Policy Brief on the Opportunities for Biofuels using Root and Tuber Crops in ACP Countries

Executive summary

Biofuels are likely to be of some assistance in supplementing the energy requirements in African, Caribbean and Pacific (ACP) countries, as environmental concerns due to the depletion of fossil fuels, increasing costs of oil production and retail prices at the pump are on the increase. The total reliance on fossil fuels provides an opportunity in ACP countries to produce ethanol from tropical root crops (TRC). It is recommended that governments of the ACP countries give careful consideration to the opportunities tropical root crops can provide for biofuel production; without losing the objective of meeting food needs of people. Furthermore, for ACP countries that are considering biofuel production from root crops, may need to consider current and potential incentives that will stimulate the production both of food and biofuel in the three regions.

Context

Biofuel produced from agricultural crops first emerged in the 1970s and has today assumed a prominent position on the global energy agenda, largely due to its potential to address the pressing issue of fossil fuel substitution and as a potential solution to reducing global warming (Oleh, 2005). Biofuels are fuels from plant origin and they are renewable. They are divided into two categories: bioethanol and biodiesel. Bioethanol can be produced from sugar, starch, cellulose materials (for example, sugarcane, cassava) while biodiesel can be produced from palm oil, soy oil, rapeseed oil, Jathropha oil, waste oil from restaurants and food processors and even from algae. Biofuels have been identified as having the greatest potential to meet global demands for a substitute to fossil fuels, particularly for transport, in response to these demands, global biofuel production tripled between 2000 and 2007.

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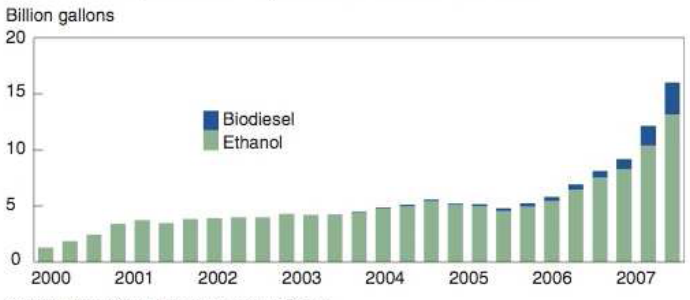

Source: International Energy Agency; FO Licht.

US gallons

Claimed advantages of biofuels over other renewable (wind, solar etc.) are:

a. Both Biodiesel and Bioethanol have the potential to reduce greenhouse gases.

b. Improve energy security.

c. Not intermittent, as when the wind blows and when the sun shines (but this may alter with climate change).

d. Generate additional revenue for farmers, investors, governments and the public at large.

Although, the availability of adequate food supplies could be threatened by biofuel production to the extent that land, water and other productive resources are diverted away from food (UN-Energy 2007), the emerging opportunities for biofuel production in ACP could potentially be an avenue for mitigating chronic food security (FAO, 2007) through increased incomes and foreign exchange. In 2006, global fuel ethanol reached 13.2 billion US gallons. The United States' fuel ethanol industry alone produced 4.86 billion gallons while Brazil produced 4.5 billion gallons. Together, the USA and Brazil produced 70% of the world's fuel ethanol (www.biofuelsbusiness.com April 2007). The production and use of biofuels in ACP states is limited and mainly from sugar cane.

The Kyoto Protocol and Convention on Climate Change Protection has placed increasing pressure on world ethanol production. Demand for ethanol has increased dramatically around the world over the last few years and the market analysts believe the high growth rate will continue over the coming years (see grash overleaf). It is not only the traditional consumers such as Brazil and the USA that have increased their consumption, but other countries (such as the EU, India, Thailand, China, Australia, Canada, Central America, Peru, Columbia) are adopting the use of ethanol for blending with gasoline. Some countries already have ethanol-gasoline blending programmes and the majority of these are ethanol importers.

ACP countries have looked for alternatives to fossil fuels as the cost of obtaining them has increased. Population growth has intensified transportation needs and industrial activity, creating an increased demand for refined oil. In order to meet fuel demands, ACP governments rely mainly on importation of fuel and provide high levels of subsidy. Biofuel from TRC offers a potential alternative and opportunity although these opportunities are more realistic in the case of Africa than the Caribbean and Pacific**.** TRC, such as cassava, are utilised by Brazil, Thailand and Indonesia due to land availability, mechanisation and policy support. However, a potential issue is impact on food prices, and competition for land for food production.

Table 1: Market Demand for Ethanol in Nigeria

Ethanol Markets in Nigeria	**Annual Market Demand**
Gasoline (E10 Blend)	1.30 Billion Litres
Paraffin (Replacement with Ethanol-Based cooking Fuel)	3.75 Billion litres
Raw material for portable ethanol (re-distillation market)	0.12 Billion litres
Total market size	5.22 Billion litres

Market value: US$3.08 Billion. Annual projected growth rate: 5%. Source: B. S. Anga (2009).

In Nigeria demand for ethanol is growing.Most of the ethanol consumed is imported (more than 80 million litres per year). The Nigerian Government indicated its intention to start implementating the E10 policy on ethanol in 2007, developing ethanol production from cassava and sugarcane. Nigeria's current annual demand for the industrial, pharmaceutical and beverage industries is estimated at 160 million litres, a figure expected to rise exponentially to 900 million litres once the E10 policy on ethanol in fuel is fully implemented (UNIDO, 2006). The Nigerian National Petroleum Commission has a mandate to source farm land, private investors and to work with research institutions that will drive the E10 policy.

Some ACP countries have initiated policies on biofuels. South Africa is understood to have carried out research and produced ethanol-driven vehicles and these still remain in the strategic arsenal of the country and have not been disseminated as the current situation favours fossil fuel driven cars. Malawi has implemented at least 10% ethanol blending and the Zambian National Energy Policy of 2008 selected cassava as one of the crops that will provide biofuels in Zambia's energy mix (Ministry of Agriculture, Zambia, 2010). This is a recognition of biofuels as a viable option of meeting some of the country's energy needs. However, the constraints on the cassava supply chain, where this occurs, needs to be resolved for this to happen. A national strategy on cassava was therefore launched in July 2010 to spearhead the cassava value chain operationalization. In this regard, cassava as an energy crop is scheduled to be boosted by this strategy developed with the participation of both government and the private sector. The development of the strategy was supported by the European Union as an all-ACP Agriculture Commodities Programme.

Roots crops such as cassava stand as one of the richest fermentable substances for the production of crude alcohol/ethanol, with dry chips containing up to 80% of fermentable substances (starch and sugars).Crop yields and potential alcohol production of

the highest-yielding cultivars of several carbohydrate producing crops showed that sweet potatoes produced 40% more alcohol per unit area than Jerusalem artichoke and two to four times as much as the other carbohydrate crops. Potatoes are somewhat lower in total carbohydrates than sweet potatoes; thus, alcohol yields would be less even if total yields were similar. The technology for making alcohol from potatoes is well developed and this crop is worthy of consideration in areas where high yields are possible.

The principal argument driving the food and biofuel production is the assertion that biofuel production is impacting negatively on the availability of food. This, it is argued, is occurring in several ways. Firstly, feedstock that would otherwise be used for human consumption are being diverted for processing into biofuel for transportation i.e. there is less total food available for people to eat. Second, demand for biofuel has increased competition for land and water resources which would otherwise be used for cultivating edible crop. Third, increased biofuel production will lead to higher food prices, meaning less people are able to afford to buy food supplies. These have been contradicted in many instances. Speaking at UN Food and Agriculture Organization (FAO), conference in April 2008, Brazil president Luiz Inacio Lula da Silva proclaimed that biofuel provides an opportunity for countries to attain energy security without threatening access and availability of food. The International Food Policy Research Institute reports that farmers in Brazil have established a system of rotation between sugar cane and food crops that maintains soil fertility and a year-round balance between food and energy levels (Moreira 2006). Attention should be directed toward cultivation of crops for non-food use which do not displace existing food production destined for domestic consumption since, in some cases, cultivating non-food products may provide a higher value added, a higher profit and higher income. Food insecurity and poverty problems do not essentially rely on the incapability of individual to produce foods by themselves, but depend on individual's ability to access foods with their income.

There are few economic opportunities for bio-fuel production using TRC in the Caribbean and South Pacific (Anon 2009). Production of ethanol from cassava Fiji was tested in 1977 (Chandra 2010). Whilst it was demonstrated that ethanol could be produced on an experimental scale, the possibility of commercial production at that time was uneconomical. Production of bio-fuels from TRC in the South Pacific is considered by many to be unwise whilst there is widespread poverty and malnutrition. The priority for government policy should be on feeding its people through TRC (Chandra, *op.cit.*).The situation in the Caribbean is more or less similar to that in the Pacific.

According to Prakash (2005), cassava utilization as an industrial input, notably ethanol will depend on its availability and price competitiveness with alternative products such as maize. Such competition is anticipated to grow in the medium term, which would put increasing pressure on cassava producers and processors to lower costs of production if they wish to expand their current shares in domestic and international markets. China, however, has recently demonstrated the viability of cassava based ethanol production, by making large-scale investments in the country's production sector as well as being prepared to source cassava from international markets. In addition, the prospect of biofuel programmes in many countries around the globe could lead to a significant growth potential for cassava, especially when such programmes are based on mandated demand, which in turn could provide cassava inflows with favourable market access.

Conclusion

It is likely that fuel production from agricultural crops may augment conventional fuel production and utilization practices in many regions, if the supply or price of conventional fuels rises. Ethanol and biodiesel

appears to have considerable potential to be used as substitution of gasoline and diesel fuel. A number of key factors will influence the demand of biofuel, including potential performance of the bio-products, their sustainability, 'cost of use', politics, consumerism, the green movement and global climate change. Biofuel has some advantages over conventional petroleum oil, i.e. more sustainable, renewable, non-toxic and is biodegradable.

Policy Recommendations

1. Careful consideration should be given to the opportunities of root and tuber crops for biofuel production without losing the objective of meeting food security needs of people in ACP countries.

2. For ACP countries that are considering biofuel production from root crops, they may need to consider incentives that will stimulate both the production for food and for use of fuel ethanol in the various regions.

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