KENYA

1. INTRODUCTION

This report examines Kenya's approach to addressing the Energy Trilemma by balancing energy security, equity, and environmental sustainability. As a regional leader in renewable energy, Kenya has achieved remarkable progress in expanding access to electricity, decarbonizing its energy systems, and aligning with global commitments under the Paris Agreement and the Sustainable Development Goals.

The report provides an in-depth analysis of Kenya's energy policies, achievements, and the challenges that remain, particularly in ensuring reliability, affordability, and inclusivity. It highlights opportunities for leveraging innovative technologies, enhancing regional equity, and fostering community engagement to achieve a resilient and sustainable energy future. By focusing on actionable strategies, this report offers a comprehensive roadmap for strengthening Kenya's energy sector while maintaining a balance across the Trilemma dimensions.

As a leader in renewable energy in Africa, Kenya aims to achieve a balanced energy system that satisfies the three pillars of the Energy Trilemma—Energy Security, Energy Equity, and Environmental Sustainability. Kenya has a total installed electricity capacity of 3,199.9 MW and a peak demand of 2,177 MW in 2024 (Energy & Petroleum Statistics Report, 2024). Current electricity access rate is over 75% with 9.66 million customers connected to the grid as at June 2024. The bulk connections are managed by the key state entities, the Kenya Power & Lighting Company (KPLC) and the Rural Electrification and Renewable Energy Corporation (REREC). There is increasing private-sector electrification especially in rural remote areas through off-grid technologies such as mini grids and solar home systems.

The country aims to achieve universal access to clean cooking by 2028 with The Kenya National Bureau of Statistics (KNBS) data KNBS Demographic and Health Survey (DHS) revealing a high dependence on traditional cooking fuels. In total, 68.5% of the population, or 9.1 million households (1.7 million in urban areas and 7.4 million in rural areas), rely on traditional cooking fuel options as their primary source (KNBS, 2022).

Kenya is a net importer of petroleum products, a process that is coordinated by the Ministry of Energy and Petroleum. According to the Energy and Petroleum Regulatory Authority (EPRA) 2023-2024 financial year report the country imported 9,059,597.15 cubic meters, representing a 2.10% decline from the previous year with the decrease being largely attributed to a reduction in domestic demand

As part of its efforts to decarbonize the transport sector, Kenya is also promoting the adoption of electric vehicles (EVs) by facilitating infrastructure development and offering favorable policies to enhance EV penetration. This aligns with the country's broader commitment to achieving a sustainable and low-carbon economy.

2. POLICY CONTEXT

Kenya's national energy policies are guided by its Vision 2030 blueprint, which outlines a long-term strategy for environmentally responsible economic, social, and political development. Aligned with global frameworks such as the Sustainable Development Goals (SDGs) and the Paris Agreement's Nationally Determined Contributions (NDCs), the Ministry of Energy and Petroleum has spearheaded progressive initiatives to advance the sector. These policies collectively aim to enhance energy access, promote sustainability, and position Kenya as a renewable energy leader in Africa.

Key policies driving these efforts include:

- The Energy Act (2019): This act establishes the regulatory framework for energy production, delivery, and consumption. It promotes energy governance and encourages private sector participation to foster innovation and efficiency.
- National Energy Policy (2018): This policy emphasises sustainable energy development, ensuring affordable, reliable, and environmentally responsible energy access to meet both national and county development needs while safeguarding environmental sustainability for future generations.
- The Kenya Energy Sector Investment Plan (ETIP) 2023-2050: This plan identifies priority decarbonisation technologies such as renewable energy, green hydrogen, e-mobility, energy storage, and clean cooking. It also facilitates the scoping of projects to attract funding from public and private sources, anchoring an orderly and effective energy transition.

Kenya's e-mobility policy, currently being spearheaded by the Ministry of Roads and Transport, is aimed at promoting the adoption of electric vehicles (EVs) and reducing carbon emissions. The policy focuses on developing EV charging infrastructure through public and private partnerships, introducing favorable tariffs and incentives to encourage EV adoption, establishing technical standards for EVs and charging stations, and supporting local manufacturing and assembly of EV components. By leveraging Kenya's renewable energy resources, the policy aims to integrate e-mobility into the country's broader sustainability strategy.

Kenya’s hydrogen strategy represents a significant milestone in its energy transition journey. Recognising the transformative potential of green hydrogen, the country has prioritised its development as a key enabler of decarbonisation and economic growth. The commissioning of Kenya’s first green hydrogen plant in Morendat, Nakuru County, marks a pivotal step towards establishing the country as a regional hub for hydrogen production and export.

The Kenya Hydrogen Strategy, developed in collaboration with international partners, outlines a framework for scaling up hydrogen production, focusing on:

- Leveraging Kenya’s abundant renewable energy resources to produce low-cost, green hydrogen.
- Supporting industrial applications, such as fertiliser production and steel manufacturing, to reduce carbon emissions in hard-to-abate sectors.
- Encouraging public-private partnerships to attract investment and drive innovation in hydrogen technologies.
- Establishing export corridors to tap into global demand for green hydrogen, particularly in Europe and Asia.

These efforts are further supported by the publication of the Kenya Green Hydrogen and Its Derivatives Guidelines, which provide a roadmap for regulatory frameworks, infrastructure development, and capacity-building initiatives. By integrating hydrogen into its energy mix, Kenya is not only diversifying its energy portfolio but also strengthening its position as a global leader in sustainable energy.

These policies have yielded significant achievements. Kenya has emerged as one of the few African countries to generate over 80% of its electricity from renewable sources, including geothermal, hydropower, solar, and wind. Electricity access has surged from 19% in 2010 to 75% in 2024, reflecting the effectiveness of these interventions. Furthermore, initiatives such as the expansion of mini-grids and off-grid solar solutions have improved energy equity, particularly in rural and underserved areas.

Despite these advancements, challenges remain. Scaling investments to meet growing energy demand, addressing affordability, increasing productive uses of energy, and reducing regional disparities in access are critical issues. Seasonal variability, particularly with hydropower, and the socio-economic impacts of renewable energy projects on local communities also require attention.

Kenya's policy framework provides a solid foundation for navigating these challenges. By prioritising inclusive planning, leveraging innovative technologies, and fostering public-private partnerships, the country is well-positioned to achieve a resilient, equitable, and sustainable energy future.

3. CHALLENGES AND OPPORTUNITIES

3.1 ENERGY SECURITY

Kenya's energy security is driven by diversification of energy sources and efforts to enhance grid reliability. The country's energy mix is composed of 80% renewable sources (Energy & Petroleum Statistics Report, 2024), including geothermal, hydropower, wind, and solar energy. Geothermal energy, contributing 41.71% of total energy production, forms the cornerstone of the country's power generation. However, reliance on hydropower presents challenges due to seasonal variability, which affects supply stability.

To address these issues, Kenya has strategically expanded geothermal capacity and increased energy imports from neighbouring countries, such as Ethiopia and Uganda, to stabilise supply during periods of low domestic generation. Investments in infrastructure, including the Isinya-Namanga 132kV and Turkwel-Ortum 220kV transmission lines, have enhanced grid stability and facilitated the integration of renewable energy projects. Efforts to reduce system losses, which stood at 23.2%, highlight ongoing initiatives to improve energy efficiency and support growing demand.

3.2 ENERGY EQUITY

Kenya's pursuit of energy equity is reflected in its efforts to expand access to affordable and reliable electricity. As of June 2024, the electrification rate exceeded 75%, with 9.66 million grid-connected customers (Energy & Petroleum Statistics Report, 2024). This progress demonstrates significant advancements, but affordability challenges persist, particularly amidst rising costs and economic pressures.

To mitigate the impact of global energy price volatility, the Energy (Net Metering) Regulations 2024 were introduced. These regulations are expected to allow consumers to offset energy bills by exporting surplus renewable energy to the grid. Time of Use (TOU) tariff schemes have also facilitated savings of Ksh 1.838 billion for commercial and industrial users, driving greater efficiency and reducing operational costs during off-peak periods.

Addressing regional disparities remains central to Kenya's energy equity goals. Nairobi, which consumes 43.7% of total energy, contrasts sharply with underdeveloped regions like North-Eastern Kenya and South Nyanza. Expanding mini-grids and off-grid energy solutions is essential to bridging these gaps, ensuring inclusive energy access, and reducing inequality across the country.

3.3 ENVIRONMENTAL SUSTAINABILITY

Kenya is recognised as a regional leader in environmental sustainability, with an ambitious target to achieve 100% renewable energy generation by 2030, aligning with its Net-Zero Emission goal for 2050. In the 2023/2024 financial year, 83% of the energy supplied to the national grid came from renewable sources. These efforts have significantly reduced carbon emissions, with CO2 emissions from electricity generation declining by 29.6% to 652,285 tCO2 due to lower reliance on thermal generation.

The commissioning of Kenya's first green hydrogen plant in Morendat, Nakuru County, and the publication of the Kenya Green Hydrogen and Its Derivatives Guidelines mark major advancements in diversifying the clean energy portfolio. Growth in captive solar PV capacity, which now stands at 229.2 MW, further underscores Kenya's leadership in renewable energy.

Nonetheless, challenges persist. Expanding renewable energy projects, such as wind farms, has raised concerns over land use and the displacement of local communities. Addressing these issues through inclusive planning, active stakeholder engagement, and equitable compensation mechanisms is critical to achieving a just and sustainable energy transition.

By aligning strategic investments with environmental and social considerations, Kenya can further its energy ambitions while fostering resilience, inclusivity, and sustainability across its energy landscape.

4. POLICY PATHFINDING FOR MANAGING THE TRILEMMA

Kenya's energy transition is an intricate balance of competing priorities in energy security, equity, and environmental sustainability. Leveraging the insights from the 2024 World Energy Trilemma Report, this section outlines how global signals align with Kenya's unique challenges and opportunities, while identifying actionable strategies to ensure a just and resilient transition.

4.1 APPLICABILITY OF GLOBAL SIGNALS TO KENYA'S ENERGY TRANSITION

The 2024 World Energy Trilemma Report highlights evolving global trends that are highly relevant to Kenya's energy landscape.

- Energy Security: Global trends underscore the shift from supply adequacy to resilience against multifaceted disruptions, such as climate variability, cyber threats, and supply chain vulnerabilities. Kenya's renewable energy dominance (80%) and infrastructure investments are steps in the right direction. However, reliance on hydropower (subject to seasonal fluctuations) and increasing dependency on geothermal resources expose vulnerabilities. Strengthening grid resilience through energy storage and smart technologies, and diversifying energy imports, are critical next steps.
- Energy Equity: Expanding equitable access to energy remains a cornerstone of Kenya's energy strategy. Policies like net metering and Time of Use tariffs align with global efforts to balance affordability and economic opportunity. Yet, rising costs and regional disparities persist. Lessons from global case studies on equitable transitions could help Kenya refine its strategies, particularly in underserved areas like North-Eastern Kenya and South Nyanza.
- Environmental Sustainability: Kenya's leadership in renewable energy, including the commissioning of its first green hydrogen plant, positions it well to align with the report's emphasis on broader planetary boundaries. However, Kenya must integrate circular economy principles and address environmental challenges associated with renewable energy, such as land use conflicts and resource extraction impacts.

4.2 ADDRESSING TRENDS AND SETTING PRIORITIES

Kenya's energy policies already reflect some key global trends, such as decentralised energy systems and community-led electrification. To accelerate progress, the following areas warrant prioritisation:

- Energy Storage: Expanding battery and grid storage systems to complement growing renewable energy penetration and mitigate seasonal variability.
- Hydrogen Strategy Implementation: Strengthening the regulatory framework to attract investment in green hydrogen production and export, establishing Kenya as a regional hub.
- Regional Integration: Enhancing cross-border collaborations to stabilise supply chains and create a more interconnected and resilient energy network.
- Measurement and Metrics: Developing robust indicators to monitor resilience, equity, and sustainability across all dimensions of the Trilemma.

4.3 ENSURING A JUST AND RESILIENT TRANSITION

To achieve a just transition, Kenya must address socio-economic and environmental considerations holistically:

- Land Use and Community Compensation: Renewable energy projects, such as wind and solar farms, must adopt inclusive planning processes to mitigate land disputes and displacement. Transparent compensation mechanisms and stakeholder engagement are vital.
- Workforce Upskilling: Expanding training programmes to prepare the workforce for emerging energy sectors like green hydrogen, energy storage, and e-mobility.
- Social Impact Evaluation: Introducing metrics to assess the socio-economic benefits of energy projects, ensuring inclusivity and equitable distribution of gains.

5. BEYOND TRADITIONAL DIMENSIONS

Kenya's energy transition requires leveraging emerging opportunities beyond conventional approaches:

- Digital Tools and Technologies:
    - Optimising Grid Management: Deploying smart grids and advanced data analytics to enhance system reliability, forecast demand, and manage distributed energy resources.
    - Cybersecurity: Strengthening defences against emerging cyber threats to safeguard critical energy infrastructure.
- Multi-Sector Collaboration:
    - Water-Energy-Food Nexus: Integrating energy planning with agriculture and water management to drive resource efficiency.
    - Public-Private Partnerships: Mobilising investments through collaborative frameworks to fund innovative projects and expand infrastructure.
- Community Engagement:
    - Inclusive Decision-Making: Encouraging co-ownership models and community participation in planning to address resistance and foster trust.
    - Energy Literacy: Implementing educational campaigns to increase awareness of energy technologies and sustainability practices, particularly in rural areas.

Kenya's energy transition journey thus demonstrates remarkable progress but faces critical challenges that require strategic interventions. By integrating global insights, enhancing collaboration, and prioritising resilience and inclusivity, Kenya can effectively manage the Energy Trilemma and set a benchmark for sustainable energy transitions in Africa.

6. CONCLUSION

Kenya's energy transition therefore illustrates a dynamic and progressive approach to addressing the complexities of the Energy Trilemma. By achieving significant milestones in renewable energy adoption, electrification, and green hydrogen, the country has established itself as a leader in sustainable energy in Africa. However, challenges such as regional disparities, infrastructure limitations, and environmental trade-offs remain pivotal.

Strategic investments in energy storage, regional integration, and digital technologies will be crucial to sustaining progress. Equally, prioritising social inclusivity through community engagement and workforce upskilling can ensure that no one is left behind in this transition.

By aligning national strategies with global insights from the 2024 World Energy Trilemma Report, Kenya is poised to set an example for balancing energy security, equity, and environmental sustainability. A focus on resilience, innovation, and justice will enable Kenya to navigate the complexities of its energy landscape while paving the way for a robust and inclusive energy future.

WORLD ENERGY COUNCIL

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