**SESSION II. INDUSTRY, POLICY, AND SUSTAINABILITY**
**October 18, 2007 – 2:00 – 4:30 p.m.**
***Moderator:*** **Gregory Geoffroy**
***Speaker:*** **James Greenwood**

**Gregory Geoffroy**
President, Iowa State University
World Food Prize Council of Advisors

Our next speaker is James Greenwood, who represented Pennsylvania in the U.S. House of Representatives for 12 years, where he was a leader in environmental issues, health and government and corporate relations. As a member of the Energy and Commerce Committee, he demonstrated particular expertise and experience with the energy security policy and oversight.

From 2001 to 2004 he chaired the Subcommittee on Oversight and Investigation of the Energy and Commerce Committee, leading inquiries into areas including governance at Enron and WorldCom and terrorist threats to our national infrastructure.

Prior to his election to Congress, Mr. Greenwood served six years in the Pennsylvania General Assembly and six years in the Pennsylvania Senate.

Since 2005 Mr. Greenwood has served as President and CEO of the Biotechnology Industry Organization, representing more than 1100 companies, academic institutions, public research centers, and related organizations in all 50 states and 31 foreign countries. He has testified and spoken widely on the next generation of biotechnology that will affect how the world produces food and fuel.

Mr. Greenwood graduated from Dickinson College in 1973 with a Bachelor's Degree in Sociology. And please join me in welcoming the Honorable James Greenwood to the podium.

**James Greenwood**
President and CEO, The Biotechnology Industry Organization

Well, good afternoon. It's nice to be here in Iowa. I think I am probably the only retired out-of-state congressman in Iowa not running for president today. Great relief to the cab drivers – they don't have to listen to me.

I would like to begin my remarks by thanking the organizers of the 2007 Norman E. Borlaug International Symposium for making this event possible and for inviting me to speak today on behalf of the biotechnology industry.

I also must recognize Dr. Borlaug's lifelong contributions to improving life for billions of men, women and children worldwide. He is the father of the Green Revolution and a pioneer and a longtime champion of biotechnology's "Gene Revolution." Agricultural biotech has followed a trail Dr. Borlaug laid, using genetics to improve the quality and abundance of our food supply. On behalf of BIO members in the industry, I want to acknowledge that debt. I also congratulate Dr. Borlaug on the recent honor of receiving the Congressional Gold Medal for his ongoing efforts to combat hunger. The biotechnology industry is proud to play a significant role in meeting that challenge.

I can tell you that last night I had an occasion to observe that not only does Dr. Borlaug think globally, and in the microscopic sense when it comes to being sure that food is available and affordable, but he applies that at the very most microscopic level. I happened to be on the elevator when his aide was taking to him into his room a small carafe of whole milk that he had ordered. And he said that he almost rejected it because he thought it was outrageously priced.

The men and women of the biotechnology industry believe biotech innovations can help solve some of the biggest global challenges, included fighting disease and improving health, feeding a growing world population, and meeting the increasing world demand for energies in ways that are sustainable and eco-friendly.

The challenges of procuring sufficient food and fuel for a rapidly growing world population are clearly interrelated. It is about getting the energy we need to power our bodies and to power our civilizations.

Agricultural products can be used for food and fuel. And fossil fuels are an essential of modern agriculture. Food is obviously the energy that enables our human bodies to locomote, to sense, and to manipulate our environment. Fuel is the energy that enables us to multiply our leverage by powering machines and devices.

In the first instance, our bodies are able to extract the sun's energy soon after it is absorbed through photosynthesis into plants or concentrated in animals as protein. And in the latter case, coal, gas, oil – the fossil fuels that provide 86 percent of our energy are hydrocarbons in which the sun's energy was absorbed millions of years ago. They are bioenergy, concentrated in carbon. But there are multiple problems with getting most of our energy from carbons.

First, when we burn fossil fuels, we release air pollutants that harm our health and our environment, including greenhouse gases that are affecting our climate. Global temperatures are projected to rise three degrees or more this century, in large part due to greenhouse emissions from fossil fuels.

Second, the fossil fuel economy also makes much of the world depend on sometimes politically unstable regions to supply its energy. In addition, fossil fuel is a diminishing, nonrenewable resource. New oil is getting harder to find and to extract.

That fact, along with political instability and burgeoning demand, has made oil increasingly expensive. In fact, earlier this week oil reached a record price of more than – I think my staff put $85 – I think it's $87 per barrel.

These problems will only get worse if we don't significantly alter our fuel consumption patterns. The world population today stands at more than 6.6 billion people. It is projected to grow to 10 billion people by 2030, inexorably increasing the global demand for energy.

Today developing countries use 30 percent of global energy. That percentage will grow rapidly in the coming decade, driven by population growth and by economic expansion.

Growing even faster than the human population is the number of trucks and cars operating on our planet. While the world's population doubled between 1950 and 1996, the number of cars increased tenfold. Today there are more than 600 million motor vehicles in the world with all but a small fraction burning fossil fuels. And under present trends the number of vehicles is projected to double to more than 1.2 billion by the year 2030. The global transportation sector is responsible for 25 percent of the world's energy-related greenhouse gas emissions.

So the challenge for the world is: Can we meet our growing energy needs in a way that is sustainable and that significantly reduces the negative consequences of our present fossil fuel economy? Fortunately and happily, the answer is yes.

The solution is to look to biology and to extract the sun's energy from plants, a renewable resource, to meet our fuel needs. Today the primary way to do this is by producing ethanol made from starch.

With present technology we can break down starch from corn kernels, sugar cane, palm oil, or other plant sources, into sugar and then distill it into ethanol, a liquid transportation fuel. In addition to being a renewable energy source, biofuels such as ethanol and biodiesel release far less carbon and other pollutants into the atmosphere than do fossil fuels.

World production of ethanol more than doubled between 2000 and 2005, while the production of biodiesel quadrupled. Brazil and the United States together account for 90 percent of the world's fuel ethanol production of more than 30 billion liters annually.

But that is still just a drop in the barrel, with biofuels providing about one percent of the world's liquid transportation fuels. Obviously, we will need to dramatically increase biofuel production to meet our energy demands while reducing our reliance on fossil fuels.

But there is a problem with relying on ethanol from starch crops for fuel, as you have just heard from the previous speaker. At some point the value of starch as an energy source competes with its value as food and feed.

This problem has led biotechnology researchers to look at the rest of the plant, like the leaves and the stalks of corn, or corn stover, left in the field after the harvest. These inedible plant fibers are largely cellulose, designed by evolution to provide the plants with rigid structure. They also contain the sun's energy, just not in the form of easily accessible starch.

The question is – Can we sustainably and affordably extract fuel energy from this cellulosic biomass? And again, fortunately, happily, the answer is yes.

Recent advances in the relatively new field of industrial biotechnology using advanced genomics, proteomics, and bioinformatics are making it possible to convert cellulosic biomass to fermentable sugars that can be used as feedstocks for a new type of carbohydrate crude oil or cellulosic ethanol.

Enzymes that break down cellulose are found in nature, in fungi as well as in microbes that are in the guts of termites. We can use gene-splicing techniques and other biotech tools to cut and paste the genes for producing those enzymes into other organisms, such as yeast or bacteria that we can grow in large quantities and use for industrial-scale conversion of biomass feedstocks into a cellulosic ethanol fuel.

Cellulosic ethanol technology makes a much larger pool of feedstocks available for ethanol production, sources that neither humans nor livestock consume as food. These will enable us to dramatically boost biofuel production.

A comprehensive analysis by the United States Departments of Agriculture and Energy found that more than one billion tons of agricultural residues and dedicated energy crops could be sustainably harvested by 2030 for biofuels production in the United States. That is enough biomass to produce 30 times the current U.S. ethanol production – 30 times.

According to the Natural Resources Defense Council, this volume of biofuels could reduce U.S. greenhouse gas emissions by 1.7 billion tons per year, reducing transportation-related emissions by 80 percent by the year 2050. The cellulosic biofuel potential in Europe is estimated to be in the range of replacing 20-25 percent of its transportation fuels. And many small developing countries with favorable growing climates could, with cellulosic ethanol, technologically meet all of their liquid fuel needs with biofuels.

So what is the catch? A big barrier to commercial production of cellulosic ethanol has been the cost of producing these enzymes. As recently as 2001 the cost of enzymes for making ethanol from corn stover was $5.00 per gallon. By 2005 new advances reduced the cost to a mere 10 to 18 cents per gallon. With today's cheaper, more efficient enzymes, the cost of making ethanol from cellulose is estimated between $1.50 and $2.50 a gallon. With even further innovations, scientists predict the cost of a gallon of cellulosic ethanol will be lowered to 90 cents. I should run for president on that platform.

In 2004, Iogen Corporation became the first company to begin commercial production of cellulosic ethanol with their plant in Ottawa, Canada, which converts wheat straw into ethanol. It has an annual capacity of 260,000 gallons.

Abengoa Bioenergy has constructed a commercial-size ethanol plant in Salamanca, Spain, with a capacity of 1.2 million gallons of cellulosic ethanol from wheat straw each year.

Here in the United States, my organization, the Biotechnology Industry Organization, successfully lobbied for funding of a Department of Energy integrated biorefinery demonstration projects initiative. This year the Department of Energy provided $385 million in grants to help build six commercial-scale cellulosic ethanol plants.

These include a plant in Emmetsburg, Iowa, that will have the capacity for 30 million gallons of ethanol from corncobs, fiber and stalks. These plants should come online between 2008 and 2009. And just yesterday Senator Harkin announced in a press call a bipartisan agreement on inclusion in the Farm Bill of $1.3 billion to enable farmers to establish biomass crops and for grants and loans for cellulosic biorefineries.

But with all of the progress and potential, I realize that not everyone shares my enthusiasm or optimism for biofuels. We continue to see comments in the media that appear to come from critics who have not yet grasped that biotechnology has changed the ethanol picture and that we are not talking about meeting oil fuel needs solely with ethanol from starch.

This misunderstanding has given rise to several myths, including the notion that increasing demand for corn to produce ethanol will create food shortages. But the reality is, we can produce abundant crops for both food and fuel. In the first instance, agricultural biotechnology has helped produce increases in crop yields since the production of commercial biotech crops in 1996.

For example, the average U.S. yield was around 115 bushels per acre in the decade prior to the introduction of biotech crops and increased by 16 percent to more than 137 bushels per acre in the following decade.

For corn converted to ethanol, just with today's technology, each two-bushel-per-acre increase in overall yield can produce 403 million gallons more in ethanol. Further, biotech innovation, along with modern farming methods, should continue to produce even higher yields in the future.

But beyond that, cellulosic ethanol technology will reduce even more the pressure on food supply. We will be able to harvest nonfood crops like switchgrass and agricultural wastes, woodchips and other sources of biomass not used for human consumption.

The second myth is that growing more crops for food and fuel will have negative environmental impacts, including the need to convert habitat to farmland. But, in fact, more than 20 percent of the increase in U.S. crop productivity in the past 35 years has come from expansion of cropland. The bulk of progress has come from biotech improvements to crop seed and modernized farm methods.

A third myth is that commercial cellulosic ethanol production is at least ten years off. Again the critics have perhaps not kept up with the technology. I mentioned commercial cellulosic ethanol plants that are in operation today in Canada and elsewhere, as well as biorefineries scheduled to come online as early as next year. These first few plants will help find ways to make ethanol from cellulose more efficiently and cheaper, allowing the industry to continue to expand and to meet the growing consumer demand for cleaner alternative fuels.

If we continue our commitment to cellulosic ethanol, the United States alone could produce 60 billion gallons of ethanol by 2030 through a combination of grain and cellulosic feedstocks. That will be enough to replace 30 percent of projected U.S. gasoline demand without harming food, feed, or fiber production.

To give you the picture, 60 billion gallons of biofuels is enough to fill six million tanker trucks, or could fuel over 100 million automobiles for a year if used as E85 blended fuel. That would also eliminate roughly five Exxon/Valdez-size supertankers of imported crude oil each day, or nearly 2,000 shipments a year.

Biotechnology innovation can help the world meet our 21st century challenges of food and energy security. Crop biotechnology is producing abundant food and fiber while empowering small-scale sustenance farmers. Advances in biofuel technology can help every nation reduce its independence on nonrenewable oil, reduce greenhouse emissions, and even strengthen rural economies as new markets for biofuels grow.

Bioenergy can also help many biomass-rich developing countries who are now net importers of energy to become self-sufficient, or even energy exporters. Of the world's 47 poorest nations, 38 are net oil importers. 25 import all of their oil, consuming much of their national income to pay for it.

A bio-based economy based on clean, abundant, renewable energy can become a strong engine for sustainable international development and help lift living standards worldwide by providing a new source of income for small farmers in rural communities.

Achieving this vision is not guaranteed. Production of large volumes of biofuels will require some major shifts in public policy and farming practices and increases in government funding to spur the production of commercial-scale biorefineries.

To succeed, we must encourage development of markets and support for private-investment biofuels. High oil prices certainly help, but as oil markets fluctuate, we need a sustained commitment moving beyond oil. Government purchasing policies, fleet standards, and blending requirements can help kick-start demand as we make the jump to a bioeconomy. We must accelerate the transactions to next-generation biofuels by supporting cellulosic ethanol research so that we can use the full range of biomass feedstocks.

We must build infrastructure and transportation fleets that are able to use the new fuels. We must promote innovative and sustainable farming practices and ensure that farmers participate in the economic benefits of the new technologies. We must invest in the next-generation commercial biorefineries.

No one program or strategy will make sense for every country. Brazil, the United States, and the European Union have been pioneers in developing domestic biofuel industries. But the people of every country can benefit from biotechnology innovations, choosing the policy options and technologies that best meet their needs.

We are committed to working with each of you and the groups, nations and communities you represent, to make real our hopeful vision of an abundant food and fuel for the 21st century.

Thank you.