

# Bamboo charcoal and sustainable management

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## Abstract

This paper describes bamboo charcoal and its innovative uses besides as fuel. It discusses sustainable biomass energy situation in Africa and that bamboo biomass and charcoal could be a substitute of woody biomass and charcoal, which could develop into a sustainable bamboo biomass energy source for African countries.

Keyword: bamboo charcoal, sustainable biomass energy

## 1. Introduction

With the fast economic growth, the demand on wood charcoal is increasing fast while the trees for wood charcoal grow very slow. To stop deforestation of wood charcoal production, many governments have ban on wood charcoal production. To mitigate the conflict between deforestation from wood charcoal production and conservation of forest resource, bamboo charcoal has been invented as a substitute for wood charcoal. Beside the similar functions like wood charcoal, bamboo charcoal has some unique properties.

Compared to wood charcoal, bamboo charcoal has very high specific surface area, about 150-400 m<sup>2</sup>/g, which is 2-3 times bigger than wood charcoal's. Therefore bamboo charcoal has very strong absorption capacity and hence it has been widely used as absorption materials for water purification, waste water treatment and air cleaning etc.

## 2. Bamboo charcoal use

In Asia Bamboo charcoal is more and more prosperous because of its excellent properties. Below are some uses of bamboo charcoal in general.

Bamboo charcoal has a good market in Japan and China due to a felling ban in natural forests and the good character of bamboo charcoal. In addition to bamboo charcoal being used for fuel, there are several other uses:

Agriculture: As a carrier of organic manure and micro-organism in the soil, bamboo charcoal can improve the vigour of the soil, so people use it as a good

soil improver.

Chemicals: Bamboo charcoal can be used as the raw materials of bamboo active carbon. Bamboo charcoal shows strong absorption because of the special structure of micro holes of the bamboo stem, and the function would be more outstanding after it is activated. Tests show that the absorption properties of bamboo active carbon are extremely good.

Medicine and health care: Pillows and mats made of bamboo charcoal can soothe the nerves, relax backaches, and control snoring. Bamboo charcoal also has the functions of deodorization, dehumidifier and fungicide, which are essential to family needs.

Environment protection: Bamboo charcoal can be used as a water clarifier, shield off electromagnetic waves and absorber of poisonous gases. Pollution indoors caused by poisonous materials would be absorbed if the panels were made of bamboo charcoal instead of the asbestos flakeboard and plastic boards. 95% of the nicotine and other poisonous materials would be absorbed if cigarette filters were made of bamboo charcoal. It is discovered that bamboo charcoal loaded with microorganism could purify waste water efficiently.

Other fields: Bamboo charcoal can be made into many kinds of compound materials in the material industry. It also can be made into handicrafts, feed additives and high capacity rechargeable storage batteries, textile added with bamboo charcoal etc.

## 2. Bamboo biomass and charcoal as a sustainable biomass energy source

In many African countries woodfuel and wood charcoal are the main urban household energy source, but woodfuel and wood charcoal supply is a problem due to increasing demand and decreasing forest resource. Bamboo charcoal from an easily renewable and sustainable bamboo resource, could be the substitute of wood charcoal and supply household energy for many African countries.

The African continent increasingly depends on wood and charcoal for cooking and heating homes. In 2000, nearly 470 million tons of wood were consumed in homes in sub-Saharan Africa in the form of firewood and charcoal, more wood per capita than any other region in the world.<sup>1</sup> Ethiopia and Ghana are two African countries where more than 90% of all households rely on fire wood and charcoal - as the primary energy source for domestic cooking and other productive activities<sup>2</sup>. Ethiopia's forest cover decreased from 4.2% in 2000 to 3.5% (4 mil ha) in 2005, equal to deforestation rates of 141,000 hectares per year. Ghana's total forest cover decreased from 37% in 1993 to 24% in 2005 (5,517,000 ha), presently representing annual deforestation of 115,000 hectares. In Ethiopia, 90% of forest

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removal is associated with firewood and the production of 3.2 million tons of charcoal. In Ghana in 2004, 7 million tons of wood were used to produce approximately 1.4 million tons of charcoal. The demand for wood as biomass for fuel wood and charcoal making represents a threat to the use of resources in both countries and is expected to remain unchanged for many decades to come. This demand is influenced by low household incomes, urbanization, and the growth of informal sector activities. Bamboo can serve as a viable alternative biomass for firewood and charcoal at the household level. This action to use bamboo for energy will promote bamboo as a renewable energy biomass and will address the following problems in both countries:

1. Current unsustainable use of wood as biomass for firewood and charcoal making
2. Increased charcoal production results in major ecological consequences (deforestation, reduction of carbon sequestration, loss of biodiversity and desertification)
3. Prohibitive policies and regulatory mechanisms support inefficient firewood and charcoal production activities
4. Lack of technologies and incentives to develop sustainable energy from biomass

**Target Groups:**

- **Rural Communities and local households** in the State of Benishangul Gumuz and Southern State at Hagereselam in West and South West Ethiopia and Mpohor Wassa East District in the Western Region of Ghana.
- **The Ethiopian and Ghanaian National Governments** will be encouraged to adopt policies and mechanisms to use bamboo as sustainable biomass for firewood and charcoal production activities. The action will also target local and provincial governments, institutions and organizations.

**Beneficiaries:**

- **Low income local households** in targeted Ethiopian Mozambican, and Ghanaian rural communities.
- **Low income charcoal producers and micro small enterprises (MSEs)**, such as the vast number of Ethiopian and Ghanaian women, ranging from 16 to 63 years old, who serve as firewood carriers in local communities, as well as, micro and small scale enterprises involved in charcoal production, local transportation, distribution and trade.
- **Government institutions and research centres**, such as the Ethiopian Rural Energy Development and Promotion Centre (EREDPC), Ethiopia's Federal Micro and Small Enterprises Development Agency (FeMSEDA), Ghana's Bamboo and Rattan Program (BARADEP), and the Forestry Research Institute of Ghana (FORIG), will be involved in project implementation activities, thus benefiting from integrating bamboo components into their sustainable development programs.

Ethiopia, Mozambique and Ghana's energy sectors depend heavily on traditional biomass fuels, such as firewood and charcoal. The heavy dependence of a large segment of the population on biomass fuels has been recognized as a major socio-economic development obstacle for both countries. Their reliance on wood fuel has become a serious threat to their ecosystems. Next to commercial logging, agricultural practices and mining, Ethiopia and Ghana's heavy reliance on wood fuel contributes to exacerbating this unsustainable trend. Although wood as biomass is often considered a renewable energy source, this only holds true if annual increment exceeds annual allowable cut. Continuous deforestation may well lead to national ecological disasters. Today, forest growth in Ethiopia and Ghana is less than half of wood fuel demand. This makes firewood an unsustainable energy

option and calls for urgent action. In Ethiopia, Mozambique and Ghana, alternative renewable sources for biomass, which can replace traditional wood as biomass, are desperately needed. This action will introduce bamboo as a viable sustainable biomass alternative to meet energy needs of targeted local populations. The action will help to meet the needs of target groups and beneficiaries. The action will benefit low income households by helping them sustainably meet their everyday energy needs. In addition, the action will benefit local entrepreneurs who rely on charcoal making as a source of income.

It aims to tap into untapped bamboo resources to serve as sustainable biomass energy to meet everyday needs of the local populations. The action will disseminate and use best bamboo charcoal production technologies and practices among the targeted groups. The initiative will also work with national and local governments to draft policies, measures and strategies, to promote bamboo as biomass for energy. Furthermore, through working with partners, the action will devise marketing and awareness raising strategies to enhance the use of bamboo charcoal production technologies and processes. The action has the potential for replication in other African countries such as Kenya, Nigeria, Mozambique, Tanzania, Uganda and Sudan where vast bamboo resources are available.

### 3. Bamboo charcoal, one option of sustainable forest management

Ethiopia's bamboo resources amount to 1 million hectares and constitute 25% of the country's total forest cover. Ghana has approximately 300,000 hectares of bamboo resources which cover 5% of the country's total forest land. The availability of bamboo resources in both countries makes bamboo a viable biomass alternative for energy. Bamboo is one of the fastest growing plants on earth, which makes the resource a truly renewable energy source. Bamboo charcoal's heating value is over 30,000 J/g offering comparable heating properties to wood charcoal for cooking and heating. In Ethiopia, the average annual dry bamboo culm increment is 10 tons/hectare and thus it is possible to harvest over 10 million tons annually of dry bamboo for biomass energy. With a 30% bamboo charcoal yielding rate, sustainable harvest of bamboo resources could potentially provide 3.3 million tons of bamboo charcoal annually, thereby bamboo charcoal could potentially replace wood charcoal production in its entirety. Ghana has a strong potential to produce 0.9 million tons of bamboo charcoal on a sustainable basis with a 30% yielding rate, thereby bamboo could potentially replace 64% of the country's wood consumption for charcoal production. INBAR and its partners in Asia have proven bamboo charcoal to be a viable alternative to wood for fuel and charcoal used for cooking and heating. Bamboo charcoal is produced through controlled burning of bamboo in improved traditional charcoal making kilns (casamance), low technology metal kilns and brick kilns at the local level where bamboo resources are locally available. INBAR projects have proven that through capacity building and training activities, wood charcoal producers can easily shift to produce bamboo charcoal. INBAR

partners in China, where bamboo plantation management and charcoal making technologies are the most advanced in the world, are actively involved in the organization's charcoal projects worldwide. INBAR is actively involved in promoting bamboo for livelihood and economic development and environmental sustainability in both Ethiopia and Ghana. In 2003, INBAR worked with the Ghanaian government and local partners to develop a National Bamboo Strategy. Since 2005, INBAR has supervised a Common Fund for Commodities project for East Africa which encompasses the development of an Ethiopian National Bamboo Strategy in collaboration with Ethiopian government agencies. Thus, INBAR's dedication to carry out activities in both countries responds to local interest and support for the development of viable livelihood development and environmental conservations programs through bamboo.

## Reference

- 1 Robert Sanders, "Study of Energy and Health in Africa focuses spotlight on charcoal and forest management," UC Berkely News, March 31, 2005. [http://www.berkeley.edu/news/media/releases/2005/03/31\\_africa.shtml](http://www.berkeley.edu/news/media/releases/2005/03/31_africa.shtml)
- 2 ECA/UNESCO, "Africa Review Report on Agriculture and Rural Development". Fifth Meeting of the Africa Committee on Sustainable Development (ACSD-5)/Regional Implementation Meeting (RIM) for CSD-16. Addis Ababa. 22-25 October 2007