Kenya Climate Innovation Center

SECTOR MAPPING AND MARKET ASSESSMENT **ON THE IMPROVED COOKSTOVES (ICS) SECTOR IN KENYA**

ACKNOWLEDGEMENT

Kenya Climate Innovation Center (KCIC) would like to extend its gratitude to our Donors (DANIDA, UKAID and World Bank) for supporting this study. Although limited on resources, we managed to achieve a document that shall go a long way in building our information base to our entrepreneurs. Secondly we would like to acknowledge the relentless effort made by our consultant, Africa Center for Energy and Environment Solutions (ACEES) and the entire KCIC management team in bringing this report to fruition. It is our hope that this report will be a value addition to the body of knowledge already in existence in this sector.

Climate Innovation

ACCELERATING INNOVATION IN CLEAN TECHNOLOGIES IN KENYA

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LIST OF ABBREVIATIONS

ACEES	-	Africa Center for Energy and Environment Solutions
CBO	-	Community Based Organization
CCAK	-	Clean Cookstoves Association of Kenya
CDM	-	Clean Development Mechanism
CER	-	Certified emission reduction
ERC	-	Energy Regulatory Commission
GACC	-	Global Alliance of Clean Cookstoves
GVEP	-	Global Village Energy Program
ICRAF	-	International Center of Research and Forestry
ICS	-	Improved Cook Stove
IWA	-	International Working Agreement
KCIC	-	Kenya Climate Innovation Center
KCJ	-	Kenya Ceramic Jiko
KEBS	-	Kenya Bureau of Standards
KIPI	-	Kenya Intellectual Property Institute
KIRDI	-	Kenya Industrial Research and Development Institute
KUSCCO	-	Kenya Union of Savings and Credit Cooperative societies
LPG	-	Liquid Petroleum Gas
MFI	-	Micro Finance Institutions
MoEP	-	Ministry of Energy and Petroleum
NGO	-	Non-Governmental Organization
PoA	-	Program of Activities
REA	-	Rural electrification authority
ROSCA	-	Rotational Saving and Credit Association
SACCO	-	Savings and Credit cooperative societies
SCODE	-	Sustainable Community Development
SME	-	Small and Medium Enterprise
VSLA	-	Village Saving and Loan Association
VSLA	-	Village Saving and Loans Association

From the field survey, the manufacturer-distributor-end user model was the most preferred with

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of Kenyans using it with a majority of businesses being sole proprietorship at 61%, in rural, peri-urban and urban areas equally. The preferred mode of payment for the products was mainly cash at the point of sale standing at 88.4% while credit sales are also catching on through SACCOs and Mkopa system.

EXECUTIVE SUMMARY

Climate Change is a reality, and its effects are manifest. To combat some of the causes such as deforestation, global warming due to GHG emissions, some stakeholders have taken it upon themselves to try and mitigate the effects of climate change. Kenya Climate Innovation Center (KCIC) aims at stimulating, supporting and strengthening green innovations in Kenya in reducing greenhouse gas emissions that cause global warming. To better understand and execute their mandate they commissioned a study to provide a detailed analysis of the state of the improved cook stoves sector in Kenya focusing on actors, technologies, business models, financial models and regulatory framework, and thereafter synthesizing the result for dissemination to KCIC entrepreneurs and other interested parties.

To achieve this, the study used consumer surveys, manufacturer and retailer surveys, key informant interviews from Central Region, Coast Region, and Western Region as a representative sample of Kenya. Additionally, the team undertook literature review and desk-based analysis in regard to improved cook stove sector in Kenya.

The study findings, indicate that Kenya has a mature ICS sector coupled with inherent desire for adoption of modern technologies. The sector has a diverse range of actors some are directly involved while others are indirectly involved. These range from Pottery groups, to assembler and the entire juakali sector, to large ICS manufacturers like Burn stoves and Cookswell Company limited, to various International and National, Government departments and parastatals, SACCOs, the private sector such as Financing Institutions, Banks, MFIs, Stoves associations and finally the most important actor the consumers.

The products referred to as Improved cookstoves have two main categories namely the legacy stoves improved from traditional three stone hearths like Upesi, and the KCJ and Uhai from the all metal charcoal stoves to the environmentally cleaner exotic stoves such as Envirofit, Biolite, Burn, Wisdom, and Ecozoom. The main questions investigated were consumer behavior, choices, and issues affecting the adoption or non-adoption of these technologies through a market-based approach. In this regard, the researcher investigated the ICS business value chain, market players, and the various distribution models. From the field survey, the manufacturer-distributor-end user model was the most preferred with 56% of Kenyans using it with a majority of businesses being sole proprietorship at 61%, in rural, peri-urban and urban areas equally. The preferred mode of payment for the products was mainly cash at the point of sale standing at 88.4% while credit sales are also catching on through SACCOs and Mkopa system. With regards to products quality, the study confirmed that the testing of the legacy stoves has not been happening despite the existence of a testing standard in Kenya – many said it was the duty of the inventor. Meanwhile, most of the exotic stoves are branded, have been tested and even offer a warranty.

The study also investigated challenges/ barriers to enabling a robust ICS market in Kenya, these included financing both for manufacturers and consumers, awareness on the quality and benefits of ICS, capacity building for the whole value chain, enabling policies and regulations. The study looked at opportunities and existing solutions to counter the barriers. The survey also cited successful models and case studies and recommended what needs to be done to further boost and sustain the ICS market such as building synergies between the various actors, building on quality of the products, working with networks and associations who are stakeholders in the sector and product diversification.

1.0 Introduction

Kenya has undergone unprecedented socioeconomic, political and technological changes since independence, the interlink that has led to the backdrop against which changes in the environment are viewed. Human activities have contributed significantly to degradation of the country's natural resources. The anthropogenic activities of man have severely undermined the sink function of the environment hence threatening the lives of people. Continued deforestation and forest degradation for agriculture and firewood, unsustainable charcoal burning, illegal logging and use of inefficient energy conversion technologies has continuously undermined the efforts of climate change mitigation in Kenya. Land use land cover change has remained one of the greatest contributors to climate change in Kenya. As a driver of change, Kenya Climate Innovation Center provides a platform for local innovators in renewable energy, agri-business and water and sanitation to enhance the quality of their products with an aim of reducing greenhouse gas emission and resilience to climate change impacts as they grow their businesses. The center hence is aimed at stimulating, supporting and strengthening green innovations in Kenya.

1.1 Background

United Nations Initiative *"The international year for sustainable energy for all"* seeks to engage governments, companies and civil societies towards achieving three goals by 2030: - Universal access to energy services, reduce global energy intensity by 40%, **and increasing utilization of renewable energy globally to 30% of primary energy use** (Savacool, 2012) . In tandem with the Kenya Vision 2030 that puts energy as one of the key anchor towards the achievement of national development agenda – economic, social and political pillars (Kenya Vision 2030) and Kenya Climate Innovation Center (KCIC) that aims at promoting business innovations that have a major impact on water, agribusiness and energy. At the national level, wood fuel and other biomass accounts for about 68% of the total primary energy consumption, (MoE, 2004 ; MoEP, 2015). Global Alliance of Clean Cookstoves (2015) reports that globally, about 3billion people rely on open fires and simple stoves and 4.3million die prematurely annually as a result of illnesses attributed to indoor pollution and up to 25% of black carbon emission comes from burning solid fuels for household energy needs. Hence the greater need for improved cooking solutions in the short term and alternative clean energy source for households in the long-term.

Kenya has a long-lived and highly developed improved cook stove sector compared to other African countries. The most recent figures indicate that between 30% and 40% of Kenyans have acquired "improved" stoves of some type (USAID, 2011). Effectiveness regarding knowledge of the level of efficiency and whether the households use the stoves is still in fuzzy. A study by Mtsami in Wundanyi, Mwatate and Voi Districts established that 98.5% of the households in the target districts were aware of improved cook stove technologies but only 32% had adopted one or more improved cook stove technologies. This implied that despite the high awareness levels on improved cook stoves by households their adoption rates were still quite low (Mtsami, 2010) .

For effective delivery of its service to the small and medium enterprises (SME) in the clean cookstoves sector, KCIC seeks to understand the imbricated issues surrounding the production, distribution, and use of clean cookstoves technology thus contracting ACEES Limited to carry out an in-depth sectoral assessment. An integrated desk-based research and fieldwork sought to unfold the socio-cultural and economic dynamics impeding the acceptance of ICS, technical challenges and opportunities availed for rapid deployment of the technologies. The research further analyzed existing reports to bring out proven marketing strategies, business models in the local and regional context as reported in successful case studies. Actors mapping, roles, and synergies is critical to delivery of technologies, hence high-level snapshot of key actors such as producers, distributors, technologist/technicians and installers linking them with their complementary services

Savacool B.K., 2012; The political economy of energy poverty: a review of key challenges; Energy for Sustainable Development 16 (2012) 272 - 282
Kenya Vision 2030, 2007; A Globally Competative and Prosperous Nation
Ministry of Energy (MoE), 2004; Sessional paper No.4 on Energy
Ministry of Energy and Petroleum, 2015; National Energy policy; Final draft

to build on synergies and distinguishing competition.

1.2 Project Objective

The aim of the study was to provide a detailed analysis of the state of the improved cook stoves sector in Kenya focusing on actors, technologies, business models, financial models and regulatory framework, synthesizing the result for dissemination to KCIC entrepreneurs and other stakeholders.

United Nations Initiative *"The international year for sustainable energy for all"* seeks to engage governments, companies and civil societies towards achieving three goals by 2030: -

Universal access to energy services, reduce global energy intensity by **40%**

increasing utilization of renewable energy globally to 30%

of primary energy use

2.0 METHODOLOGY

This section describes the methodology used for the study.

2.1 Literature review

Documented literature in the form of case studies, policy briefs and reports were reviewed. The objective of the literature review was to gather data on actors, market strategies, financial models and best technologies business models that work among other issues discussed in this report. All relevant data and information available on ICS from Ministry of Energy, GIZ, Global Alliance of Clean Cook stoves (GACC), World Bank reports, SNV studies and Stockholm Environment Institute (SEI) policy briefs were reviewed.
Improved cook stoves literature was sourced from development partners, implementers and research organizations pivoting the results towards best practices in marketing strategies and business models. National and International case studies were of interest and adaptability assessment was carried out.

2.2 Field survey

An intensive field survey was done focusing on consumers, distributors and retailers as well as manufacturers who also directly sell their products to consumers. Besides the distribution chain, we also assessed consumer behavior and choice process. The field survey was conducted between 9th June and 30th June 2016.

2.2.1 Consumer survey

The consumer survey addressed what led the consumer to purchase a given stove and what led the consumer to prefer product A over product B. It was also of interest to understand tradeoff reasoning of a consumer in making his/her choices. This information was crucial for the development of marketing strategies and communication skills of entrepreneurs while building their business models. The questionnaire-based research focused on previous administrative boundaries representation namely: - The Western region – Kisumu, Homabay, Migori, Kakamega and Bungoma, Nairobi and Central regions – Kiambu, Thika, Athi River and Coast region - including Mombasa, Kilifi, and Kwale. For the household survey, 70.3% of the respondents were female, and 83.7% were between the age 18years – 40 years. These findings imply that cooking is a female role and so may influence the purchase of an ICS, also the younger population are more prone to adapting new technologies. The household questionnaire used to gather this information is attached as Annex 1.

2.2.2 Manufacturers and retails survey

The researcher adopted an integrated approach of using questionnaires and focus group discussions for the collection of both qualitative and quantitative data. Quantitative data such as stoves sold per day, stoves produced per day, the number of distributors, resellers and installers per area or manufacturer. This data was classified into the type of stoves, emission levels, efficiency and indoor air pollution level. Most of the retails and manufacturers interviewed ran sole proprietorship kind of business. The Retailers and Manufacturer's questionnaires are annexed as 2 and 3 respectively.

A bar graph showing nature of business

70.3%

For the household survey, 70.3% of the respondents were female and 83.7% were between the age 18years – 40 years.

83.7%

barriers and opportunities (Figure 2).

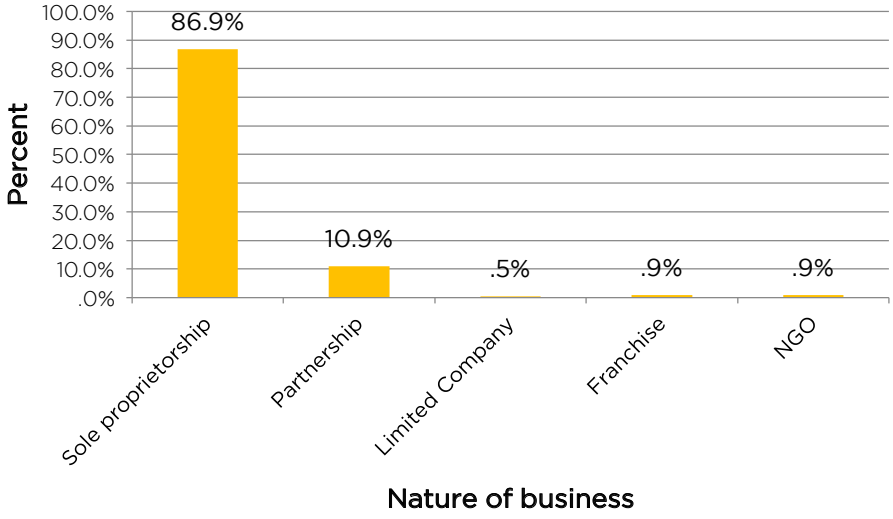


Figure 1. Nature of businesses

2.3 Stakeholder validation workshop

A stakeholder's validation workshop was held on 22nd November 2016 to critique and allow other stakeholders input on the findings of the study. The list of attendees is annexed as Annex 4 and the discussions have been incorporated in this report.

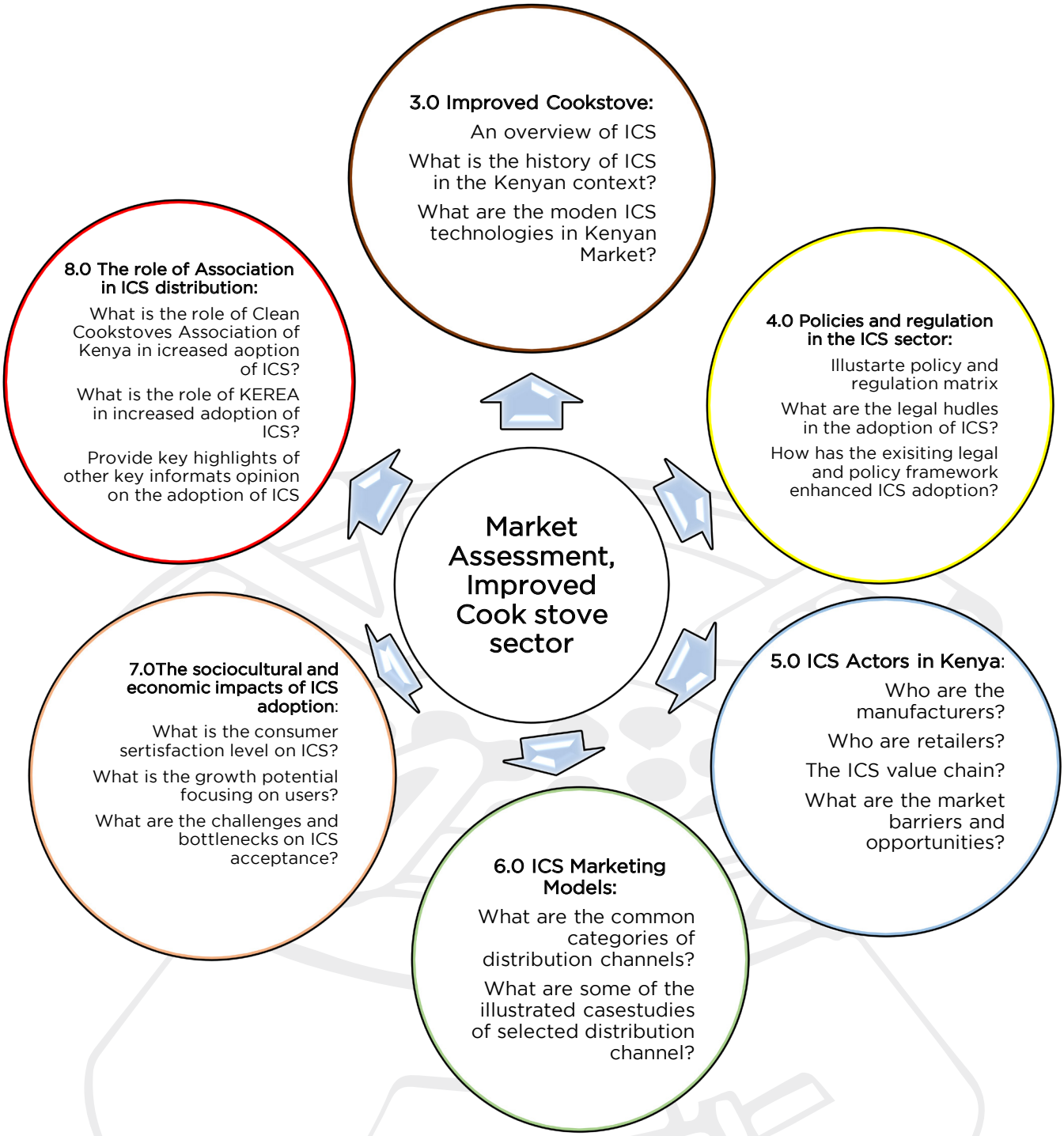
2.4 Key informants Interviews

Interviews with the Ministry and other key relevant institutions staff formed an important part of this study. Interviews were done on an ad hoc basis to pursue specific lines of inquiry about improved cookstoves policy, regulations, and standards. There was also, a variety of unstructured meetings to explore specific topics such as barriers and opportunities in the sector. A semi-structured interview guideline (Annex 5) was prepared. Interviews focused on the following groups of stakeholders: managers of respective government departments, national policy making representatives, recipients and other representatives of the private sector.

The Systematic Presentation of Study Findings

The study findings have been arranged in five main subheadings elaborating the research questions leading to the understanding of the clean cookstoves market segment

A stakeholder's validation workshop was held on **22nd November 2016** to critique and allow other stakeholders input on the findings of the study.


3.0 Improved Cookstove:
An overview of ICS
What is the history of ICS in the Kenyan context?
What are the moden ICS technologies in Kenyan Market?
4.0 Policies and regulation in the ICS sector:
Illustarte policy and regulation matrix
What are the legal hudles in the adoption of ICS?
How has the exisiting legal and policy framework enhanced ICS adoption?
5.0 ICS Actors in Kenya:
Who are the manufacturers?
Who are retailers?
The ICS value chain?
What are the market barriers and opportunities?
6.0 ICS Marketing Models:
What are the common categories of distribution channels?
What are some of the illustrated casestudies of selected distribution channel?
7.0The sociocultural and economic impacts of ICS adoption:
What is the consumer sertisfaction level on ICS?
What is the growth potential focusing on users?
What are the challenges and bottlenecks on ICS acceptance?
8.0 The role of Association in ICS distribution:
What is the role of Clean Cookstoves Association of Kenya in icreased aoption of ICS?
What is the role of KEREA in increased adoption of ICS?
Provide key highlights of other key informats opinion on the adoption of ICS
Market Assessment, Improved Cook stove sector

3.0 OVERVIEW OF IMPROVED COOKSTOVES SECTOR IN KENYA

Improved cook stoves are used to refer to stoves that have better efficiency and reduced emission from the baseline stove (predominantly traditional 3-stone fire and traditional metal charcoal stove without insulation). GACC technical report (2015a) describe Improved cook stoves solutions to include all cook stoves that improve fuel efficiency without reducing particulate matter emission to low levels as per the International Workshop Agreement (IWA) guidelines for improved cook stoves. The stoves that meet tier 2 as per the IWA protocol are referred to as efficient, stoves that meet tier 3 for indoor emission or higher are counted as clean and stove that meet tier 3 overall and higher are referred to as clean for environmental impacts (GACC, 2012) . They are classified into five main categories: legacy and basic, intermediate advanced, modern and renewable fuel stoves as presented in the table below 1.

Table 1. Classifications of improved cook stoves

Improved Solutions		Clean Cooking Solutions		
Legacy and Basic ICS	Intermediate ICS	Advanced ICS	Modern Fuel stoves	Renewable Fuel Stoves
Example: Kenya Ceramic Jiko, KuniMbili stove	*Example:*Ecozoom, Burn stove, Jikoupesi	*Example:*Gasifier	*Example:* LPG	*Example:* Biogas, ethanol gel stove
Key features: Small functional improvement over baseline technology; artisan produced	*Key features:* Rocket principal to enhance combustion efficiency; some with high end materials and good finishing	*Key features:* Fan jet or natural draft gasifier with very high combustion efficiency and reduced emission; often attain tier 3-4	*Key features:* Relies on fossil fuel or electricity; zero emission with very high efficiency	*Key features:* Derived from renewable non-woody fuel; some are supplement energy sources
What is included: • Basic efficient charcoal • Basic efficient wood	*What is included:* • Portable rocket • Fixed rocket chimney • Highly improved	*What is included:* • Fan gasifier • Char stove	*What is included:* • LPG • Electric cooker • Kerosene	*What is included:* • Biogas • Ethanol • Solar oven • Fireless cookers

Source: Adopted from GACC technical report (2015)

80% of the urban households use KCJ for charcoal burning. In Nairobi for example about 500,000 households use KCJ for heating, cooking, and grilling. And a staggering figure of half million KCJ stoves is being pushed into the market annually

3.1 The History of improved biomass cook stoves in Kenya

Improved Cook Stoves (ICS) activity in Kenya started in 1981 following the United Nations Conference on New and Renewable Sources of Energy held in Nairobi. In the late 80s and early 90s, Home Economic Branch (HEB) of Ministry of Agriculture and GTZ Special Energy Program (GTZ-SEP) stepped up the dissemination of Maendeleo liners and other energy conservation forms . This brought into limelight the Maendeleo Liner stove that was an inbuilt insulation liner for heat conservation and proper airflow for complete combustion. For charcoal burning, the program introduced the well-known Kenya Ceramic Jiko (KCJ) that today can be found in all parts of Kenya. KCJ has been the most preferred charcoal-burning stove in Kenya and the East Africa Region. About 80% of the urban households use KCJ for charcoal burning. In Nairobi for example about 500,000 households use KCJ for heating, cooking, and grilling. And a staggering figure of half million KCJ stoves is being pushed into the market annually. The USAID report highlights that the technology, training, and business model have been exported to dozen other countries and East and Central Africa region. The Toyola case study in Ghana is a successful dissemination of a re-branded KCJ. Energy access reports that, 'Toyola Energy Ltd. Is an enterprise that fabricates and sells charcoal efficient cook stove – improved Kenyan Jiko type – to 30,000+ households a year in Ghana.' . The wide uptake of this technology have been necessitated by the low price, suitability to African cooking culture and communal system and charcoal saving. The technology has undergone a lot of innovative modifications and transformation in Kenya, trying to address the issues of efficiency, adoptability, multi-fuel application, and aesthetics. The study conducted confirmed that despite increase in population and awareness, the adoption rate of improved cookstoves has hardly increased as compared to the USAID study above, as it stands at 78%. (Figure 3).

Figure 3: Access to Improved Biomass Cook stoves

3.2 Types of improved cook stoves

There are two main types of improved cook stoves, 1) portable ICS and 2) fixed ICS. The portable systems can easily be carried to different locations, they are light, easy to transport and can be used both in rural and urban areas. Most of the portable stoves are for charcoal burning because they are not fitted with chimneys to eliminate smoke. However new innovation of portable wood stoves are emerging in the market whereas, fixed ICS are permanently fixed either on the floor or wall. They are ideal and common in rural households and mostly are firewood stoves. The stoves exist in different sizes and design depending on the installer or manufacturer/installer or technician. Their thermal efficiency ranges from 18% to 45% depending on the design configuration. However, all the improved cooked stoves exhibit the rocket (Approvecho Research Center, 2011) principal for enhanced draft and combustion efficiency allowing for sufficient primary air underneath the pieces of sticks and enough draft chamber for full combustion.

Figure 4: Rocket stove operation principal

3.3 Modern Improved Cook Stoves (M-ICS)

With the introduction of climate financing and Carbon Emission Reduction (CER) trading, new technologies emerged in the market, with higher aesthetic values, higher efficiencies and with higher tiers. ICS testing for CER verification became prominent, and new exotic innovations flooded the market. Donor financing and other financial facilities came into play. These stoves are also referred to as intermediate ICS (GACC, 2015a) . They are highly engineered, efficient and attractive however the glaring questions that are barely answered include, how are these technologies adaptable to the local needs? What are the socioeconomic and product specific attributes that lead to consumer adoption of the technology? On constraint and obstacles to the market uptake, USAID report highlights that customers are seeking products that are, available, affordable and appropriate. Intermediate ICS are not yet available in all markets, nor are they always affordable on a cash basis. In rural areas where donor stove programs are not active, general lack of awareness about M-ICS persists. Figure 5 below is an illustration of some examples of M-ICS in the Kenyan market. The survey conducted illustrated that KCJ still dominates the improved cook stoves market. It is accessible, affordable, locally manufactured, meet most of their requirement - warming the house, cooking, life style – as well as easily repairable.

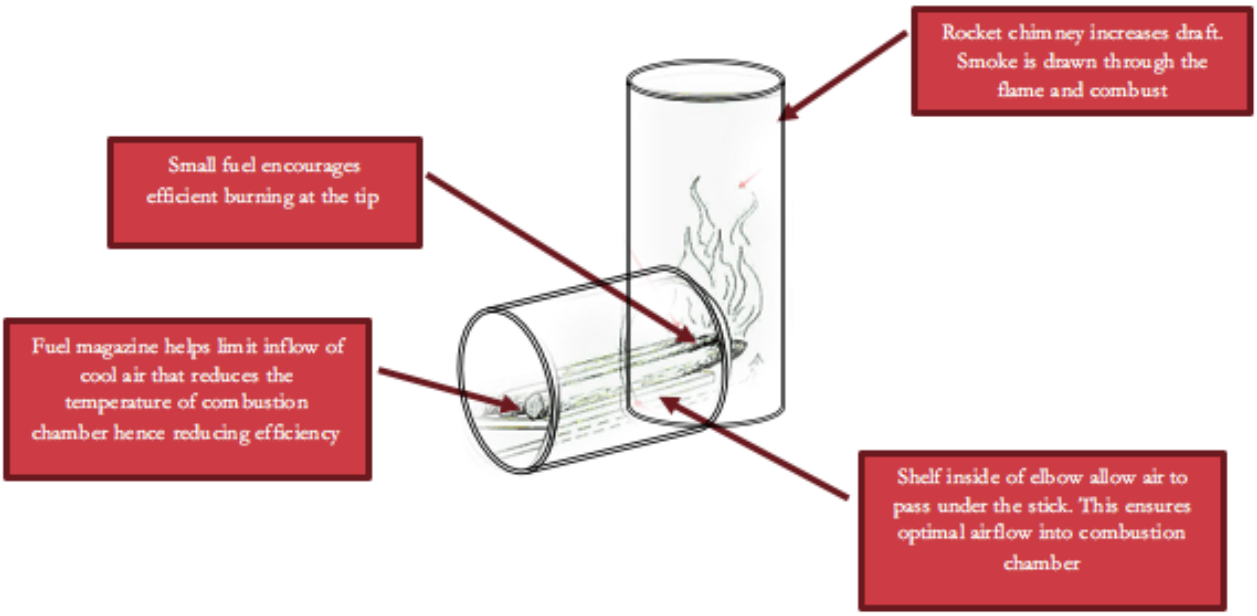


Figure 5: Examples of M-ICS in the Kenyan Market

4.0 POLICY, LEGISLATIVE AND INSTITUTIONAL FRAMEWORK AFFECTING IMPROVED COOKSTOVES SECTOR

4.1 Synthesis of Policy and Regulation in the ICS the Improved Cook stoves sectors include: -

- Energy policy (final draft 2015)
- The energy bill, 2015
- Energy (Improved Biomass Cookstoves) Regulation, 2013.

Table 2. Policy and regulation matrix

Policy/Regulations	Key highlights of influential statements	Sections	Possible Implication on manufacturers/ Distributers	Implication on Users
1. National Energy and Petroleum Policy, Final draft 2015	Biomass, biofuels and biogas amongst other sources are considered renewable energy and tax and other concessions are encouraged to promote development of such.	Section 3.0 on Renewable energy	Opportunity for lobbying for tax holidays hence reduced price on technologies and fuels such as pellets	More access
	Over reliance of biomass energy threatens the achievement of constitutional requirement of 10% tree cover, hence wood fuel supply management is crucial	Section 3.4 on Biomass energy resource	Review technology type and biomass sources upon government stringent measures on biomass based technologies	
	Promote efficient conversion and cleaner utilization of biomass Promote alternative energy sources e.g. LPG Provide incentives for biofuel, biogas production projects	Section 3.4.5; 3.5; 3.6.3	Incentives are limited for alternatives accept for biomass based technologies.	Likely to be persuaded to adopt alternative energy options
2. Energy Policy Sessional paper No.4 2004	Promote sustainable biomass harvesting through efficient exploitation and utilization technologies while at the same time providing policy triggers to shift energy consumption to cleaner fuels like LPG and Kerosene	Section 2.3	The statement is leaning towards support of LPG and Kerosene hence undermining the efforts of biomass technology innovators	With effective user financing mechanism, consumers might have tendency for moving up the energy ladder
	Enhance increased use of LPG as we reduce on biomass consumption. Establish specific laws and regulation	Section 5.1 and 5.2	Regulation is promoting more LPG adoption	

Policy/Regulations	Key highlights of influential statements	Sections	Possible Implication on manufacturers/ Distributers	Implication on Users
	to management of biomass sector			
	License charcoal production Promote private sector participation in biomass energy production, distribution and marketing Increase the rate of adoption of efficient charcoal and fuel wood stoves. Increase efficiency of improved charcoal stoves to 40-50% by 2020	Section 6.3	Stringent measures shall ensure promotion of highly efficient stoves rewarding the innovators.	Might need to pay more for quality and high efficient technology opening doors for choices on alternatives
	Establish biomass energy technologies databases	Section 7.2.3	Characteristics to ensuring all stoves are tested and can be an additional link to users and more open competition	Can easily access product of their choice.
	Promote private sector participation in charcoal production		Equally efficient technologies shall be required, hence stringent laws	
3. The Energy Bill 2015	Regulation and licensing of biomass producers, transportation and distribution	Schedule VI, Function of county government		
		Article 56, CAP 2 Energy Efficiency and Conservation Agency	Describes the coordination of resource conservation, equipment and appliances.	
		Schedule IV Energy Regulatory Authority	Regulate actors (ICS manufacturers, retails and distributers)	End user quality product

Policy/Regulations	Key highlights of influential statements	Sections	Possible Implication on manufacturers/ Distributers	Implication on Users
4. Energy Regulations (Biomass) improved cook stoves	Requirement for licensing of manufacturers, installers and technicians. They shall fall in four classes B1 – B4 Installation certificate and records of installation shall be kept by institutional users	Article 4,5 and 6	More organized value chain	Quality assurance
	Warranty on improved biomass stoves as per Kenya standards	Article 11	This shall ensure that all stoves are tested and warranty provided	
5. Environment Policy: The sessional paper No. 6 of 1999 on environment and development	Make environmental impact Assessment (EIA) a requirement for all projects and programs, especially for hydro-electrical, thermal and geothermal activities, as well as those requiring wood.	Chapter 4. section 4.5 on energy	Create opportunity for cleaner production	
	Promote widespread adoption of energy efficient technologies			
	Provide economic incentives for energy conservation and encourage private investment in energy development including alternative sources of energy		NETFUND Grant Award for local innovators	Reduced HAP
6. The forestry Act of 2005	Mandates the KFS to enforce the conditions and regulations pertaining to charcoal making and other forest utilization activities	Part II section V	Mainly affect fuel end of the supply chain	Increased charcoal prices due to licensing levies

SEI (2014) discussion brief echoed, the need for the government to recognize the value of bio-based energy in the entire energy mix and have an elaborate holistic discussion in national energy policy and laws. As a leader in Sub-Saharan Africa (SSA) in clean cookstoves technology distribution, the government needs to support private sector actors by removing market barriers such as taxation in order to achieve large-scale market transformation. The working paper by Fiona and Jacqueline (2015) recommends a specific government agency to be established to support the activities in the charcoal and clean cookstoves sector with a dedicated fund to promote the sector. Other funds could be sourced from carbon finance and climate finance funding. They, however noted that there is no, "one size fit for all" approach to successful cook stove initiative, user-driven quality technology, access to finance, enabling policies and commercial approach is the key to success stories. ICRAF/SEI technical brief (Musungu A. et.al; 2014) further recommends policy revision pointing out such issues like: ensuring of standards and regulations on stoves design, enforcement of existing regulations, capacity building as a requirement for manufacturers, distributors and installers licensing, market linkage of clean technologies to sustainable charcoal production.

4.2 Legal hurdles to ICS

a) Standards and labelling: There exist Kenyan improved cookstove standards of 2005. Currently, the standards are under review and were presented for public comments before final adoption. However, although the ICS standards have been in existence for a decade implementation has suffered a great blow among others things due to wide spread production in the non-regulated informal sector and lack of proper implementation guidelines. Many manufacturers and distributors of ICS (60%) didn't test their stoves and for them who tested their stoves were for comparison with the leading brands and customer quality assurance.

b) The Kenya scaling up renewable energy program (SREP) report (2011) mentions biomass energy on passing with the involvement of civil society as key actors in the household program. The report targeted biomass energy for power generation and not as source of household energy alternative.

c) The energy (Improved biomass) cook stoves regulation (2012) seeks to license manufacturers, installers, technicians and distributers as per their mandate. However, the policy does not spell out vividly on capacity building plan for thousands of the ad-hoc SMEs in the improved cookstove manufacturing.

d) Whereas taxation in other renewable energy option is being zero-rated biomass appliances and technologies are fully taxed.

e) Policy incoherency has made it impossible for the government to collect tax amongst charcoal and wood vendors. Whereas transportation of charcoal and wood remains illegal, sales of the same is unquestioned in the marketplaces.

4.3 Opportunities presented as a result of existing legal and policy frameworks

a) The policy recognizes over reliance of biomass as a source of energy threatens the achievement of the constitutional requirement of 10% tree cover, hence wood fuel supply management is crucial. Furthermore, the government has taken steps towards promoting the use of LPG as an alternative fuel for household cooking in Kenya by removing taxation on LPG in recent budgets.

b) Regulation of the charcoal sector is likely to result in an increase in the price of charcoal to the end user, to reflect the real cost of sustainable charcoal production. The price hikes will incentivize users to invest in and use more efficient charcoal cook stoves and alternative energy sources.

c) The improved cookstoves regulation similarly will ensure that the actors in ICS manufacture and importation are controlled enhancing energy and environmental conservation. This regulation will promote education and training along the improved cookstove value chain building a more sustainable and well-informed actor.

5.0 IMPROVED BIOMASS COOK STOVES SECTOR PROFILING

5.1 The Improved Cookstoves business value chain

The improved cookstoves business actors can be described by simple value chain consisting of Manufacturers, distributors, and users as was observed in the field survey (figure 6). This is as a result of imbricated overlapping roles in distribution levels. Common occurrence include: -

a. The manufacturer is the same as the distributor to retail and local vendors.
b. Manufacturer to distributor to end user.
c. Distributor to retail to end user.
d. Distributor to end-user.
e. The Retailer also distributes the stoves to various stockiest or franchise market to the end-user.

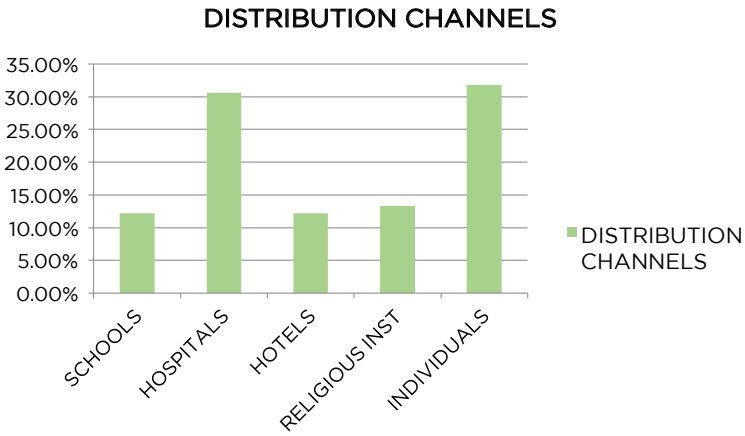


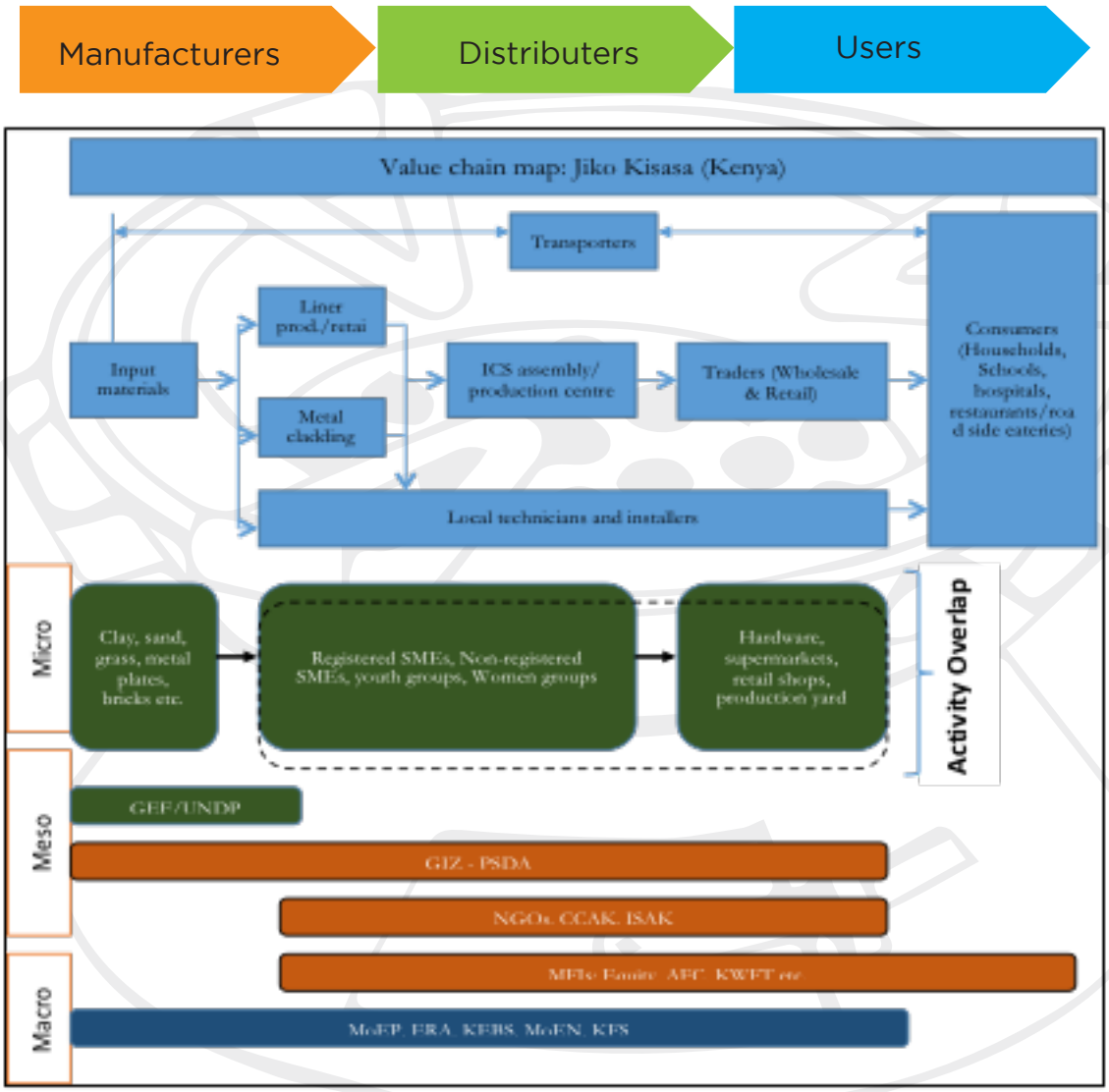
Figure 6: Distribution channels

The above distribution channels are dependent on the various market/financial model approach by different actors within the value chain, the common aspects being manufacturer – Distributer and user. Figure 7 highlights Generic view of distribution model. The indirect actors in the ICS sector include:

Figure 7: Typical ICS value chain

Climate change impacts and call for exerted efforts to maintain the global rise in temperature to 2oC above the pre-industrial era, as well as national drivers for bio-diversity conservation has generated interest in the sector, government, financial institutions, and donors have engaged in the sector. They either have direct or indirect influence in the value chain (figure 7). A cross-sectorial interaction and internal relationship between the various sub-categories form a complex relationship between different entities within the value chain. Moreover, each improved cook stove value chain has its unique interaction and different levels of actor's engagement. A case example of Jiko kisasa is illustrated in figure 8. The influencing actors have been classified as micro (Direct players in the value chain), Meso (financiers and support instruments) and macro (the high-level policy makers and regulatory mechanisms). Our research focused on Manufacturers, Retails and Users and their interaction with the meso and macro in the adoption of improved cook stoves market in Kenya.

Figure 8: JikoKisasa market value chain
Source: Developed form Wanjohi and Krain, 2009



5.2 ICS Manufacturers in Kenya

The focus of Global Alliance for Clean Cookstoves activities in Kenya, has resulted in the emergence of numerous local and international innovators/manufacturers in Kenya. GACC targets 100 million clean and efficient cookstoves internationally and 1 million improved cookstoves disseminated and maintained in Kenya by 2020 (GACC, 2015) . In this respect, there are several ICS manufacturers in Kenya under the following categories, private limited companies, sole proprietors, women/youth groups, CBOs/ NGOs mainly distributing carbon-financed stoves in rural areas for free or highly subsidized. A Sole proprietorship in the informal SME sector dominates the improved cookstoves manufacturer sector accounting for 82% of total ICS manufacturers. They mainly produce legacy stoves such as KCJ, upesi liners, ceramic institutional stove. The production of such is widely distributed across Kenya in the Juakali sheds in major towns and market places.

On average over 85% of the manufacturers interviewed had been in business for more than 2 years, and about 90% manufactured charcoal stove. The Majority of the 10% wood stoves manufacturers produced improved institutional stoves. On average annual production capacity was observed as 24,000 units/manufacturer. Gender equality is becoming common in the Kenyan manufacturing sector with about 30% of the employees in the interviewed manufacturers were women. Although most of the manufacturers of legacy stoves produce in the range of 600 – 2000 units per stoves monthly, innovative distributors like Cookswell limited based in Kitengela sell about 26,400 Units/year (GIZ and StovesPlus, 2014) .

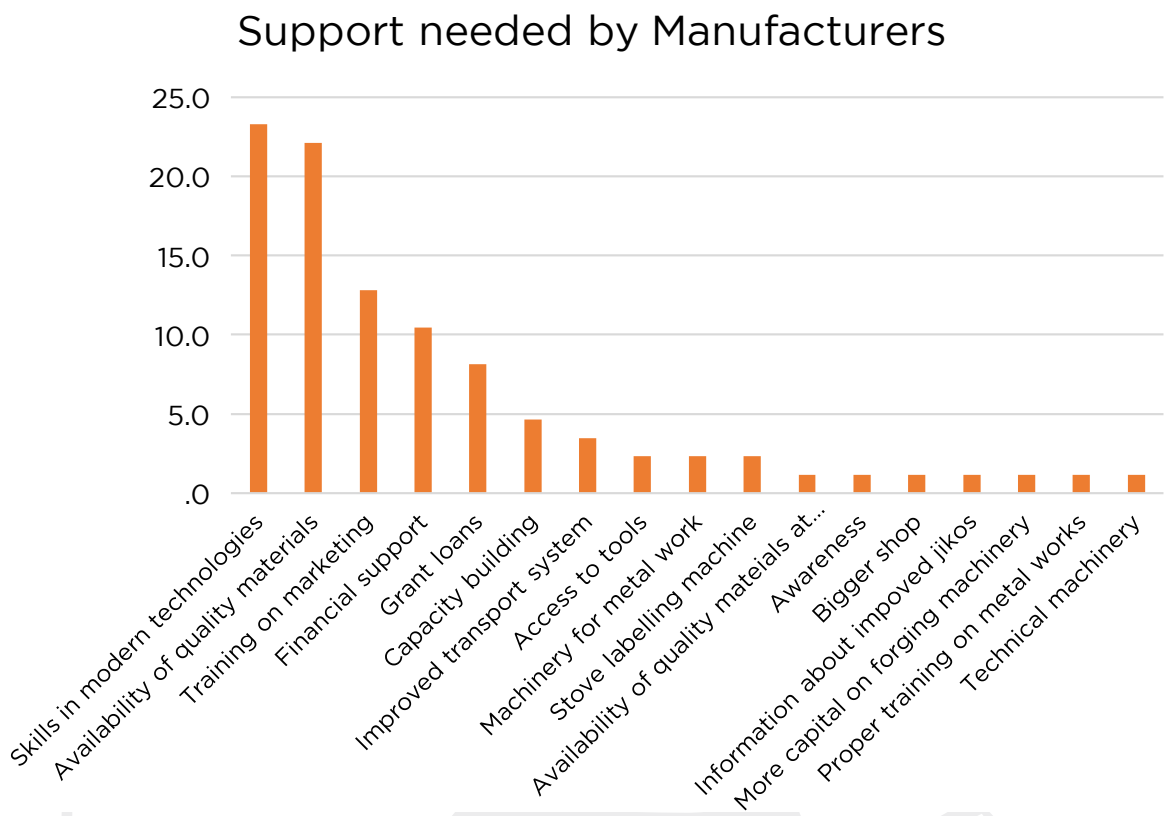
Recently intermediate stoves like Burn stove have opened their local branch in Kenya with one of the main manufacturing unit set and operational in Ruiru – Kiambu County. Intermediate stoves manufacturer are growing as a result of carbon finance and climate finance schemes that provide subsidies to the distribution of the high tier exotic stoves in the local market . Table 2 below gives highlights of some of the known manufacturers and distributors and distribution channels (GACC, 2012) .

	Type of stove	Manufacturer	Thermal efficiency	Cost range	Key feature	Production capacity	Distribution channel
Legacy stoves	Kenya Ceramic Jiko	Mainly the Juakali sector (Different part producers and assemblers)	25% – 35%	$4 - $10	Metal cladding and ceramic liner. Effective training and size standards have been made	Cumulatively large but most metal cladding manufacturers produce few 100s per month. There are few liner producers hence about 10000 liner/ month/entrepreneur	Retails, small vendors in the market places, super markets
	Uhai stove	Keiyo Pottery Enterprise, Various private entrepreneurs	36%	$10 - $18	Improved Ceramic liner for directed heat to the bottom of the pot	Demand driven	Middlemen and market retails
	Multi-purpose stove	Various SMEs	Wood (20%); Charcoal (30%)	$10	Removable ceramic charcoal grate to enable both firewood and charcoal burning	Demand driven, Not extensively produced	Retail markets
	Upesi Liner (portable and fixed)	Keiyo potteries, Various GIZ trained technicians	25% - 30%	Fixed $3 - $4 Portable $10	Liner permanently fixed in the kitchen Liner with metal cladding to make Kuni-mbili stove	Demand driven but an estimate of over 1.2million have been installed by GIZ trained technicians Produced by most producers and was highly supported by GIZ-PSDA	Liner installed by trained installers on demand basis and referral's Portable stoves sold at market outlets
	Fixed brick rocket stove	GIZ trained technicians	25% -35%	$5 - $15	Fixed wood rocket stove. Mainly in rural kitchen	Demand driven and user prepare materials and pays installation fee	Direct service to consumer
Intermediate Stoves	CO_2Balance	Distributed by CO_2Balance	35%	Highly subsidized by carbon finance fund. Installation fee of $2	Fixed wood stove	20,000 stoves were distributed	Direct to consumer
	JikoPoa	Fine Engineering	22%	$14 (subsidized)	Ceramic liner inside	80 units produced per day	Distributed through paradigm project
	Envirofit Stove	Envirofit	30% - 35%	$38 (subsidized)	Rocket stove principal, ceramic liner	Demand driven	Direct sales through sales officers, NGO partnership
	Biolite stove	Biolite Ltd	Upto 65%	About $90 (Subsidized)	Rocket principal, fan driven, self-generated electricity for charging	Demand driven	Partnership distribution
	Burn Stove (Jikokoa)	Burn Manufacturers	Upto 45%	About $38 (Subsidized)	Highly engineered	Demand driven	Retails shops, middlemen, Supermarkets, contracted distributers, partnership with other product distributers
	Ecozoom Dura, Jet	Ecozoom Ltd	45% - 55%	About $43	Highly engineered with secondary air inlet	Demand driven	Contracted distributers

Source: GACC, Kenya Country Action Plan

Most manufacturers sell their products on cash to distributors and retail, 87% of manufacturers sold their stoves on cash basis. However, with the rising cost of production and material, the cost per unit of the stoves is rising, and cash sales will not be fashionable in the future if target distribution is to be met. Credit financing is gaining momentum though with 10% total sales made on credit. This momentum gaining could be an opportunity for enhanced distribution of ICS in low-income communities. Main challenges listed by manufacturers included access to finance, awareness creation, marketing, research and development and governance of the sector. However, they were also quick to point out some opportunities in the sector building from increasing demand from institutions and households, access to loan facility although expensive, specialization in part production and the emergence of exotic intermediate ICS. The manufactures mainly in the informal sector listed the following as the main areas of support required (figure 9).

Figure 9: Areas of intervention in ICS manufacturing
Figure 10. Areas of intervention in ICS manufacturing



5.3 Kenya ICS retails

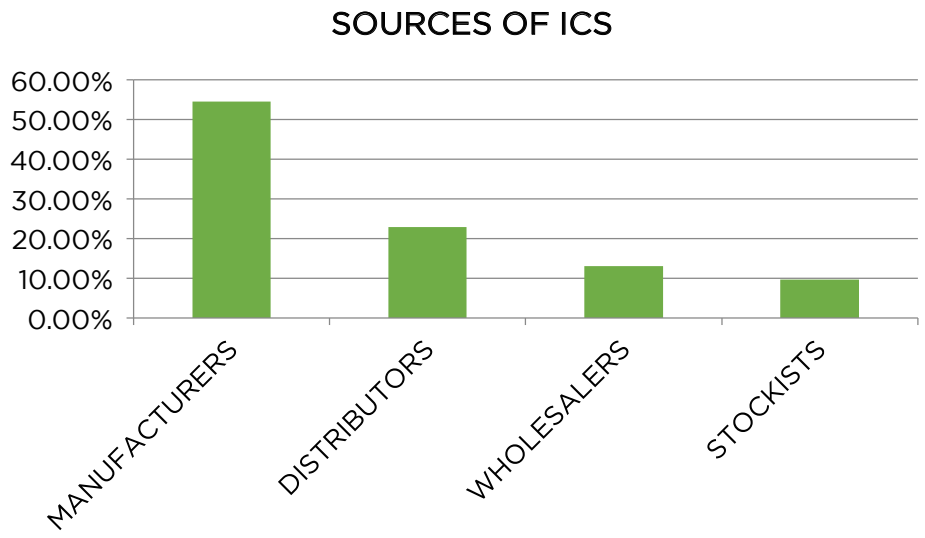
There are thousands of ICS retails in Kenya. Retailers are mainly involved in the selling of ICS products. However, there is a tendency of overlap in the sector with some retails acting as assemblers, distributors and technicians. The retails are mainly comprised of a sole proprietorship with an average capital stock of not more than 2 million Kenya shillings. The survey showed that 86.9% of retailers interviewed operate the sole proprietorship, 10.9% are partnerships, 5% limited companies, 0.9% are Franchisees and 0.9% are NGOs from the sampled group. On average 80% of all the respondents have been in the ICS business for more than 2 years. This is indicative of a stable and growing need. The target market is distributed equally in rural and urban areas.

On average Kenya retail business employs 5 people, 2 female and 3 males. The predominant stoves sold at the retail outlets are improved charcoal stoves, accounting for 91%, and other ICS accounts for only 6.4% explaining the distribution channels in table 2 above. The Quality of stoves sold is however not a concern for most retail shops, only about 6.3% of total stoves sold in the market outlets had Kenya Bureau of Standards Mark. This is a case that the retails thought that should be a concern for the manufacturers. With the Energy Improved (Biomass) cook stoves regulation (2012), it will be mandatory for all stoves manufacturers in the market to have KEBS label of quality. Similarly, 93% of the stoves stocked had no warranty, the few that had warranty were mainly one year's warranty. Most of the warranty were replacement warranty and however about 36% of the warranty were repair warranty. A similar question of knowledge of warranty from consumer end indicated that about 55% did not know anything about stoves warranty and very few can claim warranty or have ever claimed warranty.

On supply end most of the retail shops got their stoves directly from the manufacturers, however about 30% were supplied by distributors (figure 10). The end market or consumers being households, hotels, and schools in that order. The supply route is either delivery by the shopkeeper or client purchase from the shop. About 94% of the clients pay cash, and only about 4% take on credit in trust basis. Average annual profit per shopkeeper was estimated at Kshs 200,000. Growth in profit level was observed which could be attributed to increasing demand, market availability, good customer relation, quality of the stoves, increased income and more awareness on the importance of Improved cook stoves. Most of the retails do not seek a loan for capital which they explained to be mainly due to the size of business – predominantly - small scale and the interest rate that makes it very expensive to pay back. If sales are on credit, most retails would want to be repaid within 3 months.

The businesses also expressed various capacity needs and top on the list is investment capital, capacity building, access to affordable loans and marketing strategies.

Figure 11. Sources of stoves



5.4 Market barriers and Opportunities in the ICS sector

Despite more than three decades of improved cookstoves dissemination in Kenya, there is a lack of thriving market. This may be due to a couple of reasons described below: -

Table 4. Highlights of Market Barriers and Opportunities

ICS market Barriers	ICS market opportunities
Access to finance/cost barrier: Both manufacturer and user financing are critical to the development and adoption of quality ICS. Most manufacturers did not want to spend money in research and development, product testing and market trials due to limited funds. More funds hence should be channeled to support improvement and market trial of innovative design. Moreover, most startup business don't have access to start-up funds. Most start-up businesses/distributers tend to collapse in the first 2 years of establishment due to lack of operational funds.	Growing interest of multi-national organization: Global Alliance of Clean Cookstove target to disseminate 1million improved cookstove in Kenya by the year 2020. The ambitious plan has facilitated and opened up opportunities for innovators and manufacturing financing. Spark Fund II aims at supporting innovative approaches in clean cooking sector. Other actors like SNV-RBF program, USAID jikosafi programme amongst many others creates an open opportunity for ICS manufacturers to seek for funds for products development, market trials and proof of concepts
Capacity building: Human capacity is a pre-requisite to quality product design and development. Not many of the innovators understand user centric approach to product development. This results to products not penetrating the market easily.	Carbon financing: Under CDM – PoA several stoves have been distributed in Kenya. This is an opportunity for distributers to secure subsidies for their products. The second phase of CDM is commencing soon and the government is strategically positioning itself to benefit from the carbon credit fund. Other funds within the carbon credit frameworks include: voluntary carbon trading, gold standard amongst many others.
Market strategies: Most retails and manufacturers of improved biomass stoves have not adopted innovative marketing strategies and branding of product. Although the survey illustrated that over 75% of the producers, retails and retails have attained at least secondary school education, marketing skills is still low. Sustainable Community Development (SCODE) is one local enterprise that produce and sell ICS branded and with innovative distribution channels.	Increasing Consumer financing: Eighty percent of the people who were willing to acquire intermediate stoves and clean cooking stoves have not done so due to cost. Today there are several credit financing mechanisms that have supported users through flexible loans and there is observed increase in ICS adoption. Dissemination through SACCOs and also use of Mkopa model is growing in popularity.
Enabling policies: Whereas there are tax exemption on other products such as solar lighting products, improved cook stoves sector does not have tax exemptions. In this respect, the cost of improved cookstoves have remained high, yet biomass energy accounts for the highest energy demand in Kenya. GVEP (2012) reports that one other way to enhance quality is to lower entry barriers for big multinational cookstove players to come and invest locally on quality cookstoves manufacturing in Kenya.	Awareness on the benefits of ICS It was observed that over 75% of respondent knew about improved cookstoves and their benefits. About 89% of respondents who owned ICS bought them because they saved on fuel. This is an important gesture to upcoming traders. With heightened sensitization they can readily sell their products. This has been proved by the aggressive marketing of the Jikokoa (Burn), it ranks second to KCJ.

Quality of product: Many cookstoves in the past were designed in the laboratory without due consideration of the actual field condition, over time they would deteriorate in performance and hence being left redundant and user gets back to traditional habits. From the survey only 8% of dealers/retails sold stoves with KEBS standardization mark. This is a quality assurance mark and gives assurance to consumers that the stove is of right quality. Most of the legacy stoves manufacturers don't test their stoves. Most users will tend to buy quality products and meet their needs.	Willingness of Consumers to buy ICS Over 70% of Kenyans who don't have ICS were willing to acquire one. There is an already created urge of people to save on their fuel consumption as well as enjoy other benefits like reduced indoor air pollution and reduced environmental degradation. Other push factors creating more pressure on consumers is the dwindling fuel resource and increasing charcoal prices.
Input materials: The cost of input materials are in the increase hence the cost of the final product. Continued rise in cost of product is unattainable to the local people hence low adoption of the ICS mainly in the poor rural areas.	

On supply end most of the retail shops got their stoves directly from the manufacturers, however about

30% of kenyans who dont have ICS were willing to acquire one

70% of kenyans who dont have ICS were willing to acquire one

6.0 MARKETING AND DISTRIBUTION MODELS OF ICS PRODUCTS

6.1 ICS distribution channels

Except for the legacy improved cook stoves, the manufacturers mainly determine distribution models. Common features of ICS distribution models follow the following two common channels.

Class A: Cash sales distribution channel (Figure 11)

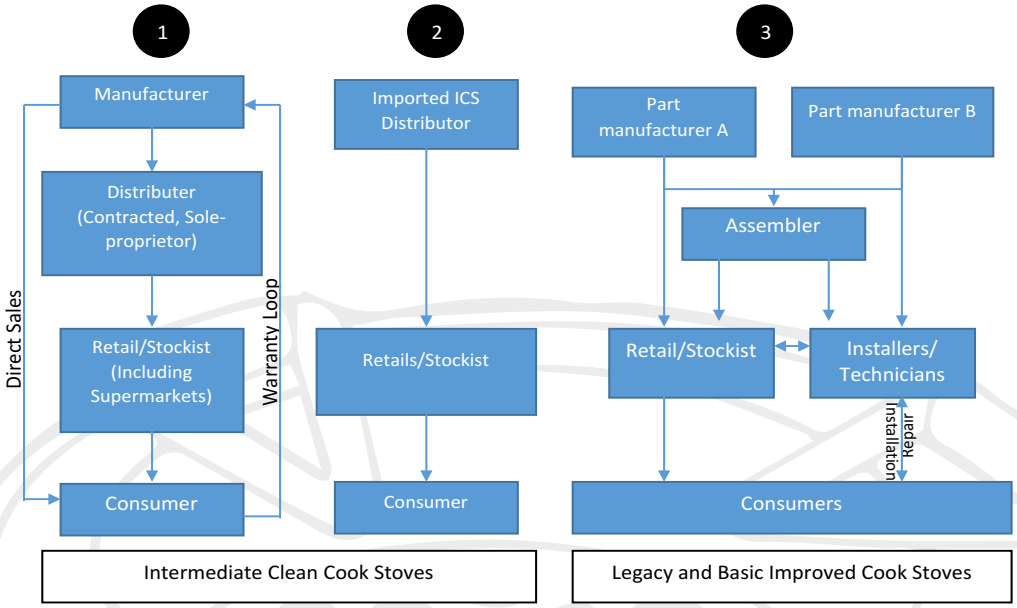


Figure 12. Basic distribution channels

Class B: Credit financed distribution model (PAYG Model)

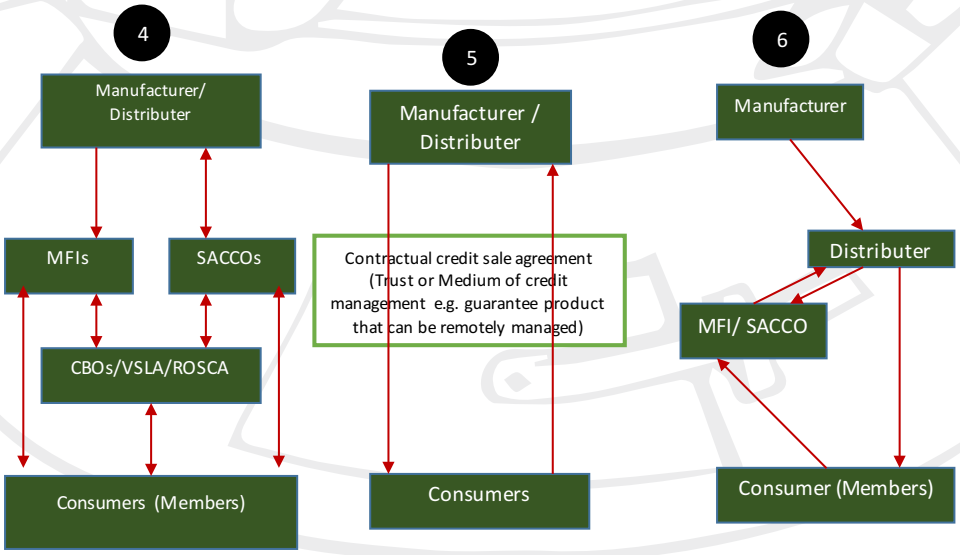


Figure 13. Basic flow of PAYG business models in the ICS sector

The models illustrate market driven distribution models. According to GACC (2015) technical report, there is rising demand side trend including the growing middle class with more disposable income (KNBS, 2015) . This is a good gesture for rapid adoption of improved cookstoves technologies. This was observed from the survey indicating over 70% consumer awareness of improved cook stoves and their benefits. Moreover, the report illustrates that the market – oriented solutions account for much of the recent dynamism in the clean cook stove landscape. This is a manifestation of increasing industrial scale production (bringing production to the users – Burn stove), innovative distribution and financial models as in the above schematics, and entry of many new entrepreneurs and investor. Other support financial structure in the distribution model includes climate finance funds, carbon trading, and ICT payment innovation. Table 4 below is a summary of the six distribution models in figure 11 and 12 describing key features, challenges, and opportunities.

Table 5. Summary of main marketing models in the ICS market

Model No.	Key features	Challenges	Opportunities
1	Mainly the manufacturer enters into a contractual agreement with the distributer. The manufacturer establishes the retail price range and sells the stoves to the distributer in cash. The distributer has an opportunity to sell direct to the consumer but also seek for other stockiest to retail for rapid sales. The manufacturer provides marketing and promotional materials to the distributer. Most of the time the stoves are provided with warranty, however the effectiveness of which is still very low.	• The product flow is uni-directional making consumer hesitant to accept • The direct loop from manufacturer to users often break the chain and may lead to collapse of some distributer • The cost of the stoves are likely to go higher • Manufacturers and distributer compete in bulk supply tenders	• With proper training on Warranty and feedback loop, the manufacturer has the opportunity to build huge data on consumer experience for further product development
2	Mainly is used by distributers of imported cookstoves. Often the manufacturer establishes local distributer(s) to market their products. The distributer takes the lead role in establishing the price of the products and build his own networks	• High risk upon technology breakdown no replacement and hard to repair	
3	The chain has employed thousands of SMEs. It has promoted specialization and differentiation of roles. Stockiest and retails are supplied with assemblers but have closer link with technicians for part supply incase of demand. This is a typical supply chain in the legacy improved cook stoves. The assemblers either go for the liners from liner manufacturer or buys the liners from liner stockiest. The products are relatively cheap and locally made (between $3 - $10)	• Quality assurance from the part producers and assembler end. An assembler might get quality metal cladding but poorly treated liner affecting the whole product quality. Or an Upesi liner produce build quality liner but the installer/technician does poor installation	• Has numerous back-flow loops hence high confidence of actors, e.g. users can return to retail or to technician to repair, retail can get parts direct from manufacturer etc. • Has wider range of actors hence easy to build on required volumes for big orders

4	This is an emerging model that is based on user financing. It has fully developed feedback loop and products are under warranty. It employees a PAYG sales method. It uses networks to build on the distribution stream. The actors must belong to a network, community groups or a SACCO to benefit from the loan arrangement. The MFI stocks the improved cook stoves and sell it direct to members or through local SACCOs and community groups who are members. It is being tested by the Result Based Financing with SNV	• You must be a member of a SACCO or group to benefit	• Provide an avenue to attract more climate finance and subsidies • An avenue for organized capacity building or awareness creation by manufacturer • Opportunity for data and information for product improvement • Potential of reaching many people.
5	It is a PAYG system that the manufacturer/distributer access user directly. It is an emerging model that borrows from solar PV lamps. The user purchase the stove on trust and pays an agreed amount through mobile money transfer to the distributer/manufacturer.	• You must have built credit trust with a complimentary product chain • Mechanism for defaulters not yet established	• Able to attract climate finance and subsidies • Provide user confidence on stoves • Opportunity for higher adoption rate
6	This is another concept of PAYG where, the MFI/SACCO select the distributers to supply the stoves. The MFIs responsibility is to enlighten the members that they have got loan for the product. The members can access the financing through contractual repayment agreement.	• You must be a member of a SACCO or an MFI • There has to be upfront grant as security	• Many people would be able to access loan financing

With the robust distribution models and increasingly new ICS products in the market there are new opportunities arising in the sector. Alternative fuels, more skilled technicians, increasing demand as observed in the survey and willingness of consumers to purchase improved cookstoves as well as access to grants and investment financing.

6.2 Cases studies illustrated

6.2.1 Jiko Safi Credit Facility (Model 6) – Kenya Union of Savings and Credit Cooperatives (KUSCCO)

KUSCCO has a membership of 1,350 saving and credit cooperative societies (SACCOs) and has geographical spread in the whole country. Following market model No.6 in figure 15, as a financier (SACCO union) it negotiated a contract with stoves manufacturers/distributers and member SACCOs to distribute high tier Improved Cook Stoves in Kenya to their members. KUSCCO received grant from USAID and Winrock International as guarantee loan. This was intended to overcome distribution and end-user financial barriers in the dissemination of ICS.KUSCCO will support its 1350 SACCOs that will provide credit to their individual members seeking to purchase cook stoves. To demonstrate their strong commitment, KUSCCO and its member SACCO shall commit $2 of their own fund for every $1provided by USAID, tripling the benefit impacts. For sustainability as a revolving fund, KUSCCO tags an interest of 6% on the loan per stove financed whereas the SACCO gives the loan to the members at 10% interest. The stoves project started in 2013

The model

If a SACCO wishes to buy stoves for its members, KUSCCO gives it a loan up to three times its savings that is similarly transferred to the user/members in the same manner by the SACCO. KUSCCO then provide linkage between their selected distributers and retails of stoves to SACCOs to promote their products describing the benefits. Once the consumers are convinced and would like to make an offer, they can obtain up to 3 times their savings to purchase product directly from the distributer or retail or purchase from their SACCO. This payment is done in a period of agreed upon period of time.
Preliminary lessons learnt

It is more efficient to stick to specialty, hence financial advice shall be provided by KUSCCO as technical and quality of product promotion be handled by selected retails and distributers. The retails hence focus on marketing, awareness creation and selling of products. The SACCOs similarly are suited to management of members and ensuring financial access and repayment of loans. Most of the SACCO members in urban set-up can easily afford the cost of the stoves (averaging $40) in cash hence very little value is added by KUSCCO on financial access however the rural SACCO members have benefited greatly from the credit and more sales realized in the rural areas.

6.2.2 Toyola market model for Improved Ceramic Stoves (Legacy stove) – Model 3 figure 14

Toyola Energy Ltd is a for profit business founded in 2006 in Ghana. It has 90% shareholding in KT Ceramics that makes stoves liners and a wholly owned subsidiary. They obtained a loan from E+Co to start commercial production and sales of ICS, "Coalpot" – a similar version to KCJ - providing work to more than 77 artisans at the wake of ICS production. Further loans and carbon financing have enabled the growth of the business which by 2011 had five production centers in different parts of Ghana. In 2009/10 the company had an income of US $550,000 of which 72% came from direct sales and 28% came from carbon finance. He only have five direct employees but works with large number of self-employed artisans on a subcontracted manner.

The Model

Toyola engages self-employed artisans to make the metal stove's bodies and the ceramic liners to his specification. He then assembles and distribute through dealers and local market agents. He gives 2 months' credit to his dealers and market agents who also pass the credit facility to their customers. 75% of customer use credit whereas 20% buys cash and 5% buttering with other produce. About a third of the customers who use credit are given "Toyola money box" to reserve their savings on

charcoal and use this money to pay their loans.

The model build on extensive training program of everyone involved in production. 40% of stove body produced are outsourced and all the liners are produced by KT Ceramics. The assembly is carried out by self-employed artisans at Toyola's production center. Each artisan must check the quality of the material and components from the very previous stages and reject poor quality product. A random quality check is done to ensure efficiency and durability for sustained carbon financing. Payment is on work done basis. All stoves are serialized and Toyola records the name of who buys the stove with serial number, who sold it and who assembled it for traceability of the source of problem if there is and for carbon financing.

Lessons Learnt

Toyola ICS distribution has grown rapidly over the years and more centers have been mushrooming. The sales rose form 21,000 in 2007, 52,000 in 2010, and 154,000 in 2013 (Figure 12). The model has been boosted with the self-employed artisans who don't have to raise capital to establish his production line but use existing production line and get paid per the number of stoves produced. Until 2013 they had attracted 170 independent artisans. The technology is not heard for others to replicate but one key element is type of quality control systems in place and sales and finance network that Toyola has built

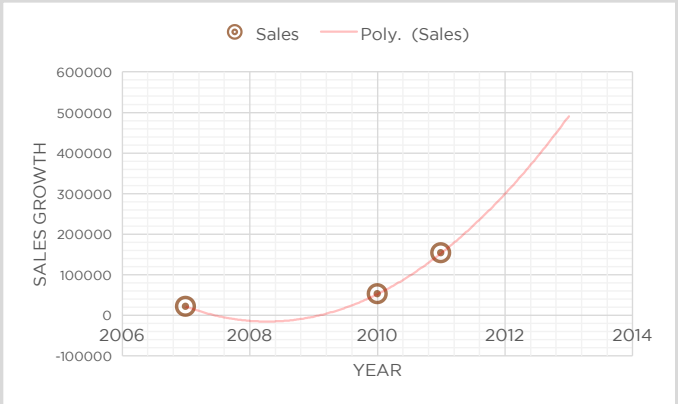


Figure 13. Sales pattern in Toyola business model

6.2.3 Cookswell Jikos Kenya

A Kenyan based limited company established in 1992. It has become one of the big manufacturers of several models of ceramic based cookstoves for sales regionally and in the European Union. The venture as recorded by GIZ and StovePlus (2014) didn't use any subsidy to come to scale. The company today operate as a typical using re-invested profit to build the company. Majority of investment being allocated to training, equipment, market promotion, internal quality control and assurance system, external quality control and ICS product certification

The model

The company employs centralized production system. Most of the production is based on metal sheet work with minimal electricity works used for welding only limited parts of the stoves and oven burner. All the materials are locally sourced and are purchased in cash. He engages the artisans to produce the stoves and pays them per unit of stove produced. The retail price for his stoves are between US$ 5 to US$ 45 depending on the size with one year's warranty.

The distribution model is basically done through 2 main outlets – at the factory gate and a warehouse in lower Kabete road where stoves are sold directly to the users. Much of the sales are made through wholesale volumes purchased by their partners who distribute to supermarkets such as Uchumi and Nakumatt. With spread of supermarkets to other east Africa countries, Cookswell is able to reach the regional market. Additional service is the use of M-Pesa payment system. Lessons learnt

KCJ is well established and a familiar name in Kenya household with much influence on stoves in the East African Region. He faces stiff completion from the emerging stoves but his quality control and warranty has supported his business growth.

6.3 Financing schemes – key highlights of benefits and associated risks

Driven by health concerns, environment, and growing recognition of the importance of modern energy access for development, efforts to bring cleaner and more efficient stoves to billions of people in developing and least developed countries has gained new momentum amongst several international and national actors. Lambe et. Al. (2014) Recognizes that one of the key challenges to the adoption of clean cookstoves technology is inadequate resources for project implementation, including startup cost, product development, promotion and user financing. Field study indicated that most people purchase stoves from own financing/ saving although credit financing is gaining recognition with several people securing funds from community-saving clubs - VSLA, ROSCA and Chama's, Microfinance Institution (MFI's) and from friends and relatives. On whether one would like to acquire improved or clean cooking solutions, over 80% showed interest but the main barrier was the upfront cost. A holistic approach integrated with innovative consumer financing hence brings opportunity for increased adoption of these technologies.

Increased industrial scale production of improved cookstoves is a manifestation of market-oriented solutions in ICS dissemination and adoption. Innovative financing models, distribution, and entry of many new investors in the sector are all promising factors for increased access to improved cooking solution. According to GACC technical report (2015b), extending access to clean cooking solutions is only feasible with price reduction, increased end-user financing and, non-market distribution approaches for the very poor instances. It has become a common knowledge that access to financing and human resource is a pre-requisite to effective production, distribution, and adoption of new technology (Atteridge, 2013). The table below highlights various existing financing mechanisms in Kenya Clean Cooking financing. The report further gives a key insight that consumers seek for funds with minimal risk hence it might not be limited to loans/credits, but other mechanisms would include saving via groups "merry go round", remittances and payment through employers.

Table 6. Financing models in the ICS sector

Stockholm Environment Institute report, (Fiona et.al; 2015) describes the main challenge of carbon financing and subsidies is market distortion with a possible effect of collapse of new / local innovators/distributor networks.

Increased industrial scale production of improved cookstoves is a manifestation of market-oriented solutions in ICS dissemination and adoption. Innovative financing models, distribution, and entry of many new investors in the sector are all promising factors for increased access to improved cooking solution.

	Type of fund/Fund manager	Purpose	Target group	Channel of administration	Associated Risks	Risk level
1	Kenya Climate Innovation Center	Product development, Marketing, Proof of Concept	Entrepreneurs, Distributer, Innovators	In-kind support and Grant	User acceptance of new technology	Medium
2	National Environment Trust Fund (NETFUND)	Award, Product development, Market value chain development	Entrepreneurs, Distributer, Innovators	Award grant, In-kind product development support	User acceptance of new technology	Medium
3	Kenya Union of Savings and Credit Cooperative societies (KUSCCO)	Consumer credit financing	Consumers	Union SACCO's members	Default in payment	Limited
4	SNV/MESPT	Result Based Financing	Consumer financing	MFI's members	Default in payment	Limited
5	Carbon Markets(e.g. Ecozoom manufacturers) (PoA, Gold standard and VCS etc.)	Subsidy, Enable research and development, after sale support	Consumer, Innovator	In-direct (reduced cost of product)	Market price distortion, Un-certainty of stove uptake and usage, time for generating carbon revenue	Medium
6	K-REP development Agency	Asset financing	Consumer	3 Months credit financing for various ICS products through loan banks for energy savings	Default payment	Limited
7	Employer Loan	Consumer credit financing	Consumers	Check off system by employer in pay-slip	None	None

80% showed interest but the main barrier was the upfront cost. A holistic approach integrated with innovative consumer financing hence brings opportunity for increased adoption of these technologies.

7.0 SOCIOCULTURAL AND ECONOMIC ISSUES IN THE ADOPTION OF ICS

Academic research and literature have viewed income as the single most important attribute to the adoption of new cooking technologies as described in the energy stacking and fuel switch ladder by Scalgand Zuretz (2009) . The model suggests that as people become richer, they may be expected to move from traditional biomass fuels to more advanced and less polluting fuels (figure 13).

Figure 14. The theory of fuel switch

Source: Scalg and Suzarte, 2009
Further researches have also considered noneconomic attributes such as age, occupation, education, household size and gender (Gupta and Kohlin, 2006; Heltberb, 2004, Okuthe&Akotsi, 2014) . On other surveys, Okuthe and Akotsi (2014) describe that age is critical in considering target group for capacity building; in their study most of the respondent were youths. These past researches can therefore generally be viewed as leaning towards socio-*/8economic attributes. Takeshi et.al. (2011) bring the aspects of product specific attributes to alternative technology adoption and fuel switching. The report highlights that socioeconomic characteristics of a given individual at a given moment is fixed hence attribute responsible for variation in choice are product specific. An example of the noted product specific attributes includes the cost of stove, convenience on usage, savings, and smoke emission levels. They basing their studies on discrete choice analysis and stated preference survey design summarized their findings in a 4 quadrants matrix illustrated in figure 15 below.

Figure 15. Four categories of clean cooking stoves determinant Source: Takeshi et al; 2011
Quadrant 1 (Q1) and Q3 help to identify target groups and market segments. And Q2 and Q4 identifies product specific attributes

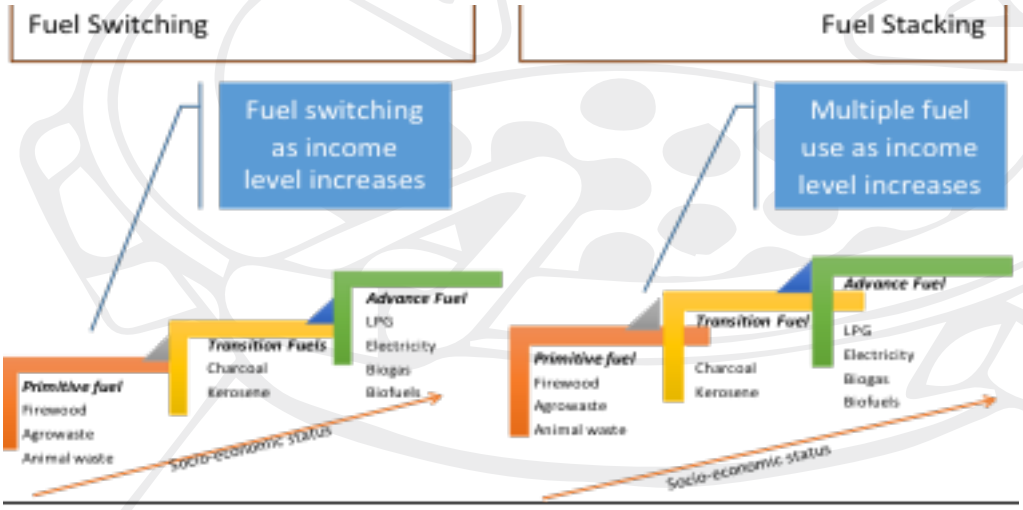


Figure 14. The theory of fuel switch

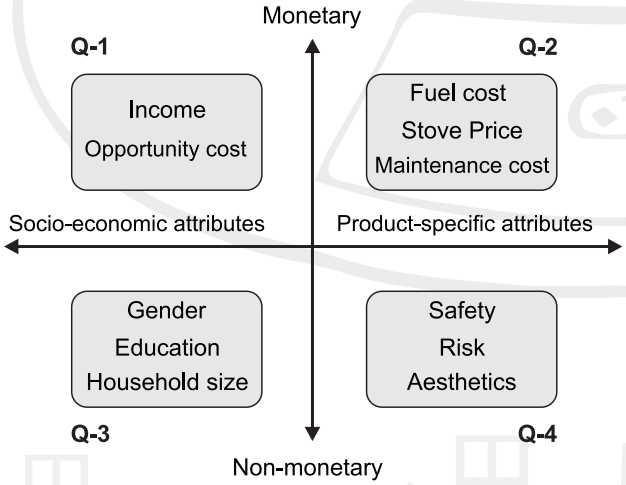


Figure 15. Four categories of clean cooking

to help designers design stove with the high probability of acceptance. Further illustrative studies on consumer behavior was studied by Anderson et.al (2015) on factors influencing individual choices about the adoption of new technologies. The first case study focused on customer journey map, a visualization of customer experience with a given technology of choice from purchase to after sale service. The study compared Phillips stoves against alternatives as illustrated in Appendix 1 and the role of MFI in the distribution of the stove. The study focused on one main micro-finance institution –VEP (operates like merry go round) - that promoted Philips stoves in Kiambu County. Key highlights on the process of promotion, adoption and support were divided into two main aspects, risk of reduced effect of the technology and success factors to reach the desired effect. The results are listed below: -

Risks of reduced effects

I. Prior and proper preparation is required before any given promotional activity, and a repeat exercise is recommended because not everyone will be present in the initial meeting.

II. While making promotion, of product, it is important to understand that single product promotion might not create all-inclusive impact and that not all members are present at all times so single verbal promotional activity might not reach all the intended beneficiaries.

III. Members signing up for false information on expected benefits and creating signing up impulse would have the negative consequence on stoves adoption.

IV. Some people would be servicing other loans and are supposed to be addressed carefully and allow cross consultation with peers/spouses for all credit financed products.

V. A long wait before stoves delivery to consumers have tendency to some members who have signed up changing minds or losing interest in the product.

VI. The stoves that don't meet the customer's expectation is an unpleasant surprise to the user and there is a tendency of spreading this wrong message hence building negative ambassadors.

VII. In an unfortunate event that the user is not able to use the stove as demonstrated, most of the users find their way around it and most of the times end-up using it wrongly decreasing their satisfaction and in some circumstances abandoning the technology or leading to breakage.

VIII. Customers not being aware of added service such as warranty and the components of the warranty is critical to breakage of a stove. A survey conducted indicated that only about 17.2% of the ICS had a warranty while 82.8% did not have any warranty. Of the ones that had a warranty, 45.5% of the respondents were aware of what the warranty entailed whole 54.5% did not know. Also, only 20% had ever used their warranty.

IX. Unavailability of appropriate fuel or hardship of accessing the appropriate fuel is key to the success of a given technology.

X. Users not using the technology because of malfunctioning buttons, molten bases, broken fan and short lifespan are all negative aspects of stoves distribution.

Success factors to reach desired markets

– Some of the things to consider to reach desired markets

I. A local partner with existing trust base with the users/community.

II. Users making well informed decision based on accurate expectation without compulsion or impulse buying based on false/exaggerated statements.

III. Proper and well planned demonstration of the new stove functionality to avoid breakages or reduced satisfaction.

IV. Users having realistic lifespan of the product.

7.1 Customer satisfaction survey on ICS

The survey questioned about 850 households in Coast, Western and Nairobi regions. 70% of the respondents were female. A half of the respondents were between age 25 – 35 years, however, there were about 5% of the old generation similar demography to Okuthe and Akotsi (2014). And about 70% had attained a level of secondary and college level education.

7.1.1 Access of Improved Cookstoves

About 76% of the respondent owned an improved cook stoves distributed as indicated in Table 6 below. The most popular ICS is the KCJ, then the Jikokoa, followed by improved firewood jikos, envirofit, Upesi Jiko and Ecozoom. The table below is suggestive that KCJ is better known since it has been in the Kenyan market from the 1980s and that Jiko Koa is gaining ground. This could be attributed to marketing promotion, local production, and multiple distribution channels employed. There are other numerous ICS in the market and most respondents learned about them in marketplaces. Although the credit financing is building on community groups as disseminating strategy, only 5% of respondents received information on ICS through such groups. Intense lobbying and awareness creation need to take place around this segment of consumers. It was interesting to know the mode of payment of the improved cookstoves and 88% purchased in cash (figure 15). This is a reflection of the predominant cookstove in the market. Legacy stoves are commonly sold on cash basis in the local vendor shops. Mainly the intermediate stoves have been promoted through subsidies and credit financing because of high cost.

Stove type	No. of Respondents
Burn Stove (Jikokoa)	72
Envirofit	27
Ecozoom	9
JikoUpesi	25
Kenya ceramic jiko (KCJ)	467
Improve firewood stoves	29

Table 7. Improved Cook stove adoption trend

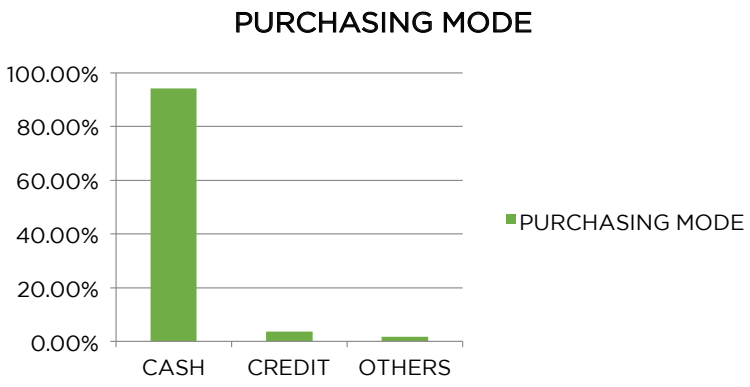


Figure 16. Purchasing modes

There are about 40% of the 2% who purchased in credit got their funds from MFIs otherwise 60% received their loans from chamas (ROSCA and VSLA) and family members. This could be due to the flexibility of lending and interest rate.

7.1.2 Stoves needs – Why did I buy my ICS?

Consumer need and satisfaction is basic to the design principal of any technology. Mbeo et.al (2013) described user-centered design approach to ensure product services is in tandem to the user requirement. And conforms to Takesh et.al (2011) finding on product specific attributes. Saving on fuel (product specific attribute), accessibility and aesthetic topped the reasons for purchase of stove). Figure 16 below: Reason for purchase

Figure 17. Reasons why people adopt ICS

There is a bigger number who are not sure why they bought their stoves, and this could be an avenue for capacity building.

7.1.3 Use and satisfaction level – Did it meet my expectation?

When asked if they still used their stoves, 92.2% were still using while 7.8% had stopped using their stoves. Of the users 66.2% used their ICS daily, 16.3% used it 1-3 times in a week, 1.4% used it once a month, 9.1% took more than a month and 6.5 used only occasionally. User satisfaction on averaged at 94.5% and 97.4 stated that they would replace their ICS if it broke down while only 2.6% would not replace.

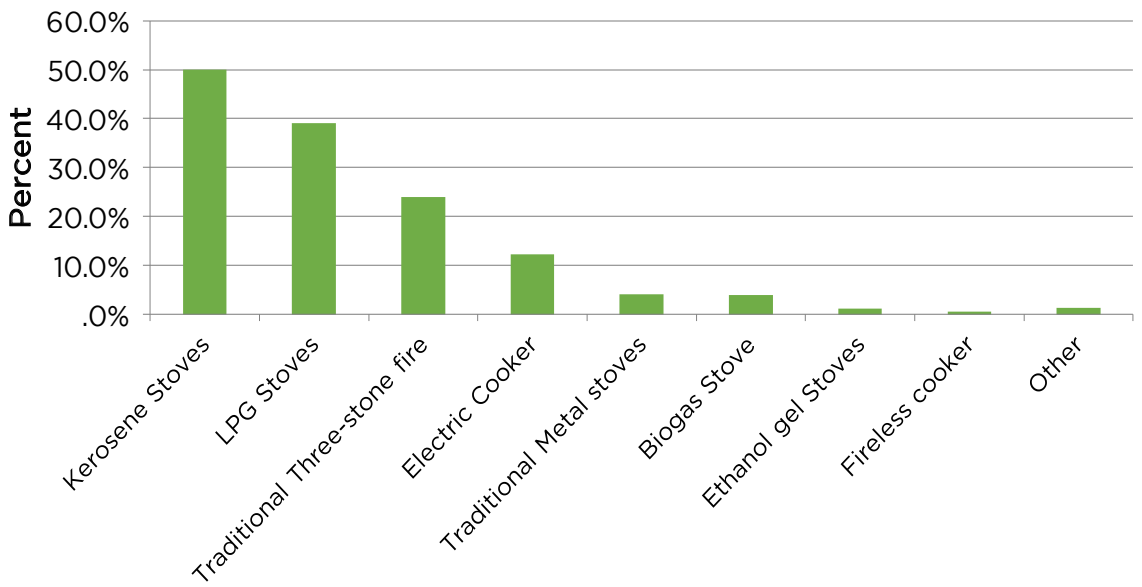
7.1.4 The Futuristic perspective – Would I recommend it to another person?

About 78% of respondent have shared their experience with the improved cook stoves with a neighbor. The power of ripple effect can therefore not be disregarded. User satisfaction and positive influence to a neighbor can create a self-advertised product brand.

7.2 Growth of the ICS sector – The consumer perspective

The growth of the ICS sector is dependent on various factors including user satisfaction, access to other technologies and government policies. We assessed alternative fuels of interest and kerosene and LPG were widely used amongst the respondents. And with the government policy of no taxation on LPG, there is a potential of more dynamics in the ICS sector.

Figure 18. Other energy options used in households for cooking



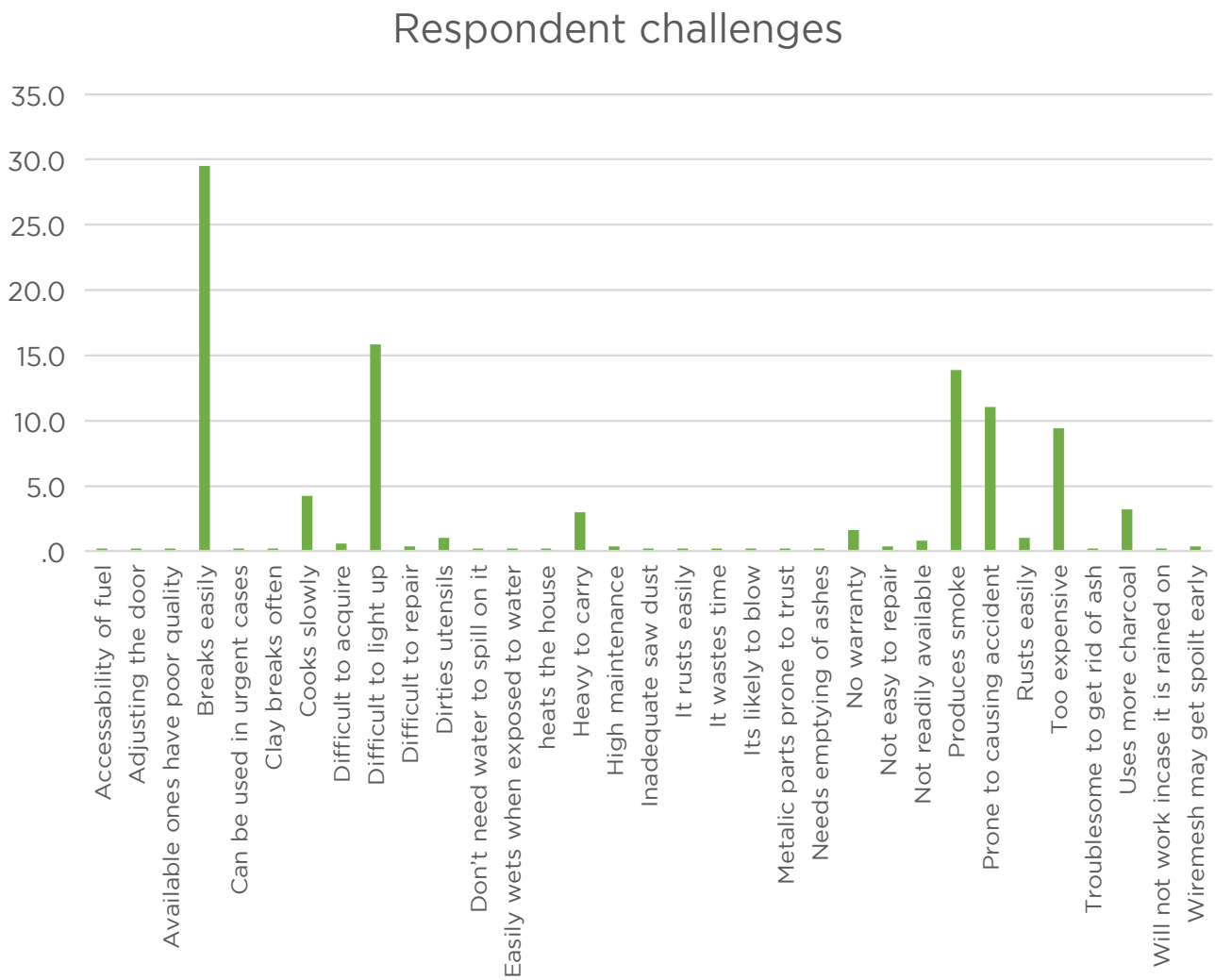
7.3 Key challenges and bottlenecks in ICS acceptance - The consumer perspective

Below are some of the listed issues from consumers as to the reasons for not adopting the technology or slow adoption

a) Hard/hectic to use
b) Lack of money to buy
c) Not knowing the importance
d) Not knowing the availability
e) The stoves are expensive
f) It is hard/cumbersome to light
g) I have other alternatives (e.g. kerosene stove)
h) Its operation is hard and involving

The above key highlights are in tandem to the Kenya baseline survey report (2006) that listed accessibility, cost, installation procedure, where to get the technology and contentment with what is available as key to the lack of penetration of improved cook stoves (legacy stoves) in Kenya. The respondent challenges and frequencies are presented in the figure below.

Figure 19. Challenges as mentioned by users



It should be noted that the respondent data was not disaggregated to specific ICS hence every challenge represented is a valid challenge from the user perspective. However, the highly frequented challenge is a challenge that is common and cut across most of the ICS stoves. Low frequency might mean that the challenge is not common to most ICS or can also mean that it is specific to an ICS that is least disseminated.

7.4 Focus Group Discussions

Focused group discussion with other stakeholders highlighted the following as key concern and recommendations: -

- Local producers have very little gain from sales (legacy stoves) this is as a result of the long value chain of actors.

- A Carbon credit is an under-exploited financing opportunity in the ICS sector but can contribute substantially in the issuance of subsidies and reduction of product cost.

- Although there exist ICS standards in Kenya very few producers/retailers are aware and it is expensive and difficult for manufacturers and retails to verify the quality of products due to lack of technical capacity.

- The county government is yet to have implementable policies.

- And there is the need for clarity on roles of National Government and County when it comes to some issues on Energy.

- More intense campaign need to be undertaken for awareness creation.

- Most of the county's energy resource centers are understaffed creating an information gap.

- There is the need for more capacity building both human, technical and resources for players in the value chain.

7.5 The role of Clean Cook stoves Association of Kenya (CCAK) in the development of ICS Sector

Clean Cook Stove Association of Kenya's (CCAK) is the national chapter of Global Alliance for Clean Cookstoves (GACC) it is a membership organization of all stakeholders in the Clean Cookstove sector. The CCAK mission, is to facilitate increased innovation in design, testing, production, marketing and use of clean cookstoves, and fuels through better government policies, increased public awareness and capacity building. CCAK's vision is to have 7 million households in Kenya using clean cooking stoves by 2020. The entry of this UN foundation and its selection of Kenya as one of the three target countries to pilot is business plan is a major boost to the sector. Through its national chapter, stakeholders have access to findings of detailed studies, surveys, discussions and opinions on the sector with a detailed work plan on how to undertake interventions that will catalyze the clean cookstove and fuel market and lead to sustained market growth.

7.6 Emerging issues in the Improved Cookstoves sector

- The goal is beyond improved biomass stoves, and the intention is to move people to clean and healthy cooking technologies – reduction of Household Air Pollution (HAP) through adoption of certified stoves.

- Taxation on ICS products is a major drawback to the adoption of the stoves.

- Use of multiple cooking technologies is a common practice in Kenyan households and this is as a result of several factors including duration of cooking, user, what is cooked and time of usage People also undertake fuel staking.

- Stove durability and quality is of concern to CCAK.

- The stove adoption issue is not only stoves but fuel as well, more so for the emerging gasifier stoves.

- There should be a comprehensive national bio – energy strategy.

- Currently, CCAK is coordinating

various working groups on aspects of Country Action Plan (K) on outstanding issues, barriers, policies and regulations that may be a hindrance to market growth in Kenya. This is an integration of GOK, NGOs, the private sector, Associations and individual members.

- Opportunities are huge – population growth as well as economic growth – Kenya being a middle-income country – is a pointer that clean/safe stoves may be more affordable following the energy adoption ladder.

- Most preferred business models that have proved to work: Pre financing (pay as you go) and also through SACCOs.

- GOK should handle the whole value chain and not compartmentalize stoves/fuels.

Clean Cook stoves Association of Kenya (CCAK)

7M

The CCAK mission, is to facilitate increased innovation in design, testing, production, marketing and use of clean cookstoves, and fuels through better government policies, increased public awareness and capacity building. CCAK's vision is to have 7 million households in Kenya using clean cooking stoves by 2020

8.0 CONCLUSION AND RECOMMENDATION

8.1 Conclusion

Improved cook stove market has three main broad actors – Manufacturers, distributors, and users – interacting with other stakeholders directly or in directly. However, about 80% of the manufacturers are run by the SME sector who mainly produce Legacy improved cookstoves brand. Main distribution channels are the manufacturer to retail to end-user, however, depending on financial models in the supply chain several branches come into play with multiple distribution systems. Over 90% of the manufacturers still sell their products on cash basis however PAYG system is building prominence through M-Pesa system. Most of the exotic brand are either subsidized or are exhibiting PAYG model of distribution.

Government agencies play pivotal roles in the sustainability of the market structure and growth of the businesses. Especially the Ministry of Energy and Petroleum who develop energy policies. Coordinated and coherent policies, tax policy, regulations, and standardization are critical to effective dissemination and meeting of climate change mitigation goals as well as building on business base.

Market based market approach has widely been used in the improve cookstoves market, however the dissemination of these technologies have been hindered by numerous factors mainly, enabling environment, capacity building, access to finance, access to technology and building of effective marketplace. The approach, as opposed to donor approach builds on the market, strengthen supply chain and enhance demand of the ICS.

Consumer satisfaction is the basis of every successful model. Irrespective of the mode of technology acquisition meeting user expectation is the greatest sales agent of a given product. This determines, if the stove is used regularly or seldom. In our study on average, 66% of the consumers used their improved cook stoves daily, however, the study didn't segregate the daily ICS use by type and for what. Fuel staking is common, however, the decision to acquire technology is largely dependent on product specific attributes. Therefore, besides socioeconomic issues, product specific attributes such as the ability to save on fuel, reduced indoor air emission and cost of technology are critical to their adoption.

8.2 Recommendations

Post Paris agreement present opportunity for more funds towards climate mitigation actions and ICS is core of it in the African context. The various entrepreneurs should strategically place themselves to accessing carbon and climate financing to build on their business cases. Increased investment in the sector shall catalyze the sector and build new relationships. Fully depending on carbon finance for user financing is, however, a false hope approach, but can be relied upon on research and development and market expansion. Other finance avenues like climate finance can go along-way in building/creating a guarantee for consumer loans. The manufacturers should be the drivers of quality and standardization of their products. Through active engagement with the government support the development and promotion of standards and testing and champion and advocate for change, coordinate sector knowledge, and research and mobilize resource.

Focus on high quality and scalable approaches, be technology and fuel neutral while focusing on clean, build on the past lessons without re-inventing the wheel, put consumer and user first, attract new partners and strengthen existing ones, utilize market-based approach while aiding vulnerable population.

Fuel staking and ladder reflects that as Kenya move from low to middle class economy, fuel stacking and moving up the ladder is inevitable – as the focus is on today's need, designers reflects the future needs through incorporated R&D.

Sectorial Linkages and Gaps – Building the bridges
Coordination between government agencies in policy formulation shall enhance

coherency of policies and strategies within the biomass energy value chain in a holistic approach. Moreover, technology and fuel suppliers should work together in insurance access to both fuels and technologies. Activity specialization as observed in the three distribution models is necessary for availability, accessibility, and distribution of ICS products. Manufacturers acting as retails and distributors can lead to the collapse of independent retails and distributors distributing the same product.

Synergies and Frailties in the supply chain

a) Employer – Employee distribution model: Access to upfront cost has been one of the main hindrances to the acquisition of ICS. A secure guarantee to loan repayment is a check-off system in the payroll. The distributers negotiate with the employers and demonstrate the stoves principal of operation and the users make a decision to sign up for the product.

b) Building on the quality of the product: Meeting user expectation is an ambassador for change and sales agent. The narrated benefits should match the stoves performance. Laboratory experimentation should not be used as the selling point of the technology.

c) Building a locally driven distribution network: It is a common observation that locally led distribution mechanism has succeeded in the region. Working with local franchises, and known distribution networks can lead to enhanced adoption. Building partnership with already created networks is necessary for growth in dissemination projections.

d) Product – fuel chain: Before any technology is sent to the market the manufacturer should have thought of complementary products such as fuels – technology or technology and appropriate fuel. Products that are built on locally available fuels in the natural state with minimal modification is highly likely to succeed.

f) Products diversification: Most purchases are done alongside other products, distributors selling improved cook stoves could explore the diversity of product range in their stores such as solar lighting kits as a complimentary product.

Access to finance

a) PAYG financial model: User financing has been an evolving trend with innovative and simplified credit systems from MFIs to community loan associations. According to GACC (2015b) willingness to take up financing was dependent on the perceived level of "formality" of the financing option. The most preferred consumer financing options were informal and semi- formal mechanisms that did not rely on engagement with a formal finance institution.

b) VSLA/ROSCA/Merry-go-rounds: The community based loan association are critical to village and rural stoves dissemination. Informal group savings and layaway with a vendor were the most preferred financing options. Participants were risk averse and preferred to enter into financing models that involved a savings mechanism, like layaway, rather than a borrowing mechanism, like asset finance from big MFIs.

c) Carbon finance subsidies – clearly the focus is not only for end-user financing but for market promotion, R&D and quality development.

Policy and regulatory framework – Key consideration

Governments led initiatives through removing taxes and duties to exempt technologies that are imported and by reducing the number of licenses required by cookstove manufacturers and distributors will be necessary for the distribution of ICS. A specialized agency should be established to plan and promote clean cooking stoves, coordinate technology standards and testing and manage national and sub national data on biomass energy supply and demand as recommended by Fiona (2014).
Use of theories of change and behavioral approaches in strategies, plans and activities. This could be supported by a behavior change implementation guide for clean cooking. Ensure intervention activities operate on multiple levels – individual, interpersonal, community and national.

Part One: Demographic Information

1. Name (Optional) ..... Telephone .....

2. Sex:
   a. Male { } b. Female { }
3. Age
   a. 18-24years{ } d. 36-40years{ } g. 51–60 years{}
   b. 25-30years{ } e. 41-45years{ } h. Over60 yrs{}
   c. 31-35years{ } f. 46- 50years{}

4. Marital status
   a. Married { } d. Separated{} g. Other ...{ }
   b. Single { } e. Widow{ }
   c. Divorced{ } f. Widower{ }

5. Who makes decisions in this house?
   a. Self { } b. Spouse { } c. If not, specify.....

6. What is your level of education?
   a. University{ } c. Secondary { } e. No education { }
   b. College { } d. Primary { }

Part Two: Access to Improved Biomass Cook Stove

The enumerator shows the respondent a poster containing different types of ICS in the market. Then asks which of those the respondent has or has used?

7. Do you have Improved Biomass Cooks Stove?

   Yes { } No { }

NOTE: Enumerator displays the poster of stoves to the respondent and ticks, as appropriate.

Type of stove	Tick as appropriate
a. Burn Stove (Jikokoa)	
b. Envirofit	
c. Ecozoom	
d. Jiko upesi	
e. Kenya Ceramic Jiko (KCJ)	
f. Improved firewood stoves	
g. Other, please specify	

If no, skip to Q 25

8. If yes, from whom did you learn about the technology (ICS)?
   a. Friends { }
   b. Women group { }
   c. Men group { }
   d. Just saw in the market { }
   e. My son/daughter/relative introduced me { }
   f. Media (e.g. billboard, radio, TV, papers, sms etc)

9. When did you learn about the ICS?
   a. Less than 6 months ago { } c. 2-5 years ago { }
   b. 6-12 months ago { } d. Over 5 years ago { }

10. When did you buy the ICS?
    a. Less than 6 months ago { }
    b. 6-12 months ago { }
    c. 2-5 years ago { }
    d. Over 5 years ago { }

11. How did you get finances for the purchase of your stove?
    a. My savings { }
    b. My relative { }
    c. Credit { }
    d. Other (specify) _____

12. If on credit, where did you get the loan?
    a. Friends { }
    b. Family { }
    c. Chamas/groups { }
    d. Microfinance Institutions { } Please specify _____
    e. Other _____
    _____

13. What made you acquire the technology?
    a. Because I was told it saves firewood { }
    b. I liked its appearance { }
    c. We bought it with other women in our group { }
    d. It was easily available at the shops { }
    e. I was given free of charge /gift { }
    f. Other_____

14. Do you still use the stove?
    a. Yes { }
    b. No { }

    If no, skip to Q 18

15. If yes, please explain how often you use it _____
    _____
    _____

16. Are you satisfied with how it works?
    a. Yes { }
    b. No { }

    Please explain your answer _____

17. If it broke down, would you spend money to buy another one / repair it? _____
    _____

18. Why have you stopped using the stove? _____
_____

19. Does your stove have a warranty?
    a. Yes { }
    b. No { }

20. Do you know what the warranty entails? _____
_____

21. Did you ever use the warranty at any time?
    a. Yes { }
    b. No { }

If not, please explain _____

22. What was the problem with the stove? Please explain _____

23. What is your experience with the ICS product (*Fill positive and negative experiences*)

	Positive/Benefits		Negative/challenges
1		1	
2		2	

24. Have your experience of the ICS with friends/relatives and any networks you belong to (such as women groups /youth/ church)?

    a. Yes { } If so, how many have bought the stove since then?
    No. of men..... No. of women ..... Not sure .....

    b. No { } If not, why have you not shared? _____

25. Why don't you have one? _____
_____

26. Would you like to buy one?
    a. Yes { }
    b. No { }

27. Besides improved biomass cook stoves, what other cooking appliances do you use? Tick all that apply

Type of cooking appliances		Type of cooking appliances	
LPG Stoves		Fireless cooker	
Biogas Stove		Traditional Metal stove	
Ethanol gel Stoves		Traditional Three-stone fire	
Kerosene Stoves		Other (specify)	
Electric Cooker			

The enumerator then explains where the ICS can be found.

Thank you for your time
☺

ANNEX 2: Retailers Questionnaire

Part One: Background Information

1. Name of the business.....

2. Position of respondent in the company (e.g. Managing Director/CEO; Human Resource; Sales person etc.)
....

3. What is the nature of your business?
    a) Sole proprietorship
    b) Partnership
    c) Limited Company
    d) Franchise
    e) NGO
    f) Other, please specify .....
    .....

4. How many years have you been in ICS retail business?
    a) Less than 2 years { }
    b) 2- 5 years { }

c) 5-10 years { }
d) Over 10 years { }

5. How many workers do you have?
No of males ..... No of females ..... Total .....

6. Type of stoves sold and their brand names
a) Improved charcoal stoves { }
b) Improved firewood stoves { }
c) Other .....(please specify) { }

7. What is the capacity of the stoves that you sell?
a) Domestic /Household
b) Institutional
c) Both
d) Other, please specify

Part two: Product Quality

8. Do the stoves you sell have a KEBS mark?
Yes { } No { }

9. Do the ICS you sell have warranty?
Yes { } No { }

10. If yes, what is the warranty period?

If no skip to 12

11. What is the nature of the warranty?
a) Money back { }
b) Replacement { }
c) Repair { }
d) Other, please specify { }

12. How many of your customers have claimed a warranty in the past one year?
a) Less than 10 { }
b) Between 11-20 { }
c) More than 20 { }

13. What is the stated /estimated lifespan of the stoves that you sell?
a) 1 -2 years
b) 3 – 5 years
c) 6 - 10 years

Part three: Retailer channels and Marketing Strategy

14. What is your target market?
a) Rural
b) Peri-urban
c) Urban
d) All
e) Other (specify)

15. Where are your ICS mostly sourced from? .....
Manufacturers { } Distributers { } Wholesalers { } Stockists { }
Others (specify).....

16. Where are your ICS mostly sold? .....
Schools, Hospitals, Hotels, Religious Facilities { } Individual orders { }
Others (specify).....

17. How do the ICS supplies reach your target market?
a) Supplies taken by the client
b) Deliveries by self
c) Other (specify).....

18. How do you pay for the supplies
    a) Cash
    b) Credit
    c) Other (specify).....

19. What has been your sales volume in the past 3 years?

Unit	Day	Month	Year
2015			
2014			
2013			

20. What is the average profit per year?
.....

21. What can you attribute these profits to?
.....
.....

Part four: Financing of the business

22. What is the mode of payment by your customers?
    a) Cash
    b) Credit
    c) Both
    d) Others

23. If on credit basis, do you work in collaboration with any financial institution to recover your money?
    Yes { } No { }
    If yes, list the financial institutions? .....
    If no, why? .....
    .....

24. If on credit, how long does it take you to recover your money?
a) 1-3 months
b) 4-6 months
c) 7-12 months
d) Over 12 months

Part five: Challenges and Opportunities in the ICS Sector

25. What are the main challenges you have experienced as a retailer in the ICS sector?
a) Access to finance
b) Awareness
c) Marketing
d) Other, please specify

26. What are the main opportunities in the ICS sector? List them
.....
.....
.....

27. In your opinion, what should be done to improve development of the ICS sector?
    a) Financing of businesses in the sector (loans, grants)
    b) Improving the regulatory and policy framework
    c) Awareness creation
    d) Build capacity of local stakeholders
    e) Others (specify) .....

28. Are there specific capacity needs your company /business requires?
    Yes { } No { }
If yes, list them in order of priority .....
.....

Thank you for your time

ANNEX 3: Manufactures Questionnaire

Part One: Background Information

1.Name of the business.....

2. Contact .....
.....

3. Position of respondent in the company (e.g. Managing Director/CEO; Production Manager; Human Resource; Sales manager etc) .....

4. What is the nature of your company?
   g) Sole proprietorship
   h) Partnership
   i) Limited Company
   j) Franchise
   k) NGO
   l) Other, please specify .....
   .....

5. How many years have you been in the ICS business?
   e) Less than 2 years { }
   f) 2- 5 years { }
   g) 6-10 years { }
   h) Over 10 years { }

6. How many workers do you have?
   No of males ..... No of females ..... Total .....

7. Type of stove manufactured and their brand names
   d) Improved charcoal stoves { }
   e) Improved firewood stoves { }
   f) Other .....(please specify) { }

8. What is the nature of stoves you manufacture?
   e) Domestic
   f) Institutional
   g) Both
   h) Other, please specify

9. What is your annual production capacity for the last three years? .....
.....

   If less than a year, give production capacity in months

Part two: Product Quality

10. Do you have a Kenya Bureau of Standards (KEBS) mark on your ICS?
Yes { } No { }
Give reasons for your answer
.....
.....

11. Have you patented your ICS, if applicable?
   Yes { } No { } Not sure { }
   Give reasons for your answer ....
.....

12. Do you provide warranty for your ICS?
   Yes { } No { } Not sure { }
Give reasons for your answer .....

13. If yes, what is the warranty period?

Type of stove	Warranty period
h. Improved Cook Stoves (ICS)	
i. Improved firewood stoves	
j. Other, please specify	

14. What is the nature of the warranty?
   e) Money back { }

f) Replacement { }
g) Repair { }
h) Other, please specify { }

15. How many of your customers have claimed warranty in the last one year?
a) Less than 10
b) Between 11-20
c) More than 20

16. Have you tested the performance of your ICS?
Yes { } No { }
If yes, where and why did you test your stoves? Please explain
....
.....

17. How often, do you do the testing of the ICS?
a. Every three months
b. Every six months
c. Annually
d. Other (specify why).....

18. If no, why are you not testing your stoves?
a) No testing facility
b) High testing fees
c) High cost of transport to testing facility
d) Other, please specify .....

19. What is the stated /estimated lifespan of your ICS?
d) 1 -2 years
e) 3 – 5 years
f) 6 - 10 years

Part three: Distribution channels and Marketing Strategy

20. What is your target market? (Tick all that apply)
f) Rural
g) Peri-urban
h) Urban
i) Other (specify)

21. Where are your ICS mostly sold? .....
Distributors { } Schools, Hospitals, Hotels, Religious Facilities { } Supermarkets { } Individual orders { }
Others (specify).....

22. How do you reach your target market?
d) Television
e) Radio advertisements
f) Word of mouth
g) E-marketing
h) Print media
i) Self
j) Other (specify).....

23. What nature of distributorship do you have?
a) Manufacture-distributor
b) Wholesaler – retailer
c) Retailer - end user
d) End user
e) Other (specify) .....

24. How many stoves do you sell per :
a) Day
b) Month
c) Year

Part four: Financing of the business

25. What is the mode of payment by your customers?
e) Cash

f) Credit
g) Both
h) Others (specify).....

If by cash, skip to Q 28

26. If on credit basis, do you work in collaboration with any financial institution to recover your money?
Yes { } No { }
If yes, please list them .....

If no, explain why.....

27. If on credit, how long does it take you to recover your money?
e) 1-3 months
f) 4-6 months
g) 7-12 months

Challenges and Opportunities in the ICS Sector

28. What are the main challenges you have experienced in the ICS sector?
a) Access to finance
b) Awareness
c) Marketing
d) Government policy
e) Other, please specify

29. What are the main opportunities in the ICS sector? Please list them.
.....
.....

30. In your opinion, what should be done to improve development of the ICS sector?
f) Improve regulatory and policy framework
g) Financing of businesses in the sector (loans, grants)
h) Tax removal on materials imported
i) Stove labelling and standardisation
j) Proactive marketing of the products e.g. ICS by government
k) Awareness creation
l) Build capacity of local stakeholders
m) Others (specify).....

31. Are there specific technical needs your company requires?
Yes { } No { }

If yes, list them in order of priority
.....
.....

Thank you for your time

ANNEX 5: Semi-structured Interview guideline for Key Informants

We appreciate that you have taken your time to respond to this short questionnaire.

GUIDE TO KEY INFORMANT INTERVIEWS FOR ICS / SOLAR PV

(Please indicate if you are answering for Improved Cookstoves ICS or Solar PV)- Solar PV

1. What is your take on the adoption / uptake of ICS / Solar PV in Kenya?

2. What would you say about the ICS / Solar PV market in Kenya?

3. Which policies / regulations / standards are enhancing adoption / market growth in the two sectors?

4. Are their gaps in policies / regulations / standards that you know of? Which ones are these?

5. What opportunities exist in the two sectors?

6. Describe to me any major challenges?

7. As a key player in this sector are there certain marketing models that work well in Kenya? Can you give examples?

8. Do you have any recommendations regarding the sector; Markets and Adoption?

Name.....

Organization .....

Position in Organization: .....

Contacts

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