

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:**

Societies, especially in less developed countries do not have other choice but to move towards greater use of biofuels. In many regions of the world, especially in Sub-Saharan Africa, Asia, and many parts of Latin America, many smallholder communities do not have any access to any type of energy. United Nations has estimated that around 2 billion people are in this category of 100% energy deprived population. Yet, in many of these regions, bioenergy crops could be produced and transformed into biofuels that can be used as the first step towards processes at community level to generate bio-electricity, use clean-cook stoves, introduce mechanization, and other technologies.

### **Question 2**

#### **ANSWER:**

We consider that the most important ethical challenges raised by the prospect of future generation biofuels are related to the accessibility that poor rural communities could have to these new, promising technologies. They are often based on high capital inputs, patented know how, and small, poor farmers, the ones that most need to improve their access to energy sources, may lack the capacity to get any benefit from these new technologies. The greater challenge for modern societies that want to promote easier, sustainable access to energy sources, would be to eliminate these barriers

### **Question 3**

#### **ANSWER:**

In general, a person with easy access to Internet gets every day a fairly good amount of informations on biofuels. Persons demanding more technical oriented informations about biofuels need to get suscribed to specific magazines and publications, most of which can be obtained on line. I will consider myself well informed about this subject

### **Question 4**

#### **ANSWER:**

The most important factor in driving the development of biofuels in the future will be the need for promoting agricultural and economic development with millions, perhaps billions of farmers around the world, living in marginal areas, facing a lack of resources, especially energy. There are many regions in the world in which the people has no access whatsoever to any form of energy to satisfy their daily needs for cooking, lighting, etc. Addressing the needs of these people must be the driving force for promoting bioenergy development efforts. Priority should be given to policies that encourage land tenure development so that farmer groups have access to land and can use this land to grow bioenergy crops that can be transformed into liquid biofuels for running cars, motors, for generating electric energy, for cooking and many other uses. When farming communities start to meet their energy needs, it becomes easier to promote economic development programs and achieve improvements in quality of life of the population. Future biofuel production should aim to deliver benefits to those farmer groups and rural communities that are not currently connected to the national electric energy grid, with a total dependency on imported fossil fuels to meet their daily energy needs. Establishing mechanisms and interventions that help these communities to incorporate themselves to any economic activity should be a priority.

### **Question 5**

#### **ANSWER:**

The most important aspect in promoting new generation biofuels would be the carbon balance of the process. If the biomass that will generate the biofuel has to be produced cutting forests and consequently taking carbon from the ground, the reduction in greenhouse gases emissions (GHG) will be lower than using for example crops such as cassava, sweet potato, stevia, moringa or many others, than can be grown in marginal lands, already dedicated to grow poor, degraded pastures. In this case, the plants will remove carbon dioxide from the atmosphere, and in theory, GHG emissions will be reduced compared to fossil fuels or biofuels produced through forests-cutting schemes. Probably schemes such as algae production and processing could be most successful in generating emission savings. Carbon dioxide emissions from industrial processes could be used and algae-based bioenergy processing does not compete for land. These organisms have relative simple growth requirements: water, sunlight, CO<sub>2</sub> and nutrients such as phosphorus and nitrogen. I don't see any reason why these new approaches should not be encouraged except in the case that they are promoted to further enhance the dependency of a given community or population on fossil fuels to meet their energy needs

#### **Question 6**

##### **ANSWER:**

Achieving energy security is not an easy goal for a nation. Demand from urban centers is continuously increasing and any expansion in the coverage and the capacity to generate energy in a country, is rapidly covered by the growth in population and in domestic and industrial demands for energy. This situation leaves the rural areas, especially those located in more marginal, remote sites, without interconnection to the national grid, absolutely dependent on fossil fuels to meet their energy needs. So, for any approach to be successful in improving energy security, a basic condition should be that it allows the most energy-deprived sector to improve their energy self sufficiency. In this sense, approaches that promote local production of energy will be more sustainable and successful. To encourage these schemes, local governments should introduce policy reforms in the energy sector putting a priority in systems that favor local production and local consumption of energy. Currently, there are worldwide many options to promote village-level production and local consumption of biofuels. These approaches could be very useful for the estimated 2 billion people that according to United Nations lack access to electricity worldwide.

#### **Question 7**

##### **ANSWER:**

The new approaches to biofuel production are all important. Some of them are more easy to implement than others. Some may put additional pressures on resources such as land, than others. For example, the use of woody parts for biofuel production could require extensive areas of land and this could be a constraint for its massive implementation. Considering the large sector of the world population that is 100% energy-dependent on fossil fuels, and considering that most of them are located in rural areas, the most successful biofuels approaches for promoting economic development would be those that facilitate the inclusion of the energy-dependent sectors in economic processes that allow them not only to alleviate their energy-dependency but also to generate income, employment and improvements in quality of life. One example could be the use of crops such as cassava, sweet potato and sweet sorghum in the Sub-Saharan African region. These three crops have the ability to support drought and are easily cultivated by farmers communities. They can dedicate part of this production to produce a fermentable biomass, convert it into ethanol, and use this ethanol for running cars, running station engines, home cooking, generating bioelectricity, so that biofuel processing becomes a starting point for economic development processes at the village level. To encourage the establishment of these processes all we need is a policy, a government commitment. Unfortunately, in the majority of these countries and regions in which the energy-deprived population is located, the governments lack the courage to implement these policies. Biofuel development is left to the initiatives of private sector companies and they are not interested in promoting models that aim to include the poorest of the poor in the benefits. Sugar cane, palm oil, corn, and other few crops become then the main options.

#### **Question 8**

**ANSWER:**

Turning lignocellulosic feedstock into biofuel has the limitation that a pre-treatment stage has to be conducted first. This treatment is usually dependent on the use of high technology inputs (enzymes, chemicals, processes) and this can prevent large sectors of the population from participating. Its associated high costs could be a limitation for scaling up. Development of algae as a biofuel feedstock could be a very promising field considering that it would not put pressure on arable land, and most of the water used to grow the algae can be recycled. Furthermore, a byproduct of the processing can be used as animal feed. The timescales required for the scaling up of these developments is difficult to define. In some cases, the technology is ready to be implemented and adjusted. In other cases, it is still in the research pipeline. One big constraint for the commercial development of the new approaches for biofuel production would be the lack of technical capacity in the local people

**Question 9****ANSWER:**

The use of innovative technologies such as advanced plant breeding, genetic engineering and synthetic biology is appropriate to develop new approaches for biofuel production. Science has been and would be a great contributor to improving overall efficiency of the technological processes. At the end, a key element in the generation of alternative biofuel approaches will be the final cost of the biofuel. The new technologies could help to reduce costs, avoid competition with the use of feedstocks as food, improve the efficiency in production and management of wastes and residues, etc.

**Question 10****ANSWER:**

Difficult question to answer. One important issue is that there must be a fair treatment of the investors. If they have made investments and put resources (human, economic, physical), to develop strategic knowledge. Their investments need to be protected. On the other hand, traditional knowledge developed by farmers groups through centuries and passed from generation to generation, has to be protected also from appropriation by companies. The ideal situation to govern these potential conflicts is to establish a legislation that is fair with all the parties interested so that so that positive, beneficial knowledge sharing is promoted.

**Question 11****ANSWER:**

Lack of funding, closely related to the lack of a supportive policy in favour of R&D activities for new biofuels approaches is perhaps the main limitation faced by the group of scientists, practitioners and technology developers that are working in this field in developing countries. There is an urgent need to promote scientific information exchanges between scientists from third world countries and those from developed countries, so that a new generation of researchers is formed in the developing countries, with improved capacity to develop, adapt and validate the new approaches to biofuel production that are being generated every day. If this knowledge-sharing bridges are not established, there will be a risk of a new face of technological colonialism and the best technologies available will only be used for those countries that can afford to do it.

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

New approaches to biofuel should be targeted towards the development of new processes based on feedstocks that can be grown easily by farmer groups located in marginal areas, that are based on efficient and competitive use and cost of inputs, especially energy, and that are environmentally-friendly, yielding more energy than it is required to produce the biofuel. Approaches that are only feasible because the use of economic subsidies should be avoided. Decision-making about future biofuel strategies should

be a more open process, allowing some degree of participation to those sectors of the crop-to-biofuel chain that are being left out from the benefits, especially the farmer groups that are currently totally dependent on fossil fuels to meet their energy requirements.

#### **Question 13**

##### **ANSWER:**

In some cases, the new approaches to biofuels are likely to raise problems related to land use. One concrete case is a system in which forests are cut down to grow a crop feedstock for biofuel processing. Farming communities living in the areas surrounding the forest could be dependent to a large extent on the forest as a resource to extract food, feed and fuel. If the forest is converted into a cropping area for biofuels, this change could seriously affect the food security of the communities. However, there could be cases in which an innovative use of the land resource could be beneficial to the population and could contribute to meet the energy needs of a region or country. One example is the Eastern Plains region of Colombia. 3 to 4 million hectares of land are currently used for an extensive cattle grazing system with an animal density of about 3 hectares per cow. A very inefficient meat production system. One alternative could be to allocate 1 million hectares of this region to the production of biofuel crops such as cassava, sweet potato, sweet sorghum, palm oil. Colombia could develop a biofuel revolution, improving its energy self-sufficiency, and opening employment and income opportunities for millions of landless people that are being forced out of the land by the political conflict.

#### **Question 14**

##### **ANSWER:**

In the developed world, the land available for biofuel production is scarce. The implementation of new approaches for biofuel that are dependent on the availability of large areas of land will be constrained. Only those approaches that require less land could have good potential, for example algae processing, solar energy, photovoltaic systems, etc. In the developing countries, land resource is more readily available. What they need is clear policies that favor the allocation of state-owned land to farmer groups and the establishment of biofuel production and use schemes in which these farmer groups could become principal actors.

#### **Question 15**

##### **ANSWER:**

It is commonly assumed and accepted that by growing feedstocks for biofuel production, carbon dioxide is removed from the atmosphere, and this sequestration effect can, in theory, reduce GHG emissions, in comparison to fossil fuels which are taking the carbon from the ground. However, this account is being currently challenged and considered one-sided because it does not take into account the carbon stored in the ground that is removed to plant the feedstock crop, especially in the case of converting grassland into a biofuel feedstock. The effect of the indirect use of land must then be accounted and only those systems in which the carbon generated on land to displace the fossil fuels is greater than the carbon storage in the ground, should be promoted. Only the systems that meet this condition will really generate GHGs reduction.

#### **Question 16**

##### **ANSWER:**

One environmental threat caused by the new approaches to biofuels could be the management of the wastes and residues generated in the process. In many cases, the effluents coming from biofuel processing are not managed properly and they end up contaminating soils and water reservoirs. The new approaches should address these concerns. For example, the vinasses generated in the processing of ethanol could be treated and converted into products that can be used as nutritional supplements for

animal.

#### **Question 17**

##### **ANSWER:**

Many of the arguments about the conflict food vs fuel are controversial. New approaches to biofuels, such as lignocellulosic and algae processing have the potential to eliminate these debates. However, food security is not just an issue of owning a piece of land and growing a crop on it. For many farmer groups food security is more related to the lack of market channels in which to sell their crops and generate incomes that can be utilized to purchase more food. They grow only the food they need because if they grow more, they will not find markets. In this case, additional use of land can be promoted so that the extra feedstock grown could be transformed into biofuels without compromising the food security of the farmer group. Or, in the case of crops such as sweet sorghum, part of the crop could be used for fuel (stems) and part of the crop for food (grain).

#### **Question 18**

##### **ANSWER:**

Main difference is the level of income. In a developed country the per capita income will allow the person to purchase food and keep the food security status stable. In developing countries, if not properly formulated and implemented, a biofuel program could seriously affect the food security status of a farmer group or community.

#### **Question 19**

##### **ANSWER:**

New approaches to biofuels could or could not raise problems related to the rights of farmers and workers. It will all depend on the context and conditions in which the processes are implemented. The basic right of a farmer or worker is the legitimate aspiration to participate with a share of the benefits that the whole process is generating. In first generation biofuels the farmers and the workers hardly ever are given a participation. For example, sugar cane farmers grow the sugar cane, sell it to the distillery and they don't even get the vinasses or residues in return. New approaches for biofuel should try to recognize this basic right of workers and farmers to participate as co-owners of the biofuel enterprises and not merely as feedstock producers.

#### **Question 20**

##### **ANSWER:**

The main difference between the developed world and developing countries with regard to the effects of future generation biofuels on the rights of farmers and workers is that in many developing countries, for centuries, the rights of the farmers and the workers have been neglected. Private sector with a great lobbying power control the policy making and formulation processes and the allocation of resources for the rural sector. In the case of the existence of any type of subsidies to promote agricultural development, these subsidies are rapidly and easily captured by the richest farmers and the small farmers that most need it do not have access to them. There are plenty of examples of this unfair situation in developing countries, Colombia perhaps one of the most recent.

#### **Question 21**

##### **ANSWER:**

Investment in new approaches to biofuels should be directed to generate and implement technology options that facilitate the participation of the billions of farmers that are now totally excluded from the process of biofuels generation. Participation of public and private sector, together with farmer sector, for example in the way of public-private partnerships could be encouraged. For example, through a policy

decision, the production and local consumption of biofuels could be encouraged in a given region. Farmers could participate as producers of the feedstock and receive policy incentives to do so. For example in South Brazil, farmers that take credit loan for growing bioenergy crops, receive a very low interest rate to pay the debt to the bank. This mechanism could be replicated in other countries. Private sector could participate investing in the biofuel processing facilities and in the commercialization of the biofuels, allowing the farmer groups to have a share in the biofuel business model. This type of model could have a tremendous growth potential in many developing countries

#### **Question 22**

##### **ANSWER:**

Some important policy issues that should be considered when promoting new approaches to biofuel generation are: Credit: should be at low interest rates, easy to get, long repayment terms, for production of feedstocks and for investment in processing infrastructure Legislation: policy measures such as tax discount incentives for consumers of the biofuels, at homes, for car owners, at industries. Land reform: a landless farmer, that is also dependent on fossil fuels to meet his/her energy needs, is a double burden for the State and the society. Policies should be implemented to try, first of all, to give landless farmers an easy access to land. This land can be used to grow feedstock crops that can be transformed into biofuels. With a reduced dependency on fossil biofuels it will be easy for farmers to engage in economically productive activities that help them to get out of poverty.

#### **Question 23**

##### **ANSWER:**

The most effective policies to promote and incentivise the development of new approaches to biofuels are those related to: Easy access to credit Easy access to land Incentives to consumers Financial Support to research and technology development activities Legislation on intellectual property issues

#### **Question 24**

##### **ANSWER:**

I think the issues covered in this consultation cover all the important aspects that need to be taken into account in the ethical evaluation