Large-scale Biofuels Programmes in Africa – Who Benefits?

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The tremendous interest in biofuels that we see in the world today is the result of concerns of governments in North and South about energy security, oil prices and climate change. Biofuels are seen by many as an obvious part of the solution for all three concerns. It is in the transport sector where biofuels are mainly used and where they are thought to offer potential as a greener and cheaper substitute for fossil fuels. This has led to government policies and mandates for the use of biofuel as a transport fuel. For developing country governments there are the additional attractions of foreign investment, revenue from export earnings, and a contribution to economic development generally.

The initial excitement around biofuels, as an easy answer to energy and climate change problems, is now being tempered by experience, greater knowledge of what we're dealing with and the practicalities of delivering energy services. We now know that the promise of greenhouse gas reductions is not as sure was first thought; we know the effects biofuels can have on food prices; and we know that massive expansion of biofuel production will affect agriculture, land use, and of course people living in poverty in developing countries.

The potential and the effects of biofuel production are current, live debates. The dynamic of these debates is changing all the time as new information is introduced and as the interests of different stakeholders are brought into play. However, a number of key issues can be clearly identified: the contribution of biofuels to emission savings; effects on food security; questions of land use; effects on biodiversity and environmental degradation; and of course, the role of biofuels production and consumption in human development and poverty reduction.

This paper touches on each of these key issues, considers very briefly the small-scale options, and concludes with key policy issues for civil society and others to consider. But first, we need to be clear about what we mean by the term 'biofuel'.

Bioenergy – all energy sourced from some form of biomass – is the principal source of energy in Africa; and the biomass used in Africa is mostly firewood. Other solid sources of biomass energy – charcoal, agricultural residues, animal dung – are also used, mainly for thermal energy, i.e. heat. The term 'biofuels' is widely used, and is used here, to refer to liquid biofuels, produced particularly as a fuel for transport.

There are three types of liquid biofuel, which can be produced from crops grown for the purpose: *bioethanol*, an alcohol derived from sugar or starch crops – in Africa usually sugarcane; *biodiesel*, derived from vegetable oil – in Africa, at present, palm oil and

jatropha; and, *(vegetable) oils* made by compressing seeds can themselves be used to provide energy services.

Some people refer to these as 'agrofuels', to reflect their industrial agricultural origins and the associated political economy of their production. For the remainder of this paper the term 'biofuels' is used.

A fourth category of biofuels needs also to be mentioned, namely what have become known as '2nd generation biofuels'. (IEA, 2008) These are cellulosic ethanols produced from lignocellulosic biomass, i.e. woody plant materials. These 2nd generation biofuels have only just started to be produced on any scale, with output during 2008 in the USA and Europe totalling 12 million litres and 10 million litres respectively. (REN21, 2009) There is uncertainty about their emission savings potential, some arguing that they would in fact contribute to global warming. There are also questions about their efficiency as an energy source because of the energy required to refine the solid plant material into liquid fuel. (Biofuelwatch et al., 2007) The discussion below considers only first generation biofuels.

Biofuels in Africa

World fuel ethanol production in 2008 increased by 34 per cent to 67 billion litres. This has more than doubled since 2004; and over 90 per cent comes from just two producer countries, USA 34 billion litres and Brazil 27 billion litres. (REN21, 2009) (See Figure 1 and Table 1.)

Biodiesel production totalled 12 billion litres in 2008; a sixfold increase since 2004. Two-thirds of world production is in the EU, where the main feedstock is rapeseed. (REN21, 2009)

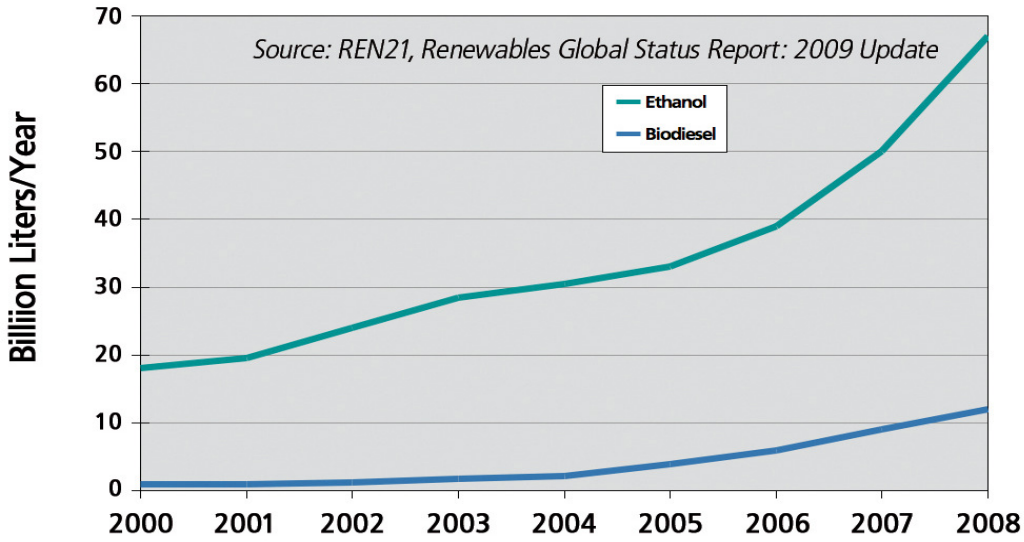


Figure 1: World Ethanol and Biodiesel Production 2000-2008

Table 1: Top Biofuel Producing Countries 2008

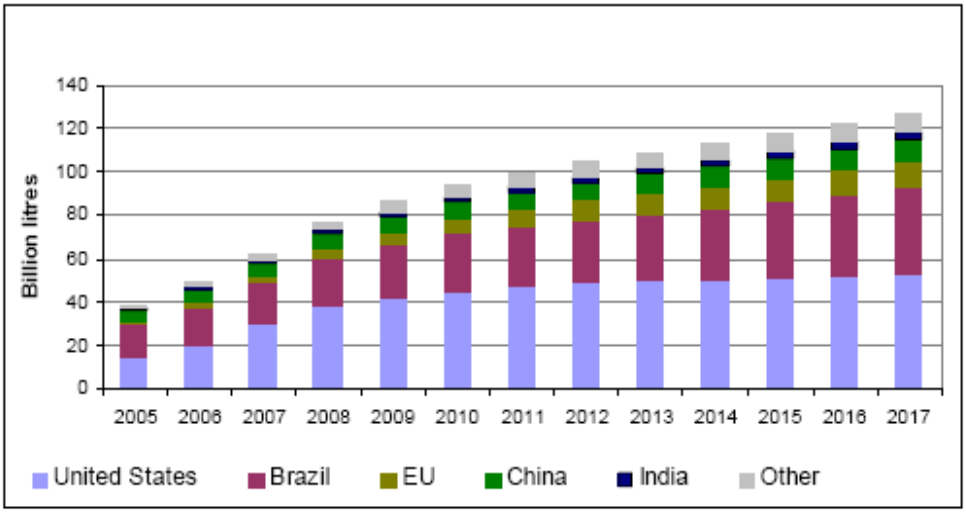
Country	Fuel ethanol	Biodiesel
	billion liters	
1. United States	34	2.0
2. Brazil	27	1.2
3. France	1.2	1.6
4. Germany	0.5	2.2
5. China	1.9	0.1
6. Argentina	–	1.2
7. Canada	0.9	0.1
8. Spain	0.40	0.3
9. Thailand	0.3	0.4
10. Colombia	0.3	0.2
11. Italy	0.13	0.3
12. India	0.3	0.02
13. Sweden	0.14	0.1
14. Poland	0.12	0.1
15. United Kingdom	–	0.2
EU Total	**2.8**	**8**
World Total	**67**	**12**

Source: REN21, Renewables Global Status Report: 2009 Update

Projections of future demand for biofuels are based on projections for petroleum fuel demand, mainly in the transport sector, and on assumptions about statutory mandates for biofuels. A 10 per cent rate of substitution for petroleum by biofuels is generally assumed.

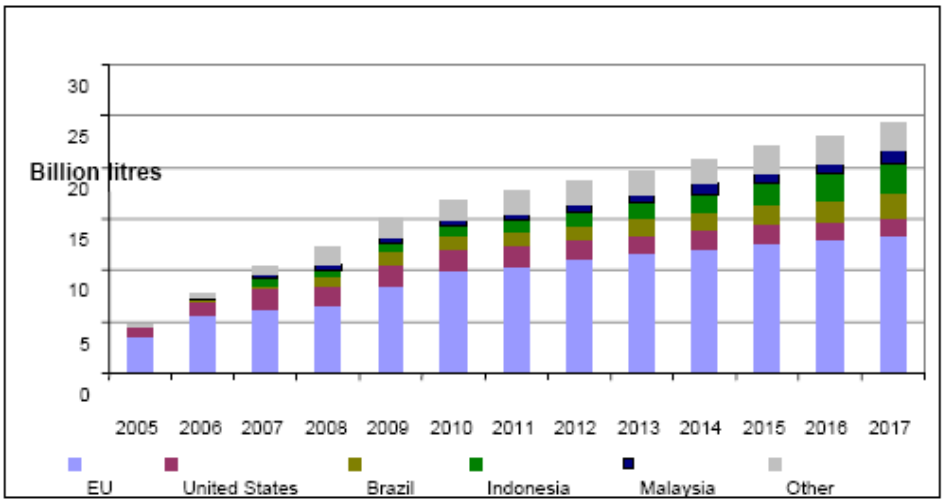
Global ethanol production is anticipated to increase rapidly and reach about 125 billion litres in 2017 – a doubling in less than ten years (see Figure 2). Global biodiesel production could also double to reach almost 25 billion litres by 2017 (see Figure 3).

Figure 2: Major ethanol producers with projections to 2017



Source: FAO, 2009

Figure 3: Major biodiesel producers, with projections to 2017

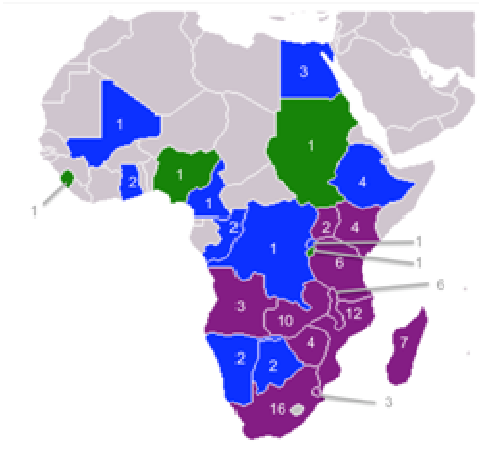


Source: FAO, 2009

When it comes to biofuel production, many developing countries have potential advantages over industrialised countries because biomass yields are higher, as result of agro-climatic differences, and production costs lower. A wider range of biofuel feedstocks can also be grown in tropical countries.

Brazil is currently the largest developing country producer, having heavily promoted the production and use of ethanol since the 1970s. In Africa, ethanol has also been produced in Malawi since the 1970s, but at a much smaller scale. Ethanol is currently produced in several other African countries (see map), mostly from sugarcane. However, total ethanol production in Africa amounted to less than 500 million litres in 2006. Most was produced in South Africa, but mainly for industrial purposes rather than vehicle fuel.

Map of Biofuel Projects



Source: PANGEA

A study by UK and Brazil estimated potential in South Africa for 7.3 billion litres, which would entail doubling the area under sugar to 1.5 million hectares (REEEP, 2007); while Karakezi (2008) estimated potential in East Africa at 1.3 billion litres based on 2002 cane production figures.

But it is biodiesel production which is the cause for much of the recent interest in biofuels in Africa, though commercial production is really quite new. Palm oil is the main feedstock for biodiesel in other developing countries, and is found in some places in Africa. A variety of other plants are used on a small scale, including for example native species such as the croton tree[1], but the greatest attention is being given to jatropha.

In parts of West Africa, the growing of jatropha and the use of its oil have a long history. Until very recently production has been entirely at a small, village-scale, but large-scale projects are now being developed in Ghana, Nigeria and Cameroon. In East and Southern Africa jatropha projects can be found in Ethiopia, Tanzania, Madagascar, Mozambique and Zambia. A market study at the beginning of 2008 identified 97 jatropha projects, with 119,000 hectares under cultivation, and plans for 2 million hectares by 2015. (GEXSI, 2008)

South Africa, on the other hand, has designated jatropha an invasive species and prohibits its cultivation. Indeed, the great potential that has been seen in jatropha as the ideal feedstock for conditions in Sub-Saharan Africa, is based on little empirical evidence. Further research will be necessary to determine jatropha's potential in terms of oil yields, including input requirements (water, fertilizer soils).

Biomass will continue to be an important source of energy for most Africans for some time to come. For transport within Africa there will clearly be some demand for domestically produced biofuel, and there may other uses (e.g. cooking, agro-processing) where demand in Africa will increase. However, investment plans and existing projects are geared towards an export market and the much greater demand for biofuels in Europe and North America. The interest in expanding biofuels production in Africa is not based on meeting the energy needs of Africans, but rather is derived from concerns about meeting the energy demand and mitigation commitments of industrialised countries. Though biofuel production in the whole of Africa is negligible in global terms today, it is set to grow, and it is the implications of future biofuel production that we need to consider.

Emission savings

The EU's stated reason for increasing biofuel use is to reduce greenhouse gas emissions, just as this has been one of the principal justifications for investment in biofuels in developing countries. At first sight, the massive use of biofuels seems to offer a way to reduce carbon dioxide emissions and provide a means to shift from fossil to

[1] *Croton megalocarpus* grows in semi-arid areas. Africa Biofuel and Emission Reduction (Tanzania) Ltd. estimates biofuel production at 103 million litres annually (http://www.africabiofuel.com/).

renewable sources of energy. Industrialised countries are already taking steps to increase the share and production of biofuels to meet their energy demands, and developing countries are beginning to follow their lead. But the certainty of lower greenhouse gas emissions from biofuels is questionable.

When considering the emission savings we need to look beyond the simple combustion of the fuel and take account of the life-cycle of biofuels. The actual carbon savings from biofuels vary considerably and depend on the type of feedstock, agricultural practices, the production chain, and the effects of land use change. There is now research evidence that emissions from deforestation, peat drainage and burning, soil carbon losses and nitrous oxide emissions, from growing biofuels will outweigh any emission savings from reduced fossil fuel consumption. (Biofuelwatch et al., 2007) With regard to jatropha, one recent study concluded that the carbon condition of soils appears to be more significant for the emissions balance than biomass and that whether net emissions reductions are achieved depends on the level of degradation of the ecosystem and alternative land uses. (Romijn, 2009)

If biofuels are not going to reduce greenhouse gas emissions by as much as was first thought, the climate change mitigation rationale for their promotion is much diluted. There may also be implications for the potential of the carbon market to provide the financing necessary for the initial investments. A number of biofuel projects have been predicated on carbon finance being available, and their viability may now be in question.

Finally, we should note that investment in biofuels is a relatively expensive way to reduce global greenhouse gas emissions from transport. Other measures may be more cost-effective, but call for action by the governments of industrialised countries, such as the use of electric vehicles.

Biodiversity and environmental degradation

If biofuel production has such an uncertain impact on the atmosphere, what other environmental factors are there?

It is well known that introducing intensive agricultural production of any kind can threaten biodiversity, carbon stocks, and land and water resources (von Braun, 2009). These impacts have all been identified with biofuel production – whether on wetlands, semi-arid lands or farm land. Large-scale biofuel plantations, as with plantations of other crops, may be associated with increased soil and water pollution (from fertilizers and pesticides), soil erosion and water run-off. (UNEP, 2007; Rossi and Lambrou, 2008)

Large-scale agricultural production is associated in particular with monoculture and the loss of biodiversity. Even on land which has low agricultural potential, the introduction of a monoculture could reduce biodiversity. (UNEP, 2007; Rossi and Lambrou, 2008)

The prospect of industrial, monocrop agriculture nowadays also raises the prospect of genetically modified (GM) crops. In the USA where maize is being grown to produce

ethanol and the residue is used for animal feed, GM maize (and soya, and rapeseed) is widely produced for animal feed. Agribusiness corporations involved in GM seed production are now working to modify maize for ethanol and animal feed co-production. (Biofuelwatch et al., 2007) GM is also being researched for second generation biofuels, to reduce the difficulties of transforming solid biomass into liquid biofuel. The interests of agribusiness and energy corporations thus begin to combine, and with the protection of IPRs could lead to even greater corporate concentration.

Land

The rapid growth in demand for biofuels of the last few years has given rise to concerns about competition between land for production of biofuels and land for food production. In the words of FAO, "Climate change and expanding biofuel production is likely to lead to greater competition for access to land. For the millions of farmers, pastoralists, fisherfolk and forest dwellers with no formal land tenure rights, this increased competition poses a tremendous threat to their livelihoods." (FAO, 2008a)

The amount of land needed for biofuel production of course depends on the feedstock and on assumptions made about demand itself. FAO estimates that the amount of land that would be used for biofuel production – at present about 1 per cent of the world's arable land – could increase up to 3 per cent by 2030 and as much as 20 per cent by 2050. (Raswant et al., 2008) *World Energy Outlook 2006* estimated the area of cropland devoted to biofuels would increase to 2-3.5 percent by 2030 (when using current technologies). (IEA, 2006)

Table 2: Land requirements for biofuel production

	2004[1]		2030 Reference scenario[2]		2030 Alternative policy scenario[3]		2030 Second-generation biofuels case[4]	
	million ha	% arable	million ha	% arable	million ha	% arable	million ha	% arable
United States and Canada	8.4	1.9	12.0	5.4	20.4	9.2	22.6	10.2
European Union	2.6	1.2	12.6	11.6	15.7	14.5	17.1	15.7
OECD Pacific	neg.	neg.	0.3	0.7	1.0	2.1	1.0	2.0
Transition economies	neg.	neg.	0.1	0.1	0.2	0.1	0.2	0.1
Developing Asia	neg.	neg.	5.0	1.2	10.2	2.5	11.5	2.8
Latin America	2.7	0.9	3.5	2.4	4.3	2.9	5.0	3.4
Africa and Middle East	neg.	neg.	0.8	0.3	0.9	0.3	1.1	0.4
World	**13.8**	**1.0**	**34.5**	**2.5**	**52.8**	**3.8**	**58.5**	**4.2**

Source: FAO, 2008a

Estimates of the land required for biofuels vary enormously – from one or two per cent of arable land worldwide, to over one third. Estimates also vary between the different categories of land taken into account (i.e. total area, arable area, all agricultural, etc.).

Though the future land requirements for biofuel production are uncertain, what is certain is the acquisition of land in African countries for agricultural production, for both food and biofuel crops. This 'land grab' has attracted a lot of media attention and been the subject of briefings by the likes of FAO, IFPRI and GTZ. But what is the reality? How serious is the threat to land access for poor farmers? How much is due to biofuels and how much to food?

By one account foreign investors have their eye on 11 million hectares in Mozambique (one seventh the country), and 24 million hectares in Ethiopia. A recent study estimated the land already allocated in the latter at 620,760 hectares, and the total in five countries (Mali, Ghana, Sudan, Ethiopia and Madagascar) at 2.5 million hectares (Cotula et al, 2009).

Not all of this is for biofuels. Nevertheless the amount of land being allocated, or considered for allocation, for the growing of biofuel feedstock in Sub-Saharan Africa is significant. A tabulation by IFPRI included projects totalling 5.5 million hectares for biofuels, though this is dominated by two schemes for China (see Table 3). (von Braun, 2009) According to the Biofuel Association of Zambia, projections for set targets add up to 184,420 hectares devoted to biofuels by 2015 (Biofuelwatch et al., 2007); and as has already been mentioned a review of jatropha projects estimated 2 million hectares by 2015 (see Table 4). (GEXSI, 2008)

Table 3: Land allocations for biofuels in Africa

Country	Investor	Area and crop
DRC	China	2.8 million ha.
Zambia	China	2 million ha. - jatropha
Ethiopia	Flora EcoPower (Germany)	13,000 ha.
Ethiopia	Sun Biofuels (UK)	Jatropha
Mozambique	Sun Biofuels (UK)	100,000 ha.
Mozambique	Sekab (Sweden)	
Tanzania	Sun Biofuels (UK)	5,500 ha. jatropha
Tanzania	CAMS Group (UK)	45,000 ha. sweet sorghum
Tanzania	Prokon (Germany)	494,000 ha.
Tanzania	Sekab	9,000 ha. sugar
Tanzania	Sekab	22,000 ha.
Ghana	Biofuel Africa (Norway)	38,000 ha.

Source: von Braun, 2009

It is in fact hard to get a comprehensive and accurate picture of how much land is being acquired specifically for biofuel production. There is a lack of transparency and information about land deals, compounded by the difference between actual and planned acquisitions, and between planned acquisitions backed with investment

financing and more speculative plans. However, if all of the plans identified to date are put into effect, the land under biofuels will exceed the FAO/IEA estimates.

Even though the aggregate picture of land devoted to biofuel is uncertain, for those living in locations affected by individual biofuel projects there are real concerns about their impact on those who depend on the land acquired for their livelihoods.

Table 4: Land allocations for jatropha production in Africa

	2008 (ha.)	2015 (ha.)	Private %	Plantation %	Mixed %	Outgrower %
Ghana	2000	600000	67	33	33	33
Cameroon	1000	13500	100		100	
Zambia	35200	134000	100	0	57	43
Ethiopia	200	125000				
Tanzania	17600	166000	80	56	22	
Malawi	4500	226000				
Madagascar	35700	500000	85	23	15	62
Mozambique	7900	170000	74	50	38	12
Mali	1800	23000	100	33	33	33
Kenya	4400	152600	75	29	42	

Source: GEXSI, 2008

One of the attractions of Africa for the biofuels industry is the perception that there are vast areas of unused or underutilised land, which can be readily given over to grow biofuel feedstocks. One private investor, for example, is quoted as saying “Africa has most of the underutilised fertile land in the world.” (Cotula et al., 2009) Much of this so-called unused land is marginal for other forms of agricultural production, and therefore its use for biofuels (e.g. jatropha) would not give rise to the displacement of food crops.

What might appear unused or underutilised land to some may be significance to the livelihood of someone else. Though land allocations by the national investment promotion agency in Ethiopia are designated ‘wastelands’ with no existing users, a recent study by found that in two regions the land allocated was being used for shifting cultivation and dry-season grazing. Similarly, there is evidence that land allocated in Tanzania and Mozambique had pre-existing users. (Cotula et al., 2009)

Just because a crop cannot be seen being cultivated on it, does not make land underutilised. In parts of Southern Africa, for example, communally-held land was often left fallow for several years, where chemical fertilisers are not used, to allow soils to recover fertility. This did not mean that the land is underutilised; indeed it means it is being used sustainably. (Gaia Foundation et al., 2008)

Even if marginal land is suitable for jatropha, or other feedstock crops, this would not prevent more fertile land being used. In one Zambian project there is an expectation that prime, arable land will be used to grow jatropha. (ABN, 2007) There is evidence

that land quality and water availability are important factors in yield for jatropha, despite its reputation for being suitable for dry and marginal areas. One study suggests that optimal oil production from jatropha requires significant annual rainfall of up to 1000-1500 mm/hectare – amounts that fall well outside what is usually considered "marginal land." (Gaia Foundation et al., 2008)

In many cases land held under communal tenure is being leased by governments for commercial biofuel production. In Zambia, for instance, the Lands Act (1995) provides for the conversion of customary tenure to leasehold, while in Tanzania land has been awarded under 99-year leases. (ABN, 2007) Traditional land tenure systems found in much of Sub-Saharan Africa often make rights to use land for grazing, firewood collection, or wild fruit gathering officially unrecognised and therefore ineligible for compensation.

Large scale biofuel production would displace rural people from the land taken over, whether it used for cultivation, grazing or gathering. Plantations, of the sizes being envisaged, would certainly displace people, and examples of displacement due to biofuels and inadequate compensation can already be found (e.g. in Tanzania (ABN, 2007)). There are also instances of land being allocated to commercial producers without proper consultation and in at least one case without the traditional land authority understanding what was being proposed. (Rughani, 2009; Knaup, 2008)

A recent review of land acquisition experience in five countries concluded that

> "Many countries do not have in place legal or procedural mechanisms to protect local rights and take account of local interests, livelihoods and welfare. Even in the minority of countries where legal requirements for community consultation are in place, processes to negotiate land access with communities remain unsatisfactory. Lack of transparency and of checks and balances in contract negotiations creates a breeding ground for corruption and deals that do not maximise the public interest. **I**nsecure use rights on state-owned land, inaccessible registration procedures, vaguely defined productive use requirements, legislative gaps, and compensation limited to loss of improvements like crops and trees (thus excluding loss of land) all undermine the position of local people." (Cotula et al, 2009)

Food security

Biofuel production affects food security, at national and household levels, mainly through its impact on food prices and incomes. (FAO, 2008b; IEA, 2008) The food and livelihood security of farmers displaced by biofuel plantations will be affected, while those encouraged to grow feedstock on their own land instead of food crops, may be at greater risk of food insecurity. On the other hand, it has also been argued that biofuels production will have a positive effect on the rural economy and food security, by enabling more people to have sufficient income to be food secure.

Certainly biofuel production globally has pushed up the prices of some food crops, and may do so again. A significant part of the dramatic food price rises in 2008 has been attributed to biofuel production from food crops. (FAO, 2008b) The International Food Policy Research Institute (IFPRI) projects maize prices to rise 20 per cent by 2010 and

41 per cent by 2020, and larger increases for oilseeds (26 per cent by 2010, and 76 per cent by 2020). FAO projects a 15 per cent increase in the price of coarse grains by 2016. (Raswant et al., 2008) However, it is biofuel production outside Africa that will contribute to this effect. Within Africa, the feedstocks for ethanol are sugar and sweet sorghum, which though food crops are not staples. For biodiesel, palm oil has some food use, but jatropha none at all.

The prices of staple foodstuffs for consumers in Africa are thus more likely to be affected by biofuels production in the USA than in Africa itself – provided the cultivation of biofuel feedstock does not use significant quantities of good quality land. There may be medium to longer term impacts on food prices through land prices, water prices, etc. but these are hard to predict.

Human development

The arguments put forward in support of investment in biofuel production include the contribution it will make to rural economic growth, employment and incomes and poverty reduction. (Raswant et al., 2008) One advocate, for example, illustrated the potential impact of biofuels in Zambia by describing a hypothetical 200 megaliter (ML) bio-refinery producing ethanol from sugarcane grown on 50,000 ha. by small-scale farmers on 10 ha. plots. He predicted an annual family income over US$10,000 from this, in a country where per capita incomes are under US$1,000. (Mathews, 2008)

In some cases the arguments are couched in terms of benefits to national economies – export earnings, reduced import costs, tax revenues, foreign investment and so on. In others the argument is about gains for wider rural development, from earnings in biofuel production and investment in associated infrastructure and services. Does the reality live up to this? So what is the evidence that large-scale biofuel production will contribute to poverty reduction?

There is remarkably little information available on actual incomes and employment in biofuels production, perhaps because it is relatively new and as yet limited in scale. Similarly, in terms of future potential incomes and employment there is little information available, certainly in comparison with what has been said about the likely environmental effects.

We have already seen that the nature of the feedstock determines the GHG emission savings and environmental impact. So, too does it affect the employment created – different kinds of fuel require different cultivation and different processing; bioethanol is different from biodiesel, sugar is different from jatropha. A further factor influencing income and employment potential is the model of production, whether the crop is grown in plantation or outgrower schemes.

One estimate that is available is that biofuel production will create 1.1 million jobs in Sub-Saharan Africa. (S. De Keiser and H. Hongo, 2005). (Raswant et al., 2008) Put another way, this amounts to the equivalent of one job per hectare. The most detailed assessment of employment potential has been for South Africa, where a possible 350,000 jobs in biofuels production has been estimated (62,000 in ethanol and 288,000 in biodiesel), with a further 350,000 jobs created indirectly. (Austin, 2005) The same study notes that biofuel production is more labour intensive per unit of energy than other sources of energy.

The direct jobs created would be in growing feedstock and its processing, possibly also in fuel distribution. Indirect jobs would be in the provision of goods and services to producers, whether at farm or processing stage. However, it is hard to see what the basis for these estimates is. They appear to be theoretical calculations, if not back of the envelope calculations, and therefore it is hard to say with any confidence what the reality will be.

If there are few reliable estimates to draw from as regards income and employment, what can be said about the rural development effects of biofuels more generally? Here, we need to distinguish between plantation and outgrower schemes, but we can also learn from past experience with other cash crops and from the experience of schemes across the world.

Outside Africa, "the cultivation of biofuel feedstocks such as sugarcane and palm oil has been linked, in several developing countries, to unfair conditions of employment, health and safety risks, child labour and forced labour." (Rossi and Lambrou, 2008) Plantations generally have a reputation for being exploitative of labour, offering poor working conditions, and insecure (often seasonal) employment. For marginal farmers in much of Sub-Saharan Africa such employment opportunities may still be perceived as relatively attractive.

Large-scale biofuel production can also offer opportunities for small-scale farmers through outgrower schemes, and most of the jatropha projects identified by GEXSI are for mixed plantation and outgrower schemes. It is not unknown for some cash crops to be grown in this way in Africa, for example, tea in Kenya. Feedstock for biodiesel lends itself more readily to small-scale farming and outgrower schemes than ethanol because for the latter it is important to process the crop soon after harvest.

Many of the projects in Zambia are based on outgrowers, with the biofuel company providing seedlings and other inputs. The farmers retain their land, but are obliged to grow only jatropha, and the crop must be sold to the company. In other schemes the biofuel company provides a loan to the farmer to buy essential inputs, and it has been known for the company also to levy charges for extension services, and scheme membership fees. Outgrowers' families may not be permitted to sell jatropha to others, and they will be required to replace trees that die from their own resources. (ABN, 2007)

The Zambian Commission Catholic Justice and Peace concluded that "for the majority of the farmers involved in growing tobacco and cotton, the out grower scheme programme has perpetuated poverty and in some cases even increased the poverty situation." (ABN, 2007) The concern now is that jatropha will not be any different.

> *"This jatropha reminds me of cotton. Many years ago when Dunavant came here, they promised that if we grew cotton, we would be paid lots of money. We stopped growing our maize to make more money from cotton. But when the time to sell it came we were paid very little. We went hungry because we had neglected growing our traditional crop maize."*
>
> Josam Ndaabona, Small Scale Farmer, Choma. (quoted by in ABN, 2007)

When considering initiatives concerned with agriculture in Africa, where most of the work in small-scale crop cultivation is done by women, and initiatives concerned with energy

in Africa, where the largest use of energy is for cooking, we must be alive to the potential for gender differences. The nature and significance of the impacts of the introduction of biofuels production upon women and men will depend on the technology and specific context. Men and women could be affected differently in terms of their access to land, their access to employment and income earning opportunities and their involvement in decision-making processes. (Rossi and Lambrou, 2008)

In particular, the so-called marginal or underutilised land that biofuels investors are interested in is important to women. If the introduction of biofuels affects access to water and firewood, for instance, the burden would be on women to find alternative supplies. So-called unutilised land can provide key subsistence functions, and their removal could have a negative impact on women's ability to meet household obligations, including traditional food provision and food security. (Rossi and Lambrou, 2008)

Small-scale options

Small-scale, village-level biofuel production is also being developed in Sub-Saharan Africa. The difference is that such projects are driven by an intention to benefit small-scale farmers and their families, rather than by macro-economic or commercial profit considerations. Pilot and experimental projects, mainly by NGOs, can be found in several countries, showing potential to increase access to energy access for the poor, and even provide sources of income for rural households, especially women.

Biofuel is not a new source of energy in Africa. Jatropha, for example, has been used in parts of West Africa for nearly two hundred years and has been widely promoted in Mali since the 1980s as a local source of fuel for cooking and lighting, as well as a viable source of livelihood for rural women. Some small-scale conversion technologies already exist and are suited to local crops; more are being developed.

On a small-scale, locally produced plant oils and biodiesel can successfully be used to power diesel engines and generators in rural villages, for agricultural processing, new enterprises, and income generation. (Karlsson and Banda, 2009) Cooking energy is the major energy challenge facing people in Africa, but the development of biofuels for cooking is still in its early stages, with a few pilot projects using ethanol for cooking (e.g. in Ethiopia). (PISCES, 2009)

As with large-scale biofuels, the experience is very recent. Case study descriptions are appearing (e.g. PISCES, 2009; Karlsson and Banda, 2009; Christian Aid, 2009; ABN, 2007; Annecke, 2009), but there is as yet little by way of analysed, empirical evidence to substantiate the perceived potential.

Conclusions

Though energy consumption in Africa needs to grow from a human development perspective, current levels of energy consumption are low and based largely on biomass. Consequently, per capita greenhouse gas emissions are low in Africa, and the continent does not need to achieve mitigation through renewable energy and biofuels. As far as greenhouse gas emissions are concerned, biofuels production in Africa is not to reduce Africa's emissions but rather to contribute to emission reduction by industrialised countries.

Indeed, biofuels production is as much if not more about energy supply and consumption in industrialised countries as it is about energy for Africans. This is driven by policy changes and financial incentives introduced, by the USA and EU particularly, to promote the production and use of biofuels. In contrast, policies for biofuels are absent in most African countries.

South Africa has a draft strategy, which focuses on a mandate for biofuel consumption (4.5 % of liquid road transport fuels (petrol and diesel) by 2013). And the biofuels industry will continue to receive a percentage Fuel Levy reduction for all liquid biofuels that comply to agreed specifications. In Tanzania a Biofuels Task Force was established in April 2006 to promote development of the sector and develop legislation to stimulate use of biofuels, but there is no policy or legislation in place. (ABN, 2007)

There is a need therefore in most African countries for national policies for biofuel production and use. In the face of the trend to land acquisition by foreign investors and the inevitable increase in oil prices, policies for biofuels will need to address both consumption and production, at the same time taking account of wider development objectives, including equity and sustainability. (Rossi and Lambrou, 2008)

Sustainability criteria or standards will be necessary and will need to be agree internationally. Such criteria can be used to regulate the international trade in biofuels and to ensure that public finance support for biofuels (including ODA) is used only in support of sustainable development and does not negatively affect food security and people living in poverty.

More research and investment is required to develop the potential of small-scale biofuel production aimed at meeting the energy needs of people living in Africa. Access to modern energy services being a prerequisite for poverty reduction and achievement of the Millennium Development Goals, the potential contribution of biofuels as a renewable and viable local level energy source should be a development co-operation research priority.

In the absence of specific biofuels policies, there are indications that action by farmers groups and civil society can help prevent the worst excesses of unregulated expansion. In Swaziland, for example, production ceased when the absence of an environment impact assessment became known. In Tanzania one company withdrew when its activities received publicity, and in Zambia there is an instance of the Government declining to allocate land in because of the likelihood of environmental degradation and the displacement of people. (ABN, 2007) There is thus a role for NGOs and community based organisations to inform those who may be affected by plans for biofuels production and to lobby national and local governments to ensure that biofuels do contribute to sustainable development.

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