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FOOD FEED, AND FUEL PRODUCTION: TODAY AND TOMORROW

FIELD HEARING

BEFORE THE

COMMITTEE ON AGRICULTURE, NUTRITION, AND FORESTRY UNITED STATES SENATE

ONE HUNDRED TENTH CONGRESS

SECOND SESSION

AUGUST 18, 2008

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FOOD FEED, AND FUEL PRODUCTION: TODAY AND TOMORROW

Monday, August 18, 2008

U.S. SENATE,
COMMITTEE ON AGRICULTURE,
NUTRITION, AND FORESTRY
Omaha, Nebraska

The committee met, pursuant to notice, at 9 a.m., at the University of Nebraska-Omaha, Strauss Performing Arts Center, 60th and Dodge Streets, Omaha, Nebraska, Hon. Tom Harkin, Chairman of the committee, presiding.

Present or submitting a statement: Senators Harkin and Nelson.

STATEMENT OF HON. TOM HARKIN, A U.S. SENATOR FROM IOWA, CHAIRMAN, COMMITTEE ON AGRICULTURE, NUTRITION, AND FORESTRY

Chairman HARKIN. The Senate Committee on Agriculture, Nutrition and Forestry will come to order.

STATEMENT OF JOHN CHRISTENSEN, CHANCELLOR, UNIVERSITY OF NEBRASKA-OMAHA, OMAHA, NEBRASKA

Mr. CHRISTENSEN. Thank you, Senator. Good morning and welcome to the University of Nebraska at Omaha and the Strauss Performing Arts Center. I am John Christensen, Chancellor at the University of Nebraska at Omaha, and on behalf of the campus community, it is a privilege to host this U.S. Senate field hearing on Food, Feed, and Fuel Production.

It is always an honor to have Senator Ben Nelson back in Omaha and on campus and it is a pleasure to welcome Senator Harkin from our neighboring State of Iowa. Senator Harkin chairs the Senate Agriculture, Nutrition, and Forestry Committee and Senator Nelson serves on that committee. Together, they have assembled a distinguished panel of experts to discuss issues concerning the economic landscape of agriculture, renewable fuels, and the potential for increasing production of grains, among many other important topics.

I trust that this will be a productive hearing and please enjoy your time on campus. With that, Senator Harkin?

Chairman HARKIN. Chancellor, thank you very, very much.

Good morning to all of you. It is good to be here in Omaha, the heartland of American agriculture, this time of the year. All I can say is I hope the ragweed count is lower on this side of Missouri than it is on the other side. My allergies——

Senator NELSON. It is always high.

Chairman HARKIN. Oh, man, it is terrible this time of the year. But with all the disastrous flooding and weather that we have had over our way, anyway, we are grateful that the crops seem to be shaping up better than we feared earlier.

I am especially glad to be here with my good friend and my colleague, Ben Nelson, former Governor of this great State and now distinguished Senator. I am just very privileged to have someone with his background and his breadth of knowledge of agriculture serving on the Senate Agriculture Committee.

Ben was very instrumental in getting our recent farm bill through, which took considerable time and effort, but I think we can take some pride in the fact, Senator Nelson, that the bill passed the committee without one dissenting vote, so we have Republicans and Democrats, North, South, East, West, on board. And it passed the Senate with 79 votes, more than any farm bill ever in Senate history. So I think it was a good farm bill and good for the future and I just want to thank Senator Nelson for all of your work and effort in getting that through.

I had one question, though, that was plaguing me as I thought about coming over. I thought, you know, since Iowa is the Corn State—supposedly, that is what we call ourselves, the Corn State—how is it Nebraska always comes up with all those Cornhusker football players who are so good and who beat us all the time? I have got to figure that out one.

Well, agriculture and rural America, are at the center of dramatic changes and challenges right now. Energy prices, in particular oil and natural gas prices are at record levels, and while they may have retreated a little bit they are expected to remain well above historic levels of the last several decades. This is a real challenge for Americans, and that's especially true in rural America where people have no choice but to purchase energy for their farms, businesses, and homes. They have to travel large distances to get to their jobs, to church, family, visits to the doctor and schools.

Rural America has been rapidly increasing the production of renewable energy, specifically biofuels and wind power, and this is a major win-win development because domestically produced renewable energy is one of the keys to reducing our dependence on fossil fuels, and on imported oil in particular. At the same time, these new industries are a shot in the arm for rural economic growth and farm income.

In just the past 2 years, grain and oil seed prices have also risen above the typical levels of the past few years, and while rising farm commodity prices have boosted income for many agriculture producers, these kinds of pronounced price shifts also have consequences for others in the agriculture sector. In particular, strong commodity prices means increased production costs for pork and beef, poultry, egg and dairy producers, as well as increasing feedstock costs for ethanol and our biodiesel plants.

These economic shifts, including rising energy prices, rising commodity prices, related changes in acres planted, the increasing production of biofuels, have led many to question whether we are on the right path. Whatever one's views on that question, it is clear

that in our present energy situation, we face both huge challenges and potentially huge opportunities.

So we policymakers need to understand the impacts and the tradeoffs better. It is especially important to examine them as witnessed and experienced here in the Midwest, where people are living their lives and operating their businesses right in the middle of these major economic shifts.

That is exactly why Senator Nelson and I have called this hearing. This morning, we want to examine the current situation with prices and production costs as well as the new opportunities and challenges that have arisen. Then we will take a look at future prospects for the transition of the agriculture sector to producing growing amounts of fuel and energy in addition to the food, feed, and fiber that we have done in the past.

With that, I will turn to my distinguished colleague and good friend, Senator Nelson.

STATEMENT OF HON. BENJAMIN E. NELSON, A U.S. SENATOR FROM THE STATE OF NEBRASKA

Senator NELSON. Well, thank you very much, Chairman Harkin, and thank you, Chancellor Christensen. I know this is a double opportunity for UNO for us to be here today, and not the least of which is the opportunity for some of the students to be able to hone their skills in taping and following along with the communications. So I appreciate that very much, as well.

Senator Harkin, it is always good to have you in Nebraska. We prefer it when it is not a football Saturday, but we are glad to have you here. I think we have Iowa right where we want them when it comes to football—off the schedule. We are hoping that the Cornhuskers are well on their way back.

It is good to be with my friend, Senator Harkin. A little known fact is every so often in December, we get a chance to hunt together and we take that very seriously. I am hoping maybe we will be able to do that again this year. It is about time.

Chairman HARKIN. I hope so.

Senator NELSON. And to say thanks for scheduling this hearing because of the importance of getting facts out about ethanol, about our energy needs, and about our energy sources and how we can deal with what is clearly the No. 1 problem in terms of our economy for every American. There are some Americans hit harder than others, but we are all affected by the low dollar, by high oil prices and escalating food prices, and sometimes it is just important to have the facts as opposed to all the opinions that are floating out there. Opinions based on fact are one thing, but opinions that seem to be lacking facts are something that we ought to deal with and get to the bottom of.

Now, I will admit that corn-based ethanol is not perfect, but it has been blamed for practically every problem under the sun. You have to ask, what is next, summer colds? Computer viruses? Bad hair days? The focus here should be on what I think is the bigger picture.

Ethanol is the only domestically produced alternative to oil-based transportation fuels. It is helping us in a major way to stretch the gasoline supply, save American consumers money at the pump, cre-

ate jobs in rural communities, improve our rural and national economy, and to top it off, help wean us off imported oil.

Ethanol is a major contributor to the U.S. gasoline supply. One study says it is the third largest behind only Canada and Saudi Arabia and ahead of Iraq and other OPEC countries. And today's corn-based ethanol is paving the way for the next generation of biofuels produced from such materials as switchgrass and stover, wood chips, and a whole host of other biomass materials.

There are those who have said, well, that makes a lot more sense than corn-based ethanol and they are happy to be part of the second generation of ethanol. I am glad that there is a second generation. I wish those folks had been here to help us in the first generation, because without the first generation, I can say without any question of being contradicted with my good friend Senator Loren Schmidt here, that if it hadn't been for corn-based ethanol as the first generation, you wouldn't be talking perhaps about a second generation.

So to ethanol's critics, I ask, why farm out our energy needs to foreign suppliers when we are producing so much clean burning renewable fuel right here on our own farms? And Senator Harkin and our committee, our Senate Agriculture Committee, worked hard to change the name officially from the farm bill to the Food and Energy Security Act, because we recognized that we are dealing both with food security and energy security here at home.

We all want to see agriculture survive and prosper, including grain farmers, livestock producers, ethanol producers, and food processors, while still benefiting the average American family, our local communities, our national energy security, and the national economy. This is money wisely invested in the American Midwest and not in the Middle East.

So I am looking forward to hearing our witnesses today and hopefully see the facts provided as we explore the relationships between food, fuel, and feed, and we have added another "F" word, fiber, because we recognize the importance of that part of agriculture, as well. I am especially pleased that we are able to do it here in the Midwest where agriculture is king and it is something that has dominated the news recently.

I am just hopeful that we will be able to see what ethanol contributes in the way of supporting lower gas prices. One estimate noted that ethanol lowers gas prices by 15 percent, which at today's prices, which are changing—fortunately, they have been going down, rising a little, but the trends seem to be good—it would lower gas prices by 57 cents per gallon. And an Iowa State study estimated that ethanol lowered the price of gasoline by as much as 29 cents to 40 cents per gallon. So I would suggest that ethanol's critics do keep that in mind the next time they fill up their tank.

So with that, let us now turn the program back to Senator Harkin, who I know will be introducing the panelists. Thank you.

Chairman HARKIN. Thank you very much, Senator Nelson.

We have two panels of distinguished individuals. The first panel was organized to talk about the current status of agriculture economics and energy, and related issues. The second panel is looking more towards future possibilities, productivity and sustainability issues. However, I am sure there is going to be a lot of crossover

from one panel to the other because we are here to talk about what is down the road in the future.

So with that, we will just start with our first panel. We have a copy of your written statements. They will be made a part of the permanent record in their entirety, without objection. I would like to ask as we go down the row—I will start with Dr. Babcock—if you could just limit your comments to maybe five or six minutes.

So we thank you for coming here to Omaha this morning. Thank you for being a part of this panel and this process, but even more so, I thank all of you for all of your involvement. I have read all of your bios and I read your testimonies last night and I just thank all of you for your involvement in this issue of agriculture and its evolution, how we are going to balance these needs, and what our future is going to be like in terms of providing both, as Ben said, the food and fiber, but also fuel.

With that, Dr. Babcock, you are first up to the plate. Welcome.

STATEMENT OF BRUCE BABCOCK, PROFESSOR OF ECONOMICS, AND DIRECTOR, CENTER FOR AGRICULTURAL AND RURAL DEVELOPMENT, IOWA STATE UNIVERSITY, AMES, IOWA

Mr. BABCOCK. Thank you, Mr. Chairman, Senator Nelson, for the opportunity to testify today about how the economics of agriculture have recently changed.

From about 1950 until just recently, we experienced a long-term decline in inflation-adjusted food and agricultural commodity prices because productivity growth outpaced demand growth. This decline in real prices meant that more of the world's poor were able to afford adequate calories and to move to a more varied diet. This increasing ability to feed a rapidly expanding population was a major success story for the second half of the 20th century.

The move toward food with higher protein and fat content has meant a steady increase in the demand for feed grains and oil seeds. This demand growth, combined with a slowdown in investment in agriculture research, may have meant a future in which supply would have more trouble keeping up with demand and a possible reversal of the long-term decline in real food prices. We will never know because the recent sharp increase in fossil fuel prices, combined with changes in biofuels policy, has made that possible future a reality today.

Up until the last 2 years, energy prices affected agriculture primarily by influencing production costs, particularly fertilizer and diesel prices. But we have now linked energy and feed prices so both production costs and crop prices are influenced by energy prices. Biofuels plants' ability to pay for corn and vegetable oil are directly influenced by crude oil prices.

Corn and soybean farmers today and in the next 5 years are in a can't lose demand situation because of the new RFS and the rapid expansion in biofuels plant capacity, so let me explain. For corn farmers, the new ethanol mandates means that they have a new demand for between 25 and 30 percent of their crop. To induce farmers to plant adequate corn acreage will require prices high enough to cover the costs of planting an additional 15 to 20 million acres. I estimate that we will need at least $3.50 to $4 corn per

bushel, and that is needed to ensure adequate acreage. This level of prices should be adequate to cover all non-land production costs. So the future looks pretty bright for corn producers.

If crude oil prices remain above $100 per barrel, then the economics of corn ethanol production will look so good that I expect the corn ethanol industry to grow beyond mandated levels, particularly if the blenders tax credit is continued.

Strong corn prices also mean strong soybean prices because of the competition for land between the two crops. The only potential downside in demand for U.S. soybeans is if South America ramps up production so rapidly that world supplies overwhelm demand. But poor policy decisions in Argentina and Brazilian plans to devote increasing amounts of land to sugar cane production suggest that soybean production in South America will not be overly rapid.

Excess biodiesel capacity guarantees that soybean oil prices will not fall too rapidly, even if South America does ramp up production. Low soybean oil prices would quickly trigger biodiesel production in idled plants, which would quickly strengthen prices. The level of the price support for soybeans and soybean oil depends on the price of diesel and whether the biodiesel tax credit is extended. With a wholesale price of $3.50, soybean oil prices should not fall below about 50 cents per pound. At current soybean oil prices, this oil price translates into a soybean price of about $11 to $12 a bushel. So corn with $4, soybeans at $11, corn and soybeans are looking pretty good for the next 5 years.

The impact of continued high feed costs on the U.S. livestock industry is fairly straightforward. Livestock prices will eventually increase enough over the next year or two to cover producers' increased feed costs. This price increase will happen either because U.S. producers or producers in other countries reduce production. It will likely be a combination of both, though high feed and transportation costs actually could work to the long-term advantage of U.S. producers.

When feed is inexpensive and shipping costs are low, producers in other countries aren't too disadvantaged by importing U.S. grain and exporting meat. But high feed and shipping costs makes imported feed a much more important cost of production, which increases the advantage of U.S. producers because they only have to ship the meat. They don't have to ship both meat and feed. Furthermore, many U.S. producers have an advantage in that their animals' manure can be readily used as a substitute for high-priced fertilizer.

But as increased feed costs work themselves through the system, we will see dairy, meat, and egg prices higher than they otherwise would be. If we somehow cap the amount of animal feed that goes into biofuels production, then we will eventually see corn and soybean productivity gains show up again in lower food prices.

To summarize, the economics of agriculture have been fundamentally changed by the linkage of energy and feed markets. There seems little doubt that we will see biofuels production from corn and vegetable oil meet the new mandated levels. If future plant capacity does not exceed these levels, then future productivity gains will only need to keep up with increased food demand rather than increased food and fuel demands. This lower threshold of perform-

ance should increase the odds that a high-quality diet will continue to be affordable for a large proportion of the world's populations.

[The prepared statement of Mr. Babcock can be found on page 51 in the appendix.]

Chairman HARKIN. Thank you very much, Dr. Babcock. I made a mistake. I should have introduced you appropriately. Dr. Babcock is the Professor of Economics and he is Director of the Center for Agricultural and Rural Development at Iowa State University, with over 20 years' experience in the field. He is a nationally recognized expert on the state of the agriculture economy and the impact of Federal biofuel policies on agricultural markets. Thank you, Dr. Babcock.

Next, we turn to Mr. Jeff Lautt, the Executive Vice President of Corporate Operations at POET, the nation's top ethanol producer. Based in Sioux Falls, South Dakota, POET is a 20–year-old company that currently operates 23 production facilities in the United States, I am told, with three more under construction. The company produces and markets more than 1.3 billion gallons of ethanol annually.

Mr. Lautt, welcome to the committee. Please proceed.

STATEMENT OF JEFF LAUTT, EXECUTIVE VICE PRESIDENT, CORPORATE OPERATIONS, POET, SIOUX FALLS, SOUTH DAKOTA

Mr. LAUTT. Mr. Chairman and distinguished committee members, thank you for the opportunity to visit with you today. POET, as you said, has 23 ethanol production facilities currently in operation and three more that will be commissioned this fall, bringing our total production capacity over 1.5 billion gallons per year.

Energy independence for the United States can be a reality. This is the result of an ever efficient corn-based industry coupled with the future of cellulosic ethanol. Thanks to the tremendous corn yield improvements, grain-based ethanol has the potential to continue to grow by leaps and bounds. We believe that 50 billion gallons of grain-based ethanol per year can be produced here in the U.S. in the next couple of decades without substantially increasing food prices or acres.

Grain ethanol production is also getting more efficient and more environmentally friendly. According to a recent study by Argon Laboratories, in just the last 5 years, the dry mill ethanol industry has reduced energy consumption by 22 percent and water usage by 26 percent. Developments are being made possible to eliminate natural gas usage by the refineries, as well.

One example is our plant in Chancellor, South Dakota, which in the next couple of weeks will commission a solid fuel boiler that will burn wood waste to power 60 percent of the plant's power needs. A pipeline is also being installed to a nearby landfill which will pipe methane gas to the bio-refinery. Eventually, this will replace nearly all of the plant's natural gas usage.

The U.S. also has an incredible natural resource of biomass. A report from the DOE and USDA show that there is over one billion tons of available biomass in this country. This biomass could eventually be turned into energy if our nation is committed to doing so. One million tons of biomass has the potential to turn into 85 billion

gallons of cellulosic ethanol annually. If you combine this with the grain-based ethanol opportunity, we could eventually produce 135 billion gallons of ethanol, which is over 90 percent of the nation's gasoline usage. This, of course, requires sound and stable policy.

Today, the renewable fuels industry is facing some major challenges. The ethanol industry has been the target of a public relations defamation campaign that has severely damaged our industry's reputation. This campaign has inaccurately pitted food against fuel. Food or fuel is not a choice we have to make. It does not need to be one or the other. It can and should be both.

An issue that clearly needs to be understood is that there is currently a small market for ethanol in the U.S. Contrary to many beliefs, there is not an undersupply of ethanol today, but rather an oversupply. That is why ethanol is currently selling for approximately one dollar under gasoline. According to auto manufacturers, most of the vehicles in this country are only warranted for 10 percent ethanol. Consequently, ethanol is essentially limited to 10 percent of the gasoline supply. This is commonly referred to as the blend wall.

The current gasoline usage in the United States is approximately 140 billion gallons annually. Ten percent of that is 14 billion gallons. However, it is not realistic to penetrate every single gallon, so experts predict the blend wall to be around 12.5 billion gallons. We expect to crash into this wall sometime in 2009, if not before.

Flex fuel vehicles along with higher blends of ethanol is certainly a big part of the long-term solution, but this will take several years to accomplish. To continue on the path of reducing our dependence on foreign oil, higher blends of ethanol are needed today. If the ethanol market is allowed to expand, investors will have the confidence they need to continue to invest in cellulosic ethanol production. Without higher blends, there is literally no place for any additional ethanol to go, which will threaten the development of the commercial cellulosic ethanol industry. We must move beyond E10 to achieve energy security.

Additionally, there has been much recent reduction on removing the tariff on Brazilian ethanol. If foreign ethanol were allowed to enter this country without a tariff as the U.S. ethanol industry is approaching the blend wall, the goal for energy independence will be set back decades. The U.S. biofuels industry will be crushed. Investment has already slowed down considerably due to the blend wall. With tariff-free Brazilian ethanol entering our country, investment will cease, and this will apply to not only grain-based ethanol, but cellulosic ethanol development, as well.

Additionally, if the tariff were to be dropped, the U.S. taxpayer would actually be subsidizing Brazilian ethanol because its use would be subject to the blenders tax credit just the same as U.S.-produced ethanol. Protecting U.S. production and modeling portions of Brazilian ethanol policy seems more reasonable.

POET is one of the leading developers of cellulosic technology. We have invested tens of millions of dollars in cellulosic research and are prepared to invest hundreds of millions more to make this a reality. The commercialization of cellulosic ethanol is not far off. POET announced last week it will be producing cellulosic ethanol at our pilot scale facility later this year in Scotland, South Dakota.

Construction of our commercial-scale facility in Emmitsburg, Iowa, is scheduled to begin in 2009. The plant is expected to commence commercial production in 2011. But if we are suddenly faced with an influx of Brazilian ethanol in our market while we are simultaneously running into an ethanol blend wall, we will not be able to see this dream become a reality, nor will the many others who are diligently working on this process.

If we truly wish to see a change in our nation's transportation fuel supply, we need to do the following. We need to create a larger market for ethanol by allowing higher blends in today's vehicle fleet. The 10 percent blend wall will stop investment in both grain-based and cellulosic-based ethanol. It is critical that the EPA approve a rate greater than 10 percent ethanol before year-end 2009.

We need to mandate that all new vehicles are flex fuel. It takes 17 years to convert our automobile fleet. It is a minimal cost to make a new car flex fuel and we should not delay this any longer.

We should incentivize the installation of blender pumps throughout the nation. Blender pumps give the consumer the choice of multiple ethanol blends. We need to allow the American consumers to choose his or her fuel blend based on performance and price.

We need to support cellulosic ethanol development. The recent farm bill has three important provisions that will help, which USDA needs to implement on a timely basis. They are loan guarantees; repowering; harvesting, storage, and transportation.

And finally, we need to focus on a U.S. solution. The natural resources are available. It is important we continue to support the upstart biofuels industry. Today's grain-based ethanol industry is the foundation for cellulosic ethanol. The tax credit and tariff are critical pieces of legislation that will allow the nation's energy potential to be fully realized. The U.S. ethanol industry has demonstrated in the past that we can meet the challenge and we stand by ready to do so in the future. Make no mistake. This problem is solvable in the United States. The natural resources, ingenuity, and technology are all right here. We simply need our nation's will.

Thank you for the opportunity to testify today. On behalf of POET and the entire renewable fuels industry, we thank you for the past legislation that is truly making a difference in the nation's energy supply and POET looks forward to working in partnership with Congress and the administration to reach the national goal of 36 billion gallons by 2022.

[The prepared statement of Mr. Lautt can be found on page 82 in the appendix.]

Chairman HARKIN. Thank you very much, Mr. Lautt, for a very good statement, very provocative, I think, in laying out where we are and where we might be headed.

Now we will turn to Mr. Dave Moody, the current President of the Iowa Pork Producers Association. He has been involved with the Association for the past 15 years. Mr. Moody has been involved in pork production for nearly 40 years and currently manages H&K Enterprise, a farrow-to-finish business. He farms over 1,000 acres of corn and soybeans at his farm near Nevada, Iowa.

Mr. Moody, thanks for being here.

STATEMENT OF DAVID MOODY, PRESIDENT, IOWA PORK PRODUCERS ASSOCIATION, CLIVE, IOWA

Mr. MOODY. Thank you for the invitation to this hearing today. As the Senator has just said, I am Dave Moody, President of Iowa Pork Producers Association and a producer from Nevada, Iowa.

We have all heard about the perfect storm and many in agriculture are being forced to respond to issues well beyond their control. We are at an important crossroads in American agriculture where we must work cooperatively to produce food, feed, and fuel simultaneously. Just last week, the USDA released the August crop report and it appears that conditions of the crop have greatly improved over previous months. During the next few weeks, farmers will begin to focus on weather conditions to mature the crop and hope that we don't see an early frost this year.

As you will learn from other speakers, these demand and supply issues will persist for several years as we work through these changes. This year's demand-supply situation has resulted in dramatic and rapid changes in commodity prices. For example, we have seen record prices for cattle and hogs this summer, but many livestock farmers still have not been able to break even because of rising input costs. As a farmer myself, this same fear of input cost inflation will possibly and probably affect the grain farming in the next couple of years.

Earlier this summer, corn reached $7 a bushel. However, it has dropped nearly $3 at this point in time. This rapid increase and decrease has resulted in tremendous stress among farmers, lenders, grain merchandisers, and consumers and others. To say that this year has been a wild rodeo in agriculture is definitely an understatement.

As we move forward, we need to look at these. The demand-supply issues for row crops has highlighted needs to balance important end use of the crops. Causes of tight supplies include cold, wet springs, delayed crop progress, flooding, weak dollar, and high energy costs. As margins for livestock and ethanol production has eroded, we must look for new approaches to improve efficiencies.

While we may have averted disaster this year that it was looking like in mid-June, we need to look at policy options for the future. One of the most encouraging may be corn fractionation for ethanol production. Fractionation is the high-speed separation of the corn kernel into four basic components so the parts can be used more efficiently. It is currently very expensive to implement this fractionation at ethanol plants and we want to help develop and support the adoption of this new technology. Congress should begin by investing in different approaches and demonstrations and then let the industry adopt the technology that shows the greatest promise. Frankly, the technology in the short term may be more effective than cellulosic ethanol.

We believe this presents the whole agricultural community and the Nation a win-win opportunity. When used in ethanol production, it reduces energy consumption, reduces transportation costs of the co-products, reduces water consumption, it increases ethanol production, and it helps to create a greater number of high-quality co-products that the livestock industry may use.

We must also work and support research institutions in ongoing scientific feed trials to ensure co-products can be used in our feeding rations accurately and the feed value can be publicly documented. As new co-products are created, feed documentation will continue to need support regardless of what type of livestock is being fed.

Other policy options—many other approaches have been discussed, such as early release of CRP. I want to thank all the Senators who have supported you, Chairman Harkin and Senator Grassley from Iowa, for supporting the early release of the CRP acres for grazing and hay.

Also, the preventative planning dates and crop insurance adjustments need to be reviewed to make sure that when we have incidents like we had this summer, that we get some sort of crop planted on these acres that get flooded out.

And finally, the Texas waiver for the EPA request has now been decided. It is behind us, and other panelists today can discuss the decision in greater detail.

In summary, Congress can take great steps forward by investing in projects and policies that will more efficiently produce food, feed, and fuel simultaneously. Thank you.

[The prepared statement of Mr. Moody can be found on page 90 in the appendix.]

Chairman HARKIN. Thank you very much, Mr. Moody.

I would now yield to Senator Nelson for the purposes of a couple of introductions.

Senator NELSON. Well, thank you, Chairman Harkin. It is my pleasure to introduce Mr. Jim Jenkins today, who is the Chairman of the Governor-appointed Nebraska Ethanol Board, which is a State agency devoted to the development of our ethanol industry in Nebraska. He also is a range-to-restaurant beef producer and comes from Callaway, Nebraska, and is no stranger to the issue from the standpoint of feed as well as fuel. So Jim?

STATEMENT OF JIM JENKINS, CHAIRMAN, NEBRASKA ETHANOL BOARD, CALLAWAY, NEBRASKA

Mr. JENKINS. Thank you. Thank you, Chairman Harkin, Senator Nelson. I, too, am honored to be a part of this discussion on this panel and certainly, as you have just outlined my background, I find myself squarely in the middle of these issues. I think this is one of the most—since moving back to my family ranching operation in 1996 and actually having participated in agriculture for over 30 years, I believe this is probably one of the most exciting times that I have witnessed. We have a lot of challenging things, but a lot of opportunities that have come about as a result of the biofuel revolution in this country.

I agree with you, Senator Nelson. What we need to do is get to the facts. There is a lot of emotion. People have lined up and drawn lines in the sand and I really am trying to encourage all of my friends on both the livestock side, the corn side, to sit down and try to work through some of these issues.

It seems to me that as I look back over the last 30 years in agriculture, the principal challenge we have faced is we have had too much food. We have had stagnant commodity prices. We have had

large subsidies going to farmers from the taxpayer. When I moved back to the ranch in 1996, my friends on the East and West Coast were telling me that they were upset because farms were being subsidized. Our international trading partners were accusing us of dumping cheap grains onto the market.

We roll forward now ten or 11 years later and we have a little bounce up in commodity prices, and now, of course, the food for fuel criticism is coming out, and despite the fact that oil has gone up 900 percent from its low point seven or 8 years ago, 9 years ago, and grain, corn has gone up around 300 percent, and commodity prices are still from an inflation-adjusted level extremely competitive and actually fairly inexpensive, we are, I believe, paying less than 10 percent—each consumer is utilizing less than 10 percent of their budget for food, we are facing this food for fuel criticism.

The other thing that I think that people need to understand is that only 19 cents out of every dollar goes to the farmer, so it is a long way from the farmgate to the consumer plate, and I know that as a restaurant operator. I know that as a rancher. The plain fact of the matter is where I am getting killed both as a restaurant operator and a rancher is high oil prices. Energy is absolutely hammering us.

And I am appreciative of the fact that what we are finally doing in agriculture is we are doing two principle things. Because of ethanol, we are diversifying our fuel or our energy portfolio, which is something that we are all advised to do in our financial portfolios. And second, we have diversified our farm economy and finally got out of the rut of $2 corn prices, which by the way are no panacea for the cattle feeding industry.

Now, I can't speak for the pork guys or the poultry people. I know they are facing some unique challenges. But the plain fact of the matter is the byproduct, co-product, distillers grains that are available to cattle feeders, basically we are able to, as most people in this room know, use nearly 50 percent of the grain, a bushel of grain that is used in the ethanol process comes back as a feed source.

Beyond that, I think it is important to understand why $2 grain is hard, bad, for the livestock industry. With $2 grain, we face an over-fattening of cattle, and I see this particularly in the restaurant industry. If you look at the No. 1 complaint that retailers and restaurant operators have, it is that for decades, we have had to trim huge quantities of fat off our animals. Now the good news is that because you can fatten cattle to a large degree on forage—80, 85 percent of their intake can come from forage—you end up now moving to more innovative grazing practices and forage usage practices that have really not been talked about to date.

For example, on my ranch, I am running 20 to 25 percent more pounds per acre than my father was running. Why? Because I have adopted what I call progressive or more modern grazing practices. We have been able to put more water on the ranch. We have used rotational grazing. The plain fact of the matter is, here in Nebraska, we have 50 percent of our lands in grass, and with $2 corn, there was not a lot of incentive to really manage those grasslands very well. I am not saying we were being bad stewards. I am suggesting to you there is a tremendous amount of innovation that has

come from using those grasslands and what happens is using those grasslands more appropriately.

Right now, I would estimate that probably less than 10 percent of ranchers and farmers in Nebraska are fully implementing some of the grazing techniques that would allow for more forage and less corn. So in addition to being able to use that foodstock coming out of an ethanol plant, 50 percent of it, we are also, I believe, able to go out and more efficiently use the corn stock residues, crop residues, and grazing lands.

Some other points I would like to make are that we need to let the marketplace work. Right now, the marketplace is currently signaling to cattle producers, feedlot operators, do not bring me that livestock when it is 500 pounds. We do not want that beef animal until it is 800 to 900 pounds, getting paid a premium for 800–pound animals. So we have a great opportunity to watch this market work.

We have seen it go from $7 down to $5, as has been indicated earlier. What I would say is that let us not panic. I know when we hit $7 corn, believe me, I was panicking. I had 1,000 head of yearlings out there that I thought the price might get caved in on. The fact of the matter is, the market is working.

The final point I would like to make is that there has been a lot of criticism of ethanol for being subsidized. Well, I think if we look back at history, we can find that—we can see that this country is made great for a couple of reasons. One, the free market has been in full force.

Second, we have had democratic institutions that have had the flexibility and the vision and the insight to partner with the free enterprise system. Look at transportation, all the key sectors, the Transcontinental Railroad that Abe Lincoln sent through to allow us to get products to market. Our educational system, whether it be land grant universities doing research for agriculture, energy, technology through our Defense Department and our space program. So the notion that we should not subsidize or help, at least initially provide a foundation and infrastructure for energy to me does not live up to our history as a nation. What we need to do is have the vision to understand that we can work together through the public and private sector to build a biofuel industry that diversifies that energy portfolio, and just as importantly, puts a strong foundation under agriculture.

We do need to be concerned about making sure that livestock producers are not critically hurt if there is a severe drought or other factors that might come in, so I would suggest as a final comment that you folks consider, the Congress consider looking at ways to mitigate major problems created by drought.

I am very appreciative of being a part of this discussion and look forward to hearing the other remarks from the panel. Thank you.

[The prepared statement of Mr. Jenkins can be found on page 71 in the appendix.]

Chairman HARKIN. That was very good.

Senator NELSON. Well, thank you very much, Jim.

It is now my pleasure to introduce Mr. Bill Lapp, who is the Principal of Advanced Economic Solutions of Omaha, providing economic and commodity analysis to agribusiness and food companies.

He is also a Director of the Kansas City Board of Trade and serves on the Board of the Farm Foundation in the Kansas City Federal Reserve Board Center for the Study of Rural America. He has over 25 years of experience in analyzing and forecasting economic conditions and commodity markets. I know he is going to tell us how we get out of the conundrum we find ourselves in. Bill?

STATEMENT OF BILL LAPP, PRINCIPAL, ADVANCED ECONOMIC SOLUTIONS, OMAHA, NEBRASKA

Mr. LAPP. Mr. Chairman, Senator Nelson, it is a pleasure to have you here in Omaha, my home town, for this hearing. We are glad to be able to facilitate this for you. As you mentioned, I am the Principal of Advanced Economic Solutions. We provide economic and commodity analysis for a broad array of food companies, and with my background, I hope to give you the perspective of food manufacturers, restaurants, and primary input producers.

Between 1981 and 2006, spikes in commodity prices have been mostly weather-related. In all cases, these increases in prices have been short-lived and with limited impact upon consumer food inflation. For the most part, the increases in commodity prices have been absorbed by food manufacturers to avoid a loss of market share, and this contrasts directly with the current environment of sustained increases in commodity prices. Today, food manufacturers are unable to absorb the sharp increase in input costs, and as a result, food price inflation has begun to accelerate and the rates of food inflation are likely to continue to increase in the coming years.

The overwhelming majority of companies that my firm works with indicate that rising input costs driven by the surge in commodity prices has created the most difficult and challenging environment from a raw material cost perspective that they have faced in more than 20 years. The current environment, with sharp and sustained input costs, has created significant pressure on margins and is compelling the food industry to raise prices to consumers.

The Bureau of Labor Statistics data on food prices confirm the trend in rising costs to the consumer as well as the producer. Historically, the Consumer Price Index for food increased by an average annual rate of 2.3 percent between 1998 and 2006 and has not been in excess of 6 percent since 1980. However, the impact of higher commodity prices is beginning to translate into higher consumer prices, and in 2007, the CPI for food rose by 4.9 percent, and thus far in 2008, the CPI for food has increased at an annualized rate of 7.6 percent. This includes double-digit rates of inflation for staples such as bread, cereal, salad dressing, rice, and eggs.

A couple things to know. First of all, the Producer Price Index for food has increased at an even greater rate, near 10 percent this year. And the second point I would make is that consumer price for proteins, for meat prices, has only been modest. This is consistent—the Consumer Price Index data from the Bureau of Labor Statistics is consistent with the American Farm Bureau Federation's survey of supermarket prices, and that shows that the five meat prices they track have increased only 1.7 percent from a year ago.

Due to the biological limitations in the livestock industry as well as high levels of fixed costs, livestock producers do not typically respond quickly to changes in feed costs. They are incapable of doing so. However, in the current environment, which is characterized by very poor and negative margins, producers are expected to reduce their output. The USDA's most recent forecast is for total meat and poultry production to actually decline in 2009 by 1.2 percent, a development that they believe will lead to higher livestock prices and ultimately higher prices for the consumers.

Earlier this year, Advanced Economic Solutions completed an analysis of the outlook for food inflation for the next 5 years, 2008 through 2012, and I might note that this is an update of a study originally completed at the request of the National Corn Growers Association. In that study, Advanced Economic Solutions estimates that consumer food inflation will increase by an average rate of 9 percent between 2008 and 2012 as the rising costs are passed on ultimately to the consumer.

I might mention a few things about ethanol and the relationship to corn and food prices, and there have been many studies and it is a tough subject to get your hands around. So I thought I would run through just a few facts.

While there has been discussion of the impact of poor weather in recent years, the reality is, as USDA data suggests, we have had above-trend or trend yields. In 2006–007, yields were 4 percent above the previous 5 years, and 2007–008, world yields were again above the 5–year average. In other words, it is difficult from a statistical point of view to blame the weather for the dramatic rise in prices we have seen in recent years.

A second fact is that the world wheat and coarse grain usage forecasts by the USDA is expected to increase 3.3 percent between 2006–007 and 2008–009, so a 2–year gain on an annualized basis of 3.3 percent. This is well above the rate during the previous 10 years of 1.2 percent and higher than the average yield we would see in the past 25 years.

The growth in this use of world wheat and coarse grain is dominated by ethanol. During that 2–year period, ethanol production in the U.S. using corn will account for 46 percent of the growth in demand. As the U.S. and the world struggles with tight stocks, high feed costs, and increased food inflation, we should keep in mind that nearly half the growth in grain use worldwide for wheat and coarse grains can be attributed directly to the mandated use of corn to produce ethanol.

A third fact I might mention is that the growth in use of grains has led world stocks of wheat and coarse grain to the lowest levels on record, and this has occurred in spite of high record prices for grain and oil seeds.

At present and in the foreseeable future, the impact of a decline in yields, such as we were threatening to do earlier this year, would be dramatic for grain and oil seeds prices and ultimately for consumer prices.

Another fact I might mention is that more acreage will be needed. We need more acreage here produced in the U.S., and particularly due to the demand mandated by the Renewable Fuels Standard. In the United States, just to meet existing demand for wheat,

corn, soybeans, and cotton, plus the mandated growth in ethanol, U.S. farmers will need to plant an additional five million acres of major crops in 2009. Grain and oil seed prices are already high, but a shortfall in acreage or yields in 2009 would drive prices dramatically higher.

And finally, let me mention that livestock margins have been extremely poor due to the increase in feed costs. When corn prices were over $8, or near $8, I should say, in late June, the pork industry, the cattle feeders, and the broiler producers were losing, in my estimate, roughly $8 billion on an annualized basis, which is more than the U.S. airline industry was projected to lose this year.

USDA analysts suggest that livestock producers will reduce output by 1.2 percent in 2009, with prices for livestock expected to increase. And while there have been limited gains in consumer prices of protein to date, the reduced availability of meat will ultimately be reflected in higher consumer prices at some point probably in 2009.

Thank you, Mr. Chairman and Senator Nelson, for the opportunity and I look forward to your questions.

[The prepared statement of Mr. Lapp can be found on page 74 in the appendix.]

Chairman HARKIN. Thank you very much, Mr. Lapp.

And now for our wrap-up witness, we go to Mr. Tim Recker, President of the Iowa Corn Growers Association. He produces corn and soybeans near Arlington in Fayette County, Iowa. His testimony here today is on behalf of the Iowa, Nebraska, and National Corn Growers Associations, which have worked so hard to promote the use of renewable fuels.

Mr. Recker, welcome again to the committee.

STATEMENT OF TIM RECKER, PRESIDENT, IOWA CORN GROWERS ASSOCIATION, AND FARMER, ARLINGTON, IOWA

Mr. RECKER. Thank you, Chairman Harkin, Senator Nelson. Thanks for the opportunity to comment on the food and fuel debate. As Senator Harkin said, I am Tim Recker, President of the Iowa Corn Growers, and I am speaking on behalf of 59,000 corn growers who are represented by the Iowa Corn Growers, the Nebraska Corn Growers, the Nebraska Corn Board, and the National Corn Growers Association.

Over 30 years ago, corn farmers saw ethanol's potential to benefit producers and consumers. Our check-offs have spent millions of dollars on ethanol research, education, and market development, and our growers know we have contributed endless hours to promote policies that would give ethanol a chance, because given a chance, we knew ethanol would succeed.

Today, producers and consumers are benefiting from the hard work corn farmers are producing for the marketplace and the market is working. We are a long way away from the huge government-owned stockpiles of grain of the mid–1980's, and even the USDA subsidies couldn't halt the exodus of farmers and the wave of bank closings. Today, the world is hungry for protein and petroleum and our corn growers can deliver both—energy from ethanol and protein from corn-fed livestock.

Our ethanol industry is still developing, but is already producing jobs that keep young people in our communities. It is improving the tax base that supports local schools and government services. And it is pumping renewed economic life into small towns and prompting new business.

And what about consumers? While high oil prices are limiting family vacations because the dollars just don't stretch, ethanol is reducing the pressure on family budgets.

Using ethanol increases our overall energy supply. Ethanol in an E10 blend means for every ten gallons of gasoline that you pump, there are 11 gallons of fuel at the pump. In E85, or putting E85 in a flex-fuel vehicle, for every three gallons of gasoline, you have 20 gallons at the pump.

My written testimony cites economic analyses that demonstrate what I am saying, but I will just point out that Midwestern consumers now save about 45 cents out of every gallon of fuel because ethanol is in the marketplace.

In retrospect, the Renewable Fuels Standard is as good for U.S. consumers as it is for corn growers. Not surprisingly, though, some interest groups want to roll back the RFS and other key policies, such as the blenders credit and the ethanol tariff.

We have seen unprecedented efforts this year to spread disinformation about ethanol, and unfortunately, some people are buying into the false claims. Today, I would like to set the record straight.

Despite what alarmists have claimed, USDA's August 12 production report projects the second-largest U.S. corn crop ever. The world agriculture supply and demand estimates project greater carryover stocks at both the national and at the international level. USDA puts the average farmgate price in this current market year somewhere in that $4.25 and projects an average price between $4.90 and $5.90 next year.

Our industry continues to produce higher yields with less erosion and less chemicals. We have gone from 66 bushels an acre 50 years ago—and that is a few years before I started farming—to a projected 171 bushels today. We have genetic experts that tell us that 300–bushel corn is a reality and a realistic target for the foreseeable future. U.S. growers are supplying plenty of corn for both food, feed, and fuel uses.

We know livestock feeders have struggled with the spike in corn prices, and it is because I am a hog producer. We want all agriculture to be profitable, but targeting ethanol will not solve livestock's problem. Many factors have produced these prices, notably increased world demand for millions of people who want more meat, milk, and protein in their diets, and at the same time feed, wheat, and barley supplies have tightened because of crop problems in other countries and the weak U.S. dollar has made it easy for foreign customers to continue buying as prices have climbed.

Changing U.S. ethanol policy won't change international demand, but it could harm U.S. livestock producers by reducing corn for ethanol, since they also use distillers grain in those diets. For livestock operations located near ethanol plants, distillers grains are a valuable alternative to help manage feed costs.

Corn growers support the U.S. livestock industry and we work with livestock producers in many ways on many issues. We spend our checkoff dollars on research to improve feed products and on the market development for red meat exports. We want to solve the problems that really hurt livestock producers, like the $50 million per week that beef producers are losing because of export problems in Japan and Korea.

Ethanol opponents have blamed corn prices for high food prices, and many economic studies confirm that other input costs, notably high oil prices, are the real culprit to our food increases. In fact, most consumers save more on fuel because of ethanol than any other corn-related increase in food prices. For an average family, their fuel savings from ethanol is estimated to be $1,500 a year. That is because the share of the food dollar that goes to all farmers, not just corn farmers, is now below 20 cents.

Look at corn's role in specific foods. Four-dollar corn contributes just 13 cents to the cost of a gallon of milk, 18 cents to a quarter-pounder, 28 cents of corn in a dozen eggs, and 31 cents of corn in a one-pound Iowa pork chop. A bowl of corn flakes and milk for breakfast contains less than two cents' worth of corn.

We are supplying enough corn for food, feed, and fuel. U.S. and world consumers are better off because of ethanol and we ask Congress to maintain the RFS, the ethanol tariff, and the blenders credit.

And I might add just as a personal note that the RFS is bigger than all of us livestock industry. It is bigger than corn. It is bigger than livestock. It is a road map for the United States, the future of energy independence, and we encourage you to support it. Thank you.

[The prepared statement of Mr. Recker can be found on page 99 in the appendix.]

Chairman HARKIN. Thank you very much, Mr. Recker. Thank you all very much for very succinct and very pointed statements.

I would like to open it up for a general discussion, to have more of a discussion than questions or anything like that. We might have some specific questions for certain individuals, but I think I would like to just start by picking up on where Mr. Recker just left off because it is the one thing that is out there that we have been wrestling with on our committee, and I hear it all the time in the halls of Congress, and that is that with these food prices going up, the ethanol is just sucking up all that corn and is causing all these prices to go up. All of you in a way addressed that question to some extent. I would like to examine it a little bit further.

We do have some statistical data on this, as I think Dr. Babcock knows. We do have some statistical basis on which to go. And then there is kind of people's generalized conceptions out there. For example, I was looking at my notes here. Mr. Jenkins, I was reading your testimony—no, no, it was Mr. Lapp. I am sorry. You had a survey in which ninety percent of those surveyed said that 90 percent of the ethanol was the primary driver of the food price rise. Well, from what I am hearing, that is not so. That just seems to be based on opinion and there seems to be a lot of PR. There has been a lot of PR out there by the grocery manufacturers and the

oil companies and others to instill that thought out there, that so much of this is driven by ethanol.

I want to know what the facts are. And again, from your knowledge base, No. 1, what is the biggest driver of food price increases now, and what is the role of ethanol? Where does ethanol come in? Is there a percentage figure? Is it small? Is it large? About where is it? I will just go down the pike. Do you understand what I am saying? In your opinion, what is the biggest driver of food price increases and what part does ethanol play in that? Dr. Babcock?

Mr. BABCOCK. Well, that is a very hard question to answer, of course, but high energy prices have affected every segment of the economy and food is no different. Food is a fairly intensive energy user and it is a lot of transportation costs embodied in food. So clearly, higher energy prices have led to higher food prices.

Ethanol, the expansion of the ethanol industry also has impacted the overall level of ingredient costs to the food manufacturers. There is no doubt about it. And it doesn't come from the direct effect only. It also comes from indirect effects in terms of competition for land, in terms of almost the knowledge of needing more corn in the future leads to higher prices today to make sure that we allocate the current supplies of corn through the future.

And I fully expect continuation of the RFS. I agree with Mr. Lapp that in the next few years, we will see meat prices and dairy prices increase because of higher feed costs. Those higher feed costs are driven primarily by expansion of ethanol.

So if you want a percentage change, probably to date, energy prices have been the No. 1 contributor to higher food prices. I would expect if we see stabilized energy that in the future, as we work through the higher feed costs through our dairy, our livestock industry, we are going to see ethanol become a larger—or feed costs become a larger contributor, and ethanol, like I said in my testimony, is the primary determinant now of feed costs.

Chairman HARKIN. Anybody else? I didn't mean to go down the row, so if anybody else wants to speak to this, just indicate.

Mr. LAUTT. Mr. Chairman, I agree with Mr. Babcock that it is a difficult thing to pick a number on. Our organization looks at a lot of the different studies that come out from the different universities and private industries that are trying to do the economic modeling of the impact as well as looking at the different studies that come out from the different government sections, as well, and we assess their assumptions they use in their modeling to make sure if we agree with it, does it make sense, since they drive the results.

The one that we thought made a lot of sense was the one that came out from the Economic Advisors for the President's Office which cited that recently, 3 percent of the overall rise in recent food prices is associated to ethanol's impact on corn prices. So it is, again, transportation costs the large driver. Corn has had some impact, but I think it is much more minimal than a lot of people have attributed to.

Chairman HARKIN. Again, if you don't want to address yourself to that, you don't have to, but———

Mr. MOODY. Well, as I stated in my comments, we have kind of faced the perfect storm. I mean, there have been a lot of things

come at the market and supplies that have caused prices to rise. But indeed, as Dr. Babcock indicated, as feed prices have risen for the protein products that consumers eat, they will be rising down the road and that is—to date, it has been very minimal of ethanol's impact on food prices, I believe. But there will be more because of that feed cost rise in 2009.

Chairman HARKIN. Well, the one thing I also want to throw out here on the table is, OK, so what I have heard from three so far, or two anyway, is the possibility of increases because of the increased demand for more grains for fuel production. But are we missing a point here? I think Mr. Recker talked about increased productivity, and on the next panel we are going to have some people talk about that, but you are all in this business. What about it? Ten, 15 years ago, if someone told me we were going to produce 150 bushels an acre, I would have said, it is impossible. Now, we are at 200, roughly, more and booming up. As you pointed out, DuPont and others are saying 300 bushels. We will breeze past that soon.

So not only increased productivity, but new hybrids are getting more mature in a shorter span of time. We have shorter growing seasons. Because of climate change or whatever else is happening out there, we are getting corn crops in Southern Canada like we used to get in Iowa. Are we taking that into account, increased productivity?

Mr. MOODY. I think that is certainly, definitely a help. One of the factors is the time line here. If this time line was a little longer, everyone would have been able to have a chance to adjust. But we are trying to make this all happen—and we are not trying. It has all happened in a very, very short time period and livestock producers, as indicated earlier by one of the gentlemen to my left here, don't make that quick change. I mean, it takes just—you physically can't when you are dealing with another living body, that you can't make that immediate change. And that is part of the big factor that has affected the livestock industry, is that this has been such a dramatic, quick change.

Chairman HARKIN. Mr. Jenkins?

Mr. JENKINS. I think one of the simpler question is whether we want to go back to $2 corn. You know, is that good for the base foundation of agriculture? Is it good for our country? Is a cheap food policy, which is what we have put in place through taxpayer subsidies, is that really the way we want to go? For 30 years, livestock producers have had subsidized grain, and as I stated earlier, the downside of that, it leads to very inefficient feeding practices.

Now, are we going to make the change quickly? No, but I can see already, living right there in a rural community, engaged in buying food in my restaurants, producing cattle and also producing corn, that there is much innovation that is beginning to happen. We have got farmers up in Custer County now putting in drip irrigation systems. Now, they are very expensive, but with the new crop prices, they are able to do that. We have no-till or minimum-till or low-till starting to now sweep the State. It has incrementally come into the State for the last 20 or 30 years, but nowhere to the degree that we have seen it now that fuel prices, oil prices, have surged. Diesel is up well over $4.

So we can go back to cheap food. I am just not sure cheap food is a great long-term policy. The fact that we could ship $2 grain overseas and have them add value to their agriculture while we end up with a subsidized farm economy, I don't think is a great solution, either.

Chairman HARKIN. Mr. Lapp?

Mr. LAPP. Chairman, I guess I am looking forward to the comments in the second panel on productivity because I know that the USDA put out a study about slowing productivity, and I think Dr. Babcock indicated that there is some slowdown in at least the investment to get there. So productivity has been slow and that is a problem, because I look at 25 years of data on yields for world wheat and coarse grains and they are increasing 1.6 percent no matter what decade you look at, and whether events increase and decrease that, but over time.

Since 2002, we have had a number of impetuses for us to move higher. We are not going back to $2 corn. The world economy has been growing. It is probably the most rapid decade of economic growth we have experienced in history. We have an extremely weak dollar. China has evolved as a major force. Energy prices have had their impacts, and there has been some impact from biofuels.

If you look at 2002 to 2006, the impact of biofuels has been much more limited than it has been in the last few years, and as I mentioned, nearly half of total world wheat and coarse grain usage from 2006 to 2008 will be strictly for the use of ethanol. So it has changed.

And I have some ideas of how this impacts the other crops and inflation and the specific one I will bring to mind is that if you are growing more corn, unless you can find acres of another crop, and perhaps some from the CRP if there were a change in policy there, you have to steal it from another crop, and the challenge there is you enter an acreage battle.

In the fall of 2006, that became very evident. I have the dubious distinction of going to a livestock producer in September of 2006 and telling them that because we don't have enough acreage, corn might reach $3. I was only off by half, which is more accurate than some of my forecasts. But the idea that we need more acreage for all these crops because demand worldwide is growing 3.3 percent a year and our yields only increase at present roughly less than 2 percent presents us with a battle and has put us at liability of having sharp increases.

Ethanol has certainly played a big role, and the fact that corn impacts the acreage of wheat and soybean oil and edible beans and other crops used to produce food has a dramatic impact.

Chairman HARKIN. Let me just ask, and I want to yield to Senator Nelson, but I just wanted to pick up on that. I was looking again at your testimony and listening to you, Mr. Lapp. You said that, basically—let me get the figures here—3.3 percent annual growth between 2006 and 2007, and 2008 and 2009, so you are talking about a 2–year period———

Mr. LAUTT. Two years———

Chairman HARKIN [continuing]. We have had an increase in usage of wheat and coarse grain worldwide of 3.3 percent. But then

you say the average increase in yields per acre—listen to this—of 1.58 percent over the past 25 years. So you have used 3.3 percent for the increase in demand over 2 years———

Mr. LAPP. Yes.

Chairman HARKIN.—1.58 percent increase in yields over the last 25 years. Is that a good way to look at it?

Mr. LAPP. You mean in terms of the time disparity there?

Chairman HARKIN. Yes, the time disparity. That is what I am———

Mr. LAPP. Sure. I think looking forward, at that time, when I initially did that research, but 2009 and beyond, what should be our expectation for increasing———

Chairman HARKIN. Well, I'm wondering, what has been the growth in productivity not in the last 25 years, but in the last 10 years, 5 years? What has been the growth in productivity? I don't know. I am asking that.

Mr. LAPP. Decade by decade, it has been similar.

Chairman HARKIN. About 1.5 percent?

Mr. LAPP. One-and-a-half, 2 percent, depending on which decade.

Chairman HARKIN. So is this a good way of looking at it? I am asking, is this an accurate way to look at this? If the demand for coarse grains has gone up over 2 years 3.3 percent but productivity has only gone up 1.5 percent, what does that tell us about what is happening down the road? Is demand going up more than the productivity?

Mr. RECKER. Senator, maybe I can help answer that.

Chairman HARKIN. Yes?

Mr. RECKER. Thirty years ago, farmers said, we know how to grow corn and we can grow it very well, but we didn't have a market for it. Every year, we had burdensome supplies. In the last 2 years of my farming career, we finally have got a demand for our product, and when you are going to see the growth, and what you are talking about is growth in the yield on those same acres that we planted 10 years ago, the double-digit kind of growth, is the technology we have in the bag that we have just begun to start tapping into that has been on the shelves of seed companies for many years until we are able to afford it.

And the technology that is in the seat in the tractor cab and the combines I drive today, being able to put nutrients with sub-inch accuracy and technology, now that we have a demand for the product, don't underestimate the Midwest corn grower from being able to over-produce the market and actually over-produce himself into an unprofitable situation again.

Chairman HARKIN. Senator Nelson?

Senator NELSON. Thank you, Mr. Chairman.

To try to understand what impact, let us say, the foreign markets of demand for product has, there seems to be some misconception about what feed corn is, that this somehow is going to be supplied to the rest of the world directly for food as opposed to feed.

Is the fact that the rest of the world is picking up so that you see an increase in many areas, whether it is China or India or some of the developing countries, where there is now a demand for product, for protein, that that demand is outstripping supply at the moment? In the past, where we were over-producing but still ship-

ping overseas, weren't we, in fact, shipping subsidized product to various countries and now the countries are, because of demand, are paying a price closer to what they should have been paying for some period of time? Is that accurate?

Mr. RECKER. I agree, and I agree, and I agree with everything you said.

Senator NELSON. And so if we look at it that way, then when it is good for American agriculture, because we are getting the price that we should be getting for profitability, it is unfortunate that other parts of the world are having to pay the price, and we can't control that unless we are going to try to control markets over the rest of the world sometimes like we have tried to do here at home. So unless we do that, we are not going to be able to solve their problems by our prices.

But my question is for you, with our high prices for our exports, won't that stimulate more production in those other parts of the world because they can produce it for less than we can? So perhaps we are not the ogre that people are trying to make us out for the rest of the world. The rest of the world can respond on their own, as well. Is that fair, Mr. Lautt?

Mr. LAUTT. Yes. I think that is dead on. We are seeing foreign countries like China, like Brazil, like India, start to respond. For example, in China today, their average yield in corn is 78 bushels an acre. Why not adopt U.S.-type technologies? Well, there has never been an economic incentive to do so. The same thing in Brazil. The same thing in all these countries.

Well, now for the first time, the price of agricultural commodities is above the price of production and the cost of production to incentivize worldwide change. I think the difficulty is we are in an evolution or a paradigm shift not only as a country, but as a globe, because this is a global market, and the paradigm shift is mentally where, A, commodities can only be used for food and feed. The reality is, we have found that they can also be used for food and feed and energy.

And I can tell you that companies like ours, as well as many others here in the U.S. and abroad, this is just the beginning. There are things like nutraceuticals, bio-based materials, chemicals, things that consumers buy readily over the shelf today that are a byproduct of petroleum will be made from things like corn in the future. So this is just the very early stages of what really is an agricultural revolution, where we are going to have multiple demand streams for our commodities.

Senator NELSON. I am a bit puzzled by the concern about ethanol using up the feed supply, where between 30, as I have heard testimony here, between 30 and 50 percent of the product was back in the form of distillers grain, I guess, or product, for feed. So the total use of 30 percent of the corn, if it is that high, or 20 or whatever the percentage of our corn crop is used, you have to factor in that number can be reduced by the brand that is created that is now available for feed. Is that being ignored, underestimated? What are your thoughts about that?

Mr. JENKINS. I just saw a publication—I won't mention which one—an agriculture publication that made reference to the feed usage, and cattle are the No. 1 user of feed corn in the United

States. It didn't have that math in there. There is no question that distillers grain is being consumed, and I think the accurate number is about 40 percent, and when you look at it from an energy perspective, from a food value or feed value, it actually goes up to 50 percent. So the cattle industry is using that. There is no question. That is happening.

The other thing that Dan Loy at Iowa State University noted in a recent interview is that—and he is a beef nutritionist—he said that the cattle industry can get by on 40 percent less corn, or they can lower the ration. My point is, we talk about acres fighting for each other. Drive down I–80 some winter and see how many corn stalks are going into an animal. I mean, there are—I would like to know, maybe somebody can quantify it, but there are literally tens of thousands, probably hundreds of thousands of acres that are simply being disked under.

Terry Klopfenstein at the University of Nebraska has demonstrated that if you put feeder cattle out on corn fields and use distillers grain to supplement their diet, you are $45 or $50—and I am doing this off the top of my head, but maybe as high as $60 better off than putting them right into a feed yard. But you have to put them out there, fence them. There are some management issues. And the great thing about it, the corn stalk nutrition does not leave those fields. They have also done research that showed the impact on yield over 9 years was zero because those cattle, of course, eat the cornstalks and deposit—90 percent of the nutrients go back right into it.

So I think we are missing one of the great opportunities the cattle industry has not to fight with wheat or corn or soybeans, but to actually fully utilize crop residues and pasture lands out there in a way that we have never used them before. That is one of the things that has not been quantified or documented, but it is absolutely happening on my ranch and ranches all around me.

Senator NELSON. Yes. That may not work quite as well for the pork producers———

Mr. JENKINS. But it does free up, if I could just say, and boy, I am not going to edge out the pork producers here because, really, I know you guys are facing a tough challenge. I have got a good friend up in Custer County who I have had long talks with about this. But what it will do is if the cattle industry can consume significantly less corn, which I think it can—how significant, I don't know, I am not an economist—and fully utilize and leverage those distiller grains, it will then free up that corn for the poultry people and help us work our way into a new sort of corn-livestock economy.

Senator NELSON. So maybe help is on the way, Mr. Moody, but you need it today, right?

Mr. MOODY. What is that?

Senator NELSON. I said, help may be on the way, but you would like to have it today.

Mr. MOODY. Yes, that is—exactly. We needed it a few months ago, is when we needed it. But yes. When you start dealing with the pork and poultry, you are dealing with a simple stomach rather than the ruminant animal that cattle are and you have to have a more specific diet, and that is why I spoke about the corn fraction-

ation to get the parts separated so that we can have a higher-quality product to be able to use. I mean, there is definitely an answer in this somewhere that everybody can live with and we just have to work together to find that answer.

There have been issues with trying to feed the distillers coming out of the backside the way it is done today with the simple stomach animals. We have got fat quality issues in carcasses if we get too much in there, and from plant to plant, there are not the same consistencies, which creates problems. You can have a little more variation in some of your beef diets, maybe, but when you get in with the poultry and the pork, you need to have a pretty specific constant diet or you get into problems. And so that is where our real challenges have been in trying to use the current byproducts or co-products of the ethanol industry.

Senator NELSON. Well, I think it may be safe to say, and I ask it as a question, is it safe to say that paradigm shifts come in a variety of different sizes. There are those that take a longer period of time to develop. This seems to be one that has come faster and some areas of agriculture have been able to adjust as quickly as they would prefer. So you get caught in the middle of a paradigm shift and you can be left with major challenges to work through that over a period of time we will work our way through, but in the meantime, there are some challenges that are very hard to meet. Is that fair to say?

Mr. RECKER. I might add that the market is working. The market did work this year. There was a concern of not having enough corn and all of a sudden, once we went past that time when we knew we were going to have enough corn, the market has plummeted over $2.50. And just to put that in perspective, $2.50 was my average selling price for the last 22 years of farming. The market dropped $2.50 in about 40 days. So corn farmers are also facing that same paradigm that you talk about.

Senator NELSON. Well, I think that we really haven't talked, but I suspect the second panel will get into it more, about the second generation of biofuels and what that will do in terms of meeting the ethanol requirements for the future in America today. Corn is not going to be able to, even with technology and with increased yields and with everything that we do, is not going to be able to meet all those expectations and requirements. That is why we will go to the second generation. But it doesn't have to be at the expense of the first generation, and hopefully we will be able to sort out how corn-based ethanol will work in the market, but also continue to be available for feed and also for livestock of all sorts, including poultry.

Chairman HARKIN. I think Senator Nelson really nailed it when he talked about the increased prices here that would lead to better production and more production around the world. I mean, that would be—rather than low prices, a little higher prices will tend to spur that production. I think that is a point that a lot of people are really missing.

I thought I might just expound on that just a little bit. You know, people are always talking about, well, other parts of the world in terms of their grain production and they are lagging behind. There are really, it seems to me, two reasons for that. One,

in many of these countries, they have increased their population substantially in the last 50 years, huge increases in population. But their systems of agriculture are like they were 100 years ago, or 150 years ago, or even more. They have not adopted the new technologies, the new agriculture practices that will allow their productivity to increase.

Second, in many of these countries that I have traveled in and looked at agriculture, one of the biggest drawbacks is the lack of infrastructure, roads, simple roads. Farmers are out there. They have got tillable land and arable land, but they can't get it to market because they don't have an infrastructure.

So you kind of combine those two things and you can see that it is not our problem, it is an internal problem in a lot of those countries. And some of those internal problems, we can't solve. It is up to those countries. If they want to make those decisions to put in that infrastructure, if they want to make those decisions to adopt new practices, new genetics, new hybrids, new tillage practices, they can do that, and we should help them. I have no problem in helping them do that, but it is up to those countries to make those decisions.

Second, the issue of subsidies came up. You talked about that, Mr. Jenkins, about subsidies. There is always this problem of the market and subsidies, and I think, again, you kind of put your point on it, that a lot of times, it does take public support to get these to mature. I always think back about when we went from horses to automobiles, cars. I am sure a lot of people thought horses were just fine. We had been using them for hundreds of years, plus those new-fangled cars, they won't go down those mud roads. Horses will. Cars won't. Well, but then the public came in and started building gravel roads and farm-to-market roads and paved roads and blacktopped roads and the rest is history.

Also, talking about subsidies, I challenge anyone here to look and see how much the taxpayers of this country have put into subsidies for the initial development of and the continual exploration and development of the oil industry and petroleum industry in this country. It dwarfs, dwarfs anything that we are doing in ethanol or ever will do in ethanol. I mean, from the very beginning, it was government policies and tax subsidies and everything that enabled the petroleum industry to develop like it did.

So again, for us to say, well, OK, now we are going to go into a new technology, into ethanol, of course, we provide some initial input to help get it going. But market forces will take over later on and spur it on. So we shouldn't be too afraid of this. We have done this in the past with numerous other things.

And there are inequalities out there. For example, we have been talking about building a pipeline for transporting ethanol. Well, because some of the existing pipelines won't do it, there are all those problems and stuff, but there is an interesting thing in the tax code. A publicly traded partnership can get certain tax benefits for building oil and gas pipelines. In the tax code, it actually is written that they get these tax benefits for the transportation of non-renewable fuels. Why is that there? Why shouldn't it be there for renewable fuels?

So Senator Grassley and I worked together. He is Ranking Member on the Finance Committee. And so we changed it and it is in the tax extenders package that is now before us, and hopefully we will be voting next month to change it so the publicly traded partnerships get the same advantage if they want to build an ethanol pipeline as if they want to build an oil pipeline or a gas pipeline.

Now, with that, I have been told by a couple of companies that if they get that, they have got right-of-way, they can begin building some ethanol pipelines that will go from Iowa to the East Coast, Nebraska, Minnesota, South Dakota. We will begin to pipe that stuff. Then it will really be cheap for the consumers back East, back in Philadelphia and Boston and New York and New Jersey. Then they will be able to have some of this ethanol and they will see it tend to reduce their gasoline prices.

But again, these are the kind of governmental policies that have skewed us one way rather than the other, and I think that it's time for us to say, well, we have something here that is home-grown. We know we are dwindling in oil resources, and as someone said in their testimony, T. Boone Pickens said we can't drill our way out of this problem. We can drill and we can get more oil, no doubt about that, but not enough to solve the problem itself. We have got to develop new technologies and new types of fuels.

Last, cellulose. We haven't talked a lot about cellulose. Now, I just read in the paper that POET is starting a new cellulose plant in South Dakota. You are doing the one in Emmetsburg where you are attaching it onto an existing corn ethanol plant. But in the farm bill that Ben and I worked so hard on, we put a lot in there to spur cellulose ethanol, both on the bio-refinery side, for loan guarantees, and on the production side to help to stimulate farmers to grow more cellulosic crops. That means we could be making cellulose ethanol in Georgia and Florida and Louisiana and Alabama and Oklahoma and Kansas, Nebraska, the Dakotas, places where we can grow trees or where we can grow grasses, switchgrasses and miscanthus and other kinds, including prairie grasses.

I just finished reading a book a little bit ago called The Worst Hard Time. I recommend it to anybody. It was written by Egan. It is about the dust bowl. He summed it up by saying that for years, we have been trying to plant different crops in this area, but really the crop that grows the best is what grew there for 12,000 years after the glaciers retreated, grasses. They sequester carbon. They are perennial. You can graze on it. And you can also harvest it for cellulose, and you don't have dust bowls any longer.

This could be a great basin of production, from the Canadian border to the panhandle of Texas and that broad swath down there. Not all of it. Obviously, some of it is going to be used for wheat and corn and other things. But there is a lot that could be used if we give the right incentives and the right signals to people.

So we put a lot in that farm bill to move us in that direction. We haven't talked a lot about cellulose, but maybe that is the next panel, too, but you are all interested in this. We have got to call this panel to a halt, and I talked too long, but what about cellulose? Isn't that also going to assist us? The RFS, Renewable Fuels Standard, says that we are going to have—we are supposed to have 32 billion gallons of the biofuels by 2022, of which—I think

I am right—no, 36 billion gallons by 2022, of which 21 must be advanced biofuels, leaving 15 for corn-based.

So what do you think about that whole area of cellulose ethanol and what that is going to mean?

Mr. LAUTT. I will take a stab at that one. That is, again, very point on, Mr. Chairman. Again, we talked about paradigm shifts. Here is a paradigm shift. Now, there are a number of companies focused in this area. Everybody is taking a little bit different approach, which I think is good. Our company is focusing on corn cobs. Part of that is we think, let us not reinvent the wheel. Today, we have X-number of acres throughout the corn belt. These cobs just get sent out the back of a combine. So we are working with different equipment manufacturers to collect these cobs in an efficient manner.

But the paradigm shift is going to become we want the farmer to collect those and deliver them to the plant, no different than they do the corn today. And so we are working with farmers, we are working with agriculture equipment manufacturers, working with different universities to understand the impacts to the field. And then our team is working on the actual science of processing those cobs.

And so the announcement that you referred to is we have been working on the research side in the laboratories. We have made some significant gains to the point we are now going to build a pilot facility to produce a set of small pilot scale which will then get transformed or commercialized at Emmitsburg and be the first facility in Iowa. And again, to Senator Nelson's comments, it is going to be integrated with an existing corn-based facility which is why the two, generation one and generation two, are very important.

But without some of these very important incentives, and I applaud you guys on all the hard work on the energy title in the farm bill, it would be almost impossible to incentivize companies like us to invest, to incentivize producers to harvest the biomass, to collect the biomass, to a point to where it gets efficient and it is sustainable, no different than our practices are today of collecting and harvesting corn and transporting it to whether it is elevators or to ethanol producers.

So it is very viable. I think there will be a number of approaches which will be successful, but there are a lot of hurdles and there will be a lot of hard work. But with the right signals through policy, which you folks have done for us, I think it is going to keep us working hard to get there.

Chairman HARKIN. Any other views on this at all?

Mr. LAUTT. And can I make one other comment, please? And that is just to show the scope and size. Just from cobs alone in the U.S., we can produce an additional at least five billion gallons of ethanol just from cobs. You have talked about grasses. We have talked about a lot of other things. Just cobs alone, we can make another five billion gallons. That is significant.

Mr. BABCOCK. I just wanted to comment on that. The key to not making the food versus fuel debate worse by cellulosic ethanol is to identify those feedstocks that don't use cropland, and there are a lot of feedstocks out there that don't use cropland. I mean, the

worst thing would be to take prime land out of production and plant grasses on it for cellulosic feedstocks. There are other feedstocks that can be used and I think corn stover, corn stocks, the corn cobs is the No. 1—it is going to be the first big volume feedstock that is going to not make worse the food versus fuel debate because it is a crop residue. The other one is wood waste that is being wasted now. So tapping into waste streams is the most efficient way to go for cellulosic feedstocks.

Mr. RECKER. I agree that any of us farmers will do whatever is profitable, but I have to agree with Dr. Babcock that we sure don't want to be convincing corn growers to be planting grassland and really exacerbating our problem with our livestock friends further by reducing the amount of corn that is planted. But there are products within the corn plant that we can use and all forms, just wood waste and waste in cities. But whatever is going to be profitable for corn farmers, they will adopt into cellulosic technology.

Senator NELSON. Well, one final comment about subsidy and the high cost of the production of ethanol that some people have raised that question pretty continually during the whole process. Ethanol is a net user of power, or of energy to produce and the comments about that. But if you really factored into the cost of oil coming from the Middle East the cost of the defense of the Middle East and the military cost associated with that, you would see that maybe the cheap oil that existed in the Middle East wasn't so cheap, and if the true cost had been shown at the pump, one wonders how much faster we would have come to the first generation of alternative fuels.

So when we look at subsidies, what we really need to look at is what the true cost is of doing it, and then another cost is maybe harder to quantify. But the real cost associated with, and it is a fair cost that we want to pay to become energy independent so that we are not relying on others, on other parts of the world for our energy needs, which has affected us significantly.

The final thing is, last week, I toured Southwest Nebraska where now there are oil wells pumping and being drilled. I know it is happening in North Dakota. They are pumping there. What has happened is the high cost of oil has now driven it back to domestic production, which we had domestic production but it cost too much to bring it out of the ground here when you could get it over there. Well, over there, we weren't factoring in the true costs.

But I think we are all today frustrated economists to one degree or another without the advantage of the skills or the education, but we are all trying to do that. But I think people are adding two and two and getting four and asking the question of why wouldn't we keep our money here at home?

We have to compliment T. Boone Pickens for raising the awareness of people today just about windpower, to name one source of alternative fuels and renewable fuels. But I think the American people are wiser today, better consumers, and we have the opportunity to do things here at home and I think most people will bear with us as we really see this paradigm shift so that we are much more energy efficient, but energy producing here at home.

Chairman HARKIN. Thank you very much, Senator Nelson.

Do any of you have any last things you would like to add that haven't been brought up or that we need to know about, or what you think we ought to be doing? It is open to anybody at all, if there are any last things.

[No response.]

Chairman HARKIN. Going, going—well, thank you all very, very much for being here. I thought it was a very good interchange and good testimony. We appreciate it very, very much.

Now we will move to our second panel. We will take a short break first. Since it is a quarter to 11, we will get back in 10 minutes.

[Recess.]

Chairman HARKIN. We will now move to our second panel. I just wanted to take this time to also mention a couple of people who are here with us today. Leland Strom, who is Chair of the Farm Credit Administration is here, Leland, right here, and also Nancy Pellet, a member and former Chair of the Farm Credit Administration is here, also.

Now, with our second panel, we wanted to look upon sort of where are we headed. The last panel is where we are, what is happening out there, what are the dynamics. I certainly got ahead of myself a little bit at the end about talking about cellulose ethanol, but this panel is focused on where are we headed.

And so again, the same rules apply. Each of your statements will be made a part of the record in their entirety. I ask that you keep to five or 6 minutes and we will just go from my left to right.

So our first witness is Mr. Dean Oestreich. He is the Chairman of Pioneer Hi-Bred and Vice President of DuPont Agriculture and Nutrition located in Johnston, Iowa. Mr. Oestreich has been with Pioneer since 1974, starting as a corn breeder, for years working global operations before becoming President of Pioneer and now also its Chairman.

Mr. Oestreich, thank you very much. It is an honor to have you here, and please proceed.

STATEMENT OF DEAN OESTREICH, CHAIRMAN, PIONEER HI-BRED, AND VICE PRESIDENT, DUPONT AGRICULTURE AND NUTRITION, JOHNSTON, IOWA

Mr. OESTREICH. Thank you, Chairman Harkin, Senator Nelson. Thank you very much for allowing me the opportunity to comment on this important topic today.

Pioneer and our parent company DuPont are fully engaged in working to help society meet the needs for food, feed, fiber, and fuel from agricultural products. We are doing this through applying science to come up with solutions, science-based solutions for society moving forward. We also recognize that policy plays an important role in the agricultural productivity equation and I look forward to working with you as you work to craft new policies to help improve U.S. agriculture as well as the global condition.

My message today is a very simple one. We have a fundamental belief that agricultural productivity can meet the needs for food, feed, fiber, and fuels from agricultural products for the global needs. Through the 20th century, the U.S. farmers have a great tradition of improving productivity by driving more yield per acre.

We are delivering improved seed products. We are getting better agronomic knowledge out there. We are hardening these crops against pests, diseases, and drought events in the marketplace today.

Since I began my career at Pioneer, we have doubled U.S. corn yields on a per acre basis. That is a very important number to think about, and we need to look at how we can do that again. It has been my opinion that the biggest problem for production agriculture in the U.S. has been over-capacity, capacity to produce more on a global basis than the world needs. I believe society and economics today are challenging agriculture to produce whatever we can responsibly.

So at Pioneer, we have committed throughout the next 10 years, to add corn and soybean yields on average through the use of products by 40 percent. We believe that through the materials in our research pipeline, which we have a very good view of for the next 10 years, we can add corn yields in the U.S. by 40 percent and soybean yields U.S. by 40 percent. Two-thousand-and-eight is the beginning year, so almost 9 years from now, we need to be able to take that forward.

So if you look at a baseline corn yield of about 160 bushels per acre in the United States today, 40 percent would take us to about 225 bushels per acre. We are doing this through research and science, through improving the native germplasm, through molecular breeding, through bringing in specific genes into the corn and soybean genome to help us bring unique traits to those. We will also be improving our inputs so we will be able to grow more corn, more soybeans with less water, and another very important target is nitrogen utilization, as well.

We believe that investments in research, both public and private, strong intellectual property protection to promote agriculture innovations, and an economic climate that allows our farmers to invest, as we talked about this morning earlier, will drive these results.

Unfortunately, much of the rest of the world is working at an agricultural productivity much below the United States, in some cases only about 20 percent of the productivity on a per acre per hectare basis as we see in the U.S. That does mean, however, that there is great potential for global expansion in agricultural productivity. There certainly are barriers that we need to overcome to move forward around the globe, such as access to credit, improved access to agronomic knowledge and information, as well as secure land tenure. It will take private investment, public research and public policy to make strides in these areas and we believe that the U.S. can help in a number of ways to be able to take steps in that direction on a global basis.

So talking about crop productivity was my first statement. The next statement is around fuel, or biofuel productivity, as well. We at Pioneer are very focused on the input side of biofuels in agriculture through seed and crop protection chemicals, and our parent company, DuPont, is working on the next generation of biobutanol and also cellulosic conversion methods. So let me just go through the productivity elements that we are talking about in the biofuel arena.

First, we have identified 7 percent variability in the corn hybrids we are working with in the amount of ethanol per bushel that they produce. So we are working on the top end of that range, in that 7 percent of variability in ethanol per bushel. We have developed the first assay for grain buyers to measure the amount of ethanol directly in a bushel of grain. We have developed hybrids with increased fermentable starch and improved feeding value of those coproducts and we are continuing our research in those areas. And we are also developing oil seed crops with higher levels of oil and modified protein characteristics for improved food, feed, and fuel.

So further down the value chain, then, we are working to develop cellulosic conversion, to develop the bugs, the microbes that do that conversion efficiently, and we are working on the genetics of those bugs to be able to make that work much more efficiently than we have been able to do in the past.

And then finally, on the next generation front, we are working on biobutanol, a next generation biofuel, also an alcohol made in a fermentation process, but it has a different set of characteristics that we believe will make it a very strong companion with ethanol. Those characteristics include being able to—it does not absorb water like ethanol does, so we can use existing pipelines. We can make a stronger blend ratio in terms of existing vehicles that are out there today. We have experimented and had good results up to 16 percent blends. It has about the same oxygen concentration as the 10 percent blends with ethanol. So we believe that this is very fundamentally a good companion product to ethanol and are working toward commercialization of biobutanol.

So farmers have a long history of productivity and we believe that through the research and the science that we are delivering and the economic situation that allows them to invest in the production, as we talked about in the first measure, will help us accelerate. That 40 percent improvement in yields I talked about is more than twice our historic rate of genetic gain per year, so it is about twice———

Chairman HARKIN. Forty percent?

Mr. OESTREICH. The 40 percent improvement in corn and soybean yields in the next 10 years is a little more than twice our historic rate of improvement, if we look at the time period as we have talked about earlier. And the reason that we believe that we can double our rate of productivity improvement is the science and also the economic stimulus that comes with global demand increasing that says that we can use agriculture to meet needs of society beyond those that we have in the past—food, feed, fiber, fuels, and biomaterials for new products.

So thank you for the opportunity for allowing me to comment on this morning and I look forward to working with you in any way that we can at DuPont to help this process.

[The prepared statement of Mr. Oestreich can be found on page 95 in the appendix.]

Chairman HARKIN. Thank you very much, Mr. Oestreich. Thank you. That is probably the most hopeful thing I have heard in a long time.

Now we turn to Dr. Thomas Foust, an internationally recognized expert in biofuels, Research Director of the Biofuels Research Pro-

gram at the National Renewable Energy Laboratory in Golden, Colorado. Dr. Foust guides and directs NREL's biomass conversion technology as well as research areas addressing the sustainability of biofuels. Dr. Foust has over 20 years of research and management experience, including over 100 publications in bioenergy.

Dr. Foust, welcome and please proceed.

STATEMENT OF THOMAS FOUST, BIOFUELS TECHNOLOGY MANAGER, NATIONAL RENEWABLE ENERGY LABORATORY, GOLDEN, COLORADO

Mr. FOUST. Thank you, Chairman Harkin and Senator Nelson. Thank you for this opportunity to address this important issue. Like you just mentioned, I am the Biofuels Research Director at the National Renewable Energy Laboratory, which is the Department of Energy's primary laboratory for researching in these issues.

I would just like to build upon what was discussed in the first panel. Although there is considerable debate on the impact that first generation biofuels are having on food and feed prices, the overwhelming consensus is that advanced biofuels, or cellulosic biofuels, will greatly lessen any impact on food and feed prices. By using non-food resources, advanced biofuels avoid any direct competition and provide us a good pathway to meet the aggressive RFS goals outlined in the Energy Independence and Security Act of what was mentioned, the 36 billion gallons.

With that said, let me address the potential of advanced biofuels. First, let us start with ethanol. As is well known, currently production of ethanol in the U.S. is almost exclusively from corn and predominately from the issues addressed in the first panel. Although the potential of corn-based ethanol is very good, ultimately, it is limited for these aggressive RFS goals unless we move to advanced biofuels.

Cellulosic ethanol is really the path over corn food-based ethanol by utilizing feedstocks which are abundant and do not directly compete with food and feed needs. Fortunately, there has been a very robust program in cellulosic ethanol in this country that myself and many of my colleagues have been involved in and the progress has been good. To put that in perspective, the Department of Energy performs a rigorous state of technology assessment every year to estimate current production costs based on performance of laboratory technology. The 2007 results, the most recent results, estimate a production cost in the $2.20 to $2.50 per gallon range. So this compares very favorably with current corn ethanol and gasoline at crude oil and corn prices.

But I think it is important to be known that this is still a pre-commercial state. It is not a mature state of technology, so more can be done to secure the long-term competitiveness of cellulosic ethanol and make sure this industry prospers, and this is the goal of DOE and NREL to achieve this by 2012.

Like previous panelists mentioned, the volume production of cellulosic ethanol is very large, well over 50 percent of current gasoline usage and as high as what the previous panel mentioned as 90 percent. So therefore, cellulosic ethanol should really remain the cornerstone of immediate U.S. biofuels, advanced biofuels develop-

ment. With the continued focus on cellulosic ethanol and continued good progress in R&D, our nation should soon realize the benefits of advanced biofuels technology.

However, as promising as cellulosic ethanol may be for addressing our nation's transportation needs, it does have some limitations. Commonly cited is reduced energy content. It does absorb water, current pipeline issues. And very importantly, ethanol is only suitable as a gasoline replacement. It really does not address diesel and jet fuels.

So I think our current advanced biofuels needs to expand beyond ethanol and specific recommendations that I would have is, like my previous panelist discussed, butanol, a member of the alcohol family, actually higher in energy content and less a tendency to absorb water, making it more compatible with the fuel infrastructure. It is a good way to go. It is a similar fermentation process to ethanol. It does have challenges. It is not as far along as ethanol. But because of the long-term potential, it should be pursued.

The other area I would like to mention is thermochemical conversion. Although the current cellulosic ethanol program does have a major thermochemical component of it, these technologies show promise well beyond ethanol. You know, to put this in kind of an analogy, if biochemical conversion is the elegant method of producing alcohols from certain feedstocks, thermochemical conversion is kind of the Swiss army knife method of attacking a wide range of feedstocks and producing a broader spectrum of fuels. Some of these can produce fuel similar to gasoline and diesel, current gasoline and diesel, so they are means to lowering the barriers to commercialization.

Finally, let me address aquatic species, or micro-algae, getting a lot of press. These technologies do provide a pathway to producing remarkable levels of lipids, ten to 100 times to 1,000 times current yields per acre of, say, for soybeans, for instance, and they do so without impacting the food, feed, and chemical infrastructure of the nation. Therefore, they could really eliminate—potentially eliminate all food, feed, fuel discussions.

And additionally, bilipids, by their inherent nature, which are the oils expressed by these algae, lend themselves to higher energy density fuels, such as diesel and jet, so they can really expand our spectrum to all fuels.

Finally, I would like to conclude, but probably most importantly with the issue of sustainability of advanced biofuels. I think it is known advanced biofuels have clear environmental benefits compared to first generation and conventional petroleum fuels, such as better energy balance or significantly reduced greenhouse gas emissions. Although those benefits are significant, I think we really need to study sustainability in a comprehensive cradle-to-grave research perspective. More understanding is needed about the overall life cycle impacts of these fuels in the overall context of land, water, and air.

One sustainability issue particularly relevant to this hearing is land use competition. It has really been getting a lot of press recently, both direct and indirect land use competition, and the role that advanced biofuels will play. The degree to which a relationship exists between land use change and large-scale biofuels really at

the RFS goals we are talking about, 30 to 60 billion, needs to be—it is beginning to be addressed, but more needs to be done.

In general, I think it is fair to say that land use changes for second generation biofuels will be less extensive than first generation biofuels, but it really needs to be understood in the context of the continental United States as well as global impacts such as Amazon rain forest.

So let me summarize by saying advanced biofuels are a step in the right direction to addressing tomorrow's food, feed, and fuel potential. The current successful effort on cellulosic ethanol needs to remain on track. However, we really do need to expand that and look at these other fuel options, diesel and jet. And then we also need to understand the policy options and really understand this whole food versus fuel controversy as we move into advanced biofuels. Thank you.

[The prepared statement of Mr. Foust can be found on page 64 in the appendix.]

Chairman HARKIN. Thank you, Dr. Foust.

I want to ask you about butanol in a second, but let us move on here to Dr. Bruce Dale, Distinguished Professor of Chemical Engineering, former Chair of the Department of Chemical Engineering at Michigan State University. He has won numerous awards in this field. Dr. Dale is interested in the environmentally sustainable conversion of plant matter to industrial products while still meeting human and animal needs for food and feed.

Dr. Dale, again, welcome to the committee, and again thank you, and please proceed.

STATEMENT OF BRUCE DALE, ASSOCIATE DIRECTOR, OFFICE OF BIOBASED TECHNOLOGIES, AND DISTINGUISHED UNIVERSITY PROFESSOR, DEPARTMENT OF CHEMICAL ENGINEERING AND MATERIALS SCIENCE, MICHIGAN STATE UNIVERSITY, EAST LANSING, MICHIGAN

Mr. DALE. Senator Harkin and Senator Nelson, thank you for the invitation to be here. I appreciate the opportunity to testify. I have been involved in cellulosic ethanol research for 32 years. My laboratory develops technologies to make low-cost biofuels from our abundant reserves of cellulosic plant materials.

For the last 8 years, I have been involved in life cycle analysis and applying life cycle analysis to biofuel production. Life cycle analysis deals with the systemwide environmental impacts of specific products or processes. It is from this background of laboratory research and life cycle analysis that I am going to speak to you this morning. My opinions are my own and don't reflect any positions on behalf of Michigan State University, I was admonished strongly to tell you.

I am going to make and then briefly elaborate on three key points. These are as follows: We can, indeed, produce many tens of billions of gallons of ethanol and other biofuels from cellulosic materials. These biofuels are going to end up being a lot 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 enhance our national security by

ending the strategic role of oil and the power of those who control oil.

No. 2, there was a recent high-profile scientific paper that linked corn ethanol to large greenhouse gas emissions due to so-called, quote, "indirect land use changes," unquote. The paper caused quite a furor. The data and assumptions, however, in that paper are not holding up very well to closer scrutiny. I believe the paper's conclusions do not currently meet standards of either scientific significance or of life cycle analysis and should not be used to shape public policy.

I believe the investments underway will allow us to cost effectively convert cellulosic biomass to fuels. A similar investment both in size and scope must be made soon in a related crucial area. We need to develop a planting, harvesting, transportation, storage, and other infrastructure that will allow us to sustainably produce and deliver hundreds of millions of tons per year of biomass to the biorefineries.

We can grow and deliver 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 a barrel. If we can efficiently convert, therefore, the energy content of cellulosic biomass, we can compete well with high-priced oil, very well.

There is at least $5 billion in public and private funds now being devoted to this task, the biofuel conversion task. I believe we will succeed much more quickly than most people realize. But we have got to 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 have proved futile, ultimately futile.

Sustainability is typically described as a three-legged stool consisting of economic, social, and environmental sustainability. All three legs are important. But I submit also that the government of a free people has a fourth crucial leg to that sustainability stool. We may call it the national security sustainability leg. Therefore, the Energy Independence and Security Act of 2007 is rightly named. First and foremost, that Act is and ought to be about providing for the common defense and promoting the general welfare by ending our near total dependence on petroleum for transportation fuels. We have got to get off petroleum. We have got to do it.

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 need to ensure that the cellulosic biofuels deliver on those promised benefits.

The key is to consider the whole system and then act to improve the system's performance. I support the recommendations of the Ecological Society of America, which are attached to my testimony, to enhance the sustainability of cellulosic biofuels. Those recommendations also focus on systemwide performance. We have got to stop thinking about pieces of the puzzle and think about the whole system.

However, inadequate and incomplete environmental analysis must not be allowed to sidetrack us. Environmental sustainability is one, but only one, leg of 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 actual data connecting U.S. ethanol production with land use change anywhere in the world. All of the conclusions of that paper are based on economic modeling. The modeling itself relies on assumptions and data that are now being debated by the scientific community. I am very involved in that 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, since they are all telling us different things, very different things.

The language in the Energy Act of 2007 required that life cycle greenhouse gas emissions be determined for significant indirect land use change. Proper life cycle analysis followed standards set out by the International Standards Organization, or ISO. The paper in Science simply does not meet those standards. It is completely inadequate in terms of allocation, system boundaries, and sensitivity analysis among other technical life cycle issues. Therefore, 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 life cycle 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? That is exactly 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 by not allowing ourselves to be diverted from our goal of ending the strategic role of oil in the world. All biofuels, not just corn ethanol, have been set back by that single paper that does not meet standards either of scientific significance or of life cycle analysis.

Third, I want to talk briefly about logistical issues. The cellulosic biofuels industry will consist of two parts, one, growing and transporting the biomass to the bio-refinery, and two, processing the crop to biofuels. While more can and should be done, I think we are largely addressing the biomass 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 bio-refineries but without the means to supply the bio-refineries with the raw materials they require. We need integrated systemwide research and development on how to grow, harvest, store, and transport cellulosic biomass to the bio-refinery. The research should include studies to improve the environmental sus-

tainability 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 bio-refinery 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 co-ops, 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 general rural employment.

I believe the Senate Agriculture Committee should take a leading role to ensure that we develop the logistics for the cellulosic biofuels industry while improving the environmental and the social sustainability of all biofuels. This effort deserves a funding level comparable to the billions now being devoted to bio-refinery development. It is just as important, if not more important.

Finally, Senator Harkin, I understand that you will soon introduce legislation requiring all new cars sold in the U.S. to be flex fuel. I enthusiastically support such legislation. I also encourage you and the other committee members to cosponsor and then pass S. 3303, 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.

Thanks. I look forward to discussion, Senator.

[The prepared statement of Mr. Dale can be found on page 55 in the appendix.]

Chairman HARKIN. Thank you.

Our final panelist today is Dr. Stephen DiMagno, and he is Professor of Chemistry at the University of Nebraska at Lincoln. His research interests include chemical catalysis, energy storage, and the use of bio-derived materials for fine chemical synthesis. I know he is going to explain to us what all that means. Thank you.

STATEMENT OF STEPHEN DIMAGNO, PROFESSOR, UNIVERSITY OF NEBRASKA-LINCOLN, LINCOLN, NEBRASKA

Mr. DIMAGNO. Mr. Chairman, Senator Nelson, thank you very much. I appreciate the opportunity to speak on behalf of the University of Nebraska about opportunities for energy research in general and in particular about those opportunities that have the

greatest potential impact for the Midwest and the State of Nebraska, namely biofuels and windpower as it relates to the production of liquid fuels.

Excepting nuclear and tidal power, all energy used on the planet is energy of captured sunlight. Fossil fuels that we use today are the result of sunlight captured and stored as chemical energy by photosynthesis and carbon dioxide fixation reactions carried out over the course of millions of years. We use these fossil fuels in huge quantities, largely because historically, they have proven to be the least expensive means to generate energy in large scale, though the———

Chairman HARKIN. Pull the microphone a little closer to you. Just pull it closer.

Mr. DIMAGNO [continuing]. In large scale—excuse me—though the increased economic, political, and environmental costs of fossil fuel combustion are now matters of serious concern. Though it took nature millions of years to capture sunlight and accumulate the fossil fuel resources we burn today, the amount of energy actually contained in the sunlight hitting the earth's surface is immense. One hour of sunlight is equivalent to the amount of energy used on the planet in 1 year.

The good news is that the energy to solve our problems is in our backyard. If efficient or even relatively inefficient methods are found to capture, store, and transport a small amount of the sun's energy in biofuels, great progress will be made toward a sustainable energy future.

The vast majority of petroleum is consumed as liquid transportation fuel. Thus, the challenge to replace imported petroleum lies in developing viable biofuels. Biofuels that are of importance to Nebraska include green ethanol, cellulosic ethanol, and biodiesel.

Green ethanol production is already a relatively mature large-scale industry for the Midwest. Nevertheless, there are many opportunities in research to improve the efficiency of green ethanol production. Improved efficiencies in the transport and use of raw materials and fermentation co-products, integration of ethanol production into cattle feeding operations, methods to increase distillation efficiency in ethanol separation, and the use of clean ethanol and/or clean carbon dioxide produced as precursors for value-added products are all areas of active research at the University of Nebraska.

In order to meet future mandates for fuel ethanol, the conversion of cellulose biomass to ethanol will be required. Research on several important problems will be essential if cellulosic ethanol is to become a viable biofuel option. These include efficient raw materials, harvesting and transport, engineering of crops to make the cellulose easier to degrade and process, biomass pretreatment and cellulose extraction, and improved production and performance of organisms and glycosidase enzymes that convert cellulose to simple sugars for fermentation. If these issues are addressed satisfactorily, Nebraska will be able to use its existing ethanol infrastructure for the fermentation and distillation of fuel-grade ethanol from biomass.

Research is also needed to boost the production of biodiesel, a biofuel derived from transesterified plant oils or animal fats. The

production of biodiesel from ethanol and vegetable oil is a relatively straightforward process, though there is still room for improvement for water tolerant transesterification catalysts.

The largest concern in the biodiesel area is the availability of sufficient quantities of inexpensive vegetable oil. Soybean production is on the order of 50 gallons per acre of oil, while approximately 20 gallons of oil are obtained per acre of corn. Further efficiencies in plant oil production are necessary if biodiesel is to be competitive and a high-volume source of transportation fuel.

Algae are a potentially large-scale source of inexpensive plant oils, as we heard earlier. Algae are perhaps the most effective photosynthetic organisms for generating biomass from sunlight. Along with affiliates at several premier institutions across the United States, the Algal Biofuels Consortium based at the University of Nebraska is developing the biology, genetic and metabolic engineering and processing of algae for advanced biofuels. Despite the great promise of algae, naturally occurring species do not appear to have all the characteristics necessary for algae to be fully economical and a viable biofuel source. For algae to achieve full potential, the ability to genetically and metabolically modify the organisms will be critical.

The direct conversion of wind power into electricity is a relatively inexpensive, reasonably efficient means to capture renewable energy, as is evident by the large increase in wind turbine construction throughout the Midwest. Where a transmission infrastructure is in place, as it is in the Ainsworth Corridor, for example, a direct feed of electrical energy into the power grid is the most efficient means to capture wind energy. However, if power is generated in a widely distributed fashion on farms and rural communities, storage of captured wind power is desirable. Direct conversion of electricity to hydrogen or liquid fuels for energy storage is essential in these settings.

In conclusion, there are many areas of energy sciences which are ripe for research and in which the University of Nebraska has an ongoing research program. I have outlined a few of these programs here today and there are others I did not have time to mention. There is still much work to be done, but the good news is that though the scale of the energy problem facing us is large, there is a truly vast amount of energy available for our use if we can find the means to use it efficiently.

Thank you very much for the invitation to appear and I would be happy to answer any questions.

[The prepared statement of Mr. DiMagno can be found on page 61 in the appendix.]

Chairman HARKIN. Thank you very much, Dr. DiMagno. Thank you all.

Again, this is looking ahead. Mr. Oestreich, I will just start with you. The 40 percent increase that you mentioned in the next 10 years in corn yields, soybean yields, how much confidence can we have in that?

Mr. OESTREICH. Again, I will go back to that. Sometimes in the corporate world, we have these lofty goals to reach out to some aspirational place. This 40 percent improvement goal in the next 10 years is not an aspirational goal but it is rather one that is added

up by looking at our pipeline that is in the research today. So it is trait by trait, material by material. The progress that we have been making today in our research is faster than we have ever seen it before. The science is incredible. The tools of biotechnology are helping us accelerate our research and do a lot more precise work on these plants. It has helped us develop a deeper knowledge of how plants work and how to improve them.

You know, a lot of society understands biotechnologies as GMOs. That is one element, and it is an important element going forward and we will see more traits and more transgenes in the future at an accelerated rate than ever before. But the additional element of biotechnology that is helping us equally is the fact that the knowledge of the plants, the understanding, the tools of biotechnology are helping us in some cases to drive parts of our research 1,000 times faster than we have been able to do it before.

So I started my career as a corn breeder and I have done this sort of work for about 12 years in my career. The tools that our corn breeders and our soybean breeders and our biotechnologists are working with today are just incredible and those are the things that are driving that accelerated productivity growth rate that I am talking about. So it is a plan and not just an aspiration.

Chairman HARKIN. Well, that raises the confidence level quite a bit.

Second, you are talking about productivity of corn and soybeans. I am also told that a lot of research is being done, and I assume by you, by DuPont, others, in as the corn yield goes up from the ear of corn itself, that research is being done into how you increase also the cellulosic content of the stalk itself. Could you address yourself to that?

Mr. OESTREICH. We are doing work to characterize our stalks and the materials that are left after the grain harvest. I will tell you that our long-term experience in working with silage for animal feeding is helpful around thinking about the cellulosic work.

The other thing that I think is changing over time and decades is that plant populations are increasing. We see plant populations increasing, so more plants per acre, meaning more biological material on the ground. We see that increasing at about 1 percent annual gains for the last 35 years. So when I started my career, an average corn population in Iowa or Nebraska would have been about 22,000 plants per acre.

Chairman HARKIN. How much?

Mr. OESTREICH. About 22,000 plants per acre.

Chairman HARKIN. Yes.

Mr. OESTREICH. Today, it would be more like 32,000 plants per acre. So we have more density of those materials out there and we are looking at how we might improve the efficiency of that byproduct use of the stubble and the cornstalks and the corn cobs, as we talked about today.

But I will also tell you that for plant breeders, No. 1 has to be yield of grain. No. 1 also has to be strong agronomics, disease resistance, growth under different environments, things like drought tolerance, nitrogen utilization. And another characteristic that we are working on is the amount of cellulosic ethanol or biobutanol in a corn stalk or a corn cob.

Chairman HARKIN. Well, I guess closely related to that is if we are going to increase this productivity, how much of it depends on greater utilization of resources—water, fertilizer, chemicals? Can we achieve this increased productivity without compromising our soil and water and other resources?

Mr. OESTREICH. I will give you an example. On our nitrogen utilization project, our goal of that project, which we believe will start to commercialize by mid-next decade, will be to allow a farmer to grow the same yields as today under 20 percent less nitrogen, or 20 percent higher yields under the current utilization of nitrogen. So improved nitrogen efficiency for a bushel of grain produced.

Drought tolerance, of course, the same targets, right? We need to be able to protect those plants better under those drought events and therefore use less water, or in some cases if you are working in an irrigated environment—I was talking to some farmers in Southwestern Kansas last week. It is very much on their minds. They have limited irrigation capability. They want hybrids that can yield equal to today or more than today with less water, and we believe we will be able to do that.

Chairman HARKIN. Dr. Foust, do you expect thermo-chemical biofuels to achieve the same cost goals as DOE projects for cellulosic ethanol?

Mr. FOUST. That is a good question. We set the target—to answer your question, yes, because we set the target, the 2012 target, based on a market target which is $1.33 a gallon, which is benchmarked at the sixty-five a barrel crude, gasoline from sixty-five dollars, so that is our R&D target.

But to answer your question kind of more elaborately, right now, based on our state of technologies, thermochemical is actually the lower-cost option. I think that is why you see———

Chairman HARKIN. Thermochemical is lower now?

Mr. FOUST. Yes, thermochemical compared to biochemical fermentation of ethanol, more of your traditional enzymatic hydrolysis fermentation. And I think the reason that is, is because of a more mature state of technology. Gasification has been around. It is just essentially a form of combustion. It has been around for 50 years And then syngas synthesis to fuels, again is a technology that has been around since World War II. The challenge is taking biomass gasification and then sinking that up with fuel synthesis.

But if you actually look at the commercial plants that are being deployed—I reflect that in my written testimony—over half of those are actually thermochemical. So right now, if you were to go out and build a plant today, with today's technology, it is actually the lower-cost option. But we do believe that the potential for biochem in the long term, since it is more efficient, to be better.

Chairman HARKIN. Senator Nelson?

Senator NELSON. This goes to anyone who would like to respond to it. Do you have any idea how long, and the ballpark would work, that it will take for the research and development necessary to provide a commercially viable product for the second generation for cellulosic material, whether it is corn chips, the other corn products, or some other cellulosic material? Do we have any idea about what we are looking at? I think some of it may be faster than other

parts of it, but I would kind of like to get an idea of what we are facing.

Mr. DALE. Yes, I would like to address that, if I may. I believe we will have our first billion gallons a year of ethanol capacity from cellulosic materials within about 5 years, and I think at about that time, the technology will be sufficiently understood, sufficiently mature, the risk taken out of it far enough that it will become very attractive for Wall Street investment, and at that point, you will see the lid blow off, and it will be a matter of how fast can we build the plants and how fast can we supply them with the raw material, which is why I am really concerned that our logistics, our infrastructure be ready at that time. But that is how I see it———

Senator NELSON. So the infrastructure side of it might slow us down, not the research and development or the scientific processes for conversion, is that fair?

Mr. DALE. The characteristic of large-scale processing industries is that 30 percent of the overall cost to make something is the processing cost. Seventy percent is the raw material cost. That is where we are with oil right now. Right now, that ratio is pretty much reversed for cellulosic biofuel, so our effort is to drive down the processing cost. As I said, we are investing at least $5 billion to do that. I think we are going to succeed more quickly than people realize.

And so within a fairly short period of time, five, no more than 10 years, I think we will have the cost of processing largely reduced. We will have good processes that are ready for investment, large-scale investment. And then we will have to make sure that we can get hundreds of millions of tons of plant material to these facilities.

Senator NELSON. Well, might it be safe to say that the conversion capability for switchgrass can be developed faster than we can get the production of switchgrass out into the fields, suitable fields across the Midwest, for example? Is that part of the problem?

Mr. DALE. I think that is true. Who is going to pay the farmer to grow it? He is not going to plant it until you have got a market. Who is going to process it? How is it going to be assembled? All those logistical issues are really important.

Also, I would just like to—sorry if I am beating something over and over again, but I don't think—unless our rural communities are able to add some value to the cellulosic material before it leaves their area, I don't think they will do very well economically. They will just be suppliers of low-cost commodity, grass or hay or whatever. We need to find ways to add value locally, perhaps by some sort of a distributed processing, so that the plant material, some of the value added can be captured locally. Otherwise, I don't think our rural communities will prosper like they could have unless we are ready to do that.

Senator NELSON. Well, we are faced with the chicken or the egg and we need the chicken and the egg at the same time, pretty hard to do in this business, though, isn't it?

Mr. DALE. You have got to do both. You have to have the chicken and the egg———

Senator NELSON. Yes, that is what we have to do. Is there any estimate as to what might be the finite limit of cellulosic material for the production of ethanol or butanol?

Mr. DALE. Do you want to try, Tom? I have been talking a while.

Senator NELSON. In other words, I mean, there are all kinds of different types of cellulosic material being talked about, but is there some limit to what we can produce in the way of the final product as an additive or as a regular fuel?

Mr. OESTREICH. I think we heard earlier in the first panel that there is a blenders limit that we talked about with the current infrastructure today of the vehicles on the road.

The plant materials that are available on a global basis are very large. We talked earlier about, from POET, I think, five billion gallons from corn cobs alone. I believe we can use about half of the corn stalks, as well as the cobs. The forestry products that are out there, the waste that comes from paper milling and others and some of the landfill materials, there are huge amounts of biomaterials that are available with efficient systems that we need to continue to increase investment in cellulosic research, both public and private, to move forward to accelerate.

We will, I agree, fully reach the targets that were laid out just a minute ago, but there will be productivity gains needed in logistics, in processing, in the microbes that go into the system. You think about ethanol, improvements that have been made in the last two or 3 years through corn yields, through improvement in processing, through less water utilization. This is an industry that is 30 years old. So productivity is an invested tool that we need over time and that will occur with cellulose, as well.

Senator NELSON. Any other thoughts?

Mr. FOUST. I would just echo what was said to that regard. You know, the one limitation that we do see is a logistics limitation. I think by the feedstock surveys that have been done, there is a potential, as referred to in the earlier panel, of producing well over a billion tons. It was actually 1.3 billion tons. And then if you just do a thumb-roll conversion, that comes up to 80, 90 billion gallons of ethanol by mid-next century. So there is almost an unlimited potential there. However, it is vehicle use, it is distribution. We heard about the blend wall. Clearly, a 10–percent market stops at 14 billion. I think, like Dr. Dale said, flex fuel vehicles will help. It is moving into the alternative biofuels so we can look at other transportation options will greatly help the situation.

But I think right now, if we keep on going the way we are, we are going to be in a stairstep fashion. We produce the biofuels until there is a glut. Prices fall off. Growth slows. Legislation, policy, incentivizing in other places in the market, and so we have this kind of continuous growth. The more futuristic that we look at the whole path forward and try to eliminate the downtimes in the market would be better for the long-term accelerated growth of biofuels.

Mr. DALE. I guess I would like to add a little bit more, if I may. I believe that there is no effective upper limit to the amount of cellulosic biofuels we can make. We have the land. We have the crop production technology. We can do this. It is at least 100 billion gallons a year and upwards of there.

It is more a matter—for one problem—this has been mentioned earlier—the agricultural problem has not been lack of ability to produce. It has been over-production. We finally now have a demand because of rising oil prices. We finally have a demand for the output of agriculture that is equal to our appetite for something. We have finite, limited stomachs. But how much we would like to travel, and I think it is an opportunity for a new era of prosperity for agriculture because we will be able to produce, particularly cellulosic materials, that are sustainable, that we can grow here in our own country and convert here, end the rule of oil in the world, and provide essentially all the transportation fuels we need.

Senator NELSON. You know, the interesting thing is there is a report that one of the oil producing countries in the world is fast experimenting on a fast track basis for alternative fuels in anticipation that someday their finite quantities of oil will be unavailable or that it will be more profitable for them to have their alternative fuels for their own use and sell the oil to the world market. So I think it is interesting that all of us are now focused on how we move away from a strictly oil-based economy.

Another matter of interest is an ethanol plant up in Dakota City is located close to a landfill and they pipe methanol from—natural methanol coming out of a landfill, which provides, I think, they said, about 15 to 20 percent of their energy for the production of ethanol.

So when we talk about the utilization of cellulosic material to produce, whether it is butanol or methanol or in this case for overall for ethanol, we are going to be limited by cost-effective methods of extracting it, and to the extent that we get economies of scale, better methods, more cost effectively accessing, we are really—our limit is finding a cost-effective way to do almost anything that we want to do in the world to begin with, but particularly in this area.

And there is some point where we will drive down the cost where the question is, will we still be able to have profitability. I would hope so. Is there a danger of losing profitability in this business?

Mr. FOUST. Oh, I mean, very much so, just for the reasons we echoed. You know, in any commodity industry, obviously profitability is based on the margins, and clearly we saw that last year with corn prices high and a bit of an over-saturation of the market.

The projections we have done at our laboratory do show that there will be, and I think you have seen it in the corn ethanol, phenomenal growth over the last couple years tapered off with growth now over the next couple years projections based on decreased profitability. Most likely we will see that in the cellulosic ethanol industry, too. I think that was—I don't know if it is completely possible to prevent that per se, but I think forward reaching policies and incentives, kind of like Dr. Dale was talking about, vehicles and making sure that there is a market and there is a growth and public perception issues about ethanol and all those issues, sustainability, all those really need to be addressed. None of them guarantee that you won't have the natural cycles of the market, but they can dampen them out.

Mr. DALE. I would also just say, as I said in my testimony, if the farmers of this country and the people in the forest business, if they are just supplying a commodity material, cellulosic biomass,

without adding any value to it, then they are going to be subject to this type of cycle. So we need to think ahead about the technologies and the policies and the business structures that would allow us, allow farming communities to add value to the biomass before it leaves their area so that more of that wealth stays there locally and they are more insulated from commodity cycles.

I believe as a chemical engineer, the whole history of developing things by chemical processing is once you have material together in one spot, you process it. You learn how to do more with it. And if we can add some value locally, we can start thinking about these regional biomass processing centers, as I call them, as a vehicle for local economic growth because you will continue to get more and more value, not just out of a bushel of corn, but now out of a barrel of biomass, you know, a ton of hay or grass. It is just the natural way things occur. But we need to set it up now. We need to think ahead and do this now.

It is said that at the beginning of the Oregon Trail back in St. Louis years ago, there was a little sign that said, "Choose your ruts carefully. You will be in them for the next 1,000 miles." OK. We are at the point now of choosing the kind of ruts we want to, quote-unquote, ruts we want our society to be in for the next 100 years.

I think if we are wise and think ahead about the kind of industry we want to base on cellulosic biomass or renewable plant material, we can really construct a future that looks quite a bit different and quite a bit better than what we have now. But we need to think about it and think it through. We can have it add value to local communities. We can have it be much more environmentally friendly. But we have got to think about that now and make sure it happens now, because otherwise we will set in place an industry that will be what it is. It won't necessarily have the properties that we want it to have.

Chairman HARKIN. Well, I see our time has about run out. I again want to thank all of you. I think what I have heard from this panel is that the future is very good. It looks very good for the production of liquid fuels for transportation that we can make from renewable resources grown in this country. That the increases in productivity that we are looking at, and the use of cellulosic materials that can grow in areas that we aren't cropping right now, including wood wastes and grasses, provide perhaps not unlimited potential, but the potential to replace most of our liquid fuels like gasoline with some form of ethanol or one of the other "nols", with butanol or something like that, or biodiesel.

Now, we haven't even talked about algae and the promise of algae-based lipids for diesel. I have heard numbers, for example, that when you are looking at corn ethanol, you are looking at around maybe 400 to 500 gallons per acre per year, somewhere in that range. If you are looking at switchgrass from acanthus, you are looking at anywhere from 700 to 1,500 gallons, depending upon yields and all that kind of thing. But I have heard figures, and not only heard figures, I have been told by some companies that are investing private resources into algae-based diesel production that they can get up to 15,000 gallons of diesel fuel per acre per year from algae, and all that algae takes is CO2 and sunlight.

So I don't know where we are on that, but I know there is a lot of research going on. So if you add that, and you add that to the cellulose, the grain-based alcohols that we can make in terms of liquid fuels, it looks like we have indeed a future in this country where, as Senator Nelson said, we can actually become fairly self-sufficient. I don't know if we can in our lifetimes, probably not in mine, that we can do away with all of the need for oil, but we can make oil more of a residual kind of commodity that we might need for certain applications, but that we can rely upon our renewable resources and fuels, to meet our fundamental needs in this country.

We haven't even talked about the other renewable energy resources, like wind and solar and all those other technologies that might focus more on the production of energy in the form of electricity rather than liquid fuels.

So I think that we are going through a time of change, let us face it, in agriculture, of big changes, and there are going to be some discontinuities. There are going to be some upsets. I keep hearkening back to when we went from horses to mechanization. I am sure that for all the harness makers and the saddle makers and the horseshoe makers and everybody else, this was very disruptive.

Or when we went from candles to electric lights. We didn't go to electric lights because we ran out of wax. We had new technologies, and we have new technologies at our fingertips now, the corn genome, for example, and all the things that we can do that we have never had the technological base to do in the past.

So I just think that we are going to have to get through this period as best we can, be sensitive to the kind of needs that are out there. We are all sensitive to food prices and fuel prices and what this means to family budgets. We are especially sensitive to this in our areas, Ben, because people here have to drive long distances. We don't have mass transit in our areas. Folks have got to go to school. School buses go long distances. People have to drive long distances just to get to their jobs. We are particularly sensitive to the impact on our consumers in this area.

So I hope with the proper Federal policies at our level, plus the proper input from the private sector, that the two can marry up and get us through this period of time without too many upsets. And I think once we start getting through this period and we see our way clear and we start producing more of these renewable fuels, then I think a lot of this uncertainty will settle down and we will then be on a nice pathway in our country to becoming more energy independent and still have the necessary food at a reasonable price for all of our consumers.

Senator NELSON. I remain confident that we can do it, if for no other reason, Senator Schmidt preceded me in working on was called gasohol at the time, and in 1991 when I became Governor, we had one ethanol plant producing ten million gallons. Governor Branstad and I joined forces with others and we continued to push for the development of ethanol, hanging onto favorable tax treatment against the odds, and we did it at the time when the price at the pump for gasoline was modest by comparison to today.

And if we could make the progress that we have made in the midst of that environment, economic environment, we ought to be able to accelerate the effort in this economic environment today

where the need is totally recognized. Back in the early 1990's, it was sort of a way to help agriculture and better for the air and we talked about less reliance on foreign sources of oil. The progress has been fairly significant, but modest by comparison to the progress we need to ultimately make. But I remain confident that we can do it as long as we remain sensitive to the unintended consequences as well as the intended consequences and push in all the directions that we have got available to us.

So thank you, Mr. Chairman. It was great to have you here.

Chairman HARKIN. Well, thank you, Senator Nelson, for having us at the University of Nebraska at Omaha. Thank you to all of our panelists. Thank you to all of our people who have come here.

The committee will stand adjourned subject to a call of the Chair. Thank you all.

[Whereupon, at 12 p.m., the committee was adjourned.]

APPENDIX

August 18, 2008

Senator Ben Nelson
August 18, 2008
Opening Statement
Senate Agriculture Committee Hearing
Omaha, NE

I'll admit corn-based ethanol's not perfect, but it's been blamed for practically every problem under the sun. What's next? Summer colds? Computer viruses? Bad hair days?

The focus here should be on the big picture: ethanol is the only domestically-produced alternative to oil-based transportation fuels. It is helping us in a big way to stretch the gasoline supply, save American consumers money at the pump, create jobs in rural communities, improve our rural and national economy—and to top it off—help wean us off imported oil.

Ethanol is a major contributor to the U.S. gasoline supply. One study says it's the third largest, behind only Canada and Saudi Arabia, and ahead of Iraq and other OPEC countries. Today's corn-based ethanol is paving the way for the next generation of biofuels produced from such materials as switchgrass and stover.

To ethanol's critics I ask, "Why farm out our energy needs to foreign suppliers when we're producing so much clean-burning renewable fuel on our own farms?"

We want to see all of agriculture survive and prosper, including grain farmers, livestock producers, ethanol producers and food processors, while benefiting the average American family, our local communities, our national energy security and the national economy. This is money wisely invested in the American Midwest and not in the Middle East.

I'm looking forward to hearing our witnesses today provide the facts as we explore the relationships between food, fuel and feed. I'm especially pleased Chairman Harkin agreed to hold this important hearing in the heartland of America, and I'm grateful we're meeting on this side of the Missouri River.

STATEMENT BEFORE THE UNITED STATES SENATE COMMITTEE ON AGRICULTURE, NUTRITION AND FORESTRY
August 18, 2008

Bruce A. Babcock
Center for Agricultural and Rural Development
Iowa State University

Thank you Mr. Chairman for the opportunity to testify today about the how the economics of agriculture has recently changed.

From 1950 to until just recently, demand growth in agricultural commodities did not keep up with the ability of farmers to produce. The result was a long-term decline in inflation-adjusted food and commodity prices. Together with growing incomes around the world, this decline in real prices meant that most of the world's poor were able to afford adequate calories while simultaneously beginning the move away from staple foods into a more varied diet. This increasing ability to feed a rapidly expanding population is one of the major success stories for the world in the second half of the 20th century.

The steady fall in real food prices combined with rising incomes has meant a steady increase in the demand for grains and oilseeds. This inexorable demand growth combined with a slowdown in investment in agricultural productivity probably foretold a future in which supply would have more trouble keeping up with demand and a possible reversal of the long-term decline in real food prices. We will never know because the sharp increase in fossil fuel prices combined with changes in public biofuels policy has made that possible future a reality today.

Up until the last two years, energy prices affected agriculture primarily by influencing production costs: particularly fertilizer and diesel prices. But now that we have linked energy and commodity markets, both production costs and crop demand are influenced by energy prices. Ethanol plants' ability to pay for corn and biodiesel plants' ability to pay for vegetable oil are directly influenced by the price of gasoline and diesel fuel. Thus to understand where commodity prices are headed in the next five years we need to understand how the biofuels policy and the expansion of capacity to produce biofuels will affect the demand for corn and soybean oil.

Corn and soybean farmers are in an enviable position. The dramatic expansion that we expect to see completed in the next three years in biofuels plant capacity combined with the Renewable Fuels Standard has created a "can't lose" demand situation. Let me explain.

For corn farmers, increasing ethanol mandates means that they have a new built-in demand of between 25% and 30% of their crop. To induce farmers to plant adequate corn acreage will require prices high enough to cover the additional costs involved in increasing corn plantings from 80 to 90 or 95 million acres. I estimate that prices below

$3.50 to $4.00 per bushel will result in inadequate acreage. Hence I do not expect prices to fall below this level in the next five years. This level of prices should be adequate to cover all non-land production costs, even accounting for the recent run-up in fertilizer, chemical and diesel costs.

If we continue to have crude oil prices in excess of $100 per barrel and a string of good weather years that drive price down below $4.00 per bushel, then the economics of corn ethanol production would look so good that we should see a new round of investment take place taking capacity of the corn ethanol industry beyond mandated levels. This next round of expansion in corn ethanol would be particularly facilitated by continuation of the blenders tax credit.

The bright outlook for corn prices over the next five years also means a bright outlook for soybeans because of competition for land between the two crops. The only potential downside in demand for U.S. soybeans is if South American unexpectedly ramps up production so rapidly that world supplies overwhelm demand. But policy decisions in Argentina and Brazilian plans to devote increasing amounts of land to sugar cane production suggest that soybean expansion in South American will not be overly rapid.

Existing excess capacity in the U.S. biodiesel industry guarantees that soybean oil prices will not fall too rapidly even if South American production does ramp up significantly. Excess capacity means that weak soybean oil prices would quickly trigger biodiesel production in idled plants, thereby shoring up prices. The level of the price support for soybean oil depends on the price of diesel and whether the biodiesel tax credit is extended. Table 1 shows that with a wholesale diesel price of $3.50 per gallon, soybean oil prices below $0.54 per pound would trigger increased biodiesel production which would tend to keep soybean oil prices from dropping too much below this break-even level. The implications of this soybean oil price support on soybeans price depends on the price of soybean meal. At current meal prices, $3.50 diesel translates into a soybean price of more than $12 per bushel with continuation of the blenders credit and more than $10 per bushel without the credit.

Table 1. Break-Even Soybean Oil Price*

Wholesale Diesel Price	With Blenders Tax Credit	Without Blenders Tax Credit
$/gal	$/pound	
2.00	0.34	0.21
2.50	0.40	0.27
3.00	0.47	0.34
3.50	0.54	0.40
4.00	0.60	0.47
4.50	0.67	0.54
5.00	0.73	0.60

*These soybean oil prices are the prices that result in a biodiesel plant which operates on 100% soybean oil just covering their variable costs of production.

Table 2 presents break-even corn prices for corn ethanol plants. If a change in the RFS creates excess corn ethanol capacity, then the corn prices presented in Table 2 are what would induce idle corn ethanol plants to begin processing corn. Thus even without the RFS, if we have $2.50 wholesale gasoline and excess ethanol production capacity , then we should not expect to see corn prices drop below $5.41 per bushel with the blenders tax credit and $4.17 per bushel without the credit.

Table 2. Break-Even Corn Prices

Wholesale Gasoline Price	With Blenders Credit	Without Blenders Credit
$/gal	$/bu	
1.50	3.55	2.31
2.00	4.48	3.24
2.50	5.41	4.17
3.00	6.35	5.10
3.50	7.28	6.04
4.00	8.21	6.97

*These corn prices are the prices that result in a dry mill corn ethanol plant just being able to cover their variable costs of production.

I would like to now turn to the economics of livestock production. The impact of continued high feed costs on the U.S. livestock industry is fairly straightforward: livestock prices will eventually increase enough over the next year or two to cover producers' increased feed costs. There are two ways that this price increase will happen: either U.S. producers will reduce production or producers in other countries—who face the same feed cost pressures—will reduce production. It will likely be a combination of both though there are reasons to believe that high feed costs combined with high transportation costs has increased the comparative advantage of U.S. livestock producers relative to other countries' producers who raise livestock with feed grains.

When feed is inexpensive and shipping costs are low, pork producers in, say Chile, are not too disadvantaged in importing U.S. grain and exporting pork because their costs are not too much greater than U.S. pork producers. But high feed grains and shipping costs means that feed makes up a much higher proportion of production costs which increases the advantage of U.S. pork producers because they only have to ship pork, not both feed and pork. Furthermore, many U.S. producers have an advantage in that their animals' manure can be readily used in crop production.

U.S. producers and other producers who rely on feed grains are disadvantaged with high feed costs relative to producers who raise livestock primarily on grass. New Zealand dairy producers and South American beef cattle producers will be selling at a higher market price with unchanged feed costs. As long as we choose to use feed for biofuels

production, we should expect to see more favorable economics for grass-fed livestock production.

As increased feed costs work themselves through the system, we will see dairy, meat and egg prices higher than they otherwise would be. If we somehow cap the amount of animal feed that goes into biofuels production, then we will eventually see corn and soybean productivity gains show up again in lower food prices.

To summarize, our decision to encourage expansion of biofuels production has changed the economics of agriculture by linking energy and feed markets. There seems little doubt that we will see biofuels production from corn and vegetable oil meet mandated levels. If future plant capacity does not exceed these levels then future productivity gains will only need to keep up with increased food demand rather than increased food and fuel demands. This lower threshold of performance should increase the odds that a high quality diet will be affordable for a large proportion of the world's populations.

Testimony of Professor Bruce E. Dale
Distinguished University Professor
Michigan State University

Senate Agriculture Committee Field Hearing
Omaha, Nebraska
August 11, 2008

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.

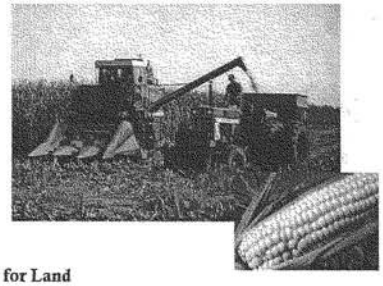
Thank you. I look forward to the question and answer period.

The Sustainability of Cellulosic Biofuels

All biofuels, by definition, are made from plant material. The main biofuel on the U.S. market is corn ethanol, a type of biofuel made using the starch in corn grain. But only using grain to produce biofuels can lead to a tug of war between food and fuel sources, as well as other environmental and economic challenges.

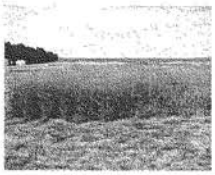
Biofuels made from cellulosic sources – the leaves, stems, and other fibrous parts of a plant – have been touted as a promising renewable energy source. Not only is cellulose the most abundant biological material on Earth, but using cellulose to produce biofuels instead of grain can have environmental benefits.

Cellulosic biofuel sources offer a substantially greater energy return on investment compared to grain-based sources. However, environmental benefits are not guaranteed. The environmental success of cellulosic biofuels will depend on 1) which cellulosic crops are grown, 2) the practices used to manage them, and 3) the geographic location of crops.



Both grain-based and cellulosic biofuels can help lessen our use of fossil fuels and can help offset carbon dioxide emissions. But cellulosic biofuels are able to offset more gasoline than can grain-based biofuels – and they do so with environmental co-benefits.

Cellulosic Biofuels Help Reduce Competition for Land



Cellulosic fuel crops can grow on lands that are not necessarily suitable for food crops and thereby reduce or avoid food vs. fuel competition. If grown on land that has already been cleared, cellulosic crops do not further contribute to the release of carbon to the atmosphere.

Because many cellulosic crops are perennial and roots are always present, they guard against soil erosion and better retain nitrogen fertilizer. Additionally, carbon is sequestered belowground in roots and soil organic matter because there is no further tillage after crop establishment. Most cellulosic sources require much less intensive management than do grain crops, saving the fuel and carbon dioxide costs associated with field crop operations such as planting, tillage, and weed control.

Cellulosic Biofuels Provide Environmental Benefits and Increase Ecosystem Services

Ecosystems are communities of living things and the environment in which they interact. Ecosystems are essential to life, providing innumerable and invaluable services such as clean water, food, and fiber, nutrient cycling, crop pollination, and pest suppression. Biodiversity refers to the portfolio of organisms in a natural community. Generally, the more diverse the portfolio, the greater the degree of ecosystem services provided.

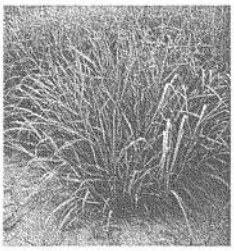
Cellulosic biofuel sources can diversify agricultural landscapes by allowing farmers to grow a greater variety of crops with more complex mixtures of plant species. This increases the diversity of plants and the birds, insects, and other organisms that live in different plant communities. A mixture of native grass and tree crops can keep wildlife habitat intact and support vital ecosystem services, including those that help other crops in the landscape.

Economic Viability of Cellulosic Biofuels Depends on Location, Technology, and Policy

Whether cellulosic biofuels are economically competitive and environmentally sustainable will depend on 1) location, 2) the development of new technology, and 3) policies that reward environmental performance.

The economic viability of cellulosic biofuels from crop residues and perennial grasses such as switchgrass and miscanthus will differ across geographic locations. Crop yields differ across the U.S., and therefore a mix of crop types is more economically viable than a single type of crop. Likewise, costs of production – harvesting, storage, and transportation – will vary by location.

Current estimates suggest that cellulosic biofuels are likely to be more expensive to produce than grain-based biofuels. However, the advent of new technologies for harvesting, storing, and converting cellulosic sources into biofuels could make them more competitive.



Policy Implications

The U.S. Energy Policy Act of 2007 mandates that biofuels make up 22% of transportation fuel mix by the year 2022. This translates to 36 billion gallons of ethanol – 15 billion gallons of grain-based ethanol and 21 billion gallons of cellulosic ethanol. The 2008 Farm Bill offers a $1.01 subsidy per gallon for cellulosic ethanol and $45 per ton to growers of biomass feedstock for biofuels.

Policies that monetarily reward the environmental performance of alternative biofuels are needed to improve competitiveness of cellulosic biofuels relative to grain-based fuels and gasoline. Aligning energy policy and climate policy through biofuel tax credits that are inversely related to their carbon footprint can provide incentives to use high yield, low carbon cellulosic sources. Policies and incentives should also decrease reliance on exotic and invasive species, favor increased biodiversity at farm and field levels, and maintain or enhance ecosystem services.

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Renewable Energy Challenges: Energy Research at the University of Nebraska

Stephen G. DiMagno
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I appreciate the opportunity to speak on behalf of UNL about opportunities for energy research in general, and in particular about those opportunities that have the greatest potential impact for the State of Nebraska, namely biofuels and wind power.

Excepting nuclear and tidal power, all energy used on the planet is the energy of captured sunlight. Fossil fuels that we use today are the result of sunlight captured and stored as chemical energy by photosynthesis and carbon dioxide fixation reactions carried out over the course of millions of years. We use these fossil fuels in huge quantities largely because historically they have proven to be the least expensive means to generate energy in large scale, though the increased economic, political and environmental costs of fossil fuel combustion are now matters of serious concern. Though it took nature millions of years to capture sunlight and accumulate the fossil fuel resources we burn today, the amount of energy actually contained in the sunlight hitting the earth's surface is immense: one hour of sunlight is equivalent to the amount of energy used on the planet in one year. The good news is that the energy to solve our problems is in our back yard. If efficient (or even relatively inefficient) methods are found to capture, store, and transport a small amount of the sun's energy, great progress will be made toward a sustainable energy future.

The vast majority of petroleum is consumed as liquid transportation fuels; thus, the challenge to replace imported petroleum lies in developing viable biofuels. Biofuels that are of importance to Nebraska include grain ethanol, cellulosic ethanol, and biodiesel. Grain ethanol production is already a relatively mature, large scale industry for the State. Nevertheless, there are many opportunities for research to improve the efficiency of grain ethanol production. Improved efficiencies in the transport and use of raw materials and fermentation coproducts, integration of ethanol production and cattle feeding operations, methods to increase distillation efficiency, and the use of ethanol and/or the clean carbon dioxide produced as precursors for value-added products are all areas of active research at the University.

* Improving Ethanol Production Efficiency: Optimization of Corn-based Feedstock Energy Conversions, Principal Investigator: David Jackson, Food Science & Technology
Co-Investigator(s): Wajira S. Ratnayake, Food Science & Technology, Rolando A. Flores, Food Science & Technology, Galen Erickson, Animal Science

*Ethanol: Utilization of By-Products, Principal Investigator: Hossein Noureddini, Chemistry & Biomolecular Engineering

*Technical and Economical Analyses of Combined Heat and Power Generation for Distillers Grains, Principal Investigator: Lijun Wang, Biological Systems Engineering
Co-Investigator(s): Milford A. Hanna, Biological Systems Engineering, Curtis L. Weller, Biological Systems Engineering, David D. Jones, Biological Systems Engineering

* Ethanol as an Energy Source and Terminal Reductant: Exploitation of Thermophilic Redox Enzymes in Catalyst Development and Screening
Principal Investigator: David Berkowitz, Chemistry

Co-Investigator(s): Paul Blum, School of Biological Sciences

In order to meet future (36 billion gallons) mandates for fuel ethanol, the conversion of cellulose biomass to ethanol will be required. Research on several important problems will be essential if cellulosic ethanol is to become a viable biofuels option. These include: 1) efficient raw materials harvesting and transport, 2) engineering of crops to make the cellulose easier to degrade, 3) biomass pretreatment and cellulose extraction, and 4) improved production and performance of glycosidase enzymes that convert cellulose to simple sugars for fermentation. If these issues are addressed satisfactorily, Nebraska will be able to use its existing ethanol infrastructure for the fermentation and distillation of fuel grade ethanol from biomass.

*Enzymes for Enhancing Ethanol Production from Lignocellulose
Principal Investigator: James Van Etten, Plant Pathology
Co-Investigator(s): Vicki Schlegel, Food Science and Technology, Kenneth Nickerson, Biological Sciences

Research is also needed to boost the production of biodiesel, a biofuel derived from transesterified plant oils or animal fats. The production of biodiesel from methanol and vegetable oil is a relatively straightforward process, though there is still room for improvement for water tolerant transesterification catalysts. The largest concern in the biodiesel area is the availability of sufficient quantities of inexpensive vegetable oil. Soybean oil production is on the order of 48 gallons per acre, while 18 gallons of oil are obtained per acre of corn. Further efficiencies in plant oil production are necessary if biodiesel is to be a competitive, high volume source of transportation fuel.

Algae are a potentially large scale source of inexpensive plant oils. Algae are perhaps the most effective photosynthetic organisms for generating biomass from sunlight. Along with affiliates at several premier institutions across the United States, the Algal Biofuels Consortium based at the University of Nebraska is developing the biology, genetic and metabolic engineering, and processing of algae for advanced biofuels. Despite the great promise of algae, naturally occurring species appear not to have all the characteristics necessary for algae to be fully economical and viable in biofuel production. For algae to achieve full potential, the ability to genetically and metabolically modify the organisms will be critical.

THE ALGAL BIOFUELS CONSORTIUM
Jim Van Etten (PI, Algal Biofuels Consortium Director)
William Allington Distinguished Professor, UNL Department of Plant Pathology. Member, United States National Academy of Sciences.

The direct conversion of wind power into electricity is a relatively inexpensive, reasonably efficient means to capture renewable energy, as is evident by the large increase in wind turbine construction throughout the Midwest. Where transmission infrastructure is in place, as it is in the Ainsworth wind corridor, a direct feed of electrical energy into the power grid is the most efficient means to capture wind energy. However, if power is generated in a widely distributed fashion on farms or in rural communities, storage of captured wind power is desirable. Direct

conversion of electricity to hydrogen or liquid fuels for energy storage is essential in these settings.

Hydrogen Production and Storage Using Wind and Nuclear Sources
Principal Investigator: Jerry L. Hudgins, Electrical Engineering
Co-Investigator(s): Sohrab Asgarpoo, Electrical Engineering, Dean Patterson, Electrical Engineering

Viability of Wind Generation for Farm & Rural Communities
Principal Investigator: Jerry Hudgins, Electrical Engineering
Co-Investigator(s): Terrence Sebora, Center for Entrepreneurship, Ronald Yoder, Biological Systems Engineering

Another option for energy storage to capture power from intermittent sources is advanced battery technology, but the efficiency and lifetime of current batteries is yet sufficient to make such systems practical for continuous use.

Finally, though I have spoken exclusively about methods to create energy, increased conservation and energy efficiency are the simplest and most accessible means to reduce the demand for imported fossil fuel. There are many ways that individuals can reduce their personal carbon foot print, of these the most important is simply to drive less if possible. In terms of energy use, the automobile is incredibly inefficient. For example, the amount of electricity supplied to cool my house and run all of its appliances every day is roughly the same amount of energy that is contained in one gallon of gasoline. I use more energy driving to work than I do running my house.

It is also important to think of energy efficiency as a foremost priority in the design and construction of new buildings. Smart, energy efficient buildings, designed to reduce their power consumption by using non-traditional sources for heating, cooling, or advanced lighting, will also be needed as the cost and environmental impact of electricity use increases.

Development, Implementation and Deployment of Smart Building Energy Systems Monitoring, Controls and Diagnostics Using a Wireless Sensor Network for Energy Efficiency and Conservation Principal Investigator: Haorong Li, Architectural Engineering - Omaha
Co-Investigator(s): Song Ci, Computer & Electronics Engineering - Omaha, Hamid Sharif, Computer & Electronics Engineering - Omaha

Passive Solar Powered Earth Contact Heat Exchangers for Cooling Buildings
Principal Investigator: Bing Chen, Computer Science & Engineering
Co-Investigator(s): Gang Wang, Architectural Engineering Mingsheng Liu, Architectural Engineering

In conclusion, there are many areas of energy sciences in which the University of Nebraska has ongoing research programs. I have outlined a few of these programs here, and there are others I did not have time to mention. There is still much work to be done, but the good news is that though the scale of the energy problem facing us is large, there is a truly vast amount of energy available for our use, if we can figure out how to use it.

I would be happy to answer any questions.

Written Statement of
Dr. Thomas D. Foust
Biomass Technology Manager
National Renewable Energy Laboratory
Presented to the U.S. Senate
Committee on Agriculture, Nutrition and Forestry
Food, Feed, and Fuel Production: Today and Tomorrow
August 18, 2008

Mr. Chairman, thank you for this opportunity to discuss important issues related to the nation's energy policies as America moves aggressively to reduce our dependence on foreign oil, improve environmental sustainability and fully meet the energy demands of the future. I am honored to be here and to speak with you today. We applaud the Committee for its examination of the complex issues surrounding current and future food, feed and fuel production issues.

I am the Biomass Technology Manager at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. NREL is the U.S. Department of Energy's primary laboratory for research and development of renewable energy and energy efficiency technologies. Researchers at NREL have been working on biofuels technologies since our laboratory was founded in 1977, with a primary focus on developing advanced, second generation biofuels technologies that do not rely on grain or other food-based feedstocks. Due to the success of these efforts at NREL, and other leading institutions, to significantly reduce the costs of advanced biofuels technology, America stands at the brink of success of greatly reducing our dependence on petroleum, both in the near- and long-term.

Several recent published studies have shown that there is sufficient biomass potential in the U.S., and worldwide, to produce significant amounts of transportation fuels without impacting food production and prices. Nonetheless, recent increases in food prices and especially corn prices have raised concerns about biofuels development. Clearly, biofuels, and specifically advanced biofuels, have great promise. However, they must be produced in a sustainable fashion in order to reap the potential benefits.

Although there is considerable debate on the impact that first generation biofuels are having on food and feed prices, the overwhelming consensus among experts is that advanced biofuels will greatly lessen any effect on food and feed prices. By using non-food resources, advanced biofuels avoid any direct competition with food and feed supplies. The only likely impact that advanced biofuels technology will have on food and feed prices will be land use competition. I will specifically address that issue in this testimony, as well as the sustainability issues associated with large volumes of biofuels production.

Advanced biofuels vary in terms of technical maturity as well as in ultimate volume production potential. I am going to discuss several advanced biofuels technologies, primarily from the point of technology maturity, but also in terms of reasonable estimates for production capacities over the next 10 – 15 years. All advanced biofuels technologies offset our petroleum consumption and at the same time reduce our carbon dioxide emissions. As I talk about advanced biofuels

capacities in the following discussion, remember that today in the U.S. we burn approximately 140 billion gallons/year (bgy) of gasoline and 60 bgy of diesel, of which 40 bgy of the latter is used in on-road applications.

Biofuels Potentials

Ethanol

First, let's start with ethanol. Current production of this alcohol fuel from the starches of corn grain is a well established technology, and accounts for almost all of the current 9.4 bgy U.S. capacity. Additional plants in planning or under construction are estimated to increase our capacity to nearly 14 bgy within several years. The limiting factor is, of course, the feedstock itself – corn grain. It is an important food and feed commodity in the U.S., and studies suggest that we cannot produce more than 15 bgy of ethanol from corn grain without significant and unacceptable lasting impacts on the economics of critical food products that depend on corn.

There is currently no other readily available starch- or sugar-based crop in the U.S. from which to ferment ethanol in quantity, hence production potential is limited, unless cellulosic biomass feedstocks can be utilized.

Cellulosic ethanol offers a path over these ethanol capacity hurdles by utilizing cellulosic feedstocks which are abundant and do not directly compete with food and feed needs. Significant technical progress has been made on increasing the economic viability of cellulosic ethanol, chiefly by reducing the costs of production. DOE performs a rigorous state of technology (SOT) assessment every year to estimate production costs for a commercial-scale plant based on emerging technologies being demonstrated at the national laboratories and in the industry. The 2007 SOT results estimate a production cost for both biochemical and thermochemical pathways in the $2.20-$2.50/gallon range. This compares very favorably with gasoline and corn ethanol at current crude oil and corn prices. However, given that cellulosic ethanol technology is still in a pre-commercial state, substantially more can be done to reduce costs. The current DOE and NREL goal is to demonstrate within four years, the technology that when commercialized will produce ethanol at $1.33/gallon (2007$). Achieving this goal will secure the competitive position of cellulosic ethanol with gasoline and corn ethanol over the long term. To drive the initial deployment of cellulosic ethanol, numerous cellulosic commercial-scale plants and near commercial-scale plants (Figure 1), are planned or currently under construction, many with DOE support. These initial plants will rapidly begin the cellulosic ethanol deployment process.

The volume production potential of cellulosic ethanol is very large. By developing both biochemical and thermochemical conversion routes, cellulosic ethanol production can utilize essentially the entire biomass resource base available. The heralded "Billion Ton Study"[1] estimated this potential to be 1.3 billion tons/year by mid century. If this resource base was converted to ethanol, the potential exists to displace over 50% of current gasoline.

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[1]R.D. Perlack et al. Biomass ad Feedstock for a Bioenergy and Bioproducts Industry: the Technical Feasibility of a Billion-Ton Annual Supply, April 2005, DOE/GO-102005-2135

Based on this potential, ethanol's partial compatibility with the existing transportation fuel infrastructure and significant achievements in both R&D and deployment, cellulosic ethanol should remain the cornerstone of near term U.S. biofuels development. With a continued focus on cellulosic ethanol and continued progress on cost-centered research and deployment, our nation can soon realize the benefits of advanced biofuels technology.

Other "non-ethanol" advanced biofuels

As promising as cellulosic ethanol may be for addressing our nation's transportation needs, it does have some limitations. Limitations commonly cited are: a reduced energy content when compared to gasoline, so consumers will experience a mileage penalty in today's vehicles when compared to gasoline; it is not fully compatible with the existing transportation fuel infrastructure; and, ethanol is only suitable as a gasoline replacement, it does nothing to address the need for diesel and jet fuels. Therefore, advanced biofuels development should be expanded into additional technologies and fuel options.

History has shown us that by embarking on and adhering to the broadest research portfolio, we will create the best set of technology options from which industry and the marketplace can choose. This will ensure that U.S. industry maintains its leadership role amid global competition. To accomplish this objective, we must embark on a robust advanced biofuels development effort that builds upon, and does not pull precious resources from, existing cellulosic ethanol efforts. This strategy needs to include these key elements:

Economic Analysis

A robust effort in advanced biofuels development needs to be built on sound and unbiased analysis of the technical performance and real-world cost of biofuels production both at the current state of the technology and the potential that could be achieved with an aggressive R&D effort. DOE is currently sponsoring NREL to work with ConocoPhillips and Iowa State University to perform this assessment.

Advanced Biochemical Conversion beyond Ethanol

Butanol, a member of the alcohol family, can be produced by a fermentation process similar to ethanol, and has certain advantages over ethanol. In particular, its energy content is significantly higher than ethanol (but still not that of gasoline) and it is more compatible with the existing fuel infrastructure, a result of its reduced tendency to absorb water and corrode pipes. However, butanol is more difficult to ferment, and the economics and technology remain well behind that of ethanol. BP and Dupont are actively engaged in a bio-butanol development program in the United Kingdom. Although, in the U.S., butanol is not yet out of the starting gate and will most likely be a minor contributor compared to ethanol in the near future, it does have long-term advantages over ethanol and should be pursued as part of a robust advanced fuel strategy. Since butanol production can potentially use the exact same resource base as ethanol production, its volume production potential is also quite large.

Thermochemical conversion

Thermochemical conversion of biomass to ethanol is a key component of the current cellulosic ethanol effort. Thermochemical conversion technologies also show considerable promise beyond ethanol and need to be equally supported and pursued. If biochemical conversion is the "elegant" method of producing alcohols from certain biomass feedstocks, then thermochemical conversion is the "Swiss army knife" method of attacking a wider range of feedstocks and producing a broader spectrum of fuels. At high temperatures and pressures, this method converts biomass to intermediate liquids or gases, which can then be synthesized into fuels by numerous proven and emerging technologies. Since some of the thermochemical conversion approaches show considerable promise for producing hydrocarbon fuels similar to gasoline and diesel and more infrastructure-compatible fuels, they are a means to lowering the barriers to commercialization. Since thermochemical conversion technologies can essentially capture the entire feedstock resource base, their volume production potential is also quite large.

Aquatic Biofuels

Aquatic species such as microalgae are capable of producing remarkable levels of lipids, sometimes referred to as bio-oils, without impacting the food, fiber, and chemical infrastructures of our nation. Aquatic species do not require arable land or fresh water and could potentially eliminate any food, feed versus fuel competition. Lipids (triglycerides) by their inherent chemical structure lend themselves well to conversion to higher energy density fuels like diesel and jet fuel. Hence, they could fill an important need in a long-term advanced biofuels strategy. Because of the potential high lipid yields of algae, studies[2] suggest that aquatic species have the potential for supplying all of the nations' fuels needs on a relatively modest amount of land.

However, for all of the significant potential of aquatic species, research challenges such as the growing of the algae to the harvesting of oil need to be overcome to make this promising area of advanced biofuels development technically and economically viable. This area should be pursued as a longer-term option.

Advanced Biofuels Sustainability

Finally, but perhaps most importantly, let me address the issue of sustainability of advanced biofuels. Advanced biofuels have clear environmental benefits when compared to first generation biofuels technologies and conventional petroleum fuels. For example, cellulosic ethanol is expected to improve upon the positive energy balance of today's corn ethanol by delivering four to six times as much energy as needed for production[3]. Additionally, DOE research has shown

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[2] M.E. Huntley and D.G. Redalje, "CO_2 Mitigation and Renewable Oil From Photosynthetic Microbes: A New Appraisal", Mitigation and Adaption Strategies for Global Change (2006), Springer 2006

[3] M. Wang et al, "Life-cycle energy and greenhouse gas emission impacts of different corn ethanol plant types," *Environmental Research Letters*, May 2007.

that cellulosic feedstocks can reduce life-cycle greenhouse gas emissions by over 85 percent, compared to gasoline[4].

Although these benefits, in and of themselves, are significant, sustainability needs to be addressed through comprehensive "cradle to grave" research. More understanding is needed about the overall life cycle impacts of biofuels pathways on our environment – our land, water and air. DOE has begun several activities in this area. In FY 08 DOE commissioned NREL in partnership with other leading national laboratories and universities to initiate an effort to collect and analyze data to assess the direct and indirect impacts of biofuels production. This work will be used to develop sustainability assessments of biofuels deployment scenarios such as those specified in the recently enacted Energy Independence of Security Act (EISA) of 2007 which calls for 36 billion gallons of biofuels production by 2022, of which 21 billion gallons have to be advanced biofuels.

One sustainability issue particularly relevant to this hearing is land use competition, both direct and indirect, for biofuels feedstock production and the role this will play in tomorrow's food, feed and fuel marketplace. One recent study[5] specifically looked at the indirect land use issue for biofuels production and concluded that the impacts can be significant. Although the methodology and hence the results reported in this research paper have been broadly rebutted by several segments of the biofuels research community, the paper does raise an important point that competition for direct and indirect land use needs to be considered when the sustainability and food price impacts of advanced biofuels are assessed.

The degree to which a relationship exists between land use change and large-scale biofuels production has begun to be addressed extensively in the research community. The hypothesis is that direct land use changes are caused by feedstock production for biofuels in a given biofuels-producing country, while indirect land use changes occur in other countries through price signals of agricultural commodities because of the increased commodity demand induced by biofuels production.

Argonne National Laboratory and Purdue University, supported by DOE, is addressing some of these issues with Purdue University by expanding Purdue's Global Trade Analysis Project GTAP model (a general equilibrium model), so that reliable results of biofuels-induced land use changes can be generated.

While the recently completed and current on-going efforts on land use changes have been focusing on corn ethanol in the U.S., sugarcane ethanol in Brazil, and biodiesel production from oil seeds in Europe, no efforts have yet been undertaken on second-generation biofuels production. DOE will be addressing this with Purdue's GTAP model in the near future. In general, it is anticipated that land use changes for second-generation biofuels production will be less extensive than those for first-generation biofuels production.

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[4] Ibid.

[5] Searchinger, T., et al, "Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change." Science; Vol. 29, 2008; p.1238-1240.

Summary

Advanced biofuels are a significant step in the right direction to addressing tomorrow's food, feed and fuel potential. The current successful, goal-focused effort on cellulosic ethanol is on target towards achieving our nation's immediate objective, to displace imported oil, reduce greenhouse gases, and minimize food and feed price impacts. However, we need to accelerate and expand our existing advanced biofuels effort to include other conversion options and fuels, beyond ethanol, to truly achieve the benefits that advanced biofuels offer. On this path, we will need to more accurately study and monitor the potential food versus fuel controversy and set proper policies and incentives in that area to minimize conflicts, meet economical food and feed requirements and launch an important industry in a sustainable manner.

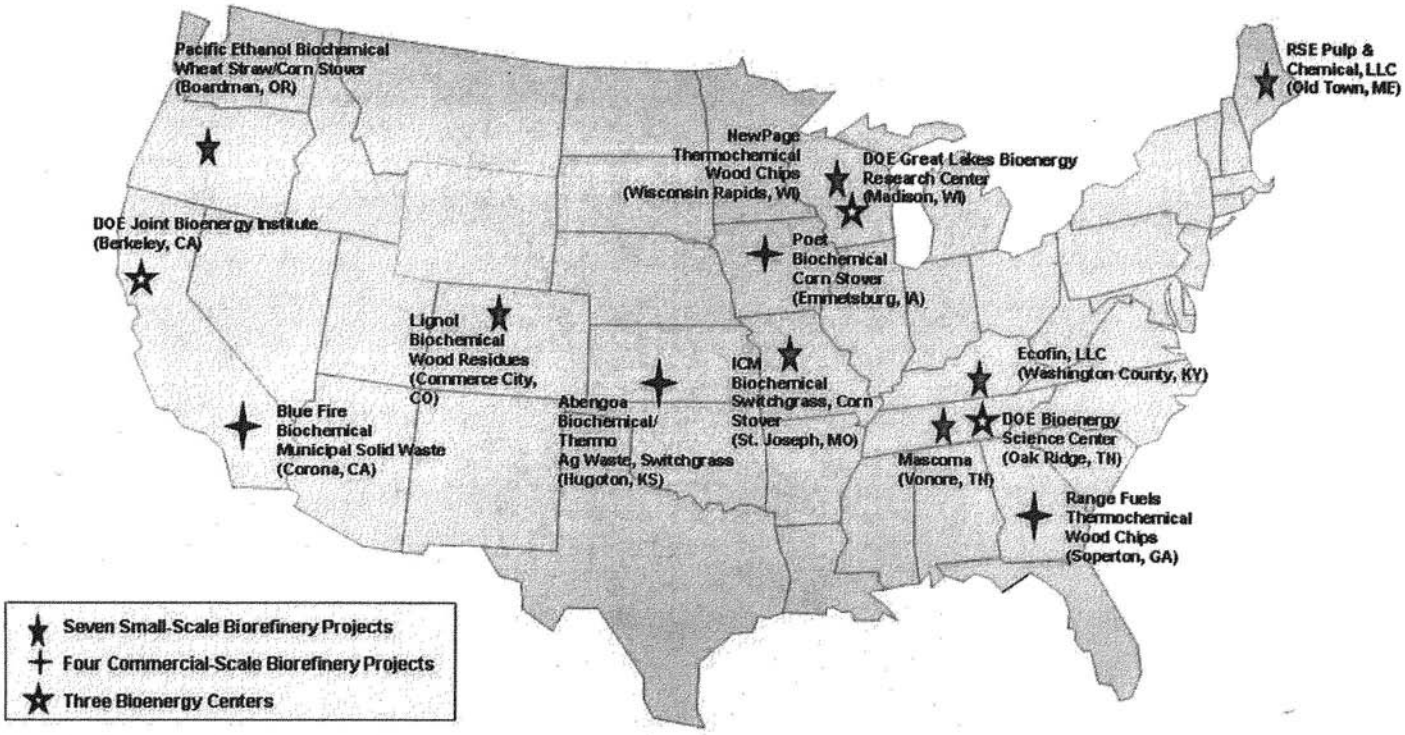

Figure 1: Current cellulosic ethanol deployments in the U.S.

Testimony of Jim Jenkins
U.S. Senate Committee on Agriculture, Nutrition and Forestry Field Hearing
Omaha, Nebraska
August 18, 2008

Good Morning Chairman Harkin and Senator Nelson. I appreciate the opportunity to present comments to you regarding the impact of high energy costs on food, feed and fuel. I appear today in my capacity as chairman of the Nebraska Ethanol Board, a state agency established in 1971 to work with communities and companies to expand the production and use of ethanol. My perspective on this issue comes from my tenure on the Ethanol Board but my experience is shaped by my day to day responsibilities as a rancher and restaurant owner. As a citizen of rural America and as a provider of food and food products to consumers, I can attest to the adverse impact of rapidly increasing energy prices. And as I've watched Nebraska emerge as the second largest ethanol producing state, I have a good sense of the positive impacts generated by that industry in many sectors of the state, including the livestock industry.

The rapid growth and maturing of the American Ethanol Industry is one of the significant business and economic stories of the past several years, particularly in the country's heartland. This new biofuel industry is a 20 billion dollar industry spanning 20 states and most importantly is providing nearly five percent of the transportation fuel requirements of the United States. While this is a relatively small percentage it nonetheless represents the first real competitive product challenge to the oil industry in its 100 plus year history. Not surprisingly, oil companies are fighting back spending millions of dollars attempting to undermine the nascent ethanol industry. Recently, 20 other groups including the American Meat Institute and the Grocery Manufacturers Association launched a campaign against the ethanol industry with the theme of "food before fuel" that accuses ethanol of being one of the principle causes of higher food prices. While ethanol has certainly contributed to the increase in food prices corn prices and therefore food prices, most objective observers concur that these increases are being driven by a multitude of factors unrelated to corn ethanol including: oil prices up 900% since 1999; surging world demand in Asia and Eastern Europe, and drought in major food producing areas of the world. In addition huge amounts of speculator money has flowed into commodities as the United States stock market has stagnated since the late 1990's.

While key farm inputs such as steel, fertilizer and fuel have doubled and tripled in cost over the past four or five years, the government's Economic Research Service (ERS) projects that from 2004 through 2008 food prices will increase 15%, with the 2008 contributing 3% to 4% to that total. Furthermore, the farmer's share of the retail food dollar has declined from 32% in 1970 to 19% in 2002, so that the majority of the cost increases takes place in the food manufacturing, processing, distribution and transportation sectors, beyond the farm gate. A research paper released in April by Texas A&M's Agriculture and Food Policy Center found that "high corn prices have had very little impact on retail food prices". The truth is that food price increases have lagged well behind other key commodities impacting our nation's economy and grain ethanol is a bit player in driving food inflation.

For most of the last fifty years the challenge for United States Agriculture was too much production. When I returned to my family's ranching operation in 1996, many in the international community was accusing the United States of undermining farmers around the world by dumping cheap, subsidized agricultural products onto the market. And my urban friends were complaining about the massive government support for the food and agriculture industries. Now farmers are less subsidized and rural economies in the U.S. and around the world are surging. After decades of stagnate prices, increased farm income is driving innovation as farmers now have the resources and the price incentives to more fully implement such things as precision guidance systems, fuel efficient equipment, advanced genetics, water and energy saving irrigation equipment. Instead of undermining food production systems around the world the biofuel industry is bringing badly needed diversification and stability to agriculture.

To date ethanol, in addition to the rapidly growing wind industry, offers our nation a significant opportunity to begin the important diversification our energy portfolio away from fossil fuels. This diversification of risk in our nation's energy portfolio is creating wealth in our own country and beginning to stem, if every so slightly, the massive transfer of energy dollars to other countries, now totaling over $700 billion dollars annually. Our dependence upon oil also undermines our national security interests and costs the taxpayer billions of dollars as we seek to protect our overseas oil supply. As former Federal Reserve Chairman Allan Greenspan wrote in his book, **The Age of Turbulence,** "...the Iraq war is largely about oil". Given these real threats to our economic well being caused by or dependency on foreign oil, it is imperative that the United States develop alternatives to oil. Even oil tycoon T. Boone Pickens has noted in his TV ads that "this is one problem we cannot drill our way out of."

The ethanol industry provides a critical foundation to begin to decentralize our energy industry enabling communities world wide to turn waste materials such as lawn clippings, wood chips and crop residues into energy. This technology is proven and available now. Brazil for example is running nearly its entire transportation fleet on ethanol produced from sugar cane. Nebraska is now a net exporter of transportation fuel, producing approximately 1.3 billion gallons of ethanol and consuming 900,000 gallons of transportation fuel. The United States through public/private partnerships is presently building six cellulosic ethanol plants that will test the capability of producing ethanol from non-corn based plant materials, providing further diversification for our rural economies. Importantly plant matter is available all over the world, whereas oil is available in a comparatively few select regions. In the end, we may in fact use most of our plant matter for food but given the present energy challenge is it not prudent to at least develop alternatives?

Change always causes some hardship. Presently the livestock industry has experienced a significant erosion in profitability as it has been forced to compete with the ethanol industry for grain. Nonetheless, there is plenty of evidence that market forces are at work providing stability to both the ethanol industry and the livestock industry. Elevated corn prices have sent a clear signal to that ethanol industry to slow expansion and, in fact, a

number of plants will go out of business over the next several years. In addition, the cattle feeding industry, which consumes over 30% of the corn crop is ratcheting down its utilization of corn and instead using less expense forage to place weight onto cattle. Dan Loy, a beef nutritionist at Iowa State University told Successful Farming Magazine that the amount of corn used from traditional finishing programs "can be cut in half". The cattle industry also is now beginning to more efficiently utilize distillers grains, which in effect replace approximately 40% of the bushel of corn that went into the plant initially. As a cattle producer, I am confident that we will be stronger and more efficient in the era of $4.00 plus corn than the three decades of $2.00 corn, which contributed to over-production and efficient feeding practices.

Throughout our history, our free enterprise system has partnered with our democratic governmental institutions to create the most dynamic economy in the world. Each of our major industries, including transportation, food and agriculture, energy, education, and our world leading technology sector has received major support from the taxpayer. A few examples include the transcontinental railroad, our interstate highways, the internet, food and agriculture research by our land grant universities, and important conservation projects implemented after the dust bowl disaster of the 1930's. These past challenges provide wisdom and inspiration for developing a vision and plan for dealing with the present energy crisis.

With your permission, Mr. Chairman, I would like to include with my testimony two exhibits which underscore my testimony. The first is a recent publication on the topic of food, feed and fuel. This publication was issued by Ethanol Across America, a public information campaign with which Senator Nelson is affiliated. I offer my thanks to Senator Nelson on his role in supporting a factual document on the impact of the ethanol industry and the negative consequences of rapidly increasing energy prices and escalating energy imports.

The second exhibit is a letter to Senators Richard Lugar and Ben Nelson from a nationally renowned livestock nutritionist at the University of Nebraska. Dr. Terry Klopfenstein has shared with Senators Lugar and Nelson the results of an analysis that clearly documents the role of distillers feed in meeting livestock feed supply needs. The document illustrates that after ethanol has been produced from corn nearly 50% of the original corn value is still available for livestock feed. This fact underscores the point that ethanol production creates opportunities for more efficient and progressive livestock feeding. It also makes the point that ethanol production from corn is a means of more efficiently using that resource to produce food, feed, fiber and fuel.

Thank you for the opportunity to talk with you today.

William G. Lapp

Principal, Advanced Economic Solutions

Testimony to the Committee on Agriculture, Nutrition & Forestry of the United States Senate

August 18, 2008, Omaha Nebraska

Thank you, Mr. Chairman, for the opportunity to address the committee. Today's hearing to explore the changing economic landscape for agriculture (including the role of renewable fuels) is highly relevant and particularly timely.

My name is Bill Lapp, and I am the principal of Advanced Economic Solutions, LLC, located in Omaha, Nebraska. Advanced Economic Solutions is dedicated to providing high quality economic and commodity analysis for a broad array of food companies. AES provides forecasts and analysis for procurement and risk management decisions, in order to help these companies in their decision-making processes and strategic thinking. With my background in providing commodity analysis and support for risk management decisions for food companies, I would like to bring to you the perspective of restaurants, food manufacturers, and primary input producers.

Spikes in the price of commodities since 1981 have been mostly weather-related; in all cases increases in commodity prices have been short-lived, with limited impacts upon consumer food inflation. For the most part, these increases in commodity prices have been absorbed by food manufacturers to avoid loss of market share. This contrasts with the current

environment of sustained increases in commodity prices. Today, food manufacturers are unable to absorb the sharp and sustained increase in input costs, and as a result, food price inflation has begun to accelerate, and annual rates of food inflation are likely to continue to increase in the coming years.

Food Company Views On Rising Input Costs and Food Inflation

The overwhelming majority of the companies that Advanced Economic Solutions works with indicate that rising input costs, driven by the surge in commodity prices, has created the most challenging environment from a raw material cost perspective that they have faced in more than 20 years. The current environment, with a sharp and sustained increase in prices, has created significant pressure on margins, and compelled the food industry to raise prices to consumers.

In a survey conducted by Advanced Economic Solutions during February 2008, food manufacturers and restaurants were clear in expressing their concerns about the rising input costs in 2008 and beyond:

- More than 90% believe 2007 was the most challenging year they have faced, and more than 90% believe 2008 will be equally or more challenging than 2007
- More than 90% believe the increase in food costs we have seen will be sustained over time
- Around 75% indicate they have begun to reflect higher costs in consumer prices, but more increases are forthcoming in the next year
- Among the causes of the increased food input prices, over 90% indicated ethanol was a primary driver of the rise in food input prices

Food Inflation History and Outlook Going Forward

The Bureau of Labor Statistics data on food prices,[1] the consumer price index (CPI) and producer price index (PPI), confirm the trend of rising food input costs as well as consumer food prices. Historically, the CPI for food increased by an annual average of 2.3% during 1998 and 2006, and food inflation has not been in excess of 6% per year since 1980.

However the impact of higher commodity prices began to translate into higher consumer prices in 2007 – from December 2006 to December 2007, the CPI-Food rose by 4.9%. Further acceleration in food prices has occurred in 2008. The consumer price index (CPI) for food rose at a 7.6% annual rate during the first seven months of 2008. This includes double-digit rates of inflation for staples such as bread, cereal, salad dressing, rice and eggs.

There are two things to note about the rise in food price inflation during the first half of 2008. First is that while consumer prices were increasing rapidly, the producer price index (PPI) for food, reflecting rising input costs, rose at an even greater rate during the first half of 2008 (9.8% annualized). While increases in the CPI-Food and PPI-Food tend to run in close parallel over time, this has not been the case recently – the annual rate of gain in the PPI-Food has been in excess of gains in the CPI-Food for the past 18 months by an average of 2.3%. The data reflect an environment where the US food industry has begun to pass on higher costs, but not to the extent they have been incurring increasing costs. In order to close this gap, one of two things will happen – either consumer food prices will go up, or producer prices will go down. Market fundamentals suggest that it will be the former.

[1] US Department of Labor Bureau of Labor Statistics (www.bls.gov)

The second point is that the increase in consumer food prices during the first half of 2008 has occurred with only modest increases in meat prices. The CPI data indicate June 2008 beef and chicken prices have risen by 3% from a year ago, while consumer pork prices have declined by 1% from a year ago. This is consistent with the American Farm Bureau Federation's Survey of Supermarket Prices,[2] which indicates the five meat prices they track had risen during April-June 2008 by an average of just 1.7% from a year ago. Due to the biological limitations (i.e. the time it takes for an animal to mature), as well as high levels of fixed costs, livestock producers due not typically respond quickly to changes in feed costs. However in the current economic environment that is characterized by poor or negative margins, producers are expected to reduce their output in response to the high feed costs. USDA's most recent forecast is for total meat and poultry production to decline by 1.2% in 2009, a development that will lead to significantly higher livestock prices in 2009 (according to USDA price forecasts).

Earlier this year, Advanced Economic Solutions completed an analysis of the outlook for food inflation during 2008-12.[3] The report concludes that the rise in commodity prices, led by corn, is having a direct impact on consumer food inflation. As a result of the sharp and sustained increase in input costs, Advanced Economic Solutions estimates that food inflation will rise by an average of 9 percent annually between 2008 and 2012, as the rising costs are passed on to consumers.

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[2] www.fb.org

[3] "Rising Commodity Prices and their Impact upon US Food Inflation", Advanced Economic Solutions, June 2008

Corn's Relevance to Food Prices

Corn is the largest crop produced in the US, with production more than four times larger than either wheat or soybeans. It is an extremely important part of the American diet, and changes in the price of corn directly impacts the price of other grains and oilseeds, as well as the price of livestock, dairy and eggs.

The price of corn and other commodity prices has risen sharply over the past two years, and is dramatically impacting the costs to produce food, costs that ultimately will be passed on to consumers. While the recent decline in the price of corn and other commodities is a welcome development for end-users, we should not take too much comfort in the current situation. Note that the recent USDA projection of the 2008 US corn crop (12.2 B bushels) historically is adjusted up or down by an average of 6.6% between the August forecast and the final estimate.

The need for more acreage will be a significant driver of the price of corn and other crops in the coming months (and perhaps years). In 2008, 234.8 million acres were planted to four major crops (corn, wheat, soybeans and cotton), a five million acre increase from a year ago and highest level since prior to the start of the Conservation Reserve program. In order to meet existing (2008/09) demand and the growth in demand to meet the rising ethanol and bio-diesel mandates, US farmers will need to plant 240 million acres in 2009, including an increase in corn acreage from 87.3 million to 93.0 million acres.

We need more acreage to be planted in 2009 and beyond, largely to meet the increased bio-fuel mandates. If additional acres are not 'found", prices are going to have to increase to ration scarce supplies. Further, weather problems in 2009 would lead to a dramatic increase in the price of grains and oilseeds from current levels. This year, early flooding caused corn prices to spike to over $8 based on the threat of reduced supply. Next year, with increased demand pressure from biofuels, the situation is even more precarious.

Recent studies have discussed how a box of corn flakes is impacted by higher corn prices[4], but this focuses on a very minor component of corn usage. In 2007/08, USDA estimates that 192 million bushels of corn were used in the production of all cereal – this represents 1.8% of total domestic use of corn and is equal to just 0.1 pounds of corn per person per day. By contrast corn use in the production of livestock, dairy and eggs totaled 6.05 B bushels – representing 58% of total domestic corn used in 2007/08 and equal to 3.1 pounds of corn per person per day. While it may be popular to discuss how little higher corn prices impact a box of corn flakes, the impact of higher corn prices upon livestock, dairy and eggs is 31 times more important to US consumers.

[4] As an example, see "Corn Prices Near Record High, But What About Food Costs?", USDA Economic Research Service, February 2008 (www.ers.usda.gov/AmberWaves/February08/Features/CornPrices.htm)

Ethanol and Its Relationship to Corn and Food Prices

The relationship between the growing use of corn to produce ethanol and the impact on corn prices and ultimately food prices has been the subject of several studies, reaching a wide range of conclusions. Because so many views are held, it may be useful to review some of the facts surrounding ethanol, corn and food prices.

1. **FACT: While there has been discussion of the impact of poor weather in recent years, USDA data indicate otherwise. World wheat and coarse grain yields in 2006/07 were the 3rd highest on record and 4% above the previous 5-year average; world wheat and coarse grain yields in 2007/08 were record high and 5% above the previous 5-year average. *In other words, it is difficult to blame weather for the dramatic rise in prices we have seen in recent years.***
2. **FACT: World wheat and coarse grain usage is forecast by USDA to increase at an annual rate of 3.3% between 2006/07 and 2008/09, well above the growth rate of 1.2% during the previous 10 years and higher than the average increase in yields per acre of 1.58% over the past 25 years (1982-2007). The growth in world wheat and coarse grain use is dominated by ethanol. During 2006/07 through 2008/09, 46% of the growth in world demand is attributable to increased use of corn to produce ethanol (2.0 B bushels or 50 million tonnes additional demand for ethanol, out of a 110 million tonne increase in total world wheat and coarse grain use). *As the US and world struggles with tight stocks, high feed costs and increased food inflation around***

the world, we should keep in mind that nearly half of the growth in grain use can be attributed to mandated use of corn to produce ethanol.

3. **FACT: Growing use of grains has led world stocks of wheat and coarse grains, as a percent of usage, to the two lowest levels on record at the end of 2007/08 and 2008/09. This has occurred in spite of record high grain and oilseed prices. *At present and for the foreseeable future, the impact of a decline in yields would be dramatic for grain and oilseed prices, and ultimately for consumer food prices.***
4. **FACT: More acreage will be needed to meet the growth in demand, particularly the demand mandated via the Renewable Fuel Standard for ethanol and bio-diesel. In the United States, just to meet existing demand plus growth in ethanol, US farmers will need to plant an additional five million acres of major crops (corn, wheat, soybeans and cotton) in 2009. *Grain and oilseed prices are already high, but a shortfall in acreage or yields in 2009 would drive prices dramatically higher.***
5. **Livestock margins have been extremely poor due to the rise in feed costs. USDA analysis suggests livestock producers will reduce output by 1.2% in 2009, with prices for livestock expected to increase. *Although there have been limited gains in consumer prices of proteins to date, the reduction in the availability of meat will ultimately be reflected in higher consumer prices for meat at some point in the coming year.***

Thank you, Mr. Chairman, for the opportunity to share my thoughts and analysis to the committee. I would be happy to respond to any questions.

Statement Of

Jeff Lautt

Executive Vice President of Corporate Operations

POET

Before the
Senate Agriculture, Nutrition, and Forestry Committee
August 18, 2008

Preamble:

Mr. Chairman and distinguished committee members, thank you for the opportunity to visit with you today. My name is Jeff Lautt. I am Executive Vice President of Corporate Operations for POET. I would like to talk with you today about food, fuel and feed production; today and tomorrow.

POET – INTRODUCTION

POET, headquartered in Sioux Falls, South Dakota, is the largest producer of biofuels in the world. POET is an established leader in the bio-refining industry through project development, design and construction, research and development, plant management, ownership, and product marketing. The 20-year old company has twenty-three (23) ethanol production facilities and three more under construction that will all be commissioned this fall. We will then be producing and marketing more than one and half billion gallons of ethanol annually and producing over four million tons of dried distillers' grains, a high protein animal feed marketed throughout the world.

The POET development model is unique. It started on the Broin family farm in the 1980's and has spurred the growth of investment by thousands of farmers and individual main street investors. POET's business model is to invest in, develop, design, construct and manage ethanol production facilities. The facilities are independent limited liability companies (LLC) owned primarily by individuals and local farmers that provide the corn feedstock. POET employs the facility's general manager and on-site technical engineer. All other employees are employed by the LLC. POET also has significant investment and Board of Director representation at each plant.

By leveraging business size and position, POET has created the most successful and profitable ethanol facilities in the industry. POET has achieved breakthrough progress beyond ethanol processing, extracting extraordinary new value from each kernel of corn.

POET is also a leader in the development of cellulosic ethanol. We have been working on cellulosic ethanol for several years. Our strategy in cellulosic ethanol production involves the utilization of existing corn-to-ethanol plants. We are doing this in order to capitalize on the existing infrastructure, utilities, roads, rail lines, and material handling. Our focus is on corncobs as the primary cellulosic feedstock, using the corn ethanol plant's existing farmer network to collect cobs. We are also looking to eliminate the use of fossil fuels by processing waste streams from the cellulosic ethanol process to energy to power the entire plant.

This approach will allow rapid deployment of the cellulosic ethanol process across an expansive corn ethanol base through a "bolt-on" approach. POET is implementing this strategy through what is called Project LIBERTY, an integrated corn and cellulose biorefinery.

Project LIBERTY will transform POET Biorefining-Emmetsburg, an existing dry mill ethanol plant located in northwest, Iowa, into an integrated corn-to-ethanol and cellulose-to-ethanol biorefinery. Once complete, this facility will produce 125 million gallons of ethanol, 25 of which will come from the cellulosic feedstocks of corn fiber and corncobs. Project LIBERTY will require almost no fossil fuels to operate. The total cost of the project will be in excess of $200 million. POET is partnered with the Department of Energy whereby the DOE, will contribute up to forty (40) percent, or $80 million, in project costs. Construction is projected to begin on Project LIBERTY in 2009 and become operational in 2011.

STATE OF INDUSTRY

One year ago, there were 123 ethanol plants producing 6.4 billion gallons annually. Today, there are 163 operating plants producing 9.5 gallons of ethanol annually, a 47% increase in capacity. There are an additional 40 plants under construction and 7 plants under expansion that will increase the overall capacity to 13.6 gallons. These are gallons of a domestically produced, renewable product that is displacing millions of barrels of foreign oil.

However, our industry is facing some major challenges. The cost of plant construction has risen dramatically over the years. Just 10 years ago, most ethanol plants' capacity was 10-15 MGPY. POET's first plant was 1 MGPY and was one of the largest in operation at the time. Traditional ethanol plants were built in corn producing states which put incentives in place to stimulate investment by farmers and other local main street investors. Incentives stimulated development of an industry at a time when new interest was sparked by technology advancements. Public policy, which was driving these incentives, was sparked by the oil crisis in the 1970's and the clean air initiatives that followed. The cost per gallon to build and fund working capital for these plants was approximately $1.75 per gallon or a total of $20-25 million dollars.

Those plants are small by today's standards. Most dry mill ethanol facilities are now designed at 50 – 125 MGPY capacity. The cost of an ethanol plant project just five years ago was $1.20 per gallon capacity. Today, the design and construction costs exceed $2 per gallon, reaching upwards of $250 million to $300 million or more to deliver a completed project. The significant increase is due to inflation of construction materials and labor. Most notably are stainless, steel, concrete, other metals and qualified, skilled, manpower.

Construction for cellulosic ethanol plants is expected to be even higher. For Project LIBERTY, we are expecting costs to exceed $200,000,000 to add 25 million gallons of cellulosic ethanol production to an existing site with existing infrastructure. That equates to $8 per gallon. Early cellulosic development will be expensive not only with plant costs, but in biomass collection, storage and transportation as well.

The ethanol industry has been the target of a public relations defamation campaign that has severely damaged our industry's reputation. This campaign has inaccurately pitted food against fuel. Indeed, food prices have risen recently. However, many international and domestic factors such as the doubling of energy prices, skyrocketing transportation costs, oil based packaging cost increases, world raw-material demand growth led by China and India's emerging middle-class, a weak U.S. dollar, global droughts, specifically wheat crops in Australia in the past couple of years, and the significant rise of index fund speculation driven by investor inflation fears, have all contributed most significantly to these unprecedented price increases in commodities over the past two years.

A prime example is the recent fluctuation in corn prices. In 2008, the price of a bushel of corn has risen from $4.80 to nearly $8.00 only to drop back to the mid $5.00 range within the last 6 weeks. This price change means that corn has gained and then subsequently lost one-third of its total product value. All of this price fluctuation has occurred while corn demand has remained basically unchanged. The divergence of market fundamentals and price has been due to the historic rise of speculative trading volume in commodity markets, not ethanol production. Even the President's own Counsel of Economic Advisors attributed 97% of the food price increases to factors other than ethanol production.

Food or fuel is not a choice we have to make. It does not need to be one or the other. It can be both. And it will be both if we have the will to do so.

Energy independence for the United States can be a reality. Brazil is a good example of what can be done. What they have done with ethanol and how they have changed their entire energy platform is something we should applaud and use as a model here in the United States. They have shown a great deal of commitment. It is important to note they used their own natural resources to lessen their dependency on oil. In the U.S, we should do the same.

The U.S. has an incredible natural resource of biomass. We could be considered to be the Saudi Arabia of biomass. For a number of years U.S. farmers overproduced grain and sold it at a hefty loss while the U.S. taxpayer made up the difference in the form of farm subsidies. Now, with the growth of biofuels, another market has been created for grain allowing grain prices to be above the cost of production for the first time in decades. This is already creating a worldwide explosion of agriculture. According to the *World Agricultural Supply and Demand Estimates* (WASDE) report from August 12, 2008, world grain production is projected to set a new record in 2008/09. It is projected to be up 3.5 percent over last year and 9.3 percent higher than two years ago.

A recent study from Stanford University showed there is over one billion acres of idled farmland around the world. This will soon go into production since the farmer can now make a profit on his labor. We are already seeing record agriculture investments in Africa. The idled farmland around the world (not rainforests) has the potential to replace nearly all of the world's gasoline usage if it were to be used to produce ethanol.

With these tremendous opportunities, agriculture companies are investing heavily in new technologies to improve productivity. DuPont predicts corn yields will increase by 40% in the next 7 years. And Monsanto forecasts 300 bushel per acre corn by 2030.

With these yield improvements, grain-based ethanol has the potential to continue to grow by leaps and bounds without substantially increasing food prices. We believe we could produce 50 billion gallons of grain based ethanol per year here in the U.S. in the next two decades.

Grain ethanol production is also getting more efficient and more environmentally friendly. According to a recent study by Argonne Laboratories, in just the last five years, the dry-mill ethanol industry has reduced energy consumption by 22% and water usage by 26%. Developments are also being made to reduce and possibly eliminate natural gas usage by the biorefineries.

One example is our plant in Chancellor, SD which in the next couple of weeks will commission a solid fuel boiler that will burn wood waste to power 60% of the plant's power needs. A pipeline is also being installed to a nearby landfill which will pipe methane gas to the biorefinery. Eventually, this will replace nearly all of the plant's natural gas usage. After these technologies are employed, ethanol will use less than one-third the amount of fossil fuel energy as gasoline to deliver one BTU to an automobile.

POET has been in the ethanol industry over twenty years and our technologies have continued to improve along the way. What is exciting is that we continue to discover new opportunities to improve our processes. The ethanol industry continues to improve by making the process more efficient, becoming more environmentally friendly and utilizing new sources of renewable feedstocks.

The grain-based ethanol industry is also the foundation for cellulosic ethanol. This dream gets closer to reality every single day. A report from DOE / USDA showed there is over one billion tons of available biomass in this country. This biomass can eventually be turned into energy – a tremendous amount of energy – if our nation is committed to do so. This also presents an incredible new opportunity for agriculture around the country. As a great deal of this biomass is in the form of agricultural residue, this presents a new income stream for farmers, new investment in equipment and new jobs.

One billion tons of biomass has the potential to turn into 85 billion gallons of cellulosic ethanol annually. If you combine this with the grain-based ethanol opportunity, we could eventually produce 135 billion gallons of ethanol, which is over 90 percent of our nation's gasoline usage!

Also, the biorefinery of tomorrow will be producing several other products in addition to ethanol and distillers' grains. Our research team is making strides in developing other biotech products. As many products have developed from petroleum, many additional goods will come from the renewable resources we use to make ethanol. For example, biochemical, neutraceuticals, specialty proteins and biopolymers will one-day be produced at the same biorefinery that today produces ethanol and distillers' grains.

The resources are right here is the U.S. to make this happen. However, an issue that clearly needs to be understood is that there is currently a small market for ethanol in the U.S. Contrary to many beliefs, there is not an undersupply of ethanol today; but rather, an oversupply. That is why ethanol is selling for approximately one dollar under gasoline right now. (This does not even include the tax credit the blenders receive.)

Since most of the vehicles in this country are only for E10, we are essentially limited to ten percent of the gasoline supply. This is commonly referred to as the "blend wall". The current gasoline usage in the United States is approximately 140 billion gallons annually. Ten percent of that is 14 billion gallons. However, it's not realistic to penetrate every single gallon, so experts predict the blend wall to be around 12.5 billion gallons. We expect to crash into this wall sometime in 2009.

Flex fuel vehicles along with higher blends of ethanol are certainly a big part of the long-term solution. But this will take several years to accomplish. To continue on the path of reducing our dependence on foreign oil, higher blends of ethanol are needed today. If the ethanol market is allowed to expand, investors will have the confidence they need to continue to invest in cellulosic ethanol production. Without higher blends, there is literally no place for any additional ethanol to go which will threaten the development of the commercial cellulosic ethanol industry.

Additionally, there has been much recent discussion on removing the tariff on Brazilian ethanol. If foreign ethanol were allowed to enter this country without a tariff as the U.S. ethanol industry is approaching the blend wall, the goal for energy independence will be set back decades. The U.S. biofuels industry will be crushed. Investment has already slowed down considerably due to the blend wall. With tariff-free, Brazilian ethanol entering our country, investment will cease. And this will apply to not only grain-based ethanol, but cellulosic ethanol development as well. Additionally, if the tariff were to be dropped, the U.S. taxpayer would actually be subsidizing Brazilian ethanol because its use would be subject to the blender's tax credit just the same as U.S. produced ethanol.

That doesn't make much sense. And why would we want to trade a dependence on foreign oil with a dependence on foreign ethanol?

POET is one of the leading developers of cellulosic technology. We have invested tens of millions of dollars in cellulosic ethanol research and are prepared to invest hundreds of millions more to make this a reality. The commercialization of cellulosic ethanol is not far off. POET announced last week it will be producing cellulosic ethanol at our pilot scale facility later this year at Scotland, South Dakota. Construction of our commercial scale facility in Emmetsburg, IA is scheduled to begin in 2009. The plant is expected to commence commercial production in 2011.

But if we are suddenly faced with an influx of Brazilian ethanol in our market while we are simultaneously running into an ethanol blend wall, we will not be able to see this dream become a reality. Nor will the many others who are diligently working on this process.

The bottom line is; there is not an ethanol supply problem in the U.S. There is a market problem with the 10% blend. So, foreign ethanol will not replace even one single gallon of foreign oil. Instead, every gallon of foreign ethanol will displace a gallon of U.S. produced ethanol. And this will cripple the future of the U.S. biofuels industry. That should not be an option.

Few will argue that our nation's dependency on foreign oil is a dangerous situation. Ethanol is clearly the most readily available fuel to compete with oil. How can the solution to the problem of dependence on foreign energy be dependence on a new foreign energy?

RECOMMENDATIONS

If we truly wish to see a change in our nation's transportation fuel supply, we need to do the following:

1. Create a larger market for ethanol by allowing higher blends in today's vehicle fleet. The 10% blend wall will stop investment in both grain-based and cellulose-based ethanol development.

2. Mandate that all new vehicles are flex fuel. It takes 17 years to convert our automobile fleet. It is minimal cost to make a new car flex fuel and we should not delay this any longer.

3. Incentivize the installation of blender pumps throughout the nation. Blender pumps give the consumer the choice of multiple ethanol blends. We need to allow the American consumer to choose his or her fuel blend based on performance and price.

4. Support cellulosic development. The recent Farm Bill has three important provisions that will help which USDA needs to implement on a timely basis:
    a. Loan Guarantee
    b. Repowering
    c. Harvesting, storage and transportation

5. We need to focus on a U.S. solution. The natural resources are available. It is important we continue to support the upstart biofuels industry. Today's grain-based ethanol is the foundation for cellulosic ethanol. The tax credit and tariff are critical pieces of legislation that will allow the nation's energy potential to be fully realized.

The U.S. ethanol industry has demonstrated in the past that we can meet the challenge and we stand by ready to do so in the future. Make no mistake; this problem is solvable in the United States. The natural resources, ingenuity and technology are all right here. We simply need our nation's will.

SUMMARY

Thank you for the opportunity to testify today. On behalf of POET and the entire renewable fuels industry, we thank you for past legislation that is truly making a difference in our nation's energy supply.

POET looks forward to working in partnership with the Congress and the Administration to reach the national goal of 36 billion gallons of renewable fuel produced per year by the year 2022.

Food, Feed, and Fuel Production: Today and Tomorrow

Presented by: Mr. David Moody
President, Iowa Pork Producers Association

FIELD HEARING OF THE SENATE COMMITTEE ON AGRICULTURE, NUTRITION & FORESTRY

The Honorable Senator Tom Harkin, Chairman

MONDAY, AUGUST 18, 2008
9:00 AM
CAMPUS OF UNIVERSTIY OF NEBRASKA – OMAHA
OMAHA, NEBRASKA

Thank you for the invitation to this hearing. My name is David Moody and I am the President of the Iowa Pork Producers Association. I am a pork producer from Nevada, Iowa.

We've all heard about "perfect storms" and many in agriculture are being forced to respond to issues beyond their control. We are at important cross roads in American agriculture where we must work cooperatively to produce food, feed and fuel simultaneously.

Crop Progress - Today

Just last week USDA released the August crop report and it appears the condition of the crop has improved from previous months. During the next few weeks, farmers will begin to focus on weather conditions to mature the current crop such as rain, heat, and frost. And as you will learn from others, these demand - supply issues will persist for the next several years.

This year's demand - supply situation has resulted in dramatic and rapid changes in commodity prices. For example, we have seen record prices for cattle and hogs this summer, but many livestock farms can't break even because of rising input costs. As a farmer myself, the same fears of input cost inflation will probably affect grain farming next year.

Earlier this summer corn reached $7.00 per bushel. However, it has recently dropped over two dollars per bushel in a short time frame. That rapid increase and decrease has resulted in tremendous stress amongst farmers, lenders, grain merchandisers, consumers and others. To say this year has been a wild rodeo ride in agriculture is an understatement.

Moving Forward

The demand – supply issues for row crops has highlighted needs to balance important end uses for our crops. The cause of tight supplies includes the cool wet spring, delayed crop progress, flooding, a weak dollar and high energy costs. As margins for livestock and ethanol production have eroded, we must all look for new approaches to improve efficiencies.

While we may have averted disaster this year, we need to begin looking at policy options for the future. One of the most encouraging is corn fractionation for ethanol production. Fractionation is high speed separation of the corn kernel into its four basic components so the parts can be used more efficiently.

It is currently very expensive to implement fractionation at ethanol plants and we want to help develop support for the adoption of this new technology. Congress should begin by investing in different approaches and demonstrations and then letting the industry adopt the technologies which show the greatest promise. Frankly, this technology shows more promise in the short term than cellulosic based ethanol.

We believe this presents the whole agricultural community and this nation with a win/win opportunity. When used in ethanol production, it helps reduce energy consumption, reduces transportation costs for co-products, reduces water consumption, increases ethanol production and will help create a greater number of high value co-products.

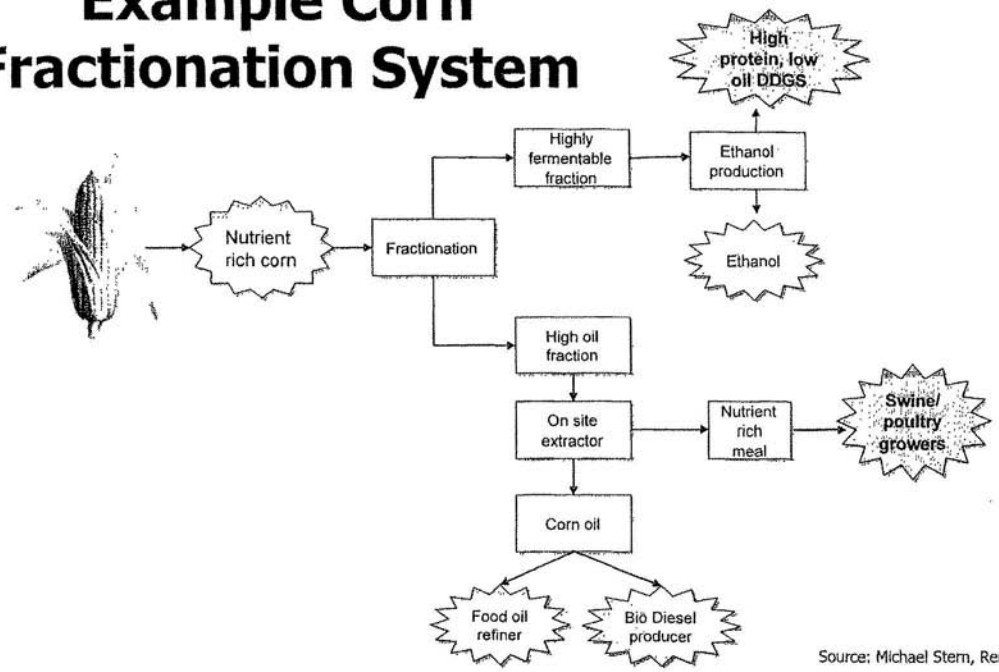
We must also support our research institutions with on-going scientific feed trials to ensure co-products can be used in feed accurately and the feeding value can be publicly documented. As new co-products are developed, feed documentation will continually need support, regardless of the livestock being fed.

Other Policy Options

Many other approaches have been discussed such as early release of CRP acres. I want to thank all the Senators who joined Chairman Harkin and Senator Grassley for supporting the early release of CRP acres for haying and grazing. Also, the preventative planting dates and crop insurance adjustments should be reviewed to help make sure flooded farmland can be planted to alternative crops. And finally, the Texas waiver request to EPA is now decided, is behind us and other panelists here today can discuss the decision in greater detail.

In summary, Congress can take a giant step forward by investing in projects and policies which will more efficiently produce food, feed and fuel simultaneously. Thank you for considering our thoughts and I would be happy to answer any questions.

Example Corn Fractionation System



Source: Michael Stern, Renessen

DEAN C. OESTREICH, CHAIRMAN
PIONEER HI-BRED INTERNATIONAL, INC.
VICE PRESIDENT-DUPONT

Dean Oestreich joined Pioneer in 1974 as a corn breeder after graduating from the University of Minnesota with a degree in agronomy. Dean held positions in Information Management between 1980 and 1990. He became director of Worldwide Parent Seed in 1990. After three years in this role, Dean was named Supply Management director responsible for seed production operations in Latin America, Africa, Asia, Middle East, and Pacific.

Dean was named vice president for the Africa, Middle East, Asia and Pacific business in 1999. He became vice president of global production operations in 2001 and was named vice president and business director, North America Operations in 2002. Dean became the 10th president of Pioneer in January 2004. He was named chairman November 2007.

He is a director-at-large for the American Seed Trade Association and a director for the Chinese Cultural Center of America. Dean is a member of the Iowa Business Council and serves on the executive committee of the Biosciences Alliance of Iowa, as well as the Board of Trustees for the Civic Center of Greater Des Moines.

STATEMENT OF DEAN OESTREICH
CHAIRMAN, PIONEER HI-BRED
VICE-PRESIDENT, DUPONT AGRICULTURE AND NUTRITION

SENATE AGRICULTURE COMMITTEE HEARING
AUGUST 18, 2008

Chairman Harkin, members of the Committee, thank you for the opportunity to address an issue that is on the minds of so many Americans and others around the globe: meeting the world's food, feed and fuel needs. Pioneer, and our parent company, DuPont, are deeply concerned about this issue and are actively engaged in identifying solutions. From discovering ways to produce more grain to adequately meet these needs, to helping farmers around the globe be more successful and profitable in agriculture, DuPont is using science to deliver solutions to this issue. Policies should help us expand agricultural productivity worldwide. I look forward to working with you as you seek to craft effective U.S. policies to expand global agricultural productivity.

Specifically, I have been asked to share our perspective on the role that increasing ag productivity can play in meeting the world's needs for food and fuel. I want to be clear: we fundamentally believe that agriculture **can** provide for the world's food, feed and fuel needs. We do not need to choose among any of these priorities.

Pioneer Hi-Bred is the world's leading supplier of advanced plant genetics to farmers around the world. I have the privilege of serving as Chairman of Pioneer. When our business was founded in 1926 by Henry Wallace, former Secretary of Agriculture under President Franklin Roosevelt, increased farmer success through productivity was the foundation of Pioneer's inception and continues to be a guiding principle for us. The track record of American agriculture keeping pace with global demands since 1926 is impressive and one in which we are proud to have played a key part.

At that time, for example, corn yields in the U.S. were about 27 bushels per acre. Since then, corn yields have increased dramatically – today the average yield in this country is about 150 bushels per acre. These gains have come from steadily improving plant varieties that yield more, require less inputs, and are more resistant to insects, disease and bad weather. Over this same time period, the global population has increased to approximately 6.5 billion and nearly one to two billion inhabitants are projected to be added every 12 to 15 years. And yet, these dramatic yield increases were achieved with only minimal increases in acres planted. In the last ten years for example, global corn production has increased by 32%, global soybean production has increased 56%, but the total acres of land used for such production has increased only 6%. Advances in technology and agricultural productivity have created nearly 150 million "virtual acres" in the US in the past quarter century.

And through increased investment in research and strong intellectual property protection to promote agricultural innovations, we will continue to help the United States keep pace with rapidly expanding global population and production demands.

It is important to note that, unfortunately, much of the rest of world is far behind the U.S. in productivity increases. Today, farmers in some regions reach only 20% of the productivity levels enjoyed by farmers in the U.S., because they lack access to modern seeds and farming methods, credit, technology, collaborative extension services, and global markets. This means there is tremendous opportunity to expand agricultural production in the world to meet our food, feed and fuel needs.

Many barriers exist that prevent or limit access to much-needed inputs in the developing world. In particular, I am referring to: access to credit, access to improved seeds and chemicals, limited product and agronomic knowledge, and lack of secure land tenure. The good news is that every single one of these limitations can be overcome. It is important to create and support policies that promote investment in global agriculture, which will strengthen the US economy and help farmers in developing countries be more successful also.

For example, lack of access to credit and risk management products, such as insurance, is a major obstacle for small-scale farmers in developing countries. They need lines of credit to invest in quality inputs and to purchase or lease land. And access to insurance programs can help reduce their vulnerability and increase incentives to invest. Many innovative pilot programs have had great success in spurring development.

For example, in Malawi, an innovative program launched in 2005 for groundnut farmers, helps them obtain certified seed, which resist disease, thereby increasing yields and profits. In addition, the National Smallholders Farmers Association of Malawi designed the index-based weather insurance contract. This program was a collaboration among several entities and ensures that if a drought leads to insufficient groundnut production, the bank pays the loans of insured farmers directly.

If there is no drought, the farmers benefit from selling the higher-value production. This is the first time that such index-based weather insurance policies have been sold to smallholder farmers in Africa. In 2003, a similar pilot was started in India, and has been expanded to more than 250,000 farmers.

These programs provide much needed security to farmers, which encourages investment and expanded development. Programs like these need to be replicated and scaled up.

Having access to the best inputs is also critical. Modern technologies can accelerate the development of seeds that better tolerate drought and salinity; utilize nitrogen more efficiently; resist pests and diseases; and provide improved nutrition. Public and private researchers should collaborate to speed development of these technologies. And governments should pave the way for the introduction and accessibility of these

technologies. Our focus should be on providing farmers with a reliable and competitive choice of quality inputs so that they can prosper, not just survive.

Access to quality inputs in developing countries is just part of the answer. Having access to quality extension services and agronomy programs, which are necessary to empower farmers to make product choices, based on what they can see works in their own environment, are essential.

Whether internationally or domestically, advanced plant breeding, biotechnology and other innovations hold potential to continue the impressive productivity gains that farmers have demonstrated by delivering more bushels per acre with reduced water and fertilizer resources per unit of production. Improvements in technology and breeding hold promise to improve grain quality as well as quantity. By producing wholesome, disease-resistant grain, farmers experience reduced levels of grain damage and waste in the harvesting, handling, transportation and storage processes used in modern grain production. High quality grain, when combined with new, more efficient biofuels production technologies can maximize the energy output per acre and provide valuable feed co-products to support a healthy livestock industry.

Pioneer believes that increased productivity is a fundamental component of meeting food and fuel needs and we are committed to enhancing the productivity of the biofuels industry. We are taking a holistic approach that focuses not only on overall corn grain yield per acre, but also on increasing yield and co-product value per bushel. For example, by developing hybrids that produce grain ideally suited for ethanol production, it is possible to produce more ethanol from a bushel of grain. Furthermore, Pioneer developed the first grain assay to accurately predict ethanol yield in corn. We have found a 7 percent variation in ethanol yield potential among our corn hybrids. In 2007, more than 180 Pioneer ethanol hybrids were identified as part of our overall Pioneer IndustrySelect® program to maximize the productivity of our seed products and bring our customers greater value.

In addition to improving the ethanol potential of grain, Pioneer also is researching ways to enhance the value of feed co-products, since nearly one-third of grain used to produce ethanol enters the feed stream as a co-product, Pioneer researchers are targeting discovery research efforts to increase the amount of fermentable starch in corn, as well as increase the feed value of distillers' grain. We are working with ethanol processors and input suppliers (enzyme companies) to better understand ways to improve overall process efficiency by matching our product development targets with processing technologies of the future.

Furthermore, we are also developing crops to have added value in the growing biodiesel industry. Canola hybrids have been developed that have substantially higher levels of oil, the primary ingredient in biodiesel production. Pioneer has characterized high-yielding soybean products for higher oil and protein levels, ideal for meeting the needs of the soy biodiesel market.

DuPont has a significant effort to deliver new technologies to the growing biofuels market. In addition to improving corn for ethanol production, DuPont is developing and supplying new technologies to facilitate the conversion of cellulose to biofuels. Next year, we will start up a pilot plant to produce ethanol from corn stover and switchgrass, further expanding the fuel production and efficiency from existing acreage and allowing us to make biofuels from non-food feedstocks. The company also is developing biobutanol, a high performance biofuel with improved performance characteristics, including better fuel mileage and compatibility with existing fueling infrastructure.

In conclusion, I urge the members of this Committee to remember that America's farmers and our agriculture industry have a long history of effectively meeting food, feed and fuel needs. And certainly, Pioneer and DuPont are not the only companies in the input side of production agriculture who are working to find innovative and sustainable ways of meeting these needs. As you know, we have recently joined with ADM, John Deere, Monsanto and the Renewable Fuels Association to form the Alliance for Abundant Food and Energy, dedicated to sustainably and responsibly improving diets around the globe and reducing dependence on fossil fuels through agriculture productivity worldwide. We can continue to do so if we promote scientific advances and effectively use these new tools to build on our successes. But our focus cannot just be on the U.S. ag industry and economy. We must also do more to increase productivity in other countries, particularly the developing world, through greater access to inputs, affordable credit, robust extension services, as well as increased research and development through collaborations.

Pioneer and DuPont are committed to working with you and your colleagues in Congress to do our part to help our nation's farmers meet global food and fuel needs.

Thank you, and I would be glad to answer any questions.

Testimony of Tim Recker
President, Iowa Corn Growers Association
Aug. 18, 2008
Omaha, Nebraska

My name is Tim Recker. I am a corn grower from Arlington, Iowa, and President of the Iowa Corn Growers Association. I am speaking today on behalf of the Iowa Corn Growers Association, the Nebraska Corn Growers Association, the Nebraska Corn Board and the National Corn Growers Association, which represent more than 59,000 corn growers nationwide, many of whom are also livestock producers.

We welcome this hearing and your leadership in confronting the repeated misinformation in the media regarding ethanol. America's corn growers will continue to provide the food, feed, and fuel our country needs.

For decades, corn growers have contributed time, effort, and precious dollars to promote and diversify the uses of corn. Over 30 years ago, corn growers recognized ethanol's potential for producers and American consumers. Through our corn checkoffs, we have spent millions on ethanol research, education, and market development. Through our grower associations, we have spent endless hours promoting policies that would give ethanol a chance – because if given a chance, we knew ethanol would succeed.

Today, our agricultural economy and our nation's consumers are benefiting from our hard work. We've left behind the government support payments that idled acres to reduce production, and we've ended government ownership of huge surplus grain stocks. Our corn farmers are producing for the marketplace and the market is working. We have come a long way from a 4 billion bushel corn carry-over in the mid-1980's, when we depended on government programs but still saw an exodus of farmers and a wave of rural bank closings.

Today's atmosphere of uncertainty and change, while challenging, is much better for farmers. The world is hungry for both protein and petroleum, and the American corn grower can help satisfy both in the form of energy from ethanol and protein from corn-fed red meat and poultry.

Across rural America, an industry is still in development to turn our corn into ethanol. In the process, it is creating jobs that give our young people a chance to come back to their home communities. It is improving the tax base that supports our local schools and government services. It is pumping renewed economic life into the Main Streets and prompting new local businesses.

Across rural America, corn growers are benefiting the environment by growing more corn with less erosion while at the same time reducing fertilizer and pesticide

applications. While benefiting the environment in these ways, we continue to deliver the most abundant, safest, and cheapest food supply in the world.

And what about consumers? In this time of high oil prices, when families are foregoing vacations and worrying about winter heating costs because the dollar just doesn't stretch, ethanol is helping to reduce the pressure on family budgets.

This issue is basic supply-and-demand economics – when the supply of a product is too tight, prices go up, and when supplies increase, prices come down, or won't go as high.

Using ethanol increases our overall energy supply. Using ethanol in the standard E10 blend means that for every ten gallons of gasoline, we have 11 gallons of fuel at the pump. Use E85 in a flexfuel vehicle and for every three gallons of gasoline, we have 20 gallons of fuel at the pump.

I've provided citations for economic analyses that demonstrate what I'm saying. I'll just summarize by pointing out that Midwestern consumers are saving about 45 cents on every gallon of fuel they buy because we have ethanol in the marketplace.

It's no wonder that Congress, in its wisdom and with leadership from Senators like yourself, passed the Renewable Fuels Standard. The RFS is good policy for U.S. consumers, just as it is good policy for corn growers.

Not surprisingly, there are those who want to roll back the RFS and other key ethanol policies such as the blenders credit and the ethanol import tariff. Some believe the misinformation about our food supply, and some buy into the misinformation about how the price of corn or ethanol policies are affecting consumer food and livestock prices. Today, I would like to set the record straight:

Corn supplies and cost:

Despite the alarmist projections of the past spring and winter, USDA's August 12 production report shows the U.S. nearing the second-largest corn crop in history in the face of this year's extreme weather. The same day, the World Agricultural Supply and Demand Estimates projected greater carryover stocks at both the national and international level. Though ethanol's opponents raised alarms about the possibility of $8 corn as recently as August 12, the average farm gate price for the current market year is now estimated at $4.25 per bushel and the average for 2008/09 is projected at $4.90 to $5.90.

The U.S. corn industry is making good on its commitment to supply adequate corn for food, feed, and fuel use. We continue to sustain higher yields – in fact, the rate of yield increases is on an upward trend, reflecting not only better seed technology, but ongoing improvements in production. Fifty years ago, we produced 66 bushels per acre in Iowa. This year, under weather challenges, we will still produce 171 bushels, and seed

genetics experts tell us 300 bushels per acre is a realistic target within the foreseeable future.

Corn Prices and the Livestock Industry:

There's no question that livestock feeders have struggled to manage this year's spike in corn prices. In many cases, our corn growers are also livestock producers. Corn growers support all of agriculture, and we want all segments of agriculture to be profitable. But we believe targeting ethanol is not the solution.

First, many factors have produced this year's corn price spike, and taken together, they are far more significant than corn use for ethanol. One of the biggest factors is the growth in world demand for livestock feed as millions more people in developing economies improve their diets with more meat, milk, and poultry products. That has coincided with tighter supplies of other feed grains, including most notably feed wheat and feed barley from Australia and Europe.

At the same time, a weak U.S. dollar has offset some of the run-up in U.S. corn prices, so that foreign customers continue bidding up corn to prices.

Changing U.S. ethanol policy isn't going to solve the international demand for more feed grains, but it could have an unintended consequence that would damage U.S. livestock producers, especially those who use distillers grain as a feed ingredient.

An effort to reduce corn use for ethanol would reduce the supply of distillers grains – a valuable feed coproduct of the ethanol process. It's important to remember that from the 3 billion bushels of U.S. corn going into ethanol this year, about 30% of the volume will still end up as livestock feed – and for livestock operations located near an ethanol facility, distillers grains has been and will continue to be a valuable feed alternative that can help manage feed costs.

Corn growers support the U.S. livestock industry. We work together with livestock producers on many policy issues. We've spent our checkoff dollars on research to improve feed products like distillers grains, and we've spent even more to help develop export markets for beef, pork, and lamb. For example, we're trying to help recover meat export markets like Japan and Korea, where the U.S. cattle industry is down $50 million a week in lost sales. One way we want to help the livestock industry is by solving export problems like these.

Corn Prices and the Consumer:

Ethanol opponents have tried to paint corn prices as the culprit in consumer food prices – but that's just not true. Multiple economic studies have confirmed that other input costs – most notably high oil prices – are the dominant factor in food price increases. In fact, the money consumers save on fuel costs because of ethanol offsets any corn-related increase in food prices by up to $1,500 in the average family budget.

When people realize how little corn goes into their food, they better understand how little corn influences food prices. The share of the food dollar that goes to farmers – all farmers, not just the corn farmer – has been decreasing for decades and is now just under 20 cents.

If you calculate corn's contribution to some specific food items, you learn that when corn costs $4 per bushel, the corn to produce a gallon of milk costs just 13 cents at the farm gate. Only 18 cents worth of corn gets you a quarter-pound hamburger, 28 cents produces a dozen eggs, and 31 cents goes into the one-pound Iowa pork chop we're so proud of. In fact, a bowl of corn flakes and milk for breakfast has less than two cents worth of corn.

To summarize – we're growing corn that our nation and the world needs. We're supplying enough for food, feed, and fuel. U.S. and world consumers are better off because we are profitable – and there is no rational excuse for the attacks on the RFS, the ethanol tariff, or the blenders credit. On behalf of 59,000 corn growers, we urge you to do all you can to retain these key ethanol policies.

Economic Studies:

"Ethanol and Food Prices: Preliminary Assessment," Richard K. Perrin, University of Nebraska, April, 2008.

"The Effects of Ethanol on Texas Food and Feed," Agricultural & Food Policy Center, Texas A&M University, April 10, 2008

"Global Agricultural Supply and Demand: Factors Contributing to the Recent Increase in Food Commodity Prices," Ronald Trostle, USDA/ERS, May, 2008

"High Agricultural Commodity Prices: What Are the Issues?" CRS Report for Congress, Randy Schnepf, May 6, 2008.

"USDA Officials Briefing with Reporters on the Case for Food and Fuel USA," May 19, 2008, Washington, DC.

"The Impact of Ethanol Production on U.S. and Regional Gasoline Prices and on the Profitability of the U.S. Oil Refinery Industry," Xiaodong Du and Dermot J. Hayes, Iowa State University

DOCUMENTS SUBMITTED FOR THE RECORD

AUGUST 18, 2008

Association of Nebraska Ethanol Producers

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Vice President
Chris Standlee

Secretary
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Executive Director
Loran Schmit

August 18, 2008

U. S. Senator Tom Harkin
Chairman, Agriculture Committee and
Members of the Agriculture Committee
731 Hart Office Bldg.
Washington, DC 20510

Dear Chairman Harkin and Members of the Agriculture Committee:

Thank you for holding this hearing in Omaha. All of the Members of the Association of Nebraska Ethanol Producers appreciate the support that you and Senator Nelson have provided to the ethanol industry.

It has been more than thirty years since the OPEC Oil Embargo which was a notice to the United States that our reliance upon imported fuels as the major source of energy for this country could be a mistake. Many years have passed since that time and although the Congress has taken some significant steps to encourage the development of alternative fuels and, specifically, ethanol, it was not until 2005 that Congress passed the first bill which recognized the necessity of establishing a definite amount of ethanol to be blended with gasoline. The 2007 Energy Bill further expanded those goals. We were, therefore, disappointed when certain Members of Congress asked Administrator Johnson of the Environmental Protection Agency to reconsider those goals. Wisely, Administrator Johnson rejected those requests.

The Congress is now encouraging the development of additional sources of alternative energy. An alternative energy plan approved by the Congress must not be reversed upon the whim of a few Members of Congress. To be effective, an alternative energy plan must be followed through with consistency.

The ethanol industry is making major investments in developing new technology. A leader in the ethanol industry has a small scale ethanol plant, which today, is making ethanol from corn cobs. This is a major step in the development of cellulosic ethanol. Another ethanol industry leader, mindful of the argument, "food or fuel", has made great progress in producing high value products including food grade protein and corn oil. Several other companies have developed fractionation systems that increase ethanol production, reduce energy requirements and produce additional high quality products.

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August 18, 2008
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The proposal to reduce the RFS goals, even though rejected by Administrator Johnson, raises a red flag to all developers of alternative energy. If the United States is to become energy independent, we must not have a 'stop and go' policy. The Congress must make it clear that this country will reduce its dependence upon foreign oil by every possible means. We must produce more oil from our own resources. We must also encourage the development of alternative fuels. The present opposition to the use of corn as a feedstock for ethanol based upon the false presumption that we can only produce food or fuel is a mistake.

The livestock industry which has benefited from low priced corn for decades is enthusiastic about the use of distillers grains in their feed rations. A few producers who complain about government support for the ethanol industry forget that import quotas established by Congress have protected U.S. livestock producers for many years.

We have increased the production of corn in Nebraska and in this country since 1990 at a rate that exceeds the consumption of corn for ethanol. Seed Corn Companies have assured me that they can further increase the production of corn per acre far beyond present production levels. This does not mean that we should not continue to research the development of ethanol from other sources.

The most effective action that can be adopted today by Congress is to let the citizens of the United States and the foreign oil producers know that we are going to reduce our dependence on foreign oil and will do so on a permanent basis. I believe that knowledge will cause a reduction in the world price of oil long before new U.S. production reaches the market.

Thank you for the opportunity to present this information.

Sincerely,

Loran Schmit

Loran Schmit, Executive Director
Association of Nebraska Ethanol Producers
cc: U. S. Senator Ben Nelson

TESTIMONY
Before the
U.S. Senate Committee on Agriculture, Nutrition and Forestry

Dave Vander Griend,
President, ICM Corporation
Colwich, Kansas

For the

Clean Fuels Development Coalition

August 18, 2008
Omaha, Nebraska

The Clean Fuels Development Coalition (CFDC) appreciates the opportunity to provide testimony to the Senate Agriculture Committee as you address a number of important issues related to the production of food, feed, and fuel.

My name is Dave Vander Griend, President of ICM Corporation in Colwich, Kansas. I am submitting this testimony on behalf of the Clean Fuels Development Coalition and our member companies and organizations.

CFDC is a broad based organization supporting the development of domestic and renewable transportation fuels, with a particular emphasis on ethanol. The organization is a true coalition with membership that includes ethanol producers, technology developers, research and development groups, design-build companies, automobile manufacturers, and many other interested parties. Now in its 21st year of operation, CFDC has been part of the phenomenal growth of the biofuels industry and has had a direct hand in the formation of many of the federal programs that have been a catalyst for this growth.

We appreciate the leadership role the Senate Agriculture Committee has assumed in helping develop our modern ethanol industry. Strong advocates and good friends like Chairman Harkin and Senator Nelson understand the potential for American agriculture to meet our needs for food, feed, and fuel. We also appreciate the advisory role Senator Nelson has assumed in our ***Ethanol Across America*** Education Program, which he helped establish. We know both of you worked very hard on many of the fuel related provisions in the recently enacted Farm Bill and we believe many of these provisions will serve as a catalyst for the development of new technologies and expanding markets.

As longstanding ethanol supporters, both Senators Harkin and Nelson have been around long enough to truly appreciate the growth in the biofuel arena, and specifically in the amount of ethanol we produce in the U.S. You and other veteran members of the Committee recognize one of the early objectives of the ethanol program was to increase the value and demand for agricultural products. That objective has been achieved thanks to the lower tax rate for ethanol blends, coupled with the certainty provided by the Renewable Fuels Standard (RFS). Billions of dollars in investment have poured into the corn ethanol industry. As that investment has taken place it has also reduced US oil imports, improved the balance of trade, replaced the dangerous additive MTBE, reduced fuel costs to consumers across the country, and reduced federal farm outlays while creating thousands of direct and many thousands more of indirect jobs. Clearly, the US Biofuels program has been a stellar, unquestionable success. With the new farm programs the Committee helped fashion, we can anticipate even more advances in technology due to various research and financial programs you have created.

The challenge before us today, however, is to understand the relationship between the rise in corn prices and the impact biofuel production has had on those prices. Furthermore, it is incumbent on all of us to ensure that as we are meeting objectives of producing domestic energy and revitalization of the rural economy, we are not doing so at the expense of consumers and global food supply.

We welcome the opportunity to provide important information to the Committee to address these and many related issues. I can emphatically demonstrate that the evolution of the biofuels production process is such that we are now able to manufacture human-grade food from the ethanol process while maintaining current yield levels of fuel-grade ethanol. I believe the traditional ethanol process in which we convert the starch portion of corn into ethanol and are left with a high protein co-product is a sound practice. At minimum, one third of the corn used for ethanol production is returned to the feed and food chain through distillers grains. There are three key points I would like to make on our current situation before we go into the exciting advances in technology that will allow us to produce food.

First is that the demand resulting from the expanded RFS certainly has had some impact on the rise in grain prices but it has been minimal. Dozens of studies from both the private and public sector have concluded that oil prices, increased world demand, decreased productivity outside of the US, and rampant speculation have combined to create a definite increase in grain prices. Those factors are correcting themselves and world grain prices are abating even as we speak.

The second point I would like to make is that even with the aforementioned factors driving grain prices, *food* prices have not been affected at nearly the same rate and have actually followed historical average increases. And ethanol has been estimated by USDA to trace back to just 3-4% of those food price increases, meaning 96% of the increase is due to other factors.

Lastly, I would like to note that the increase in the use of corn for ethanol production has not been at the expense of any of our other uses, with reserves, exports, and almost every other category showing an increase. Indeed, increased demand has resulted in increases in yield and technology. CFDC's ***Ethanol Across America*** campaign produces a series of Issue Briefs and recently released a very informative brief on these issues that I would ask be submitted for the record and I have attached to my testimony. Senator Nelson wrote the introduction to that brief and expressed what we all believe to be necessary which is to strike a balance in the use of grain for all of its different applications.

With respect to the future, and moving beyond the traditional—and I want to stress, successful—dry mill technology, there are wonderful things happening in industry.

Many of our member companies are developing various technologies to increase the efficiencies of today's modern ethanol plants, and I would like to share with you what our company (ICM) is doing in this regard. ICM is the leading process-design firm in the world having built two-thirds of the ethanol plants constructed in U.S. over the last decade.

Ethanol is commercially produced in one of two ways, using either the wet mill or dry mill process. Wet milling involves steeping prior to separating the grain kernel into its component parts (germ, fiber, protein and starch) prior to fermentation. ICM-designed plants utilize the dry mill process, where the entire grain kernel is ground into flour. The starch in the flour is converted to ethanol during the fermentation process, while also producing carbon dioxide and dried distillers grains (DDGS) as co-products. The carbon dioxide can be captured (where economics allow) so it can be marketed to the food processing industry for use in carbonated beverages and flash-freezing applications. As noted previously, distillers grains are a valuable livestock feed.

As the corn-to-ethanol industry matures, a changing economic outlook is prompting existing biorefineries to explore means of maintaining financial success in challenging tight-ethanol, high-corn markets. ICM has recognized this changing outlook and developed technology to create "new renewables" that can be built upon the existing dry mill platform – the key facilitator of the new technology is a process called dry fractionation. ICM's dry fractionation system creates new financial opportunities, reduces common expenses, and opens the door for the integration of even more revenue-generating solutions, including

the ability to create food AND fuel. Dry fractionation is also the keystone necessary for the production of cellulosic ethanol from corn fiber, the initial step forward in innovating an entirely new generation of biofuels.

ICM's Dry Fractionation system is the first component of a six-part "Ethanol Biorefinery of the Future" package designed to help the industry achieve long-term success. Additional process technologies are: Solid Fuel Combustion system, Germ-oil Extraction process, Protein Extraction from Germ process, High-value Single-cell Protein Feed from Syrup cultivation and Ethanol from Fiber process.

Dry Fractionation
After cleaning and moisture conditioning, the proprietary dry fractionation process mechanically separates the corn kernel into its three main components: endosperm (the starchy portion comprising most of the inner kernel), germ (the protein- and oil-rich center) and bran (the kernel's fibrous outer layer). More than just producing ethanol, optimizing the whole kernel in this way allows for the production of a host food-grade and feed-grade co-products:

- Endosperm – Ethanol production, food products, high-protein DDGS (competes in same markets as soybean meal), new category of low-fiber/low-oil DDGS suitable for dairy, swine and poultry markets
- Germ – Food-grade corn oil extraction, high-value food-grade protein production, germ cake feedstock, germ fiber-to-ethanol production
- Bran – Food products, feed component, gasification/combustion feedstock to produce heat energy and reduce natural gas usage, feedstock for cellulosic biofuel production

Guaranteed Increase in Ethanol Production Capacity
Dry fractionation reduces the volume of relatively non-fermentable high-fiber and germ coproducts, creating more capacity in fermentation vessels and increasing throughput. For example, a 110 MGY biorefinery employing dry fractionation will be guaranteed at a new rate of 130 MGY. Designed for 24-hour–a-day operation, 353 days per year.

Reduced Natural Gas Consumption
Typically an ethanol facility's second-largest expense, natural gas costs, can be reduced by millions of dollars by integrating dry fractionation and combustion technology at a plant.
DDGS drying typically represents a large part of gas consumption; removing the bulk of the solids handled by the system reduces the dryer load by 50 percent. Additionally, utilizing the bran and syrup as a fuel via combustion eliminates approximately 80 percent of the entire biorefinery's natural gas usage. This reduction lowers the biorefinery's CO2 footprint and also allows ICM to lower its natural gas usage guarantee from 30,000 Btu/Dgal to less than 10,000 Btu/Dgal ethanol.

Decreased Enzyme Usage
The absence of non-fermentable materials makes the cook and liquefaction process more efficient, resulting in increased enzymatic activity and a 20 to 25 percent reduction in enzyme usage.

A Platform for Emerging Technologies
A dry fractionation system is also essential for the implementation of promising emerging technologies, including:

- Starch and protein isolation from endosperm
- Cold-cook technology
- Food-grade oil extraction from germ
- Protein extraction from germ
- Cellulosic fiber conversion

A Bridge to Cellulosic Ethanol
Though commercially feasible cellulosic ethanol is still a few years away, biorefineries integrating dry fractionation equipment today will position themselves to become one of tomorrow's first producers of cellulosic biofuels. The bran produced through fractionation is today's most promising feedstock for near-

term cellulosic ethanol success. Unlike other proposed cellulosic feedstocks, the bran is always readily available at the biorefinery, and it requires no complex harvesting, transportation or storage logistics.

Pilot Biorefinery
ICM currently is constructing a pilot-scale testing facility that is co-located next to a fullscale 50 MGY ethanol plant in St. Joseph, Mo. This production facility at LifeLine Foods, is the proving ground for ICM's "Ethanol Biorefinery of the Future" package, which includes the technology to transform corn fiber to ethanol.

Mr. Chairman, fifty years ago the U.S. fed the world. We will be able to do that again with a food supply brought about by the evolution of ethanol production. The technology, ingenuity, and creative force of American agriculture all coalesce around the production of ethanol. The programs providing the impetus for this progress like the RFS, the lower tax rate for ethanol blends, and the R & D programs of USDA and DOE must be maintained. We can, and must, maximize the contribution of agriculture while creating that bridge to cellulose and advance biofuels.

Thank you for holding this hearing and for the hard work of the committee.

Issue Brief:

The Impact of Ethanol Production on Food, Feed and Fuel

Summer 2008 A Publication of Ethanol Across America

For more than three decades, critics have tried to cast ethanol as a "food versus fuel" argument. The marketplace is a better indicator of grain supply and demand. Statistics simply don't bear out the dire predictions of those who say we must choose between fueling our cars and feeding people. We don't have to make a choice. We can do both. We must do both—and we are.

As we begin, let's recall why the ethanol industry was created in the first place. First, Congress wanted to create a domestic source of energy to help offset the negative economic impact and energy security issues related to imported oil. Second, they wanted to add value to agricultural products and increase profitability for corn producers. We've made significant progress in both areas.

After years of cheap corn, American farmers are finally seeing the fruits of their investment in the ethanol industry as corn prices have surged. For 25 years, corn farmers have worked without getting a raise. Higher grain prices are creating an economic engine for rural America that is re-energizing rural communities and reducing agricultural subsidies.

The *Financial Times* reported in May 2008 that the U.S. "is starting to break its addiction to foreign oil as high prices, more efficient cars, and the use of ethanol significantly cut the share of its oil imports for the first time since 1977. The country's foreign oil dependency is expected to fall from 60 percent to 50 percent in 2015..."

The implementation of the national Renewable Fuels Standard (RFS) is a key factor in expansion of ethanol use nationally. The RFS is also a critical cornerstone for America's energy and economic security as we continue to find ways to produce our own fuels and keep dollars at home. The profound effects of our nation's dependence on imported oil are reverberating throughout our economy—impacting everything from gas prices to manufacturing to consumer spending.

While increases in commodity prices pale in comparison with that of energy costs, there are concerns about the effect of grain demand on food supplies and food prices. As the ethanol industry grows, increased demand for corn will create challenges and opportunities for consumers, livestock producers, policy makers and refiners. As we navigate this sea change in agriculture, energy and economics, these issues can be addressed without inciting emotion and distorted rhetoric.

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Dear Friends:

On behalf of my fellow Ethanol Across America board members, I am pleased to bring to your attention this Issue Brief on the production of ethanol from grain and the facts about its impact on food prices.

At a time of record gasoline prices and increasing U.S. dependence on foreign, unstable sources of energy, the continued development of alternative transportation fuels like ethanol is more important than ever. But, like all resources, we need to make sound decisions on how we use the grain we produce so that we balance the demands for the grain from food production and animal feeding with our goals for producing biofuel. This is a misunderstood issue that can sometimes be emotional as well. As the information presented in this brief illustrates, however, we can meet the needs of both the energy and food sectors. As a Senator from the "Cornhusker" state, I am acutely aware of the needs of our cattle and pork producers as well as our grain farmers. We have a vibrant and productive corn industry that is producing more than ever before, and doing so using less energy, less land and more conservation practices. It is important to remember that the better corn prices received by farmers help revitalize rural communities while, as this brief shows, having very little effect on the prices consumers pay for food.

To complement the continued increase in the production of ethanol, we are working hard to create opportunities for diversifying our biofuel production by utilizing new feedstocks that range from specialty energy crops to waste materials.Corn ethanol is a bridge to many other sources, and this bridge is being built in a responsible manner.

We welcome the thoughtful questions that have been raised regarding ethanol's impact on food and feed. As this brief demonstrates, ample supplies are available to meet the needs of our ethanol producers, animal feeders, and consumers. We appreciate your interest in this important subject and I am confident that by working together we can continue to support American agriculture's ability to supply us with food and fuel.

Sincerely,

E. Benjamin Nelson
U.S. Senate

Ethanol production is not about food vs. fuel. It's about food and fuel—and feed.
When corn is used to make ethanol, just a portion of the corn kernel is consumed—and, in fact, much of the corn is returned to increase the world's supply of livestock feed and human food.

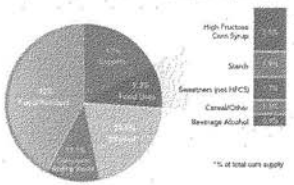
The conversion of grain to ethanol and other co-products is relatively simple. The starch and fiber are converted to ethanol and a variety of other products, depending on the process used.

A 20% reduction in oil prices would lower grain prices by 12%; achieving mandates for biofuel use would reduce grain prices by 1%.
—USDA

Basically, one bushel of corn yields one-third its weight in ethanol; one-third in high protein livestock feed (called "distillers grains"); and one-third in carbon dioxide, which can be used for food and beverage processing and industrial applications. Depending on the ethanol production process, a wide range of food products and ingredients used in pharmaceuticals and industrial applications is also created.

In essence, ethanol plants are "biorefineries" that add value to agricultural products and create greater diversity in terms of the products we can create from a kernel of corn.

U.S. Corn Use, 2007-2008*



*% of total corn supply

How much corn is in a box of corn flakes?
Ethanol critics have focused attention on the effect increased corn use may have on food prices. It's a legitimate issue, but must be put in context.

First we need to make a distinction between the corn used for ethanol and that used for food. Ethanol is made from **field corn**, a grain grown on more than 99 percent of all corn acres. Most field corn is used for livestock feed and ethanol production, while a small portion is processed for corn cereal, cornstarch, corn oil and other ingredients for human consumption.

Field corn is vastly different than the **sweet corn** people purchase fresh, frozen or canned as a vegetable for eating. About 631,000 acres are used to grow sweet corn in the United States versus more than 90 million acres used to raise field corn. Bottom line: The corn we're using to make biofuels is not the corn that people eat. Even the majority of our corn exports are used to feed livestock, not for use as human food.

The raw material in many products is a very small portion of the cost paid by the consumer. According to the United States Department of Agriculture (USDA), the cost of food ingredients represents less than 20 percent of the price paid at the checkout counter. This is especially true in food processing, particularly in the case of grains.

Farmers and livestock producers seldom own the processing factory and typically have little to do with packaging and marketing the product. Costs for these functions are added as the product moves to market. For example, 65% of the retail price of beef and pork goes to the "middle men" involved in the food processing and distribution chain.

According to the Federal Reserve Bank of Kansas City, total costs for labor, energy, marketing, processing, packaging and transportation in the food industry have risen from 67 percent in the 1980s to 80 percent today. In other words, the difference between the farm value and consumer cost for food at grocery stores and restaurants has shifted even more dramatically toward non-farm-related overhead.

The truth about food prices.

There is no question that grain prices have risen dramatically in recent months, but the effect on consumer prices has not been as dire as many predicted. The U.S. Commerce Department Consumer Price Index (CPI) released in April 2007 shows that from January 2006 to March 2007, a timeframe when corn prices nearly doubled, consumer food costs increased by less than average: 2.1 percent compared to the 25-year average of 2.9 percent.

Several studies have shown that ethanol/biofuel impacts on food prices are 2 to 4 percent of the 40 percent increase in prices globally, and about 0.2 percent of the 4 to 5 percent increase in food prices domestically.

"Ethanol is not even the primary driver of corn price increases; it's percent of the increase in corn prices occurred because of higher oil prices."
—Prof. Peter Tyler, UC Davis

An increase in grain prices will have a nominal effect on total household spending. But consider how the cost of gasoline impacts consumer costs. When crude oil moved from $55 per barrel in January 2006 to more than $135 today, gasoline went from a national average of $2.28 per gallon to a budget busting $4.16, *presenting consumers with an 82 percent increase in fuel prices!* That hits the pocketbook hard—making it more expensive to get to the grocery store in the first place.

Consider the more dramatic price increases in diesel fuel to nearly $5 per gallon, which affect every stage of production—from farm tractors to combines, from trucks to processing plants. It is estimated that the average food product is transported 1,500 miles between farm and final consumer.

According to the U.S. Department of Agriculture, higher corn prices increase animal feed and ingredient costs for livestock producers and food processors, but pass through to retail prices at a rate less than 10 percent of the corn price change. A 2008 study by Texas A&M notes: "...the increase in farm level corn prices should be impacting retail food prices very little" due to the fact that much of the cost is associated with processing.

Americans spend a relatively small amount of their disposable incomes on food—about 10 percent. By comparison, Canadian and Japanese consumers spend about 14 percent and the Chinese spend 26 percent.

Historically, food prices have surged during times of higher crude oil prices—and that's exactly what we're seeing right now. Research shows that energy prices are quickly passed through to higher retail food prices. According to nationally recognized economist John Urbanchuk of LECG, LLC, a one dollar per gallon increase in gasoline prices has two to three times more impact on food prices than a one dollar per bushel increase in the price of corn.

Some commodity analysts believe years of cheap corn have actually fueled consolidation in the food processing industry, which can in turn lead to a less competitive marketplace and higher prices.

According to syndicated ag columnist Alan Guebert: "The flood of institutionalized, cheap feed lifted the biggest boats the highest...The cheap feed caused a chain reaction: huge profits funded the continued integration of the meat industry."

If we return to a "cheap corn" scenario, it will likely result in more farmers going out of business, causing even further consolidation in production agriculture.

Ethanol is actually saving money for consumers.
By adding volume to our nation's transportation fuel supply, ethanol is helping put downward pressure on gas prices. Merrill Lynch commodity strategist Francisco Blanch says oil and gasoline prices would be about 15 percent higher if not for biofuels. This translates to a $526 a year savings on gasoline for the average family.

Pundits and food and meat processors have lamented this year's rise in corn prices with little attention to the long-term declining trends in the real price of corn. The implication that rising corn prices warrant grocery store hikes ignores the historical grocery price insensitivity to corn prices.
Food & Water Watch

Numerous studies conclude that U.S. ethanol production increased corn prices by 20 percent since 2004. When one factors in the effect of corn price on retail food price, this means ethanol has increased household spending on retail food items by just $15 per year.

"Higher oil prices affect much more than and the rest of during. They are actually one of the major factors behind higher food costs."
USDA Secretary Ed Schafer

In other words, the average family is saving more than $500 per year thanks to the presence of ethanol in our fuel supply.

Over the past 50 years, corn prices have risen about 250 percent. Over that same period, crude oil prices have risen more than 4,200 percent! If corn prices had risen at the same rate as oil prices, corn would cost $13.50 per bushel today.

A June 2008 analysis by Barclays Capital noted that even at current levels, corn price was still 42 percent below its inflation-adjusted peak in October 1974. "Perhaps instead of asking why commodity prices are so high right now, a more interesting question might be why they were so low for so long," the report says.

Ethanol production helps create more animal protein.
Ethanol critics often overlook the important role of a co-product of ethanol production. About one-third of each corn kernel is converted to distillers grains—a high protein feed for livestock. As the production of ethanol increases, so does the supply of this valuable feed source.

Livestock producers—particularly beef and dairy producers—have incorporated distillers grains into their rations as a replacement for field corn because of the feed's demonstrated superiority in animal performance. Distillers grains also displace a portion of the corn used in swine and poultry rations. Research and technology innovations are underway to increase distillers grains value for these species.

In other words, what was once a market for raw corn has shifted to a market for an ethanol co-product—so ethanol production is also contributing to the production of animal protein to feed the world. The displacement of corn with distillers grains allows corn to be used for other purposes. Additionally, improvement in processing and application of corn and other grains used in ethanol production will serve as a hedge against higher food prices.

By the Numbers

When corn is $2 per bushel, your box of corn flakes includes 2.2¢ worth of corn. When corn is $6 a bushel, your corn flakes contain 6.7¢ of corn. In fact, a 12 ounce box of corn flakes uses less than 10 ounces from a 56 lb. bushel of corn.

A can of soda contains about 2 cents worth of corn sweetener.

Meeting the demand for more corn.

The corn supply is not static—and ethanol is just one factor in the equation. A natural, but incorrect, assumption by many is that the use of corn for ethanol is driving demand. While ethanol is indeed creating new demand, it accounts for just 20 percent of the increase in corn use. (According to numerous studies from the private sector and government, it also accounts for just 20% of the increase in price, with the remaining 80% due to other factors.)

So if ethanol has not caused corn to be in short supply, the question becomes: Why are food prices so high? The overwhelming factor is the price of oil and petroleum products. Add to that the dramatic increase in demand from developing nations such as China, which has a middle class of 300 million people demanding more meat and dairy products, thus requiring feed grains. Add on droughts in Australia, Africa and Argentina—and other global events—and it becomes clear the U.S. ethanol program is hardly the determining factor.

America's farmers are the most efficient and productive in the world. Farmers respond to market signals and will grow the crops that offer the greatest potential for return.

> *A doubling of feed grain and oilseed prices would increase average food prices by less than four percent.*
>
> Joyce Balcombe, Iowa State University

In 2007, U.S. corn farmers produced a record 13.1 billion bushels of corn—and another 1.3 billion surplus bushels were already on hand from 2006. Of that 14.4 billion bushel total, 3.2 billion bushels (22 percent) went into the production of ethanol with one-third of that being returned to markets as feed. It's also important to note that ethanol production is not totally reliant on corn, with other crops such as grain sorghum being used.

> *The price of oil rising from $90 to $100 a barrel is like adding $150 billion in taxes.*
>
> Kenneth Hagen, Farm Journal Magazine

We are definitely using more corn for ethanol but also meeting all other needs for corn, including exporting more than at any time in our history. So how can we do this? How can we increase the demand by 20% for ethanol and increase another 10% for exports? Yield: More corn on the same acreage.

Average corn yield in the U.S. has risen from 126.7 bushels per acre in 1997 to 151.1 bushels per acre in 2007. Based on past performance, average production per acre is projected to hit 173 bushels per acre by 2015, perhaps as high as 180 bushels per acre. Seed technology providers have stated corn production could reach 250 to 300 bushels per acre by 2030.

Based on recent estimates, U.S. corn farmers have the potential to produce 15 to 16 billion bushels annually by 2015—perhaps as much as 18 billion bushels. Of this crop, one-third could be used in ethanol production, providing enough corn for 15 billion to 20 billion gallons of ethanol. That would leave a minimum of 12 billion bushels for livestock feed, human food and export markets—up from 10.4 billion bushels in 2007.

This increased productivity reflects the combination of optimized planting rates, nutrient management and biotechnology that has helped producers reduce the impact of insects, disease and pressure from competitive vegetation. This leads to increased yields and greater consistency from year to year.

Better yet, this increased agronomic productivity has come about without a corresponding increase in the use of fertilizers. According to the ProExporter network, the yield per acre increased 27 percent from 1988 to 2004, yet the average application of nitrogen fertilizer increased just 10 percent during the same period.

Making more ethanol from the same kernel of corn.

Corn will continue to be the domestic feedstock of choice for ethanol production in the near term. A number of advancements in corn and ethanol production are leading to greater efficiency—squeezing more ethanol out of each kernel.

Ethanol yield has already improved from 2.4 gallons per bushel in the 1980s to 2.8 gallons in modern plants. Corn hybrids developed specifically for ethanol production have demonstrated ethanol yield increases of 2.7 percent—and using the cellulose (fiber) in the corn kernel, in addition to the starch, could increase yield by another 10 to 13 percent.

With this combination of hybrid and process optimization, theoretical yields of 3.51 gallons of ethanol per bushel are within reason—with no negative impact on protein or oil content for animal feed uses of the distillers grains.

Ethanol production from other renewable feedstocks.
The Energy Independence and Security Act of 2007 sets a goal of 36 billion gallons of renewable fuels in the United States by 2022—or about 20 to 25 percent of the nation's transportation fuel supply. Only 15 billion gallons of that total can come from corn ethanol. The rest must come from "advanced biofuels," including ethanol derived from cellulosic biomass such as wood waste, grasses, and agricultural wastes.

Making ethanol from corn is a necessary first step toward the technology needed to move into cellulosic sources. The corn ethanol industry has never claimed to be the sole solution to America's domestic energy challenges, but it plays an important and essential role in the nation's energy strategy—and more importantly, it is contributing today.

As cellulose-to-ethanol technologies build on grain-to-ethanol capabilities, America will remain a world leader in ethanol production. From forestry wastes to agriculture residues, from municipal waste to new energy crops, technology innovations will transform renewable resources into ethanol across the nation and around the world.

The geographic expansion of ethanol production beyond the Corn Belt will serve to strengthen America's economy and energy security without jeopardizing our abundant food supplies. The ethanol industry will continue to be a strategic supplier of food, feed and fuel for the future.

The Impact of Fuel Prices vs. Food Prices

The U.S. currently consumes 140 billion gallons of gasoline annually. So a $2.00 increase in the price of gas (such as we have seen recently) represents a $280 billion impact on consumer spending—with many of those dollars flowing to foreign oil producers.

In contrast, about 7 billion bushels of corn are used for food and feed each year. A $2.00 increase in corn prices would have one-tenth the impact of gasoline price swings—if all costs were passed along to consumers. But they are not.

According to a 2007 analysis by the Food and Agricultural Policy Research Institute (FAPRI), the largest drivers of food price inflation in the U.S. would be fruits and vegetables, not corn-based foods (even as ethanol production expands.) In fact, FAPRI suggests that consumer food spending will increase only marginally over the next decade in inflation-adjusted terms.

Increased ethanol production adds volume to the nation's fuel supply. Merrill Lynch says "biofuels are now the single largest contributor to world oil supply growth." This helps soften the impact of gas prices. In fact, the nominal increase projected for food prices over the next ten years should be more than offset by the effect that ethanol will have on the price at the pump. Francisco Blanch, a commodities strategist for Merrill Lynch, estimates that ethanol is lowering gas and oil prices by at least 15 percent.

Moreover, increases in corn prices flow to American farmers, benefiting rural communities and reducing other agricultural subsidies. It has been said that the ethanol industry is the most significant rural development initiative since the Rural Electric Administration brought electricity to the farm. Increased farm income, investment in rural communities and the economic vitality that result will allow rural areas of our nation to contribute not only food, feed and fuel for America's future, but economic growth as well.

This "Food, Feed and Fuel" Issue Brief was produced and is distributed as part of the ***Ethanol Across America*** education campaign.

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Produced in cooperation with the USDA AGRICULTURE

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UNIVERSITY OF Nebraska Lincoln

INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES
Department of Animal Science

July 21, 2008

Honorable E. Benjamin Nelson
720 Hart Senate Office Building
Washington, DC 20510

Honorable Richard Lugar
306 Hart Senate Office Building
Washington, DC 20510-1401

Dear Senators Lugar and Nelson,

As members of the Senate Agriculture Committee, you understand the positive impact of ethanol to the farm sector and rural communities. In recent weeks, much media focus has been put on the impact of ethanol as it relates to food. Specifically, the focus has been on corn, ethanol's impact on corn prices, and a perceived choice made by the US Government to use corn for fuel rather than food.

The vast majority of corn produced in the US is and has been used for livestock feed. When corn is ground for ethanol, only the starch portion of the corn is used to make ethanol. On a dry weight basis, 33% of the corn is left for utilization as livestock feed in the form of distillers grains. The energy value of distillers grains when fed to cattle is as much as 145% that of the original corn[1,2,i] Simply multiplying 33% of the mass times 145% of the value results in a net feed value *after ethanol has been produced* of nearly 50% of the original corn value. For every two bushels of corn ground into ethanol, one bushel of feed equivalent is returned. Even at higher levels of feeding, the value is 43% net value after ethanol production.

Industry standard conversion in a dry mill ethanol plant is 2.8 gallons of ethanol for every bushel of corn. The 15 billion gallons of ethanol demanded by the Renewable Fuels Standard (RFS) in 2015 will therefore require 5.4 billion bushels of corn. Of this, the equivalent of 2.3 to 2.6 billion bushels (43 to 48%) will return to the feed market; netting a 2.8 to 3.1 billion bushel corn consumption.

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The annual corn supply (production plus carry in) in the US increased 3.8 billion bushels from 2002 to 2007.[ii] The total net use of corn for ethanol (2.8 to 3.1 billion bushels) as demanded by the RFS in 2015 is less than the production increase (3.8 billion bushels) between 2002 and 2007. Even with the increased corn demand for ethanol stipulated by the RFS, there is more corn available for food, feed and industrial uses than there was in 2002.

Too often it is forgotten that ethanol production only consumes a portion of the corn used in the production process. From a feed value perspective, 43 to 48% of every bushel used in the production of ethanol is returned to the feed market. Corn production in the US is on pace (based on the comparison of 2007 to 2002) to more than keep up with the net demand (total bushels needed less feed value return of distillers grains) of ethanol as required by the RFS.

Respectfully yours,

Terry Klopfenstein, PhD
University of Nebraska

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[i] Board invited review: Use of distillers by-products in the beef feeding industry. T. J. Klopfenstein, G. E. Erickson and V. R. Bremer.
[ii] Rick Tolman, CEO, National Corn Growers Association, Slide 19 of presentation given May 7, 2008 in St. Louis, Missouri.

QUESTIONS AND ANSWERS

AUGUST 18, 2008

SENATE AGRICULTURE COMMITTEE FIELD HEARING: UNIVERSITY OF NEBRASKA-OMAHA
AUGUST 18, 2008
QUESTIONS FOR THE RECORD: DR. BRUCE BABCOCK

Senator Tom Harkin

1. Given that increasing biofuels production has contributed to higher grain prices, on the one hand, and lower gasoline prices on the other hand, what do you think is the net effect on the average American consumer?

2. Purdue University just released a study of food prices in which they conclude that higher oil prices are responsible for ¾ of the increase in corn prices, and that the tax credit for ethanol blending is responsible for ¼ of the corn price increase. Would you comment on that, please?

3. As you know, there are suggestions being made that we should change our federal biofuels policies. In light of your research, what would be the impacts of changing the Renewable Fuel Standard or the ethanol tax credit or the import tariff?

SENATE AGRICULTURE COMMITTEE FIELD HEARING: UNIVERSITY OF NEBRASKA-OMAHA
AUGUST 18, 2008
QUESTIONS FOR THE RECORD: DR. BRUCE DALE

Senator Tom Harkin

Isn't it true that the private sector is investing pretty heavily in advanced biofuels development?

- What does that say about the appropriate federal role?
- What should we be emphasizing – basic research, technology development, demonstrations, or support for commercial plants -- and at what level of effort?
- And, what should be the scale or budget for that federal support?

SENATE AGRICULTURE COMMITTEE FIELD HEARING: UNIVERSITY OF NEBRASKA-OMAHA
AUGUST 18, 2008
QUESTIONS FOR THE RECORD: DR. THOMAS FOUST

Senator Tom Harkin

1. How certain are we that the advanced biofuel industry will be able to meet the advanced biofuel mandates of the RFS?
   - For example, it calls for 1 billion gallons of cellulosic biofuels by 2013, 3 billion by 2015, and 16 billion by 2022.
   - Will we meet those levels?

2. One of the truly attractive features of algae-based biofuels is that they have truly remarkable productivity potential. I've heard numbers of 10,000, maybe even 15,000 gallons per acre per year. That compares with soy biodiesel around 65, and corn ethanol around 450, and some of the cellulosic pathways such as switchgrass or miscanthus providing yields of 700 to 1,500 gallons per acre per year.

3. Isn't it true that the private sector is investing pretty heavily in advanced biofuels development?
   - What does that say about the appropriate federal role?
   - What should we be emphasizing – basic research, technology development, demonstrations, or support for commercial plants -- and at what level of effort?
   - And, what should be the scale or budget for that federal support?

SENATE AGRICULTURE COMMITTEE FIELD HEARING: UNIVERSITY OF NEBRASKA-OMAHA
AUGUST 18, 2008
QUESTION FOR THE RECORD: MR. JIM JENKINS

Senator Tom Harkin

You recommended broader use of innovative approaches to grazing. Do you have an estimate of what sort of productivity contributions might be possible with those approaches?

SENATE AGRICULTURE COMMITTEE FIELD HEARING: UNIVERSITY OF NEBRASKA-OMAHA
AUGUST 18, 2008
QUESTIONS FOR THE RECORD: MR. BILL LAPP

Senator Tom Harkin

You provided valuable testimony on rising commodity input costs for food manufacturers. Can you also discuss the effects of rising energy costs, including:

1. Direct effects in the form of processing and transportation energy costs, and

2. Indirect effects related to higher oil and gasoline prices leading to increases in the prices of ethanol and biodiesel which in turn increase prices for corn and soybeans?

SENATE AGRICULTURE COMMITTEE FIELD HEARING: UNIVERSITY OF NEBRASKA-OMAHA
AUGUST 18, 2008
QUESTIONS FOR THE RECORD: MR. JEFF LAUTT

Senator Tom Harkin

1. Many of us are looking forward to the success of POET's addition of corn cob processing to your corn ethanol biorefineries. Over time, do you expect adding corn cobs as feedstocks at existing biorefineries will increase or decrease ethanol production costs?

2. Isn't it true that the private sector is investing pretty heavily in advanced biofuels development?
   - What does that say about the appropriate federal role?
   - What should we be emphasizing – basic research, technology development, demonstrations, or support for commercial plants -- and at what level of effort?
   - And, what should be the scale or budget for that federal support?

SENATE AGRICULTURE COMMITTEE FIELD HEARING: UNIVERSITY OF NEBRASKA-OMAHA
AUGUST 18, 2008
QUESTION FOR THE RECORD: MR. DAVE MOODY

Senator Tom Harkin

What percent of the corn component in hog diets can be displaced by DDGS's today, and how much could that percent be increased by use of fractionization technology in biorefineries?

SENATE AGRICULTURE COMMITTEE FIELD HEARING: UNIVERSITY OF NEBRASKA-OMAHA
AUGUST 18, 2008
QUESTIONS FOR THE RECORD: MR. TIM RECKER

Senator Saxby Chambliss

1. Your testimony lists the various factors that are driving demand for corn in the domestic and international market. Of those factors, ethanol is unique in its dependence on government policy for demand, whether it is the renewable fuel standard (RFS) setting a floor for blending into gasoline, the tax credit for making ethanol economically competitive with gasoline or the import tariff reducing the amount of foreign ethanol imported into the United States.

   One of the main critiques of current ethanol policy is the steady demand pull on corn through the RFS and other incentives, forcing livestock producers and food manufacturers to compete with an industry that doesn't have to ration supply based on price.

   In order to make sure ethanol policy is market driven and can respond to price changes, should Congress consider a variable tax credit and import tariff that allows market forces to better determine the allocation of supply among the various users of corn?

2. On page three of your testimony, you mention the "unintended consequences that would damage U.S. livestock producers, especially those who use distiller's grain as a feed ingredient."

   Do you believe that distiller's grain is a better feed alternative than corn? Also, do you believe that if Congress reduced the renewable fuel standard, it would have an adverse impact on livestock production in the United States?

   As feed costs increase for livestock producers, economic analyses estimate an increase in slaughter rates in the near term and smaller herd sizes in the long term.

   Do you share this assessment and should Congress reduce incentives for biofuels in order to lessen the impact on the livestock industry?

3. As you note, USDA's August 12 production report projected 2008 corn production of 12.3 billion bushels, up 573 million from last month's projection. However, since release of that report, the futures price on the CME for December Corn has increased 66 cents, from 528.5 to 595 (August 20, 2008).

   Market analysts apparently do not believe the current projection, believing that yield and production will be lower than USDA's estimate. In fact, USDA's previous prediction for the season average price in recent years has consistently been lower than what has transpired.

Do you share the market's concern and do crop tours by your members support USDA's bullishness regarding recent estimates?

4. Earlier this month, the U.S. Department of Labor released the Consumer Price Index (CPI) for July showing an increase of 0.8 percent, twice as large as economists predicted. The July 2008 CPI is 5.6 percent higher than a year ago. While a substantial share of the increase is directly linked to the price of oil, a smaller but yet equally significant increase is tied to government sponsored ethanol incentives.

   While your testimony states "how little corn influences food prices," the contributing factor of ethanol incentives to overall food inflation places strain on consumers who live on fixed incomes and those who rely on government assistance such as the Supplemental Nutrition Assistance Program.

   In a study authored by former USDA Chief Economist Keith Collins, biofuel incentives result in a $20.5 billion increase in ingredient costs (2006-2008) and when passed on as higher meat and food prices, biofuel incentives result in increased food spending by 1.8 percent nationally. As stated in the report, annual average increase in food prices during 2000-2006 was 2.5 percent, so a 1.8 percent increase in food costs is a substantial portion of the normal increase in food prices.

   With the run up in corn prices this year not yet reflected in current food prices, how should Congress address food inflation directly resulting from government policy intervention like ethanol incentives?

SENATE AGRICULTURE COMMITTEE FIELD HEARING: UNIVERSITY OF NEBRASKA-OMAHA
AUGUST 18, 2008
QUESTIONS FOR THE RECORD: DR. BRUCE BABCOCK

Senator Tom Harkin

1. Given that increasing biofuels production has contributed to higher grain prices, on the one hand, and lower gasoline prices on the other hand, what do you think is the net effect on the average American consumer?

To date, higher grain prices have not led to large increases in food prices because higher feed costs have not yet made their way through the system. If we take 20 cents per gallon as the approximate amount of decrease in fuel prices due to ethanol expansion, then because we consume about 140 billion gallons of fuel, this is an annual benefit of $28 billion per year. A 2% increase in food expenditures, because of increased corn prices would amount to about a $20 billion per year. So to a rough approximation (which is all that we can really make) the decrease in fuel expenditures is about balanced by the increase in food expenditures.

2. Purdue University just released a study of food prices in which they conclude that higher oil prices are responsible for ¾ of the increase in corn prices, and that the tax credit for ethanol blending is responsible for ¼ of the corn price increase. Would you comment on that, please?

This is a difficult question to address because it depends on what the starting point of the analysis should be. The tax credit and high crude prices together stimulated the great expansion in ethanol plant capacity over the last two years. That large capacity together with high crude oil prices kept corn prices higher than they otherwise would have been. Over the last year, I estimate that for each $10 change in crude oil prices led to a $0.60 per bushel change in corn prices. The large drop in crude oil prices in the last two weeks explains why corn prices have fallen. The tax credit is responsible for more than $1.20 increase in corn price over the last year. So when crude oil was at $130 per barrel, I agree with the Purdue University findings. When oil is at $80 per barrel, the tax credit likely is playing a greater role than crude oil prices.

3. As you know, there are suggestions being made that we should change our federal biofuels policies. In light of your research, what would be the impacts of changing the Renewable Fuel Standard or the ethanol tax credit or the import tariff?

Because the tax credit and the RFS both work to increase the demand for ethanol, the tax credit is now largely redundant if the goal of policy is to achieve at least the RFS level of ethanol consumption in the U.S. The tax credit has worked to transfer large amounts of money to ethanol blenders. This has been a "carrot" approach to induce blenders to invest in the infrastructure need to blend increasing amounts ethanol. Now that the infrastructure is in place, one could rely on the RFS to ensure that domestic ethanol targets have been achieved. The import tariff serves to make sure that U.S. ethanol targets are met with U.S. production rather

than Brazilian production. Keeping the RFS and eliminating the tariff would eventually result in a greater proportion of mandated ethanol levels in the U.S. being met by Brazilian ethanol imports.

Senator Saxby Chambliss

1. Earlier this month, the U.S. Department of Labor released the Consumer Price Index (CPI) for July showing an increase of 0.8 percent, twice as large as economists predicted. The July 2008 CPI is 5.6 percent higher than a year ago. While a substantial share of the increase is directly linked to the price of oil, a smaller but yet equally significant increase is tied to government sponsored ethanol incentives.

   In a study authored by former USDA Chief Economist Keith Collins, biofuel incentives result in a $20.5 billion increase in ingredient costs (2006-2008) and when passed on as higher meat and food prices, biofuel incentives result in increased food spending by 1.8 percent nationally. As stated in the report, annual average increase in food prices during 2000-2006 was 2.5 percent, so a 1.8 percent increase in food costs is a substantial portion of the normal increase in food prices.

   With the run up in corn prices this year not yet reflected in current food prices, should we expect even higher levels of food price inflation directly related to biofuels?

I would have said yes had I answered this question one month ago, but the rapid decline in corn prices this fall will likely mean less downward adjustment in U.S. and world livestock production. If corn prices had remained in the $5 to $6 ranges, I would have expected hog and milk production to drop substantially over the next year or two which would have increased food inflation. $3 to $4 corn will likely work to keep food inflation pressures down.

2. Over the past seven years, the stocks to use ratio for corn has dropped from 20 percent in 2001/2002 to an estimated 12 percent in 2007/2008, just a bit over six weeks of supply. The linkage of energy and feed markets exposes livestock producers and other traditional users of corn to larger price volatility due to declining ending stocks and increased competition from built in demand from ethanol.

   Do you have any concern with ending stocks at these levels and in the long term, do you believe that the U.S. livestock sector as a whole will be less competitive in international markets than it otherwise would have been without biofuel incentives? If so, what countries would be the likely beneficiaries in terms of livestock production of U.S. biofuel policy?

The low ending stocks are somewhat deceiving if we are looking at that one statistic to measure our ability to feed our livestock herds. If there were a short crop, the shut down of ethanol plants

through a suspension of the RFS would immediately boost the amount of corn that could be fed to livestock. So I am not worried. More generally, high feed costs give a competitive advantage to livestock raised on grass. Thus beef cattle in South America and dairy producers in New Zealand have a competitive advantage. Poultry and hog producers overseas do not have a competitive advantage over U.S. hog and poultry producers because they face the same feed costs (or higher because of transportation costs) that U.S. producers face.

3. As you note in your testimony, increasing ethanol mandates means corn growers have a new built in demand of between 25 percent and 30 percent of their crop. As a result, prices will be higher than they otherwise would be without the mandate or other incentives such as the blenders' credit or import tariff.

   In addition, according to Iowa State University, the average value of an acre of farmland in Iowa increased by just over $700 during the past year. The developing biofuel economy is cited as the main driver of land prices and 2007 experienced the greatest one-year increase since 1976.

   Can you estimate the per acre benefit of ethanol incentives and is there any difference between how government benefits are capitalized into land costs whether they result from traditional support programs like the marketing loan and counter-cyclical programs or biofuel incentives such as the renewable fuel standard (RFS) and blenders' credit?

   In recent years, we have seen a number of new ethanol plants constructed. To what extent have land values changed in areas that are in close proximity to new plants? Have there been differential impacts on land values in those locations as compared to region or state as a whole?

To the extent that government ethanol support increases the price of corn (which it does) then the resulting increase in net operating margins will be bid into the price of land, much the same way that farm program benefits get capitalized into land values. Land rents are the best estimator of the additional benefits that farmers obtain from high corn prices. Rents have grown by about 60% in the last two years. Land prices would go up by this same percentage if farmers anticipate that operating margins that they have seen in the last two years would hold for the foreseeable future. There is no evidence that land close to ethanol plants has experienced any additional price increase relative to land further away, but logic suggests that this could be the case particularly in those corn growing areas where local basis has strengthened.

SENATE AGRICULTURE COMMITTEE FIELD HEARING: UNIVERSITY OF NEBRASKA-OMAHA
AUGUST 18, 2008
QUESTIONS FOR THE RECORD: DR. BRUCE DALE

Senator Tom Harkin

Isn't it true that the private sector is investing pretty heavily in advanced biofuels development?

- What does that say about the appropriate federal role?

Yes, that is true. The current scale of private sector investment is at least $3 billion. Much more will be invested if proper federal policies are developed and if federal financial investment focuses are those areas that are critical to advanced biofuels but which are not likely to receive much private support. I believe this has two key implications. First, it means that federal support ought now to focus on those critical areas that the private sector is neglecting (for whatever reason). I identify several such areas below. Second, it means that federal policy and regulations regarding biofuels must be consistent and clear and that any unintended consequences of regulations or policy should be dealt with promptly. I discuss one such unintended consequence below.

- What should we be emphasizing – basic research, technology development, demonstrations, or support for commercial plants -- and at what level of effort?

The biofuel system consists of two parts that must function together if we are to achieve the national security and other benefits we seek: 1) the agricultural/forest production system by which cellulosic biomass is sustainably grown, harvested, stored and transported to the biofuel processing facility (called the "biorefinery") and 2) the technology by which cellulosic biomass is converted in the biorefinery into fuels that replace petroleum-derived fuels. The federal scale and scope of investment in biorefinery development is generally adequate with one important exception: adequate technology development support. Basic research, demonstration scale and commercial plants seem to be adequately supported.

What has not been supported yet is technology development in flexible systems that can "plug and play" various technology options to determine optimal sets of technologies for particular types of cellulosic biomass. All of the existing support for demonstration or commercial plants requires that technology choice be made <u>prior to the federal investment</u> when, in fact, we don't generally have enough information to make such technology choices. We got the cart before the horse. This error must be rectified soon by

providing significant support for flexible technology demonstration (call them "pilot plant" or "plug and play") facilities.

The other very large area in which appropriate federal investment has not yet been made is the whole sustainable agricultural/forestry production, harvesting, storage, transport side. The changes in agriculture that must be made to sustainably produce and deliver hundreds of millions of tons of biomass to the biorefineries have not been adequately addressed. This is an absolutely critical area in which the USDA should take a strong leadership role such as the DOE has taken in the biorefinery area. Unless this whole logistics chain is addressed promptly and at the appropriate scale, we may find ourselves with excellent biorefineries but without the means to sustainably supply them with cellulosic biomass.

- And, what should be the scale or budget for that federal support?

Developing sustainable biomass production/delivery systems is at least as important as the federal investment in biorefinery development, which is on the order of $2 billion over the next 5-10 years. Thus this aspect of biofuel production merits a similar investment, at least $2 billion over 10 years.

Let me add a final note on appropriate federal policy. If we are serious about reducing our dependence on foreign oil, then we need to make that the central focus of biofuel development and act quickly to remove any artificial barriers to achieving the goal. In particular, the Congress should act promptly to correct executive branch agencies charged with implementing legislation if those agencies are acting contrary to the will of Congress. I offer one example below.

The language of EISA 2007 says that to meet the renewable fuel standard, first and second generation biofuels must meet certain greenhouse gas reduction goals. Those goals were generally achievable and reasonable. However, a confusing additional requirement was also imposed that "lifecyle" emissions of greenhouse gases must include emissions from "significant" indirect land use change. Indirect land use change means that if crops are used for biofuel production in the U. S., that market forces may operate to bring additional land into production elsewhere in the world with accompanying greenhouse gas releases.

A single paper published in *Science* in February 2008 linked U.S. corn ethanol production with very large greenhouse gas releases (through market forces, not as part of the actual supply chain) elsewhere in the world. The

paper is highly controversial and its major conclusions have not yet been substantiated by any other scientists. The paper does not meet the tests of scientific "significance" nor does it meet international standards for "lifecycle" studies. Nonetheless, it appears that EPA is about to issue a set of regulations based on this one paper that will chill private investment in biofuels.

I believe any such regulations are not supported by science at this time or by lifecycle analysis. Congress should act to instruct EPA if the intent of Congress is not being met by EPA regulations. For example, I find it difficult to believe that Congress intended that U.S. farmers and biofuel producers be held responsible for greenhouse gas releases caused by their competitors around the world. That is what this EPA interpretation of the EISA 2007 language does.

We do not impose this burden on any other domestic industry. Why are we about to impose it on an industry as critical to our national security as the emerging biofuels industry? And why on earth is EPA acting in such a precipitous manner when the science is so poorly developed?

SENATE AGRICULTURE COMMITTEE FIELD HEARING: UNIVERSITY OF NEBRASKA-OMAHA
AUGUST 18, 2008
QUESTIONS FOR THE RECORD: DR. THOMAS FOUST

Senator Tom Harkin

[Q] How certain are we that the advanced biofuels industry will be able to meet the advanced biofuels mandates of the RFS?

- For example, it calls for 1 billion gallons of cellulosic biofuels by 2013, 3 billion by 2015, and 16 billion by 2022.
- Will we meet those levels?

[A] The U.S. DOE – Office of Biomass Program (DOE-OBP) is pursuing a two tiered effort towards achieving the advanced biofuels mandates of the RFS. The first tier is a rigorous research and development (R&D) effort by the National Renewable Energy Laboratory (NREL) and other national laboratories to achieve and demonstrate at the pilot plant scale cellulosic ethanol that is cost competitive with both corn ethanol and gasoline by 2012. This effort was ramped up in 2006 with the Advanced Energy Initiative, has made excellent progress to date, and is on track to achieve the 2012 cost competitive goal. The second tier of the effort is to accelerate the commercialization and deployment process of advanced biofuels. DOE-OBP initiated and is partially funding four commercial-scale biorefinery projects and nine small-scale biorefinery projects that are currently under construction or planned for construction by the end of this decade. These biorefineries will have a total cellulosic biofuels production capacity of approximately 500 million gallons/year by early next decade. This accelerated deployment positions the U.S. biofuels industry well towards achieving the advanced biofuels capacity goals of the RFS.

Rigorous market analysis sponsored by DOE-OBP at NREL has shown that this two-tiered approach: a rigorous R&D effort to drive down the production cost of cellulosic biofuels and a cost shared effort in partnership with industry to accelerate the commercialization and deployment effort of advanced biofuels, is the best way to put the U.S. on the path towards achieving the advanced biofuels mandates of the RFS. Ultimately, market factors such as demand, supply growth rates, alternative transportation propulsion options, price of crude oil, etc. will determine the impact and penetration of advanced biofuels. Current efforts, however, are on course to enable advanced biofuels' capability to grow to significance in our transportation systems. Hence it is too early to definitively state if the advanced biofuels mandates of the RFS will be met, but the United States is on a strong path toward achieving them.

[Q] One of the truly attractive features of algae-based biofuels is that they have truly remarkable productivity potential. I've heard numbers of 10,000, maybe even 15,000 gallons per acre per year. That compares with soy biodiesel around 65, and corn ethanol around 450, and some of the cellulosic pathways such as switchgrass or miscanthus providing yields of 700 to 1,500 gallons per acre per year.

[A] Microalgae Oil Production: Comparison to Terrestrial Crops

In 2007, the United States used approximately 44 billion gallons of petroleum diesel for on-road transportation (http://eia.doe.gov). In that same year, U.S. biodiesel production was only at 0.45 billion gallons (National Biodiesel Board). The development of biofuels from current oil crops and waste cooking oil/fats cannot realistically meet the demand for transportation fuels (Tyson et al. 2004). As of 2000, the United States annually produced in excess of 2.7 billion gallons of waste vegetable oil that could be converted to transportation fuels. Even though soy oil production is

approximately 2.6 billion gallons/year, more than 90% of this oil is used in the food products market, severely limiting its use as a biofuels feedstock. Combined with other U.S.-produced vegetable oils, along with fats and greases, these feedstocks would only have the potential of replacing approximately 5% of our total petroleum diesel usage. On the other hand, microalgae have the potential to produce plant oil quantities which could provide significant replacement volumes for petroleum diesel fuel.

One of the main drivers in the development of microalgal diesel fuels is the higher photosynthetic efficiency of microalgae when compared to conventional crops and hence the potentially higher productivities per unit area. Table 1 shows that potential oil yields from algae are significantly higher than the yields of oilseed crops. Even under current yield scenarios, the potential oil yields from certain algae are projected to be 20 times higher than soybeans per acre of land on an annual basis, approximately five times more productive than jatropha and slightly more than oil palm. Algal productivity could realistically increase by as much as 5-6 fold if an aggressive productivity scenario were to be met through continued R&D. Achieving 10,000 gallons/acre/year seems optimistic, but might represent an upper limit and a community stretch goal. Due to higher growth rates and increased oil yields, the potential exists for algae to replace a significant amount of the current U.S. diesel fuel usage while using only a fraction of the land.

Table1. Comparison of Estimated Oil Yields from Biomass Feedstocks (Adapted from Chisti 2007)

Crop	Oil Yield (Gallons/Acre/Yr)
Soybean	48
Camelina	62
Sunflower	102
Jatropha	202
Oil palm	635
Algae	1,000-10,000

Productivity is only part of the equation, because per-acre capital and operating costs for algal cultures are currently higher than for terrestrial oil crop production. Even with superior productivity, the technology will not become a major source of fuel or achieve commercial viability unless production costs can be brought down from current levels. The bulk of the cost comes from the capital outlay for construction of growth, harvesting, extraction, and conversion facilities. Preliminary economic assessments, which are highly dependent on many key assumptions, indicate that at current levels of technology the cost to produce diesel substitutes through algal cultivation would range from $6-9 per gallon. An aggressive scenario that assumes major cost reductions and advances in productivity suggests that fuel could be produced for as little as $1.50 per gallon. Clearly, extensive R&D is vital to increasing productivity and lowering costs. This research should include improving development of algal growth and oil production, harvesting, extraction methodologies, as well as decreasing construction costs of pilot facilities.

There are a number of other benefits that serve as driving forces for the development and deployment of algal-based technologies. Algal feedstocks offer the opportunity to utilize land and water resources that are, today, unsuitable for most other commercial use. Land use needs for the production of algal feedstocks complement, rather than compete with, other biomass-based fuel technologies. Algae can be cultivated in areas that are far removed from farm and forest lands, thereby minimizing the impacts caused to the eco- and food-chain systems, and obviating the food-versus-fuel dilemma. In addition, many species of algae that have the ability to accumulate oils can use brackish water or water from saline aquifers, making an algae feedstock production system noncompetitive with existing human and agricultural water use practices.

Another benefit to using microalgae to produce biofuels is the mitigation of green house gases due to the algae's natural ability to utilize concentrated forms of CO_2 (e.g., provided by power

plant flue gases) and to liberate oxygen. It is a technology that could meet the potential need for carbon disposal in the electric utility industry while providing clean-burning alternatives in the transportation sector.

[Q] Isn't it true that the private sector is investing pretty heavily in advanced biofuels development?

- What does that say about the appropriate federal role?
- What should we be emphasizing – basic research, technology development, demonstrations, or support for commercial plants -- and at what level of effort?
- And, what should be the scale or budget for that federal support?

[A] Developing an economically viable, environmentally sustainable advanced biofuels industry that can contribute significantly to the nation's transportation fuel needs is truly an enormous undertaking, fraught with both technical and business risk. History has shown that the best way to proceed in such a significant undertaking is through public/private partnerships. The advanced biofuels development effort to date has been a good example of a successful public/private partnership that is on track to developing a robust advanced biofuels industry that will achieve the Renewable Fuel Standard (RFS) advanced biofuels mandates.

Early DOE investments in advanced biofuels were mostly in the national laboratories and universities to develop conversion technologies that are attractive enough to warrant private sector investment. These early efforts were very successful and have attracted private sector investment in advanced biofuels development and commercialization. Private sector investment, both in venture capital and industrial funding, has increased significantly over the past five years. Venture capital investments alone in advanced biofuels were estimated to be $750 million in 2007 (Renewable Energy World, 2008). Ultimately, private sector investment in advanced biofuels will drive commercialization and deployment.

A significant portion of this private sector investment is in partnership with the federal investment. During the past year and a half, DOE has announced the selection of four full-scale biorefinery projects and nine small-scale biorefinery projects to begin the advanced biofuels commercialization and deployment process. These efforts represent a combined investment of approximately $500 million in federal funding that leverages a private investment of approximately $1.0 billion, for a total of $1.5 billion. This advanced biofuels effort has shown how early public investment in high risk, high payoff advanced biofuels technologies, followed by cost shared investments in partnership with the private sector to reduce the technical and business risk for initial commercial deployment, can jump start the advanced biofuels industry.

Now that the nation has successfully reached this stage, the question becomes what is the appropriate federal role moving forward? Significant progress has been made in reducing the production costs of cellulosic ethanol from approximately $6.00 per gallon in year 2000 to $2.20 - $2.50 per gallon, our 2007 estimate (these are undelivered, untaxed costs, and do not take into account the lesser energy content of ethanol when compared to gasoline). Yet, much more can and must be done to reduce the production costs. The current DOE-OBP core research program at NREL and the other national laboratories and universities is pursuing a cost-driven R&D effort that will further reduce the production cost of cellulosic ethanol quite significantly over the next few years. Achieving this target will assure cost competitiveness of cellulosic ethanol with corn ethanol and gasoline over the long term and will provide the best chance of success for the advanced biofuels industry. This federal role needs to be continued. Cellulosic ethanol may compete economically with corn ethanol and gasoline at current prices (corn >$6 bushel and crude oil > $100 barrel), but if corn and/or crude oil prices were to drop, cellulosic ethanol would lose its competitive position, so business risk for the private sector remains very high.

Additionally, the federal cost sharing role on industry initial commercialization efforts needs to continue. Compounding the high risk factor is the fact that cellulosic ethanol production technology remains unproven at the commercial scale, although this first wave of federally subsidized commercial plants will hopefully alleviate some of this apprehension for investors.

In summary, there is a need to develop advanced biofuels technologies whose rising tide floats all ships, not just one or a few. Individual industry investment on its own is often proprietary and will not have the broader speed and scale impacts that will be needed. Federal investment at this stage is the best way to ensure that the entire industry sector benefits and grows. Additionally, although the current level of investment in cellulosic ethanol is encouraging, both federal and private sector investment in other advanced biofuels options is severely lacking. As outlined in my testimony, cellulosic ethanol is not capable of addressing the totality of our transportation fuel needs and, therefore, other advanced biofuels are needed. Federal investments in R&D programs are needed to develop advanced biofuels options that have higher energy density and are more compatible with the current infrastructure. Finally, critical to the future of biofuels is the long-term sustainability issues that must be understood and addressed. Since these issues are more of a public concern than an individual company issue, federal funding is required to support the necessary studies to address this critical topic.

Based on these important needs, I would estimate that a federal budget increase of at least 50% above current levels is required to address all of the important R&D and demonstration requirements, to best ensure a viable path toward a robust advanced biofuels industry. This would represent a total DOE-OBP budget of about $350 million per year.

SENATE AGRICULTURE COMMITTEE FIELD HEARING: UNIVERSITY OF NEBRASKA-OMAHA
AUGUST 18, 2008
QUESTION FOR THE RECORD: MR. JIM JENKINS

Senator Tom Harkin

You recommended broader use of innovative approaches to grazing. Do you have an estimate of what sort of productivity contributions might be possible with those approaches?

The University of Nebraska (Dr. Bruce Anderson) and other universities, including Ohio State and Missouri have documented that farmers and ranchers can improve productivity by anywhere from 10% to 40% by implementing more progressive grazing practices. These practices include better water distribution, cell or rotational grazing techniques, multiple species grazing and extending the grazing season by changing calving times, weaning times and using stock piled forages for fall, winter and early spring grazing.

Cheap corn has contributed significantly to the under-utilization of our forage resources. During the last decade over 30% of the entire calf population went directly from the cow into the feedlot. With the advent of $4.00 and higher corn prices the feedlot industry is now paying a premium for calves known as yearlings which have been run out on forage and grown from 400/500 pounds to 800/900 pounds. The cost of a pound of gain on forage is roughly 40 to 50 cents per pound whereas a cost of gain in the feedlot is now somewhere in the neighborhood of 85 cents to 1.00.

As a rancher (a grass farmer), I benefit from the premium now being paid on the yearling cattle that I have over-wintered and run out on grass. This coupled with the fact that I am running 30% to 40% more pounds per acre than my Dad did on the same land, means my ranch is turning in one of its best financial years ever.

SENATE AGRICULTURE COMMITTEE FIELD HEARING: UNIVERSITY OF NEBRASKA-OMAHA
AUGUST 18, 2008
QUESTIONS FOR THE RECORD: MR. BILL LAPP

Senator Tom Harkin

You provided valuable testimony on rising commodity input costs for food manufacturers. Can you also discuss the effects of rising energy costs, including:

1. Direct effects in the form of processing and transportation energy costs?

Response: These have been significant, and have contributed to inbound freight costs, outbound freight costs, and basically all processing due to the typical high levels of energy required. While I am unable to provide a specific impact, I would estimate that it would be lesss than the impact of higher commodity input costs, likely significantly less.

2. Indirect effects related to higher oil and gasoline prices leading to increases in the prices of ethanol and biodiesel which in turn increase prices for corn and soybeans?

Response: The rising price of corn and soybeans, as well as other crops, does not reflect higher input costs producers are facing, but rather the higher corn and soybean prices are the result of an acreage battle in the US and globally. The catalyst for this acreage battle, as I discussed in my testimony, is the dramatic surge in the use of corn to produce ethanol.

SENATE AGRICULTURE COMMITTEE FIELD HEARING: UNIVERSITY OF NEBRASKA-OMAHA
AUGUST 18, 2008
QUESTIONS FOR THE RECORD: MR. JEFF LAUTT

Senator Tom Harkin

1. Many of us are looking forward to the success of POET's addition of corn cob processing to your corn ethanol biorefineries. Over time, do you expect adding corn cobs as feedstocks at existing biorefineries will increase or decrease ethanol production costs?

   Answer: Initially it will increase costs. However, as we advance new technologies at existing biorefineries for cellulosic ethanol production and alternative energy such as a solid fuel boiler for steam production, we will gain greater efficiencies and expertise which will reduce ethanol production costs and fossil energy usage. The use of corn cobs represents a significant opportunity to expand ethanol production (5 billion gallons) to meet part of our domestic liquid transportation fuel needs while creating a new income opportunity for farmers for the sustainable collection and storage of a readily available biomass source.

2. Isn't it true that the private sector is investing pretty heavily in advanced biofuels development?
   - What does that say about the appropriate federal role?
   - What should we be emphasizing – basic research, technology development, demonstrations, or support for commercial plants -- and at what level of effort?
   - And, what should be the scale or budget for that federal support?

   Answer: It will take investments from both the public and private sectors to advance biofuels. The investments will need to be in all areas including research, technology development, demonstrations, and support for commercial plants. It is important that Congress fully fund the energy title of the farm bill. The energy title of the farm bill is critical to moving cellulosic ethanol from the lab and demonstration facilities to the marketplace. Also, it is critical that the current ethanol incentives and programs be maintained to instill the confidence of investors and lenders need to continue to invest in cellulosic ethanol production.

   In addition, without the RFS, the liquid transportation market in the U.S. is like a monopoly in that it heavily favors oil and gas. The developing industry needs the appropriate market demand to continue to signal investment and growth. Our progress to date has been remarkable as an industry. This will only continue with things like higher blends of ethanol blended gasoline allowed in all new and

existing vehicles (i.e. E15, E20, E30), a mandate requiring all vehicles sold in the U.S. have Flex Fuel technology, and blender pumps allowing consumers the choice of what to put in their vehicles. These items combined will allow the growth of the industry and the workings of a free market.

Eliminating stimulants like the blender's credit or the tariff at any time in the near future would be detrimental to the industry as it stands today and would completely stop any private investment in further development of biofuels.

SENATE AGRICULTURE COMMITTEE FIELD HEARING: UNIVERSITY OF NEBRASKA-OMAHA
AUGUST 18, 2008
QUESTIONS FOR THE RECORD: MR. DAVE MOODY

Senator Tom Harkin

What percent of the corn component in hog diets can be displaced by DDGS's today, and how much could that percentage be increased by use of fractionization technology in biorefineries?

The curent use of DDGS's from biorefineries is around 10 to 15 percent of the complete rations. In grower and finisher diets, the levels of poly-unsaturated oil in DDGS's softens the fat of pork carcasses. This creates problems at the processing facilities with "soft bellies", some processors are requesting that pork producers not use any DDGS's in the final rations fed to the pig. Additionally, there are very limited uses of DDGS's in sow diets because of the multiplying effects of any mycotoxins that might be in the corn. High levels of mycotoxins lead to reproductive problems and most producers won't take that risk.

There is very limited work at this time on the fractionated product. It appears that from a nutritional standpoint the fractionated product could be used for 100 percent of the corn in a diet. However the fractionization process creates a very fine ground product which could possibly cause stomach ulcers, in the pig. More nutritional studies need to be done to determine how to best use the product if it were to become widely available.

SENATE AGRICULTURE COMMITTEE FIELD HEARING: UNIVERSITY OF NEBRASKA-OMAHA
AUGUST 18, 2008
QUESTIONS FOR THE RECORD: MR. TIM RECKER

Senator Saxby Chambliss

1. Your testimony lists the various factors that are driving demand for corn in the domestic and international market. Of those factors, ethanol is unique in its dependence on government policy for demand, whether it is the renewable fuel standard (RFS) setting a floor for blending into gasoline, the tax credit for making ethanol economically competitive with gasoline or the import tariff reducing the amount of foreign ethanol imported into the United States.

   One of the main critiques of current ethanol policy is the steady demand pull on corn through the RFS and other incentives, forcing livestock producers and food manufacturers to compete with an industry that doesn't have to ration supply based on price.

   In order to make sure ethanol policy is market driven and can respond to price changes, should Congress consider a variable tax credit and import tariff that allows market forces to better determine the allocation of supply among the various users of corn?

To a certain extent, the ethanol industry does have to take input prices such as that of corn into account. As we have seen, the higher price of corn has had an effect on ethanol production and on decisions by companies to build or expand facilities.

A Reuters article Sept. 18 summarizes the state of the ethanol industry thusly: "Shares of U.S. ethanol makers took a beating on Wednesday (Sept. 17) as they wrestle with unpredictable corn prices and dwindling cash piles at a time when capital markets look unlikely to provide easy financing."

There may well be more prudent ways to vary tax incentives and import tariffs. Our goal should not be simply to let the marketplace work, but to encourage growth in the domestic industry so we can expand energy independence. This is a crucial consideration, and we hope that corn ethanol plays an important role as a key part of a diverse solution to this end.

2. On page three of your testimony, you mention the "unintended consequences that would damage U.S. livestock producers, especially those who use distiller's grain as a feed ingredient."

   Do you believe that distiller's grain is a better feed alternative than corn? Also, do you believe that if Congress reduced the renewable fuel standard, it would have an adverse impact on livestock production in the United States?

As feed costs increase for livestock producers, economic analyses estimate an increase in slaughter rates in the near term and smaller herd sizes in the long term.

Do you share this assessment and should Congress reduce incentives for biofuels in order to lessen the impact on the livestock industry?

We do believe that distillers grains provide a valuable feed option for livestock. They are not intended to completely take the place of feed corn, but they do provide certain nutritional benefits that go beyond corn.

We are reluctant to point out specific reasons why livestock operators have made certain decisions about herd reduction, without seeking more details about how they made their decisions.

We do not believe that reducing the RFS or incentives will greatly affect the price of corn. In fact, in April, the Agricultural and Food Policy Center at Texas A&M University released a report titled "The Effects of Ethanol on Texas Food and Feed" that concluded, "Relaxing the RFS does not result in significantly lower corn prices. This is due to the ethanol infrastructure already in place and the generally positive economics for the industry. The ethanol industry has grown in excess of the RFS, indicating that relaxing the standard would not cause a contraction in the industry."

What the RFS does do, however, is provide a higher level of confidence to investors considering this industry. And this is an important factor.

3. As you note, USDA's August 12 production report projected 2008 corn production of 12.3 billion bushels, up 573 million from last month's projection. However, since release of that report, the futures price on the CME for December Corn has increased 66 cents, from 528.5 to 595 (August 20, 2008).

   Market analysts apparently do not believe the current projection, believing that yield and production will be lower than USDA's estimate. In fact, USDA's previous prediction for the season average price in recent years has consistently been lower than what has transpired.

   Do you share the market's concern and do crop tours by your members support USDA's bullishness regarding recent estimates?

On Sept. 12, we saw a minor reduction in the USDA's crop production forecast for 2008 and a dime increase in the average farm price for corn. The corn is maturing and being harvested in some areas. We are confident we will bring in the second-highest crop ever and meet all needs.

Interestingly, the Renewable Fuels Association does question the USDA's projection of 4.1 billion bushels for ethanol use this year. They believe it is more likely that 3.8 billion bushels will be used. And of that, approximately 1 billion bushels of distillers grains will be produced for livestock. Ethanol will, according to the RFA and others, consume 22 percent of the 2008 crop.

4. Earlier this month, the U.S. Department of Labor released the Consumer Price Index (CPI) for July showing an increase of 0.8 percent, twice as large as economists predicted. The July 2008 CPI is 5.6 percent higher than a year ago. While a substantial share of the increase is directly linked to the price of oil, a smaller but yet equally significant increase is tied to government sponsored ethanol incentives.

   While your testimony states "how little corn influences food prices," the contributing factor of ethanol incentives to overall food inflation places strain on consumers who live on fixed incomes and those who rely on government assistance such as the Supplemental Nutrition Assistance Program.

   In a study authored by former USDA Chief Economist Keith Collins, biofuel incentives result in a $20.5 billion increase in ingredient costs (2006-2008) and when passed on as higher meat and food prices, biofuel incentives result in increased food spending by 1.8 percent nationally. As stated in the report, annual average increase in food prices during 2000-2006 was 2.5 percent, so a 1.8 percent increase in food costs is a substantial portion of the normal increase in food prices.

   With the run up in corn prices this year not yet reflected in current food prices, how should Congress address food inflation directly resulting from government policy intervention like ethanol incentives?

We believe that Congress should look at all the factors going into food prices, especially labor and energy. Some organizations wrongly believe there is nothing you can do in this area, that the RFS is the only factor Congress can do anything about. We have more confidence that you can work together to find the right solutions to lower the high cost of labor and energy on American businesses.

O