Review of Policy Environment for the Adoption and Diffusion of Clean Cooking Solutions in Kenya and Tanzania

Submitted by

Dr. Nicholas Ozor

Executive Director

African Technology Policy Studies Network (ATPS)

8th Floor, The Chancery, Valley Road

Nairobi

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Acronyms and Abbreviations

ABPP	Africa Biogas Partnership Program
BEST	Biomass Energy Strategy Tanzania
CAMARTEC	Centre for Agriculture Mechanization and Rural Technology
CCAK	Clean Cookstoves Association of Kenya
COG	Council of Governors
COSTECH	Commission for Science and Technology
DEEP	Developing Energy Enterprises Project
DFID	Department for International Development
EAC	East African Community
GACC	Global Alliance for Clean Cookstove
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GOK	Government of Kenya
GVEP	Global Village Energy Partnership
HIVOS	Dutch Humanist Institute for Cooperation
IMF	International Monetary Fund
ISAK	Improved Stoves Association of Kenya
ISO	International Organization for Standardization
IWA	International Workshop Agreement
KCJ	Kenya Ceramic Jiko
KEBS	Kenya Bureau of Standards
KEPSA	Kenya Private Sector Association
KFS	Kenya Forest Service
LPG	Liquefied Petroleum Gas
MEM	Ministry of Energy and Minerals
MOE	Ministry of Energy
NAMA	National Appropriate Mitigation Action
NCCAP	National Climate Change Action Plan
NEMA	National Environment Management Authority
SDGs	Sustainable Development Goals
SEAF-K	Sustainable Energy Access Forum Kenya
SIDA	Swedish International Development Cooperation Agency
SMTP	Second Medium Term Plan
TANESCO	Tanzania Electric Supply Company Limited
TAREA	Tanzania Renewable Energy Association
TaTEDO	Tanzania Traditional Energy Development Organization
TIRDO	Tanzania Industrial Research and Development Organisation
UN DESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
USAID	US Agency for International Development

Executive Summary

There is a pressing call for countries in East Africa to meet the growing energy demand while securing the health of people and the environment. A major goal of their national vision is to ensure sustainable access to affordable, reliable and modern energy for socio-economic development. In this report, we take a regional perspective to review the status of the development of clean cooking solutions in Kenya and Tanzania. The report reviews policy instruments and regulatory environment around clean cooking solutions with the aim of identifying policy gaps and proposing actions that support current policies to catalyse the adoption and diffusion of clean cooking solutions in Kenya and Tanzania.

It is evident that Kenya has a more established clean cookstove market compared to Tanzania. Donor-supported cookstove initiatives and programs have given prominence to clean cookstove development, which has contributed to the current rate of adoption and diffusion in Kenya and Tanzania. Analysis of policies provides an impression of governments' effort to promote the use of clean cookstove as an alternative to traditional sources of energy. As much as these policies exist, their rate of their impact on the clean cookstove sector is rather low. The report argues that it is not just about the existence of multiple policies but how well they are well aligned to address the problems and to help achieve the adoption and diffusion of clean cookstove sectors in the society.

The report identifies some drivers of change that can support transformational policy change in driving forward a market-driven approach for promoting the adoption and diffusion of clean cooking solutions in Kenya and Tanzania. These are: the removal of market barriers such as taxes, levies and licences; prioritization of market-driven models for clean cookstoves; conducting clean cookstove market intelligence; access to finance; tapping into local innovation through research and development; infrastructure for cookstove testing and standards; behavioural change, and exploring emerging financial mechanism such as carbon finance. Strengthening the current policy environment presents a good opportunity to stimulate a change of consumer behaviour, government thinking, policy relevance, legislative landscape and institution set-up, among other things for the adoption and diffusion of clean cookstove in Kenya and Tanzania.

1.0 Introduction

In the last decade, the need for cleaner and efficient energy alternatives to address health and environmental problems associated with continued use of traditional cooking methods has been gaining momentum at national and international levels. In a global consensus highlighting the critical role of access to energy for sustainable development, the United Nations in 2012 launched the Sustainable Energy for All (SE4All) initiative that ambitiously targets a universal access to electricity and modern cooking energy systems by 2030. Goal 7 of the United Nations' Sustainable Development Goals "ensure access to affordable, reliable, sustainable and modern energy for all" by 2030 put clean and efficient energy at the centre stage. Nonetheless, to achieve universal access to clean cooking energy for the world over the next 15 years, a total of around US$ 31 billion per year will be required (World Energy Outlook, 2017).

East Africa countries are faced with the pressing challenge of expanding access to affordable, reliable and modern energy services. Over 81% of its populations live without access to modern energy services (EAC, 2009). Traditional biomass energy, primarily wood and charcoal, plays an important role in the larger economy of East African countries, particularly in the rural areas. The majority East Africans rely mainly on wood and charcoal as their main cooking fuel. For example, between 76 - 82% of the population in Kenya and Tanzania relies on traditional biomass for cooking. Research has documented multifaceted negative implications of traditional biomass energy usage in East Africa including deforestation, increasing GHG emissions, land degradation and Indoor Air Pollution (IAP), which is linked to an estimated 15,000 deaths (of mainly women and children) in Kenya and 18,900 deaths in Tanzania annually (Clough, 2012; Lambe et al. 2015; UNIDO, 2015).

The cookstoves are regarded as one of the oldest and simplest household technologies for cooking in many developing countries. For East Africa, the development of the cookstove sector started in the 1980s, with the introduction of the charcoal cookstove by the Kenyan Ceramic Jiko (KCJ). Since then, several improved clean cooking technologies have been introduced into the market to serve both urban and rural communities. There has been wide variation in the adoption and diffusion of clean cooking solutions in East African countries. In Tanzania, the rate of adoption and diffusion of clean cookstoves has been rather slow, due to the low capacity for large-scale commercialization and the fact that most of the clean cooking initiatives have been smaller scale donor-assisted projects with short-lived funding (Clough, 2012). Kenya has the most advanced clean household energy sector in East Africa in terms the adoption of improved cookstoves technologies, diversity of producers and products, marketing and distribution of products (Lambe et al. 2015).

In spite of the significant progress, the adoption and diffusion rates of clean cooking solutions remain low: this points to the persistence of significant barriers. In addition to lack of awareness and understanding of the economic, social and environmental benefits of clean cooking solutions, recent studies have indicated the need for: (i) more efficient, affordable and durable products, (ii) more intelligent business models (marketing and distribution networks, and accessing finance for working capital); (iii) smarter and holistic policies; and (iv) better understanding of household behaviour change techniques (Global Alliance for Clean Cookstove [GACC], 2013; Namagembe et al. 2015; Lambe 2016).

There are several innovative cookstove initiatives and programs designed to address the socio-economic and environmental challenges. For instance, institutions such as the Global Alliance for Clean Cookstoves have been at the forefront of supporting the development of improved clean

cookstoves programmes and initiatives in East Africa. We also see a growing cookstove sector that has the potential for large-scale commercialization given the correct financial and business development support. In order to achieve large-scale adoption and diffusion of clean household solutions, there is a need for recognition of the relevance of clean household energy use to the larger economy, especially in rural areas. The creation of an enabling environment is critical for adoption and diffusion of clean cooking solution in Kenya and Tanzania. Such an environment must foster the formulation and implementation of pro-poor economic policies, regulation and institutions that remove market barriers, nurture home-grown innovations, facilitate access to finance and credit for the development and upscale of clean cooking initiatives.

Conducive policy environment and efficiently functioning institutions play a central role in driving deployment of clean cooking solutions market and requires long-term stability, timely and adequate adaptation. Policies and regulations that change after a short period are most likely to compromise investors' confidence. Current knowledge suggests that policy framework that provides incentives for private sector operators' engagement in the production, distribution and sale of clean cooking solutions would be an enabler for the adoption and diffusion of clean cooking solution (Rehfuess et al., 2014). A well-functioning institutional arrangement is a critical enabling environment for innovations to thrive.

This paper adopts a regional perspective, focusing on the review of existing policies and regulatory frameworks that support or hinder the adoption and diffusion of clean cooking solutions in Kenya and Tanzania. The aim is to identify the gaps and propose actions and recommendations that will help to address the identified policy gaps. The paper also examines the institutional arrangements around the clean cooking solutions and whether it is a catalyst or a barrier to adoption and diffusion of the technology. To guide the analysis, the paper will address the following interrelated questions: (i) what is the current status and emerging trends regarding clean cooking solutions in Kenya and Tanzania?; (ii) what are the existing national policy and regulatory frameworks that influence the adoption and diffusion of clean cooking solutions?; and (iii) what are the institutional arrangements for the adoption and diffusion of clean cooking solutions in Kenya and Tanzania? Specific questions include: what are the different types of existing clean cooking solutions in the market? Which stakeholders are currently involved? What form, if any, exists in the coordination of diffusion of clean cooking solutions among the various institutions involved? Are there any synergies for example in terms of integrating diffusion of clean cooking solutions in other broader development programs targeting those most likely to adopt clean cooking solutions? What is government's role in inhibiting or enhancing the dissemination of clean cooking solutions? Has community involvement been enhanced in the identification of suitable designs and in the distribution of clean cooking solution? What about fostering women's engagement as the key users and therefore beneficiaries of clean cooking solutions?

The paper will approach these questions in two steps. First, it analyses the current status of the adoption and diffusion of clean cooking solutions diffusion in Kenya and Tanzania, as well as the policies and regulatory frameworks that support the market clean solutions in the two countries. Secondly, the paper will examine the key dynamics in the development and diffusion of clean cooking solutions in the two countries. This analysis focuses on the production, marketing and diffusion of clean cookstove technologies, which has gained prominence in the current research and development (R&D) space.

The paper is organised as follows. Following the introduction, sections 2 and 3 present the methodology used and the socio-economic situation in Kenya and Tanzania. In sections 4, the report presents an overview of the cookstove market. In section 5 and 6, the paper presents analyses of the current status of the adoption and diffusion of clean cooking solutions diffusion in Kenya and Tanzania, and the policies and regulatory frameworks and policy gaps in Kenya and Tanzania respectively. Section 7 presents a cross-cutting discussion of key dynamics in the development and diffusion of clean cooking solutions, focusing on the production, marketing and diffusion of clean cookstove technologies. Section 8 we present the conclusions of the paper.

2. Methodology of the research

The paper employs mix methods for data collection and analyses, drawing on both primary and secondary sources of data. Specifically, the paper draws on empirical research published in scientific literature including peer-reviewed articles, research papers and review papers, grey literature such as policy documents, strategy and actions plans, project reports, consultancy reports, donor reports and documentaries on clean cooking solutions, among others. The paper also draws on previous studies on clean energy solutions and low carbon development that were conducted by the research team. In addition to the review, the paper relies on expert consultations and data from surveys conducted on clean cooking solutions actors in Kenya and Tanzania.

3. Socio-economic characteristics of Kenya and Tanzania

Kenya and Tanzania are two major countries in the East Africa Community. In term of both population and land size, Tanzania is the largest of the East African countries (Table 1). The population of Tanzania has almost tripled since 1967 when the first post-independence population census was carried out. At an annual growth rate of 2.7 percent, Tanzania has one of the fastest growing populations in the world. According to a recent study by Agwanda and Amani, (2014), at the current growth rate, it is expected that the population of Tanzania will reach 70.1 million by 2025. Equally, they find that the high population growth rate in Tanzania is attributed to the continuously high fertility rate, reduced mortality and low international net migration. Kenya has the second largest population in East Africa and this is projected to reach 95 million by 2050 and more than 160 million by 2100 (UN DESA, 2015). Both countries are characterised rapidly growing population and rapid urbanization that is putting significant pressure on already limited facilities and resources. While the majority of the population in Kenya and Tanzania still lives in rural areas, urban areas in both countries continue to witness increase migration of people from rural areas in search of work and better living conditions.

Kenya for a long time has long been touted as the largest economy in East Africa with a gross domestic product (GDP) of approximately US$ 70.53 billion (World Bank, 2016). This position recently changed as Ethiopian's economy grew significantly to open a 3.61 billion gap on Kenya's economy, thereby overtaking Kenya as the leading economic giant in the Eastern Africa sub-region according to data from the International Monetary Fund (IMF) (World Bank, 2016). Kenya's economy has stalled in recent years due to the high inflation rate and currency depreciation. The informal sector accounts for approximately 83% of jobs in Kenya, offering the largest share of employment. Within the public sector, compulsory social security, public administration, health insurance, and education sectors provide the largest share of employment. The economy of Kenya is largely agriculture-based, with farming and fishing accounting for around 30% of the total GDP. The manufacturing sector contributes around 10% to Kenya's GDP (Deloitte, 2017). Other significant

sectors that contribute to GDP by way of taxes are transport and storage, real estate, finance, and insurance.

Though Tanzania's economy is relatively smaller with a GDP of US$ 47.43 billion, it has expanded quickly at a rate of 7% in 2016, becoming one of the fastest growing economies in Sub-Saharan Africa (World Bank, 2016; Deloitte, 2017). This expansion slowed down during the last quarter of 2016, though growth continued into 2017. Due to the sustained economic growth, the poverty rate fell from 60% in 2007 to an estimated 47% in 2016 (Deloitte, 2017). Nonetheless, about 12 million Tanzanians still live in extreme poverty on earnings of less than US$0.60 per day according to the World Bank data (World Bank, 2016). The country remains vulnerable in event of socio-economic shocks, which are likely to send people living above the poverty back into poverty.

Like other African countries reliant on rain-fed agriculture, Kenya and Tanzania are highly vulnerable to climate change impact. In recent time, both countries have witnessed the impact of climate change including increased water scarcity, rising temperatures, erratic rainfall, and extreme weather events such as floods and droughts (WWF 2006). This impact is reflected in the mixed performance of the agricultural sector. The decline in agricultural production and the high rate of environmental degradation as a result of climate change threaten the economy and well-being of the population of Kenya and Tanzania.

Table 1: Social and economic situations in Kenya and Tanzania

Social and Economic Features	**Kenya**	**Tanzania**
Total Population (2018)	50 Million	59 million
Rural/ Urban Split	73.6/26.4%	61/ 39%
Rate of Urbanization	4.15%	5.0%
Average household size	4.4	4.8
Literacy rate	78%%	80.4%
Average Life expectancy	62.13	65.49 years
Percentage of population below poverty line	42%	67.9%
Gross Domestic Product (GDP) (2016)	US$ 70.53 billion	US$47.43 billion
GDP Per Capita (PPP) (2016)	US$ 1,455.36	US$ 879.19
GDP Growth Rate (2016)	5.8%	7.0%
Inflation Rate	9%	5%

(Source: UNICEF Statistics, CIA Database)

The production and use of clean and sustainable cooking technologies present a substantial opportunity for social and economic development in Kenya and Tanzania. Different types of clean cooking stoves, using different raw materials are produced locally to suit local conditions. In both Kenya and Tanzania, the clean cooking sector is in a transition towards a transformative stage, affording the diverse actors the opportunity to make a positive, visible and sustainable impact in the provision of clean energy for the rural masses. The prospect for large-scale adoption and diffusion of clean cooking solutions is tremendous due to a combination of multiple trends, including availability and access to fuel-efficient cookstove with low emissions; the rising demand for alternatives and

efficient biomass fuel production technologies, innovative business models coupled with growing market potential, new carbon financing opportunities; and the global agenda for clean energy, such as Sustainable Energy For All initiative and Global Alliance for Clean Cookstoves (World Bank, 2012).

4. Cookstove Market Overview

The cookstove sector in Kenya and Tanzania has been in existence for almost four decades. With support from key actors such as the donor community, non-governmental organization, private sector, government and research institutions, among others, the cookstove sector has gradually evolved resulting in a diverse range of locally manufactured stoves available in the market. However, one of the critical issues related to the adoption and diffusion of the stoves has to do with the quality and efficiency of the different stoves in the market.

In terms of the type of fuel used by the household, approximately 89% of rural households and 6.4% of urban households in Kenya use fuelwood in three stone fires, rural improved stoves, and ceramic stoves (UNIDO, 2015). In Tanzania, fuelwood accounts for approximately 90% overall energy supply and demand from the household (Biomass Energy Strategy of Tanzania [BEST], 2014). Charcoal and kerosene are the main fuel used by urban household to meet cooking needs. In the urban area, the cost of fuel is higher due to several factors including seasonal fluctuations in supply, cost of transportation, and availability of fuel at the source. According to an assessment conducted by UNIDO, the charcoal market is said to have been most variable (as much as 50%) with regards to supply and costs. Over the past decade, charcoal demand has nearly doubled in Tanzania, due to the rapid rate of urbanisation and relatively high cost of other cooking fuels like LPG or electricity (BEST, 2014). Another type of fuel is the production of briquette, made from recycled biomass waste, which has gained significant attention as a reliable clean cooking energy source in Kenya and Tanzania, particularly in the urban areas. Despite the growing popularity of briquette, the market for briquette is yet to be exploited. Very few medium scale enterprises for briquette production have taken off though, with user perception and pricing, briquette has struggled to compete with traditional fuel sources.

The use of modern clean fuel such as LPG is on the rise in Kenya and Tanzania. Kenya is considered to have the highest rate of modern energy use than other parts of East Africa. Close to 60% of Kenyans in urban areas have access to modern fuels compared to less than 10% in Tanzania (UNIDO, 2015; BEST, 2014). The current consumption per capita of LPG in Kenya is 2.1 kg. Kenya has seen a growth in demand in LPG consumption from 78,000 tons in 2008 to the current level of 100,000 tons (UNIDO, 2015). In spite of this growth, the overall coverage in terms of use and diffusion of LPG remains low. The low coverage can be attributed to the high price on LPG in the market. Currently, LPG is retailed in cylinders of 6 kg, and 13kg for domestic use, at Kshs 1,300 and 2,700 per cylinder respectively. In both Kenya and Tanzania, the promotion of biogas for cooking is on the rise through the National Biogas Program. However, due to the high investment cost during the initial stage, the adoption and diffusion of biogas for cooking are still very low.

The cookstove market is dominated by micro, small and medium-size manufacturing enterprises operating within the informal sector. The current production levels are not sufficient to meet the cooking needs of the population in both countries. However, due to the growing attention on the clean and improved cookstove, the sector is beginning to see interest and investments from international cookstove producers with the prime goal of spearheading large-scale production of

clean cookstoves in both Kenya and Tanzania. The introduction of carbon finance has stimulated the clean cookstove market in recent years with incentives such as subsidies and free cookstoves provisions in many cookstove projects (Clough, 2012).

The cookstove market is made up of several business models. Along the production chain, there are some producers who manufacture only certain components of the cookstoves, while others assemble these components. Some produce make complete stoves. Along the chain, retailers and middlemen play a key role in the supply and distribution of cookstoves, although these groups of actors have contributed to price hikes in cookstoves. The diagram below depicts a simplified value chain for the cookstove market, from stove production to the end user purchase.

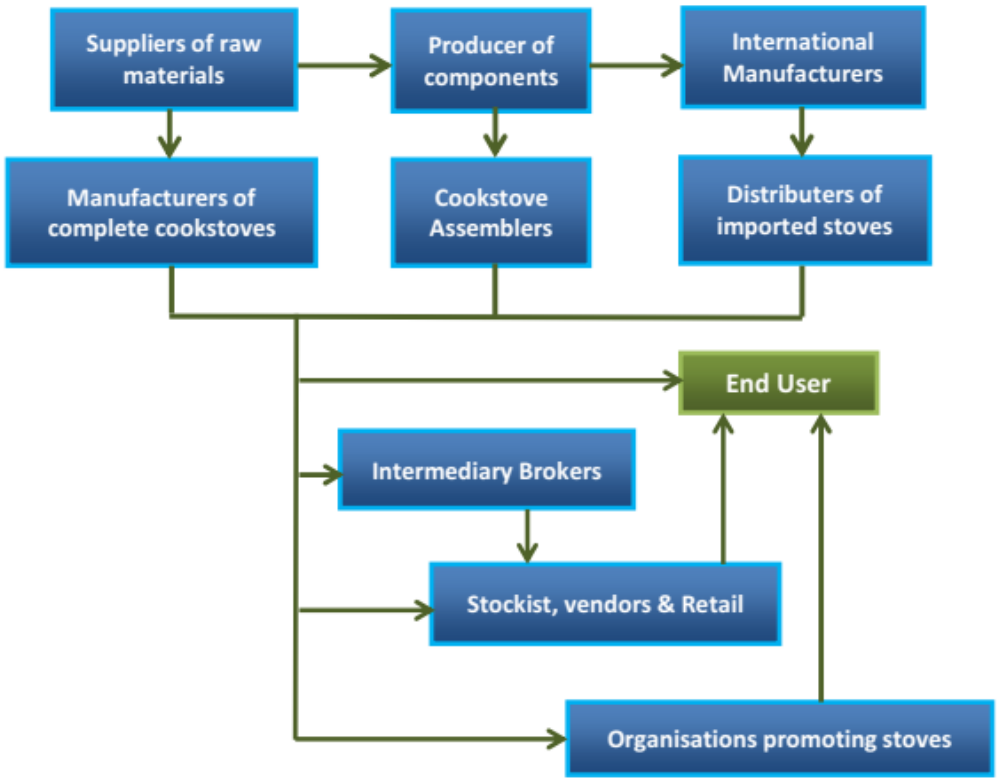


Figure 1: Cookstove market value chain in East Africa (Clough, 2012)

5. Kenya

5.1 Development of Clean Cookstoves

Inspired by the United Nations Conference on New and Renewable Sources of Energy, held in Nairobi in 1981, Kenya has been engaged in the development of cookstove over the past four decades. One of the pioneer cookstoves produced was the Kenya Ceramic Jiko (KCJ), which is a modified version of the Thai Bucket Stove (Clough, 2012). Other cookstoves that were introduced during the early years include the Mandeleo stove and the Jiko Kisasa, which are both low cost fixed wood burning stoves that can be assembled in-house with locally available materials. Building upon the existing stoves in the market, the GIZ introduced a much more efficient stove called the rocket in a portable and fixed form at a higher price to the end user. The design of the cookstove has evolved and improved significantly, gaining local user acceptability. During this period, local artisans have received technical training skills on improved cookstove development, which has contributed to local innovations in cookstove designs and new types of cookstoves such as multipurpose Kuni Mbili and Uhai stoves. Imported cookstoves from Envirofit and the Kenyan Jiko Poa, Upesi, Uhai, and Rocket stoves have been in the Kenyan market since 2010. There are few mechanized systems that produce cookstove such as the Jiko Poa stove produced by Fine Engineering (UNIDO, 2015).

With the evolution and improvement in the cookstove sector, Kenya has experienced a decent level of commercialisation with a market that is established than other countries in East Africa. The cookstove value chain is dominated by small to medium scale productions. A major portion of the production of cookstove is done by hands limiting the large scale production.

A recent study by Global Village Energy Partnership (GVEP) International estimates that between 2.5 and 3 million Kenyan households use some form of improved cookstoves with the cost ranging from US$6-20 (GVEP, 2012). The current overall uptake of clean cookstoves at the national level is estimated at 47%. In Nairobi, about 500,000 households use KCJ for heating, cooking, and grilling (Kenya Climate Innovation Center [KCIC], 2016). Each year, approximately half million KCJ stoves are being pushed into the market annually. Most clean cookstove in Kenya fall below ‘tier 2’ category as defined by the Global Alliance for Clean Cookstoves (GACC) showing significant margins for improvement. In terms of the fuel use, studies indicate that between 50-60% of charcoal are using some type of clean cookstove with adoption rate at around 80% in Nairobi and Mombasa (Clough, 2014; UNIDO, 2015). The adoption rate of the woodstove is significantly lower than charcoal at around 4% - even though the rate of adoption is quite higher in areas woodstove interventions have occurred. In addition to charcoal, many low-income urban households have adopted kerosene stoves due to their affordability, availability and convenience to use. Also available in the market are the imported biomass stoves like Envirofit, which are being distributed by Paradigm Project and East Africa Energy. In order to domesticate this stove, Envirofit is setting up a production facility in Kenya.

The LPG market in Kenya is currently underdeveloped, with 5-7% of households depending on LPG as the main cooking fuel (UNIDO, 2015). The use of LPG penetration is predominant in urban areas at 21% while only 1% of rural households use LPG as the primary fuel. The city of Nairobi accounts for 60% of the total population using LPG, followed by Mombasa with 15% percent of the market. The rest are scattered through emerging urban areas in the country (ibid). The relatively high cost of LPG in Kenya contributes to the current underdeveloped status of the LPG market and constrains investment across the value chain and keeps retail prices high for end users. In order to address this problem, a recent LPG cooking initiative called the Pima Gas has been tested and promoted by

Premier Gas. The scheme offers a 1 kg gas cylinder and refills at a price as little as 50 KES (US$0.49). The aim is to reduce the high upfront costs of LPG hardware and refilling in order for low-income urban households to have access to affordable LPG. Table 2 presents the different types of cookstoves available in the Kenyan market.

Table 2: Different types of existing clean cooking solutions in Kenya

Kenya	Kenyan Ceramic Jiko		Uhai Stove		Mulit-purpose stove	
Cost Range	$4-$10		$10 - $18		$9	
Thermal Efficiency	30-40%		36%		20% Wood, 30% Charcoal	
Manufacturer	Various		Keyo Pottery Enterprise, various		SCODE, around Kiria, various	
Key Features	Ceramic liner with metal cladding. Production has been sustained on commercial basis		Improvement on the KCJ with clay rim to retain and direct heat.		Ceramic liner and metal cladding with removable charcoal grate so it can be used with both wood and charcoal	
Production Capacity	Demand driven. Collectively large but individual producers make a few hundred a month. Liner producers may have higher capacity.		Not extensively produced- demand driven. Most production in the hundreds per month.		Not extensively produced- demand driven. Most production in the hundreds per month.	
Distribution Channels	Complete stoves sold through middlemen, retailers, markets & small vendors.		Sold through retailers, middlemen and markets.		Sold through retailers, middlemen and markets.	
Availability and Use	Use ◑ Availability ◕		Use ◔ Availability ◔		Use ◔ Availability ◔	

Kenya	 Fixed Brick Rocket Stove	 Co2Balance	 JikoPoa	 Envirofit Wood Stove
Manufacturer	Various, GIZ trained	Made in Mombasa, distributed by Co2Balance	Fine Engineering, Nairobi	Envirofit (Imported)
Cost Range	Starting at $15	Free (subsidised), installation $2	$14 (subsidised)	$23.5 (subsidised)
Thermal Efficiency	24%-32%	Around 35%	22%	33%
Key Features	Fixed wood stove made from fired clay bricks held together with mortar	Wood stove made entirely from ceramics based on rocket stove principle	Ceramic liner inside metal cladding with pot skirt	Highly engineered wood stove manufactured in China
Production Capacity	Demand driven, end user gathers material and pays for installation.	GS projects will install 20,000 stoves each	Can produce 80 pieces a day.	Demand Driven
Distribution Channels	Direct sales	Stove distributed within vulnerable communities free of charge	Distributed through Paradigm Project	New to the market, still setting up distribution networks
Availability and Use	Use ◔ Availability ◔	Use ◔ Availability ◔	Use ◔ Availability ◔	Use ◔ Availability ◔

(Source: Clough 2016)

5.2 Current Initiatives to promote Clean Cookstoves in Kenya

There are several programs targeting the development and promotion of clean cooking solutions in Kenya. These programs are mainly implemented by non-governmental organizations, civil society organizations, the private sector, and development donor in collaboration with national institutions in Kenya. Kenya's Ministry of Energy (MoE), through the Department of Renewable Energy, has been at the forefront of promoting cookstove over the past four decades. Through the established energy centres across the country, the government has promoted the adoption and diffusion of cookstoves as well as training of artisans and entrepreneurs on cookstove technologies. Currently, the ministry is implementing three clean energy initiatives, with cookstove components. These include Energy Plus Initiative, Kerosene Free Kenya and Sustainable Energy for All.

The United Nations Development Programme has implemented several collaborative projects on clean cooking solutions in Kenya. Some of these initiatives include the UNDP's Low Emission Capacity Building (LECB) Programme, a country-driven initiative that promotes essential cooperation between relevant institutions, engaging the public sector and industry in a concerted effort to design and implement approaches to low emission development that are consistent with national development priorities (UNDP, 2016); The Standards and Labelling Program and Access to Clean Energy Services initiatives aims to strengthen the capacity of Kenya's Ministry of Energy and Petroleum as well as assisting the development of standards and policies.

The Global Alliance for Clean Cookstoves (GACC) is working with the Clean Cookstoves Association of Kenya (CCAK), Kenya's Ministry of Environment, Water, and Natural Resources, the Ministry of Health and the World Bank to promote the adoption of clean cookstoves and fuels in Kenya. So far, between 1.5 and 3.5 million improved cookstoves have now been deployed in Kenya: despite the fact that most of these are still at Tier 1-the most basic, efficiency level. The work of GACC has resulted in the emergence of numerous local and international innovators/manufacturers in Kenya. The GACC targets 100 million clean and efficient cookstoves internationally and 1 million improved cookstoves disseminated and maintained in Kenya by 2020 (GACC, 2015).

In 2008, Global Village Energy Partnership (GVEP) International initiated the Developing Energy Enterprises Project (DEEP) in East Africa which aimed to create a sustainable and widespread network of energy entrepreneurs involved in the manufacture and distribution of clean cookstoves, solar PV products and services, clean fuel briquettes, and biogas systems. This program targeted energy access to 1.8 million people in Kenya, Tanzania, and Uganda. Working with women and men in over 900 energy-related micro, small and medium enterprises (MSMEs), the program has far exceeded its goals with over 4 million beneficiaries as of February 2013.

The Africa Biogas Partnership Program (ABPP) is a Public-Private Partnership initiative implemented by Dutch's SNV and Hivos and the Kenya National Federation of Agricultural Producers (KENFAP). This initiative aims to provide access-to-energy services through the installation of biogas digesters in partnership with local enterprises, NGOs, and governments. Currently, the largest initiative for the promotion of both clean cookstoves and fuel in Kenya is spearheaded by the Global Alliance for Clean Cookstoves (GACC). Under the theme "Cooking shouldn't kill," The GACC has mobilized global resources from development funders, private investment and governments to drive the development, marketing distribution, and uptake of clean cookstoves and fuels. In Kenya, the GACC is focusing on the distribution of clean cookstoves to at least one million households and this is locally managed by the Clean Cookstoves Association of Kenya (CCAK), and supported by local

institutions such as the Improved Stoves Association of Kenya (ISAK). Additional details of the various initiatives can be found in Table 3.

Table 3: Clean Cookstove Initiatives in Kenya

Initiative/Project	Who	What	Challenges	Partners
The Improved Cook Stoves for Households and Institutions Project (2011-2015)	The project is run by HIVOS, working with SCODE - a local NGO and assembler of improved cookstoves.	The program aims to build the capacity of SCODE a local NGO and stove assembler so that they can go on to further support small-scale producers, end users and institutions with the aim of scaling up the commercialisation of the technology. SCODE will open up 5 new branches for the project.	Maintaining consistent quality of the cookstoves when parts are sourced from different suppliers.	HIVOS, SCODE, EU,
Developing Energy Enterprises Program (DEEP) (2008-2013)	Implemented by GVEP International with technical support from IT Power	The program provides business and technical support to existing micro energy enterprises through training, mentoring, and market linkages. It also links entrepreneurs to financing through its loan guarantee program to enable them to expand their businesses. The program has trained over 300 entrepreneurs in Kenya	Changing mindset of entrepreneurs to realise the market potential of the energy business.	IT Power, Practical Action, Coastal Rural Support Program Kenya
Improved Cookstove for East Africa	Collaboration between Uganda Carbon Bureau, Care International and the Nordic Climate Facility	The project aims to provide sustainable access to affordable and efficient cookstoves. Improving affordability of these cookstoves is achieved by the setting up of a CDM Program of Activities (registered 2011) that will provide stove suppliers with access to revenue from the CDM carbon market.	Delays in registering the project in the country. Identification of suitable stove producers to work with	Uganda Carbon Bureau, CARE International, Nordic Climate Facility.
Improved Stoves and Portable Solar Lighting Program	SNV provides capacity building and advisory services in renewable energy	Since 2011 SNV have expanded their activities into the cookstove sector working on a model for commercialisation. They are working with various partners including GIZ and ISAK and Envirofit distributors to build capacity, create market linkages, strengthen distribution and improve access to finance	Raising consumer awareness on improved cookstoves. Developing standards for the sector	GIZ, ISAK
Kenyan Stoves Project Energizing Development, EnDev) (2005 – 2012)	Implemented by German-based NGO GIZ (formerly under the PSDA program)	The project supports access to modern cooking energy by promoting the sustainable production, marketing, installation and use of improved cooking stoves. These stoves include the portable or installed Jiko Kisasa stove and the built-in mud or fired brick stove, the Rocket	Maintaining quality standards amongst producers. Educating end user on proper use & maintenance of the stoves.	Ministry of Energy, Ministry of Agriculture, Ministry of Education
East Africa Energy	East Africa Energy is an NGO focusing on reducing carbon emissions through market-based approaches	East Africa Energy is distributing the Envirofit imported charcoal stove in urban areas of Kenya through the development of a network of vendors. They are also linking with existing networks to distribute products through. The project will be linked to carbon finance to provide the stove at a subsidised price.	Delays in the registration of the carbon project. Monitoring of the stoves for tracking purposes.	Envirofit, AdvanceAid
The Paradigm Kenya Efficient Stoves for	Paradigm Project is a carbon project	Paradigm project aims to distribute approximately 250,000 improved household cooking devices in 7 years. It is selling the	Setting up effective distribution networks.	Food for The Hungry, World

Livelihoods and the Environment Project	developer focusing on sustainable change	Envirofit wood stove and jikopoa stove through a network of stove vendors on a commercial basis and through NGO's.	Monitoring requirements for carbon credits restrict distribution methods	Vision, World Food Program
Improved Cookstove Project – CO_2 Balance	CO_2 Balance is a UK based carbon project developer	CO2Balance have several projects in Kenya including Kisumu, The Abadares and Shimba Hills. Projects focus on communities with high biomass use and distribute stoves virtually free of charge subsidised by carbon revenue. Communities are also educated on stove use	Creating continuous funding for projects	-
Stoves for Life – Eco2librium	Eco2librium develops and implements carbon projects to foster sustainable energy and natural resource use.	Eco2librium works with local groups to build their capacity to produce the ceramic Upesi stoves and provides mechanisms to distribute and sell stoves to communities. The project works around Kakamega forest and provides the stove at 80-90% subsidy.	-	My Climate

(Source: Clough, 2012; World Bank, 2016)

5.3 Policy environment for Clean Cookstoves Development in Kenya

With a relatively advanced cookstove sector, Kenya has made a significant effort to promote the adoption and diffusion of a cleaner, more efficient cookstoves and fuels. The government of Kenya worked closely with stakeholders including the GACC, the Clean Cookstove Association of Kenya, and the Petroleum Institute of East Africa to provide an enabling policy and regulatory environment for the clean cookstove sector. In 2016, the government announced the removal of the 16% value-added tax (VAT) on LPG (Government of Kenya, 2016). The VAT, which was introduced in 2013, increased the price of LPG, limiting the adoption and diffusion of clean-burning cooking fuel and compelling consumers to return to heavily-pollutants such as kerosene, charcoal, and firewood. The policy change has spurred a wide adoption and diffusion of LPG and high efficient clean cookstoves.

In line with the policy change on VAT removal on LPG, the government announced an increase in the cost of kerosene by Kshs 7.20 ($.07 US) (GACC, 2016). The move seeks to discourage the use of kerosene while facilitating the adoption and diffusion of cleaner cookstoves and fuel. This change was influenced by the growing government recognition of the evidence of the toxic effects of kerosene use on human health (respiratory diseases), and the sustained sensitization and advocacy from several interest groups pushing for cleaner cookstoves adoption and diffusion. This signifies how a monetary policy change can drive a healthier, sustainable usage of clean energy at the household level and provide a conducive environment for growth in the clean cooking market.

In addition to the tax removal on LPG, the Kenya government has also drastically slashed down the import duty on energy efficient cookstoves from 25% to 10%, thus bringing the duty to similar cookstoves and cookers that use electricity, and gas, among others with a current duty rate of 10%. The outcome of this positive step is expected to be passed onto cookstove users thus boosting the efficient cookstoves adoption and diffusion as well as enhancing further growth of the companies that design, produce, and distribute cookstoves and products with that are affordable and environmentally friendly.

The efforts by the government show the sensitivity of the government to call for policy reforms that produce an enabling environment for a well-established and sustainable clean cooking sector. These recent actions are fundamental to pursuing a universal access to energy for cooking by 2030 as specified in the Sustainable Energy for All Action agenda, achieving the Sustainable Development Goals and implementing Kenya's Nationally Determined Contribution to addressing climate change. These positive policy changes are not only vital for the sustainable growth of clean cookstove market in Kenya but also a good learning experience for other countries.

5.4 Policies supporting Clean Cookstove in Kenya

Kenya has witnessed a significant transformation in the policy arena with the development of many policies and regulatory frameworks since the promulgation of the 2010 Constitution. The section below briefly outlines the specific government policies that are relevant to the adoption and diffusion of clean cooking solutions in Kenya. These policies, strategies and regulatory frameworks include the 2010 Constitution, the Vision 2030, the Second Medium Term Plan (SMTP), National Climate Change Action Plan (NCCAP), National Energy and Petroleum Policy, and the Green Economy Strategy and Implementation Plan 2016 – 2030.

a) The 2010 Constitution

The Constitution creates a devolved system of government decentralising power to the County levels. It declares equity as an underlying principle of governance and assures Kenyans access to essential economic, social, and environmental rights. The Constitution calls for a 10% forest cover of the total land area of Kenya. Currently, the forest cover of Kenya is estimated to be 3.467 million ha representing 5.9 percent of the land area, out of which 1.417 million ha is made of indigenous closed canopy forests, mangroves and plantations (GOK, 2015). Kenya has a wood demand deficit of over 10 million m^3 which high the critical need for sustainable wood supply (UNIDO, 2015). With such deficit, the Constitution calls for strategies and technologies that help Kenya achieve the 10% increase in forest cover. An important and fundamental co-benefit of clean cookstoves initiatives is the reduction of wood demand for fuel and subsequent contribution towards balancing the current deficit. The Constitution through the Clean Energy National Appropriate Mitigation Action (NAMA) guarantees a clean and healthy environment through the mitigation of greenhouse gas emissions and improvements in noise, air and healthcare related pollutants resulting from wood burning for cooking under articles 42, 69, and 70 in protection of the environment (Government of Kenya [GOK] 2010).

b) Kenya Vision 2030

The Vision 2030 is Kenya's long-term development blueprint, which is implemented through a series of five-year medium-term development plans with the recent plan being the Second Medium Term Plan (SMTP) 2013- 2017. The Vision 2030 targets a transformation of Kenya into a middle-income country with the capacity to provide a high quality of life to all its citizens by 2030. The Vision 2030 recognizes the central role of energy to the economic, social, and political development of the country. It provides a policy framework for "cost-effective, affordable, and adequate quality energy services" on a sustainable basis over the period 2004-2023.

The promotion of clean cookstove development in Kenya is seen as an important intervention to fulfilling Vision 2030's goal of increasing national forest cover to 10% by 2030 as well as creating wealth by building a reliable business for small, medium and large enterprises. The Clean Energy NAMA directly addresses multiple articles under the Constitution's Bill of Rights in the form of indirect economic-social-environmental co-benefits associated with healthcare related particulate emissions and a clean and healthy environment (Articles 42,69, and 70). It supports building a clean, secure and sustainable environment that cuts household air pollution by reducing the amount of wood burning. It also directly addresses Vision 2030's stated concern about the relationship between poor air quality due to wood reliance and upper respiratory infections.

c) Third Medium Term Plan (MTP3) 2018-2022

The Third Medium Term Plan (MTP3) 2018-2022, which succeeds the Second Medium Term Plan (SMTP) 2013-2017 underscore the need to protect the environment and building resilience to climate change (MTP3). Under the SMTP, there was a notable achievement in the area of environmental management and protection. The area under forest and tree cover increased from 6.9 % in 2013 to 7.2 % in 2016. A total of 47 County Environmental Action Plans were developed and finalized. The goals of the SMTP aligns with the Sustainable Development Goals (SDGs) – to achieve economic development without destroying the environment, reducing extreme poverty, achieving health and wellbeing of all Kenyan citizens, reducing human-induced climate change with sustainable energy. The MTP3 also calls for an increase in the share of energy generated from renewable energy sources. The plan seeks to offer incentives to attract both domestic and foreign

investment including increased reliance on Public Private Partnership (PPP) arrangements in implementing programmes and projects. t, therefore, provides an enabling platform for the development of clean cooking solutions as a means to contribute towards a clean energy provision and environmental protection in Kenya.

d) National Energy and Petroleum Policy 2015

The National Energy and Petroleum Policy (NEPP) draft stipulate that Kenya's overall energy and petroleum policy is to ensure affordable, competitive, sustainable and reliable supply of energy to meet national and county development needs at least cost while protecting and conserving the environment. The NEPP draft is the result of a combined effort to harmonize different provision within the energy sector including the Sessional Paper No. 4 of 2004, the Energy Act 2006, the Geothermal Resources Act Nº.12 enacted in 1982; the Petroleum Act (Chapter 308 of the Laws of Kenya); and legal frameworks and regulations, administrative procedures, government guidelines and circulars on for energy development in Kenya.

The policy reiterates the deficit in wood supply and demand, emissions from wood fuels, and inadequate alternative clean energy sources as major challenges. The policy notes that firewood and charcoal account for 69% of Kenya's total energy consumption highlighting the huge gap between the existing tree cover and the constitutional requirement for 10% tree cover. The policy also raised the serious health-related problems such as Upper Respiratory Tract Infections caused by increased indoor air pollution as result of the use of wood fuels and solid fuels in the households. It also highlights the urgency to move consumers from the consumption of kerosene and wood fuel towards more efficient renewable energy solutions (GOK, 2015 p. 95)

e) National Energy Policy 2014

The energy policy seeks to ensure affordable, competitive, sustainable and reliable supply of energy to meet national and county development needs at least cost while protecting and conserving the environment. The policy among other things prioritises and promotes the development of local technologies in energy development and delivery.

f) The Energy Bill 2015

The Energy Bill 2015 is a good response toward the recognition of the changing environment of energy regulation in Kenya. It recognizes the different sources of renewable energy and the creation of the corresponding licensing and regulatory agencies. It makes provision for the establishment of the plethora of regulatory bodies such as Energy Regulatory Authority, National Electrification and Renewable Energy Authority, Rural Electrification and Renewal Energy Corporation, Energy and Petroleum Institute, Energy and Petroleum Tribunal, etc. With the addition of so many regulatory bodies, the 2015 Bill fails in trying to streamline energy regulation and ensure that red-tape is eliminated. While each entity has its own legal personality, there is need to have a homogenous set of regulatory bodies with similar corporate structures and different functions.

This Bill and others make provision …

"*(l) to undertake feasibility studies and maintain data with a view to availing the same to developers of renewable energy resources; (m) develop and promote, in collaboration with other agencies, the use of renewable energy and technologies, including but not limited to biomass, biodiesel, bio-*

ethanol, charcoal, fuel-wood, solar, wind, tidal waves, mini-hydropower, biogas, cogeneration and municipal waste…"[1]

The Bill makes provision that any undertaking or works under it shall be in compliance with the local content provisions. The release of the 2015 Bill was coupled with the release of the draft "Energy (Local Content) Regulations, 2014" (the "Regulations"). Local content refers to the preference given to Kenyan citizens with suitable skills and training in matters of employment governed by the 2015 Bill. It also entails the use of certain goods and services made in Kenya and in the specific county where an energy project is being implemented. The Energy Regulatory Commission requires foreign project sponsors to have local offices where procurement, project management and implementation decision making will occur to the satisfaction of the Commission. How a lapse in the regulations is the lack of clarity about whom such decisions are to be made. In addition to the local office, any potential license applicant must also file a "Local Content Plan" which should generally contain plans for employment, training and succession, research and development, technology transfer, legal services, and financial and insurance services[2].

g) National Climate Change Action Plan, 2013

Kenya's National Climate Change Action Plan guides the transition of the country towards a low carbon climate resilient development pathway. It designates improved cookstoves as one of the country's six top Priority Mitigation Programmes (NCCAP, 2013), identifies the promotion of improved cookstoves as a priority intervention. A shift to support the Government's efforts to reduce over-reliance on fuelwood and reduces deforestation and increases access to clean reliable energy. It recognizes the considerable social, economic, and healthcare-related co-benefits associated with improved cookstoves, especially for women and children – including reducing time to collect fuelwood, reducing indoor air pollution, and potentially introducing cost savings to households.

h) Green Economy Strategy and Implementation Plan (GESIP) 2016-2030

The GESIP is Kenya's blueprint in advancing towards a low-carbon, resource efficient, equitable and inclusive socio-economic transformation. The plan builds upon Kenya's commitment to a Low-Carbon Development Pathway and represents an advancement of this commitment to integrate resource use efficiency and minimizing environmental impacts into Kenya's economic development. Even though the plan does not specifically mention clean cooking solutions as a means to pursuing a low carbon pathway, the plan clearly reiterate the need for eco-innovation and technologies that address indoor air pollution, increase resource use efficiency, ensure equity and social inclusion. These principles directly speak to the critical functions and contribution of clean cooking solutions to Kenya's green economy agenda.

i) The Forest Conservation and Management Act, 2016

For a long time, there was a ban on charcoal burning in Kenya under the Forest Act of 2005. This provision has been reversed by a new Forest Conservation and Management Act, 2016, which makes provisions for charcoal-burning on a sustainable basis to stop forest destruction and ensure a constant supply of fuel to families that cannot afford alternative fuels. The new charcoal rules which are currently being enforced by the Kenya Forest Service (KFS) seek to regulate an industry that has largely been viewed as illegal and promote it as a sustainable enterprise but the short-term effect

[1] The Energy Bill 2015. http://www.erc.go.ke/images/docs/Energy_Bill_Final_3rd_August_2015.pdf
[2] ibid

has been a spike in the retail cost of charcoal, hurting household budgets. The rules which came into effect after gazettement in 2016 aim at making the industry attractive to investors in order to achieve sustainable charcoal production while promoting conservation and reforestation and the use of technology for production.

5.5 Key policy gaps in Kenya

Despite the relatively advanced sector, several policy challenges remain in the clean cookstove and fuel markets in Kenya. The most notable gaps in the enabling environment have to do with tax and tariff policies, the infrastructure for cookstove quality testing, regulations on biomass and modern fuels, and access to finance.

i) Clean Cookstove taxes and Tariffs

The Kenya government recently reduced import duty on energy efficient cookstoves from 25% to 10%, thus bringing the duty to similar cookstoves and cookers that use electricity, and gas, among others with a current duty rate of 10%. In spite of the reduced rate taxes on efficient cookstoves serves as an impediment to the development and diffusion of clean cookstove in the market, considering that the clean cookstove subsector is one of the least prioritised energy subsectors. The current tax rates on cookstove are still at levels that significantly reduce consumers' access to highly efficient clean cooking appliances as well as limit the growth of the cookstove sector.

ii) Infrastructure for Cookstove Quality Assurance

In spite of the development of new International Organization for Standardization/international Workshop Agreement ISO/IWA stove standards, cookstove quality standards and testing remain a significant policy gap. The provisional ISO standards, while an important step forward, have limited awareness and buy-in among local stakeholders; existing local standards are not aligned to the provisional ISO guidelines; many local African stove models remain untested; and the build quality of artisanal products distributed via pure private-sector channels (e.g., Kenya ceramic jiko-style stoves) is often low. Furthermore, the testing costs are prohibitively high for many potential users (e.g., artisanal and semi-industrial manufacturers). Existing stove and fuel testing protocols are not harmonized into the Kenyan context. At the moment, there are two testing centres in Kenya (Kenya Industrial Research and Development Institute (KIRDI) and University of Nairobi (UON) (Kenya Renewable Energy Clean Cooking, 2017). Importers have tested their stoves in foreign labs whose methods and conditions differ from those in Kenya. This has led to conflicting verifying claims. There is also no labelling system to inform the public about the performance of these products which exposes Kenyans to the risk of using sub-standard products (see above). A Cook-stoves Standards and Labelling Committee was formed in July 2017 convened by CVAK (Kenya Renewable Energy Clean Cooking, 2017).

iii) Regulation of Biomass and Modern Fuels

The policy around energy for cooking has centred on promoting modern fuels, such as LPG rather than the sustainable use of biomass energy, which serves as the major source of cooking energy for most Kenyans. Insufficient investment in forestry management and conservation, poor incentives throughout biomass fuel supply chains, impede more rational biomass fuel use that can complement demand-side efforts to reduce biomass consumption and supply-side policies that promote modern and alternative renewable fuels. There is an on-going debate on production of charcoal and wood fuel following the recent ban on production of charcoal by the Kitui County Government. Other counties that depend on Kitui for charcoal are crying foul as a result.

iv) Lack of access to finance to promote clean cookstove market

The lack of access to finance is a cross-cutting obstacle to faster clean cookstove market growth. At the micro level, this policy challenge cuts across the value chain where artisan and small/ medium. Clean cookstove manufacturers and distributors are often unable to access credit to fund product innovation, distribution network development, and consumer marketing.

5.6 Stakeholders and Actors in the Clean Cookstoves Sector

The Clean Cookstoves has garnered enormous interest and support from diverse group of actors, ranging from government, development donors, private sector actors, non-governmental organizations and civil society organizations.

- ***Government Agencies and Ministries***

Within the government, there are several ministries that are directly connected to the promotion of the clean cookstove sector. The Ministry of Energy and Petroleum, under the Fourth Schedule of the 2010 Constitution is responsible for energy policy and regulation of electricity and gas reticulation. The Ministry seeks to facilitate the provision of clean, sustainable, affordable, reliable, and secure energy services for national development while protecting the environment. The Ministry of Agriculture is involved in the promotion, construction, and use of clean cookstoves. The Ministry of Environment and Natural Resources is responsible for safeguarding Kenya's environment and for promoting the use of clean energy technologies. The National Environment Management Authority (NEMA) is a principal instrument of Government for the implementation of all policies relating to the environment. The Kenya Bureau of Standards (KEBS) is responsible for the development of the standards for improved biomass cookstoves for both domestic and institutional use. Kenya Industrial Research Development Institute (KIRDI) is a state research institution which has established a state of the art energy laboratory and Stove Testing Centre. The Energy Regulatory Commission (ERC) is in charge of providing regulations, license and guidelines for the manufacturing of clean cookstoves, and the Community Development Trust Fund (CDTF) promoted clean cookstoves at the community level by supporting local community-based organizations (CBOs) to undertake the initiatives by themselves. The Council of Governors (COG) through its energy committee is strategic in advocating for energy issues in counties nationally. The COG has been strategic in advocacy for increased resource allocation from the national Government. The COG can be lobbied by CCAK.

- ***International Donors and Development Partners***

Several international donors and development agencies are involved in the promotion of clean cooking solutions in Kenya. These include the World Bank, the Dutch Directorate-General for International Cooperation (DGIS), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the Global Environment Facility (GEF), the UK Department for International Development (DFID), European Union (EU), the US Agency for International Development (USAID), the German government, Shell Foundation, UN High Commission for Refugees (UNHCR), UNICEF, and UN Development Program (UNDP).

- ***Non-Governmental Organization***

Non-governmental organizations play a major role in the adoption and diffusion of clean cooking solutions in Kenya. Some of the prominent NGOs involved in the clean cookstove sectors include – the Dutch Humanist Institute for Cooperation (HIVOS), Care International, Ex-Spring Valley Kayole (ESVAK), Global Alliance for Clean Cookstoves (GACC), Energy, Environment and Development Network for Africa (AFREPREN/FWD), Kenya Union of Saving and Credit Cooperative Organisation

(KUSCCO), International Lifeline Fund, GVEP International, Millennium Village Projects, World Vision, and Winrock International.

- ***Private Sector***

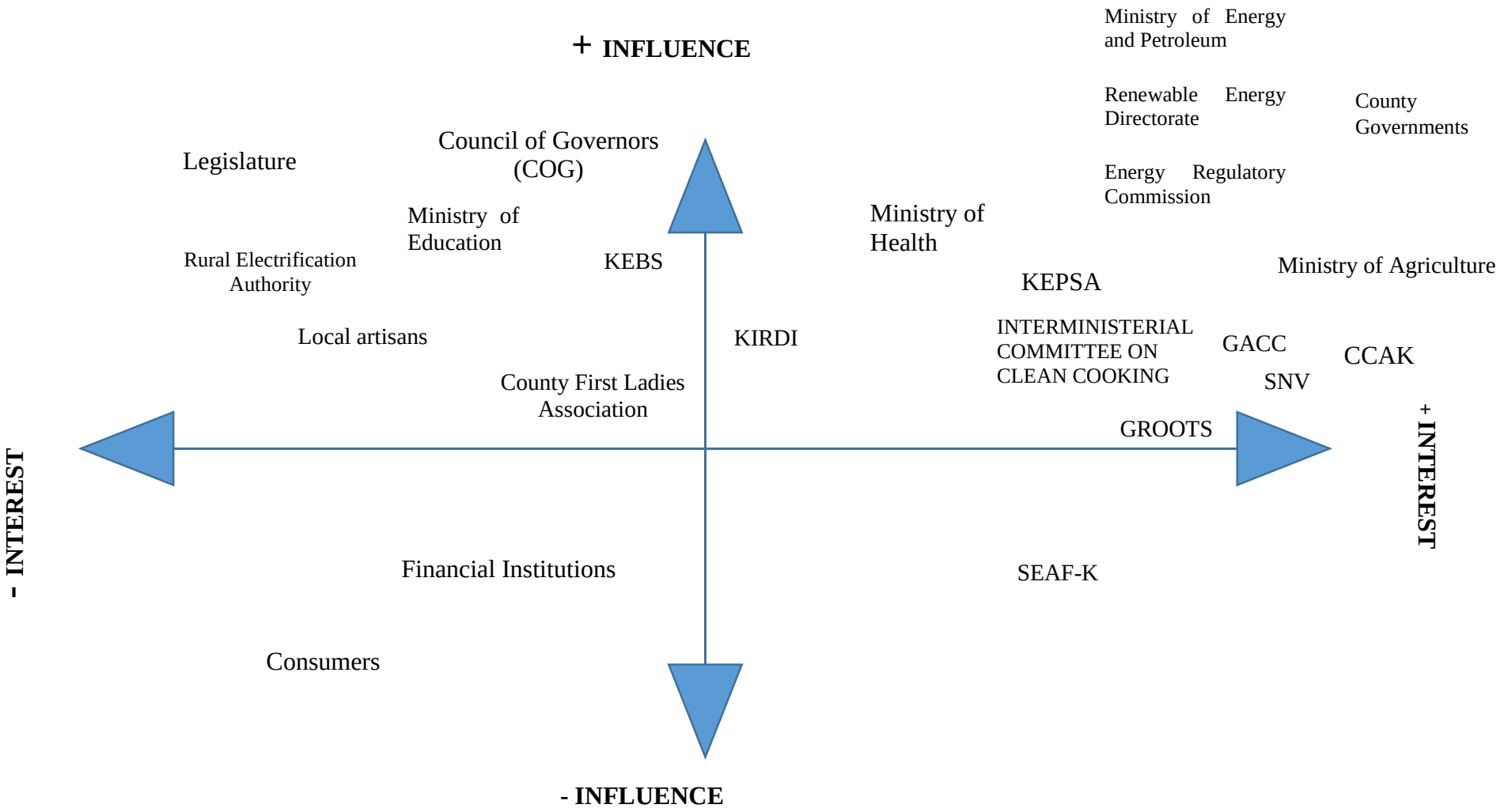
The private sector is leading the development and sale of clean cookstove in Kenya. Some of the recognized entities in the sector are Chujio Ceramics, Envirofit, EcoZoom, Ekero, Endev Kenya, Kartech, Keyo Pottery Enterprise, Fine Engineering Lakenet Energy Solutions, Musaki Enterprises, Practical Action, Premier Gas Company Limited, Improved Stoves Association of Kenya (ISAK), Clean Cookstoves Association of Kenya (CCAK), Riumbaini Energy Saving Stoves, and Rural Technology Enterprise.

- ***Clean Cookstove Programs***

Individual and collaborative cookstove related projects and programs in Kenya include – the Developing Energy Enterprises Project (DEEP), the Food for the Hungry, Energy Sector Management Assistance Program (ESMAP), Modern Cooking Appliances and Fuels, Energy Access Program, Rural Energy Technology Assistance Programme (RETAP), Kenya Renewable Energy Programme and Kenya Improved Cookstoves project.

Figure 2 below shows the power analysis across different actors, their influence and interest in promoting use and adoption of clean Cookstoves in Kenya.

Figure 2: Power Analysis (*Source:* Kenya Renewable Energy Clean Cooking, 2017)



6. Tanzania

6.1 Development of Clean Cookstoves

The cookstove sector in Tanzania became functional four decades ago with the fabrication of the Morogoro wood and charcoal stove through a collaborative effort between local universities and international development donors. This initiative caught the attention of the government, prompting a move by the Ministry of Energy and Minerals with support from the World Bank to introduce the Kenyan Ceramic Jiko (KCJ) in Tanzania in 1988. The cookstove sector has seen new and improves local designs such as the KUUTE and Jiko Bora. Two major organizations, the Commission for Science and Technology (COSTECH) and Tanzania Traditional Energy Development Organization (TaTEDO) have been spearheading research, modifications and dissemination of these cookstoves.

Whilst there have been several donor-funded cookstoves initiatives, the majority of these initiatives have been at localized scale with funding short-lived. The current cookstove sector is dominated by informal artisans who do not have the capacity produce on a large scale. As a result, cookstoves produced are of substandard quality and there is very little consistency in the quality of the cookstoves. Most of existing cookstove initiatives have failed to successfully reach commercialization scale and the country is yet to have a sustained commercial market, particularly in the rural areas when cookstoves are most needed.

The arrival of imported clean cookstoves and alternative fuels into the Tanzanian cookstove markets provides much better options to increase fuel efficiency and reduce indoor air pollution. However, the adoption and diffusion of the imported cookstoves are heavily limited by the higher prices and low demand. According to UNIDO, 2015, the adoption rate of clean/improved cookstove in *Dar es Salaam city with about 800,000 households is estimated to be 40% while other urban areas have about 20%. At the national level, the adoption rate for clean cookstove is only* 3% indicating a very low level of cookstove use (Onesimo, 2014; UNIDO, 2015).

Clean cookstoves are a relative concept that depends on the desired improvement from the traditional stove designs (Onesimo, 2014). Such improvement can be emission reduction, fuelwood saving, portability, convenience and quick cooking among other properties. Clean or improved cookstoves types vary depending on the region or district in Tanzania. For example, the improved firewood cookstoves found in rural areas play a significant role in the reduction of 40% of household air pollution, approximately 70%wood waste reduction and time-saving (ibid).

A variety of locally manufactured cookstoves are available in the market, most made by small informal enterprises whose focus is on quantity and lowering costs rather than quality and design. Field assessments suggest that a typical locally manufactured household stove costs between TZS 1,000 (USD 0.5) to TZS 10,000 (USD 5) while an imported improved firewood stove costs around TZS 60,000 (USD 30) (UNIDO, 2015). The charcoal stoves that urban households use are frequently all-metal designs (traditional stoves) with a low efficiency of approximately 15%. The stove emits heat at a rapid rate and costs only TZS 5,500. Efficient charcoal stoves with ceramic liners for retaining heat are 30-40% efficient; however, these stoves are over 35% more expensive than traditional stoves. According to Ministry of Natural Resources and Tourism (MNRT), a typical household in Tanzania consumes roughly 1 tonne of charcoal annually when using a traditional stove, which is

equivalent to TZS 125,000[3] (USD 62.5) per month. This fell to 0.4 tonnes when using an improved charcoal stove, TZS 50,000 (USD 25) per month (UNIDO, 2015). The price of an Enviroft charcoal stove (CH5200 model) is higher than other improved charcoal cookstoves, TZS 75,000 (USD 35), but it has up to 60% fuel consumption and 50% reduction in cooking time[4]. Another clean cookstove that was introduced into the market is the rocket stove technology both fixed and portable. Several local artisans were trained through the GIZ led Program for Basic Energy and Conservation (ProBEC) program to locally produce the cookstoves, however, many producers were unable to sustain production when the program came to an end. A more recent addition to the cookstove market is the ethanol stove introduced by Safi International, a Norwegian bio-ethanol stove and fuel company that sells and distributes ethanol stoves (cookers) and ethanol fuel through a franchising model. Two modern gasifier stoves namely, Jiko Mbono (now Jiko Bomba) are both natural draft top-lit updraft gasifier stoves were fabricated locally developed by Kiwia and Laustsen Ltd, and Jetcity Stoveworks respectively using mild steel sheets and channels. The Jiko Mbono cookstove uses pellets as fuel, which is made from grounded agricultural waste with jatropha cake binder, whereas Jiko Safi cookstove uses jatropha whole seeds as fuel.

A much efficient and clean cooking solution is the use of the LPG. In recognition of this, the government of Tanzania in 2006 removed all forms of taxes from LPG and cylinders to encourage the transition from charcoal consumption to LPG use even though all taxes remained on LPG cookers and other accessories (UNIDO, 2015). The impact of the tax exemptions was quite significant as Tanzania witnessed a high rate of the adoption and diffusion of LPG. The LPG consumption is driven less by the price but by the availability of gas and cylinders (Biomass Energy Strategy [BEST], 2014). In spite of the considerable growth in the LPG market over the past 5 years, the market is limited by the high cost of constructing refilling stations and poor distribution networks in urban and peri-urban areas (UNIDO, 2015).

There are several types of clean cookstoves that are available in the market as shown in Table 3. All indicators point to a growing clean cookstove market that has considerable support from key actors at different levels from government, development donor to private sector actors. Currently, activities within the cookstove sector are not well coordinated enough to achieve a sustained commercial market outside the main urban areas. Several studies have pointed to three major limiting factors, which include weak institutional structure for clean cookstoves, weak coordination of the sector with low levels of stakeholder engagements, and the limited prioritization of government policies related to clean cookstoves (UNIDO, 2015; Onesimo, 2014; Rajabu and Ndilanha, 2013). The different types of cookstove in the market in Tanzania can be found in table 4.

[3] Current price of a kilo of charcoal in Dar es Salaam is TZS. 1500

[4] http://arti-africa.org/2013/06/envirofit-improved-cookstoves-are-here/

Table 4: Different types of existing clean cooking solutions in the market

Tanzania	 Improved Charcoal Stove	 Improved Charcoal Stove	 Envirofit Imported Stove
Manufacturer	SECCO, Dar-es-Salaam	CAMARTEC, Arusha	Envirofit (Distributor L's Solution)
Cost Range	$6.25 - $7.5(subsidised)	~$40 medium	$12 (subsidised)
Thermal Efficiency	35%	25%	33%
Key Features	Ceramic liner with metal cladding. SECCO make complete stove. Subsidised by about $3, will generate carbon revenue through VCM.	Ceramic liner made from bricks with outer metal cladding and metal charcoal grate. Metallic parts sourced elsewhere.	Highly engineered wood stove manufactured in China.
Production Capacity	Currently around 700 stoves a month. Sold over 6000 stoves so far.	Sold over 500 so far but capacity to make more	Demand Driven. 16,000 sold to date through L's Solution
Distribution Channels	Sell through network of 48 agents around Dar-es-Salaam	Sell through agricultural fairs and contacts	Through roadshows and network of distributors
Availability and Use	Use ◔ Availability ◔	Use ○ Availability ○	Use ◔ Availability ◔

Tanzania	 Portable rocket wood stoves	 Fixed rocket wood stoves	 Fixed Maasai Wood Stove
Manufacturer	M&R Appropriate Technology Engineering	Various (Many ProBEC trained)	ICSEE (manufactured locally)
Cost Range	$20	$20 -$70 (depending on size/material)	$45 (subsidised)
Thermal Efficiency	30-35%	Around 25%	24%
Key Features	Liner made from clay and sawdust, with metal cladding and insulation material	Made by fabricating mild steel sheets, galvanised sheets and inserting insulative bricks inside the combustion chamber.	Stove brings hot gases around the pot before escaping through chimney.
Production Capacity	M&R sell 500 – 800 annually. Currently seeking investment for expansion.	Demand driven. On average producers make 20-30 per month.	300 installed so far by ICSEE. Factory capacity currently 150 / month
Distribution Channels	Mainly direct sales and exhibitions	Mainly direct sales and exhibitions	Sold within Maasai community, installed through local women
Use and Availability	Use ◔ Availability ◔	Use ◔ Availability ◔	Use ○ Availability ○

(Source: Clough, 2012)

6.2 Current Initiatives to promote Clean Cookstoves

It is becoming increasingly evident that affordable, sustainable and modern energy for cooking can be achieved through the adoption and diffusion of efficient clean cookstove in rural and urban

households in Tanzania. Programs and initiatives to develop and promote clean or improve cookstoves are on the rise and the impact of some of these programs and initiatives are evident. Some of the key clean cookstove programs and initiatives are as follows:

a) Partnership on Women's Entrepreneurship in Renewables (wPOWER) Project

In 2012, CARE International launched a three-year program "Partnership on Women's Entrepreneurship in Renewables (wPOWER)". Funded by the US Department of State, the program sought to integrate women from Village Savings and Loans Groups into small-scale clean energy value chains across Kenya, Tanzania, and Rwanda. Based on a supply enhancement model, the project empowers women at the bottom of the pyramid to become entrepreneurs for clean cookstoves and solar lanterns by participating in a market-driven process that provides linkages with respected global /local manufacturers or suppliers of clean energy products. The wpower project is being implemented in 19 districts of the following regions: Dar es Salaam, Tanga, Arusha, Manyara, Morogoro, Mwanza, Shinyanga. The project has trained over 200 entrepreneurs who have sold more than 7,500 clean cookstoves and positively impacted the lives of over 96,000 people in these regions.

b) Tanzania Improved Cookstoves (TICS) Programme

The Tanzania Improved Cookstoves (TICS) Programme targets improvement in access and sustained use of appropriate cooking technologies for poor rural households and urban commercial biomass users in the Lake Zone of Tanzania. Through market linkages with the manufacturers of clean/ improved cookstove product and service providers, the SNV has been actively working with communities in Misungwi, Magu, Sengerema, Kahama, Geita, Bukoba, Morogoro, Singida and Dodoma to establish clean cookstove enterprises. Over 20 small enterprises have been established and about 6,500 stoves have been produced and sold.

c) ARTI's Clean Cookstoves Initiatives

Since 2013, ARTI Energy Limited, a commercial enterprise established in 2011 has been promoting Envirofit and Burns clean cookstoves. So far, over 45,000 cookstoves have been sold across Tanzania. With a retail cost of between TZS 65,000 to 85,000, these cookstoves have energy efficiency level of 60% and save energy up to 3 times less compared to the traditional stoves. The Company has also established a biomass briquettes small-scale factory in the Coast region, they produce around 5 tonnes daily for both domestic institutional/industrial use.

d) Tanzania Domestic Biogas Programme (TDBP)

Under the African Biogas Partnership Program, the Tanzania Domestic Biogas Programme (TDBP) was established to support the design and installation of domestic biogas through a market-oriented approach. Through a collaborative effort between Centre for Agricultural Mechanisation and Rural Technology (CAMARTEC), Ministry of Energy and Minerals, and SNV, the first phase of the program (2009-2013) successfully ended with the installation of approximately 8796 domestic biogas plants countrywide. The second (current) phase targeting the installation of 20,700 plants nationwide.

e) Country Action Plan for Clean Cookstoves and Fuels

The SNV, Tanzania Renewable Energy Association (TAREA), and the Clean Cookstoves and Fuels Alliance of Tanzania (CCFAT) in consultation with a wide range of clean energy stakeholders have developed a Country Action Plan for Clean Cookstoves and Fuels. The Country Action Plan aims to support the acceleration of sustainable, commercial clean cookstove production and distribution,

which would reduce charcoal consumption by 50% in half of the fuelwood consuming households and all the institutions by 2020. The key interventions in the Country Action Plan include:

- Support and lobby government through the Ministry of Energy and Minerals (MEM), now Ministry of Energy to develop and implement the biomass energy policy & strategy.
- Advocate for policy frameworks that support tax relief and incentives for clean cookstoves and fuels producers in Tanzania.
- Strengthen an agreed coordinating platform (chapter or working group) to enhance collaborative efforts among stakeholders thereby creating an enabling environment for market growth, and securing funding for its operations.
- Establish a standards working group with the Tanzania Bureau of Standards (TBS) through the above-mentioned acceptable platform, chapter, or working group, and supporting TBS to develop clean cookstoves and fuels standards based on ISO standard.
- Carry out action research (value chain analysis) to identify existing stove producers, their products and their clientele with a focus to identify enterprises and gaps in the market and building linkages for the expansion of the clean cookstoves market.
- Commission a study into the challenges and opportunities for women in the sector.
- Undertake a baseline market demand assessment study at district and regional levels.
- Special focus on usage and preference of women.
- Develop appropriate strategies, mediums, tools and messages for awareness rising.
- Establish monitoring and evaluation data collection systems.
- Support the expansion of the charcoal briquette and biomass briquettes and pellet industries.
- Support the development of clean cookstoves and fuels market networks.

Table 5: Clean Cookstove Initiatives in Tanzania

	Who	What	Challenges	Partners
Sustainable Energy Enterprise Company	TaTEDO is an NGO with over 20 years experience in the ICS sector. In 2000 it started SECCO a private company based in Dar-es-Salaam	TaTEDO set up SECCO to promote the commercial dissemination of quality improved stoves, SECCO makes a range of cookstoves and improved ovens. Their bestselling product is the charcoal domestic stove and they are currently working with E+Co to link the project with carbon finance. So far they have sold over 6000 charcoal stoves under the project	Creating awareness and demand for the stoves particularly outside of Dar-es-Salaam	TaTEDO, SECCO, E+Co
Introduction of Envirofit Stove	E+Co is an NGO that invests services and capital in small and growing clean energy businesses in developing countries	In 2010 E+Co started coordinating the introduction of the Envirofit stove through local distributors Zara Solar, L's Solutions and Alternative Energy Tanzania. L's Solutions have continued the distribution of large numbers distribution 16,000 stoves in the past year, targeting rural areas through road shows and retailers	Marketing is very resource intensive with several visits to areas required to realize sales potential	E+Co, Envirofit, L's Solution
Program for Basic Energy and Conservation (ProBEC) (2005-2010)	A SADC program implemented by GIZ. Since the program ended activities have been taken over by the Rural Energy Agency	Aim to assist low-income groups in access to sustainable and affordable energy. Promote improved cookstoves through training on stove construction (rocket, clay & charcoal stoves), and assisting in marketing activities. Offered indirect subsidies through raw materials, kiln access and transport.	Many artisans stopped production after the project ended, although REA have taken over the marketing activities their limited resources are spread across several sectors	Ministry of Energy and Minerals, GIZ
Developing Energy Enterprises Program (DEEP) – (2008-2013)	Implemented by GVEP International with technical support from IT Power.	The program provides business and technical support to existing micro energy enterprises through training, mentoring, and market linkages. It also links entrepreneurs to financing through its loan guarantee program to enable them to expand their businesses. The program has trained over 300 entrepreneurs in the Mwanza region.	Changing mindset of entrepreneurs to realise market potential of energy business	IT Power, EAETDN
Improved Cookstove for East Africa	Collaboration between Uganda Carbon Bureau, Care International and the Nordic Climate Facility	The project aims to provide sustainable access to affordable and efficient cookstoves. Improving affordability of these cookstoves is achieved by the setting up of a CDM Program of Activities (registered 2011) that will provide stove suppliers with access to revenue from the CDM carbon market.	Delays in registering the project in the country. Identification of suitable stove producers to work with	Uganda Carbon Bureau, CARE International, Nordic Climate Facility.
Biomass Pellet Stove	Partners for Development are a US-based NGO aiming to improve the quality of	Working with local stove manufacturer Kiwia and Lausten they have developed an energy efficient gasifier stove that cooks using biomass pellets. PFD is also producing the biomass pellets from agricultural	-	Partner for Development, Kiwia and

	life for vulnerable people in underserved communities	residues and aims to distribute them through a network of vendors. Aiming to register the project under CDM		Lausten
Maasai Stove Project	ICSEE is an NGO working on projects around environmental conservation and community development	Working with local Maasai women the project has developed a fixed wood stove that greatly reduces exposure to smoke within the household. The stove is locally manufactured and installed by trained local women. On purchasing a stove women get access to a buyers club and other home improvement items.	-	ICSEE

(Source: Clough, 2012; World Bank, 2016)

6.3 Policy environment for Clean Cookstoves Market in Tanzania

Perhaps the most inclusive mechanism that provides a more conducive policy environment for the adoption and diffusion of clean cookstoves and fuels in Tanzania is the Biomass Energy Strategy (BEST) Tanzania project. The project which commenced in 2013 resulted in multiple products including the Tanzania Biomass Energy Strategy and Action Plan and a national BEST Communication Strategy. The process consisted of several national stakeholder workshops and forums involving over 150 stakeholders from governmental, non-governmental, civil society organizations, community-based organizations, and private sectors. The BEST Tanzania Project, led by the Ministry of Energy and assisted by the BEST Steering Committee identifies strategies to address key issues in the biomass energy sector, particularly deforestation and degradation caused by charcoal and commercial wood fuel production. The project is expected to – ensure a more sustainable supply of biomass energy; raise the efficiency of biomass energy production and use; promote access to alternative energy sources where appropriate and affordable, and ensure an enabling institutional environment for implementation. The BEST Communication Strategy is intended to help build awareness and a common understanding of the biomass energy sector issues and to provide the media with information for public dissemination. In the National BEST Action Plan, key recommendations include the development of a biomass energy policy, supply-side and demand-side actions with a long-term view to the year 2030.

The government of Tanzania has also shown some level of commitment towards clean energy use through the provision of tax incentives. In 2006, the government waived all forms of taxes on LPG and gas cylinders. Six months into the implementation of this decision, industry actors confirmed a 50% growth in the market (UNIDO, 2015; Ministry of Natural Resources and Tourism [MNRT], 2014). The LPG market has since seen a good level of stability. Another example of government policy incentive was the decision to subsidize electricity connection charges to customers of Tanzania Electric Supply Company Limited (TANESCO).

6.4 Policies supporting Clean Cookstoves Development in Tanzania

As a representative of the people of Tanzania, the government has a crucial role to play in the provision of a conducive environment for investment and use of the clean cookstove. There are several existing policies and regulations that may encourage the adoption and diffusion of clean cookstoves. These policies briefly discussed below could provide the basis for developing specific clean cookstove policies or bring to a light hidden aspect of these policies that promotes or inhibits the adoption and diffusion of cookstoves in Tanzania.

a) Tanzania Development Vision 2025

The Tanzania Development Vision 2025 is the country's blueprint on which all existing policies, strategies are anchored. The overall goal of the Vision 2025 is to achieve a high-quality livelihood for its people and develops a strong and competitive economy. A major limitation of this strategic document is the silence on the promotion of clean energy use such as clean cookstoves. As key determinants of quality living, clean energy cooking solutions for the people, particularly in rural areas of Tanzania should have featured prominently in the Vision 2025. This, however, is not the case. The Vision recognises individual and the private sector initiatives as driving forces for building a strong, productive and renewing economy; however, it remains vague on the specific details and the strategy to achieve this. As a long-term development strategy In Tanzania, the expectation is that it

will inspire all other strategies for the country. Therefore it is recommended that any amendments to the vision document should take into consideration emerging role of clean cooking solutions and initiatives that address forest degradation through reduction of fuelwood and charcoal, indoor air pollution and improve socio-economic livelihoods.

b) The National Strategy for Growth and Poverty Reduction (NSGRP)

The National Strategy for Growth and Poverty Reduction (NSGRP) is a vehicle for realizing Tanzania's Development Vision 2025. The strategy supports a framework for the adoption and diffusion of clean cooking solutions in Tanzanian. Even though there is no specific mention of clean cookstoves, the strategy advocates for scaling up the role and participation of the private sector in priority areas of growth and poverty reduction. In digging deeper into the priority areas, the clean energy solutions and the clean cookstove subsector play a prominent role in contributing economic growth and poverty reduction particularly in rural areas and among urban poor. The strategy, under cluster II, calls decent shelter and energy use, with emphasis on affordable and reliable modern energy services. This opens up an enormous opportunity for local investors to explore the clean cookstove sector as one of the strategies towards the use of reliable and affordable modern energy.

c) The National Energy Policy (NEP) 2003

The national energy policy (NEP) is perhaps the most critical policy for the adoption and diffusion of clean cookstoves in Tanzania. It provides the framework for energy development and consumption in the country. It outlines the diverse energy sources and stipulates the roles of each source in developing the energy sector. According to the policy, biomass energy contributes more than 90% of Tanzania's energy supply. In spite of this important contribution, biomass energy receives very limited attention in the policy compared to the emphasis on petroleum, electricity, and gas, among other energy sources. However, the policy underlines the necessity for reliable and sufficient sources if the country should pursue a sustainable development pathway. Given that the tedious and often low-productive time-consuming labouring for firewood is mainly done by women the policy provides an opportunity that encourage the adoption and diffusion of clean cooking solution as it provides an institutional focus on improvements of rural and semi-urban energy practices in order to reduce women workload and to involve them in the problem solving and decision-making processes on energy issues.

d) National Science and Technology Policy (1996)

The policy encourages research and development in the clean cookstove sector. It calls for the development of new and renewable energy sources. The policy calls for the reduction of laborious activities performed by women and children by promoting appropriate technologies designed in consultation with women. It also encourages strengthening mechanisms for diffusion, extension and commercialization of technologies relevant to the needs of the people, especially in rural areas. The policy calls for the development of training and research institutions, where innovations can be produced in the clean cookstove sector.

e) National Environmental Policy (1997)

The National Environment Policy internalizes environment considerations in other sector policies and programmes and coordinates them in order to achieve sustainable development. While not directly mentioning the clean cookstove idea, the policy seeks to offer a good opportunity for the

adoption and diffusion of clean cookstoves through the minimization of fuelwood consumption and the promotion of sustainable renewable energy resources.

f) National Investment Policy (1996)

The National Investment Policy has a strong support for clean cooking technologies as it calls for investments in:

- Development of all possible commercial and alternative sources of energy with emphasize on utilizing domestic resources as well as reducing dependence on biomass fuels,
- Promoting adoption of energy systems which are efficient and not detrimental to the environment, and
- Promoting sub-regional and regional cooperation and collaboration in the energy sector.

g) The National Forest Policy (1998)

The National Forest Policy is favourable towards the adoption of clean cooking technologies. It emphasises alternative sources of energy with the goal to reduce the pressure on the forest. Along with the policy, the Forest Act of 2002 provides enforcement mechanisms for forest conservation and promotion of alternative energy sources. The implementation of these instruments according to have contributed to a reduction in the level of unregulated activities such as charcoal burning and timber harvesting, forest encroachment, and fire incidences. The clean cookstove sector presents a sustainable solution for curbing rapid exploitation of forest resources through the adoption and diffusion of efficient clean cookstoves. Future amendments to the policy and legislative instruments must explicitly highlight the potential contribution of clean cookstoves towards the reduction of forest degradation.

h) The National Micro-finance Policy

The National Micro-finance policy makes provision for financial services to households, smallholder farmers, and small and micro enterprises in rural areas as well as in the urban sector. It offers a good avenue for local investors, micro and small enterprises to invest in businesses by securing financial services from government-sanctioned micro-finance agencies. This implies individuals, micro and small enterprises involved in the manufacture, distribution and marketing of clean cookstoves have the opportunity to expand or build their business.

i) The Economic Empowerment Policy

The Economic Empowerment Policy seems to be a promising policy that can foster the development of the clean cookstove sector. The policy seeks to provide an enabling environment for various groups of Tanzanians to participate effectively in economic activities in all sectors of the economy. It hopes to address all economic empowerment needs of the individual citizens of Tanzania and local enterprises in which there are not less than 50% ownership by citizens of Tanzania. The policy proposes multiple strategies that may assist local investors to explore and utilize both local and foreign market. These strategies include; facilitating production of high-quality products at competitive prices and encouraging the use of modern technology in economic activities. To assure the citizenry about the commitment of the government to implement this policy, the Economic Empowerment Act 2004 was enacted, which subsequently led to the establishment of the Economic Empowerment Council with the mandate to implement the empowerment policy. The policy, acts

and institution for national empowerment present local investors with a good opportunity to improve the clean cookstove subsector.

6.5 Key policy gaps in Tanzania

In Tanzania, the 2003 Energy Policy continues to be the overall policy framework for the different energy subsectors. Several identified gaps in the policy do not facilitate the promotion the clean cookstove sector in Tanzania. The policy exists without implementation strategy to spell out the different strategies for the different energy subsectors and to measure the progress of implementation of the policy. The key gaps identified in the policy include:

- The low priority accorded the clean cookstoves and biomass energy use in the policy and by several energy-related government agencies;
- The lack of a national policy framework for cookstove subsector and biomass energy;
- The lack of clean cookstove and biomass fuel emphasis in the policy seems to suggest that the subsector as inferior source of energy equivalent with underdevelopment;
- The poor public awareness of biomass energy efficiency issues, and options;
- Poorly-regulated governance of commercial clean cookstove production and market;

Additionally, a study by African Energy Policy and Research Network (AFREPREN) identified policy gaps between national and local levels. These gaps include:

- The top-down approach to the formulation of the energy policy, thus neglecting some realities at the lower level.
- The policy-making process was biased towards macro-energy issues such electricity than micro energy issues such as clean cookstove
- Ministries linked to this process lacked policy-based research to inform correctly the policy development or any change that needed to be included in the policy
- The policy formulation was donor-driven to the extent the support for review and final drafting was donor funded. In this case, the content and priorities of the policy may have been substantially influenced by donor interests.
- Lacked clearly stipulated implementation structures and sustainability potential.

6.6 Stakeholders and Actors in the Clean Cookstoves Sector

As a sector with the high potential market, there are a diverse group of actors, ranging from government, development donors, private sector actors, non-governmental organizations and civil society organizations involved in the development of clean cooking solutions in Tanzania. The level of involvement may vary depending on the roles and responsibilities of the actor.

- ***Government Agencies and Ministries***

All energy and energy-related issues fall under the mandate of the Ministry of Energy. The ministry supports biomass energy development in such areas as biogas, biomass briquette, or biomass cogeneration primarily through projects or programmes usually funded through a combination of co-financing with development partners and/ or international donor financing. The ministry has commenced the process of updating the national energy policy as well as developing a renewable energy policy. Apart from the ministry of energy, other important ministries related to the cookstove sector include Ministry of Finance, Ministry of Natural Resources and Tourism (MNRT), and the Ministry of Agriculture. Key functional agencies and institutions involved in the cookstove sector are

Tanzania Commission for Science and Technology (COSTECH), National Environmental Management Council (NEMC), Tanzania Industrial Research and Development Organisation (TIRDO), Tanzania Investment Centre, Rural Energy Agency (REA), Small Industries Development Organisation, Small and Medium Enterprise Competitive Facility, Vocational Education and Training Authority (VETA), and Centre for Agriculture Mechanization and Rural Technology (CAMARTEC), among others.

- ***International Donors and Development Partners***

Several donors and development agencies are involved in the promotion of clean cooking solutions in Kenya. These include, among others the World Bank, Norwegian Agency for Development Cooperation (NORAD), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Swedish International Development Cooperation Agency (SIDA), the Global Environment Facility (GEF), the UK Department for International Development (DFID), European Union (EU), the US Agency for International Development (USAID), United Nations Educational, Scientific and Cultural Organization (UNESCO), and UN Development Program (UNDP).

- ***Non-Governmental Organization***

Non-governmental organizations play a major role in the adoption and diffusion of the clean cooking solution in Tanzania. Some of the prominent NGOs involved in the clean cookstove sectors include – the Dutch Humanist Institute for Cooperation (HIVOS), SNV, Care International, Global Alliance for Clean Cookstoves (GACC), Karagwe Vocational Development and Poverty Alleviation, Mwanga Environmental Conservation Advisory Organisation, GVEP International, E+Co, Kagera Integrated Environmental Resources Management and Community Development (KEMCOD), and Human Development and Relief Services (HUDERES).

- ***Private Sector***

The country has reiterated its commitment to private sector engagement in leading the development of clean cookstove sector in Tanzania. Some of the recognized private sector actors are Tanzania Chamber of Commerce Industry and Agriculture (TCCIA), Business Environment Strengthening (BEST AC), Confederation of Trade Industry (CTI), Dove GreenTech, Nyumbani Innovations Limited, and Tanzania Private Sector Foundation.

7. Cross-Country Discussions

The review of clean cooking energy solutions in Kenya and Tanzania provides some reflections on the current status of the development clean cooking solutions as well as the factors which by virtue of the existence or functions encourage or hinder the adoption and diffusion of clean cooking solutions in both countries. The paper also point outs some vital elements that may account for the current rate of adoption and diffusion of clean cooking solutions in Kenya and Tanzania.

It is evident that Kenya has a more matured clean cookstove market compared to Tanzania. Cookstove development in both countries started around the same period, even though the development of improving cookstove in Tanzania was greatly influenced by the Kenya cookstove model. While Tanzania seems to be catching up, Kenya will most like continue to be at the forefront of the adoption and diffusion of the clean cookstove. In spite of the several decades of manufacturing and dissemination, the improved cookstove markets in both countries have failed to flourish. Both countries are faced with similar challenges to adoption and diffusion of the clean cookstove. These challenges include the low demand, lack of technical skills, low consumer awareness particularly in rural areas, limited distribution networks, and lack of financial access for working capital, affordability, and overall quality of stoves. An assessment of household clean energy technologies in Kenya and Tanzania in 2012 by the African Biodiversity Collaborative Group, USAID, and GVEP concluded that a major hindrance to widespread adoption and commercialization of clean cooking solutions was the lack of financing for both the consumer and the entrepreneur as well as lack of skilled technicians and maintenance facilities, lack of production standards and quality control, cultural reluctance to change from traditional 'three stone' cooking methods, and reticence on the part of lending instructions due to small loan amounts, high transaction costs, and lack of qualified banking personnel to assess consumer loans for household technologies(GVEP, 2012).

It seems fair to say that external donor-supported initiatives and programs have mainly given prominence to clean cookstove development, which has contributed to the current rate of adoption and diffusion in Kenya and Tanzania. Of course, the role of government and small/micro enterprises has shaped the continued existence of the clean cookstove sector. However, the major question is how variation in the amount, nature and timing of the human capital, technical skills, and financial resources invested in the cookstove sector over time may help to explain the different statuses, adoption and diffusion of cookstove in the two countries. An assessment would assist in improving the understanding of the usefulness or relevance of the different measures and instruments to creating an enabling policy environment for the adoption and diffusion of clean cooking solutions in Kenya and Tanzania.

A market assessment by the Global Alliance for Clean Cookstove in 2012 revealed the following finding in the dissemination of clean cookstove in Kenya and Tanzania (GACC, 2012). In Kenya, with regards to regulating and testing, standards only apply to cookstoves in supermarkets, which is a fraction of the market. For the remaining part of the market, the vast diversity of the local artisanal base makes it extremely difficult to monitor and enforce standards in the informal cookstove sector. In Tanzania, the standards for testing and regulating cookstove are being developed for some cookstoves. There are testing centres in both countries but they are rarely used by local manufacturers due to the exorbitant fees for testing. In terms of awareness, various stakeholders in the cookstove sector are fully aware of clean cookstove but stove performance has not been a top

priority. Many consumers do not fully pay attention to the potential benefits of the quality cookstove, with most demand based on price and superficial visual appearance. In Tanzania, consumer awareness of clean cookstove remains low. With the establishment of a task force for the cookstove, it is expected that a coordinated and focused approach to awareness and promotional activities will be implemented to help increase consumer awareness and improve demand. In both countries, governments to a large extent are aware of the clean cookstove sectors even though the sectors are not prioritized over other pressing demands.

In both countries, existing research does not fully demonstrate the market demand and the intricacies of all the promising cookstove market. There are no precise statistics for adoption and diffusion of the clean cookstove. The reality is that there have been limited investments in research and development, product testing and market trials in the clean cookstove sector due to limited financial resources. The lack of start-up capital and operational funds means most start-up enterprises tend to collapse in the first 2 years of establishment. A key observation is that some clean cookstove in the market offer consumers very little benefits in terms of fuel savings and emission reductions and are not easily set apart from poorly performing cookstoves. In spite of the evidence showing the economic benefits of LPG coupled with the rising prices of charcoal in both countries, the use of LPG is relatively low. This is because access to LPG can sometimes be unreliable and initial costs of obtaining the set can be prohibitively high for consumers especially for urban poor and rural households. Kenya appears to have a more stable and reliable LPG supply and demand continue to increase despite the price hikes.

Current literature on clean cookstove seems to have dealt with the knowledge development and diffusion to a limited extent. This implies that there is a limited understanding of the how local learning, technological skill development and modification of clean cookstoves have been realised as part of the development and diffusion of clean cookstoves in Kenya and Tanzania. A deeper analysis should include issues of how local entrepreneurs and artisans acquire modern cookstove technologies and knowledge, and the sources and learning networks they draw on to develop their business acumen and technical skills.

The existing literature seems to focus more distinctive, individual factors that influence the diffusion of clean cookstoves rather than on the interaction among these factors and how these interactions shape the adoption and diffusion of clean cookstove in Kenya and Tanzania. For example, it is evident that ‘market formation’ component that is the timing, size and type of markets that have actually formed, including customer demand and user preferences provides a conducive infrastructure that encouraged the adoption and diffusion in Kenya and Tanzania. Yet, it is less clear whether and how the ‘entrepreneurial experimentation’ component facilitates the cross-sharing of experiences in the clean cookstove sector and how it contributes positively to the 'knowledge development and diffusion' component by facilitating learning through imitation and knowledge sharing.

Looking at various policies, there is an impression of the governments’ intent to promote the use of clean cookstove as an alternative to traditional sources of energy. As much as these policies exist, their rate of impact on the clean cookstove sector is rather low. It is not just about the existence of multiple policies but how well they are well aligned to address the problems and to help achieve the

goals of the clean cookstove sectors. For example, in Tanzania, the National Investment Promotion Policy encourages the transfer of appropriate technologies and human resource development, including the enlargement and development of local technological capacity (KCIC, 2016). It also promotes the development and growth of small and medium scale industries which serve the domestic and export markets. This policy seems to promote solutions that directly speak to the challenges confronting cookstove sector. On the other hand, if the existing policies do not speak clearly to the existing problems confronting the cookstove sector, then dealing with them becomes more challenging. For example, with the knowledge of the high rate of environmental degradation due to excessive forest harvesting, the government of Kenya policy priority is to improve rural electrification rather than clean biomass energy. This says much about the government's thinking, planning and prioritization about the sector.

8. Way Forward

A transformation clean cooking sector with a diverse group of consumer segments will require stepped-up investment and a differentiated approach. To ensure that the revived interest in the clean cooking sector does not fade, innovative approaches and substantial investments are critically required to accelerate the adoption and diffusion of high-quality clean cookstoves and fuels. While a major national effort is required, sector approaches, intervention priorities, and technologies will have to be tailored to the development stages of target clean cookstove markets and the specific needs of the different consumer segment.

For poor consumer segments, clean cooking solutions, such as LPG, biogas, or ethanol powered stoves are likely to remain too expensive for a long time without large public-sector subsidies or innovative utility business models. To address the need of the poor consumer segments, the emphasis must be on promoting low-cost artisanal and intermediate clean cookstoves with enhanced efficiency that can generate high fuel savings and related socio-economic, and environmental benefits while producing no or very little health effects.

While market-based approaches are ideally preferred for promoting basic and intermediate improve cookstove, for the poorest consumers and for marginalized groups especially in rural Kenya and Tanzania, market-creation efforts for clean cookstoves will likely take a longer period to establish. This means the application of more direct subsidy models, despite some risks of distorting the market can be justified. In the case of poor urban consumers already facing substantial fuel cost, there are growing opportunities for the private sector. Penetrating into such consumer segment will mean exploring various emerging opportunities such as capitalizing on carbon finance markets and growing demand through businesses that generate fuel savings (e.g., via highly efficient charcoal stoves), or providing competitively priced alternatives to expensive biomass (LPG, biofuels, biomass briquettes) that can also create significant health co-benefits. As noted earlier, the cost of highly efficient fuels is deemed second to their availability and access urban areas.

For a more established cookstove sector, characterized by growing segments of middle-income consumers with disposable incomes, market-driven approaches hold great promise for upscaling the market and sustainable access to clean cooking solutions. The optimal strategy for consumer segments with higher levels of the income distribution involves expanding uptake of modern fuels and renewable biofuels, such as LPG and ethanol.

9. Recommended Policy Actions

The report identifies action points that can support transformational policy change in driving forward a market-driven approach for promoting the adoption and diffusion of clean cooking solutions in Kenya and Tanzania. These are:

i) Governments in Kenya and Tanzania should lower barriers in the clean cookstove markets to encourage the adoption and diffusion of clean cooking stoves and their components through the removal of taxes and duties on imported cookstove technologies and parts as well as reducing the number of licenses required by cookstove manufacturers and distributors. As a market with a great potential for growth, the establishment of specialized agency can significantly assist in planning and promote clean cooking stoves, coordinate technology standards and testing, and manage national and sub-national data on clean cookstove sector, including biomass energy supply and demand.

ii) Governments must prioritize market-based approaches, but also deploy direct subsidies linked to health and climate impacts. Market-driven models should be accentuated wherever feasible to ensure sustainability. However, maximizing climate and health benefits might also require targeted subsidies delivered through carbon markets and other financing mechanisms. Indirect subsidies for cooking market support and facilitation (e.g., consumer awareness, testing centres, industry associations) have been an essential feature of all successful clean fuel and cookstove programs, both in Africa and globally to date (World Bank, 2014). The results of direct subsidies for producers have been more mixed, however, and subsidies for consumers have been the most problematic in both modern-fuel and clean cookstove markets—with some evidence of slower longer-term cookstove adoption than through purely commercial approaches, higher risks of promoting technologies that are not desired by consumers, and serious sustainability challenges when fuel subsidies are withdrawn

iii) Market intelligence is a vital public good for cookstove sector development in Kenya and Tanzania, where the sectors lack in-depth data and information. The provision of systematized field data on the performance of old and emerging clean cookstoves; livelihood impacts of clean biomass and modern-fuel stoves; and knowledge on the potential clean energy consumer can assist in lowering entry barriers into the market and helping inform the design of appropriate products for the market while providing periodic insights and trends to support decision-making processes. Private-sector firms are poorly positioned to generate such market intelligence, given the high cost of deploying large-scale consumer surveys in rural Kenya and Tanzania. Currently, donors have stepped up their market intelligence activities through the GACC and the World Bank's funded ACCES program. Such donor driven activities in most cases are one-off contributions to providing baseline data. Longer-term government engagement (e.g., incorporation of more data on household cooking into national energy, health, and demographic surveys) is needed to create a repeatable baseline for clean and improved cooking solution penetration and use data. The government should, therefore, take interest and invest in market intelligence activities.

iv) In building a sustainable market for the clean cooking sector, government and donor must make provision for access to easy financing to support manufacturers, distributors, retailers, and end-consumers). Access to finance is a major hindrance across cookstoves and fuel value chains, however governments and donors are uniquely well positioned to support critical upstream and midstream finance bottlenecks (e.g., in-country producers, importers, and distributors), via their engagement with financial institutions and small and medium enterprise promotion activities. For relatively low-cost consumer durable products,

downstream financing of subsidies is less promising, given the high transaction costs of financing sub-US$100 products in Africa, with no successful cases of downstream cookstoves financing at scale. However, for higher-cost cooking technologies (US$500–1,500), such as biogas digesters downstream finance is essential and can be beneficial (World Bank, 2014).

v) It is essential to tap local innovation: Research and development in the local cookstoves sector should be promoted to match the support (finance and policy access) that larger, donor cookstoves partners can access. Targeted funding is required to build the local capacity of cookstoves testing centres.

vi) In spite of current support from the GACC, the WB ACCES program, and other donors on the quality and standards of the cookstove, there is still more to be done to facilitate a robust stove- and fuel-testing infrastructure. The capacity of local testing laboratories to test the quality and performance of cookstoves is still constrained, and access to regional testing facilities is very expensive for many micro and small cookstoves enterprises. Cookstoves efficiency testing and field-testing know-how to verify the activities of stove manufacturers and carbon project developers are important capabilities to build at the national levels. Governments in Kenya and Tanzania can play an important role in linking stove-testing results to consumer-labelling provisions and awareness-raising interventions, in order to improve the overall quality profile of the cookstoves and cooking fuel market over time. A note of caution on donor efforts for quality assurance is that excessively burdensome standards and testing procedures, if poorly deployed or if improperly interpreted by governmental standard-setting bodies, may serve as a disincentive to market entry for high-quality cookstoves producers.

vii) Governments in collaboration with all key cookstoves actors must design interventions to drive consumer behaviour change. Simply distributing cleaner cooking solutions and fuels will not lead to optimal health and environmental outcomes. The challenge of achieving the benefits of universal clean cooking in both countries is not simply one of technology and economics. Rather, clean cookstoves end-user behaviour and preferences should inform all intervention. All implementers of clean cookstoves interventions, including the private sector, NGOs, and governments, should take the cookstoves user's needs and behaviour as their starting point. There is no one-size-fits-all solution for addressing the household cooking challenge, rather a differentiated approach based on specific socio-cultural contexts and needs is recommended. This will require better and more disaggregated data on cookstove users' preferences and capacity to pay for a clean cookstoves to inform the direction of investment and innovation in the clean cookstoves sector.

viii) An emerging financial opportunity for clean cookstoves in Kenya and Tanzania is carbon finance. Carbon finance can be a catalytic finance mechanism for cookstoves projects, particularly those that do not rely exclusively on carbon revenues to maintain and scale implementation. Carbon revenues can bring about a range of ancillary benefits for the project developer and end-user, including quality assurance, monitoring and reporting of progress over an extended time period.

10. Gender Inclusivity

Even though Kenya and Tanzania are traditionally patriarchal societies, women are progressively occupying more empowered roles while gender mainstreaming initiatives have taken prominence in different sectors of economies. However, inequalities are still rife, especially in rural areas. Like many African countries, women and girls in Kenya and Tanzania are responsible for cooking. In the rural areas, they spend hours each week collecting fuelwood for cooking, which lessens their chances to improve their income, education and makes them vulnerable to safety and environmental hazards. At the same, women and girls are exposed to respiratory diseases emanating from household air pollution (HAP) during their cooking expeditions. The use of low-grade biomass with basic cooking devices in unsuitable cooking spaces is the major cause of HAP. The adoption of clean cooking solutions and fuel by women and girls can significantly contribution to the reduction of the disease burden associated with indoor pollution while providing an efficient and cost-effective way of cooking. There is a wide recognition by women regarding the high expenditure on wood, charcoal and kerosene as well as the urgency for better alternatives in clean cookstoves. A gender-sensitive and the integrated clean cooking sector is well in order as illustrated by the important role women play in domestic tasks in the household. Any effort of policy that targets clean cookstoves should mainstream gender perspectives and especially the crucial role of women in socio-economic development. Integrating women's perspective into these policies and other strategies will emancipate them from the heavy burden fetching fuelwood and cooking as well as empower them to undertake other productive ventures.

11. Conclusion

This paper has reviewed the development of clean cooking solutions; mainly clean/improve cookstoves in Kenya and Tanzania. Further, the paper has analysed the policy and regulatory environment, including the gaps that may influence the adoption and diffusion of clean cookstove in both countries. The development of cookstoves dates back to forty years ago in both countries, principally dominated by the informal sector operators and as such limited their access to formal business interventions such as insurance, technical assistance, financial investment, research and development, among others. It is quite clear from multiple policies, programs and regulations discussed in this paper that there is a general recognition of the social, economic and environmental values of clean cookstoves. However, with a sector driven by informal set-ups, general policy incentives and public initiatives have been less effective in bringing significant transformation in the cookstove sector. This situation has restricted the growth of both the cookstove sector, making it difficult for many producers to commercialize at scale.

The clean cookstove sector in both countries for a very long time remained unregulated and lacked specific policy measures and incentives that encourage the adoption and diffusion of clean household cookstoves. However, there are slight improvements in the specific policy initiatives that foster the development of the clean cookstove sector. Tanzania recently develops the Biomass Energy Strategy (BEST), which seeks to promote access to alternative energy sources, including clean cookstoves and to raise the efficiency with which biomass energy is produced and utilised. In Kenya, there are visible efforts to incentivise cookstove diffusion with the government of Kenya reducing the import duty on energy efficient cookstoves from 25% to 10%.

Despite promising trends, there are several gaps in policy and regulatory frameworks associated with the clean cookstove markets in Kenya and Tanzania. The most notable gaps in the policy environment have to do with institutional set-up, prioritization of government policies, tax and tariff policies, the infrastructure for cookstove quality testing, access to finance and regulations on biomass and modern fuels. Nonetheless, the cookstove sector could still benefit from utilizing effectively existing policy environment.

Government agencies play important roles in the growth of the clean cookstove markets. Coordinated and coherent policies, tax incentives and funding, regulations, and standardization are critical to effective adoption and diffusion of clean cooking solutions as well as building on business base for clean cookstoves. It is essential for stakeholders in the cookstove sectors to advocate for inclusive policies that support clean cookstove business start-ups and formalization while lobbying for the prioritization of clean cookstove development, which is currently not among government priorities. An enabling policy environment presents a good opportunity to stimulate a change of consumer behaviour, government thinking, policy relevance, and legislative landscape, among other things for the adoption and diffusion of clean cookstove in Kenya and Tanzania.

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