



Policy Brief



Bio-Energy for Africa: Opportunities, Constraints and Trade-Offs

Bio-energy, which refers to all fuels derived from biomass, is the largest single source of renewable energy. The proportion of bio-energy in some developing countries exceeds 90% of their primary energy supply. Bio-energy is an essential energy option for a wide-range of applications, and it will remain an important source of energy in most developing countries for the foreseeable future. Nevertheless, the current utilisation of bio-energy in Africa is unsustainable and inefficient. About 65% of Africans rely on traditional biomass for cooking. Most of these people live in rural areas. Coupled with efficiency levels of just 10–20% for burning biomass, bio-energy utilisation in Africa has exacerbated environmental impacts, in particular, deforestation. Bio-energy use for cooking has added to health problems and mortality as a result of the indoor air pollution it causes. However, there is huge potential for deploying modern, more efficient, biomass fuels in Africa. Bio-energy has the highest potential for expansion among renewable energy technologies, mainly because the technology is mature and is a relatively easy substitute for fossil fuels. Modern biomass technologies, such as biogas and improved cooking stoves, could be used as substitutes for traditional cooking stoves in the household sector. Biogas could also be used for power generation and transport. Bio-energy, in the form of bio-ethanol and biodiesel, could serve as a substitute for petroleum products in the transport sector. The diverse benefits of bio-energy may include reduced greenhouse gas emissions, creation of rural livelihoods, foreign exchange savings, and reduced dependence on imported sources of energy.

Key messages

- Africa has a vast potential to produce bio-energy.
- Bio-energy has significant potential to mitigate greenhouse gases.
- Bio-energy production may also help create rural livelihoods, earn foreign exchange, and reduce dependence on imported sources of energy.
- Some important challenges, including land use and environmental challenges, must be properly addressed.

Opportunities and challenges

There are vast opportunities for modern bio-energy in Africa due to the high productivity of biomass, including from such agricultural crops as sugar cane, maize, sorghum and cassava, and also from wood and agricultural waste. Recently, non-edible oils such as jatropha oil have been found to be promising feedstock for biodiesel in Africa. Jatropha can grow under a wide variety of climatic and land conditions. African countries are five times more productive, in terms of photosynthesis efficiency, than temperate countries, with Sub-Saharan Africa having the greatest bio-energy potential of all world regions owing to large areas of suitable crop and pasture land, favourable climatic conditions, and the low cost of labour.

In addition to their direct energy benefits, bio-energy projects can achieve improved health, reduced greenhouse gas emissions, expanded rural livelihoods, foreign exchange earnings and reduced dependence on imported energy. The opportunities for new export markets in the emerging global trade in biomass and bio-energy products have also become attractive to many African countries.

Traditional bio-energy includes bio-energy in the form of firewood, charcoal, crop residues, and animal dung, and has been used as a source of energy throughout human history for cooking and heating. Modern bio-energy refers to biomass converted to higher-value, more efficient energy carriers, such as biogas, ethanol, and biodiesel. In stationary applications, biomass is used for production of heat and electricity, including combined heat and power, also known as cogeneration. In transport applications, liquid biofuels, such as ethanol and biodiesel have attracted the greatest attention in recent years.

Bio-energy has significant potential to mitigate greenhouse gases, provided that resources are developed sustainably and that efficient bio-energy systems are used. Current systems and key future options, including perennial cropping systems, use of biomass residues and wastes, and advanced conversion systems, are able to deliver 80-90% emission reductions compared to the fossil energy baseline. Mitigation using bio-energy includes options such as fuel switching from diesel or heavy fuel oil to biodiesel, fuel switching from coal to biomass, and electricity generation from liquid and solid municipal waste.

While Africa has a vast potential to produce bio-energy, this potential has not been realised due to the inability to effectively develop and implement appropriate policies, inadequate regulatory and institutional arrangements, and lack of coordination between national and local authorities.

Some other challenges are that:

- Expansion of bio-energy requires the increasing use of agricultural and forest lands. Large-scale, mono-crop plantations of bio-energy crops grown at the expense of natural forests are causing deforestation and destroying natural habitats and landscapes. The general concern is that undeveloped land is difficult to find without interfering with food production and important ecosystems, such as natural forests.
- There are concerns that biofuel feedstock production could displace the production of food crops (for food and feed) and negatively affect prices, mainly through competition for land and water and competition for crops as feedstock.
- Bio-energy has environmental benefits and risks depending on factors such as feedstock type, processing, and interactions with the local community. Environmental risks posed by the production of bio-energy feedstock include nutrient mining, land degradation, mining of water resources (especially for those feedstocks that use much water), problems associated with monoculture, harvesting methods that expose land to greater erosion, pollution from pesticides and fertilizers, and biodiversity loss. However, bio-energy crops can also contribute to improving the environment if conditions are right.

Recommendations

Some African countries are already implementing modern bio-energy projects as part of a sustainable development strategy that recognises the diverse benefits of bio-energy. Some general recommendations for further development of bio-energy are the following:

- African countries could use regional economic communities (RECs) to enable countries within a REC to pool their resources and jointly use their comparative advantage in global markets for mutual benefit.

- Given the substantial upfront investments required for bio-energy development, African governments must assist private sector investment through the implementation of appropriate policies targeting farmers, processors, traders, and consumers. These policies should include fuel tax exemptions, government support to research, investment subsidies, and production in government-owned facilities.
- It is important that African governments adopt an integrated food policy that includes the transfer of food from food surplus areas to food deficit areas. This, and improving post-harvest storage, will improve food security and help reduce tensions between food and biofuel production. To ensure that local communities and indigenous peoples are not dispossessed of their land by large-scale bio-energy plantations, land reform laws and other checks and balances may need to be implemented by some African governments.
- To facilitate the integration of modern bio-energy technologies into energy systems, greater coordination is required at regional, national, and local levels in Africa. This can be achieved by creating effective institutional, legal and regulatory frameworks covering biomass production, conversion technologies, environmental issues, biodiversity, and socio-economic issues.
- African governments should build on the Committee on World Food Security's *Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests* and enact laws that curb speculative acquisitions of agricultural land and ensure that land leases are transparent and equitable.
- Although some external funding sources exist for financing bio-energy development in Africa, African countries should first mobilise internal sources of funding for bio-energy development.

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