Biofuels: biodevastation, hunger and false carbon credits

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Biofuels are fuels derived from crop plants, and include biomass directly burnt, and especially biodiesel from plant seed-oil, and bioethanol from fermenting grain, sap, grass, straw or wood. Biofuels have been promoted and mistakenly perceived to be "carbon neutral", that they do not add any greenhouse gas to the atmosphere; burning them simply returns to the atmosphere the carbon dioxide that the plants take out when they were growing in the field.

This ignores the costs in carbon emissions and energy of the fertiliser and pesticides used for growing the crops, of farming implements, processing and refining, refinery plants, transport, and infrastructure for transport and distribution. The extra costs in energy and carbon emissions can be quite substantial particularly if the biofuels are made in one country and exported to another, or worse, if the raw materials, such as seed oils, are produced in one country to be refined for use in another. Both are very likely if current trends continue.

Growing demand for biofuels

Demand for biofuels has been growing as the world is running short of fossil fuels. Oil and gas prices have shot up within the past several years, while the pressure to reduce carbon emissions to mitigate global warming is increasingly pointing to biofuels as one of the main solutions. George W. Bush has offered biofuels to cure his country's addiction to oil. A "billion ton vision" was unveiled to make available 1.3 billion tons of dry biomass for the biofuels industry by the middle of this century, to provide 30% of US fuel use, if all things work out, such as a 50% increase in crop yield. Biofuels Corporation plc, the first 250 000 Mt biodiesel processing plant in the UK was opened by Tony Blair at the end of June 2006, and it will be using imported castor oil and palm oil as well as home grown rapeseed oil to make biodiesel. But UK lags far behind other European Union (EU) countries in biofuel use.

The European Union adopted a Biofuels Directive in May 2003 to promote the use of biofuels in transport at 5.75% of market share by 2010, increasing to 8% by 2015. These targets are not likely to be met on current projections. The market share for EU25 is 1.4%; Austria leads at 2.5%, while UK's share is a mere 0.2%.

The European Commission is to make a progress report before the end of 2006; it has put out a document for public consultation, which ended in July 2006. Among the issues considered was the need for a biofuels certification scheme based on standards of sustainability. EU countries are already growing bioenergy crops, mainly oil seed rape; and tax relief and incentives are granted for biofuels in ten or more countries . The "set-aside" agricultural land meant to protect and conserve biodiversity is likely to be brought back into agriculture to grow bioenergy crops.

A report published in 2002 by the CONCAWE group – the oil companies' European association for environment, health and safety in refining and distribution - estimated that if all 5.6 million hectares of set-asides in the EU15 nations were intensively farmed for bioenergy crops, we could save merely 1.3-1.5% of road transport emissions, or around 0.3% of total emissions from those 15 countries. These and other similarly pessimistic estimates are fuelling the growth in biofuels industries in Third World countries, where, we are now told, there is plenty of "spare" land for growing bioenergy crops. The sunshine is brighter all year round, so crops grow faster, yield more and labour is cheap.

In the case of GM crops, however, we're told there *isn't* enough land, and we need GM crops to boost yields to feed the world. GM crops have failed to boost yields so far, and are overwhelmingly rejected worldwide, especially in African countries where GM food and feed are being dumped as "food aid". Biotech companies are already promoting GM crops as

bioenergy crops and hoping for less regulation and more public acceptance, as they won't be used as food or feed. But that will leave our ecosystem and food crops wide open to contamination by GM crops that are far from safe. The United Kingdom Energy Research Centre, which consists of members from all the government research councils, has already included "public perception and use of GM technologies for bioenergy" in its "Short term Research Challenge" .

Deforestation, species extinction and food price hikes

Biofuels are bad news, especially for poor Third World countries. Bioenergy crops do take up valuable land that could be used for growing food, and food security is becoming a burning issue. World grain yield has fallen for six of the past seven years, bringing reserves to the lowest in more than thirty years. Chronic depletion of aquifers in the major bread baskets of the world, drought and soaring temperatures are taking their toll and set to do even more damage to food production. The pressure on land from food and bioenergy crops will certainly speed up deforestation and species extinction, and at the same time result in food price increases worldwide, hitting the poorest, hungriest countries the hardest.

Calculations based on the best-case scenario of unrealistically high crop yields and high recovery of biofuels from processing still end up requiring 121% of all the farmland in the United States to grow enough biomass to substitute for the fossil fuels consumed each year.

The EU's own technical report published in 2004 shows that the target of 5.75% biofuel substitution for fossil fuels will require at least 14 to 19% of farmland to grow bioenergy crops. There will be no set-aside land left to protect natural biodiversity, as that's only 12% of farmland in the EU. Satellite data reveal that 40% of the earth's land is already used up for agriculture, either growing crops or for pasture. *There is no spare land for growing food, let alone bioenergy crops*.

Deforestation speed-up in tropical Brazil, Malaysia and Indonesia

Tropical forests are the richest carbon stocks and the most effective carbon sinks the world. Estimates run as high as 418 t C/ha in carbon stock, and 5 to 10 t C/ha a year sequestered, 40% of which is in soil organic carbon. The carbon stock in old growth forests would be even greater, and according to a new study in Southeast China, soil organic carbon just in the top 20 centimetres of such old growth forests increased on average at a rate of 0.62 t C/ha each year between 1979 and 2003. When tropical forests are cut down at the rate of more than 14 m ha a year, some 5.8 Gt C is released to the atmosphere, only a fraction of which would be sequestered back in plantations.

The additional pressure on land from bioenergy crops will mean yet more deforestation and a greater acceleration of global warming and species extinction. Vast swathes of the Amazon forest in Brazil have already been cleared for soybean cultivation to feed the meat industry so far. Adding soybean biodiesel to the requirement may cause the entire forest to die back. At the same time, sugarcane plantations that feed the country's huge bioethanol industry also encroaches on the Amazon, but far more so on the Atlantic forest and the Cerrado, a very bio-diverse grassland ecosystem, two-thirds of which are already destroyed or degraded.

The pressure on the forests in Malaysia and Indonesian is even more devastating. A Friends of the Earth Report, *The Oil for Ape Scandal* reveals that between 1985 and 2000 the development of oil-palm plantations was responsible for an estimated 87% of deforestation in Malaysia. In Sumatra and Borneo, 4 million hectares of forests were lost to palm farms; and a further 6 m ha are scheduled for clearance in Malaysia and 16.5 m ha in Indonesia.

Palm oil is now referred to as "deforestation diesel", as palm oil production in Indonesia and Malaysia is projected to rise dramatically in the biofuels fever. Palm oil is already widely used in the food and cosmetic industry, having replaced soy as the world's leading edible

oil. And as petrol and gas prices have gone through the roof, oil palm is finding its place as *the* major bioenergy crop. With yields of 5 tonnes (or 6 000 litres) of crude oil per ha a year, oil palm produces more by a long shot than any other oil crop; for example, soybeans and corn generate only 446 and 172 litres per ha a year.
Current global palm oil production of more than 28 million tonnes per year is set to double by 2020 . Malaysia, the world's leading producer and exporter of palm oil, is making it mandatory for diesel to contain 5% palm oil by 2008, while Indonesia plans to halve its national consumption of petroleum by 2025 through substitution with biofuels. Malaysia and Indonesia have announced a joint commitment to each produce 6 million tonnes of crude palm oil per year to feed the production of biofuels.

Food price hikes as more diverted into biofuels

Demand for biofuels has turned traditional food crops into "bioenergy" crops. Food and energy now compete for the same "feedstock", with the result that food prices have gone up substantially, over and above the price of petroleum and natural gas that normally goes into producing food. By 2006, around 60% of the total rapeseed oil produced in the EU has gone into making biodiesel. The price of rapeseed oil went up by 45% in 2005, and then an additional 30% to about $800 per tonne. Food giant Unilever estimated a further price increase of some 200 euros per tonne for next year due to additional biodiesel demand. The total additional cost to food manufacturers from biodiesel is estimated to be close to one thousand euros by 2007.

Cereals prices have shot up. US corn prices have increased by more than 50% since September 2006, and has now hit a 10-year high at $3.77 a bushel. US demand for bioethanol has diverted corn from exports, leaving Asia corn buyers desperate. World wheat prices also hit a 10-year high of $300 a tonne in October 2006, amid fears of a supply crisis within the next 12 months if there is another disappointing year of global production. Another concern is the rising demand for biofuels to be created from crops such as wheat, corn and soya.

Bioenergy crops deplete soil minerals and reduce soil fertility especially in the long term, making the soil unsuitable for growing food. The processing wastes from all biofuels have substantial negative impacts on the environment, which have yet to be properly assessed and taken into account. Although some biodiesel may be cleaner than diesel, others are not (see below). Burning bioethanol generates mutagens and carcinogens and increases ozone levels in the atmosphere.

Energy balance and carbon savings unfavourable on the whole

Biofuels are rated on energy and carbon in many different ways that are not completely transparent. The ones I shall use as defined are *energy balance*, the units of biofuel energy produced per unit of input energy; and *carbon saving*, the percentage of greenhouse gas emissions prevented by producing and using the biofuel instead of producing and using the same amount of fossil fuel energy.

Biofuels generally give small to negative energy balance on a life-cycle analysis, in fact, mostly negative energy balance when proper accounting is done, which means that the energy in the biofuel is *less* than the sum of the energy spent in making it. It is likely that carbon savings will be equally unfavourable when all the costs are included.

Currently, most energy audits that give positive energy balance include energy content of byproducts, such as the seedcake residue left over when oil has been extracted, that can be used as animal feed (though it is by no means so used as a rule), and fail to include infrastructure investments, such as the energy and carbon costs of building refinery plants, and roads and depots needed for transport and distribution; and certainly not the costs of exporting to another country. None of the audits includes environmental impacts. In the only case analysed by researchers at the Flemish Institute for Technological Research,

sponsored by the Belgian Office for Scientific, Technical, and Cultural Affairs and the European Commission, it found that, "biodiesel fuel causes more health and environmental problems because it created more particulate pollution, released more pollutants that promote ozone formation, generated more waste and caused more eutrophication."

A compilation of energy balance and carbon saving estimates is given in Box 1. Sugarcane bioethanol in Brazil is estimated to have an energy balance of a staggering 8.3 on average, and up to 10.2 in the best case; far ahead of any other biofuel, especially those produced in temperate regions, estimates for which range from a high of 2.2 to well below 1, a negative energy balance. The carbon saving of Brazilian sugarcane bioethanol at between 85 and 90%, is also bigger by far than any other biofuel, which ranges from just over 50% to –30%, i.e., the biofuel incurs 30% *more* greenhouse gas emissions to produce and use than the energy equivalent in fossil fuel.

With two exceptions, all estimates include energy in byproducts and exclude infrastructure costs. None include environmental damages or depletion of soil, or costs of export to another country. As can be seen, with the possible exception of Brazilian sugarcane bioethanol, none of the bioenergy sources gives good enough returns on investments in energy and carbon emissions, even with the best gloss put on. When realistic accounting is done, they could all result in negative energy balance and carbon saving.

Box 1
Energy Balance and Carbon Saving of Biodiesel and Bioethanol

Biodiesel	**Energy Balance**	**C Saving**
OSR (EU)	1.59	52%
OSR (UK)	1.78	
OSR (EU)	1.90	
OSR (Australia)		50%
Soya (USDoE)	2.22	40%
Soya (US)	0.53*	
Bioethanol		
Wheat & sugarbeet (EU)	1.08	27%
Corn (US)	1.13-1.34	13%
Corn (US)	0.78*	
Corn (US)	1.14	11%
Corn (US)	0.61	-30%
Corn (US)	1.65	
Maize (N France)	1.03	24%
Maize (N. France)	0.94	17%
Sugarbeet (EU)	1.18	
Wood (US)	0.64	
Wood (Scand)	0.80	
Sugarcane (Brazil)	8.30– 10.20	85 – 90%

*Includes infrastructure costs and excludes by-products

There are features that account for the relative success of sugarcane bioethanol. Apart from the prolific growth rate of the crop in tropical Brazil, the production involves a closed cycle, where the energy for the refinery and distillery process comes from burning sugarcane residue; hence no fossil fuels are needed. Refining and distillation are very energy intensive especially for bioethanol. The large energy balance will be reduced substantially when infrastructure and export costs are included, though it could still be positive.

But even with the positive energy and carbon accounting, there are serious doubts that sugarcane bioethanol is sustainable. Among the main concerns are ecological and social impacts, including food security. These are especially important in a country where human rights and land rights are very problematic.
There is a lot of false accounting that inflates carbon savings. For example, the huge loss of soil organic carbon due to intensive sugarcane cultivation replacing forests and pastureland

has not been taken in account, nor the fact that natural forests allowed to regenerate would save 7 t more carbon dioxide per ha each year than that saved by the biothanol from a ha of sugarcane. And these are not the only forms of false accounting.

False carbon credits in southern Africa's Jatropha biodiesel

Under international rules, none of the greenhouse gas linked to the production of biofuels will be attributed to the transport sector. The emission that arise during biofuel production will be counted towards agricultural and industry and or energy sector emissions. Also, all the emissions that come from growing and refining in Third World countries, will count towards those countries' emissions, so a country importing the biofuel such as the UK can use them to improve its greenhouse gas inventory. This allows rich importing nations to out-source some of their emissions and claim credit for doing so under the Kyoto Agreement. This is how plantations of Jatropha trees have become established in Malawi and Zambia.

Jatropha is a drought resistant plant that requires little or no input of pesticides or fertilisers. Jatropha beans can be harvested 3 times a year, and the by-products can be used to make soap and even medicine. Refining is done in South Africa. Many farmers switched from tobacco to Jatropha, which is considered a good thing, as tobacco is a very environmentally unfriendly plant to grow. So far there are 200 000 ha of Jatropha in Malawi and 15 000 ha in Zambia, almost all under a formal lease or agreements with the UK-based company D1-Oils.

Southern Africa is one of the most vulnerable regions in the world to climate change. All climate models predict that the region (not including most of South Africa, Lesotho and Swaziland) will become a lot warmer and drier, with more frequent and severe droughts, interspersed by more severe flooding. This could cause massive crop failures and a collapse of food production.

About 80% of Zambia's population rely on biomass for all or most of their energy needs, with only 12% having access to electricity. In Malawi, 90% of primary energy production comes from biomass, ie, firewood and charcoal. Most rural people rely on burning firewood, often on inefficient cooking stoves, which causes serious pollution and are a major cause of ill health and death. Women and girls are particularly affected.

Jatropha plantations may have serious impacts on the food and energy security of the region, especially if they expand. So far, there has been no lifecycle analysis or sustainability study on Jatropha biofuel.

It is quite clear that biofuels currently come in many different forms, most of which are not carbon neutral. There is an urgent need for transparent life cycle auditing of energy and carbon emissions and other sustainability criteria involving impacts on health, environment and social welfare. Many have called for a mandatory certification scheme based on clear criteria of sustainability that safeguard the world's most sensitive forest ecosystems as well as the long term fertility of our land and soil. These criteria should also guarantee food sovereignty (the right to be secure in food supply of people's own choice) and related land and labour rights to all.

We have many renewable and truly sustainable alternatives to the current biofuels as described in ISIS' 2006 Energy Report *Which Energy*? We have proposed to assemble these options in a zero-emission, zero-waste food and energy "Dream Farm 2". One of the core technology used is anaerobic digestion, which turns wastes (and environmental pollutants) into crop and livestock nutrients and energy in the form of biogas, consisting of 60% or more methane, which can be used to power cars as well as for generating electricity.
I have estimated that if all the biological and livestock wastes in Britain were treated in anaerobic digesters, it would supply more than half the country's transport. Admittedly, the vehicles will need a different engine, but such cars are already on the market, and biogas

methane-driven cars have exhausts so clean that they were voted environmental cars of the year in 2005. Most significant of all, Dream Farm 2 runs entirely without fossil fuels. As Robert Ulanowicz, Professor of theoretical ecology says, "I'll bet people will be surprised at how quickly the carbon dioxide levels in the atmosphere can come down if we stop burning fossil fuels."