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Market mapping for improved cookstoves: barriers and opportunities in East Africa

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ABSTRACT

The East African region has been a hub for the development and marketing of improved cookstoves since the 1980s. However, there are differences in the rates of uptake of stoves between Kenya, Uganda and Tanzania. This article uses a participatory approach to market mapping, identifying the key barriers to market growth. The findings illustrate common barriers of access to finance, but also differences between the countries in their stove value chains and enabling environments. Participatory use of market mapping techniques would help to catalyse further action at the national level.

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Introduction

Cookstove markets in East Africa are perceived as vibrant, and have received significant attention from donors and the private sector. In Kenya, for example, progress is being made across a range of types of cookstove. Improved charcoal stoves, starting with the Kenya Ceramic Jiko in the 1980s and now improved with a range of project interventions, are widely recognised and taken up. It is estimated that 30–40% of households own an improved stove of some type (Winrock et al. 2011), although no reliable, countrywide data exists. At the same time, new stove companies like Burn Manufacturing have established themselves, and have been able to attract large investments, for example from the multi-national company General Electric, Acumen Fund and the US Overseas Private Investment Corporation. Other global cookstove manufacturers such as Envirofit are also marketing their products in Kenya. Market penetration rates for clean cookstoves in Uganda and Tanzania lag behind at 8% and 5% (ADP 2012), respectively, but there is significant potential for growth.

Encouraging the wider spread of clean cookstoves is a crucial development issue with both health and environmental implications. Household air pollution contributes to at least 581,000 deaths in Africa per year (of 4.3 million globally) (World Bank 2014), with the majority of these being women and children. There are environmental implications too with traditional cooking releasing both greenhouse gases and short-lived climate pollutants, contributing to 25% of total black carbon emissions globally. In addition, around a third of woodfuel is harvested unsustainably, contributing to deforestation (GACC 2018).

This article focuses on market systems and how they can be supported to expand and deliver better for people who are felt to be in need of their products. It suggests an approach to development which relies on market forces and private sector actors to drive development (Sesan 2014). This is not to say, however, that aid agencies or the public sector have no role to play. Indeed, as we argue, they have much to do to shape markets and facilitate the actions of the private sector.

The Global Alliance for Clean Cookstoves (GACC – renamed in 2018 as the Clean Cooking Alliance) has supported market assessments across East Africa to review the best intervention points to “help

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with the creation of thriving markets for clean cookstoves and fuels" (ADP 2012). Building on this, as part of the "Barriers" project, Practical Action Consulting deployed market mapping techniques (EUEI-PDF and Practical Action 2015) in primary research carried out in 2015, in order to update these findings. Market mapping allows us to identify particular barriers, make comparisons between countries, and, in future, use the mapping as a tool for participatory action among all actors in the market system.

In this article, we introduce the framework, and then present findings of market mapping exercises carried out in Kenya, Uganda and Tanzania. The exercises concentrated on the market for improved biomass cookstoves (ICS). These range from very basic stoves which are manufactured by small-scale artisans, up to far larger-scale national manufacturing operations and imported manufactured stoves. These stoves span a range in terms of their performance for both efficiency and emissions of particulate matter and gases. In this case, therefore, we are using the term "improved" to cover both "basic" and "advanced" stoves (Putti et al. 2015). We compare the findings to identify some of the main differences which help to explain the wider uptake of improved cookstoves in Kenya compared to Uganda and Tanzania. We conclude by highlighting the areas for future action, and reflecting on the usefulness of the market mapping tool as a framework for analysis and a guide to future action.

Market mapping tool

The energy market system analytical framework was developed by Practical Action and codified in collaboration with the European Union Energy Initiative-Partnership Dialogue Facility (EUEI-PDF) (EUEI-PDF and Practical Action 2015). The framework has been summarised in other publications (Leopold et al. 2015; Bloomfield, Waters, and Franz 2015). It "provides a systematic approach to categorising energy markets" by dividing the market into three levels: (i) the market chain; (ii) inputs, services and finance; and (iii) the enabling environment (Figure 1).

Level 1, the cookstove market chain, contains all the actors who own the stove, from the project developer up to the cook who will use it. The functions across the market chain can be combined and internalised within a single company in some cases. For example, a national stove manufacturer may be responsible for design, production, distribution and sometimes even retail of its products. At other times, these functions are all carried out by separate actors.

Level 2 contains the inputs, services and finance providers that support the market chain. Services can include product design, quality control and testing. Transport can be a very important and costly service in the cookstove sector. Inputs include materials and components. Financing can include banking services, loans for businesses as well as consumers, and other inputs such as results-based finance or carbon finance.

Level 3 contains the policies and regulations that impact the cookstove sector including, for example, quality standards, VAT and subsidies, import duties, and forestry regulations around the production and sale of charcoal. It also includes a key set of socio-cultural factors around cooking practices, awareness of the benefits of clean cooking, and financial and economic factors around affordability.

This is similar to GACC's framework of enhancing demand, strengthening supply and fostering an enabling environment (GACC 2011). The main difference in the market mapping tool is that demand is one of the factors driving value chain actors and is understood in the context of social, cultural, financial, and economic factors in the enabling environment; and supply is separated into the market chain, and the inputs and services which support it. The framework is also different in that it focuses on particular market sub-sectors: in this case the market for improved biomass stoves. It does not explore markets for other types of stoves or clean fuels such as the markets for liquid petroleum gas (LPG), or solar cookers which are addressed more broadly by GACC's market assessments. This has the advantage of being more focused in terms of the market actors it engages with and the issues it identifies.

The market mapping tool is ideally used as part of a systemic approach to boosting cookstove or clean fuel markets. This approach involves bringing market actors together, using the co-creation of a

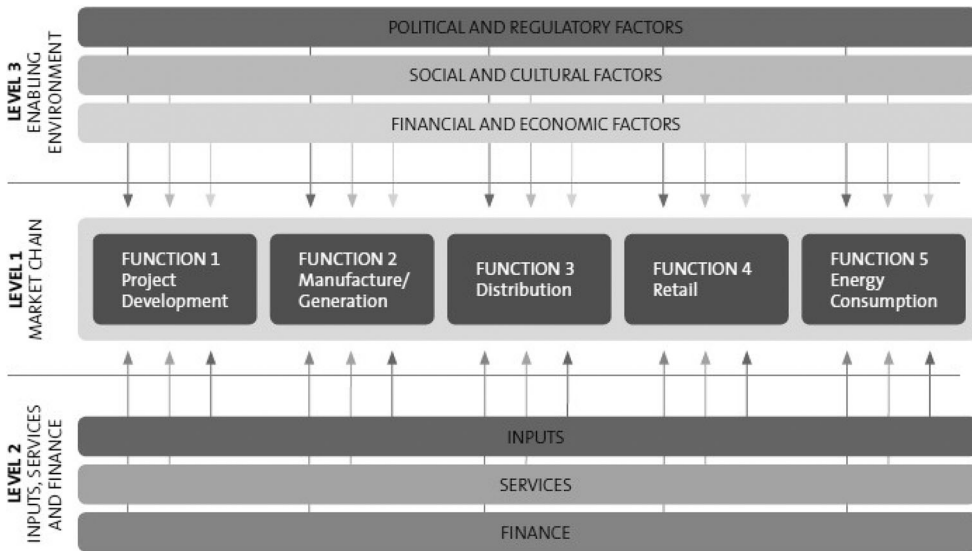


Figure 1. Basic market map.

market map to jointly identify points of leverage which could unlock rapid progress. This process and ongoing dialogue and action also help to break down barriers and misconceptions between market actors, improving relationships which are critical to creating a market system that grows and meets the needs of more consumers.

In this case, however, market mapping was simply used as a tool for analysis. Households, ICS market actors, and policymakers were surveyed, with the results used to create market maps, and to identify the most prevalent barriers blocking the growth and development of ICS markets. These could then be used as the basis for a more participatory process of action to strengthen and develop these markets and the relationships within them in the future.

Methodology

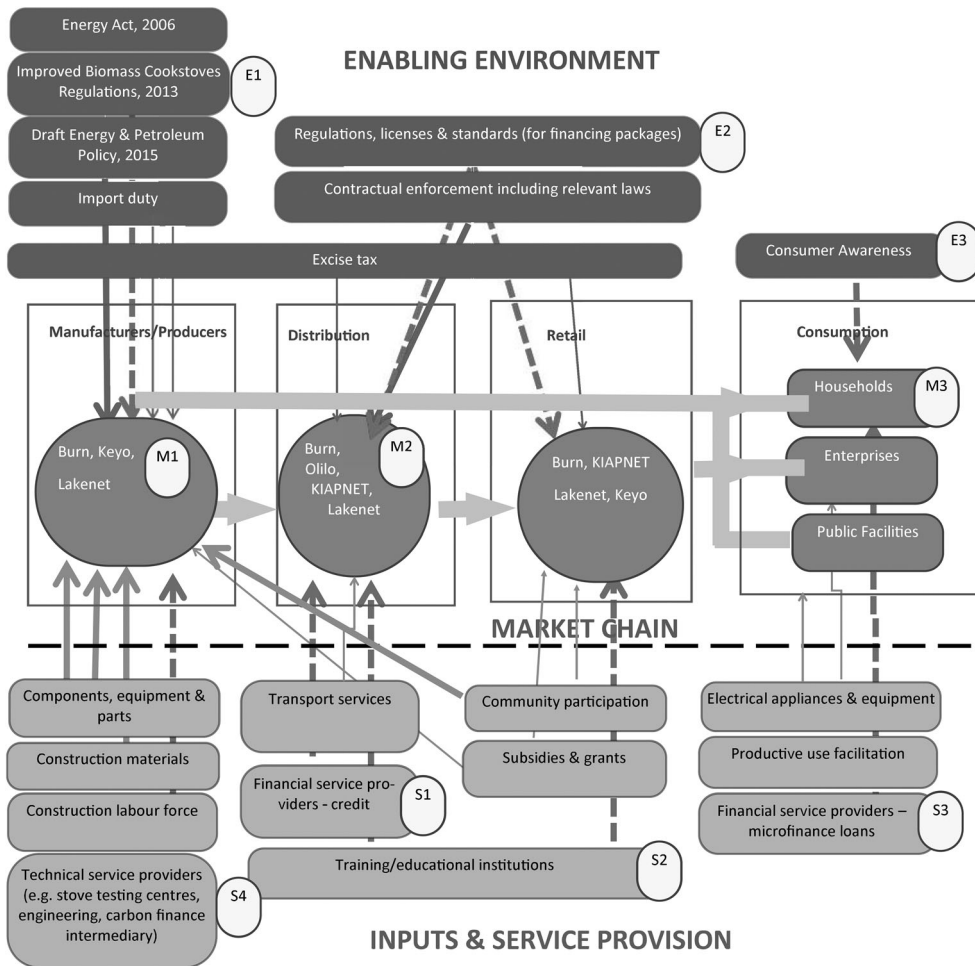
In order to gain an in-depth understanding of the cookstoves sector in each country, 13 field researchers conducted semi-structured interviews with a sample of 39 businesses of different sizes and locations. These were selected based on background knowledge and literature reviews of the cookstoves sector to ensure they would give a fair representation of different types of enterprise and experience. Larger numbers of small-scale producers were interviewed in Uganda, reflecting the nature of the market there which favours these artisanal producers. A third of interviewees were women (Table 1).

In addition, the team surveyed 150 households across urban, peri-urban and rural areas in the three countries. The questionnaires focused on people's current cooking practices and their knowledge and perceptions of improved cookstoves. They also talked to 38 financial institutions (banks and savings and credit organisations).

Representatives of these stakeholders were later brought together in a workshop to create market maps and identify the key barriers and opportunities in the sector. The workshop followed a methodology developed by Practical Action and described in full in an online toolkit (Practical Action n.d.). The maps identify the key actors in the market chain, and many of the issues in levels 2 and 3 are similar between each map (Figures 2–4). Workshop participants identified priority market barriers (labelled on the diagrams as M, E or S), and these form the heart of our discussion.

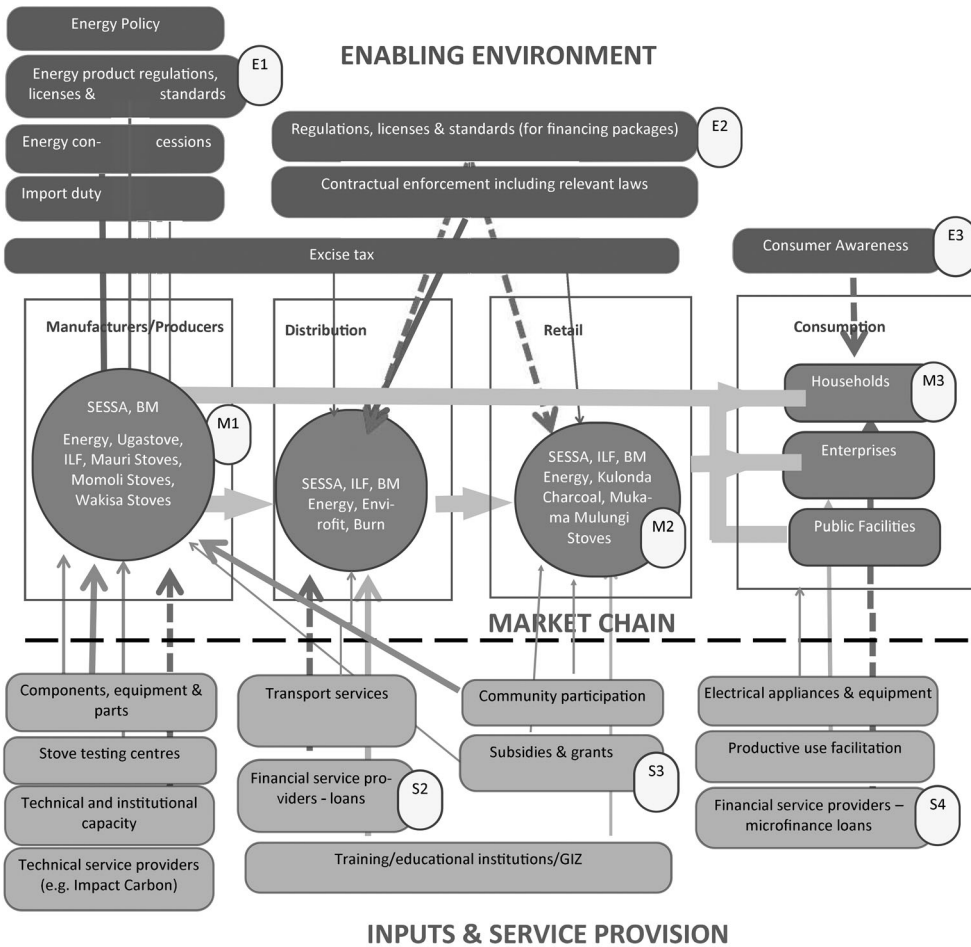
Table 1. Sample of firms interviewed.

	Kenya	Uganda	Tanzania
<i>Scale of enterprise</i>			
Large-scale	4	3	2
Medium-scale	2	4	3
Small-scale	4	13	4
<i>Location of enterprise</i>			
Rural	6	10	5
Urban	4	10	4
<i>Type of company</i>			
National/local	8	20	8
International	2	0	1
<i>Gender of respondent</i>			
Men	6	13	7
Women	4	7	2
Total	10	20	9



Kenya ICS Market Map

Figure 2. Kenya ICS market map.



Uganda ICS Market Map

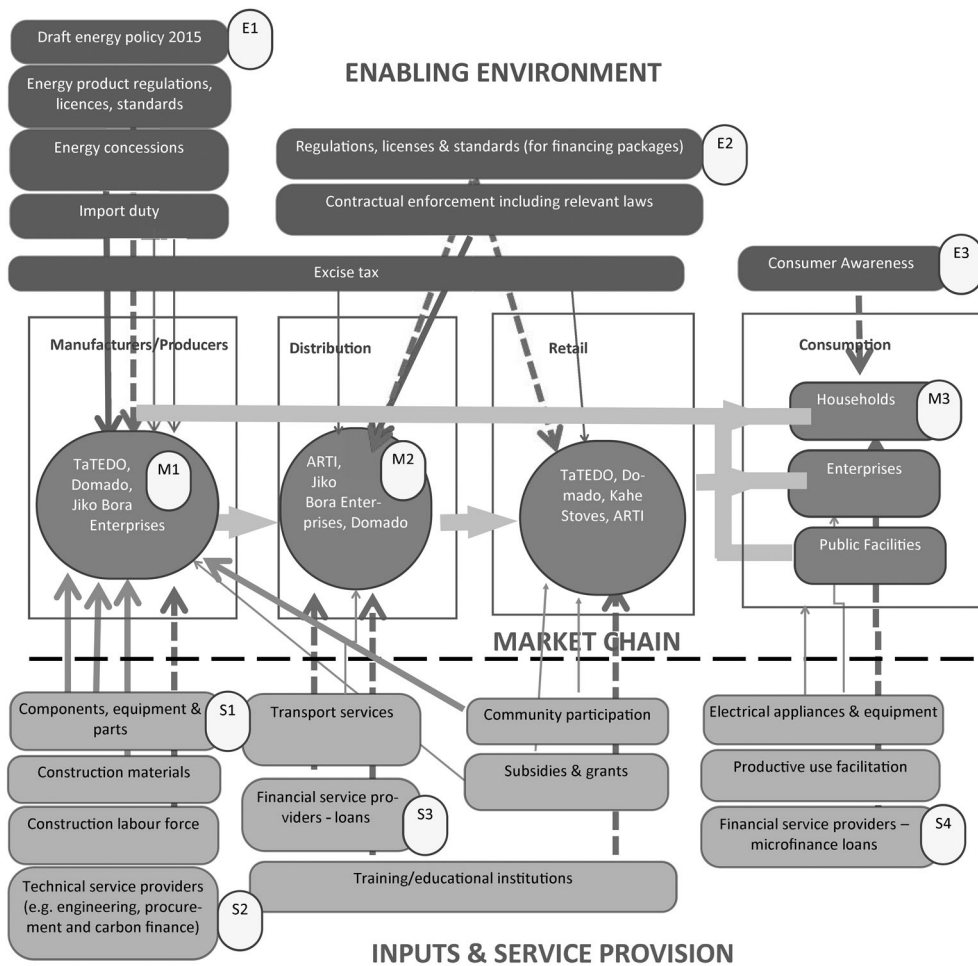
Figure 3. Uganda ICS market map.

Market map in Kenya

Kenya has the most developed cookstove sector in the East African region in terms of numbers of people using improved stoves, the diversity of producers, and the selection of products. The rates of uptake of improved stoves in urban areas are high, but there is still a significant challenge in reaching rural communities.

Although comprehensive clean cooking figures have not been recently collected, in 2014 56% of households relied on firewood as their primary fuel and 17% charcoal (KNBS 2015). An estimated 2.25 million households (of a total of around 7.6 million) own an improved cookstove (GVEP and GACC 2012a), and LPG is gaining popularity in urban settings (used by 25% of urban households in 2014; KNBS 2015). Kenya is targeting the uptake of 5 million improved cookstoves meeting a minimum ISO Tier 3 for air quality standards (SEforAll and MEP 2016) and an increase in clean fuel use to 42%, all by 2020.

Since the emergence of an improved cookstove market in Kenya in the 1980s and the successful introduction of the Kenya Ceramic Jiko (KCJ), "the Kenyan cookstoves market has long been viewed as a pioneer in the East African region" (ADP 2012). A broad artisanal base remains, and only recently have



Tanzania ICS Market Map

Figure 4. Tanzania ICS market map.

manufactured stoves began to make inroads through companies such as Burn Manufacturing, the Paradigm Project, and Envirofit.

Much stove production is done through informal artisans working in dispersed areas across the country, but mainly in Kisumu County (Western Kenya) and Muranga County (Central Kenya) where clay is readily available. This stove production is often not assessed against quality standards and many producers struggle to break even.

Market chain

There are a wide range of businesses in the cookstoves market chain in Kenya. Manufacturers vary from small artisanal groups (such as Keyo Women’s Group and Lakenet) to industrial-scale manufacturers such as Burn Manufacturing which, between its launch in 2013 and July 2017 has sold over 280,000 stoves and now has the leading brand of charcoal stove in the country. There are also a range of distributors and retail outlets involved in the market chain.

The market mapping exercise identified a range of challenges in the market chain itself and the relationships between players:

- Distribution and availability of products in more remote areas remains a problem, leaving rural communities with few stove choices designed to work with firewood (rather than charcoal) (M1). Even where people aspire to quality products, these are not available to them.
- There were a range of issues depressing demand from rural households (M2).
 - (i) Many consumers appear extremely price sensitive and unwilling to pay more for higher quality stoves.
 - (ii) Some international manufactured stoves have been given away free of charge, but have been left unused because the designs do not fit with local cooking practices. For example, the pot rests or the openings to insert fuel were too small (as also found by, for example, Loo, Hyseni, and Ouda 2016).
 - (iii) Seasonality of demand in particular for rural households where purchases of this nature tend to only be made during the crop harvest towards the end of the year, and only then if the harvest has been good and there is money left over after paying for, for example, school fees, medical costs and farm inputs.

Inputs, services and finance

A range of issues were highlighted at this level of the market chain. The most significant barriers were related to the costs and difficulties of services such as transport, and difficulties in accessing finance.

Services

- *Transport costs of both raw materials and the finished product. "It is thought that many of the smaller companies that make up the distribution network even of larger producers such as Envirofit and Paradigm struggle to access the finance necessary to purchase stock and transport products cost-effectively to new markets."* (S1)
- There is little mention of the ICS sector in training or educational institutions, creating a skills gap (S4).
- Stove testing facilities are now available at the Kenya Industrial Research and Development Institute and University of Nairobi. However, these can be difficult to access for small producers located in, for example, Western Kenya.

Finance

- *Access to finance can be difficult especially for artisanal producers, with finance providers viewing them as informal, disorganised, and lacking sufficient accounting records* (S2). Companies are often looking for working capital. This is also the case for small distributors. This leads to high collateral requirements and interest rates. Recently, the Kenyan government introduced a cap on interest rates charged by commercial banks at 4% above the Central Bank rate (currently 10%). This will make credit more affordable, but it is likely that banks will still be wary of lending to the cookstoves sector. At the same time, however, some banks and microfinance institutions will provide training in good business practices, book-keeping, marketing, and so on to help informal companies become eligible for loans in future.
- *End-user finance* (S3). The availability of consumer finance for cookstoves is limited, likely because loan sizes are too low for microfinance institutions and banks, but too high for cash purchases (at a maximum of around US\$15). There is scope for partnerships and follow-on loans between small-scale solar and cookstove companies. There is clearly a role for government intervention here in

building consumer awareness around the availability of credit and pay-as-you-go models (PAYGO) among consumers in remote areas, as well as to support access to microfinance for clean cooking options

- Lack of easy access to carbon finance in the absence of an institution to link small companies to the carbon market and help deal with the required documentation. Ezy Life stoves (the Paradigm Project) have managed to access carbon finance. While this will help to reduce the price for consumers, falling prices and lack of availability of credits mean business models cannot rely on these payments.

Inputs

- Raw materials availability and costs were mentioned as a constraint.
- Unreliable and unaffordable power supplies for some businesses that have adopted machinery to increase their production.

Enabling environment

The enabling environment for clean cookstoves in Kenya is relatively favourable compared to Uganda and Tanzania. Improved cookstoves have been promoted “by a large variety of government agencies, development partners and non-governmental and community organisations” since the early 1980s (Vulturius and Wanjiru 2017). Recent Government policy revisions have improved things further: removing 16% VAT on LPG and efficient biomass stoves, increasing kerosene costs, reducing fuel-efficient stoves’ import duties from 25% to 10%, and removing excise duty on ethanol for cooking and heating (GACC 2016).

However, sector actors highlighted the fact that improved biomass cookstove regulations are still in a draft format (E1), and there is a lack of enforcement of regulations meaning that standards are not adhered to (E2). Although there is relatively good consumer awareness (especially in some market segments) about the benefits of clean cooking, households are still unsure about how to distinguish between counterfeit and quality products, and which products might best meet their needs (E3).

Market map in Uganda

As in Kenya, the cookstoves sector in Uganda initially emerged in the 1980s and was promoted as a means of combatting concerns over deforestation. However, progress was initially slow and government targets were not met. During the 1990s, steady progress was made, with support initially from GIZ (German Development Assistance) and a range of other donors. UgaStove was founded during this period and is now Uganda’s largest ICS business, producing around 200 stoves per day. The market also consists (as in Kenya) of a large number of artisanal producers making up to 100 stoves a month. The carbon market has been relatively well-organised in Uganda which has helped to bring down the sales price of stoves. Production levels are estimated at around 240-300,000 stoves per year. If universal energy access is to be achieved by 2030, this needs to be increased to around 1.35 million per year (SEforAll 2015).

Recent figures for the uptake of improved cookstoves are not available, but the Uganda National Alliance of Clean Cooking (UNACC) estimates that only 500,000 households (7%) were using clean and efficient cookstoves in 2012. A national household survey from 2012/13 found that 75% of households use wood for cooking and 21% use charcoal (SEforAll 2015). At the same time, fuelwood is becoming scarce and even in rural areas, 36% pay for fuel (GVEP and GACC 2012b). Costs are rising and respondents from the small town of Lira found that firewood was becoming unavailable nearby,

and was sometimes more expensive than charcoal. These costs could potentially be a powerful driver for increasing demand for more fuel-efficient ICS.

Uganda, along with Kenya, is one of the Global Alliance for Clean Cookstove's focal countries. The UNACC has developed a plan to reach 5 million households with clean cooking solutions by 2020, with support from a range of donors and partners. This would represent a dramatic scaling up from the current situation, and will require an approach which focuses on the key market system barriers.

Market chain

As highlighted above, the market chain for improved cookstoves in Uganda has a large number of small-scale artisanal producers (many centred around Lira), together with a few larger-scale national manufacturers. Some imported stoves are also found including the Burn Manufacturing *Jiko Okoa* stove (assembled at a satellite facility in Uganda), Envirofit and Smart Stoves. Stoves are sold through a network of retailers, although efficient distribution remains a challenge.

The range of challenges in the market chain itself and the relationships between players included:

- Storage space for sufficient stock for these bulky items is difficult especially for small-scale distributors who are also selling other commodities. The cost of storage can be as much as the original cost of production. For final retailers, storage is also a problem and often means stoves are only available to order, and not to purchase immediately (M1).
- There is a lack of effective demand from customers (M2), partly because there is an affordability gap, and also because of a lack of consumer awareness. One small-scale artisanal producer said, "I am compelled to sell ICS at a price which is very low to match the low purchasing power of the residents, therefore contributing to losses". A World Bank study (Rebel Group Consortium 2015) found that the designs of charcoal stoves were a much better fit with local practices and led to higher rates of adoption than for wood-burning models. Also, although there was willingness to pay, in particular for charcoal-burning stoves, this was often hampered by a lack of consumer credit.

Inputs and services

Key issues emerging were:

- Raw materials availability. Good quality clay needs to be transported to the production sites at great expense (S1).
- Carbon finance has been more widely available in the Ugandan context than in Kenya or Tanzania, thanks largely to the presence of "Impact Carbon" which acts as an intermediary linking local producers with the voluntary carbon market. The injection of carbon credits has helped to reduce the sales price of better-quality stoves. Beyond that, however, there remain difficulties in enterprises accessing finance to grow their businesses (S3).
- The main source of consumer finance in rural parts of Uganda is through village savings and loans schemes. These are rarely used for the purchase of ICS. There is no access to commercial lending schemes for ICS (S2).

Enabling environment

- Although the government has included clean cooking in its energy sector policies and targets over the years, sector stakeholders found this engagement to be minimal and not backed by significant resources (E1). The more recent founding of the UNACC chaired by the Government may help to

improve coordination, as well as a greater focus on clean cooking as part of the government's SEforAll Action Agenda.

- A second key issue is the lack of regulations on ICS standards, with producers and installers not needing to be licenced by the energy regulator. In theory, stoves should be sent for testing at Makerere University, through the Uganda Bureau of Standards, but many are not. The market includes producers selling counterfeit copies of well-known brands, and there is poor enforcement and follow-up against this (E2).
- Linked to a lack of consumer demand, there is a lack of awareness in many rural areas about the benefits of clean cooking (E3).

Market map in Tanzania

As elsewhere in the region, the improved cookstove sector began to develop in Tanzania in the 1980s. The government and its partners introduced local versions of the Kenyan Ceramic Jiko. The NGO TaTEDO (the Tanzania Traditional Energy Development Organisation) took the lead in developing technologies and remains a leading promoter and trainer, but most initiatives have so far been project-led. The sector is dominated by small-scale artisanal producers. Commercialisation is limited, and there is very little effective quality control. The *"national penetration of ICS remains low at approximately 5%"* (GVEP and GACC 2012c) or about 1 million stoves, most of them charcoal-burning.

A 2016 national "Energy Access Situation Report" by the Rural Energy Agency and the National Bureau of Statistics only touched very briefly on clean cooking, with just eight pages out of 378, and focused entirely on fuel choice rather than stoves. This indicates the lack of political focus on the issue. The study found that 96% of households use biomass fuels, 71% using wood, and 37% charcoal. Charcoal is the fuel of choice in urban areas, with Dar es Salaam accounting for the vast majority of this. The pressure on biomass around Dar es Salaam has seen *"the price of charcoal increase by a staggering 1000%"* between 2003 and 2012 (GVEP and GACC 2012c). Even in some rural areas of the country, people are having to pay for firewood as deforestation progresses and it becomes a scarce resource (Riedijk 2011).

Despite Tanzania not being one of the Global Alliance's focal countries, there have been efforts to coordinate action on clean cooking at the national level. SNV has facilitated an ICS Taskforce, drawn together to address the problem of a fragmented sector, and bringing together the private sector, civil society representatives and government. The task force is chaired by the Ministry of Energy and Minerals (MEM), with the Tanzania Renewable Energy Association (TAREA) elected to hold the secretariat. It produced a Country Action Plan for Clean Cookstoves and Fuels in 2014 in collaboration with the Clean Cookstoves and Fuels Alliance of Tanzania (CCFAT). There are also plans to develop a Biomass Energy Strategy and to undertake supply and demand-side actions. This sets targets for the first time, aiming for 11.2 million households with an improved stove by 2030 (76.4%) (SEforAll and MEM 2015).

Market chain

The ICS market in Tanzania is thin, with few actors and limited demand. This could be related to the large land size and continuing availability of firewood in rural areas. As noted above, the sector is dominated by small-scale artisanal producers who are not well-organised and are producing for local markets.

Challenges identified in the market chain have included:

- Distribution between producers, retailers and customers (M1). Recently distribution has been recognised by regional and district local governments as an issue, and they have included clean cookstoves and support to their distribution in their development plans.

- There are low capacities among cookstove companies to enable them to manage their businesses effectively and keep good records. This has created a lack of trust from financiers who need to see a good track record before making loans (M2). Many ICS businesses have this only as a secondary activity, alongside agricultural production.
- There is low demand from customers (M3), and a low awareness of the need for purchasing clean cookstoves. This situation has not been helped by occasional give-aways of stoves by various agencies. Demand for stoves is seasonal, with the best time to sell stoves, according to one producer, being at Eid al-Fitr after the holy month of Ramadan.

Inputs, services and finance

There are a wide range of issues blocking the development of this nascent market:

Finance

- There is a lack of finance available to ICS producers to expand their businesses, including in particular for working capital to buy more raw materials and pay for sufficient storage space. There is a lack of trust in the sector too by commercial banks (S1).
- Consumer finance is also lacking with lenders requiring high amounts of collateral in the form of household goods or livestock before offering credit (S2).
- In addition, there is no access to an intermediary to support carbon finance to help bring down the cost of clean stoves.

Services

- Transport costs, long distances and poor roads make it difficult for distributors to reach wider markets in the populous regions of the south (S3).

Inputs

- The cost of raw materials is high, in particular for steel used for metal cladding of nearly all the stoves produced in Tanzania (S4).

Enabling environment

There is an overall lack of policy attention to clean cookstoves in Tanzania including in its updated national energy policy, or in the Biomass Energy Strategy (E1). The SEforAll Action Agenda includes targets which were agreed in 2014 together with the CCFAT, however, it seems unlikely that these will be well-resourced from public funds.

There is also a lack of effective regulation and testing (which is voluntary) (E2). This contributes to a lack of trust in the sector by agents, and a lack of consumer awareness about which products are of a good quality (E3). There have been few national awareness campaigns, or advertising campaigns by large manufacturers.

Discussion

We compare the findings to identify some of the main differences which help to explain the wider uptake of improved cookstoves in Kenya compared to Uganda and Tanzania (Table 2). Table 2

highlights where market actors identified similar barriers to further expanding uptake, but it does not analyse the intensity of each of these barriers. So, while a similar barrier may be identified in each case, it may have a larger impact in one market than another. Where a barrier is not identified in a particular country (for example, seasonality of demand was not highlighted in Uganda), this issue may still exist, but was not *prioritised* as a problem by stakeholders. A greater number of issues were highlighted in the Kenyan market even though it is more established. This suggests that the issues identified in Uganda and Tanzania are more focused around fewer, larger barriers.

There are common barriers in terms of inputs and service provision, especially a lack of finance (highlighted at the global level in SEforAll's Energizing Finance series; SEforAll 2017). The challenges of storage, transportation and distribution of both raw materials and finished products appear to be accentuated in Tanzania and to a degree in Uganda where distances between areas of production and markets are greater and most producers are small-scale and artisanal. These issues seem common to the cookstoves sector across the continent. The World Bank (2014, 112), for example, also identifies supply-side issues around technical capacity for production, access to finance for producers and distributors, and cost-effective distribution. The question of distribution in particular has been largely overlooked by the sector and there could be economies of scale for greater collaboration between actors on this issue.

In areas where firewood remains the fuel of choice (rather than charcoal), there is still a lack of products which meet the cooking needs and fuel availability of households. Factors include the ability to cook for large families, the types and size of fuel stoves can burn, the speed of cooking and the ability to control cooking heats. In general, manufacturers of imported stoves had received little input or feedback from users about how well they performed in preparing their staple foods. Other cultural factors may also be important, such as the need for stoves to produce heat and light, as found in Guatemala (Bielecki and Wingenbach 2014). These issues are significant, but a limitation of this research may be that it did not capture these aspects as fully as they may deserve.

Table 2. Comparison of priority market barriers.

	Kenya	Uganda	Tanzania
Level 1: Cookstove market chain			
<i>Producers-retailers</i>			
Lack of variety of products, especially those burning firewood as a fuel (rather than charcoal)	✓	✓	
Producers have low levels of business capacity: only produce stoves as a secondary business line			✓
Lack of good communications along distribution chain			✓
<i>Consumer demand</i>			
Seasonal demand (around harvests or religious festivals)	✓		✓
Affordability gap: customers are unwilling or unable to pay for any kind of stove (sometimes due to give-aways)		✓	✓
Customers are unwilling to pay for higher quality products	✓		
Available designs do not meet all cooking needs	✓		
Level 2: Inputs, services, finance			
<i>Finance</i>			
Business finance not available especially for artisanal producers	✓	✓	✓
Carbon finance not easily available	✓		✓
Consumer finance not easily available for buying stoves		✓	✓
<i>Costs and availability of inputs and services</i>			
Cost and availability of raw materials (clay and/or steel)	✓	✓	✓
Transport costs for raw materials and finished products	✓	✓	✓
Expense of storage space		✓	
Electricity supply for producers unreliable and costly	✓		
Training institutions do not cover stove production and performance	✓		
Stove testing facilities limited: only in capital city	✓		
Level 3: Enabling environment			
Lack of public awareness of the need for clean cookstoves		✓	✓
Lack of public awareness to distinguish quality products	✓		✓
Clean cooking not prioritised in national plans and budgets		✓	✓
Standards not in place	✓	✓	✓
Standards not enforced effectively	✓	✓	✓

There is clearly a need for greater public sector attention to clean cooking, especially in Tanzania and to a degree in Uganda. The cookstove sector itself in these countries also needs to be more organised and work more effectively through its new sectoral groups and alliances, to lobby effectively and support wider market activation efforts. The clean cooking sector in Kenya has received greater attention from policy makers, helped by greater civil society engagement and organisation of market actors to have a coherent voice. These market mapping exercises can be used as a starting point for further discussions and multi-stakeholder interaction. Their purpose is less an analytical one to allow comparison between markets, but more urgently, to help local stakeholders come to an agreed understanding of the key starting points for action.

There is clearly a need for a combination of coordinated actions by different actors: governments, the development community, and national financial institutions. The recent reports from SEforAll (SEforAll 2017) and Practical Action's Poor People's Energy Outlook 2017 (Practical Action 2017) highlight the barriers that companies in the cookstoves sector face in securing financing. Gendered barriers exacerbate this further both in terms of consumers (purchasing and decision-making powers) and entrepreneurs. The fact that this was not raised as an issue in the market mapping workshops, although a third of business interviewees were women, reveals a common blind spot among actors in the sector. The PPEO 2017 goes on to make broad-level recommendations to help address these barriers, echoing the more detailed country-level findings highlighted by these assessments.

Conclusion

The improved cookstove market in Kenya is more established and reaches more customers than those in Uganda and Tanzania. This is related to a more sustained focus from policymakers and a range of other stakeholders over time, which has created a more fertile ground for a vibrant market to emerge, which has gradually built up trust among consumers. The interviews and market mapping tools used here helped to highlight the different nature of some of the supply side challenges in Uganda and Tanzania compared to Kenya; and the need for coherent and high-profile attention from government policy makers to the issue.

In terms of next steps, in all three countries there is a striking difference between the urban market for charcoal stoves, and a rural market for woodfuel stoves. Urban charcoal stove markets are far more developed and relatively well-served, in contrast to rural markets which are largely pre-commercial. In this context, it would be helpful to develop market maps for these markets separately. While some of the issues in the enabling environment will be similar between rural and urban areas, many of the market chain and finance and services issues will vary in nature or intensity.

What is needed is not so much a blueprint of recommendations. But the next step is to use this analysis to create a discussion among market actors. There is clearly both a failure of trust, a need for innovative ideas, and a lack of focus about where government intervention could best support the sector. A programme of market facilitation, backed by high-profile government support, would be the next step to catalysing action.

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