

Active Venture
Charcoal Dust Briquettes



(photos ARTI energy)

Summary

Teams of 3-4 people will own or rent movable equipment with which they can convert any waste biomass (crop residues, branches and twigs from forestry operations, cutoffs and sawdust, savannah grass, rubbish from cleaning fields, etc) into charcoal dust in the field. They then sell this dust to a briquette manufacturing operation that produces briquettes from this dust (see photo above). Briquettes are then sold in urban areas as they can be used exactly like the normal known charcoal.

ARTI in Daressalaam has achieved technical proof of concept (<http://arti-africa.org/>). A first training has resulted in charcoal dust production initiated in Mgololo area. We are working on developing this further to allow sufficient incomes for the teams producing chardust and to upscale the production. Another challenge is to develop affordable machines that can do the briquetting. The marketing of the briquettes will then be taken care of through the Transaction Security Services of the company Biashara Mapema.

Funding so far has been committed by FARIP initial funds and by the REPIC program.

Status of financing	USD committed	USD not yet raised
1 A first training by ARTI in Magunguli was the first step, resulting in a demonstration to proof of technical and operational concept in the southern highlands and three chardust production teams operating regularly	25'000	
2 Set up further chardust teams and get them started as independent producers		5'000
3 Set up the company and operations for briquetting		5'000
4 A 6-month production period will follow that will explore all the operational issues and attempt to solve them	85'000	
5 Develop and build/test affordable extruders. <i>This will be set up as a separate FARIP venture</i>		30'000



History and Situation

Charcoal is used in large and increasing quantities in urban areas for cooking. It is by far the biggest source of energy for the majority of the population that mostly has a low income (BOP population, bottom-of-the-pyramid). However, forest depletion is the looming problem. It is difficult to improve this situation because for most urban dwellers there is no alternative for cooking. And for rural people it is a widespread source of hard-earned cash, and in times of crop failures often the only source of cash.

ARTI-Tanzania, a NGO dedicated to "bring the benefits of clean energy products to individuals and communities throughout Tanzania" (<http://arti-africa.org/>), has successfully developed a suite of technologies that allow to carbonize any sufficiently dry biomass in the village, eg. crop residues, savannah grasses, woody scraps and chips from forest operations, bush

and grass from clearing fields that otherwise would be burned before cultivation, etc. Steel drums are stuffed with the biomass and then lit at the top. The fire burns downwards and fails to fully burn the charred remains above the fire due to lack of oxygen. When the fire reaches the bottom it is extinguished. The result is charcoal dust and bits and pieces in the drum. This is then ground to a uniform consistency and mixed with porridge from waste starch made of peelings and cutoffs from cassava tubers, sweepings from grain mills, any starchy waste unsuitable for human consumption. This mixture is then pushed through an extruder that gives damp "sausages" of compressed charcoal dust. These are dried and then sold. Such briquettes are used exactly the same like normally produced charcoal, eg. for cooking.

ARTI has a commercial operation near Daressalaam producing such briquettes for the Daressalaam market (<http://arti-africa.org/2013/08/mkaa-mkombozi-sustainable-charcoal-briquettes/>). They are in high demand because due to their higher density they burn longer and hotter than the traditional charcoal from wood and still are about the same price.

For several years now farmers in the southern highlands of Tanzania have been exploring with the help of EFCO (<http://www.ef-co.org/>) and REPIC (<http://www.repic.ch/repic-en/>) how they could add value to the huge amounts of waste biomass from their forestry operations, mainly planted pines



and eucalypts and black wattle (*Mimosa*). They have become aware of the efforts of ARTI. Negotiations established that ARTI provides trainings and equipment on the whole technology suite.

Interest for this has also been voiced from Soroti in eastern Uganda (Gaudesius Opio, Engineer), an area with heavy savannah vegetation, lots of agricultural residues, and high cassava production

The Business Idea and Innovation

A. Chardust Teams

Teams of 3-5 people move around with their equipment in the landscape in southern highlands and on-the-spot convert the available waste biomass into chardust. They sell this chardust to a briquettes manufacturing company. This business itself is the main innovation.

B. The briquette manufacturing company

It purchases chardust from rural teams, along with waste starch for the porridge. They manufacture the briquettes and sell them to urban areas. This in itself is not an innovation as it already works with ARTI. The innovation is the replication of ARTI's operation at a location in the southern highlands yet to be identified. Local jobs are created, possibly including the teams mentioned in A.

C. The marketing

Marketing of branded briquettes shall be through the Transaction Security Services of TruTrade Ltd (<http://www.trutradafrica.net>) who work on a commission that is calculated from how much the chardust teams finally can earn. Such marketing through TSS is an innovation for cooking energy. For TruTrade the briquettes combine with other closely related products to share the same delivery logistics, eg. oil and potatoes, beans, rice, maize flour etc marketed to BOP consumers in the urban areas through local small restaurants franchised by TruTrade Ltd. These restaurants also act as shops and sell over the counter.

Status at present

1. **Technical proof of concept is achieved by ARTI.**
2. **Proofs of concepts for operations, economic viability and scaling up for southern highlands is not yet achieved.** Some research suggests that the carbonization kilns are not efficient enough to provide an acceptable daily income for the teams. So a next round of experimentation and technical testing must develop the equipment by which such teams can earn a decent and reliable daily income. Also, first experiences with the extruder equipment from ARTI suggests that we must develop it further to reach commercial viability.
3. Activities so far have been a training by ARTI in southern highlands that successfully introduced the kiln for chardust production. Chardust production is now under way. An ergonomically more efficient technology was also subsequently introduced by EFCO, ie. fires in open pits. This is promising but will have to be explored further. Briquetting turned out to be a challenge with the equipment provided by ARTI. Improvements could be made to reach higher outputs. However, generally extruders need to be designed and built specifically for this purpose.
4. Ragga Tweve of Magunguli in southern highlands wants to build the briquetting business in his area which is heavily forested and where most farmers now plant their own forests. He plans to engage chardust teams and do the briquettes manufacturing.
5. The FARIP Board had committed funding for a first training in Magunguli
6. EFCO has successfully submitted a proposal to REPIC for a larger effort to research and operationalize chardust briquette production, most importantly for increasing the labour efficiency. This active venture of FARIP is an element mentioned in the proposal to REPIC. REPIC finances 50% of all costs related to building this venture.

Next activities

1. The ARTI training was done to respond to following questions:
Can the ARTI operation in Daressalaam be replicated with the available equipment at a smaller level in the area around Magunguli-Makambako, and can briquettes be produced that urban dwellers can use?
The answer is no. While chardust-production has been achieved, the briquetting equipment for use in rural areas turned out to be inefficient. Furthermore the extruders ARTI is using in Daressalaam are prototypes that are far too expensive to replicate and which also have their engineering issues. The technical issues encountered therefore suggest further actions that must answer these questions:

- What technology should be tried for sawdust? - What is a useful design for extruders to operate under conditions such as in Magunguli or Makambako?
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2. For a full 6-month season produce chardust and briquettes with the available technology and explore the marketing. The questions to answer here are:

What are the technical, operational and economic challenges we encounter and how can we cope with them? What is a breakeven price for chardust delivered to the briquette manufacturing,
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calculated backwards from the sales prices of the briquettes in town? What are the main cost factors of briquetting and marketing and where to apply leverage for becoming more efficient?

3. Experiment with various models of kilns that are efficient enough to allow teams to produce enough chardust per day to make a daily income above that of casual labour on the fields and in forests (presently around 8'000 TSH per day should be the target). The question to answer is:

*- What kiln design will allow a chardust team to earn at least 1'000 TSH per hour of work for each of its members?
- How does the "Kontiki" charring pit compare to the ARTI kilns in terms of ergonomic efficiency?*

4. Work out the best location for the briquette manufacturing. There is a trade off between on the one hand proximity to urban centers in order to cut down on transport costs (briquettes are bulky) and higher wages, and on the other hand lower wages in the villages and the chance for regular incomes there in manufacturing. The question to answer is:

Where are the best locations for doing the manufacturing of briquettes? And by which criteria is that decided?

5. Establish more chardust teams and launch their operations in order to increase the production of chardust. The question to answer is:

What is required financially na din terms of training for such teams to successfully to the point of earning 1000 TSH per hour and person?

6. Design, develop, build, test affordable extruders that fit the specifications of operating them at locations such as Magunguli and Makambako. The question to answer is:

*- Is it possible to construct such designs in Tanzania itself, with only critically essential parts to be imported?
- Will their costs per kg of brikets still allow to compete against normal charcoal?*

7. Explore and initiate useful binders. Experience so far confirms that cassava flour works. But it is an expensive ingredient making up to 25% of the costs of the brikets. The questions to answer are:

*- Are there cheaper alternatives to cassava that still result in useful brikets, eg. clay?
- How does extensive cassava production specifically for binder look like, and could it reduce the price?*

Funding requirements

farip has financed the launch of this effort. In the meantime the REPIC program has taken over most of the funding. However, FARIP is challenged to continue to contribute its share to the effort to achieve the 50% a REPIC-financed venture must raise itself. The following is what we presently are looking for

Training and equipping chardust teams: 5'000 USD not yet committed

These are teams of 3-5 usually young rural people (mixed gender) who shall be equipped and trained to produce chardust and sell it to the briquetting manufacturing at prices that allow them to earn 1000 TSH per hour per person. The grants here shall be for training, and whatever equipment is required they will purchase-lease from the project to begin with and later own it.

The objective is that these teams take up operations as their own commercial enterprise.

Set up briquetting company: 5'000 USD not yet committed

Ragpa Tweve intends to establish himself as the entrepreneur who purchases chardust and sells brikets. We expect this company can be launched with maximum 5'000 USD in terms of equipment and operational start-up capital. This amount will be a loan and disbursed in installments as and when it is required. Repayment is expected to be within a 1-year period.

The objective is that the company successfully produces brikets in Magunguli.

Develop and test affordable extruders: 30'000 USD not yet committed

This includes the specification, design by EFCO partners in Switzerland, possibly prototype building and testing in Switzerland, preparation for construction in suitable workshops in Tanzania (eg. SIDO in Iringa?), travel by engineer to workshop and stay there for supervising the prototype, testing of the prototype in Magunguli and finally preparations for replications.

This effort will be designed as a separate FARIP venture in its own right.

General assessment

Should it become economically viable to convert waste biomass in the southern highlands into charcoal briquettes for the cities in the south, this will become a major breakthrough with big potential for impacts on rural incomes, environment (replacing the cutting of high value local trees for charcoal), and CO2 savings. Also this operation is scaleable and presumably fairly easily replicable in terms of technology, operations and marketing, eg. there is nothing to suggest that what would work in southern highlands of Tanzania would not work in the same way in eastern Uganda.

The biggest challenge presently appears to be the increase of the labour efficiency of the chardust production along with briquetting with affordable extruders. So far everything suggests that marketing the briquets through the Transaction Security Services of Biashara Mapema can work, provided the final pricing of the briquets and feedback by users shows they are competitive. This market introduction is yet to happen.