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Policy Debate on Global Biofuels Development



Photo: Alfred Szwarec

Women and children carrying fuelwood in a rural area, Senegal

We are delighted to dedicate this joint issue of Renewable Energy Partnerships for Poverty Eradication and Sustainable Development Newsletter with Renewable Energy for Development (RED), (www.sei.se/climate/newsletter.htm) to a policy debate on Global Biofuels Development. This was prompted by the substantial interest and feedback that resulted from an article by a leading UK environmentalist, George Monbiot entitled: "Fuel for nought: the adoption of biofuels would be a humanitarian and environmental disaster". It was published in The Guard-

ian newspaper, November 23, 2004 and immediately generated a highly animated response from the bioenergy community. The current level of oil prices, ongoing trade reforms and associated impacts on sugar producers, the concerns over abrupt climate change and the EU biofuels directive are some of the driving forces which point towards the need for a new biofuels regime. The accumulated experience of the Brazilian ethanol programme, and the successful mitigation of much of its negative impacts, further support the promotion of bio-

fuels on a global scale. Combining bioenergy production with food crop production could bring about a number of benefits including enhancing the rural livelihoods of poor people in developing countries. Continued high levels of agricultural subsidies in industrialised countries have the potential to undermine this exciting potential. The adoption of broader sustainability criteria are urgently needed incorporating new opportunities and strategies for change to resolve environmental, social and economic problems.

- Maria M. Morales



Photo: Alfred Szwarec

Corsa flex-fuel vehicle, Brazil

Table of Contents:

<i>Comment & Analysis: Fuel for nought: The adoption of biofuels would be a humanitarian and environmental disaster, by George Monbiot</i>	2
<i>Response 1 Food for thought - world trade in biofuels offers sustainable food supply and much more by Dr. Peter Read</i>	4
<i>Response 2 Reflection about food, feed, fibre and fuel, by Sergio C. Trindade</i>	6
<i>Response 3 Agreeing and disagreeing, by Prof. José R. Moreira</i>	7
<i>Response 4 Arguments for bioenergy development, by Dr. Jeremy Woods and Dr. Peter Read</i>	8
<i>Response 5 Comparative advantage in the production of biofuels, by Francis X. Johnson and Prof. Francis Yamba</i>	10
<i>Response 6 Food versus fuel - an old argument that refuses to move on, by Dr. Frank Rosillo-Calle</i>	11

Comment & Analysis: Fuel for nought: The adoption of biofuels would be a humanitarian and environmental disaster

by George Monbiot, the Guardian, www.monbiot.com
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23 November 2004

If human beings were without sin, we would still live in an imperfect world. Adam Smith's notion that by pursuing his own interest, a man "frequently promotes that of ... society more effectually than when he really intends to promote it", and Karl Marx's picture of a society in which "the free development of each is the condition for the free development of all" are both mocked by one obvious constraint. The world is finite. This means that when one group of people pursues its own interests, it damages the interests of others.

It is hard to think of a better example than the current enthusiasm for biofuels. These are made from plant oils or crop wastes or wood, and can be used to run cars and buses and lorries. Burning them simply returns to the atmosphere the carbon that the plants extracted while they were growing. So switching from fossil fuels to biodiesel and bioalcohol is now being promoted as the solution



Photo: Alfred Szvarec

Flex-fuel pumps already in use in Brazil

to climate change.

Next month, the British government will have to set a target for the amount of transport fuel that will come from crops. The European Union wants 2% of the oil we use to be biodiesel by the end of next year, rising to 6% by 2010 and 20% by 2020. To try to meet these targets, the government has re-

duced the tax on biofuels by 20p a litre, while the EU is paying farmers an extra €45 a hectare to grow them.

Everyone seems happy about this. The farmers and the chemicals industry can develop new markets, the government can meet its commitments to cut carbon emissions, and environmentalists can celebrate the fact that plant fuels reduce local pollution as well as global warming. Unlike hydrogen fuel cells, biofuels can be deployed straight away. This, in fact, was how Rudolf Diesel expected his invention to be used. When he demonstrated his engine at the World Exhibition in 1900, he ran it on oil. "The use of vegetable oils for engine fuels may seem insignificant today," he predicted. "But such oils may become in course of time as important as petroleum." Some enthusiasts are predicting that if fossil fuel prices continue to rise, he will soon be proved right.

I hope not. Those who have been promoting these fuels are well-intentioned, but wrong. They are wrong be-

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cause the world is finite. If biofuels take off, they will cause a global humanitarian disaster.

Used as they are today, on a very small scale, they do no harm. A few thousand greens in the United Kingdom are running their cars on used chip fat. But recycled cooking oils could supply only 100,000 tonnes of diesel a year in this country, equivalent to one 380th of our road transport fuel.

It might also be possible to turn crop wastes such as wheat stubble into alcohol for use in cars - the Observer ran an article about this on Sunday. I'd like to see the figures, but I find it hard to believe that we will be able to extract more energy than we use in transporting and processing straw. But the EU's plans, like those of all the enthusiasts for biolocomotion, depend on growing crops specifically for fuel. As soon as you examine the implications, you discover that the cure is as bad as the disease.

Road transport in the UK consumes 37.6 m tonnes of petroleum products a year. The most productive oil crop that can be grown in this country is rape. The average yield is 3-3.5 tonnes per hectare. One tonne of rapeseed produces 415 kg of biodiesel. So every hectare of arable land could provide 1.45 tonnes of transport fuel.

To run our cars and buses and lorries on biodiesel, in other words, would require 25.9 m hectares. There are 5.7 m in the UK. Even the EU's more modest target of 20% by 2020 would con-

sume almost all our cropland.

If the same thing is to happen all over Europe, the impact on global food supply will be catastrophic: big enough to tip the global balance from net surplus to net deficit. If, as some environmentalists demand, it is to happen worldwide, then most of the arable surface of the planet will be deployed to produce food for cars, not people.

This prospect sounds, at first, ridiculous. Surely if there were unmet demand for food, the market would ensure that crops were used to feed people rather than vehicles? There is no basis for this assumption. The market responds to money, not need. People who own cars have more money than people at risk of starvation. In a contest between their demand for fuel and poor people's demand for food, the car-owners win every time. Something very much like this is happening already. Though 800 million people are permanently malnourished, the global increase in crop production is being used to feed animals: the number of livestock on earth has quintupled since 1950. The reason is that those who buy meat and dairy products have more purchasing power than those who buy only subsistence crops.

Green fuel is not just a humanitarian disaster; it is also an environmental disaster. Those who worry about the scale and intensity of today's agriculture should consider what farming will look like when it is run by the oil industry.

Moreover, if we try to develop a market for rapeseed biodiesel in Europe, it will immediately develop into a market for palm oil and soya oil. Oilpalm can produce four times as much biodiesel per hectare as rape, as



Photo: Maria M. Morales

Sugarcane field, Mauritius

it is grown in places where labour is cheap. Planting is already one of the world's major causes of tropical forest destruction. Soya has a lower yield than rape, but the oil is a by-product of the manufacture of animal feed. A new market for it will stimulate an industry that has already destroyed most of Brazil's cerrado (one of the world's most biodiverse environments) and much of its rainforest.

It is shocking to see how narrow the focus of some environmentalists can be. At a meeting in Paris last month, a group of scientists and greens studying abrupt climate change decided that Tony Blair's two big ideas - tackling global warming and helping Africa - could both be met by turning Africa into a biofuel production zone. This strategy, according to its convenor "provides a sustainable development path for the many African countries that can produce biofuels cheaply". I know the definition of sustainable development has been changing, but I wasn't aware that it now encompasses mass starvation and the eradication of tropical forests. Last year, the British parliamentary committee on environment, food and rural affairs, which is supposed to specialise in joined-up thinking, examined every possible consequence of biofuel production - from rural incomes to skylark numbers - except the impact on food supply.

We need a solution to the global warming caused by cars, but this isn't it. If the production of biofuels is big enough to affect climate change, it will be big enough to cause global starvation. ■



Photo: Anders Arvidsson

Roadside sale of petrol, Benin

Response 1

Food for thought - world trade in biofuels offers sustainable food supply and much more

by Dr. Peter Read, Massey University, New Zealand (p.read@massey.ac.nz)

As convenor of the expert workshop satirised by George Monbiot (*Guardian*, Tuesday, Nov 23) maybe I can set the record straight. The workshop addressed the policy implications of potential abrupt climate change that may, with a decade or so more of research, become recognised as imminent abrupt climate change, unavoidable without urgent steps at that time. We would be in much better shape to take such steps if there were in existence at that time a large-scale global bioenergy industry.

But, apart from this “be prepared” aspect, we saw so many beneficial side-effects from the creation of global bioenergy that we concluded with a resolve to bring these to the attention of the policy community, so thank you George for raising our profile.

So what are these beneficial side-effects? Firstly, a powerful new approach to cutting the level of greenhouse gases that opens the door to more ambitious climate policy. Deployed on a large enough scale, it can reduce atmospheric carbon dioxide (CO₂) concentrations from their present present 375 parts per million to pre-industrial levels (around 280 ppm) by 2060.

That’s much better than 400 ppm by 2100, which is about the best that can be done with the methods promoted by the Kyoto Protocol in its present form. If recent bad news that climate change seems to be speeding up is confirmed, the world can deploy this approach urgently, to help avert abrupt climate change.

The new approach involves the novel concept of “negative emission

energy” that combines bioenergy and “CCS” – the capture, compression and “sequestration” of the CO₂ product of com-



Photo: Maria M. Morales

Tomato vendors in a rural area of Senegal

bustion deep underground. Apply CCS to bioenergy, and consuming more biofuel means that less CO₂ remains in the atmosphere.

This is because the carbon in the biofuel is taken from the atmosphere, through the photosynthesis that is the basis of all plant growth, and CCS can potentially stop some of it getting back into the atmosphere when the biofuel is used (most of it if the biofuel is used for power generation).

The main thing is to replace gasoline and deter investment in unconventional oil such as tar sands. In that case only a modest proportion is captured from the ethanol fermentation, or other processing plants like Fischer Tropsch, but it does the trick.

The key to creating a negative emission energy system is, firstly, to grow biofuel crops on a large scale. With the raw material supply assured, its conversion to electricity, and to tradable biodiesel and biogasoline, is straightforward. The more costly linkage to CO₂ sequestration can await bad news of imminent abrupt climate

change. But changing the pattern of land use involves many stakeholders, takes time and should start soon.

How that is done in different places depends on local customs and circumstances – it can be accomplished more quickly with the farmers of the USA and the EU, already accustomed to adapting to policy incentives, than it can in the developing world, where changed patterns of land use must be based on painstaking capacity building and demonstration, in projects that yield quick returns to exigent communities on or near to subsistence levels.

That it can be done on a large scale has been demonstrated in Brazil where motorists in dual-fuel VW’s can switch over to ethanol produced from sugarcane when the price of oil rises – as they are now doing in droves. Yes George, the initial development of Brazil’s ethanol from sugar led to horrendous environmental problems, but these have now been largely (and profitably) overcome by making use of waste bagasse for biofuel based power generation.

The lessons from Brazil can be applied in Africa and Asia, not to mention here in New Zealand where I am writing and in other developed countries with surplus land. For the shortage is not of land but of capital investment in land especially where biofuels can be grown on degraded land that is poorly suited to food production, and the degraded lands can effectively be upgraded. An exciting example of such investment, and one that adds a new twist to the negative emissions energy concept, leads to cheaper and productive long term storage of carbon, rather than costly and unproductive CCS.

This is to store carbon in soils through partial conversion of the biofuels into

charcoal, thereby adapting the ancient Japanese practice of adding charcoal to poor soils in order to raise water retention and soil fertility. Then, instead of conflict over land for growing energy and for growing food, there is synergy through raised fertility funded by energy consumers. Projects linking bioenergy to carbon sequestration and soil improvement could be funded through the Kyoto Protocol's Clean Development Mechanism, suitably adapted.

Bio-based alternatives for long-term storage of carbon are less costly than CCS. So the Kyoto Protocol's focus on domestic action in industrial countries, with CCS and technologies that deliver electricity when the wind blows or the sun shines – rather than gasoline substitutes when the tank is empty – raises compliance costs. There is also a technical limit to how much intermittent wind and/or solar power can be absorbed. Such domestic action is much more costly than the biofuel alternative, which can be zero. So some re-jiggling of Kyoto is needed, with a greater focus on low cost and multi-benefit land use change and with greater reliance on potential gains from North-South trade.

Global bioenergy provides a sustainable development path for the many African countries that can produce biofuels



Photo: Anders Avvidson

Woman selling charcoal, Zambia



Photo: Edward Sumoto

ACC Strategy Expert Workshop, "Greenhouse Gas Emissions and Abrupt Climate Change: Positive Options and Robust Policy", Paris 30/9-1/10 2004

cheaply, which can benefit through exporting ethanol and biodiesel. No need to cover England's pleasant land with bioenergy plantations as Monbiot suggests. Just enough to keep the farmers busy on surplus agricultural land when the WTO outlaws current developed country export subsidies, enabling world food prices to rise to a level that gives low cost producers a chance.

Quite what the balance of food and fuel co-production would be in different places, and quite where the gains from trade would arise, is a research programme that cries out for funding. But rest assured, George – the land is there if the investment is, with raised living standards, not the starvation you foresee.

This can come about through very many thousands of small and medium scaled projects over, say, 20 years, suited to the socio-economic and environmental circumstances of the diverse communities where they are located. A substantial capacity building programme is needed over the years ahead, to train thousands of "barefoot merchant bankers" to initiate such projects through helping these communities perceive and implement opportunities to help themselves.

Apart from its developmental and farm policy benefits, large-scale bioenergy also provides long-term energy security in the face of high oil prices, through the growth of global trade in biofuels such as ethanol or biodiesel. And it provides a solution to

the intractable problem of greenhouse gas emissions from transport.

It is our hope that understanding of these potential "multi-win" aspects can help the work of the G8 in 2005. Prime Minister Tony Blair has stressed that he considers the twin themes of Africa and Climate Change to be the key issues of Britain's G8 presidency next year. The workshop showed that addressing the problem of abrupt climate change and solving the problems of Africa can go hand in hand. ■



Photo: Maria M. Morales

Sugarcane cutter from Kwazulu Natal, South Africa

For more information on the Paris workshop visit www.acstrategy.org created by Edward Sumoto.

Response 2

Reflection about food, feed, fibre and fuel

by Sergio C. Trindade, SE2T International, Ltd (strindade@alum.mit.edu)

It is obvious that there are limits to the expansion of biofuels, dictated by natural resource availability and costs, the same way that there are limits to the expansion of hydrocarbons. The food versus fuel discussion is an old one and it keeps coming back perhaps because people who enter the field of biofuels are not well documented. In fact, the discussion is broader than food versus fuel, as it should consider food, feed, fibre and fuel.

Monbiot errs when he refers to the European Union wanting 2% of the oil used to be **biodiesel** by the end of next year, rising to 6% by 2010 and 20% by 2020.¹ The EU Directive clearly calls for **biofuels** making up 2% of all transportation fuels by energy content and 5.75% (not 6%) in 2010. Furthermore, the targets are voluntary.

Monbiot incurs in the same short-sightedness of other analysts when he entirely omits the **opportunity for biofuels trade**, a matter that the International Energy Agency (IEA) is presently examining in its Task #40. Thus,

¹ The European Union, 8th May 2003. Directive 2003/30/EC: On the Promotion of the Use of Biofuels or Other Renewable Fuels for Transport, Official Journal L 123, 17/05/2003 p. 42 – 46)



Photo: Anders Arvidson

Making charcoal while clearing forest for agriculture, Zambia

as with fossil fuels, which are imported everyday into the EU market, biofuels, such as ethanol and biodiesel, could also be daily imported from sources that can produce them at the lowest cost and with the least local environmental damage. Why not? Does Monbiot worry about the local environmental impact of oil exploration and exploitation? He would just have to look at the jungles of Ecuador and the past Texaco oil operations there to get the picture.

Furthermore, Monbiot appears not to understand that fuels are in the lower range of value for use of biomaterials. Pharmaceuticals are way ahead, and food production brings a higher return than fuel uses. Thus, car owners would not dictate the use of biomaterials as fuels versus food.

The issue of soybeans development in Brazil is also misunderstood by Monbiot. While there is no denial that the rain forest has been encroached in Brazil, and elsewhere, it was not the penetration of soybeans that did it. It began with misdirected policies to develop the Amazon, which encouraged deforestation for cattle husbandry, the business that provides the fastest return to any investor in that area. When the pastures created by the defor-

estation get exhausted, soybeans penetrate. The Brazilian savannah, the cerrado, a higher altitude version of the American prairie, was non-productive frontier land, which has become a bread basket of industrial agriculture in Brazil yielding soybeans, rice, cotton, maize and crops for domestic consumption. Given its abundance in many parts of Brazil besides the cerrado, soybeans have become a preferred source of biodiesel, despite its relative low yields compared with other oil-bearing vegetables. But, as biodiesel develops in Brazil from a very low base, the sources of vegetable oils will diversify into castor oil, palm oil and other oils available in the country and closer to consuming markets. Furthermore, in Brazil biodiesel is likely to be made from bioethanol rather than the fossil-derived methanol, as is presently the norm in the EU and the USA.

The issue of hunger is not so much that there isn't enough food to go around. The world has a huge surplus of food. This happens in the European Union, where the Common Agriculture Policy has distorted the market in order to protect EU agriculture to the extent that piles of sugar, meat and other foodstuffs have to be stored and financed by the EU taxpayer or dumped into international markets. The problem of hunger is more related to lack of jobs and disposable income to buy food.

The sustainability of biofuel markets in the longer run is connected with diversifying feedstocks, to go beyond dedicated food cultures and include cellulosic feedstocks from urban, agricultural and forest residues. International trade is another crucial element for the sustainability of biofuel markets. ■



Photo: www.pontalunical.br

Cane stalks

Response 3

Agreeing and disagreeing

by Prof. José Roberto Moreira, Centro Nacional de Biomasa, Brazil (bun2@tsp.com.br)

I fully agree with several of the facts reported in the article. However, I have to state that I fully disagree with the conclusion.

It is very useful to understand that biomass, through crop wastes, wood or energy crops is being used as a source of energy, which is likely to increase in the near future. From those biomass sources, only energy crops will have a chance of contributing significantly as a global energy source. Among the energy crops with best chances are sugarcane, sweet sorghum and palm oil. As correctly stated by Mr. Monbiot, crops with low yield require so much land extension that they will not be economically competitive compared to those previously mentioned. Sugarcane may yield 10,000 litres of alcohol per ha, while palm oil 6,000 litres of biodiesel per ha. On top of that, both energy crops can generate surplus electricity to be sold to the grid through the burning of a significant share of their residues. The bonus is that all this fuel and electricity will be available at near zero CO₂ emission.

Regarding the conclusion reached by Monbiot - biofuel large-scale production would be a humanitarian disaster - I understand that there is substantive evidence showing that biomass as a source of energy requires a lot of man-power in the low and middle levels of education. However, that this is the case it is quite suited to the rural areas of developing countries.

Sugarcane in Brazil employs around 1 million workers exclusively in the activity related to ethanol production. This results in about 1 job per 20m³ of ethanol produced annually. Therefore, to produce the equivalent of the UK road transport fuel demand would require employing 3 million people. Considering UK road

transport represents 1/130 of the global world consumption and that half of global use goes to the road transport, the global supply to only fulfill this sector would create nearly 200 (130/2 X 3) million new jobs. These people would have the opportunity to acquire food and other products with the income generated. This means a real opportunity for further food production and a growing motivation for other small farmers to better use their lands and even explore unused land, since an increased food demand would result. Demand for more food would also result in more job opportunities in rural areas. Thus, it is necessary to understand that biomass energy should be seen as energy produced by the poor, instead of energy used by the poor.

Through this new opportunity for farmers to increase their revenues we can reduce the total amount of poor



Irrigation by a windmill driven pump, Senegal

Photo: Maria M. Moraes

people in the world by some 200 to 300 million at least, with the help of biomass energy.

His concern with land availability exists but it is necessary to recognise that a significant amount of rainfed agricultural land is presently available that is currently unused, due to the scarcity of food de-

mand. Recent evaluations of such land-use expansion conclude that more than 1,400 Million ha are available. Using high yielding energy crops such as sugarcane, the 40 million barrels per day of oil assumed to be used in road transportation worldwide, could be displaced with a requirement of 350 million ha of land. As a “small” side benefit it would be possible to generate 6,800 TWh/year (or just half of present global electricity generation).

Thus, it is very clear that the usage of high yielding energy crops can:

- replace half of the present oil consumption at world level;
- generate half of the present world electricity demand;
- create 300 million new jobs;
- significantly reduce global GHG emissions, and if necessary become a net sink of CO₂, assuming carbon capture and storage is practiced.

All these can be achieved with the parallel and very important participation of several nations, including the developed ones, where bioenergy production will be small but a very useful option to create new opportunities for local farmers and consequently receive support from the rural population.

Thus Mr. Monbiot, I understand bioenergy does not have the solution for the 2 billion poor people in the world but at least we can help some 15% of them to become active producers and to earn some money. On top of that, we could add “small” benefits like full mitigation of climate change and a brighter future for many tropical countries.

If a better solution is at your knowledge I would like to be informed. ■

Response 4

Arguments for bioenergy development

by Dr. Jeremy Woods, IC London (jeremy.woods@imperial.ac.uk); Dr. Peter Read, Massey University, New Zealand (p.read@massey.ac.nz)

This paper seeks to step back from a direct critique of the Monbiot Guardian report to look at the key issues raised in the report and the fundamentals of why bioenergy is “good or bad”.

“The World is finite”: avoiding Malthusian conclusions

Managing land so as to substantially increase the total amount of terrestrial photosynthesis (net primary production or NPP), and hence the supply of biomass, raises understandable concerns related to the human “ecological footprint”. These neglect the reality that natural ecosystems do not maximise the sustainable productivity of the land where they have evolved. Natural ecosystems evolve to manage risk and therefore where risk can be overcome e.g. through active land management, net primary production can be raised, sometimes very significantly. Such simple investments as stock-proof fencing to prevent animals destroying crops and plantations at the seedling stage or survival irrigation during periods of drought can improve on nature. Carbon fixing soil amendments can also yield productivity and environmental benefits, including enhanced fertility and water retention.

Efficient management of part of the land, in lieu of widespread low-productivity traditional land management, can enable natural bio-diversity to flourish in conservation areas. Such efficient management can yield food and forestry products co-produced with biomass on existing cropland. Alternatively (and hence additionally) estimates of land requirements to effectively mitigate all current anthropogenic emissions of CO₂ fall well short of the ~1.5 Gha of potential arable land (IPCC, 2001) that is not in use – there is no shortage of land but of

investment in land.

On plausible technological assumptions and oil price projections, CO₂ reductions obtained from better use of land and of the resulting products from that land, can have low or even negative cost, taking account of the added value that can be gained from co-products. Done on a large enough scale, such better land



Harvest of sugarcane, Zambia

use can contribute to rapid reductions in CO₂ levels (~30 ppm per decade is quite possible) e.g. through subsequent linking of bioenergy with CO₂ sequestration and other techniques for long-term storage of the carbon captured by enhanced photosynthesis.

Such CO₂ capture involves the extra cost of CO₂ separation, compression and safe storage (CCS) if and when abrupt climate change is deemed sufficiently imminent for urgent action. But the bioenergy with CCS linkage system cannot be embarked upon if the long slow process of improving land use practices world-wide, on a painstaking, location by location, basis, has not been well advanced. Delay with developing a global bioenergy market leaves the Earth ever more exposed to the threat of abrupt climate change.

Estimating how much bioenergy could be available in the future is a central dominating question for those who try to assess the potential for the supply of modern biomass energy services. The question is often, falsely, answered by a simplistic “biomass for energy = yield land area” equation and indeed for estimating the potential for dedicated bioenergy crops, this is a necessary first step. However, this seemingly obvious first step is clouded by two different factors:

1. The co-production of non-energy agricultural and forestry products with biomass for energy; the biomass “residues” arising through food and non-food crop production can be converted using modern highly efficient technologies for the supply of energy services at various scales appropriate to the local socio-economic situation. When carefully managed and with efficient recycling, these “modern technologies” result in no net loss of nutrients contained in the residues to the agricultural systems that supplied them and therefore do not represent a conflict with food production i.e. the production of bioenergy has no negative impact on soil fertility or food productivity. For example, in the case of anaerobic digestion (biogas) the process of extracting useful energy carriers (e.g. biogas) results in the co-production of a nitrogen-enriched and therefore superior fertiliser when compared to the original dung and agricultural residues used to produce the biogas. In parallel, there are also reductions in household air pollution when biogas substitutes for traditional fires / cook stoves for domestic cooking - a major killer of women and children in rural poor households in developing countries. Interestingly, where residue-



Photo: Anders Arvidson

Bus station in Dodoma, Tanzania

use for energy provision has been reduced e.g. by domestic fuel switching from traditional biomass to paraffin or LPG, the fires set by farmers to “clear” their fields may actually result in greater atmospheric pollution and soil damage due to the increased fire load. Such a situation is currently occurring in some regions of China.

2. Locally provisioned bioenergy can result in significantly greater food crop yields, primarily by enabling irrigation and better farm-level processing of agricultural products e.g. drying prior to storage. In the case of Hosalli village (Karnataka State, a semi-arid region of India), 4 ha of dedicated multi-species (indigenous and alien) woodlot production has allowed 8 ha of new land to be irrigated enabling increased local food and cash cropping (Ravindrinath et al, 2004). In Sao Paulo State in Brazil, there is evidence that areas of land under sugarcane have resulted in state-of-the-art farming which has raised food crop productivity, gross agricultural production and per capita wealth significantly in that state (Moreira, 2004, pers comm; Leal, 2004, pers comm).

At the regional or global level, the question of “food versus fuel” can only begin to be satisfactorily answered using GIS analysis and a systems modelling approach which accounts for changing demographics and demand. The STS (Science, Technology and Society) Centre at the University of Utrecht has carried out such analysis and has concluded that the land resource is sufficiently large to account for both fu-

ture food production needs and for significant scales of bioenergy supply (Smeets and Faaij, 2004; Hoogwijk et al, 2004). To our knowledge, no work of similar detail has evaluated land use constraints and availability. A less detailed but similar approach was taken by Sorensen, 1999, with similar conclusions.

It is clear that bioenergy cannot provide all of the world’s energy demands though the provision of bioenergy. Its highly site and climate-specific nature and the changing role of technology and demographic demands mean that estimates of its potential depend upon the scenario assumed (Hoogwijk et al, 2004). Under certain circumstances and optimistic projections, bioenergy could supply very substantial amounts of global energy indeed. It is worth noting that under one of Hoogwijk’s *SRES scenarios with low population and rapid tech progress, the projected potential bioenergy supply from Africa alone is 400 EJ per year (currently equal to total global primary energy consumption) and a global supply of 1000 EJ per year is calculated.*

Given the large potential, even within the pessimistic bioenergy scenarios, there are significant opportunities to use bioenergy in the near and medium term as a tool for combating a range of serious issues from the global to local scale. Such issues include: rural poverty, local air and water quality, provision of affordable energy services, as well as climate change mitigation.

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Photo: Dr. Hood

Woman carrying wood, Sudan

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Response 5

Comparative advantage in the production of biofuels

by Francis X. Johnson, SEI and Prof. Francis Yamba, CEEEZ, Zambia (Yamba@eng.unza.zm)

George Monbiot's use of the Brazilian example actually helps to disprove his case. Of course it is correct to note that deforestation is driven in many cases by rich people's demand for meat, with so much land cleared for cattle-grazing and production of soya beans, lands that are poorly suited for such uses. Sugarcane is not grown in rainforest areas because the climate is unsuitable, and furthermore the amount of land taken up by sugarcane is very low in relation to output, as it is so productive. The Brazilian ethanol programme did have some transient negative environmental impacts in the early years, but these impacts have receded due to the fast learning curve and high productivity of Brazilian ethanol from sugarcane. The Brazilian ethanol programme remains the largest and most effective renewable energy and climate mitigation programme that the world has ever seen.

What Monbiot really points to is a food vs. food debate, NOT a food vs. fuel debate. It is about equity and control of development agendas in global institutions, NOT about markets driving farmers from food to fuel. The choice is much more likely to be about whether to grow export crops OR to grow for the local and regional market. With the appropriate institutions in place, it is unlikely that farmers would ever be choosing to grow fuel instead of food; indeed, they will most likely grow both, as the economic



Photo: Maria M. Morales

A handful of sugarcane bagasse



Photo: Maria M. Morales

Vegetable market in the streets of Dakar, Senegal

flexibility and higher value-added attained through diversification is a fundamental element of modern efficient agro-industries. The bio-refineries of the future will no doubt incorporate this flexibility into their design where they have not already done so.

There is no escaping the related set of facts that: (a) tropical biomass is on average 5x more productive than temperate biomass; (b) biomass is more labour-intensive than other sources of energy; and (c) densely populated areas (especially island states like UK) with growing demands for fuel will need to import liquid fuels in any medium-term sustainable scenario that also avoids excessive subsidisation of less productive biomass.

European and North American biomass sources are not economically competitive in this global context and often receive excessive support whereas those funds could be channeled into developing countries where not only is it more productive, but where biomass offers the poor new options for sustainable livelihoods.

So instead of the EU spending 300 billion USD a year subsidising its farmers for food, that money can be invested into biomass production in less densely populated areas that are in great need of development and have excellent potential for highly productive biomass

(southern Africa), which can be exported to the EU.

There is always the economic issue, when comparing to fossil fuels, that oil and gas are just sucked out of the ground, whereas biofuels require a sophisticated chain of activities to be turned into energy resources. Even though oil prices are rising now, economic reality is that these prices will later be driven down again by competition as alternative fuels emerge and are internationally traded in larger volumes. There will therefore generally always be some increment of difference in costs that has to be addressed through incentive schemes such as the carbon markets. This increment can be thought of as an environmental externality, as the cost of achieving sustainability, or whatever - but it will remain there for some time to come. So the OECD countries or Annex I countries will have to absorb the difference, although it is important to note that this difference has been shrinking steadily - and in the case of Brazilian ethanol - the difference has almost disappeared.

Finally, of course there are some other inescapable truths in the issues that Monbiot raises: that biomass is not the only answer, and that increasing population will put some strains on land resources in the long-term. However, increasing population will put strains not just on biomass but on almost ALL resources and sectors, particularly water and transport. Energy efficiency will certainly require much more attention in sustainable energy futures, since demand-side energy solutions are the only feasible route in the long-term. Yet, given that the transport sector has proved the most intractable among all the end-use sectors, biofuels are an excellent place to start, in terms of finding creative intersections between the goal of climate mitigation and the goals of equitable and sustainable development. ■

Response 6

Food versus fuel - an old argument that refuses to move on

by Dr. Frank Rosillo-Calle, Imperial College, ICCEPT/EPMB, London (f.rosillo-calle@imperial.ac.uk)

Biofuels or food production? It is not a matter of either farming for fuel or farming for food. The two do not need to stand against each other. However, after working in bioenergy for more than 20 years I know how complex and heated the arguments can be. It is natural and right that people are concerned with the issue of “food versus fuel” as it can be extremely serious and affect us all. What strikes me is the superficiality with which such a complex issue is often portrayed. I have seen this old argument repeated many times over the years and, despite our enhanced understanding, it refuses to move on.

Those who preach “doom and gloom” have never been proved right because their arguments have been based on shaky grounds. Let me give you a few examples. The uses to which we put our land are multiple, and food is just one of them. Energy from agriculture is nothing new since, historically, considerable quantities of land have been set aside to provide feed for working animals¹. Even with the mechanization of agriculture, huge areas are currently dedicated to animal feed for meat we do not really need. How many million of hectares of land have been deforested in the tropics so that we can have cheap burgers? Think how much grain could be grown to feed millions of people. If our political priorities were to feed people not animals or big profits, then we could have eradicated hunger a long time ago. Today 800 million people are starving and many more are undernourished; and this without “biofuels” so to speak.

Look to Holland, a small country with a large population and capable not only



Road sales in Eastern Province, Zambia

Photo: Anders Arvidson

of feeding itself, but also of exporting large quantities of food. This shows how much farmers can produce given the right conditions (capital, good management practices, market, technical expertise, land rights, etc). True, there cannot be many countries like Holland, but it shows that the earth’s carrying capacity is much greater than we often recognise.

I remember when in 1975 Brazil set up the National Alcohol Programme (NAP). Its critics said that it meant people would starve because *all the best land will be taken over to produce ethanol*; they often blame the NAP for all Brazil’s social ills – for feeding cars not people. As a person with good knowledge of the NAP² I felt a sense of outrage to read so many banalities even in journals you would regard as serious. As I said, I have written quite a bit on this issue, but let me just mention a paper I wrote with Prof. David Hall in 1987³ in which we showed that the food versus fuel was not the issue; the food problem was embedded in Brazil’s socio-economic and

political system. If anyone is interested to find out a few truths I advise you to read it; you would be surprised to see how little this argument has changed over the years, despite the lessons learned!

People were not starving because of the NAP, but due to the perverse nature of Brazil’s social and food systems. Yes, there were (and still are today) many people starving, but not because of lack of food but because they could not afford to buy it – thus confirming yet again Nobel prize-winner Amartya Sen’s analysis of the causes of famine. Meanwhile millions of tonnes of food [and particularly soybean] was (and is) sold as animal feed to satisfy affluent Western societies.

Critics of the NAP blamed it also for horrendous environmental pollution. Yes, there was serious pollution in the early years of the programme, as with any programme of similar nature, because environment then was not a priority for the then policy makers. In fact there was a school of thought that regarded environment “as the enemy of economic development.” Removing poverty was the main priority and this was best achieved by rapid economic growth; environmental concern was a secondary matter. In this scenario why should the NAP be different to any other industry? By examining the NAP in isolation, and blaming it for all sorts of pollution, critics were ignoring the fundamental causes, with few of them bothering to find out the underlying reasons.

The negative energy balance was another area frequently cited by critics (the energy you need to put in to obtain a process/product was always greater than that coming out). Often such criticism was based on experience from corn-based ethanol in the USA; which used high agricultural inputs in corn produc-

² My PhD was a technical and socio-economic analysis of the NAP

³ Rosillo-Calle F, Hall D (1987) Brazilian Alcohol - Food versus Fuel, *Biomass* 12 (2): 97-128

¹ This is still the case in many developing countries

tion, particularly fertilisers that were cheap and inefficiently applied. Although in the early years such criticism was justified, time has confounded the critics since, even in the USA, the energy output/input ratio is 1.67⁴, thanks to improved management.

You often hear the argument that the world will be flooded with energy crops if gasoline and diesel was to be replaced worldwide. However, will it ever happen? No, and there are various reasons. Firstly, who in his/her right mind will propose such alternatives? Biofuels are just another alternative among others. Secondly, the market will prevent this happening, because food will always be a priority and if prices go up biofuels would be quite simply uncompetitive, as other alternatives will emerge. However, replacing a small percentage (10% or even 20%) could bring many social, economic and environmental advantages, as discussed in detail in this issue.

There is also a strong symbiosis between agriculture and bioenergy which

are mutually complementary and beneficial – a reality that is largely ignored by critics. For example, there are a large number of products, by-products and co-products obtained in the process of producing biofuels (animal feed, oil, sugar, ethanol, yeasts, energy, etc). Thus when critics argue about land competition, they need to have a closer look to realise that “biofuels” are often just another co-product. Let’s take Brazil and USA, the world’s largest ethanol producers.

In Brazil, thanks to the NAP it has been possible to create a dynamic and innovative agro-industrial complex that has brought many socio-economic and environmental benefits, particularly to rural areas⁵. In the 2004/05 harvest, Brazil has produced over 24 Mt of sugar, 15 billion litres of ethanol, and many other by-products. Its distilleries are energy self-sufficient and are able to generate large electricity surpluses to sell to the national grid; the NAP employs about one million people directly⁶, just 5.5 Mha and thus the country have not been flooded with sugarcane as critics said!

In the USA, corn-based ethanol has become a flourishing agro-industrial complex with major social, economic and political ramifications. Ethanol production is almost a by-product of the entire delivery chain (co-produced with animal feed, oil, etc. that have as much, or even more, value than ethanol itself).

I do not believe that biofuels can solve the world’s transport fuel and pollution problems; nor should they. But biofuels can make an important contribution from a socio-economic, energy, and environmental point of view, without causing any competition with food production. On the contrary, they can enhance food production significantly. So let’s have a robust discussion on “food versus fuel” in which all pros and cons are scientifically argued! ■

⁴ See for example, Shapouri et al (2004) *The 2001 Energy Balance of Corn-ethanol*, USDA, Office of the Chief Economist, Washington DC

⁵ Of course nobody can deny that there are also some negative impacts

⁶ There are different estimates for employment due to the way statistics are compiled e.g. during harvesting season the number of workers increases significantly which is not always reflected correctly in total full-time jobs equivalent. There are many more indirect jobs that depend on the sugarcane and ethanol industry



www.bioenergy-lamnet.org



www.carensa.net



www.sparknet.info

LAMNET, a Global Network on Bioenergy, focuses on the promotion of small- and medium-scale decentralised bioenergy systems and the large-scale implementation of bioethanol production and generation of heat and electricity based on suitable biomass resources.

CARENSA, the Cane Resources Network for Southern Africa, analyses the role of bioenergy from sugarcane and sweet sorghum in promoting sustainable development and improving global competitiveness in the region of southern Africa, including technical, socio-economic, environmental and institutional dimensions.

SPARKNET is a multi-stakeholder interactive Knowledge Network focusing on how people, in the context of acute poverty, can gain access to better energy services and improve their livelihoods.

The network makes available unique online resources for policy makers, companies, and civil society on energy poverty in Southern and East Africa.

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