ACP Science
and Technology II Programme

BIOCHAR PLUS — Energy, health, agricultural and environmental benefits from biochar use: building capacities in ACP Countries

ELSA cooking stove demonstration to researchers and women, Jimma, Ethiopia (June 2016).

SUMMARY OF RESULTS

Biochar knowledge and research findings were transferred into technology implementation, community development and policy advancement in Western, Eastern and Southern Africa. Existing biochar research and knowledge were analysed, structured and circulated during awareness raising and networking events to decision makers and the general public. Good practices and pilot activities on biochar, waste biomass recycling and ELSA improved clean cooking stoves resulted in the communities absorbing biochar technology due to endogenous learning and a participatory approach. The Africa Biochar Partnership was established as a continental platform for promoting and developing biochar and pyrolytic clean cooking systems: it serves as a hub for local, national, regional and continental institutions (municipalities, ministries, public development agencies, etc.), universities, research centres, foundations and the private sector for peer-to-peer exchange, learning, training, and coordination of biochar programmes.

BACKGROUND

A large part of humanity still relies on wood for almost all of its energy needs. In sub-Saharan Africa the three-stone fire is a widely used system to generate energy for cooking using wood fuel. Such traditional stoves are very inefficient, harnessing only 5-15% of biomass energy. Furthermore, they require more fuel than necessary and result in a progressive environmental degradation, and increase of time required for collecting wood and of costs to buy it. The inefficient combustion system is the primary cause of indoor air pollution, a major global health hazard for the exposed persons, mostly women and children. In recent years, biochar produced through improved pyrolytic clean cooking stoves has been proposed as a winning strategy to address the above-mentioned issues. These ensure efficient combustion, minimise pollutant emissions, are suitable for the feedstocks available in the areas of use, are available at low cost and produce biochar, a carbon-rich compound which can increase soil fertility when added to the soil.

The project tackled the limited existing knowledge on biochar technology in sub-Saharan Africa. This environmentally friendly technology was introduced to different stakeholders, from technology end users, mainly women and farmers, to researchers, policy makers and the private sector. They were exposed to this innovative technology, improved their knowledge and built capacities to use and exploit the benefits of biochar, such as: improved energy access; reduced diseases connected with current inefficient and hazardous cooking systems; enhanced soil fertility; reduced human pressure on the environment; and opportunities for socio-economic development. Adopting biochar can generate sustainable energy value chains through the introduction of pyrolytic clean cooking stoves and/or plants, the production and/or collection and distribution of fuel from waste biomass, and the collection and selling of biochar.

Multiple benefits from the adoption of the pyrolysis and biochar were achieved by local communities, including empowerment of the women. Women play an essential role in fuel collection and cooking. Due to the introduction of biochar and clean cooking systems, they now save time on cooking and improve cooking conditions. Saving time in firewood collection and reducing the physical burden placed on young girls and women allows them to enjoy a better quality of life.

PROJECT IMPLEMENTATION PERIOD
February 2014 – January 2017

CONSORTIUM
- Università degli Studi di Udine, Italy
- ECREEE - ECOWAS Centre for Renewable Energy and Energy Efficiency, Cape Verde
- STARTER - Studi Analisi e Ricerche Territoriali, Italy
- ASA Initiative, Ghana
- Université de Lomé, Togo
- CORD SL, Sierra Leone
- Jimma University, Ethiopia
- Bindura University of Science Education, Zimbabwe

Associated partners:
- African Union Commission (AUC), Ethiopia
- United Nations Industrial Development Organization (UNIDO), Austria
- Cornell University, USA

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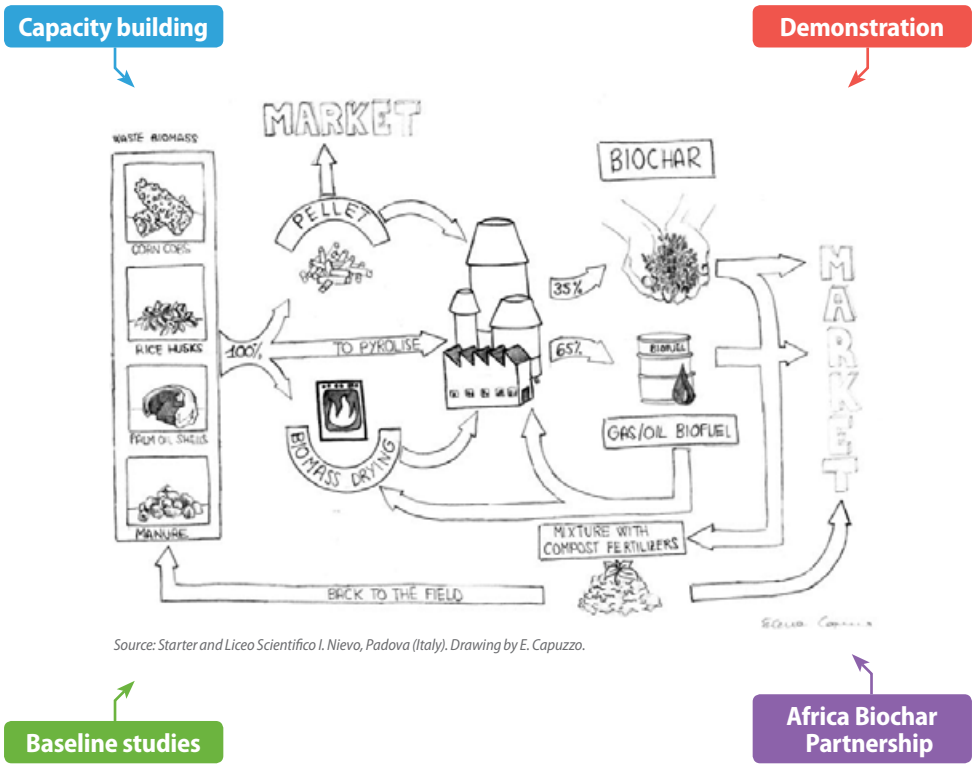
PROJECT WEBSITE
https://sites.google.com/site/biocharplusproject/home

Biochar Plus

METHODOLOGY



Source: Starter and Liceo Scientifico I. Nievo, Padova (Italy). Drawing by E. Capuzzo.

Local capacity of different society groups (educational institutions, farmers, women, entrepreneurs, etc.) on biochar usage was increased through training and awareness raising activities. Users could see and test biochar technology, understand its benefits and focus on organising a biochar system. The recognition of biochar and biochar systems was promoted to be included in regional and national strategies as an instrument to favour socio-economic development. Biochar systems have multiple benefits pertaining to energy, agriculture and food security, environment, sustainable forest management, health, and gender equality. For the introduction of a biochar system the three pillars of biochar technology were addressed: waste biomass input, pyrolytic process, and energy and biochar outputs. This allowed proper management of all emerging issues posed by the introduction of such system and to better exploit biochar opportunities given the local conditions.

Pellets produced with waste biomass by the community, Cape Coast, Ghana (April 2016).

Capacity building

Biochar Plus informed and built capacities of research organisations, non-governmental organisations (NGOs), civil society actors and technology developers to enable them to scout implementation opportunities in their areas. The most recent biochar knowledge was channelled through informative and educative kits (produced in English and French) intended for policy and decision makers, as well as for researchers and those implementing biochar systems in the field.

Demonstration

As a clean cooking pyrolytic device, the ELSA concept offers multiple benefits, including the possibility to launch local start-ups producing and selling these stoves. During demonstrative sessions on stove construction and use throughout different countries in Western, Eastern and Southern Africa, agro wastes such as palm oil kernels and maize cobs were used as sustainable fuel. An assessment on the availability of residual and low value agro wastes was performed to avoid energy to food competition and possible trade-offs.

Baseline studies

Biochar technology includes the use of different scales of pyrolytic devices, ranging from pyrolytic stoves to industrial plants, suitable for processing larger amounts of biomass and waste. In both cases, entrepreneurs and small and medium-sized enterprises (SMEs) could develop these activities and produce opportunities for socio-economic development. A baseline study and project pipeline, to be included in the National Renewable Energy Investment Plan of Guinea Bissau, was prepared for the Ministry of Energy and Industry, UNIDO and ECREEE including a preliminary feasibility study on macadamia nut shells. A baseline study and project pipeline on biomass electricity produced by sawdust and biochar, to be included in the National Renewable Energy Investment Plan of Zimbabwe, was also produced.

Africa Biochar Partnership

The introduction of biochar can simultaneously address some of the challenges Africa faces in terms of energy, health, food security, environmental protection, socio-economic development and climate change mitigation and adaptation. Existing initiatives and activities are scattered throughout the African continent. Biochar Plus stimulated the establishment of the Africa Biochar Partnership (ABP), a hub for continental and regional institutions, universities, research centres, foundations, NGOs and the private sector for peer-to-peer exchange, learning, training, and coordination of programmes to foster biochar development strategies and implementation of biochar systems in Africa. ABP focuses on promoting research and technology transfer, advocacy, policy development, stakeholders and end users engagement, networking and dissemination of best practices.

RESULTS

Outputs

Stoves

- >3,700 locally produced Elsa pyrolytic clean cooking stoves, adjusted to local users' needs, and distributed mainly to women: Ghana (3,609), Zimbabwe (38), Ethiopia (60), Sierra Leone (33).

Woman demonstrating Elsa stove use at exhibitions on clean cooking, Cape Coast, Ghana (April 2016).

Biochar

- 3,050 kg of biochar applied by 48 farmers on their fields in Ghana, Sierra Leone and Ethiopia.

Networking

- Africa Biochar Partnership (ABP). The first round of application to ABP took place in Nairobi during the international workshop 'Biochar Systems for Africa' held at ICRAF in March 2016, and involved 26 participants.

Capacity building

- 9 capacity building events in Lomé (Togo), Jimma (Ethiopia), Bindura (Zimbabwe), Banjul (The Gambia), Cape Coast, Kumasi and Akpafu-Mempeasem (Ghana), Milan (Italy), Nairobi (Kenya), involving around 750 people from research organisations, NGOs, civil society actors and technology developers and end users (women and farmers).
- 1 MSc thesis 'Methods and approaches to the application of biochar systems in Ghana. Sierra Leone, Zimbabwe Ethiopia and Cameroon', University of Padova, Italy.

Documentation

- Translations of latest available biochar knowledge into local languages (also dialects).
- 1 informative and 1 educative kit on biochar (English and French).
- Macro policy study of biochar systems potential in Ghana, African Center for Economic Transformation (ACET), 2016.
- 2 feasibility studies for industrial plants processing.

Informative and educative kits on biochar.

Visibility

- Project website.
- Facebook page.
- 1 video on how biochar can address deforestation issues and landscape restoration.
- 1 international conference in Nairobi, together with GEF6 Biochar for Sustainable Soil project.
- 3-day event at Expo 2015 in Milan https://www.youtube.com/watch?v=LahwkNlVY0g
- Scientific days and academic meetings in Kara and Lomé (Togo).
- 1 information event in Brussels, Belgium.
- Participation in a multi-stakeholder workshop (Cotonou, Benin).
- Participation in the European Development Days 2016 in Brussels, Belgium.
- Presentations at international events in Senegal, Benin, Ghana and Mali.

Publications

- Mengesha T.T., Venkata Ramayya A., 2015. Heat transfer validation and comparative evaluation of biochar yield from pyrolysis cook stove. Journal of Agricultural Science and Technology B 5: 389-400.
- Kibret H.A. *et al.*, 2016. Design, fabrication and sensitivity testing of an efficient bone pyrolysis kiln and biochar based indigenous fertilizer pelletizing machine for linking renewable energy with climate smart agriculture. Journal of Engineering and Applied Sciences, 11: 7951-7957.

Workshop on ELSA stove involving researchers in Bindura, Zimbabwe (December 2014).

RESULTS

Outcomes

- Awareness on biochar multiple benefits (energy access and efficiency, clean cooking uptake, soil fertility, environmental sustainability, and socio-economic development) raised among research and policy communities, civil society and private sector of Ghana, Togo, Sierra Leone, Ethiopia and Zimbabwe.
- Increased scientific knowledge on biochar at African research institutions.
- Socio-economic implications of possible biochar introduction identified, including: the effects that a biochar system has for socio-economic development, both in terms of social wellbeing and economic growth; under what conditions can these benefits be realised to the maximum potential and which institutions should be engaged; how other sectors (e.g. waste management) can benefit from or be associated with the biochar system in order to drive biochar uptake and improve general wellbeing and economic progress.

Impacts

Usage

- It has been demonstrated that biochar systems improve households' as well as farmers' livelihood, support healthier households through clean cooking, and offer new business opportunities.
- 67 local communities and villages exposed to biochar technology in Zimbabwe, Ethiopia, Ghana, Cameroon and Sierra Leone.
- 36 farmers from Ethiopia, Ghana and Sierra Leone tested biochar to improve soil fertility and they observed an increase in crop growth.
- Local Biochar Plus partners in Ghana, Zimbabwe and Ethiopia started local production of the ELSA clean cooking device for research and business purposes.
- In Cape Coast (Ghana), pellet produced by multisource waste biomass is being produced and sold in the local market as cooking fuel.
- 24 scientific institutions around Africa improved their knowledge of biochar and can start training people on biochar.

Policy implications

- The project has identified: policies that can facilitate or limit the adoption of biochar systems in Ghana and in the continent; the state of current research / policy interface; how lessons learned from biochar-related initiatives in Africa can be capitalised; actors and their interaction; governance systems; crucial institutions for these governance systems and significance for policy advancements; possible dissemination channels on biochar.
- A discussion has been started with the African Union Commission on possible biochar technology incorporation into Energy and Rural Development, Health, Public Private Partnerships (PPP) and Technical and Vocational Education and Training (TVET) policy areas.
- The World Bank and other donors demonstrated their interest in developing biochar related activities in other countries.

Sustainability

- A research proposal was submitted to the African Union.
- The Africa Biochar Partnership (ABP) is actively working on the topic of biochar technology in strong collaboration with the International Biochar Initiative (IBI). The World Bank has decided to follow up this project with a pilot programme in Burundi.
- The NGOs involved in the project are diffusing biochar technology and ELSA stoves among final users through microfinance support.

TESTIMONIAL

Mrs. Hannah Bangura, farmer, Brama village, Sierra Leone

"I used to buy expensive fertiliser, and one year after using it weeds took over my garden. Applying biochar has improved my livelihood. This technology improved my life by increasing my income level generated from the garden as a result of the use of biochar combined with compost and backyard manure. Now I can buy stationery for my children to go to school and I can afford medical bills when the family is sick, which was not possible before. I feel independent now, because I have my own resources. I will continue to propagate this technology to other communities."

ELSA system during cooking demonstration to women in Bindura, Zimbabwe (December 2014).

ACP-EU Co-Operation Programmes in the fields of Higher Education and Science, Technology and Research
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