

SSA ACCESS TO CLEAN COOKING TOOLKIT



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1. An Introduction to Clean Cooking in Sub-Saharan Africa (SSA)



Cooking is a fundamental part of life. However, in some developing countries, solid fuels like wood and coal are often used in traditional stoves for cooking. The use of such polluting fuels and technologies result in household air pollution, causing respiratory illnesses, heart problems and even death. In fact, indoor air pollution causes more than 4 million premature deaths every year—50 percent of which are with children under the age of five (5). These effects have led to the need for a global switch to clean cooking – using modern stoves and fuels – to transform lives by improving health, protecting the climate and the environment, empowering women, and helping consumers save time and money. Clean and Improved Cooking involves the deployment of modern cooking fuels rather than traditional biomass, kerosene, and charcoal for cooking. Clean cooking has been on the sustainable development agenda for decades, but only recently became a major priority on the global development agenda as part of Sustainable Development Goal (SDG) 7: affordable and clean energy. Clean Cooking solutions involve both devices and fuels such as clean cookstoves, biogas, liquefied propane gas (LPG), renewable energy, ethanol, etc.



2. Reliance on Solid Fuels for Cooking in SSA



Solid fuel cooking refers to cooking apparatus that deploys charcoal, wood logs, pellets, among others to generate appliance heat or used for smoke flavouring. Nearly a billion people in SSA rely on traditional biomass (wood) for cooking, which has negative impacts on human health and the environment. This reliance on solid fuels for cooking can be linked to several factors including simultaneous usage of multiple fuels and stove technologies and unawareness of stoves that run on renewable fuels such as biogas, ethanol and solar.

2.1 Effects of reliance on solid fuels for cooking in SSA

A continued reliance on solid fuel for cooking in SSA causes the following:

2.1.1 Public Health Crisis: Household Air Pollution (HAP)

Evidence from the most recent World Health Organization (WHO) survey on the global burden of disease shows that nearly 600,000 Africans die annually and millions more suffer from chronic illnesses caused by air pollution from inefficient and dangerous traditional cooking fuels and stoves. Household Air Pollution arises from cooking smoke and is linked to around 2.5 million premature deaths worldwide per year. Such HAP particularly in rural areas, damages health and impairs productivity, causing almost 490,000 premature deaths per year in SSA, with women and children getting affected the most by resultant health issues such as asthma, tuberculosis, adverse pregnancy outcomes, paediatric sleep disorders, depression, bacterial meningitis, a variety of moderate-to-severe physical injuries associated with firewood collection, burns, and widespread minor ailments from smoke inhalation, such as eye irritation and headaches.

2.1.2 Greenhouse Gas Emissions

Africa is responsible for only 3.8 % of global greenhouse gas emissions. However, cooking with biomass contributes to global black carbon emissions which is the second largest contributor to climate change after carbon dioxide. Other emissions from solid fuel cooking include the release of particulate matter, carbon monoxide and other harmful Products of Incomplete Combustion (PIC). These harmful gases cause HAP and are often strongly linked to acute lower respiratory infections (ALRI), chronic obstructive pulmonary disease (COPD), lung cancer, ischemic heart disease, cerebrovascular diseases, cataracts, and low birth weights.

2.1.3 Significant Costs

African households spend 7% on average of their expenditure on high-cost solid cooking fuels; this poses bigger challenges for the urban poor that spend 15 to 20 percent of their monthly income on such fuels and due to the high cost of these fuels, annual total fuel spending in SSA has risen to US\$10 billion. Furthermore, there is a loss of time suffered by Africans who waste billions of potentially productive hours on avoidable fuel-collection and the slow cooking time of traditional solid-fuel cookstoves. For an individual African firewood-gathering household, the average time spent on fuel collection daily ranges from under 1 hour to more than 5 hours, with a regional average of 2 hours spent on the task daily. Additionally, harvesting biomass for cooking increases the risk of local forest degradation and deforestation.

2.1.4 Gender Prejudice

The negative effects of traditional solid fuel for cooking on gender equity are clear. Women bear the major burden of the costs of solid fuel for cooking, considering that women are primarily responsible for fuel collection in most markets, bearing the burden of cooking duties, and are at greater risks of physical injury and sexual violence during fuel collection trips. There are also decreased educational opportunities for girls because of these assigned responsibilities that take up time that would have otherwise been spent on engaging in productive educational activities.

2.2 Business-As-Usual Scenario Projection (2030)

It was expected that by 2020, tens of millions of new SSA households would have gained access to at least minimally improved cooking solutions without any further interventions. However, by 2020, 80% of Africa's population remained without clean cooking solutions and more than 60% without access to even minimally improved cooking solutions. This represents a much lower level of access than what is currently witnessed in other regions like South Asia, where the lack of clean cooking solutions is being addressed as a major crisis. In the absence of significant public- and private-sector investment, the spread of clean cooking solutions across SSA will be highly uneven – with successes in countries, such as Ghana, Kenya, Senegal, and South Africa (where the combined penetration of ICS and clean fuels is already above 50%) serving as exceptions amidst the overwhelming majority of SSA countries still mired in the use of traditional solid fuel for cooking.

Furthermore, the vast gap in clean cooking access between rural and urban areas will likely widen further in the absence of new targeted investments. African governments, the development community, and the private sector can and must do better. In the

absence of coordinated actions, enabling policies and scaled-up finance, the number of people in Sub-Saharan Africa relying on traditional biomass cookstoves could amount to 660–820 million by 2030. Also, the annual total fuel spending in SSA will have doubled, amounting to US\$20 billion per year.



3. Alternative Fuels and Stoves



In an effort to promote access to clean energy via cooking, the use of alternative cooking fuels have been encouraged, as a more efficient method of combatting problems associated with using traditional fuels for cooking. Some of these alternative fuels and cooking stoves will be highlighted in this section of the toolkit.

3.1 Briquettes

Briquettes are a form of energy which are like firewood or charcoal. Most fuel briquettes are made by compressing biomass materials into a unit, solid in nature, through manual or automated machines or other techniques. Briquettes can be made from non-carbonised raw materials such as food wastes. The biomass materials may also be carbonised before being compacted into briquettes. Briquettes, when utilised, are sustainable and energy efficient. Ultimately, they reduce pollution levels in urban areas. For instance, in an informal settlement in Nairobi, research reveals that the utilisation of slow burning charcoal dust and soil briquettes reduced household cooking energy expenditure by 70%, if families produced their own equipment, and by 30% if families purchased briquettes from other sources.

Briquettes are a cheaper form of energy, hence their popularity among low-income populations, particularly in informal urban settlements. The production and sale of briquettes offers several income opportunities for participants in the energy supply chain of SSA. For instance, in Kenya, the Eversave Briquettes, produce 10 tonnes a month of charcoal briquettes which are made from charcoal dust collected from trading sites and mixed with gum Arabic. This woman-led enterprise is recorded to have a 20–30% profit margin. In addition to the benefits of briquettes providing income opportunities, briquettes aim to reduce waste and sustain rural-urban linkages. In Cameroon, for instance, Kemit Ecology, is a start-up enterprise that helps

to transform household waste into ecological briquettes, thereby contributing to urban waste management in the country.

3.2 Liquefied Petroleum Gas

Liquefied Petroleum Gas (LPG) is a by-product from the petroleum extractive industry and is abundant globally, but supply is unevenly distributed by North America and the Middle East. Bio-LPG is an exact substitute for fossil LPG, and technical potential exists in many developing countries. Thus far, Bio-LPG has not been commercialised in developing countries, but several studies are underway, which will shed more insight and potentially create a basis for exploiting this source as a renewable fuel source for cooking. The use of LPG causes minimal household pollution and negative health impacts. It emits lower greenhouse gases than other cooking fuels and technologies. It is observed that increased production in LPG would contribute to reduced poverty particularly for women and girls, in cooking. In Ghana, LPG has taken a significant share of the market. The country has established specific targets for LPG's share of the household energy market (50%) and included LPG explicitly in their INDCs. The demand is also increasing in urban areas in Tanzania. Tanzania targets 75% clean cooking access by 2030, but does not identify a specific proportion targeted for LPG. However, Tanzania grants VAT exemption for LPG, however, this exemption does not apply to stoves/cylinders.

3.3 Biofuels

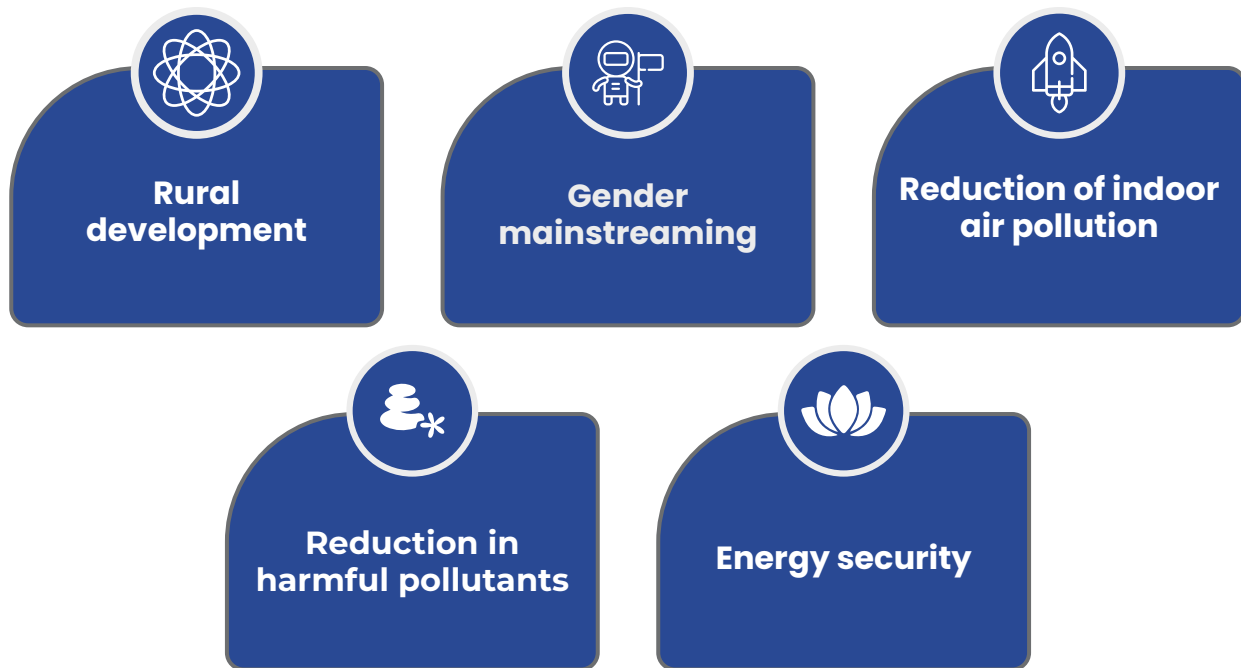
Liquid biofuels can be categorised into three (3): Vegetable/Plant Oil, Biodiesel, and Bioethanol. Vegetable oil is produced from crops and seeds, and it is used in diesel engines, generators, and pumps. It is mostly used for cooking and lighting. Biodiesel on the other hand is produced from a field of feedstock, such as oil feedstock, animal

fats or waste vegetable. Biodiesel can be used in pure form or blended with petroleum diesel at any concentration for use in most modern diesel engines. Ethanol is a liquid biofuel that can be made from a variety of feedstocks, including sugary materials such as sugar cane, molasses, starchy materials such as cassava, potatoes, and maize; and cellulosic materials such as wood, grasses, and agricultural residues. Bioethanol offers many positive properties as a renewable, efficient, and largely safe household cooking fuels. It should also be noted that since the quality of the biofuels and the efficiency of the stoves varies, they do not necessarily provide a better cooking experience than conventional fuels like charcoal and kerosene.

According to the World Bank, the leading alternative bio-fuel businesses in SSA by the number of households reached are illustrated below:

S/N	Country	Biofuel	Number of Households Reached
1	Nigeria	Ethanol gel	350-400
2	Uganda	Carbonized briquettes	56
3	Nigeria	Ethanol gel	40
4	Mozambique	Ethanol	25-40
5	South Africa	Ethanol gel	25
6	Tanzania	Ethanol gel	25
7	Kenya	Ethanol gel	15
8	Kenya and Madagascar	Ethanol	14
9	Ethiopia	Ethanol	7
10	Kenya	Carbonized briquettes	5
11	Zambia	Pellets	3
12	Ghana	Pellets	2
13	Rwanda	Pellets	1.5

Some of the contributions of Biofuels to Sustainable Development include:



3.4 Biogas Digesters

The biogas technology as a source of energy, is an integrated waste management system that is clean, renewable, naturally produced and under-utilised. The gas produced is similar to natural gas and it is composed of 50–70% methane. Biogas is accessible to low-income households for heating and cooking, through anaerobic digestion of readily available organic waste. Compared to other regions of the world, biogas technology has not been effectively promoted in Africa. This is because of several social and technical reasons. For instance, the technology needs a high level of skill and supervision for reliable operation and the daily labour input for its operation can be quite demanding.



4. Impact of Clean Cooking with Alternative Fuels and Stoves



4.1 Clean cooking and population health

Access to clean cooking fuels and technologies in the world from 2010–2019, was recorded to be about 1.0% per year. In Sub-Saharan Africa, the share of people with access to clean cooking stands at 17% as of 2020; however, the population growth in the region increased to around 940 million people in 2020. It should be noted that the use of inefficient, polluting fuels and technologies is a health risk and a major contributor to diseases and death, particularly for women and children in low- and middle-income countries. Research depicts that millions of people die every year as a result of household air pollution which is produced by cooking with inefficient stoves and conventional fuels. It is not surprising to note that the increased level of poverty in the Sub-Saharan region has led many households in rural or peri-urban areas to backslide into using charcoal, kerosene or fuel wood and these sources of cooking fuels are considered harmful to population health.

It is stated that cooking with clean cookstoves and fuels improves public health by reducing harmful emissions of particulate matter and black carbon in Sub-Saharan Africa. It is recorded that household air pollution causes up to 4.3 million deaths per year worldwide. In 2018, it was recorded that the health impact resulting from direct exposure to smoke from biomass cooking led to about 2.2–3.8 million excess deaths per year, which accounted for about 3.9%–6.4% of global mortality. This thus makes air pollution the largest environmental source of ill-health globally.

4.2 Clean cooking and the environment

Clean cooking solutions can help address the problems of deforestation and forest degradation. In addition, the utilisation of clean cooking solutions helps reduce

emissions of major climate forcing agents which include greenhouse gases (GHGs) and short-lived climate pollutants (SLCPs). Solid fuel cookstoves emit a variety of pollutants, and these pollutants have different consequences for climate change. Pollutants such as black carbon have strong adverse effects on the environment. Black carbon aerosol from solid fuel combustion interact with the Earth's radiation budget directly by absorbing solar radiation. Its ability to absorb visible and infrared radiation in addition to instantaneously increasing the albedo of the clouds, reduces the amount of sunlight reaching the surface thus absorbing solar radiation rather than reflection. In many SSA countries, there is the existing concern for the use of charcoal for cooking and its environmental impacts including deforestation. Instead, cooking with charcoal briquettes which are made from charred agricultural waste, have been shown to reduce deforestation.

4.3 Clean cooking and gender equality

In Sub-Saharan Africa, women generally play a major role in household cooking decision-making activities. Without access to cleaner cookstoves and fuels in SSA, women endure hardships. It is critical to provide women access to modern energy as a means of empowering women at household levels in advancing gender equality. Women are usually the first to suffer from the environmental degradation caused by heavy reliance on biomass and conventional fuels for cooking. Women found in the rural areas are particularly vulnerable to these environmental impacts. Research reveals that women and children in developing countries can spend up to 10 hours a week gathering fuel. In addition, 42% of households reported incidents of gender-based violence during firewood collection in Chad over a six-month period.

Women can play a key role in increasing awareness and generating demand for clean cooking solutions, partly as a result of their networks and community relationships. Also, the clean cooking value chain offers new pathways for

empowering women economically, providing opportunities for women entrepreneurs to contribute to a thriving global industry for clean cooking. Women can be economically empowered in the production of clean cookstoves. For instance, women can be employed as experts in the products they use regularly and are likely to further help generate awareness and demand among a wider cadre of consumers as stated above.

4.4 Factors that Influence the Use of Alternative Cooking Energy Sources

The factors that influence the use of alternative cooking energy sources can be categorised into 3As: Awareness, Affordability and Accessibility. This section will highlight the benefits associated with alternative cooking energy sources.

4.4.1	Awareness	Awareness refers to the degree of knowledge and perception of the adoption and use of clean fuels. Research has shown that low access to information on clean fuels and cooking stoves have impacted the utilisation of clean fuels by rural households in Sub-Saharan Africa. Awareness may be driven by targeted marketing campaigns to help expand the coverage of clean cooking and its benefits in SSA.
4.4.2	Affordability	Affordability of clean cooking fuels refers to the capacity of households to pay for these cooking fuels. It is a factor of variables such as income; financial autonomy among women to access clean cooking technologies; government policies on clean cooking fuels subsidies, etc.
4.4.3	Accessibility	Accessibility on the other hand, refers to variables which impact the ability of households to procure clean fuels and stoves when needed. It may consider certain circumstances such as: distance to rural clean fuels distribution centres; road connectivity from habitations to local distribution centres; accessibility to sources of clean fuels, etc.

5. Key Developments and Trends in Clean Cooking across SSA



Clean Cooking across SSA has developed over the years with the integration of new technologies across countries in SSA. Apart from these innovations, however, there have also been certain key developments which have resulted in newfound expectations for the growth of the sector. These developments are discussed hereunder:

5.1 Emergence of an Aspirational Lower/Middle class with Rising Incomes

This arises from the increase in urban population, as a result of SSA's two decades of rapid urban population growth; the expectation of the African population's discretionary income to grow 50% over the next decade to 130 million households. There is also growing evidence across multiple SSA markets of consumer willingness to pay for basic ICS.

5.2 Escalating Prices for Cooking Fuel

Due to inflation in prices and scarcity of cooking fuel resources, a large and growing share of SSA consumers (50%) already pay an expensive amount for their cooking fuels and have seen that they can benefit tangibly from adopting basic energy-saving cookstove alternatives. It is expected that with adequate consumer awareness, more customers will jump to clean cooking to save money.

5.3 Accelerating Innovation in Clean Cooking Technologies

There is accelerating technological innovation across the full spectrum of cooking technologies, including most notably the development of fan-gasifier biomass

cookstoves that combine high rates of fuel efficiency (up to 50%) and very low levels of particulate-matter emissions (90%+ reduction vis-à-vis traditional biomass stoves). Other notable developments are the increased use of scalable and centralized industrial production – international players, such as Philips [ACE], Envirofit, and BURN Manufacturing, have opened new Africa-based manufacturing facilities, and EcoZoom also plans to do so in the near future – along with improved capacity for regional semi-industrial players. All these factors hold the promise of improved clean and improved performance and higher product quality at lower cost.

5.4 Increasing Availability of Funding for Manufacturers and Distributors

There are a growing number of entrepreneurs across all segments of the clean fuel and Improved (biomass) Cookstove (ICS) value chain: over recent years, the number of Africa-based industrial and semi-industrial ICS manufacturers has grown from less than 10 firms to more than 40.

5.5 Emergence of New Distribution and Financing Models for Reaching The Poor

This is a trend that affects both supply and demand in SSA's clean cooking sector. There are new distribution and financial models for reaching the poor including carbon finance, microlending, lay-away and leasing schemes, and utility models for distributing renewable biomass pellet or ethanol fuels.

5.6 Positive Developments in the Enabling Environment for Clean Cooking Solutions

The enabling environment for clean cooking solutions includes institutional and policy initiatives governing the clean cooking sector. Policy initiatives in the clean cooking sector have evolved rapidly to comprise certain coordinating platforms and

advocacy initiatives that have improved sector transparency; increased donor-collaboration, cooperation between the governments and the private sector; and the continued mobilization of funds and raising of global awareness for clean and improved cooking solutions. These initiatives include the Global Alliance for Clean Cookstoves (GACC); the United Nations' (UN's) Sustainable Energy for All (SE4All); the World Bank's Africa Clean Cooking Energy Solutions (ACCES) initiative; new knowledge networks, such as HEDON; and specific technology and fuel champions with an Africa-wide mandate, such as the Global LPG Partnership, the Africa Biogas Partnership Programme (ABPP), and Project Gaia.

Steady growth has also been realized in funding for cooking initiatives and interventions in SSA, with the governments of Germany, the Netherlands, the United Kingdom, and the United States being the most active donors through a range of programs and funding vehicles. Among multilateral institutions, the World Bank is the primary funder of clean cooking initiatives via ACCES, the Biomass Energy Initiative for Africa (BEIA), the Energy Sector Management Assistance Program (ESMAP) multi-donor trust, and other leading operations with dedicated biomass energy and cookstove components. Providers of wholesale finance have also grown, with a recorded increasing number of investors carbon finance project developers over the years.

Apart from these, stove-testing centers have become key players in the SSA clean cooking ecosystem and are active in Ghana, Kenya, Nigeria, Senegal, South Africa, and Uganda, having significantly scaled up their stove-cooking capacity with the help of the GACC and other donors.

Finally, a growing number of research and advisory institutions are regularly contributing to Africa's cooking-sector knowledge development. The most important, aside from the GACC, are the World Bank; GiZ; United States Agency for International Development (USAID); NGOs; health researchers across several institutions globally, typically funded by the U.S. National Institutes of Health; and independent research organizations, most prominently the Stockholm Environment Institute (SEI).

6. Challenges to Maximised Access to Clean Cooking in SSA



6.1 Unwillingness to fully adopt new cooking solutions

The unwillingness to adopt new cooking solutions is as a result of different factors. Firstly, those who are more prone to the effect of traditional means of cooking are women and children, whereas, most times; given the cultural history and evolution, they do not have the economic power to impose such decision on the men who have the economic power and are less willing to do so. Accordingly, research carried out in India and Ethiopia in households headed by female revealed a willingness to adopt improved cooking solutions. Furthermore, socio-demographics across several family sizes in several nations show varying degree of result in terms of willingness to use improved cooking stove based on the size and make-up of the family. In some jurisdictions, larger families consisting of a greater percentage of adults prefer to use traditional sources of fuel because larger number of adults were seen as abundant labour available for fuel collection necessary traditional stoves, thus reducing the intention to adopt improved cooking stove.

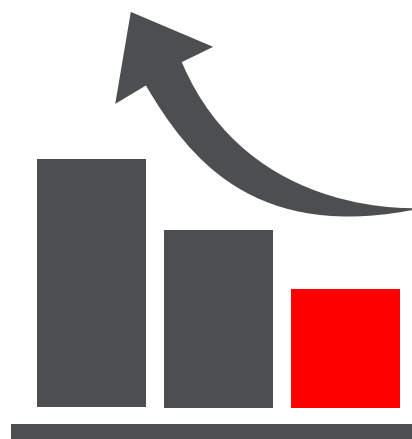
6.2 Consumer's limited ability to pay for higher cost, clean, and improved cooking stoves and fuels

An analysis of existing research reveals that higher income households adopt sustainable cooking systems more frequently than lower-income households and that household income represents a major driver for the adoption of improved cooking stoves. This is because clean cooking technologies are relatively high when compared with the purchasing power of the individuals in the communities where clean cooking technology is most lacking. Accordingly, research conducted in a rural community in Tanzania revealed a 17% adoption of clean cooking technology

triggered by an increase in purchase price. It was also discovered that the availability of the option to purchase in credit did not improve the situation. Besides the cost of the initial purchase of an improved cooking stove, there is also a recurring cost of purchasing the fuel (either electricity or natural gas) required to power the stoves. When compared with the woods obtained at no cost and lit by a matchstick that cost considerably less than a dollar, the willingness to utilise clean cooking technologies is further weakened.

6.3 Low awareness of the benefits of improved cooking technologies

The awareness of the risks associated with traditional cooking stoves have been found to influence the level of adoption of sustainable cooking systems. Studies conducted in Malawi revealed that awareness of the negative effects of deforestation and forest degradation of biomass reliance increased the probability of ICS adoption among households, while studies conducted in India indicate low awareness and knowledge among households of the health risks associated with traditional cookstoves, and suggest this act as a barrier to the adoption of liquified petroleum gas. In Particular, a knowledge of the health risk and benefits greatly influences the decision to adopt clean cooking solutions. Conversely, where there is a lack of such knowledge, there is a tendency to put more weight to the cost and other factors against the adoption of improved cooking stove.



7. Recommendations

7.1 Consumer education and awareness building

Education and awareness as discussed above is a huge factor in the adoption of improved cooking solutions. Education in this sense has been defined as a process including several educational activities aimed at improving customers' ability to better purchase, use and appreciate goods and services and protect their rights and interest. Mechanisms that foster such awareness, knowledge sharing and education on the health benefits and otherwise of improved cooking stoves should be spearheaded in low income and rural communities. It has been suggested that policy makers can provide customer education programs to facilitate learning, adoption and sustained usage of improved cooking stoves. Methods such as involving opinion leaders or creating figures such as clean cooking ambassadors by locating a clean cooking enthusiast, etc.

7.2 Innovative financing techniques for the poor

Clean cooking is a specifically a challenge to low-income countries and communities. As such, innovative ways of financing improved cooking stove would need to be adopted to encourage a high level of its adoption in these areas. It has been submitted that selling improved cooking stoves to those at the bottom of the pyramid implies high logistics and marketing costs, but equally creates the opportunity to reach many potential customers in a context where competition is usually less fierce than in mature markets. Therefore, high volume of sales must be reached to reduce cost. In this vein, the suggestion of offering basic solutions at affordable prices to specific market segments with low purchasing power and products with higher prices to high income households has been proffered alongside the option of selling a bundle of products and services, rather than single goods, thus,

creating customer-specific or industry-specific solutions that are more competitive than generally available standalone products.

7.3 Marketing solutions that build end-user trust

Manufacturers and retailers of clean cooking stoves can also play a key role in the promotion of clean cooking solutions. One means through which manufacturers can promote clean cooking solution is through collaboration with retailers to organise trials, develop pre-sale consultancies, and offer after-sale assistance to support customers throughout all phases of the purchasing and consumption process.

7.4 Clean cooking sector funding

Funds like the Clean Cooking Fund by the World Bank in collaboration with Energy Sector Management Assistance Program can provide support to low-income countries and communities in the adoption of clean cooking solutions. This fund provided technical advice, and country grants to World Bank operational teams. The program saw the access to clean cooking solutions to about 20million people in Bangladesh, China, Egypt, Indonesia, Mongolia, Senegal, and Uganda between 2015–2020. Increased creation of clean cooking sector funds on a national scale can upscale access to improved cooking solutions across SSA.

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