

This response was submitted to the consultation held by the Nuffield Council on Bioethics on *New approaches to biofuels* between December 2009 and March 2010. The views expressed are solely those of the respondent(s) and not those of the Council.

Prof Keith Smith

QUESTIONS ANSWERED:

Question 1

ANSWER:

In favour, if, and only if, biofuels can be so produced that they (a) reduce rather than increase global warming, and (b) do not compete for land needed for food crops or require land that would otherwise remain under natural forest.

Question 2

ANSWER:

Increases in the price of food for people in the developing world, driven by competition for land and irrigation water; Managing diverse forest ecosystems sustainably as sources of biomass, as opposed to replacement by monoculture plantations.

Question 3

ANSWER:

Yes. I am a coauthor of the Crutzen et al (2008) paper on the implications of nitrous oxide emissions on the greenhouse gas balance of biofuels, and have been actively engaged in the subject since 2006. General scientific journals (Nature, Science, PNAS); specialist journals e.g. Glob Change Biol; scientific magazines, e.g. Chemistry World; general media. Scientific meetings and debates on the subject.

Question 4

ANSWER:

Important factors: 1. Your 3 factors mentioned in the background information. 2. The economic/political need to allow the aviation industry to flourish, albeit with a reduced growth rate, without it contributing ever more strongly to greenhouse gas emissions -- there is a greater and more obvious need for liquid fuels than is true for surface modes of transport. Priority: give more balanced consideration to using biofuels in ways other than for vehicles -- e.g. biomass for CHP, or simply for electricity generation. Advantages: potential win-win situation through use of wastes as feedstocks/ nutrient-rich sewage effluent for irrigation, thus reducing landfill and eutrophication, as well as creating jobs in new industries.

Question 5

ANSWER:

Agricultural/forestry residues, and also municipal wastes/sludges (see Q4 above); Perennials grown for biomass (lignocellulosic fuels), provided that the need for N inputs can be kept very low -- in the regions of the world with high rates of N deposition from the atmosphere, this source of N can be fully sufficient, and use of biomass cropping on previously set-aside land may actually reduce N₂O emissions that would otherwise occur (see Conen, F., Atmos. Chem. Phys. Discuss., 7, 11191, 2007). Possibly algae/halophyte cultivation in medium to long term.

Question 6

ANSWER:

The UK is too small and too heavily populated to provide a large proportion of our fuel needs from biofuel. -- thus lowering energy consumption should be a top priority: low-energy appliances/ more public transport/ better insulation/ etc. However, a more systematic management of woodlands, with sustainable

harvesting of biomass, could make a major contribution to power generation in the more wooded/forested areas of Britain. In areas like my own (rural Devon), has the energy potential of the hundreds of miles of annual hedge trimmings been evaluated as a source of biomass fuel?

Question 7

ANSWER:

New processes involving conversion of ligno-cellulosic materials and/or algae to biofuel seem likely to be a source of new jobs, both in constructing the infrastructure and running it. New industries need protection from excessive market fluctuations in price and in demand, if they are to get the necessary investment.

Question 8

ANSWER:

Plants are already in operation in Sweden to produce biofuel from waste material from the forest industries, and here seems no reason why in forest regions, e.g. SW Scotland, we can't do the same. We appear to be on the threshold of having viable systems for syngas systems using various organic residues, and could produce a win-win outcome in the UK, with its urbanised population and large waste output. 5-year timescale? General reading also indicates that several large international companies are investing heavily in algal sources. 10-year timescale for commercial sources?

Question 9

ANSWER:

pass

Question 10

ANSWER:

pass

Question 11

ANSWER:

Absence of adequate centralised (i.e. government-led) programme, providing funding. Too much left to private industry initiatives.

Question 12

ANSWER:

Developing satisfactory substitute for aviation (jet) fuel, and conversion of municipal waste. Decisions must involve the government, but be based on independent scientific and economic advice.

Question 13

ANSWER:

Yes. Use of crop land to grow biofuel crops, of whatever type, could conflict with need to grow food. In a world where WTO and EU rules apply, we are open to imports of feedstocks for biofuels, and we need to ensure against indirect land use change whereby virgin land is converted to agriculture to make up for agric land taken for biofuel crops. New "wonder crops" such as Jatropha, could be grown in developing countries in the tropics as part of a carefully managed system of local sustainability, whereby the shrubs could be used on a small scale, e.g. in intercropping and in hedging to protect livestock, and then the

product used for well water pumping, fuelling the local generator or the health worker's vehicle etc etc, instead of expensive imported petrol and diesel. However, large-scale plantation development will be likely to be accompanied by takeover of essential food-producing land, AND make use of N fertilisers, thus adding to emissions.

Question 14

ANSWER:

See previous answers

Question 15

ANSWER:

Yes. See previous answers. This raises a very big issue about the governance in countries such as Indonesia, Brazil, Malaysia, where illegal logging and forest clearance still appear to be rife. Until better safeguards against iLUC are in place in a country, imports of biofuel feedstocks from that country should be banned.

Question 16

ANSWER:

Nothing to add to the analysis in the background information.

Question 17

ANSWER:

New approaches seem less likely to have an impact on food security than with 1st generation biofuels, where there is the problem of direct diversion of the wheat or maize crop to biofuel production -- but there is still a danger that plantations of lignocellulosic feedstocks (poplars, willows, miscanthus etc) could similarly compete for arable land. Perhaps we need to look at a new version of the old postwar controls that designated land for agriculture (and thus forced forestry onto Class4/5 land), and this time reserve agric land for food crops and not perennial biomass crops, except where a licence is issued when arable land is clearly in surplus.

Question 17

ANSWER:

New approaches seem less likely to have an impact on food security than with 1st generation biofuels, where there is the problem of direct diversion of the wheat or maize crop to biofuel production -- but there is still a danger that plantations of lignocellulosic feedstocks (poplars, willows, miscanthus etc) could similarly compete for arable land. Perhaps we need to look at a new version of the old postwar controls that designated land for agriculture (and thus forced forestry onto Class4/5 land), and this time reserve agric land for food crops and not perennial biomass crops, except where a licence is issued when arable land is clearly in surplus.

Question 18

ANSWER:

I am concerned that international agribusiness may take over large areas of land in the developing world used up to now for indigenous agriculture, in order to produce feedstocks for future generation fuels. The example of *Jatropha* (see earlier answer) is relevant here (although as it is an oilseed, albeit not one with an edible oil, perhaps it comes in the "1st gen" category?)

Question 19**ANSWER:**

See comments above re international agribusiness in developing countries. Dangers of overwhelming pressure being exerted on poor farmers to lease/sell land for biofuel crops

Question 20**ANSWER:**

Structures in developed world provide much better capacity for farmers and workers to opt in or out (see previous question).

Question 21**ANSWER:**

Big need for public investment and control of development -- see answer to Q 11 above.

Question 22**ANSWER:**

1. The need to ensure that any life cycle analysis of the greenhouse gas balance of the biofuel has been subject to adequate peer review, involving not just environmental consultancy firms and economists, but also people expert in the complexities of the biogeochemical cycles of carbon and nitrogen, who can adequately assess changes in both the direct and the indirect emissions of GHGs as a consequence of the biofuel production. The treatment of the issue of N₂O emissions by the Gallagher Review indicates that such expertise can be lacking. In the small world in which assessments of environmental sustainability of biofuels are made, there is a need for clear declarations to be made by any assessor organisations that there is no conflict of interest.

Question 24**ANSWER:**

Nothing to add.