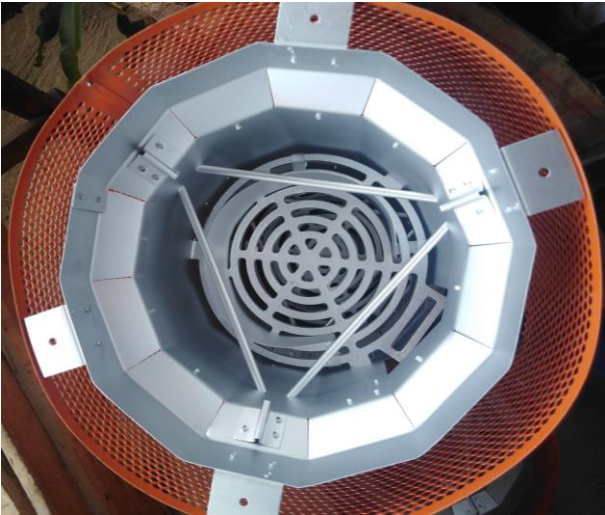


**REPORT OF THE TECHNICAL PRODUCTION PROCESS ASSESSMENT OF
SELECTED UNACC MEMBER COMPANIES**



Compiled and submitted by Julius Mugabi

1. Introduction

This is a report of technical assessment of biomass cookstove and charcoal briquettes production processes of the selected production companies who are members of Uganda National Alliance for Clean Cooking (UNACC). This was meant to understand the opportunities and challenges faced and support needed in the sector. This will also support efforts by UNACC together with their partners to popularize and promote the sector standards and certification and general development of the sector.

1.1 Scope of the assessment

The assessment focused on manufacturing and quality control, procurement (raw material supply and selection), research and development and personnel; the assessment took into account:

- a) the company's size
- b) the products and their categories
- c) how their products could be economically and profitably produced and distributed whilst assuring continuous improvement in quality.
- d) current manufacturing capability, i.e. what they do and how they do it, technology and know-how, R&D capabilities.
- e) Supply categories, raw material supply stability and capabilities.
- f) Record keeping
- g) Quality control
- h) Human resource

1.2 Team of assessors

A team of experts composed of staff from Uganda National Bureau of Standards, Ministry of Energy and Mineral Development, Centre for Renewable Energy and Energy Conservation and Centre for Integrated Research and Community Development Uganda were contracted by UNACC to conduct the technical assessment of 10 UNACC member organizations' production processes for household biomass cookstoves and carbonized briquettes. It is important to note that the assessors were not representing their organizations but were selected solely based on their knowledge of the sector.

The following are members of the team that did the assessment;

- a) Mr. Ronald Ahimbisibwe
- b) MS. Justine Akumu
- c) Mr. Derrick Kiwana
- d) Dr. Juliet Kyayesimire
- e) Mr. Julius Mugabi

The following UNACC member organizations as selected by UNACC were assessed.

Organization	Location	Products	Contact Person
Green fit ltd	Kampala, Busega Community	Biomass cook stoves and ovens	Fred Bakule
Good fire ltd	Busunju trading centre	Carbonized briquettes	Virginia Ssemakula
Clean Environment for Africa ltd (CEFA)	Kibuye -Makindye	Institutional cookstoves, household cookstoves, incinerators, baking ovens etc	Jim Ssebaduka
Seb Engineering Ltd	Wakiso, Hoima road	Biomass cook stoves	Ssezibwa Ronald
Energy Uganda Foundation	Lusanja-Kabuwoko off Kitezi road	Cookstoves	Abdul Busulwa
Africa Energy Stoves (AES) Ltd	Lubiri ring road, Rubaga division	Biomass cookstoves	Isma Wamala
Josa Green Technologies	Njovu estate, Nansana	Carbonized briquettes	Asiimwe Samuel

Best of Waste Ltd	Kitezi trading centre	Carbonized briquettes	Betty Zzizinga
Green Bio Energy Ltd	Bugolobi	Carbonized briquettes	Zziwa Hillington
Potential Energy Ltd	Liberty Close Plot 7550, Bukasa, Kampala	Household biomass cookstoves	Laura Toledano

1.3 Tools

The following Uganda standards together with the assessment tool (attached) were used;

- a) US 761:2019, Household biomass stoves — Requirements
- b) US 765-2:2019, Solid biofuels — Specification — Part 2: Carbonized briquettes
- c) Assessment form (Attached)

2. Technical assessment of the stove production process

2.1 Green-fit Works Ltd

2.1.1. Profile

Green-fit Works limited is a company that specializes in the production of biomass cook stoves and ovens. The company is limited by shares, was registered and began its operation in 2018. The company is headed by Mr. Fred Bakule, Mbalire Denis as the quality control in-charge and employs 26 staff, 22 of whom are male and 4 females. Of the 26 staff, two (2) are in management, eighteen (18) are involved in stove fabrication and the rest in stove sales. The company has an installed production capacity 4,000 stoves per month with an actual production ranging between 2,400- 3,500 stoves monthly. The company is situated in Kampala, Busega Community.

The company specializes in the production of the following products:

- a) household cook stoves for charcoal, firewood and dual purpose;
- b) institutional cook stoves using firewood and honey comb briquettes in schools;
- c) cook stoves for use in restaurants (both firewood and charcoal);
- d) ovens, grills and barbeques using firewood and charcoal;
- e) pits ovens and tandoori ovens
- f) production of stainless steel saucepans and smokers.



Figure 1—Green-fit stoves

2.1.2. Product and standard identification

The company does not keep a copy of Uganda Standards for cookstoves US 761:2017, Biomass stoves-requirements. The company though is aware that the standards exist and are relevant to the stove production process.

The stoves are labelled as Green-fit stoves however the brand is not registered or trademarked by Uganda Registration Services Bureau. The company's labels for the stove products do not include all the marking requirements specified in US 761:2017.

The company has never applied for certification because they were not aware of its benefits.

2.1.3. Product testing

The company stated that they submitted their stoves for testing to the Centre for Research on Energy and Energy Conservation (CREEC) in 2018. The parameters tested were thermo-efficiency and indoor air emissions. They however did not complete the required payment to access results. The company however conducts in-house water boiling tests on their stoves from time to time to ascertain the performance of the following parameters:

- a) time taken to boil one litre of water;
- b) how much charcoal/ firewood is used to boil 1 litre of water;
- c) how long it takes to light a stove;
- d) how long it takes for the stove to burn a specified amount of fuel.

Records of test results are not kept by the company technical and quality management team. There is no documentation of the efficiency of the stove or the power of the stove. From the company's explanation, the testing measures conducted for the stove are neither standardized nor documented. The company has no documented procedure for sampling of the stoves to be tested. The company currently uses customer feedback to improve the performance of its products.

2.1.4. Facility organization

The company does continuous production of stoves with a production outlet in Nsangi that sells 700-850 household stoves and 100 ovens per month. The company also produces stoves against orders for NGOs and Microfinance companies. The stoves made on order have a different shape from those produced continuously as indicated in the figure (2) below:



Figure 2 — Left stove is produced on order, has a different shape from that produced to stock (right stove)

The company issues work orders to its laborers and assesses defects on bottom plate, liner fixing. The defects are identified and sent back to the laborer for refinement and where that is impossible, the rejects are used for production of spare parts like handles, doors. A batch is therefore identified as a separate entity produced by a particular worker.

2.1.5. Quality Systems and Assessment

The company has a head of quality who reports to the Operations Manager. The company's quality department is composed of the head of quality control and two senior technicians. Staff are aware of the tests and method of assessments needed to ensure quality.

Store personnel are also responsible for quality of the stoves by ensuring the materials accepted in the stores conform to the preset specifications for example cracked liners and sheets thinner than gauge 28 are rejected.

The store personnel are monitored by quality control personnel however there are no internal audit checks for the quality control set up.

2.1.6. Materials, components and services

The company purchases the following materials:

- a) Mild steel (soft), gauge 28 for the stove body and gauge 26 for the bottom and G28 rings for the pot stands;
- b) Clay liners

The company buys mild steel from manufacturers that conform to the standard. The mild steel rolls show the date of production, thickness and the standard they meet.

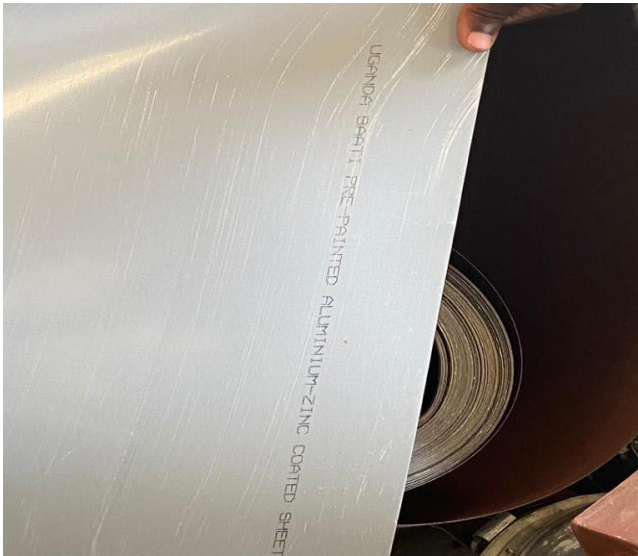


Figure 3 — Mild steel sheets



Figure 4 — Clay liners

The company has selects and rejects materials at the point of production and only purchases materials that conform to its required quality. The company has no records indicating the accepted quality for raw materials and rejected raw materials. The company also doesn't have an acceptance criterion for raw materials.

2.1.7. Process and controls

Raw materials and ingredients are adequately inspected, processed at necessary points and stored to ensure only wholesome materials of acceptable quality are preserved for production. The quality assurance

team ensures the right mixing ratios for clay used for the stove liners, and that the liners are dried to the correct moisture content before being fired in the kiln. The dryness of the liners is assessed through the colour of the liner and the sound made when the liners are hit with an object.

Green- fit Works Ltd does not conduct any further testing to ensure the conformance to quality of the materials under overall conditions. The company doesn't use packaging to preserve stove integrity unless dictated by the client. There is however a limit to stacking, for example, a small stove is stacked over a big stove. Products are currently not coded as a means of batch identification and there are no records of the coding.

2.1.8.Maintenance

The company does post sale and in-service maintenance by sending its workers to the field to do repairs and receiving samples for the repair of liners at the factory. There are however no records of maintenance. The company states however that they have only maintained four (4) stoves since they started doing business in 2018.

2.1.9.Monitoring and Measuring equipment

The company has no weighing equipment for measurement of stove weight.

2.1.10. Records and documentation

The company keeps no records for internal activities such as cleaning, raw material inspections, production, quality monitoring, internal tests etc.

2.1.11. Conclusion

Green- fit Works Ltd does not observe the requirements of national standards for product development and improvement. The company has not implemented major quality assurance practices and does not keep any documentation regarding processes and controls. The company cited lack of knowledge of the need for documentation and record keeping of such processes.

2.2 SEB Engineering Services Ltd

2.2.1 Profile

SEB Engineering Services Limited is a company that specializes in the production of steel based products ranging from bridges to biomass cook stoves. The company is limited by shares, was registered and began its operations 2010. The company is headed by Ssezibwa Ronald, and Diana Zamukunda as the quality control in- charge and employs 20 staff on contract basis, 12 of whom are male and 8 females. Of the 20 staff, two (2) are in management, eight (8) are involved in stove fabrication and the rest in stove sales. The company has an installed production capacity 4,000 stoves per month with an actual production ranging between 3,000- 3,500 stoves monthly. The company is situated in Kayunga- Gombe B Wakiso district, Hoima road

The company specializes in the production of steel products and household cookstoves.



Figure 5 — The fast cooking multi fuel stove

2.1.1. Product and standard identification

The company does not have a copy of Uganda Standard for cookstoves despite of being aware of its existence.

The stoves are labelled as Fast Cooking Stoves however the brand is not registered or trademarked by Uganda Registration Services Bureau. The label on stoves does not meet all the marking requirements as provided in the standard.

The company has never applied for certification because they were not aware of its benefits.

2.2.2 Product testing

The company has not tested their stove with any accredited or recognized UNBS testing facility. The company however conducts in-house water boiling tests on their stoves from time to time to ascertain the performance of the following parameters:

- a) time taken to boil one litre of water;
- b) temperature of the stove;
- c) cooking time per litre;
- d) energy used .

At the time of assessment, the company was redesigning their stove and hence only keeps design records. Records of test results are not kept by the company technical and quality management team. There is no documentation of the efficiency of the stove or the power of the stove. From the company's explanation, the testing measures conducted for the stove are neither standardized nor documented. The company has no documented procedure for sampling of the stoves to be tested. Improvement on the performance of cookstoves is only based on customer feedback.

2.2.3 Facility organization

The company intends to use manufacturing to order as opposed to manufacture to stock. The company uses a production line system in which starts with fabrication of every part of the stove. Every component of the stove is checked and then assembled. Components with defects are rejected depending on the acceptable tolerance.



Figure 6 — Workshop and fabrication scan points

Bar codes and serial numbers are assigned to every component for the stove under development

2.2.4 Quality Systems and Assessment

The company has a head of quality who reports to the designing engineer. The designing engineer reports to the technical operations manager. Staff are aware of the tests and method of assessments needed to ensure quality.

Store persons have some pre-set criteria for accepting or rejecting incoming raw materials. The store personnel are monitored by quality control personnel however there are no internal audit checks for the quality control set up.

2.2.5 Materials, components and services

The company procures steel from manufacturers that conform to the European steel standards since, according to the company, there are currently no national standards for steel. The company also uses American structural welding code standards for welding.

The company also has an acceptance criterion for raw materials and keeps records of rejected raw materials.

2.2.6 Process and controls

Raw materials are adequately inspected, processed at necessary points and stored to ensure only clean and wholesome materials are preserved for production. The company does not conduct any further testing to ensure the quality of the materials under overall conditions. The company doesn't use packaging to preserve stove integrity unless dictated by the client. Product under development are coded as a means of identification but there are no records of the coding.

2.2.7 Maintenance

The company relies on customer feedback for product improvement and has done any maintenance thus far of in-service stoves. There are no records of equipment maintenance.

2.2.8 Monitoring and Measuring equipment

The company has a digital weighing scale that is calibrated by UNBS. The company has standard tape measures and veneer calipers which are used for measuring and monitoring dimensions of cookstoves.

2.2.9 Records and documentation

The company keeps records for internal activities such as cleaning, raw material inspections, production, quality monitoring, internal tests etc.

2.2.10 Challenges faced by the company

SEB Engineering Services faces challenges of very unreliable electricity, which is at a high cost in spite of being connected to a three phase transformer. Very high taxation costs on raw materials (steel) which makes the capital costs prohibitive.

2.3 Africa Energy Environment savings and Construction Company Ltd (AEESCCL)

2.3.1 Profile

Africa Energy Environment savings and construction company (AEESCCL) limited was established in 2009 and registered as a private/ company limited by shares on 6 August 2010. The company offers products in bioenergy sector mainly production of both household and institutional cookstoves as well as biomass derived fuels (Briquettes). The product and trademark name as used by the company for its product is AES Cookstove. The company is located along Kabaka's lake on Lubiri ring road, Rubaga division Kampala district.

As of October 2020, the company employs twenty-eight (28) skilled employees in production, this included 24 males and 4 females.

2.3.2 Product and standard identification

AEESCCL does not have a copy of the Uganda standard for cookstoves neither does the management know the requirements indicated in the standard as per stove construction. Much as the company is registered with URSB, the trademark mark for cookstoves (AES) is not registered by any national registration agency. With reference to Figure 7, the sticker used on the stove only indicated the trademark name with no markings as required by the standard.

In 2017 AES applied for certification of the product with UNBS but the process was not successful considering no response from the standards body was received.



Figure 7 — AES product label

2.3.3 Testing.

AES conducts tests after every two years with the last report conducted at CREEC in 2018 with report number B/TR/2018/018 where the stove had a 30% thermal efficiency. Through recommendations, a modified AES stove was produced and still tested for the same parameters, this time round the efficiency was 37% as indicated by report number B/TR/2018/071. All tests were conducted using the Uganda standard US 761:2019. There was no documented sampling procedure for clay, sheet metal and finished stove.

2.3.4 Facility Organization

AES employs manufacture to stock strategy. Initially, serial numbers were assigned to stoves to distinguish the batches, unfortunately this turned to be expensive as one tag could cost between Ugx 1,300-Ugx1,500.



Figure 8 — AES product label (no longer in use)

2.3.5 Quality system and assessment (Quality control).

AEECCCL employs a full time quality control staff who reports to the CEO. It is a responsibility of every personnel to ensure quality cookstoves fabricated. For example, the right gauges for stove jackets is known to every artisan.

2.3.6 Materials, components and services.

AES produce cookstoves of different sizes i.e. size 1, size 2 and size 3. These sizes are fabricated from the same material, variation is mainly in gauges. Material used include steel sheet, clay. Saw dust, Rivets and paint. Gauge 24 is used on pot stands for size 1 stove, gauge 22 on size 2 and 3, gauge 25 on metal cladding. These dimensions are not benchmarked on any standard rather referred from the cookstove operational manual drafted by Impact carbon former GVEP to stove producers. Currently AES employs visual inspection for quality for the quality check for all material as they reach the factory.

2.3.7 Process and controls

The company is equipped with a store that accommodates all materials right from liners, metal sheets, insulation materials. After assembling, the stoves are arranged according to the sizes. These stoves are not coded since the process makes the stove more expensive.

2.3.8 Maintenance

Operation at AES is mainly artisanal with rudimentary equipment mostly used, the maintenance of such tools is dependent on handling operation at that particular time, no documented maintenance system is available. The sales receipt has a warrant period and items to be replaced or maintained by AES (see figure 9).

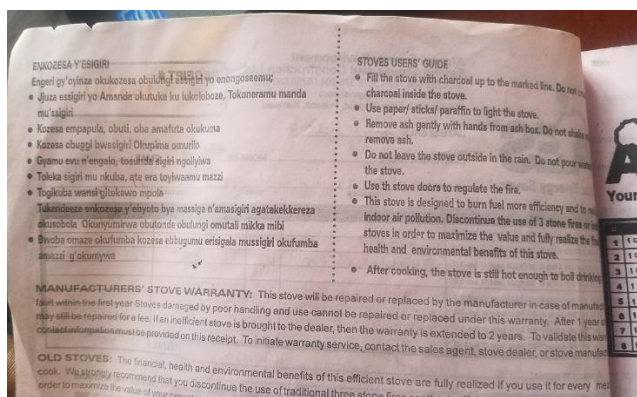


Figure 9 — Receipt containing warrant period

2.3.9 Monitoring and measuring equipment.

No measuring instrument was available at site

2.3.10 Records and Documentation

Records available are mostly administrative, Samples received (Liners, sheet metals, reverts, paints etc.).

2.3.11 Challenges faced by AES

- Variation in the cost of materials
- Weak regulations of cookstoves on local markets, this compromise the cost and efforts for AES cookstove considering that there are poor quality stoves sold very cheaply on market.

2.4 Green Bioenergy Limited

2.4.1 Profile

Green bioenergy limited (GBE) is a social enterprise fighting poverty and global climate change by providing environmentally friendly cooking energy alternative sources. Considering a large rate of deforestation for firewood and charcoal production, Green bioenergy is mitigating this by training people on how to produce charcoal briquettes from waste. The company started operation in 2011 and registered as a private/company limited. Briketi is the umbrella brand for the eco-friendly briquettes produced by GBE. According to the company, this brand name signifies that the product is made to high standards, with high quality materials, long durability, and local resources. The company is located in Kabembe, Mukono district.

As of October 2020, the company employs twenty eight (28) skilled personnel in production, and 6 in administration. The production team is entirely comprised of only male.

2.4.2 Product and standard identification.

GBE has no copy of the current Uganda standard for briquettes to benchmark their product. The main reason is attributed to lack of awareness by the company. Briketi is the umbrella brand term for the GBE briquettes as shown in the figure below.



Figure 10 — Brand name for briquette product

GBE packaging does not have all the information as specified in the standard and only product sold through supermarket is labelled but those sold to communities like refugee camps, open market are not labelled. Below are figures showing the different branding.

The company has never applied for certification.



Figure 11 — Branding of briketi packages

The label does not have a prepackage control report

2.4.3 Testing.

GBE has conducted tests with CREEC in 2017 and MIT lab in 2018. Results obtained from these two labs are still considered much as the company does continuous production. The only test conducted on site is burning time where water is boiled until the sample is burnt to ash, however no standard in this pursuit.

The fact that one of the inputs in derived fuel (briquettes) is charcoal dust collected from different vendors, it's necessary to a sampling criteria in place, however this is not the case with BGE.

Only results tested previously from CREEC and MIT is available. These tests were done 2-3 years ago using the available protocols like Water boiling test for efficiency, fuel consumption, cooking time and burning rate.

2.4.4 Facility Organization

GBE employs production to stock , produces daily dried and packaged in sacks as shown below.





Figure 12 — Briketi produced for stock

Targets are set weekly were by 300kgs in packages of 50kgs are produced to stock. The figure below is used by workers to meet the set weekly targets,

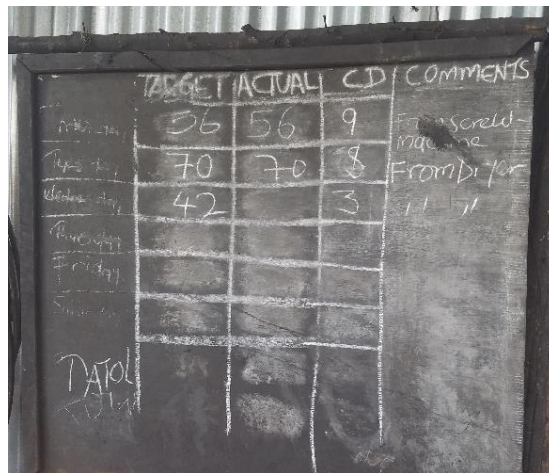


Figure 13 Daily production chart

Briketi GREEN BIO ENERGY LTD MUKORO - KATEMBE BIN CARD										
ITEM	LOCATION	PRICE	QTY	QTY	QTY	QTY	QTY	QTY	QTY	QTY
1	101020	56	-	140	2255	2255	0	0	0	0
3	101020	56	-	140	2085	2085	0	0	0	0
5	101020	42	-	105	1980	1980	0	0	0	0
6	101020	56	-	140	1840	1840	0	0	0	0
4	101020	42	-	105	1735	1735	0	0	0	0
5	101020	56	-	140	1585	1585	0	0	0	0
7	101020	-	5000	-	5000	5000	0	0	0	0
10	101020	56	-	140	4935	4935	0	0	0	0
11	101020	56	-	140	4785	4785	0	0	0	0
12	101020	56	-	140	4635	4635	0	0	0	0
13	101020	56	-	140	4485	4485	0	0	0	0
14	101020	42	-	105	4335	4335	0	0	0	0
15	101020	56	-	140	4185	4185	0	0	0	0
16	101020	56	-	140	4035	4035	0	0	0	0
17	101020	56	-	140	3885	3885	0	0	0	0
18	101020	56	-	140	3735	3735	0	0	0	0
19	101020	56	-	140	3585	3585	0	0	0	0
20	101020	42	105	105	3435	3435	0	0	0	0
21	101020	56	-	140	3285	3285	0	0	0	0
22	101020	56	-	140	3135	3135	0	0	0	0
23	101020	42	-	105	2985	2985	0	0	0	0
24	101020	56	-	140	2835	2835	0	0	0	0
25	101020	56	-	140	2685	2685	0	0	0	0
26	101020	42	-	105	2535	2535	0	0	0	0
27	101020	42	-	105	2385	2385	0	0	0	0
28	101020	42	-	105	2235	2235	0	0	0	0
29	101020	70	-	175	2085	2085	0	0	0	0

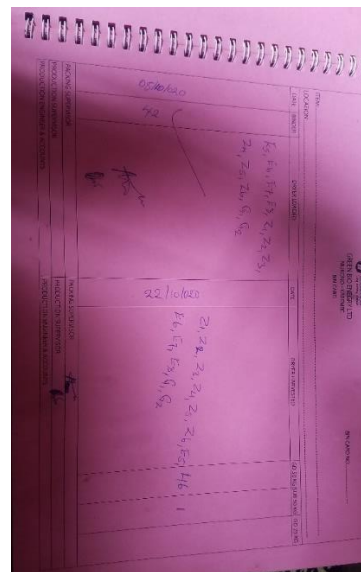


Figure 14 — GBE Bin Card

2.4.5 Quality system and assessment (Quality control).

Charcoal dust is delivered to GBE after sorting, this minimizes the risks of subjecting the crusher to stones and other metal or unwanted material.



Figure 15 — Crushing hammer mill and sorted charcoal dust

Currently GBE does not have a quality control department on assumption that all workers can maintain their roles with responsibility of producing quality products. The staff is not well acquainted with the requirements as stated in the standard.

2.4.6 Materials, components and services.

The following are raw materials and equipment used in production.

- a) Charcoal fine,
- b) Hammer mill for crushing
- c) Mixer
- d) Molding press
- e) Bagging and storage
- f) Drying Racks

Apart from charcoal fines, the rest of the process is controlled at the facility, this provides sufficient time to check faults during operation, however no documentation is done in regard to quality check throughout the production flow.

2.4.7 Process and controls

The schematic layout of GBE production line includes collection of charcoal fines, sieving, drying, crushing, mixing, molding, drying, sieving and bagging. All these processes are supervised by the quality manager who ensures all ingredients are adequately mixed. The finished products are well packaged and weighed on a balance to match the desired weights. Some packages are sold through super markets and others sold on retails. As mentioned earlier, only packages labelled are sold through super markets.

2.4.8 Maintenance

Maintenance schedules for equipment is not documented anywhere. Equipment are maintained upon fault during the production process.

2.4.9 Monitoring and measuring equipment.

Only the balance scale is available, however there no evidence of calibration.

2.4.10 Records and Documentation

Still require improvement in this area since most of the records are not available.

2.4.11 Challenges

- a) Breakage of briquettes on transport
- b) Production is dependent on weather

2.5 Josa green technologies

2.5.1 Profile

Josa Green Technologies Ltd (Josa) is an integrated multidisciplinary Firm founded in November 2012 and legally registered and incorporated in March 2013. Josa Green Technologies is engaged in providing full scale range of environmental and energy solutions, products and services in the areas of Energy Saving Cook stoves, Briquettes and conservation innovations. Some of the products made include Honey-comb briquettes, cookstoves, institutional cookstoves, brooding kits etc. Their production facility is located in Njovu estate in Nansana Wakiso district. Currently, Josa employs a total of 17 personnel. The installed capacity of Josa is 250 tones monthly of briquettes annually but currently doing 60 – 80 tones per month.

2.5.2 Product and standard identification

GBE had a copy of the current Uganda standard for briquettes and cookstoves to benchmark their product. The company is however not implementing the standards. Company claims they applied for certification online but UNBS did not get back to them. Product labels do not have all the required information as per the standard.

2.5.3 Testing

Josa conducts internal testing which is done for every batch of briquettes while external testing is done biannually. Internal testing, only burning rate is done and external testing only calorific value. There was no evidence of records of test results, sampling criteria and defined testing protocols.

2.5.4 Facility Organization

Josa has a mixed production strategy where by both produce to order and produce to stock are both used. Only products made on order are identified; by order number. The rest are not distinguished from others since the production line is one.

2.5.5 Quality system and assessment (quality control)

Josa does not have adequate quality control system. Quality of raw materials is checked visually by an administrator or accounts assistant. Quality checks are only done at the point of sale.

2.5.6 Materials, components and services

There was neither evidence of material acceptance criteria nor records quality checks on raw materials.

2.5.7 Processes and controls

Raw materials and finished products are visually inspected, processed as necessary and stored to assure that only clean, wholesome. There was and no evidence of any production control measures. Briquettes are well packaged to protect them.

2.5.8 Maintenances

There were no records of equipment maintenance and calibration. Equipment are repaired on breakdown and no records are kept.

2.5.9 Records and documentation

Josa does not keep records of production and quality control.

2.5.10 Challenges

- a) Drying of briquettes is slow process
- b) Packaging is very expensive if you are to use ideal materials like boxes
- c) Fluctuating prices of raw materials

2.6 Energy Uganda Foundation (EUF)

2.6.1 Profile

EUF was established in 2008 and registered as a private/ company limited by shares on 16 October 2008. The company is involved in fabrication of biomass household cookstoves with an installed capacity of 8000 stoves monthly but operates at less than 3000 stoves capacity and employs 28 personnel as of October 2020. The company is located in Lusanaja –Kabuwoko along Kitezi road.

2.6.2 Product and standard identification

EUF management did not have a copy of the Uganda standard for cookstove and their stoves labels (see figure 16) don't have all the information as required by the standard. The company reported that their brand name is fully registered but no certificate was provided. The company produces EUF and Super stoves.



Figure 16 — Product label of EUF stoves

2.6.3 Product testing

The company indicated they test for emissions, durability & thermal efficiency every 6 months but no testing records were available. No defined test methods and sampling criteria are used.

2.6.4 Facility organization

Stoves are produced both on order and to stock and no any identification is assigned to differentiate between batches.

2.6.5 Quality system and assessment (quality control)

The company does not have a basic quality control system in place. One staff is in charge of all the quality checks and no defined inspections made to raw materials and final product. No records are kept.

2.6.6 Materials, components and services

The company purchases and utilizes the following raw materials;

- a) Galvanized steel sheet G28, G26, G24, G22
- b) Clay, Mica, Cement, saw dust

The only requirement is the thickness of the steel sheet. No defined acceptance criteria and records of inspection are available.

2.6.7 Processes and controls

Apart from basic visual inspections, there no basic documented processes and controls.

2.6.8 Maintenance

The company has no maintenance system in place.

2.6.9 Monitoring and measuring equipment

The company does not have any measuring or weighing equipment.

2.6.10 Records and documentation

EUF does not keep basic records and documentation for traceability purposes.

2.7 Potential energy

2.7.1 Profile

Potential Energy is an NGO that was created in 2009 that has to date served almost 300,000 families, mainly refugees in Darfur, Sudan. PE expanded to Uganda in 2016, when it trialled a gasifier stove leasing program, however due to the high cost of the stove and long repayment terms, PE decided to focus on its own, more affordable stove going forward, the Berkeley Darfur Stove (BDS) which is duly registered in the United States of America.

To make BDS easily accessible, PE sells through various market-based and aid approaches and has a strong history of collaboration with retailers, NGOs and governmental organizations, which include financing options.

The stoves are strategically placed within established distribution networks to help generating demand since locals already have much trust in these institutions. Since the introduction of the stove in Uganda in July 2017, sales revenue has grown an average of 20% month-over-month, selling over 2,000 over the first year. The current production capacity in Uganda is 2,000 stoves per month. Given the easiness to assemble, this can be easily scaled if the demand grows or a large project requires mass production in short time. The NGO which is located in Bukasa, Kampala maintains a total of 9 full time personnel with 16 casual staff.

2.7.2 Product and standard identification

The NGO makes one model of stove, the Berkely Darfur Stove with either a cool mesh or not. The company has standardized processes and defined standards for the raw materials. A copy of a Uganda standard is kept at the company. The product label has all the information as required by the standard.



Figure 17 — BDS stoves with a cool mesh and without

2.7.3 Product testing

BDS stoves are tested for requirements in the US 761:2019 every time materials are changed and records are available. No sampling criteria is defined. All raw materials are tested and verified for pre-set specifications before they are accepted.

2.7.4 Facility organization

The facility produces both on order and to stock. All stoves are assigned unique serial numbers for identification. Stores are different for different raw materials and finished products.

2.7.5 Quality system and assessment (quality control)

At Potential Energy, the responsibility of quality rests with every personnel. However, there is one overall quality controller who reports to the production manager. All personnel are aware of the quality checks and criteria they have to do. The same is well documented.

Raw materials are inspected by the store keeper before they are accepted in. also since they import the grates and steel sheets, these come with certificate of conformity. Regular quality audits are conducted for the production process and improvements made where necessary

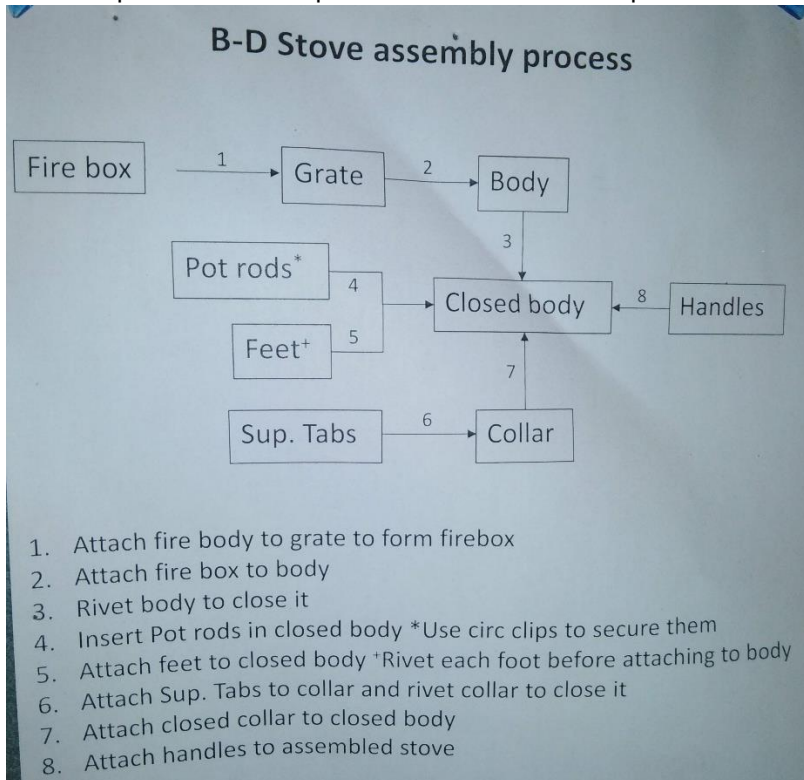


Figure 18 — Previous process flow

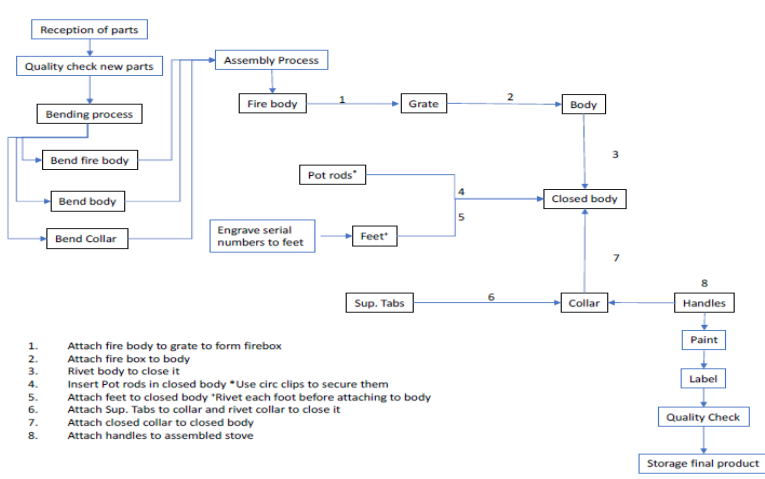


Figure 19 — Current improved process flow

Finished stoves are well packaged in boxes which are adequately marked. A user manual in both English and Luganda languages is enclosed.



Figure 20 — BDS stove packaging box

2.7.6 Materials, components and services

The following materials are used ;

- Mild steel sheets
- Cast iron grates
- Wooden handles
- Heat resistant aluminium

Steel materials are all imported from India. There is a defined acceptance criteria, for example grates are heated in charcoal for 2 hours to check their thermal performance. The thickness of the steel sheets are also measured and compared with internal standards.

Batch no.		Piece	Date	# Pieces	Good	Bad	Quality Control Supervisor
G	6		20/08/2019	39	30	9	OK
FB	50		20/08/2019	50	—	—	OK
ST	1		20/08/2019	1	—	—	OK
C	5		16-08-2019	250	250	0	OK
H	250		21 st /08/2019	250	—	—	OK
H	250		21 st /08/2019	250	—	—	OK
C	250		21 st /08/2019	250	250	—	OK
G	90		22 nd /08/2019	90	90	—	OK
B	1 box		22 nd /08/2019	25	25	—	OK
FB	50		07/08/19	50	50	—	OK
PR	1		22-08-19	—	—	—	OK
FB	1		23-08-19	50	50	—	OK
G	2 boxes		23/08/2019	50	—	—	OK
C	3		23/08/2019	150	—	—	OK
B	1 box		23/08/2019	25	—	—	OK
F	2 boxes		26/08/2019	150	—	—	OK
FB	2 pieces		26/08/2019	50	—	—	OK
B	1 box		26/08/2019	25	—	—	OK
G	12 boxes		27/08/2019	300	100	200	OK
FB	3 pieces		28/08/2019	75	—	—	OK
F	2 boxes		29/08/2019	350	—	—	OK
C	2 boxes		30/08/2019	50	—	—	OK
B	2 boxes		31/08/2019	50	—	—	OK

Figure 21 — Some records of material inspections indicating the rejected and accepted

2.7.7 Maintenance

The facility has in place a periodic maintenance of machines in which only servicing and inspection is conducted but no record of activities done are kept. The measuring equipment are calibrated.

2.7.8 Records and Documentation

The company keeps most of the records though some works done are not recorded. All the processes are documented and displayed on the notice board.

2.7.9 Challenges

- a) Limited storage space
- b) Delayed delivery of raw materials from India.
- c) High cost of testing

2.8 Others

2.8.1 Good fire limited located in Busunju along Mityana road dealing briquettes production

The company had not been operating for about 3 months. All machines had broken down, there was no activity going on. There was no evidence that production would resume.



Figure 22 Good fire facility in Busunju

2.8.2 Best of Waste Ltd located in Kitezi trading center dealing in briquettes production.

The company employs 7 personnel, the owner is in charge of every process and none is recorded. There is no basic quality control and process system in place. And no defined standards whether internal or otherwise are followed.



Figure 23 Briquettes and brooder stoves made by best of waste

2.8.3 Clean Energy for Africa-UG located in Kibuye Makindye

The company deals in household cookstoves, institutional cookstoves, baking ovens, incinerators, grills, steam bath and sauna, carbonized briquettes and fireless box cookers. The company does not keep a basic

quality and process improvement system in place. Personnel are not aware of the national standards, internal tests nor are processes documented.



Figure 24 — Some of the stoves made by CEFA

3. Observations and Recommendations

3.1 General observations

3.1.1 For most companies, most of the production processes are not documented which hinders effect process improvements.

3.1.2 Most companies have never tested or take long test or conduct inadequate tests on their products. Most companies though aware of the existence of national standards have not taken efforts implement them. Lack of knowledge about benefits of standards implementation was given as a reason for this.

3.1.3 All companies except one does adequate inspections and material selection for their stove and/or briquettes production. Most don't have internal specifications of materials and acceptance criteria.

3.1.4 Testing fees, as reported by every company assessed, remains a challenge and an inhibitor for testing and quality improvement.

3.1.5 Most companies assessed don't have adequate technical staff available to implement a basic quality control system. Most of them don't know the quality parameters to be monitored on their products.

3.2 Recommendations

3.2.1 UNACC should trainings on quality control, record keeping and documentation to members. A process that is not documented and measured cannot be improved.

3.2.2 If possible, start with a small committed group of about 10 members and assist them until they get certified. These will then act as an example and inspiration to the rest.

3.2.3 There is a need to find solution for the high costs of testing. Laboratories are also very few compared to the market.

3.2.4 UNACC should set and enforce minimum standards for its members. This will facilitate self-regulation.