POLICY WATCH:

A biofuel conundrum

As scientists raise alarming questions about the true carbon cost of some biofuels, policymakers must decide how best to promote low-emission versions, reports **Sonja van Renssen**.

It seemed like such a good idea: rather than running cars on dirty oil, why not use a carbon-neutral fuel made from plants? Back in December 2008, European leaders agreed that 10% of all transport in the European Union (EU) should run on renewable energy by 2020. In practice, this is a target for biofuels because electric vehicles, the other alternative to petrol and diesel power, are expected to need at least another decade's development.

However, in mid-September, a group of 19 independent scientists accused the EU of overestimating the reduction in greenhouse-gas emissions from bioenergy use, owing to a 'serious accounting error'. The scientists, members of the European Environment Agency's (EEA) scientific committee, challenged the belief that bioenergy is always carbon neutral because burning plants simply releases the carbon they absorbed in their lifetimes[1]. In fact, the committee said, when energy crops take the place of forests — which would have stored more carbon — they can actually lead to a net increase in carbon dioxide in the atmosphere. The potential consequences of this accounting error are 'immense', the scientists added.

This is not the first time the carbon neutrality of bioenergy has been questioned. In June 2010, three Brussels-based non-governmental organizations (NGOs) issued a report in which they pointed out that harvesting trees for energy creates a 'carbon debt': when you cut down a forest and burn it for energy, the carbon in the trees is emitted right away, whereas new trees take years grow back[2]. "The EU is taking out a sub-prime carbon mortgage that it may never be able to pay back," warned Ariel Brunner, head of EU policy at BirdLife International.

The European Commission denies that the EEA's paper causes fresh problems for its biofuels policy. A spokeswoman said it "ignores the reductions in greenhouse-gas emissions because of not having to use fossil fuels", and added that "trees absorb carbon only until a certain stage of maturity". These rebuttals may be fair, but the paper nonetheless comes at a difficult time for the commission. It has been mired in an increasingly complex debate over how to account for a phenomenon called indirect land-use change (ILUC) when judging biofuels' climate contribution. Biofuels (bioenergy used for transport), incidentally, are a testing ground in Europe for policies that may well later apply to biomass (bioenergy used in power plants).

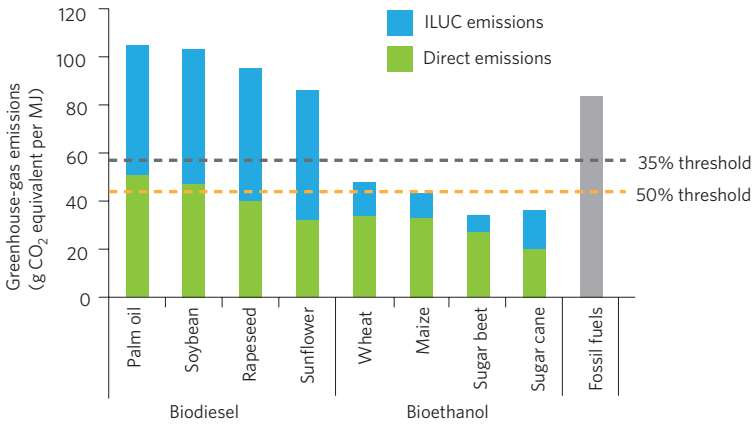

Figure 1 | Bar chart showing the greenhouse-gas emissions from direct and indirect land-use change for different energy crops. The orange and grey dashed lines across the bars show the threshold for a 50% and 35% emission saving, respectively, compared with fossil fuels. Initially biofuels will have to deliver a 35% saving under EU law, but this will rise to 50% in 2017. Indeed, when policymakers talk about raising the threshold in the context of the ILUC debate, they are reportedly talking about raising it to 50% — this graphic shows that according to what we know about the scale of ILUC, this policy approach wouldn't solve the problem. ILUC data is from a draft report of the International Food Policy Research Institute; direct emissions data is from the EU's *Renewable Energy Directive*, © European Union, http://eur-lex.europa.eu.

The ILUC debate has occupied European policymakers for several years. ILUC refers to the displacement of one use of land for another, as a result of energy crops being grown somewhere else. In practice, ILUC is often the displacement of tropical forest by food production, because the former food croplands have been used to grow energy crops. The result is the unintended release of greenhouse-gas emissions as large natural carbon sinks are destroyed (Fig. 1). The Institute for European Environment Policy (IEEP) calculates that when ILUC is taken into account, the plans of EU countries for biofuel use to 2020 would actually lead to between 81% and 167% more greenhouse-gas emissions than if fossil fuels were used instead[3].

There is still no policy proposal on the table that takes account of ILUC, although two main options are under consideration. One is feedstock-specific ILUC factors that reflect the impact of different feedstocks on land use. Modelling suggests that biodiesel (such as from palm oil) would fare much worse than bioethanol (such as from sugar cane) in this analysis. ILUC factors were backed by scientific experts at the commission's own Joint Research Centre in Ispra, Italy, last November, who concluded that "there is strong evidence that the ILUC effect is significant and that this effect is crop-specific"[4]. NGOs and a cross-party group of members of the European Parliament also support feedstock-specific ILUC factors, and California already implements them, with ILUC values regularly reviewed in line with scientific progress.

However, leaked minutes from a meeting between EU commissioners in July suggest that the commission is leaning more in the direction of a second option on the table: increasing the threshold of greenhouse-gas savings that all biofuels must meet to count towards the EU's 10% renewables-in-transport target. This threshold is currently

set at a saving of 35% compared with fossil fuels. The commissioners forsee returning to the issue of feedstock-specific ILUC factors in a few years' time. However, this feels very much like a political fudge: ILUC-factor supporters say that raising the threshold would do little to stop biofuels displacing agriculture, because there is no causal link between direct carbon dioxide emissions and indirect land-use effects. The EEA scientists say raising the emission-savings threshold could even exacerbate the ILUC problem; for example, it could encourage more — especially productive — land use, even if yields are low, if it reduces emissions from other inputs such as fertilizers.

What is at stake here is the European biodiesel industry. More than half of Europe's cars run on diesel, so when the 10% renewables-in-transport target was announced, investments in biodiesel seemed like a safe bet. But ILUC changes everything: leaked studies from the European Commission show that ILUC cancels out most of biodiesel's climate benefits and, furthermore, diesel from EU rapeseed, Asian palm oil and South American soybeans turns out to be worse for the climate than fossil diesel[5].

EU policymakers could yet be tempted by a new, third option to tackle ILUC, added to the table on 5 October 2011. A report by accountancy firm Ernst & Young, commissioned by an industry-led consortium, proposes that rather than penalizing producers for ILUC impacts, policymakers reward them for practices that mitigate ILUC, such as using biofuel byproducts as animal feed and better-integrated farming systems[6]. As a reward, the authors suggest extending the carbon credit of 29 g of carbon dioxide equivalent per MJ that already exists for growing biofuels on severely degraded or contaminated land. This could raise US$1.6 billion for producers in 2020 alone if 10% of the biofuels used in Europe that year qualified for it, the authors calculate. This assumes these biofuels would be worth 30% more than standard biofuels.

However, an existing incentive to promote so-called next-generation biofuels — those derived from waste or grown on land unsuitable for food — based on the same principle of creating a premium product, is not working. There is no price premium for next-generation biofuels so far and they are still more expensive.

So, many in the industry and NGOs advocate a mandatory target based on greenhouse-gas emissions for advanced biofuels. Others want a feed-in tariff similar to that for wind and solar — a premium in Euro cents per litre for the first billion litres produced per plant, suggests Michael Persson, vice president for finance and corporate affairs at Inbicon, DONG Energy in Denmark.

Next-generation biofuels will be the European transport fuel of the future — and they completely avoid the problem of ILUC. However, first-generation biofuels won't entirely disappear, they will continue to be imported from Brazil, Malaysia and other producers. Resolving the ILUC issue will relieve many investors regardless of the final mix of policy instruments used. The challenge for policymakers is not to decide whether biofuels are good or bad, but how to best support those that offer the greatest greenhouse-gas savings. ❐

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MARKET WATCH:

Vital statistics

A new report warns of the environmental impact of Asia's rise. But the relationship between pollution and economic growth is not simple, argues **Anna Petherick**.

The Asia-Pacific region is getting dirtier as it gets richer, warns the latest United Nations Environment Programme (UNEP) report[1] for the region. Whereas global carbon efficiency (emissions per US dollar of economic output) improved at a compound rate of 1.2% between 1970 and 2005, the Asia-Pacific region showed a corresponding 0.65% decrease. The world as a whole may be cleaning up its act, but the growing impact of Asia's economic rise is of increasing concern, according to the report, published in September 2011. China's CO_2 emissions outstripped those of the United States in 2006, more than a decade sooner than predictions made in the 1990s[2].

The relationship between increasing wealth and environmental impact is not linear, however. One popular way of looking at it is adapted from Simon Kuznets's Nobel-Prize-winning discovery that a society becomes less economically equal as its overall level of income rises, until it reaches a certain level of average income after which prosperity begins to be spread more equally. An environmental Kuznets curve (EKC) can be represented by the same inverted U-shaped curve, but this time environmental degradation increases with per capita income up to the turning point. Then countries start to get cleaner as they get richer (see Fig. 1).

The EKC — conceived in 1991 by World Bank researchers Gene Grossman and Alan Krueger — shook conventional wisdom that economic growth is always bad for the environment.

So, should smart environmentalists encourage China to grow its economy even faster? Surely vigorous Asian economies would clean up sooner if they ploughed quickly through the EKC's dirty hump of middle income? Sadly, it's not so simple. A detailed analysis of Malaysia, for example, has shown that it is possible for a country to become richer without improving its eco-friendly credentials (in that case, owing to government policies)[3].

Since its inception, the EKC has sparked a huge number of publications contesting its shape and broad applicability. "The pattern