# Perspective of Bioenergy and Jatropha in Uganda

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#### Introduction

Uganda is a land-locked country covering an area of 236,040 square kilometers with estimated population of over 28 million in 2006 at a growth rate of 3% per annum; one of the highest in the world. Over the last 2 decades the country recorded a fairly steady economic growth with GDP real growth rate estimated at average of 6% in the last decade (MFEP, 2006). A growing economy combined with a fast growing population means a growing energy demand. Uganda's energy supply and utilization is dominated by biomass (MEMD, 2006). Access to electricity in Uganda is limited to 9% of the population, the remaining 91% of the population mainly use biomass is form of firewood or charcoal for their energy needs (MEMD, 2007). Uganda has a high potential for hydro-power generation but has installed capacity of only 280MW which in recent years has fallen to less than 150MW leading to unprecedented power shortages. This has forced the country to invest in thermal power plants. By the end of 2008 the electricity generated from thermal plants will exceed 150MW. Use of thermal power plants has increased the country's expenditure on petroleum and has hiked the retail price of electricity. Efforts to develop new hydro-power plants are ongoing but such investments take years to accomplish.

The transport sector in Uganda is totally dependent on imported fossil fuels whose prices have hit all time highs, more than \$100 per barrel of petroleum on the world market and US \$ 1.5 per liter pump price. The fuel bill for a country like Uganda constitutes almost 50% of the budget. The escalating prices of fossil fuels have made it imperative for government to promote the development and utilization of renewable energy resources including bioenergy and their associated technologies.

## **The National Energy Policy**

Uganda's national energy policy promotes accelerated power generation from renewable resources and emphasizes the development/adoption and utilization of other modern fuels and technologies. The government's commitment to develop the use of renewable energy sources is aimed at creating means for socio-economic development especially

transforming rural areas. In implementing the policy the government expects to address poverty issues, catalyse industrialization and protect the environment.

The renewable energy resources that the policy lists are: biomass, geothermal, hydropower, wind and solar energy. It has been noted that biomass is the biggest contributor of the total energy used in Uganda and stands at 91%. Biomass includes firewood, charcoal, shrubs, grasses, forest and agricultural crop waste and agro-industrial residues. Whereas these sources are widely used for energy generation, the processes are often inefficient. Biomass contributes provides almost all the energy needed for cooking in urban and rural house holds and in rural industries. Fuel wood and charcoal requirements have contributed to the degradation of forests as the trees have been harvested at alarming rates to meet the demand. Charcoal consumption over the recent past has been increasing at a rate close to urban growth of 6% per annum.

The government's renewable energy policy recommends blending of diesel with 20% biodiesel. By specifying the maximum proportion of biodiesel blends the governments hopes that investors will be attracted to invest in biodiesel production knowing that there is a market for it. To ensure that the biodiesel is integrated in the agriculture system the government is promoting oil seed production not only to meet the need for feed stock for biodiesel but also for edible vegetable oil production. The bio-diesel will be used for the transport sector and also for rural electrification and farm power production. The expected benefits from the policy include;

- Improved national energy security by using indigenous renewable energy sources instead of imported fossil fuel
- Create employment and income in rural areas
- Promotion of local renewable natural resources
- Reduced emission of carbon dioxide to the atmosphere
- Promotion of a new source of income to farmers
- Support rural electrification strategy
- Promotion of technology transfer

Blending of all diesel used for transport in Uganda with 20% biodiesel would translate into a market potential of 100 million litres of biodiesel in 2008 increasing to approximately 200 million litres in 2012 given the annual average increase in diesel consumption of 17% (obtained from the rate of fuel imports projections).

## Jatropha Farming in Uganda

*Jatropha curcas* L. belongs to the family *Euphorbiaceae*. It is a multi-purpose tree of Mexican and Central American origin with a long history of cultivation in tropical Africa and Asia. Jatropha grows throughout most of the tropics and survives on poor, stony soils while being resistant to drought. The plant requires a minimum of 250 mm rainfall per year but grows best on 900 to 1200 mm. It can easily be propagated from seeds or cuttings. It reaches a height of up to 8 m and is cultivated mainly for the production of seeds which contain 35 - 50 %. Seed yields of 2-5 tons per ha have been routinely achieved. Jatropha starts producing seeds within 12 months but reaches maximum productivity level after 4 to 5 years.

In Uganda Jatropha has been grown mainly as a support tree in small-holder vanilla farms. The variety/cultivar of Jatropha grown locally is not known and therefore there is no information on its seed yield potential. Furthermore, the Jatropha plants that have been observed in Mukono district where most vanilla is grown, show a healthy plant with good foliage cover but with no signs of prolific seed production. This may be because it is grown under shade and for providing support to the vanilla crop. It is therefore important to evaluate the local jatropha germplasm potential as a source of oil.

In the last two years there has been interest in Jatropha as a crop for oil seed production. A number of organic Processors in Mukono District have started buying jatropha seeds from the vanilla growers. The seeds are then used as raw materials for oil extraction and the oil is either converted into biodiesel first or used directly in internal combustion engines. A flower growing company Bas Lankveld based in Mukono District (<u>www.royalvanzanten.com</u>) buy jatropha seeds from farmers and use it as a source of fuel for running their machinery. The company has also established a jatropha farm of 11 ha and would like to expand it to 100 ha.

The Energy Advisory project in the Ministry of Energy and Mineral Development supported by GTZ promotes alternative energy sources at policy level and in the rural areas. The project is piloting the use of jatropha oil in powering and electricity generate in Luwero district. The electricity produced is being used to run a maize mill.

In 2007 GTZ co-sponsored a feasibility study for the establishment of an integrated vegetable oil and biodiesel project in Mid-Western Uganda. The project model is to have an out grower system that produces sunflower for edible oil production and a core farm to produce jatropha. The reasons for this were three fold.

1) The sunflower is an already known crop among the farmers and therefore they would accept it outright.

2) For social and political acceptance of the project it is important to link biodiesel with vegetable oil production. Uganda is a net importer of vegetable oil.

3) The core farm would be a training centre for farmers wishing to grow jatropha.

The feasibility study presents positive economic outcomes of the integrated vegetable oil and biodiesel project showing large and positive IRR. With peak production of biodisel at 2 million liters per annum the challenge will be on how to get it into the main stream distribution system for petroleum diesel in order to reach the consumers.

Other feasibility studies are being carried out by the Ministry of Energy and Mineral Development with the support of USAID and by the Norwegian Afforestation Group NAG.

Interest in jatropha production and processing in Uganda is very high. Mukwano group of companies (<u>www.mukwano.com</u>) the largest importer of vegetable oil runs the largest sunflower out-grower scheme in the Districts of Apac and Lira. Annual production of

sunflower in these two Districts is estimated at more than 10,000 MT contributing more than USD 17 million to the local economy. Mukwano intend to establish a 1000 ha jatropha plantation and build a processing facility for biodiesel.

Jatropha oil has been tested in Tanzania as a substitute for firewood in cooking among rural populations (www.pobec.org). Substitution of firewood by plant oil for household cooking in rural areas will not only alleviate the problems of deforestation but also improve the health of rural women who are subjected to the indoor smoke pollution from cooking by inefficient fuel and stoves in poorly ventilated space. Jatropha oil performs very satisfactorily when burnt using a conventional (paraffin) wick after some simple design changes in the physical configuration of the lamp.

## Barriers to bioenergy development and use

Several barriers stand in the way of bioenergy development and use in Uganda and these are:

- 1. **Prospects for petroleum deposits exploitation:** Petroleum deposits have been discovered in the Western Rift Valley and prospects are high that the quantities so far discovered are adequate for commercial exploitation. It is feared that the government will put more emphasis and give preferential investment incentives in the Petroleum development which will marginalize bioenergy.
- 2. **Inadequate Legal and Institutional Framework:** There is no standard procedure and legal instruments to support investment in bioenergy. Whereas in some countries like India they have created government funded bioenergy units to promote its development, Uganda has not moved an inch in this direction.
- 3. Limited Technical and Institutional Capacity: The public and private sectors have limited technical and institutional capacity to manage bioenergy projects. Training at University needs to proportionately emphasize bioenergy in the engineering and other related professional courses. And to this end it is necessary to initiate masters' degree programmes in engineering and management professions that specialize in bioenergy so as to create a critical mass of skilled personnel in these fields.

- 4. Lack of Financing Mechanisms: All commercial banks in Uganda do not offer products that support long term investments. Long term loans can only be obtained from the East African Development Bank and the African Development Bank. But these banks finance large projects only.
- 5. **Underdeveloped market:** Whereas there is potential for demand of bioenergy products, the market is not yet developed in order to realize actual demand. The public is also unaware of the technologies and the products.
- 6. Lack of Research and Development Support: There is a dearth of budgetary support to higher learning and R&D institutions to carry out adaptive research that can promote the development of bioenergy in Uganda.

## Benefits of developing and deploying biofuels

Interest in bioenergy in Uganda and other countries is driven by a number of factors and events. First is the fact that fossil fuel prices continue to rise and as we talk have gone above the USD 100 per barrel mark. This price increase has taken place over a short span of time and is greater then that experienced during the energy crisis of the 70s. Consequently, expenditure on fuel in many of the developing countries is approximately 50% of all imports. In these circumstances the prospects for development of biofuels development become attractive to many governments as they are likely to decrease on import expenditure, create local employment, attract technology transfer and promote capacity building.

### Conclusions

It is apparent that biofuels are not a panacea to the energy needs of a country, but if developed in such a manner that they get integrated in the social and economic development of many developing countries they offer a stepping stone for economic development. This opportunity is a reversal of the old economic models that relegated developing countries to producing raw materials for export. First, the technologies used in first generation biofuels manufacture are not patented and can be deployed by anywhere and secondly farmers can grow the energy crops. More importantly one of the target energy crops, Jatropha can be grown on marginal soils without competing for land

meant for food crops. With the expanded demand for biofuels in industrialized countries it has meant that excess harvests that for year were responsible for depressed market prices are no longer available. This is the first time since the 70s that commodity prices have gone up and this offers a window of opportunity to farmers in developing countries for increased production of almost all agricultural crops. Increased production and better prices for most commodities means overcoming poverty: thus biofuels are a means of overcoming poverty.

## References

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