Kenya Climate Innovation Center

ASSESSMENT REPORT

KENYA'S CLEANTECH SECTOR

DEVELOPED WITH TECHNICAL SUPPORT OF:

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RIGHTS AND PERMISSION

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EXECUTIVE SUMMARY

Kenya's cleantech sector is rapidly emerging as a cornerstone of the country's transition to a green, climate-resilient economy. Anchored by national commitments to renewable energy, circular economy models, climate-smart agriculture, e-mobility, and digital climate innovations, the sector contributes to sustainable industrialization, green job creation, and inclusive economic growth. Despite generating over 80% of electricity from renewables and demonstrating vibrant innovation across waste management, agritech, clean cooking, water systems, and mobility, growth is constrained by regulatory inconsistencies, limited access to finance, high upfront costs, fragmented policy enforcement, and underrepresentation of women and persons with disabilities.

This assessment, commissioned by the Kenya Climate Innovation Centre (KCIC) under the GreenBiz Programme, provides a comprehensive analysis of the sector across six key areas: sub-sector mapping, enabling environment evaluation, business model innovations, GESI integration, green skills and employment potential, and strategic policy and investment recommendations. A mixed-methods approach including desk review, 42 business interviews, seven focus group discussions, and stakeholder validation ensured a robust, evidence-based understanding of the ecosystem, capturing perspectives from entrepreneurs, investors, policymakers, academia, and community actors.

Findings reveal that renewable energy dominates the ecosystem (45.2% of enterprises), supported by large-scale infrastructure such as the Olkaria geothermal complex and Lake Turkana Wind Power Station, while emerging areas including circular economy solutions, bio-waste valorisation, PAYG solar, briquettes, e-mobility, and smart water and waste systems are gaining traction. Hybrid and community-based business models are driving affordability, market access, and grassroots innovation, though adoption remains uneven. Technological and technical capacities are expanding through digital tools, IoT-enabled monitoring, and adaptive R&D, yet gaps persist in local manufacturing, technical skills, digital inclusion, and supportive infrastructure.

To unlock the sector's full potential, the report recommends harmonizing national and county-level policies, establishing a national cleantech strategy and enterprise registry, and standardizing licensing, certification, and regulatory frameworks to support predictable and inclusive growth. Key interventions include promoting circular economy practices, formalizing waste actors, embedding GESI across funding and training programs, incentivizing private investment, and scaling localized R&D, smart waste systems, and nature-based solutions. Strengthening green skills, youth employment pathways, and awareness campaigns will catalyse market demand and workforce readiness.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS

ADB	African Development Bank
AI	Artificial Intelligence
APRA	Accelerated Partnership for Renewables in Africa
BESS	Battery Energy Storage Systems
CDM	Clean Development Mechanism
COP28	28th Conference of the Parties
CSO	Civil Society Organization
DANIDA	Danish International Development Agency
DFI	Development Finance Institutions
DOE	Department of Energy
EIB	European Investment Bank
EPR	Extended Producer Responsibility
ETF	European Training Foundation
FGDs	Focused Group Discussions
FiTs	Feed-in Tariffs
GDP	Gross Domestic Product
GESI	Gender Equality and Social Inclusion
GESIP	Green Economy Strategy and Implementation Plan
GW	Gigawatts
IDI	In-depth Interviews
IFI	International Financial Institutions
ILO	International Labour Organization
IoT	Internet of Things
KBA	Kenya Bankers Association
KCIC	Kenya Climate Innovation Centre
KCV	Kenya Climate Ventures
KIIs	Key Informant Interviews
M&E	Monitoring and Evaluation
MW	Megawatts
NbS	Nature-based Solutions
NCCAP	National Climate Change Action Plan
NDCs	Nationally Determined Contributions
NSE	Nairobi Securities Exchange
OECD	Organisation for Economic Co-operation and Development
PAYG	Pay-As-You-Go
PPP	Public-Private Partnership
SDG	Sustainable Development Goals
SPG	S&P Global
STEM	Science, Technology, Engineering, and Mathematics
UNDP	United Nations Development Programme
VC	Venture Capital

1.0 INTRODUCTION

1.1 Background

The global shift toward sustainable development and climate resilience has spotlighted clean technologies (cleantech) as a crucial pathway to achieve economic growth while addressing pressing environmental challenges. Cleantech encompasses a broad set of products, services, and business models that reduce negative environmental impacts through improvements in energy efficiency, resource use, emissions reduction, and sustainable production practices. For many countries including Kenya, the economy is highly climate-sensitive, particularly in agriculture, energy, and water. Therefore, cleantech provides an important pathway toward climate resilience, green job creation, and inclusive growth.

Kenya has rapidly positioned itself as a cleantech trailblazer on the African continent. Kenya's cleantech sector is a dynamic and rapidly growing industry, driven by the country's commitment to sustainability, climate resilience, and green economic growth[1]. As of 2023, more than 80% of the country's electricity was generated from renewable sources, that is, geothermal (48.2%), hydro (21.3%), wind (16.1%), and solar (3.9%)[2] which places Kenya among the global leaders in clean energy adoption. The government's Vision 2030 and Kenya's updated Nationally Determined Contributions (NDCs)[3] emphasize the expansion of clean energy infrastructure and energy efficiency measures, encouraging both public and private investments. Innovations such as mini-grids and smart metering are improving energy access, especially in off-grid rural areas, while energy-efficient solutions in industries and households are reducing carbon footprints and operational costs.

Beyond energy, water and waste management is another critical cleantech subsector addressing urbanization challenges and environmental conservation. Kenya is advancing circular economy models through wastewater treatment, plastic recycling, and sustainable solid waste management initiatives[4]. Programs such as the Extended Producer Responsibility (EPR) regulations are fostering corporate accountability in waste reduction.

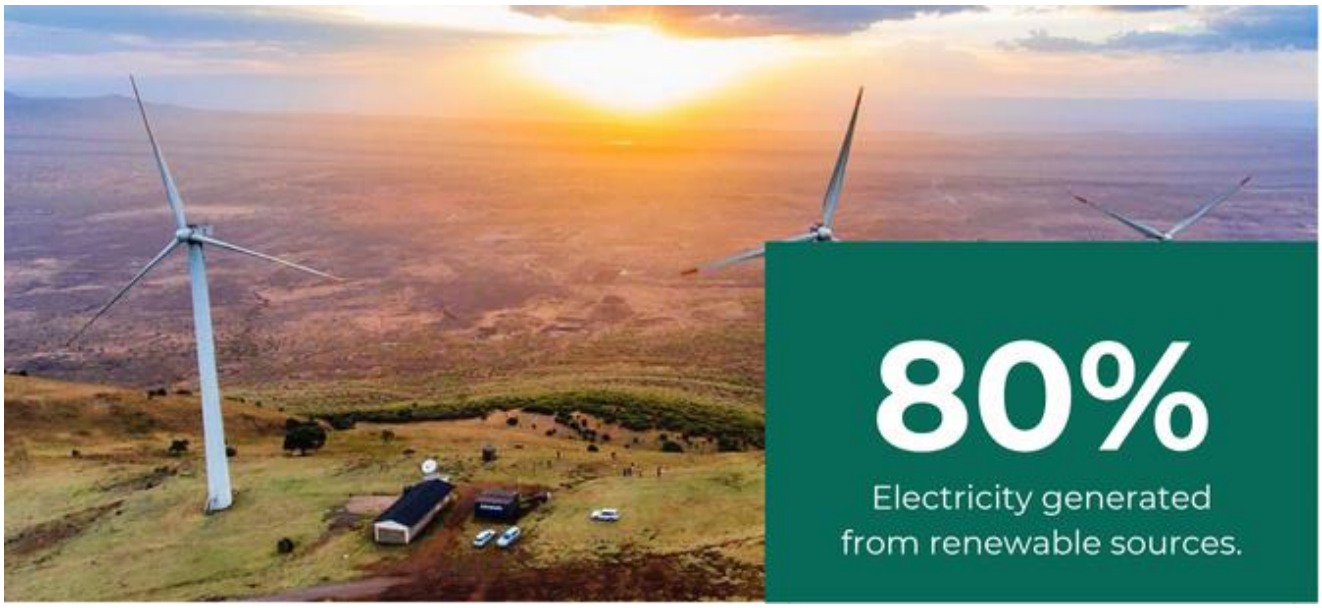

Figure 1: Ngong Hills Wind Power Station.

[1] Kenya Innovation Outlook: Emerging technologies edition. Link
[2] Off-grid renewable energy solutions to expand electricity access: An opportunity not to be missed. Link
[3] Kenya's Updated Nationally Determined Contribution. Link
[4] Press Review - Nairobi Workshop on Circular Economy. Link

Additionally, companies are leveraging green technologies, such as biogas generation from organic waste and water harvesting systems, to improve resource efficiency. Innovations are emerging in off-grid solar solutions, pay-as-you-go (PAYG) financing models, improved cookstoves, waste-to-energy systems, electric mobility, and digital climate tools such as AI, IoT, and blockchain for environmental monitoring. Similarly, agribusiness is integrating climate-smart technologies, including precision agriculture, smart irrigation, bio-based fertilizers, and solar-powered irrigation, to enhance food security while mitigating environmental impact. Kenya's thriving agritech startups, supported by institutions like the Kenya Climate Innovation Centre (KCIC), are spearheading sustainable agricultural transformation.

Figure 2: Solar-powered irrigation

Kenya's commercial forestry sector is also emerging as a key pillar of the cleantech space, playing a crucial role in carbon sequestration, ecosystem restoration, and sustainable timber production. With the government's commitment to increasing tree cover to 30% by 2032 according to the Ministry of Environment and Forestry, afforestation and reforestation programs are gaining momentum albeit slowly. Public-private partnerships and carbon credit markets are expected to drive investments in sustainable forestry, providing economic opportunities while enhancing biodiversity. As Kenya continues to strengthen its cleantech policies, financing mechanisms, and innovation hubs, the sector is poised to be a major driver of economic growth, environmental conservation, and climate resilience in the region.

The role of institutions such as the Kenya Climate Innovation Centre (KCIC) has been instrumental in advancing cleantech entrepreneurship. Through initiatives like the GreenBiz Programme (a–2025), implemented in partnership with the Danish International Development Agency (DANIDA), KCIC supports more than 300 climate-smart enterprises and aims to create over 3,000 full-time jobs. These enterprises operate across sectors such as renewable energy, Agritech, water and sanitation, circular waste solutions, and eco-friendly manufacturing. The GreenBiz Programme not only provides financial and technical support but also strengthens market access, policy advocacy, and gender and social inclusion.

At the international level, Kenya's cleantech ambitions are reinforced by its leadership in key climate diplomacy platforms. Hosting the African Climate Summit in 2023 and championing initiatives such as the Africa Green Industrialization Initiative and the Accelerated Partnership for Renewables in Africa (APRA), Kenya has demonstrated commitment to positioning climate action as an economic opportunity. The U.S.-Kenya Climate and Clean Energy Industrial Partnership further underscores this ambition, with joint investments in clean energy deployment, green supply chains, and decarbonized industrialization.

By focusing on these sectors, KCIC and partners aims to directly and indirectly contribute to the achievement of SDG 1 (no poverty); SDG 2 (no hunger); SDG 6 (clean water and sanitation), SDG 7 (affordable and clean energy), and SDG 13 (climate action). Others are SDG 15 (life on land); SDG 8 (decent work and economic growth) and SDG 12 (responsible consumption and production). KCIC has thus engaged the services of a consultant to undertake a comprehensive sector analysis and consolidate sectors contribution to economic growth in Kenya.

Despite these advancements, Kenya's cleantech sector still faces several challenges. These include financing gaps for early-stage startups, bureaucratic hurdles in project implementation, limited access to affordable technologies in rural areas, and underrepresentation of women and youth in sector leadership. Addressing these barriers will require coordinated policy reforms, innovative financing mechanisms, capacity building, and inclusive business models that reflect the needs of all segments of society.

In this evolving landscape, the need for a comprehensive, evidence-based assessment of Kenya's cleantech sector becomes paramount. This assessment seeks to unpack the sector's current state, map emerging opportunities, highlight bottlenecks, and provide actionable insights for policy, investment, and innovation. It is grounded in Kenya's national development priorities and global commitments to climate action, sustainable development, and inclusive economic transformation.

1.2 Purpose and Objectives of the Assessment

This assessment was commissioned by KCIC to evaluate the current state, emerging trends, opportunities, and challenges within Kenya's cleantech sector. The overarching goal is to generate actionable insights that inform policy recommendations, business strategies, and investment decisions, ultimately accelerating the transition to a green economy.

Furthermore, the assignment includes the development of advocacy materials targeted at policymakers, emphasizing the need for an enabling regulatory framework that fosters innovation and sustainable business practices. The primary objective was to evaluate the current state of Kenya's cleantech sector and its potential to drive sustainable economic growth, generate green employment, and mitigate environmental challenges. This involved a detailed assessment of emerging business models, the sector's economic feasibility, the integration of Gender Equality and Social Inclusion (GESI) principles, and its overall contribution to Kenya's economic transformation.

The specific objectives of the assessment included:

- Map out key sub-sectors within Kenya's cleantech space and assess their performance and impact.
- Evaluate the enabling environment, including policies, regulatory frameworks, and financing mechanisms.
- Identify emerging business models and innovation trends that promote sustainability and inclusivity.
- Examine the integration of Gender Equality and Social Inclusion (GESI) principles in cleantech initiatives.
- Assess the potential for green job creation, green skills development, and socio-economic transformation.
- Provide policy and investment recommendations to strengthen Kenya's cleantech ecosystem.

1.3 Scope of the Assessment

The assessment covered the cleantech ecosystem broadly, with a focus on six sub-sectors: renewable energy, climate-smart agriculture, waste and water management, e-mobility, clean cooking solutions, and green manufacturing. It explored their technological maturity, market readiness, financing patterns, scalability potential, and contribution to Kenya's green transition. It also evaluated social and environmental outcomes, with a particular emphasis on inclusivity, economic empowerment, and environmental restoration.

The research involved both secondary desk review and primary data collection through a national survey of cleantech enterprises, and stakeholder consultations through Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs). Additional insights were gathered from policy documents, investment reports, and cleantech case studies in secondary data review and analysis.

1.4 Significance of the Report

This report comes at a pivotal moment as Kenya aims to mainstream green growth into its national development framework and accelerate implementation of the Sustainable Development Goals (SDGs). It offers a comprehensive presentation of the cleantech sector's trajectory, highlights the role of policy, private capital, and digital innovations in unlocking sector growth, and surfaces critical gaps that must be addressed to enhance sector resilience and inclusivity.

By consolidating learnings and evidence, the report is intended for use by a diverse audience: policymakers, cleantech entrepreneurs, investors, development partners, and advocacy organizations. Its recommendations are meant to catalyse the creation of an enabling environment where green innovations can flourish, jobs can be created at scale, and the broader goals of climate mitigation, adaptation, and sustainable development can be achieved.

2.0 METHODOLOGY

2.1. Overview

This assessment employed a structured, multi-phased methodology to generate an evidence-based understanding of Kenya's cleantech sector. The approach emphasized inclusivity, evidence-based analysis, and stakeholder engagement combining both primary and secondary data sources. The goal was to capture the breadth and depth of the cleantech ecosystem and generate actionable insights for policy, investment, and innovation. In essence, the assessment was conducted in six core stages as indicated in Figure 1.

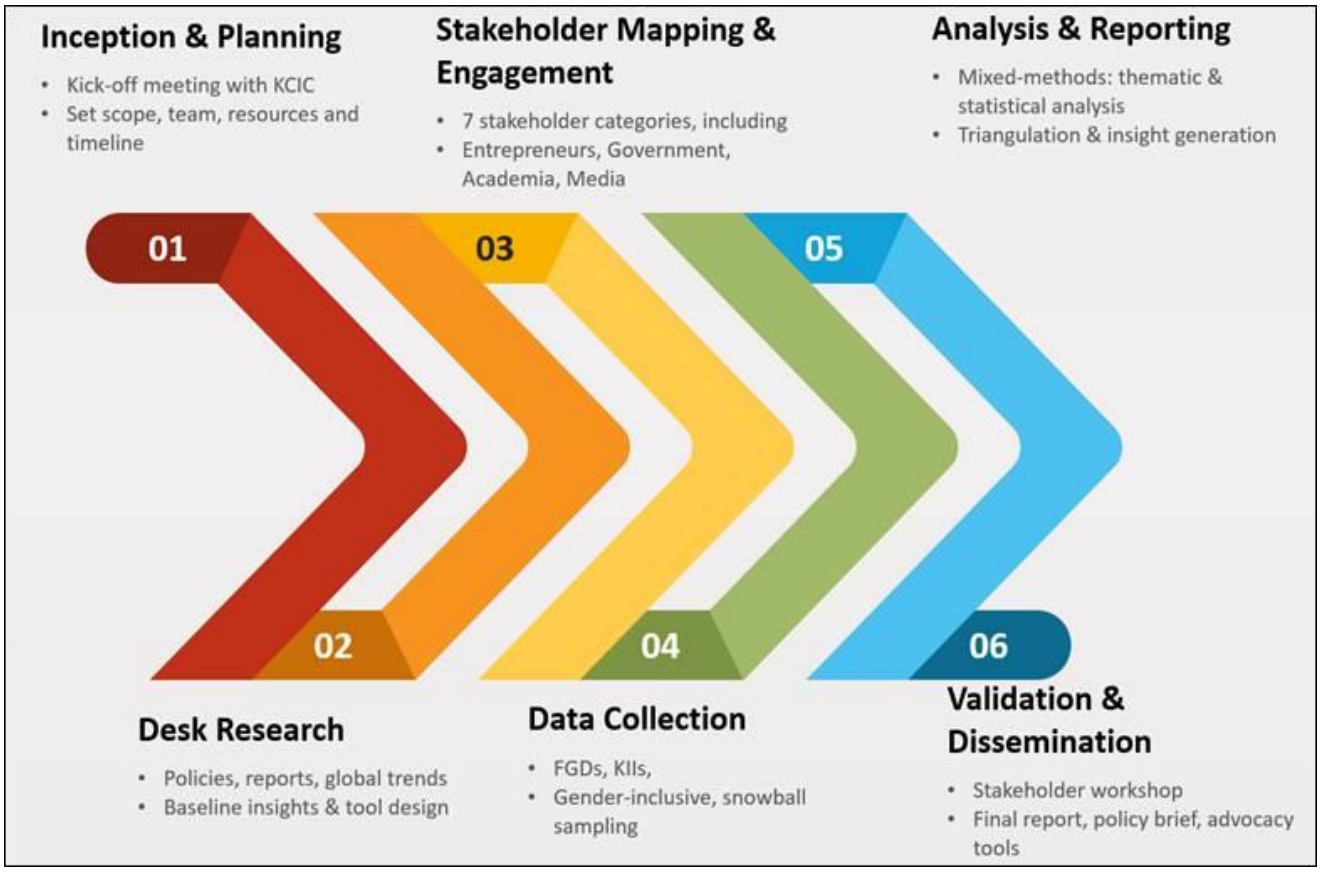

Figure 3: The Approach

2.2. Inception and Planning

The inception phase commenced with an engagements and meetings to align on the scope, objectives, deliverables, and timelines. A detailed work plan was developed outlining key activities, roles, and responsibilities which guided the assessment.

2.3. Desk Research

A comprehensive review of existing literature, policy documents, sector reports, and global best practices was conducted to establish the baseline context of Kenya's cleantech sector. Key references included the existing strategies, policies, legal, regulatory and institutional frameworks including but not limited to the constitution of Kenya, Kenya Vision 2030, the Climate Change Act (2016) and its revisions, the National Climate Change Action Plan (2023–2027) (See Appendix I for summary), the first, updated and second NDCs and various publications from international development agencies and research think tanks. The

review informed the design of primary data collection tools and provided insight into key policy and market dynamics of the cleantech sector in this report.

2.4. Stakeholder Mapping and Engagement

A stakeholder mapping exercise was conducted to ensure a comprehensive understanding of the cleantech ecosystem. It was also critical to identify and categorize the key actors operating within or influencing the cleantech space. The mapping focused on actors spanning the public, private, academic/research, development partners, community champions and media sectors. This process ensured that the assessment captured a diversity of voices and perspectives across the ecosystem.

The stakeholder groups in Table 1 were engaged through interviews, focus group discussions, and consultative meetings:

Table 1: Stakeholder List

S/N	Stakeholder Group	Description / Sub-categories
1	Cleantech Entrepreneurs	- Waste and Circular Economy Innovators - Clean Digital Technology Providers - Agri-waste Solution Providers - Waste-to-Energy Enterprises - Energy Efficiency - Renewable Energy - Sustainable Agriculture and Forestry - E-mobility
2	Ecosystem Partners	Incubators, accelerators, and technical assistance providers supporting cleantech innovation
3	National Government and Regulatory Institutions	Ministries and statutory bodies with mandates in energy, environment, waste management, innovation, and climate policy
4	County Governments	Departments in devolved units implementing climate and green economy initiatives at sub-national level
5	Development Partners	International organizations and donors supporting climate resilience, green infrastructure, and SME development
6	Academic, Research, and Development Institutions	Universities, think tanks, and applied research institutions promoting cleantech innovation and policy
7	Media Players	Media outlets and journalists specializing in environmental reporting and climate change communication

2.5. Primary Data Collection

Building on insights from the desk review, qualitative and quantitative data were collected. Semi-structured interview guides were developed and pre-tested to ensure clarity and contextual relevance. Data collection prioritized inclusive participation, with deliberate effort made to capture the perspectives

of women, youth, and marginalized groups. Snowball sampling was also applied to identify additional informants with valuable insights into sector dynamics.

The primary data were collected through a national survey of forty-two (42) cleantech enterprises, ten (10) Key Informant Interviews (KIIs) with specific sector experts, and six (6) Focus Group Discussions (FGDs) with groups of ecosystem players. These engagements explored critical themes such as business models, financing, policy barriers, innovation uptake, gender equality and social inclusion (GESI), and sectoral impact.

2.6. Data Analysis and Reporting

Quantitative data were cleaned, validated, and analysed using descriptive and inferential statistical methods. Qualitative data were analysed thematically to extract common patterns, stakeholder perspectives, and innovation trends. The findings were triangulated across data sources to enhance accuracy and credibility.

The insights informed the development of this comprehensive report, which includes sectoral analysis, policy recommendations, and investment opportunities.

2.7. Validation and Stakeholder Feedback

Preliminary findings were shared with the key stakeholders during a validation workshop convened by KCIC. Feedback from participants were incorporated into the final report to ensure alignment with stakeholder priorities. The findings were also disseminated through policy briefs, knowledge products, and advocacy materials to influence policy dialogue and sector programming.

3.0 FINDINGS

3.1 The Sector Overview

Kenya's cleantech evolution reflects a transition from conventional energy sources to a diversified green ecosystem that encompasses geothermal, wind, solar, agriculture, waste management, clean mobility, sustainable cooking, and eco-friendly manufacturing.

Kenya's cleantech space is shaped by a diverse mix of sub-sectors that reflect the country's commitment to sustainability and low-carbon development. Findings from a survey of 42 cleantech businesses in Kenya revealed that Renewable Energy is the most dominant sub-sector, representing 45.2% of these enterprises. This is followed by Sustainable Waste Management (16.7%), Sustainable Agriculture/Forestry (11.9%), and Circular Economy initiatives (7.1%). Smaller shares are occupied by Energy Efficiency, E-mobility, and Water Management, each ranging between 2.4% and 4.8%. Additionally, 9.5% of the surveyed businesses operate across multiple sectors, often blending technologies or solutions without a distinct thematic focus.

The desk review research and focus group discussions highlighted key infrastructure and policy developments that reinforce these sectoral trends. Kenya leads Africa in geothermal energy production with an installed capacity of about 891.8 MW, anchored by projects like Olkaria, and is advancing with new investments such as Olkaria VII (KenGen, 2023).

Wind energy also plays a significant role, with flagship projects like the 310 MW Lake Turkana Wind Power Station and the 102 MW Kipeto Wind Farm (LTWP, 2019; Kipeto Energy Plc, 2021). Solar power is rapidly expanding with installations such as the Garissa and Alten-Kesses plants, which are improving energy access in off-grid regions (Ministry of Energy, 2018; Technext, 2024).

The cleantech ecosystem is further bolstered by initiatives like KCIC's GreenBiz Programme, which supports over 300 green businesses (KCIC, 2023), and substantial venture capital inflows totalling $638 million in 2024 alone equivalent to 88% of East Africa's total (Technext, 2024). Focus group participants affirmed these trends, highlighting increasing demand for alternatives like biogas and briquettes, and business models that convert bio-waste into fertilizers or animal feed.

3.2 The evolution of the cleantech sector

Kenya's cleantech sector has evolved significantly over the past two decades, driven by growing energy demand, environmental concerns, and policy shifts toward sustainable development. Initially centred around small-scale solar and improved cookstoves, the sector has since diversified to include innovations in e-mobility, waste-to-energy, green hydrogen, and smart water systems. This evolution has been shaped by supportive regulatory frameworks, such as the National Climate Change Act (2016, Revised 2023), Green Economy Strategy, and various renewable energy policies, positioning Kenya as a regional leader in clean technology adoption and climate resilience. The evolution of the cleantech sector across these subsectors is as follows:

3.2.1 Renewable Energy

Kenya's journey toward renewable energy began in the 1950s with geothermal exploration in the Olkaria region of the Great Rift Valley. However, it was not until 1985 that the first geothermal power plant, Olkaria I, became fully operational with an installed capacity of 45 MW. Over the next three decades, the state-owned power company, KenGen, expanded geothermal development in the Olkaria

I, II, III and IV fields, eventually reaching a combined capacity of approximately 985 MW[5]. In parallel, the government implemented policies to foster broader renewable energy investment. Notably, the introduction of feed-in tariffs (FiTs) in 2008, Kenya National Energy Policy, National Industrialization Policy Framework, National Sustainable Waste Management Policy, 2020 which have encouraged private sector involvement in wind, small hydropower, and biomass energy production. Later, expansions have targeted geothermal, solar, and biogas helping to unlock flagship projects such as the 310 MW Lake Turkana Wind Power Station (Africa's largest) and the 100 MW Kipeto Wind Power Station, operational since July 2021 (LTWP, 2019; Kipeto Energy Plc, 2021). These efforts have driven a significant transformation in Kenya's energy sector, increasing installed generation capacity from 180 MW at independence to an estimated 3,321 MW today, with approximately 90% being green[6].

Figure 4: Olkaria2 Station

These developments reflect Kenya's determined shift toward a low-carbon energy future, in line with its ambition to achieve 100% renewable electricity generation and net zero by 2050[7]. While that target has not been fully realized, the country has made remarkable strides. As of 2023, 89.6% of Kenya's electricity was generated from renewable sources, positioning the country as a regional leader in clean energy (KNBS, 2024). The electricity mix was dominated by geothermal (48.2%), followed by hydro (21.3%), wind (16.1%), solar (3.9%), and thermal power (10.4%). Despite these gains, Kenya still faces key challenges in scaling up its energy systems, particularly the high capital costs and lengthy development timelines of geothermal projects, as well as regulatory and financing constraints that limit the deployment of mini-grids in underserved rural counties.

From 2019 to 2023, Kenya also witnessed dynamic changes in licensed captive power capacities, which rose by 11.6% to 390.4 MW in 2023 from 349.8 MW in 2022 (KNBS, 2024). Solar energy showed the most significant growth, more than doubling from 46.3 units in 2022 to 88.2 units in 2023, while biomass expanded from 2.9 to 19.5 units. On the other hand, hydro and thermal power saw moderate declines, and biogas dropped sharply from 2.8 to 0.2 units. Capacities in geothermal, waste heat recovery, cogeneration, coal, and bagasse remained unchanged during this period (Table 2).

[5] https://www.gdc.co.ke/blog/gdc-marks-15-years-with-significant-milestones-cementing-its-impact-on-the-geothermal-landscape-cleanenergyweek/
[6] https://www.trade.gov/country-commercial-guides/kenya-energy-electrical-power-systems
[7] Kenya Energy Transition & Investment Plan 2023-2050. Link

Table 2: Licensed Captive Power Capacities (2019-2023)

Technology	2019	2020	2021	2022	2023
Hydro	26.0	26.0	28.3	32.4	30.2
Coal	30.0	30.0	30.0	30.0	30.0
Cogeneration	32.0	32.0	32.0	32.0	32.0
Waste and heat recovery	0.0	0.0	28.5	83.5	83.5
Bagasse	15.7	15.7	60.2	60.2	60.2
Solar	3.5	35	35.0	46.3	88.2
Biomass	1.5	1.5	2.9	2.9	19.5
Thermal	18.5	18.5	46.1	53.9	42.9
Biogas	2.6	2.6	2.8	2.8	0.2
Biothermal	-	-	-	2.1	0.0
Geothermal	3.7	3.7	3.7	3.7	3.7
Total	**133.5**	**165.0**	**269.5**	**349.8**	**390.4**

Source: KNBS, 2024

These trends highlight Kenya's ongoing diversification of energy sources and its gradual transition toward a more sustainable and resilient energy mix, with an increasing focus on solar and other emerging technologies. Kenya is looking to leverage public-private partnerships (PPPs) in its efforts to ramp up energy expansion that will power its energy transition industrial revolution.

3.2.2 Wastewater Management

Kenya's wastewater management has evolved significantly over the decades, transitioning from rudimentary pit latrines and centralized sewage systems in major urban centres to more sustainable and decentralized cleantech solutions. In response to rapid urbanization, water scarcity, and growing environmental concerns, the country has gradually adopted advanced technologies such as constructed wetlands, anaerobic digesters, membrane bioreactors, and reverse osmosis. Initially limited to small-scale research and pilot projects, these innovations have gained traction due to their potential to treat wastewater efficiently while enabling resource recovery, including nutrient extraction and biogas production. Policy and regulatory support-such as the enactment of the Sustainable Waste Management Act (2022) and the National Sustainable Waste Management Policy (2021) has further accelerated the integration of circular economy principles into wastewater treatment, marking a shift toward cleantech solutions that address both sanitation and energy needs in Kenya. Some Counties have domesticated the national policies in their water management. For instance, the Nairobi City County has innovatively incorporated smart water metering systems to monitor water usage and curb wastage. On this a county official interviewed reported that: ***"Our target is to connect over 1 million Nairobi residents with smart water meters to curb water loss and improve billing accuracy and address non-revenue water which currently stands at above 40%."*** This is part of the broader goal of the county transitioning toward a circular economy through wastewater management, by focusing on resource efficiency, waste reduction, and recycling. Through its Sponge City initiative, Nakuru County recycles wastewater for reuse in urban green spaces such as the city park, significantly reducing operational and maintenance costs previously incurred for irrigation and landscaping.

"Our target is to connect over 1 million Nairobi residents with smart water meters to curb water loss and improve billing accuracy and address non-revenue water which currently stands at above 40%."

Figure 5: Smart water meter

3.2.3 E-Mobility

The E-mobility sector is still gaining momentum in Kenya. From a modest base of 65 electric vehicles in 2018, Kenya's e-mobility adoption remained subdued afterwards with just 129 units in 2019, 104 in 2020, and 284 in 2021-before accelerating in 2022 with 796 registrations and surging to 4,047 new EVs in 2023, driven largely by electric motorcycles (2,557 units), followed by e-bicycles, tuk-tuks, buses, cars and "other" types according to NTSA data[8]. By end of 2024, the total registered EV fleet approximately doubled to about 5,294, including nearly 4,862 electric motorcycles, 185 tuk-tuks, 123 passenger cars, 32 buses, and 87 forklifts as shown in Table 3. However, EVs remained under 0.2 % of all vehicles on the road.

Table 3: EVs statistics in Kenya

Type of vehicle	2018	2019	2020	2021	2022	2023	2024
Electric bicycles					321	1,353	-
Electric Motorcycles	44	96	28	144	366	2,557	4,862
Electric Tuk Tuk		4	21	35	40	39	185
Electric passenger cars	12	15	31	62	36	45	123
Electric buses & mini buses					3	18	32
Electric other vehicles	9	14	24	43	30	35	87
Total vehicle Registered	**65**	**129**	**104**	**284**	**796**	**4,047**	**5,294**

Source: NTSA and EMAK

Looking ahead, under robust policy support-including special EV tariffs, VAT and excise duty reductions, and infrastructure rollout, the Electric Mobility Association of Kenya forecasts over 60,000 electric

[8] https://masharikirpc.org/policy_brief/kenyas-path-to-sustainable-transport-bridging-gaps-in-electric-mobility.pdf

two-wheelers and around 2,000 e-buses will be on the Kenya roads by 2030[9], with cumulative e-car sales surpassing 7,600 units, and total passenger EV stock possibly exceeding 30,000 vehicles by decade's end.

3.2.4 Clean Air Technologies and Initiatives

Air quality monitoring in Kenya has historically been limited, with most urban centres lacking consistent, real-time data on pollution levels. Until the mid-2010s, air quality data was primarily derived from satellite imagery or short-term research projects, offering little continuity or policy influence. Nairobi led the way in formalizing air quality governance, beginning with heightened awareness around 2018 due to rising cases of respiratory illnesses and WHO reports on urban pollution. A major shift occurred in 2022 with the enactment of the **Nairobi City County Air Quality Act, 2022** which laid the groundwork for sustained air quality monitoring. In 2025, Nairobi launched a **city-owned air quality sensor network**, the first of its kind in Kenya comprising over 50 reference-grade and low-cost sensors[10]. Supported by the Breathe Cities initiative, the system provides real-time data through public dashboards and is guiding efforts to reduce air pollution by 30% by 2030.

Nakuru County followed suit, initially through academic-led initiatives spearheaded by Egerton University. By 2023, it began installing low-cost air quality sensors across key locations such as hospitals, schools, and public parks, with support from Respira, Sensors Africa, and the Flanders International Climate Action Programme (FICAP). A Nairobi City County staff intimated that, ***"these efforts have since evolved into a more integrated system powered by AI forecasting models and a city-wide air data management platform.***" In parallel, cities like **Mombasa, Kisumu,** and **Eldoret** have started piloting similar technologies, mainly through collaborations with local universities and international NGOs. For instance, Mombasa has worked with coastal health networks to monitor port-related emissions[11], while Kisumu has engaged in sensor-based tracking in high-traffic areas. Although these cities are still in early phases compared to Nairobi and Nakuru, their efforts signify a broader national shift toward evidence-based air quality governance. Together, these initiatives mark a critical evolution in Kenya's urban environmental management, aligning with global efforts to combat climate-linked health risks.

3.2.5 Climate-Smart Agriculture

Kenya's Vision 2030, officially launched on June 10, 2008, outlines a long-term development agenda aimed at elevating the country to middle-income status by 2030 through ambitious economic, social, and political pillars. Embedded within its medium-term plans is the **Green Economy Strategy and Implementation Plan (GESIP) 2016–2030,** a government-led policy framework designed to deliver low-carbon, resource-efficient, and inclusive economic growth. Together, *Vision 2030* and the Green Economy Strategy link climate resilience directly to cleantech adoption (Muriithi & Ngare, 2023).

Climate-smart techniques promoted under these strategies include solar-powered irrigation systems, soil and crop monitoring technologies, and conservation methods such as composting and the use of biogas digesters to convert waste into fertiliser (Mbugua & Waswa, 2025). Since the 2010s, ICT-based advisory systems, notably mobile and voice platforms, as well as community radio have provided smallholder farmers with timely weather forecasts, market information, and agronomic guidance. These digital tools have enhanced decision-making and resilience, even in areas with limited physical infrastructure.

[9] https://www.scribd.com/document/737563815/Electric-Mobility-Association-of-Kenya-Policy-Paper-1713893552
[10] https://www.cleanairfund.org/news-item/news-roundup-june-2025/#:~:text=With%20the%20support%20of%20Breathe,data%20to%20identify%20pollution%20hotspots.
[11] First Results From a Calibrated Network of Low-Cost $PM_{2.5}$ Monitors in Mombasa, Kenya Show Exceedance of Healthy Guidelines. Link

3.2.6 Circular Economy

Kenya has increasingly embraced the circular economy model as a response to the environmental and economic challenges posed by the traditional linear approach. The country has been working toward a sustainable, circular economy since 2021 (Sustainable Inclusive Organisation, 2021). This model emphasizes conservation, resource efficiency, and waste minimization through practices like recycling, reuse, and the adoption of sustainable production systems. The government, through agencies like the National Environment Management Authority (NEMA), has implemented supportive policies and legislation aimed at ethical waste disposal, recycling, and the elimination of environmentally harmful practices such as the use of single-use plastic bags. These efforts aim to reduce pollution, extend the lifecycle of materials, and promote a green economy. One of the Key informants remarked "***Kenya's journey toward a circular economy is not just a policy ambition, it is a grassroots-driven transformation that hinges on local innovation, inclusive systems, and rethinking waste as a resource***."

Despite these advances, Kenya's transition to a circular economy is still in its early stages and faces several obstacles, including limited infrastructure, insufficient public awareness, and policy implementation challenges (Netherlands Enterprise Agency, 2021; Odongo & Thomsen, 2021). While the ideal circular economy model is often shaped by Global North narratives, in Kenya, real circular practices are mainly driven by micro and small enterprises, with larger corporations often using the concept instrumentally (Turing, 2021). Moreover, the role of designers in reducing waste and developing circular products is gaining recognition (Nazir & Maina, 2022), and resource recovery initiatives in urban areas are also proving effective (Mugambi et al., 2020). However, more focused studies are needed to evaluate how public policies specifically shape Kenya's circular economy landscape. This ongoing shift not only positions Kenya as a potential leader in sustainable development in Africa but also highlights the growing importance of local innovation, inclusive policy, and stakeholder engagement in fostering a resilient circular economy (Karcher et al., 2020; Bleischwitz et al., 2022).

3.2.7 Carbon Credit

Kenya's hosting of the African Climate Summit in 2023 and its leadership in the Nairobi Declaration demonstrate the country's commitment to positioning green growth as a key driver of both environmental sustainability and economic development. By promoting market-based solutions such as carbon credits, renewable energy investments, and debt-for-nature swaps, Kenya is attracting international financing and building strategic partnerships to advance its climate agenda. The Kenyan's Government call to view green growth not only as a climate domineering but also as a source of multibillion-dollar economic opportunity highlights Kenya's visionary approach to leveraging the climate crisis as a catalyst for innovation, sustainable development, and global leadership (Abuya, 2025).

To anchor this ambition, Kenya has enacted the Climate Change (Amendment) Act, 2023, which provides a robust legal and institutional framework for regulating carbon markets. The Act mandates registration of all carbon trading activities establishes a National Carbon Registry and requires a minimum of 40% revenue share from carbon credits to be allocated to local communities with oversight provided by the Ministry of Environment.

Carbon credit generation in Kenya spans a wide range of projects, including nature-based solutions like afforestation and mangrove restoration (e.g., the Mikoko Pamoja project), clean energy solutions such as improved cookstoves and solar mini-grids, and climate-smart agriculture initiatives that promote soil carbon sequestration. These projects not only mitigate greenhouse gas emissions but also generate co-benefits such as employment, improved health outcomes, and enhanced ecosystem services.

Figure 6: Mangrove Forest in Lamu

However, there are several challenges including greenwashing, the permanence of offsets, and county governments valuation of carbon credits. The market's dependence on voluntary schemes and fluctuating global carbon prices also exposes project developers to financial risks. Kenya is actively addressing these challenges by aligning its carbon market strategy with devolved governance structures, particularly through integration with County Climate Change Action Plans (CCCAPs) and the Financing Locally-Led Climate Action (FLLoCA) program. Furthermore, as a key participant in the African Carbon Markets Initiative (ACMI), which aims to scale Africa's voluntary carbon market to 300 million credits annually by 2030. Kenya is positioning itself as a continental leader in shaping an inclusive and credible carbon trading ecosystem.

3.2.8 Clean Energy (cooking solutions)

Between 2013 and 2023, Kenya made substantial progress in expanding access to clean cooking technologies. In 2013, nearly 90% of households depended on traditional biomass for cooking; by 2023, access to clean cooking solutions had risen to 31%, driven by the increased uptake of liquefied petroleum gas (LPG), bioethanol, biogas, and electric stoves. This shift not only contributed to improved household air quality and environmental outcomes but also supported job creation, generating around 19,000 formal jobs in the LPG, ethanol, and biogas sectors, along with an estimated 15,000–35,000 informal jobs. To further accelerate this transition, the 2023 National Cooking Transition Strategy set a target for universal access to clean cooking by 2028, including measures such as the removal of VAT on clean cooking technologies. However, affordability remains a key challenge for many households, particularly in low-income communities.

Kenya's commitment to integrating clean energy with broader economic development was further reinforced in 2024 through the launch of the US-Kenya Climate and Clean Energy Industrial Partnership. This strategic alliance aims to position Kenya as a continental leader in climate-smart industrialization, focusing on three pillars: the deployment of clean energy technologies, the development of clean energy supply chains, and the advancement of green industrial infrastructure (E3G, 2024; Abuya, 2025). These collaborative efforts not only underscore Kenya's role in Africa's clean energy transition but also aim to stimulate inclusive economic growth, create sustainable jobs, and enhance resilience to climate change.

Complementing these national and international initiatives, Kenya has also adopted innovative approaches to increase access to clean energy at the household level. Since June 2016, the Ministry of Finance has zero-rated LPG, a move designed to make clean cooking fuels more accessible to lower-income households. This policy enabled the introduction of Pay-As-You-Go (PAYG) LPG smart meter

technologies, which have allowed many Kenyans to transition from traditional fuels to LPG by making payments more flexible and affordable (Shupler et al., 2021). These combined efforts policy incentives, international partnerships, and technological innovation are critical to achieving Kenya's clean energy and development goals.

Figure 7: bioethanol stoves (Koko) by ESMAP World Bank

In summary, Table 4 illustrates the progression of Kenya's cleantech sector from the 1950s through to 2020s.

Table 4: Summary on evolution of cleantech sector

Timeline	Description
1950s–70s	Geothermal exploration; first small hydropower projects
1990s	First wind farm (Ngong, 1993); Chandaria cleaner production pilot
2000s	ICT in agriculture; initial solar home systems
2010s	Climate-change laws; growth in solar mini-grids, e-bikes startups, nutrient recovery projects
2020s	Lake Turkana operational; national strategies for clean cooking (2023), electrification (2018), circular economy (2020s); rapid private-sector engagement

3.2.9 E-Waste Management

Kenya's e-waste sub-sector has evolved rapidly over the past two decades: starting with modest digital equipment importation and a 2008 import tax on used computers, through the 2010 rollout of NEMA's national e-waste guidelines and early pilot "take-back" schemes by firms like Nokia and Sony Ericsson[12]. From about 3,000 tonnes a year in 2012, generation surged past 50,000 tonnes by 2021, yet only around 1 % is formally collected and recycled[13]. The 2019-2024 National E-Waste Management

[12] https://www.academia.edu/69550871/E_waste_Management_In_Kenya_A_Case_Study_Of_Mobile_Phone_Waste_In_Nairobi

[13] https://www.nema.go.ke/index.php?option=com_content&view=article&id=392:the-inaugural-e-waste-conference-held&catid=10:news-and-events&Itemid=551

Strategy under Ministry of Environment and Forestry set out five thematic areas including stakeholder coordination and infrastructure build-out. Meanwhile, key legal instruments under EMCA (1999, revised 2015), Waste Management Regulations (2006) and (2024), proposed E-Waste Regulations and Extended Producer Responsibility (EPR) Rules (2021), plus the broader Sustainable Waste Management Bill and Policy have been developed-with most still awaiting final Cabinet or Parliamentary enactment.

Today, regulation and enforcement fall under NEMA (the statutory regulator), while the ICT Authority oversees e-waste collection via the National Refurbishment and E-Waste Management Programme, handling public-sector device disposal in partnership with PPRA. Major operational players include WEEE Centre (licensed by NEMA) operating collection centres in Nairobi, Mombasa and Kisumu and partnering in sorting, dismantling and safe disposal, alongside other small innovators. The sector is also poised for further growth and formalization through public awareness, capacity-building projects and investment in circular-economy infrastructure, notably a pilot Material Recovery Facility underway at Konza Technopolis under a World Bank-supported regional project led by NEMA[14].

3.3 Integration of Cleantech Sector with Climate Agenda

On the international stage, Kenya has taken proactive steps to align its cleantech initiatives with global climate objectives. At the Africa Climate Summit in 2023, The Government launched the Accelerated Partnership for Renewables in Africa (APRA), aiming to boost renewable energy development and green industry across the continent (IRENA, 2023). Furthermore, at COP28, Kenya introduced the Africa Green Industrialization Initiative, targeting the financing of 15 GW of renewable energy capacity in Africa by the end of the decade (COP28 UAE, 2023). These efforts are complemented by significant international investments, such as a $1.5 billion green fertilizer project with Fortescue Future Industries and a $1 billion geothermal project at Suswa in collaboration with Indonesia[15]. Through these initiatives, Kenya demonstrates its commitment to integrating cleantech solutions into both national development strategies and global climate action frameworks.

3.4 Mapping of Ecosystem Players

In Kenya's cleantech sector, government agencies and state-owned enterprises such as the Geothermal Development Company (GDC), Kenya Electricity Generating Company (KenGen), and the National Environment Management Authority (NEMA) play leading roles in advancing renewable energy and carbon management initiatives. The private sector and innovative startups are driving progress in biogas (e.g., Afrisol), sustainable charcoal production (Eco-Charcoal), and e-mobility solutions (Ampersand, Ecobodaa, BasiGo). Industry associations and NGOs, including the Kenya Renewable Energy Association (KEREA), Energy Storage Association of Kenya (ESAK), Kenya Association of Manufacturers (KAM), and Kenya Private Sector Alliance (KEPSA), play crucial roles in policy advocacy, capacity building, and promoting circular economy solutions. Development partners such as the Kenya Climate Innovation Centre (KCIC), Africa Trade and Investment Development Initiative (ATIDI), and African Sustainable Investment Alliance (AFSIA) provide essential financial support and technical assistance to strengthen the cleantech ecosystem. Additionally, environmental and research institutions like the Stockholm Environment Institute (SEI) contribute by offering data-driven insights that inform policy formulation and project design. Appendix 1 outlines the cleantech players in Kenya as well as their functions.

[14] https://www.nema.go.ke/images/Docs/Ecoflash/Ecoflash%203rd%20Edition%202024.pdf

[15] Africa Energy News. (2023). *Kenya secures $4.48 billion in green initiatives at COP28: A breakdown of key climate projects*. Retrieved from https://africaenergynews.co.ke/kenya-secures-4-48-billion-in-green-initiatives-at-cop28-a-breakdown-of-key-climate-projects

3.5 Emerging Business Model

Kenya's cleantech sector is undergoing a dynamic transformation, propelled by the urgent need to address environmental challenges, create green jobs, and respond to growing economic opportunities. National policy frameworks such as the Climate Change Act, Energy Act, and the Sustainable Waste Management Act are providing a supportive foundation for innovation and investment. Within this enabling environment, entrepreneurs are deploying a variety of business models, from Business-to-Consumer (B2C) and Business-to-Business (B2B) to community-based and hybrid approaches, to deliver clean energy, waste management, and nature-based solutions. These models aim to address both commercial and social goals, including environmental conservation, financial inclusion, and youth and women empowerment. This section presents a synthesis of findings from literature, survey data, and stakeholder interviews across three areas: innovative business approaches, scalability and commercialization, and market potential and trends.

3.5.1 Innovative Business Approaches

Kenya's cleantech enterprises are experimenting with new and blended business models. The most dominant model is Business-to-Consumer (B2C), used by 60% (See Figure 2) of surveyed firms, particularly in solar energy, clean cooking solutions, and household waste technologies. These businesses target end-users directly, especially low-income and off-grid households, offering accessible solutions such as Pay-As-You-Go (PAYG) solar systems. The PAYG model enables customers to make small, flexible payments via mobile money, improving energy access, reducing health risks from kerosene use, and promoting financial inclusion.

Business-to-Business (B2B) models are also significant (38.1%), where firms supply larger clients like hospitals, counties, and NGOs. B2B models support longer-term contracts and operational scale but require higher capital and institutional relationships. Meanwhile, community-based and cooperative models are less common (2.4%) but were strongly emphasized in focus group discussions as critical for social inclusion and environmental sustainability. These models often engage local farmers, youth, and women in ventures such as tree nurseries and decentralized waste systems, fostering ownership and resilience in underserved regions.

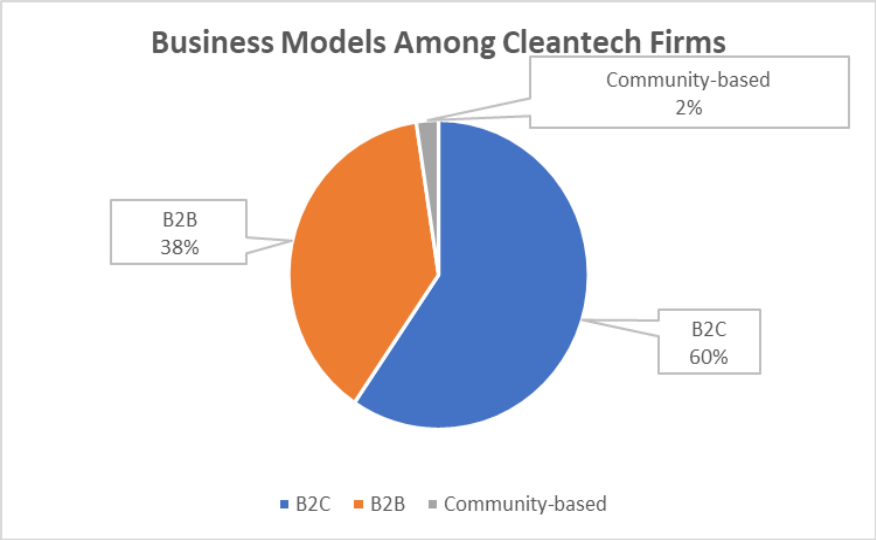

Figure 8: Prominent Business Model Among Cleantech Sector

Qualitative findings revealed growing interest in hybrid models that blend B2B, B2C, and cooperative elements. Entrepreneurs noted that combining direct sales with community engagement enhances market reach and trust. For instance, one waste processor shared how they collaborated with informal waste

collectors (community) while also serving both households (B2C) and institutional buyers (B2B). Such integrated models were praised for balancing commercial viability with inclusive impact, particularly in climate-vulnerable and low-income settings.

Additionally, businesses are leveraging digital and nature-based innovations. Smart Waste Technologies (SWT) use IoT, AI, and mobile apps to track and optimize waste collection, reduce costs, and curb illegal dumping. Focus group participants pointed out that while digital tools improve efficiency, their uptake is limited by digital literacy and high deployment costs. Nature-Based Solutions (NbS), such as reforestation and bamboo cultivation, were cited as cost-effective ways to create green jobs and enhance climate resilience, particularly when combined with community participation. These trends, alongside the reuse of bio-based materials, carbon capture, electric mobility, and hydrogen fuel adoption, reflect Kenya's shift toward a more circular, inclusive, and climate-smart economy.

3.5.2 Scalability and Commercialization

Scaling cleantech enterprises in Kenya remains a work in progress. Most businesses are still in early or growth phases, with limited financing, regulatory challenges, and operational constraints restricting their transition to maturity. Survey results show that over 80% of cleantech firms face difficulty accessing finance, making it the most pressing barrier to scale. Additional constraints include bureaucratic inefficiencies (35.7%), uncertainty around standards (33.3%), and a shortage of skilled labour (26.2%), all of which hinder technology development and commercial rollout.

Despite these challenges, some growth is evident. In 2022, a third of enterprises surveyed reported turnovers below KES 100,000, but by 2024, this number had dropped by half, signalling early revenue growth and improved business development. Enterprises that benefited from structured support, particularly from incubators like the Kenya Climate Innovation Centre (KCIC), were better positioned to scale. Focus group participants noted that KCIC played a key role in helping them obtain product certification, improve branding, and attract funders, all of which contributed to enhanced investor confidence and market access.

Many entrepreneurs reported beginning their ventures with small-scale operations, such as briquette production or tree nurseries, before expanding gradually. However, several highlighted persistent barriers to scale, such as the high cost of permits, complex licensing procedures, and informal operations that limit access to credit and government support. One participant observed, "*Scaling and distribution remain major challenges for B2C models in low-income areas.*" Others emphasized that growth was most feasible when hybrid models were used, that is, blending B2C, B2B, and community engagement to diversify income streams and expand market reach.

The commercialization of cleantech is not just a matter of technology readiness, but also ecosystem maturity. In Kenya, most cleantech ventures remain in early revenue stages, with only a small portion achieving full market consolidation. Effective scaling will require stronger public-private collaboration, policy clarity, and investment in commercialization expertise. Stakeholders underscored the need for commercialization specialists, tailored financing models, and networks that support early adopters. One key aspect of product development highlighted was the speed of patenting. One stakeholder intimated that whereas there is considerable improvement, Kenya Industrial Property Institute (KIPI) still grapples with resource insufficiency key to supporting rapid innovation patenting. Governments can help by streamlining regulations, subsidizing early-stage risk, and rolling out national programs that validate and promote cleantech adoption. Without such interventions, most enterprises will remain trapped in the pilot phase, unable to unlock their full market potential.

3.5.3 Market Potential

Kenya's cleantech market is growing, particularly in renewable energy (45.2%), waste management (16.7%), and sustainable agriculture and forestry (11.9%). Rising environmental awareness, worsening impacts of climate change, and resource degradation, such as deforestation and water scarcity, are creating a growing demand for clean and affordable solutions. Cleantech entrepreneurs are increasingly responding with innovative products and services, including biogas digesters, briquettes, solar lighting, biofertilizers, and smart recycling technologies, targeting both rural and urban markets.

However, the expansion of the market is hindered by several key barriers. Survey findings show that 31% of firms identified inadequate consumer knowledge about cleantech products as a top constraint, while 28.6% cite regulatory uncertainty, and 19% face challenges related to high upfront costs. These challenges are particularly difficult for Business-to-Consumer (B2C) enterprises that rely on last-mile delivery models to reach individual customers in low-income or remote settings.

Participants in focus groups echoed these concerns, describing challenges in licensing, inconsistent enforcement, and limited public awareness. Despite these obstacles, the outlook remains positive. Many firms plan to expand operations (35.7%) or diversify their offerings (33.3%), for example, there is growing interest among the youth in turning organic waste into fertilizers, insect protein, or animal feed such as using black soldier flies.

Focus group discussions confirmed these concerns and revealed further bottlenecks. Entrepreneurs described frequent delays in obtaining licenses, inconsistent enforcement of environmental policies, and the absence of product standards, issues that undermine market trust and limit access to formal procurement systems. One participant remarked, "*The rules are there, but applying them is unpredictable and costly*." This regulatory complexity particularly affects new or small-scale firms attempting to enter or expand in the cleantech space

Despite these barriers, the future remains promising. A significant share of firms (35.7%) plan to expand geographically, while another 33.3% intend to diversify their offerings, including converting organic waste into animal feed or compost using black soldier flies (BSF). These innovations reflect a broader trend toward integrated circular economy solutions that reduce waste while generating income and environmental benefits.

The market is also seeing increased adoption of hybrid business models, blending B2C, B2B, and community-based strategies. These models are gaining traction for their ability to link sustainability goals with market access. These inclusive models are particularly effective in areas with limited infrastructure, where building local trust and participation is essential to uptake.

Focus group participants emphasized that community-based and cooperative models, while less common, are crucial for sustainability and inclusion. Bamboo cooperatives and tree nurseries were repeatedly cited as models with "immense potential", especially for empowering women and youth. Yet they face challenges such as high permit costs, limited access to quality planting materials, and exclusion from public procurement programs. These systemic gaps limit their ability to fully commercialize and scale.

International trends also offer both opportunities and risks. The global oversupply of solar and battery technologies, largely driven by China, is pushing prices down. While this benefits Kenyan consumers, it presents challenges for local producers seeking to compete on cost and quality. Meanwhile, global investment in solar photovoltaic (PV) and battery energy storage is accelerating and may soon surpass oil and gas investments, creating momentum Kenya can tap into, especially with artificial intelligence (AI) playing an increasingly vital role in energy forecasting, smart grid management, and trading optimization.

Kenya can harness this momentum by boosting local cleantech production, adopting AI and digital technologies to improve efficiency, promoting corporate investment in clean energy, and strengthening public-private partnerships to drive large-scale, resilient growth.

Survey data and field insights both suggest that hybrid models, blending market access with social inclusion, offer the best pathway forward. These models empower women, engage youth, and provide local solutions to climate challenges. For example, community-based bamboo projects combine environmental conservation with economic empowerment, while cooperative waste programs increase trust and adoption in low-income areas.

3.6 Integration of Gender Equality and Social Inclusion (GESI) principles in cleantech initiatives

3.6.1 Inclusion Strategy

Kenya's cleantech sector is gradually integrating Gender Equality and Social Inclusion (GESI) principles, but significant implementation gaps persist. While national frameworks such as the Climate Change Act (2016) and Vision 2030 emphasize the inclusion of women, youth, and marginalized groups in sustainable development, their operationalization within the cleantech ecosystem remains limited and uneven. This gap between policy and practice is particularly visible at the enterprise level, where inclusive strategies are often informal or ad hoc.

Key gaps include limited disaggregated data, lack of gender-responsive budgeting, and absence of actionable GESI indicators in many cleantech initiatives. Policies like the Sustainable Waste Management Act (2022) and National Solid Waste Management Strategy (2014) highlight inclusivity but lack targeted gender provisions.

The survey showed that 57% of businesses were owned by men, largely due to women's limited access to startup capital. The findings also show that youth make up 47% of the workforce, indicating strong youth engagement. Women represent 19% of employees, while persons with disabilities (PwDs) account for just 2.7%. Although the representation of youth is encouraging, deeper challenges remain, especially for women and PwDs, who are significantly under-represented in technical, managerial, and leadership roles. The lack of inclusive hiring and promotion mechanisms contributes to these disparities.

Community-based and hybrid business models have shown promise in promoting inclusive participation. In sectors such as clean energy, waste management, and bamboo forestry, women have taken active roles in nursery management, marketing, and household-level technology distribution. Youth, particularly young men, are commonly involved in more technical and labour-intensive functions, including bamboo processing, solar system installation, and digital support services. Notably, firms like Arumloo and Nazava Water Filters serve as examples of good practice, employing high proportions of women, including single mothers, and engaging youth through structured technical roles and mentorship programs. The FGDs revealed persistent gaps in gender and youth inclusion across the cleantech ecosystem. Women are under-represented in leadership and technical roles, and youth engagement lacks structured support. While adoption of cleantech is growing, it favours larger enterprises due to better access to innovation capital, leaving startups behind.

Despite these positive examples, enterprise-level strategies for inclusion remain underdeveloped. Few firms have institutionalized gender-responsive recruitment policies, hiring quotas, or leadership development pathways. Structural barriers such as limited access to finance, low technical capacity, and exclusion from decision-making processes continue to limit the ability of women and other marginalized groups to fully participate and lead within the sector. Moreover, social norms and stereotypes further reinforce these inequalities, often relegating women to lower-tier or informal roles. Without deliberate

strategies to mainstream GESI in enterprise operations, Kenya's cleantech transition risks reinforcing rather than reducing existing social inequities.

3.6.2 Impact on Social Equity

Cleantech initiatives are increasingly recognised for their potential to promote social equity by addressing structural inequalities and creating inclusive economic opportunities. These initiatives are particularly impactful for women, youth, and marginalised groups, who often bear the effects of environmental degradation and limited access to clean energy, water, and sanitation.

Programs such as M-KOPA and the Kenya Off-Grid Solar Access Project (KOSAP) have significantly improved energy access in underserved rural areas. These interventions not only enhance household living conditions but also open new avenues for economic empowerment, such as enabling small-scale businesses and improving children's ability to study at night through reliable lighting. Such developments reflect a broader shift toward inclusive green growth, where clean technology facilitates community well-being and sustainable livelihoods.

In addition to energy access, cleantech products like improved cookstoves, solar lighting systems, and water-efficient toilets are transforming daily life, especially for women. These technologies reduce indoor air pollution, lower the risk of respiratory diseases, and free up time previously spent on fuel collection and water management. One participant remarked, ***"Women are transitioning their homes from charcoal and firewood to gas and solar lighting. They are leading the shift to clean energy."*** This shift not only improves health outcomes but also creates space for women to engage in education, entrepreneurship, and leadership.

Furthermore, community cooperatives and waste-to-value models offer employment opportunities for youth and women in roles such as waste sorting, energy system maintenance, and product distribution. These inclusive models have been particularly effective in climate-vulnerable areas, building resilience while enhancing local ownership.

Nevertheless, systemic challenges persist. Women continue to be under-represented in technical and decision-making roles, largely due to social norms, skills gaps, and limited access to resources. The lack of gender-disaggregated data and tailored training programs further constrains the sector's ability to track and improve equity outcomes. To unlock the full potential of cleantech as a vehicle for social justice, Kenya must confront these structural barriers and embed accountability into inclusion strategies.

3.6.3 Opportunity for Improvement of Gender Inclusion in the Sector

To strengthen the integration of Gender Equality and Social Inclusion (GESI) in Kenya's cleantech sector, stakeholders must take deliberate actions that align policy reforms, financial tools, and capacity-building efforts. Key opportunities for improvement include (Figure 3):

Figure 9: Opportunities for improvement of gender inclusion in the sector

3.6.3.1 Skills Development (Vocational and Entrepreneurship Training)

There is a critical need for practical, market-relevant training that equips women and youth with technical and leadership skills in cleantech. Current training programmes often lack alignment with real-world demands. As one participant noted, ***"You can't talk about empowering women and youth in cleantech without giving them the tools to lead. Skills training isn't a bonus; it's the bridge between participation and real influence in this sector."*** Therefore, there is a significant opportunity to enhance this growth by investing in vocational training and certification programmes to better tap into Kenya's demographic dividend and advance a green economy. A stakeholder further stated ***"Kenyan universities currently lack curricula focused on specialized waste management technologies such as plastic recycling through densification, extrusion, and baling. Moreover, there is a critical skills and technology gap in the area of textile circularity, particularly in converting post-consumer clothing back into yarn, highlighting a pressing need for innovation and capacity building in sustainable materials recovery."***

3.6.3.2 Financial Inclusion

Women- and youth-led cleantech enterprises face exclusion due to collateral requirements and high interest rates. Introducing targeted grants, low-interest loans, and de-risking instruments can expand access to innovation capital. Many survey respondents cited finance as their greatest barrier to growth, noting that women particularly struggle due to limited asset ownership.

3.6.3.3 Gender-Sensitive Regulatory Support

Governments can incentivize inclusion through public procurement preferences, tax relief for inclusive enterprises, and quotas in climate financing schemes. Introducing public procurement quotas for women- and youth-led enterprises, tax incentives for inclusive employers, and gender targets in climate-related funding schemes can motivate firms to prioritize GESI in their operations. These measures shift inclusivity from being a voluntary or peripheral activity to a core business compliance and performance standard. As one focus group participant noted, ***"If inclusion is not built into the rules of the game, most businesses will not prioritize it. Regulation creates both accountability and opportunity."*** Establishing a clear policy environment that mandates or rewards inclusion can accelerate transformation across the cleantech value chain.

3.6.3.4 Strengthened Data Systems

Robust gender, age, and disability-disaggregated data are essential for tracking inclusion outcomes, identifying gaps, and ensuring evidence-based decision-making in cleantech. Without reliable data, it's difficult to design effective interventions or measure progress toward equity goals. As Benjamin emphasized, ***"We cannot improve what we don't measure, if we want real inclusion, we must start by collecting the right data and using it to guide action."*** Monitoring frameworks should be embedded in project design and implementation, with GESI indicators linked to investment decisions, reporting, and certification processes.

3.7 Financial Flows and Investment Trends

3.7.1 Government and Development Financial Institutions (DFI)

Kenya's cleantech sector has attracted significant financial attention in recent years, spanning public sector allocations, development finance, private equity, venture capital (VC), and blended finance mechanisms. The sector has received Government backing via public expenditure that was KSh 108 and KShs 120 billion on green projects in FY 2017/18 and FY 2018/19 respectively, with roughly 60% of the funding coming from the internationally[16] actors. But Kenya's Energy Transition and Investment Plan (ETIP)[17] projects have a requirement of US $600 billion to 2050[18], largely for power and transport, with approximately 90% reliance on DFI and private capital. Delivering this investment could potentially support an additional 500,000 net new jobs, of which 50% is directly stimulated by Net Zero investments in solar PV, EV charging and hydrogen fuelling stations. Kenya thus continues to rely on DFIs who to play a key role-providing concessional funding, guarantees, and risk mitigation, especially in grid infrastructure, clean cooking, and off-grid energy access.

3.7.2 Private Equity & Venture Capital (VC)

Kenya leads East Africa in VC funding, securing US $537 million through 73 deals in 2024, this is about 26% of Africa's total VC, with 67% allocated to climate and energy-focused startups[19]. Cleantech sector specifically captured **46% of startup investment** in 2024 (~US $638 million), eclipsing fintech, with high-profile rounds including: **d.light**: US $176 million for off-grid solar, **BasiGo**: US $42 million (equity + debt) for electric buses and **SunCulture**: US $12 million for solar-based water systems[20] which could potentially religionize the off-grid energy access and drive clean innovations in Kenya and EAC region.

3.7.3 Blended Finance & Local Capital

At national level, Kenya expects to meet its NDC targets (US $62 billion for the updated NDC (2020–2030) and USD 56 billion for the second NDC (2031–2035). While the first NDC was entirely reliant on international support, subsequent NDCs show increasing domestic contributions, from 13% in the updated NDC to 20% in the second NDC[21]. Further, Kenya is developing green bonds-launching clean-cooking bonds in 2023-and local currency guarantees to foster domestic investment[22]. The Government plans to adopt a combination of private sector capital and de-risking instruments to finance Kenya's energy transition and decarbonization plan.

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[16] https://www.fsdkenya.org/wp-content/uploads/2022/05/22-05-12-Green-Finance-in-Kenya.pdf
[17] Kenya's Energy Transition and Investment Plan (ETIP). Link
[18] https://www.seforall.org/system/files/2025-05/Kenya-ETIP.pdf
[19] https://www.citizen.digital/tech/kenya-leads-africa-with-most-start-up-funding-in-2024-n355493
[20] https://iea.blob.core.windows.net/assets/98bc7ce1-b22d-48c9-9ca2-b668ffbfcc4b/Kenya2024.pdf
[21] https://bricsconsulting.co.ke/opinion-pieces
[22] https://iea.blob.core.windows.net/assets/98bc7ce1-b22d-48c9-9ca2-b668ffbfcc4b/Kenya2024.pdf

As a result, we have a major boost at project-Level financing in power through blended public–private funding that include: Menengai II geothermal (35 MW) received US $117 million in financing from AfDB, TDB and FinnFund[23]. Malindi solar + battery storage (52 MW + 40 MWh storage) has attracted around US $50 million in UK-backed investment[24]. Dandora waste-to-energy (45 MW) project (US $197 million) is progressing after regulatory clearance[25]. A KenGen floating solar plant (42.5 MW) is under development at Kamburu Dam[26].

3.7.4 Cost of Capital & Currency Risk

High borrowing costs have hindered energy investment, influenced by foreign-exchange exposure: Kenyan shilling depreciation (28% vs USD since 2018) raises project risk IEA. Off-taker risk, regulatory delays, and inflation increase the weighted-average cost of capital. DFIs are using guarantees and local currency lending to mitigate these[27].

Kenya continues to upscale financial access through digital platforms with adoption of mobile money growing from 27.9% in 2009 to 82.3% in 2024, while mobile banking now reaches 32.6% of adults.

According to conducted by the Central Bank of Kenya, the Kenya National Bureau of Statistics and Financial Sector Deepening (FSD) Kenya, further highlights the financial landscape shaping this green transition. The rise of digital financial services, including the Hustler Fund with 28.9% of adults taking loans, signals a dynamic shift in financial accessibility, creating avenues for innovative green finance solutions.

3.7.5 Investment Trends

- **Shift to cleantech**: Cleantech accounted for nearly half of new startup funding in 2024, marking a pivot from previous fintech dominance.
- **Geothermal leadership**: Kenya, with approximately 989 MW geothermal output (47% energy mix), remains Africa's geothermal hub, attracting global partnerships.
- **High-value corporate deals**: Notable public–private investments include Microsoft/G42's US$1 billion geothermal-powered data centre, backed by the U.S. DFC and other multilateral support.
- **Expansion of off-grid solutions**: Pay-as-you-go solar (e.g., d.light), clean cooking (e.g., KOKO Networks with US$179 million political-risk guarantee), and electrification of transport are gaining investor traction.
- **Debt vs equity trend**: In 2024, 62% of Kenya's VC funding was debt-financed-reflective of asset-backed cleantech models-leaving only 28% as pure equity.

[23] Jean Marie Takouleu (12 June 2023). "Kenya: Globeleq starts work on its first geothermal power plant in Menengai". *Afrik21.africa*
[24] CDC Group Invested US$50 Million In Malindi Solar Group, To Build A 52 Megawatts Solar Photovoltaic Power Plant in South-East Kenya". London: Africa Private Equity and Venture Capital Association (AVCA)
[25] Carmen (29 November 2022). "Dandora Waste to Energy Plant, Kenya". *Power-Technology.com*. New York City
[26] Brian Ambani (17 July 2024). "KenGen to add 42.5MW solar power to national grid by 2027". Business Daily Africa. Nairobi, Kenya.
[27] IEA (2025), How a high cost of capital is holding back energy development in Kenya and Senegal, IEA, Paris https://www.iea.org/commentaries/how-a-high-cost-of-capital-is-holding-back-energy-development-in-kenya-and-senegal, Licence: CC BY 4.0

3.7.6 Challenges and Gaps

Access to finance remains a significant barrier for cleantech enterprises in Kenya, with multiple overlapping challenges impeding investment flow into the sector. Most stakeholders interviewed cited issues of high-risk perception among financers, reported by 45.2% as shown in Figure 4, which discourages lending and investment in early-stage or unproven technologies. This is compounded by lengthy and complex approval processes (40.5%), which create bottlenecks and deter smaller players from pursuing formal financing channels. A substantial awareness gap among investors (35.7%) further limits funding opportunities, as many remain unfamiliar with the business models, returns, and impact potential of cleantech ventures.

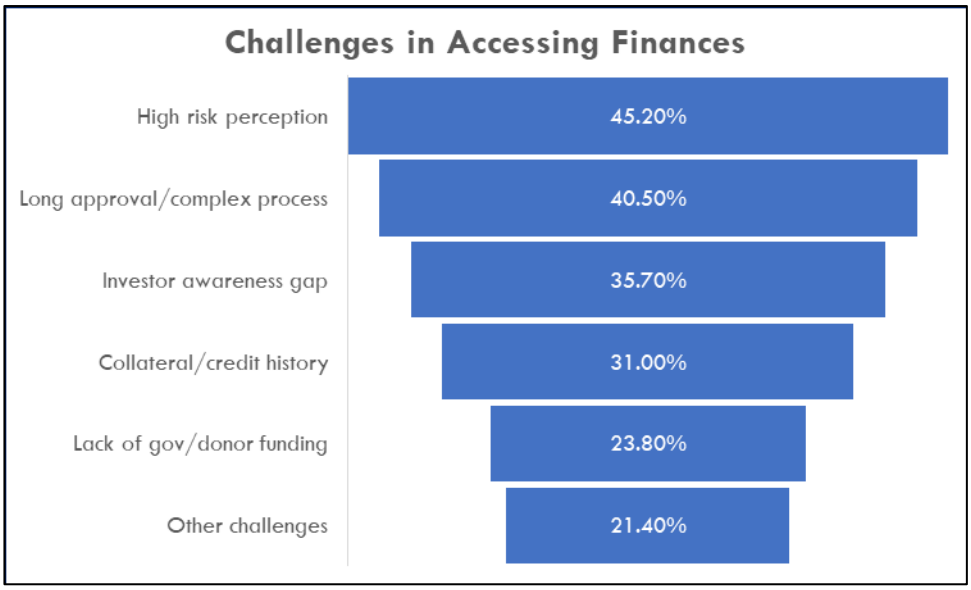

Figure 10: Challenges in accessing finances

Additionally, limited collateral or weak credit histories affect 31% of respondents, making it harder to secure loans from traditional financial institutions. The absence of robust government or donor-backed financial instruments (23.8%) and other operational constraints (21.4%) underscore the need for targeted policy reforms, financial innovation, and capacity-building efforts to unlock capital for Kenya's green transition.

3.8 Technological and Technical Capabilities

3.8.1 Key Technologies

Kenya has made strides towards the enhancement of various clean technologies. One of the most significant achievements has been the widespread uptake of off-grid solar solutions. With rural electrification rates still low, companies like M-KOPA and D.light have introduced pay-as-you-go solar systems that allow users to access lighting and energy services affordably via mobile money. The International Energy Agency (IEA) posits that 20% of households in Kenya utilize solar-powered mini-grids and sometimes standalone systems. These innovations have significantly reduced reliance on biomass and kerosene in off-grid areas, improving air quality and cutting greenhouse gas emissions. The deployment of solar mini-grids in rural areas has been accelerated further by collaborations between the government through policies like the Renewable Energy Feed-In Tariff (REFiT) with firms like Renew via Energy.

Another major advancement lies in clean cooking technologies such as the Improved Cookstoves (ICS). Over 90% of rural households still depend on wood and charcoal, contributing to deforestation and

indoor air pollution. The use of improved cookstoves, such as those from M-Gas and Bbox, increases fuel efficiency and reduces harmful emissions. Supported by initiatives like the Kenya Clean Cooking NAMA, some clean cooking solutions are integrated with smart metering and PAYG models, improving affordability and access. This technology enables the country to cut down emissions by 30% by 2030.

In agriculture, Kenya has embraced climate-smart technologies to counter the effects of droughts, pests, and other climate-related risks. Solutions such as solar-powered irrigation systems and biowaste composting are being deployed to enhance soil health and productivity. The Kenya Climate Innovation Centre (KCIC) has played a vital role in supporting businesses working on precision farming, solar dryers, and resilient seeds to improve yields for smallholder farmers.

Water management is another domain benefiting from clean technologies. Innovations such as solar-powered water pumps, low-cost filtration systems, and GSM-enabled water ATMs are helping address water scarcity and contamination, especially in rural areas. Startups like Baridi are deploying solar cold chains for fisheries, ensuring better food preservation and income stability for communities.

In the urban areas, Kenya is advancing e-mobility and waste management solutions. Startups such as Mazi Mobility and BasiGo are manufacturing electric bikes and buses, reducing emissions from urban transport. Waste-to-energy technologies and recycling innovations such as T-Bin's smart waste system are supporting sustainable waste handling. These initiatives align with Kenya's Extended Producer Responsibility (EPR) Regulations, which mandate sustainable waste management practices and circular economy models.

3.8.2 Digital Technologies

Digital innovations are central to scaling and optimizing clean technologies as they not only improve performance and monitoring but also make cleantech solutions more accessible and financially viable. In the energy sector, Internet of Things (IoT) sensors and AI-driven analytics are used for predictive maintenance, load balancing, and real-time monitoring of energy systems. PowerGen and Gridless are companies that deploy smart grid technologies to improve grid efficiency, stabilize supply, and reduce power loss. Peer-to-peer (P2P) energy trading platforms and blockchain solutions are emerging, allowing households to generate, store, and sell excess energy boosting energy resilience. "*Digital tools are not just add-ons, they're becoming the backbone of clean technology. From pay-as-you-go solar to AI in farming, we are seeing how innovation can unlock access for the underserved and drive environmental impact at scale.*" FGD participant

In climate-smart agriculture, digital tools have improved productivity and climate adaptation. IoT soil sensors from firms like Rhea Africa enable farmers to monitor soil moisture and optimize irrigation. AI-powered drones and satellite imagery support precision farming by identifying land-use changes, pest activity, and disease outbreaks. Platforms like iProcure use big data to connect farmers with inputs, while Twiga applies AI to optimize supply chains and logistics. These tools ensure smallholder farmers make data-driven decisions that improve yields and sustainability.

In the water and sanitation sector, smart digital tools enhance access and quality. Smart water meters and IoT-enabled filtration systems detect leaks and contamination in real time, reducing water waste. Startups like eWATERpay and Majik Water are deploying GSM-controlled water ATMs, enabling low-cost, trackable water distribution in underserved communities.

Waste management is also benefiting from AI and blockchain integration. Solutions like T-Bin use smart sensors to automate collection schedules, while AI-assisted waste sorting improves recycling efficiency. These technologies support compliance with Kenya's EPR regulations and improve circular economy outcomes.

Digital innovation further supports carbon trading and climate finance. Startups now use blockchain and AI to verify carbon credits and track emissions, ensuring transparency in environmental markets. Governments and firms are increasingly using these systems for automated compliance checks and data-driven climate policy enforcement. Moreover, technologies such as cloud computing provide flexibility

and data management capabilities that support business growth. Public-private collaborations such as those involving Safaricom's Spark Fund help to fund and accelerate cleantech adoption across Kenya.

While digital innovations are transforming Kenya's cleantech landscape, achieving scale and inclusivity requires tackling digital exclusion, strengthening policy frameworks, and ensuring cybersecurity. The widespread use of mobile technology, particularly M-Pesa and USSD, has enabled low-income households to access pay-as-you-go clean energy and climate-smart services. Yet, disparities in digital literacy and connectivity remain key constraints. National and county governments must invest in digital infrastructure and incorporate cleantech tools into devolved systems and climate plans. Furthermore, empowering youth and women innovators, promoting open data ecosystems, and ensuring data protection will be critical to building a digitally enabled, equitable cleantech sector. ***"The potential for inclusion of digital integration in cleantech is massive, but digital exclusion is still real. If we want to see real transformation, we must match innovation with investment in last-mile connectivity, skills, and gender-inclusive design."*** KII respondent.

3.9 Feasibility and added value of the cleantech sector

3.9.1 Feasibility of the Cleantech Sector

Geothermal

Geothermal Energy in Kenya has a potential of up 10,000 MW distributed across twenty (20+) prospect areas mainly within the Kenya tertiary rift. Kenya began geothermal exploration in 1952 commissioning the first 15 MW geothermal plant in 1981 and has since increased its installed geothermal capacity to over 950 MW and stands in eighth position among geothermal electricity-producing countries worldwide, and top position in Africa[28]. Kenya's geothermal power plants boast an average capacity factor of over 90% and provide a stable electricity supply.

Wind Energy

Kenya's wind potential is among the best in Sub-Saharan Africa with 73% of the country experiencing wind speeds above 6 m/s or higher at 100 m above ground level according to data from the Ministry of Energy. The International Finance Corporation (IFC) estimates that in areas where wind speed is above 8.5 m/s Kenya's technical wind potential can reach 140 GW[29].The best wind sites are found in the North of the country, mainly around Lake Turkana, a 310 MW is the largest in Africa, highlighting the promise of this region for future wind power development. Lake Turkana wind public-private partnership (PPP) project with an annual average capacity factor of over 60% offers an excellent example of Kenya's exceptional wind conditions. Other Kenyan wind energy sites include: Kipeto, Ngong Hills, Kinangop, Marsabit, Habasweni and potential sites in Nyeri, Meru, Laikipia, Nyandarua, Lamu, Loitoktok and Narok.

Solar Energy

Kenya being in the tropics enjoys excellent solar conditions in many parts of the country, with average yields between 1,700 -1,800 kWh/kWp and capacity factors of around 20%, constitute a significant energy asset, with potentially very low levelised cost of electricity (LCOE)[30]. The current solar capacity is about 6% of the total installed electricity capacity of 3074 MW.

Hydroelectric Power

Kenya's potential for hydro stands in the range of 3,000 -6,000 MW, with over 800 MW already exploited mainly in large installations owned by KenGen.

[28] IRENA. (2023, February 16). Global geothermal market and technology assessment. https://www.irena.org/Publications/2023/Feb/Global-geothermal-market-and-technology-assessment 56 Ministry of Energy, Kenya. Updated Least Cost Power Dev

[29] GWEC. (2020). Exploring Africa's Untapped Wind Potential. https://gwec.net/wp-content/uploads/2021/04/IFC-Africa-Wind-TechnicalPotential-Oct-2020-1.pdf

[30] Green Hydrogen Strategy and Roadmap for Kenya. Link

Other Sources

Other potential sources include biomass, waste-to-energy, and green hydrogen energy given the abundance of their requisite resources. Biomass energy, particularly from crop residues, bagasse, and livestock manure, is readily available across the country, especially in agro-industrial zones, offering scalable solutions for rural and industrial energy needs. Waste-to-energy holds strong potential in urban centres where municipal solid waste is rapidly increasing, though it requires supportive infrastructure and regulations for sustainable deployment. Green hydrogen production via electrolysis is technically viable given Kenya's surplus geothermal and wind power, positioning the country as a future hub for clean hydrogen, although high initial investment and technology readiness remain key challenges (Table 5).

Table 5: Other sources of energy and their scalability potential

Energy Source	Estimated Potential (Electricity)	Key Opportunities
Biomass (residues, bagasse, manure)	1,000–2,000 MW	Sugar factories, agri-industrial zones
Waste-to-Energy	45–150 MW	Urban WTE plants (e.g., Dandora[31])
Green Hydrogen (electrolysis)	GW-scale (long-term)	Green ammonia, fertilizer, exports, mobility

While Kenya holds vast renewable energy potential, the feasibility of scaling cleantech also depends on grid infrastructure, financing, and local capacity. Integration challenges, especially in remote, high-resource areas, limit uptake, while intermittent sources like wind and solar require investment in storage and hybrid systems. Supportive policies exist, but implementation gaps and affordability constraints persist. Strengthening local manufacturing, technical training, and county-level energy planning will be key to unlocking inclusive, climate-resilient growth in the sector.

3.9.2 Added Economic Value

Economically, cleantech adds substantial value via job creation, foreign investment, and cost savings. Major projects like LTWP have created thousands of jobs (2,000+ during construction, 150–200 permanent) and reduce government fuel imports by up to US $120 million annually. The sector has attracted over US $20 billion in investment opportunities, including a US $1 billion geothermal-powered data centre announcement during President Ruto's Washington visit. Cleantech startups-especially in PAYG solar, waste-to-energy, and sustainable agri-tech-drive rural economic development, quadrupling incomes in some mini-grid communities. The rising e-mobility landscape is creating jobs across manufacturing, maintenance, and infrastructure sectors, supporting a broader green economy.

3.9.3 Environmental Benefits

Environmental gains from Kenya's cleantech sector are significant. Renewables now virtually dominate Kenya's energy mix-nearly 90% clean electricity-thanks to scaling geothermal, wind, hydro, and solar. LTWP alone was built to offset approximately 736,000 tons of CO_2 annually[32], stabilizes the grid, and improves air quality by reducing reliance on thermal power. Off-grid solar systems facilitate a shift from kerosene lamps, reducing indoor pollution and improving health. Waste-to-energy plants in Kakamega and Nairobi are repurposing municipal waste into power, mitigating landfill emissions and advancing

[31] https://www.power-technology.com/data-insights/power-plant-profile-dandora-waste-to-energy-plant-kenya/?cf-view
[32] https://www.afdb.org/en/projects-and-operations/selected-projects/lake-turkana-wind-power-project-the-largest-wind-farm-project-in-africa-143

circular economy goals. Biogas, recycling startups, and climate-smart agriculture continue to support environmental resilience and biodiversity.

3.10 Green Skills, Jobs, and Socio-Economic Impact

The Green Economy Strategy and Implementation Plan (GESIP, 2016–2030), the Climate Change Act (2016), Kenya Vision 2030, and waste and energy-related frameworks have helped Kenya transition to a green economy. This has put the cleantech sector at the heart of the country's plan for sustainable development, which presents new opportunities for socio-economic transformation, enterprise development, and employment. The expansion of the cleantech sector is not only driving increased demand for green skills but also enhancing social inclusion by creating pathways for participation among youth, women, and marginalized populations.

3.10.1 Decent Job Creation Potential

Kenya's commitment to a green economy positions it as a regional leader in climate action. The country is projected to create between 40,000 and 240,000 direct green jobs by 2030, making it one of Africa's top three nations for green employment[33]. Key sectors driving this growth include transmission infrastructure, poultry, electric mobility, aquaculture, smart climate agriculture, sustainable waste management, and renewable energy (e.g., solar, geothermal, and wind). This potential can be confirmed with 95.2% of respondents identifying their jobs as sustainable, with 47% of reported jobs held by youth, 19% by women, and 2.7% by persons with disabilities. However, the sector's scale is limited by barriers such as difficulty accessing finances (81%) and bureaucratic inefficiencies (35.7%).

There are projections, however, which include over 111,000 jobs in solar energy (installation, sales, maintenance), 22,316 in geothermal, 18,438 in waste and recycling (the highest in Africa), and more than 14,000 in electric mobility[34]. These opportunities particularly benefit youth, women, and underserved populations, with initiatives like the Kibera Community Youth Program (KCYP) demonstrating success in employing youth in solar PV assembly[35].

Survey findings (Figure 5) revealed that despite the cleantech sector's potential, its growth is hindered by limited training resources, misaligned skill development systems, and a significant green skills gap. Most institutions lack practical, industry-relevant programs, and qualified trainers are scarce, particularly for SMEs. "*The cleantech sector holds immense promise for Kenya's youth and women, but without deliberate investment in skills and financing, we risk leaving our most capable changemakers behind.*" KII respondent

Poor policy implementation further burden enterprises, which often resort to costly internal training. Therefore, to catalyse job growth in the cleantech sector, the government should prioritize targeted policy reforms and institutional investments.

[33]FSD Africa. Link
[34] FSD Africa, *Forecasting Green Jobs*.
[35] UNEP. (2023). *Kenya National Workshop on Green Jobs and Skills Development*. Link

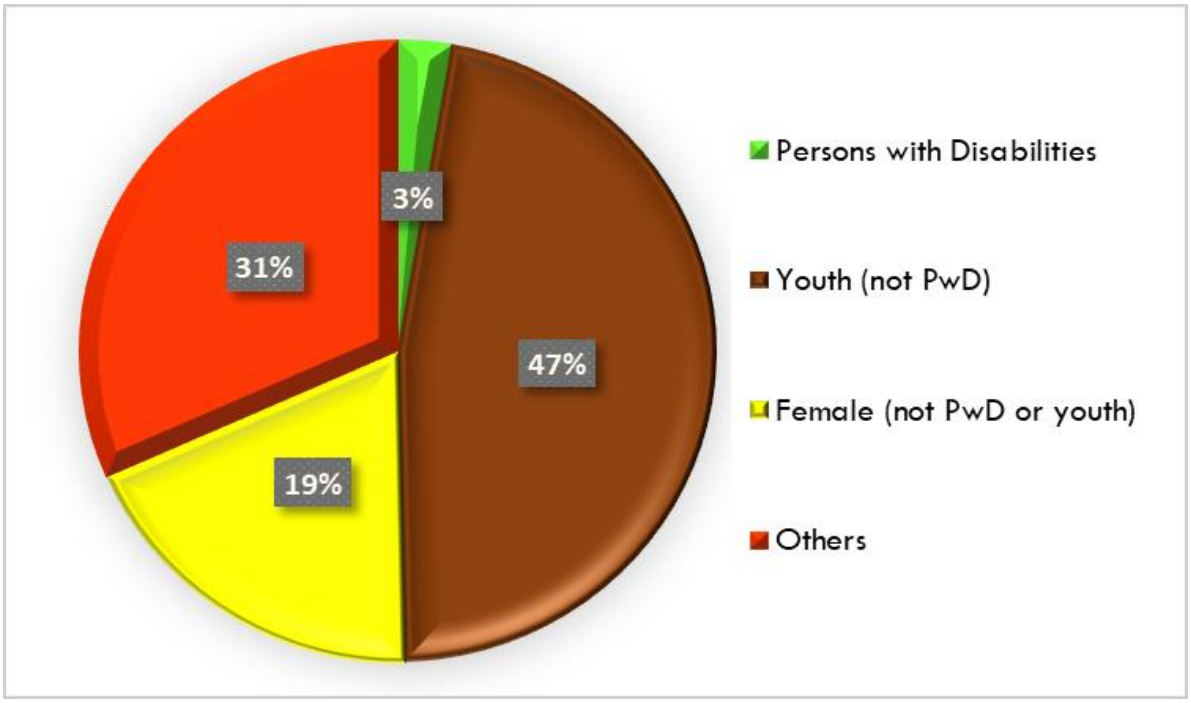

Figure 11: Inclusion in the cleantech sector

The Green Economy Strategy and Implementation Plan (GESIP) should be amended to include a national cleantech employment target and a clear implementation roadmap. This will provide a coordinated framework for tracking green job creation and aligning it with national development priorities. Additionally, a Cleantech Youth Employment Fund should be established under the Public Finance Management Act (2012), aimed at financing youth- and women-led enterprises in key areas such as solar energy, sustainable waste management, and agri-tech innovation.

3.10.2 Green Skills Development and Gaps

Cleantech sector growth in Kenya is driving up the need for green skills, but significant gaps persist. A 2022 UNEP study highlighted deficiencies among energy efficiency professionals in areas such as compressed air systems and cooling technologies, while the renewable energy sector requires skilled technicians, engineers, and maintenance personnel. The growing e-waste burden has spurred training programs in safe e-waste processing and recycling, but these are insufficient (ETF, 2023). Firms report a lack of technical skills (33%) as a major constraint, with specific gaps in bamboo carpentry, solar maintenance, and circular economy practices (Figure 6). Current training infrastructure struggles to keep pace with technological advancements in smart grids and waste-to-energy solutions, and curricula are often outdated.

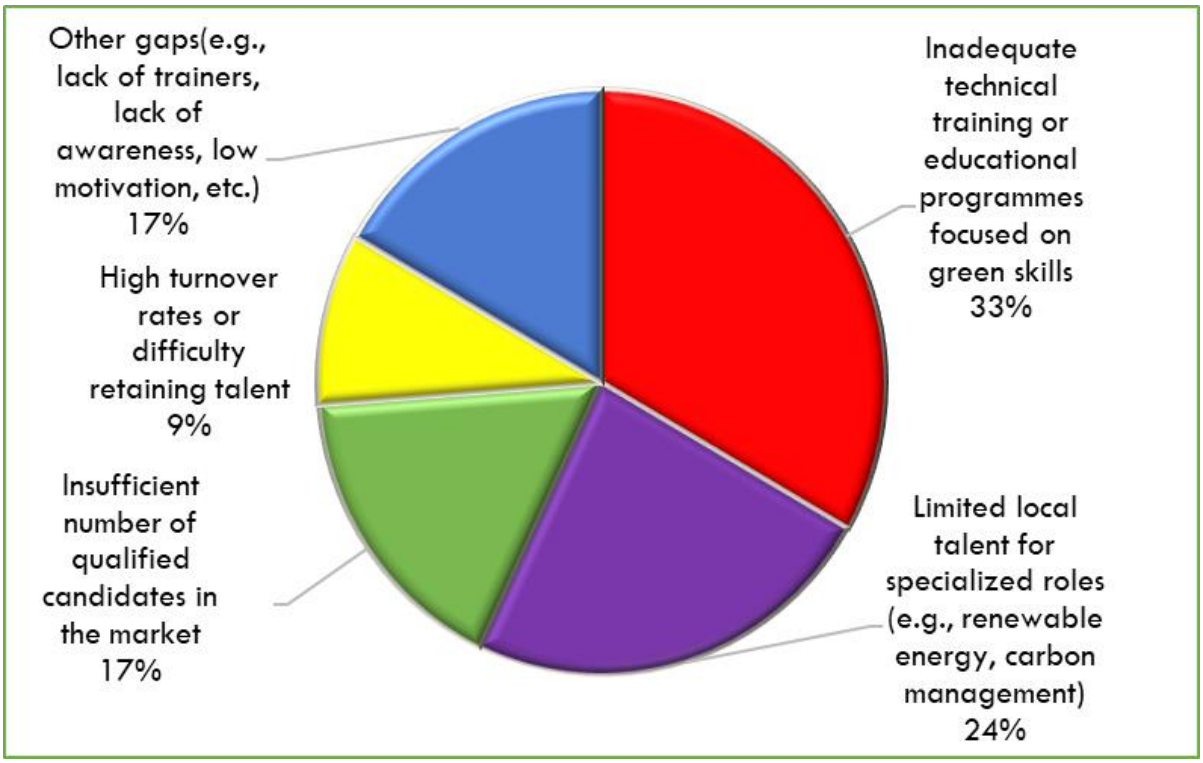

Figure 12: Main Gaps in Green Skills and Competencies

Formal education programs are not aligned with market needs as revealed by the survey findings, with universities and TVETs focusing on theoretical content rather than practical, hands-on training. The lack of dedicated green skills programs and qualified trainers exacerbates this issue, particularly for SMEs. Businesses often resort to internal training, increasing operational costs. There is an urgent need for vocational training in areas like solar PV installation, energy auditing, eco-design, and soft skills such as climate finance literacy and gender-responsive engagement. To address this, participants emphasized the need for vocational training that is both climate-focused and industry-aligned. Suggestions included integrating cleantech into Technical and Vocational Education and Training (TVET) curricula, expanding government support for green apprenticeships, and strengthening partnerships between cleantech firms and training institutions. One of the FGD participants remarked "*Cleantech firms are ready to hire, but they're forced to train from scratch because most training institutions still teach outdated theory. We need green curricula and apprenticeships, not just green talk. Without practical, hands-on skills, many graduates will remain locked out of cleantech opportunities for personal innovations and jobs*"

Efforts to integrate environmental awareness into formal education are ongoing. The Integrated Solid Waste Management Plan for Nairobi (2010–2020) emphasized the need for public education and the inclusion of green literacy in school curricula. This aligns with Article 34 of the Sustainable Waste Management Act (2022), which mandates the integration of waste management content into national education systems. Developing a robust green workforce will therefore require coordinated investments in training infrastructure, curriculum modernization, and strategic partnerships with both local and international institutions. Moreover, mainstreaming Gender Equality and Social Inclusion (GESI) principles across capacity-building programs remains critical to ensure equitable access, particularly for women, youth, and rural populations. Recent assessments by the ILO (2025) indicate that improvements in vocational training infrastructure are already enhancing green employment prospects for young people across the country.

3.10.3 Socio-Economic Impact

The green economy transformation in Kenya yields extensive socio-economic benefits, including economic resilience, improved livelihoods, social equity, and public health advancements, particularly for marginalized groups. Cleantech creates formal and informal jobs across skill levels, addressing unemployment and underemployment (UNEP, 2008; ILO, 2025). Sectors like solar power, e-waste recycling, and clean cooking technologies promote income diversification and poverty alleviation. In rural areas, green technologies such as solar irrigation and organic fertilizers enhance agricultural yields and food security while reducing climate vulnerability. Clean energy solutions, including solar home systems and clean cookstoves, reduce indoor air pollution and respiratory diseases, especially in slums and off-grid areas (FSD Africa, 2024; ETF, 2023).

The sector also advances gender equality and social inclusion (GESI) by empowering women and vulnerable groups through leadership roles and entrepreneurship in waste management and solar distribution[36]. Investments in green infrastructure improve urban sustainability and create construction jobs. Survey data highlights that cleantech businesses track their environmental and social impacts, measuring outcomes like carbon footprint reduction, job creation, community development, and waste reduction. These efforts contribute to inclusive, climate-resilient economic transformation.

However, focus group discussions noted that challenges such as limited access to credit, inadequate policy support, and the informal nature of some operations persist and therefore hinder scaling. Businesses face difficulties in reaching markets due to poor road infrastructure and low public awareness of cleantech benefits. The financial ecosystem is not fully conducive to cleantech growth, with high upfront costs and limited financing options. Targeted support, such as accessible financing and tax incentives, were proposed by most firms in the focus group discussions to enhance the sector's socio-economic impact and promote a just transition.

To address the identified challenges and build on existing initiatives, the following actionable policy recommendations are proposed (Table 6).

Table 6: Policy Recommendations for Enhancing Green Skills and Jobs

Recommendation	Government Action	Relevant Policy/Regulation	Rationale
Integrate Green Skills into National Curriculum	Develop green skills modules with KICD for CBC and TVET curricula; ensure industry alignment	Amend Basic Education Act (2013) and TVET Act (2013)	Aligns training with market needs and prepares learners for cleantech careers
Establish Dedicated Green Skills Training Centres	Set up regional centres through NITA and TVETs offering short courses and apprenticeships	Develop Green Skills Training Framework under TVET Act (2013)	Addresses trainer shortages and improves access to specialized technical training

[36] Asian Development Bank (ADB). (2012). *Gender tool kit: Energy – Going beyond the meter*. https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/documents/gender-toolkit-energy.pdf

Incentivize Private Sector Training Investment	Provide tax credits or subsidies to firms investing in employee green skills development	Amend Income Tax Act (Cap. 470)	Encourages private sector participation in workforce development
Support Green Entrepreneurship	Launch a fund via MSEA for loans, mentorship, and market access for cleantech startups	Establish fund under Micro and Small Enterprises Act (2012)	Enables SME growth and inclusion in the green economy, particularly youth- and women-led ventures
Promote Green Finance	Collaborate with CBK and banks to offer green loans; issue government-backed green bonds	Capital Markets Act (2012); develop green lending guidelines	Expands access to affordable finance for cleantech innovation and scale-up
Facilitate Market Access for Cleantech Products	Organize trade fairs, buyer linkages, and awareness campaigns through EPCK and counties	Develop Cleantech Market Access Strategy under Export Promotion Act (2015)	Enhances visibility and consumer adoption of cleantech products and services

3.11 Opportunities and Challenges in the Clean-tech Sector

3.11.1 Emerging Opportunities in the clean tech sector

Expanding Digitalization in Cleantech Delivery: The rise of Internet of Things (IoT), artificial intelligence (AI), and mobile applications is reshaping how cleantech services are delivered and monitored. Entrepreneurs are increasingly developing smart solutions for waste tracking, energy usage monitoring, and predictive maintenance.

> *For example, electric mobility firms are leveraging digital platforms to operate battery-swapping stations and monitor fleet performance in real time. With the growing use of electric motorcycles and buses in cities, digital infrastructure, such as charging networks and app-based diagnostics, offers high-potential business models to scale clean transport.*

Scaling Renewable Energy: Kenya continues to lead in East Africa with its renewable energy portfolio, with major investment opportunities in underexploited sources:

- ✓ Wind energy projects like the Lake Turkana Wind Power Station (310 MW) demonstrate the viability of large-scale deployment. There's room for replication in other wind-rich regions such as Marsabit and Isiolo.
- ✓ Geothermal energy, already a national strength with facilities like the Olkaria Power Station, provides reliable baseload power. Expansion across the Rift Valley can further reduce fossil fuel dependence and stabilize grid supply.
- ✓ Solar PV systems are increasingly cost-competitive. With enabling measures like Special Economic Zone (SEZ) tax breaks and the Draft Solar PV Regulations (2020), investors are incentivized to enter the solar mini-grid, commercial rooftop, and appliance markets.

Circular Economy and Waste-to-Energy Innovation: The transition toward a circular economy is gaining momentum, with startups and county governments investing in waste conversion and resource recovery.

- ✓ The Kakamega Waste-to-Energy Plant (10 MW) is a pioneering model showing how municipal waste can be turned into clean electricity. Similar setups in Kisumu and Nakuru are in planning stages.
- ✓ Circular products, such as bamboo-based furniture, composting systems, and upcycled construction materials, are emerging in response to Extended Producer Responsibility (EPR) policies and growing consumer demand for sustainable alternatives.
- ✓ Entrepreneurs are also tapping into black soldier fly farming, where organic waste is converted into insect protein and fertilizer, addressing both food security and waste reduction.

Clean Cooking and Off-Grid Solutions: As charcoal bans and LPG price hikes affect low-income households, the demand for non-carbonized cookstoves, biomass briquettes, and bioethanol fuels is surging. Entrepreneurs are scaling clean cooking solutions that are both affordable and environmentally friendly, especially in peri-urban and rural settings. These technologies not only reduce indoor air pollution but also create local manufacturing and distribution jobs.

In off-grid regions, solar-powered lanterns, fridges, and water pumps are improving livelihoods and boosting microenterprise. Programs like KOSAP and partnerships with Pay-As-You-Go solar firms continue to expand these innovations to underserved counties.

Sustainable Agriculture and Green Inputs: Climate-smart agriculture offers opportunities for cleantech firms to serve the agricultural sector with solar irrigation systems, organic fertilizers, and digital weather forecasting tools. The national Climate Smart Agriculture Strategy and increasing awareness of soil health and regenerative practices have created demand for bio-inputs and efficient irrigation. Entrepreneurs are developing solar dryers, automated drip kits, and microbial fertilizers to meet this need.

Local Manufacturing of Cleantech Components: Rising import costs and global supply chain disruptions are catalysing interest in local manufacturing of clean technologies, including solar panels, cookstoves, briquette machines, and water filters.

Supported by SEZ incentives and a push toward local value addition, this opportunity can create green industrial jobs and reduce Kenya's dependence on imported components. Firms that invest in technology transfer, skills training, and quality assurance will have a competitive edge.

Inclusive Innovation by Youth and Women: Youth- and women-led green enterprises are increasingly shaping Kenya's cleantech landscape. From solar startups to circular economy cooperatives, these innovators are building localized, context-relevant solutions that generate both environmental and social returns.

The rise of green cooperatives, especially in bamboo farming, briquette production, and solar installation, illustrates the potential of inclusive entrepreneurship. These ventures not only create jobs but also serve as platforms for leadership and skill-building among underrepresented groups.

Policy Incentives and Impact-Linked Finance: Kenya's enabling policy environment, including the National Energy Policy (2018) and upcoming Green Enterprise Development Fund for MSMEs, signals growing public support for cleantech expansion. These instruments provide a framework for scaling public-private partnerships, piloting innovative financial products (like green bonds), and incentivizing

local investment. Moreover, Kenya's interest in carbon markets opens new income streams for cleantech businesses aligned with emission reduction goals.

3.11.2 Challenges in the cleantech sector

Despite its potential, Kenya's cleantech sector faces significant barriers that hinder scalability and widespread adoption. The most critical challenge, as identified by the survey, is limited access to finance, with many firms struggling to secure credit due to high collateral demands, short repayment timelines, and risk-averse financial institutions unfamiliar with cleantech business models.

In the waste management subsector, informality poses major challenges, including inadequate data on operations, employment, and business performance. Waste collectors face high licensing costs requiring separate County and NEMA permits. Their predominantly informal business structures, coupled with limited access to banking and payroll systems, hinder operational efficiency and participation in circular economy models. Health and safety risks are widespread, as many workers lack proper protective equipment. Unclear and shifting NEMA regulations further heighten uncertainty, undermining sustainable waste management efforts and limiting meaningful public engagement. The sector also contends with strong social stigma around waste collection and low awareness of viable business models. The challenges are further summarized in Table 7.

Table 7: Key Challenges in Kenya's Cleantech Sector

Category	Challenge
Financial	• High interest rates (up to 25%) and strict collateral requirements limit startup financing.
	• Limited access to climate finance for women and youth-led enterprises (only 7% women trained, 5% equity access).
	• Absence of early-stage de-risking instruments for capital-intensive projects like geothermal energy.
	• High cost of imported cleantech equipment and limited affordable alternatives.
Institutional & Regulatory	• Overlapping, unclear licensing and certification procedures at national and county levels.
	• Weak policy enforcement and lack of standardized product certification discourage formalization.
	• Fragmented public-private collaboration limits knowledge sharing and coordinated sector growth.
	• Lack of transparent and attractive feed-in tariffs, especially for geothermal, slows private investment.
Technical & Skills	• 31% of firms cite lack of technical expertise in areas like solar, bamboo carpentry, and biowaste.
	• Outdated curricula and shortage of qualified trainers in TVETs and universities.
	• Weak R&D linkages between academia and industry limit innovation and product localization.
	• 23.8% of firms report difficulty accessing necessary tools and technologies.
Social & Cultural	• Cultural perceptions (e.g., food taste from clean cookstoves) impede adoption of clean cooking tech.
	• Gender bias and socio-economic exclusion affect participation and access for women and marginalized groups.
Environmental & Resource-Related	• Geothermal projects face high upfront exploration costs and long lead times with uncertain outcomes.
	• Hydropower reliability is undermined by erratic rainfall patterns, especially in arid regions.

4.0. POLICY AND INVESTMENT RECOMMENDATIONS

This chapter presents key policy and investment recommendations aimed at accelerating the growth and impact of Kenya's cleantech sector. Drawing from stakeholder insights, field data, and sector analyses, the recommendations target critical levers across regulation, finance, innovation, skills development, and inclusion. They are designed to guide ecosystem actors, including government, investors, development partners, and private sector stakeholders, in creating an enabling environment that fosters sustainable, inclusive, and commercially viable cleantech solutions. They have been organised based on the thematic issues that were assessed.

Sector Overview / Enabling Environment

1. Harmonize and operationalize cleantech policies at the national and county leels

Responsible Stakeholders: Ministry of Environment, Ministry of Energy, and Council of Governors (CoG)

✓Facilitate a national dialogue to align the Climate Change Act, Energy Act, and Sustainable Waste Management Act with devolved county strategies. Develop clear implementation roadmaps and capacity-building programs to support localized enforcement and sector coordination.

2. Develop a national cleantech sector strategy and registry

Responsible Stakeholders: Ministry of Industrialization and Kenya National Bureau of Statistics (KNBS)

✓Establish a national registry of cleantech enterprises and innovations. This will help map industry trends, track impact, and coordinate investments in high-potential subsectors like circular waste and bioenergy.

3. Review and update the National Environmental Policy to strengthen circular economy and sustainable procurement frameworks

Responsible Stakeholders: Ministry of Environment, NEMA, Treasury

✓Streamline regulatory processes and embed clear guidelines to support circularity, predictable compliance, and environmentally responsible public procurement.

4. Create a more predictable and inclusive policy environment for waste management and cleantech enterprises

Responsible Stakeholders: NEMA, County Governments, Ministry of Environment

✓Clarify and stabilize regulatory requirements, reduce uncertainty for investors and SMEs, and support long-term sector planning.

Emerging Business Models

5. Create a Cleantech Business Model Acceleration Toolkit

Stakeholders: Kenya Climate Innovation Centre (KCIC), KEPSA, and Energy Research Centres

✓Develop toolkits and technical assistance packages to help early-stage cleantech businesses adopt and refine hybrid business models. Focus areas include integrating digital tools, engaging cooperatives, and combining B2C and B2B channels for scale.

6. Digitize and simplify cleantech licensing and compliance processes

Responsible Stakeholders: NEMA, County Governments, and eCitizen platform developers

✓Launch a centralized digital licensing system with tiered compliance levels for startups, cooperatives, and SMEs. Include step-by-step guides, fee waivers for youth- or women-led enterprises, and a public dashboard to increase transparency.

7. Formalize waste collectors and aggregators

Responsible Stakeholders: County Governments, NEMA, CoG

✓Support structured registration, licensing, and data systems to improve operational efficiency, compliance, and access to finance and social protection mechanisms.

8. Establish clear and consistent pricing regulations in waste management

Responsible Stakeholders: County Governments, NEMA, Competition Authority of Kenya

✓Standardize pricing frameworks for waste transport, recovery, and disposal to enhance transparency, reduce exploitation, and improve value-chain predictability.

9. Promote circular business models

Responsible Stakeholders: Ministry of Environment, KCIC, Private Sector

✓Prioritize resource recovery, recycling, reuse, and circular waste enterprises through incentives, capacity building, and market development programs.

10. Strengthen partnerships with community-based organizations (CBOs)

Responsible Stakeholders: County Governments, CSOs, Private Sector

✓Enhance community participation, data collection, and sustainable operations through structured collaboration and co-implementation arrangements

Integration of GESI Principles

11. Embed GESI compliance in all public and donor cleantech funding programs

Stakeholders: Public Procurement Regulatory Authority (PPRA), DPs (e.g., GIZ, World Bank), and Treasury

✓All public calls for proposals and donor funding windows should require GESI indicators such as gender balance in staffing or inclusive governance, as part of eligibility and reporting requirements.

12. Launch sector-specific GESI training and mentorship hubs

Stakeholders: National Industrial Training Authority (NITA), Women Enterprise Fund, and Youth Enterprise Development Fund

✓Establish technical training hubs tailored for women and youth in cleantech disciplines like solar installation, waste valorization, and clean cooking systems. Link trainees to enterprise development and employment pathways.

Financial Flows and Investment Trends

13. Establish a Cleantech Blended Finance Facility targeting underserved entrepreneurs

Stakeholders: Central Bank of Kenya (CBK), National Treasury, and Development Finance Institutions (DFIs)

✓Set up a facility that combines concessional finance, guarantees, and technical assistance to de-risk investments in youth- and women-led cleantech enterprises. Include pipeline support to improve investability.

14. Incentivize private equity and venture capital through tax reliefs and co-investment guarantees

Stakeholders: Kenya Revenue Authority (KRA), Capital Markets Authority (CMA), and Ministry of Finance

✓Introduce tax deductions or co-investment guarantees for funds investing in early-stage cleantech innovations, especially those aligned with national development priorities.

Technological and Technical Capabilities

16. Support localization and adaptation of global cleantech innovations

Stakeholders: Kenya Industrial Research and Development Institute (KIRDI), Academia, and Private Sector

✓Invest in adaptive R&D to customize cleantech technologies (e.g., solar, biogas, e-mobility) to Kenya's context. Support technology transfer hubs, local prototyping, and patent support services.

17. Expand support for Smart Waste and Nature-Based Solutions (NbS)

Stakeholders: Ministry of ICT and Digital Economy, NEMA, and Kenya Forest Service

✓Develop grant and infrastructure programs to scale digital waste management tools (e.g., IoT tracking) and community-led NbS, such as bamboo-based reforestation and biochar production.

Feasibility and Added Value of the Cleantech Sector

18. Undertake a national cleantech feasibility and competitiveness study

Stakeholders: KNBS, Ministry of Trade, and Research Institutions (e.g., Tegemeo Institute)

✓Assess economic, social, and environmental returns across cleantech subsectors to inform targeted investments and public procurement policy. Focus on cost-benefit ratios, job potential, and climate mitigation outcomes.

19. Position cleantech as a core pillar in Kenya's green industrialization roadmap

Stakeholders: Ministry of Industrialization, Kenya Association of Manufacturers (KAM), and UNIDO

✓Align industrial incentives, SEZs, and export strategies with cleantech manufacturing (e.g., solar panels, clean stoves, water purification units). Prioritize local production and value addition.

Green Skills, Jobs, and Socio-Economic Impact

20. Integrate green skills training into TVET curricula

Stakeholders: TVETA, Ministry of Education, and Kenya National Qualifications Authority (KNQA)

✓Update curricula in TVET institutions to include modules on solar technology, sustainable agriculture, circular economy, and e-waste handling. Ensure certification pathways and linkages to job placement schemes.

21. Support skills development in green technologies across the cleantech value chain

Stakeholders: NITA, TVETs, Industry Associations

✓Provide targeted training for workers and entrepreneurs in emerging green technologies, including waste valorization and digital-enabled cleantech solutions.

22. Integrate green skills and green jobs training into secondary and tertiary education

Stakeholders: Ministry of Education, KICD, Universities

✓Introduce foundational green economy modules to prepare learners for future cleantech opportunities.

23. Launch a national cleantech youth employment accelerator

Stakeholders: Ajira Digital Program, Youth Fund, and Private Sector Foundations (e.g., Safaricom Foundation)

✓Create targeted programs that match cleantech startups with skilled youth through paid internships, apprenticeships, and venture-building support, particularly in rural and peri-urban areas.

Opportunities and Challenges

24.Address cleantech awareness and demand creation through coordinated campaigns

Stakeholders: Ministry of Environment, Media Council of Kenya, and CSOs

✓Roll out mass awareness campaigns on the benefits of cleantech products and services. Use community radio, influencer marketing, and roadshows to drive adoption, especially in underserved counties.

25. Develop an inclusive cleantech innovation sandbox

Stakeholders: Ministry of Innovation, ICT Authority, and KCIC

✓Create a regulatory and financial sandbox that allows early-stage cleantech innovators, especially women and youth, to test, iterate, and scale solutions with support from legal and financing mentors.

5.0 APPENDICES

APPENDIX I: KENYA'S STRATEGIES, POLICY, LEGAL, REGULATORY AND INSTITUTIONAL FRAMEWORKS

S/N	INSTRUMENT	TARGET /PURPOSE	WEAKNESS
STRATEGIES			
1	Draft Kenya National Energy Efficiency and Conservation Strategy (2020)	Improve energy efficiency in transport, industry, buildings, etc.	Still in draft form; lacks actionable investment incentives
2	Green Economy Strategy and Implementation Plan (GESIP), 2016	Promote low-carbon, resource-efficient, inclusive green growth	Weak coordination and poor monitoring mechanisms
3	Green Hydrogen Strategy and Roadmap for Kenya	To guide the development of a green hydrogen economy in Kenya by leveraging renewable energy sources (e.g., wind, solar, and geothermal) for hydrogen production, fostering industrial decarbonization, export potential, and energy security	Still at early stages of implementation; limited infrastructure, high production costs, and unclear investment frameworks may hinder short-term impact
4	Kenya Bioenergy Strategy (2020–2027)	Promote sustainable production and consumption of bioenergy, accelerate transition to clean cooking by 2028, support investor information and regional bioenergy trade	No quantitative targets; lacks detailed financing and institutional coordination mechanisms; limited integration with county-level planning
5	Kenya National Climate Change Action Plan III (NCCAP III) 2023–2027	Provide detailed mitigation & adaptation actions across sectors (energy, agriculture, forestry, infrastructure, etc.) aligned with NDCs and national security priorities	Implementation challenges at county level; need enhanced financing instruments; limited private-sector mobilisation
6	Kenya National Electrification Strategy (KNES), 2018	Achieve universal electricity access, including off-grid solutions	Ignores policy for productive use and local cleantech innovation
7	Kenya Vision 2030	Long-term development plan with a pillar on clean energy and green growth	Not detailed on cleantech pathways and emerging innovations
8	Updated Nationally Determined Contribution (NDC I), 2020	Commit to reducing GHG emissions by 32% by 2030 relative to the BAU scenario through adaptation and mitigation in key sectors	Broad commitments; lacks technology-specific targets and costing details
9	Second Nationally Determined Contribution (NDC II), 2023	Reinforce NDC I and integrate security, gender, and enhanced transparency into climate actions	Limited mechanisms for monitoring cleantech-specific progress; financing roadmap remains unclear
NATIONAL POLICIES			
1	Feed-in Tariff (FiT) Policy (2008, revised 2012)	Support renewable energy investments via fixed tariffs	Replaced by auctions but no clear or consistent successor implemented
2	Kenya National Energy Policy, 2018	Provide direction for energy development, including renewables	Doesn't strongly support cleantech R&D or startups
3	National Industrialization Policy Framework	Drive industrial growth through sustainable and clean production	Weak incentives for private sector cleantech investments

S/N	INSTRUMENT	TARGET /PURPOSE	WEAKNESS
4	National Sustainable Waste Management Policy, 2021	Promote circular economy and cleantech in waste recovery	Poor implementation at county level and limited private sector uptake
5	**National Green Fiscal Incentives Policy Framework** *(draft, 2023)*	Promote green investments via fiscal tools including carbon tax, rebates, subsidies, tax exemptions, green bonds, concessional loans, ecological transfers, and the establishment of a green investment bank	Still in draft, implementation timeline unclear; limited uptake by financial institutions and counties
	LEGAL & REGULATORY FRAMEWORKS		
1	Climate Change Act, 2016 (Amended 2023)	Provide legal basis for climate resilience and low-carbon development	Weak inter-agency and inter-county coordination
2	Energy Act, 2019	Regulate energy supply, promote renewable energy and energy efficiency	Enforcement and alignment with fast-changing cleantech trends is slow
3	Environmental Management and Coordination Act (EMCA), 1999 (Amended 2015)	Provide environmental governance and EIA/ESIA for projects	Doesn't address cleantech-specific waste like PV modules
4	Public Finance Management Act, 2012	Ensure prudent use of public funds, including climate finance	Poor climate budget tagging; little incentive for county-level cleantech investment
5	Sustainable Waste Management Act (2022)	To promote a circular economy through sustainable waste management practices, including segregation, recycling, waste-to-energy, and extended producer responsibility	Implementation gaps due to limited enforcement capacity, inadequate infrastructure at county levels, and low public awareness.
	KEY INSTITUTIONS		
1	Energy and Petroleum Regulatory Authority (EPRA)	Regulates electricity, petroleum, and renewable energy	Bureaucratic licensing; slow innovation adaptation
2	Kenya Climate Change Directorate (KCCD)	Coordinate climate change policy and mainstream climate action	Low technical capacity on cleantech and data analytics
3	Kenya Industrial Property Institute (KIPI)	Protect industrial property rights, patents, and trademarks	Limited outreach to cleantech inventors; high processing costs
4	Kenya Industrial Research and Development Institute (KIRDI)	Support R&D in industrial and environmental technologies	Underfunded; low commercialization of cleantech prototypes
5	Kenya Investment Authority (KenInvest)	Facilitate and promote investments across sectors	Weak targeting of cleantech as a key investment area
6	Kenya National Innovation Agency (KeNIA)	Coordinate and promote innovation, including cleantech	Poor innovation-commercialization linkage; lacks seed funding
7	Kenya Private Sector Alliance (KEPSA) – Green Growth Committee	Mobilize private sector in climate-smart and green technologies	Limited public sector response to private recommendations
8	Ministry of Energy and Petroleum	Lead energy planning and policy implementation	Coordination challenges with counties and other ministries
9	National Environment Management Authority (NEMA)	Environmental regulation and compliance including EIAs	Cumbersome approval timelines for cleantech projects

APPENDIX II: CLEANTECH PLAYERS

SUBSECTOR	STAKEHOLDER/PLAYER	TYPE OF ACTOR	FUNCTION
Renewable Energy	Kenya Electricity Generating Company (KenGen)	Government	Develops and operates geothermal and hydro power plants
	Kenya Renewable Energy Association (KEREA)	NGO	Industry advocacy and capacity building
	Ministry of Energy	Government	Policy formulation and regulation
	USAID	Development Partner	Funding and technical support for renewable projects
	University of Nairobi, JKUAT	Academia	Research and innovation in renewable technologies
	M-KOPA Solar	Private Sector	Off-grid solar energy provider
Energy Efficiency	Energy and Petroleum Regulatory Authority (EPRA)	Government	Regulatory oversight for energy efficiency
	Kenya Association of Manufacturers (KAM)	NGO/Industry	Promotes energy-efficient manufacturing
	GIZ Kenya	Development Partner	Technical assistance on energy efficiency projects
	Kenya Climate Innovation Centre	NGO	Supports energy efficiency startups and SMEs
Water Management	Water Resources Authority (WRA)	Government	Water resources regulation and management
	Kenya Water Towers Agency	Government	Conservation and restoration of water catchments
	Water.org	NGO	Access to clean water and sanitation
	African Development Bank (AfDB)	Development Partner	Financing water infrastructure projects
Sustainable Agriculture	Ministry of Agriculture	Government	Policy and support for sustainable farming practices
	Alliance for a Green Revolution in Africa (AGRA)	NGO/Development Partner	Capacity building and sustainable agriculture programs
	Kenya Agricultural and Livestock Research Organization (KALRO)	Research organization	Research and innovation in sustainable agriculture
	Farm Concern International	NGO	Farmer advisory and market linkages
Green Building and Sustainable Construction	Green Building Society of Kenya (GBSK)	NGO	Advocacy for sustainable construction standards
	National Construction Authority (NCA)	Government	Regulation and certification
	Kenya Green Building Society	NGO	Capacity building and awareness

E-mobility	Energy and Petroleum Regulatory Authority (EPRA)	Government	Regulation of e-mobility infrastructure
	Kenya Climate Innovation Centre	NGO	Supporting startups in e-mobility
	BRCK	Private Sector	Technology solutions including e-mobility
Carbon Management	Climate Change Directorate, Ministry of Environment	Government	Carbon policy and climate action coordination
	Kenya Carbon Alliance	NGO	Carbon trading and offset projects
	World Bank	Development Partner	Funding carbon capture and climate resilience projects
Circular Economy Solutions	Kenya Association of Manufacturers (KAM)	NGO/Industry	Promoting circular manufacturing practices
	Circular Economy Africa	NGO	Advocacy and capacity building in circular economy
	Kenya Private Sector Alliance (KEPSA)	Private Sector	Business policy advocacy and partnerships
Environmental Monitoring and Data Analytics	National Environment Management Authority (NEMA)	Government	Environmental regulation and monitoring
	Strathmore University	Academia	Data analytics and environmental research
	Spatial Collective	Private Sector	GIS and environmental data solutions
Commercial Forestry	Kenya Forest Service	Government	Forest conservation and management
	Green Belt Movement	NGO	Community forestry and advocacy
	World Wildlife Fund (WWF)	NGO	Forest conservation projects
Sustainable Waste Management	National Environment Management Authority (NEMA)	Government	Waste regulation and enforcement
	Waste Electrical and Electronic Equipment Centre (WEEE Centre)	NGO	E-waste recycling and awareness
	Nairobi City County	Government	Urban waste collection and management
Blue Economy	Kenya Marine and Fisheries Research Institute (KMFRI)	Government	Marine resource research and management
	Blue Economy Secretariat	Government	Policy coordination for sustainable ocean economy
	Kenya Oceans Alliance	NGO	Advocacy and marine conservation

APPENDIX III: CHALLENGES FACED ACROSS DIFFERENT CLEANTECH TECHNOLOGIES

Technology	Sector	Companies	Main Challenges
Mobile Apps for Agri-Market Linkages	Agri-Tech / Supply Chain	Twiga Foods, iProcure	Digital literacy, platform trust, connectivity in rural areas
IoT-Enabled Soil Sensors & Smart Irrigation	Climate-Smart Agriculture	Rhea Africa, SunCulture	High costs, low awareness among smallholders, limited training
Precision Agriculture (Drones, AI Models)	Digital Agriculture	UjuziKilimo, TechforTrade	Training costs, regulatory lag on drone usage
Solar Cold Storage & Cooling for Fisheries	Post-harvest Management	Baridi, InspiraFarms	Rural energy access, tech servicing, cost of units
Blockchain for Carbon Tracking	Carbon Markets	Kenya Climate Ventures (pilots), Tamu Tamu, startup-led trials	Regulatory readiness, technology complexity, high setup costs, verification capacity gaps
E-Mobility (EV Bikes & Buses)	Transport	BasiGo, Mazi Mobility, Roam, Ampersand	Charging infrastructure gaps, policy uncertainty, vehicle import costs
Improved Cookstoves (ICS) & PAYG LPG	Clean Cooking	BURN Manufacturing, M-Gas, Bboxx	Cultural resistance, affordability, limited scale in rural markets
IoT/AI for Grid Management & Predictive Maintenance	Energy Efficiency / Digital Grid	Gridless, PowerGen	Lack of skilled personnel, grid modernization costs
Pay-As-You-Go (PAYG) Solar Systems	Energy Access (Off-grid)	M-KOPA, D.light, SunCulture, Powerhive	High upfront costs, limited rural financing, tech maintenance gaps
Solar Mini-Grids	Renewable Energy	Renewvia Energy, Powerhive, PowerGen, KOSAP	Grid extension competition, licensing delays, limited community ownership models
Waste-to-Energy Solutions	Energy & Waste	Sanergy, Biogas International, Sistema.bio	Feedstock inconsistencies, grid connectivity, permitting & land use
Smart Waste Systems	Waste Management / Circular Economy	TakaTaka Solutions, T-Bin, Mr. Green Africa	Low recycling rates, informal sector dominance, consumer behaviour change
Smart Water ATMs / Purification Tech	Water Access & Sanitation	Drinkwell, Majik Water, eWATERpay	Infrastructure theft, limited community trust, inconsistent water supply