

Woodfuels in Kenya and Rwanda: powering and driving the economy of the rural areas

The number of woodfuel consumers in Africa is projected to increase from around 2.5 billion in 2004 to 2.7 billion by 2030, with sub-Saharan Africa accounting for the highest increase. Rwanda and Kenya are two good examples of countries in which woodfuel plays a key role in energy provision, poverty alleviation and economic development.

About 94 percent of the African rural population and 73 percent of the urban population use woodfuels as their primary energy source, with the urban settlements relying heavily on charcoal and rural areas being more dependent on firewood (see Box). Woodfuels are used for heating and cooking and to support small and medium industries like beer brewing, tobacco curing, and brick-making.

■ Demand surpasses production capacity

Rwanda: Primary energy supply is dominated by biomass resources in Rwanda. Wood supplies about 57 percent directly and wood for charcoal 23 percent, while agricultural residues and peat provide 6 percent and petroleum products 11 percent. Only

Geoffrey Ndegwa

Cologne University of Applied Sciences
Cologne, Germany
gefmaina@yahoo.com

Dr Thomas Breuer

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Prof. Dr Johannes Hamhaber

Cologne University of Applied Sciences

5 percent of the country's population are connected to the electricity grid, with 3 percent of these being in the rural areas and 25 percent in the urban areas. 88.2 percent of the total households use biomass in form of fuelwood at 1.45 kilograms (kg)/person/day, while 7.9 percent use charcoal at 0.48 kg/person/day. There is a combined per capita demand of wood (both for fuelwood and charcoal) of 1.93 kg/person/day, which creates an unsustainable situation because it largely surpasses the production capacity of 0.46 kg/capita/day.

Unlike in many African countries, all the biomass energy demand in Rwanda is met by plantations, mostly of eucalyptus. Currently, about 450,000 hectares or 17 percent of the country is covered by forests, with 46 percent being natural forests and the rest public and private plantations. 65 percent of the plantations are state and district owned, while institutions own 9 percent and 25 percent is privately owned. 30 percent of the state forests is left for soil protection, which reduces the amount of plantations that can be harvested to 194,000 hectares.

Most of the charcoal is consumed in Kigali, and the main supply areas are the rural areas of Southern and Western

Provinces, where it is produced using the traditional earth mound kilns with an efficiency of merely 12 percent.

Kenya: The principal energy supply sources in Kenya are biomass at 68 percent, petroleum at 22 percent, electricity at 9 percent and coal at less than 1 percent. Over 90 percent of rural households use firewood for cooking and heating while 80 percent of urban households depend on charcoal as a primary source of fuel for cooking. In

Definitions

Woodfuel: includes all types of biofuel derived directly and indirectly from trees and shrubs grown on forest and non-forest land. The most important for Kenya and Rwanda are fuelwood (firewood) and charcoal.

Charcoal: refers to a solid residue derived from the carbonisation, distillation, pyrolysis and torrefaction of wood (trunks and branches of trees) and wood by-products, using continuous or batch systems (pit, brick and metal kilns).

Fuelwood (firewood): includes "wood in the rough" in small pieces, chips, pellets and powder derived from forests and isolated trees, as well as wood by-products from the timber industry and recovered wood products.

Woodfuel is often considered to be a poor man's trade. The actors are not formally organised, and hence lack a collective voice.

2006, biomass demand was estimated at 38.1 million tonnes against a sustainable supply of 15.4 million tonnes, creating a demand-supply deficit of 60 percent.

Electricity, which is seen as the ideal alternative to woodfuel and biomass, remains far beyond the poor majority as its cost remains high at 0.15 US dollars (USD) per kWh. 83 percent of the population have access to electricity, although only a low 18 percent of them are connected to the grid. Connection is lowest in the rural areas, where it stands at 4 percent, compared to 51 percent in the urban areas.

The traditional three-stone stove is the most common technology in the rural areas, with the Ministry of Energy reporting that it is used by about 96 percent of the rural population. The energy policy (2004), and the Vision 2030 for Kenya, sector plan for Energy (2008) set the goal of increasing the national adoption rate of efficient wood stoves to 30 percent by 2020, and efficient charcoal stoves to 100 percent in urban areas and 60 percent in the rural areas by 2020. The government also targets to improve the efficiency of the charcoal stoves from the current 30–35 percent to 45–50 percent by 2020 through investment in research and development.

■ A major source of employment ...

Studies have shown that wood and other biomass resources generate at least 20 times more local employment within the national economy than other forms of energy, per unit consumed. This is due to the huge amount of manpower (unskilled labour) required



Photo: giz

for harvesting, processing, transporting and trading of the fuels. The value added on wood energy at the village level is retained locally, helping to reduce poverty, unlike fossil fuels which have to be imported, acting as a drain on the national foreign currency reserve.

In Rwanda, the woodfuel sector directly employs about 20,000 people, and these in turn support around 300,000 people. They include 7,000 loggers engaged in felling, sizing and stacking the wood and about 8,000 charcoalers, most of them in the impoverished rural areas of the Southern and Western Provinces. About 200 to 300 transporters and 2,000 charcoal vendors living chiefly in the urban areas are also directly employed in the sector.

In Kenya, the charcoal sub-sector employs about 200,000 charcoalers from impoverished rural areas of semi-arid districts like Kitui, Narok and Kajiando. There are also around 2,700 transporters, based mostly in the urban areas, and almost 500,000 charcoal vendors. The employees then support about 2.5 million people in terms of

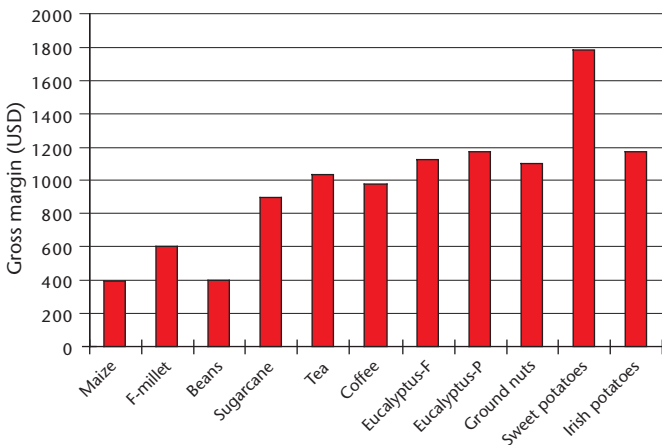
basic commodities like food, clothing and education.

■ ... and income

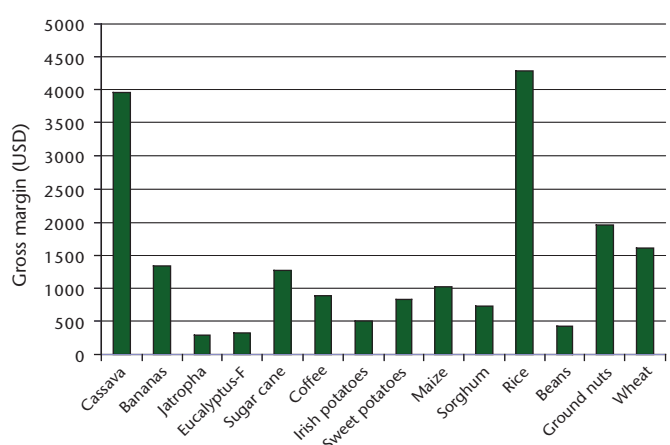
The woodfuels sector has a major economic impact both at national level and in the rural areas. In Rwanda, it is estimated that the turnover from woodfuel was about 122 million USD in 2007, which is around 5 percent of the country's GDP, with the fuelwood sub-sector having 55 million USD and the charcoal sub-sector 67 million USD. In Kenya, 1.6 million tonnes of charcoal are consumed each year, with a turnover of about 419 million USD, which, at 16 percent value-added tax charged by the Kenyan Government, can contribute 67 million USD in tax each year.

The establishment of woodlots of fast-growing tree species has been recommended to ensure sustainable woodfuel supply in many developing countries. A study done by Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) and the authors of this article established that growing eucalyptus is quite profitable in

Gross margins for 1 hectare selected crops, Kisii district, Kenya



Gross margins for 1 hectare selected crops, Rwanda



Kenya, giving a better gross margin than most other cash and food crops. However, even though growing eucalyptus in Rwanda has a positive gross margin, other crops like cassava, rice and groundnuts have a higher gross margin due to the poor prices paid for eucalyptus products compared to Kenya (see Figures).

Woodfuel trade has a huge impact on the economies of the rural areas of Kenya and Rwanda. For every stere of wood sold in Kenya and Rwanda, more than 20 percent of the final market price is retained in the rural areas, either as farmers' income or labour expenses, for the residents, providing the much-needed income. For charcoal, almost 50 percent of the final price of a sack of charcoal is retained in the rural areas as income for the farmers, charcoalers and labourers.

■ Challenges

Although the woodfuel sector plays an important role in powering and driving the economies of the rural areas of Kenya and Rwanda, it is faced by many challenges that hamper it from giving maximum benefits to the supply chain actors and the country as a whole. These challenges can be categorised by typology as:

Financial: Corruption is the greatest economic vice that faces the sector during harvesting, transport and trade in woodfuels. It ranges from harassment by police officers to forest and local government officials demanding bribes for harvesting and transport permits. The chief actors in the supply chain are also poor and unable to invest in the expensive and more efficient biomass conversion technologies – a fac-

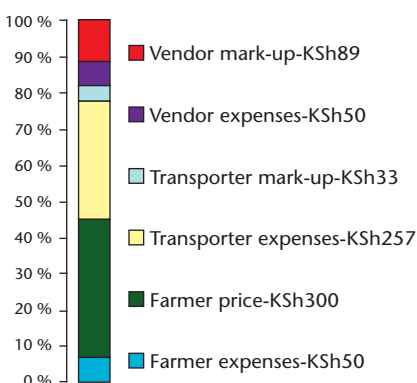
tor resulting in massive wastage of the woodfuel resource. This is especially the case in charcoal making, where the earth mould kiln, with an efficiency of about ten percent, is commonly used. Due to the sector being informal and, in some cases, illegal, the actors cannot access credit facilities to raise capital, and neither can those with finances invest due to the high risks involved.

Environmental: Unsustainable woodfuel procurement from natural forests has been blamed for forest degradation in many developing countries. Use of inefficient conversion technologies like charcoal kilns and stoves leads to massive emissions of greenhouse gas emissions to the atmosphere and wastage of wood, with a negative effect on the environment.

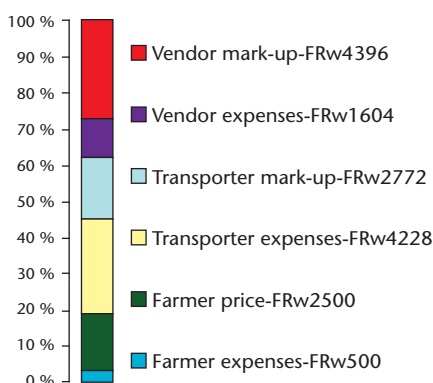
Social: Woodfuel is considered to be a poor man's trade, and the actors are looked down upon by other members of society. They are not formally organised in associations like in other sectors but rather operate individually, hence lacking a collective voice and bargaining power to push for their agenda within the government.

Technology adoption: The sector is characterised by low technology adoption, mostly due to lack of capital to invest in the more expensive and efficient biomass conversion technologies.

Price share of actors in one sack of charcoal in Kenya (in Kenyan shillings)



Price share of actors in one stere of Fuelwood in Rwanda (in Rwandan francs)



Technical skills: Most of the operators in the supply chain are poor and have few or no formal skills, especially in charcoal making. Thus they learn the trade by watching others, which limits innovation and development of the sector.

Legal and legislative: Neither countries have had a proper legal and legislative framework to govern the sector – a factor that has fanned corruption and hindered development of the sector. However of late, both have developed important legislations whose implementation is underway that are hoped to streamline the sector.

Health: Emissions from woodfuel stoves contain poisonous fumes that

normally affect women and children, who are traditionally charged with the duty of cooking in Africa. This has been said to be a major cause of death or sickness to many people, especially in sub-Saharan Africa.

Sustainability: The current demand for woodfuel in both countries outstrips sustainable supply. However, there is great potential to improve the productivity of the current plantations, which is about 20 percent of the achievable level in Rwanda and 50 percent in Kenya. Better management, improved seedlings and use of farm inputs can go a long way in reducing the overall deficit. Diversification of energy resources by adopting biogas and solar, which are abundant in the

rural areas of both countries, is also recommended to ease the pressure on the woodfuel resources.

■ The way forward

Although the sector faces a lot of challenges, its importance means that it cannot be ignored but should rather be streamlined to ensure that it remains a sustainable energy and economic resource. To achieve this, several measures are recommended. They include:

- Formulation and implementation of legislation that will stem corruption and promote sustainable and efficient production, conversion,

Everything has its proper place

In some parts of Africa, eucalyptus is being promoted as a fast-growing and profitable source of biomass for charcoal and material for construction work. There are more than 600 species of the tree, which originally came from Australia. It was already introduced in Ethiopia in the late 19th century.

The role of eucalyptus outside its home country is controversial. Claims range from its usefulness in making charcoal and in construction to its being a threat to biodiversity and the environment. For instance, Wang Rusong, an ecological environment researcher with the Chinese Academy of Sciences, says that “it is common knowledge in ecology that eucalyptus absorbs a large quantity of nutrition from the earth”, adding that “massive planting of eucalyptus will bring disaster to local ecotypes”.

On the other hand, Tesfaye Teshome of the Ethiopian Tree Fund Foundation points to the plant’s role in alleviating fuel and construction material problems. He maintains that eucalyptus has a comparatively economical rate of water consumption to biomass produced. Furthermore, he says that claims about the plant’s allelopathic effect are based on a miscon-

ception stemming from litter being collected by people for fuel, which leaves the ground bare. Equipped with strong tap roots as well as a good lateral root system, several species are “very reputable for catchment protection”, Tesfaye Teshome states, and concludes that in Ethiopia at least, it is “totally unacceptable to disfavoured eucalyptus today”.

Be this as it may, a lack of undergrowth is an ominous feature in several areas where eucalyptus has been planted, despite the trees allowing plenty of sunshine to come through. Many Mediterranean eucalyptus “forests” really consist only of eucalyptus, lacking not only insects, and hence birds that could feed on them, but also other plant life. Attributing barrenness to dead leaves and twigs being removed from the ground does not necessarily prove its actual cause, which could indeed be the leaves and twigs themselves.

Claims about eucalyptus having a strong allelopathic effect are based on the high content of ethereal oils in the tree’s leaves and bark. These oils act as a powerful deterrent to other organisms, both animals and plants, and may thus stifle the growth of truly healthy woods. So what about Australia’s koalas, who normally eat noth-

ing but eucalyptus and live in these trees? Interestingly, too, the Australian eucalyptus forests do have healthy undergrowth. But unlike eucalyptus plantations, these biotopes have developed over very long periods, giving individual species time to adapt to one another.

There is a long history of small woods that are managed as coppices, also in charcoal iron production in Europe. Fast-growing eucalyptus varieties raised in small coppices in the immediate vicinity of village communities appear to make sense as a fuel supply. They take some of the strain off the primordial forests, often used for firewood and charcoal, while relieving women, whom fuel supply is up to so often, of at least some of their back-breaking burden. Coppiced eucalyptus quickly grows new shoots, providing a largely renewable source of biomass. While some Australian eucalyptus varieties offer top-grade timber, fast-growing species with corkscrew-like fibres will only provide a low quality, although they may be suitable for supplying scaffolding poles.

*Mike Gardner
Freelance journalist
Bonn, Germany*



Photo: giz

Studies in Kenya and Rwanda have shown that wood and other biomass resources generate at least 20 times more local employment within the national economy than other forms of energy.

distribution and trade in woodfuels. This should be accompanied by a long-term action plan with a two-pronged approach laying emphasis on supply-side management establishing fast-growing tree plantations and efficient conversion technologies and demand-side management vigorously promoting efficient biomass stoves.

- Establishment of a woodfuel management body consolidating all the functions and organisations in the sector which are currently scattered

over different government ministries and agencies. This should be followed by the creation of a woodfuel development fund to facilitate development production, trade and use managed by the body. Such a fund could provide money for research, development and promotion of efficient technologies, and organise skills development and marketing workshops for the actors. The fund could raise revenues through taxes imposed on the sector and also benefit from both government and donor funding.

- The process of policy-making should be improved through: raising the effectiveness of public participation, inter-ministerial co-ordination and multidisciplinary collaboration, participation of affected stakeholders including the poor and the marginalised groups and the private sector whose investment would bring in the scarce financial resources. There is also the need for transparency, accountability and easy access to information to build confidence in the whole process.

- Regular surveys and development of a comprehensive databank on production, conversion and consumption trends, which is important in planning or monitoring and evaluation to establish effectiveness of formulated policies.

- Involving research institutions in the research and dissemination of efficient technologies. Schools would be used to sensitise the students and pupils to the importance of adopting efficient stoves which hopefully would be passed on to the parents.

Zusammenfassung

Der Holzbrennstoffsektor in den Entwicklungsländern ist eine wichtige Energiequelle – für Feuerholz und Holzkohle. Den armen ländlichen Haushalten bietet er zudem die Möglichkeit, sich neue Arbeitsplätze und – beispielsweise durch den Verkauf von Brennholz – auch neue Einkommensquellen zu erschließen. In Ruanda wurde 2007 mit Holzbrennstoff ein Umsatz von 122 Millionen US-Dollar erwirtschaftet, das sind etwa fünf Prozent des Bruttoinlandsprodukts (BIP). In Kenia werden jährlich 1,6 Millionen Tonnen Holzkohle verbraucht, dies entspricht einem Umsatz von rund 419 Millionen US-Dollar. Etwa 20 Prozent der Erträge durch Feuerholz und über 40 Prozent der Erträge aus Holzkohle verbleiben in beiden Ländern bei Bauern und Landarbeitern und fördern so die länd-

liche Wirtschaft. Der Beitrag ist ein Auszug aus einer Studie, die 2010 in Kenia und Ruanda durchgeführt wurde, und beleuchtet die Bedeutung des Sektors für die Minderung der Energie- und der allgemeinen Armut in den ländlichen Regionen.

Resumen

En los países en desarrollo, los combustibles provenientes de la madera constituyen una fuente importante de energía, tanto en forma de leña como de carbón. Asimismo, el sector resulta primordial para los medios de subsistencia de la población rural pobre en términos de creación de empleo y generación de ingresos a partir de la venta de estos mismos productos, como por ejemplo la leña. En Ruanda, los combustibles provenientes de la madera representaron una facturación de 122

millones de dólares norteamericanos en 2007, lo cual equivale a alrededor del 5 por ciento del PIB del país. En Kenia se consumen todos los años 1,6 millones de toneladas de carbón, que arrojan una facturación de aproximadamente 419 millones de dólares norteamericanos. En ambos países, cerca del 20 por ciento de los ingresos generados por la leña y más del 40 por ciento de los ingresos derivados del carbón permanecen en las áreas rurales donde benefician a los agricultores y trabajadores del campo, con el consiguiente beneficio para las economías rurales. El presente artículo es un fragmento de un estudio realizado en Kenia y Ruanda en 2010 y resalta la importancia de este sector para las áreas rurales en lo que respecta al alivio de la pobreza, tanto energética como financiera.