







Executive summary

SalvaTerra and its Ugandan partner, the Centre for Research in Energy and Energy Conservation (CREEC) have been hired by PUR Projet to conduct a feasibility study for the dissemination of improved cookstoves (ICSs) among coffee producers part of the Rwenzori Farmers' Co-operative Union in Kasese / Fort Portal area, Uganda.

The objective of the study is to provide recommendations to PUR Projet, in order to disseminate the promising ICSs and to coordinate this activity with the agroforestry ones. After a field and desk study to understand the baseline situation on ICS and fuels at national and local level, three promising ICSs have been identified in order to be tested in the next phase of the study. The field and desk study was carried out by cross-referencing the analysis of the ICSs market at the national and regional level, the household survey results that provide information on cooking habits, fuel and stoves use in the project area, as well as the assessment of available ICSs at the local level.

Although promoted for decades in Uganda through humanitarian projects or, more recently, carbon finance, ICSs are still relatively little used, especially in rural areas. The Ugandan market has dozens of different models of ICSs, of varying quality, imported or locally produced. Most of them have been designed for urban populations: small, light, portable and charcoal-fired. ICSs intended for use by rural populations generally run on firewood and are built with locally available materials (clay, cement, organic matter). The best-known models are the mud "Rocket Stoves", such as the Lorena, developed and distributed by GIZ since 2004 in Uganda, or the "Six brick Rocket Stove", promoted by Aid Africa.

A multitude of entrepreneurs are active throughout the territory, particularly around the big cities where the market is the most developed. While most producers have a low production capacity, a few larger groups stand out, such as Ugastove limited or the production units set up by the International Lifeline Fund, which produce several thousand pieces per month. However, the distribution networks for these ICSs are limited, not allowing for the availability of ICSs in the most remote and hard-to-reach areas of the country. In the project area, especially around Kasese, some initiatives have been implemented at household and institutional level (institutional stoves in schools). The technology of ICSs is therefore known to the population, but none of these projects directly involves the villages benefiting from PUR Project activities.

At the local market level, two companies are currently active: based in Kasese, they sell mud ICSs to nearby communities. The stoves offered are of good quality and well adapted to the needs of the local population and run on firewood. The "Mubende rural wood stove", sold by the oldest company, is a tried-and-tested design adapted from the one distributed by ILF in rural areas. The second model, proposed by a young company (created in 2019), is also a mud cook stove fuelled with firewood, but with a more recent design and a chimney. Both companies source the raw material locally and manufacture on site. It should also be noted that small charcoal ICSs are on sale in hardware shops in Kasese, but sales are reported as anecdotal by retailers, as most users rely on firewood.

In the project area, households use a wide variety of utensils and cooking methods. Therefore, the stove selected should allow both high intensity heat to boil water and fry and low intensity heat to slow cook food. The ability to cook several dishes at the same time was also highlighted during the interviews, in order to reduce the time spent cooking per day (on average 5.5 hours). Households still rely on traditional stoves: three stone open fire or traditional mud stoves are the two commonly used cooking methods. Very few ICSs are used. Although it is admitted that these stoves are fuel consuming, emit a lot of smoke and increase the risk of accidents, users are unable to access the ICSs technology on the local market. This is a particularly important issue in a context of wood scarcity. Women and girls spend an average of 9 hours a week collecting firewood, and often encounter difficulties: conflicts with landowners, risk of accidents and injuries, etc.

Respondents have a positive attitude towards the ICSs, although most of them have never tried it or seen it working. The two most important criteria when considering the acquisition of an ICS are smoke reduction and lower fuel consumption. Indeed, most respondents report serious health problems for children and women due to smoke exposure. The increase in income, the scarcity of wood and the inconveniences due to the use of traditional stoves encourage several families to consider acquiring an ICS in the near future.

Favouring the criteria of smoke reduction, fuel savings, adaptability of cooking methods and the local manufacture of stoves, the following three technologies are proposed for testing:

- The ILF rural wood stove: it is two clay-fired liners built *in situ* for 2 pots, with an ash chamber which also act as air inlet, with two firewood inlets, each for one liner, without chimney. It was promoted by International Lifeline Fund and then Humankind;
- The smokeless wood stove: built *in situ*, it has only one firewood inlet that power two cooking fires and a chimney to evacuate the smoke out of the kitchen. It seems promising, but there are few references attesting to the effectiveness of this technology;

• The six bricks shielded wood stove: portable, composed of six burnt bricks enclosed in a metal cover, this stove can accommodate only one saucepan at a time. Numerous references attest to its effectiveness, has it has been promoted by Aid Africa for years in rural areas.

After validating this short-list and to move towards the next step, e.g. in situ trials, PUR projet should as soon as possible finance the purchase (3rd ICS: 75,000 UGX/u or 17,2 \in /u) or in situ building (1st ICS: 300,000 UGX/u or 69 \in /u and 2nd ICS: 250,000 UGX/u or 57,5 \in /u) of 7 ICSs of each type (total budget: 4,375,000 UGX or 1,006 \in), so that the 6-week in situ trials can start in the 21 pilot households. A slight upward re-evaluation of the budget may take place, depending on the associated transport costs.

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Acronyms

AEST	Appropriate Energy Saving Technology
ARDSO	African Rural Development & Sustainable Organisation
ART	Agency for Rural Transformation
BMZ	Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung (German Ministry for cooperation)
CREEC	Centre for Research in Energy and Energy Conservation
FAO	Food and Agriculture Organization of United Nations
GACC	Global Alliance for Clean Cookstoves
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German technical cooperation)
нн	Household
ICSEA	Improved Cook Stoves for East Africa limited
ICS	Improved Cookstove
ILF	International Lifeline Fund
JEEP	Joint Energy and Environment Projects
Ltd	Limited
MIT	Massachusetts Institute of Technology
NGO	Non-Governmental Organization
NNF	New Nature Foundation
NORAD	Norwegian Agency for Development Cooperation
PPI	Poverty Probability Index
PPP	Purchasing Power Parity
TSOF	Three Stone Open Fire
UGX	Ugandan Shilling
UK	United Kingdom
UNACC	Uganda National Alliance on Clean Cooking
UNCDF	United Nations Capital Development Fund
UNDP	United Nation Development Programme
USAID	United States Agency for International Development
USD	United States Dollar
WB	World Bank
WWF	World Wildlife Fund

1. Introduction and methodology

1.1. Context and objectives

PUR Projet is a French Non-Governmental Organisation specialized in the development of forestry, agroforestry and agro-ecological projects. In Uganda, PUR Projet is currently supporting coffee producers, part of the Rwenzori Farmers' Co-operative Union - Kasese / Fort Portal area, mostly promoting agroforestry implementation, the adoption of arabica coffee good agricultural practices, and the promotion of income-generating activities. It also aims to disseminate Improved Cookstoves (ICSs) among the coffee farmers' households (HHs). Its objective is to install 300 ICSs in 2021.

SalvaTerra and its Ugandan partner, the Centre for Research in Energy and Energy Conservation (CREEC), have been hired to conduct a feasibility study for the dissemination of ICSs among these coffee producers' HHs.

The steps of the feasibility study can be summarised as follows:

- **Preparation:** To understand the baseline situation on wood fuels, cooking devices, and cooking habits, at the national and local levels, in order to identify three promising ICSs to be tested;
- Fieldwork: To propose and test three different ICSs for local HHs and assess their performance and the satisfaction of the users;
- **Recommendations:** To provide recommendations to PUR Projet, in order to disseminate the promising ICSs and to coordinate this activity with the agroforestry ones.

This report presents the results of the first step, the market assessment of ICSs at the national and local levels, as well as a summary of the consumer survey on fuels, cooking devices, and cooking habits. The cross-analysis of these studies leads to the recommendation of three ICSs to be tested.

1.2. Methodology

Literature review: A literature survey was conducted that mainly focused on the ICS sector in Uganda and in the project area (Western Uganda, Kasese District). A long list of ICSs promoted in Uganda has been established, then narrowed down by targeting ICSs successfully disseminated, preferably in rural areas.

Local market survey: ICS producers operating in the project area (including Kasese District) were subject to semidirective interviews in order to understand their business structure and the nature of their products, the target market, and to estimate their production volumes.

Baseline survey: The HH surveys were conducted in 25 HHs in Kasese District, prioritizing areas where PUR Projet has been working for several years. Sampled villages, shown in the table 1 were selected using two criteria: the accessibility of the villages and the number of beneficiaries participating in project activities in 2019. The surveys were administered in HHs selected randomly within the villages. The questionnaire is inserted in Annex 1, and its detailed results are inserted in Annex 2.

S/N	Village	Primary cooperative	Surveyed HH
1	Kikokera	Ibanda	5
2	Kyarugomoka	Mubuku	3
3	Kiboota	Mubuku	5
4	Karujumba	Balimi	4
5	Kibisire	Balimi	4
6	Kanyabusogho	Balimi	4

Figure 1 : List of villages targeted for the HH survey (Authors, 2020)

The survey tool was uploaded on tablet-based Kobo toolbox survey platform for an easy and fast data collection process.

2. Overview of past initiatives: national level

The analysis under this Part 2 are mostly based on the own experience and knowledge of the national expert, Mr. Ronald KAWEESA, as well as the following reports: ADKINS et al., 2010¹; ANDERSON, 2017²; ESMAP, 2015³; GACC,

¹ ADKINS et al., 2010. Field testing and survey evaluation of household biomass cookstoves in rural sub-Saharan Africa. 13p.

² ANDERSON, 2017. Classification of Stove Technologies and Fuels. 4p.

³ ESMAP, 2015. The state of the global clean and improved cooking sector, 129p.

2012⁴; GIZ, 2011⁵; Gold Standard, 2017⁶; GTZ, 2008⁷; HOIGT, 2019⁸; UNIDO, 2015⁹; NNF, 2019¹⁰; MOSES and MCCARTY, 2019¹¹; SNV, 2014¹².

2.1. Available ICS on the market for rural users

Four types of traditional cookstoves are currently in use in Uganda:

Three Stones Open Fire (TSOF)	Mud Stove	Traditional Clay Charcoal Stove	Metallic Charcoal Stove
Users: Rural	Users: Urban/rural	Users: Peri-urban/rural	Users: Urban

Figure 2: Four types of traditional cookstoves on use in Uganda (Authors, 2020)

ICSs have been promoted and distributed by government actors, NGOs, international agencies and donors for many years, with mixed success, particularly in rural areas where a large number of HHs still use traditional cookstoves. Small cookstove producers and distributors have also been trained to meet increasing demand and needs for ICSs.

A variety of firewood and charcoal cookstoves exist on the market for both urban and rural consumers. Uganda has more than 50 ICSs producers operating mostly in the central region Districts of Kampala and Wakiso. The available ICSs are of varying qualities, most of them showing small functional improvements over baseline technologies and are typically made from local materials by local artisans or self-built. Others use the rocket principles and higher quality materials to improve efficiency of combustion of fuel and less emissions (UNIDO, 2015).

A majority of producers are located in urban or peri-urban areas, where the market is developed. Therefore, adoption is higher among urban HHs, who have also been the target of dissemination campaigns over the last decades (GACC, 2013). The majority of businesses produce on a small scale, that is, no more than 1,000 units per month. Ugastove and International Lifeline Fund (ILF) are among the largest producers, with a global production of 9,000 units per month for Ugastove¹³.

The following stoves have been selected in the long list of ICSs to be assessed, regarding their target users (peri-urban and rural areas) and type of fuel used (biomass stoves).

13 https://ugastove.net/

⁴ Global Alliance for Clean Cookstoves, 2013. Uganda ICS Market Assessment –Sector mapping, 70p.

⁵ GIZ, 2011. Two-pot Rocket Lorena with Air By-pass: Uganda.2p.

⁶ Gold Standard, 2017. Stakeholder Consultation Report, Mumende Cookstoves. 93p.

⁷ GTZ, 2008. Construction Manual for Household Rocket stoves. 39p.

⁸ HOIGT, 2019. Adoption and sustained use of energy efficient stoves in rural Uganda. 64p.

⁹ UNIDO, 2015. Baseline report of clean cooking fuels in the Eats African community. 187p.

¹⁰ New Nature Foundation, 2019. Annual report - Kibale wood stove project. 15p

¹¹ MOSES and MCCARTY, 2019. What makes a cookstove usable? Trials of a usability testing protocol in Uganda, Guatemala, and the United States. 16p.

¹² SNV, 2014. Grassroots solutions for scaling up improved cookstove access in Uganda. 60p.



Figure 3:ICSs available on the Ugandan market (Authors, 2020)

NB: Top-Lit UpDraft (TLUD) also known as Advanced ICSs is a wood burning stove which has a high thermal efficiency due to the combustion of gases from pyrolysis, thus reducing indoor air pollution.

#	Stove type	Manufacturer	Cost range*	Average lifespan	Key features	Area of dissemination	Distribution channels	Projects/ organisations	Introducti on date
1	Shielded rocket stove	Local manufacturers (GIZ-trained)	3,700 – 75,000 UGX 1 – 17 €	2 years	<u>Materials:</u> Clay stove <u>Fuel:</u> Wood	Northern Uganda	Organizations	GIZ Agency for Rural Transformation (ART) in the "Promotion of Efficient Energy Saving Technology (Cooking stoves) among HHs living in the Kachung Central Forest Reserve" project.	2004
2	Rocket Lorena (with/withou t chimney) & derivated versions	Local manufacturers (GIZ-trained)	3,700 – 75,000 UGX 1 – 17 €	2 years	<u>Mat:</u> clay, organic matter <u>Fuel:</u> Wood, crop residues	Country wide	Door-to-door, Micro- entrepreneurs Organizations	- USAID - GIZ (EnDev, various)	90's (USAID) 2004 (GIZ)
3	Six bricks Rocket stove	Local manufacturers	10,000 – 75,000 UGX 2 – 17 €	-	<u>Mat:</u> Burnt bricks <u>Fuel:</u> wood <u>Cert:</u> CREEC, 2019	Northern Uganda (Gulu district) Refugee camps	Distributed by Aid Africa	 Aid Africa African Rural Development & Sustainable Organisation (ARDSO) 	2006
4	Rural Wood stove (enclosed or portable)	 International Lifeline Fund (ILF) Mubende stoves Ltd. Local manufacturers (various) 	15,000 – 40,000 UGX 3-9 €	-	<u>Mat:</u> clay/metal liner (opt) <u>Fuel:</u> Wood, crop residues, dung	Central Uganda (Mubende district, Kasambya)	ICSEA Ltd.	- International Lifeline Fund (ILF) - Humankind	2012
5	Imported wood stove	 UpEnergy Group (from Kenya) Biolite (Home stoves, from China) BURN Various 	150,000- 300,000 UGX 35 - 60 €	2-5 years	<u>Mat:</u> metal <u>Fuel:</u> Wood, crop residues, dung	Kampala, urban areas	Retailer sales Organized groups, Door to door sales, Corporate sales, Trade	- Biolite "Biolite HomeStove Programme" -	/

_										
								fairs and exhibitions		
	6	Dualstove (wood&char coal)	Ugastove Ltd.	22,000 UGX 5€	-	<u>Mat:</u> clay/metal liner (opt) <u>Fuel:</u> wood or charcoal	Kampala, Northern Uganda (Lira, Gulu & Arua districts)	Retailer sales Organized groups, Door to door sales, Corporate sales, Trade fairs and exhibitions	/	/
	7	Local Charcoal stove	 Ugastove Ltd. Mubende stoves Ltd. Appropriate Energy Saving Technology Limited (AEST Ltd.) as "Maaka stove" GreenBio energy ILF (Okelo Kuc) Various 	18,000 - 55,000 UGX 4 – 13 €	-	<u>Mat:</u> clay liner, metal shell <u>Fuel:</u> charcoal, briquettes	Kampala, Northern Uganda (Ugastove) Eastern Uganda (AEST) Central Uganda (Mubende district, Kasambya) (Mubende stoves)	micro- entrepreneurs network, door- to-door ICSEA Itd (Mubende stoves)	 AEST: The Charcoal Project and MIT's Development Lab (D-Lab) ILF 	2013
	8	Imported charcoal stoves	 Envirofit (from Kenya) UpEnergy Group Inc. Various 	35,000- 175,000 UGX 8-40 €	1-10 years	Mat: metal, clay liner Fuel: charcoal, briquettes	Kampala, urban areas	Retailer sales Organized groups, Door to door sales, Corporate sales, Trade fairs and exhibitions	1	1
	9	Awamu Troika/Mwot o stove	Awamu Ltd.	50000-300000 UGX 11-70 €	-	Mat: metal Fuel: wood Cert: CREEC	Kampala, Central- Eastern Uganda	Vendors network	'Promoting Improved TopLit Up-Draft Cookstoves in Uganda' project by the Biomass Initiative for Africa (BEIA), funded by WB	2011

*costs cover material costs only

Figure 4 : Long list of ICSs considered in the study (Authors, 2020)

2.2. Recent and ongoing initiatives in the Cookstove Sector in Uganda

2.2.1. ICS initiatives at national level

At the national level, there are a number of existing and planned initiatives to stimulate the cookstove sector in Uganda.

On-going	"Promotion of Renewable Energy and Energy Efficiency Programme" (PREEP) ¹⁴ , implemented by <i>Deutsche Gesellschaft für Internationale Zusammenarbeit</i> (GIZ) with <i>Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung</i> (BMZ) and The Energizing Development Partnership Programme (EnDev) funding (actual project: 2019-2023): distribution of HH mud rocket stoves (ICS n°1/2 in figure 4), mainly in rural areas. The program also supports establishment of rural-based commercial stove producers and suppliers.
	" Biolite HomeStove Programme " (UNFCCC, 2018) ¹⁵ , implemented by Impact Carbon, funded by GACC Spark Fund (2013-2020). So far, this Programme distributed approximately 2,500 domestic fuel-efficient and fan-assisted wood cook stoves to Ugandan HHs (ICS n°5 in figure 4).
	"The Green Schools NAMA Project ^{"16} (2017-2027) The Nationally Appropriate Mitigation Actions (NAMA) project is to provide sustainable energy solutions to boarding schools (18,000 primary schools, almost 3,000 secondary schools, and about 50 tertiary schools) in the mainly off-grid rural areas with solar energy, efficient institutional wood cook stoves, and biogas technologies.
	" Improved Cookstoves in East Africa " (UNFCCC, 2020) ¹⁷ (ICSEA), implemented by the Uganda Carbon Bureau, and financed via carbon credits and multi-donor seed funding (2012-2019, reconducted): distributes shielded wood stove throughout Uganda by ICSEA limited (ICS n°4 in figure 4).
Past	" Uganda Wood Cookstoves " ¹⁸ Nature Bank, (2011-2018): started in Kampala, this project aimed at replacing conventional stoves by wood rocket stoves using carbon offset funds (ICS n°4 in figure 4).
	"The Energizing Development Partnership Programme " (EnDev) is coordinated by GIZ with a multidonors funding (Germany, Sweden, Switzerland, United Kingdom, Norway, the Netherlands) (2009-2019). It gives permanent access to modern energy technologies and energy services to HH, social institutions, etc. The projects take place in 24 countries in Africa, Latin America and Asia. In Uganda, it provided Lorena-type ICSs (ICS n°2 in figure 4) for 550,000 people in collaboration with NGOs and private partners.
	"Clean Cooking Sector Support program" (Ministry of foreign affairs of Netherlands, 2019) ¹⁹ Uganda National Alliance on Clean Cooking (UNACC), Netherlands Enterprise Agency (2016-2018). The objective was to strengthen coordination and innovation in the clean cooking sectors of Bangladesh, Uganda, Kenya, Ethiopia and Ghana through harmonised support to the clean cooking sector organisations in these countries.
	"The Green Charcoal Project and Greening the Charcoal sector " (UNDP, 2014) ²⁰ (2011-2014 /2014-2018) by Global Environmental Fund through the United Nation Development Programme (UNDP) and co-financed by the Food and Agriculture Organization of United Nations (FAO), United Nations Capital Development Fund (UNCDF), GIZ and the Government of Uganda. The main goal

¹⁴ PREEEP GIZ, 2012. Promotion of modern biomass energy technology – Factsheet. 2p.

¹⁵ UNFCCC, 2018. PoA design document form: Biolite improved cookstoves programme. 63p.

¹⁶ <u>http://www.nama-database.org/index.php/Green Schools in Uganda</u>

¹⁷ UNFCCC, 2020. Component project activity design document form: Mubende stoves Uganda. 67p.

¹⁸ <u>https://www.naturebank.com/projects/uganda-wood-cookstoves/</u>

¹⁹ Ministry of foreign affairs of Netherlands, 2019. End of program report Clean Cooking Sector Support, 43p.

²⁰ UNDP, 2014. The Green Charcoal Project - Addressing Barriers to Adoption of Improved Charcoal Production Technologies and Sustainable Land Management Practices through an Integrated Approach. 12p.

of the project is to develop and promote improved charcoal production technologies and sustainable
land management practices that integrate all elements of the value chain from cutting down trees
to the end user's cook stove.

Figure 5 : Existing and past ICSs initiatives in Uganda (Authors, 2020)

2.2.2. ICS initiatives at regional/district level

At the regional / district level, there are a few programs and initiatives for ICSs' promotion:

Since 2006 (on-going)	"Kibale fuel wood project " by New Nature Foundation (NNF, 2019) ²¹ / In Kibale town, located between Kasese and Fort Portal. 2,610 stoves made from locally available materials like mud, bricks and dung have been installed since inception, with 399 stoves in 2019 alone. The Project's target is to provide cookstoves to 57,600 beneficiaries around Kibale (rural area). The design of these stoves is adapted from classical "rocket stoves", with each stove having one or two "burners", depending on a family's requirements (derivated from ICS N°2 in figure 4).
2017-2020	"Increasing access to sustainable and renewable energy alternatives in the Albertine Graben" ²² Implemented by the World Wildlife Fund Uganda (WWF UCO) / funded by Norwegian Agency for Development Cooperation (NORAD): 27,774 households (22,320 and 5,454 during 2012/3 and 2013/4 respectively) and 20 secondary schools have been provided solar stoves and ICSs over the last two years.
2013	Joint Energy and Environment Projects ²³ (JEEP), within BEAI projects: Kasese is the pilot region for dissemination of Lorena Energy Saving Stove (ICS N°2 in figure 4).
2012	Building of Institutional cook stoves in Kasese ²⁴ in two schools, UNDP funding / implementation by the Friends of Nature NGO.

Figure 6 : Existing and past ICSs' initiatives in Kasese area (Authors, 2020)

NB: The ICSs presented in 2.1 that were not mentioned in 2.2.1 and 2.2.2 are still available on the market but are no longer the subject of particular programs or initiatives (distributed by the private sector only).

2.2.3. Lessons learned

Of the many initiatives on ICSs, there are a few important points to highlight, both technically and economically, and strategies for the acceptance of ICSs.

First, a majority of projects recall the importance of providing the right material to the right population: understanding local conditions and needs local context, i.e. home architecture styles, seasonal patterns, energy supply chains, cooking practices, and other related energy needs, etc.

SHANKAR et al, 2020²⁵ points out the importance to understand the customer experience over time, as "Uptake of new cooking technologies and fuels requires adaptation to new cooking practices. Technologies that fail to maximize fuel and device durability, reparability and replaceability in local markets at affordable rates over time will likely not be sustained. Facilitating long term change includes anticipating and mitigating resistance to some household or community level behaviour changes needed to meet total energy needs". From SNV analysis (SNV, 2014)²⁶, access to post-

²¹ New Nature Foundation, 2019. Annual report - Kibale wood stove project. 15p.

²² NORAD, 2017. Increasing access to sustainable and renewable energy alternatives in the Albertine Graben Project. 28p.

²³ https://jeepfolkecenter.org

²⁴ <u>https://undp-climate.exposure.co</u>

²⁵ SHANKAR et al., 2020. Everybody stacks: Lessons from household energy case studies to inform design principles for clean energy transitions. 9p.

²⁶ SNV, 2014. Grassroots solutions for scaling up improved cookstove access in Uganda. 60p.

acquisition support, such as a repairs warranty and follow-up with users, must not be neglected, therefore advising the promotion of ICSs available locally or with a spare parts service on the local market.

PREEEP projects also encourages the consideration of social and technical aspects in the promotion of ICSs: good quality locally available materials are to be favoured as they play a major role in ensuring thermal efficiency of a stove. Adding that the stove needs to be supplied with user guides and a proper training from manufacturers on how to effectively use the stove.

EnDev projects advocate an approach to support producers of ICSs in establishing a sustainable market: to ensure financial gains for dealers, to have an efficient, affordable and easily available product and to establish a marketing system driven by income generation. The capacity building of local artisans is a key part of these projects as lack of resources, both financial and human (marketing skills and network, technical expertise) is a frequently cited as a barrier to the success of ICSs' projects.

3. ICS local market

There are a few manufacturers in the District:

• The first ICS manufacture has been registered under the name "Agency for Rural and Urban Development" since August 2006, and is based in a permanent structure in downtown Kasese

It is a small company that employs up to five people (two women), all trained within the company/on the job. Women are in charge of community mobilization campaigns and users' trainings.

They make only one type of firewood ICS, called "ILF rural wood stove" (corresponding to ICS n°4 in figure 4, cf. figure 7 section 5.1) sold for 300,000 UGX (69 euros). The team is able to produce up to 50 units a month and does not work with other retailers. In 2019, the company sold 240 stoves in the immediate community.

The ICS they provide is made from clay, cement, lime, mica and anthill soils. Most raw materials are locally sourced (within 2 km): clay is extracted from nearby swamps and other materials are available in hardware shops. Mica has to be purchased in Kampala. Although most raw materials can be found locally, the respondent indicated that sourcing material is often a problem, due to costs, availability of materials and transportation.

Initially funded partly through an NGO grant, the company is facing difficulties in getting loans, because of the administrative workload and high interest rates. Monthly expenditures amount from 500,000 UGX to 1 million UGX, and monthly income ranges from 1 to 3 million UGX, depending on sales.

The manager said the greatest needs of the company were training for the staff in marketing and accounting/, as well as on stove design/fabrication.

• The second ICS manufacture implanted in Kasese town started producing in October 2019, registered as "Lawsebe Energy Company Limited" with the authorities.

The young company currently employs two people, both of whom are men. They were trained by a German mechanical engineer under his initiative called "Energy Saving Stoves EastAfrica". These two entrepreneurs have named the stove « Energy saving smoke free stove », derivated from the fixed Lorena Rocket stove (corresponding to ICS n°2 in figure 4, cf. figure 8 section 5.2).

The technicians have been trained by a technical institute. So far, the company lacks proper infrastructure and qualified personnel.

The stove they produce is a firewood improved stove with a chimney, promoted in Kasese and Fort Portal. It is sold for 250,000 UGX (57 euros) within the district boundaries. Since the beginning of the year, around 80 stoves have been sold.

It is made of clay, cement, lime and fired bricks, all from local hardware shops of brick manufacturers. Clay is also collected from nearby swamps (1 km distance). The team is able to produce up to 20 units a month.

One of the major marketing difficulties lies with transportation costs, which are very high, especially when traversing in the hilly areas to market the stoves.

In the future, the company is willing to employ more technicians so that they can increase production and improve product marketing. They are willing to train local populations to disseminate this stove design, which is very appreciated by the community (according to the manufacturer).

When asked about the market for ICS, both respondents mentioned that there is high competition with traditional mud stoves, which are cheaper and easily available in communities. They also highlighted poor incomes and reluctance to change as reasons that make selling ICS difficult. In both cases, transportation costs have been mentioned as the most

important weakness for the business, and respondents highlighted the lack of awareness among the population about the benefits of using ICSs.

Apart from that, they believe that the market is important, especially since firewood in becoming increasingly scarce due to deforestation.

During the survey exercise, it was noted that there are no ICSs out-lets in the villages, apart from two above mentioned manufacturers. Therefore, the village communities do not have access to clean cooking devices and rely solely on traditional cooking methods. In Kasese town, a few improved charcoal stoves (5-10 units) are sold at hardware shops, to meet the needs of urban HHs using charcoal to cook. None of these shops sell improved firewood cook stoves, which are preferred by rural HHs. However, these products are not commonly sold and it is seen by retailers as a small-side business.

4. Consumers' habits

4.1. Respondents profiles

The results presented below are mainly based on the questionnaire administered to 25 HHs part of the Kasese Coffee Producers' Cooperative.

It is worth noting a Poverty Probability Index (PPI)²⁷ analysis has been included in the questionnaire to determine the poverty likelihoods and to extrapolate on the willingness to pay of these HHs, regarding ICSs (in case these are partly subsidised).

100% of respondents were women, aged between 21 to 94 years old, either directly involved in cooking activities or making decisions on acquiring HH fuels and cooking technologies. HH size varies from 2 to 13 members, with an average size of 7 persons per HH. 8% of the interviewed HHs live under the national poverty line of Uganda (based on Uganda's 2012/13 National Household Survey, corresponding to 1,137 UGX/day), and 69% of HH live below the \$2,50/day poverty line (2005 PPP line).

4.2. Cooking practices

The majority of HHs surveyed (92%) were found to cook in separate enclosed and sheltered kitchens both in the rainy and dry seasons. Only 4% have an indoor poorly ventilated kitchen or outdoor non-sheltered kitchen. All respondents declared that they always cook in the same area (outdoor sheltered kitchens), no matter the season or the time of day.

Respondents use a wide variety of pans, both in term of diameter (from 6 cm to 46 cm) and material (clay or metal). Most of the pans used have a flat bottom, although traditional pans (for example, those used to cook beans) have a curved bottom. In spite of this great diversity, the most commonly used saucepan is made of metal and measures between 25 and 30 cm in diameter.

The large majority of respondents (96%) use their stove/TSOF to boil water, stir fry, slow cook, and roast food. 50% of the respondents also use their stove to smoke fish. However, this operation is common only in communities that live nearby the river, and tends to be less and less used because of fish scarcity (according to resp.).

The analysis of the most prepared dishes tells us about the nature of the cooking operations: Matooke (plantains), beans, cassava & cassava flour are the main dishes that are cooked by interviewed HHs. Most of these dishes are simmered or cooked for a long time, thus requiring a constant heat.

All the respondents cook at least two times a day (lunch and dinner), and a majority (64%) cooks three times a day. Most HH own only one stove or TSOF and cook from only one pot at a time. However, most respondents are willing to cook simultaneously if given the chance, especially for dinner and lunch. Indeed, these are the meals that take a longest time to prepare: between two and three hours each. Women spend an average of 5,5 hours cooking per day.

- → ICS requirements:
- Ability to generate both high intensity heat to boil water and fry and low intensity heat to slow cook;
- Adaptability to a variety of ustensils used;
- Possible simultaneous cooking (to accommodate at least two pots).

4.3. Stove usage

²⁷ <u>https://www.povertyindex.org/</u>

92% of the respondents use only one stove: 50% TSOF and 50% traditional mud stove. Most mud stoves were homemade stoves, with one or two cooking spots, recently installed/repaired (50% less than a year) and in good conditions.

When asked what were the main advantages and disadvantages of cooking with TSOF, a majority of respondents agreed upon the dangerousness of the stove in terms of smoke generated, risk of injury and high fuel consumption.

Although traditional mud stoves are seen as more practical than TSOF (they are faster to cook upon and able to cook several dishes at a time), users are more divided regarding smoke emissions or fuel economy, and still report risks of injury (cf. Annex 2. Household survey Data & graphs)

It is important to point out that traditional stoves are used not only for cooking but also for HH heating or as a light source for family gatherings.

A majority of respondents (19 resp.) is willing to change their actual stove/TSOF for an improved one as soon as possible, but lack of skills or local manufacturers in the area prevents them from doing so.

Only two respondents use a secondary stove, an improved charcoal stove (bought in the city) and a Mubende rural wood stove (donated by an NGO) respectively. Users appreciate the fuel economy, the fast cooking time and the ease of ignition. However, they note that clear understanding of its operations is essential. They also deplore the fact that these technologies are not readily available in local markets.

According to the respondents, the standard of living in the zone is on the rise (improved income from cash crops, such as coffee), allowing several families to consider the acquisition of an ICS.

- → ICS requirements:
- Ability to save fuel compared to traditional stoves
- Less smoke emissions compared to traditional stoves
- Equal or faster cooking time
- Safer than traditional stoves

4.4. Fuel usage

All HH depend on firewood. Among all the HHs surveyed, only one respondent uses a mixture of charcoal and firewood. It is also important to note that 64% of the HHs collect their main cooking fuel while 24% both buy and collect fuel. The rest (12%) buy firewood from a local market.

This indicates that the ICS to be promoted in the area must run on wood, or combination of both wood and charcoal.

Firewood that is collected mostly comes from an area close to the main house: 70% of the collections come from less than 1 km, the maximum distance indicated being 2 km. Still, it is a time-consuming activity as the average time spent collecting wood per week is nine hours. Firewood is first collected on HH lands, then on community land and open land or bush. A few respondents admit taking wood from the Government or their neighbours' land, as firewood is scarce.

Women and children are always the ones collecting wood, and girls collect more often than boys. Collectors mentioned that the main barriers to collecting wood were increased wood scarcity and the danger of collecting, specifically due to wild animals (snakes, etc.) and conflicts with landowners who refuse entry to their land and chase the collectors away. They also mentioned that the arduousness of the work and the distances and time spent collecting the wood were barriers to wood collection.

Regarding wood scarcity, it is important to note that agroforestry practitioners attest to a greater availability of firewood since the beginning of the project.

The quality of the firewood available on the market is uneven, with prices varying according to species and availability. However, in the project area, wood is mainly sold in bundles of three sticks. Each stick of wood is about 1 m long and between 10 and 15 cm wide and costs about 500 UGX. In rare cases, the entire tree is purchased (eucalyptus sp.) and then cut into pieces by HH members. On average, 46 of these sticks are used per week per HH, representing a total price of 25,000 UGX/week (around 25kg, although it is indicative as it varies according to the type of wood and the degree of drying). One respondent declared using crop residues to cook (maize combs and stalks) only during the dry season. No mention has been made of the transformation of these crop residues prior to combustion.

Therefore, with the increase of firewood scarcity as well as the time taken for gathering fuel, it is expected that HHs' willingness to acquire ICSs will progressively increase.

→ ICS requirements: Firewood stove or mixed charcoal and firewood stoves

4.5. Consumers' opinions and knowledge of ICSs

All respondents have a good a priori knowledge on the use of ICSs. Most of them are familiar with Rocket mud stoves and charcoal saving stoves, without distinction of particular models.

When asked what first consideration the HHs would have in mind when considering purchasing ICS, the majority (48%) mentioned reducing smoke, closely followed by fuel saving (39%), and finally clean kitchen and stove durability (resp. 9% and 4%).

Most respondents never used/witness a functioning ICS due the lack of availability on local markets, and few have heard of the disadvantages (32% cited negative aspects). In most cases, reluctance to use ICS is related to maintenance needs and installation prices. The requirement to use only adequate pieces of wood (properly dried, good quality) was also raised, as well as the size of the wood. For instance, Mrs. Violet Muhindo, 75 years old, said "*I'm afraid I won't be able to carry the necessary pieces of wood if they are bigger than for traditional stoves*". It is important to recall that these fears, due to a lack of knowledge of how ICSs work, are unfounded since the size of the logs would rather tend to decrease with the use of ICSs.

The incompatibility of pots and pans and the impossibility of roasting food were also mentioned.

In summary, reducing smoke and fuel savings are the core considerations for using ICS, followed by a clean cooking environment and cooking time. It is important to note as well that cost did not appear as highly as would be traditionally expected.

4.6. Indoor air pollution awareness

All of the respondents declare being aware of the danger of indoor air pollution, and took action by separating the kitchen from the main house. 80% of the respondents report having suffered illnesses/burns due to wood-burning, mainly affecting young children and female cooks.

"I have suffered from persistent flu and cough as well as eye problems due to the smoke from the kitchen" says Mrs. Scovia Muthahe, 23 years old. "We normally get flu and cough while cooking" also reports Mrs. Masika Yoneki, 42 years old. Mrs. Mary Muhindo, 47 years old, as well as three other respondents mention partial blindness due to smoke exposure.

5. Recommendation: 3 ICSs to be tested

When selecting the ICSs to be tested, it is important to keep in mind that the objective is not to completely replace the use of traditional stoves but to cover the most common uses in order to minimise smoke emissions and maximise the efficient use of firewood. Most studies report a simultaneous use of traditional and improved cookstoves (SHANKAR and al., 2020).

By cross-referencing analyses of local and national markets and consumer habits, we first exclude the following ICSs mentioned in the long-list (see figure 4 in Part 2.1) for the following reasons:

- Shielded rocket stove: does not meet HH needs because it has only one pot;
- Imported wood ICS: not readily available on the local market, hard access to spare pieces;
- Charcoal/dual ICS: not readily available on the local market and does not meet HH needs since they rely mostly on firewood;
- TLUD: not readily available on the local market, complex use,and does not meet HH needs since it cannot adapt to any saucepan.

Second, we propose to test the following three ICSs:

5.1. Stove A: ILF Rural wood stove



- Consists of two clay-fired liners built *in situ* or within the stove body for two pots
- Ash chambers which also act as air inlets
- Grate where firewood rests while burning
- two firewood inlets, each for one liner
- No chimney
- Estimated cost from local manufacturers: 300,000 UGX
- Locally available
- ➔ Initially distributed by ILF, also promoted by United Organic Coffee Growers around Mt. Elgon areas, by Humankind as "Mubende rural wood stoves", and by the NGO called Rural Development Inter-Diocesan Service (RDIS) in Rwanda.

Figure 7: ILF rural wood stove (ICS n°4 in section 2.1) (Kaweesa, 2020)

5.2. Stove B: Smokeless wood stove



- One firewood inlet
- Two pots or fireplaces but can be designed to accommodate even more
- All the two pots receive heat/fire simultaneously
- A chimney is attached to it from the outside that drives out the smoke from the stove
- Estimated cost from local manufacturers: 250,000 UGX
- Locally available
- ➔ Recently promoted design, in Kasese and Fort Portal, from Tanzania

Figure 8: Smokeless wood stove (derivated from ICS n°2 in section 2.1) (Kaweesa, 2020)

5.3. Stove C: Six brick shielded wood stove



- Portable wood stove
- One fire inlet
- Clay liner with metal cover
- Thermal efficiency of 32.3%
- Certified by CREEC
- Estimated cost: 75,000 UGX
- → It has been promoted by Aid Africa in rural communities.

Figure 9 : Six brick shielded woodstove (ICS n°3 in section 2.1) (Kaweesa, 2020)

Annexe 1. HH questionnaire

How many people regularly live and eat in the household? Are all household members ages 6 to 12 currently in school?
Are all household members ages 6 to 12 currently in school?
Can the (oldest) female head/spouse read and write with understanding in any language?
What type of material is mainly used for construction of the walls?
What type of material is mainly used for construction of the roof and dwellings?
What type of toilet facility does the household mainly use?
How many mobile phones do members of your household own?
Does any member of your household own a radio?
Does every member of the household have at least one pair of shoes?
Type of kitchen/ if Indoor, is the kitchen ventilated?
Do you always cook in the same area?
Most used pots: diameter/type/picture
What do you use the stove for?
How many times do you cook during the day?
When cooking for BREAKFAST/LUNCH/DINNER, how many fires do you use simultaneously?
When cooking BREAKFAST/LUNCH/DINNER, how long do you usually cook for?
What are the 3 main dishes you cook on a daily basis?
How many stoves do you use on a daily basis?
Type of stove/description/picture
What is the condition of the stove?
How did you acquire the stove?
What are your main purchasing criteria?
Since when did you start using this stove?
What are the main advantages of the stove?
What are the main disadvantages of the stove?
When do you plan to change the stove?
Are you going to buy/build the same model in the future? If not, which type of stove would you like to acquire?
What type of fuel did you use in the last 12 months?
Estimated fuelwood/charcoal/crop residues/animal residues consumption per WEEK/MONTH
How do you supply fuelwood/charcoal?
If you COLLECT AND BUY fuelwood, how much is bought and how much is collected?
Distance from house to point of collection for fuelwood
How many times per week do you collect fuelwood?
Where does the fuelwood collected come from?
How long does it take to go from your house to the edge of the main fuelwood collection area and back, and to collect fuelwood, in hours?
Who usually collects fuelwood in the household?

Are there any challenges to collect woodfuel?

Do you know about improved cookstoves? If Yes, which type of stoves do you know? Do you own an improved cookstove? If No, why don't you use one? What do you think are/would be the main AVDVANTAGES of ICS? According to you, what is THE MOST IMPORTANT advantage (from the list above)? What do you think are/would be the main DISADVANTAGES of ICS? According to you, what is THE MOST IMPORTANT disadvantage (from the list above)?

During the last 12 months, did any household member suffer from ill-health or injury as a result of fuelwood or charcoal burning? Which were the symptoms?

Did you know indoor smokes/air pollution was dangerous for your health?

Did you do something to prevent it?

Annexe 2. Household survey data & graphs

Mud stoves Advantages	%	Mud stoves Disadvantages	%
Fuel economy	58%	Generates smoke	42%
Rapid cooking	58%	High fuel consumption	33%
Can cook two dishes simultaneously 4		Hard to clean	33%
Little smoke	33%	Dangerous for children	17%
Ease of ignition	17%	Needs maintenance/cracks	17%
Fire is enclosed within the stove	8%	Cannot be moved	8%
		Doesn't allow gathering around the fire	8%
		Not possible to enjoy warmth	8%
		No chimney	8%
TSOF Advantages	%	TSOF Disadvantages	%
TSOF Advantages No advantages	<mark>%</mark> 46%	TSOF Disadvantages High fuel consumption	<mark>%</mark> 100%
TSOF Advantages No advantages Rapid cooking	% 46% 31%	TSOF Disadvantages High fuel consumption Dangerous for children	% 100% 92%
TSOF Advantages No advantages Rapid cooking Mobile	% 46% 31% 15%	TSOF Disadvantages High fuel consumption Dangerous for children Generates smoke	% 100% 92% 92%
TSOF Advantages No advantages Rapid cooking Mobile Can accommodate any saucepan	% 46% 31% 15% 8%	TSOF Disadvantages High fuel consumption Dangerous for children Generates smoke Unstable	% 100% 92% 92% 77%
TSOF Advantages No advantages Rapid cooking Mobile Can accommodate any saucepan Possible to gather around the fire and tell stories	% 46% 31% 15% 8%	TSOF Disadvantages High fuel consumption Dangerous for children Generates smoke Unstable Fire needs tending	% 100% 92% 92% 77% 23%
TSOF Advantages No advantages Rapid cooking Mobile Can accommodate any saucepan Possible to gather around the fire and tell stories No maintenance/does not crack	% 46% 31% 15% 8% 8% 8%	TSOF Disadvantages High fuel consumption Dangerous for children Generates smoke Unstable Fire needs tending Hard to clean	% 100% 92% 92% 77% 23% 23%
TSOF Advantages No advantages Rapid cooking Mobile Can accommodate any saucepan Possible to gather around the fire and tell stories No maintenance/does not crack	% 46% 31% 15% 8% 8% 8%	TSOF Disadvantages High fuel consumption Dangerous for children Generates smoke Unstable Fire needs tending Hard to clean Difficult ignition	% 100% 92% 92% 77% 23% 23% 15%



Reasons for purchasing ICSs

Saucepan sooty and hard to clean

8%



Annexe 3. Bibliography

ADKINS et al., 2010. Field testing and survey evaluation of household biomass cookstoves in rural sub-Saharan Africa.

ANDERSON, 2017. Classification of Stove Technologies and Fuels. 4p.

ESMAP, 2015. The state of the global clean and improved cooking sector, 129p.

ESMAP, 2019. Clean cooking behavioural diagnostic. 86p.

Global Alliance for Clean Cookstoves, 2013. Uganda ICS Market Assessment –Sector mapping, 70p.

GIZ, 2011. Two-pot Rocket Lorena with Air By-pass: Uganda.2p.

Gold Standard, 2017. Stakeholder Consultation Report, Mumende Cookstoves. 93p.

GTZ, 2008. Construction Manual for Household Rocket stoves. 39p.

HOIGT, 2019. Adoption and sustained use of energy efficient stoves in rural Uganda. 64p.

JEEP, [20-08-14] Available online: https://jeepfolkecenter.org

KENNEY et al., 2017. Report from Uganda case studies of improved cookstove companies: AEST / Awamu Biomass Energy / Green Bio Energy / Humura Investments Ltd. / UpEnergy

MARTIN et al., 2013. Using Formative Research to Design a Behaviour Change Strategy to Increase the Use of Improved Cookstoves in Peri-Urban Kampala, Uganda.

Ministry of Energy and mineral development of Uganda, 2008. Construction manual for household rocket stoves.39p

Ministry of foreign affairs of Netherlands, 2019. End of program report Clean Cooking Sector Support, 43p.

MOSES and MCCARTY, 2019. What makes a cookstove usable? Trials of a usability testing protocol in

Uganda, Guatemala, and the United States. 16p.

NAMA. Green schools in Uganda [20-08-14] Available online: <u>http://www.nama-database.org/index.php/Green_Schools_in_Uganda</u>

Nature Bank. Uganda Wood cookstoves, [20-08-14] Available online: https://www.naturebank.com/projects/uganda-wood-cookstoves/

New Nature Foundation, 2019. Annual report - Kibale wood stove project - 15p

NORAD, 2017. Increasing access to sustainable and renewable energy alternatives in the Albertine Graben Project. 28p

PREEEP GIZ, 2012. Promotion of modern biomass energy technology - Factsheet. 2p.

SHANKAR et al., 2020. Everybody stacks: Lessons from household energy case studies to inform design principles for clean energy transitions. 9p.

SNV, 2014. Grassroots solutions for scaling up improved cookstove access in Uganda. 60p.

UNDP, 2014. The Green Charcoal Project - Addressing Barriers to Adoption of Improved Charcoal Production Technologies and Sustainable Land Management Practices through an Integrated Approach. 12p.

UNDP, Climate exposure, [20-08-14] Available online: <u>https://undp-climate.exposure.co</u>

UNFCCC, 2018. PoA design document form: Biolite improved cookstoves programme. 63p.

UNFCCC, 2020. Component project activity design document form: Mubende stoves Uganda. 67p.

UNIDO, 2015. Baseline report of clean cooking fuels in the Eats African community, 187p.



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