International Conference and Policy Debate on 'Bioenergy Sustainability Schemes - An African Perspective'

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

16-18 June 2008

Arusha, Tanzania

Proceedings

August 2008

COMPETE is co-funded by the European Commission in the 6th Framework Programme – Specific Measures in Support of International Cooperation (INCO-CT-2006-032448).

Conference Objectives

The main aim of this COMPETE conference was to elaborate recommendations addressing the opportunities and challenges of the global bioenergy development from an African Perspective.

This international conference was organised by Imperial College, United Kingdom and WIP Renewable Energies, Germany in cooperation with TaTEDO, Tanzania in the framework of the Competence Platform on Energy Crop and Agroforestry Systems for Arid and Semi-arid Ecosystems – Africa (COMPETE), funded by the European Commission, DG Research.

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Conference Organisation

Background

The use of bioenergy has come to the fore most recently as a result of the concept of it being used to mitigate climate change. There are many arguments in favour of the use of biomass, e.g. security of energy supply, diversification of energy sources, low-carbon emission, an alternative market for agricultural products, and rehabilitation of degraded lands, among others. However, the current debate focuses on the possible negative social and environmental implications, especially with regards to land competition, questions about the reduction of emissions in practice and the 'fuel versus food' debate. Some of these implications are related to either the lack of policy or policies that do not encompass sustainable development.

One of the main problems in tackling climate change has been the lack of appropriate policies. Global-level policies have often ignored the human and social needs which energy fulfils, particularly in developing countries. Although there is no single policy or measure which can provide a total solution, there is need for immediate action. If African countries are willing to engage in the "bioenergy sector" in part by replacing the traditional use of biomass with more modern forms whilst ensuring that they can fulfil their own energy needs, it will be necessary to meet sustainability assurance (environmental, social and economic) and incorporate it into local policy and governance.

Implementation

The COMPETE Conference and Policy Debate on 'Biofuels Sustainability Schemes - An African Perspective' on 16-18 June 2008 in Arusha, Tanzania, brought together more than 60 high-level participants including decision makers from several African countries, representatives from the Private Sector, NGOs, the donor community, FAO, UNEP, international initiatives (e.g. RSB) as well as national and international energy experts and stakeholders.

The main aim of this COMPETE conference was to elaborate recommendations addressing the opportunities and challenges of the global bioenergy development from an African Perspective.

Thereby, emphasis was given to:

- ensure that a strong African perspective is encouraged to emerge in the global arena of energy, climate change and bioenergy policy making
- engage the policy and decision makers of African countries in sustainable bioenergy development
- assist African countries in the development of strong regional and national policies on the sustainable development of bioenergy resources for indigenous and export markets
- highlight ways of developing food AND fuel and avoiding the food versus fuel conflict

The main outcome of this COMPETE conference was the elaboration of a **COMPETE Declaration on Sustainable Bioenergy for Africa** (see page XX) along the lines of two Roundtable Discussions engaging high-level decision-makers from Kenya, Mozambique, Tanzania, Uganda, Zambia, as well as the Union Economique et Monétaire Ouest Africaine (UEMOA).

Conference Programme

MONDAY 16th JUNE 2008

Session 1:

Bioenergy Policy Developments in Africa – Presentations by African Policy-makers

Chair: Dr. Rainer Janssen, WIP Renewable Energies, Germany

Session 2: Sustainable Development Pathways for Bioenergy Production

Chairs: Mamadou Dianka, UEMOA, Burkina Faso and Dr. Rocio Diaz-Chavez, Imperial College, United Kingdom

Session 3: Resources, Opportunities and Impacts for Bioenergy Development

Chairs: Touria Dafrallah, ENDA-TM, Senegal and Dominik Rutz, WIP Renewable Energies, Germany

Session 4: Investment, Regulation and Good Practice Reward

Chairs: Estomih Sawe, TATEDO, Tanzania and Dr. Veronika Dornburg, Copernicus Institute, Utrecht University, Netherlands

TUESDAY 17th JUNE 2008

Elaboration of COMPETE Declaration on Sustainable Bioenergy for Africa **57**

09:00 – 10:00

Roundtable 1: Policy strategies to enhance the bioenergy potential in Africa

Chair: Prof. Francis Yamba, CEEEZ, Zambia

Secretary: Dr. Rainer Janssen, WIP Renewable Energies, Germany

Panellists

- H. E. Jaime Himede, Vice – Minister, Ministry of Energy, Mozambique
- Mr. Oscar Kalumiana, Director, Ministry of Energy and Water Development, Zambia
- Mr. Mamadou Dianka, Coordinator Biomass Energy Regional Programme, UEMOA
- Mr. Styden Rwebangila, Ministry of Energy and Minerals, Tanzania

10:00 – 11:00

Roundtable 2: Sustainability tools and means to assure, monitor and reward sustainable bioenergy production in Africa

Chair: Dr. Jeremy Woods, Porter Institute, United Kingdom

Secretary: Dr. Rocio Diaz-Chavez, Imperial College, United Kingdom

Panellists

- Ms. Faith Odongo, Senior Renewable Energy Officer, Ministry of Energy, Kenya
- Mr. Turyahabwe Elsam, Director of Renewable Energy, Ministry of Energy and Mineral Development, Uganda
- Ms. Martina Otto, UNEP, Roundtable on Sustainable Biofuels (RSB
- Ms. Janske van Eijck, Diligent Tanzania Ltd.

Conference Closing

11:30 – 12:30 Summary and Conclusion
Prof. Francis Yamba, CEEEZ, Zambia
Dr. Jeremy Woods, Porter Institute, United Kingdom

Field Trip to Village Electrification Scheme – Leguruki Village, Tanzania **63**

13:30 – 16:30

MONDAY 16th JUNE 2008

Session 1:

Bioenergy Policy Developments in Africa – Presentations by African Policy-makers

Opening Address

Hon. William Mganga Ngeleja (MP), Minister for Energy and Minerals, Tanzania

The official opening address of the COMPETE Conference and Policy Debate on 'Biofuels Sustainability Schemes - An African Perspective' was delivered on behalf of Hon. William Mganga Ngeleja (MP), Minister for Energy and Minerals by Honorable Isidore Shirima, Regional Commissioner, Arusha Region

Chairperson/Chairman,
Distinguished Participants,
Ladies and Gentlemen.

It is pleasure for me to be afforded this opportunity of opening this important conference on policy debate for biofuel sustainability schemes-an African perspective. I understand that the purpose of this conference is to establish a platform for policy dialogue and capacity building and identify pathways for the sustainable provision of bio-energy. I am also informed that the conference will provide inspiration and background information for policy makers, investors and service providers. This opening session is partly an opportunity for me to participate on behalf of the Government of Tanzania in this important conference.

I would like to take this opportunity to welcome you all to this conference and also to thank TaTEDO, Imperial Collage and WIP for their efforts in organizing the conference on behalf of other COMPETE project partners. I would also like to thank the European Union (EU) for co-financing the conference.

Mr Chairman, I am glad to note that the theme of this conference will debate on Biofuel Sustainability-An African Perspective. For the government as well as the donors and civil community in this country, biofuel development and the sustainable development are concerns, which are on top of our development agenda today. We are all aware that energy is a crucial input to all income earning and poverty eradication initiatives. The use of biofuel as an alternative to mineral fuel for transport and industries to a large extent, could contribute to increased productivity and reduce high expenditure of importation of fuel for African countries, which in turn could stimulate economic growth and thereby contribute enormously in the war against poverty.

Mr. Chairman, There has been growing interest in liquid biofuels in Africa and rest of the world in recent years. As Africa has a large arable land resources and favourable climate for growing energy crops, there is no doubt that this continent has the potential to provide the much-needed energy for transport, industrialisation and poverty reduction efforts at the same time contribute to the climate change mitigation and adaptation.

It is worth little that African countries are party to the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol, which demands for cleaner fuels to reduce emissions of greenhouse gases, if there are no economic and environmental gains to the people in Africa.

Mr. Chairman, We have all seen the contradicting views on growing crops for food or for biofuel production and there is no doubt that the vast tracts of land are required to replace mineral petrol to any significant degree. There is need to provoke debate on research and development for biofuels that are cleaner, more versatile, and can be used on more semi-arid marginal lands.

However, we are aware that biofuel development can present a number of connected challenges that oblige the African governments to be very keen in formulating and implementing the right policies. However, provided we develop and implement biofuel policies intelligently, biofuels can be positive both for the environment - and for sustainable development. There are ofcourse other considerations linked to agricultural policy and issues of security of energy and food supply. But our fundamental benchmark in biofuel policy must be an environmental one with social and economic consideration to the energy and food security.

Mr Chairman, Many African countries have spare agricultural land resource and a genuine comparative advantage in biofuel crop production. Biofuels can be produced from competitively locally grown plant oil as well as sugar and starch plants and can reduce foreign exchange expenditure on the imports. Growing crops for biofuel will not be meaningful, if biofuels cannot contribute to the tumbling down the fuel expenses in economic sectors. A welcome side effect of increased growing in biofuels is the fact that African countries stand to gain from biofuel expansion.

Mr Chairman, Despite the potential of biofuel development available in Africa, production has not reached the commercial levels. Efforts of developing biofuels are still at infant stages. There are number of investors interested to come in from abroad and other few are already active in the field. Due to the fact that the local market is being developed gradually, it is anticipated that biofuels could be produced for both local and foreign markets.

Mr. Chairman, the efforts of COMPETE project to formulate, create awareness and implement a strategy for creating biofuel sustainability through establish a platform for policy dialogue, capacity building and identify pathways for the sustainable provision of bio-energy will definitely result into a positive contribution to the overall socio-economic development of the African countries. I am sure African Governments will benefit from recommendations which will result from this conference. The key issue is to share skills, experiences, guidance on what works required and benefits for our continent.

Mr. Chairman, your programme, shows a number of topics that will be discussed during the different conference sessions. I humbly suggest that debate should also be directed to the better ways of improving the quality of energy services for poor especially people in rural areas to use biofuels to generate electricity, process agricultural products and create income in order to improve their livelihoods.

Mr. Chairman, given the potential of biofuels in addressing Africa's energy challenges and associated risks and trade-offs, it is critical that the biofuel development efforts are targeted to maximize the benefits while minimizing the risks and trade-offs.

Mr Chairman, I hope that over the next two days the conference will not only come up with a comprehensive resolutions for achieving the objective of developing biofuel on sustainable basis in Africa and to offer support to policy making activities, but also come up with sound recommendations and commitment from the partners to effectively put into actions such resolutions.

Finally, **Mr. Chairman**, distinguished participants I would like to wish you fruitful discussions in the next two days of this conference. With these brief remarks, I have the pleasure to formally announce this conference open.

Thank you for your kind contribution

Welcome Address – 'COMPETE in Action'

Estomih N. Sawe, TaTEDO, Tanzania

Mr. Chairman

Honorable Isidore Shirima, Regional Commissioner, Arusha Region, Honorable Minister from Mozambique, Your Excellencies, colleagues and friends, Ladies and Gentlemen.

1.0 INTRODUCTION

On behalf of the organizers of this conference, Dr. Jeremy Woods and Dr. Rocio Diaz Chavez from Imperial College, UK, with close support of the COMPETE project Coordinator, Dr. Rainer Janssen from WIP, Germany and also with local support from my colleagues, Mr. Jensen Shuma, Pamela Semiono and Shukuru Bartholomeo from TaTEDO, Tanzania and other COMPETE partners, I am delighted and grateful for this opportunity to give this opening remarks on the overview of the COMPETE project.

I am also pleased to welcome you to this International Conference and policy dialogue, which aims to share and deliberate on biofuels policy experiences and lessons, hoping to come up with effective and action oriented recommendations for policies and strategies for sustainable biofuels development in Africa.

Mr. Chairman

Please, allow me to extend to all of you, on behalf of the Tanzanian delegation, my warm welcome to Arusha City, indeed, one of the most attractive tourist destinations and conference Centers of Tanzania. I would like to encourage you to take some days off to visit some of these areas after the conference. I also, would like to thank you all for taking several days from your busy schedule, to participate in this conference. This is a clear indication that, we all believe that sustainable energy in particular biofuels development has a crucial role in the Continent's efforts on poverty reduction and sustainable development which are necessary for achieving the MDGs.

Mr. Chairman

As we are all aware, probably nothing can be more timely and useful than a conference on biofuels development for Africa at this period of global concerns and efforts to confront the current crisis of rising food and fuel prices from which Africa is the most vulnerable continent.

Mr. Chairman:

We have among us, outstanding participants from the International, Regional, National and Donor communities; we are also most pleased to have with us, Minister from Mozambique, all have so kindly agreed to share with us their experiences.

Mr. Chairman, Excellencies, Distinguished participants,

This conference is meant to be forward looking and a dialogue on policies for sustainable development of biofuels in Africa. It has been organized in the context of the COMPETE project, package three, on the "Sustainability analysis of alternative land use" which aim to ensure that, the project contribute to practical tools required by the continent policy makers, industries and investors.

2.0 THE COMPETE PROJECT OVERVIEW

Mr. Chairman

2.1 COMPETE PROJECT OBJECTIVE AND ACTIVITIES

The objective of the COMPETE project is to, among others; stimulate sustainable bioenergy development and implementation efforts in Africa. The project aims at establishing a platform for policy dialogue in the major multi-and bilateral funding organizations and key stakeholders throughout the bioenergy provision and supply chains. The COMPETE project is co-funded by the European commission in the 6th Framework Programme - specific measures in support of international cooperation for the period from January 2007 to December 2009.

The COMPETE project activities aim at facilitating the implementation and delivering outputs from a matrix of multi-disciplinary and cross-sectoral work packages led by several renown Scientists and Practitioners carrying out specific activities such as, evaluation of potential for sustainable provision of bioenergy in Africa in relation to land and technologies, facilitating South-South technology and information exchange, developing innovative tools for funding bioenergy initiatives, supporting development of efficient policy mechanisms and establishing platform for effective knowledge sharing.

Mr. Chairman.

The COMPETE project partnership consists of twenty European and twenty three non- European partners – eleven partners are from seven African countries, three regional African policy and financing bodies, nine partners from Latin America and Asia – and the Food and Agriculture organization of the United Nations, we are pleased, most of these partners are present in this conference,

Mr. Chairman, Excellencies, distinguished participants

2.2 THE COMPETE PROJECT ACHIEVEMENTS

Some of the COMPETE project achievements, so far include the following;

- Created a website: www.compete-bioafrica.net and a logo.
- Developed a COMPETE stakeholders database, published several issues of the project newsletter and flyers.
- Cooperated and participated in a variety of national and international events and initiatives.
- Participated and contributed significantly in the first high-level biofuels seminar in Africa in Addis Ababa, which was organized by the African Union Commission (AUC), the Government of Brazil and UNIDO on 30th July – 01st August, 2007.
- Also organized international workshop on improved energy crops and Agro forestry systems for sustainable development in Africa in Mauritius in June, 2007.
- Organized round tables on the occasion of the Professional System Skills and prospective of Biofuels in Africa, in Ouagadougou, Burkina Faso in November, 2007.
- Organized seminars and field trips to Brazil in October 2007 and to India in February 2008.
- The project has been registered as official partner of the United Nations Commission on Sustainable Development (CSD).

2.3 LESSONS LEARNED

Mr. Chairman.

Please, allow me to share, some of the early lessons learned from the COMPETE Project activities, they include among others;

- Biofuels can play an important role in improving the lives and livelihoods of people in Africa. The Biofuels powered technologies has huge potential for providing modern energy services that can contribute to greater employment, income opportunities and social well being in rural areas. Presently, biofuels represent a fast growing industry seeing a more than 17 percent increase in 2006. The challenge for Africa is to come up with effective policies and strategies that will ensure African countries are secure in fuels and food.
- Liquid biofuels production is already significant in South America, North America, Europe and some Asia countries. In Africa, there are initiatives of developing a number of energy crops, ethanol production in Kenya, Malawi and Zimbabwe, but have not resulted into significant impact on the global biofuels market. African biofuels development has been hindered by several barriers including among others; low awareness and understanding of biofuels issues at all levels, land ownership uncertainties, lack of clear policies, lack of affordable financing, inadequate institutional capacity and awareness, lack of local technology production, and poor market understanding and development.
- Unfortunately, the huge potential for biofuels development to meet local energy needs, reduce dependence on imported oil and contribute to the development of the agriculture sector has not been fully recognized and appreciated by many African countries.

On Policy issues

- Most African countries have no policy in place to support biofuels development, no fiscal and financial incentives and no blending targets. However, land grabbing and other initiatives, mostly by foreign investors interested in exporting biofuels feedstock to meet foreign blending targets are going on without appropriate regulations in place.
- Where policies are being developed, they have tended to be driven mostly by outsiders with limited involvement of most local stakeholders, such policies also in some cases tend to favour large scale industrial farmers, with smaller scale farmers being left out, or just mentioned as providing inputs to larger farmers with no regulations in place to protect them and ensure fair trade deals.
- With the growing interest in biofuels worldwide, many African countries at the moment are not well prepared to harness the potentials from this fast growing industry to benefit from international trade in biofuels while at the same time protecting the environment and rural communities from potential destruction of livelihoods, indecent work, exploitation, food insecurity and other disadvantages resulting from large scale cultivation of energy crops for biofuels production.

Mr. Chairman.

Indeed, the efforts of the COMPETE Project has enabled most of the participating partners to access a wide range of biofuels knowledge which is proving to be very useful in the development of policies and strategies for biofuels initiatives in the project partner countries of Africa. Also, the knowledge is providing useful inputs in implementing field activities in partner countries. For example, for my organization, TaTEDO, our on going programme to electrify more than 100 villages through straight vegetable oil powered MFPs has benefited from similar ongoing field experiences in India and Mali.

2.4 COMPETE PROJECT RECOMMENDATIONS

Mr. Chairman

From the COMPETE shared information and lessons already learned, the project is in a position to offer the following recommendations for consideration and implementation, which are African countries need;

- To develop comprehensive regional and national biofuels policies, regulations and strategies in consultation with stakeholders, including regional economic communities to include incentives for indigenous private sector and small farmers to take a leading role in the biofuels industry to ensure that local households, business, and communities capture the benefits of energy services afforded from biofuels development, as well as associated income and job opportunities. Policies should be clear, long term, stable and ensure biofuels development by local people, for local people has higher priority in Africa and should enhance the ability of local people to access modern energy services.

- To raise resources in particular financing for Infrastructural development for production, processing, storage, transporting and marketing of biofuels products. It is important to realize that biofuels need to be seen as one aspect of an integrated framework for enhanced land management that encompass food and fuels. Financing is a key barrier especially for small scale farmers who need capital for purchase of seeds and other necessary inputs to grow biofuels and develop related business. It is important to involve local finance and microfinance institutions that are close to local markets. Furthermore engaging international institutions, such as multilateral and bilateral donors, in provision of upstream grant support, long term financing, and risk mitigation will also be important to support investments in biofuels initiatives. The role of carbon financing should be fully explored.

- To commit resources for biofuels research and development (R&D), capacity building, technical support for biofuels technologies demonstration and adaptation are crucial in order to drive down costs, enhance greater use of locally produced biofuels by rural poor to have better access to electricity and fuels for meeting productive and consumptive energy needs. African research centers that encourage biofuels technologies especially small scale technologies should be encouraged.

- To establish a regulatory and institutional framework in order to regulate and provide incentives for development and growth of a sustainable biofuels industry. Adequate political commitment and putting in place effective policy and regulatory frameworks are crucial elements that can improve the investment climate for bioenergy. A firm legal basis is fundamental to properly regulate and support the development of biofuels. African countries which will have sound policies to promote the production and use of biofuels will be at the forefront of realizing the economic, social and environment benefits of the biofuels industry.

- To encourage international and regional cooperation is essential for developing sound biofuels industries. This includes cooperation with international development agencies of the UN, the World Bank and African Development Bank, and others. International cooperation activities should include an emphasis on local capacity building and technical assistance, joint R&D, technology transfer, reduction of trade barriers, investment and partnership. Many opportunities for enhanced North-South and South-South cooperation should be explored. The need for the development of local Centers of excellence is important in fostering local know-how on biofuels and South-South information exchange.

Mr. Chairman

This conference aims at contributing to a process of achieving the above recommendations and also to the on going efforts to develop policies that will capture the many opportunities expected from biofuels development in Africa while also minimizing the many potential threats that could result from implementing policies that do not encompass sustainable biofuels development in Africa.

3.0 CONCLUSION

To conclude my project overview remarks, Mr. Chairman, I would like to sincerely thank the EU for funding the COMPETE project which has made it possible to learn a lot as mentioned above and also has made it possible to organize this conference. I would also like to extend our appreciation to WIP through Dr. Rainer Janssen for the innovative efforts of formulating the COMPETE project and to all the COMPETE partners for their continuous efforts to ensure the success of the project.

Finally, Mr. Chairman, Excellencies, distinguished participants,

By hosting this conference, the COMPETE project has indeed set the ball rolling. Now, however, it is up to all of us to make this conference a success. And that success will be measured by the practical and effective recommendations that will emerge from this conference and thereafter be effectively implemented by relevant stakeholders for the betterment of the livelihoods of the majority of the African people who should indeed be our main concern in the efforts of developing sustainable biofuels industry in Africa

Thank you very much for your attention.

Bioenergy Policy Developments in Mozambique

H.E. Mr. Jaime Himede, Vice Minister, Ministry of Energy, Mozambique

Biofuel Policies in Mozambique

In order to address the high and rising oil prices the President of the Republic of Mozambique has launched a campaign to produce biofuels from Jatropha curcas with the main aim to mobilise the private sector and thus to stimulate investment.

An Interministerial Group has been set-up under the coordination of the Ministry of Energy involving several other ministries such as the Ministry of Agriculture and the Ministry of Science and Technology.

In order to ensure the sustainability of biofuels production in Mozambique and to avoid a conflict between food and fuel production, the Government has initiated an agro-ecological zoning process to identify appropriate land for food or fuel production. Through this process 1-2 million hectare of marginal land has been allocated to feedstock for biofuel production.

In June 2008 a conference was organised to prepare the elaboration of a Biofuels Strategy for Mozambique. The finalisation of this strategy is foreseen until the end of 2008.

The Government of Mozambique is committed to proceed with the development of the biofuels sector in a sustainable way. Within its National Biofuel Task Force a dedicated working group is addressing sustainability standards and their implementation. Additionally, iInitiatives are implemented focussing on capacity building, and (international) funds are being mobilised for the development of national and international biofuels markets.

Biofuel Projects in Mozambique

Up to date several biofuel projects are in the preparatory stage in Mozambique.

A Mozambican joint venture company will invest $150 million in the production of biodiesel from jatropha over the next six years. The Mozambican company Odeveza S.A., owned by a group of Canadian and Mozambican firms, claims that the projects would create about 700 jobs and could make Mozambique one of Africa's biggest biofuels producers. The $150 million investment is aimed at intensive jatropha production for biodiesel extraction in an area of over 70,000 hectares identified in the districts of Barue and Gondola in Manica province and Buzi in Sofala province," company director, Fernando Azevedo told reporters in Maputo.

Furthermore, in October 2007 Mozambique approved a $510 million deal with London-listed Central African Mining & Exploration Company Plc (CAMEC) to build a plant to produce 120 million litres of ethanol a year by 2010. The raw material for the ethanol production will be sugar cane planted over an area of 30,000 ha in the southern province of Gaza.

Bioenergy Schemes – Witherto in Africa? The Zambian Case

Oscar Kalumiana, Director Department of Energy,
Ministry of Energy and Water Development, Zambia

Introduction

The energy policy in Zambia currently has a strong focus on biofuels with the aim to exploit potential socio-economic benefits of modern bioenergy use in Africa. However, the development of coherent bioenergy policies faces severe difficulties due to the inability of many African governments to handle the cross-sectoral aspects of bioenergy involving institutions responsible for energy, environment, lands and agriculture amongst others.

The main driver for bioenergy development in Zambia is the unavailability of modern energy services and the strong dependence on traditional bioenergy (wood fuel, charcoal), especially for rural areas and the urban poor. In Zambia, access to electricity has slowly increased from 17% in 1996 to 20.4% in 2006 with an electrification rate increase from 2% to 4% in rural areas. Thus, the transition to modern energy remains very slow, and considerable efforts are needed to achieve the goal to reduce dependence on wood fuel in Zambia from current 70% to 40% by 2030. Thereby, modern energy systems need to place strong emphasis on income generation schemes in order to successfully replace charcoal which presently serves as income generator for a majority of urban poor and rural dwellers.

Bioenergy in Africa – The Debate

In order to address the issue of modern bioenergy development in Africa it is urgently needed to establish platforms of dialogue between governments and the population. Energy security has to be tackled both on the national level (ensuring security of supply) as well as on the household level (contributing to poverty reduction). Environmental issues have to be balanced against sustainability of livelihoods and an improvement of living conditions.

For this it is important to 'Africanise' the transition to modern energy services. Solutions have to be developed within Africa to suit the needs of the African population – and not imported or transferred from abroad.

The following opportunities are offered by the modern biofuels/bioenergy sector:

- Increase of energy security
- Reduction of the burden on economies by rising prices of oil
- Contribution to the access to modern energy services
- Contribution to environment protection (reduced GHG emissions, reduced deforestation)
- Product diversification, creation of new markets and job opportunities

Pros and Cons of Biofuels in Africa

Biofuel Opportunities

1. Unprecedented political and social support
    a) African countries are setting ambitious production targets
    b) Support both at country and regional levels, e.g.

i. Southern African Development Community, SADC
ii. Association for African Non-oil Producing Countries
iii. Forum for Energy Ministers of Africa, FEMA
iv. Common Market for Eastern & Southern Africa, COMESA
v. African Union – African Energy Commission

2. Excellent conditions for producing biofuels
   a) Good climate
   b) Good soils
   c) Abundant land, e.g. only 14% of arable land in Zambia is under cultivation

3. Large potential markets
   a) Local/village level – energy access, farm activities
   b) National level – transport fuels, electrification, other uses
   c) International level – contribution to renewable targets of developed countries

Biofuel Threats

1. Competition Food versus Fuel

   The potential competition between food and fuel production is a genuine concern for Africa, as increased fuel production may lead to increased food prices and cause hunger especially in the urban poor population. The following solutions are proposed from an African perspective:

   - Initial focus on non-food feedstock for fuel production
   - Improving under-productivity of current agricultural systems
   - Africa should not rely on food aid as long term solution to its food supply problems, but increase its overall agricultural production

Policy Issues for the African Biofuels Sector

For the development of a successful African biofuels sector it is important to identify sustainable business models suitable for the African framework conditions (e.g. outgrower schemes). Thereby, the future production potential in African countries has to be analyses with respect to competing uses for resources such as land and water. For Zambia it is envisaged that 5% of diesel can be replaced by biodiesel and 10% of petrol by bioethanol in 2015. Furthermore, exports to the markets of developed countries seem possible. Finally, the following main criteria for the development of a sustainable African biofuels sector are highlighted:

- Market development
  - Accessibility and infrastructure development
  - Standards/specifications
  - Fair Trade and ecological labelling
- Socio-economic Issues
  - Food security
  - Sharing of benefits
  - Gender equality

Status of Strengthening Policy, Regulatory and Institutional Framework for Biofuels Development in Tanzania

Styden Rwebangila, Ministry of Energy and Minerals, Tanzania

Introduction

The government of Tanzania is committed to establish a regulatory and institutional framework for biofuels development in order to exploit the following opportunities:

- Reliability and security of energy supply
- Potential to replace traditional use of biomass
- Saving on foreign currency
- Market development for crop products (local & export)
- Employment creation in bioenergy business chains
- Land rehabilitation (for some bioenergy crops)
- Technology transfer.
- Eradication of poverty.

Thereby, it is acknowledged that a balance between food and fuel production, as well as protection of the environment and biodiversity has to be ensured. Furthermore, it has to be guaranteed to that biofuels development brings maximum benefits to the local population and leads to a strengthening of the national economy.

Biofuels Policies in Tanzania

Currently, there is no specific policy on biofuels in Tanzania, but the National Energy Policy of 2003 includes sections on bioenergy. Due to this lack of legal and institutional framework the processing of enquiries for investment in the bioenergy sector is made difficult.

In order to prepare the development of biofuel policies the government has established a National Biofuels Task Force in March 2006 under the coordination of the Ministry of Energy and Minerals. The Task Force which is chaired by the Ministry of Planning Economy and Empowerment since June 2006 has the following main objectives:

- Review existing biofuels sub-sector framework [policies, legislation (laws & regulations), strategies, programmes, standards, etc.]
- Prepare enabling environment to facilitate sustainable development, promotion and utilization of biofuels in Tanzania
- Develop well defined, coordinated and integrated modalities and procedures for dealing with the development of biofuels
- Develop a sustainable programme for biofuels industry development focussing on community, commercial and national interests by linking it to economic growth, poverty reduction and economic empowerment
- Prepare modalities for biofuels developers and investors

Biofuels Task Force

The Tanzanian Biofuels Task Force has so far implemented the following activities:

- Organisation of SWOT analysis workshop for biofuels development in Tanzania
- Prioritisation of strategic actions
- Preparation of Draft Action Plan and draft budget
- Elaboration of Draft Biofuels Development Guidelines
- Inclusion of biofuels in Petroleum Supply Bill (defining biofuels as official fuels and allowing blending with fossil fuels)
- Preparation of a biofuels project document on **"Strengthening the policy, legal, regulatory and institutional framework to support the development of a sustainable biofuels industry in Tanzania"**

Thereby, the latter biofuels project constitutes the next important step for the development of a legal and institutional framework for biofuels in Tanzania. The following project components are included in the project preparation document:

- Establishment of project monitoring unit within Ministry of Energy and Minerals
- Review of existing policies and legislation relevant to biofuels developments
- Revision/amendment of policies and/or legislation or development of new biofuels policy and/or legislation
- Review of National Land Use Plan and identification of suitable land for biofuels (mapping and zoning) to ensure sustainability of biofuels production
- Capacity building to Government departments and institutions to enable effective coordination of biofuels activities
- Creation of public awareness

This proposed biofuels project will mainly build upon the elaborated Draft Biofuels Development Guidelines which shall provide the principles for the development of the biofuels sector in Tanzania. The following guidelines have been agreed upon:

- Establishment of effective institutional framework (biofuels one stop centre)
- Development of criteria for sustainable production
    - Positive impact on local communities
    - No land use change/productive land for biofuels
    - Protection of vulnerable biodiversity
    - No clearing of forest
    - Protection of water sources (surface/ground/catchments)
- Thorough Environmental Impact Assessment (EIA)
- Contract farming to ensure benefits for the local population

Finally, it is common understanding in Tanzania to place emphasis on the production of biofuels for local demand (rural electrification, national transport fuel). However, export of biofuels is considered for a transition period during the establishment of the internal biofuels market.

Session 2:
Sustainable Development Pathways for Bioenergy Production

Sustainable Bioenergy Production - International Developments

Martina Otto, United Nations Environment Programme (UNEP)

Opportunities and Risks of Bioenergy Development

Opportunities

- Expanding energy access in developing regions: eliminating energy poverty; reduced health impacts from indoor air pollution
- Revalorizing agriculture: improved productivity and incomes (incl. trade opportunities)
- Powering secondary industries, businesses, infrastructure: economic diversification, growth and sustainability

Risks

1) Increased GHG emissions, exacerbating climate risks, particularly impacts on vulnerable regions and people, loss of biodiversity, which provides the basis for ecosystems and the services they provide; due to direct and indirect land use change

   Risk mitigation measures:

   - No go areas
   - Agro-biodiversity

2) Competition for water (food production, drinking); agriculture currently uses 70% of the world's (85% of the developing world's) fresh water, and climate change impacts will create further pressure in areas that are already suffering from droughts

   Risk mitigation measures:

   - Efficient use of water
   - Rainwater harvesting
   - Adequate crop choices

3) Food security, food prices

   Risk mitigation measures:

   - Productivity increases where possible
   - Use of marginal lands for bioenegy production
   - Cascading use of biomass

4) Land tenure - If bioenergy crops become more valuable, the consolidation of land into larger holdings may favour larger landowners and displace small farmers; Labour conditions, development benefits bypassing local communities

Good Planning and Management

The following crucial steps for good planning and management of bioenergy development in Africa have been identified in order to avoid potential risks:

- Choice of the area ('no go areas', e.g. PA, HCVA; 'no regrets', e.g. marginal land)
- Choice of the crop (adapted to local conditions and needs)
- Good agricultural practices (water, soil, new technologies, methods serving double purpose)
- Choice of the end use (local – national – international markets)
- Involvement of local communities in planning, production (business models incl. equity, outgrower concepts) and use

Furthermore, the following tools exist to ensure social and environmental benefits of bioenergy development:

- Appropriate policies, institutional and legal frameworks
- Enforcement of environmental laws and regulations
- Institutional capacity building
- Internationally agreed system (standard, certification) to ensure sustainability of biomass intended for biofuels production
- Harmonised methodology for LCAs for biofuels
- Land use mapping
- Ecosystem service values / internalizing externalities / cost benefit analysis taking into account co-benefits
- Near-term research involving developing countries
- Technology transfer (N-S-S)

International Initiatives

Among others, the following international initiatives are currently engaged in ensuring a sustainable development of the bioenergy sector in Africa:

A) Round Table on Sustainable Biofuels (RSB)

Multi-stakeholder initiative to develop a standard for sustainable biofuel production

Governance structure:

- **Steering Board** composed of international stakeholders
- **Secretariat** based at EPFL (Coordination of the RSB)
- 4 **Working Groups** to make recommendations to the Steering Board. 270 participants from IGOs, NGOs, private sector and academic institutions.
- **Global stakeholder** feedback at every step
- **Outreach meetings**

Currently, a preliminary standard for sustainable biofuel production is available.

B) Global Bioenergy Partnership (GBEP)

In the July 2005 Gleneagles Plan of Action, the G8 +5 (Brazil, China, India, Mexico and South Africa) agreed to "... promote the continued development and commercialisation of renewable energy by: [...] d) launching a Global Bioenergy Partnership to support wider, cost effective, biomass and biofuels deployment, particularly in developing countries where biomass use is prevalent".

Activities:

- Review of the Current State of Bioenergy Development in G8 + 5 countries
- Facilitation of sustainable development of bioenergy and collaboration on field projects
- Harmonization of methodologies on GHG emission reduction measurement
- Awareness raising and information management

C) UNEP Roundtable on Bioenergy Enterprise Development

Roundtable gathering centres of Excellence to:

- Collect information and share good practice
- Identify barriers and ways to address them (agronomical/technical, set up/planning/management, financial, research/information/outreach, policy/regulatory)
- Provide handholding services to entrepreneurs / farmers

Sustainable Biomass: Issues and Global Perspective

Dr. Uwe Fritsche, Oeko-Institute, Germany

Global Bioenergy Potentials

The following figure 1 presents results on the global bioenergy potentials based on research sponsored by FAO and the German Umweltbundesamt. It highlights the potential contribution of bioenergy production from degraded land as well as from residuals and waste, both significantly reducing the risks commonly attributed to direct and indirect land use change issues.

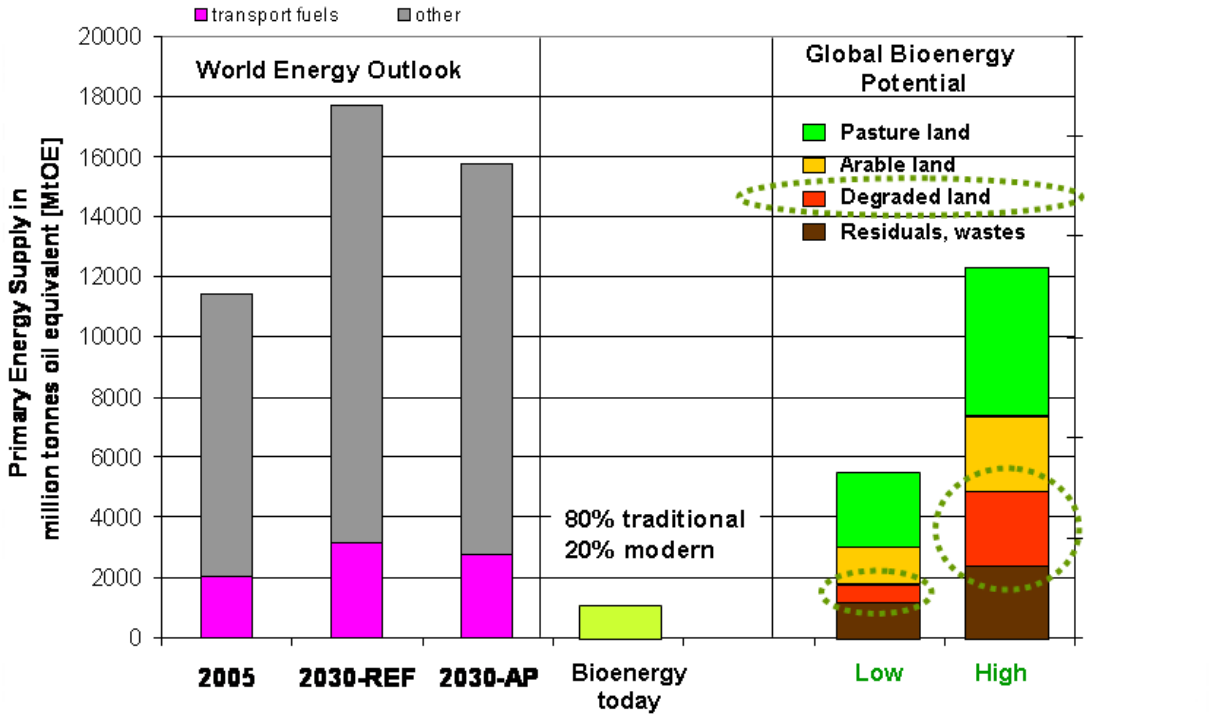

Figure 1: Global bioenergy potentials

In order to identify unused and degraded land the following information base is urgently required for most African countries:

- Regional identification and quantification of land cover and land use
- Information on applicable plants/cultivation schemes for biomass on degraded lands for typical model cases
- Verification of global data sets

Sustainability Standards

The following table summarises standards for sustainable biomass production. Thereby, land use/biodiversity and GHG reduction can be based on global conventions and thus be WTO compatible.

Standard	Scope	Regional Adjustment	Time Horizon
Clarification of land ownership	regional/local	no	short-to-medium term
Avoiding negative impacts from bioenergy-driven changes in land use	global	no	short term
Priority for food supply and food security	regional/local	yes	medium-to-long term
No additional negative biodiversity impacts	regional/local	yes	medium-to-long term
Minimization of greenhouse gas emissions	global	no	short term
Minimization of soil erosion and degradation	regional/local	yes	short-to-medium term
Minimization of water use and avoidance of water contamination	regional/local	yes	short-to-medium term
Improvement of labor conditions and worker rights	regional/local	no	short term
Ensuring a share of proceeds	regional/local	no	short term
Avoiding human health impacts	regional/local	no	medium-to-long term

Source: OEKO (2006) study for WWF

Table 1: Standards for sustainable biomass production

In Europe, several standards for sustainable biomass production are currently under development (e.g. in Germany, The Netherlands and United Kingdom). On EU level, the 2008 Proposal for a Directive on the promotion of the use of energy from renewable sources establishes **mandatory** sustainability requirements for all biofuels (including imports), such as:

- Minimum GHG reduction, incl. CO2 from direct land-use change; indirect effects are under debate
- Protection of natural habitats; no "relevant" reduction of biological/ecosystem diversity
- Social issues: mandatory monitoring

International Initiatives

Among others, the following international actors are currently addressing the issue of sustainable biomass development:

- Global Bioenergy Partnership (GBEP)
- FAO (Project BEFS (Bioenergy and Food Security))
- RSB (Roundtable on Sustainable Biofuels)
- IEA Bioenergy Task 40
- USA: inter-agency group on sustainability assurance system
- Convention on Biological Diversity - CBD-COP9 follow-up

On 3-6 June 2008 the FAO organised in Rome a 'High-level Conference on World Food Security: The Challenges of Climate Change and Bioenergy'. In the following an excerpt from the conference declaration is presented:

""7 (f) It is essential to address the challenges and opportunities posed by biofuels, in view of the world's food security, energy and sustainable development needs.

We are convinced that in-depth studies are necessary to ensure that production and use of biofuels is sustainable in accordance with the three pillars of sustainable development and takes into account the need to achieve and maintain global food security.

We are further convinced of the desirability of exchanging experiences on biofuels technologies, norms and regulations.

We call upon relevant intergovernmental organizations, including FAO, within their mandates and areas of expertise, with the involvement of national governments, partnerships, the private sector, and civil society, to foster a coherent, effective and results-oriented international dialogue on biofuels in the context of food security and sustainable development needs.""

Conclusions and Way Forward

- Few developing countries deal with life-cycle GHG emissions, biodiversity and social issues (BR, MZ…)
- Need to actively support countries in dealing with sustainability standards and certification; (support by FAO, UNEP, GBEP Task Force + donors)
- Social issues (land rights, food security) need more attention and mandatory reporting
- African countries should become active in global dialogue and prepare national implementation

Climate Change and Sustainable Biofuel Production in Africa

Prof. N.H. Ravindranath, Centre for Sustainable Technologies (CST), Indian Institute of Science, India

Background

Climate change is one of the most important global environmental concerns, which is likely to impact natural ecosystems such as forest, wetlands and grasslands as well as human systems such as food production and coastal settlements. Africa is one of the regions which is more likely to be adversely impacted by climate change than any other region, due to large dependence of the population on the natural resources which are likely to be impacted by climate change and further the adaptive capacity of the population is low. Mitigation and adaptation are the two measures to address climate change. The priority in Africa should be on adaptation, since the contribution of Africa to the global GHG emission is insignificant. In the global efforts to mitigate climate change, biofuels to substitute fossil fuels, are among the critical mitigation options (IPCC, 2007a).

Many countries around the world have formulated policies to promote biofuels to substitute fossil fuels. Biofuels are gaining additional importance in the context of unprecedented increase in price of petroleum fuels. In the global efforts to address climate change and oil security, biofuels are likely to play an important role. Africa has vast potential land area, of around 870 million ha, suitable for agricultural production. Currently in Africa only about 224 million ha are under crops. There is large interest in growing biofuel crops in Africa using the vast potential land available.

According to projections made by IPCC (2007b), agricultural production and food security is under threat due to climate change and variability. Further, forest ecosystems as well as grasslands are likely to be adversely impacted. If annual or perennial biofuel crops have to be grown to meet the biofuel demands, it is necessary to consider the likely impacts of climate change on sustainable production of biofuel crops. In this report, an attempt is made to assess the likely implications of the climate change on biofuel crop production and possible adaptation measures to cope with the projected climate change.

Projected climate change

IPCC (2007a) has projected a global average surface warming in the range of 1.8-4 ^{0}C. The African continent is likely to experience warming at levels higher than the global mean which could be in the range of 3-5^{0}C warming by the end of the century. It is predicted that the African climate will generally become warmer and drier, with more extreme events such as droughts, storms and floods. However, there are considerable differences in rainfall projections across the continent. Most Sub-saharan Africans live in dry or sub-humid agro-ecological zones, and recent climate change models (GCMs) show that climate change will affect the rainfall patterns in these zones. The models of climate change project that northern and southern Africa will become drier. The eastern and western regions of the continent are expected to experience more rainfall and higher temperatures. Further the rainfall is likely to decrease in much of the Mediterranean Africa, northern Sahara and southern Africa, and some parts of east Africa may receive increased rainfall. There is some uncertainty about whether additional rainfall will lead to greater availability of water resources for consumption and food production. There is less doubt that sea level rise and increased intensity and frequency of cyclones will cause problems for coastal cities and major river delta areas.

Impacts of climate change

The IPCC (2007b) has provided information on regional level impacts of climate change. The projected impacts for African continent on food production, water resources and forest ecosystems, are presented here from IPCC. Agricultural production and food security (including access to food) in many African countries and regions is likely to be severely compromised by climate change and climatic variability. Agriculture yields and dependence on natural resources constitute a large part of local livelihoods in many, but not all, African countries. Agriculture is a major contributor of the current economy of the most African countries, averaging 21% and ranging from 10% to 70% of GDP. Agriculture losses are shown to be possibly severe for several areas (e.g. the Sahel, east Africa and southern Africa) accompanied by changes in length in growing period impacting mixed rain-fed, arid and semi arid systems under certain climate projections. At the local level, many people are likely to suffer additional losses to their livelihood when climate change and variability occur together with other stressors.

Climate change and variability are likely to result in species loss and extinctions and also constrain the 'climate spaces' and range of many plants and animals in Africa. Lack of access to safe water, arising from multiple factors, is a key vulnerability in many parts of Africa. This situation is likely to be further exacerbated by climate change. Some assessments show severe increased water stress and increased drought risk for parts of north and southern Africa and increase in runoff in east Africa.

Africa is characterized by low coping and adaptive capacity. This is due to the extreme poverty of many African countries, frequent natural disasters such as drought and floods, and agriculture heavily dependent on rainfall. The implications of climate change leading to land degradation, water stress, decline in the crop yields, threat to forest biodiversity and biomass production will have implications for biofuel crops.

Bio-energy options and crops for Africa

The potential bioenergy options, feedstocks, conversion processes and potential end uses for Africa are given in the Table 1. Bio-energy options include liquid biofuels (ethanol through fermentation and bio-diesel through esterification), biomass power from woody bio-mass (through combustion and gasification) and biogas through anaerobic digestion.

Table 1: Bio-energy options, feedstock, conversion process and potential end uses

Biomass Source	Conversion	End Use
Lignocellulosic biomass **-wood** **-crop residue**	Combustion and Gasification	-Electricity - Heat (process) - Cooking
Sugar (Sugar cane) or Starches (e.g. Maize)	Fermentation	Ethanol for transportation.
Vegetable oils **- Shrubs (Jatropha)** **- Trees (Pongamia, Oil Palm)**	Esterification	Biodiesel for transportation.
Cattle dung, leaf litter	Anaerobic digestion	Biogas for cooking and power

The broad categories of biofuels, climate and land requirement as well as intensity of cultivation are provided in Table 2. Land suitability for production of different biofuels is given by IIASA/FAI, 2002. Jatropha and oil palm are perennial crops whereas the rest of the biofuels crops are annual. Sugarcane requires irrigation whereas other biofuel crops can be grown even without irrigation, though irrigation increases the yield. Jatropha can be grown in semi-arid conditions and even on degraded soils. However, oil palm is most suited to high rainfall zones.

Table 2: Potential rainfall, land and cultivation practices for bio-energy crops

Bio-energy Crops	Rainfall(cm)	Land and Climate	Cultivation practice
Sugarcane	150 – 250	Tropical and Sub-tropical Good quality land	Intensive Irrigation + fertilization
Oil palm	180-500	Moderate-high quality land Humid tropical	No irrigation in Humid Fertilize for high yields
Maize (Grain) **Sweet Sorghum (Stalk)** **Cassava (Root)**	70-150	Semi-arid Moderate to high quality land Cassava: Low quality-land : drought resistant	Intensive practices for high yields Irrigation and Fertilization for high yields
Jatropha (Seeds)	60-120	Tropical, sub-tropical and semi-arid Poor to moderate land Not irrigated - drought resistant	Not intensive No irrigation and fertilizer application
Woody Biomass (ligneous biomass)	50-500	Arid, semi-arid, humid Tropical to temperature Poor quality land - OK Drought resistant	No irrigation, fertilization, fertilizer application Low intensification

Source; Wetland International (2008)

Impacts of climate change on Biofuels

There are no dedicated studies on the likely impacts of projected climate change on different biofuel crops. There are annual as well as perennial biofuel crops and further irrigated as well as rain fed crops. Finding of the IPCC (2007b) concluded that the projected climate change is likely to lead to increased water stress, land degradation and reduction in crop yields. The implications projected by the IPCC for the annual food crops as well as forest ecosystems could be extrapolated to biofuel crops. The key impacts of climate change which can be extrapolated are:

- An increase in 5 to 8 % in arid and semi-arid land.
- Decline in the agriculture yield due to drought and land degradation; by 2020 in some countries of Africa yields from rain fed agriculture could be reduced by 50%.
- Increased water stress for annual as well as perennial cropping systems in arid and semi-arid regions.

The potential impact of climate change on biofuel crops extrapolated from the IPCC findings for different biofuel crops are given below:

***Sugarcane*;** is an irrigated crop and it is unlikely to be impacted by climate change, unless reduction in the rainfall and increase in temperature contributes to water stress.

Maize; is largely a rain-fed crop and likely to be adversely impacted leading to reduction in yield by 25 to 50% even in the short term.

Sweet sorghum; will experience impacts similar to maize, under rain-fed condition.

Jatropha; is supposed to be cultivated in marginal lands under rain-fed conditions, and thus likely to be subjected to reduction in yields, unless irrigated.

Oil-palm; a perennial crop grown under humid conditions, is likely to be subjected to initial increase in yield in the short term due to elevated CO_2, if no significant reduction in rainfall occurs, however, could experience decline in yield beyond moderate warming.

Thus, the annual as well as the perennial biofuel crops are likely to be subjected to adverse impacts leading to reduction in yield.

Potential adaptation strategy for sustainable biofuel production

In the context of projected climate change and the likely adverse impacts, it is necessary to develop and implement adaptation strategies for sustained biofuel production. Currently there is limited research on potential adaptation practices and strategies even for food crops. Thus, only potential win-win adaptation strategies could be considered. It is important to note that the majority of the adaptation strategies required to cope with the current environmental stresses are also required to cope with climate change impacts. An illustrative list of potential adaptation strategies are as follows:

Sugarcane; assured irrigation, increase in irrigation efficiency and efficient water management practices

Maize and sweet sorghum; adoption of drought resistant varieties and soil water conservation practices

Jatropha; breading for drought and pest resistance, and adoption of soil and water conservation practices

Conclusions

Africa is projected to experience climate change on a significant scale with rise in temperature, decline in rainfall in many regions, and increased occurrence of drought and floods. The projected climate change is likely to lead to land degradation, water stress, increased pest occurrence and ultimately reduction in yields of annual as well as plantation crops. If biofuels are going to be cultivated on a large scale in Africa to produce ethanol and bio-diesel, it is very important to develop and adopt adaptation practices and strategies for sustainable crop yields. However, it is important to state that there is limited research and knowledge on the impacts of climate change on biofuel crops or potential adaptation strategies at regional level for Africa. Thus, it is very important to recognize the importance of climate change and initiate research on assessment of impacts of climate change and for developing adaptation strategies for different biofuel crops in different regions of Africa.

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Sustainability Criteria for Biofuels – a Mozambican Approach

Anna Lerner, GTZ-ProBEC, Mozambique

Background – Bioenergy in Mozambique

In recent years the development of bioenergy has gained increasing interest in Mozambique, both from Government as well as from the private sector. The status of bioenergy development is summarised in the following statements:

- Favourable climatic condition, sub-tropical climate and sufficient rainfall in many provinces.
- Large population living in rural areas that could benefit from labour intensive biomass production.
- Destructive use of traditional biomass for energy.
- Supportive government encouraging investment.
- Land suitable for a variety of potential biofuel crops.
- Biofuel part of poverty reduction strategy and contributing to national energy security.
- EU, Chinese and Indian interest in buying Mozambican biofuels.

A Biofuel Assessment Report has been elaborated which is subject to public consultations in summer 2008. Furthermore, the Mozambican Government is currently developing a Biofuel Strategy.

So far, only few biofuel projects have been implemented. Due to the on-going discussion on (social and environmental) sustainability aspects of biofuels, the Mozambican Government has paused the land allocation process for biofuels projects in order to proceed with a detailed land zoning exercise. Land zoning thereby has the aim to identify land which can be allocated to biofuels production without negative impact (i.e. without endangering the food supply of the population). Furthermore, South-South cooperation partnerships (e.g. with Brazil) are on-going for the development of the biofuels sector in Mozambique.

In Mozambique, biofuels are aimed for export and for domestic use as fuel blending for national/regional markets as well as for rural electrification projects. Main crops of interest are sugar cane and sweet sorghum (for ethanol production) and jatropha together with soy, sunflower and coconut (for biodiesel production).

The GTZ Programme ProBEC

The Programme for Basic Energy and Conservation (ProBEC) is a SADC (Southern African Development Community) project, implemented by the German Development Co-operation, GTZ.

ProBEC aims to improve energy security for low-income population groups in a socially and environmentally sustainable manner. Currently ProBEC is actively involved in Malawi, Lesotho, Mozambique, Tanzania, South Africa, Swaziland, and Zambia, and it is in negotiation to set up further activities in Botswana and Namibia.

ProBEC focal areas for the Bioenergy Component are:

- Sustainability criteria for biofuels
- Socio-economic aspects of biofuels

Social and environmentally sustainable production of biomass

Activities of ProBEC to ensure the social and environmentally sustainable production of biomass in Mozambique include the following:

- Technical assistance to SADC Secretariat on international development of sustainability criteria for biofuels
- Technical support to SADC and national biofuel task forces
- Support to working group within the National Biofuel Task Force of Mozambique on developing nationally adjusted sustainability standards for biofuels
- Appraisal exercise of the Cramer framework (sustainability criteria developed in the Netherlands) in Mozambique
- Assist GTZ HQ in its assessment of areas of High Conservation Value (critical biological or social value) in Mozambique
- Case study on Potential of Sustainable Biomass production, by the Kenyan Ministry of Agriculture and GTZ, assessing availability of land for sustainable production of various energy feedstocks.

Furthermore, the following actions are undertaken to deepen the knowledge on socio-economic aspects of biofuel production:

- Sustainability criteria and socio-economic impact analysis for a large-scale sugar cane project in the SADC region.
- Sustainability criteria and socio-economic impact analysis for small scale project focusing on jatropha oil as fuel for electricity generation
- "Crop decision tool" for biofuel practitioners in SADC.

Sustainability Standards

The following sustainability standards have been identified as prime priorities for a sustainable biofuels development in Mozambique:

- **The right of food is a priority.**
- **Social standards are equally important to environmental standards.**
- **Obligatory sustainability reporting reinforces implementation of existing law.**
- **Community consultation and equal ownership structures.**
- **Social indicators are country specific.**
- **Certification scheme must be adapted to small scale actors.**

Session 3:
Resources, Opportunities and Impacts for Bioenergy Development

Bioenergy: resources, opportunities and impacts; where are we now?

Dr. Andre Faaij, Copernicus Institute, Utrecht University, Netherlands

Bioenergy Production Potential in 2050

The following Figure 1 shows the bioenergy production potential in 2050 for different levels of change in agricultural management. The graph is taken from Smeets, Faaij 2007 "Progress in Energy & Combustion Science".

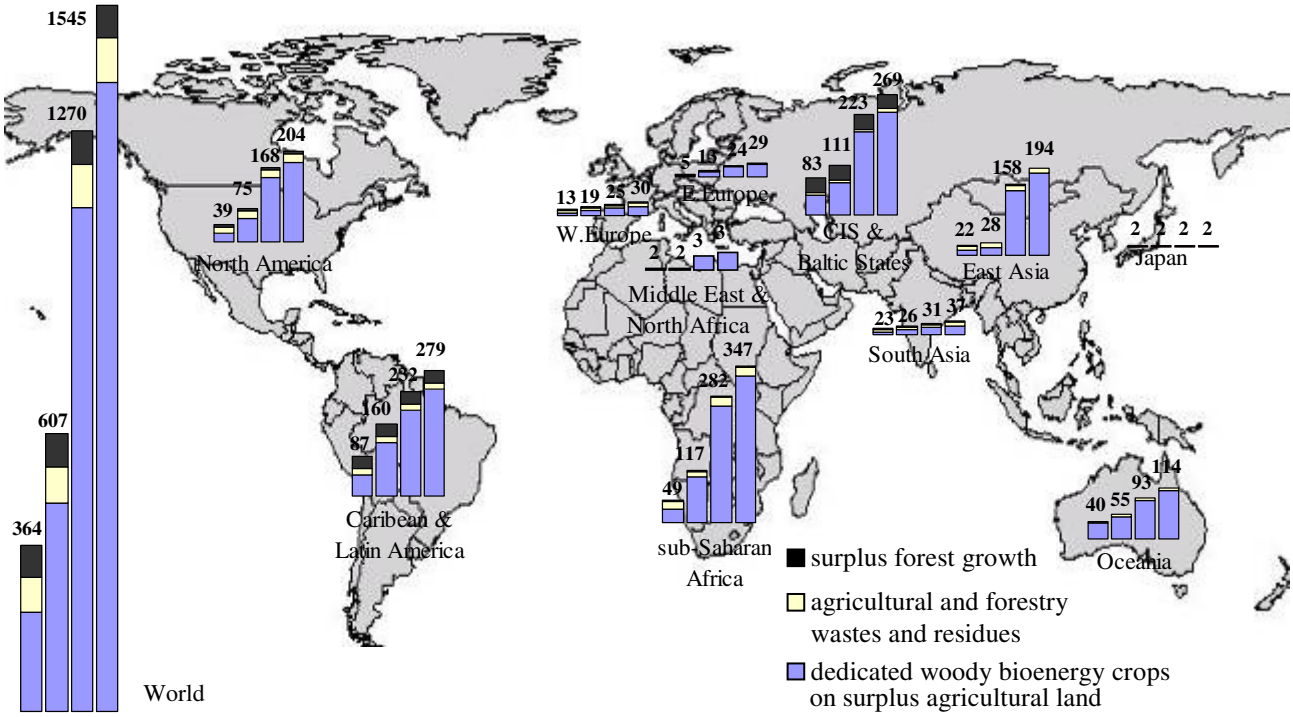

Figure 1: Bioenergy production potential in 2050

The total bioenergy production potential in 2050 is presented for four different systems in EJy-1 (the left bar is system 1, the right bar is system 4). With increased investment in the agricultural system and significant improvements in agricultural management, an annual worldwide bioenergy potential of more than 1.500 EJ could be realised. Within this 'system 4' sub-Saharan Africa could contribute with a bioenergy production potential of more than 300 EJ per year.

Table 1 shows the biomass and energy yield for different crops and perennials.

Crop	Biomass yield (odt/ha* yr)	Energy yield in **fuel** (GJ/ha*yr)
Wheat	4 - 5	~ 50
Corn	5 – 6	~ 60
Sugar Beet	9 – 10	~ 110
Soy Bean	1 – 2	~ 20
Sugar Cane	10 – 20	~ 180
Palm Oil	10-15	~ 160
Jatropha	5-6	~ 60
SRC temperate climate	10 – 15	100 - 180
SRC tropical climate	15 - 30	170 - 350
Energy grasses good conditions	10 - 20	170 – 230
Perennials marginal/degraded lands	3 - 10	30 – 120

Table 1: Biomass and energy yield per hectare and year

Cost Supply Curve for Energy Crops

Figure 2 shows the production costs of energy crops for differenet scenarios in the year 2050 (Hoogwijk, Faaij, Biomass & Bioenergy, 2008).

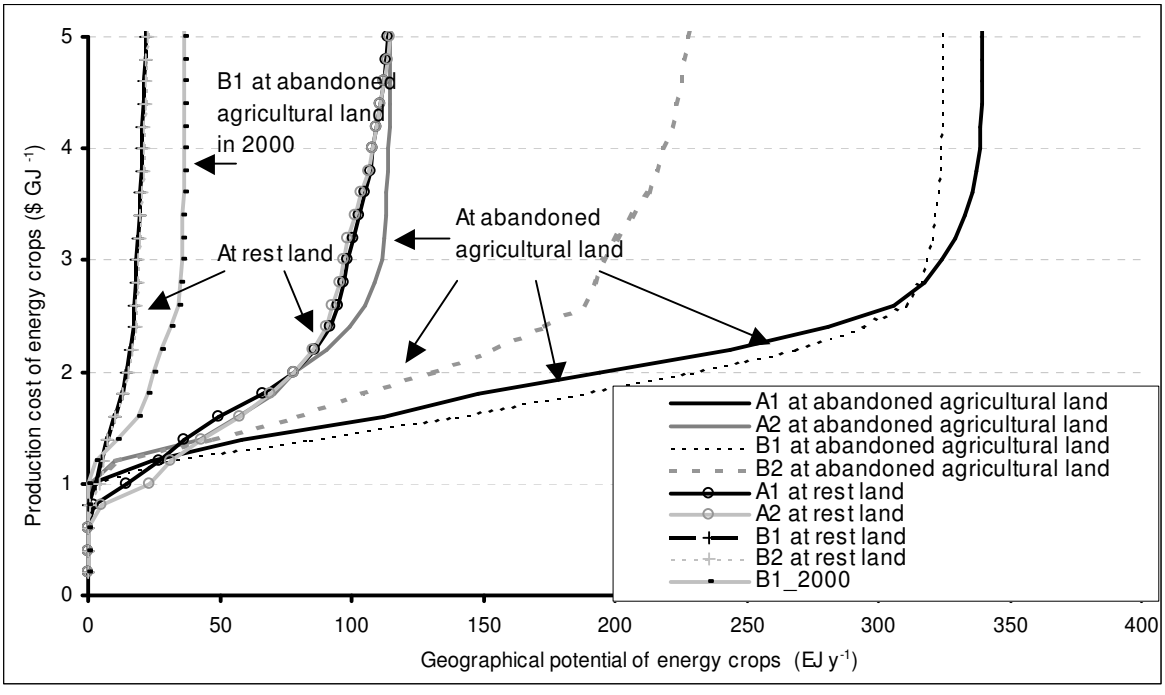

Figure 2: Production costs versus geographical potential of energy crops

Global Biomass Potential

Figure 3 shows the results of a recent study by V. Dornburg et al. in comparison with biomass potential studies found in the literature.

It is shown that biomass can play a significant role in a sustainable future energy supply.

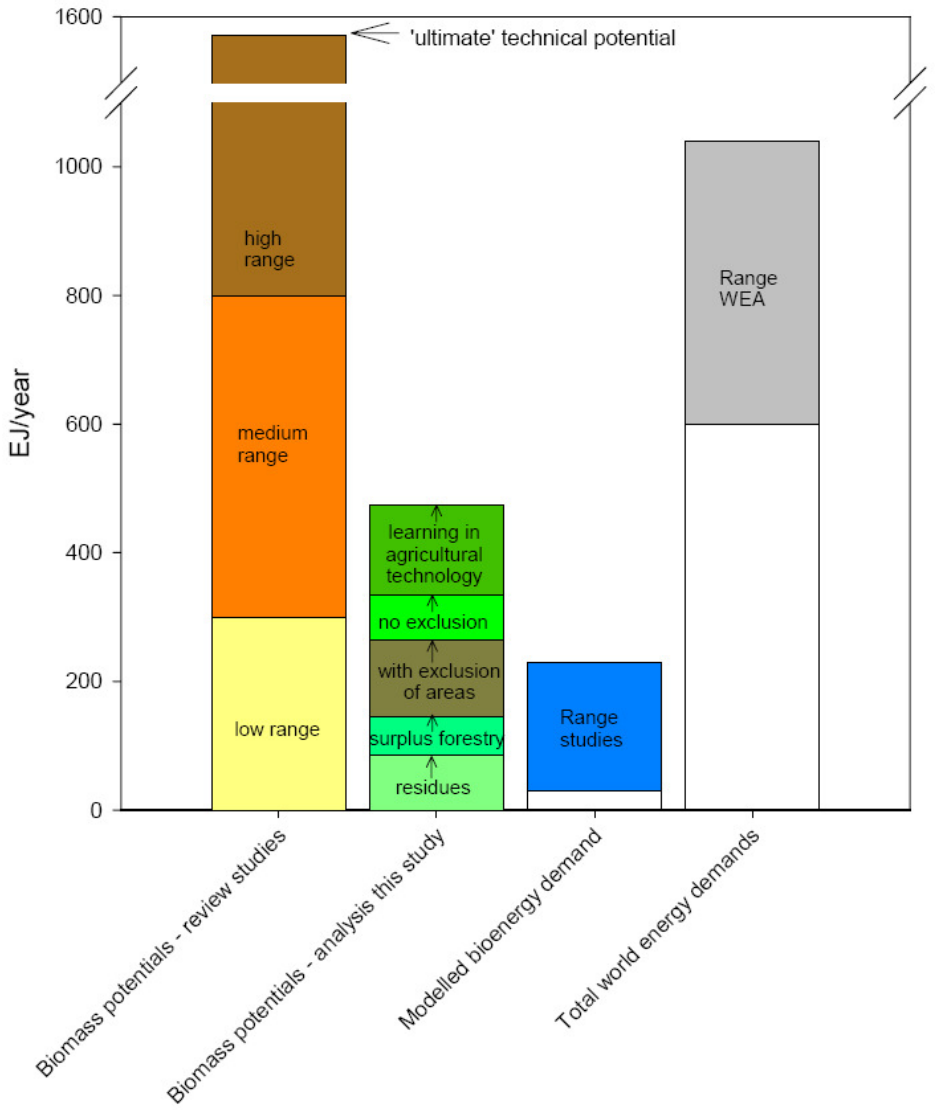

Figure 3: Biomass potential, bioenergy demand and total world energy demand.

In order to realise this global biomass potential large investment in agriculture (and livestock) is urgently needed (2nd green revolution). An exploitation of the vast biomass potential is feasible with increased water use efficiency, less land use, protection of soils and better incomes.

Increased investment in agriculture is also essential for food security. Thereby, bioenergy can mobilise the money and bring sustainable economic activity into the rural regions.

Future Vision on Global Bioenergy

Figure 4 shows regions worldwide projected to be suitable for bioenergy production from lignocellulosic crops, agricultural residues and forests.

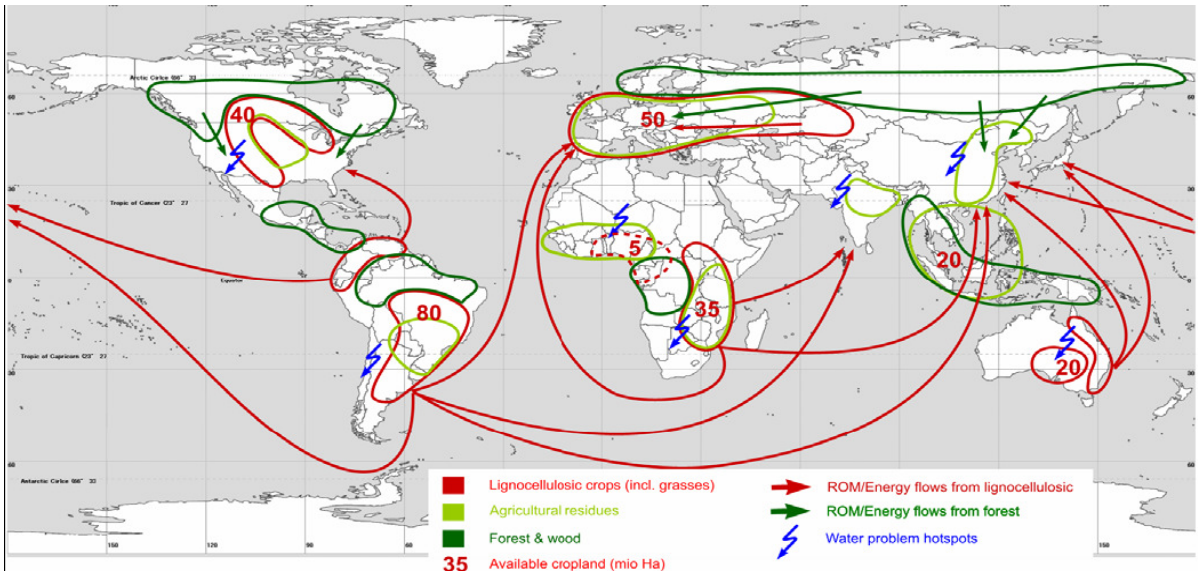

Figure 4: Global regions for bioenergy productin and potential trade flows (GIRACT FFF Scenario project; Faaij, 2008)

Certification of Bioenergy

The following criteria for sustainable production of bioenrgy have been developed by the Cramer Commission in The Netherlands:

1. **GHG balance** -> Chain performance (30-80%+..)
2. **Land-use/competition with food**: reporting; to be developed.
3. **Biodiversity** -> reporting/FSC/RSPO; to be developed.
4. **Wellfare** -> Reporting EPI; to be developed further.
5. **Well being** -> ILO, Social accountability standards, etc.
6. **Environment**
   - Waste; law, GPG's
   - Agrochemicals; law, GPG's (further development).
   - Soil quality; reporting/monitoring (further development).
   - Water quality & quantity; law, reporting/monitoring (further development).

Currently, initiatives on the certification of bioenergy are on-going by Governments (UK, NL, D, B, EC), NGOs, international bodies (UNEP, UNCTAD, FAO) and market stakeholders (RSB, RTSP). This marks the first time that governments actually try to set 'sustainability criteria' for a commodity. Thus, the development of sustainability standards for bioenergy can have important implications for food products, fodder, materials etc.

Figure 5 shows cost impacts of compliance with various sustainability criteria compared to the reference situation for ethanol production in Brazil (Smeets, Junginger, Faaij, Walter, Dolzan, 2006/2008). Analysed sustainability criteria include mechanical harvesting, organic cane, wages, child löabour compensation and environmentally friendy ethanol production.

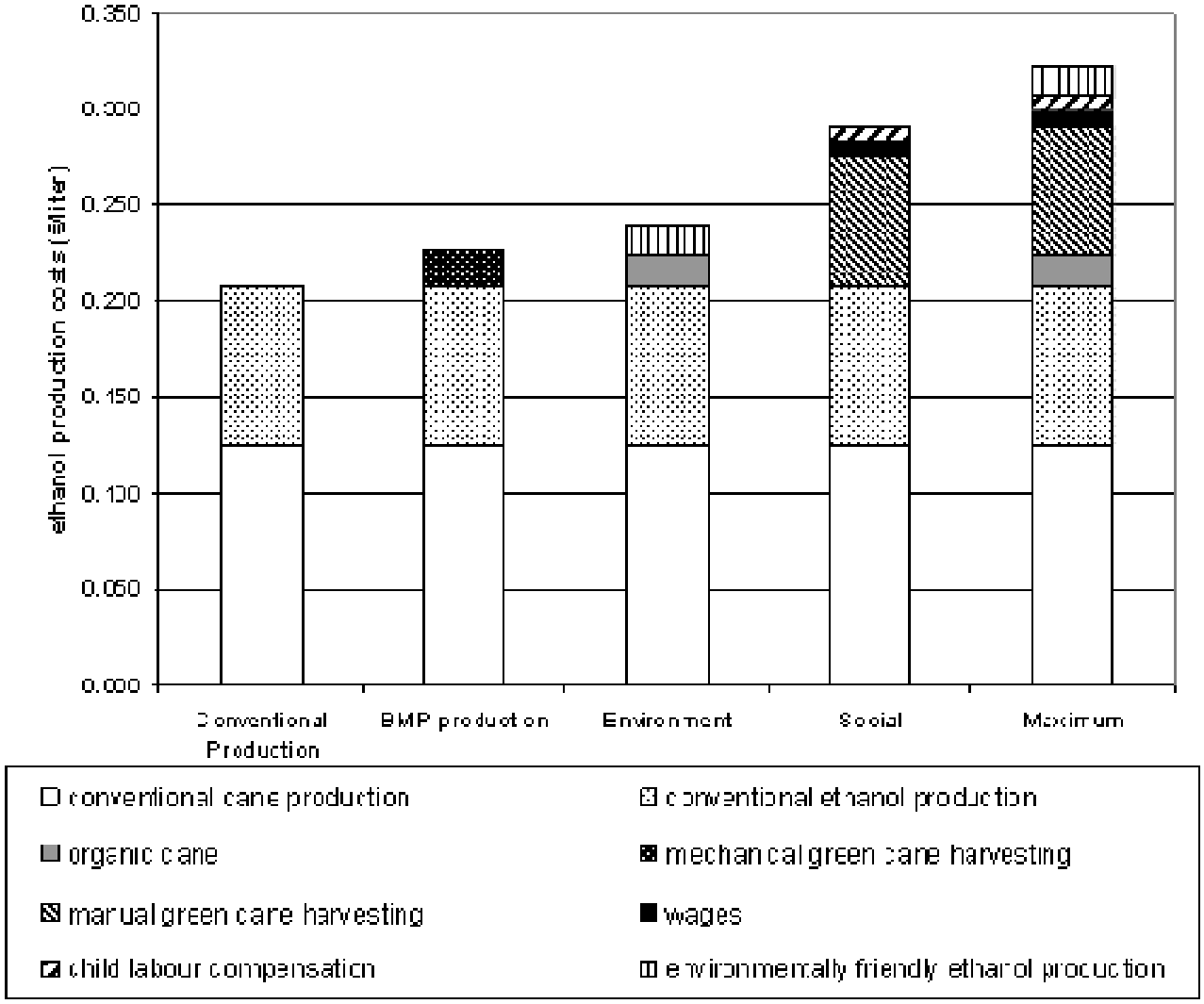

Figure 5: Cost of compliance with sustainability criteria

Key needs for sustainable biomass resources

Finally, the following key needs to ensure the sustainability of biomass production are summarised:

- Resources need to meet criteria in broad sense.
- Resource base needs to be diversified (lignocellulose, cultivated, marginal & degraded lands).
- Real market experience needs to be built in different settings.
- Sustainable (international) markets and certification to be established.

Resources, Opportunities and Impacts for Bioenergy Development

Faith Odongo, Senior Renewable Energy Officer, Ministry of Energy, Kenya

Bioenergy Resources and Opportunities in Kenya

1) Forests and wood fuel plantations

Wood fuels are the major form of energy for many developing countries (domestic, institutional, small scale industrial establishments, tea industry etc). Wood fuel accounts for up to 68% of National Energy Consumption in Kenya. Due to demand supply imbalances, wood fuels are often used in an unsustainable manner.

The following activities constitute opportunities for sustainable wood fuel development:

- Tree planting and management on privately owned lands (Sustainable wood fuel production)
- Promotion of improved wood stoves for households and institutions
- Improvement of existing stoves to levels that achieve complete combustion and minimize emissions
- Development of sound reforestation programmes
- Testing of new and existing stove designs for their emission characteristics
- Testing of wood burning boilers for efficiency and emission characteristics
- Enterprise development, job creation & income generation
- Dissemination of efficient charcoal kilns for conversion of wood to charcoal
- Development of efficient fireplaces for centralized heating in homes
- Fuel wood for direct combustion of solid biomass for space heating, process steam and electricity generation
- Use of fuel wood fired boilers in tea industries as opposed to oil fired boilers

2) Biogas generation

The most promising resources for biogas generation in Kenya comprise animal dung (cattle, sheep, pigs, camels, goats etc), waste from abattoirs, and plant material.

The following activities constitute opportunities for sustainable biogas generation in Kenya:

- Use of animal waste to generate energy
- Improvement of crop productivity arising from the use of digested slurry from biodigester processes (soil conditioning)
- Design, development and dissemination of low cost digesters
- Development of engine designs that use biogas technology
- Research and development of digested and undigested material from different feed stocks

3) Liquid Biofuels

Biomass resources for the production of liquid biofuels include Jatropha, yellow oleander and croton (biodiesel), sugarcane, sweet sorghum (bioethanol), as well as cellulosic feedstock (wood, crop residues and grasses, paper) for second generation biofuels.

The following activities constitute opportunities for sustainable liquid biofuel in Kenya:

- Energy farming: use of underutilized land, particularly dryland for bioenergy production (large and small scale)
- Genetic improvement of existing crop varieties
- Development and dissemination of oil extraction and refining methods
- Development and dissemination of equipment and appliances to use liquid biofuels
- Promotion of plants that produce bioethanol and biodiesel
- Rural Enterprise development

Potential Impacts of Bioenergy Development in Kenya

a) Dependency on woodfuel as an energy source

- Land degradation arising from charcoal harvesting
- Unsustainable wood harvest often causes severe environmental damage as well as reduced supply of woodfuel
- Pertinent need to improve the efficiency of wood burning stoves to minimize the concentration of pollutants environmental concerns
- Assessment of health effects of emissions from wood stoves and biomass conversion technologies

b) Large scale production of energy crops

- Competition with other land uses such as food production
- Reduction of natural plant and animal species diversity due to monoculture
- Invasiveness of certain plant species
- Deterioration of soil quality due to continuous use of pesticides and fertilisers
- Increase in the prices of food products

Resources, Opportunities and Impacts – The Brazilian Experience

Prof. Arnaldo Walter, University of Campinas, Brazil

Background

Arguments in favour of the use of biomass: (i) security of energy supply, (ii) diversification of energy sources, (iii) low-carbon emissions, (iv) alternative markets for agricultural products, and (v) rehabilitation of degraded lands.

Arguments against the use of biomass: (i) possible negative social impacts (e.g., wealth concentration), (ii) negative environmental implications (e.g., inadequate GHG balances, erosion, water consumption and water contamination), (iii) land competition (e.g., "fuel versus food" debate).

Benefits of Biofuels for Developing Countries

The following benefits of biofuels development have been highlighted:

- Many developing countries in the tropics have comparative advantages for producing biofuels (land availability, adequate weather conditions, and sufficient workforce).
- Biofuels production offers a high potential to create jobs, especially in rural areas.
- Biofuels use can bring the combined benefit of enhancing energy security and reducing high foreign currency spending.
- Blending gasoline with ethanol offers the benefits of phasing out lead.
- Automotive use of ethanol also reduces emissions of particulate matter, carbon monoxide, and toxics, and causes less ozone formation. These advantages are even more relevant when the existing fleet is relatively old.
- Large-scale use of biofuels is one of the main strategies for reducing greenhouse gas (GHG) emissions.

Driving Forces for Biofuels Development

The following reasons for Developing counties to get engaged in biofuels production have been identified:

- Macro-economic targets: (i) reduction of oil dependency, (ii) savings of foreign currency.
- Socio-economic targets: jobs creation and economic development, but are biofuels a better option than food production?
- Local versus global environmental priorities: local benefits should be the priority, but there is no long-term future for biofuels with poor GHG balance.

Biofuels Production in Developing Countries

The following open issues are currently discussed with respect to the most promising approach for biofuels production in developing countries.

a) Small-scale versus large-scale production

- Cost reduction due to scale-effects;
- Large-scale production will ensure fuel quality with respect to international specifications;
- Technology development easier with large-scale production;
- Large-scale production induces wealth concentration. Benefits for local population is not guaranteed

The best solution would most probably be large-scale production based on small producers.

b) Domestic market versus exports

The first step should be the production for the domestic market. Then, explore opportunities of the international market (biofuels for export).

c) Biodiesel versus ethanol:

- Developing countries are more dependent on diesel than on gasoline;
- Biodiesel production is in general more expensive (lower productivities, worse energy balance), but blending of biodiesel is easier;

The Brazilian Experience – Production of Biofuels

Since 1975 Brazil is engaged in the large-scale production of ethanol with a production volume of 24 Gl in 2008, whereas biodiesel production is rather recent (started in 2005 with 1 Gl required in 2008).

The main drivers for the development of the ethanol sector were the reduction of oil dependence as well as support to the sugarcane sector. For biodiesel development, on the other hand, the main focus was placed on socio-economic targets (support to poorest people). However, until today both cases are dominated by the agro-business sector (sugarcane and soy-beans).

The Brazilian case can best be described as follows:

- Adequate conditions (weather, land availability, working force).
- Existence of previous know-how (sugarcane) and well-established agro-business.
- Large size of the domestic markets (18 Gl of ethanol in 2007, and possibly 50 Gl by 2020; 1 Gl of biodiesel in 2008 for B2/B3).
- Land availability: only 1% of arable lands is used for sugarcane production (ethanol); land available for agriculture expansion is 2 times higher than lands currently occupied with crops (90 Mha + 60 Mha).

The following results have been achieved through the development of the Brazilian bioethanol sector:

- Reduction of oil dependency due to displacement of gasoline.
- "Reduction" of foreign debt due to the reduction of oil imports.
- Stabilization of the sugarcane sector.
- Cost reduction due to technology development and scale-effects.
- Creation of about 1 million direct jobs (but most of them on harvest).

Similar results will most probably not be achieved through the development of the biodiesel sector in Brazil.

The following Table shows results from socio-economic assessments in the State of Sao Paulo comparing cities with and without sugar mills. It is obvious that the sugar and ethanol sector in Brazil contributes to an improvement of living conditions.

Parameter	SP – with sugarcane	SP – without sugarcane
# of cities	181	415
Population (x 1,000)	2.4-500	2.4-500
R$/people/month	300.5 ± 69.8	268.3 ± 88.2
Gini index	0.516 ± 0.045	0.532 ± 0.046
Wealth 20% poorest (%)	4.00 ± 0.85	3.45 ± 1.06
Electrification (%)	99.63 ± 0.65	98.58 ± 2.90
HDI	0.793 ± 0.025	0.774 ± 0.035

Table 1: Socio-economic benefits of the sugar and ethanol sector in Brazil

Challenges of Biofuel Development for Developing Countries

The following requirements are crucial for the development of a sustainable biofuels sector in African countries:

- Biofuels production should not jeopardize food supply and the environment
- Biofuels should bring GHG benefits with respect to fossil fuels.
- Biofuels production should not induce wealth concentration (large-scale production based on small producers)
- Biofuels production in Africa should focus on local socio-economic development. Africa should not exclusively supply developed countries with biomass/biofuels.
- Biofuels industry should be well planned (e.g. raw-materials production, creation of conversion capacity and market development almost at the same time).
- Biofuels industry requires developed infrastructure and confidence of all stakeholders.
- Investment capacity has to be created.
- Fuel quality needs to be ensured.

Food Security and Pro-Poor Perspectives for Bioenergy Development

Rommert Schram, FAO, Tanzania

The Bioenergy and Food Security (BEFS) Project

The objective of the BEFS project is to mainstreaming **food security concerns** into national and sub-national assessments of bioenergy potential.

The BEFS project is structured along the following 3 phases:

1. Develop an **analytical framework** and give guidance to assess the bioenergy and food security nexus
2. Assess **bioenergy potential** and food security implications
3. Strengthen institutional capacities, exchange knowledge, pilot sustainable and food-secure bioenergy projects and **influence policies**

BEFS Analytical Framework

The BEFS project consists of the following 5 Modules which are described in more detail below.

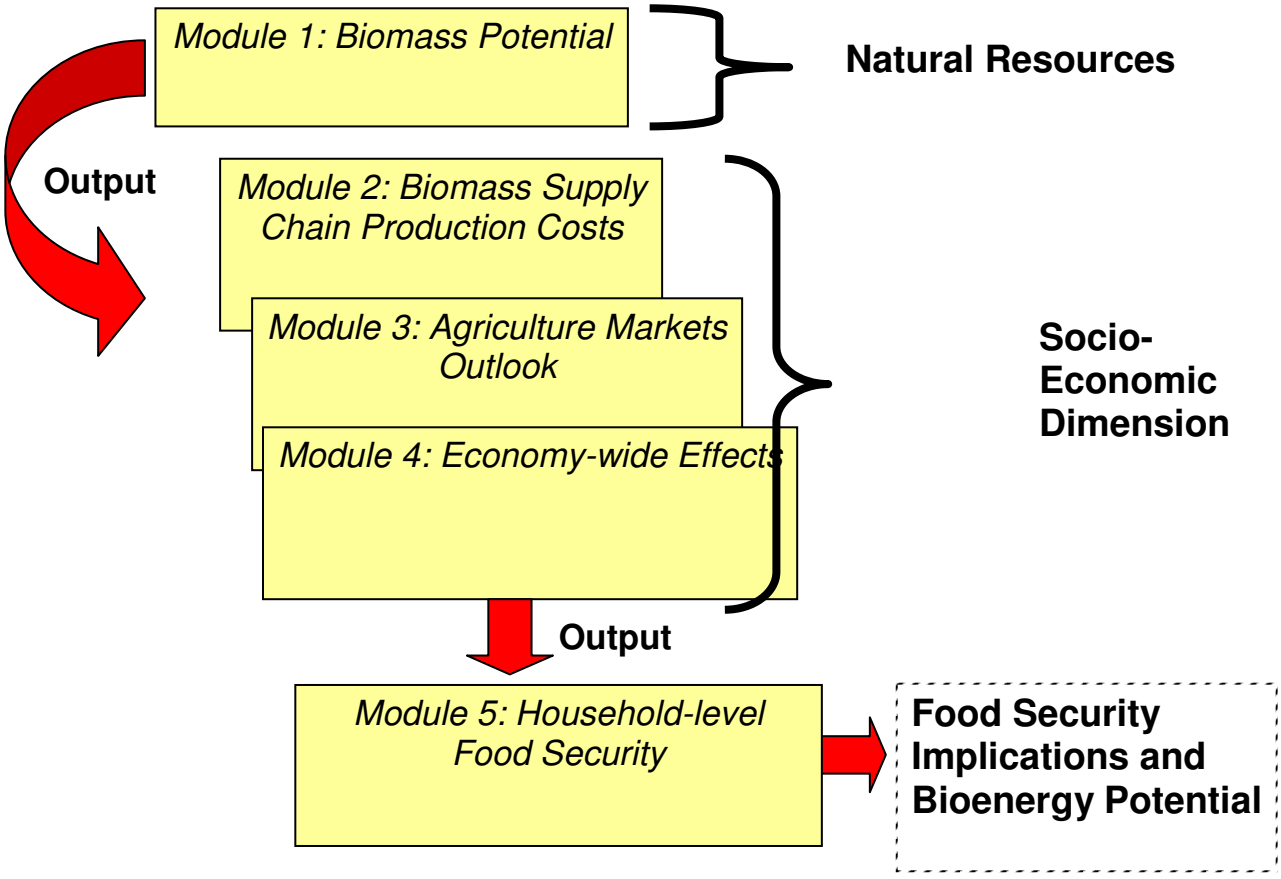

Figure 1: Modules of the BEFS project

Module 1: Biomass Potential

Objective: Determination of potential biomass feedstock production with respect to biophysical, environmental & agricultural management factors

- **Determine the land suitable** for production of a specified bioenergy feedstock under rain-fed and irrigated conditions (Agro-Ecological Zoning (AEZ) approach, based on agro-climatic and agro-geographic criteria)
- Evaluate **optional production systems** in terms of inputs, practices, and technologies that may contribute to improve the yield in a sustainable manner (based on agronomic parameters)
- Estimate of **land available** for bioenergy production (by subtracting forest areas, protected areas, build-up areas, etc.)
- Assess **current land use** of suitable areas (to evaluate possible competition with food production)
- Analyse **land administration and governance** on suitable land

Module 2: Biomass Supply Chain Production Costs

Objective: Calculation of the biomass supply chain production cost

Based on:

- **Cost of biomass production** (USD per ton of crop) for the production that is biophysically and technically feasible, as defined in module 1, under the various production systems
- **Cost of the industrial processing** of 'biomass to biofuel' (USD per liter) based on existing and potential industrial technology efficiencies
- **Cost for logistics on handling**
    - Feedstock (infrastructure, equipment, labour, collection, storage, pre-processing and transportation from the field to processing centres)
    - Processed biofuel (pre-processing (blending), transportation, dispensing)

Module 3: Agriculture Markets

Objective: Projects biomass and bioenergy production under various economic and technological assumptions

Based on OECD-FAO AGLINK-COSIMO model, which:

- Provides mathematical representations of national and global **agricultural markets**
- Produces an equilibrium solution of the **market outcomes** based on the supply and demand system
- Shows **changes in production** shares of different agricultural commodities resulting from biofuel demand
- Investigates the implications of **biofuel policies**, namely regulations, subsidies and taxes, and their impact on markets and biofuel production

Module 4: Economy-wide Effects

Objective: Evaluation of the implications of bioenergy production for all domestic sectors of the economy

Based on a country-specific **equilibrium model** linked to the GTAP global model, which:

- **Assesses changes** in incomes, welfare, prices and output in all sectors of the economy as a result of the additional production of biomass
- Allows to analyze the links between agricultural and energy markets
- Examines the potential role of **subsidies**, carbon credit, fossil fuel tax, etc. on biomass use, **land use patterns**, and **inter-market effects** through prices domestically and (when cross-border trade occurs) internationally

Module 5: Household-level Food Security

Objective: Analysis of the effects of changes in domestic prices and income due to variation in bioenergy production, on national and household level food security

Based on:

- **Household level food security** (based on household level data of Household Budget Survey Tanzania)
- Other components (**Labor** markets, **Price** transmission, **Cost-benefit** analysis)

BEFS Case Study - Tanzania

Energy and Economy

Economy**:** Dependant on **agriculture** (45 percent of GDP in 2005)

Poverty: **High poverty** level (44 percent undernourished 2001-2003)

Energy supply mix (IEA, 2004):

- 90 percent from biomass, mostly wood (charcoal)
- 7 percent imported petroleum and electricity supply (Hydro, gas, diesel and coal)

Access to electricity

- 10 percent of Tanzanian households
- 2 percent of households in rural areas

Fuel price

- Increase of almost 100 % over the past two years
- Impact on food prices due to transport over long distances

Type of Feedstock

- Bioethanol (sugar cane, sweet sorghum, cassava, sisal)
- Biodiesel (Jatropha, palm oil, sunflower, castor bean)
- Biogas (organic and crop residues, woody biomass, sisal, fishing industry wastes)
- Wood fuel (indigeneous species, wattle, eucalyptus)

Production/farming System

Bioethanol

- Estate in combination with outgrower scheme
- 20-30.000 ha
- National / international

Biodiesel

- Estate in combination with outgrower scheme
- Smallholders only
- National / international

Biogas

- At municipality level
- At household level
- National

Wood fuel

- At community level
- At household level
- Estate in combination with outgrower scheme
- National / international

Pro-poor Bioenergy Production

The following criteria are important in order to ensure that bioenergy production improves the living conditions of the poor in Tanzania:

- Inclusion of smallholder farmers (outgrowers) in the supply of feedstock (estate *and* outgrowers)
- Linking smallholder farmers to a secure market
- Creating links to credit, agricultural inputs (fertilisers, chemicals, improved varieties) and extension services
- Ensure that bioenergy crop is produced in rotation with food crop (rotation is required for pest and disease control) or intercropping

The result of such pro-poor bioenergy production can be the intensification of production, namely increased food production in parallel with cash crop production.

Constraints and Risks of Pro-poor Bioenergy Development in Tanzania

- Bioenergy regulation not yet in place, but
- Bioenergy Task Force **developing biofuels policy** (Ministry of Agriculture, Ministry of Energy, Economic Planning and Empowerment, and other related ministries)
- For investors: lack of infrastructure and clear guidelines
- For the poor: remoteness and geographic isolation, lack of rural infrastructure, gender, access to land

Session 4:

Investment, Regulation and Good Practice Reward

UEMOA Steps on Promoting Liquid Biofuels Markets

Mamadou Dianka, Coordinator Biomass Energy Regional Programme, UEMOA, Burkina Faso

West African Initiative for Promoting Liquid Biofuels

During year 2006, UEMOA through Biomass Energy Regional Programme (PRBE) organised a feasibility study outlining the markets opportunities, supply chain and the technological and economical benefits for promoting liquid biofuels in 8 West African countries.

Main findings of the study

From a regional point of view, the agricultural production potential for the ethanol sector is very consistent with (i) the humid areas of Ivory Cost, Guinea Bissau, Benin and Togo where rain fed sugar cane, cassava and cashew tree are cultivated and (ii) the geographical zones around the Niger, Senegal and Gambia rivers with intensive irrigation of sugar cane and rain fed oils seeds such as cotton, jatropha and ricin. A co-operation with sub-regional organisations charged with the development of these Sahel zones would enable setting projects in motion. It involves OMVS (which includes Senegal, Mali, Mauritania and Guinea Conakry), OMVG (which includes Senegal Gambia, Guinea Conakry and Guinea-Bissau) the Niger River Office in Mali where more than 1.5 millions hectares for biofuels production is possible

The preliminary options for each country are the following:

- **Benin** - the most suitable raw material for the production of ethanol is cassava. With an average production of 2.8 million tonnes of cassava per annum, Benin could produce 20,000 m^3 of ethanol by using just 5% of its annual harvests (no competition with food supply needs).
- **Burkina Faso** - sugar cane seems to be the most accessible raw material for the production of ethanol at present, based on new cultivations. If the 5,000 ha owned by SOSUCO were used for this purpose, one can reasonably estimate the production of ethanol at 20,000 m^3 per annum. Another potential source is the sweat sorghum if the plantation envisaged in the Sourou Valley becomes a reality. As for biofuels, SN CITEC (Dagris Group) plans to build a factory in the short term with a production capacity of 10,000 tonnes per annum based on cottonseed.
- **Côte d'Ivoire** - the country has a large potential to produce ethanol as a result of extensive availability of cheap molasses, enabling the profitable production of ethanol, gel fuel and/or biofuel. The potential is 19,000 m^3/yr. Production costs are estimated at 121, 165 and 122 FCFA/l for ethanol, gel fuel and biofuel respectively (1 Euro is 655 FCFA).

- **Guinea- Bissau** - the cashew tree apple currently seems to be the most suitable raw material to use for the production of ethanol. The annual production is estimated at 400-600 thousand tonnes, of which only 30% are employed for the production of juice, wine and spirits. If the remaining 70% could be used to produce ethanol, the ethanol production potential would be approximately 8 400-12 600 m^3/yr.
- **Mali** - the real production potential depends mainly on the new sugar mill in Markala. The envisaged output of 170,000 tonnes of sugar per annum will result in an availability of 61,000 tonnes of molasses per annum, which can be converted into 18,000 m^3 of ethanol.
- **Niger** - the ethanol production potential is very low in Niger due to the absence of sugar cane production and low precipitation. However, there is particular interest to produce biodiesel from jatropha oil. Initial calculations based on cost estimates indicate that biodiesel could compete with (fossil) diesel.
- **Senegal** - the ethanol production potential in Senegal is considerable. The Senegalese Sugar Company (CSS) produces roughly 35,000 tonnes of molasses with a high sugar content per annum, which they plan to convert into 2,500 m^3 of industrial ethanol (96%) and 10,000 tonnes (12,500 m^3) of anhydrous ethanol for use as biofuel. As for biofuels several project promoters were identified; including 30,000 hectare of sugar cane and 20,000 hectare of jatropha.
- **Togo -** In spite of the presence of a small sugar industry, the immediate potential for the production of ethanol is low unless new sugar cane plantations are developed. The private sector has particular interest to produce jatropha oil as a source for biodiesel. Initial calculations based on cost estimates of the various production factors indicate that biodiesel could compete (5% lower prices) with fossil) diesel.

Competitiveness

With the exception of Benin and Guinea-Bissau the local production of anhydrous ethanol can compete with gasoline. Feasibility in Benin suffers especially from illegal import of hydrocarbons from Nigeria while production costs in Guinea-Bissau are high due to high raw material costs and low capacity utilisation as a result of the limited seasonal availability of cashew apple. In these countries, modest support measures (for example tax exemptions) could render the production of anhydrous ethanol viable.

On the other hand the production of anhydrous ethanol as fuel substitute for imported hydrocarbons should be especially stimulated in Ivory Coast (-50%), Senegal (-48%), Mali (-34%), Burkina Faso (-17%). These countries with important resources can save on the import of hydrocarbons, especially by developing local resources.

Regarding the production of biodiesel in Niger and Togo, preliminary calculations indicate that this fuel can compete with (fossil) diesel. Biodiesel production costs are 5 to 11% less than those of diesel. These costs are highly sensitive to the price of jatropha seeds.

Table below summarises opportunities that are considered a « programme d'urgence » for short-term implementation.

Potential projects in the UEMOA countries

Country	Type project/ potential	Scale of units	Investment	Remarks
Benin	20 000 m^3/yr ethanol based on cassava	1 000 - 10 000 m^3/yr	FCFA 337 Mio (small cut) FCFA 2.6 Mld (large cut)	Biofuel is 11% more expensive than gasoline
Burkina Faso	20 000 m^3/yr ethanol based on sugarcane	20 000 m^3/yr	FCFA 5.3 Mld	Biofuel is 17% less expensive than gasoline
Ivory Coast	19 000 m^3/yr ethanol based on molasses	10 000, 5 000 et 4 000 m^3/yr	FCFA 2.1 Mld FCFA 1.2 Mld FCFA 966 Mio	Biofuel is 50% less expensive than gasoline
Guinea-Bissau	~10 000 m^3/yr ethanol based on cashew tree apples	1 000 m^3/yr	FCFA 652 Mio	Biofuel is 2% more expensive than gasoline
Mali	18 000 m^3/yr ethanol based on molasses	18 000 m^3/yr	FCFA 4.8 Mld	Biofuel is 34% less expensive than gasoline
Niger	Biodiesel based on jatropha	10 000 m^3/yr	FCFA 500 Mio (factory) FCFA 3.5 Mld (plantation)	Biodiesel is 11% less expensive than diesel
Senegal	15 000 m^3/yr ethanol based on molasses	15 000 m^3/yr	FCFA 3.2 Mld	Biofuel is 48% less expensive than gasoline
Togo	Biodiesel based on jatropha	10 000 m^3/yr	FCFA 500 Mio (factory) FCFA 3.5 Mld (plantation)	Biodiesel is 5% less expensive than diesel
Total General	**Ethanol (93 000 m^3/yr) and biodiesel (20 000 m^3/yr)**	**Ethanol : 1 000 - 20 000 m^3/yr ;** **Biodiesel : 10 000 m^3/a**	**Ethanol : FCFA 23.2 Mld** **(EUR 35,4 mio)** **Biodiesel : FCFA 8.0 Mld (EUR 12.2 Mio)**	**Substitution of 57,100 m^3 of gasoline and 19,000 m^3 of gasoil. Forex savings FCFA 20.6 Mld (EUR 31.4 mio)**

Actions forward

The principal recommendation is to continue the development of a biofuel sector in the UEMOA region. The potential to produce anhydrous ethanol and/or biodiesel starting from local raw materials exists and is promising in all the Member States. However, a strong will to reform the hydrocarbons sector and to take inciting measures enabling investments is necessary.

Specific recommendations for the steps to be followed

1. Organisation of a validation workshop, bringing together the owners of the identified projects; this should have the effect of drawing the attention of the public authorities and the financial institutions to the need to support the sector with financial and institutional incentives.

2. Adoption of Community directives to develop the market. The adoption of such directives would encourage the Member States to take appropriate legal and fiscal measures to promote the production and local consumption of biofuels.

3. Implementation of a support programme to promote awareness, to assist the private to carry out technical and financial feasibility studies and to prepare investment dossiers, to facilitate technology transfers and research & development at the level of local specialised institutes.

4. Implementation of real agro -energy policies aimed at the long-term development of the enormous assets in term of space available for the production of a large variety of feedstock species to produce ethanol and biofuel. This policy will also have to settle the land question in order to facilitate private investment. The World Bank, the European Union and the Government of Brazil could provide support.

5. Establishment of bioenergy sector development funds intended to stimulate a favourable investment climate in the sector, and to provide direct finance to the private sector establishing production units. UEMOA could associate with the sub-regional financial institutions such as the West African Development Bank (BOAD) and the African Guarantee and Economic Co-operation Fund (FAGACE).

6. To envisage support activities and follow-up of the setting in motion of projects carried by the private and public sector aimed at the creation of a favourable market development climate. To this end, PRBE could be institutionalised in a sub-regional agency coordinating and stimulating the development of the bioenergy sector in the West African region.

Implementation Strategy for UEMOA Policies Promoting Liquid Biofuels

1. Actors

- **Strong involvement of the private sector**
- **UEMOA** – regional coordination
- **Ministries in charge of energy** – creation of favourable conditions for the production and use of biodiesel
- **Ministries in charge of agriculture** – creation of favourable conditions for the cultivation of energy crops.
- **Ministries in charge of environment** – institutional support toward MDP projects.
- **Ministries of finances** – creation of favourable fiscal conditions
- **Others** – universities, banking sector

2. Identified Constraints

- **Lack of sensibilisation** and familiarisation of the private sector on the agricultural, industrial and commercial opportunities; agricultural and technological information is lacking.
- **Lack of financial instruments and mechanism** to promote the investment and trade in the sector.
- **High cost of feedstock:** – agricultural infrastructure, cost of transport and logistics.
- **Market and legislation:** underdeveloped market because of the absence of appropriated incentives and legislation in the sector.

3. Recommendations

- Adoption of common **policies, directives and legislations** to promote the market
- Development of **capacity building** program to disseminate knowledge and information
- Development of **energy crops policies** targeting long term perspectives.
- Stimulate the emergence of an organised private sector association to promote and professionalise the sector
- Creation of a **regional funds** to promote the sector in association with the financial instition of the Region (BOAD, Fagace) and development of a pilot project per country.
- Assistance to the private sector to enable the emergence of production and trade projects.

4. Priority Actions

- Support **policy-makers and parliament** to develop national policy, law and regulations
  - Technical studies
  - Development of guidelines for adequate institutional, legal and regulatory frameworks
  - Best practices sharing
  - Training and information sharing
  - Enhance regional cooperation

- Support **regional economic communities** to harmonize national policies and establish regional strategies
  - Technical studies
  - Best practices sharing
  - Training and information sharing
  - Enhance regional cooperation

- Support **national dialogue** on the opportunities and challenges of biofuels
  - Awareness raising campaign
  - National workshops
  - Rural communities meetings

End of Oil – Future of What? Threat or Opportunity to Empower African Societies

Per Carstedt, SEKAB, Sweden

SEKAB Initiative on Verified Sustainable Ethanol

The initiative on Verified Sustainable Ethanol launched by SEKAB for ethanol imported from Brazil to Sweden has the following main objectives:

- Securing supply of sustainable ethanol for the E85 market until EU regulations or other measures are in place

  This will keep consumer trust in the fuel

- Embrace and support the process in Brazil towards a more sustainable and verifiable production

  This will result in an accelerated process towards more sustainable Brazilian ethanol.

- Influence and accelerate the EU process for sustainability criteria

  A working model for sustainability in Sweden will inspire and accelerate the process of developing sustainability criteria in Europe.

The following Sustainability Criteria have been selected for the SEKAB initiative:

- Net reduction of fossil CO_2 at least 85%
- Commitment to increase mechanical harvesting
- Zero tolerance to child labour
- Labour rights and working conditions (Forced labour, Health & Safety, Wages, Freedom of association)
- Implementation of UNICA's environmental protection program
- Zero tolerance of deforestation of rain forest
- Full traceability of all physical flows
- Ensure sustainability from field to wheel

Figure 1 shows the ethanol chain of logistices for ethanol imported from Brazil to Sweden indicating the tracability of verified sustainability criteria from field to wheel.

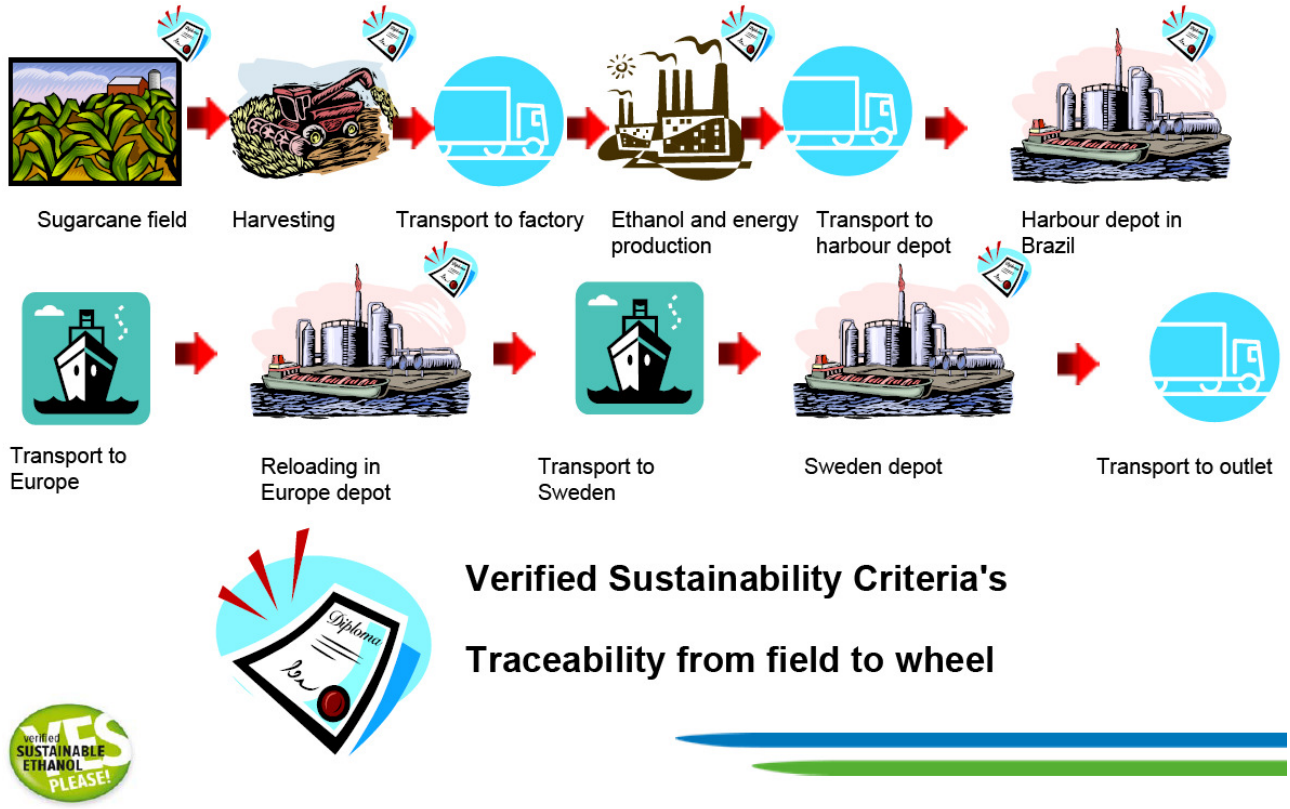

Figure 1: Ethanol chain of logistics

Figure 2 shows the world map of sugar cane production highlighting that more than 100 countries could supply biofuels to the world. This will significantly increase security of fuel supply with respect to the status quo where 20 oil producing countries supply the rest of the world.

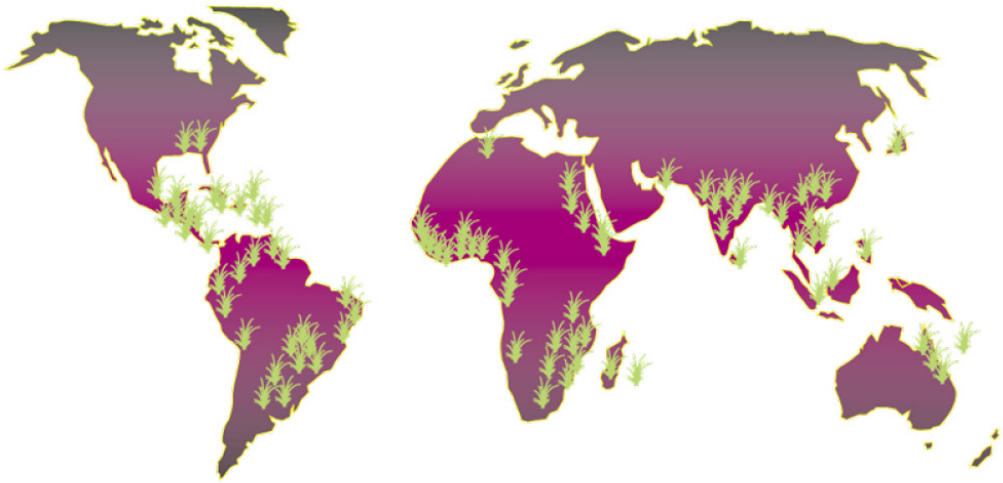

Figure 2: Global availability – world map of sugar cane production

Biofuels Production in Africa – Background

- Africa shows the highest vulnerability with respect to expensive oil
- Africa contributed least to climate change, but will have to pay the highest price for climate change
- Several African countries have very favourable natural conditions, land and water availability
- African countries have a very large need for social and economical development
- African countries have a large available labour force
- African countries are a potential platform for large scale exports

National Ethanol Development Programmes in Tanzania and Mozambique

In both countries, 2 million ha of land are allocated for sugarcane as a national goal by 2030, resulting in (absolute terms):

- Up to 80 new ethanol plants (25 000 ha each)
- Up to 16 billion litres of ethanol per year
- Up to 4 000 MW additional installed capacity for the grid (3.000 operating hours leading to 12 TWh/ renewable electricity/year)
- 400 000 - 800 000 new jobs (high level mechanisation)
- Up to 2-4 million people lifted from poverty
- Independent of imported oil plus billions of annual US$ in export revenues

Within these development programmes SEKAB intends to:

- Develop first African Role Model BioEnergy clusters
- Guarantee long term market access to Scandinavia
- Develop power generation to a new magnitude
- Transfer knowledge to assure globally best practices for large scale long term sustainable production
- Support the change of vehicle fleet, fuel infrastructure development and local phase out of imported oil

Figure 3: Sugar cane initiative in Tanzania

Figure 4: Sweet sorghum initiative in Mozambique

Ensuring Social Sustainability

The following figure shows the components of social sustainability, namely the realisation of a functioning health, social and economical system in African countries.

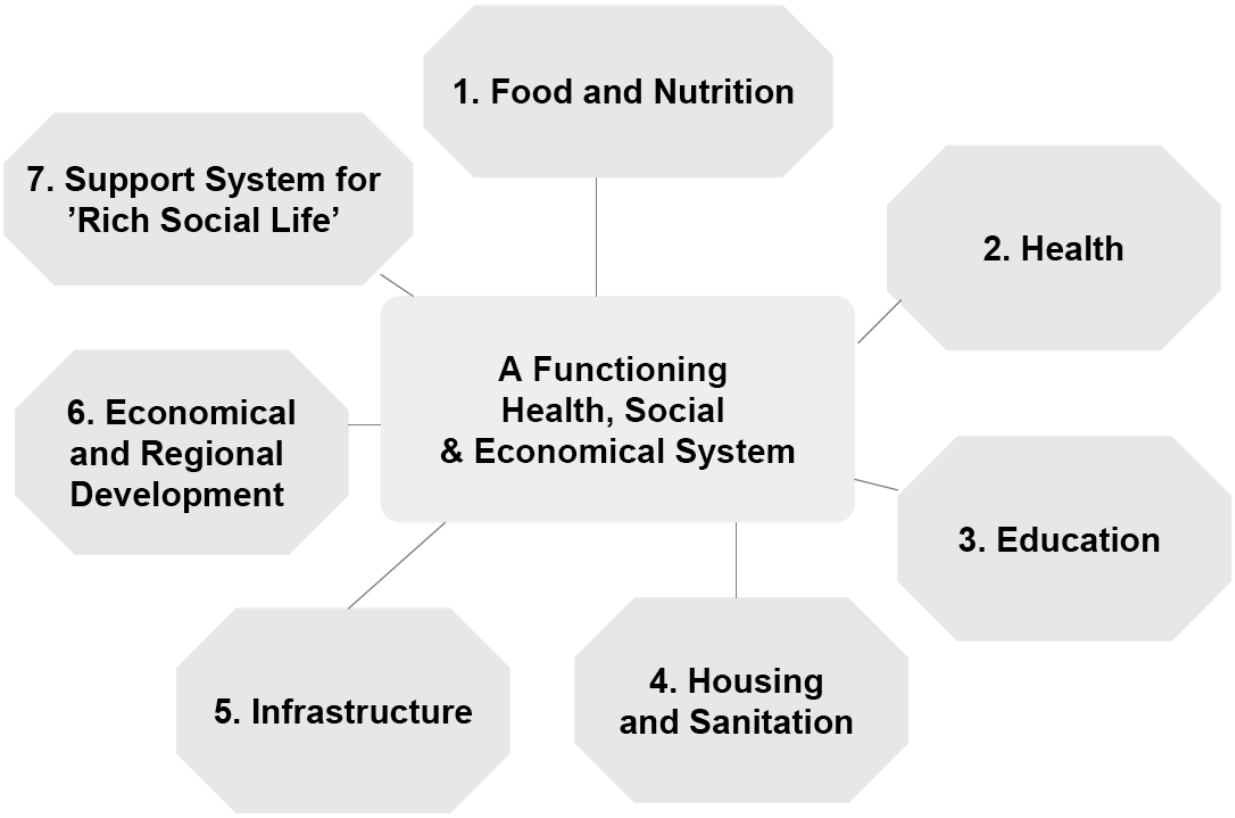

Figure 5: Components of social sustainability

With respect to 'Food and Nutrition' SEKAB is engaged in the development of the following set of criteria (work in progress):

- **Employees**: "One proper meal per day"
- **Dependents:** "Physical access to ingredients" for proper food & nutrition; Electricity and Ethanol Stoves to each household
- **Community:** Proper supply systems for food offerings; Out Grower Schemes to increase the supply of local food; Education on food and nutrition

FELISA – Its Establishment and Progress

Dr. Hamimu Hongo, FELISA Ltd., Tanzania

Introduction

Due to the escalating price of petroleum, the world is facing a growing challenge of energy supply. The transport sector is the most vulnerable as it relies almost exclusively on liquid fuels. Fortunately, alternative energy sources exist. Liquid fuels for transport can be produced in an environmentally friendly way using energy crops such as Jatropha, oil palm and sugar cane.

Millions of African smallholder farmers are living in extreme poverty as they have limited or no access to both inputs and markets. Huge transport costs make their competitivity an illusion even in the assumption that policies on trade would be fair. If farmers can produce fuels themselves they kill two birds with one stone: transport costs go down and the market is ensured.

African governments have to prepare policies that target the smallholders as major beneficiaries in the development of this new economic sub-sector. Biofuels hold enormous potential for the African agriculture and for its economies in general. They should thus be treated by the authorities as an absolute priority, so that the African energy sector will be less dependent on external influences, exchange rates, and will produce clean energy, which in turn will yield Kyoto-bonuses.

Fluctuations in oil prices have thwarted development plans in Tanzania and Africa in general and has forced many countries to review development and services plans, overall expenditure and external trade relations. Therefore, recently most African countries like Tanzania has started thinking about alternatives to fossil oil. The following benefits which can be accrued from biofuels production may be used as drivers for biofuel programmes in Tanzania: Creation of jobs, reduction of oil imports (foreign savings), reduction of GHG emissions, opportunities for CDM and Carbon trading and reduction of air pollution.

The FELISA Company

It was noted that most countries in SADC in particular, were not paying great attention to agriculture particularly when there was a food surplus. So farmers were demoralized during surplus years as most governments were sensitive only when there was food shortage.

The Founders of FELISA (Farming for Energy for Better Livelihoods in Southern Africa) thought that its now high time to start farming for energy as energy has now came to be a big problem in most member states.

FELISA Objectives

- Establishment of an oil palm plantation of 5000 hectares,
- Support of an out- grower scheme of 5000 hectares,
- Construction of a palm oil press for the production of Palm Oil (CPO),
- Set-up of a biodiesel production unit, and
- Set-up of a biogas driven electricity plant.

FELISA Achievements

- FELISA has acquired land totaling 4,258 ha. The land is surveyed and title deeds are in its final stage.
- About 29 farmer groups have been registered and assisted by FELISA.
- As of December 2007, 10,000 hybrid seedlings have been distributed to farmers.
- About 160 farmers from different villages have been trained on good palm husbandry.
- The palm oil press is installed and in operation.
- The biodiesel reactor has been purchased but not installed.
- At least 70 ha are under palm, the first harvest is expected for 2009.
- The nursery has been expanded from 30,000 to 60,000 seedlings (ready to be planted by December 2008).

Constraints

The following main constraints have been experienced during the establishment of the FELISA company in Tanzania:

- It is not easy to get bank loans as most of the banks in Tanzania do not have loan facilities for perennial crops.
- Political support is very minimal although in theory the Government of Tanzania is interested in the promotion of biofuels.
- So far Biofuel laws on blending and other incentives are not yet operational in Tanzania, the Government is in the process of preparing a biofuels strategy.

Summary

Initially, farmers were very reluctant to start with activities in cooperation with FELISA as they were not certain about aims, objectives and potential success.

However, the Policy of FELISA to allow farmers to use their land for both food and energy crop production was a leap forward for farmers, as now they were very certain that they still own their land and very likely that they will also own the crops produced as FELISA was just training and supplying the farmers with high yielding seedlings, whereas the rest in the production chain will be in the hands of the farmers themselves.

TUESDAY 17th JUNE 2008

COMPETE Round Tables – COMPETE Declaration

The main aim of this COMPETE conference was to elaborate recommendations addressing the opportunities and challenges of the global bioenergy development from an African Perspective.

Thereby, emphasis was given to:

- ensure that a strong African perspective is encouraged to emerge in the global arena of energy, climate change and bioenergy policy making
- engage the policy and decision makers of African countries in sustainable bioenergy development
- assist African countries in the development of strong regional and national policies on the sustainable development of bioenergy resources for indigenous and export markets
- highlight ways of developing food AND fuel and avoiding the food versus fuel conflict

The present COMPETE Declaration on Sustainable Bioenergy for Africa was elaborated along the lines of the following two Roundtable Discussions engaging high-level decision-makers from Kenya, Mozambique, Tanzania, Uganda, Zambia, as well as the Union Economique et Monétaire Ouest Africaine (UEMOA).

Roundtable 1: Policy strategies to enhance the bioenergy potential in Africa

- H. E. Jaime Himede, Vice – Minister, Ministry of Energy, Mozambique
- Mr. Oscar Kalumiana, Director, Ministry of Energy and Water Development, Zambia
- Mr. Mamadou Dianka, Coordinator Biomass Energy Regional Programme, UEMOA
- Mr. Styden Rwebangila, Ministry of Energy and Minerals, Tanzania

Roundtable 2: Sustainability tools and means to assure, monitor and reward sustainable bioenergy production in Africa

- Ms. Faith Odongo, Senior Renewable Energy Officer, Ministry of Energy, Kenya
- Mr. Turyahabwe Elsam, Director of Renewable Energy, Ministry of Energy and Mineral Development, Uganda
- Ms. Martina Otto, UNEP, Roundtable on Sustainable Biofuels (RSB)
- Ms. Janske van Eijck, Diligent Tanzania Ltd.

COMPETE Declaration on Sustainable Bioenergy for Africa

Policy strategies to enhance the bioenergy potential in Africa

Bioenergy should be seen as part of the solution of energy needs and greenhouse gases reduction and not as part of the problem. Major opportunities as well as constrictions need to be considered within the range of alternatives that bioenergy can provide especially in developing countries. Five main topics considered within policy strategies are as follows:

1) Visions guiding the implementation of policy strategies for bioenergy development in Africa

The following visions should provide the guiding principles for bioenergy policy development in African countries:

- ***Rural development and improved livelihoods*** for the rural population in African countries
- ***Increased energy access*** and ***income generation*** opportunities
- Successful ***transition from traditional biomass to modern biomass***
- Sustainable large-scale production of biofuels ***involving communities, smallholders, cooperatives and local enterprises***
- Support to ***rural production and marketing*** of bioenergy
- ***Reduced dependence on imported expensive fossil fuels***
- Achievement of the ***Millennium Development Goals (MDG)***

2) Markets (local, national, international) for bioenergy development in Africa

The following policy measures and principles for bioenergy market development should be implemented in African countries:

- Create ***policies and (technical) standards*** to facilitate and guide bioenergy market development in Africa (both, local and export markets)
- Give ***priority to small-scale projects and local markets*** (e.g. rural electrification, water pumping, transport fuels in agriculture)
- Create new and long term ***national markets*** for bioenergy (e.g. blending targets)

- Then, explore ***export, global markets*** and large-scale projects (e.g. sugar cane)
- In all cases, ensure ***value created for local farmers*** and rural development
- Consider ***bioenergy by-products*** as a strategy of efficient use of biomass for (local) market creation and for multiple products (e.g. energy, food-fuel, materials, chemicals).
- Develop **appropriate policy frameworks for investors** in cooperation with investors as well as creating links with communities
- Integrate bioenergy development in ***overall investment policies***
- Establish mechanisms for "equitable markets" and access to the different markets for African countries first at local level and then on regional and global level.

3) Agro-ecological zoning as means to ensure sustainable bioenergy development in Africa

Agro-ecological zoning can provide an effective means to avoid food-fuel conflict and ensure food security AND bioenergy development in African countries through:

- Inclusion of bioenergy in ***national land use plans and regulations***
- ***Harmonisation of policies*** in the agricultural and energy sector
- ***Zoning and identification of real potential*** of countries and regions to produce food, energy crops, materials and chemicals
- Identification of ***appropriate use of land and water resources*** (resource allocation to food and/or fuel production)
- Promotion of ***better land use management*** (zoning resolution needs to reflect complexity)
- ***Create and enforce regulatory frameworks*** on land use issues involving the ***private sector and smallholder farmers***
- Ensuring ***participatory mapping*** from grass-root level
- Create frameworks and policies to ensure ***priority of food*** over energy production
- Ensuring appropriate ***flexibility*** of land allocation
- Promotion of ***intercropping*** of food and energy crops
- ***Dissemination of information*** on agro-ecological zoning to the public (farmers)

4) Appropriate land tenure systems as pre-requisite to ensure sustainable bioenergy development in Africa

Appropriate land tenure systems should ensure that bioenergy development in Africa brings benefit to the rural population. We acknowledge that land (ownership) is a very sensitive issue in African countries, and that land ownership of foreign investors is not permitted in many African countries.

- ***Concessions/ownership granted by national authorities*** for bioenergy projects focussing on rural and social development
- ***Clear procedures on land tenure*** issues for investors (one stop centres)
- Investors need to consult with ***Government authorities AND the local population to be responsive to their needs (participatory approach).***
- Investors need to ***respect rules and regulations*** of the host country
- ***Avoid displacement*** of the rural population
- ***Avoid corruption*** regarding land use issues demonstrating transparency in all process regarding land tenure

5) Capacity building and R&D

Capacity building of all stakeholders (decision-makers, farmers, extension services, technicians, scientists, researchers) as well as enhanced R&D activities are urgently needed to build-up the necessary human resources in African countries to ensure a sustainable bioenergy development. Fields of specific importance include:

- Knowledge on ***policies and strategies*** and capacity to develop and implement clear strategies and regulations
- Expertise on ***energy and environmental planning***
- ***Agricultural and technical expertise***, R&D on new crops and improved crop management systems
- ***Standardisation*** to guarantee adequate quality of bioenergy products
- Establishment of ***structures for the development of a suitable knowledge base*** and continuous knowledge improvements (e.g. for farmers)
- Promotion of ***technology transfer*** as well as South-South and North-South cooperation
- R&D on infrastructure needs for the whole supply chain of biomass

Sustainability tools and means to assure, monitor and reward sustainable bioenergy production in Africa

1) Why sustainability assurance and certification schemes are needed?

Major dangers and opportunities exist for the exploitation of biofuels in Africa, either for domestic or export purposes. Many of these problems and opportunities stem from the likely changes in economic land value, the potential for rural employment provision or the exclusion of rural populations from the land. As with agriculture in general, longer term environmental and social impacts, positive and negative, could also result from changing land use to include the provision of bioenergy. Therefore, a set of tools to understand, monitor and quantify these impacts, opportunities and threats must be developed. These 'sustainability tools' will include environmental and social impact assessment (EIA and SIA), strategic environmental assessment (SEA), life-cycle assessment (LCA) and will also need to be underpinned by local to global standards monitored through assurance and certification schemes. Sustainability tools must focus on the local communities but must also consider all stakeholders in the potential biofuel supply chain including national and international governments and international organisations as required. The following points should be considered for the African context and worldwide regarding the use of sustainability tools:

- There is an urgent need to implement the use of ‚sustainability tool sets' as outlined above.

- However, viewing biofuels in isolation from the rest of the agricultural and forestry production sectors is inconsistent and potentially distorting. Therefore sustainability tools **should be implemented across the land-use sectors.**

- These tools will by definition need to encompass economic, **social, and environmental (including climate change) principles.**

- Understanding and being sensitive to the scale and context of feedstock production and conversion industry is of critical importance. The implementation of tools needs to be practical **for the use of (small scale or large scale) farmers.** Therefore, there is need **to improve and develop capacity** to understand the level of detail required at a particular scale and to appropriately enforce the monitoring. This is a central component to the viability of such schemes.

- Sustainability tools are already in place for **existing management tools,** with some complying to existing ISO standards. They are gaining support as planning tools at multiple scales.

- Major opportunities for investment in agricultural production, related infrastructure and knowledge could be driven, in-part, by foreign investors and so the **option to export biofuels** and include the **private sector** must be retained.

- The standards underpinning the sustainability tools will need to include **social issues, land tenure, guidance for the selection and participation of stakeholders** and on **contract development, particularly for farmer groups (e.g. cooperatives).**

2) What level of scale and complexity is needed for the sustainability tools

Guidance on the use of the tools is needed at the various scales of production and conversion and the market that the product will reach (e.g. internal or for export). If internal, the tools should consider transitions towards sustainable agriculture and forestry. The monitoring process should reward good practice and penalise bad practice. Considerations on the scale include:

- Need to **define scales** of commercial products and **differentiate crops** for large and small scale
- Understand the implications of the different **scales and conditions** of small holders, large scale or hybrid systems and **empower small scale** farmers to have more secure market opportunities
- Three areas to consider**: agriculture, production** (conversion) **and marketing**
- Encourage **large scale projects to support small holders** (multi-scale) applying **Corporate Social Responsibility** principles
- Consider the **social structures** and work conditions of the **small holders** which is **more sustainable but more expensive,**

3. Sustainability tools and applications in biofuel production

The application of standards and certification may vary from government and private sectors and may be seen as regulatory or reporting duty. The inclusion of climate change considerations in the life cycle assessment of products may also put an additional element into the sustainability views of the production system. Some of the reflections on this are:

- There is need of a **model framework in Africa** that considers other issues such as **land use change impacts** (indirect)
- Use **existing tools** (EIA, EA) and **policies** in place but **distinguish between the available tools with the new themes**
- Consider **available models of production** (e.g. sugar cane)
- Need to use **cooperation "blocks" in Africa** such as ECOWAS for sharing knowledge
- Use of other models and **South-South cooperation** including **CDM experience**
- **Education** is needed in all steps towards achieving sustainability

TUESDAY 17th JUNE 2008

Field Trip to Village Electrification Scheme – Leguruki Village, Tanzania

Estomih N. Sawe, TaTEDO, Tanzania

Introduction

Leguruki Village is located on the slopes of Mt. Meru in Leguruki Ward, King'ori Division of the Meru District in Arusha Region. The village population is estimated to be 4000 inhabitants in 2007. Total village area is 2185 hectares of which 1740 hectares are suitable for agricultural activities. More than 90% of the villagers are subsistence farmers. Other sources of income include livestock keeping, trading and employment in schools, churches and businesses.

Figure: Energy team for Leguruki Village

Energy profile: Leguruki village is not connected to the national grid electricity. The closest village where there is electricity is King'ori Madukani which is located 6 km south. Majority of the villagers use kerosene for lighting and an average household spends approximately Tsh 9,000 per month on kerosene. Other means of lighting include dry cell batteries, car batteries and generators. A household uses four dry cell batteries per month for torches and radio. Each battery is sold at Tsh 600, making a total expenditure of Tsh 2400 per month.

Battery charging services is provided by one of villagers who own diesel generators in the village. One full charging of a 70Ah battery is Tsh 1000. On average a fully charged car battery can be used for 10 days.

There are about 10 villagers owning generators and majority are located at the centre of the village. Generators owners don't sell electricity to neighbours.

Jatropha grows well in Leguruki and surrounding villages and is used for fencing and demarcation of farms and household land. Leguruki also grows sunflower whose oil could as well be used as a fuel.

MFP plant installed at Leguruki

The major challenges faced by villagers with regard to energy includes lack of cheaper options to generate electricity, lack of skilled technicians for installation, repair and maintenance of solar PV systems, high consumption of firewood and charcoal, unavailability and lack of knowledge on efficient/improved cook stoves. These issues were identified during a participatory energy planning meeting at the village in May 2007.

TaTEDO's Interventions

In August 2007, TaTEDO initiated energy project activities in Leguruki village. One energy service platform, also known as *multifunctional platform*, was installed and started providing milling and dehusking services. During evenings the plant generates electricity to power 60 houses and businesses which are connected to a small minigrid. TaTEDO is working with villagers and Meru District Cooperative Officer to develop management and operation structure. In February 2008, it was decided that the platform businesses will be managed and run by electricity consumers cooperative.

Improved cookstove installed at Noseiya Primary School in Leguruki.

In October 2007, TaTEDO introduced improved cookstoves in Leguruki. One improved institutional cookstove was built at Nosheiya Primary School located in the north of the village. During the same period, improved charcoal baking technology was introduced through two local entrepreneurs, one being the owner of a popular restaurant in the village. Introduction of these technologies has raised significant awareness and interest of people from the village and outside.

Figure: Mr. Luka Mbise's family in Leguruki is happy with the good lighting at their home. The family can now have the bible reading sessions and children can do their studies in the evening.

Impact

Presence of electricity has benefited at least 40 households and 20 businesses where they can operate for longer hours after dark and have been able to initiate new businesses such as barber shops and video shows. Street lighting has improved security during evenings while children are able to study longer and under better lighting. Firewood consumption at the school has decreased dramatically to almost half from use of 8 m^3 of wood per week.

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The COMPETE Project

COMPETE Objectives

The Competence Platform on Energy Crop and Agroforestry Systems for Arid and Semi-arid Ecosystems – Africa (COMPETE) will establish a **platform for policy dialogue and capacity building** and identify **pathways for the sustainable provision of bioenergy**

- to improve the quality of life and create alternative means of income for the rural population in Africa
- to aid the preservation of intact ecosystems in arid and semi-arid regions in Africa
- to enhance the equitable exchange of knowledge between EU and developing countries

COMPETE Activities

COMPETE will deliver a matrix of multi-disciplinary and cross-sectoral work-packages

- to evaluate current and future potential for the **sustainable provision of bioenergy** in Africa in comparison to existing land use patterns and technologies
- to facilitate **South-South technology and information exchange** capitalising the world-leading RD&D in bioenergy in the key countries Brazil, Mexico, India, China and Thailand
- to develop **innovative tools for the provision of financing** for national bioenergy programmes and local bioenergy projects, including: carbon credits, bilateral and multi-lateral funding instruments, and the role of international trade
- to develop **practical, targeted and efficient policy mechanisms** for the development of bioenergy systems that enhance local value-added, assist local communities and address gender inequalities
- to establish the **Competence Platform** to ensure effective dissemination and knowledge exchange inside and outside the network

COMPETE Partnership

The COMPETE partnership comprises 20 European and 23 non-European partners - 11 partners from 7 African countries, 3 regional African policy and financing bodies (African Development Bank; Food, Agriculture and Natural Resources Policy Analysis Network of Southern Africa; UEMOA - Biomass Energy Regional Program), 9 partners from Latin America and Asia - and the Food and Agriculture Organisation of the United Nations (FAO).

COMPETE Website: **www.compete-bioafrica.net**

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