeline of projects for investment. The vast majority of DFI energy spending to date has gone into grids (57%) and, more recently, policy support (28%) (Figure 9.3).

Going forward, DFIs will continue to bolster public spending in areas of the energy sector that are not yet commercially viable. While the government is seeking to mobilise more private sector financing into grids, DFIs will continue to be important sources of finance, as shown with the African Development Bank and United Kingdom funding injection of up to USD 59 million into the Transmission Network Improvement Project in January 2024. DFIs are also active in funding demonstration projects in key demand-side activities, like energy efficiency programmes or EVs and mass transit.

Figure 9.3 Disbursements from development finance institutions to Kenya, 2013-2022



Source: OECD (2024), International Development Statistics (online databases).

DFIs also play a vital role in derisking private sector investments, providing guarantees or other credit enhancements. These blended finance transactions have become increasingly common, with sub-Saharan Africa accounting for nearly half of the climate-related blended finance transactions between 2020 and 2022. Kenya has been one of the top recipient countries of these deals, given that the country has relatively lower risks than many of its regional peers and there is already interest from the private sector in the country's energy sector.

The use of blended finance is also important to keep the cost of capital affordable. In recent surveys carried out for the IEA's Cost of Capital Observatory, respondents confirmed that they were able to provide capital to utility clean energy projects in Kenya at 8.5-9.0% in 2022 (latest data within the Observatory). While this was lower than other countries on the continent, it was still two to three times higher than Europe or North America. Respondents to the survey noted that they expected the cost of capital to increase, primarily due to dollar shortages experienced across the country in 2023 (which have since eased in 2024) and rising global interest rates.

Attracting further investment

National roadmaps can ensure that investment from all sources is well co-ordinated and prioritised to meet energy transition needs

In February 2024, the government published the Energy Transition and Investment Plan 2023-2050. The Plan estimated that USD 600 billion in investment would be necessary to reach the country's energy, transport and industry goals by 2050. The bulk of this investment will occur in the power and

transport sectors, which account for nearly 90% of investment by 2050. This spending expectation is USD 165 billion more than the business-as-usual case, but this would help drive numerous socio-economic benefits, including potentially supporting an additional 500 000 new jobs by 2050.

The Energy Transition and Investment Plan presents a high-level view of investment needs, which can be followed up with the creation of sector-specific roadmaps that include clear target setting and project mapping where possible (for example, for grid development or utility-scale power). These detailed roadmaps can also identify where the private sector is expected to play a key role. This facilitates greater private sector investment by providing clarity over priorities. It also ensures that the private sector is being deployed as efficiently as possible to achieve the government aims.

An additional advantage of such roadmaps is that they allow for the targeting of concessional financing to areas where it can have the most catalytic impact. There is a large donor presence in Kenya, with concessional involvement across all elements of the energy sector. This concessional activity could be targeted towards areas that are less commercial – such as providing energy access to the most vulnerable households, as seen under KOSAP – or to provide equity capital to help spur the development of more local climate-related start-ups.

Clear roadmaps also help remove uncertainty for investors, as uncertainty can be a major deterrent. While Kenya has a strong regulatory environment, in recent years there has been increased uncertainty due to the moratorium on PPAs and the introduction of a new procurement mechanism for power projects. Despite these uncertainties, innovative funding solutions are being explored to drive investment, including addressing the key challenge of how to finance the maintenance, expansion and modernisation of transmission infrastructure, such as through PPPs. Progress is being made on the creation of Africa's first independent transmission project between the government, Africa50 and PowerGrid India, with three other lines identified for potential PPPs.

Energy access financing has been complicated by uncertainty over the fiscal regime and its impact on costs

The Kenyan government has overseen a rapid expansion of electricity access, to 75% in 2022, while there has been slower progress in clean cooking, with just 31% access in 2023. Despite this progress, energy access projects have faced a complex investment environment in recent years as pressure on consumers due to Covid-19 and the subsequent cost of living spikes have affected profitability within the sector.

While there are already multiple government and donor-led programmes to drive universal access targets, the private sector plays a vital role in providing financing. Margins in the sector are small to keep products affordable to end users, so fiscal regimes governing the sector require sensitive design that allows for commercial business models, affordable end products and demand stimulation, all while not depriving the government of key revenue that can be reinvested.

Under the current fiscal incentive regime, some off-grid appliances, including some clean cookstoves, are subject to import duties of 35% as well as VAT of 16%, making them unaffordable for large portions of the population. Over the last decade, Kenya has put in place several amendments concerning the VAT rate applied to solar equipment and accessories. The Finance Act of 2016 amended the VAT Act of 2013 to provide a VAT exemption on the supply of specialised solar equipment and accessories and raw materials or inputs that are used in the manufacturing of equipment that exclusively uses or stores solar power. However, there has been a lack of clarity over the implementation of these exemptions, particularly in relation to appliances that could also feasibly be powered by the grid, such as many solar televisions or solar refrigerators. These appliances are an important part of demand stimulation, but without fiscal incentives, it is harder for them to remain affordable for end users or profitable for private companies to sell.

Table 9.1. Fiscal incentives for selected solar products in key markets

	Solar home system		Solar PV		Solar water pumps		Solar televisions, refrigerators and fans	
	VAT	Import duty	VAT	Import duty	VAT	Import duty	VAT	Import duty
Kenya	Exempt	0%	Exempt	Exempt	16%	0%	16%	25%
Uganda	0%	0%	Exempt	Exempt	18%	0%	18%	25%
Mozambique	17%	8%	17%	7.5%	16%	5%	16%	20%
Nigeria	10%	0%	5%	5%	7.5%	5%	7.5%	20%

Sources: Energy for Growth Hub (2022), How the global energy crisis is improving the prospects of solar in Nigeria; BDO (2022), The East African Regional Handbook on Solar Taxation; Renewable Energy Association of Nigeria (2020), Policy Research on the Imposition of 10% Tariff Duties on Solar Components: Making a Way for Solar in Nigeria; GOGLA (2022), Off-Grid VAT and Duty Tracker; Africa Clean Energy (2021), Impact Assessment of VAT and Import Duty Exemptions for Stand-Alone Solar in Nigeria; Energypedia (2022), Solar Home System Challenges for the Private Sector in Mozambique; GET.invest, (n.d.); Club of Mozambique (2023), Mozambique: New VAT Code in force in January 1st.

A similar story is visible in clean cooking, where incentives have been unclear, particularly in relation to LPG, which saw VAT levies cut to 8% in 2022 and then fully removed in 2023. Several studies have demonstrated the benefits of incentives for clean cooking. In 2021, the Clean Cooking Alliance calculated that a VAT of 16% on LPG and improved cookstoves would generate roughly KES 48.6 billion in government revenues by 2030. However, the study found that, compared to a scenario where both LPG and improved cookstoves had

VAT exemptions, there would be significantly lower stove uptake, resulting in an additional KES 94.6 billion in healthcare, environmental and affordability-related costs, more than offsetting any revenue gains from the VAT. Moreover, another study looking at clean cooking practices across low- and middle-income countries found that the proportion of households using traditional cooking technologies increased 1-2 percentage points following the VAT exemption removal on LPG and improved cookstoves. These studies demonstrate the value of fiscal incentives, not just as a means to attract private investment, but also to drive quicker uptake of clean cooking solutions.

The Draft National Green Fiscal Incentives Framework indicates that the Treasury will review the incentive framework for the off-grid and clean cooking sectors. Any incentive review should also seek to ensure consistency with priorities set by the Ministry of Energy and Petroleum and the Ministry of Environment. Private sector engagement can play an essential role in ensuring these incentives are designed in a way that does not block investments. The benefits of such engagement have already been visible in relation to the Climate Change (Amendment) Act, when discussions with the private sector led to a reduction of the proposed level of tax on revenue generated by private companies from the sale of carbon emission reduction credits.

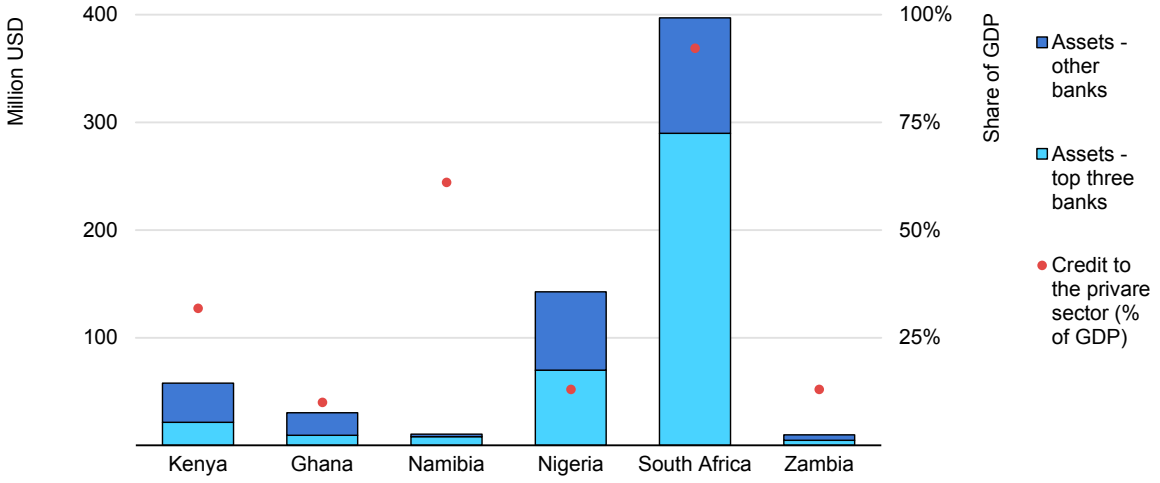
Local finance can play a larger role in clean energy financing with the right instruments and derisking mechanisms

Kenya has one of the most developed financial markets on the continent. Banks are well-capitalised, behind only South Africa and Nigeria, with a lower share of market concentration among the top three banks. Kenya also has one of the most advanced regulations in Africa relating to environment, social and governance risks – part of a trend that has served as a tailwind to clean energy investments globally. These environment, social and governance regulations help banks to factor in the risks associated with climate change and help incentivise lending to green activities. Kenya's regulations include transparent financial reporting standards and climate stress testing for banks (one of only six countries in Africa, as of October 2023, to have this). In October 2021, the Central Bank of Kenya issued the Guidance on Climate-Related Risk Management to commercial banks and mortgage finance companies, which in the long run is likely to help drive investment into clean energy investments.

Despite this, there are still some limitations on commercial banks' activities in the energy sector. Commercial banks can struggle to finance larger scale energy projects, which currently often occur via project finance structures, given a mismatch over tenors. Banks are often unable to provide debt for more than a

5- to 7-year tenor, whereas energy projects generally require debt over 15-20 years. For energy access projects, banks generally provide capital at high interest rates – often around 20% – with significant collateral requirements that are prohibitive for most locally owned businesses. Given that these businesses also struggle to access international sources of debt finance, this can lead to an over-reliance on equity financing, which is generally more expensive and is also in shorter supply. These issues are not unique to Kenya, and a common solution is to include commercial banks in a blended capital structure, whereby DFIs or other institutional investors provide the longer-term capital.

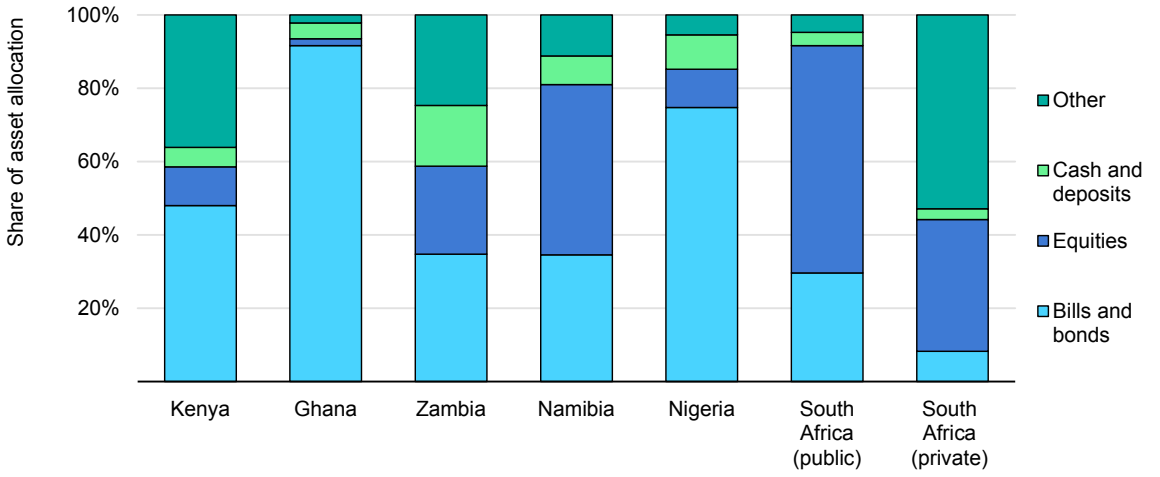
Figure 9.4 Banking assets and credit to the private sector in selected sub-Saharan African countries, 2023



IEA. CC BY 4.0.

Sources: World Bank (2024), World Development Indicators; European Investment Bank (2024), Finance in Africa.

Figure 9.5 Pension fund allocations by sector, selected sub-Saharan African countries



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Source: Annual reporting from country regulators.

Alongside commercial banks, pension funds in Kenya represent an excellent source of long-term, patient capital to fund energy projects. Between 2006 and the end of 2020, assets under management in Kenyan pensions grew sevenfold. However, as seen across the continent, roughly half of Kenyan pension assets are invested in government securities, where they can secure risk-free rates of 18%.

While this reduces pension funds' incentive to invest in alternative assets, including infrastructure, steps have been taken to further develop capital market expertise in this area. For example, the European Investment Bank is working with the Central Bank of Kenya to develop a green taxonomy, following the development of a Green Sovereign Bond Taxonomy. Green bonds have already proved a useful tool for assets in Kenya, including real estate (Acorn issuance to develop student housing in 2019) and clean cooking (first-of-its-kind issuance by Burn in 2023). A further advancement is expected with the creation of the Dhamana Guarantee Company, a provider of local currency guarantees for pension funds. Dhamana will be modelled on existing successful infrastructure guarantee facilities, such as InfraCredit Nigeria, which has issued over 16 guarantees since its launch in 2017, allowing 19 local pension funds to invest in infrastructure projects. Replicating this model in Kenya could prove instrumental in unlocking this source of more patient capital.

Recommendations

To reach its objectives, the government of Kenya could consider:

- Building on the Energy Transition and Investment Plan by creating sector roadmaps that specify clear targets and identify where private financing is most needed.
- Reviewing fiscal incentives for off-grid appliances to ensure that energy and fiscal priorities are aligned and that customers can access affordable solutions for electricity and clean cooking.
- Continuing to strengthen the green finance industry via the introduction of a green taxonomy and providing clarity on the Draft National Green Fiscal Incentives Framework to facilitate greater access to climate finance.
- Working with donors and development finance institutions to support capacity building at commercial banks and develop capital market instruments designed to mobilise domestic financing sources into energy projects.

Annexes

Acknowledgements, contributors and credits

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Syrine El Abed designed and directed the report. Jenny Birkeland assisted with co-ordinating the report, and wrote the chapters on access to electricity and access to clean cooking; Zakia Adam wrote the section on energy statistics; Trevor Criswell wrote the chapter on renewable energy; Jonathan Elkind wrote the chapter on general energy policy; Conor Gask wrote the chapter on energy efficiency; Emma Gordon wrote the chapter on energy investment; Kieran McNamara wrote the chapters on electricity and energy and climate; and Alessio Scanziani wrote the chapter on energy security and prepared the figures, supported by Naomi Trick. The report benefitted from reviews and insights from other IEA staff, including, Carlos Fernandez Alvarez, Sophie Attali, Heymi Bahar, Nouhoun Diarra, Zachary Egan, Paolo Frankl, Oliver Joy, Milosz Karpinski, Alison Pridmore, Pietro Rinaldi, Ali Al Saffar, Melanie Slade, Cecilia Tam, Gianluca Tonolo, Fabian Voswinkel, Adam Ward, Mary Burce Warlick and Daniel Wetzel. Astrid Dumond and Isabelle Nonain-Semelin managed the editing, layout and publication of the report. Jennifer Allain edited the report. The graphic design of the report was done by Poeli Bojorquez.

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Energy balances and key statistical data

	2005	2010	2015	2020	2022	2023
Indicators						
Population (millions)	36	42	47	52	54	55
GDP (billion USD, 2015 prices and PPPs)	111	140	176	211	238	252
TES/GDP (toe per thousand 2015 USD PPP)	6.1	5.8	5.9	5.5	5.1	5.0
Share of renewables in TES	85%	80%	81%	80%	80%	80%
Share of renewables in power generation	74%	64%	86%	94%	88%	90%
Share of modern renewables in power generation						
Total energy supply (PJ)	**678**	**815**	**1 042**	**1 165**	**1 226**	**1 260**
Coal	4	6	13	21	30	37
Oil	101	155	182	207	218	212
Natural gas	-	-	-	-	-	-
Renewables	574	654	847	937	977	1 008
Hydro	11	12	12	15	11	10
Bioenergy	527	604	671	734	759	772
Solar PV	0	0	0	0	1	2
Wind	0	0	0	5	8	7
Geothermal	36	38	163	182	199	217
Other renewables	0	0	0	0	0	0
Others	0	0	0	0	1	3
Electricity output (TWh)	**5.7**	**7.2**	**9.7**	**11.7**	**12.9**	**12.7**
Coal	-	-	-	-	-	-
Oil	1.5	2.6	1.4	0.8	1.6	1.3
Natural gas	-	-	-	-	-	-
Renewables	4.2	4.6	8.3	10.9	11.3	11.4
Hydro	3.0	3.2	3.5	4.2	3.0	2.7
Bioenergy	0.2	0.3	0.2	0.2	0.3	0.2
Solar PV	0.0	0.0	0.1	0.1	0.4	0.5
Wind	0.0	0.0	0.1	1.3	2.1	2.0
Geothermal	1.0	1.1	4.5	5.1	5.5	6.0
Other renewables	-	-	-	-	-	-
Others	-	-	-	-	-	-
Imports (PJ)	**141**	**184**	**225**	**247**	**276**	**284**
Coal	4	6	13	21	30	37
Oil	137	178	212	225	244	243
Natural gas	-	-	-	-	-	-
Electricity	0	0	0	0	1	3
Bioenergy	0	0	0	0	0	1
Others	1E-06	0	-1E-06	0	0	0

	2005	2010	2015	2020	2022	2023
Total final energy consumption (PJ)	**420**	**508**	**606**	**664**	**696**	**704**
Coal	4	6	13	21	30	37
Oil	78	115	162	182	188	181
Natural gas	-	-	-	-	-	-
Electricity	17	21	29	32	37	38
Bioenergy	321	365	402	429	441	448
Others	0	-1E-06	0	0	1E-06	0
Buildings (PJ)	**338**	**388**	**437**	**462**	**474**	**477**
Coal	-	-	-	-	-	-
Oil	16	20	27	26	26	26
Natural gas	-	-	-	-	-	-
Electricity	6	9	14	16	18	18
Bioenergy	316	359	396	419	430	433
Others	-1E-06	0	0	1E-06	0	0
Industry (PJ)	**42**	**51**	**59**	**58**	**73**	**87**
Coal	4	6	13	21	30	37
Oil	22	26	24	11	14	15
Natural gas	-	-	-	-	-	-
Electricity	11	12	15	16	19	20
Bioenergy	5	7	7	10	11	15
Others	0	-1E-06	-1E-06	0	0	-1E-06
Transport (PJ)	**40**	**69**	**111**	**144**	**148**	**140**
Coal	-	-	-	-	-	-
Oil	40	69	111	144	148	140
Natural gas	-	-	-	-	-	-
Electricity	-	-	-	-	-	-
Bioenergy	-	-	-	-	-	-
Others	0	0	0	0	0	0
GHG emissions (Mt CO_2-eq)	**15**	**20**	**23**	**25**	**28**	
Coal	0	1	1	2	3	
Oil	7	11	13	14	15	
Natural gas	0	0	0	0	0	
Other	7	8	9	9	10	

Abbreviations and acronyms

CDM	Clean Development Mechanism
COP	Conference of the Parties
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
DAC	direct air capture
DFI	development finance institution
EAC	East African Community
EAPP	East African Power Pool
EPRA	Energy and Petroleum Regulatory Agency
ESCO	energy services company
EU	European Union
EUR	euro
EV	electric vehicle
FIT	feed-in tariff
FY	fiscal year
GDC	Geothermal Development Company
GDP	gross domestic product
GHG	greenhouse gas
IEA	International Energy Agency
IPP	independent power producer
KenGen	Kenya Electricity Generating Company
KES	Kenyan shilling
KETRACO	Kenya Electricity Transmission Company
KNBS	Kenya National Bureau of Statistics
KNCTS	Kenya National Cooking Transition Strategy
KOSAP	Kenya Off-Grid Solar Access Project
KPLC	Kenya Power and Lighting Company
KPRL	Kenya Petroleum Refineries Limited
LCPDP	Least Cost Power Development Plan
LED	light-emitting diode
LMCP	Last Mile Connectivity Project
LNG	liquefied natural gas
LPG	liquefied petroleum gas
LT-LEDS	long-term low-emission development strategy
MEPS	minimum energy performance standard
NAP	Kenya National Adaptation Plan
NDC	Nationally Determined Contribution

NEECS	National Energy Efficiency and Conservation Strategy
PAYGo	pay-as-you-go
PPA	power purchase agreement
PPP	public-private partnership
PV	photovoltaic
REAP	Renewable Energy Auction Plan
REREC	Rural Electrification and Renewable Energy Corporation
SAF	sustainable aviation fuel
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SDG	Sustainable Development Goal
USD	United States dollar
VAT	value-added tax

Units of measure

BTU/hour	British thermal units per hour
g CO_2	gramme of carbon dioxide
GW	gigawatt
GWh	gigawatt hour
kb/d	thousand barrels per day
km	kilometre
kt	kilotonne
kV	kilovolt
kWh	kilowatt hour
L	litre
Mt	million tonnes
Mt CO_2	million tonnes carbon dioxide
MW	megawatt
MWh	megawatt hour
PJ	petajoule
t	tonne
TWh	terawatt hour
Lge	litres of gas equivalent

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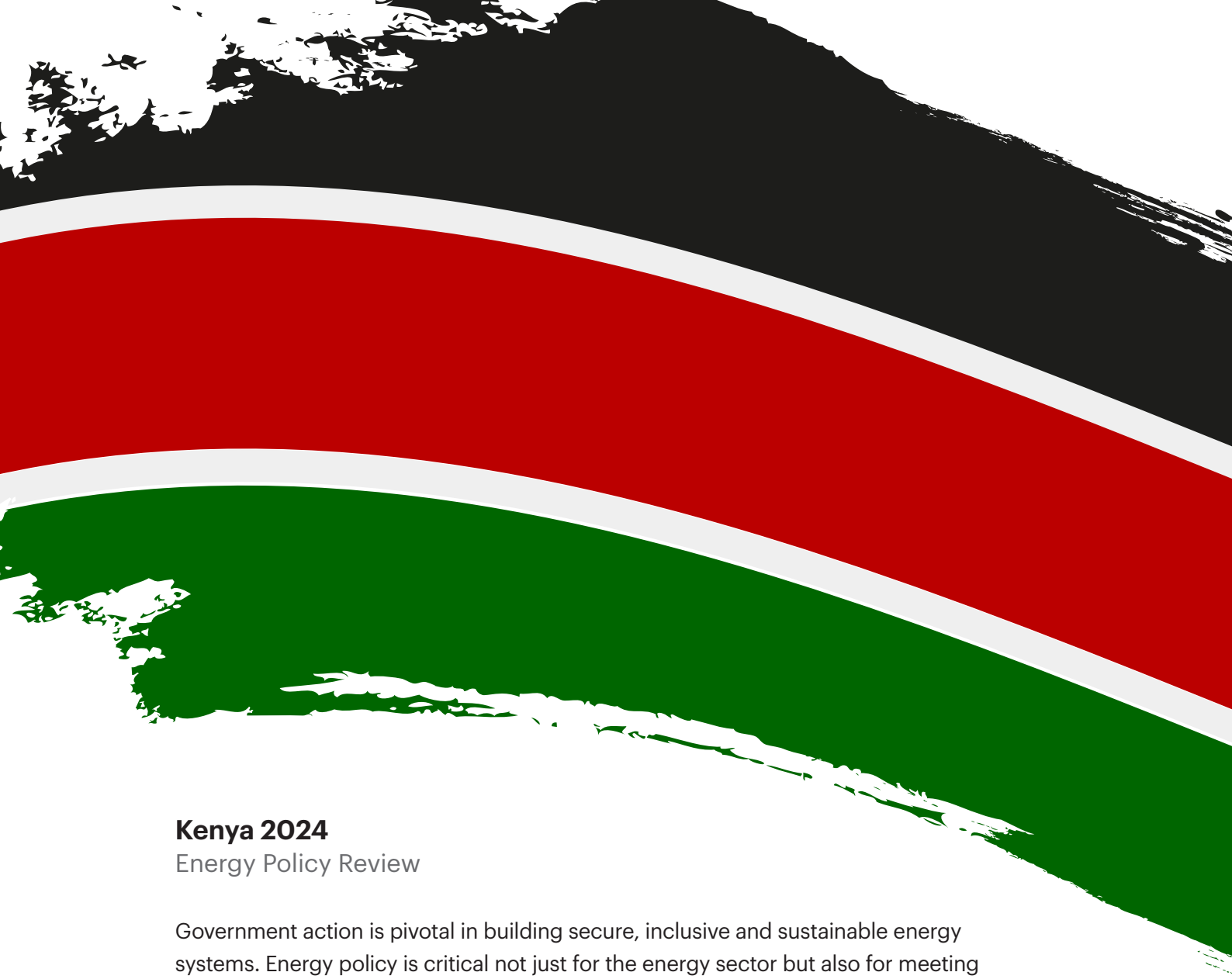

Kenya 2024

Energy Policy Review

Government action is pivotal in building secure, inclusive and sustainable energy systems. Energy policy is critical not just for the energy sector but also for meeting environmental, economic and social goals. Governments need to respond to national specific needs, adapt to regional contexts, and help address global challenges. In this context, the International Energy Agency (IEA) conducts *Energy Policy Reviews* to support governments in developing more impactful energy and climate policies.

This *Energy Policy Review* of Kenya was prepared in collaboration between the government of Kenya and the IEA, whose strong partnership achieved an important milestone in 2023 when Kenya joined the IEA family as an Association country.

The review leverages the IEA's extensive knowledge and the inputs of expert peers from IEA member countries to assess Kenya's most pressing energy challenges and provide recommendations backed by international best practices, especially as Kenya revises its 2018 Energy Policy to adapt it to current energy trends and needs.

The report highlights Kenya's leadership in areas such as promoting universal access to modern energy and developing its renewable energy capacity, especially geothermal. It also encourages the exchange of best practices among countries to foster learning and strengthen political will for a sustainable and affordable clean energy future.