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LEAP-RE
Long-Term Joint EU-AU Research and Innovation Partnership on Renewable Energy

Report on policy, legislative and regulatory environments

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Summary

The deliverable D10.6 for this report was developed in connection with task 10.3 of the PURAMS project. This project aims to develop a standalone solar cooking appliance (cooker), to address the challenges caused by traditional cooking methods and faced by rural communities in Africa. The specific objectives of the project can be summarised as follows: To do an off-grid market assessment for solar cooking, a solar resource assessment to enable cooker design and capacity assessment to support the piloting of systems; to develop a standalone solar cooker and pilot it; to identify business models and engage policy makers to create an enabling environment; to develop or improve solar photovoltaic module technology for use in the cooker design. This specific deliverable deals with objective number 3 and therefore policy makers were engaged to get their insights about clean cooking and educate them on the benefits of electric cooking in general especially about healthcare. Recommendations were drawn as a result of the survey that was undertaken by the 3 countries on this project on how they can enable the growth potential of electric cooking, especially using standalone solar devices. From the study, it is evident that there exists various policies/legislations that aim to support the uptake of clean cooking. These include national policies, national strategies, standards and regulations among others. These legislations have set various objectives including increased uptake of clean cooking across the various industry and household levels. Governments have also made efforts to incentivise clean cooking. However, despite these efforts, there is still an overreliance on traditional biomass meaning that the effectiveness of these policies is somewhat wanting. In Kenya for instance, about 86% of the households in the rural areas use wood stoves as their primary fuel (MoEP, 2020). Some of the key reasons as to why there is still low adoption of clean cooking despite these efforts are: ? Poor financial support ? Lack of an enabling environment for e-cooking ? High cost of the technologies, high implementation costs and high requirements of infrastructure and facilities. ? Lack of awareness and illiteracy. ? Deep-rooted cultural preferences and practices. ? The policy makers not engaging the stakeholders well. ? Poor political support.

Approval

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LEAP-RE

Long-Term Joint EU-AU Research and Innovation Partnership on Renewable Energy

Research & Innovation Action

September 2023

D10.6 Report on Policy Legislative and Regulatory Environment

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D10.6 Report on Policy Legislative and Regulatory Environment

Version N°1

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D10.6 Report on Policy Legislative and Regulatory Environment

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Abbreviations and Acronyms

Acronym	Description
MoEP	Ministry of Energy and Petroleum
SDG	Sustainable Development Goals
CCAK	Clean Cooking Association of Kenya
CBO	Community Based Organization
KOSAP	Kenya Off-Grid Solar Access Project
TVET	Technical and Vocational Education and Training
EPRA	Energy and Petroleum Regulatory Authority
KPLC	Kenya Power and Lighting Company
KEFRI	Kenya Forestry Research Institute
CLASP	Collaborative Labelling and Appliance Standards Program
KEREA	Kenya Renewable Energy Association
REREC	Rural Electrification and Renewable Energy Corporation
EDCL	Energy Development Corporation Limited
REG	Rwanda Energy Group

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REMA	Rwanda Environment Management Authority
RSB	Rwanda Standard Bureau
BEST	Biomass Energy Strategy
ESSP	Energy Sector Strategic Plan
NST1	National Strategy for Transformation
BRD	Development Bank of Rwanda
CAP	County Action Plan
UNFPA	United Nations Population Fund
ICS	Improved Cookstoves

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Summary

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From the study, it is evident that there exists various policies/legislations that aim to support the uptake of clean cooking. These include national policies, national strategies, standards and regulations among others. These legislations have set various objectives including increased uptake of clean cooking across the various industry and household levels. Governments have also made efforts to incentivise clean cooking. However, despite these efforts, there is still an overreliance on traditional biomass meaning that the effectiveness of these policies is somewhat wanting. In Kenya for instance, about 86% of the households in the rural areas use wood stoves as their primary fuel (MoEP, 2020). Some of the key reasons as to why there is still low adoption of clean cooking despite these efforts are:

- Poor financial support
- Lack of an enabling environment for e-cooking
- High cost of the technologies, high implementation costs and high requirements of infrastructure and facilities.
- Lack of awareness and illiteracy.
- Deep-rooted cultural preferences and practices.
- The policy makers not engaging the stakeholders well.
- Poor political support.

Environment **Lessons Learnt from the survey undertaken are**

- Significance of community engagement in the initialization, formulation and implementation of policies,
- There is a need for sustainable financing mechanisms towards stakeholder engagements,
- The important role of policy and regulatory frameworks sensitizations to the stakeholders,
- The imperative of adopting technological advancement in e-cooking.
- It is important to synchronise the many policies for ease and effectiveness of implementation.

Recommendations

For the realisation of accelerated adoption of clean cooking in the 3 countries, and on the African content, and to match with the acceleration of universal electricity access, the following recommendations initiatives and strategies are proposed;

1. Foster adequate public participation to involve all the stakeholders in the decision-making process
2. Introduction of a favourable tax environment for investments in clean cooking technologies and the relevant infrastructures
3. Ensure the development of realisable and well-determined strategies towards clean cooking technologies and promotion.
4. Introduction of rigorous campaigns for the creation of awareness especially with the high-level decision-makers
5. Foster realisation of access to affordable and reliable electricity supply for the facilitation of e-cooking adoption as a major anchor to clean cooking.
6. Establishment of special tariffs for electric cooking to enhance adoption
7. Promote the use of solar-powered cookers in rural areas as this will be a sustainable solution given the financial status of rural dwellers

1. Introduction

This report presents the landscape of electric cooking in Mozambique, Kenya and Rwanda. Policy documents were reviewed and they range from National Policy, National Strategy, Law/Act of Parliament, Regulations, Procedure, Administrative action, Presidential directive and Standards/Incentive to understand how clean cooking and electric cooking is integrated into existing policies and identify gaps which were then analysed to draw recommendations

2. Country Profiles

2.1 Kenya

Kenya's energy landscape comprises traditional and modern energy sources. In rural areas, a substantial percentage, close to 90% of the population, still rely on traditional cooking methods, mostly using solid biomass fuels like firewood and charcoal (Emily Bolo, 2022). The issues posed by this reliance on traditional cooking methods include indoor air pollution which leads to health risks, deforestation, and time consumption due to fuel collecting. This primarily affects women and children who are mainly responsible for cooking. In addition, many communities in rural areas lack reliable access to electricity. This aspect of energy poverty derails their ability to adopt modern cooking technologies and other energy-efficient solutions, limiting socio-economic development opportunities.

Nevertheless, through a variety of policy and legislative actions, Kenya has achieved significant progress in promoting renewable energy, clean cooking, and e-cooking. The 2010 Kenyan Constitution mandates the decentralisation of functions to County Governments. It outlines that County Governments are tasked with the planning and development of the energy sector. This includes creating county energy plans encompassing aspects like petroleum, coal, renewable energy, and electricity master plans. It also involves managing physical planning related to energy resources, providing land and access rights for energy infrastructure, and regulating and licensing the retail supply of petroleum and coal products. The specifics of County Government roles in the energy sector are explained in the 2015 National Energy Policy. It recognizes the right of every person to access reasonable standards of living and gives the government power to regulate resources on behalf of the public.

The Ministry of Energy and Petroleum (MoEP) was tasked to establish the energy policy under the Fourth Schedule of the Constitution. The Kenyan government has made significant strides to ensure citizens' access to energy keeping in line with the nationally determined contributions as prescribed in the Paris agreement, Access to Modern Energy Cooking services by 2028 and the SDG7 Energy Compact of Kenya on clean cooking energy.

The Energy Act (2019) provides an extensive framework for energy regulation, development and promotion of renewable energy. Other policies include The National Energy Policy (2018), which supports the conversion of cookstoves to uptake modern and clean fuels in households and institutions; and the Kenya National Energy Efficiency and

Conservation Strategy (2020), which focuses on the efficiency of the cookstoves which can help reduce the amount of energy used. Kenya has also set targets for renewable energy generation, placing a high priority on geothermal, wind, solar, and hydroelectric power.

Similar to many other lower middle-income countries, Kenya has a rather complex energy landscape that is rife with potential and challenges alike. Kenya currently has an installed capacity of 3321.2 MW of electricity, with a majority of the energy mix coming from renewable sources such as geothermal, hydroelectric, solar PV and wind generation. The following figure highlights the energy mix in Kenya as of August 2023.

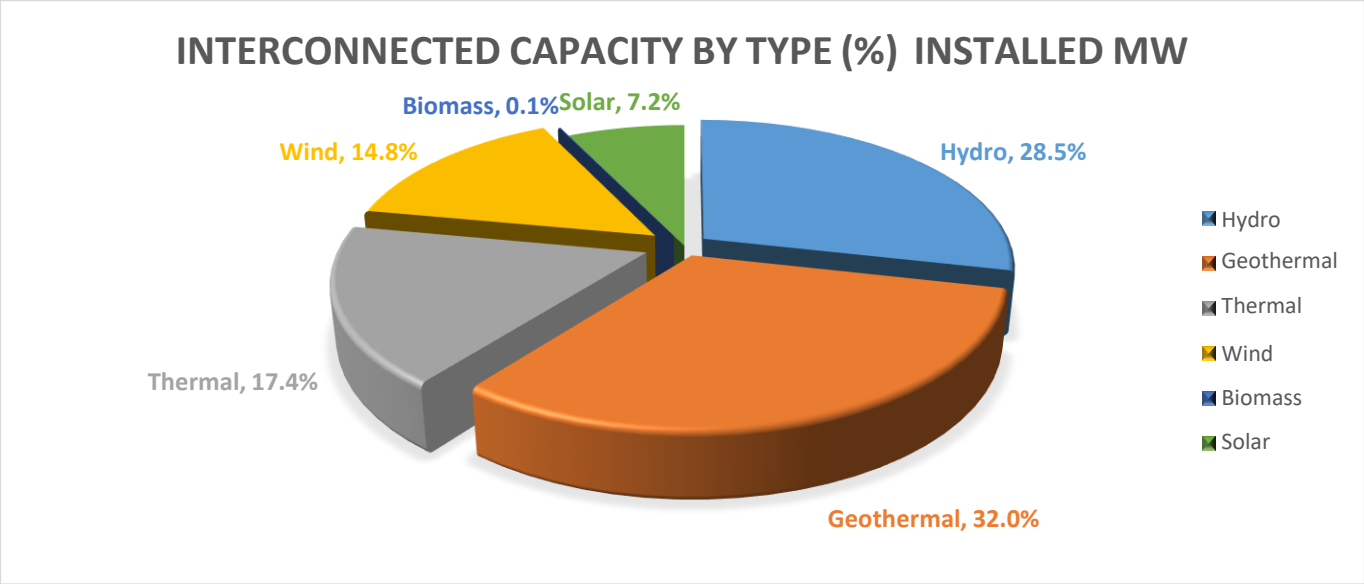


Figure 2:1 Kenya's Energy Mix (Kenya Power, 2023)

Kenya has implemented various programs in collaboration with organizations like the Global Alliance for Clean Cookstoves (GACC), SNV and Clean Cooking Association of Kenya (CCAK) to promote the adoption of modern cooking technologies. For instance, the Paradigm project by GACC was established in 2010 to ensure the adoption of clean cookstoves and fuels. SNV collaborated with GROOTS Kenya, a national network of women-led Community-based organizations (CBO) active at the grassroots level, to implement the Voice of Change Program, by involving policymakers at the county level, as well as national advocacy organizations to make a strong case for the transformation of the energy sector and champion for clean cooking. This has led to increased adoption of clean cookstoves and fuels in Kenya through interventions at both the demand and supply sides. CCAK facilitates the adoption of clean cookstoves and fuels in Kenya by

engaging relevant stakeholders to advocate for an enabling environment and conduct training programs on improved cook stoves in the County Energy Centers.

Other efforts that have been made to promote e-cooking solutions include ensuring energy access to all, especially in rural regions, by 2030 through grid extension and decentralized energy systems.

2.1.1 Policy and Governance Analysis

2.1.1.1 Existing energy and renewable energy policies

Kenya Country Action Plan (CAP) 2013

The Kenya CAP was developed with the support of the Clean Cooking Alliance and it defines what stakeholders in the Kenyan clean cooking sector can do to catalyze a thriving market for clean cooking solutions in Kenya. It presents a comprehensive summary of 24 priority intervention options necessary to affect change and provides interested parties (potential donors, entrepreneurs, NGOs, and policymakers) with a menu of ways to get involved in scaling up the widespread adoption of clean cooking technologies in Kenya. This is to remove the barriers to the widespread adoption of clean cookstoves and fuels in Kenya.

The CAP proposes several actionable interventions that are categorised into three primary domains: augmenting demand, reinforcing supply, and cultivating a conducive environment. These interventions entail a comprehensive understanding of consumer needs, the development of advanced technologies, the provision of consumer financial options, and the establishment of innovative distribution mechanisms. The CAP(2013) additionally underscores the significance of implementing standards, rigorous testing, ongoing monitoring and evaluation, the construction of a data-driven baseline, and active engagement with relevant national stakeholders.

The plan additionally examines regional perspectives and emphasises the importance of collaborative efforts across East Africa to foster the clean cookstove sector. It underscores potential region-level interventions which include improving access to financial resources, harmonising regional standards, exploring carbon finance opportunities, and enhancing awareness initiatives.

The CAP outlines specific targets and key performance indicators (KPIs) that are pertinent to Kenya, to achieve the adoption of clean cookstoves and fuels in 7 million households by the year 2020. These targets are categorised into various dimensions, including the number of clean cookstoves distributed, lives preserved, livelihoods enhanced, women empowerment, and preservation of the environment.

The plan concludes with a call for collaboration and active participation from a diverse range of organisations, encompassing potential investors, businesses, non-governmental organisations (NGOs), and policymakers. The overarching goal is to facilitate the up-scaling of the adoption of clean cooking technologies in Kenya, thereby fostering the development of a thriving market. The CAP serves as an invaluable roadmap inviting stakeholders to partake in endeavours aimed at generating substantial improvements in terms of human dignity, livelihoods, women empowerment, and environmental preservation.

Nationally Determined Contribution

Kenya's first NDCs, submitted to the UNFCCC in 2015 under the Paris Agreement, serve as a crucial instrument, outlining the country's commitment to reducing greenhouse gas emissions by 30% by 2030 and promoting low-carbon development. The government identified clean cooking as a priority Nationally Determined Contribution area (2017 NDC Sector Analysis), given the negative environmental, health, and economic effects of household reliance on dangerous cooking fuels. Some of the key mitigation options that were outlined to achieve this target are LPG Stove Substitution and Improved Cookstoves. Kenya has since revised her Nationally Determined Contribution (NDC) and pledged to reduce greenhouse gas emissions by 32% by 2030.

The Revised Nationally Determined Contribution (Updated NDC) outlines Kenya's mitigation and adaptation strategies from 2020 to 2030 and proposes priority areas for these actions during this period. The Updated NDC sets a higher ambition level compared to the first NDC, although considerable international support is needed to fully tap into the potential for mitigation and adaptation measures to achieve the overall NDC targets. Some of the priority mitigation activities include increasing renewables in the electricity generation mix of the national grid and promoting clean, efficient and sustainable energy technologies to reduce overreliance on fossil and non-sustainable biomass fuels. It therefore clearly highlights the need to connect both clean cooking and electrification.

Kenya Action Agenda (2016)

The Kenya Action Agenda (2016) was formulated within the framework of the Sustainable Energy for All (SE4All) initiative, presenting a long-term vision for the energy sector spanning from 2015 to 2030. It details how Kenya plans to meet its SE4All goals, which include: achieving 100% access to modern energy services; increasing the share of renewable energy in the country's energy mix to 80%; and doubling the rate of improvement in energy efficiency by 2030. Furthermore, it identifies current

plans/strategies and gaps related to these targets and seeks to promote modern and clean cooking through high-impact initiatives.

National Energy Policy (2018)

The 2018 National Energy Policy reaffirms the mitigation targets outlined in climate change planning documents, acknowledging the necessity to shift consumers from kerosene use to efficient renewable energy solutions such as LPG, natural gas, and electricity. It points out that biomass, positioned at the lower end of the energy hierarchy, meets 60% of Kenya's cooking energy needs. A key aim of the policy is to promote the transition to cookstoves powered by modern and clean fuels in households and institutions.

The policy establishes a framework for connecting electricity generated from solar energy to both national and isolated grids, a critical component for electric cooking. It stipulates that the national government will devise and execute a National Electrification Strategy to expedite connections with a goal of universal electricity access by 2020. The formulation of the *Kenya National Electrification Strategy (KNES)* marks a significant stride towards this aim. This strategy outlines the obstacles to achieving universal access in Kenya. Its main objective is to ensure all households and businesses in Kenya have access to electricity as quickly as possible and at a suitable quality of service. It identifies the most cost-effective and efficient solutions for electrification coverage considering available supply options and energy service demand. These options include grid intensification and densification, grid expansion, and off-grid supply solutions (mini-grids and standalone systems). For Solar Energy utilisation, it specifies that when grid extension and mini-grid service are not feasible, off-grid standalone energy systems such as solar photovoltaic systems will be implemented.

Gender Policy in Energy (2019)

The fundamental purpose of this policy is to facilitate the integration of gender perspectives within the establishments, policies, and programs of the Ministry of Education, County Governments, and relevant stakeholders. A notable goal within this policy is advocating for environmentally sustainable and clean cooking solutions. It recognizes and addresses gender disparities within clean cooking initiatives and programs promoting environmental sustainability, pledging to foster these areas. As part of its strategies to execute the policy, it pledges to evaluate the accessibility of electricity to households, as well as the degree of renewable solution adoption, particularly in rural and difficult-to-access areas.

National Bioenergy Strategy (2020-2027)

The National Bioenergy Strategy (2020-2027) outlines Kenya's current bioenergy status, envisions a desired future, and proposes a pathway to reach that future. It introduces strategic interventions and projected outcomes for the short term (2020-2022) and medium term (up to 2027) to encourage the sustainable production and consumption of bioenergy.

In terms of transitioning to clean cooking fuels and technologies, the strategy outlines various desired outcomes. These include considerations related to VAT, import duty, and other fiscal incentives for clean cooking solutions, increasing the number of households and institutions using improved biomass cookstoves and cleaner fuels like bioethanol. The strategy also seeks to document and address policy, regulatory, technical capacity, and financing gaps related to different types of bioenergy. Moreover, it aims to co-design financing options for clean cooking solutions with development partners and the private sector. The strategy also strives to enhance the capacity of the health and energy sectors for clean cooking. It expresses a commitment to achieving clean cooking targets, specifically 100% access to improved biomass cookstoves by 2028 and 100% access to modern bioenergy services by 2030.

Kenya Ethanol Cooking Fuel Masterplan (2021)

The 2021 Kenya Ethanol Cooking Fuel Master Plan is aimed at facilitating the establishment of an Ethanol Cooking Fuel (ECF) industry in the country. The master plan recognizes ECF as a viable, clean, and affordable alternative for cooking purposes. It comprehensively outlines the various sources of ethanol and offers recommendations to boost the demand for ethanol cooking fuel while supporting the growth of the domestic ethanol industry. The master plan is an outcome of the Mobilizing Investment project for implementing Nationally Determined Contributions and is spearheaded by the Climate and Development Knowledge Network (CDKN). It addresses key inquiries related to the development of a local bioethanol industry. Additionally, the masterplan works in conjunction with the Ministry of Energy and Petroleum (MOEP) to actualize components of the Bioenergy Strategy, while providing support to Kenya's Interministerial committee on clean cooking initiatives.

National Climate Change Action Plan 2018-2022

The National Climate Change Action Plan (NCCAP) for the period 2018-2022 was crafted as a successor to the NCCAP for 2013-2017. Its primary objective is to provide a framework for Kenya to achieve its 2015-2030 National Adaptation Plan (NAP) and

Nationally Determined Contribution (NDC) commitments under the Paris Agreement, which falls under the United Nations Framework Convention on Climate Change (UNFCCC). A significant focus of this plan is the promotion of clean cooking as a crucial climate initiative in the energy consumption sector. Outlined within the plan are a series of actions, expected results by June 2023, and results achieved as of June 2020. A key action relates to addressing deforestation and forest degradation through the development of alternative technologies, such as clean cooking, the use of briquettes, and sustainable charcoal production. As of June 2020, 1,494 improved cooking stoves had been supplied and installed in households and institutions. In addition, the plan aims to assess the health impacts of transitioning to clean cooking, and effectively reduce household deaths related to biomass energy use from 21,560 annually (49% of total deaths) to 20% (MOEF, 2018). To encourage the adoption of clean cooking, the plan advocates for the use of fiscal and tax policies and regulations. Additionally, the plan highlights the transition to clean cooking with alternative fuels like liquefied petroleum gas (LPG), ethanol, and other clean sources, not only in urban but also in rural areas. An important target is the scaling up of biogas technology, aiming to construct 6,500 digesters for domestic use and 600 biogas systems in schools and public facilities to enhance access to clean energy. Furthermore, included in these actions is expanding renewable energy for electricity generation in a manner that is climate resilient and accommodates the needs of rural areas. The plan also encompasses expanding the generation capacity for captive renewable energy and reinforcing both energy efficiency and conservation efforts.

SDG7 Energy Compact of Kenya on Clean Cooking Energy

Under the SDG7 Energy Compact, Kenya has committed to transforming all public institutions such as boarding schools, hospitals, TVET institutions, prisons, etc., from using biomass; Micro- Small and Medium-sized enterprises (MSMEs) within the cooking sector (including bakeries, restaurants, food kiosks, food processors) and the hospitality industry to clean cooking solutions. The plan also involves reviewing and/or developing policies and regulations that support the accelerated adoption and use of modern energy cooking services. Furthermore, Kenya aims to become a champion in accelerating the adoption and use of clean cooking solutions at the global, regional, and national levels.

Kenya's Least Cost Power Development Plan

Least Cost Power Development Plan (LCPDP) is a strategic framework established by the government that aims to meet the growing electricity demand while minimizing costs and maximizing the utilization of available energy resources. It provides a framework for institutional, technical, economic and financial design and for implementation of specific

programs. This plan is paramount to accelerating the adoption of clean cooking technologies such as e-cooking since power cost is one of the major barriers to universal electricity access and clean cooking in Kenya.

Feed-in Tariff Policy 2021

Kenya's Feed-In Tariff (FIT) 2021 policy primarily focuses on accelerating the adoption of renewable energy technologies for electricity generation, rather than specifically targeting clean cooking adoption. However, it indirectly contributes to clean cooking adoption by promoting the use of renewable energy sources, which can be harnessed for cooking purposes as well. This policy aims at increasing electricity access through incentivization of RE projects to reach the underserved communities in Kenya, hence reducing overreliance on solid fuels as the only means of cooking. It also emphasizes more on the integration of clean cooking solutions with energy access. Through its promotion of renewable energy uptake, it has largely contributed to raising awareness of the environmental and health benefits of clean cooking to the target communities.

Kenya National Clean Cooking Strategy (KNCCS)

The Kenya National Clean Cooking Strategy (KNCCS) is an ongoing project that is currently in development. To create and manage the strategy, EED Advisory is the principal contractor working in partnership with MECS (Modern Energy Cooking Services) and the Ministry of Energy & Petroleum (MoEP).

The specific objectives of the KNCCS are:

- To establish the baseline of Kenya's clean cooking sector, including the identification of the key barriers and drivers that are likely to affect further uptake of clean cooking solutions.
- To assess gender dimensions in Kenya's clean cooking sector and make appropriate recommendations to facilitate gender mainstreaming in programme design, implementation, monitoring, evaluation, and reporting.
- To determine the most appropriate cooking energy mix to meet the 2028 goal of universal access to clean cooking.
- To develop a roadmap for achieving universal access to clean cooking by 2028 by identifying strategic interventions, setting timelines, estimating the cost, and deriving indicators for monitoring and evaluating its implementation.

Kenya has strong policies in place concerning both electricity access and clean cooking sectors. However, these two sectors are traditionally dealt with as separate issues, even though the clean cooking sector is significantly impacted by electricity access. The National Climate Change Action Plan (NCCAP) 2018-2022 and the Ministry of Energy's Gender Policy both address clean cooking and electrification but fall short of establishing a connection between them. To create a supportive environment for both sectors, the Ministry of Energy is currently formulating The Kenya National Electric Cooking Strategy (KNeCS) and The Kenya National Clean Cooking Strategy (KNCCS). The aim is to link these two sectors, thereby augmenting the adoption of clean cooking in Kenya. It is expected that these Strategies will contribute significantly to the comprehensive National Clean Cooking Strategy 2022-2028.

2.1.1.2 Regulatory and Government Agencies and Bodies

The unique aspect of Kenya's cooking sector is that its responsibilities are distributed among several different ministries. These include the Ministry of Environment and Forestry (which encompasses the Climate Change Directorate), the Ministry of Energy & Petroleum, and the Ministry of Health. The below table is a summary of the regulatory bodies and government agencies in the energy and clean cooking sector.

Regulatory Bodies Responsible for Overseeing the Energy Sector and Clean Cooking Initiatives	
Ministry of Energy and Petroleum (MoEP)	It is responsible for the formulation and articulation of energy policies through which it provides an enabling environment for all stakeholders. Its tasks include national energy planning, training of manpower and mobilization of financial resources. *Significance within the Energy Sector and Clean Cooking Initiatives.* *The Ministry is dedicated to enhancing collaborations with the Ministries of Health, Environment and Forestry, Industrialization, and Agriculture, as well as the National Treasury and Planning to deliver on Universal Access to Modern Energy Cooking Services to Kenyans by 2028. MoEP is leading the development of the Kenya*

	National Clean Cooking Strategy (KNCCS) which will bring cohesion to the clean cooking sector and the Kenya National Electric Cooking Strategy (KNeCS), which will bring together the clean cooking and electricity access sectors. *The Kenya Off-grid Solar Access Project (KOSAP) is a flagship initiative of the Ministry of Energy & Petroleum designed to fill in the gaps around the Last Mile Connectivity Programme (LMCP). This $150 million project, financed by the World Bank, provides both Results-Based Financing (RBF) and debt facilities to encourage solar energy service companies, such as mini-grid developers and solar home system developers, to extend their infrastructure into underdeveloped areas. Additionally, KOSAP incorporates a clean cooking element valued at $6 million (SNV, 2020). Electric cooking appliances are already eligible for the KOSAP clean cooking RBF, but there are plans to more directly connect the more substantial electricity access aspect of KOSAP with its clean cooking element.*
Energy and Petroleum Regulatory Authority (EPRA)	The Energy and Petroleum Regulatory Authority (EPRA), formerly the Energy Regulatory Commission (ERC) is an independent regulatory authority established under the Energy Act, 2019 with responsibility for economic and technical regulation of electric power, renewable energy, and downstream petroleum sub-sectors. Its mandate consists of the enforcement and review of regulations and the management of electric power tariffs and tariff structures. It is also involved in matters related to the sale of petroleum and petroleum products, including paraffin and LPG. *Significance within the Energy Sector and Clean Cooking Initiatives* *EPRA has recently announced a significant increase in electricity prices effective from April 1, 2023. The new tariffs will see consumers using 30 units and below pay KES 12 per unit, up from KES 10, while those using eleven and ten units will pay KES 15.80*

	per unit. This increase in electricity prices is viewed as a hindrance to the promotion and widespread adoption of electric cooking. *Cooking gas prices have reached a two-year low due to tax relief measures. This decrease is a result of new tax provisions stipulated in the Finance Act of 2023, which involved the removal of certain taxes. These measures aim to make Liquefied Petroleum Gas (LPG) more affordable for consumers.*
The Kenya Bureau of Standards (KEBS)	The government agency is responsible for the development of standards, metrology, conformity assessment, training, and certification services. *Significance within the Energy Sector and Clean Cooking Initiatives* In relation to clean cooking, *KEBS provides standards for improved biomass cook stoves for both domestic and institutional use.* *Kenya, through the Kenya Bureau of Standards (KEBS), has adopted ISO 19867-1:2018, which pertains to clean cookstoves and clean cooking solutions, featuring harmonized laboratory test protocols for emissions, performance, safety, and durability. At a national level, KEBS has also formulated additional standards for the clean cooking sector, which are vital for boosting the credibility, safety, and reliability of clean cooking solutions available in the country. These standards include:* • *KS – ISO 17225: Solid biofuels — Fuel specifications and classes* • *KS -1814:2019: Biomass Cookstoves Performance requirements* • *KS – 2759:2018: Ethanol Fuelled cooking Appliances* • *KS 2838: 2019: Denatured technical alcohol for use as cooking and appliance fuel — Specification* • *KS – 2912:2020: Solid biofuel —Sustainable Charcoal and carbonized briquettes* • *KS 2951:2022: Biogas Systems- Code of Practice for farm and industrial scale biogas systems*

	• *E- Cooking Standards – GlobSl LEAP Electric Pressure Cooker Test Method, and others.*
Role of Government Agencies in Promoting Renewable Energy Technologies and Clean Cooking Solutions	
Ministry of Environment, Climate Change and Forestry	It is mandated to undertake national environmental policy and management, forestry development policy and management, development of re-afforestation and agro-forestry, restoration of strategic water towers, protection and conservation of the natural environment, and pollution control. *Promotion of renewable energy technologies and clean cooking solutions.* In line with the promotion of the clean cooking initiative some of its key objectives include: *(a) to modernize and commercialize the charcoal value chain specifically the adoption of modern kilns (b) decriminalize the charcoal trade (c) support scaling up of clean cooking technologies (e) promote youth-owned and operated briquetting enterprises where agricultural waste is available in commercially viable quantities (coffee waste, rice husks, maize cobs, coconut husks).* (MINISTRY OF ENVIRONMENT, CLIMATE CHANGE & FORESTRY, 2023)
Clean Cooking Association of Kenya (CCAK)	Advocate for an enabling environment at both national and county levels to catalyze the growth of the clean cooking sector and promote the adoption of clean cooking technologies, capacity building of the sector, and sector coordination. *Promotion of renewable energy technologies and clean cooking solutions.* *The CCAK mission is to facilitate increased innovations in the design, testing, production, marketing & and use of clean cookstoves and fuels through better government policies*

	increased public awareness and capacity building. Some of the clean cooking initiatives include: ○ *Encourage the adoption of clean cooking technologies and solutions such as:* - *Biogas/Bioethanol* - *Improved cook-stoves* - *LPG* - *Electric Cooking* - *Solar cookers* - *Briquetting & improved charcoaling* ○ *Environment Advocacy* ○ *Research and Development in clean cooking sector* ○ *Capacity building & training* *The main target groups include: the rural poor, women groups & small scale farmers.* *Recently, CCAK partnered with the Kilifi County Government, Mama Doing Good, and the Rural Electrification & Renewable Energy Corporation to conduct a three-day workshop on enhanced cook stove methods at the Mtwapa Energy Center in Kilifi County. The session sought to enhance skills among various county groups in the production of advanced cook stoves. Participants were introduced to the renewable energy solutions available at the institution, ensured workshop safety, and guided on ICS fabrication. This initiative is a part of the Voices for Just Climate Action (VCA) project, sponsored by WWF.* *In 2022, CCAK partnered with African Center for Technology Studies (ACTS), KPLC in launching e-cooking hubs in both Nakuru and Kitui Counties.*
Kenya Power and Lighting Company Limited (KPLC)	KPLC is a State Corporation with a GoK shareholding of 50.1% and a private shareholding of 49.9% as of June 2014. It purchases electrical energy in bulk from KenGen and other power producers and undertakes distribution, supply and retail of electric power.

	Promotion of renewable energy technologies and clean cooking solutions. *KPLC's **Pika na Power** programme has aided in raising awareness and creating opportunities for e-Cooking appliance retailers to demonstrate and sell their products to KPLC's 7 million customers.*
Kenya Electricity Generating Company Limited (KenGen)	KenGen is a State Corporation with the GoK 70% and a private shareholding of 30% as at June 2014. It is mandated to generate electric power, currently producing the bulk of electricity consumed in the country. The company currently utilises various sources including hydro, geothermal, thermal and wind to generate electricity. *Promotion of renewable energy technologies and clean cooking solutions.* *The majority of Kenya's grid electricity is generated from renewable sources, with hydro and geothermal the most significant sources. This is an opportunity to catalyze the clean energy transition through electrification.*
Rural Electrification and Renewable Energy Corporation (REREC)	REREC was established under section 43 of the Energy Act of 2019 as a successor of the Rural Electrification Authority (REA) with an expanded mandate of Kenya's green energy drive, in addition to implementing rural electrification projects. *Promotion of renewable energy technologies and clean cooking solutions.* *As part of its mission to promote broader and diverse access to electricity for households and institutions, REREC is collaborating with KPLC on various initiatives, including the KOSAP project. The components of this project, which are being implemented jointly, include the development of Mini Grids for community facilities, enterprises, and households, using a Public-Private Partnership (PPP) model. In addition, the project encompasses the deployment*

	of Standalone Solar Systems and Solar Water Pumps for community facilities. *REREC has however implemented various rural electrification projects in the past including solar mini-grids, The 50 MW Garissa Solar Power Plant,* the *Electrification of Public Primary Schools, installation of Solar PV Systems in institutions (primary, and secondary schools and health facilities), Hybridising diesel power stations with solar.* *REREC recently took over the management of 16 Energy Centers in the country. The centers offer programs on renewable energy, technology demonstrations, and training covering a range of technologies such as solar PV & and water heating systems, biogas, improved cook stoves, improved-efficiency charcoal and cook stove kilns, wind and energy efficient devices (fireless cookers). The centers also offer technical assistance and training to prospective individuals and groups.*
Kenya Electricity Transmission Company Limited (KETRACO)	This is a GoK (Government of Kenya) wholly-owned company established to be responsible for the development, maintenance, and operation of the national transmission grid network. It is also responsible for facilitating regional power trade through its transmission network. *Promotion of renewable energy technologies and clean cooking solutions.* *KETRACO recently announced the installation of a more stable and reliable power supply in Kitui County and its sub-counties. Alternatively, households could use battery-supported electric cooking devices, both grid-connected and solar for off-grid* (Modern Energy Cooking Services (MECS)).
Kenya Forest Service (KFS)	KFS's mandate is to enhance the development, conservation, and management of Kenya's forest resources based in all public forests and assist County Governments to develop and manage forest

	resources on community and private lands for the equitable benefit of present and future generations. *Promotion of renewable energy technologies and clean cooking solutions.* *In Kenya, Charcoal producers and transporters must be licensed by the Kenya Forest Service (KFS); commercial charcoal producers must organize themselves into Charcoal Producers Associations (CPAs); and charcoal wholesalers or retailers should not trade with unlicensed producers.*

Table 2:1 Summary of Kenya's Regulatory Bodieies

2.1.2 Legislative and Regulatory Review:

Kenya has developed and is still developing various regulations and laws at both national and county levels to address energy and renewable energy issues. These reforms aim to improve the sustainability of the national economy and reduce GHG emissions. They also support Kenya's implementation of the Paris Agreement and the achievement of the first Nationally Determined Contribution (NDC), which outlines the country's climate targets.

Table 2 below presents a summary of the relevant national regulations in Kenya related to energy and renewable energy, particularly those related to clean cooking, e-cooking, and solar energy utilization.

Category	National framework	Overview
	The Constitution of Kenya	The Kenyan Constitution of 2010 provided for the establishment of autonomous County Governments (sub-national governments) within different contexts, entities that are closer to energy resources and consumers. The potential role of county governments is creating strategic linkages between people and the resources; facilitating actual implementation of new clean energy techniques such as e-cooking. Article 42 of the constitution grants every individual the right to a clean and healthy environment, thus establishing a legal frame for clean energy taking into account, for instance, the destruction of forests for fuel wood. (Techno-policy spaces for e-cooking in Kenya)
	Kenya Vision 2030 (issued by the Government of Kenya)	The Government of Kenya (GOK) affirms clean cooking as an important and priority component of its development agenda. In light of this affirmation, and recognition of other existing global and local commitments such as SDGs, the GoK commits to Accelerate Actions in Clean cooking targeting to achieve Universal Access to Modern Energy Cooking Services by 2028. To achieve this commitment, the Government of Kenya will take a multi-pronged approach that focuses on four key aspects of the current cooking sector value chain. These aspects include fostering a conducive enabling environment, strengthening the sector supply chain stimulating demand for clean cooking solutions as well and addressing pertinent cross-cutting challenges. (SDG7 Energy Compact of Kenya on Clean Cooking Energy)

	Big Four Agenda	The aim of the 'Big Four' Agenda is to make Kenya a globally competitive and prosperous country with a high-quality life for all Kenyans by 2030. The Agenda establishes four priority areas, which are Ensuring Food and Nutrition Security, Affordable Housing, Enhanced Manufacturing, and Universal Health Coverage. The Ministry of Energy has identified strategic initiatives for the Big Four Agenda. The initiatives focus on the realization of improved energy access, energy efficiency, and conservation.
	Climate Change Act	This document is the national legislation that sets a response framework to climate change and provides mechanisms and measures to achieve low-carbon and climate-resilient development. This Act shall be applied for the development, management, implementation, and regulation of mechanisms to enhance climate change resilience and low carbon development for the sustainable development of Kenya. This Act shall be applied in all sectors of the economy by the national and county governments to; • Provide incentives and obligations for private sector contribution in achieving low carbon climate resilient development • Promote low-carbon technologies, improve efficiency, and reduce emissions intensity by facilitating approaches and uptake of technologies that support a low carbon, and climate-resilient development. • Provide mechanisms for, and facilitate climate change research and development, training, and capacity building. • Integrate climate change into the exercise of power and functions of all levels of governance, and enhance cooperative climate change governance

		between the national government and county governments.
	Sessional Paper No. 4 on Energy (issued by the Ministry of Energy and Petroleum)	The Sessional Paper on Energy No.4 calls for the creation of fiscal and regulatory frameworks to provide enabling conditions for the country's technological growth and usage. This allows many technologies and accountable players to enter the opportunity areas provided by increasing electricity connection. While the law encourages alternative clean cooking technologies, the greater electricity connection allows for a transition from conventional and resource-intensive cooking choices such as biomass to contemporary ones such as e-cooking. (Techno-policy spaces for e-cooking in Kenya).
	The Energy Act (issued by Parliament)	The major guiding piece of legislation for renewable energy in Kenya is the Energy Act of 2019. This Act of Parliament repealed the Energy Act, of 2006, the Kenya Nuclear Electricity Board Order No.131 of 2012 (Order), and the Geothermal Resources Act. This Act amalgamated energy-related legislation, established energy sector organizations, provided for national and local government energy functions, encouraged the use of renewable energy sources, particularly geothermal energy, and consumer protection, and regulated midstream and downstream coal, power, and petroleum operations. The 2019 Energy Act established the Rural Electrification and Renewable Energy Corporation. The Corporation among other things is mandated to develop, promote, and manage in collaboration with other agencies, the use of renewable energy and technologies, including but not limited to biomass (Biodiesel, bio-ethanol, charcoal, fuel-wood, biogas) municipal waste, solar, wind, tidal waves, small hydropower, and co-generation but excluding

		Geothermal. The Energy Act (2019) also established the Energy and Petroleum Regulatory Authority (EPRA). With EPRA operating as the principal regulatory entity, it assumed an essential role in supervising and licensing energy-related activities, particularly within the domains of energy generation, distribution, and supply. Regarding the cooking sector, The Energy Act 2019 specifies policies and strategies for renewable energy sources which include: taking the necessary steps to transition the country from the use of kerosene, firewood and charcoal to environmentally friendly fuels such as LPG; promoting efficient conversion and cleaner utilization of biomass energy; promote use of briquettes as an alternative to wood fuels; provide incentives for biofuel production projects and consumption and implement a bioethanol pilot project; promote the use of biogas an alternative to wood fuel and kerosene for both domestic and commercial use and development of a clean cooking fund.
	Energy (Appliances' Energy Performance and Labelling) Regulations (issued by the Ministry of Energy and Petroleum)	The Regulations require that specified appliances manufactured or imported in Kenya be tested for energy performance in an accredited laboratory, get registered with the regulator, and be affixed with the appropriate Energy Star label. (Government of Kenya, 2016)
	Energy (Energy Management) Regulations (issued by the Energy	THE ENERGY (ENERGY MANAGEMENT) REGULATIONS, 2012 regulate the owners of industrial, commercial, and institutional facilities using any form of energy like manufacturing of e-cooking appliances. It states that the owner or occupier shall

	Regulatory Commission)	develop an energy management policy for the facility, conduct an energy audit of the facility through a licensed energy auditor at least once every three years, and ensure at least fifty percent of the recommended energy savings specified in the energy investment plan by the end of three years. (Government of Kenya, 2012)
	Performance Standards for Cooking stoves	In 2019, new Performance Standards for cook stoves were gazette and CCAK was to develop a voluntary star labeling scheme for cookstoves on sale based on these standards. Some standards include; KS ISO 19867-1:2018-standard test sequence for emissions and performance, safety and durability; ISO 19869:2019-Provide quantitative and qualitative measurements of cooking system performance. Requirements and guidance are provided for evaluation of usage, usability, fuel consumption, energy consumption, power, emissions, safety, and durability; ISO/TR21276:2018- Establishes a precise vocabulary for cookstove technology and testing.
	Energy (Solar Photovoltaic Systems) Regulations	These laws control the setup, use, and upkeep of solar photovoltaic (PV) systems in Kenya, including solar-powered kitchen appliances. The regulations are designed to safeguard the performance, quality, and safety of solar PV systems as well as the rights and interests of both customers and service providers. According to the regulations, all solar PV systems and their individual parts must be approved by the Energy and Petroleum Regulatory Authority (EPRA) and certified by the Kenya Bureau of Standards (KEBS) or another recognized organisation. Incentives including tax breaks, duty waivers, and feed-in tariffs for solar PV installations are also included in the legislation.

	The Environmental Management and Co-ordination Act	This is an act that provides for the establishment of an appropriate legal and institutional framework for the management of the environment in Kenya. The act covers various aspects of environmental protection and conservation, such as environmental impact assessment, environmental audit, environmental standards, environmental education, public participation, etc. The act also provides for incentives for environmental management, such as tax relief, subsidies, grants, awards.

Table 2:2 Summary of the relevant national regulations in Kenya

Some of the legal barriers or incentives that may affect the adoption of solar-powered cooking appliances include;

1. The 2016 Forest Conservation and Management Act: With the unsustainable use of biomass fuels for cooking, Kenya's forests and biodiversity are threatened and are the target of this law's protection and conservation efforts. Millions of people rely on charcoal as a source of income and fuel, therefore the act's prohibition on its production, transit, and sale without a licence may have an impact on their way of life. Additionally, the legislation offers incentives for community involvement in the sustainable utilisation of wood & non wood forest products, rewards for ecosystem services, and carbon credits in order to encourage the protection and restoration of forests. These incentives may open up possibilities for promoting solar-powered cooking equipment as a means to lessen the strain on forests and increase the advantages of forests.
2. The 2019 Energy (Solar Photovoltaic Systems) Regulations: These regulations may create both barriers and incentives for the adoption of solar-powered cooking appliances in Kenya. On one hand, they may increase the cost and complexity of installing and operating solar-powered cooking appliances, as they require compliance with certain standards and procedures. On the other hand, they may also increase the confidence and trust of consumers and investors in solar-powered cooking appliances, as they ensure their quality and reliability.
3. The Environmental Management and Coordination Act, 1999: Solar-powered cooking equipment can profit from this legislation since they can lessen the environmental implications of cooking with biomass fuels, such as deforestation, land degradation, air pollution, and greenhouse gas emissions. The legislation may also stimulate the use of solar-powered cooking equipment by requiring environmental impact assessments and audits for projects involving the production or consumption of biomass fuel.

The private sector, however, faces difficulties and uncertainty as a result of some of these laws and rules incomplete implementation or enforcement. For instance, the Energy Act (2019) created the Clean Cooking Fund, but it is not yet operating. The fund is supposed to give financial assistance for clean cooking efforts. By 2025, public institutions must implement clean cooking technologies under the Energy Management Regulations (2012), although there is no specified procedure or financial reward for doing so. The creation of a national climate change action plan is required by the Climate Change Act (2016), although the plan does not specifically address difficulties with clean cooking.

Furthermore, some of the current laws and rules could harm the private sector in ways that weren't intended. For instance, In June 2022, the government introduced a 15 per cent subsidy to reduce the cost of power. However, with the removal of the subsidy and the introduction of new tariffs in April 2023, the price of power bills has increased by 77 per cent (KIPPRA, 2023). This is a substantial barrier to the promotion and adoption of clean cooking, particularly e-cooking, which relies on electric stoves and appliances. Elevated tariffs mean that even if households have access to the electrical grid, using electric stoves or induction cooktops can become prohibitively expensive compared to traditional cooking methods like wood or charcoal fires.

Millions of people rely on charcoal as a source of income and fuel, therefore the Forest Conservation and Management Act 2016's prohibition on its manufacture, transit, and sale without a license may have an impact on their way of life.

2.1.3 Clean Cooking and e-Cooking Initiatives and Incentives

Kenya has several clean cooking/e-cooking initiatives aimed at promoting sustainable and environmentally friendly cooking solutions (in line with SDGs). Some of these initiatives include:

Mwananchi Gas Project: This was a government initiative aimed at providing affordable and clean cooking gas to low-income households in Kenya. It involved the distribution of LPG (liquefied petroleum gas) cylinders to communities that previously relied on traditional biomass fuels like charcoal and firewood (National Oil Corporation of Kenya, 2016). Key objectives of the project were to reduce respiratory diseases and mortality rates that are associated with household air pollution caused by the sustained use of firewood and charcoal and to reduce deforestation. The project however faced several challenges including a supply of defective cylinders, a lack of technical support, and a policy for recognition and accounting for the collected revenue. In 2022, the auditor general raised concerns about the possibility of achieving the project’s objectives and its overall sustainability and it was reported that the country incurred huge losses (Parliament of Kenya, 2023).

Pika na Power: An initiative of the Kenya Power & Lighting Company (KPLC), to create awareness and promote the use of electric cooking appliances to replace traditional biomass cook stoves. With this, KPLC aimed at demonstrating how efficient, clean, and affordable cooking with electricity is thus reducing indoor air pollution and improving energy efficiency (Modern Energy Cooking Services, 2023).

PayGo Cylinder Smart Metering: PayGo Energy's introduction of smart meters for LPG cylinders enabled users to monitor their gas consumption, promoting efficiency and preventing unnecessary waste (PayGo Energy, 2023). Since it allows for a pay-as-you-go mode of payment; whereby the consumer pays in small amounts, it is thought to be favourable in cases where consumers cannot afford to make high payments at once.

V4CP (Voice for Change Partnership): V4CP advocates for increased adoption of clean fuels by influencing policies and practices related to clean cooking technologies in Kenya and other countries. By working with Civil society organizations (CSOs), it aims to create an enabling environment for the adoption of cleaner cooking solutions (Multi Stakeholders Platform on Climate Smart Agriculture, 2020).

KNBP (Kenya National Biogas Program): The KNBP promotes the use of biogas technology for cooking and other household energy needs. Biogas is a renewable energy source produced from organic waste, providing a sustainable alternative to traditional fuels (Kenya Biogas Program, 2023).

SNV's Improved Cook Stoves (ICS) Kenya: SNV is a Dutch non-profit international development organization that works to improve the lives of people in developing countries. It has been actively involved in promoting clean cookstoves in various countries, including Kenya. This is done through multiple approaches, including market development, awareness, behaviour change, policy support, and collaboration with government agencies and other stakeholders to advocate for policies that support the adoption and use of clean cookstoves monitoring and evaluation to assess the effectiveness and impact of their clean cookstoves initiatives. This helps to identify successes, challenges, and areas for improvement (SNV, 2023).

Envirofit Kenya: Envirofit is a social enterprise that produces clean cookstoves and biomass cookstoves. These cookstoves are designed to be more fuel-efficient and produce fewer harmful emissions compared to traditional cooking methods. Envirofit has been working in Kenya to distribute these stoves to households and communities (Envirofit, 2023).

Burn Manufacturing: Burn Manufacturing is a Kenyan-based social enterprise that produces clean cookstoves. Their Jikokoa stove, for example, is designed to be affordable, efficient, and reduce indoor air pollution. Burn Manufacturing works to make clean cooking solutions accessible to low-income households in Kenya. (Burn Stoves, 2022)

Solar Sister: Solar Sister is an NGO that focuses on women's empowerment and clean energy access. They support female entrepreneurs, known as "Solar Sister entrepreneurs,"

to distribute clean energy products, including clean cookstoves, in rural areas of Kenya. (Solar Sister, 2018).

The Clean Cooking Alliance (CCA): Although not directly operating in Kenya, CCA is a global initiative that supports clean cooking efforts in various countries, including Kenya. They collaborate with local partners and stakeholders to promote clean cooking technologies and foster market development for clean cookstoves. Their initiatives include the Pay-as-You-Go system that has allowed households to access clean cooking technologies, like improved cookstoves and solar-powered appliances, through flexible payment plans. This approach, although there have been concerns about its being exploitative since the final cost the consumer pays is way high, has helped overcome the financial barriers to adopting cleaner cooking solutions. (Clean Cooking Alliance, 2023).

Safe Access to Fuel and Energy (SAFE) Project: Part of the World Food Programme (WFP) project in Kenya, the SAFE initiative is aimed at addressing the energy needs of vulnerable communities, especially those affected by food crises and emergencies. It aims to reduce reliance on traditional fuels and improve the health and well-being of refugee communities. (OSZIR, 2019)

SEforALL: Kenya joined the SEforALL program and started creating a Rapid Assessment. This was followed by a lengthy and inclusive process that produced the Action Agenda and the Investment Prospectus, which were backed by the SEforALL Africa Hub and finished in late 2015. The Africa Carbon Markets Initiative, which will assist Kenya in developing and marketing carbon credits to support sustainable energy and climate change mitigation and adaptation projects, is one of the initiatives that the country has participated in with SEforALL (Sustainable Energy for All, 2023).

KOSAP: Through the use of off-grid solar solutions, the Kenya Off-Grid Solar Access Project (KOSAP) aims to increase access to power in rural and underserved areas. In remote areas where grid extension is not practical or cost-effective, KOSAP, which is financed by the World Bank, aims to offer clean, sustainable, and inexpensive energy to homes, businesses, and community facilities. The project supports the development of solar panels, mini-grids, and other off-grid technology, which will boost the neighborhood's economic, educational, and healthcare potential. (REREC, 2020). The initiative is promoting the productive use of solar energy for income-generating activities such as small-scale businesses and agri-processing.

Global LEAP Off-Grid Appliance Awards: The Global Lighting and Energy Access Partnership (Global LEAP) hosts competitions to identify and promote energy-efficient appliances suitable for off-grid use. These competitions include e-cooking solutions like

electric pressure cookers and induction stoves. Winners of these awards often find their products being adopted in Kenya and other African countries.

SunTransfer: SunTransfer, a social enterprise operating in Kenya, provides solar-powered systems for both household and productive use. They offer solar home systems, solar water heaters, and solar-powered water pumps; supporting SMEs and helping farmers irrigate their fields and improve their agricultural productivity.

Husk Power Systems: Husk Power Systems, an organization initially founded in India, expanded its operations to Kenya. They provide mini-grid solutions powered by solar and biomass, catering to rural communities. The electricity generated is not only used for lighting but also for powering small businesses and e-cooking appliances.

Solar-Powered Cold Storage Facilities: Various organisations like Solar Freeze, and SokoFresh in Kenya have set up solar-powered cold storage facilities in rural areas. These facilities allow farmers to store and preserve their produce, reducing post-harvest losses and increasing income.

Solar Lantern Distribution: Several initiatives, including those by non-profit organizations like the United Nations Population Fund (UNFPA) distribute solar lanterns to rural communities in Kenya. These lanterns provide clean and reliable lighting, making it easier for children to study at night and for businesses to operate after dark.

2.1.3.2 Policies and Incentives to Promote Clean Cooking/E-Cooking

The following incentives and financial assistance programs could encourage the use of solar-powered cooking appliances in Kenya and other cooking technologies (Karanja, Mburu, & Gasparatos, 2019):

1. **Subsidies and Tax Incentives**: To lower the upfront cost of purchasing solar-powered kitchen appliances, the Kenyan government may grant subsidies or tax breaks. By taking these steps, consumers may be able to buy solar cookers and be encouraged to switch from conventional to healthier cooking techniques.

2. **Loan facilities by finance and micro-finance institutions**: Consumers may be able to get money for solar-powered kitchen appliances by setting up microfinance options or soft loan schemes. Low-income households will find it simpler to embrace the technology because they will be able to pay for the equipment in instalments. (Shifting Paradigms, 2015)

3. Government grants and rebates: Giving grants or rebates to families or communities who buy them can help accelerate adoption. Potential consumers' financial burdens can be greatly reduced by these financial incentives, which can also increase interest in renewable cooking options.

4. Bulk Purchase and Group Discounts: Negotiating bulk purchase agreements with manufacturers and offering group discounts to communities or cooperatives can bring down the cost of solar cookers, making them more accessible to a larger audience.

5. Research and Development Support: Investing in research and development for solar-powered cooking technologies can drive innovation and lead to more efficient and affordable appliances, encouraging wider adoption.

6. Variable electricity tariffs: These can be used to encourage the use of electricity for cooking by allowing variable electricity tariffs according to the hour of use, and setting preferential tariffs around meal hours. (Nyaga et al., 2021).

By combining these incentives and financial support mechanisms, Kenya can take significant steps toward promoting the adoption of solar-powered cooking appliances, reducing reliance on traditional cooking fuels, and contributing to a more sustainable future.

2.1.4 Barriers and Opportunities

2.1.4.2 Barriers

1. Affordability and accessibility

One of the primary barriers to the adoption of e-cooking and solar energy technologies in Kenya is affordability. Many households, especially in rural areas and low-income urban settlements, may find the initial cost of purchasing electric cooking appliances or installing solar systems & related technologies prohibitive. While e-cooking is considered a long-term cost-saving measure due to the reduced dependence on fuels like charcoal or kerosene, the upfront investment remains a significant obstacle for many families.

The lack of accessible financing options for the procurement of solar panels or e-cooking appliances is a related barrier to the adoption of clean cookstoves in Kenya. Many Kenyan households lack access to affordable loans or credit facilities, thus rendering the acquisition of these technologies a tumultuous task. To overcome this challenge, the development of financial instruments tailored to the specific needs of low-income and middle-income households is essential.

2. Cultural Preferences and Habits

In Kenya, cultural diversity is reflected in the wide range of cooking practices deeply ingrained in tradition. Numerous communities have a strong preference for using solid fuels like firewood, charcoal, or animal dung, considering them integral to their cultural heritage. Encouraging individuals and communities to embrace modern e-cooking technologies could encounter resistance due to their deep attachment to these traditional practices and scepticism about the advantages of new cooking methods. Additionally, there exists a widely held perception that food prepared on three stones fire and charcoal has a distinct aroma and taste and thus may be favoured over electric cooking methods, presenting a potential obstacle to the widespread adoption of e-cooking technologies.

3. Technical Limitations and Infrastructure

Lack of access to reliable electricity and inadequate infrastructure are substantial barriers to the widespread adoption of e-cooking and solar energy in Kenya, particularly in rural areas. Many regions still lack access to the national grid, making it challenging to power electric cooking appliances. Similarly, unreliable electricity supply and frequent power outages can hinder the efficient use of e-cooking technologies. Moreover, in areas with limited solar exposure or shading issues, the effectiveness of solar energy systems may be compromised. A lack of local expertise for repair of electric cooking appliances in various areas also hinders their adoption.

Ensuring the long-term functionality of solar systems and e-cooking appliances can also be challenging due to the unavailability of spare parts and maintenance services.

4. Limited Awareness and Education

Low awareness and limited knowledge about the benefits and availability of e-cooking and solar energy technologies can also act as barriers. Many people may not be aware of the existence of such solutions, their advantages, or the potential cost savings they offer in the long run.

5. Policy and Regulatory Framework

Inadequate policy and regulatory frameworks can pose challenges to the integration of e-cooking and solar energy technologies into the mainstream energy sector. Uncertainty about regulations, standards, and support mechanisms may deter investments in clean cooking solutions. Though the country has various policies, regulations and strategies to support clean cooking, there is a general lack of actionable steps to transition from policy

to action. Additionally, there is a lack of communication of these policies to the various stakeholders including the end users resulting in good policies held at the high levels.

6. Intermittent Energy Supply

Solar power generation is intermittent, and Kenya experiences seasonal variations in solar radiation, leading to unreliable energy supply, especially during cloudy or rainy periods.

2.1.4.3 Opportunities and potential strategies to overcome these barriers and accelerate the adoption of clean cooking and solar energy technologies

1. Financial Incentives and Support

Implement subsidies programs or tax incentives to reduce the upfront costs of e-cooking appliances and solar energy systems. This can make these technologies more affordable and attractive to a wider range of households.

Establish microfinance schemes or low-interest loans to facilitate access to financing for clean cooking and solar energy projects, particularly in rural areas where affordability is a significant barrier.

Exploring public-private partnerships, partnering with development partners to increase access to financing and assist the consumers to transition to clean cooking by offsetting the high initial costs of these appliances.

2. Public Awareness and Education

Launch comprehensive public awareness campaigns to educate communities on the benefits of clean cooking and solar energy. These campaigns should focus on health advantages, reduced environmental impact, potential time & cost savings and any other economic benefits, and improved energy access, especially in rural areas.

Collaborate with local leaders, community-based organizations, and learning institutions to educate the public on the range of clean cooking technologies, the technical aspects of using and maintaining them and promote behavior change towards adopting cleaner energy solutions.

Involvement of local communities in planning, design and implementation of projects.

3. Capacity Building and Training

Provide training programs for local technicians and entrepreneurs to enhance their skills in installations, maintenance and repair of e-cooking appliances and solar energy systems. This can boost confidence in the technologies' reliability and encourage its adoption.

Establishing service centers or partnerships with local businesses to provide maintenance and repair services and a robust supply chain for spare parts and components.

Empower women and youth with technical skills and knowledge related to clean cooking and solar energy, as they often play critical roles in household energy decisions.

4. Public-Private Partnerships

Foster collaboration between the government, private sector, and non-profit organizations to address technical limitations and infrastructure challenges. Joint efforts can lead to more efficient and effective solutions.

Leverage the expertise of the private sector to develop and distribute affordable, high-quality e-cooking appliances and solar energy products tailored to local needs. These organizations often have established networks and resources to reach remote and underserved communities.

5. Local Innovation and Research

Invest in research and development to explore innovative approaches to clean cooking and solar energy that align with Kenya's cultural practices and preferences.

Encourage local entrepreneurs and startups to develop innovative business models and technologies that can accelerate the adoption of clean cooking and solar energy.

6. Integration with Existing Programs

Integrate clean cooking and solar energy initiatives with existing government programs related to health, environment, and rural development; for example, incorporating solar cookers into school feeding programs. This can create synergies and increase the overall appeal and impact of these efforts.

Align clean cooking projects with gender empowerment programs to address the disproportionate burden of traditional cooking methods on women's health and time.

7. Demonstration Projects and Pilot Programs

Conduct demonstration projects and pilot programs in target communities to showcase the benefits of clean cooking and solar energy technologies firsthand. This can build trust and interest among potential adopters.

Collect data and feedback from pilot programs to inform future policy decisions and scale-up initiatives.

8. Advocacy and Policy Reform

Engage in advocacy efforts to prioritize clean cooking and solar energy on the national energy agenda. Advocate for supportive policies, regulations, and funding mechanisms to accelerate the transition to cleaner energy solutions.

Strengthen collaborations with relevant government ministries and agencies to ensure the integration of clean cooking and solar energy strategies in the national energy plan; streamline permitting processes and reduce bureaucratic hurdles.

9. Intermittent Energy Supply

A lot of effort is made in promoting the use of energy storage solutions such as batteries to store excess energy for use during the night and season when it is cloudy.

Combining solar with other renewable energy sources like wind or hydropower for more consistent power generation.

Educating users on managing energy consumption during low sunlight periods.

2.2 Rwanda

Energy sector in Rwanda is made up of three sub-sectors: electricity, biomass and petroleum. Each of these is then divided into focus areas. The structure is well elaborated in Figure **2** below.

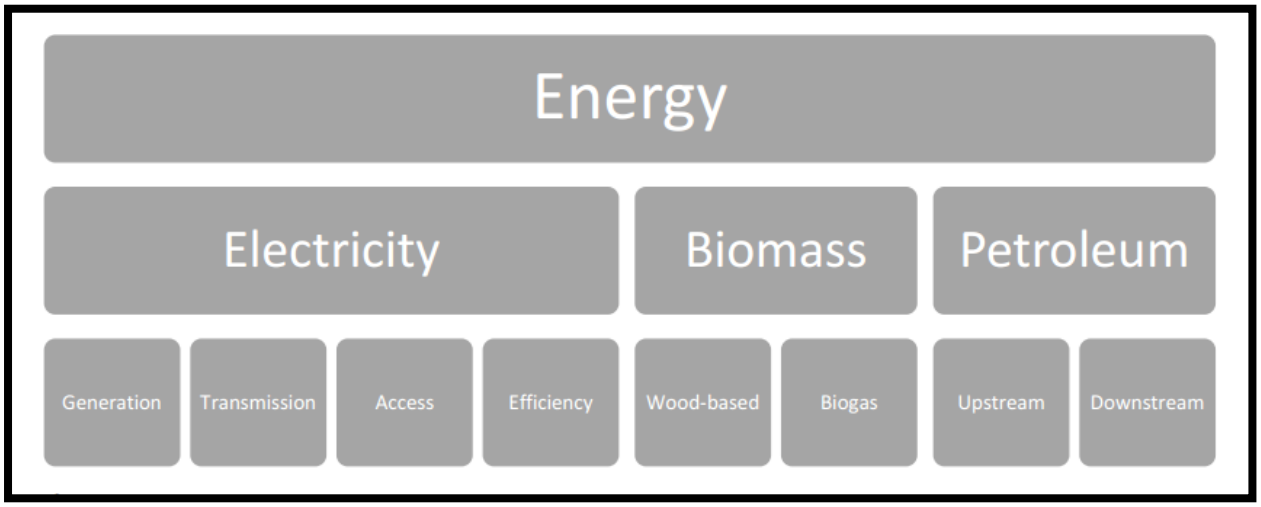


Figure 2:1 Shown Energy Sector Structure (MINIFRA, ENERGY SECTOR STRATEGIC PAN,2018)

Electricity is increasingly used and will drive Rwanda's growth, but currently it accounts for only 2% of all energy consumed, as shown in Figure 3. Electricity is generated from a range of technologies and resources and the grid is being developed to expand access. The rise of off-grid technologies in recent years has been a major innovation, and they are now a major contributor to expanding access. Efficiency across generation and transmission, as well as consumption, is increasingly important, with significant economic and environmental benefits possible.

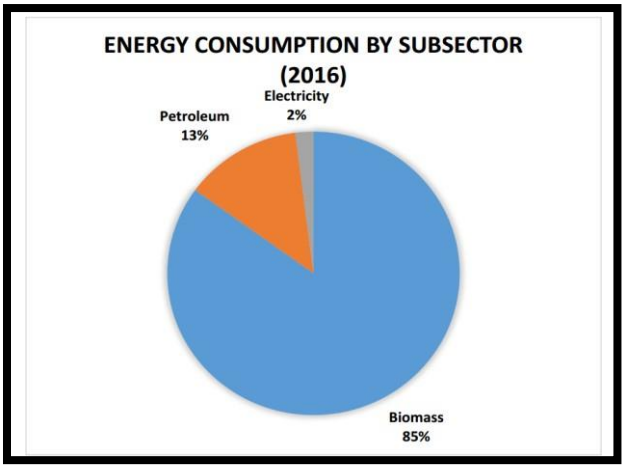


Figure 2:2 Energy Consumption in Rwanda (MINIFRA, ENERGY SECTOR STRATEGIC PLAN,2018)

In contrast, biomass accounts for 85% of all energy consumed. The subsector covers bioproducts. Bio-products are fuels developed from biological materials, split into those that are wood-based, such as wood and charcoal, and biogas, which is derived from waste matter. Biomass is largely consumed for cooking, with wood used by rural households and charcoal by urban households.

Petroleum focuses on the procurement and storage of petroleum and related products, such as diesel, kerosene, and Liquefied Petroleum gas [LPG] and natural gas. 13% of the country's total energy consumption is from petroleum. Petroleum is used in transport, electricity generation and, as LPG, in cooking. The use of LPG in cooking is expected to increase significantly as urban households switch from using firewood and charcoal. Households are the largest category of energy consumer, at 82%, with transport at 8%, industries at 6% and others at 4%. This is illustrated In Figure 4.

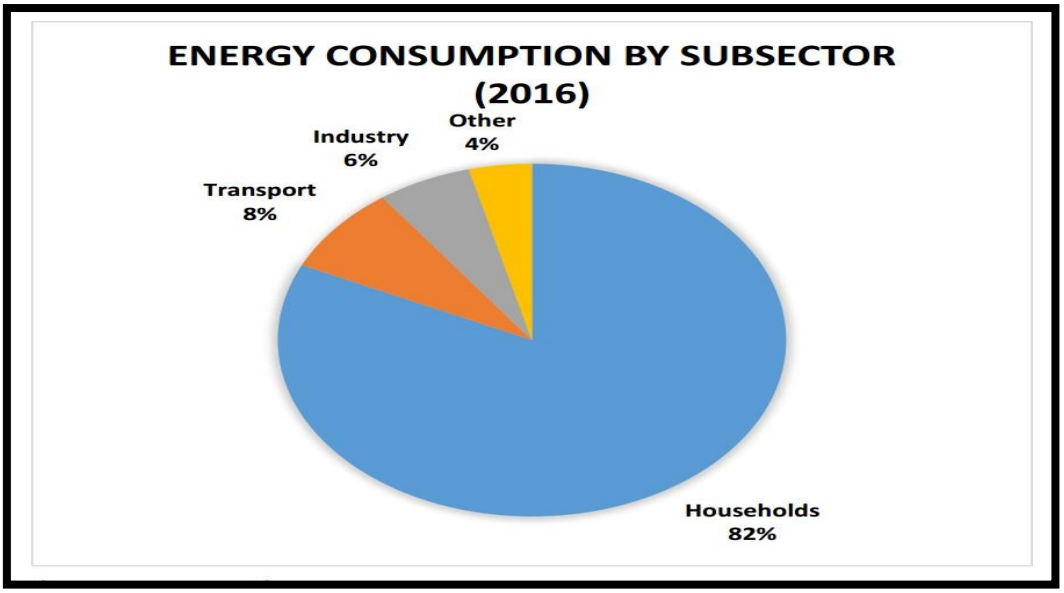


Figure 2:3 Energy Consumption by subsector

The Rwanda Energy Sector Strategic Plan 2018, shows electricity supply capacity of 218 MW and various projects in the pipeline to enable attainment of the National Strategy for Transformation (NST-1) targets. According to Rwanda Biomass Energy Strategy (BEST, 2019) the BAU will result in increased deficit of wood biomass amounting to 11 559 tonnes of wood equivalent (TWE) per annum, by 2030 which is associated by demand and supply of 12 119 TWE and 560 TWE per annum, respectively, by 2030 as shown in the table below. Total growth means supply for each of the respective years.

BAU scenario (2018-2030)			
	2018	2024	2030
Total Demand (1,000 tons/year)	-7,981	-9,861	-12,119
Total Growth (1,000 tons/year)	1,393	416	560
Balance	-6,587	-9,441	-11,559

Table 2:3 Balance of wood supply and demand in BAU scenario

An alternative scenario - the "BEST" scenario - which seeks to create a sustainable balance between the consumption and production of woody biomass, envisages a surplus of 1,576

TWE by 2030, based on supply and demand of 5,485 TWE per annum and 3,908 TWE per annum, respectively, by 2030 as shown in table 2.5 below.

BEST scenario (2018-2030)			
	2018	2024	2030
Total Demand (1,000 tons/year)	-7,175	-5,456	-3,908
Total Growth (1,000 tons/year)	2,374	3,296	5,484
Balance	-4,801	-2,159	1,575

Table 2:4 Balance of wood supply and demand in the BEST scnatio

Both supply-side and demand-side interventions are required to reach a sustainable balance between the production and consumption of biomass for energy as illustrated in Figure 5 below.

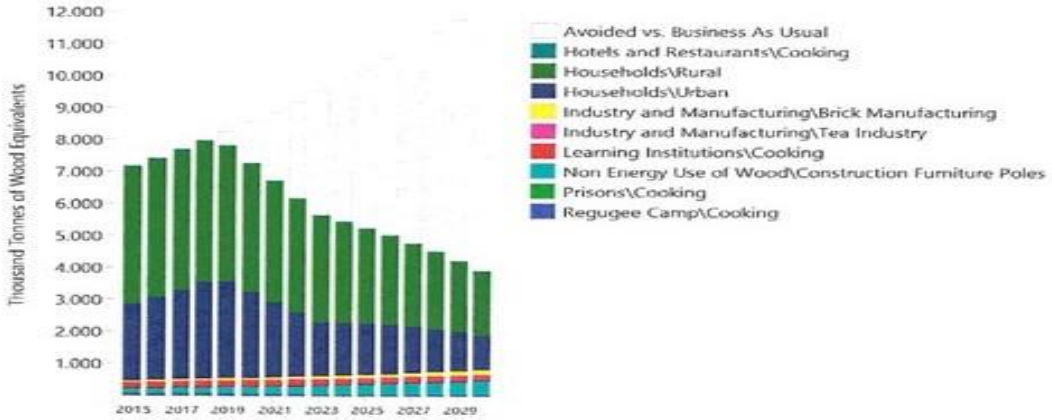


Figure 2:4 Demanda nd Supply-side uel balance

The greater impact to wood fuel rebalancing is achieved by reducing the projected demand: in fact, if all demand side solutions proposed are implemented, the total demand would decrease from 7,980,890 tonnes of wood in 2018 to 3,908,960 tonnes in 2030, i.e. A reduction of 51%.

2.2.1 Policy and Governance Analysis

Energy Sector Strategic Plan (ESSP) and other strategic documents clearly target to boost the use of clean energy for both domestic and industrial use. Rwanda heavily relies on traditional biomass for both domestic and agroindustry. Increase in demand for cooking fuel and industrial processing has exerted immense pressure on forest resources and the country aims to reach a potential net reduction in wood use to 5,770,000 tonnes by 2030 through a number of measures, including developing a modern and efficient charcoal value chain.

In addition, the Second Economic Development and Poverty Reduction Strategy (EDPRS II) targeted a reduction of biomass uses from 94% in 2009 to 50% in 2020 in national energy consumption. National Strategy for Transformation (NST1) targets to halve the number of households depending on firewood as a source of energy for cooking from 83.3% (2014) to 42% by 2024. This will be achieved by focusing on promoting use of alternative sources of energy such as biogas, biomass pellets /briquettes and use of improved cooking stoves and electric stoves. Furthermore, the targets to attain universal access to electricity have also been set. It's anticipated that 52 percent of households will be connected to the grid and 48 percent connected by off grid electricity by 2024.

Rwanda's total greenhouse gas emissions in 2018 were 7.82 million metric tons of carbon dioxide equivalent (MtCO2e) according to the World Resources Institute Climate Analysis Indicators Tool (WRI CAIT). The increasing costs of fossil fuels, degrading forestry resources, the threat of climate change, and the need to increase energy security and access have put alternative energy sources at the forefront.

According to Rwanda's Nationally Determined Contribution (NDCs), the country is committed to the Paris Agreement and has dedicated the resources required to achieve substantial emissions reductions. Like other countries, Rwanda has priorities and actions needed towards low carbon and climate resilience. The country's ongoing economic growth is therefore highly threatened by climate change and vulnerability to the impacts of climate change is high. Therefore, adaptation actions are very important. According to Third National Communication (TNC) the emissions reported is up to 2015, therefore this is a baseline year. With the exclusion of forestry, emissions level is at 5.33 million tCO2 e and agriculture contributes 55% while the energy sector accounts for 31% of the total.

The Third National Communication Report to the United Nations Framework Convention on Climate Change, 2018 describes national circumstances and institutional arrangements, national greenhouse gas inventory, national climate change mitigation assessment, vulnerability assessment and adaptation to climate change .

2.2.2 Legislative and Regulatory Review:

Rwanda has different policies targeting the energy sector in which clean cooking is embedded and treated in an integrated approach. The following are policy documents/regulatory framework and strategies that govern Rwanda energy sector.

1. **Energy policy**

Energy Policy provides high-level direction on the longer-term goals, priorities, and approaches needed in the sector. In this way, the energy policy directives support the development of harmonised implementation strategies and action plans that are clear, well-coordinated, and aligned to EDPRS-II. Closely linked to the policy, the laws and regulations of the sector act as a solid foundation upon which to base actions; these are principally concerned with the conduct,rights and operational constraints affecting the market-place and policy delivery

The policy was set to address the following critical sector challenges:

i. Energy security and a sound demand-supply balance;
ii. Dramatic increase in access to modern energy services;
iii. Improvement and streamlining of stakeholder coordination to ensure effective partnership and delivery on set targets;
iv. Need for a robust legal and regulatory framework required;
v. Necessity for an institutional, organisational, and human capacity development;
vi. Inadequate infrastructure requiring huge investment;
vii. High cost of fuel for electricity generation;
viii. Vulnerability to climate change.

The main laws and regulations connected to the exploitation and use of Rwanda's energy resources comprise the Investment Code (2008, pending revision, 2014), Electricity Act (2011), the Law Establishing EWSA (2010) and the Law Repealing EWSA (2013), the Law Establishing and Determining the Mandate of the Rwanda Utilities Regulatory Authority (2001) and as revised (2013), the Law on Mining and Quarry Exploitation (2008),16 and the Petroleum Law (2013). A set of other proposed laws, including the Gas Law and Law on Public-Private Partnerships were still in final draft, pending approval by Cabinet at the time this energy policy was published. The mandate to regulate business operations across all energy sub sectors falls under the Rwanda Utilities Regulatory Authority (RURA). As an independent regulatory agency, RURA is obliged to regulate in an accountable, transparent

and fair manner for the benefit of all stakeholders. Ultimately, the existence of a clear legal and regulatory framework for the sector plays a fundamental role in boosting investors' confidence in Rwanda and attracting more private sector operators. The action agenda for strengthening the legal and regulatory framework to align with the policy includes revising current legislation and putting in place new laws,regulations, and technical guidelines and standards. This includes potential new laws specific to promoting renewable energy and energy efficiency. In the longer-term, consolidation and integration of various laws and regulations into a unified national energy law shall be pursued.New legislation shall be benchmarked with other East African countries, and attempts made to harmonise regional frameworks wherever possible.

Given the complexity of the sector and its diverse resource base, the mandate of developing the sector is shared across multiple institutions. There is a continuous need and efforts to streamline the sector's institutional framework to enable integrated resource planning and support improved inter and intra-institutional decision-making, avoiding duplication of efforts. The following table some of the key actors in the energy sector and their respective roles, while making recommendations on institutional reform.

Regulatory Bodies Responsible for Overseeing the Energy Sector & Clean Cooking Initiatives in Rwanda	
Ministry of Infrastructure (MININFRA)	The Ministry of Infrastructure (MININFRA) is the lead Ministry responsible for developing energy policies and strategies, and for monitoring and evaluating projects and program implementation. It is in charge of setting an enabling policy and legal framework for the sector, including a suggested general approach to the optimal use of state subsidies in the sector, budget preparation, resource mobilization (together with MINECOFIN), and political oversight over government programs designed to expand energy access and service provision. With regards to petroleum, it is in charge of developing and managing petroleum related infrastructure.
Ministry of Trade and Industry (MINICOM)	MINICOM is responsible for the development and oversight of the downstream17 petroleum sub sector, including implementation of

	the downstream petroleum policy, establishing and developing petroleum-related legislation, setting the strategic reserve requirement, and creating an enabling environment for petroleum products trade in line with the national energy policy objectives.
Ministry of Finance and Economic Planning (MINECOFIN)	The Ministry of Finance and Economic Planning leads on resource mobilisation to support energy investment and related financing requirements. MINECOFIN ensures the fiduciary framework to manage grants, loans, and other concessional finance from development partners into the sector.
Ministry of Natural Resources (MINIRENA)	The Ministry of Natural resources is responsible for ensuring the sustainability of natural resources exploitation, including water extraction, and for developing and managing compliance to the national environment policy and law. MINIRENA is in charge of developing and implementing policies on petroleum exploration and development until the point of resource extraction.
Ministry of Education (MINEDUC)	The Ministry of Education and its affiliated research agencies (NIRDA and NCST), plays a role in the energy sector by building the competency and human resources base for sector development and by helping to link sector policies and strategies to research, technology development, and innovation. MINEDUC ensures that TVETs address skill shortages in the sector, including jobs related to electrical engineering and renewable energy technology installation and maintenance.
Ministry of Local Government (MINALOC)	Local governments have the authority and mandate to coordinate the implementation of discrete enabling policies to drive local economic transformation. Districts are responsible for maintaining the District's infrastructure. Specifically, they have direct responsibility for all decentralized service delivery, including those that may be related to energy at the grassroots (such as ICS, Biogas and many more). This includes national programs to scale

	up sustainable energy consumption currently being implemented by the electricity utility targeting communities.
Ministry of East African Community (MINEAC)	The Ministry for East African Community Affairs is a coordinating body for EAC and Rwandan priorities within EAC Protocols, Treaties and Strategies. MINEAC follows commitments signed by Rwanda on energy projects and ensures Rwanda and Partner States deliver on them. The Ministry advocates on energy-related government positions and interests in regional meetings and forums.
Rwanda Energy Group Ltd (REG Ltd)	The legal mandate of Rwanda Energy Group Ltd is to translate energy sector policies and programs into the implementation of tangible projects to achieve the government's vision in the sector and to efficiently operate and maintain the country's power transmission system.
Rwanda Development Board (RDB)	Rwanda Development Board plays the lead role in investment mobilization and promotion for the energy sector, acting as a gateway and facilitator. It actively promotes private investor participation in the energy sector, including local financial institutions. It leads on facilitation of foreign direct investment (FDI) into strategic energy generation projects, as well as other programs and activities involving cleaner, more energy-efficient technologies. RDB also issues Environmental Impact Assessments for all energy projects for which one is required. It is expected to also host a centralized authority or advisory agency for PPPs across government.
Rwanda Utilities Regulatory Authority (RURA)	The scope of its mandate extends to public utilities involved in renewable and non-renewable energy, electricity, industrial gases, pipelines and storage facilities, and conventional gas extraction and distribution. As the regulator, RURA's principal mandate is to ensure consumer protection from uncompetitive practices while ensuring that such utilities operate in an efficient, sustainable, and reliable manner. RURA also has the important role of updating the electric grid code, ensuring quality of service standards for power,

	assessing and reviewing energy tariff structures, licensing all power generation, transmission, and distribution companies as well as retail petroleum filling stations and related storage facilities.
National Industrial Research Development Authority (NIRDA)	Its scope will evolve around continuous research on energy mix to feed the growing industries and will also provide the necessary information after thorough research on which industries employ clean efficient energy needs.
Rwanda Environment Management Authority (REMA)	REMA has the mandate to coordinate, oversee and implement environmental policy. Generally speaking, all infrastructure development is subject to environmental impact assessment. REMA is mandated to enforce environmental compliance in the development of energy resources.
Rwanda Standards Board (RSB)	As an agency under the Ministry of Trade and Industry, RSB develops national technical regulations including national technology and performance standards. RSB plays an increasingly important role in establishing, publishing, and disseminating national standards for energy technologies such as biogas digesters and solar appliances.
National Commission of Science and Technology (NCST)	NCST with aid from higher institutions of learning, will continue to oversee the scientific tools and provide modern necessary technology to be employed in the energy sector.

Table 2:5 Regulatory bodies in Rwanda in the eenergy and clean cooking sector.

2. Energy Sector Strategic Plan (ESSP)

The Energy Sector Strategic Plan (ESSP) for 2018/19-2023/24 presents the current status of and plans for, the energy sector, covering its three subsectors: electricity, biomass, and petroleum. Key data, achievements, and challenges are presented. From this context, several high-level target objectives (HLTOs) are set out, as outlined below, along with high-level plans to achieve them. These targets represent the key areas of progress to be achieved through the duration of the ESSP and will be measured under the NST-1 reporting framework. Beneath these HLTOs, further targets will be monitored by the Ministry of Infrastructure (MININFRA). The ESSP is a more focused action plan that measures short-term progress toward long-term goals and objectives. It also takes into account anticipated resource constraints and risks/uncertainties in the implementation strategies. The ESSP shall be updated at a minimum on an annual basis. Falling underneath the ESSP, and in parallel to the ongoing least-cost power development plan, sub-sector implementation Action Plans owned by the relevant ministries (and generally not subject to Cabinet approval) shall be elaborated. These shall be developed for seven priority areas in the electricity sub-sector, including hydropower, methane gas, geothermal, bioenergy, solar power, peat and efficiency, and demand-side management. The action plans shall be aligned with the overall policy objectives. High-level target objectives highlighted in the ESSP are

- Generation capacity increased to ensure that all demand was met and a 15% reserve margin was maintained.
- Reliability of electricity supply improved: the average number of power interruptions per year was reduced to 14.2 and the average number of hours without power to 91.7.
- Household access to electricity increased to 100%.
- Productive user access to electricity increased to 100%.
- New major national and urban roads are provided with street lighting.
- Losses in the transmission, distribution networks, and commercial were reduced to 15%.
- Halve the number of HH using traditional cooking technologies to achieve a sustainable balance between the supply and demand of biomass through the promotion of the most energy-efficient technologies
- Petroleum strategic reserves increased to cover three months' supply.

3. National Strategy for Transformation NST1

NST1 builds on lessons learned, successes, and challenges encountered in previous medium-term development strategies. It therefore entails interventions to enable the

transformation journey towards achieving Vision 2050 aspirations. rationale for the National Strategy for Transformation. It was developed when Vision 2020 had two years to come to an end with the year 2020. EDPRS2 and its associated Sector Strategic Plans (SSPs) and District Development Plans (DDPs) ended in June 2018, and a new 7-year Government Program presents the mandate of the government to cover the period from 2017 to 2024. The implementation instrument for the remainder of Vision 2020 and for the four years of the journey under Vision 2050 will be the National Strategy for Transformation (NST1).

NST1 integrates far-sighted, long-range global and regional commitments by embracing:

- The Sustainable Development Goals (SDGs) consist of 17 Goals with associated targets and indicators, across a range of economic, social, and environmental aspects.
- The African Union Agenda 2063 and its first 10-Year Implementation Plan 2014-2023 which is dedicated to the building of an integrated, prosperous, and peaceful Africa, driven by its citizens and representing a dynamic force in the international arena.
- The targets of the Paris Agreement and other international treaties and agreements NST1 merge into the 7-Year Government Program (2017-2024) and the national medium-term development strategy, which were previously standalone documents.

4. Vision 2050

Vision 2050 aspires to take Rwanda to high living standards by the middle of the 21st century and high-quality livelihoods. The implementation instrument for the remainder of Vision 2020 and the first four years of Vision 2050 will be the National Strategy for Transformation (NST1). NST1 will provide the foundation and vehicle for Vision 2050

Specific priorities and strategies are presented in different pillars discussed below. vision 2050 aspirations focus on five broad priorities:

- High Quality and Standards of Life
- Developing Modern Infrastructure and Livelihoods
- Transformation for Prosperity
- Values for Vision 2050
- International cooperation and positioning

2.2.3 Clean Cooking and e-Cooking Initiatives and Incentives

The Government of Rwanda is partnering with the private sector and facilitating a competition-based development of markets for clean-cooking products and technologies. The Ministry of Infrastructure (MININFRA) recently approved an ambitious new Biomass Energy Strategy (2019-2030) and an amendment to its NDC, with targets of reducing the percentage of households that use firewood for cooking from the baseline value of 79.9% in 2017 to 42% by 2024, and phasing-out the use of charcoal in urban areas. The clean cooking agenda has been recently moved to MININFRA and Rwanda Energy Group (REG) through its subsidiary Energy Development Corporation Ltd (EDCL) have the mandate to implement it. The Rwanda Standards Board (RSB) is tasked with certifications and setting standards for cooking products and a testing lab was developed. In October 2019, MININFRA published the Biomass Energy Strategy: A Sustainable Path to Clean Cooking 2019-2030. In May 2020, the Government updated its Nationally Determined Contributions under the Paris Agreements which includes promoting the use of efficient cook stoves as a mitigation measure since cooking accounts for 14% of the GHG emissions from the energy sector. Implementation of the Biomass Energy Strategy will require substantial grant resources made available to the sector to address the affordability and awareness gaps as well as the unproven nature of many new technological solutions in Rwanda. Cash expenditure on cooking fuels remains rare in Rwanda outside the richest 10 percent of households as 97 percent of households use either firewood or charcoal, which means that the market for clean cooking solutions will require partial subsidies to become commercially viable. The Results Based Finance (RBF) program which is being monitored by (Rwanda Development Bank (BRD) is meant to attract clean cooking companies to join and grow the clean cooking sector.

2.2.4 Barriers and Opportunities

Major drivers of households' lack of access include the lack of alternative solutions, low awareness, and unaffordability; but awareness-raising, behaviour-change campaigns, and financing support for high-performing technologies that reduce fuel use can overcome these obstacles. Households in Rwanda have few available options for meeting their cooking needs, in terms of fuels and stove technologies. Self-built stoves and traditional charcoal stoves are commonly used. Efficient cookstoves account for only 13.5 percent of stoves nationwide. Clean fuel stoves, including liquefied petroleum gas (LPG) and biomass pellets, are used by about 1 per cent of households, mostly in urban areas. Affordability

underscores the choices households make, especially in rural areas, where households across all consumption quintiles rely on firewood as their primary fuel. About 76 per cent of households spend an average of 7 hours per week acquiring fuel (either by collecting or purchasing it) and preparing it for their stoves, with a disproportionate burden on households using firewood. Women and girls disproportionately spend more time engaging in cooking-related activities and bear the burden of Drudgery. Households using charcoal tend to purchase it in small quantities at frequent intervals, especially if they are resource-constrained. A majority of households in Ubudehe categories (socioeconomic classes) 1, 2, and 3 are dependent on firewood to meet their primary cooking needs.

Adapting to improved and modern cooking requires increased awareness, availability of affordable and diverse technological and financing solutions that fit the needs of diverse consumers, and financing support to fill affordability gaps. The RBF subsidy will help to address the affordability gap, provide cost-sharing to support the development of the market bring in more efficient and improved stove technology, and foster innovative business models that could expand the coverage for households. The expectation is that the RBF scheme will enable more households to afford clean cooking solutions and attract clean cooking technologies and service providers into the market.

2.3 Mozambique

Mozambique faces a formidable clean cooking challenge: Mozambican adults are heavily reliant on biomass for cooking (71.2%) (rural, 91.8% & urban, 33.7%) [WHO, 2019), with firewood being by far the most predominant fuel source (64%). 22% (urban, 48.4%; rural, 6.7%) use charcoal as their primary source of fuel for cooking. Only a small portion of the population has access to cleaner fuel sources or energy-efficient technologies for cooking, however, 1.4% primarily use electricity for cooking and an additional 3% (primarily) use LPG [urban, 8.3%; rural, 0.2%) (WHO, 2019).

This has led to an array of interlinked development challenges: Mocumbi et al. (2019) estimate that in Mozambique, 17154 deaths/year are caused by household in-door air pollution; an average of 62.7Mt per year was released into the atmosphere as a result of tree cover loss between 2001 and 2020. In total,1.25Gt of CO_2 was emitted in this period.

Women and girls are disproportionately affected, with greater exposure to cooking smoke, as well as the drudgery of collecting fuel and lighting/tending fires, which results in missed educational and economic opportunities.

Historically, Improved Cookstoves (ICS) have been heavily promoted in Mozambique by Endev. Adoption rates have been high in areas where ICS have been promoted by EnDev~90-95%. However, recent evidence shows that the health benefits of ICS are much more limited than previously thought (WHO, 2016).

The market potential for eCooking in Mozambique is growing rapidly given the upward rise in the proportion of the population with access to electricity, which has doubled, from 17% in 2009 to 34% in 2020 (ALER, 2021). The country has an emerging eCooking sector, with 1.4% of the total population already cooking primarily with electricity (WHO, 2020). Access to electricity and eCooking is concentrated in urban areas, with 73% of the urban population now connected and UNDP (2020) reporting that 17% of the urban population cooks with electricity.

Mozambique's low electricity tariff ($0.10/kWh) means that eCooking is already the most affordable option, even without considering the generous lifeline tariff ($0.02/kWh < 100kWh/month). Reliability and access, particularly in rural areas, hinder greater uptake, creating an opportunity to pilot battery-supported and solar-powered cooking.

Further study of the existing eCooking market in urban areas involving primary research is needed to inform potential future interventions by gaining a deeper understanding of the

key actors in the eCooking value chain and the key market segments that have already adopted eCooking.

The Regulatory Framework of Off-grid Energy in Mozambique

Aiming to ensure good energy for all by 2030, the Government of Mozambique announced that it has developed and approved with the competence bodies within the Ministry of Mineral and Energy Resources the package of technical regulations complementing Decree 93/2021 Regulation on access to off-grid energy. The list of regulations and instruments are as follows: Regulation on concessions for mini-grids and registration for energy services (Decree no 93/2021 of 10th December); Regulation on technical and safety standards; Regulation in interconnection: Regulation on the standards of quality of services and commercial relations; Regulation on mini-grid tariffs.

The regulatory framework marks a new era for the energy sector, especially for mini-grid developers and operators to be able to work in Mozambique. It aims to ensure the conditions for the private sector to accelerate its investments and scale its operations in diverse technologies applicable to the off-grid context, such as solar home systems, mini-grids, and improved cooking solutions.

The Energy Regulatory Authority (ARENE), in collaboration with the National Energy Fund (FUNAE), the Ministry of Mineral Resource and Energy (MIREME), the BRILHO Programme (Funded by the Government of the United Kingdom and Sweden, and implemented by the NSV Netherlands Development Organization), and specific contribution from otter entities, developed the package f regulations that represents a strategic leap to provide quality energy solutions to the entire population, including those in of grid areas.

The ARENE has approved the following regulations: i) Regulation on Tariffs for Mini-grids (RN 1/ARENE-CA/2022), which aims to establish parameters for the application of tariffs for concessionaires; ii) Regulation of the interconnection of Mini-grids (RN-2/ARENE-CA/2022). Which establishes the terms, conditions and procedures applicable to the interconnection of mini-grids to the national Electricity Grid; 3. Regulation on Technical and Safety Standards (RN 3/ARENE-CA/2022) defines the technical and safety standards applicable to electrical equipment and installations of mini-grids and autonomous systems; iv) Regulation on Service, Quality and Commercial Relations (RN 4/ARENE-CA/2022) establishes the quality regime, to which the service provided by Mini-grid concessionaires is subject and regulates commercial relations between the concessionaire and its clients. All these regulations were published by the Official Gazette of the Republic of Mozambique (BR- Segunda-feira, 15 d maio de 2022, 1a Serie no 92).

Electricity generation (off-grid)

Mini-grid &off-grid sectors:

- 14,000mini-gridcustomers
- 50mini-griddevelopers
- 116,000off-gridlighting/appliance customers
- 70,000PAYGOSHS

2.3.1 Policy and Governance Analysis

eCooking policy outlook: Mozambique's National Electrification Strategy aims to achieve universal electricity access and clean cooking by 2030, but the Strategy separates electrification efforts from clean cooking. The country's electrification policy is enshrined in the National Electrification Strategy, but the clean cooking sector is not guided by a clear set of policies.

Key policy stakeholders: Electricity Company of Mozambique (EDM), Ministry of Energy (MIREME), Energy Fund (FUNAE), Conselho Nacional de Electricidade (CNELEC), National Inspectorate for Economic Activities (INAE), Mozambican Renewable Energy Association (AMER), National Petroleum Institute, and the Energy Regulatory Authority, "Authoridade Reguladora de Energia-ARENA".

RISE (Regulatory Indicators for Sustainable Energy) scores:

37%	19%	20%	2%
Electricity Access	Clean Cooking	Renewable Energy	Energy Efficiency

Targets:

Electricity Access	Clean cooking
100% electricity access by 2030 ongrid/off-grid)	100% clean cooking access by 2028

Key government/NGO programmes creating the enabling environment in which eCooking can scale

- **GoM** is reducing energy poverty by providing electricity to the poorest groups in remote areas using social tariffs.

- **GIZ/EnDev Mozambique –**EnDev Mozambique supports households in connecting to the national grid, assists in the distribution of high-quality photovoltaic products, and strengthens the distribution of clean cooking solutions.

•**BRILHO Mozambique**–This is a five-year £22.8 m energy access programme in Mozambique funded by FCDO. The programme, which runs 2019-2024, provides catalytic grants, RBF grants, and TA to private energy access and clean cooking companies.

•**Beyond the Grid Fund for Africa (BGFA)–**BGFA, through its second call for proposals (BGFA2), aims to accelerate the provision of off-grid energy services in Mozambique.

•**SDG Results: Access to Renewable Energy–**The objective of the SDF Results Facility is to provide 2 million people in developing countries, including Mozambique, with access to renewable energy.

•**EEP Africa**–The15th EEP Africa for Proposals (CfP15) attracted applications from early stage off-grid and on-grid clean energy projects in active development phase in Southern and East Africa including Mozambique.

2.3.2 Legislative and Regulatory Review:

Energy Laws and Regulations 2023

The prevailing legal instrument for electrification in Mozambique was the Electricity Law from 1997 (Law no 21/97), updated in July 2022 to Law no 12/2022 to reflect Mozambique's current social, technical and financial dynamics, emphasizing renewables. Clean mining is gaining ground.

The Fund for Sustainable Access to Renewable Energy (FASER) – the beneficiaries are energy companies and parts of the population that still do not have access to energy. FASER is jointly implemented by the German Agency for Cooperation (GIZ) through the Energizing Development (EnDev) programme and Foundation for Community Development. The funds came from the EU as part of t PROMOVE, a comprehensive EU approach to rural development.

New Electricity Law

The new Electricity Law (12/2022 of July 11) regulates the entire chain of energy generation, from production, storage, transport, distribution, commercialisation and energy consumption, while also concerned about import and export of power.

Regulation of Licences for Electrical Facilities.

Decree no 60/2021 of August 18, 2021, is about the Regulation of Licenses for Electrical Facilities in response to processes of simplification of procedures applied to the licensing electrical facilities, ensuring more incredible speed and lower costs.

New Legislation

Mozambique introduced a range of reforms to the legal system, including in reaction to:

i. Customs and tax matters (Customs Tariff Schedules, approved by Law 11/2016 of 39 December and Regulations on the Tax Benefits Code, approved by Decree 56/2009 of 7 October).
ii. Export licences.
iii. Strict anti-corruption measures.
iv. Compulsory independent audits.
v. An environmental protection policy, it has also set up an online "one-stop-shop" to register companies and publish corporate documents.

By Law, economic activities such as energy, mineral resources or construction are granted a general trading licence by the Ministry of Industry and Commerce. Likewise, in many countries in Mozambique, a series of actions and policies about the renewal of the energy sector have been adopted. The guidelines are assumed to increase awareness of energy usage and guarantee supply to people while guaranteeing market access and investment opportunities. With this regard, the Government of Mozambique approved the Constitution of the Agency for the Promotion of Investment and Exportations (APIEX) and replaced it with the Agency for Investment and Export Promotion (Ministerial Diploma no 29/2020) to be responsible for promoting investments; review and approving project applications, and to monitor the implementation of projects in various sectors.

The Movable Assets Registration.

It is a legal framework that does not deal directly with the energy sector. Still, his framework is believed to secure movable assets, which approved the creation of the Registration Office for Security over Movable Assets. The registration Officer started to operate in September 2021 with limited operational capacity.

Judicial decisions, court judgments, results of public enquiries

It is claimed that in Mozambique, there is no available Law, court judgments, judicial decisions or outcomes of general questions on the interpretation and application of the relevant legislation related to the energy sector.

The Energy for All Programme.

It is reported that the EDM (the state company of energy) made in the year of 2021 about 307,000 new connections, and it was intended to install another 320,000 new connections. The population increase that benefits from new links is part of the Proenergia Programme, funded by partners such as the World Bank, the European Union, Norway and Sweden. However, the programme has setbacks brought by the military instability caused by the army insurgencies in Cabo Delgado Province, northern Mozambique, but also due to

extreme climate events such as cyclones and floods that have caused extensive destruction to the electrical grid in those areas in specific.

Analyze the legal framework governing renewable energy technologies and cooking appliances in each country.

Major events or developments
The Mphanda Nkuwa project- an example of Mozambique's opens to investment
The new hydropower Mphanda Nkuwa is one of the electrical projects that seeks foreign investments and is meant to fulfill the Government's vision of universal electricity access by 2030 in response to SDG 7, which envisages affordable, reliable, sustainable and modern energy for all.

Mozambique Renewable Energy Integration Program (MREP)
The Government of Mozambique will receive an investment from the African Development Bank (AfDB) to develop renewable energy resources. The grant is from the Sustainable Energy Fund for Africa (SEFA), will be administered by the AfDB and implemented by the Mozambique Renewable Energy Integration Program (MREP).
The funds will support the national electricity company and provide financial capacity for technical, economic, environmental and social feasibility studies to develop a floating solar power plant on the Chicamba reservoir. Also, it will support the funding of a feasibility study for storing energy battery systems, EDM staff capacity and tender preparation support. Lastly, the grant will be used to conduct studies to increase the share of variable renewable energy production in Mozambique's energy mix. Additionally, the programme will promote studies to develop floating solar photovoltaic power on EDM's existing hydropower assets.

Identify any legal barriers or incentives that may affect the adoption of solar-powered cooking appliances.

Proposals for Changes in Laws and Regulations
People from the legal arena argue that Mozambique faces a challenge in the energy sector that has to do with the interconnection between various existing frameworks that apply to projects on energy or electricity. The example that thy give is that all energy-related tasks are generally subject to the licensing framework outlined in the Electricity Law and Regulation but in the context of public-private partnership and public procurement frameworks. Other frameworks, such as the law governing state companies, which applies to EDM, the company that detains the monopoly on sales of electricity in Mozambique, and land legislation must also be considered when carrying out a project in this area.

The legal people admit the existence of tensions between various frameworks in respect to applicability of the respective provisions that oftentimes are difficult to resolve considering that public entities ae no always equipped to giver answer as they lack that capacity to do so.

The existence of public authorities that sometimes have similar jurisdiction and competencies, such as the water sector, where national and regional entities are involved and whose roles are not always clear, is also responsible for causing confusion and doubts for private investors and foreign tenders.

Lastly, Mozambique sometimes faces unfriendly investment regulations, particularly in the energy sector. In the World Bank's Doing Business 2021 publications, a comparative analysis of business regulation of more than 190 economies, Mozambique remains classified at 138th position.

Evaluation of the legal framework for private sector involvement and investments in clean cooking initiatives.

The report on Business Environment Reform Facility- Business Environment Constraints in Mozambique's Renewable Energy Sector on Solar PV Systems and Improved Cook Stoves (2016) states that one of the key challenges facing both sectors is weak demand, because most rural consumers lack information and acknowledge about ICS (Improved Cook Stoves) and Solar PV products and the financial means to purchase them and the lack of maintenance support for products installed that reduces customer confidence in the quality of ICS and Solar PV systems and 3) consumer finance is almost non-existent.

On the supply side, the business environment is not conducive to companies deploying innovative solutions to overcome demand constraints.

Legislation to incentivise investment in sectors of national importance is not applied consistently. Public sector and donor interventions to sustain the sector tend to create perverse incentives and crowd out private investors.

Some suggestions towards policy Reforms

The development of off-grid Solar PV by using the most efficient and cheapest technology available on the international market has to do with the following:

1. Catalyse international investment;
2. Eliminate barriers and reduce the cost importing PV equipment and accessoris;
3. Facilitate access to global expertise.

While the ICS sector is to deliver large-scale adoption of ICS responding to the local needs and tastes of users, to have reform is needed to:

1. Support a national, regional system for Research and Development (R&D) based on testing and recognising industry standards;

2. Establish economies of scale in production and distribution so as to lower consumer prices;
3. Eliminate barriers and costs of improving components for locally produced ICS.

2.3.3 Clean Cooking and e-Cooking Initiatives and Incentives

- Emerging mini-grid and SHS industries; also, recently began to experiment with eCooking.
- Some solar mini-grid pilots were financed by Government of South Korea, but most installed mini-grids were financed by Fundo de Energia/National Fund for Rural Electrification (FUNAE) and are diesel powered with operational and reliability concerns, an issue that is likely to slow the uptake of these larger systems.
- Last year, FUNAE launched a tender for the development of 5 solar mini-grids, under the second phase of the Renewable Energy for Rural Development program introduced by the government in 2018 and part financed by Belgium.
- There is also an issuance of a request for expressions of interest to seek consultants to draft feasibility studies and project outlines for additional 11 solar mini-grids.
- The focus on off-grid systems has shifted from standalone systems to mini-grids, due to their greater rural development potential. EnDev is currently prioritizing pico- and micro-hydro (PHP and MHP), and small-scale PV as well as working with Burn Manufacturing to experiment with eCooking, while BRILHO is expected to attract regional off-grid energy market leaders into the Mozambican market.

2.3.4 Barriers and Opportunities

Key barriers/drivers in the enabling environment

- Relatively low cost of electricity: US$0.141 per kWh for households (compared to the continent's average) and US$0.061 for businesses.
- Fiscal benefits for renewable energy investors, but not applicable to cooking.
- Low consumer awareness of electric cooking and low availability of electric cooking appliance.
- Low access to electricity amongst the rural population.
- Unreliable electricity supply

Key supply side barriers/drivers

- eCooking is already a mainstream solution, with UNDP (2020) reporting that 17% of urban households already use electricity to cook and WHO (2019) reporting that 3.9% of urban households already use electricity as their primary cooking fuel.
- Strong supply chains for importation of appliances from China and South Africa in place, with many companies now expanding product range into energy-efficient eCooking appliances.
- The distribution infrastructure in the eCooking and off-grid sectors can be improved. There are high distribution costs due to the thinly dispersed rural areas and the vast distances between the ports of Nacala, Beira, and Maputo and the interior regions, which is worsened by the poor state of the road network, significantly driving up transportation and logistics costs.
- Limited access to after-sales services for modern energy-efficient electric cooking appliances, especially outside of the major cities.
- Reliability of electricity prevents many from using it for cooking. Although it is improving in major cities, it remains poor at the fringes of the grid (slums, rural areas) and most of the country still off-grid.
- High import costs for businesses in the sector due to taxes and tariffs. Renewable energy solutions such as eCooking appliances are subject to VAT rate of 17% and import duties vary between 7.5% and 20% depending on the component type.
- Several suitable consumer financing mechanisms are already in use in Mozambique, but have not yet been applied to eCooking.
- Several international organizations who are piloting eCooking in other countries are operating in Mozambique, e.g., Engie, Burn Manufacturing.

3 Methodology

In this study, the following methods were used:

- Literature review

In order to understand existing policies in clean cooking and Ecooking in Mozambque, Rwanda and Kenya , a through literature review was conducted

- Developed questionnaire

To understand the existing policies, identify gaps and recommend improvements to support the growth of electric cooking, using solar, a questionnaire was developed for all the three countries. The questionnaire was developed for all three countries to collect data on the overview of the policy, legislative and regulatory environment of all three countries.

- Data collection using kobo toolbox

Data collection was done through consultative meetings with policy makers, researchers and different experts in clean cooking including solar to get insights on how clean cooking policies are developed and executed.

- Data analysis using Excel

Data collected were analysed using excel for graphical representations of the findings from the survey and the analysis of the results were done to compare with the findings from the survey and recommendations were drawn.

4 Survey Findings and Analysis:

4.1 Kenya

The respondents to the questionnaire were drawn from different entities playing a role in the clean energy development sector from regulation, legislation, advocacy, research, market development, policy making and implementation.

Policies and Framework documents on clean Cooking

The stakeholders acknowledge the availability of framework documents targeting energy use in the cooking sector cutting across the National policies/strategies on clean cooking, parliamentary acts, regulations, presidential directives, energy plans and standards/incentives among others as depicted in the figure below.

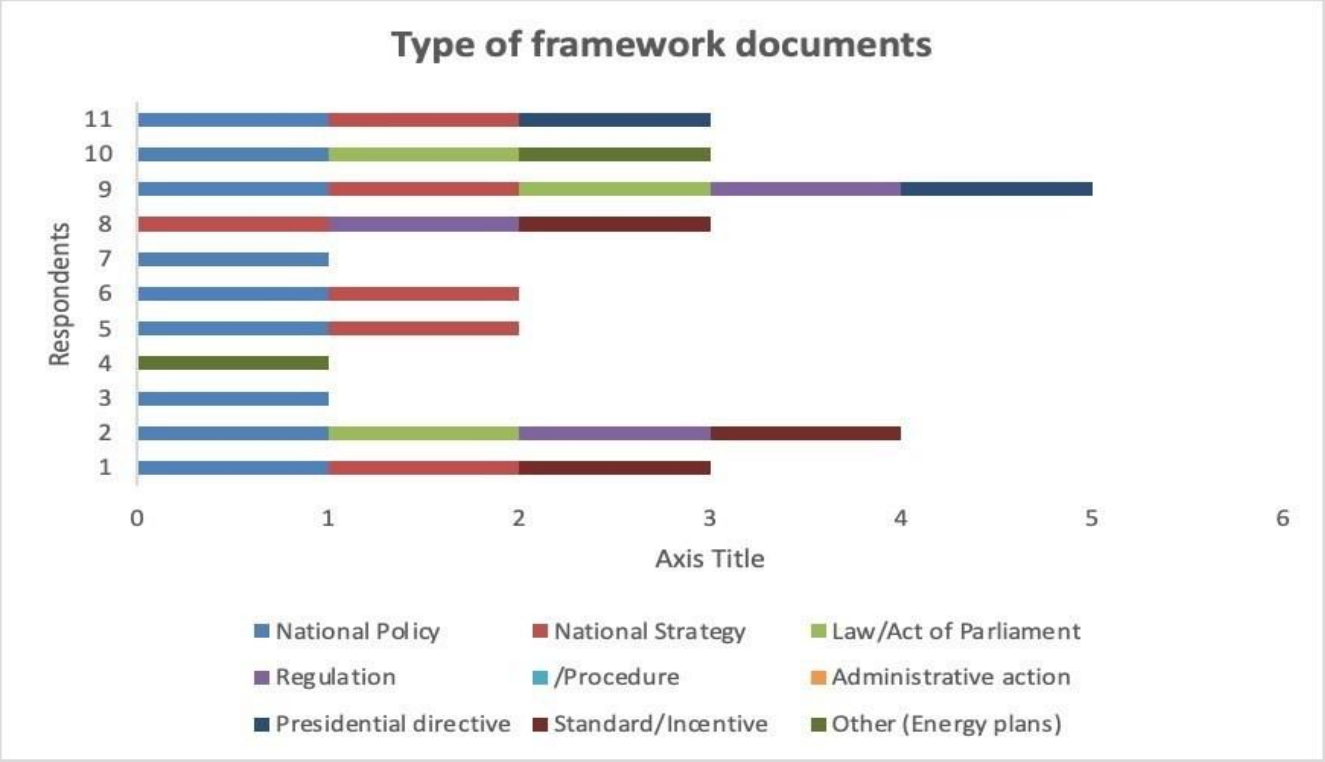


Figure 4:1 Type of framework documents analyszed

Some of the National Strategies cited in Kenyan responses include the Kenya National Clean Cooking Strategy (KNCCS 2020), The Bioenergy Strategy (2020), Behavior Change and Communication Strategy for Clean Cooking (2022), which are meant to provide direction for the sector enhancement.

Kenya has Laws/Acts of Parliament, which legally enforce the guidelines for this sector, for instance the Energy Act 2019. In addition, there are specific Regulations and Procedures in place to ensure compliance and standardisation such as Liquified Petroleum Gas (LPG) regulations (2019). Moreover, administrative actions and Presidential directives are issued to emphasise certain priorities or initiatives. Standards and Incentives are used to encourage best practices and stimulate growth in the clean energy and cooking sector, i.e., Biomass cookstoves standards of 2019.

These policies and frameworks primarily prioritize addressing the challenges to increased uptake of electric cooking and clean cooking, alongside a strong focus on mitigating climate change. The objectives reflect a concerted effort on promoting energy-efficient and environmentally friendly cooking practices while simultaneously tackling the urgent challenge of climate change. Additionally, the policies emphasize the importance of addressing health issues associated with conventional cooking methods, ensuring unbiased access to clean energy sources, and fostering economic development through sustainable energy solutions.

These priorities collectively underline a holistic approach to sustainable development that encompasses both environmental and societal concerns, aiming for a healthier, more equitable, and climate-resilient future.

The data highlights the pivotal role of financial resources and political commitment in driving successful policy implementation. It emphasizes that policies deeply rooted in the social and cultural fabric of communities are more likely to be embraced and effectively executed. Furthermore, the findings highlight the enabling impact of a favorable economic environment and the essential nature of public communication and information dissemination in garnering public support. While legal and technical aspects are important, they are not as influential as the broader factors of financial support, political will, community engagement, and effective communication.

Implementing Bodies

The national and county governments, the MoEP, standard bodies, regulators and other sector players are majorly responsible for formulating and implementing policies in the clean energy and e-cooking sector. These entities work in collaboration to develop, enforce, and monitor these policies to guide the sector's operations, while ensuring they align with national energy goals and adhere to best practices. Their collective efforts are crucial in shaping a sustainable and efficient clean energy and cooking sector.

Impacts of Clean Cooking Policies on the Target Groups

The majority of policies have been effective in promoting the uptake of clean energy and reducing fossil fuel use among their target groups. This reflects positive strides towards cleaner and more sustainable energy practices.

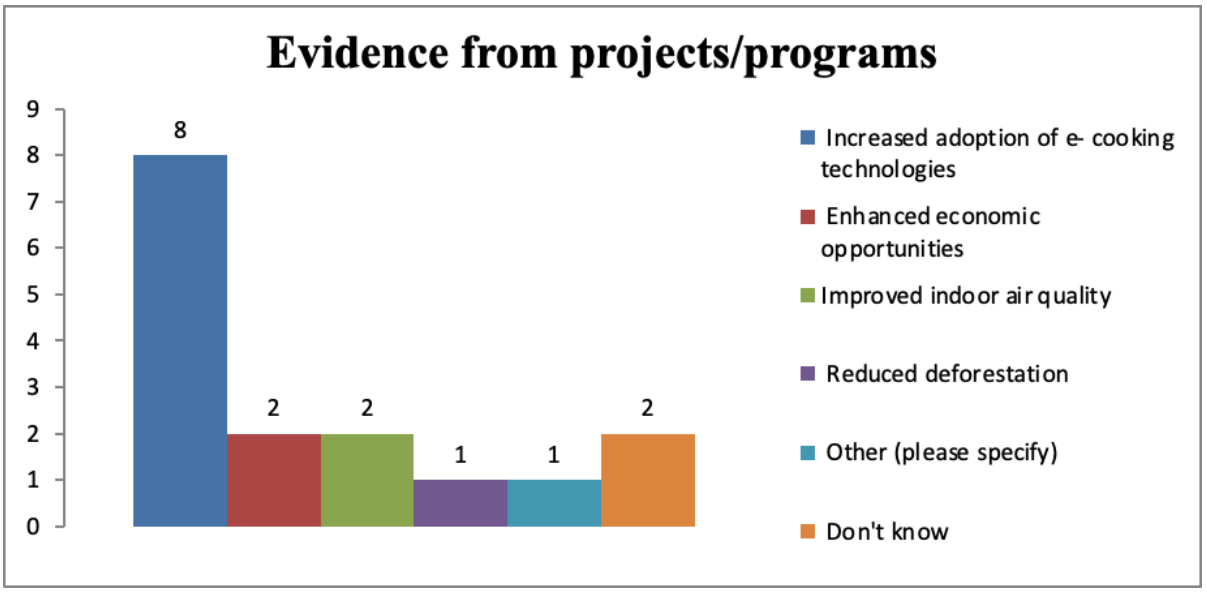


Figure 4:2 Evidence from projects/programs

However, the impact of policies aimed at reducing fuel costs appears to be somewhat limited, suggesting the need for further refinement in addressing the affordability aspect of energy consumption. Notably, policies focused on improving health outcomes related to energy use have shown positive results, underscoring the critical link between clean energy adoption and public health benefits.

Barriers Hindering Clean Cooking Adoption and Policies Implementation

The data shows that there are several big problems that make it hard to use modern and clean cooking methods and therefore making policies in this area less effective. The most important of these problems is the high cost of implementing these solutions, which is a very tough financial challenge. Moreover, the need for a lot of infrastructure and facilities, along with the requirement for strong support from both politics and finances, are major obstacles. There are also issues with not involving the right people, facing resistance because of long-held social and cultural practices, and a lack of awareness about these new methods. While there are some legal issues and conflicts of interest, they are not as important as the major challenges. To overcome these barriers, a comprehensive approach that includes financial incentives, building better infrastructure, involving the community,

and running effective awareness campaigns is needed. Policymakers should focus on these strategies to encourage more people to use modern and clean cooking methods.

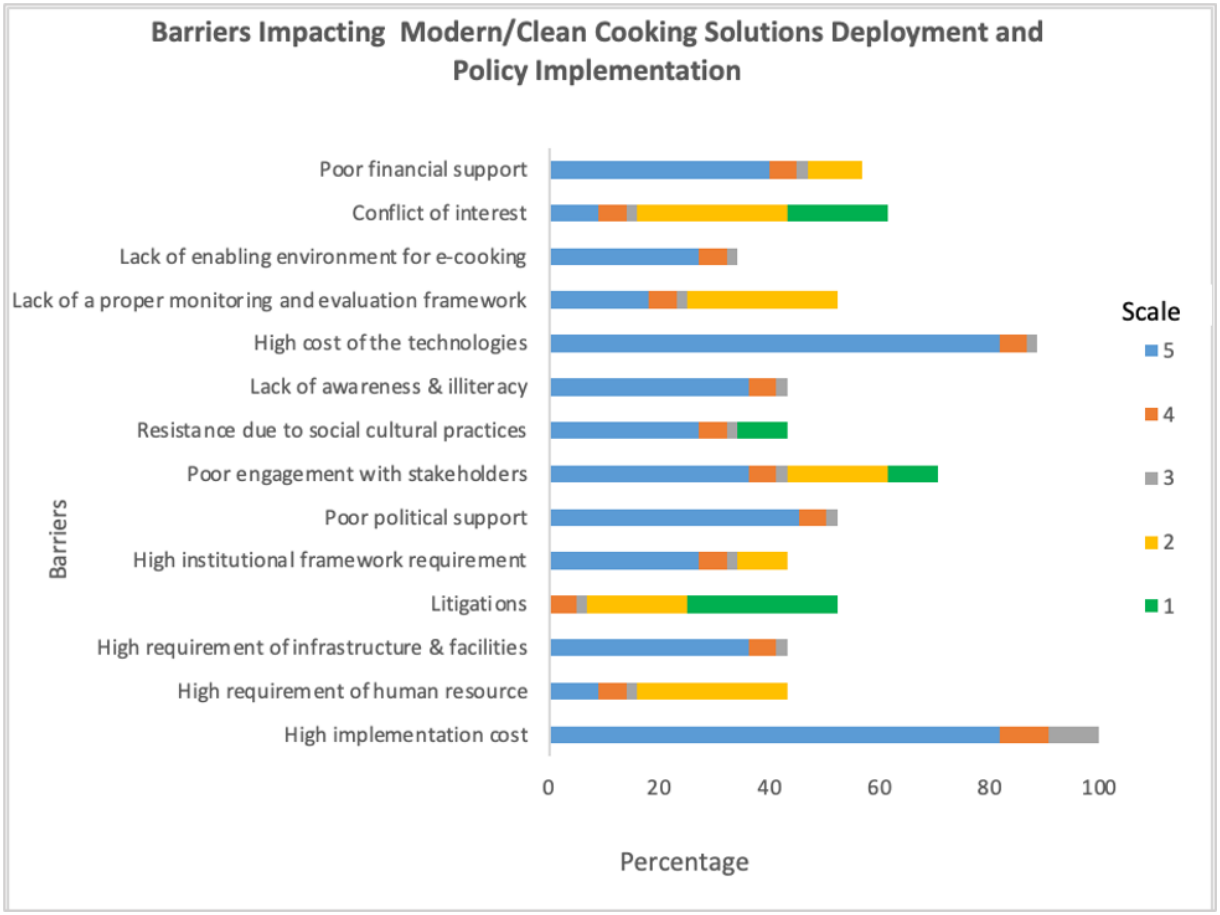


Figure 4:3 Barriers Impacting Modern/Clean Cooking solutions deployment and Policy Implementation

The data reveals several key barriers to the widespread adoption of clean cooking technologies. These obstacles include limited consumer awareness, financial burdens such as import costs and tariffs, the restricted availability of clean cooking technologies, and challenges associated with unreliable electricity supply and high electricity costs. Inadequate infrastructure for electricity access and distribution further complicates the accessibility of these technologies. To promote the adoption of clean cooking methods, it is imperative for policymakers and stakeholders to prioritise initiatives that raise consumer awareness, alleviate financial constraints, enhance infrastructure, and address electricity-related issues.

Identified Stakeholders in Clean Cooking

Stakeholder Name	Involvement Category
Ministry of Energy and Petroleum	Policy
Modern Energy for Cooking (MECs)	Research, Policy, Capacity Building
SCODE	Distribution and pilot studies
Burn manufacturing	Assembling and wholesaling
CCAK	Policy, Capacity Building, Awareness Creation
County Governments	Policy, Capacity Building
Kenya Power	Capacity Building, Policy Development
CLASP	Research
Developers of the technology - Strathmore University	Publicity and Promotion through TV Programs
GIZ/Endev	Capacity building and financial support
SNV	Capacity building and awareness
Appliance manufacturers/ distributors	Product development
E-cooking Congress of Parties	Creating Awareness
eCOLIBRIUM, KYSEDO, Camellion ltd	Capacity Development and Mainly Implementation
Kenya Bureau of Standards (KEBS)	Standards and Regulations Development

Table 4:1 Identified Stakeholders in Kenya's Clean Cooking Sector

Sector	Entity	Role of the entity in clean cooking
Government institution	EPRA	Regulator
Academic institution	EED advisory	Research & analytics; project implementation

Government institution	Machakos County government	Legislator/Policy making , Regulator and Policy implementation
Government institution	KPLC	Policy implementation
Government institution	KPLC	Legislator/policy-making
Research institution	KEFRI	Research
NGO	CLASP	Market development Interventions for E-cooking appliances
NGO	CCAK	Policy implementation
Renewable Energy Professional Association	KEREA	Advocacy, Access to finance, Access to Technologies, Access to Markets
Government institution	Kisii County government	Policy implementation
Government institution	REREC	Policy implementation

Table 4:2 Kenya's Interviewed stakeholders

Government's Approach on Clean Cooking and Electricity Access

The respondents strongly agree on the clean cooking and electricity access being a government priority in Kenya with most of them alluding that they are treated as separate problems in approach.

Kenya has an ambitious target of attaining universal electricity access by 2030 with the current level being more than 76%. This access will be greatly achieved through grid extension and partly off-grid minigrids & SHS with average 75% and 25% contribution respectively.

With the set renewable energy targets by the GoK, the grid is envisioned to be 100% fed from clean and renewable energy majorly from the vast geothermal, wind and solar resources endowed to the nation. Various RETs are being exploited to supply power in the off-grid regions with wind and solar PV fed minigrids taking preeminence in the projections.

There isn't a clear distinction between the energy portion utilized for the access of electricity and that set for clean cooking implying that their approach should be an integrated planning framework as opposed to the "separate-problem" approach.

In addition, the sector has not yet established any legislation related to the deployment and integration of e-cooking and solar energy systems.

4.2 Rwanda

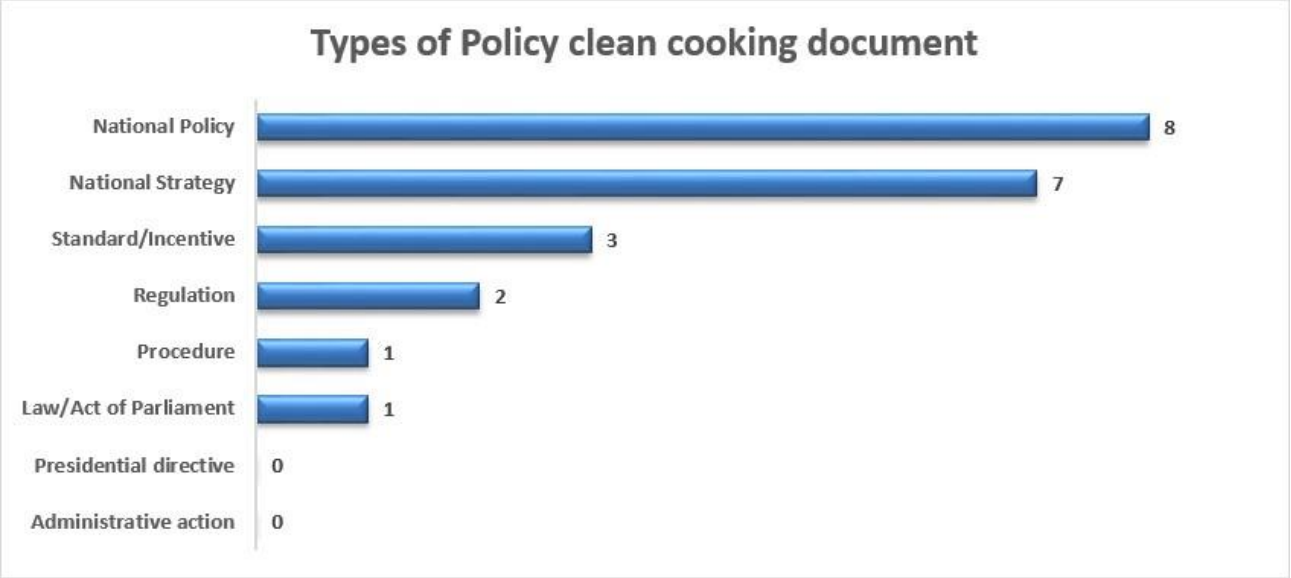
In Rwanda, the following stakeholders were identified and interviewed

Sector	**Entity/Company**	**Position of interviewed staff**	**Entity/Company role in the Clean Cooking**
NGO	Energy Private Developers (EPD)	Clean cooking subsector secretariat	Policy influencer
Development agency	GIZ Rwanda	Advisor	Policy influencer
Government institution	Energy Development Corporation Ltd (EDCL)	Social Energy Manager	Policy implementer
Government institution	Ministry of Infrastructure	Renewable energy senior engineer	Legislator/policy-maker
Government institution	Rwanda Utility Regulatory Authority	Energy project monitoring officer	Regulator
Government institution	Rwanda Standard Board	Director	Standardisation
Government institution	Rwanda Environment Management Authority	Environment and Climate Change Adaptation and Mitigation Specialist	Regulator
Researcher	Independent researcher	Consultant	Policy influencer
Government institution	Development Bank of Rwanda	Renewable Energy Fund Manager	Policy influencer

NGO	Practical Action Rwanda	Energy Specialist	Policy influencer

Table 4:3 Identified and Interviewed Stakeholders in Rwnda

We have been informed by the respondents that in Rwanda the policy documents where clean cooking is considered are in the form of National Policy, National Strategy, Law/Act of Parliament, Regulation, Procedure, Administrative action, Presidential directive, Standards and Incentives as illustrated below:



Those policy documents were developed to :

i. Specifically increase the uptake of electric cooking/clean cooking in general
ii. Specifically increase the uptake of electric cooking/clean cooking in Households
iii. Specifically increased the uptake of electric cooking/clean cooking in Market vendors
iv. Specifically increase the uptake of electric cooking/clean cooking in Bar and restaurant
v. Specifically increase the uptake of electric cooking/clean cooking Food and beverage industry
vi. Increase uptake of clean sources energy without any bias and Address health issues associated with conventional cooking methods.
vii. Reduce use of fossil fuel by using alternative source of energy including solar to reduce Climatic change impacts as illustrated in figure below

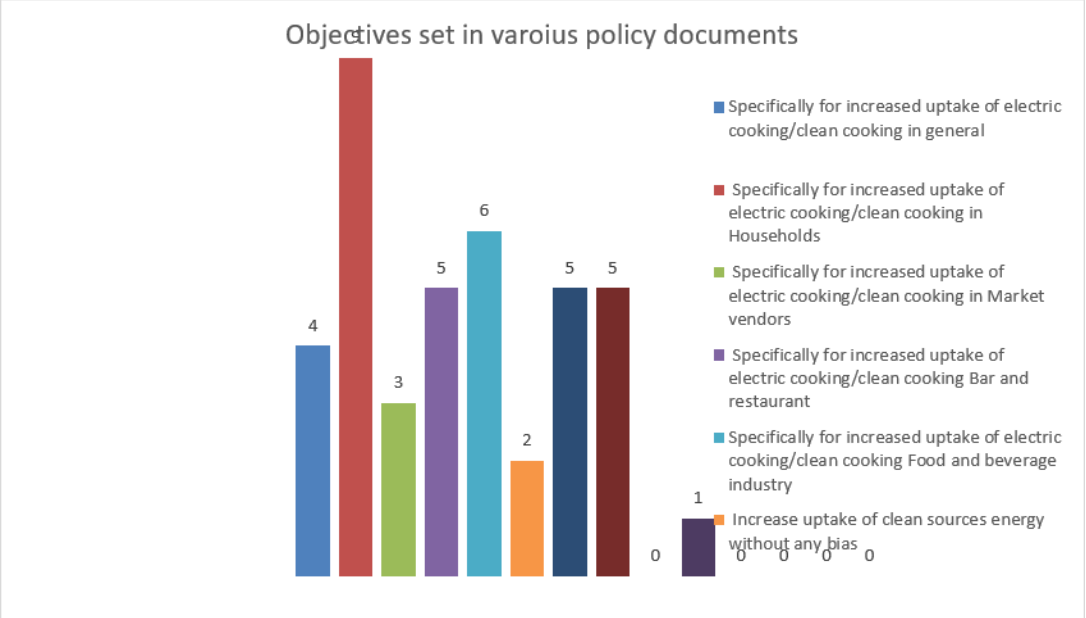


Figure 4:4 Objectives indentified in various policy documents for Rwanda.

Rwanda has a target of reducing the percentage of households that use firewood for cooking from the baseline value of 79.9% in 2017 to 42% by 2024 and it has been set in 2018 8in the biomass Energy Strategy but there has been slow progress to successfully achieve this target. Only a few months until 2024 but the percentage of people that use clean cooking technologies is still relatively low. Factors that have been cited by the responds as barrier to policy implementation related to energy and clean cooking are shown it the following figure

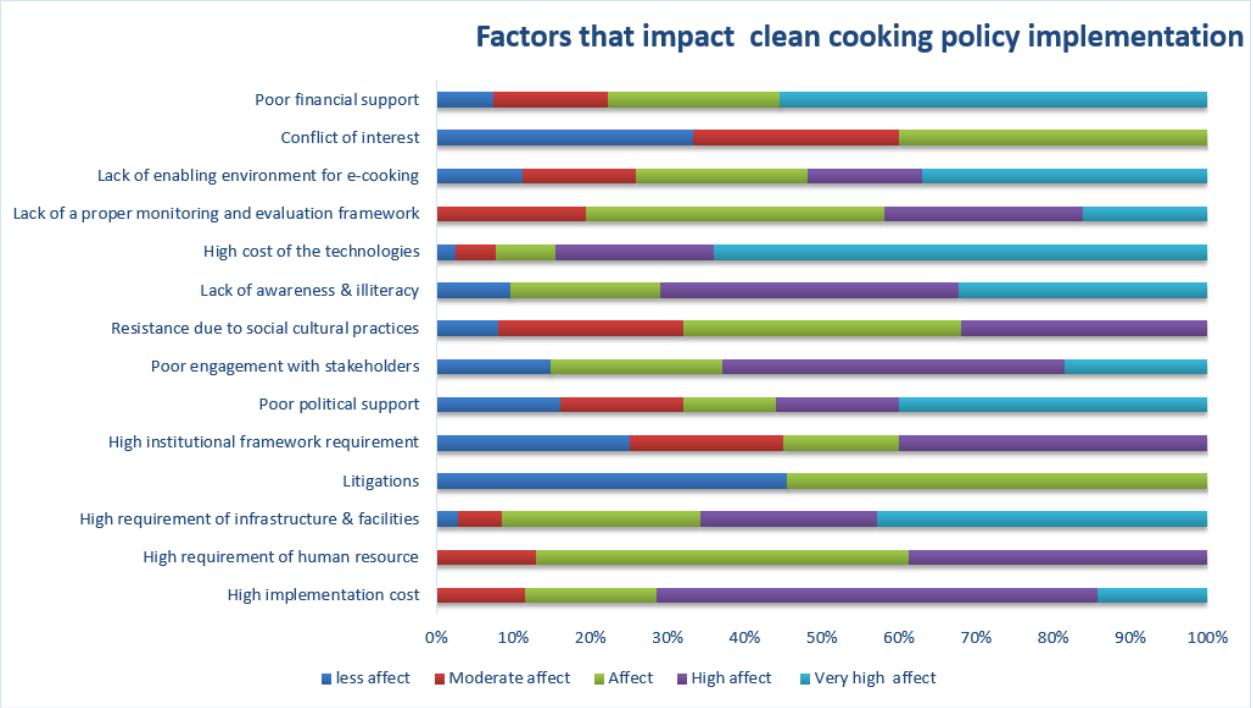


Figure 4:5 Factors that impact clean cooking ploicy implementation in Rwanda.

5 Best Practices and Lessons Learned

Stakeholder engagement Processes in the Development of Sustainable E-Cooking Frameworks

Public participation processes undertaken in Kenya, Rwanda, and Mozambique include Stakeholder engagement workshops, public sensitization, public discussion forums/barazas, the establishment of e-cooking hubs and group Engagement workshops, and holding regional validation workshops across the country. In addition, Demonstration kitchens are set up to showcase e-cooking technologies, allowing stakeholders to experience the benefits firsthand. These provide practical insight into the advantages of e-cooking and foster interest among stakeholders.

These approaches encounter several challenges such as; inadequate public awareness on the benefits of e-cooking, lack of commitment by stakeholders in the policy development process, limited access to reliable data due to legal and regulatory requirements, insufficient financing and political goodwill.

By ensuring sufficient financing, thorough sensitization and fund mobilisation together with signing of MOUs and NDAs, consultations amongst the stakeholders will facilitate navigating these challenges for a seamless stakeholder engagement in the sector.

Interventions facilitating access to clean cooking in Kenya

One of the key interventions that have successfully facilitated access to clean cooking is awareness campaigns conducted on clean cooking benefits together with innovative clean cooking pilot projects. Other factors that have also played a good role include training programs for clean cooking practices, NGO programs that create an enabling environment, infrastructure development for electricity access and subsidies for clean cooking technologies as depicted in the figure below.

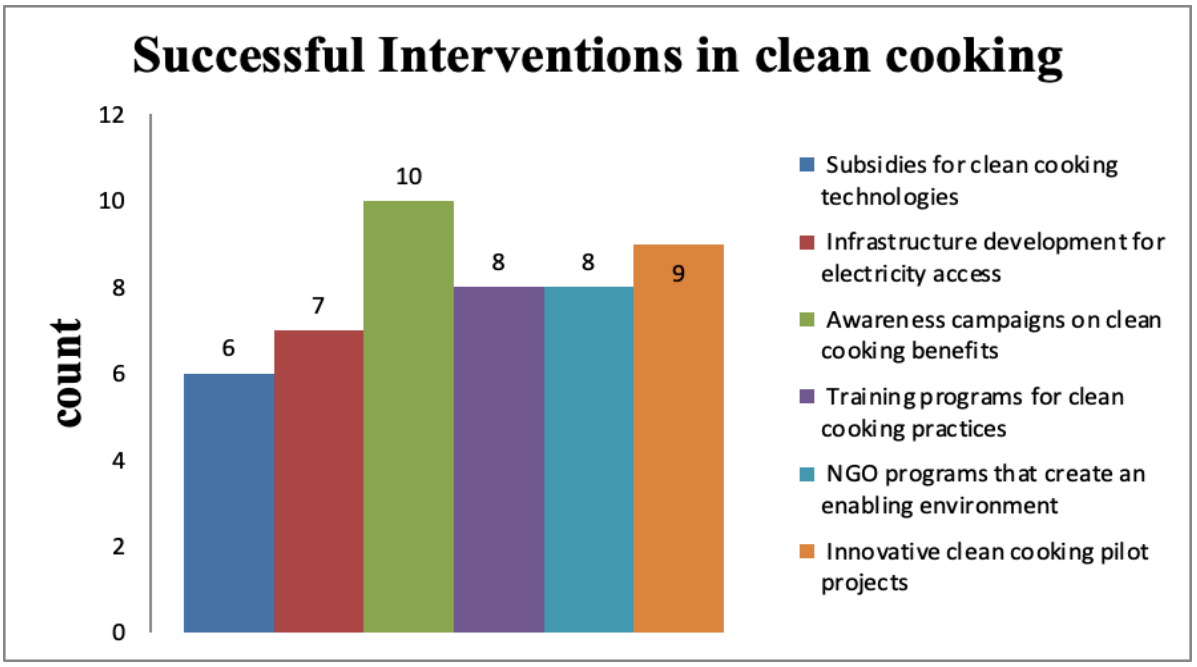


Figure 5:1Successful interventions in clean cooking

However, the subsidies in clean cooking technologies have somehow failed to facilitate realisation of the deemed universal access due to their susceptible nature relying on government funding.

Programs Promoting e-cooking Initiatives/Projects in Kenya

1. ***Awareness of the Existing Programs***

Majority (91%) of the respondents from the survey were aware of projects and initiatives actively undertaken by governments and sector stakeholders in promoting e-Cooking as depicted in the figure below. Some of these initiatives include; the Modern Energy Cooking Services, Community of Practice for e-cooking Kenya, eCAP project, E-Cooking Congress of Parties, KYSEDO and ECOLIBRIUM NGOs among others.

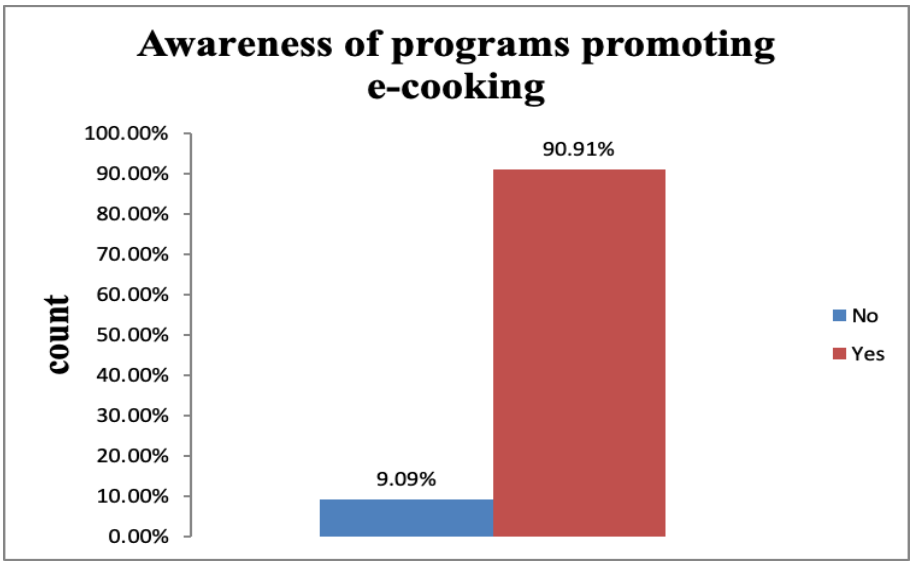


Figure 5:2 Awareness of programs promoting e-cooking

Increased adoption of e-cooking technologies demonstrates that these projects and initiatives have actively impacted the sector. Other prospected evidence from the initiatives included enhanced economic opportunities, improved indoor air quality and reduced deforestation.

There has been more visibility of clean cooking solutions and evidence that have discounted age old myths that cooking with electricity is expensive.

2. Lessons Learnt from these programs

The following key lessons have been drawn from these clean cooking promotion projects;

- Significance of community engagement in the initialization, formulation and implementation of policies,
- Need for sustainable financing mechanism towards these stakeholder engagements,
- Role of policy and regulatory frameworks sensitizations to the stakeholders and
- The imperative of adopting technological advancement in e-cooking.

6 Recommendations

For the realisation of accelerated adoption of clean cooking in our countries and to match with the acceleration of universal electricity access, the following recommendations need to be implemented in the adopted initiatives and strategies;

- Foster for adequate public participation to involve all the stakeholders in the decision making process
- Introduction of favourable tax environment for the investments in clean cooking technologies and the relevant infrastructures
- Ensure development of realisable and well determined strategies towards clean cooking technologies and promotion.
- Introduction of rigorous campaigns for the creation of awareness especially with the high-level decision makers
- Foster realisation of access to affordable and reliable electricity supply for the facilitation of e-cooking adoption as a major anchor to clean cooking.
- Establishment of special tariffs for electric cooking to enhance adoption
- Promote the use of solar powered cookers in rural areas as this will be sustainable solution given the financial status of rural dwellers

7 Conclusion

In regards to clean cooking and universal access to electricity, Kenya, Rwanda and Mozambique have been making tremendous efforts through promotion of renewable energy and clean cooking initiatives and policy measures together with legislative actions. Governments, NGOs and other organisations are working in synergy to accelerate this space. Increased adoption of clean cooking options, improved health outcomes and environmental protection are key benefits resulting from these efforts by the stakeholders. Several ministries share responsibility for the cooking sector, with numerous initiatives promoting sustainable cooking solutions.

Despite the progress made, there are still challenges to achieving widespread adoption of clean cooking technologies in Kenya. Some of the identified challenges include affordability, cultural preferences for traditional cooking methods and the need for education and awareness campaigns. However, various strategies have been put in place to circumvent these barriers including financial incentives, favourable tax environments, rigorous public awareness campaigns, capacity building, public-private partnerships, local innovation, integration with existing programs and advocacy for policy reforms. The need for community engagement in the initialization, formulation and implementation of policies and also sustainable financing mechanisms towards stakeholder engagements are some of the key lessons drawn from this survey.

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