The Charcoal Project Policy Brief No.2:

Challenges and Opportunities for Charcoal Briquette Enterprises in East Africa

On March 30, 2021, The Charcoal Project hosted a webinar titled "Charcoal Briquette Enterprises: Challenges and Opportunities in East Africa." This policy brief summarizes the findings from various projects, lessons, and recommendations made during the webinar. This is the second in the series of webinars and policy briefs hosted by The Charcoal Project on making charcoal more sustainable. The Charcoal Project is a US-based nonprofit focused on finding sustainable solutions for those that rely on biomass for their primary energy needs for cooking and heating.

Charcoal Briquettes are a Sustainable Fuel Choice for Households and Small Businesses

Throughout sub-Saharan Africa, firewood and charcoal are used for cooking and heating because of their relative low cost, ease of access and convenience. Despite efforts to promote the use of more modern fuels, charcoal and firewood consumption is projected to increase in the coming decades. Where biomass sourcing is unsustainable, this increase could have drastic impacts on natural forests and woodlands. Charcoal briquetting utilizes waste and byproducts generated from production and trade of woodfuels to develop an entirely new product (briquettes) with many of the desired properties of traditional lump wood charcoal. By using charcoal dust, residual biomass from charcoal production, and agricultural residues, briquettes not only address inefficiencies within the charcoal sector but also those in the agricultural sector. The production and sale of charcoal briquettes presents a promising new enterprise for urban and rural actors in sub-Saharan Africa, but the sector is still in a nascent stage. With sufficient support, the charcoal briquette industry has the potential to grow to become an important contributor to the cooking fuel sector in the coming decade.



Coconut shells, charcoal dust and macadamia nut shells can all be used for briquettes

The Wonder of Charcoal Briquettes

Charcoal briquettes burn longer than lumpwood charcoal and can produce substantial fuel savings for households. Depending on the raw materials used to produce them, briquettes can also burn cleaner than firewood and traditional lump wood charcoal, potentially providing some health benefits, particularly for women. To be considered "sustainable" charcoal briquettes should be produced from sustainably sourced feedstock, such as from agricultural waste, organic municipal waste, coppiced tree prunings, sawmill waste or charcoal dust (waste from charcoal). The multiple benefits of briquettes and the large potential that exists to produce them sustainably make briquettes an ideal candidate for inclusion in circular bioeconomy initiatives.

Briquettes burning in a cookstove

To Succeed, Charcoal Briquette Enterprises Must Become Viable Businesses

Scaling briquette ventures has been a consistent challenge in the region. Yet, for the charcoal briquette industry in Africa to realize its true potential, it needs to operate as a viable business sector. The market for cooking fuel in SSA is enormous with fragmented competition and low barriers to entry. Charcoal briquettes produced in industrial settings and adhering to all the regulatory structures, effectively compete against a mostly informal firewood and charcoal sector, whose feedstock is mostly free or has escaped regulation. We assessed the business models of several charcoal briquette enterprises in the region that are trying to balance these competing influences. These cases serve to illuminate both the potential of the sector and the challenges that it currently faces. We highlight the challenges that could be addressed at policy-level and propose policy interventions that would greatly boost the contribution of charcoal briquettes to the energy, environment, and poverty eradication ambitions of African nations.

Women entrepreneurs in Kenya

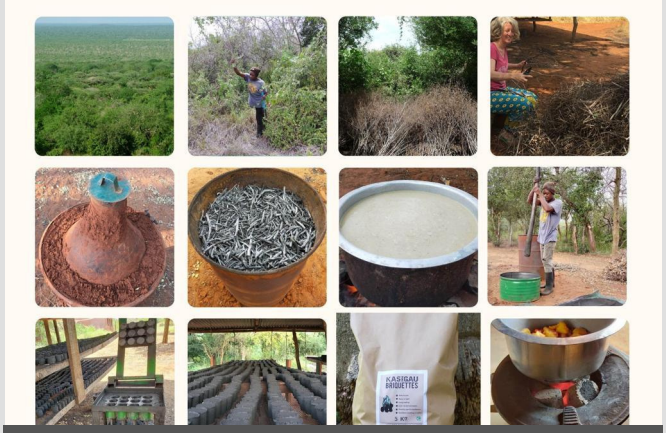
Green Bio Energy workers in Uganda

Business Model I: Fusing Agroforestry and Small-scale Manufacturing to Boost Livelihoods and Create Sustainable Fuel

Customer purchasing briquettes

The Centres for International Forestry Research (CIFOR) and World Agroforestry (ICRAF) are technically supporting a project that is converting tree residues into charcoal briquettes in Kenya's Kasigau Corridor, a conservation dryland landscape of about 200,000 hectares frequently affected by drought and floods. The project's primary objective is to reduce emissions from deforestation and forest degradation (REDD+) through various strategies including charcoal briquette production from tree prunings. The naturally regenerating branches and twigs of trees that undergo scheduled coppicing are carbonized (burned under limited oxygen) in drum kilns, before they are bound with cassava starch and compressed into charcoal briquettes. The partners are carrying out long-term studies to assess the effects of the coppicing plan on biodiversity including plants, butterflies and birds. The whole process of sourcing raw materials, processing, transportation and consumption of charcoal briquettes is also being assessed for climate impacts using life cycle assessment (LCA).

Communities along the Kasigau Corridor, such as Eco-charcoal Ltd., are developing similar briquette and conservation enterprises. Eco-charcoal produces about .25 ton/month with an operating profit margin of 20 - 40%. Eco-charcoal is planning to extend its knowledge on harvesting tree branches/twigs to local women to increase its feedstock collection capacity and enhance livelihoods in the community. Enterprises such as Eco-charcoal are small, but have significant potential to expand as capital for investment becomes available. The impacts of these businesses extend deep into the community and help generate resilient livelihoods for women that can be replicated in other contexts.



Charcoal briquette production by Eco-charcoal in Kasigau, Kenya

Another innovation involves using charcoal dust, a waste stream, which accumulates wherever charcoal is produced or sold, for charcoal briquettes. Women in urban informal settlements such as Kibera, Nairobi, one of the largest slums in Africa, collect charcoal dust from charcoal traders in their area, which they sieve, mix with water, bind with soil/clay and press into various shapes and sizes. When residents in the informal settlements produce their own charcoal briquettes or buy from local producers, they reduce the cost of cooking energy by 70% and 30%, respectively. Somewhat larger scale enterprises also recover charcoal dust for briquettes production. Eversave Charcoal Ltd. located in Mai Mahiu, Kenya uses charcoal dust to produce 115 tons/year. To supplement the charcoal dust, the company carbonizes macadamia nut shells acquired from a local processor, another way of enhancing tree-based circular bioeconomy solutions.

A third innovation using tree residues is processing sawdust into non-carbonized briquettes, which are mainly used for industrial purposes. Kings Biofuels, at Thika, Kenya produces 2400 tons/year and mostly sells to paint, carton and tea industries. While consulting with Kings Biofuels, ICRAF, International Water Management Institute (IWMI) and partners have replicated this model in Ghana under a public-private partnership supported by the Dutch government, WLE and CGIAR.

Business Model II: Scaling Charcoal Briquette Enterprises

Chardust Ltd. is a Kenyan company established in 1999, which produces briquettes of various grades and sizes from charcoal waste salvaged from traders in Nairobi. With estimated charcoal consumption in Nairobi of around 1,500 tons/day, of which 10-12% is discarded as dust and fines, there is a theoretical dust accumulation rate of 150 tons/day.

Through a process of sieving, milling, mixing and densification, Chardust produces cylindrical, spherical and pillow-shaped briquettes. The main markets are poultry farmers, restaurants and tourist camps, where the fuel is mainly used for space heating and water heating. Sales of BBQ fuel are also made via supermarkets to the urban middle class. Chardust has not succeeded in penetrating the mass household market, due to certain performance and cost limitations. At its peak, Chardust employed 70 people and sold 200 tons/month into local markets.

Production of agglomerated briquettes

Chardust identifies a number of challenges with replication and scaling of its commercial model and approaches that have been taken to address them:

- **Performance limitations of briquettes compared with wood charcoal:** Briquettes have higher ash and lower heating value than wood charcoal, depending on the materials used, making them harder to light and giving off less intense heat. They are sensitive to handling and moisture, and cannot be extinguished/re-lit without changes to cooking practices. In response, Chardust pre-selects, sieves and sorts raw material to maximise quality, and targets markets where the lower heat outputs and slower burn are considered desirable, such as space heating, water heating and meat grilling.

- **One-sided enforcement of regulations against the formal sector:** As a formal, registered company, Chardust and other briquetting companies are subject to multiple fees, licences and taxes, especially VAT. These requirements are inconsistently enforced in the informal sector, so the playing field is not level. In response, producers such as Chardust need to adopt a low-cost and business-like approach to their operations to remain competitive such as sharing business premises and staff to cost-share on overheads, minimising haulage distances from feedstock to factory and factory to customer, concentrating on pre-carbonised feedstock, and targeting business-to-business sales to avoid distribution mark-ups. It is also important to lobby for the removal of VAT on briquettes.

Unloading charcoal dust for production

- **Growing shortage of feedstock:** The quantity of feedstock available is declining, as the charcoal supply chain is consolidating with more direct deliveries to customers, so less repacking of charcoal by wholesalers (with resulting dust accumulation). There is also more competition for the dust. This pushes up raw material costs, hence product costs, and results in tighter margins. While it may not be suitable for all producers, Chardust chose to target 'premium' markets with higher mark-ups (e.g. small-size retail, middle class outlets and eco-conscious customers).

Charcoal briquettes face some inherent performance limitations, and market potential is constrained by weakly regulated competition and a growing shortage of low-cost feedstock. But with a focus on product quality, smart niche marketing and a business-like approach, the entrepreneurial briquette producer can still flourish, as Chardust has proven.

Business Model III: Marketing and Manufacturing Charcoal Briquettes in an Urban Setting

Green Bio Energy is a company based in Kampala, Uganda, that produces briquettes and improved cookstoves. The company has been in business since 2011 and currently produces 60 tons/month of briquettes, which it sells under the Briketi brand name. GBE launched the Briketi Eco-Stove in 2013, which was one of the first cookstoves designed for briquettes. The company employs at least 30 people directly and another 100 indirectly throughout the supply chain in the Kampala metropolitan area.

The growing urban population in SSA has led to an increasing number of businesses and institutions, such as schools, restaurants and poultry farms. Energy consumption is an essential need not only for households, but also for these businesses and institutions. This has been a business opportunity for GBE as institutional clients generate large orders and also use the company's custom, large scale stoves. There have been several challenges facing promotion and adoption of briquettes in urban areas, as they compete directly with wood charcoal, which is unregulated, and therefore has a price advantage. GBE has tried a number of different distribution models to reach household consumers, but even in an urban setting, a large number of distributors is costly to maintain. Balancing household customers with larger institutional clients allows the company to maintain a rational cost structure. The company can also leverage its delivery equipment to include feedstock pick-up, to make the most efficient use of its capital investments.

Urban populations have not entirely embraced briquettes, or may have a bad experience using briquettes if they did not understand the differences from charcoal. Grassroots marketing efforts can overcome these cultural challenges and show the energy savings of briquettes, particularly when used with improved stoves, but these programs can be costly to implement. Here is where government involvement in educating consumers on the benefits of clean cooking technologies would help companies like GBE realize quicker market acceptance.

Given rising urbanization in SSA and resulting increased demand for charcoal, SSA governments need to find ways to be supportive of urban briquette producers like GBE. Besides providing an important source of manufacturing jobs, these businesses provide a solution to the negative impact the growing demand for charcoal is having on forests. Briquettes are an option that would greatly enhance the sustainability of urban cooking.

Green Bio Energy team


Pouring the binder


Finished briquettes


Bagging briquettes

Business Model IV: Rural and Peri-urban Production of Charcoal Briquettes

Nyalore Impact Limited is a company based in Homa Bay, Kenya, which produces briquettes and improved charcoal stoves for the rural and peri-urban community. Nyalore faces a number of factors which impact the uptake of clean cooking alternatives in rural areas. Consumers lack awareness of clean cooking options and availability of customer financing for improved cookstoves is limited. At the same time, competition from informally produced cooking fuels impacts demand for briquettes.

Nyalore Impact Briquettes and Cookstoves

On the positive side, consumer response to charcoal briquettes has been good for Nyalore Impact in Homa Bay. Customers appreciate the value of briquettes in terms of energy and cost savings, particularly during COVID, when families returned home and they were cooking for large households. Generally speaking, customers in the peri-urban areas around Homa Bay have been more receptive to briquettes as they are more likely to have heard about the product benefits and more likely to have access to the fuel than more rural households.

Extruder machine

Briquette producers working in rural and peri-urban areas face additional challenges over their urban counterparts. The infrastructure for doing business, such as availability of skilled technicians and modern machinery, is well below what can be found in an urban area. Also access to capital is more limited, which increases the difficulty of importing modern machinery and attracting skilled workers. Using inferior technology leads to poor quality of the products and inhibits consumer acceptance and complicates operations management. Nyalore Impact has struggled with this issue as it tries to improve the quality of its briquettes but cannot do so without access to good quality machinary.

A number of actions can be taken by governments and other stakeholders hoping to improve access to clean energy solutions in rural and peri-urban areas. First, additional resources must be spent to increase consumer awareness of the benefits of clean cooking solutions, whether it be for stoves or fuel. Second, funding for companies like Nyalore Impact should be supported to make sure that these solutions become available in these areas.

Briquette producers can also take steps to improve the sector overall. Focusing on quality as well as learning how to measure health, environment and economic impacts will improve consumer confidence, bring much needed education to potential buyers and attract investors. While rural consumers are in need of clean cooking solutions, peri-urban communities may offer a better avenue for success for producers, at least in the short term, as these communities are more likely to adopt the new fuel.

LESSONS LEARNED AND POLICY RECOMMENDATIONS

- Charcoal briquettes are a viable alternative to traditional wood charcoal and contribute to improved livelihoods and sustainable environment.
- Briquette producers need to find long-term, sustainable alternatives to charcoal dust from the charcoal value chain as a raw material, as competition from multiple uses has increased prices and availability.
- Successful production and trade of charcoal briquettes can be cost effective with cheaper and sustainable sources of raw materials, effective and efficient sizes of operations, good quality of product and appropriate customer segments.
- Briquette producers are at a competitive disadvantage due to the informality of firewood and traditional wood charcoal sectors.
- Effective enforcement of charcoal regulations would place briquettes on an even playing field with respect to taxes, labor costs and government regulation.
- The briquette sector suffers from a lack of government and NGO support and would benefit from interventions that increase awareness and financial support as a cleaner cooking option.
- Financial investments would enhance the growth of briquette SMEs into large-scale operations making price competition more even with firewood and charcoal.
- Technological advancement should be carefully implemented so as not to push small-scale, informal briquette enterprises out of business such as those in urban informal settlements.

ACKNOWLEDGEMENTS

- Thank you to all the people, communities, organizations and funders involved in the works presented presented in this brief. We sincerely appreciate the contributions of all the webinar participants.
- Thank you to The Charcoal Project staff, people and community groups and our supporters.

AUTHORS

- Mary Njenga, World Agroforestry (ICRAF) and University of Nairobi
- Matthew Owen, Bioenergy Consultant, Kikenni Consulting, and Director, Chardust Ltd.
- Ziwa Hillington, Managing Director, Green Bio Energy Ltd.
- Dorothy Otieno, CEO, Nyalore Impact Ltd.
- Tuyeni Heita Mwampamba, Institute of Ecosystem and Sustainability Research, UNAM
- Sylvia Herzog, Director, The Charcoal Project

REFERENCES & USEFUL LINKS

- Ministry of Energy (MoE), & Cleaner Cooking Association of Kenya (CCAK). (2019). Kenya Household Cooking Sector Study. Assessment of the Supply and Demand of Cooking Solutions at the Household Level. Nairobi, Kenya.
- Njenga M and Mendum R (eds.) (2018). Recovering Bioenergy in Sub-Saharan Africa: Gender Dimensions, Lessons and Challenges. Resource Recovery & Reuse Series: Special Volume. International Water Management Institute (IWMI), Colombo, Sri Lanka. Pp 96 ISBN 978-92-9090-877-7 http://www.iwmi.cgiar.org/publications/resource-recovery-reuse/special-issue/
- Webinar, Charcoal Briquette Enterprises: Challenges and Opportunities Based on Experiences in East Africa, https://youtu.be/igmtaLv2sSo
- The Charcoal Project website: https://www.charcoalproject.org
- The Urban Briquette Making Pilot Study (CTCN): https://www.ctc-n.org/system/files/dossier/3b/20210504_Briquette%20Sector%20Study_Final.pdf
- CIFOR website: www.cifor.org/gml
- Green Bio Energy website: https://greenbioenergy.org
- Nyalore Impact webpage: https://www.charcoalproject.org/entrepreneurs/nyalore-impact-ltd/
- Circular Bioeconomy TPP (CIFOR-ICRAF). https://www.cifor.org/cbe
- RRR (IWMI) https://www.iwmi.cgiar.org/publications/resource-recovery-reuse/