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COMPETE

Competence Platform on Energy Crop and Agroforestry Systems for Arid and Semi-arid Ecosystems - Africa

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List of Acronyms

AU	African Union
BEDP	Bagasse Energy Development Programme
CASCADe	Carbon Finance for Agriculture, Silviculture, Conservation and Action against Deforestation
COMESA	Common Market for Eastern and Southern Africa
COMPETE	Competence Platform on Energy Crop and Agroforestry Systems for Arid and Semi-Arid Ecosystems
ECOWAS	Economic Community of West African States
EU	European Union
FANRPAN	Food Agriculture and Natural Resources Policy Analysis Network
FAO	Food and Agriculture Organization of the United Nations
FCFA	Fédération des Communautés Francophones et Acadienne (Canada)
GWP	Global warming potential
IFAD	International Fund for Agricultural Development
N2O	Nitrous oxide
NEPAD	New Partnership for Africa's Development
PPP	Public- Private Partnership
RSB	Roundtable on Sustainable Biofuels
SADC	Southern African Development Community
SSA	sub-Sahara Africa
SSC	South- South Cooperation
U.S	United States
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USDA-ODE	United States Department of Agriculture-Ohio Department of Education

1. INTRODUCTION

Bioenergy is emerging as an opportunity that can offer an alternative supply of energy other than fossil fuels. According to a USDA-ODE Bioenergy Experts Workshop (2007), the benefits of biofuels include: lower carbon dioxide emissions; a renewable resource, a domestic feedstock supply; food security, the revitalization of rural economies. However, complex interactions of a variety of factors ultimately determine whether bioenergy options are socially, economically, and environmentally sustainable. Critics of the bioenergy drive have argued that the scale of production expected to meet global and national demands could have devastating impacts (Madjera, 2008). Whether energy crops will be a blessing or a curse for Sub Sahara African (SSA) countries will depend on the policy adopted and implemented. No single bioenergy "solution" can work for the entire continent or country. Instead, a diverse portfolio of bioenergy options based on the local availability of biomass sources, land use systems, the structure of local agriculture, investment in infrastructure, feasibility of conversion technologies, environmental sensitivities, and geographic and cultural issues specific to communities must be considered (USDA-ODE, 2007).

Biofuel issues are not elaborately discussed in most national policy frameworks in SSA. Up until 2007, the national energy policies in many of the countries contained strategies for renewable energy in general with no specific strategies for the biofuels sector (Jumbe *et al*, 2007). This could be attributed to the fact that impetus for biofuels has just gained momentum during the last two or so years. However, South Africa and Ghana have developed specific biofuels strategies with even more specific targets and more recently (Compete, 2009) Mozambique has developed a biofuels policy. It is hoped that many countries will start to reorient their energy policies to be more inclusive on biofuels as a variety of Sub-Saharan African countries are currently engaged in the formulation of appropriate policies and implementation strategies to ensure sustainable bioenergy for economic development (COMPETE, 2009). These policies should aim at mobilising the benefits offered by bioenergy feedstock production to reverse the long-term decline in real agricultural commodity prices and to boost agricultural and rural development.

It is in this context that this paper presents a policy roadmap which will help countries in developing their biofuel policies by providing a framework for potential research, education and extension activities as well as areas for future collaboration among all stakeholders involved in bioenergy production so as to ensure long-term sustainability (social, economic, environmental) of bioenergy as a viable energy.

In outlining the policy roadmap for biofuel production in SSA, the following issues will be tackled. Firstly, the paper will look at the challenges of biofuel policies based on the emerging sustainability issues of biofuel production. The second part will focus on the principles which should guide biofuel policy formulation. Last but not least will be the presentation of possible policy actions to ensure environmental and social sustainability.

2. THE POLICY ROADMAP

The roadmap contains a brief range of practical recommendations in the area of national and regional policies in order to overcome existing barriers for bioenergy implementation in large- and small-scale projects according to different bioenergy feedstock. According to University of Free State (2005), policies are written statements or sets of statements that describe principles, requirements, and limitations and are characterised by indicating "what" needs to be done rather than how to do it. Such statements have the force of establishing rights, requirements and responsibilities. Thus a policy acts as a framework that supports (or inhibits) balanced and effective governance and healthy growth and interaction of a society's many facets. Its effectiveness rests in proper assessment, whole picture balance, appropriate regulations, adequate enforcement, and incentives for behavioural change.

With the recent surge of national and political support for the development of bioenergy alternatives to fossil fuels, there have been concerns arising from the potential paradigm shift for agriculture and energy which have social, economic, and environmental implications. It is therefore imperative to review some of these issues so that a roadmap will be drafted based on informed decisions. The issues are drawn largely from the studies done under the project COMPETE (Competence Platform on Energy Crop and Agroforestry Systems for Arid and Semi-arid Ecosystems – Africa).

2.1 Emerging Issues for Biofuel Policy Development

There are a number of emerging issues, and questions around biofuels that will inform policy direction for biofuels in SSA. The trends show the stages of biofuel development in different countries and their understanding of potential and challenges of biofuels. Trends also give a clear picture that most of policy development is normally nationally driven.

Policy Coherence

Biofuels are a fairly modern, diverse and cross-cutting sub-sector that brings together food security and energy issues (NEPAD, 2007). This intersection between energy security and industrial production creates a lot of challenges for policymakers in SSA around biofuels. This is because the so called "biofuels portfolio" falls within two critical and powerful Ministries (Ministries of Energy and Agriculture) in most African nations leading to challenges in terms of policy development, programme implementation and investment.

Biofuels are also shaped by policy domains in transport, environment and trade sectors. For example, according to FAO (2008), biofuels currently rely on many of the same agricultural commodities that are destined for food use. Their feedstocks compete with conventional agriculture for land and other productive resources; food and agriculture policy is therefore central to biofuel policy development. At the same time, biofuels are only one among many possible sources of renewable energy, a field where technological innovation is moving rapidly. Therefore, biofuel policy must be considered within the wider context of energy policy.

Similarly, biofuels only constitute one option for reducing greenhouse gas emissions, and so must be evaluated against alternative mitigation strategies (FAO, 2008). Choices in the field of transport policies also crucially affect the demand for liquid biofuels. Finally, trade policies can support or hinder the development of environmentally sustainable biofuels. If trade barriers prevent the most efficient and most sustainable geographic pattern of biofuel production and trade, they may undermine the environmental objectives of biofuels.

This split responsibility has in most countries, created strong territorial issues. According to a Zero Draft paper on Agroforestry Policy initiatives (2009), for instance no single 'policy space' exists for coordinating the range of policies that have impacts on agroforestry. This magnifies the potential for omissions or conflicts resulting in gaps and perverse policy incentives. Agroforestry systems are suggested as a solution to alleviate problems of competition for land between energy crops and food crops because they will be grown on same piece of land. Only if the role of biofuels is considered in relation to each of these policy domains can it be ensured that they play the appropriate role in reaching the various policy objectives.

Policy direction for SSA

Another emerging issue not fully articulated in many papers on biofuels is an assessment on how policy has progressed in the last three decades in Africa. The question is to understand emerging trends and how this would assist shape future biofuels policies. Leading scholars on the topic of policymaking in SSA like Olukoshi (2005) argue that capital investment for new developments in SSA [like biofuels which has greatly depended on foreign capital] must be driven more by a "domestic investment orientation". Most African countries, he contends, tend to frame their policy making around "attracting foreign capital". This is clearly evident in early post-independence years planning. This trend still continues to date in SSA. For example, in recent times, especially the Northern part of Ghana is said to be witnessing an influx of foreign companies engaged in jatropha and sugar-cane plantation for biofuel production (Amankwah, 2009) (see also Box 1). These companies are acquiring large tracks of land for large scale production. Regrettably, some of these companies that are investing in biofuel production acquire large tracks of land, but only pay the farmers for the portion of the land they utilize, in spite of an existing contract.

Box 1: Land-grabbing for agro-fuels in Southern countries threatens smallholder farmers

There is currently a massive land grab for agro-fuels in Southern countries, much of it conducted by European companies wanting to export to the EU. The plans of private companies for acquiring domestic land constitute a threat to smallholder farmers, whose lands are likely to be confiscated and who are then reduced to unemployment. In Northern Ghana over 10,000 hectares, involving six settlements near Kpachaa, are being cleared of vegetation and developed into a jatropha plantation. In the same region, large tracts of land are being developed for the production of ethanol fuel from sugar cane.

In some areas of Senegal, such as Bigona, if the forest is cleared to cultivate jatropha it means that 68% of rural households' incomes will be wiped out and all poverty-control goals annihilated. International investors are currently in discussions with the Senegalese government over plans aimed at producing agro-fuels with jatropha and sugar cane in areas of between 50,000 and 200,000 hectares.

In Tanzania, 60% of fertile land with irrigation potential has been allocated for agro-fuels production in the Rufiji region. The expansion of monoculture plantations diverts scarce land and water away from food production, precisely those resources to which smallholder farmers, particularly women, have least access.

In Ghana, the shea trees, whose nuts, harvested to be sold on local markets for cosmetic and soap production provides an important source of supplementary income for poor rural women, have been ploughed under to make way for jatropha production for biodiesel. Moreover, farmers have reported that jatropha was planted not on marginal land but rather on the land most suitable for food crops. "Not only is land-grabbing causing the displacement of local food production and farmers, but conflicts over access to land, water and other resources are developing subsequently. Even more alarming, cases of violations of peoples' rights to access land, resulting from the pressure to monopolise land use for biodiesel and ethanol production, have been documented, for example in Guatemala" (CONCORD, 2009).

Most of the problems encountered in biofuel production in SSA mainly emanate from the fact that most of the countries do not have biofuel policies in place, even though bioenergy is defined in various national policies and strategy which vary from country to country. For example, South Africa has a specific biofuel strategy which aims at achieving market penetration of 4.5% biofuels by 2013 (Jumbe et al, 2009). Ghana contains specific strategies for bioenergy development, with a target of substituting 20% of national gas and oil consumption with biodiesel and 30% of paraffin to be replaced with Jatropha oil by 2015. Mozambique has recently adopted a policy for large scale production of biofuels, including the gradual introduction of blending of fossil fuels with biofuels, initially at 5-10%. At least four big projects have been approved for ethanol and biodiesel production (Mateveia, 2009). In countries like Tanzania there is no bioenergy policy in place yet but biofuel guidelines are in the process. Even more surprising is Malawi, which has more than 20 years experience in bioethanol production but does not have a specific biofuel strategy. The absence of biofuel policies in most SSA countries could be attributed to the fact that interest on biofuels has just emerged during the last couple of years. Hence, it is expected that this growing impetus for biofuels is likely to instigate changes to the existing national policy frameworks to support the development of a vibrant biofuels sector (Jumbe *et al*, 2009).

It has also been noted that there is significant disparity in bioenergy policies across SSA and dispersed initiatives are taking place. According to Jumbe and Msiska (2007), unlike in developed countries, Africa as a whole and its regional economic groupings such as SADC, COMESA, ECOWAS, do not have a coherent regional policy agenda for developing the biofuels sector with specific targets. This has contributed to poor coordination, varied pace of development, lack of political leadership and poor commitment in the biofuels industry development. This absence of coherent regional and international policy frameworks largely emanates from the inadequate awareness and sensitization of the political and administrative leadership of the SSA region regarding the benefits as well as dangers of mismanagement of biofuels.

Food versus fuel – high food prices

Historically, agriculture prices have been linked to energy prices especially in developed countries. This is because increased cost of fossil fuel based inputs (diesel, fertilizers, pesticides) leads to rising prices of agricultural products (IFAD, 2008). Literature and practice from the region point to a number of issues that are informing the development of biofuels policy in SSA. There is the food versus fuel controversy, where questions are being raised around the need for research and data to understand to what extent agriculture and the energy sector can meet biofuels demand without compromising food security. If farmers (both large and small scale farmers) benefit from high commodity prices, would this compromise net purchasers of food? In South Africa for example, the average price for maize in 2005 increased by 28% and for sugar by 12.6% with some experts attributing this rise to growing demand for ethanol in global markets (UN, 2007). Concerns also rise over growing crops for export, when the needs for energy access at home are significant. Whereas elevated carbon emissions have negative effects that will play out over decades and centuries, rising food prices and reduced food production mean that people today will potentially go hungry (Sexton *et al,* 2009). To some extent, biofuel policies may trade food in the stomach for fuel in the tank.

According to Sexton *et al* (2009), a key rationale for biofuel policy is economic development in underdeveloped countries and rural development in industrialized economies. But the food market impacts of biofuels may constrain the welfare benefits. Higher output prices do not universally benefit the rural poor (Wiebe, 2008). For example, the rural poor suffer from higher food prices in countries like Bangladesh and Guatemala, while those in Madagascar and Ghana are better off because they grow more of their own food. The effect of food price increases is even worse for the urban poor, who suffer welfare losses across countries (Wiebe, 2008).

Climate change and environment

Biofuels as a global phenomenon has been pushed by environmental groups that see it linked to greenhouse gas emission reduction. Most countries in SSA are signatories to the UNFCCC conventions. These are commitments from countries to reduce global greenhouse gas emission. However, the question still remains on how effective biofuels will be to perform this role and whether biofuels is the right yardstick to use. Sceptics cite intensive farming practices utilizing more energy (fossil fuels) through extensive mechanization. For SSA, with

low net emissions of greenhouse gases, arguments are that they have other urgent priorities like poverty, and energy access as pre-condition for economic development. While bioenergy production is meant to reduce greenhouse gas emissions, some analysis have actually indicated a wide divergence in carbon balances in the production chain, according to technologies used, locations and production systems, with some even leading to greater emissions than fossil fuels (FAO, 2009).

There is also a potential of creating 'carbon debts' which might take decades to 'repay', when land with high carbon content such as forest is converted to grow energy crops. Searchinger *et al* (2008) found that a 15-billion-gallon (56-billion-liter) expansion of U.S. corn ethanol production would bring an additional 26.7 million acres (10.8 million hectares) of land under cultivation and actually double carbon emissions relative to fossil fuels over 30 years. It would take 167 years for corn ethanol to overcome the carbon debt it incurs from land-use changes and start providing carbon savings (relative to fossil fuels). Switchgrass, which yields more ethanol per acre, could provide carbon savings within four decades (Searchinger *et al*, 2008).

Studies have also shown that if the nitrogen exceeds the agronomic requirements of subsequent crops or is not used efficiently, there is a risk of volatilization in the form of nitrous oxide (N_2O) (Albrecht, 2004). N_2O is one of the most important trace gases and has a global warming potential (GWP) 200-300 times higher than that of carbon dioxide. Thus there is growing concern that the wide scale use of woody legumes might result in massive release of N_2O into the atmosphere.

A comprehensive carbon balance assessment must thus take into account direct as well as indirect land use change which refers to emissions from land that has been put into agricultural production, because other agricultural land has been converted to bioenergy crops or because of increased demand for food crops as a result of energy cropping (Albrecht, 2004).

Land use and tenure security

Land is at the centre of biofuels production. This is because large tracks of land are required to gain maximum profit from biofuels for both ethanol (as in the case of sugar plantation) and biodiesel (in the case of oil crops production). The land question rides on the fact that large tracts of land are taken away from communities who are socially and economically vulnerable groups. It is these communities' mainly traditional systems whose tenure regimes are not secure. There has been an increase in number of land conflicts linked to biofuels.

In addition, it is evident that prime land taken for biofuels use competes with land for growing food crops, thereby compromising food security. In terms of land use, the aim of a sustainable biofuels policy, it is argued, should be to manage the diverse land use spectrum of both large and small scale development, in time and space, with change resulting from interactions among ecological, economic and socio-political factors. In addition improved cultivation systems such as agroforestry require medium to long term investments (Angelsen and Kaimovitz, 2004). Farmers are not committed to long term investments if their land tenure is not secure. For instance, the land tenure system in Tanzania has placed constraints on the long-term investment in land that would be vital for increasing the agricultural productivity, as about 30% of the farmers are tenants on leased land (Edwards et al, 2007; Msikula 2003).

Impact on water resources

Water is needed to produce feedstocks as well as convert plant material into fuel. According to Sexton et al (2009), evapotranspiration by energy crops constitutes much of the water consumed in biofuel production. By some estimates, the water consumed by energy crops through evapotranspiration could by 2110 meet and even exceed the total water used for evapotranspiration by global croplands in 2002 (Fingerman and Torn, 2008). Furthermore, as prices for agricultural commodities rise because of biofuel-induced demand, farmers will also find it profitable to use more chemicals per unit of land. Higher input prices could also induce the adoption of precision pest-control technologies, but unless such conservation is considerable, more chemical use will lead to increased pollution of water resources from farm runoff and groundwater percolation (Sexton *et al*, 2009).

Impact on poverty alleviation

Most of the developments around biofuels are occurring in lands in rural areas of SSA. These are areas where the poorest and vulnerable of these nations reside, especially small scale farmers. In terms of rural development, the issues are:

- Would biofuels in these areas contribute to poverty alleviation through provision of energy for reproductive and productive energy needs?
- Would biofuels contribute to rural poverty reduction through employment and opportunities for improved livelihoods of rural populace
- Would it reverse the rural-urban migration by making rural areas viable economic areas?

Gender Issues

Further, issues linked to biofuels and genders are emerging. Gender practitioners are questioning how biofuels will contribute to women's and children's lives especially the rural and urban poor. Energia (2009) argues that women in many developing countries lack access to modern energy. Women are primarily responsible both for securing energy for their households, and in poor regions they rely heavily on traditional biomass fuels such as firewood, charcoal and agricultural residues for most of their energy use. Women in these areas are greatly in need of modern energy services to reduce the time and labour involved in providing for their families, and to open up new opportunities for education and economic advancement. Therefore well-planned policies on biofuels production have the potential of transforming women's current roles as energy suppliers into sustainable livelihoods that trigger new advancements in rural development and self-reliance. However, if gender considerations are not incorporated into biofuels policies and practices, the livelihoods of women and their families could be threatened.

Knowledge, skills and information

Lack of knowledge and understanding has also been raised as some of the factors which might hinder implementation of biofuels and uptake of improved agroforestry systems. According to Lundgren and Nair (1985) each agroforestry system is unique, combining the experience and knowledge of forestry, agriculture, ecology, soil science and rural socio-economics. This therefore calls for capacity building of all stakeholders including farmers, extension services, scientists and research in order to ensure sustainable implementation and management of improved agroforestry systems. Lack of access to extension services and information can also impinge on the adoption of agroforestry.

Capital and Credit

Implementation and adoption of bioenergy production and agroforestry systems can be hindered by inadequate access to capital to invest in agroforestry systems. If financial resources are lacking, farmers will be less willing to invest as daily struggle for survival will take precedence over future benefits to be accrued in energy crop production and agroforestry systems. Financing is necessary for training and capacity building, policy development, demonstration/pilot projects, research, improvement of agricultural efficiency and technology development (COMPETE, 2009). Barriers exist which affect financing of biofuel production. COMPETE Work Package 5 on financing and trade identifies challenges faced by project developers and investors/financiers.

i) Project Developers

- Financial institutions always ask for collateral
- High interest rates of banks for investments, Grant conditions often too stringent
- Too many intermediaries, i.e. no direct access from project developers to funding institutions; projects on the ground are at the bottom of bioenergy funding “food chain”

ii) Investors

- Inexperienced project developers
- Weak business proposals
- Inadequate local co-financing
- Bioenergy projects often involve high risk
- Investment pay-back times are often too long (Hofman, 2009).

These financial challenges affect small producers more because they can not meet the conditional requirements of commercial banks. A good example is given for Benin, where it is estimated that in 2002, the activity sector “agriculture, tree growing and fisheries” received only 6.1 billion FCFA of credits out of a total of 121.1 billion FCFA in credits given by banks (or 3.6%). Of this amount, nothing went directly to agricultural producers (Adjavon, 2004). Consequently, 84% of farmers continue to count upon their own resources in order to conduct agricultural activities, and only 10% of small farms had recourse to microfinance organisations (Political-economic Analysis Group, 2003).

2.2 Principles to guide biofuel policy formulation

According to FAO (2008), biofuel policy development should be guided by the following five principles.

1) Biofuel policies must protect those who are poor and have insecure access to sufficient food. Priority should be given to the impact of higher food prices on vulnerable people in rural and urban areas who have to buy food, particularly in the least-developed countries. This is so because high energy prices initiate or exacerbate price volatility of agricultural commodities, and hence have impact on food security. Therefore, safety nets are required to protect poor net food buyers either through food subsidies, food distribution, or targeted cash transfers via social programmes.

2) Policies should facilitate growth in developing countries by improving economic and technical efficiency and by creating conditions where poorer countries and small farmers can take advantage of future market opportunities.

3) Biofuel policies should be environmentally sustainable. They should ensure that biofuels are produced in ways that are effective in reducing greenhouse gas emissions, while protecting land and water resources from depletion, environmental damage and pollution. Future support for biofuels is likely to be assessed against sustainability criteria, and some countries have already taken an interest in the environmental sustainability of the products they would like to import.

4) Biofuel policies should seek to reduce existing distortions in biofuel and agricultural markets and avoid introducing new ones. They should also take into consideration unintended consequences that may go beyond national borders. Border protection in the form of tariffs on ethanol has provided a protective barrier and affected farmers. Some governments have granted exemptions from fuel excise taxes that are available only to domestic biofuel producers.

5) Policies should be developed with appropriate international coordination to ensure that the global system supports the goals of environmental sustainability, agricultural development and poverty and hunger reduction.

Gustavo Best (COMPETE, 2009), suggests that there is a need for an international forum in which sustainability criteria can be determined without creating unnecessary barriers to trade. In this respect an on-going initiative is provided by the Roundtable on Sustainable Biofuels (RSB) which has elaborated a set of 10 principles for sustainable biofuels. Furthermore, the International Community should support countries with natural production advantage such as countries in Sub-Saharan Africa, to meet the (local and global) demand for biofuels in a sustainable way.

2.3. Suggestions on Biofuel Policy Actions

The emerging issues on biofuel production gave a clear picture and justified the need for proper policy direction in the biofuels sub-sector. This section will suggest potential biofuel policy actions based on the policy principles advocated by FAO (2008) in order to ensure sustainability of the bioenergy sector.

Policy formulation

The need to formulate and review biofuel policies is urgent in light of the emerging knowledge on biofuels and their implications. It is especially critical for SSA countries as they may be affected by food-fuel conflicts and climate change. Policies which take into consideration all the issues which might affect biofuel production and marketing are therefore a necessity.

The question however, remains on how to do it, based on the fact that the absence of policies in SSA has been attributed to inadequate awareness and sensitization of the political and administrative leadership of the SSA region regarding the benefits as well as dangers of mismanagement of biofuels (Jumbe and Msiska, 2007).

With respect to awareness raising and sensitization, there is need to involve political and administrative leadership as well as all stakeholders such as farmers, women and indeed all ordinary citizens who have a stake in the business of energy production and consumption. People need to be conscietised on the potential benefits and detriments of biofuel production. One of the ways to do it is through South-South Cooperation (SSC) whereby policymakers will be exposed to successful interventions in biofuel production. South-South Cooperation refers to cooperative activities between newly industrialized southern countries and other, lesser-developed nations of the Southern Hemisphere. Such activities include developing mutually beneficial technologies, services, and trading relationships. SSC aims to promote self-sufficiency among southern nations and to strengthen economic ties among states whose market power is more equally matched than in asymmetric North-South relationships. SSC is important to these nations for two reasons. First, SSC contributes to economic advances in southern nations, especially in Africa, southern Asia and South America. Second, SSC lacks the overtone of cultural, political, and economic hegemony sometimes associated with traditional North-South aid from the United States, Russia, and Western Europe. For example, COMPETE aims to foster SSC between partners from Africa, Latin America and Asia. African COMPETE partners have been introduced to successful interventions in the fields of energy crop and agroforestry systems to highlight best practices as well as their replication potential in Africa (Janssen and Rutz, 2009).

Policy makers can also learn from case studies where indirect effects of biofuel production have been avoided. These include, oil palm cultivation on Imperata grassland in Indonesia; sugarcane-cattle integration model in Brazil; soy-cattle integration in Brazil; sugarcane yield increase in the Phillipines and smallholder yield increase in Liberia (Malin, 2009).

It is also imperative that policymakers learn from other countries who have successful bioenergy policies in place. Mauritius' Bagasse cogeneration presents such success story (see box 2). Mauritius is one of the few countries in the world that can boast a relatively high share of renewable energy sources in its electricity mix. In a typical year, around 21-23% of the country's electricity is generated from renewable energy, with hydro-electricity and bagasse contributing roughly 2-4% and 19-21%, respectively (Deenapanray, undated). Mauritius's policies and instruments have had significant positive impacts on the reduction of greenhouse gases, as well as other pollutants. African countries can also benefit from the application of similar policies and instruments.

Box 2: Mauritius: A Bioenergy Policy Success Story

The Mauritian experience in cogeneration is one of Africa's success stories in the energy sector. Through extensive use of cogeneration in the country, the sugar industry is self-sufficient in electricity and sells excess power to the national grid. In 1998, close to 25% of the country's electricity was generated from the sugar industry. By 2002, electricity generation from sugar estates stood at 40% of total electricity demand in the country. Government support and involvement has been instrumental in the development of the cogeneration program in Mauritius. First, in 1985, the Sugar Sector Package Deal Act (1985) was enacted to encourage the use of bagasse for electricity generation.

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, an additional incentive to the industry. A year later, foreign exchange controls were removed and the centralization of the sugar industry was accelerated. These measures have resulted in the steady growth of bagasse-based electricity flowing into the country's grid.

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

Source: Sustainable Bioenergy Development in UEMOA Member Countries, 2008

Political Coherence

Policy coherence is about ensuring that the external impacts of other policies do not undermine the aims and objectives of biofuel development. With regard to energy security, it is important to ensure equal conditions for different sources and suppliers of renewable energy, at the national and international levels, and to avoid promoting biofuels over other sources. In the case of greenhouse gas mitigation, carbon taxes and tradable permits constitute mechanisms that place a cost or price on carbon and thereby stimulate the most efficient carbon-reduction response, which may involve energy conservation, biofuels and other technologies (FAO, 2008).

It is advisable that Sub Sahara African countries adopt a common policy to be accepted and followed by possibly all countries of the subcontinent. This however needs to be in conformity with global policies and it is recommended to ensure that Africa works closely with other trading blocks in developing its continental biofuels policy.

Financing Biofuel Production

It has been highlighted that financing of biofuel production is a major challenge especially for small scale producers.

There are however, strategies which can be exploited to overcome financial barriers:

- Creation of sustainable legal and regulatory bioenergy frameworks
- Focus on demand side and market development (e.g blending regimes)
- Improve capacity, communication and information sharing for resource mobilisation
- Encourage bioenergy public-private partnerships(PPP)
- Entrepreneurial and developer support services
- New/innovative financing mechanisms need to be exploited such as carbon finance (Hofmann, 2009)

One such innovative mechanism which can be exploited by African governments is the Carbon Finance for Agriculture, Silviculture, Conservation and Action against Deforestation (CASCADe) Programme (Leagnavar and Otto, 2009). Africa under COMESA is already piloting a coordinated carbon finance instrument as part of the Africa Climate solution. The programme is spearheaded by UNEP through its bioenergy and finance programs, with the aim of helping small-scale rural bioenergy projects obtain revenue through the carbon market. This helps to overcome bottlenecks, such as covering the significant upfront investments of bioenergy projects.

Creation of Biofuel Markets

Small scale farmers are sceptical about producing biofuels because they are not assured of stable viable markets for their energy crops. The creation of stable markets can be achieved through:

- Creation of policies and standards which facilitate and guide bioenergy market development in Africa
- Prioritising small scale projects and local markets (e.g rural electrification and transport fuels for agriculture)
- Exploring export, global markets and large-scale projects
- Ensuring value creation for farmers and rural development through (Janssen et al, 2009):
    - Developing and implementing policies and regulations.
    - Creating a favourable environment for investment in the agricultural sector.
    - Clearly defining social requirements and guidelines for investors in bioenergy projects to ensure benefits for the local population. This may be achieved in cooperation with social sustainability criteria integrated in international initiatives to ensure sustainability of bioenergy production.
    - Putting in place incentives and measures of risk reduction such as subsidies and tax exemptions to foster the development of the bioenergy sector. Specific incentives need to be established for local businesses and smallholder farmers.
    - Identifying and promoting suitable feedstock and bioenergy technologies with respect to local and national framework conditions.
    - Provision of financing opportunities for farmers and investors to facilitate implementation of small and large scale bioenergy projects.
    - Diversification of agricultural production.
    - Promotion of the participation of national stakeholders in the full bioenergy value chain (not just raw material provision).
    - Promotion of outgrower schemes and community engagement to ensure ownership of the local population. Promotion of the engagement of farmer organisations (COMPETE, 2009).
    - Gender strategies to achieve maximum benefit from these projects through participation of both women and men. Through:

In order to create viable markets for biofuels in Africa, it is important that regulation and standards are established through:

- Establishment of cooperation links with international standardisation initiatives.
- For export markets, bioenergy produced in Africa needs to comply with technical and sustainability standards existing or under development in potential importing countries (USA and Europe).
- For national markets, suitable (technical and sustainability) standards need to be developed with respect to national framework conditions in consultation with national stakeholders. Standard development should be based on existing international standards and shall take into account different feedstock.
- National guidelines for social requirements of bioenergy projects should be elaborated in close cooperation with local communities. Focus should be placed on the production of biomass feedstock.
- National and regional consensus on social, environmental and economic sustainability criteria for bioenergy projects in Africa should be achieved.
- Minimum standards for African countries should be defined on regional level (e.g. SADC, ECOWAS).
- Regulations for the promotion of bioenergy in African countries should be transparent and well integrated into existing laws and regulations. Overregulation of the bioenergy sector should be avoided.
- African Governments should establish suitable national regulations and targets for (voluntary or mandatory) blending of biofuels with fossil fuels.
- African Governments should establish suitable subsidy schemes and price guarantees for bioenergy to create stable national markets (COMPETE, 2009)

Enhancing international system support to sustainable biofuel development

According to FAO (2008), international trade rules and national trade policies for agriculture and biofuels should be made more conducive to an efficient and equitable international allocation of resources. The current combination of subsidies, mandates and trade barriers does not serve this purpose. Land grabbing in developing countries by European companies also affects allocation of resources. Trade policies should enhance opportunities for agricultural producers and biofuel processors in developing countries, in line with their comparative advantage, by eliminating existing trade barriers. This will contribute to a more efficient pattern of biofuel production at the international level. It is therefore essential that;

- International community must ensure that productive land is not confiscated by European companies for the expansion of agrofuels production in developing countries at the expense of food production for local needs and that projects resulting in land-grabbing respect the human right to adequate food and the FAO's Voluntary Guidelines on the Right to Food;

- EU should revise its mandates for the amount of biofuels to be used in the transport sector.
- EU should create incentives for research and investment in "second generation" biofuels. These include "closed loop" agricultural systems which ensure that little energy is wasted in the production process. It should be ensured that the most efficient technologies are used for producing biofuels, and the use of waste products should be encouraged (CONCORD, 2009).

Ensure Environmental Sustainability

Policies formulated to effect biofuels and agroforestry must meet the boarder policy objectives of SSA countries. Some of the objectives are stated in international treaties. For example, the Convention on Biological Diversity requires member states to protect and encourage customary use of biological resources, and respect and maintain knowledge, innovations and practices of local communities. Thus, indigenous energy crops in a particular area should be capitalized so as to avoid introduction of potentially invasive alien species.

Some of the actions which are needed to ensure environmental sustainability are:

Understand impact of energy crop production on water quantity and water quality

Water requirements for current biofuel production are not clearly understood because the data are not publicly available. Large-scale biofuel production could significantly increase industrial water consumption, and for some regions, lack of water could limit construction of production facilities. Irrigation for energy crops is another water supply issue. Comprehensive and accurate data on crop water requirements of various energy crops should be done and matched with available water resources in a particular area before these can be grown to avoid water use conflicts. Input (pesticide, fertilizer) requirements that may end up in the water supply will vary depending on the biomass crop and location. Run-off from crops that require these chemicals and wastewater discharge from biofuel production will call for more extensive research and monitoring to assess impacts on ground and surface water supplies.

Carry out research on environmental impacts of energy crops and biofuel production

The field of research on environmental impacts of energy crops and biofuels is relatively new. While some studies have attributed greenhouse gas emission reduction to energy crops and biofuels there are concerns however that sometimes they can increase emissions. Thus, it is important to carry out life-cycle accounting of biofuel production including direct and indirect land use changes, agricultural practices and energy crop processing and end uses. There is thus need to understand how large-scale changes in land use can affect greenhouse gas emissions, and how global warming will transform landscapes and impact agriculture. We need to identify the best strategies for ensuring a sustainable transition of land to bioenergy production. This requires that impacts of crop production practices be analysed under different biophysical factors as well as different land sizes.

Promote rural development

This can be possible through community engagement and development of people led policies. Communities should be made aware of benefits, impacts and trade-offs of bioenergy production. Engagement will be critical in reaching a consensus on determining what scale of production is socially acceptable, clearly defining infrastructural and workforce needs, providing community input on locating of biofuel production facilities, assessing appropriate risk levels, negotiating ownership options, identifying realistic returns from investments in bioenergy, and many other issues.

Supportive programs should be put in place for the production of energy crop to help subsistence farmers. These programs should offer to farmers:

- Access to capital to invest in improved energy crop and agroforestry systems
- Training in agroforestry farming techniques
- Reliable markets for their energy crops
- Extension services on agroforestry

Land-policy issues are also critical in achieving rural development, especially the need to ensure that the land rights of vulnerable and disadvantaged communities are respected. Measures should be put in place to:

- Avoid displacement of rural population
- Avoid corruption regarding land use issues demonstrating transparency regarding land tenure.
- Ensure that concessions/ownership granted by national authorities for bioenergy focus on rural and social development (Janssen et al, 2009).

Land use and Food-Fuel Crisis

The food crisis caused by competition for land between food and energy crops can be mitigated through:

- Integration of energy crops and agroforestry systems whereby energy crops are grown in the same unit of land with food.
- Zoning and identification of real potential of countries and regions to produce food and energy crops (Janssen et al, 2009).
- Agro-ecological zoning initiatives by African Governments to identify available and suitable land for food and bioenergy production. Thereby, decisions will be informed by the prevailing situation and bioenergy development need not be restricted to marginal and degraded land.
- Participation and ownership of local communities in bioenergy projects.
- Specific conditions for land acquisition and tenure for bioenergy investors.
- Motivation of bioenergy investors to dedicate part of the land to grow food crops.

Capacity building

There is also need for capacity building of all stakeholders including farmers, extension services, local business/investors, and researchers in order to ensure sustainable implementation and management of bioenergy systems.

Agroforestry and energy crop management should be included in extension programmes.

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