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Sustainability of Large Scale Biomass Production for Biofuels

Chairman Harkin, Ranking Member Chambliss:

I appreciate the opportunity to testify this morning. I have been involved in cellulosic ethanol research for over 32 years. My laboratory develops technologies to make low-cost biofuels from our enormous reserves of cellulosic plant materials. For the last eight years, I have also been active in applying lifecycle analysis to biofuel production. Lifecycle analysis deals with the system-wide environmental impacts of specific products. It is from this background of laboratory research and lifecycle analysis that I speak to you today. My opinions are my own and do not reflect any positions on behalf of Michigan State University.

I am going to make and then briefly elaborate on three key points. These are as follows:

1. We can indeed produce many tens of billions of gallons of ethanol and other biofuels from cellulosic materials. These biofuels will ultimately be less expensive than petroleum fuels. They can also be much better for the environment and bring new prosperity to rural America—if we do them right. Cellulosic biofuels will also markedly enhance our national security by ending the strategic role of oil and the power of those who control oil.
2. A recent high profile scientific paper linked corn ethanol to large greenhouse gas emissions due to so-called "indirect land use change" and caused quite a furor. The data and assumptions used in that paper are not holding up well to closer scrutiny. I believe the paper's conclusions do not currently meet standards of scientific significance or of lifecycle analysis and should not be used to shape policy.
3. I believe the investments underway will allow us to cost-effectively convert cellulosic biomass to fuels. A similar investment in size and scope must be made soon in a related crucial area. We must develop the planting, harvesting, transportation, storage and other infrastructure that will enable us to sustainably produce and deliver hundreds of millions of tons per year of biomass to the "biorefineries" where the biomass will be converted to liquid fuels.

We can grow and deliver many millions of tons of cellulosic biomass for less than $80 per ton. The energy content of cellulosic biomass at this price is equal to the energy content of oil when oil is about $25 per barrel. If we can efficiently convert the energy content of biomass into liquid fuels, we can compete well with high priced oil. At least $5 billion in private and public funds are now being devoted to this task. I believe we

will succeed more quickly than most people realize. But we must stick to our objectives and not allow ourselves to be diverted. I have lived long enough to see several declarations of energy independence, all of which were ultimately futile.

Sustainability is typically described as a three legged stool consisting of economic, social and environmental sustainability—all three legs are important. I submit that the government of a free people has a fourth, crucial leg to its sustainability stool. We may well call it the national security sustainability leg. Therefore the Energy Independence and Security Act (EISA) of 2007 is rightly named. First and foremost that Act is about providing for the "common defense" and promoting the "general welfare" by ending our near total dependence on petroleum for transportation fuels.

I am committed to making sure biofuels are produced in an environmentally beneficial manner. Cellulosic biofuels, particularly those made from perennial grasses and woody crops, are by their nature well-suited to provide environmental benefits. We must ensure that cellulosic biofuels deliver those potential benefits. The key is to consider the whole system and act to improve the system's performance. I support the recommendations of the Ecological Society of America (ESA, attached) to enhance the sustainability of cellulosic biofuels. These recommendations also focus on system-wide performance.

However, inadequate and incomplete environmental analysis must not be allowed to sidetrack us. Environmental sustainability is one, but only one, leg to our sustainability stool. That brings me to my second point.

A recent high-profile paper in the journal *Science* linked the production of U.S. corn ethanol to large greenhouse gas releases caused by land use change elsewhere in the world. There are no solid data connecting U.S. ethanol production with land use change anywhere in the world.

All of the conclusions are based on economic modeling. The modeling relies on assumptions and data that are now being debated by the scientific community. I am very involved in the debate. The paper is not holding up well to additional scrutiny. For example, three different models have now been applied to this indirect land use analysis, and all three are giving quite different results. Obviously, not all three can be correct at the same time, so it is unclear what weight to give any of the models.

The language in EISA 2007 required that lifecycle greenhouse gas emissions be determined for significant indirect land use change. Proper lifecycle analysis follows standards set out by the International Standards Organization (ISO). The paper in *Science* simply does not meet these standards. It is completely inadequate in terms of allocation, system boundaries and sensitivity analysis, among other technical lifecycle issues. Furthermore, until the scientific community is able to come to some consensus about the validity of the conclusions, the paper's conclusions cannot be regarded as scientifically significant.

Even if there were scientifically significant lifecycle research linking corn ethanol to indirect land use change, it seems to me that making U.S. farmers responsible for land use decisions made by others is both unfair and a terrible precedent. Are we going to make every U. S. industry responsible for greenhouse gas generation by its competitors around the world? In effect, that is what we are doing to U.S. corn growers through the indirect land use change issue.

The furor over indirect land use change offers one of the best recent examples of what I mean about not allowing ourselves to be diverted from our goal of ending the strategic role of oil in the world.

Third, I wish to talk briefly about logistical issues. The cellulosic biofuels industry consists of two parts: 1) growing and transporting the biomass to the biorefinery and 2) processing the crop to biofuels. While more can and should be done, I think we are largely addressing the crop processing issues. But we are not doing anywhere near enough to address the logistical issues connected with cellulosic biofuels. If current trends continue, we may very well find ourselves with excellent biorefineries, but without the means to supply the biorefineries with the raw materials they require.

We need integrated, system-wide research and development on how to grow, harvest, store and transport cellulosic biomass to the biorefinery. This research should include studies to improve the environmental sustainability of both corn and cellulosic biofuels. For example, integrating cover and companion crops with corn agriculture will do much to enhance corn's environmental performance. Cover crops could provide an additional source of cellulosic biomass to the biorefinery as well as high value animal feed protein. Cellulosic biomass sustainability research could and should teach us how to grow energy crops that sequester carbon in the soil, enhance biodiversity, reduce erosion, use nitrogen and other nutrients efficiently and improve the water holding capacity of soil. We should develop and reward approaches that enhance the environmental performance of the entire linked system of crop production, biofuel production and animal feeding.

We should also find ways to strengthen rural communities as we develop the cellulosic biofuels industry. For example, cellulosic biomass is inherently bulky and difficult to transport. Regional biomass processing centers, perhaps owned by farmer coops, could pretreat and densify biomass for both animal feed and biofuel production. Similar regional processing could convert cellulosic biomass to liquid bio-oils for subsequent upgrading to fuels. These regional processing centers could provide a way for farmers and farming communities to capture more of the value added to their crops and generate rural employment.

This committee should take a leading role to ensure that we develop the logistics for cellulosic biofuels industry while improving the environmental and social sustainability of all biofuels. This effort deserves a funding level comparable to the billions now being devoted to biorefinery development.

Finally, Senator Harkin, I understand you will soon introduce legislation requiring that all new cars sold in the United States be flex fuel. I enthusiastically support such legislation. I also encourage you and the other Committee members to cosponsor and then pass S3303, the Open Fuel Standards Act. Taken together, flex fuel legislation and open fuel standards will help provide true fuel choice. When the American car owner has fuel choice; so will the car owners of the world. When we have fuel choice and inexpensive, sustainable biofuels, we will have ended the power of those who control oil.

Thank you. I look forward to the question and answer period.