

Agricultural waste for clean cooking in institutions

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Under this project we implement the following UN **SDGs** :

- **SGD 7** Affordable and clean energy access
- SDG 15 Life on land
- SDG 2 Zero Hunger
- **SDG 3** Good health and well being
- **SDG 8** Decent work and Economic growth

Institutions such as schools, universities, prisons consume 80% of Uganda's firewood harvested making them the leading contributors to deforestation for cooking energy. With Uganda's potential production of agriculture residues between 1,186,000 and 1,203,000 tons annually, our modern institution size stoves will enable institutions use clean cooking briquettes made these agricultural waste such as maize combs, banana peelings and food remains from schools so as to reduce deforestation for cooking energy. Agricultural wastes are acquired from farmers at a fee which enables them earn extra income from what they deemed waste material. This is also intended to add value to post harvest losses as they can be dried and sold off as raw material for briquette production. I have already attempted to implement the idea and results show a financial saving of \$2500 for St. Kizito High School Namugongo due to reduced cost of cooking energy.. This is also intended to add value to post harvest losses as they can be dried and sold off as raw material for briquette production. We have already implement the idea and results show a financial saving of \$2500 for St. Kizito High School Namugongo due to reduced cost of cooking energy. Apart from





households and institutions

the institutions, we have farmers who supply us with agricultural waste, with the biggest beneficiary being a widow in Luweero district growing maize at large scale. She testifies that she used to burn the maize combs after removing the maize grains but now earns income from them which she now saves for her sons University education.



ovens

Traditionally, institutions such as schools, bakeries, universities, prisons and many more have been highly dependant on firewood as a source of cooking fuel because they lack of an affordable alternative. Alternatives like briquettes have existed but their was lack of appropriate stove and oven technology to enable such institutions use these briquettes. Most institutions resulted to energy saving wood stoves but unfortunately they still need to cut trees for their cooking fuel. This is

Institutional briquette stoves &

" On top of the environmental and health benefits the institution reduces cost of cooking energy by 35% annually "



Maggie Kigozi tours our cylindrical model of the institutional briquette stove

now no longer a challenge because the technology now exists. At St. Kizito High School Namugongo, 3 stoves and an oven that use briquettes where constructed and have shown tremendous results. The whole of 2017, this institution did not use any firewood but made a financial saving of \$2500 using our clean cooking briquettes. The school previously spent USD \$6300 on 30 trucks of firewood annually but in 2017 managed to reduce annual expenditure on cooking energy to USD \$4200 on 21 tons of clean cooking briquettes. On top of this saving, the school also registered improvement in the cooking



Our oven that uses briquettes and solar powered funs

staffs' attitude towards their work because working conditions improved. The cooking staff is no longer exposed to intense smoke previously emitted where using firewood. The cooking time has also reduced giving the cooks more time to engage in other profitable activities, 2 ladies on the cooking staff started up a side business within school making potato fries and eggs to supply at the school canteen, this is an activity they are privileged to do in the free time that opened up. They informed us that they needed that extra income to support their families. January this year, 4 more institutions Ndejje University, St. Kizito Junior School, Ndejje Senior Secondary School and Uganda Martyrs Seminary came on board and we managed to register the project into a clean energy company

Testimonials



Mr. Kazibwe Ezekiel Head teacher St. Kizito High School Namugongo

" My school is saving up to Ugx 2,520,000 every term ever since we started using briquettes, we are honored to have been the first institution to successfully do away with firewood. For the love of the environment and good health, we hope many more institutions will join the eco-friendly cooking technology."



Mr. Bulime Joseph Headteacher St. Kizito Junior School Namugongo

"Our neighbors used to complain of smoke from the school Kitchen, they even threatened to go to the town council. With these briquette stoves, we cook without emitting any smoke and our relationship with the neighbors has improved greatly."

Other institutions include;

- Uganda Martyrs Seminary
- Ndejje University
- Makindye Junior Academy
- Ndejje Senior Sec. Sch.

The business potential behind clean cooking briquettes

The idea has 2 major sources of income, income from construction or renovation of cooking stoves in institutions to our briquette stove technology and from sale of our clean cooking briquettes. Other sources of funds identified are grants and prizes due to our continuous research and innovations in the field of clean energy, smart agriculture and youth empowerment.

The construction of our stoves is valued at USD700 per stove and the renovation of wood stoves to our briquette stove technology is valued at USD280 per stove of which an institution requires a minimum of 2 working stoves. Our clean cooking briquettes cost USD \$0.2 per Kg of which institutions feeding an average of 1000 students require 21000kgs of briquettes annually which translate into an annual income of USD \$4,200 from just one institution. The unit cost of production including labor is 45% of market price of the briquettes making it very profitable.





A successful proof-of-concept project has been piloted at St Kizito High School Namugongo. In this school, it is only briquettes that are used in cooking. There

is no firewood used. The project reveals that a secondary school of 1000 students needs 20,000 Kgs of carbonized briquettes annually to substitute firewood. The school saves money if it uses briquettes instead of firewood for cooking. The benefits of using briquettes are economic, environmental, healthrelated and socio-economic. Briquettes reduce respiratory complications asso-

ciated with cooking with firewood; and saves trees/forests. The project could provide jobs thousands of youths, women and to other people in the community. In the country, over 40,000 educational institutions could potentially transit from firewood to briquettes for cooking. The educational institutions are spread across the country and could be accessed for marketing the briquettes.

Table 1:	Parameters a	and assume	tions used	in briquettes	business	scenarios

			Remarks
1	Population of an average high school	1000	Needs 20,000kg of briquettes annually
2	Average residential population in a University	3000	Needs 30,000 kg
3	Number of High schools to be served by the project	30	Will need 600,000 kg annually
4	Number of universities to be served by project	4	Will need 120,000 kg
5	Briquettes to be produced and sold annually		720,000 kg
6	Price of 1 kg of briquettes	\$ 0.23	(800 UGX) Wholesale price before packaging
7	Dollar exchange rate	1 dollar = 364	0

1.1 Capital and recurrent expenditures needed for MBE

Table 2 Capital investment for Medium scale briquettes production (capacity of 10,000 kg monthly)

	Item	No	Unit cost	
1	Carboniser for 1000 kg	1	\$2000	\$2000
2	Solar drier for 2000 Kg	1	\$2200	\$1200
3	Land/space (renting or leasing)		\$1000	\$1000
4	Medium scale (automated) Briquettes making equipment (1 crusher combined with an extruder)	1	\$2000	\$2100
5	Modifying 6 energy-saving stoves in 3 schools	6	\$250	\$1500
6	Electric installations	1	\$200	\$200
	Total capital investment			\$ 8,000



Table 3 Recurrent expenditures for a medium-scale enterprise: Based on presumed monthly production of 10,000 Kgs of briquettes

	Recurrent operational costs		Income projections		
	Item	Particulars			
1	Collection, sorting and supply of agro-waste (raw materials); enough to produce 10,000 Kgs of bri- quettes	\$500	Gross Sales (GS) from 10,000 kg of bri- quettes at \$0.247 per Kg	2,470	
2	Casual Labor needed in carbonization, crushing, extrusion and drying	\$300			
3	Packaging	\$150			
4	Power (electricity)	\$ 60			
5	Distribution/delivery	\$100			
6	Administrative costs	\$50			
	Equipment maintenance	\$100			
7	Statuary trade/income taxes or levies	\$100			
	Total costs (TC)	\$1360			
			Profit margin (TC-GS) \$2470-\$1360	1110	
	Payback period (PBP) Investment capital \$7,400 + start-up operating capital \$1360 (\$8760) divided by monthly profit margins; \$ 8760 divided by \$1110				

Business scenario for the Farmers.

Uganda's potential production of agriculture residues is between 1,186,000 and 1,203,000 tons annually. To most farmers after harvest, the residue such as maize combs are considered a waste and are often burnt yet they make the best fuel briquettes. In our project we offer Ugx 1000 / USD \$0.28 for every 100kg of Maize combs. If carbonized we offer UGx 3000 / USD \$0.83 per 100kg sack. Our study in Luweero District shows that in some communities in Luweero, farmers can accumulate up to 3000kgs of Maize combs. But Maize combs are not the only residue that we use, we also purchase the maize stock and other crop residue which accumulates and attract a higher financial gain for the farmer. Using this practice, farmers will increase on the incomes they earn. Other farm wastes we use include cow dung, rice husks, coffee husks, banana fiber, matooke stems, and all other solid bio-waste from farms.



A farmer delivering Maize combs to our production unit in Namugongo

Business scenarios for the garbage collectors.



In Kampala: over 92 % of the waste generated is organic in nature, containing on average a moisture content of 71.1 %, 1.65 % nitrogen,0.28 % phosphorus, 2.38 % potassium and a gross energy content of 17 MJ/kg. Most of the municipalities and towns have poor waste management approaches . Waste is neither sorted at source nor at the land fills and this makes it hard to recycle, or re-use. In the ideal situation, a garbage collector can separate the organic waste, dry it and sell it off to the briquette producers. Alternatively, they can go ahead to carbonize it, crush it into fine char and sell it off to the briquette producers at the market price of Ugx 3000 / USD \$0.87 per 100kg of char/carbon. With over a ton of char generated a day, the average garbage collector has the potential to earn an extra Ugx 30000 / USD \$8.7 a day.



Testimonials

Kawuma Rogers

Male Waste Managers Ltd

"Our family waste collection business brings in over 8 tons of waste a day of which 70% is organic. We had only managed to recycle plastics until we learned about the use of organic waste in briquette production. There is extra value in waste"



Mzee Cyrus

A local farmer in Kira

"Maize combs where useless to me after harvest and I used to incur a cost to dispose it off but now I can actually earn a little money from someone disposing it off for me"

Our Urban & sustainable gardening project



Space is optimally utilized in growing high value vegetables.



The organic waste that do not make good briquettes are applied as organic fertilizers

Ornamental gardening is also demonstrated



ad Caracteristic and the second second

Re-using plastic bottles as building material for mushroom house

Urban fish-farming (wetland conservation that pays)





Our gravity fed irrigation scheme at St. Kizito high school

Namugongo

A gravity fed irrigation system is a cheap effective way to provide water for a smaller sized crop area. This type of irrigation is the most waterefficient way to irrigate, and when you rely on gravity, it is the most energy-efficient as well.

The basic system is very simple consisting of an elevated reservoir with a 1 inch PE pipe coming out the bottom that feeds water to a smaller



¹/₂ inch PE pipe that connects water to the basic irrigation system that is all controlled by a manually operated valve that regulates the rate at which the cropsare watered. The components of the irrigation system:

A water reservoir ;The water reservoir is mounted on an elevated ground. The reason to elevate the tank is that it adds pressure which needs to be kept consistent at the point where the drip lines are fed so that the water is distributed equally. Currently the pressure keeps fluctuating because of multiple uses of the same tank for water supply to other activities in the school.

Piping; There is a pipe at the base of the reservoir that lets water flow out. A smaller diameter pipe is connected to this pipe to transport water to the garden for irrigation and a shut off valve at this connection point is installed to regulate water flow. **Different sized piping is used to increase the pressure;** This was done by gradually decreasing the size of the pipe lines used such as starting with a 1 inch PE pipe at the base of the reservoir then decreasing the size to a ¹/₂ inch PE pipes so that it would then be a garden hose transmitting to the crops

Valve; A shut off valve was placed between the reservoir pipes and the irrigation pipes



Green paper growing very well due to irrigation

Green paper growing very well due to irrigation



SUSTAINABLE DEVELOPMEN

Goal 7:

Ensure access to affordable, reliable, sustainable and modern energy for all.

The briquettes are a more affordable, reliable and sustainable source of cooking energy in the Ugandan setting because most can not afford solar, Hydro or Gas especially for use in Institutions. With the Institutional briquette stove, and ovens, institutions such as schools, prisons, universities, hospitals and bakeries now have access to the briquette cooking technology and can save cost on cooking while conserving the Environment.

CREATING OPPORTUNITIES FOR **DECENT WORK AND ENSURING** ECONOMIC GROWTH GOOD JOBS AND FOR ALL FCONOMIC GROWTH



- Youth training workshops, and school/ University programs, equipping youth with both practical and entrepreneurial skills to start and run briquette and smart agriculture enterprises.
- Extra income generating opportunities in Agricultural sector and waste management sector (trading off of organic waste)

"How our projects fit into the UN SDGs"

CLIMATE ACTION



The trees we save act as the natural carbon filtration system that reduces the carbon in the atmosphere. As much as we need to reduce carbon emission, we need to also increase carbon absorption by protecting the existing natural forests and reviving the plant cover that was destroyed



Due to clean, smokeless cooking, the cooks are no longer exposed to smoke that may result into respiratory complication.

> ZERO HUNGER

GOOD

HEALTH

3

Urban and sustainable gardening is intended to equip youth with modern approaches to commercial vegetable, spices and mushroom growing in an urban setting. This is to ensure even in the urban areas. food can be grown reducing on food insecurity.

ON LAND



By providing an alternative source of cooking energy to institutions that are consuming 80% of wood harvested. In the long run saving the forests and there inhabitants





We have partnered with Ndejje University in both research and implementation

Our achievements in 2017



Representation at the International Student Energy Summit SES2017 in Mexico

Out of many submissions from around the world, our founder and CEO **Kakembo Galabuzi Brian's** submission of the Waste to Energy Youth Project was chosen among the 4 most inspirational clean energy projects. He was invited as change maker panelist to inspire over 600 youth who attended this summit. As a Ugandan, he did his country proud and the African continent in general.

Hosting of the Climate Change Coordinator for UNEP Region Of African Office

In partnership with Ndejje University, St. Kizito High School Namugongo and EBAFOSA-Uganda, we hosted Dr. Richard Munang appreciated our project and committed to offering support to such innovative climate action projects.

Dr. Richard Munang in December helped us secure a USD \$3000 grant from EBAFOSA and the African Centre for Technology Studies.





2017

iF Social Impact Prize 2017 winners



iF team members from Taiwan, China, Korea and Germany after careful and intense scrutiny decided to support our project among the six outstanding projects that won 2017 iF social impact prize with money to help to continue the good work!!

We are very grateful to the entire iF Team and especially members from Taiwan, China, Korea and Germany for supporting our work, and we commit ourselves to doing greater achievements this year.

Waste to Energy Youth Project



WEYE Clean Energy Company Ltd

"Your number one source of affordable, clean and smokeless cooking energy."

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Objectives

- To produce high quality, smokeless and eco friendly, equip practical entrepreneurial skills.
- To reduce on deforestation by providing alternative sources of cooking energy produced from agricultural waste.
- To lead the transition of institutions such as schools, universities and prisons from firewood consumption to clean cooking briquettes.

Products

Kyoto Ecobriquettes. High Quality, Burns three times longer Smokeless, Affordable, Environmentally friendly.



ECO FRIENDLY, LONGER BURNING & COST SAVING

 Institutional briquette stoves
(Cost saving, Energy saving, Environmentally friendly, Health friendly, Time saving, High effi-

