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Rethinking Biomass Energy in Sub-Sahara Africa

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Preface

In a paper produced for the International Conference on Renewable Energies in 2004, Stephen Karakezi, Kusum Lata and Suani Teixeira Coelho provided an explanation for the growing momentum on biomass energy around the world. This growing interest is driven by the following:

- Biomass energy contributes to poverty reduction in developing countries. It is crucial for the achievement of the Millennium Development Goals (MDGs) – especially in wealth creation and the reduction of extreme poverty, hunger, maternal and infant mortality, health care delivery, access to quality sources of water, and addressing environmental degradation;
- It meets energy needs at all times, without expensive conversion devices;
- Biomass sources deliver energy in all forms that people need (liquid and gaseous fuels, heat and electricity);
- It can reduce women's workload. Reduction in drudgery and indoor air pollution from traditional biomass use leads to free time, increased sense of wellbeing and increased productivity for women;
- The feedstock is considered carbon dioxide-neutral and can act as a carbon sink;
- Biomass energy helps restore unproductive and degraded lands, increasing biodiversity, soil fertility and water retention;
- For farmers, biomass energy can provide an important hedge. Crop diversification can lead to increased agricultural productivity levels, especially in the rural areas, which could, in turn, result in improved incomes for agricultural businesses. Biomass energy, if developed in a sustainable manner, can create opportunities for increased food and fuel production, especially in rural areas;
- The diversification of domestic energy supply leads to increased energy security and independence from imports.

In several countries of Sub-Sahara Africa (SSA), biomass energy accounts for 70–90 per cent of primary energy supply. By the year 2030, one billion Africans will depend on traditional biomass for meeting their energy needs. Half a million Africans die annually as a result of indoor air pollution arising from the use of solid biomass fuels. In several countries in the region, the proportion of the population with access to electricity is in decline (UNDP, 2008). Forest loss in several countries of the region is occurring at an alarming rate. Outside South Africa, biomass energy is a key contributor to deforestation and an important source of greenhouse gas emissions from the region. Should these trends continue, efforts to address poverty and the climate challenge will be at risk.

We did not accept to write this paper out of a wish to contribute to the already crowded literature on biomass energy in Africa. There is neither a dearth of analysis nor a shortage of experts on biomass energy and the poverty trap in Africa. However, we are increasingly concerned over the lack of progress on energy poverty in Africa, and how this is often presented as an intractable technical and economic challenge.

It is an established fact that without access to sustainable energy, the MDGs will remain a mirage. While we recognise the challenges of financing and shortage of technical skills, we believe that addressing these issues is essentially political – the will to realign governance structures and interests to address energy poverty and empower people to make choices that improve their lives. We also believe that the tools to tackle poverty and the climate crisis are available.

Our aim is to provide a brief commentary and stimulate debate on opportunities and linkages to address the twin challenges of our time – ending poverty and tackling the climate crisis.

We have relied on research reports, presentations and reviews conducted by specialists, particularly the African Energy Policy Research Network, international organisations such as the Food and Agricultural Organisation and the International Energy Agency (IEA). All three case studies cited in this paper are from Karakezi et al., 2008.

This paper is written on behalf of VENRO and German NGO Forum Environment and Development within the VENRO-Project "Prospects for Africa – Europe's Policies" on the Africa-EU Partnership (www.prospects-for-africa.de). It represents a civil society contribution towards the Africa-EU-Energy Partnership.

1. Traditional Biomass Energy: Improving its Use and Moving to Modern Energy Use. International Conference for Renewable Energies, Bonn, 2004.
2. Scaling Up Bioenergy in Africa, presented during the International Conference on Renewable Energy in Africa, Dakar, 16–18 April 2008 by Stephen Karakezi, Waeni Kithyoma, Ken Muzee and Annah Oruta.
3. WHO, 2007.

Cooking outside with wood, Ivory Coast – © by Lineair / www.das-fotoarchiv.com

Sub-Sahara Africa's Poverty Challenge

Energy is a means to an end – the end being the growth in human welfare. Energy scarcity continues to constitute a roadblock to progress against poverty and growth of SSA's economies. Poverty and the absence of economic growth, on the other hand, stymie efforts to expand access to energy services and ensure energy security in the region. Addressing poverty and growth therefore remain SSA's priority energy issue.

The economic outlook for SSA is both challenging and uncertain. Challenging as a result of widening poverty and uncertain because there are no clear indications that current global economic meltdown is bottoming out. In all circumstances, access to modern, efficient and affordable energy is essential for the growth which makes poverty reduction possible.

Until recently, SSA has witnessed remarkable positive economic development. Over the past five years, growth averaged six per cent, while inflation had fallen to single digits before the fuel and food shocks of 2008. Many countries, especially commodity exporting ones, had built up significant external reserves. These positive developments come from stronger economic reforms, rise in commodity prices, favourable external environment, debt relief and increased aid (IMF, 2009).

According to the IMF Economic Outlook for the region, the gains of the past years may be at risk as a result of the current global economic slowdown. Demands for African commodities have fallen; commodity prices have collapsed; and remittances to the region have shrunk. Foreign direct investment has slowed and portfolio investor flows are being reversed – shaking Africa's once vibrant capital markets. In many ways, the meltdown may be reversing the gains of the past decade of reforms – gains that provided a flicker of hope that equitable growth would begin to reduce the number of poor people in the region.

Global poverty has fallen sharply on the strength of China's growing prosperity over the past two decades. The proportion of the world's population living in poverty fell by half – to 26 per cent in 2005 from 52 per cent in 1980. In the past 20 years, poverty has been declining at the rate of one per cent per annum (Collier, 2007). As a whole, the developing world is on track to meet the MDGs of reducing by half in 2015 the number of people living in poverty from 1990 levels (World Bank, 2008).

Poverty in East Asia – the world's poorest region – has fallen from nearly 80 per cent of the population living on 1.25 US-Dollar per day in 1981 to 18 per cent in 2005. This is largely based on the dramatic progress made by China. In South Asia, the proportion of the population living on 1.25 US-Dollar a day fell from 60 per cent to 40 per cent over the 1981–2005 period – an equivalent of 600 million people still in poverty by 2005.

SSA is the only region with no decline over the 1981–2005 period. Poverty rate stood at 50 per cent in 1981. In absolute terms, the number of poor people nearly doubled from 200 million in 1981 to 380 million in 2005. If this trend continues, by 2015, one in two of the world's poorest people will live in Africa compared with one in ten in 1980.

Significant Energy Resources amid Growing Poverty

Poverty and the challenge of the African energy sector are inextricably linked. The region has significant energy resources, fossil and renewable alike, even though these are unevenly distributed. Oil and gas is mostly found in the West, while coal is the predominant energy resource of the South. Hydro and geothermal resources are mostly found in the countries of East Africa. Central Africa has huge hydropower resources as well as biomass.

According to the IEA in 2007, 12.7 per cent of total world crude oil production occurred in Africa – much of it in Nigeria and Angola in the West as well as Libya and Algeria in North Africa. The region produces 6.8 per cent of total world gas output

Over 70 per cent of Africa's crude oil production is exported. Refining capacity is only 3.3 per cent of the world's total. Even in major oil producing countries like Nigeria, no new refineries have been built over the past decade. This robs the region of the benefits of adding value to the hydrocarbon product and meeting the regional demands for refined petroleum products.

Nearly five per cent of the world's total coal production occurs in Africa, essentially South Africa. The entire region has nine per cent of total world uranium deposits, but it is only South Africa that has nuclear power plants.

Only seven per cent of the region's hydropower potential is being utilised.[4] Hydropower production constitutes only three per cent of total world output. This leaves a huge reservoir of opportunities to close the energy gap in the region through a clean and cost-effective renewable energy source.

About 80 per cent of electricity is produced from fossil fuels, mainly coal, in South Africa, as well as oil and gas in North and West Africa. Approximately 17 per cent of power production comes from hydropower, while nuclear power from South Africa accounts for 2.5 per cent of the continent's power production. The rest of the 0.5 per cent is produced from non-hydro renewable energy sources

4. Ogunlade Davidson 2009: Energy in Africa – Prospects and Sustainability.

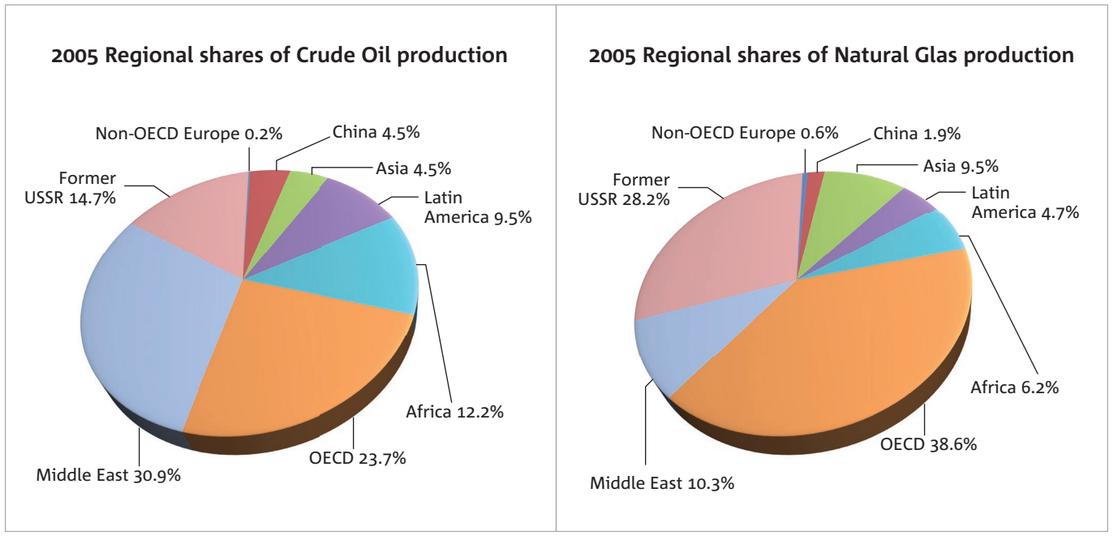


Figure 1: Regional crude oil and natural gas production.
Source: IEA, 2008.

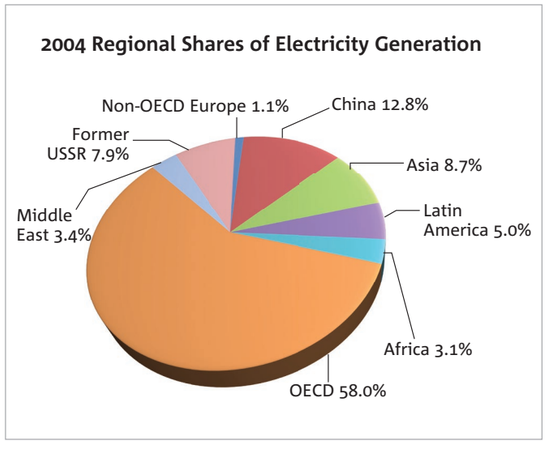


Figure 2: Regional shares of electricity generations.
Source: IEA, 2008.

including geothermal, wind and solar energy (Davidson 2009). Africa accounts for only three per cent of total world electricity production.

Less than 20 per cent of SSA's population have access to electricity services. There are important regional variations, with certain countries having electricity coverage of less than ten per cent of their population. Per capita consumption of power in the region is 542kwh (Davidson 2009). In several countries in SSA, electricity consumption per capita is in rapid decline. In Sierra Leone, DRC, Chad, Ghana, Sao Tome and Principe and Zimbabwe, electricity consumption per capita has declined by 54.7 per cent, 42.1 per cent, 31.3 per cent, 22.3 per cent, 23.8 per cent, and 10.1 per cent, respectively (UNDP, 2007).

SSA's 800 million people, or approximately 12 per cent of global population, consume about three per cent of total world final energy consumption. Disparities within the region are significant, with South Africa representing a huge proportion of total energy production and use.

Energy and the Millennium Development Goals

Energy plays crucial roles in addressing poverty and meeting the MDGs. *Energy for the Poor Underpinning the Millennium Development Goals* concludes that energy is essential in meeting the targets of reducing by half the number of people living in extreme poverty. It accomplishes this by underpinning wealth creation through micro enterprises, extending economic activities beyond daylight hours and encouraging locally owned businesses, which creates employment and assists in bridging the digital divide.

Table 1: Total Deaths Attributable to Solid Fuel Use

Countries/Regions	Population Size (000)	Total deaths attributable to solid fuel use	Total deaths attributable to solid fuel use as proportion of population (%)
Sub-Saharan Africa	858,744	459,400	0.053
India	1,198,003	407,100	0.034
Brazil	193,734	4,100	0.002
China	1,345,751	380,700	0.028
Indonesia	229,965	15,300	0.007

Source:
Population figures: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2009). World Population Prospects: The 2008 Revision. Highlights. UN. New York.
Total death attributed to solid fuels use: WHO, 2007: Indoor Air Pollution, National Burden of Disease Estimates.

Table 2: Number of People Using Traditional Biomass (in millions)

	2000	2030
China	706	645
India	585	632
Other Asia	420	456
Latin America	96	72
Sub-Sahara Africa	583	996

Source: Karakezi et al, 2008.

Energy is key to reducing hunger and improving access to safe drinking water. Energy access improves the supply of pumped drinking water and provides a basis for better-quality water used in cooking.

Energy is also essential in reducing the burden of diseases and decreases child and maternal mortality. It is a key component of functioning health systems, for example lighting operating theatres, refrigeration of vaccines and other medicines, sterilisation of equipment and transport to health clinics. However, according to WHO (2007), Africa loses nearly half a million lives as a result of respiratory diseases due to indoor air pollution. This makes traditional biomass use one of the worst killers in the region, alongside malaria and HIV/AIDS.

In efforts to achieve universal primary education and to promote gender equality and empowerment of women, modern energy services contribute by reducing time spent by women and children, particularly the girl child, on basic survival activities – gathering firewood, fetching water, cookin. The provision of suitable lighting improves home study, increases security and enables the use of educational media and communications in schools, including information and communications technologies.

Beyond 2015, the outlook for access to modern energy services remains bleak. While electricity services are in decline, nearly one billion people in SSA will rely on traditional biomass energy by 2030. This scenario portends great danger for human and climate security.

Biomass Energy Resources, Technologies and Challenges

What follows is a brief review of biomass energy resources, the various categories of technologies and the market situation for each of them.

Biomass energy resources

Wood, charcoal and agricultural wastes make up the bulk of the traditional biomass resources in SSA.

Wood. The consumption of wood is the predominant source of biomass energy, and represents the largest single source of energy for most families in SSA. In rural areas, wood is collected "free" from nearby forests. Women and children collect and transport this source of energy, often on their heads. Up to a third of the day is spent on wood collection and transportation. In addition to this drudgery, women and children suffer most from indoor air pollution arising from the use of wood for cooking.

Forests are the main sources of wood for energy production. In SSA, forests cover 26.5 per cent of total land area (World Bank 2008). The annual rate of deforestation is estimated to be 0.7 per cent. Only 11.3 per cent of the land area of the region is nationally protected. Forest resources are unevenly distributed within the region, with Central African countries having the most abundant forest endowment. In several countries, the rate of forest loss is high due to population pressure, human settlement, timber production, agricultural expansion and wood collection for cooking.

Charcoal. In several energy policy documents around the region, it is a primary objective that households will, over time, experience a transition from firewood to more modern sources of energy such as kerosene, gas or electricity. This energy transition has not occurred. Charcoal has become an increasingly dominant energy source for urban households.

Wood collector, Ethiopia – © by Lineair / www.das-fotoarchiv.com

Rapid urbanisation, increasing poverty and high population growth rates are driving the growth in the use of charcoal in urban cities and peri-urban areas. The traditional production of charcoal puts significant pressure on the environment. More efficient charcoal production, innovative fuel switch programmes, and market development of efficient charcoal stoves are some of the toolkits for addressing the environmental pressure stemming from charcoal production and use.

Agricultural residues. In several countries, agricultural residues constitute important sources of energy. According to an assessment for West African Economic and Monetary Union (UEOMA) countries, agricultural residues amount to about five tons of dry matter per hectare of sorghum, four tons of straw and 2.5 tons of bran per hectare of rice, two tons of tops per hectare of groundnut and cowpea, and ten tons of stubble per hectare of maize (UEMOA, 2008). In many countries, these are sources for both traditional as well as modern utilisation of biomass energy, such as biogas, with biofuels also presenting opportunities for electricity production through cogeneration technologies.

Energy crops. As energy scarcity intensifies and pressure for efficiency and modernisation continues, the cultivation of energy crops – from plantations for wood and charcoal supply to crops for biofuels – is the fastest growing source of biomass energy supply. Though modest compared to the contribution of wood, charcoal and agricultural residues, crops specifically cultivated for energy purposes are taking off in communities around the region.

Key drivers for energy agriculture include rising international prices for petroleum, rising populations, scarcity of wood and higher wood and charcoal prices as well as the growing appetite for international investments in biofuels.

Biomass energy technologies

Biomass specialists Karakezi, Lata and Coelho, in their submission to the International Conference on Renewable Energies in 2004, reviewed the state of the biomass technologies in three categories: traditional, improved and modern technologies.

Traditional biomass energy technology

Traditional biomass energy is the local source of energy that most poor people, especially in rural areas, depend on. It has the advantage of being low cost and the combustion equipment usually comes at no cost at all. People in SSA are dependent on traditional biomass energy to a far greater degree than other regions.

According to IEA forecasts, the use of traditional energy sources will decrease in several regions, but it is likely to increase in South Asia and SSA. In the medium term, the energy scene in SSA will be dominated by traditional biomass energy.

Wood harvesting and charcoal production are some of the key forces driving deforestation in the region. According to Butler (2006), between 1990 and 2005, total wood removal increased by 42 per cent, 44 per cent, 51 per cent, 92 per cent, 83 per cent and 235 per cent in Angola, Burundi, DRC, Gabon, Ghana and Rwanda, respectively. Only in Central Africa Republic and Mauritius did the rate of wood loss decline in the same period. Wood removal for fuel consumption was at its highest in DRC, Nigeria, Uganda, Ghana and Kenya at 78,795m^3, 72,711m^3, 42,041m^3, 28,253m^3 and 24,256m^3, respectively.

Traditional wood energy technologies such as the open fire or three-stone stoves are inefficient, resulting in significant energy and wood loss. Where wood or charcoal are commercialised, the use of traditional technologies imposes costs on families and small enterprises. In a survey carried out by ICEED (2008), the average cost of wood for boarding secondary schools in two states in Nigeria was eleven per cent of total food cost and 15 per cent for street restaurants. More efficient technologies mean significant savings.

Improved biomass energy technologies

Improved biomass technologies are low technologies that can be manufactured in all countries; components are often locally sourced, manufacturers require only basic training, and the technologies are rarely encumbered by Intellectual Property Rights (IPRs). Improved cooking stoves for household and institutional uses, charcoal kilns, efficient fish, tobacco and tea dryers are good examples of this range of low technologies. The most promising element in this range of technologies is the cooking stoves. They reduce heat loss, have enhanced combustion efficiency, reduce indoor air pollution, save money, improve safety, make more time available for women and children, reduce pressure on forests, generate incomes and create jobs (Kees, 2007).

Several wood and charcoal stove models have had relatively good market successes. The Ceramic Kenyan Jiko has sold over two million stoves, and has had an impact on stove development in other parts of the region. German Technical Cooperation (GTZ) programmes have disseminated about 1.5 million stoves in 25 years. Around the region, there is a good range of stoves from the Jiko to clay, metal and Lorena rocket stoves (Lorena, 2007).

However, despite significant efforts and clear sustainable development benefits of improved cooking stoves, access to efficient stoves has been dismal in most of Africa. Only in few countries such as Kenya have these low-technology stoves made a major inroad in the energy market. In most countries, stove programmes are small-scale, donor-dependent and project-based. In several cases, the

Case Study 1: The Kenya Ceramic Jiko (Improved Charcoal Cook stove)

The Kenya Ceramic Jiko (KCJ) is one of the most successful stove projects in the Africa. The KCJ is made up of a metal cladding with a wide base and a ceramic liner. At least 25 per cent of the liner base is perforated with holes of 1.5 cm diameter to form the grate. The stove has three pot rests, two handles, three legs and a door. The door is used to control the airflow. The standard model weighs about six kg, which means it can be carried around easily.

The stove is suitable for cooking and space heating The KCJ helps to direct 25–40 per cent of the heat from the fire to the cooking pot. The traditional metal stove that the ceramic Jiko replaces delivers only 10–20 per cent of the heat to the pot, whereas an open cooking fire yields efficiencies as low as ten per cent. The cost of the stove is about two US-Dollar, which makes it accessible to the majority of the urban population in Kenya, although this cost does not include fuel costs (charcoal).

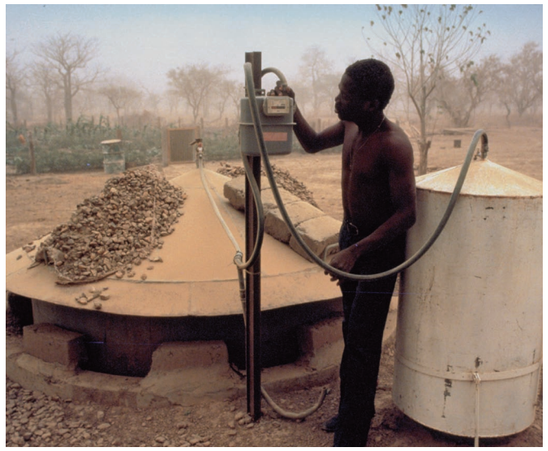
The manufacture of the KCJ is now a relatively mature cottage industry. As expected, the level of specialisation in the manufacture of the stove has increased, as has the level of mechanisation. There is now a discernible labour division. Shauri Moyo is the principal artisanal production centre in Nairobi, where there are artisans whose occupation is to purchase clay liners and metal claddings and to assemble and retail complete stoves to customers. There are two types of stove producers in Nairobi: mechanised manufacturers and semi mechanised producers. It is estimated that mechanised producers are manufacturing close to 3,200 liners a month. Semi-mechanised producers are now producing an estimated 10,600 liners per month.

Based on achievements to date, the KCJ can be declared a success story. The future of this stove is not completely secure, however, because of several constraints. The overall penetration rate for Nairobi, for example, was found to be around 50 per cent, indicating that the dissemination of the KCJ is far from complete. Another source of concern is the lack of quality control, a question that has not been adequately tackled so far. Quality control will require the intervention of concerned NGOs and government agencies.

Source: Karekezi et al 2008.

road from project to energy market place has remained long and rough. Only in few African countries will improved and quality assured cooking stoves be found in shops and markets – alongside kerosene, gas and electric cooking equipment.

Some efforts are being made to bridge the market gap for improved cook stoves. The electronics manufacturers Philips and Beyond Petroleum (BP) are working independently to supply stoves to the international market. These efforts are still in their development stages.



Biogas plant, Burkina Faso – © by Lineair / www.das-fotoarchiv.com

Few energy technology options available to the poor offer as many co-benefits as improved cooking stoves. However, these benefits remain undelivered as a result of policy, product quality, promotion, pricing, financing and constraints relating to the lack of innovative partnerships.

Policy priority. Development of household energy, especially for the poor, is not a priority of energy policy around the region. Annual national budgets are often the most important decision-making tool in allocating national resources. Compared to spending on electricity and petroleum, the proportion of energy sector budgets devoted to household energy pales in significance. Appropriations for efficient wood stoves are often non-existent. Since energy governance remains centralised and monolithic, poor people, especially women, hardly participate in key decision-making processes on these issues.

Product quality. Many stove models are delivered by small enterprises with limited capacity for product testing and quality assurance. Beyond efficiency guarantees, product finishing, appeal and branding are also important constraints.

Promotion. As the stove market is dominated by small enterprises, the margins are slim and leave little to product promotion. Government has not filled this gap by providing awareness around stove dissemination as a public good.

Pricing and finance. Despite the low price of several stove products, 2–10 US-Dollar means a lot to the poor. Today in several countries, there are no financial intermediaries providing micro-lending for household energy equipment. There is also a significant gap in funding stove enterprises, especially within the domestic financial market.

Partnerships. Partnership for Clean Indoor Air is one of the few international networks working to promote efficient cook stoves. However, there is no international coalition with political and financial clout that drives high-level advocacy, political as well as financial mobilisation. This would be necessary in setting an ambitious international target.

Modern biomass energy technologies

Modern biomass energy technologies are technologies in the higher end of the spectrum. They usually require more technical skills and have higher capital costs. Three easily identifiable biomass energy technologies include: biofuels for transportation, bagasse-based co-generation and biogas for the production of heat or electricity.

Biogas

Biogas technology simply formalises a natural decomposition process and thus has an edge over other modern biomass energy technologies that require considerably more investment, advanced technology, and/or resources than basic biomass digesters provide.

Country	Number Distributed
Tanzania	>1,000
Kenya	500
Botswana	215
Burundi	279
Zimbabwe	200
Lesotho	40
Burkina Faso	20
Source: Karekezi & Kithyoma 2003.	

Biogas technology has the potential to mitigate a wide spectrum of environmental undesirables: it improves sanitation, it reduces greenhouse gas emissions, it provides a high-quality organic fertiliser, and it reduces demand for wood and charcoal for cooking, preserving forested areas and natural vegetation. However, in SSA, biogas's greatest benefit may be that it can help alleviate health problems arising from indoor air pollution.

The number of biogas plants in existence in all the countries of the region is almost insignificant. Progress is hampered by high upfront construction costs, feedstock collection and transportation. Inadequate technical knowledge of design, construction and operation also constitute barriers.

Jatropha nursery in Kaffrine, Senegal – © by Trees for the Future

Biofuel

Programmes on bioethanol and biodiesel are gaining momentum in Africa. This is driven mostly by rising petroleum prices, the increased flow of international investments and, to some extent, climate change concerns. In South Africa, the government plans to invest 437 million US-Dollar in five biofuel projects, and a conglomerate of commercial maize farmers plans to build eight ethanol plants. In Ghana, the government pledged two million US-Dollar to assist a large-scale jatropha cultivation scheme in the centre of the country. Sugar cane and cassava in Nigeria, Jatropha in Tanzania and Kenya, and palm oil in Cameroon have also been attracting significant investment from both public and private sectors.

Biofuels have the potential to provide communities in SSA with multiple essential energy services such as electricity for lighting, small appliances or battery charging; supporting income generating and educational activities; and for pumping water, cooking, and transportation.

The benefits of biofuels are many, especially the possibilities for an additional income stream for farmers. However, concerns about biofuels are compelling and pressing. These concerns include the following:

Food and fuel. More than in any other region, food shortages are endemic in several parts of Africa. Poverty, environmental decline and conflicts are taking their tolls on the nutrition of the population, especially children. When energy crops compete with food production for available agricultural land, this raises the issue of food security to high levels. More so, when staple food crops such as corn increasingly become feedstock for global biofuels production, global food prices rise with severe consequences for the poor.

Fuel and environment. The rising global appetite for biofuels is also fuelling concern over the expansion of fuel crop plantations into virgin forests. Further, questions are being raised about energy use and emissions of greenhouse gases arising from the biofuels production cycle.

Land rights. With considerable incomes being generated by biofuel cultivation, the issue of competitive use of agricultural land will become increasingly relevant as land used for agriculture and cash crops might get diverted for biofuel cultivation. As multinational corporations accelerate

Case Study 2: Mali Jatropha Electrification

The Garalo Project in Garalo commune, Mali, was established to provide the local community with access to electricity produced from Jatropha oil. Small-scale farmers are at the heart of the business model, supplying Jatropha oil to a hybrid power plant. Electricity is then sold by the private power company ACCESS to residential and business consumers.

Currently, 247 households are connected to the micro grid after a payment of 30 US-Dollar as a contribution to the connection costs. As for electricity consumption, there are two broad tariff categories. Subscribers with 50, 150 and 300 W are paying a monthly lump sum for their electricity consumption which is respectively five US-Dollar, twelve US-Dollar and 24 US-Dollar. In addition, there is a modest monthly contribution for street lighting which is 0.07 cents, 0.16 cents and 0.30 cents according to the power.

Other subscribers with higher power and theoretically higher purchasing power are billed according to their metered consumption at a tariff of 38 cents/kWh. In addition, they have to pay fixed charges and higher contributions to street lighting. Despite these relatively high prices, the recovery of the bills is over 90 per cent, demonstrating the willingness to pay for modern energy services. The whole model is based on the land ownership of small-scale farmers and the availability and status of the land. The project has potentials to increase human capital, natural capital, social capital, physical capital and financial capital.

Source: Karakezi et al., 2008.

their investments in export-led biofuels production, issues of land rights become pertinent. There is significant anxiety that peasants may increasingly lose control of their land as big corporations intensify investments in large plantations.

Policy support. Within Sub-Saharan Africa, there is a lack of policies to support small-scale biofuels development at the local level, including fiscal and financial incentives and provision for small and medium enterprises fuel blenders. In cases where biofuels policies do exist, they tend to focus on subsidies for large industrial biofuels producers, with smaller scale farmers mentioned as providing crop inputs for these larger operations. Policies are needed to ensure that local households, businesses, and communities reap the benefits of energy services afforded from biofuels development, as well as associated income and job opportunities. Policies should be long-term, stable, and clear, and ensure biofuels development by local people, for local people.

Affordable financing. A key barrier to small-scale biofuels development is access to affordable financing. This is required by small farmers who need working capital for the purchase of seeds and equipment as well as debt and equity financing to build biofuel businesses.

Institutional capacity and awareness. Currently in SSA, there is insufficient awareness that opportunities of small-scale biofuels offer, as well as too little capacity to develop these programmes and projects. This includes a lack of capacity in the public sector (regional, national, and local) for the development of effective policies to promote small-scale biofuels development; with the private sector, including small farmers, to design, develop, implement, and operate these projects; among consumers who lack information on the costs and benefits of these technologies; and with local NGOs, credit providers, market intermediaries financiers, and others, all of whom have a significant role to play in the development and advancement of small-scale biofuels. Each of these groups will require capacity building and support to develop a small-scale biofuels potential.

Biomass cogeneration

There is substantial experience in the region for agro-based industries using cogeneration to meet their heat and electricity needs. These industries are often sugar, paper, wood plants. These technologies allow industries to generate their own electricity – and sometimes add electricity sales as an additional source of income. Mauritius, Kenya and a few African countries have significant installed capacities of co-generation electricity production.

Lack of awareness of its potentials, de-industrialisation and increasing plant closure and financing issues are key barriers to the development of the co-generation industry. Even more so, the investment policy framework is usually not supportive of these additional investments by firms. Incentives such as feed-in tariffs, reduced import duties and other fiscal measures are important in stimulating increased production of power and sale to the national grid by co-generation plants.

Case study 3: Co-generation in Mauritius.

The Mauritian experience in co-generation is one of the success stories in Africa. As a result of an extensive use of co-generation in Mauritius, the country's sugar industry is self-sufficient in electricity and sells excess power to the national grid. In 1998, close to 25 per cent of the country's electricity was generated from sugar industry, largely using bagasse, a by-product of the sugar industry. By 2002, electricity generation from sugar estates stood at 40 per cent (half of it from bagasse) of the total electricity production in the country.

Government support and involvement has been instrumental in the development of a cogeneration programme in Mauritius. First, in 1985, the Sugar Sector Package Deal Act (1985), was enacted to encourage the production of bagasse for the generation of electricity. The Sugar Industry Efficiency Act (1988) provided tax incentives for investments in the generation of electricity and encouraged small planters to provide bagasse for electricity generation. Three years later, the Bagasse Energy Development Programme (BEDP) for the sugar industry was initiated. In 1994, the Mauritian Government abolished the sugar export duty, which served as an additional incentive to the industry. A year later, foreign exchange controls were removed and the centralisation of the sugar industry was accelerated. These measures have resulted in the steady growth of bagasse-based electricity in the country's electricity sector.

Bagasse-based co-generation development in Mauritius has delivered a number of benefits including reduced dependence on imported oil, diversification in electricity generation and improved efficiency in the power sector in general. Using a wide variety of innovative revenue sharing measures, the co-generation industry has worked closely with the Government of Mauritius to ensure that substantial benefits flow to all key stakeholders of the sugar economy, including the poor smallholder sugar farmer. The equitable revenue sharing policies that are in place in Mauritius provide a model for emulation in ongoing and planned modern biomass energy projects in Africa.

Source: Karekezi et al., 2008.

The Domestic Energy Sector is Ripe for Reforms

The entire energy sector in most countries in SSA has left a huge gap between demand and supply of essential energy services – electricity, transport fuels and heating energy alike. The past 20 years of Washington-led reforms have done little to narrow this gap. Energy sector liberalisation of these years bypassed the concerns of poor people in SSA. This system is ripe for reforms in several ways.

Strengthen energy governance reforms

Energy governance in Africa is dominated by government, centralised and gives priority to conventional fuels. Despite reforms liberalising energy markets with increased entry by private companies, policy attention to biomass energy – as reflected in fiscal incentives, budgets and programmes – has been scanty.

There is need to encourage energy governance reforms that increasingly devolve energy decision-making to local government levels and focus on energy services that are important to the lives of poor people. Such governance reforms should be premised on the principles of rights to development and equitable access to public resources through annual energy sector budgets. A budget-tracking mechanism with indicators of equitable access is required. This provides opportunities to channel resources to low biomass energy technologies yielding significant co-benefits for the poor.

Think big!

In several countries around the region, improved biomass energy programmes, especially for cooking stoves, are small-scale, characterised by poor standards, weak supply chains, poor funding and inadequately trained personnel. Only in exceptional circumstances has this business model had an impact on stove delivery in the region. This calls for a new approach if the region is to reduce by half the number of people who are cooking with traditional biomass technologies in the next decade.

While small-scale rural-based train-the-trainer models work for rural areas, countries should set policies that encourage large-scale industrial producers of improved cooking stoves – ensuring higher quality and low prices. Only such programmes can deliver the size, quality and promotion needed to expand stove programmes.

Engage the political process

The prevailing practice in Africa's energy governance is sustained by vested interests – a constellation of major companies, contractors, politicians and bureaucrats. As a result, most economic and technical analysis fails to provide change in the role of governments in championing change. What is often lacking is a power mapping of the energy sector's political economy – which would allow a proper understanding of the interests of major stakeholders in re-aligning energy governance.

There is need to move from analysis to advocacy, engagement and coalition-building around the right to energy for human development. The self-reinforcing objectives of poverty reduction and climate justice provide a platform to build these coalitions, engage with the government and promote advocacy for expanding the use of improved and modern biomass energy technologies.

Deepen domestic financial market response

Market growth for several improved and modern biomass energy technologies is often hindered by inadequate finance. International development finance will hardly be enough to provide the required volume of funding on a sustainable basis. Deepening domestic financial reforms holds the key to channelling resources to clean energy, including biomass energy technologies. This reform includes the expansion of options for microfinance.

Strengthening regulation for biofuels

SSA countries should set clear and enforceable sustainability criteria for biofuel investment. This ensures that concerns over agricultural production, environmental protection and gender issues are fully addressed.

Market development

Market development can be achieved by creating policies and technical standards to guide and facilitate the development of the biomass energy market in Africa, integrating biomass energy development into the overall investment policies as well as developing appropriate policy frameworks for investors.

The creation of new and long-term markets can be enhanced by the setting of national blending targets for fuels and targets for contribution to electricity needs. The strategies for market development have to ensure value creation for farmers and rural development.

The Role of Development Cooperation

International development cooperation can play important roles in making the energy sector serve the needs of the poor in SSA. The following is a number of steps these agencies can consider in addressing energy poverty through biomass energy development:

Set global targets on energy access

While much of the developing world is on track to achieve the MDGs, Africa is the only region where the number of poor people will increase significantly. In fact, there will be a doubling of the number of the poor in the region between 1980 and 2015. While several socio-economic and political drivers of Africa's growing poverty are well-known (Handley et al. 2009), the role of energy in wealth creation has received less attention. The fact remains that without access to sustainable energy, the MDGs will not be achieved – in Africa or any other region of the world.

All over SSA, there is a yawning gap between energy demand and supply – across all energy sources. The scarcity of convenient household fuel is driving the "mining" of wood farther into pristine forests. Refining capacity within the region is far short of demand – deepening import dependence and shortages even within oil-producing countries such as Nigeria. Low power generating capacity, poor transmission and distribution infrastructure as well as revenue leakage among utilities account for the diminishing availability of electricity. In several countries, the proportion of the population with access to electricity is in decline (UNDP, 2008).

We must set global energy access targets. While energy access missed the train as the ninth MDG, widening poverty and the climate crisis create the impetus to rethink the role of sustainable energy in tackling the twin menaces of poverty and global warming.

We must commit ourselves to reducing by half the number of people dependent on traditional biomass energy technologies within a decade. The co-benefits in terms of most MDG indicators, including the reduction of greenhouse gas emissions, are compelling and urgent.

Scale up quick gains

A number of biomass energy technologies represent low-hanging fruits – where massive scale-up can be achieved at low cost and with enormous co-benefits. One excellent example is improved cooking stoves.

In several countries, wood and charcoal use is by traditional methods. Several efficient stove models cost between 2–3 US-Dollar. Demand for them is high, but there are significant supply chain constraints. What is required is a massive market development initiative to scale up these stoves – ensuring that within a decade a target of at least 50 per cent coverage is achieved.

A global biomass cook stove partnership is needed

The challenges of poverty and the climate crisis demand new thinking and partnership. A global partnership for improved cook stoves can learn from several global initiatives such as the drive to expand the coverage of insecticide-treated bed nets, treatment drugs for malaria, tuberculoses and HIV/AIDS drugs. Major corporations, such as Philips, Shell Foundation, the United Nations system and governments can partner to deliver a global partnership that secures the right to safe and efficient cooking for the world's poor. The climate emergency and the momentum that the Copenhagen process creates provide important advocacy opportunities. This will build a strong global supply chain, ensure the delivery of quality stoves, bring down prices and support high-level advocacy work.

Strengthen the links between energy access and technology transfer within UNFCCC negotiations

There is a compelling need to reset the technology transfer debate within the United Nations Framework Convention on Climate Change (UNFCCC) negotiation process. The negotiation processes have perhaps overlaboured intractable Intellectual Property Rights issues to the disadvantage of existing technologies where joint gains are more easily realised. A preponderance of technologies required to make major progress in developing countries is in the public domain and unencumbered by patents. Market transformation for efficient woodstoves, for instance, is key to curbing emissions from developing countries and making sustainable development impacts. Regrettably, the technology transfer debate in international climate negotiations may have strayed off this important course.

There is perhaps the need to segment the debate on technology transfer. The bottom one billion people in developing countries living on about one dollar a day require basic energy services to improve their chances of better living standards. Their needs and contributions should begin to form a central pillar of the technology transfer debate. In segmenting the debate, barriers in transferring technologies at the higher end of the spectrum will be separated from quick gains that can be delivered by market transformation initiatives to address the technology needs of the bottom one billion people, a large proportion of whom are in SSA.

Make the carbon market serve the poor

The carbon market was designed as an important innovation and technology transfer mechanism. African countries have attracted very few Clean Development Mechanism (CDM) projects. There may be need to set up carbon market transformational programmes to help countries break existing barriers to attracting carbon finance for improved biomass energy and other renewable energy technologies. Experiences from the Nairobi Framework collaboration need to feed into a post-2012 carbon market architecture.

Development assistance

Being pivotal to the achievement of the MDGs, it is perhaps time to beam the search light on energy spending by bilateral and multilateral development agencies. The commitment to poverty reduction and climate justice does not often reflect in budget proportions targeting access to sustainable energy access for the poor.

Beyond development assistance, there is need to channel resources through mainstream export and development finance agencies. Often, the portfolios of these agencies are dominated by centralised fuels, with doubtful impacts on the poor. Export and development finance therefore have a role in supporting the growth of the proposed global partnership.

Set corporate sustainability standards

The international community must address concerns over sustainability, food and fuel conflicts as well as social concerns over new biofuel investments by multinational corporations. Countries of origin should set minimum standards for their international corporations ensuring compliance by holding these companies accountable within the laws of their home countries.

Cooking inside with wood, Mali – © by Lineair / www.das-fotoarchiv.com

Conclusions

A number of conclusions can be drawn from the overview of the biomass and energy poverty situation in SSA. These lessons include:

Traditional biomass use and poverty
The correlation between the use of traditional biomass and deepening poverty is very strong. The dependence on traditional biomass energy perpetuates poverty. Poverty, in turn, restricts the energy options available to poor people and makes the transition to more efficient and convenient energy use difficult.

Energy poverty will deepen in SSA
The proportion of the population with access to electricity is in decline in several SSA countries. The number dependent on traditional biomass energy is steadily increasing and will double in 20 years. This limits the scope for poverty and emission reduction, and compromises the achievement of the MDGs.

Improved cooking stoves hold important co-benefits
Improved cooking stoves present an important opportunity to address poverty, reduce morbidity and mortality arising from indoor air pollution and provide the poor with a role in climate change mitigation.

Market development is weak
Stove programmes suffer from poor policy priority and support, poor product quality, weak promotion and inadequate financial flows. The result is a weak supply chain incapable of delivering stoves at a quality and price for the great majority of poor people.

Most stove programmes have failed
In all SSA countries, only few stove programmes have consistently reduced the proportion of the population dependent on traditional biomass. Stove programmes have essentially been driven by donors, have weak market orientation, are often small-scale and receive low priorities in government budgeting.

The failure of stove programmes is political
There are no influential constituencies advocating for increasing budget allocation to household energy provision for the poor. Budget allocation, where it exists, pales in insignificance compared to petroleum, electricity and other energy forms. There is a need to build coalitions around household energy issues. NGOs have specific responsibilities to engage in policy processes where energy priorities are determined.

Support community-based biofuel projects
There is need to pilot more innovative business models for delivering electricity through biofuels. The Garalo project in Mali provides an important example.

The need for reform
The energy sector is ripe for a new wave of reforms. The benefits of 20 years of energy sector liberalisation have bypassed the poor. Decentralisation of energy governance, increased participation of stakeholders, especially women, in energy sector decision-making, and budget-tracking of energy expenditure to ensure equitable allocation are some elements of energy governance that deliver equitable opportunities for the poor and address key concerns such as climate change.

Targets must be set
There is need for a global target to reduce by half the number of people without access to sustainable energy. This requires global partnership in terms of advocacy, financing and ownership.

Technology transfer
As countries negotiate for an effective and equitable deal in the run up to the Copenhagen climate conference, improved cooking stoves provide an opportunity to demonstrate the value of technologies at the lower end of the spectrum in tackling climate change. Low technologies offer opportunities for the poor to participate in reducing emissions. Unlike cutting-edge technologies, they encounter market barriers, rather than problems of patents. In many ways, they offer sustainable development benefits for individual users, assisting them in adapting to dwindling wood resources and meeting their everyday need.

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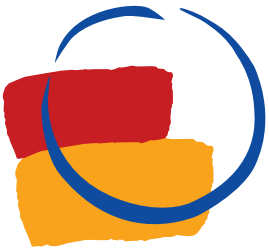

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