

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.

Advanced Biofuels USA

QUESTIONS ANSWERED:

Question 1

ANSWER:

If we value energy security, being able to move persons and goods by motor vehicle and plane; if we value military strategic flexibility and understand that our reserves of fossil fuels soon will not be adequate to produce the energy needed to meet these valued items, then we must find ways to develop the fuel from other means that pose the least damage to our environment and promise the greatest economic and social value to the people of the Earth. I believe that advanced biofuels is the preferred way to achieve these goals.

Question 2

ANSWER:

To be ever aware of local conditions and beware of making inappropriate generalizations regarding the balance of needs, wants and values for individuals, specific communities, geographic regions and political entities.

Question 3

ANSWER:

Yes. Advanced Biofuels USA, Biofuels Digest, public relations materials, attending conferences, corporate web sites, nonprofit organization web sites.

Question 4

ANSWER:

Government policies (local, state, regional, State, International) Availability of financing Price of oil
Community opinion, values; community leadership To what policy concerns should priority be given? •
Land ownership clarification • Secure, reliable respect for intellectual property by all persons, entities and states. • Scientifically reliable, comparable analysis of direct and indirect greenhouse gas emissions and other pollutants (life cycle analysis) based on adequate, credible data and models developed specifically for this purpose. Such analysis should not be restricted to biofuels or advanced biofuels, but to any fuels used for transportation, heating and electricity. The analysis should compare emissions, etc., not only to some historic statistics, but to contemporary analysis. It seems more pertinent to compare the emissions related to creating a gallon of tomorrow's petroleum-based gasoline to the emissions related to crating a gallon of tomorrow's bio-based gasoline than to compare tomorrow's bio-based gasoline to 2005's petroleum-based gasoline. • Land use policies at all levels of government, including assessment and discussion of a wide range of possible land use in each area from residential/commercial/industrial development to recreational park land, conservation land and various agricultural uses • Best, sustainable, energy conservation practices for all types of land use options, via imposed building codes and other appropriate programs. • Possible carbon tax (not cap and trade) and other resource use or abuse taxes that are used for direct development of technologies and implementation of strategies to alleviate specific damage to the Earth and societies. Once the violation is "fixed," the tax is withdrawn. What advantages not mentioned here could and should future biofuel production aim to deliver? Energy security; military strategic flexibility; rural economic development; climate change mitigation

Question 5

ANSWER:

At this point, many new technologies are being developed. Some remain a glimmer in some entrepreneur scientist's eye. We are nowhere near a place where we can pick winners and losers. The world has many unique circumstances; "one size" does not fit all of them. We should be encouraging more innovative thoughtful experimentation that begins with the intent to find the most sustainable methods to convert biomass into biofuels. Existing research in enzymes and catalytic conversion of sugars into drop in fuels shows great promise, but results are being held close to the chest while intellectual property rights are secured. How should these be encouraged? Improve financing of basic research with flexibility to research approaches and goals. Improve financing that will get more innovative technologies through the "Valley of Death." Recognize that we are engaged in development of conversion technologies that have never been done before except in small niches in nature. Are there any reasons why these new approaches should NOT be encouraged? Some sustainability and environmental parameters for eventual development of technologies should be discussed and implemented; but basic research can go many directions and we should not unduly restrict the many directions that research could go in order to find useful ways of developing our world. All change and development has pros and cons from learning to make and use wheels to seeking and manipulating the mechanism of the atom; from creating wings and propeller designs that enable human flight to bombing the moon to find out if there's water. Biomass has been used for fuel since we discovered how to harness fire. If we continue to expand our population and desire the minimal comforts of life for that population, we will need to use biomass for fuels in more thoughtful, prudent ways.

Question 6**ANSWER:**

Any and all. See above answers. The specific answer for a specific community rests on what approach is best for that community—what are the expectations from their society for use of fuels; what resources does the community have as far as agriculture/aquaculture, etc. Remember that the person or entity that provides your fuel has significant leverage over you. When your expectations of obtaining fuel are intentionally not met—or demands for payment (in many forms) are increased, you feel the pressure of that leverage. If you remove that power from that outside entity and secure it for yourself, it can result in significant consequences that have nothing to do with getting a vehicle to move from place to place, charging a cell phone or heating food. This potential transfer of power can be revolutionary. Successful energy independence can relieve small countries of the need for allegiance to specific large energy-providing countries; just as it can change the balance of power among large states. Increasing energy security with home-grown fuels may result in decreasing political stability; awareness of this transformation should not be overlooked. This could be an exciting positive development for the world; but all change provides opportunities for positive as well as negative consequences. The savvy leaders will keep this in mind. How should these be encouraged? Encouragement of appropriate technology transfer. Encouragement of studies such as that done recently for Tanzania which outlines the status quo and begins to outline options and political, economic, social and environmental issues that are implicated in the process of finding what that community/society deems positive development. Are there any reasons why these new approaches should NOT be encouraged? Not that I can think of. All approaches should be encouraged with leaders working to determine how to best direct the implementation for the good of their society and the greater Earth's benefit.

Question 7**ANSWER:**

Which of the new approaches to biofuels will be most successful in supporting economic development? Again, we don't even know about all possible approaches. Some will be more appropriate for some situations than others. For example, an island with a serious solid waste management problem may find a good, sustainable gasification process better than landfill on limited land, better than shipping/barging waste to other locations. Places where grasses grow a tall as houses might find enzymatic conversion of energy cane or grasses into green crude the way to go. In other places existing oil refineries might work

to develop green crude resources so that they can transparently diversify and produce all their fuel, chemical, plastic and industrial products from whatever feedstock gives them the best return on their investment—and with the cost of extracting and transporting petroleum going up, biomass-based crude could become a cost-effective solution. How should these be encouraged? Attitude. Set reasonable standards to protect the environment and let entrepreneurship and private financing do what they can. If they can't/won't work under the set conditions; then government will have to step in until the social value becomes adequately monetized. Are there any reasons why these new approaches should NOT be encouraged? The parameter/standard setting should determine what approaches will be encouraged.

Question 8

ANSWER:

Of all the new approaches to biofuel feedstock development, pretreatment and processing (including any additional to those mentioned here), which is looking most promising for eventual commercial and sustainable use? Again, I think we are not in a position to pick winners and losers. Each of these technologies may be the best practice given a specific circumstance and environment. Over what timescales might such developments be commercialized? Some could be commercialized tomorrow given adequate financing and policy development. We do have a problem in areas such as the Eastern US along the piedmont and Appalachian corridor. Smaller, non-contiguous farms with transportation challenges may not be able to economically provide any energy crops even though there may be potentially significant acres of marginal land, reclaimed mining land and winter rotation energy crops. For these areas to contribute to a biofuel economy, harvest-site intermediary conversion technologies must be developed. Are there any risks associated with these developments? I think there are a lot of perceived risks; in the US, growers who have been operating with the comfort and relative consistency of quotas and subsidies are afraid to have those security blankets yanked out from under them. They are reluctant to take the risk of investing millions in the bricks and mortar only to see the same level of income result after the effort, anxiety and work. There needs to be more than social value to incentivize transformation of agriculture from food/fiber/feed to also include fuels. Financial investors are terrified of an industry that relies on variable commodity price/availability on both the feedstock and end product ends; and doesn't give them a clear exit in 3 years with an ROD of 20%. So the risk is that we will have great, beneficial ideas that won't get implemented until gas is over \$100/gallon for a sustained period and growers are so desperate that they will enter into multi-year contracts to produce energy crops. That is unlikely unless for some reason they can't get more for food/feed/fiber crops. And I'm betting that it will be a long time before energy crops will demand as much as food/feed/fiber crops. Farmers will grow what gives them the best return on their investment. Thus, I think the immediate biofuels feedstocks are going to be from agricultural and food processing residues and municipal solid waste. Once conversion efficiencies improve, then there may be demand for sustainably grown energy crops; perhaps as rotation crops in the US, and forest waste if we can get our definition of biomass corrected, federal lands included and develop sensitive trucking of forest management residues. I really don't think farmers are going to grow crops that don't make them as much as food/feed/fiber crops do. Remember, when farmers sell their corn crop, they don't ask how that corn is being used—for compostable carry-out containers, for corn syrup, for hog feed or for ethanol. They want to get the best price they can to cover their expenses and provide an income. And recall that ethanol refineries went out of business when their feedstock (corn) price blew up far beyond the wildest imaginings of their business plans. The market did a serious correction as gas/natural gas/fertilizer prices dropped; with corn prices dropping by half and more. We notice that food prices, even those not connected to corn such as vegetables, have stayed quite high.

Question 9

ANSWER:

Yes. Without these developments, we may not be able to use our land resources as effectively as possible.

Question 10

ANSWER:

One of the first items of business as the US was defining itself was the development of the patent and trademark office. The founders recognized the importance of respecting ownership of one's creative work. A key issue is Respect around the world for intellectual property. Certainly, things are changing so fast that before a patent is awarded, the research is dozens of steps beyond where it was at the time of the application. Therefore, Non-Disclosure Agreements have become essential to protecting rapidly evolving technological developments. Again, attitude. These must also be respected. The problem is that small businesses with all their resources engaged in the development of new technologies can become crippled and destroyed if they have to fund legal challenges. What is the best way of governing these? International agreements that reliably and confidentially communicate patent applications around the world. I don't think the level of trust exists with inventors that such confidentiality could be respected and enforced at this time. Perhaps an international patent authority could hold in a central place world-wide applications and contract to nations to research other patents and patent applications.

Question 11**ANSWER:**

Financing, financing, financing. And see answers to other questions

Question 12**ANSWER:**

They should be targeted to sustainable advanced biofuels. Private financiers and funding bodies will decide what they want to fund; governments should be funding research that comports with set objectives; not set technologies.

Question 13**ANSWER:**

Corporate interests will be a big force in any popular agricultural activity. If rubber is needed, they'll plant rubber plantations; etc. If people want to live in a certain area, developers will buy land and build houses, roads and shopping centers. Problems currently attributed to biofuels are not new and they are not restricted to biofuels. It is only fair that when talking about land use change and any positive or negative consequences, that the same analysis is done for other land use change and individual societies through their political systems will decide where their values shake out. For example, an increased demand for electricity to power plug-in vehicles will require extensive new sources of electricity generation and transmission. A significant number of members of my community are fighting new, large transmission lines and a large transfer station planned to run from West Virginia to mid-Maryland (and, then, of course, from that substation in all directions to other communities). Other communities have fought erection of windmills atop Appalachian mountain ridges in Maryland. I doubt that these communities are unique in their desires to maintain their property values and scenic views. They didn't even mention the land use change from forest and farmland to transmission line paths and substation. As it is every few miles in this area the Appalachian Trail is bisected by transmission lines. Take a look at the land use change resulting from coal mining (it is hard to even get minor amounts of energy grasses to grow on reclaimed land after years of amendment with manure and other soil conditioners), extraction of oil from shale, oil sands, etc. Note that over the past 15-20 years in the US 7% of agricultural land has been changed to residential/commercial/industrial uses. I don't recall seeing any study of the impact that land use change had on international agricultural practices. The only way to fairly assess the impact of land use change is 1) Be very careful about assumptions. Do NOT base assumptions about land use change on amounts of energy crops produced/sold or converted. Some of the feedstock might have been grown on marginal land that was not used for food. Some may be bringing an income to a farm that used to be a dairy that went out of business ("(Maryland) Agriculture Secretary Buddy Hance said, "Since 2007, we've lost more than 100 dairy farms, leaving us with just over 500 operations. This loss is in large part due to rising costs and declining prices." Frederick News Post Monday Advance December 27, 2009 p.M-4.) Unless you know the provenance of the feedstock and the prior use of the land, you can't assume that someone

somewhere in the world is “making up the difference.” 2) Have detailed, credible data about current land use around the world so that reasonable analysis can be made. In the US, the closest unit of analysis is the county and all counties are not accounted for. In addition, a specific piece of land is not always planted in the same crop. Crops rotate—not always on the same schedule. Farmers should not be discouraged from growing more appropriate crops on their land, instituting innovative best practices. Some land use change may result from such beneficial changes. 3) Don’t forget to take into consideration improved yields and decreased use of fertilizers based on improved soil analysis and GPS-driven fertilizing practices. Farmers can be expected to get higher yields from the same amount of land; beneficial/positive land use change. And, they will be looking for markets for these crops that won’t negatively impact the price they get for the crop. They won’t want to flood the market, so might decide to decrease the acreage in a certain crop if they improve yields. This must be factored into any calculations. 4) Land use policies and land ownership will impact decisions about “making up the difference” around the world. Assumptions should not be made about land use decisions that cannot be practically carried out under the policies/procedures/laws and practices of a community. 5) How are corporate development strategies in developing countries accounted for in these models? Surely a human being standing in front of you offering you something of value for your interest in land or for your agreement to grow certain crops has a bigger impact on a grower’s decision about how to use his/her land than the actions of a grower expanding crop yields in Iowa or Nebraska. 6) Keep in mind real markets and real effects on those real markets. If the amount of corn exported from the US in a given year does not change, then how is a market so severely impacted that individuals or corporations will go to great expense to dismantle a forest to “make up the difference?” 7) When calculating emissions, don’t make assumptions about fuel used; for example, we can expect that much farm equipment and transportation vehicles will be using biodiesel which has less emissions than petro-diesel. 8) Don’t include how many calories the humans working in the process consume; chances are they would have consumed those whatever work they were doing 9) Include any co-products in the calculations (heat, electricity generation, high-protein animal feed, etc.). 10) Take into account improved engine design and, in the US, upgraded CAFÉ standards. So, to answer this question, we need to do more research on practices that have the greatest measureable impact on how and where energy feedstocks are developed. We should assess the costs and benefits economically, socially, and environmentally and spend our time, attention and effort on those with the greatest scientifically proven negative impact.

Question 14

ANSWER:

I think the biggest difference is in land ownership practices, policies, laws and documentation. Following that, and related to that, are practices, policies and norms related to how decisions are made about appropriate use of land. Just as each community/society must determine what are appropriate technologies, they must take into account what are the most appropriate, sustainable feedstocks and development practices. How this is done will depend on the norms and changes in that culture. The international community may try to set standards and policies. Enforcement is another issue altogether and will, under our current international circumstances, rely on the local enthusiasm for enforcement of those standards. Likely more “mileage” and effectiveness will come from peer pressure and international outrage about practices far out of line with international standards. My question is always to ask what interests are funding the outcry. Adequate funds for travel, information development, and influence peddling must come from some entity or person(s), likely with an interest in the outcome be it economic, religious, personal or something else.

Question 15

ANSWER:

Not unless the science, models and data are adequate to do a quality assessment. I don’t think we are there yet. Also, not unless identical assessments are conducted for comparison for all other competing sources of energy for the particular situation. For example, a jatropha-to-biodiesel project in a country where the fuel will be used for cooking, heating and transport relatively close to its production location might have a different indirect land use change (international or local) profile than a North American

biodiesel facility that uses food processing waste fat from a neighboring poultry processing facility. Or electricity from a coal-fired power plant that fuels an electric car driven in compared a corn-ethanol plant in the middle of high-yield corn fields in Minnesota that's powered by wind energy. And those should be compared to the iLUC and other indirect emissions related to gasoline derived from petroleum extracted from the oil sands in Canada or crude from Saudi Arabia that requires military monitoring and/or escort from well to refinery. We are getting closer to significantly sustainable biofuels. Don't discourage the promise of this development with untested controversial theories about results of world decision-making on agricultural land use. Encourage the transition over all the world to the most sustainable practices possible for food, feed, fiber and fuel production.

Question 16

ANSWER:

Encourage the transition over all the world to the most sustainable practices possible for food, feed, fiber and fuel production. Emphasis lately has been focused on biofuels production. Use the concerns raised and addressed in the conversations on biofuels to enhance our conversations about all the ways we use the land and seas of the Earth. If we develop statistical models for analyzing carbon footprints over the life cycle of various biofuels grown under various conditions for various purposes, then surely we can do the same for petroleum, for electricity, and even for the use of land for residential, commercial and industrial development. We can analyze better how the concept of "smart growth" is working or not working to decrease vehicle miles traveled, to conserve energy and water, etc. It doesn't make sense to look at biofuels only; or to compare emissions to a static 2005 gasoline emissions benchmark that has no bearing on tomorrow's gallon of gasoline. Level the playing field; apply similar analysis to all forms of fuel; make the analysis applicable to specific situations and circumstances. How could harms for environmental security be dealt with? There should be international goals, standards; some agreement as to how they will be monitored and enforced. These goals and standards should be based on sound reliable, tested scientific models. As those are being developed, as a practical matter, governments should identify for themselves social values, should fund research and development to achieve those social goods that have no financial value for investors.

Question 17

ANSWER:

I think the allegation that the increase in corn prices in the US led to food price increases overall and specific corn shortages in Mexico was exaggerated. It seems that increase in oil/gasoline prices and related increases in natural gas/fertilizer prices contributed to the increase in prices and the supply/demand/price consequences we observed. We could just as confidently say that it was oil speculators who caused the corn shortages in Mexico. Once the price of oil came down, the price of corn came down, and even though silos in the US Midwest remained full of corn as growers waited for higher prices, we didn't hear of any more tortilla riots. The reason that we will have food security and fuel security issues in the future is because our population keeps exploding. We have the same amount of room to feed, clothe and fuel more and more people. Yes, there will be controversies about how to best use our land and seas. If we could hold our population steady or decrease it over time by natural attrition, we would not have to prepare to have these fights. We could use technology to improve production of all agricultural products to the benefit of the world with its current population. Not so if additional "carbon footprints" are seen across the lands.

Question 18

ANSWER:

It is in everyone's interest to help developing countries become energy self-sufficient and to develop systems to prudently manage this process from land use and ownership/decision-making authority issues to division of responsibility for expenses and benefits of use of the production of the land and its income. As noted above, energy independence comes with political consequences that may not be in the interest of energy-exporting nations. The same holds true for food independence. For example, some years ago a

friend of mine was in the Peace Corps in a Pacific Island country. He and others worked to help villagers fish beyond the reefs, using methods unlike the dynamiting they were used to. They were successful and the villagers were catching more than enough fish to feed themselves. They didn't have to eat the canned fish they had become used to when they worked for the plantations. They wanted refrigerators and a refrigerated boat to collect their catch to sell it in the city. This did not sit well with the local powers who saw not only a loss of their market for canned fish in the villages; but a threat to their market in town, as well. If this was such a threat on the local level, we can imagine that change to food and fuel independence will also have indirect consequences and interests who will fight such change for personal, professional and economic reasons of their own.

Question 19

ANSWER:

How do we eliminate greed and aspiration to power from the development equation. That which spurs innovation and development also hampers its socially valuable expansion. Biofuels are no different from any other agricultural product, any other industry. Again, local custom, circumstance, policies, practices and laws are crucial. International pressure can be put through well-meaning advocates for better treatment of workers, farmers, growers at all levels. For one, growers/farmers should be paid a reasonable price for their product. This should enable them to pursue best sustainable practices.

Question 21

ANSWER:

Investment needs to come from everywhere. And it will. However, because there is such a disproportionate social vs. monetary value in the early stages of technologies that 1) have never been done before; 2) require large capital investment even for pilot or demonstration facilities; and 3) rely on commodities markets for both input (feedstock) and output (fuels markets), governments must foot the bill until the technologies are proven to have commercial potential and until the inputs and outputs have more stable pricing. I think a valuable place to put some investment is in processes to convert biomass to an intermediary at the place of harvest. This could address significant issues related to transport, storage and consistency of product and bring us closer to development of "drop in" biofuels that can use existing infrastructure. Subsequently, more investment should be directed to turning green crude into finished biofuels, biochemicals and other products now made from petroleum.

Question 23

ANSWER:

Respect that people involved in basic biofuels research are trying to create technologies, products and systems that are sustainable and beneficial to our world and environment. Make sure that any laws and regulations are based on sound science with credible, reliable data. Understand that everyone in the value chain must make a safe, secure living or the whole enterprise will collapse due to the weak link failing. Look outside the narrow confines of biofuels and include not only policies and procedures, tests and monitoring for biofuels but also for all other types of fuel production. AND work on changing attitudes that makes not having children a more respected and valued choice, one that should be revered as beneficial to the Earth. Certainly some people will not be able to help themselves or have religious beliefs counter to this; they should be encouraged to not only tolerate those who chose differently, who chose not to increase the population, but to embrace the value of that choice.

Question 24

ANSWER:

I am very impressed with the comprehensiveness of the questions and the attention to detail in making this a fair representation of the current questions and controversies involved in the realm of biofuels today. I can think of many other situations where such a consultative approach would have been very

appreciated. Thanks for the opportunity.