

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.

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## **QUESTIONS ANSWERED:**

### **Question 1**

#### **ANSWER:**

It is inevitable and to be desired providing it is done in a sustainable manner. The last 50 years of cheap energy in the western world has been a liberation and society must accept that whatever the fuel source this must end both from a climate change point of view and also from the position of fuel security. This move however will hopefully improve society by decreasing our energy waste and by the creation of new jobs in the biorenewable economy.

### **Question 2**

#### **ANSWER:**

Sustainable production and utilisation. It will be of no benefit to grow the necessary biomass in the third world using non-sustainable methods in order to obtain additional cheap energy. There needs to be policy lead on this by world governments and matters should not be left to market forces alone.

### **Question 3**

#### **ANSWER:**

I am well informed. I am a biochemist with a major research interest in matching biomass composition to conversion process. My information comes from peer reviewed journals, editorials, press releases, radio news and electronic news letters.

### **Question 4**

#### **ANSWER:**

The need to reduce GHG emissions is paramount. The UK is mandated to do this under several EU agreements and faces humiliation and financial penalty should we fail to meet our targets. The bigger picture however is that should we fail to make changes there is a possibility that temperature rise will make human existence at present population densities unsustainable in many parts of the world and that if we fail to act now when matters are within our control we may enter a state of runaway climate change where things are beyond our control. There needs to be an acceptance however that there will be insufficient amounts of biofuel to replace fossil fuel usage at present levels. Given this we hope to see decreased levels of wastage (we are currently very energy wasteful) and the reinstatement of agriculture, food and biomass production as key policy matters in the developed world. For too long these have been largely ignored as the attitude has been that food and energy could be purchased at the lowest cost with no consideration to energy or food security.

### **Question 5**

#### **ANSWER:**

We need to prevent competition between food production and fuel production, but there are likely to be trade offs. This situation is made worse by the likely consequences of climate change which include many currently fertile areas of the world becoming arid and no longer fit for agriculture. Second generation fuels are to be encouraged, biomass which involves use of food material should be prevented by effective policy. Improved use of agricultural, domestic and industrial biomass waste is something which is not very sexy but is really important as we cannot afford to discard this material in landfill or throw away by incineration.

### Question 6

#### ANSWER:

energy security will rely on sustainable provision of biomass from sources close to the user. It will be best achieved by use of non-food lignocellulosic crops and better waste management.

### Question 7

#### ANSWER:

the sustainable cultivation of non-food biomass crops will be of general benefit in both the developed and the third world but it must be ensured that farmers in developing countries are not lured into cultivating biomass instead of food as has been the case for tobacco, cotton and other cash crops. Furthermore, multinational companies must not be allowed to purchase land in developing countries to grow biomass where this impacts on food production.

### Question 8

#### ANSWER:

It must be remembered that the whole point of pretreatment should be improved processability without concomitantly increased energy inputs. Lignocellulosis is such a process. Pyrolysis requires high energy inputs and whilst it will be of value in some circumstances the poor quality of the derived oil and the energy required for pyrolysis will make this process unfavourable as a general processing method (unless factors such as cheap H<sub>2</sub> from fuel cell come into play which could be used for fuel improvement). The best thing to do with biomass is to combust it for heat and energy. Making liquid fuels is a stop gap whilst we convert from existing internal combustion engine technologies to new battery or fuel cell solutions. Torrefaction needs consideration. this needs no input and effectively removes hemicellulose and protein so increasing energy density, biomass processability and decreases emissions of the biofuel for thermochemical conversion.

### Question 9

#### ANSWER:

All approaches are appropriate providing each intervention is looked at on a case by case basis. GM for example often gets considerable flak but really a thing should be judged by what it is not by how its made and often the prejudice against GM is due to ignorance of what GM is and for that matter what conventional breeding is. Key points are: we must improve biomass crop yields with little or no inputs, we may wish to improve composition and crop quality, we will want to improve biomass crop resilience to environmental stress e.g. drought. We will have to be aware of causing weediness and of possible inadvertant effects e.g. varieties which become poisonous to live stock or become allergenic. These can be screened for and GM is no more likely to achieve these dire consequences than other improvement methods. indeed in many ways it is more specific. It may also allow us to breed varieties which can be grown on land unsuitable for food production. All approaches are therefore relevant and should be used as required with adequate safety screening before variety release (as is already the case)

### Question 10

#### ANSWER:

tricky! country of origin must have a share of the IP associated with new varieties. IP associated with process or GMOs must go primarily to the developers but there needs to be measures in place to allow licencing of IP if we are to have effective uptake of new technologies. This question needs expert opinion.

### Question 11

**ANSWER:**

time and money. We are needing marketable solutions in the next 5-10 years, wildly new approaches may not have time to be developed before our 2020 commitments are due. Money, all of this research on field sized experiments costs a lot of money at a time when academic institutions face cuts and institutes are being closed like sea side ice cream shaks at the beginning of October.

**Question 12****ANSWER:**

The R&D should be targeted at both short term and long term solutions. At first farmers are going to need entry crops to get the biomass ball rolling. These may be multifunctional allowing grazing and usage as biomass. Farmers cannot commit land to biomass in the absence of stable markets for the product and also when using the land for wheat for example will pay them 4X more. These entry crops could be grown on marginal land and would not require new machinery or tie the land up for years e.g. reed canary grass, maybe switch grass?. these are not necessarily the crops we want them to grow in the future, they are a way of hitting our short term goals. later we will want them to grow the new varieties of miscanthus and willow etc. but the time for that is maybe not right now. Forage grasses hit many targets as this is a rich source of biomass for fermentation and also great for forage. Strategy needs to be decided by a steering body representing biomass users, producers, the gov. and academics. It must be transparent and less complex than the mess of NGOs which seem to proliferate in this area at present. Currently, investment in R&D is confused with many bodies funding overlapping areas. The best initiative is that of the RCUK who have pooled their money together for a coherent strategic focus.

**Question 13****ANSWER:**

of course there are likely to be problems and trade offs. It will not be possible to replace current levels of fossil fuel usage with biofuels so there will always be a demand for more biomass. this will if left unregulated have impacts on communities, natural diversity and maybe on food production unless regulated tightly. However, the public must understand that there are likely to be some difficult choices. the watch word is sustainability, we may have to manage with less than we would like but be in the knowledge that production is sustainable. however it is inevitable there will be some casualties from this new agriculture.

**Question 14****ANSWER:**

The developed world is short of land and needs biomass. It has stronger legal frameworks preventing adverse impact and governments who will enforce these as they want to be re-elected. The developing world in contrast is vulnerable, look at what has hapened with oil and gas production; multinationals have a tendency to operate policies in such countries which would be illegal in the developed world. They are vulnerable to having valuable habitats destroyed and land producing food given over to biomass. We need regulation!

**Question 15****ANSWER:**

There are several papers citing the effect of iLUC and how this can result in some circumstances in the release of far more GHG that would be saved by the cultivation of biomass in the first place e.g. destruction of forest and perennial grass lands. Disturbance of soil should be minimised as should destruction of forest or perennial grassland in an unregulated manner.

**Question 16**

**ANSWER:**

There is going to be competition for land use and it is reasonable to assume that for some consideration of profit is going to outweigh any consideration of environmental impact or even GHG off set due to change of land use. With appropriate regulation however it will be possible to improve some land by bio-remediation of brown field sites and to utilise low value land. This must of course be viewed in the light of possible loss of biodiversity. In the developed world there are procedures and processes which could easily be adapted to stop the majority of inappropriate development but in developing countries there is a real need for multilateral regulation.

**Question 17****ANSWER:**

the new approaches to bio-fuels will mitigate some of the effects on food security as they are not food crops but there is likely to be competition for land usage which will affect food security. The developed and developing worlds need to embrace these new agricultural opportunities with the security of effective regulation to prevent harm being done in order to provide the already developed world fuel at the expense of the world's hungry.

**Question 18****ANSWER:**

The difference is one of vulnerability. In the developed world there are laws and regulations which can be adapted and enforced. In the developing world there is a history of the poor being exploited by the rich. This must not be allowed to happen in order for the developed world to source cheap biomass!

**Question 19****ANSWER:**

There are likely to be both problems and opportunities especially in the developing world. There needs to be legislation to prevent the unscrupulous from exploiting the vulnerable with low wages and unsafe and unfair working practices. However, it must be realised that if properly carried out biomass production could offer agricultural workers real chance of better wages and improved living standard.

**Question 20****ANSWER:**

Workers in the developed world are generally better protected from exploitation in the work place by regulations, but there are exceptions to this. Consider the Chinese mussel pickers who were drowned only a couple of years ago on Morecombe Bay.

**Question 21****ANSWER:**

Investment should be made on a merit basis, certainly before investing from the public purse we need to be sure that investments are likely to lead to sustainable and genuine returns to the tax payer. Industry will invest primarily according to anticipated profit and market dominance, this must be tempered by life cycle assessment considering adverse impacts and GHG reductions. Investment cannot be left entirely to business, there needs to be an attitude that we invest in society and look for opportunity to invest from the public sector which although may not produce high profit (these will be targeted by industry) will give rise to sustainable economic and sociological outcomes. Think for example of biomass production schemes allowing remote communities to become partially self-sufficient for energy. Partnerships between business and the public are to be encouraged providing business does not see this as a means of being bank-rolled, benefits must and should be mutual.

## **Question 22**

### **ANSWER:**

change in land use, farm gate prices for biomass, subsidy to farmers to enable take up of biomass production, ethical production in the UK and overseas, life cycle assessment by independent regulators to ensure developments are sustainable sociologically, ecologically as well as economically, threat of biomass production to food security, not to be blinded by the need for biomass production when there are other components of effective energy policy e.g. carbon sequestration, nuclear power, use of waste, limiting land fill, renewable wind and water power.

## **Question 23**

### **ANSWER:**

Regulate energy prices to persuade energy producers to use more biomass. Facilitate growers to take up biomass production in the knowledge that they will get a fair and sustainable price for their produce, make tax concessions to reward uptake of biomass and biorenewable solutions, work with business to help them move towards sustainable heat and power production. Cut the reliance on cheap forest waste which is undermining uptake of biomass production in the UK, it is not sustainable in the long term!

## **Question 24**

### **ANSWER:**

This is a great opportunity to reinvigorate the UK agro-economy and to reestablish the lost link between land, food and fuel security. It needs forceful regulation which goes beyond party politics and the UK needs to be a leading light for countries less willing to accept their moral obligations to produce heat and energy ethically and sustainably in a manner which will not result in dramatic climate change or the exploitation of the vulnerable. I am sure we can do this if we can have commitment and act quickly for time is running out.