The development of biofuels in the developing world is a matter of high emotion. It promises a huge range of benefits from increased local employment to decreased greenhouse gas emissions. It could bring greater energy security and prosperity. On the other hand, it could increase deforestation, shift the poor off the land and reduce the availability of food.

No easy transition

by Chris Cragg

In September 2007, the International Rice Research Institute (IRRI) in Laguna, the Philippines, brought together some 41 experts from agricultural research institutes from around the world for three days. They were brought together by the realisation that biofuel production had doubled in the previous five years and was likely to double in the next five. While the US and Brazil produced 90% of the bioethanol and the Europeans most of the biodiesel, it was realised that biofuel production in Asia was about to take off. Furthermore the use of maize grain was already pushing up grain prices everywhere.

If anybody was expecting any solution to the complex problem of what was or was not an acceptable mechanism for biofuel production, then the list of questions set out for the conference was pretty daunting in itself. Would there be enough food for the poor? Would biofuels threaten existing tropical forest? Could carbon trading foster more sustainable land management? Would it really mitigate climate change? Would there be soil deterioration? Could the second-generation biofuels be downscaled to village level? Were there useful plant genes to improve biofuel production?

Yet, if the conference did not and could not come up with any immediate answers to this barrage of questions, the participants certainly came away with a renewed understanding of the complexity of the issues. For a start, not merely are biofuels divided neatly into ethanol and biodiesel, but the sheer range of crops that can produce them is enormous.

In the ethanol division, for example, there is sugar-cane, cassava, sweet sorghum, maize and even wheat and each produces different volumes of US gallons of fuel per acre, ranging from 660 to 227. These numbers are disputed, in relation to the kind of soil, how crops are grown and not least how they are refined. The same applies to biodiesel, where the range of possibilities run from Chinese tallow (Tradica Sebifera), via jatropha and palm oil to coconut, rape seed, soya, sunflowers and even peanuts.
There are at least a few lines in the sand. As the UN Development Programme (UNDP) has pointed out, over 30 years the carbon sequestered by tropical rain forest will always be more than that saved by turning it into biofuel. Such a forest will absorb three times as much carbon as a palm oil plantation.

Rural poor

Given the roller-coaster ride that biofuels production has had in public opinion, developers are extremely sensitive to the rain-forest issue. In Malaysia, which is the largest exporter of palm oil in the world, the government points out that its forested land amounts to 20.9 million hectares, while the plantations amount to 4.3 million. This, it is claimed, can be made to produce at least 30% more by improved techniques and there is thus no need to fear forest destruction.

The Indonesians too have been under fire, probably with more reason. Since 1964, Indonesia's primary forest cover has fallen from over 130 million hectares to 82 million in 2005. Since production of palm oil has risen from under 2 million tonnes in 1990 to over 16 million, overtaking Malaysia in 2006, environmentalists are concerned that an accelerated push for more jatropha

Photo: George Mollering/ANP

planting will add to what rising population pressure has already done in terms of forest destruction.

In practice, what the push for increased biofuels means is, in the words of UNDP, "a merging of the agricultural and energy industries" and few fully understand its consequences or the complex market forces likely to be unleashed. In the short term, even in a period of low oil prices, per hectare rewards from palm oil or ethanol production can be much higher than their food equivalents. However, this process can go into reverse as the Brazilians discovered in the 1990s, when for a variety of reasons the price of sugar escalated rapidly. In effect, the marriage of the food and energy commodity markets could have a highly destabilising impact on both.

This in turn raises a truly worrying issue. As the UNDP also point out, biofuels "could lead to new and stable income streams" for the rural poor, but it "could also increase marginalisation of the poor and indigenous peoples and affect traditional ways of living if it ends up driving poor farmers without clear land title from their land and destroying their livelihoods."

In many parts of the developing world the concept of 'land title' is also haziest. The sudden decision of a remote landowner to radically change land-use can be devastating. It can prompt mass-migration to already over-crowded cities.

Outrage

Biofuels compete with other demands for land-use. The Philippines provides a spectacular example. Back in 1903 at the first official census the population was put at 7.6 million. It is now 88.6 million on a total land area of 29.8 million hectares. Of this, 5.7 million hectares is deep forest, while only 14.1 million is usable for agriculture. While official figures suggest that only 0.3% of this goes under housing and tarmac every decade, the area devoted to rice, the staple crop, fell by 250,000 hectares in 2000 alone.

In this context the announcement of large scale biofuel plantations can cause enormous controversy. In January 2007, the Philippine's Biofuels Act came into force. This required oil companies to sell a minimum of 1% biodiesel blend (B1) within three months and gasoline with 5% bioethanol (E5) within two years. In May, the British company NRG Chemical Engineering signed a memorandum of understanding with the Philippines National Oil Company (PNOC) worth $1.3 billion to build a biodiesel refinery, two bioethanol plants and create a million hectare jatropha plantation on Palawan and Mindanao. Initially, the refinery would use coconut and vegetable oils and the ethanol plants sweet sorghum. Initial output would be 350,000 tonnes a year in early 2008, growing to 3 million tonnes eventually.

This deal provoked outrage. Even one of the sponsors of the Biofuels Act, Senator Miriam Defensor-Santiago was against it. Jatropha got a pounding in the press. It had "toxic fruit and bark and required 1,000 millilitres of rainwater every year to reach maturity". (In fact the average annual rainfall in the Philippines actually is 1,000 millilitres.) In September 2007, an official allegedly close to the discussions was reported as saying that the deal had collapsed. If it hasn't then little more has been heard about it.

At present the country with seven biodiesel plants producing 275 million litres from coconut oil can comfortably reach the initial B1 target. The E5 target is less certain. Currently sugar cane is planted on 344,700 hectares, which should meet about 79% of bioethanol demand. There are plans for an additional 238,000 hectares mostly on Mindanao. Currently the two existing distilleries can meet about 19% of demand. What is certain is that biofuels are increasingly available with Shell, Seaoil and Petron all selling E10 in Manila filling stations.

It has to be said that private sector interest in biofuel crop production was greatly increased all over South and South-East Asia from 2005 onwards by the erroneous belief that biofuels would play a major part in the granting of money under the Kyoto Clean Development Mechanism (CDM). This however has so far proved elusive. As of October 2008, out of some 1,186 projects approved for CDM, none has been about transport biofuels and only one 'methodology' has so far been approved. This latter is a potential scheme to turn waste fat from restaurants and slaughterhouses into biodiesel.

Getting CDM aid is in any case an extremely complex and much criticised procedure. However in the case of biofuels, the stringent project vetting procedure runs straight into all the dilemmas understood at the IRRI conference. Projects have to incontrovertibly prove that they save carbon emissions. Given the reluctance of the CDM executive board to sanction straight reforestation projects, it is not a surprise that biofuels are low on the list and regarded as high in complexity.

As a result there is a demand within the scientific research community for "internationally agreed sustainability criteria" that really nail down the value of biofuels as a greenhouse gas reducer. In essence, what is needed is a set of criteria that can choose between a producer that rips up hundreds of hectares of primal forest to plant a monoculture, from one that directly uses a necessary food crop to create fuel and separates it from yet another that maximises both food and fuel crops by increasing the efficiency of land use and agriculture. The ultimate ideal is the use of non-food crops that can be grown on marginal, non-forest, land that would not be otherwise used; the target of 'the second-generation' biofuels.

> *Few fully understand the complex market forces likely to be unleashed by the push for biofuels*

Standardisation

Two former associates of IRRI, Adam Liska and Kenneth Cassman, have been working on a system of standardisation of such criteria, via a life-cycle assessment of various crops, their ability to mitigate greenhouse gases and their net energy yield. They make the obvious point that such a standardisation of methodology might work strongly in favour of helping certain biofuels make a significant contribution, while ruling out others. At the moment, nobody is clear which are the real winners.

The perception is that some agreed 'sustainability criteria' might be valuable before governments legislate to make biofuel mixes mandatory. But mandatory requirements and plans are roaring ahead: Thailand B10 by 2012, Philippines B10 by 2011, Indonesia B20 and E15 by 2025, Vietnam B5 and E5 by 2025, Malaysia B5, China E15 by 2020 and India B20 and E5 by 2012. Consequently the concern is that enthusiasm for petroleum import substitution is running away with the argument. Furthermore, it has to be acknowledged that the 'second generation' biofuels using cellulosic biomass, on which so many hopes are placed in developed countries, require capital-intensive refining that is far out of reach for most poor farmers.

If there was one thing agreed for sure at the IRRI conference, it was that rice itself would never make a biofuel crop; there are far better uses for it. Dr Reiner Wassman, coordinator of the Rice and Climate Change Consortium, almost laughs at the notion. He has other ideas. Rice is almost unique in one property. It gets its nutrients from water flow, so there is no need for crop rotation. Indeed, if rice straw is ploughed back into the ground it generates methane. Consequently millions of tonnes of this straw are burnt off each year. If just some of this could be used to generate electricity locally, then this really would make a fantastic contribution to reducing emissions. But that, as they say, is another story. ■


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