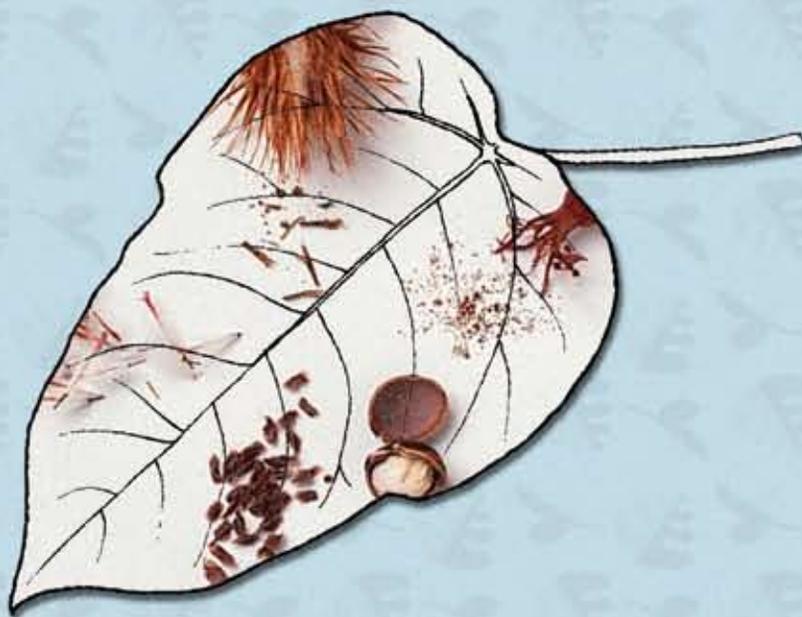


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PROCEEDINGS OF THE
STAKEHOLDERS' WORKSHOP ON
JATROPHA / BIOFUELS
IN KENYA



JUNE 28, 2007
THE PANAFRIC HOTEL
NAIROBI



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Proceedings of the National Stakeholders' Workshop on
Jatropha / Biofuels in Kenya

June 28, 2007

The Panafric Hotel

Nairobi

The National Stakeholder's Workshop was jointly organized by the Government of Kenya (the Ministry of Environment and Natural Resources, and the Ministry of Energy), and the World Bank



Abbreviations & Acronyms

| | | | |
|---------|---|--------|--|
| AF | Afforestation | GHGs | Greenhouse gases |
| ALRMP | Arid Lands Resource Management Project | GIS | Geographical Information System |
| ASALs | Arid and semi-arid lands | GNP | Gross national product |
| BOD | Biological oxygen demand | GOK | Government of Kenya |
| BTF | Biofuel Trust Fund | GTZ | German Agency for Technical Cooperation |
| CERs | Certified emission reduction credits | ICRAF | World Agroforestry Centre |
| CBD | Convention on Biological Diversity | ICIPE | International Center of Insect Physiology and Ecology |
| CBOs | Community-based organizations | IUCN | The World Conservation Union |
| CDA | Coast Development Authority | IFAD | International Fund for Agricultural Development |
| CDF | Constituency Development Fund | IRR | Internal rate of return |
| CDM | Clean Development Mechanism | JKUAT | Jomo Kenyatta University of Agriculture and Technology |
| CER | Certified emission reduction | KAPP | Kenya Agriculture Productivity Project |
| DFO | District Forest Officer | KARI | Kenya Agricultural Research Institute |
| DMP | Desert Margins Project | KBDA | Kenya Biofuel Development Authority |
| DEG | German Development Bank | KBPA | Kenya Biofuel Producers Association |
| EB | Executive board | KEBS | Kenya Bureau of Standards |
| EMCA | Environmental Management and Coordination Act | KEEP | Kenya Energy-Sector Environment Program |
| ENNDA | Ewaso Nyiro North Development Authority | KEFRI | Kenya Forestry Research Institute |
| ENSDA | Ewaso Nyiro South Development Authority | KenGen | Kenya Electricity Generating Company |
| ERSW&EC | Economic Recovery Strategy for Wealth and Employment Creation | KFMP | Kenya Forestry Master Plan |
| ESDA | Energy for Sustainable Development–Africa | KFS | Kenya Forest Service |
| EU | European Union | KIRDI | Kenya Industrial Research and Development Institute |
| FCF | Forest Conservation Fund | KPC | Kenya Pipeline Company |
| FAN | Forest Action Network | KPLC | Kenya Power and Lighting Company |
| FAO | Food and Agriculture Organization of the United Nations | KTDA | Kenya Tea Development Authority |
| GAF | Green Africa Foundation | KVDA | Kerio Valley Development Authority |
| GDP | Gross domestic product | LATF | Local Authority Transfer Fund |
| GEF | Global Environment Facility | | |

| | | | |
|--------|--|----------|---|
| LEA | Larfarge East Africa | SGP | Small grants program |
| LBDA | Lake Basin Development Authority | SRA | Strategy for Revitalizing Agriculture |
| LULUCF | Land use and land use change in forestry | SWA | Sector-wide approach |
| M&E | Monitoring and evaluation | SWOT | Strengths, weaknesses, opportunities, and threats |
| MDG | Millennium Development Goals | TARDA | Tana and Athi River Development Authority. |
| MENR | Ministry of Environment and Natural Resources | TCNA | Tree Crops Research Network Africa |
| MKEPP | Mount Kenya East Pilot Project | TOFNET | Trees on Farm Network |
| MoE | Ministry of Energy | TOR | Terms of reference |
| MSEs | Micro and small enterprises | UNCBD | United Nations Convention on Biological Diversity |
| NALEP | National Agriculture and Livestock Extension Programme | UNCCD | United Nations Convention to Combat Desertification |
| NBDC | National Biodiesel Committee | UNCED | United Nations Conference on Environment and Development |
| NBFC | National Biofuel Committee | UNDP | United Nations Development Programme |
| NBTF | National Biofuel Trust Fund | UNFCCC | United Nations Framework Convention on Climate Change |
| NBFRCL | National Bio-Fuels Research and Certification Laboratory | US | United States |
| NBSC | National Biofuel Steering Committee | VI-SCC | VI Skogen – Swedish Cooperative Center |
| NEPAD | New Partnership for Africa's Development | VDF | Vanilla-Jatropha Development Foundation |
| NGOs | Nongovernmental Organizations | WETPA | Western Kenya Tree Planters Association |
| NRM | Natural resources management | WKCDD/FM | Western Kenya Community Driven Development and Flood Mitigation |
| OP | Office of the President | WTO | World Trade Organization |
| PFP | Participatory forest management | WWF | World Wildlife Fund |
| PIN | Project idea notes | | |
| R&D | Research and development | | |

Executive Summary

The Kenya Forest Service, through a grant from the World Bank, commissioned a four-month study in mid-2007 to examine profitable and proper management practices of sustainable energy crops, principally *Jatropha*, while addressing land degradation and deforestation issues (both critical to Kenya's economy). The study was to elaborate on *Jatropha*'s viability and contribution to biofuel energy in Kenya. Key stakeholders from the public and private sector were invited to a one-day workshop to discuss the results of the study, as well as two project idea notes (PINs) for possible development of carbon offset projects based on *Jatropha*. The consultant presented his report to key stakeholders, including representatives from government, local authorities, nongovernmental organizations (NGOs), communities, and other interest groups. The workshop also provided an opportunity for the participants to learn more about the potential attributes of *Jatropha* such as improving community livelihoods, rehabilitating degraded sites, and contributing to the nation's energy sector. It will also enable stakeholders to identify opportunities to support communities through projects such as land rehabilitation and biofuels development, and to identify policy interventions necessary to support a vibrant biofuels program.

The expected outcomes of the workshop were:

- To ensure key stakeholders are adequately briefed on the *Jatropha* and biofuel study outcomes, as well as the two project idea notes, which described opportunities to use the crop in Clean Development Mechanism (CDM) projects.
- To enhance synergies in ongoing and future *Jatropha* development activities.
- To identify and promote investment opportunities on biofuels through greater private/public sector partnerships.
- To enhance opportunities for the improvement of livelihoods in arid and semi-arid lands.

The main recommendations of the workshop included the following:

- Identify investment opportunities—for carbon sequestration, employment, and income generation, and soil improvement and other environmental gains—within natural resources management (NRM) projects, the Arid Lands Resource Management Project (ALRMP), the Western Kenya Community-Driven Development and Flood Mitigation

(WKCDD/FM) project, and other programs in the energy and forestry sectors.

- Review and expand the membership of the National Biofuel Steering Committee (NBSC) and define terms of reference (TORs) to provide cross- sectoral linkages.
- Address gaps in the value chain through research and development (R&D) in strategy, quality, reliability of the feedstock, and the institutional framework to provide strong partnerships between communities and the private sector.
- Develop capacity at the local capacity level to champion biocarbon projects in the forestry and energy sectors.

- Support activities on the ground through the generation of empirical data, sufficient training, and capacity building.
- Arrange for knowledge transfer for NBSC through technology and information sourcing in areas with promising *Jatropha* investments.
- Exercise caution and carry out due diligence before major investment decisions are made.

This workshop was facilitated through the financial support of the World Bank and the German Agency for Technical Cooperation (GTZ).

Acknowledgments

This report was compiled by Alfred Gichu (KFS), Meshack Muga (KFS), Robinson Ngethe (Consultant) and Ben G. Wamugunda (consultant) under the supervision of Enos E. Esikuri (Team Leader and Senior Environmental Specialist, The World Bank).

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Welcome

1.0: Welcome Remarks and Official Opening

Mr. Anthony Maina, director of the Dryland Forestry Programme in the Kenya Forest Service (KFS), welcomed participants to the workshop and observed that the forum provided a major opportunity for stakeholders to embrace the new paradigm shift in forest resource management in Kenya. He emphasized that future forestry expansion programs will take place in the vast arid and semi-arid land areas (ASALs). Participants were requested to take advantage of the opportunities presented by the new Forest Act and the enabling policy frameworks to initiate forestry projects in the dry lands.

1.1: Official Opening Address by Prof. James Ole Kiyiapi, Permanent Secretary (PS), Ministry of Environment and Natural Resources

The following is the address by the PS, Ministry of Environment and Natural Resources, during the official opening of the workshop.

Representatives from the World Bank,

Representatives from other Development Partners,

Colleagues from other Government Ministries,

Members from the NGO community,

Farmers and community representatives,

Ladies and gentlemen,

I am extremely delighted to preside over this function as I am convinced it holds great potential to reshape and redirect the forest sector's contribution to environmental conservation and livelihood improvements in the country. This is borne out by the realization that traditional approaches to conservation and production cannot continue to sustain our health and livelihoods unless we deliberately initiate innovative programs that are capable of delivering conservation, production, and livelihood improvement goals at the same time. Any effort that tries to integrate the three components responds directly to our national policy goals and the wishes of the people and communities of this country.

Forests are already recognized as important pillars to other sectors of our economy such as agriculture, tourism, water, energy and the construction industry, which contribute greatly to employment creation and poverty reduction opportunities for many Kenyans. Continued growth of these sectors and the national economy as a whole are

therefore dependent on a vibrant forest sector. To sustain the level of management required to buttress a vibrant forestry sector, my ministry has—through the Kenya Forest Service—resolved to spare no effort toward instituting management regimes that respond to the wishes of communities and the national agenda.

Ladies and gentlemen, the area under gazetted forests in this country is very small and the scope for increasing the area is limited. Any future forest development programs will have to be in the farm lands and the dry lands. The ministry will therefore continue to support the Kenya Forest Service in strengthening the forest extension services to enable us to push the frontiers of forestry development beyond the limited gazetted forests. Farm forestry and dryland forestry programs should be strengthened and promoted as primary producers of timber, fuelwood, and non-wood tree products.

The new 2005 Forests Act and the proposed policy provide the necessary framework within which to actualize these aspirations. These two instruments provide for wide stakeholder involvement in forest development, institutional reform, involvement in decision making, and sound forest management. The act provides an expanded mandate to the new Kenya Forest Service that will apply to state forests, local-authority forests, and private forests. All forests in the nation will therefore be managed within the framework of the new act. My ministry—through the Kenya Forest Service—is well-prepared to take up the challenges of this transformation, which is designed to ensure efficiency, accountability, wide consultation, and representation in decision making and equity in the distribution of forestry resources. We believe that this new environment will provide the required impetus to accelerate growth in the forest and other related sectors.

Kenya's arid and semi-arid areas present very promising entry points for extensive afforestation and reforestation interventions. These areas are generally inhabited by poor households and are characterized by poor and erratic rainfall and poor soils, leading to low crop productivity. Continuous cropping in these fragile ecosystems and deforestation has resulted in severe land degradation and desertification. Addressing these problems requires exploration of interventions that will raise overall land productivity, restore ecosystem productivity, and improve the livelihoods of the inhabitants. The availability of extensive rangelands and local-authority lands in these areas allows for establishment of feasible programs targeting land rehabilitation, biodiversity conservation, soil and water conservation, and improvement of community livelihoods. This is the niche that Jatropha and other tree-based energy crops should exploit.

Ladies and gentlemen, I am informed that Jatropha presents some of the most promising pathways to arrest extensive land degradation in the arid and semi-arid areas by combining livelihood improvements and environmental conservation goals. The ease of establishment, fast growth, drought tolerance, ability to survive on poor soils, and multiple uses make it a candidate species for domestication by resource-poor households. Jatropha oil is an important product for meeting the cooking and lighting needs of the rural population. It has the potential to serve as boiler fuel for industrial purposes and is a viable supplement for diesel. The cooking option provided by the oil will not only alleviate the problems of deforestation but also improve the health of rural people, especially women, who are subjected to indoor smoke pollution from cooking by inefficient fuel and stoves in poorly ventilated spaces. Oil from jatropha, if produced in sufficient quantities, is also likely to trigger energy switching activities within industries—like KTDA,

KenGen, and cement manufacturers—that are eager to “green” their products and processes, as well as those intending to benefit from incentives provided under the climate change mitigation processes.

Ladies and gentlemen, allow me to briefly discuss the issue of climate change. Climate change presents real threats to the survival of mankind. Indeed, some of the manifestations have already been witnessed locally, including persistent droughts and flooding. It is also now widely recognized that human activities, including deforestation and industrial emissions, are the primary cause of this change. Discussions in most international forums and regional conferences are never complete without an agenda focusing on identifying and implementing mitigation measures to forestall future catastrophes. We must therefore deliberately associate ourselves with activities that provide tangible benefits in mitigating against climate change. The Clean Development Mechanism (CDM) of the Kyoto Protocol and the emerging voluntary markets for carbon offset programs in developed countries require special mention, as they have opened opportunities for communities in Kenya and other developing countries to benefit from conservation efforts. Kenya has already acceded to the Kyoto Protocol and has established a Designated National Authority to coordinate activities that will ensure that the country plays its due role in demonstrating its commitment to addressing the problem of global warming. The country has also submitted the Initial National Communication and has in addition communicated its definition of a forest to the CDM Executive Board. The country can therefore host projects within the energy sector, manufacturing, and forestry under the CDM. I am happy to note that several projects have already been developed to take advantage of

incentives provided within CDM, especially in the forestry and energy sectors.

I am informed the Jatropha tree, which will form the basis of our discussion today, is eligible for carbon–offset programs within the CDM. Farmers and communities who will pick up the tree for incorporation within other farming systems can therefore benefit directly from carbon stocks that accumulate within the biomass of growing trees. Enough consideration will however be necessary at the initial stages to guarantee success and sustainability since carbon benefits, especially under forestry, accrue in the long term and investors should be assured of permanence of carbon stocks within the farm holdings. My ministry will continue to provide necessary institutional support and capacity building efforts to ensure development of successful projects.

Successful development of energy tree-crops like Jatropha will require close collaboration among this ministry, the Ministry of Energy, the Ministry of Agriculture, the Ministry of Industry, the private sector, and communities. I am therefore happy that these ministries and institutions are represented here. This is particularly important as we endeavor to develop a framework where development of biofuel feedstock is supported by an enabling policy framework that triggers demand from the industry. Issues of food security also have to be secured within the arrangements. I would therefore be delighted to see close linkages established as one of the outcomes of this workshop.

Ladies and gentlemen, I am informed that the study that has been completed and which will be discussed today was intended to explore profitable and proper management practices of sustainable energy crops with a

focus on Jatropha, mainly due to its restorative qualities for degraded land, but also because of its use as a biofuel feedstock. The findings of the report will therefore be an important reference point for interventions required to further develop the area of biofuel feedstock for industries and Jatropha development in particular. I understand that several activities on Jatropha promotion have been initiated mainly through the NGO community. I commend the efforts of these agencies that have had to work sometimes without the necessary supportive environment. I hope this study has identified possible collaborative linkages to scale up current activities.

Ladies and gentlemen, this study has been accomplished through the kind support of the World Bank. The Bank has for several decades now been a very close partner in development of forest resources. May I take this opportunity to sincerely thank the Bank for this assistance. This study is certainly not an end in itself and it should trigger discussions on investment opportunities on biofuels and policy enhancement opportunities for the common good of all Kenyans. I also wish to thank all other development partners who are with us today, and who have continued to offer assistance in support of sustainable management of the country's natural resources.

With those few remarks, ladies and gentlemen, I declare this workshop officially open.

1.2: Question/Answer/Comments arising from the presentation

Question: Which is the parent ministry for Jatropha activities (biofuels) in view of the fact that the oil is an energy source whose source is a tree?

PS: Many issues revolve around Jatropha and all of us have a role to play without necessarily ascribing specific mandates to institutions. We should, however, learn to exploit comparative advantages where they arise. We must therefore admit that the Kenya Forest Service within my ministry, with its huge pool of technical expertise and its extension network, has a major role in production and promotion of Jatropha, while issues on energy policy and biofuels development are vested in the Ministry of Energy. We need therefore to develop a close working relationship to ensure smooth implementation of programs along the chain.

Question: What is your opinion on agronomic issues and marketing of Jatropha?

PS: These are challenges of development and I hope the study has identified them. There is, however, a need to conduct systematic studies on agronomic/ silvicultural practices by research institutes and universities to advise policy and program implementers. We should, however, be careful to avoid duplication of efforts in this area by identifying the most appropriate centers for research activities.

Comment: The practical challenge is to identify who is handling what aspects in the Jatropha value chain.

Comment: There are unsung heroes such as officers on the ground from KFS, MoE, and the NGO movement who work closely with farmers.

Comment: All that needs to be said today is to get practical, since biofuel production is not a small issue and it requires frank speaking. There is an opportunity for each stakeholder, including those not represented in this forum, to contribute.

Question: Farmers are going all over looking for resources to plant trees, how is the Government of Kenya (GoK) addressing this issue?

Response

- The provisions of the Forest Act 2005 require that KFS provide extension support to farmers and communities interested in tree farming.
- The ministry will strengthen its support to KFS to ensure that resources to support afforestation efforts are available.
- KFS will in the near future activate and operationalize the Forest Management and Conservation fund, which will support community efforts in management and conservation of forest resources in the country.

2.0: Overviews of the Forestry and Energy Sectors

The Ag. Director, Kenya Forest Service, Mr. David Mbugua and Mrs. Faith Odongo from the Ministry of Energy presented overviews on recent developments in the forestry and energy sectors.

2.1: Overview of the potential for development of Jatropha/ biofuel in the forestry sector by David K. Mbugua; Ag. Director, Kenya Forest Service

Jatropha is an easy-to-establish small tree with multiple uses that answer directly to many critical needs of resource-poor farmers in Africa. Due to its fast growing ability when established, it is one of the most common hedge plants in Africa and requires minimum care. The tree offers uses in conservation as well as income generation activities, which makes it a candidate species for domestication by resource-poor households. It can grow on lands not usually attractive

for agriculture, thereby supplying raw materials for industry and fuels for basic energy services, while at the same time helping to improve the environment.

Harnessing the potential of Jatropha would therefore help in meeting energy needs for rural communities while at the same time expanding the income base of households, which could help alleviate protracted rural poverty.

2.1.1: Economic importance

Jatropha oil is an important product from the plant with potential for meeting the cooking and lighting needs of the rural population. It serves as boiler fuel for industrial purposes and is a viable supplement for diesel.

The cooking option provided by the oil will not only alleviate the problems of deforestation but also improve the health of rural women, who are subjected to indoor smoke pollution from cooking by inefficient fuel and stoves in poorly ventilated space.

The following benefits are associated with the Jatropha system: (a) income generation through the sale of soap and oil; (b) reducing crop losses caused by stray livestock or wind damage; (c) increasing rainfall infiltration, resulting in more irrigation water needed for local gardens; (d) increasing soil fertility by use of press cake as fertilizer; (e) increasing use of inexpensive local resources rather than expensive external resources; (f) reducing disputes between farmers and livestock owners regarding crop damage, as well as among farmers themselves regarding the boundaries of their fields; and (g) improved livelihoods through creation of wealth and employment.

2.1.2: The Jatropha system

The “Jatropha system” is characterized by its multiple uses in soil stabilization, bioenergy production, erosion control,

livestock control, and income generation (for example, soap production) among other uses. This makes it a valuable pathway to the improvement of livelihoods, especially for women. It has the advantage of combining short-term benefits—such as income generation through the sale of soap and oil—with long-term benefits such as conservation of natural resources.

The adoption of the system would further improve investment at the household level due to the savings made by the reduced usage of kerosene for lighting and cooking.

2.1.3: Distribution in Kenya

Jatropha curcas grows well in the entire East Africa region. In Kenya, *Jatropha curcas* is found in western Kenya (Western and Nyanza provinces), the Rift Valley, and the Coast and Eastern provinces. Its favored niche in these sites is bushlands and along rivers. This makes it a reliable species for marginal lands, thus reducing competition for space with food crops.

2.1.4: Opportunities presented within the Kenya Forest Service (KFS)

The extended mandate of the new KFS requires that all forests be sustainably managed regardless of ownership. In this case, local-authority forests, community forests, and private forests will have to be managed within the framework of the new act. *Jatropha* would offer a very promising intervention to reclaim and productively manage most of these areas. The Forests Act 2005 requires KFS to provide extension services to ensure sustainable management of forest resources in the country. In this connection, services will be availed through the already established service network to guide development of *Jatropha* in areas where it can be grown.

KFS will establish a forest conservation fund through which communities will be assisted with resources to support conservation efforts. KFS has the capacity and technical expertise for high-quality germplasm improvement through the tree biotechnology program and through established collaborative linkages with Kenya Forestry Research Institute (KEFRI). Communities will be involved in management of state forests to maximize their conservation and productive roles for the mutual benefit of both parties. Besides the above, KFS has initiated deliberate programs in the drylands to promote nonwood forest programs. *Jatropha* as a biofuel will be promoted alongside other candidate species like gums and resins, honey production, commercial insect farming, and others.

Jatropha fits within the Kenyan definition of a tree as communicated to UNFCCC. Under the circumstances, communities and individuals will be able to benefit from expertise within KFS to promote carbon-offset projects that will participate either within CDM or the emerging voluntary markets for certified emission credits (CERs). This opportunity needs to be exploited by farmers, ranchers, communities, and local authorities with large tracts of land that are currently degraded and could be rehabilitated through incentives provided by the carbon markets.

2.1.4.1: Specific opportunities for promoting Jatropha in the ASALs in Kenya

The underlying conditions in the arid and semi-arid lands (ASALs)—land availability, poor soils, insufficient rainfall for crop production, and extensive land degradation—favor the promotion of *Jatropha*. In addition, *Jatropha* (a) is nonpalatable to grazing animals; (b) is fast growing, with the ability to provide benefits in the short term; (c) has a long gestation period of more than 50 years, especially when established from seed; (d) has low labor and

maintenance requirements; and (d) can be integrated into other cropping systems.

The proposed forest policy, which is awaiting parliamentary debate, recognizes the importance of the drylands, especially on the richness of biodiversity. It also recognizes the potential of the drylands to supply marketable commodities on a sustainable basis such as gums, resins, aloe, charcoal, essential oils, silk, edible oils, biofuels, commercial juices, frankincense, indigenous fruits, honey, and timber. These products can go a long way toward improving the livelihoods of Kenyans living in the drylands. In order to do this, the policy recommends the following:

- Forests and other types of woody vegetation in the drylands will be sustainably managed and conserved for the production of wood and non-woody forest products.
- The establishment of forest-based microenterprises and community forest associations will be supported.
- Degraded and overexploited areas will be rehabilitated by community forest associations with government support.
- Research, technology development, education, and training in drylands forestry will be intensified.
- Tree planting in the drylands will be promoted.
- Community forest associations will be supported to develop management plans and manage community forests.

In order to implement some of these aspirations, the Kenya Forest Service has established a dryland forest program. The program's objectives are:

- Conservation and management of forests, trees, and allied resources;

- Promotion of dryland forestry to produce fuelwood and to supply wood and non-wood forest products;
- Promotion of forest research, training, and education to ensure a vibrant forest sector; and
- Technical backstopping.

2.1.5: Utilization

With the reduced land size that is supposed to meet a myriad of household needs, one would wonder why *Jatropha* needs such attention. *Jatropha curcas* lends itself greatly to many rural households due to its multiple uses that directly respond to the needs of resource-poor farmers.

The *Jatropha* system is feasible, economically sound, environmentally sustainable, and socially acceptable. Dissemination and scaling up of the domestication of this important tree species is needed for the benefits to be enjoyed by farmers.

2.1.6: Questions/Answers/Comments

Question: Croton seeds and other oil producing seed are available and their past non-exploitation, especially pricing and quality control, is a concern. Would a similar fate befall *Jatropha*?

Answer: We need to appreciate the circumstances under which we are promoting *Jatropha* and other potential energy crops. These crops are being promoted under the global efforts to mitigate climate change. As such, there are several built-in incentives that support most of these efforts and did not obtain in the past. In fact, croton seeds to support clean industrial production systems are already in high demand from areas that we are currently managing, and we are unable to service the requirements. I, however, admit that due diligence is required when we are promoting these activities and the need therefore for close

sectoral linkages to generate and provide information to both producers and policy implementers..

Comments

- Forest areas in ASALs could be concessioned for establishment of nuclear estates.
- Machines for pressing and extraction of biofuels can be fabricated at the village level in order to make the value chain workable.
- Jatropha can grow easily and this is an advantage of getting into its farming
- There are several seed sources and a lot of ongoing research.
- There is a need for various institutions dealing with Jatropha to sit together to avoid duplication of efforts. The proposed biofuel steering committee is best placed to play this role.
- There is a need to expand quantities of extracted oil to economically viable scales.
- There is a need to promote integrated biomass production as a way to transform strategy.
- There are conflicts/constraints in land tenure issues that need to be addressed so that investors could be attracted to the areas.

2.2: Overview of Jatropha Biofuel in the Energy Sector by Faith Odongo, Senior Renewable Energy Officer, Representing the Permanent Secretary, Ministry of Energy

Biofuels development is a rapidly growing industry with a huge global market. The country needs to develop strategies to derive the greatest benefits from it. This should be in line with the National Energy Policy as well as other government policies. There is a tendency to grow fuel crops that offer the best economic returns, and thus we should

consider the implications if the land is also utilized for food crops.

The strengths of the biofuels industry are that (a) there is regional and local sourcing; and (b) there is regional and local control.

Specific energy policy objectives include (a) enhancing security of supply; (b) promoting indigenous energy resources; and (c) utilizing energy as a tool to accelerate economic empowerment for urban and rural development.

2.2.1: The policy environment

The current policy environment is favorable in that it (a) promotes energy efficiency and conservation as well as prudent environmental, health, and safety practices; (b) provides sustainable quality energy services for development; and (c) provides an enabling environment for the provision of energy services.

2.2.2: Expected benefits

Some of the expected benefits from promotion of Jatropha include (a) economic development and poverty reduction (job creation/rural enterprises); (b) transformation of marginal lands to productive areas; and (c) protection and regeneration of natural resources such as water and soil.

2.2.3: Policy recognition

Policy recognition must include:

- Creating awareness of tree growing as a commercially viable business enterprise;
- Setting aside land for the production of feedstock;
- Protecting the environment from the impacts of energy production and consumption such as atmospheric pollution, deforestation, climate change,

soil erosion, siltation of hydropower reservoirs and river systems, and contamination of groundwater;

- Recognizing the need for private sector participation in biomass energy production, distribution, and marketing; and
- Providing tax incentives such as fiscal incentives to financial institutions to provide credit facilities to consumers and entrepreneurs.

Other measures include:

- Building capacity to keep up with the dynamic technological and policy issues;
- Formulating and enforcing standards and codes of practice;
- Minimizing international trade barriers in order to attract investments;
- Introducing power alcohol and biodiesel as motor fuel blends in the long term to enhance security of supply;
- Facilitating the exchange of information and data; and
- Participating in the development of energy sector cooperation frameworks and protocols with regional governments and international bodies.

2.2.4: Legislation

The Energy Act 2006 will take effect by July 2007 and will do the following:

- Enhance incentives to the private sector and ensure prudential regulation of the energy sector.
- Empower the minister to promote the development and use of biodiesel and bioethanol among other forms of renewable energy.
- Establish the Energy Regulatory Commission to regulate the production, distribution, supply, and

use of renewable and other forms of energy. This is in addition to protecting the interests of consumers, investors, and other stakeholder interests.

- Monitor and ensure the observance of the principles of fair competition.

2.2.5: Strategy and Action Plan for Biofuels Development:

The strategy and action plan for biofuels development emphasizes (a) examination of the economic and environmental aspects; (b) sustainability (pre-feasibility and feasibility studies); (c) standardization of training procedures and products; (d) development of an effective extension service; (e) establishment of a critical mass media to make the operations viable; (f) development of a profitable marketing chain; and (g) research.

The National Biofuels Committee (NBFC) was established in 2006. Its membership includes the ministries of Energy, Agriculture, Water and Irrigation, Environment and Natural Resources and Trade and Industry. NBFC will focus on biodiesel and bioethanol research. It will also restructure the sugar industries in case sugar cane is the feedstock. Existing frameworks in the tea and coffee industries will provide useful experience.

Conclusion

The ministry will collaborate with the relevant institutions in the development of an institutional, legal, and regulatory framework for the biofuels industry.

- The private sector and NGOs are strongly urged to actively participate.
- Development partners are encouraged to provide support.

3.0: The Viability Of *Jatropha Curcas L.* as a Biofuel Feedstock and its Potential Contribution to the Development of Kenya’s Biofuel Strategy: Presentation of the main study by Robinson Ngethe, Consultant (AGFOR Technical Services)

*3.1: Potential for *Jatropha* as an energy crop*

The study analyzes the formulation of a biofuel strategy, action plan, and policies related to the improved management of *Jatropha curcas* for the economic development of the country, including major interventions in ASALs. The interventions—involving *Jatropha* and other bioenergy tree/crops—are expected to benefit target beneficiaries in about three years. This is likely to be expressed through a more efficient management of natural resources in the areas and improved livelihood opportunities for the beneficiaries. Some of the proposed interventions involve:

- Strengthening of community investments and national institutions;
- Stimulation of biofuel demand by local users;
- Formulation of a biofuel strategy and action plan;
- Enhancement of environmental benefits through rehabilitation of degraded lands in the catchments and livelihood investments;
- Development of biofuel production, processing, storage, and distribution systems;
- Establishment of a certification and quality control laboratory to provide linkages to production, research, and product development;
- Enhancement of synergies through coordinated research, training, production, and provision of extension services; and
- Promotion of national, regional, and international cooperation for technology transfer.

*3.2: Scope and status of *Jatropha* activities*

There are over 30 institutions working on biofuels and *Jatropha*-related activities, including government ministries, public and private companies, nongovernmental organizations (NGOs), community-based organizations (CBOs), and research and training institutions. At the energy policy level, the Ministry of Energy (MoE) is the principal actor. It has the key mandate and responsibility to facilitate the provision of secure and sustainable supplies of energy to support the country’s socioeconomic development. At the feedstock level and environmental management and conservation, the Kenya Forest Service (KFS) is the key actor. Major energy consumers like KenGen, cement manufacturers, and KTDA are strategically placed to stimulate local demand of biofuels from *Jatropha* by switching to clean energy production systems. Other actors include various local authorities with jurisdiction over large tracts of lands where considerable degradation has taken place through extraction of fuelwood and other tree products. The Ministry of Special Programmes—through the Arid Lands Resources Management Project (ALRMP)—has immense opportunities for the integration of *Jatropha* investments and value addition to natural resources management projects and activities in over the 28 ASAL districts. Through a participatory process, ALRMP has developed a comprehensive draft ASAL policy strategy and action plans that carefully describe district-specific NRM activities. Other institutions with relevant mandates are the six regional development authorities—the Kerio Valley Development Authority (KVDA), Coast Development Authority (CDA), Tana and Athi Rivers Development Authority (TARDA), Lake Basin Development Authority (LBDA), Ewaso Nyiro North Development Authority (ENNDA), and Ewaso Nyiro South Development Authority (ENSDA).

At the community level, the Vanilla *Jatropha* Development Foundation (VDF), Green Africa Foundation (GAF), and other NGOs are the main players in western Kenya and the southern rangelands of Ukambani respectively, while Lafarge (a private company) and UNDP-GEF-SGP have started some activities in the Coast Province.

3.3: Economic and policy interventions

3.3.1: Biofuel Strategy Developments and Institutional Framework

The overall development policy environment and institutional framework in the country is favorable for the formulation of a biofuel strategy and action plan. For example, it is fully provided for in the Sessional Paper No.4 of 2004 on Energy. This is in addition to the ongoing work by the national biofuel committee and the biodiesel task force initiated by MoE, TOFNET, and VDF. The proposed future interventions focus on formulating a biofuel strategy and action plan that is in line with sector-specific needs and national development plans, including Vision 2030.

The Forests Act 2005 and draft forest policy provide for elaborate mechanisms for public-private sector participation in the management of dryland forests, as well as identifying investment opportunities for nonwood forest products. This is also highlighted in the ASAL draft policy and will certainly be included in the future work plans for the new KFS. While the formulation of a biofuel policy is expected to promote investment opportunities for *Jatropha* and other biofuels, its absence is not in the short term a major deterrent for promoting *Jatropha*-related activities. As the consultations with KenGen, KTDA, and others indicate, there is no major constraint within the framework of current laws and policies that limit users and other stakeholders from embracing biofuels for carbon sequestration, fuel switching, or to provide specific energy

needs to communities for poverty alleviation interventions such as off-grid electricity generation, soap and candle making, or other environmental rehabilitation uses. There is merit in mainstreaming ongoing pilot actions and biofuel strategy formulation options hand-in-hand with practical activities that add value to the community and private investments.

3.3.2: National Biofuel Committee (NBFC)

The membership of the NBFC needs to be expanded and transformed to a strong biofuel steering committee (NBSC) with specific deliverables and a strategic framework that will enable it to lobby for *Jatropha*-based investments and other energy crops. This will re-energize ongoing activities and stimulate public/private sector investments in *Jatropha*. Some information gaps exist on the most suitable market outlets, cost-benefit analysis, institutional framework, feedstock supply chain, standards, quality control, and provision of extension services. Some scoping assessments need to be conducted on a demand basis in order to adequately inform the strategy formulation process and the implementation of current and future pilot activities. It is important to harmonize the roles and responsibilities of the National Biodiesel Committee (NBDC), NBTF, and other pilot activities in order to avoid duplication. Some systematic activities have been recommended in the biofuel strategy formulation road map in order to unlock the process of action planning for biofuel investments for Kenya. This will ultimately lead to the establishment of a quasi-government organization, the Kenya Biofuel Development Authority (KBDA), a Biofuel Trust Fund (BTF), and a nationwide producer-led association—the Kenya Biofuel Producers Association (KBPA)—that will deal with feedstock issues. The study recommends that the action planning process develop TORs for each structure.

Initially, MoE and other stakeholders can help stimulate the production of Jatropha feedstock from local producers by guaranteeing its use by agencies—such as KenGen, KTDA, KPLC, KPC, and Kenya Railways Corporation—where it makes business sense. It is imperative that government agencies and state enterprises start to make biofuel their preferred choice. This can be done through incentives like exemption of excise tax on biofuels. The projected stimulation of the local biofuels market is good for the sector since farmers at the bottom of the value chain cannot sustain a market risk for a long time.

3.3.3: Biofuel Trust Fund and Sustainability

The study recommends the establishment of a Biofuel Trust Fund (BTF) based on the lessons learned from other trust funds such as tourism, water, and biodiversity. The proposed BTF will have a mandate to extend financial resources to institutions—such as the Agricultural Finance Corporation (AFC) and microenterprise finance agencies—that have long experience and infrastructure countrywide in accessing credit in a competitive manner to farmers and other stakeholders. The trust fund should be established to provide seed and venture capital to upcoming biofuel enterprises, development of business models, financing options for household energy development and consumption, as well as support for training, research and development, and formulation of an enabling policy and legislation. BTF funds can be augmented with carbon credits and additional support from the exchequer, Forest Conservation Fund (FCF) and other development partners, Constituency Development Fund (CDF), Local Authority Trust Fund (LATF), and the Youth Enterprise Fund, among others. The process to establish the BTF should be implemented alongside that of formulating the biofuel strategy and action plan. To secure a sustainable supply of Jatropha feedstock, production could be based on (a) nuclear estates with outgrower schemes, or (b) on one

similar to the KTDA that is fully serviced by small-scale farmers, or on (c) a combination of both.

3.3.4: Technology transfer and learning from others

In order to enhance adoption and mitigate risks in the Jatropha value chain, the NBSC should undertake a technical study visit to Mali or any other country with relevant experience. The objective of the proposed visit is to share knowledge and understand best practices in Jatropha business enterprises and community investments with a view to validating them for the Kenya situation. It is prudent for key players to learn from best practices in other countries so as to fast track the uptake of the Jatropha value chain technology. There are good experiences elsewhere in Africa. In Zambia, for example, smallholder farming of Jatropha has provided improved livelihoods through improved lighting, cooking, and small-scale electricity generation. The expanded NBSC will constitute a critical pool of stakeholders who can steer biofuel strategy formulation and technology transfer processes. Undoubtedly, the visit will also help prepare the NBSC team to effectively address the opportunities and challenges as well as providing business information to off-shore investors who can partner with locals

3.3.5: Cost–benefit analysis

There is an urgent need to undertake a cost-benefit analysis based on proven business models of Jatropha in order to make the transition from pilot establishment of Jatropha to commercial levels within a competitive market niche. It is therefore incumbent upon KEFRI/KARI/KIRDI and the universities to support the case of potential benefits of Jatropha with empirical data on silvicultural/agronomic management regimes, oil content, yield, inputs, pricing forecasting, enterprise business models, gross margin analysis (including benefits from carbon sequestration), fuel

switching, and natural resource management at every stage from production to the pre-blending stage.

3.3.6: Research and participatory technology development

Research is needed to select high-oil-yielding provenances and varieties for the various agroecosystems and regions and the best mass production techniques. Some of the critical research priorities identified include systematic collection of Jatropha germplasm from the center of origin, as well as identification of provenances with desirable characteristics according to use through characterization and evaluation for drought resistance, desired growth habits, seed yield, oil content, nontoxicity (for fodder), or high toxic content (for pesticides).

3.3.7: Fears and challenges

It is important to undertake a social and environmental impact assessment to gauge Jatropha's acceptability to communities, particularly pastoralists, due to alleged fears of invasiveness and poisoning of livestock. This is especially necessary because of the recent experiences with *Prosopis juliflora* ("mathenge"), which will undoubtedly influence public acceptance of any large-scale introduction of Jatropha and other biofuel crops in ASALs. It is important to address these fears through enhanced public awareness and community training to avoid negative lobbying and advocacy. These risks are minimal in the Southern Rangelands, the Coast, and western Kenya areas, where the communities are more agrarian and generally more receptive to land use changes.

Judging by experience with other agricultural commodities, the pioneers normally reap maximum rewards. However, when supply expands much more rapidly than demand, prices get depressed. Care must therefore be taken that small-scale farmers who take up Jatropha do not entirely replace all the other enterprises, especially those linked to

food production. Some commercial trials are needed to enhance the confidence of venture enterprises regarding the viability of Jatropha across the value chain. Some of the land-use related risks include:

- Mismanagement of common resources, including forests on land set aside for Jatropha;
- Lack of favorable credit facilities; and
- Unsustainable management of natural resources in the dryland areas due to expansion of crop/tree farming in vulnerable ecosystems in the marginal areas, such as land clearing for food production, charcoal production for cash income, and recurring droughts that render the environment vulnerable to degradation by livestock and other land uses.

In addition, the process of capacity building (training, awareness creating) for participatory forest management in local authorities and other categories of forests can be a complicated and time-consuming exercise. For example, putting an enabling environment (strategies guidelines, and institutional framework) in place and implementing participatory forest management may prove to be a much slower process than anticipated.

3.4: Development strategies and interventions

It is important to develop silvicultural and agronomic models for Jatropha/vanilla enterprises for the various agroecological zones. The Jatropha/vanilla option is particularly feasible in the Coast province, southern rangelands and western Kenya.

3.5: Establishing a Biodiesel Standards, Quality, and Certification Laboratory

The proposed laboratory and training center will be used for establishing standards for biofuels. It will include training, certification, and quality control systems;

determining the industrial uptake of biofuels; promoting their use; and establishing a marketing and distribution system. This is in addition to coordinating relevant demand-oriented silvicultural and agronomic research to raise the yields of biofuel crops and domesticate them in new areas.

3.6: Questions/Answers/Comments

Question: Is there a possibility of supporting farmers financially?

This can be done through the established community-based financing mechanism, or through the proposed Forest Conservation and Management Fund. The study also recommends the establishment of a Biofuel Development Fund. There are other pathways—like the NRM, WKCDD/FM, and ALRMP, the youth development fund, the Women’s Fund, and other community-based financial institutions—that could also provide financial support.

Question: What CDM opportunities are there for refining biodiesel for automotive use?

Question: What policies is the government putting in place to ensure feedstock is pressed to biodiesel for export?

Question: How will the refined Jatropha oil reach the customer at the market and at what price?

Comment: (i) There is a need for applied research focusing on community-level processing technologies that are simple, reliable, and efficient. (ii) Development and demonstration of processing technologies that are affordable and sustainable by rural communities are necessary. Inclusion of strong industrial research/commercialization for both Jatropha and CDM projects are necessary. KIRDI and the biofuels steering committee

can play a major role. The commercialization aspect has to be speeded up. We can learn from mistakes from existing projects. Pilot projects should now be running on Jatropha.

Comment: KFS: Expectations for this workshop are to have farmers describe their experiences, challenges, and expectations on Jatropha farming.

Comment: Sensitization of farmers on Jatropha—on matters of planting, tending, and harvesting—should be done before introducing it. Challenges and risks should be explained to them so that any experiences are not a surprise.

Comment: Follow-up on farmers who have agreed to plant Jatropha should be done on time.

Comment: The strategy for the production of Jatropha should be in line with Vision 2030.

Question: What would a farmer in Kilifi sell his seeds from Jatropha and what are the market rates?

Answer: The price of seed varies from Ksh 10 to 1000 per kg depending on the source. This needs to be streamlined.

Comments: To bridge the gap between production and processing, the private sector needs to be willing to invest in Jatropha activities and must have sufficient information to guarantee a good return. The private sector should also be willing to partner with research institutions on the Jatropha value chain. This is because national research priorities may be quite different from the biodiesel agenda. The issue of high investments for Jatropha to have viable projects is a hindrance to the private sector. Industries like Bamburi, Magadi Soda, and others. There must be other investments outside biodiesel production.

Question: KenGen seems to be the driver in Jatropha production in Kenya. Is it part of their growth strategy? How can other players in the petroleum sector be involved?

Answer/Comment: KenGen is not the driver of biofuel activities in the country currently, but holds a lot of potential in stimulating demand for Jatropha oil. In any case, for a business enterprise like KenGen due diligence is required on the viability of Jatropha and other biofuel sources in order to inform investors.

Question: Will Jatropha compete with Eucalyptus? Do you think we risk farmers' frustration/fatigue after their poor experience with eucalypts?

Comment: These are issues that need to be addressed during the formulation of the biofuel strategy. New opportunities have their down side, which require due diligence and caution. Jatropha can be economically viable if the costs are low and site conditions are suitable. If undertaken by small-scale farmers, it is important to think beyond fuel and look at other potential cottage industries (soap and candle making, fertilizer, press cake, electricity generation, and environmental benefits).

4.0: Best Practices for Jatropha Feedstock Production: Carbon Finance and Related Options in Kenya: Results From a Pre-Feasibility Study by Dr. Jochen Statz (UNIQUE Forests Consultant)

4.1: Tapping Carbon Finance options:

4.1.1: Global lessons

There is a huge worldwide biofuel demand. The key drivers of this demand include:

- Surge in fossil fuel prices

- Dependence and supply security risks
- Climate change

Some countries have introduced certain deliberate economic policies to stimulate this demand. Some of these include:

- **European Union:** 10 percent biofuels by 2020 and 20 percent CO₂ emission reductions based on 1990 level
- **China:** 20 percent biofuels by 2020 (statement Ministry of Finance)
- **India:** 20 percent biodiesel blend by 2012 (National Commission on biofuels)
- **South Africa:** 4.5 percent biofuels by 2013 (draft biofuel industrial policy).
- **USA:** 30 percent of the 2004 gasoline demand for vehicles to be met by biofuels by 2030.

However, the biofuel sector, especially in developing countries, operates under the following risks:

- Competition with food production, therefore possibility of a rise in food prices
- Land availability, possibility of a rise in land prices.
- Ecological footprints (CO₂ balance, water balance, biodiversity loss)
- Assurance of prosperity and social well-being of farmers.

4.1.2: Environmental benefits of Jatropha fuel

Its vegetable origin makes it a renewable energy feedstock source. Jatropha oil burns with a clear smokeless flame. The fuel is free from sulfur and releases less particles; it is not poisonous and is biodegradable at 98 percent in 3 weeks. Additionally, the fuel meets the European biofuel standard, INTO 14214.

4.1.3: *Jatropha curcas*—some facts

The following are some facts about propagation and management of *Jatropha*:

4.1.3.1: *Cultivation:*

- **Soil:** Requires low fertility soils (*Jatropha* prefers alkaline site conditions)
- **Optional:** Fertilizer with small amounts of magnesium, sulfur, and calcium
- **Intercropping:** Intercropping is possible with many cash crops such as coffee, sugar, fruits, and vegetables. *Jatropha* offers protection against livestock. It needs at least 600mm of rain annually to thrive; however, it can survive three years of drought by dropping its leaves. *Jatropha* is thus excellent at preventing soil erosion as the leaves it drops act as a wonderful soil enriching mulch. The cost of 2,500 *Jatropha* saplings (enough for one ha.) in Pakistan is around British Sterling £125 or just 12.5p each. The cost of 1kg. of *Jatropha* seeds in India is 6 Rupees (equivalent to approximately £0.07).
- **Spacing:** The recommended spacing is 2x2m, 2,200 to 2,500 trees/ha, or 1,000 per acre. However, one expects a 20 percent mortality rate per acre.
- **Jobs created:** one job for each 4 hectares of *Jatropha* plantation.

4.1.3.2: *Yields and returns:*

- One hectare can be expected to yield around 7–10 tons of seed per year (equivalent to 2.2 to 2.7 tons of oil).

- Seedlings yield seeds in the first year after planting; within five years, the typical annual yield reaches 3.5 kg. of beans.
- *Jatropha* trees are productive for up to 30–40 years.
- One hectare of *Jatropha* plantation yields 25,000 rupees / year (around £300) in India (One Indian rupee is approximately equal to Ksh. 170).

4.1.3.3: *Biodiesel production*

Jatropha oil can be used as a kerosene substitute for heating and lamps. The oil pressed from 4kg of seeds is needed to make one liter of biodiesel. Press cake (seedcake) is left after the oil is pressed from the seeds. It can be composted and used as a high grade nitrogen-rich organic fertilizer (green manure). The remaining oil can be used to make skin friendly soap.

Biodiesel costs around 16 to 20p per liter to grow and refine in India. Glycerol, a by-product of biodiesel refinement, can be sold in India for around 45 to 70p/kg.

One metric ton of seedcake (the leftovers after pressing) fetches around \$100 (£55). The landed cost of 1 ton of *Jatropha* oil to Northern Europe is between \$348 and \$500 for oil contents of 29 percent to 40 percent (£180 to £260). Refining *Jatropha* oil into biodiesel costs less than \$125 (£65)/t. When filtered, *Jatropha* oil can be used in many diesel vehicles with only small modifications to the engine.

4.1.3.4: *Yield of Jatropha*

Research in varied parts of the world show encouraging yields for *Jatropha*. Thailand experienced 2.1 tons per hectare per year and India 1.7 tons per hectare when the plants reached 3 years. Mali has had 2.6 tons per hectare, while Paraguay (when the plants reached 9 years) has had

4.0 tons per hectare. Nicaragua yielded 5.0 tons per hectare per year.

4.2: Options for Jatropha CDM activities in Kenya – National Options

CDM is a mechanism whereby a party from an industrialized country may purchase emission reductions which arise from projects located in developing countries. The carbon credits are termed certified emission reductions (CERs) expressed in tons of CO₂ equivalent to generate CERs. A project must undergo a rigorous process of documentation and approval involving a variety of national and international stakeholders. CERs can then be sold to the carbon market (emission trading schemes as part of a cap-and-trade system).

4.2.1: Key methodology issues for LULUCF (Land Use and Land-Use Change in Forestry) projects

CO₂ agricultural sequestration projects are only eligible under current Kyoto rules if they transform a nonforest into a forest (Kenya's draft CDM forest definition puts the minimum of 30 percent canopy cover, 2 m. tree height and 0.1 hectares area.)

The first choice is always to adopt an approved CDM methodology, but also new methodologies can be proposed (currently six approved methodologies available)

Carbon credits from agricultural activities that are not eligible can be traded on the voluntary market and national representatives can influence negotiations for inclusion in a post- Kyoto 2012 regime.

Carbon credits can be only claimed for activities that are additional and justification has to be provided.

4.2.1.1: Methodological issues and challenges

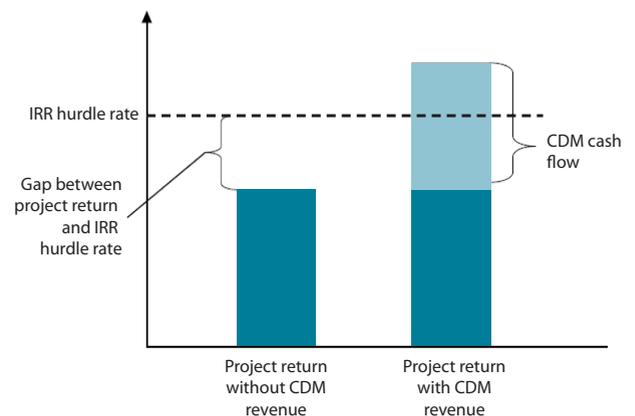
Calculations indicate that LULUCF projects would not be feasible in the absence of CDM.

4.2.1.2: More methodological issues and challenges

Pitfalls:

- **Double counting:** Who gets credits and who is included in project boundary? Both producers and consumers have to be included.

Fig 1: Project return with or without CDM revenue



- **Pre-project activities:** What would the feedstock plantations replace? Not forest, and not agricultural land earmarked for food production.
- **Edible vs. non-edible:** Biofuel production vs. food production. Use approved CDM methodologies as developing them is costly!

Bear in mind the Kenya draft CDM forest definition of 30 percent crown cover, 2 m. tree height and 0.1 ha minimum size.

Also only one biodiesel methodology for using waste cooking oil as feedstock (AM 45, China) is approved by the Executive Board (EB).

Table 1: Parties involved in CDM projects

| Party | Role |
|---------------------------------|---|
| Project proponent | Aggregates areas and carbon credits; enters legal agreement with carbon fund |
| Carbon Fund | Buys carbon credits at market price (the higher the input and delivery risk, the lower the price) |
| Extension service provider | Ensures high adoption rate of new management activities to generate carbon credits |
| Research and monitoring support | Investigates high-potential carbon project activities, develops efficient monitoring methodologies and extension technologies |
| Project sponsor | Supports project proponent to overcome project development and implementation barriers |
| Government agencies | Provides enabling environment because land tenure on public land, requires government approval |

4.2.1.3: Jatropha feedstock production scheme

Production units are 25,000 ha plantations. Each production unit includes: (i) two nurseries of 10 ha, equivalent to 10 plantation modules of 2,500 ha each; (ii) one crushing unit (processing 60,000 tons of seeds from 25,000 ha); (iii) two oil extraction units @ \$4 million; estimated total investment (including plantations) of \$50 million.

Table 2: Jatropha biodiesel pilot production

| | |
|---------------------------------|---------------------------|
| Plantation size | 25,000 ha |
| Annual biodiesel production | 70,000 tons |
| Annual electricity output | 150 GWh/year |
| Annual emissions reduction | 170,000 t CO ₂ |
| Annual revenues (at US\$ 4/CER) | \$700,000 |

4.2.2: Jatropha CDM potential

Suited for both fuel switching and afforestation schemes
 GHG mitigation potential: 1-12t CO₂e/ha/yr (fuel) or 2.5-5.0t CO₂e/ha/yr (AF)

Eligible projects:

- The biofuel crop must grow to between 2m (at 30 percent canopy cover and minimum of 0.1 ha)
- Must be on land not deforested since 1990
- tCER potential: approximately 15 tCERs per ha/year could be significant income stream.

4.2.2.1: Methodological option for Jatropha project

A possible approach is combining Approved Method (AM) 42 (Biomass plantations for energy) with AM 45 (waste cooking oil based biodiesel). These are project activities that reduce emissions through the production, sale, and consumption of blends of petrodiesel with biodiesel.

PIN 1: Jatropha GHG sequestration afforestation (AF) project

Rationale and potential

- Idea: planting Jatropha on land that was not previously forested, resulting in the sequestration of atmospheric carbon.

- Afforestation of land under communal management in the Tana River Basin
- However: KenGen should start with pilot plantations on its own land
- Taking advantage of the soil conservation properties of Jatropha
- Location: taking into account the layout of the national power grid
- Alternatively: providing the feedstock for decentralized energy generation
- GWP/Emissions factor: max. 1.0
- Impact on IRR at US\$4/tCO₂e: 3 to 7 percent.

PIN 2: Jatropha fuel switching

Rationale and potential

- Idea: mitigation of emissions through fossil fuel switching to a renewable source of energy (Jatropha)
- Single buyer for electricity output is KenGen
- Electricity output: approximately 150GWh/year
- Issuing 15-year power purchase agreements to producers
- Capital required: min. \$50 million
- GWP/Emissions factor: maximum of 1.0
- Impact on IRR at US\$4/tCO₂e: 0.5–3.5 percent.

PIN 1+2 will make a viable Jatropha CDM project. The recommended institutional set-up is as shown in the table below.

Table 3: Organizations and institutions involved in Jatropha activities

| Type of organisation | Potential partner | Additional partners |
|---------------------------------------|----------------------|--|
| Project proponent | KenGen | |
| Extension service provider/Aggregator | Kenya Forest Service | KTDA, VIAgroforestry, Catholic Relief Service, DEG |
| Research/ monitoring support | KEFRI | Extension agencies, NGOs |
| Project sponsor | KenGen | Bio-Carbon Fund, Japanese Forest Development Fund |
| Government agencies | KFS, KEFRI | MOE, MENR & MOA |

Table 4: Combined SWOT for both Jatropha-PINs

| | |
|---|---|
| <p>Strengths:</p> <ul style="list-style-type: none"> • tCER potential is something in region of 15 tCERs per ha/year (assumed price: US\$ 4/ tCO₂) • The plant is robust and has positive environmental properties. • Experience of KenGen with CDM. • IRR of 8–15 percent. | <p>Weaknesses:</p> <ul style="list-style-type: none"> • Minimum size required is 25,000ha. • Decentralized production of feedstock vs. centralized processing • Large aggregators with limited Jathropha experience • Initial investment capital required • CER-premium on IRR of only 0.5–3.5 percent. |
| <p>Opportunities:</p> <ul style="list-style-type: none"> • Existing and documented knowledge on <i>Jatropha</i> cultivation • Water resources user associations provide a good organizational basis with the mandate to generate additional income | <p>Threats:</p> <ul style="list-style-type: none"> • Cooperation of farmers is crucial; how about their opportunity costs for land use? • A very modest stock of country-specific <i>Jatropha</i> experiences • IRR benefit is small • Volatile markets for CERs • Recognition of potential, but few concrete policies • Hen and egg situation |

Carbon credits are a bulky commodity. Projects producing less than 25,000–50,000 tCO₂/year are not financially viable. Thus carbon finance must be an add-on component to existing or planned project to minimize costs, e.g. internal control system is used for organic certification and to monitor carbon sequestration. Project aggregation and institutional set-up are poorly reflected in the PIN formats, but will be key for efficient and cost-effective carbon finance projects in agriculture.

4.3: Questions/Answers/Comments

Comments:

- Yield variations per hectare are not uniform and have no correlation with locations.
- A Kenya model should be developed for the CDM.
- The issue of economies of scale is a hindrance to small-scale farmers to benefit from carbon credits

Question: Does production of biofuel pollutants from Jatropha have any effect on the environment?

Answer: There is a need to maintain due diligence through environmental impact assessments (EIA) and audits. In any case, the EMCA makes it a requirement.

Question: Are there opportunities to renegotiate carbon credits?

There are guidelines on this one through the biocarbon financing mechanism.

Question: 25,000 hectares requirement eliminates small-scale farmers unless you organize them into cooperatives. How feasible is this? How long will it take us to get there?

Answer: Right now the issue is complex but it will be looked into.

5.0: Investment Opportunities in Sustaining Demand and Supply of Jatropha feedstock by Eng. Pius Kollikho (Corporate Planning Officer, KenGen)

5.1: Investment opportunities in KenGen

Advantages of using biofuel include:

- Global reduction of GHG emissions
- Reduction of location pollution
- Save on foreign exchange
- Employment opportunities and economic empowerment of farmers
- Economic development of the country
- Not subject to price fluctuation like crude oil

Further opportunities for KenGen include:

- Catchment conservation through Jatropha cultivation
- Reduction in emissions from our thermal plants due to blending
- Reduction in fuel costs
- Possibility of biodiesel plant/both grid-connected and isolated

Challenges likely to face biodiesel development include:

- Market risks
- To keep processing plants running efficiently there is need to have sufficient and reliable quantities
- Storage life of biodiesel?

Conclusion

There are opportunities for the development of biofuels. KenGen is committed to developing more clean energy, environmentally sustainable projects, and R & D in the energy sector, as well as other projects that will enhance cost competitiveness.

There is a need for a project appraisal and a comprehensive feasibility study to rank the project alongside other projects.

5.2: Best Practices and Carbon Finance by KenGen

Carbon credits from:

- CERs: Sequestration in biofuel trees (Jatropha)—planted areas must be originally degraded
- CERs: fuel switching to biodiesel and additional biomass energy

Investments

There are investment opportunities in:

- Plantations—economy of scale
- Processing plants
- Infrastructure to transport raw materials to generation plants.

Risks

- Market risk
- Biofuel feedstock constraints—to keep processing plants running efficiently, there is a need to have sufficient and reliable quantities
- Price risks.

Farmers must be assured of a market for crops and good prices.

Pollution from biofuel processing operations

- It is important to understand chemistry of wastewater, especially biological oxygen demand (BOD)
- Disposal of wastewater should be done in an environmentally sound manner

Conclusion

It is important to get the process correct since best practice will lead to value addition to farmers, the energy industry, and the economy. Furthermore, there will be extra revenue from carbon finance.

Caution:

Farmers should not sacrifice food crops for biofuels but find a way of supplementing both.

5.3: Question/Answer/Comments

Question: What are the policy guidelines in energy production?

Answer: Proper appraisal and feasibility studies are needed. Power purchase agreements should be signed with KPLC and the tariffs set by the Electricity Regulatory Board. The generation sector also is liberalized.

Question: What is the amount of diesel used in KenGen per month and if blended with for example 1-2 percent biofuels and what would this translate to in terms of money?

Answer: KenGen spends around 2 billion annually on diesel for electricity production; savings can be worked out from these estimates.

Comments

- There is a need to know the location of power plants as we plant Jatropha for ease of transporting the feedstock to the factories.
- KenGen has six CDM projects operating currently.
- There is a lot of potential in spending on alternative energy sources so as to save on foreign exchange.

6.0: Exhibitions by NGOs

During the workshop, there were exhibitions running over the tea and lunch breaks. These were done by two organizations: Green Africa Foundation (GAF) and Vanilla-Jatropha Development Foundation (VDF), who work with farmers in rural communities. The main exhibitions included (a) publications and a clinic on ongoing activities; (b) video shows of the field activities and various trials in the field; and (c) farmer interviews and some Jatropha oil in use (oil lamps, soap).

7.0: Way Forward and Action Planning

7.1: Remarks by Enos Esikuri, Senior Environmental Specialist, World Bank

Mr. Enos Esikuri made the following observations:

- **Biofuels the world over present both challenges and opportunities** that need to be addressed in order to achieve the intended objectives in a sustainable manner. This workshop is thus intended to clearly show the opportunities and challenges presented by renewable energy such as that from Jatropha. Some observations:
- **Policy/political championing.** Production of biofuels has to be part of the operating national energy strategies. The introduction of renewable energy (especially biofuels) is foremost a policy/political (i.e., it goes beyond expounded policy, and must have political champions) decision (of course backed by some economics/environmental considerations). But the driving factor has mainly been and continues

to be *political*. It is therefore important to get the political leadership engaged and if possible identify political champion(s) to help in the push.

- **There are several promising experiences in sub-Saharan Africa that can be useful to Kenya.** In Mali, the Mali Folkecenter (MFC) have been working for the last 8 years on the development of Jatropha biofuel for powering Malian villages with significant success. Today they have implemented more than 200 hectares of *Jatropha* plantation with selected varieties that provide fruits/seeds in 8 months. MFC has also converted two of their pick-up trucks to run on pure *Jatropha* oil (with help from Elsbett GmBH, a German engine conversion company). This year MFC is going to support more than 1,000 hectares of *Jatropha* in partnership with villages to power a generator of 375 KW, which is enough to supply villages of 9,000 inhabitants in South Mali in cooperation with a Malian private company.
- **The need for South-South technology transfer.** For the past two years, MFC has also been working on South-South transfer of technology and knowhow on *Jatropha* biofuels in other African countries. For example, they are providing technical support on *Jatropha* projects in Tanzania, Benin, Burkina Faso, Senegal, and Algeria. MFC has also developed a variety of systems for rural electrification with *Jatropha* systems from 1 KW to 500 KW. The current technologies adopted at MFC can easily be replicated in Kenya as part of the South-South technology transfer process.
- **Biofuels and climate change.** There is a need to ensure synergies with adaptation to climate variability and change. In response to the 2005 Gleneagles Group of Eight (G8) Summit, the World Bank Group has prepared the Clean Energy

Investment Framework. This addresses clean energy for development, the development of a low carbon economy, and adaptation to climate change. The framework offers opportunities to marshal new and more resources toward biofuels, forestry, and land management activities that support the larger development agenda.

- **The need for partnerships, especially private-public partnerships (PPPs).** Partnerships are crucial for the success of biofuel activities. Such partnerships should include the communities, government, donors, private sector, etc. It would thus be important to create and or strengthen the enabling environment for such partnerships, especially PPPs.
- **Economic viability.** *Jatropha* for production of biofuel can be economically viable if (a) the costs are low, site conditions are suitable, and appropriate varieties are used; (b) it is done via small-scale farmers, which would also help enhance the livelihoods of poorer farmers; (c) activities think beyond biofuel and look at potential cottage industries around the feedstock (soap making, fertilizer, etc).
- **Need for caution when introducing renewable energy crops.** It is important to remember that these renewables are not always cost-effective under marginal conditions and can be a problem if they are replacing other crops in more arable areas. More importantly, one must consider the potential negative ecological aspects, especially if irrigation is used in water-scarce arid/semi-arid areas.
- **Due diligence:** Prior to the introduction of *Jatropha* and other similar biofuel sources, a thorough viability assessment is crucial to inform investments. One could consider:
 1. Cost-efficiencies at small/large scales;

2. Economic viability;
3. Ecological aspects/costs—this is also vital to ensure that production of biofuels does not in itself become a pressure on natural resources (some signs with palm oil and forestry in Indonesia);
4. More importantly, costs of introducing such energy crops versus the costs of NOT introducing these crops—for example, a scenario elucidation of WITH and/or WITHOUT such renewable energy crops, as well as what the trajectory would look like at the local, national, and even international levels;
5. *Jatropha* biofuels production for export or local use? This question needs to be addressed since it has various implications (for example, if most raw feedstock is exported then local activities could be hindered).
6. Another issue to consider is that the biofuel technology could be replaced by other sources such as hydrogen in another 25 years or so, so there is a need to ensure we are in step with the latest R&D.

7.2: Discussions on the way forward

A panel under the Chairmanship of Isaac Kalua discussed the way forward and arrived at the following recommendations:

Equipment. There is a need to focus on target beneficiaries; development of simple machines for extraction of oils would be useful to local communities.

Resource Center. A biofuel resource center for information exchange and technology transfer and information needs

to be established as a one-stop shop for biofuels in the country.

Seed Quality and supply. To enhance quality control, there should be methods of assessing Jatropha seeds in a systematic way. There is a need for outlets to disseminate seeds to farmers.

Partnership. There is need to have strategies, structures, and processes to start utilization of Jatropha. KIRDI is funding a project on biodiesel but there is a missing link to industrial commercialization research that should be included. There is a need for an organization such as KPCU with a commercial dimension to drive the process. Additionally, a clear stakeholder analysis is necessary. We also need to undertake a value chain mapping exercise.

Technology Gaps, Training, and Capacity Building.

Information gaps exist, hence necessitating research through involvement of the private sector in research activities. There is a need to:

- Formulate and authenticate information based on agroecological zones (database updated on a regular basis)
- Address the gaps in technology through research and development
- Raise the awareness of farmers on the potential of Jatropha
- Develop Jatropha biodiesel standards in collaboration with the Kenya Bureau of Standards (KEBS).

Caution:

It is necessary to:

- Appreciate that farmers are fatigued due to investing in uncertain enterprises.

- Learn from past mistakes with macadamia, eucalyptus and Prosopis “mathenge.”
- Separate pro-poor and transport-based investments.
- Concentrate first on the local market before we focus on the world market.
- Evaluate the risk due to overproduction that can lead to farmer’s frustration, as has happened before.
- Address the risks and potential dangers arising from pests and diseases.
- Understand pricing issues related to feedstock and across the value chain.
- Undertake feasibility of commercialization of cash crops such as sunflower, coffee.
- Focus on local utilization of Jatropha for effective production of feedstock.

Future

- Jatropha offers the opportunity to link current initiatives to Vision 2030 (“Big is good, small is beautiful”).
- Capacity building of farmers is crucial and municipal waste utilization for biofuels production can be of great use in the energy sector.
- Gender issues need to be put in perspective; the participation of women in this initiative is necessary.

7.3: Closing Remarks by Representative of the Director of Renewable Energy, MoE.

The remarks were made by Mrs. Faith Odongo on behalf of the Ag. Director Renewable Energy. She noted that the day was full of fruitful deliberations and that the policy framework and institutional framework are already in place for promotion of biofuels and Jatropha. She further observed that there is willingness on the part of the participants and stakeholders to upscale the issues

discussed and noted that there are gaps in the scientific base/knowledge that need to be filled.

It is urgent that restructuring and coordination of Jatropha biofuels activities be addressed. This should take account of the available information and put them in the best use. A database needs to be compiled and regularly updated on biofuels to identify different organizations and institutions working on biofuels and their activities.

She concluded by thanking the consultant, the various partners, donors, presenters, session chairs, exhibitors, and participants for their contribution to make the workshop a success.

As a tribute to the workshop, Green Africa Foundation invited each participant to plant ten (10) Jatropha trees. This will be a total of eight hundred trees on a site in Kitui. The date of the event will be communicated later.

Appendix A: Workshop Program

| Time | Presentation | Responsibility | Chairperson | Rapporteur |
|---------------|--|---|------------------------|-------------------|
| 8.30-9.00am | Registration | Dryland Forestry Program | | Alfred Gichu (AG) |
| 9.00-9.30am | Welcome address and Official Opening | PS, Ministry of Environment and Natural Resources | Anthony Maina (AM) KFS | AG |
| 9.30-9.45am | Workshop Objectives | Robinson Ng'ethe, Consultant | | |
| 9.45-10.00am | Overview of the biofuels sub sector | PS, Ministry of Energy | AM KFS | AG |
| 10.00-10.30am | Overview of the Opportunities for Biofuels in the Forestry Sector | Director, Kenya Forestry Service | AM | AG |
| 10.30-11.00am | Tea Break and clinics by Green Africa. | | | |
| 11.00-12.00pm | Overview of <i>Jatropha</i> activities and biofuel strategy and action planning | Robinson Ng'ethe, Consultant | AM | Meshack Muga (MM) |
| 1.00-2.00pm | LUNCH | BREAK and clinics by Green Africa Foundation | | |
| 2.00-2.20pm | Investment Opportunities in sustaining demand and supply of <i>Jatropha</i> feedstock | Pius Kollikho, Corporate Planning-KenGen | Lorna Umuodo (LU) | MM |
| 2.20-3.00pm | Best practices for <i>Jatropha</i> feedstock Production: An overview of worldwide activities | Tim- Unique Forests | LU | MM |

| Time | Presentation | Responsibility | Chairperson | Rapporteur |
|-------------|--|--|---|-------------------|
| 3.00-3.30Pm | Carbon-finance-related options for <i>Jatropha</i> feedstock production and energy projects in Kenya: Results from a pre-feasibility study | Jochen–Unique Forests | LU | MM |
| 3.30-4.00pm | Discussion on best practices and carbon finance | Pius Kollikho, KenGen | LU | MM |
| 4.00-4.30 | TEA | BREAK | Clinics by green Africa and VDF | |
| 4.30-5.30pm | Way Forward and Action Planning | All with Panel Discussions | Lorna, Ng'ethe, Yuko, Gichu, Enos Esikuri, Kengen | AG |
| 5.00-5.20pm | Some observations and remarks | World Bank, Kenya Finnish Embassy VDF, GAF | Isaac Kalua | AG |
| 5.20-5.40pm | Closing Remarks | Director of Renewable Energy, MoE | Isaac Kalua | MM |
| 5.40pm | Departure after Vote of thanks Dr. Nyamai. | | | AG |

Appendix B: List of Participants

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