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AGRICULTURE AND RURAL AMERICA'S ROLE IN ENHANCING NATIONAL ENERGY SECURITY

HEARING

BEFORE THE

COMMITTEE ON AGRICULTURE, NUTRITION, AND FORESTRY UNITED STATES SENATE

ONE HUNDRED TENTH CONGRESS

FIRST SESSION

JANUARY 10, 2007

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AGRICULTURE AND RURAL AMERICA'S ROLE IN ENHANCING NATIONAL ENERGY SECURITY

Wednesday, January 10, 2007

U.S. SENATE,
COMMITTEE ON AGRICULTURE,
NUTRITION, AND FORESTRY,
Washington, DC

The Committee met, pursuant to notice, at 9:32 a.m., in room SR–328, Russell Senate Office Building, Hon. Tom Harkin, Chairman of the Committee, presiding.

Present: Senators Harkin, Lincoln, Nelson, Brown, Klobuchar, Chambliss, Roberts, Coleman, Thune, and Grassley.

Senator CHAMBLISS. Good morning. As is customary at the first official get-together of the Agriculture Committee in a new session when we have had a change of power, it is the time to welcome the new Chairman—welcome, excuse me, the return of the new Chairman. Tom Harkin, obviously, has been very involved in this Committee's work for the entire service that he has given to the U.S. Senate and the great people of Iowa.

Tom has also been a good friend to me. He and I had the opportunity to work very closely on the 2002 Farm Bill when you chaired the Committee over here then, Tom, as you remember. And over the last couple of years we have had a very good working relationship as Chairman and Ranking member, and I know that will continue.

You know, being Chairman of this Committee has its privileges and it has its problems and challenges, and certainly this year, Tom, you are going to be challenged with reference to energy issues which we are going to talk about today with the Farm Bill and with trade issues, but with your experience, your knowledge, and your commitment, along with the good staff that you have in Mark and others, I know that certainly you are up to the challenge. My staff, as well as all members on this side look forward to working with you on addressing these issues, and particularly as we get into the Farm Bill negotiations.

But Tom, I congratulate you as coming back in as Chairman and I look forward to a great year on the AG Committee.

Chairman HARKIN. Thank you very much.

Senator CHAMBLISS. With that, I will hand you the gavel.

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

Chairman HARKIN. Well, Senator Chambliss, thank you very much for those very kind and overly generous remarks. I thank you for your great leadership of this wonderful Committee, which we all love. Over the last couple of years, and I say that in all sincerity and candor, you have been exemplary as a Chairman. You have been fair and open. And again, I would be remiss—you know, it was Pat Leahy who used to always make the statement that Senators are a constitutional impediment to the smooth functioning of staff. And with that disclaimer, I want to say I want to thank Martha Scott. Martha has just been wonderful, and I am glad she is going to be continuing on. Both she and Mark Halverson have worked very closely together.

Martha, thank you very much for your great leadership of the staff for the last couple of years. We look forward to that continuing relationship.

I thank you again, for your leadership of this Committee and for really starting the process of the hearings on the Farm Bill last year. So much of the work that whoever was going to be Chairman this year has already been done by you. You had good field hearings all across the country. I thank you for that. You came to Iowa and we had a great hearing in Iowa. And you went to several other States, so you saved me some travel and I appreciate that very much, and getting set up.

So we have got a good basis. We have some good hearings that you have started as a basis for moving ahead on the Agriculture Committee. It is, for me, again—I was thinking this morning as I came in. I think this is the fourth or fifth time that the gavel has changed in this Committee since I have been here. Pat, I think it is four or five. I cannot remember which. I will have to think about that again. And I think that is good. That has been over twenty years, so if you average it out, about five years per side. I think that lends itself to a closer working relationship, and it lends itself to a more bipartisan atmosphere on this Committee. I do think that this Committee, of all the Committees I have worked on in both the House and Senate, this Committee is the least partisan in terms of its approach. We may have regional differences, obviously, and we tend to protect our own regions, obviously, but it does not come down to partisan matters. It usually comes down to what our regional interests are. But we have worked those out in the past. We had a good bipartisan effort on the last Farm Bill in 2002. The Senate was run by Democrats then and the House was run by Republicans, and I think we worked out a pretty darn good Farm Bill. It seemed to work pretty well.

And so I look forward to that same kind of working relationship this year. This is not going to be any kind of a Democratic bill or a Republican bill. It is going to a bill for all America, and for all of rural America.

And so, with that, you mentioned the challenges and that type of thing. I have to, again, confess a little bit here that one of the biggest challenges for me now as Chairman is to be here on time. I am congenitally late for everything.

[Laughter.]

Chairman HARKIN. I think I was born—I don't know. Maybe I was born late. I don't know, Pat. So now I have got to be here on time since I am Chairman. So to me that is going to be one of my biggest challenges is to make sure I beat Roberts here in the morning.

Senator CHAMBLISS. We will start without you the first couple of times.

[Laughter.]

Chairman HARKIN. You probably will.

Let me just, again, say, before I make my opening statement, just a couple of things. I will continue the same policy that Senator Chambliss had, that unless there is some real burning desire or some immediacy to a Senator's schedule, opening statements will be restricted to Chairman and Ranking Member. We will do 10–minute rounds of questions. We will ask our panelists who our here, our witnesses, to provide up to 6 minutes and no more. Please do not read any statements. Summarize as best you can within that 6–minute timeframe. And those will sort of be the general ground rules which, basically, you had set up, and I think that is a good way to operate.

So I will just, then——

Senator ROBERTS. Mr. Chairman, can I just say one thing?

Chairman HARKIN. Yes, sir.

Senator ROBERTS. I have three Committee meetings at the same time. I don't know how that worked out. I was usually up in the bubble up in the Intelligence Committee and did not know what was going on anywhere. At any rate, I just wanted to say something to you personally. I do not know in the history of this Committee if we have had a Chairman that came on and then rode off to other pastures and came back. I do not know about the history of that, but that may be unique. And I would just say that there is a space for your portrait up there if we want to reserve that for you and to welcome you back.

I am going to date myself. One of my favorite movies was called Shane. And Brandon De Wilde told Alan Ladd after he killed the bad guy as he rode off into the mountains, "Shane. Come back, Shane. Come back." So now we are saying, "Tom. Come back, Tom. Come back.".

And so I want to welcome you back and I want to thank the former Chairman and our current Ranking Member. I have been riding shotgun with him. He has complained that I am a lot like the Vice President in terms of wielding a shotgun.

[Laughter.]

Senator ROBERTS. But I want to thank him for starting this. And I want to thank you for holding a hearing in regards to energy. I don't know if we are going to have an energy title or whatever. The biggest concern I have is that we do not compromise one title at the expense of another. It has to be part of a team effort.

And with that, I would just ask permission to make my full statement part of the record, and that I am going to have to leave early.

Welcome back, Tom.

[The prepared statement of Hon. Pat Roberts can be found on page 70 in the appendix.]

So I would just, again, proceed with my opening statement, then I will recognize our Ranking member, and then we will proceed to our witnesses.

So I want to say good morning to all my colleagues, to our witnesses. I saw the huge audience out in the hallway, so obviously there is a great deal of interest in the subject of this hearing. I am pleased to welcome you this first hearing on the Senate Committee on Agriculture, Nutrition, and Forestry of the 110th Congress.

And again, Senator Chambliss, as I said earlier, I look forward to working with you and Martha Scott, and all the staff, in providing leadership to this Committee.

I also want to welcome our new members, Senator Sherrod Brown from Ohio, Senator Bob Casey—well, they are not here, but Lindsay Graham from South Carolina, Bob Casey from Pennsylvania, Amy Klobuchar from Minnesota, and John Thune from South Dakota.

Our most important Committee task this year, of course, will be to formulate a new Farm Bill. When we wrote the last Farm Bill, which was titled the Farm Security and Rural Investment Act of 2002, we included an energy title for the first time. Since then, we have seen vigorous growth in energy production in rural America, especially in the form of biofuels and wind power, revealing a new and encouraging energy supply capability in rural America.

During the same period, we have become increasingly aware of just how precarious our national energy situation is. Energy prices have gone up and appear to be staying up. Environmental impacts of energy use, especially from autos and power plants are still a major concern. The evidence of climate change is absolutely clear and very ominous. And we know that combustion of fossil fuels is the primary contributor to the greenhouse gases that drive global warming.

On top of all that, our use of petroleum is rising steadily, and we are importing about 60 percent of that petroleum from foreign sources, many of whom are politically unstable or unfriendly to the U.S. In short, we need to initiate a major transition of our energy sector to one that is far more efficient, is much less reliant on fossil fuels and on imported oil, and is utilizing vastly more domestically produced renewable energy.

This convergence of national energy needs and national security with agricultural sector energy capabilities represents a genuine opportunity for all of us: for farmers, ranchers, and all who call rural America home. We can, and I believe we must, formulate and pass a Farm Bill that encourages and accelerates the rural production of energy for the whole Nation.

In other words, we have the opportunity now to move our agricultural sector from one that supplies food and fiber alone to a sector that supplies food, fiber, and energy. This is a convergence with a real win-win potential, to help the Nation with its pressing energy needs and national security needs while promoting rural development through business expansion to energy suppliers.

Our new bill this year will not be a, quote, Farm Bill, in the classical, old-fashioned manner. It must be bold, innovative, chal-

lenging, and supportive of a transition to a bio-economy based on our rich resources of productive land, our agribusiness infrastructure, and our hardworking, patriotic, rural citizens.

So that is why I wanted this first Committee hearing to begin to set the stage for bringing our agriculture and rural sector's renewable energy capabilities to bear on our national energy needs. That is why I have chosen to focus this first hearing on what is arguably our most critical energy need, and that is reducing our dependence on foreign oil.

To that end, we have invited two panels of witnesses this morning to talk to us about significantly increasing the production of biofuels, and the challenges and implications associated with that expansion.

And again, with that, I welcome Senator Chambliss. Again, thank you for your great leadership. I look forward to our close relationship, and I yield to you for an opening statement.

STATEMENT OF HON. SAXBY CHAMBLISS, A U.S. SENATOR FROM THE STATE OF GEORGIA

Senator CHAMBLISS. Well thank you very much, Mr. Chairman, and I congratulate you again. I look forward to a very, as I say, challenging but interesting—a year in which we have some great opportunities for American agriculture, and we look forward to your leadership.

But also I would like to welcome our new members. Senator Thune is kind of coming back since he served on the House Agriculture Committee with Senator Roberts and myself. And we are looking forward to leaning on our new members' experience in agriculture to bring us some fresh ideas to the Committee.

The hearing today on agriculture and rural America's role in enhancing national energy security is timely and appropriate, and it is the first hearing before this Committee and the 110th Congress. Agriculture in the United States is undergoing one of the most profound changes we have ever seen and previously held assumptions about the role of farmers and ranchers across our country are radically changing.

The Chairman is right to point out that agriculture and foreign policy are not only about food and fiber, but also fuel. Renewable fuels like ethanol, biodiesel, and wind are the centerpiece of our discussion today, and support for these sources of energy is indisputable.

Biofuel production is helping to spur a rural renaissance in the Midwest as large amounts of capital are being spent to expand biofuel production. Other regions of the country can and need to share in this renaissance. Areas such as the Southeast are just beginning to build corn ethanol plants like one that I helped dedicate last week in Camilla, Georgia, and have tremendous potential for growing energy-dedicated crops.

I am extremely excited about the research being conducted at Georgia Tech, the University of Georgia, Auburn University on woody biomass and switchgrass. It is my hope and intention that the energy title in the 2007 Farm Bill will accelerate this progress, in hopes of commercializing these feedstocks earlier to relieve some of the pressure on corn demand.

The exuberance surrounding biofuels is evident in the aggressive growth of the industry over the past year. From January 1, 2006, the Renewable Fuel Standard went into effect, and since then the United States has used more than 5 billion gallons of ethanol, outpacing RFS requirements by more than 25 percent. According to the RFA, in the next 18 months, the industry will add nearly 6 billion gallons of new production capacity.

In short, in 2008, new capacity will exceed the minimum that is called for in the RFS. This progress is astounding to say the least; however, this expansion has not come without affecting the rest of the agriculture sector. For the first time in memory, corn prices increased during the 2006 harvest season, and exceeded a critical threshold of $4.00 per bushel on the Chicago Board of Trade just last week. This is far beyond the estimates of the U.S. Department of Agriculture just last year, and of the National Corn Growers Association, when that organization advocated a higher standard in the 2005 Energy Policy Act. The 87 percent increase in the price of corn in just the last two years is a welcome development for corn growers, but it is increasing a critical input cost for cattle, dairy, hog, and poultry producers in my State and across the country.

Mr. Chairman, the RFS is bidding corn and fuel grains away from traditional customers and beginning to affect the livestock and poultry industries. If corn prices continue to set new highs over the next year, the industry in my home State of Georgia will come under increasing pressure, and I fear continued price spikes will force some producers out of business.

We find ourselves in the position of encouraging an industry that directly competes with another that is important in all our States, and I hope the end result is not a policy that encourages livestock operators to further integrate and consolidate. I strongly support the biofuel sector, and, like my colleagues on the Committee, want to find ways to expand their use in order to lessen our dependence on imported oil. However, doing so may require modification of existing incentives. The research community is tirelessly working on new processes to convert cellulosic biomass to ethanol.

The expansion of the ethanol industry will depend on this critical research and future incentives, and I look forward to testimony today particularly my friend from Georgia Tech on this issue, and Mr. Chairman, I would like to give you a personal invite down to Georgia to see some exciting things that we are doing, both at Georgia Tech, as well as at the University of Georgia, and our research departments here on this conversion of cellulosic material into ethanol. It is pretty exciting to see what we are doing. And as we discuss these issues, perhaps we should focus more on feedstocks that do not compete with animal agriculture, while at the same time promoting innovation.

I want to thank our witnesses in advance. I look forward to hearing their testimony. And at this time, Mr. Chairman, I would ask unanimous consent that written testimony from Auburn University be inserted into the record.

Chairman HARKIN. Without objection.

Senator CHAMBLISS. Thank you.

[The following information can be found on page 150 in the appendix.]

With that, we will turn to our panels. We have two panels. The first panel will cover America's energy security and the potential role that biofuels can play in our nation's future.

We have, of course, Dr. Collins from USDA to testify on the economics related to increased biofuel production, and also a summary of the technology status and research potential of biofuels.

Our first panelist is the Honorable Phil Sharp, President for Resources for the Future.

Dr. Keith Collins, Chief Economist for the Department of Agriculture.

Mr. J. Read Smith, Committee Co-chair of the 25 X 25 Committee.

And Dr. Michael Pacheco, Director of the National Bio-energy Center from the National Renewable Energy Laboratory.

Our first witness will be Phil Sharp, again, a longtime friend and colleague of mine. Phil and I came to the House together in 1974, so we were in that same class. I served together in the House with Phil for—well, I was there for 10 years and then came to the Senate, and then Phil went on to serve for another 10 years in the House. I think until about 1995. He was one of the key players during all that time on the Energy Committee on the House of Representatives.

I just got to thinking, Phil, when I saw that you were going to be here this morning that there are not too many of us left from that Class of 1974. I was just thinking about, in the Senate, there is Chris Dodd, Max Baucus, Me, and Chuck Grassley are the only ones left from that Class of 1974.

So I am glad that you have continued your involvement in this area of energy and renewable energy. And I congratulate you on taking the helm of the Resources for the Future. With that, we welcome you, Phil, to the Senate Agriculture Committee. It is good to see you again.

STATEMENT OF HON. PHILIP SHARP, PH.D., PRESIDENT, RESOURCES FOR THE FUTURE, WASHINGTON, DC

Mr. SHARP. Well thank you very much, Mr. Chairman. I certainly appreciate the invitation. It is nice to be back with you. We were both Watergate babies, elected in 1974. And if I am accurate, both your family and mine had our first child in that first term. Not the wisest way to plan a family.

Chairman HARKIN. That's right.

Mr. SHARP. But Mr. Chairman, I am President of Resources for the Future, which is a nonpartisan think tank and not engaged in advocacy. So what I say here are my own opinions. And I was asked simply to comment briefly on the energy challenges our Nation faces, and particularly with respect to oil.

And, of course, as those in this Committee and elsewhere that have dealt with energy issues know, our first and foremost difficulty is always reconciling the various goals we try to get energy policy to serve. We clearly want cheap energy supplies to fuel prosperity. We do not want to damage our national security and we do not want to damage our environment in the process. And that is a very tall order, and there simply are no silver bullets, of course, for hitting that complex target.

With respect to oil, the first couple of charts in my testimony demonstrate what everybody knows. We are scheduled to continue to grow in our import of foreign oil and in our general use of oil.

The pie charts on Chart 3 most startlingly show the EIA projections for 2030 that suggest that we do not in any significant way alter between now and then the proportion of our energy that will come from petroleum products, roughly 40 percent of everything we use now and then. This is in spite of the EIA's calculations of all the proposals in the law as of 2005 that might make an alteration.

Now, it is pleasant to note, however, that already those projections are off with respect to ethanol because it is very clear if what has been happening this last year is sustained, it will more than meet what is assumed in that model.

Mr. Chairman, the oil dependency, of course, as you have articulated and others have articulated, brings a certain number of risks to us in terms of foreign policy: the possibility of a serious supply disruption, the pressure to compromise important foreign policy goals for the sake of oil supply, the possibility that global production will not keep pace with global demand, and therefore there will be intense competition between us, China, and others over short supplies, the pressure to militarily protect the oil markets.

Many new groups have come into the American public arena, bipartisan in nature and nonpartisan in nature, reasserting the advocacy that we must act more forcefully in this regard: the Energy Futures Coalition, the National Committee on Energy Policy, the Energy Security Leadership Council, and recently a taskforce of the Council on Foreign Relations. None of this is new to members of this Committee. We have simply, in the past, not been able to change the course over the last 30 years because we have simply not been willing to pay the price that was necessary, and it was always more expensive than the cheap oil we were able to buy from abroad.

The history also has been one of an up-and-down in world oil prices. When the prices go up, we find intense interest by consumers in fuel-efficient vehicles and alternative fuels. We find that same intensity among investors and government policy is asserted to try and make changes in both arenas. When prices go down, we see a withdrawal of that interest. And so we have had an on again, off again proposition, which means that, if we want to make a difference, we have to sustain policy to do so.

Now, the newest of our energy goals, and it has not totally been accepting in this country, but I think increasingly the consensus is that we must do something over time about greenhouse gas emissions, which are very much the result of our burning of hydrocarbons. And what we see over the next decade here in the United States and abroad is not a pretty picture in this regard, because most of what is anticipated for investments in the electrical sectors as well as the oil sector are likely to increase significant greenhouse gas emissions.

If we look at electricity, for example, in the United States, we are about to build a whole new wave of power plants, many of them planned to be coal combustion. This is even more dramatic a case in China and in India.

In terms of our oil supply, we not only expect to use more here and abroad over the next twenty years, but also there be a shift to unconventional fuels, which, because they require so much energy to produce, they also create considerably more greenhouse gas emissions.

If you look at Chart 4, that is a complex display of the alternatives to conventional gasoline or oil, whether it is biodiesel or it is oil shale. And that is displayed in terms of the generally estimated costs for the production of those alternatives, as well as the range of likely greenhouse emissions. In simplistic terms, let me say to you what the story there is, if the oil prices, the driving factor in what decisions that were made by investors, what we will see is investment in those energy sources that are highest in carbon emissions, rather than those that are lesser.

Now, what is missing from that chart is the work that you folks have done here in the last few years that has already had a profound effect. The subsidies that the Federal Government has put into play has significantly reduced those cost figures for cellulosic ethanol, biodiesel, and corn ethanol so that they have come into the range of being competitive in the world market, or what is anticipated in world oil prices. The significant thing, I think, is that those policies or something like them have to be sustained if you expect for these fuels to play a significant role.

I will leave it to more knowledgeable colleagues here at the table and on the panel to identify just how big a role and what the complex issues are surrounding each of those fuel developments.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Sharp can be found on page 122 in the appendix.]

Chairman HARKIN. Thank you very much and I will have some questions for that chart. I looked at that last evening.

Now we turn to Dr. Keith Collins, who is no stranger to this Committee or the House Committee. I am told that this is the 76th time Keith Collins has testified before the Agriculture Committee. Is that factual?

Mr. COLLINS. That is about right, Mr. Chairman.

[Laughter.]

Chairman HARKIN. Over how many years, Keith?

Mr. COLLINS. I did my first hearing in 1993. And I can tell you when I did, my hair was black. You can see what it has done to Mr. Roberts.

Senator LINCOLN. Give him a plaque.

Chairman HARKIN. Yes, give him a plaque. Just nail it down there.

Well, Dr. Keith Collins, who is the Chief Economist for the Department of Agriculture has been a great source of information on a bipartisan basis for this Committee for a long, long time. We just welcome you back, Keith. Thank you for your great service and your continued service. I look forward to your testimony.

STATEMENT OF DR. KEITH COLLINS, CHIEF ECONOMIST, U.S. DEPARTMENT OF AGRICULTURE, WASHINGTON, DC

Mr. COLLINS. Thank you very much, Mr. Chairman, and I appreciate that personal comment, and thank you for the invitation today to discuss the implications of bio-energy for U.S. agriculture.

I think there is nothing more exciting than renewable energy in agriculture today. The producers are generating electricity from wind. They are using manure to produce biogas, and the biogas is being used to produce electricity and it is being scrubbed and sold as renewable natural gas. But nowhere has interest and discussion been more intense than in the area of liquid biofuels.

The prospects for biofuels are shifting from niche markets to mainstream energy sources, and that is crucial to reducing U.S. fossil fuel imports. Ethanol production last year was three times greater than 2000. Biodiesel production was over 100 times greater than in 2000.

Since June alone, U.S. ethanol production capacity in operation and under construction has increased by an astounding 4 billion gallons. We are on a track to exceed 12 billion gallons of ethanol production in 2009, more than doubling last year's level in 3 years.

In 2000, 6 percent of U.S. corn production was used to produce ethanol. Last year, it was 20 percent. Within three years, it is likely to well exceed 30 percent. And biodiesel now accounts for 13 percent of U.S. soybean oil use, compared with almost none 6 years ago.

This increased use of crops for biofuels is having, and is expected to continue to have, a sustained major positive impact on crop producers, rural areas, and the agriculture sector broadly, including fertilizer suppliers, seed suppliers, equipment suppliers, and so on.

The rapid fuel growth raises a number of questions. I believe we are entering right now a critical three to 4 year period where several key supply and demand issues will be sorted out. First, consider biofuel supply. How will crop markets adjust to increased demand for corn? Thus far, the demand increases this past year have been largely met by drawing down stocks, but stocks for corn are now at a historically low level. This spring, high corn prices are expected to draw substantial acreage away from other crops, particularly soybeans, and into corn. As more increases in corn acreage occur in subsequent years, we are going to see that continued pressure on the corn acreage base.

Higher ethanol production over the next several years is likely to push corn prices to record highs, especially if the weather does not help. Higher corn yields are likely to temper price increases in acreage shifts, and corn productivity trends have gotten stronger over the last several years.

A related issue, as Senator Chambliss mentioned, is the impact of higher feed costs for livestock and dairy. Sustained higher feed costs, if you hold everything else equal, mean lower livestock, poultry, and milk production, and higher livestock and livestock product prices, but as those prices of livestock products rise, that will restore profits to the livestock sector, but there is some period of adjustment.

Importantly, about 30 percent of corn used in ethanol can return to animal feed as Distiller Dried Grains or other feeds, and ad-

vances are occurring that will likely make DDGS a more useable feed for hogs and poultry.

Second, consider biofuel demand. Will ethanol prices stay high and demand continue to grow? In the near time, although corn prices have soared this fall and oil prices have dropped, ethanol returns remain above the levels attained prior to 2006. Over the long term, while ethanol prices to producers will reflect the price of gasoline and the ethanol tax credit, they are increasingly going to reflect blending opportunities.

Ethanol is a blend component, and its key market is blends up to 10 percent. As ethanol's share of the blended gasoline market moves into the eight to 10 percent range, ethanol's demand and price premium in the marked will depend on the ability to use ethanol in higher blends, such as E85.

To move ethanol beyond low level blending and substantially reduce crude oil imports, infrastructure such as E85 pumps and flexible fuel vehicles are needed. But to ensure their development, ethanol supplies must exceed what is practical from corn. Breakthroughs that allow commercialization of cellulosic ethanol are needed to provide that supply boost. Successful commercial-scale production would allow many other feedstocks to be used for ethanol.

In conclusion, USDA sees renewable energy as a prime opportunity to stimulate economic growth in agriculture in rural areas. We have a range of grant, and loan, and research programs that support renewable energy. Last year we spent over $250 million on those programs. We also coordinate joint biomass research with the Department of Energy and other Federal agencies, and we draw on the Department of Energy to help us implement our programs.

We are very optimistic that biofuels will create greater economic opportunities in rural America, and contribute significantly to diversifying the Nation's energy supplies.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Collins can be found on page 73 in the appendix.]

Chairman HARKIN. Thank you, Dr. Collins for the testimony. I have some questions about that, too.

Now we turn to Read Smith, who is one of the great leaders of the 25 X 25 Renewable Energy Project. This has sort of captured the imagination of a lot of people around this country. It is a great alliance of national agriculture and forestry leaders in promoting agriculture's potential contribution to our energy independence.

They have laid out a very challenging scenario for this country, and one that I hope that this Committee and our new bill this year will be involved in trying to meet some of those goals.

So Mr. Smith, thank you for your leadership in the whole are of renewable fuels. Welcome to the Committee and please proceed.

STATEMENT OF J. READ SMITH, 25 X 25 STEERING COMMITTEE, WHEAT, SMALL GRAINS, AND CATTLE PRODUCER, FORMER PRESIDENT, NATIONAL ASSOCIATION OF CONSERVATION DISTRICTS, ST. JOHN, WASHINGTON

Mr. SMITH. Thank you and good morning, Chairman Harkin and Ranking Member Chambliss, and members of the Committee.

Thank you for the opportunity to share with you today on behalf of the nearly 400 organizations that comprise the 25 X 25 Renewable Energy Alliance.

My name is Read Smith. I am one of the two Co-chairs of the Alliance. And along with my wife and son, I manage our family farming interest in Whitman County, Washington. Our principle crops there are wheat, barley, minor crops, and I also manage a cow-calf operation.

Mr. Chairman, on behalf of the 25 X 25 Alliance, I want to begin by welcoming you back to the Chairmanship and thanking you for your longtime leadership in both energy and conservation.

Today's hearing on energy solutions from agriculture and forestry make a dramatic statement about the importance to this Committee on accelerating the development of renewable energy from our Nation's farms, ranches, and forests, and it is very much appreciated by those of us who make their living from the land.

As you well know, our Nation and the world are searching for new energy solutions. Due to increasing demands and limited supplies and our growing reliance on imported oil from unstable regions of the world, directly compromising our national security, Americans cannot continue on the path that some have called "Yesterday Forever." As energy demands increase both here and abroad, we will need to come up with additional energy supplies, ones that are sustainable instead of importing oil from the Middle East, we can produce energy here at home in the "Middle West" and other parts of the country using America's agriculture and forestry lands for fuel as well as food, feed, and fiber.

With these challenges and opportunities as a backdrop, our group of highly respected agricultural leaders came together in 2004 to discuss agriculture's role in helping our Nation meet those energy needs. The vision was emerged as 25 X 25, and that is that 25 percent of the energy supplies we use in our country will come from renewable sources by the years 2025, while still producing safe, abundant, and affordable food, feed, and fiber.

This vision has grown into an alliance of nearly 400 groups, as well as 22 current and former Governors, 4 state legislatures, 30 current and former Senators, and many members of this Committee, and 94 current and former Representatives.

Mr. Chairman, a 25 X 25 energy future will generate increased farm income, stimulate rural development, and help improve air, water, and soil quality. It will also result in improvements in wildlife habitat and conservation on crop land, range land, and pasture lands.

Last year, we commissioned a major analysis from the University of Tennessee to determine the ability of America's farms, forests, and ranches to provide 25 percent of the total U.S. energy needs by 2025 and to assess the economic impacts of the 25 by '25 goal on the agricultural sector and the overall economy. The analysis revealed the following findings:.

The 25 X 25 goal is achievable. This goal can be met without compromising our ability to produce food, feed, and fiber. Reaching the goal would have extremely favorable impacts on rural American and the Nation as a whole.

By reaching 25 X 25, annual net farm income could increase by $37 billion. With higher market prices, an estimated cumulative savings in government payments could result in a $15 billion.

Contributions from America's fields, farms, and forests could result in the production of over 86 billion gallons of ethanol and biodiesel by the year 2025.

And with your permission, Mr. Chairman, I would submit that entire research project for the record.

Chairman HARKIN. Without objection.

[The following information can be found on page 134 in the appendix.]

The 25 X 25 partners are now working to construct a road map to achieve our 25 X 25 vision. Over the past 6 months, representatives from the endorsing entities have been jointly and in working groups meeting to develop a detailed 25 X 25 implementation plan, which will include policy recommendations to achieve this goal. The plan will be ready for Congress in February, in time for crafting the new Farm Bill.

In our view, American agriculture is uniquely positioned to play a major role in improving energy and national security, strengthening the rural and national economies, and improving the environment. The first step in achieving the 25 X 25 energy future is to establish 25 X 25 as a national goal. And Mr. Chairman, you, along with Senators Grassley, Salazar, Lugar, and 12 others introduced 25 X 25 as Concurrent Resolution 97. We thank you and we look forward to your continued leadership and support.

In the coming weeks, as you once again take up Farm Bill legislation, we urge you to ensure that the energy title is structured and funded to match both the challenge and the opportunity facing our Nation.

Thank you again for this opportunity to appear today, and I hope you will look to us as a resource as you move forward with the Farm Bill, and I would be pleased to respond to questions later.

[The prepared statement of Mr. Smith can be found on page 133 in the appendix.]

Chairman HARKIN. Thank you very much, Reed. And again, we look forward to having that. You say you will have that by February?

Mr. SMITH. Yes.

Chairman HARKIN. Hurry.

Mr. SMITH. We are.

Chairman HARKIN. OK. We need that.

Next we turn to Dr. Pacheco. Dr. Pacheco I hope I pronounced that right.

Mr. PACHECO. Yes, you did, Senator.

Chairman HARKIN. Thank you.

Dr. Pacheco joined the National Renewable Energy Lab in January of 2003 to serve as the Director of the National Bio-energy Center. This center was established the Secretary of the United States Department of Energy in 2000 and it is headquartered at NREL.

As the center Director, Dr. Pacheco provides strategic guidance, technical direction, and management oversight of the National Bioenergy Center at NREL. Dr. Pacheco is also responsible for helping

DOE coordinate bio-energy research activities supported by DOE and carried out at the five national laboratories.

Dr. Pacheco, welcome to the Committee, and we look forward to your testimony.

STATEMENT OF MICHAEL PACHECO, DIRECTOR, NATIONAL RENEWABLE ENERGY LABORATORY, GOLDEN, COLORADO

Mr. PACHECO. Senator, thank you very much, and in the opening remarks, when you were talking with Dr. Sharp about the Class of 1974, I was also a member of the Class of 1974, but that was the graduating class of Montville High School.

[Laughter.]

Chairman HARKIN. Wait a minute. How old am I?

[Laughter.]

Mr. PACHECO. Thank you, Mr. Chairman. And thank you, the Committee, for this opportunity to discuss how rural America can improve our Nation's energy security. I direct the National Bio-energy Center, as you said, at the National Renewable Energy Laboratory in Golden, Colorado. NREL is the U.S. Department of Energy's primary laboratory for renewable energy and energy efficiency, and I am honored to be here today.

The Committee is to be commended for examining the role that agriculture and forestry can play in reducing our dependence on imported oil. This is a crucial subject for our Nation. Biomass is the only renewable option that we have for liquid transportation fuels.

Let me begin by emphasizing that the biomass resource base in our country is huge. Every State in the Nation can benefit economically from an expanding biofuels industry. A recent study by USDA and DOE found that the U.S. could produce annually 1.3 billion tons of biomass dedicated to fuels. As illustrated in my written testimony, this amount of biomass holds as much energy as 3.5 billion barrels of oil. That is 60 percent of the oil that we use in the United States each year. Already today, our Nation produces 5 billion gallons a year of ethanol from corn grain, and the industry is growing about 30 percent annually.

Corn ethanol can ultimately produce about five to 10 percent of the liquid fuels that we need. To move the biofuels industry to where we need it to be, we have to go beyond corn grain as the primary resource. We need to move to cellulosic biomass: trees, grasses, non-edible materials, some of which are residues from existing industries. That is the focus of our research at NREL and of the biomass program within the Department of Energy.

Our goals are to make cellulosic ethanol as cheap as corn ethanol within the next five years, also, to make cellulosic ethanol cost competitive with gasoline by the year 2030. While these goals are aggressive, and they will require revolutionary approaches for producing, collecting, and converting the biomass, we believe that both of these goals are achievable with adequate research support and a focused R&D effort.

The encouraging progress that we have had to date with cellulosic ethanol lends credence to our longer-term targets. As illustrated in my written testimony, the past five years of DOE's research have drastically cut the cost of making ethanol from cel-

lulosic biomass. In partnership with two of the world's largest enzyme manufacturers, we have been able to reduce the cost of the required enzymes more than tenfold, and we have reduced conversion costs by another 30 percent over those five years by improving the biomass conversion process itself.

Critical to our progress at DOE are our many partnerships with industry on the development of what we call biorefineries. NREL, together with our partners, are developing technology for fully integrating facilities that can use biomass instead of petroleum to produce fuels, power, and chemicals, virtually everything that we make from petroleum today. We are partnering with ethanol technology providers, ethanol producers, biotech companies, chemical companies, and companies in the agriculture, forestry, and oil industries. We are working to increase the yield of ethanol from existing facilities, develop new biofuel technology options, and expand the slate of feedstock to include cellulosic biomass.

The emergence of cellulosic biorefineries from our existing facilities is one of the reasons that we believe, at NREL, that the cellulosic ethanol industry will not replace today's corn and grain industry, it will evolve from it.

There are other important biofuel technologies, including thermochemical gasification and pyrolysis of cellulosic biomass. These technologies can convert a wider range of feedstocks. They can also reduce the costs of the biofuels, and they may ultimately lead to an entirely new generation of biofuels.

This week, the Department of Energy, yesterday and today, is hosting a 2–day workshop with industry, and there are 33 different companies at that workshop. In order to better define what research is needed in order to utilize these thermal technologies to produce biofuels, in addition to the technology that we are working on in ethanol today. Developing all of these different technology options is important to maximize the benefit that biofuels will bring to the rural economies, and to ensure worldwide competitiveness of U.S. industry.

Ethanol, biodiesel, and other biofuels definitely reduce our dependence on petroleum. Cellulosic ethanol can supply a large portion of our overall demand for gasoline, and we can expand our resource base and our biofuel options in the future as required.

As the Director of our Nation's Research Center on Bio-energy, I can assure you that your investments in biofuels research today will provide sustainable benefits for all future generations. Biofuels are an environmentally and economically beneficial way for us to bridge the gap between rising energy demand and peaking oil production, while reducing our U.S. dependence on imported oil.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Pacheco can be found on page 114 in the appendix.]

Chairman HARKIN. Thank you, Dr. Pacheco. Thank you very much for your statement.

We will turn to 10–minute rounds of questions, now. And I will just start with Phil Sharp. Again, I want to get that Chart 4, the Chart 4 that we talked about that I looked at last night.

You have cellulosic ethanol equivalent to about 100–let me get it out here and look at it again. You have cellulosic ethanol equiva-

lent to about $120 to $140 per barrel of oil, shale oil equivalent to $55 to $80 per barrel of oil. Now, since neither of these are being produced in volume today, how do you get those numbers?

Mr. SHARP. Well, I did not compile the numbers. Dr. Richard Newell got it from a whole bunch of studies and projections that have been done. The truth is, I think nobody knows for sure on these kinds of things.

Chairman HARKIN. Okay.

Mr. SHARP. But those are guesstimates as to what those kinds of costs are. Obviously, you have provided subsidies that helped bring down, potentially, over time those costs.

Chairman HARKIN. OK. I wanted to——

Mr. SHARP. But I think the oil companies probably have come forth with a lot of information that would suggest that the oil shale are in those numbers. So my suspicion is that we have a more likely accuracy on those numbers than on the cellulosic biomass.

Chairman HARKIN. Dr. Pacheco, do those numbers mean anything to you? Have you looked at that in your research at all?

Mr. PACHECO. Absolutely, and those numbers concur, currently, with best available technology. We believe that the cost of producing cellulosic ethanol today is in the low $2.00 range, around $2.30 is typically the number that we use, but there are large error bars on that, since it has been pointed out.

Chairman HARKIN. $2.00 of what?

Mr. PACHECO. That is per gallon of ethanol.

Chairman HARKIN. Per gallon.

Mr. PACHECO. So to put it on barrels, you would need to need to multiply that by about 40.

Chairman HARKIN. So that is a little bit cheaper than what they got.

Mr. PACHECO. That would be barrels of ethanol.

Chairman HARKIN. That's right.

Mr. PACHECO. Again, from a technical point of view, there is another correction, because ethanol has less energy per barrel, about 30 percent. So you would need to multiply it by another factor, about 1.3.

Mr. SHARP. These numbers, I believe, are corrected for the energy content.

Mr. PACHECO. They do sound correct, Senator.

Chairman HARKIN. I see what you are saying.

Mr. PACHECO. And consistent with our numbers.

> [The range of cost for producing ethanol from cellulosic biomass that Dr. Sharp shows in Chart IV of his testimony is $120-140 per BOE (barrel of oil equivalent.) This cost range is actually about 30 percent lower than NREL's current cost estimate for cellulosic ethanol. NREL currently estimates cellulosic ethanol at about $2.20/gal ethanol, which would correspond to $170 per BOE. Significant technology improvements are needed to make cellulosic ethanol cost-competitive with ethanol made from corn.]

Chairman HARKIN. I see. Well, again, my point is that in both cases, technological improvements may well lower the production costs. In your judgment, Phil, which of these alternatives is likely

to see the largest production cost reductions from research and development?

Mr. SHARP. Well, I am not a very good one to answer that, Senator. I think that it is very hard to say. I think it is going to depend on where the emphasis gets placed. Each has its own specialty. I mean, shale oil in Colorado depends heavily on other environmental considerations as to whether the huge investments get made there or do not. The investments that were made in the 1970's and 1980's all crashed when the oil price crashed, but a lot was learned in which these companies now are willing to come back and say, we will try again.

If they are successful and they get into the marketplace first, it only compounds the competitive situation for these other fuels like cellulosic biomass and cellulosic ethanol.

Chairman HARKIN. Keith Collins, in the Biofuel Security Act of 2007, which we introduced last week with Senator Lugar and others, we called for increasing biofuel production levels to 60 billion gallons per year by 2030. That is a little bit less energetic than the 25 X 25 is, but still up there. We all expect that we need to be producing biofuels from cellulosic feedstocks. We were talking about that. We cannot get it all from corn, for example.

So my question for you is, how do we steer the economics of ethanol production so that we support and protect the role that grain-based ethanol plays now in the future, but also nurturing the development and commercialization of cellulosic ethanol? Do you understand what the point of my question is? Obviously, a lot has been invested in corn ethanol. A lot has been invested in these plants, but we know we have to move on. So how do we protect our initial investments and keep a market there for corn and while promoting and encouraging the commercialization of cellulose?

Mr. COLLINS. That is an enormous challenge, Senator Harkin. It strikes me that, for some years to come, the investments in grain-based ethanol will be well-protected. Their cost of production, as just noted, are substantially below current estimates of cellulosic ethanol. I think those investments could be stranded only if those costs of cellulosic ethanol production were to plunge sharply below the costs of grain-based ethanol production. That could possibly happen. I do not particularly see that. I have had a chance to see some confidential business information of firms that are planning on building demonstration cellulosic ethanol plants, and they have some projections of their cost structure now and out into the future. And they have their cost structure coming pretty much in line with corn-based ethanol.

So it strikes me that there is a prospect here that we go from dominance of corn-based ethanol to a rise in cellulosic ethanol, and the two proceed to grow together for some time to come. So I think that would be sort of the Goldilocks world of ethanol, I guess, where you could continue to turn on your corn-based investments, but you would not be putting such pressure on a corn acreage base that you would be jeopardizing the livestock sector.

And I think that is the kind of goal that the research community has in mind, that the public policy community has in mind. And I think that is what a lot of the programs that are promoting the

development of cellulosic ethanol have in mind as well. And so hopefully we can stay on that kind of successful, ideal path.

Chairman HARKIN. The question I have for you, again—I would like each of you to respond to this, if you want to, and that is the chicken and egg situation we find ourselves in. There are some who say biomass plants will not be built without existing contracted supplies of biomass to guarantee that the plants have the raw material to process. The producing side says, we are not going to shift to producing it until we have a market for it and we have the plants there that will take it. How do we break that down?

Mr. COLLINS. I have a lot of faith, sort of, being an economist, in the market overcoming these chicken and egg situations. It overcomes them all the time. And I think if the technology is there for profitable production of cellulosic ethanol, entrepreneurs will, in fact, spur the planting and the harvesting of biomass.

And that is going to come in so many different forms. Obviously, the low-hanging fruit here are residues and waste materials. There is already a lot of work being done on that. And there is the plant in Iowa, the Broin company plant, that is just starting construction and using corn stover as well as corn in the same plant to increase their ethanol production.

So the early transition here is going to be the existing ethanol facilities, corn-based facilities, that also start using cellulosic material. This does not happen overnight. This is going to happen over time. We do not even have a demonstration cellulosic ethanol plant in operation in the United States today. You have to go from a demonstration plant to a commercial plant. This is going to take time.

And so, as that ramps up, then I think you are going to see these opportunities for farmers to plant and harvest this stuff. And of course there are all kinds of ideas for the 2007 Farm Bill on how you could stimulate some farmer production of biomass to get going down that road.

Chairman HARKIN. Yes. Senator Chambliss and I, as well as many others, have talked about this. How do we start that process? And that is going to be a part of this bill, I can assure you. I do not have the answer right now.

Mr. COLLINS. Well, there was an answer in Iowa, the Chariton Valley project.

Chairman HARKIN. Yes, we have someone here on the second panel. John Sellers is here to testify what they have done out there.

Anybody else in response to my chicken and egg question here?

Mr. SMITH. Senator, I will submit that our implementation plan of 25 X 25 will include components around the chicken and the egg issue regarding the production of dedicated energy crops. And I think in our vision of 86–plus billion gallons of ethanol and biodiesel, it certainly includes a very large percentage of that will be from biomass. Certainly late generation corn ethanol plants may be converted, eventually, to biomass as this comes in.

In fact, our UT study indicates that by 2012 when cellulosic ethanol is fully incorporated into the industry that we may actually see a decrease in corn acres due to the redirection of ethanol to cellulosic versus corn.

Chairman HARKIN. I want to follow up on that, maybe in my next round.

But Dr. Pacheco, just, again, getting back to the cellulose plants. As I understand it, and I could be wrong in this, that the only real commercial-size cellulose plant is in Canada someplace. That is what I was told. I have not been there. I forget the name of the company.

Mr. PACHECO. Iogen has a demonstration plant in Canada?

Chairman HARKIN. Pardon?

Mr. PACHECO. Iogen has a demonstration plant in Canada?

Chairman HARKIN. That is what I am thinking of, yes.

But is the technology ready to be scaled up and tested at the commercial plant levels?

Mr. PACHECO. On a technical basis, absolutely yes, Senator Harkin. All of the technology pieces are in place, and many of our industry partners feel that the technology is technically viable, as Dr. Collins from USDA has pointed out, and I agree entirely with him. The problem is that the costs are quite a bit higher; almost double the cost of making ethanol from the food resources.

So I think to come back to your root question, I think what is really needed is a combination. One is a continued, aggressive technology development program together with policy drivers that will incentivize the use of cellulosic materials rather than food resources.

Chairman HARKIN. I think we need to put more money into this research end of it, but now you say DOE is doing this research.

Mr. PACHECO. Both DOE and USDA.

Chairman HARKIN. Do you feel that they are coordinating well enough?

Mr. PACHECO. Absolutely.

Chairman HARKIN. And where is the coordination taking place? Who is overseeing this?

Mr. PACHECO. It takes place both at the laboratories and at the Technical Advisory Committee, where both the USDA and DOE partner in leading an advisory committee where members of industry, together with universities and a number of other institutions come together. It is about a 30 panel member that helps guide the two agencies, together with workshops that we jointly participate in.

Chairman HARKIN. I need to understand personally—I just need to understand that structure better, and how much DOE is putting into and how much Department of Agriculture is putting into it, and how much the private sector is putting into it, and how that is all coordinated, because that is going to be one important component, I think, of our Farm Bill that we are going to be putting out. It is just looking at that research and how much research money do we need to put in there to continue that tenfold decrease.

Mr. PACHECO. Absolutely.

Chairman HARKIN. To really get it down.

Mr. PACHECO. Absolutely. And there are other approaches and other fuels that we could work on that would benefit farmers and foresters that today, because of budgets, we are limited to focusing on the cellulosic ethanol, but there are certainly other approaches that we can pursue as well.

Chairman HARKIN. Thank you all very much.

And now I turn to our Ranking Member, Senator Chambliss.

Senator CHAMBLISS. Thank you very much, Mr. Chairman. Gentlemen, thank you for being here to enlighten us on an issue that—am I doing something, Bob?

I realize I got radioactive seeds to cure my prostate cancer, but I did not know that it did that.

[Laughter.]

Senator CHAMBLISS. Keith, thanks for always coming up and sharing your thoughts with us. You have been a great asset to us down at USDA. And a couple of years ago, I asked you to do a study on this issue, and thank you for your prompt attention to that and thanks for the report that you issued. And due to the changing nature of this business, I want to hand you a letter this morning just asking you to update that study that you did and come back to the Committee and give us the updated ideas and thoughts that you have on that.

Mr. COLLINS. Yes, sir.

Senator CHAMBLISS. And Keith, I want to just follow up on the last response you gave there to the Chairman's question. I want to talk about this food versus fuel debate, which is a frequent topic among policymakers, and let me ask you four questions and just ask that you give a general discussion on this issue.

First, if oil prices remain high for the foreseeable future, would this provide additional incentives to the corn ethanol industry to expand capacity?

Second, if corn prices continue to rise and ethanol plants outbid U.S. animal agriculture food processors and the export market, would traditional users of corn reduce consumption or would we expect to see a new wave of consolidation in those industries?

Third, where do you expect to see shifts in corn production where it is not presently occurring today?

And then, fourthly, what are the constraints on farmers exiting the CRP to increase corn production?

Mr. COLLINS. I hope I got them all. Senator Chambliss, you can remind me.

First, if oil prices stay high, will that provide incentives to continue ethanol expansion? The answer is generally yes, but ethanol expansion depends on the profitability of ethanol, and that is just not a function of the price of oil. The price of ethanol can vary quite substantially compared with price of oil or the price of gasoline.

Historically, there has been a $0.35 or more premium of ethanol over the price of gasoline, largely due to the tax credit and the scarcity of ethanol. As ethanol becomes much more abundant and goes beyond the E10 market, if there is not another option for ethanol, such as exports or E85, it is highly possible, as already mentioned, with the Btu value of ethanol being two-thirds the Btu value of gasoline, you could see ethanol prices fall below gasoline prices. So yes, high crude prices will continue ethanol expansion, but the price of ethanol in relation to gasoline will also be a factor in that expansion over time. It looks to us like we are going to see that expansion continuing for some time to come.

What will happen if ethanol plants outbid traditional users? This is what markets do. Prices ration a fixed supply. If the supply is

being outstripped by demand, then prices will go up and it will ration the use among users. I think that ethanol plants, at least in the current environment, can bid quite high for corn. And so the adjustment will come from those sectors of the demand sector that are most responsive to prices. That might be exports. That might be certain users.

So yes, there will be some adjustments in use. There could be some adjustments in feed use as well. And feed use would mean higher production costs, which would get reflected into lower livestock returns and some slower growth in livestock production or maybe even some declines, depending upon how high corn prices might get.

I have forgotten the third one. Oh, it was where corn production would shift.

Senator CHAMBLISS. Shifts in corn.

Mr. COLLINS [continuing] I think the obvious one is going to be soybeans, and I would expect over the next couple of years we are going to need a lot of acreage in corn. And I would expect most of that is going to come from soybeans.

And you can think back 1five years ago, we had 60 million acres of soybeans, last year we had 75 million. It is not unthinkable to see soybeans going back down to the 60's and even the low 60's. That would not jeopardize our domestic use of soybeans. It would reduce our export of soybeans, I think, more than anything. But there you have Brazil and Argentina have been tremendously increasing their soybean production and could be an offset there. I would expect that to happen.

So I would expect to see corn go into soybeans—soybeans go into corn, rather. So we will see more corn on corn production, year after year corn in the heart of the Corn Belt. I would expect to see corn migrate west to some extent, north to some extent, as genetic changes in corn have made that more possible. I would also expect to see some cotton areas shifting into corn as well. We are already hearing that.

There has been some early work in December surveying farmers on their intentions of acreage for 2007. And one survey showed farmers plan to plant about 86 million acres to corn. Last year they planted 78.6. So farmers are responding to the higher prices, and I would expect that to occur.

Last, constraints on exiting the CRP. I think they are not real hard constraints, I do not think, for a lot of acreage. Of course, a lot in the CRP is highly erodible land. If you leave the CRP and go back into production, if you want to participate in farm programs—you have crop acreage base, you want to participate in the Market Assistance Loan Program, you have to farm highly erodible lands according to a conservation plan. So you would have to farm that land according to an approved NRCS conservation plan.

Secondly, it depends on the practice the land is in, and there are lots of practices in the CRP. It could be woodland. It could be waterway. It could be a construction practice. It could be anything. Depending on the practice, that is going to determine how hard it is to convert that land into production crop land. But I see grassland CRP acres in the heart of the Corn Belt as probably not that hard to convert. You might have to drill soybeans in the first year

and go to corn in the second year as the soil quality makes it more adaptable to corn.

So I do not see big barriers there. But I also do not see a lot of CRP acreage coming into corn over the next few years. There are just not that much CRP acres that could potentially come out of the CRP.

Senator CHAMBLISS. USDA annually gives us the projection on yields on all crops, particularly in light of weather conditions which are so critically important. I doubt that you have had time to do that for this year, but would you please just make sure that this Committee gets that projection as soon as possible, as soon as you complete that report for this year.

Mr. COLLINS. Well, the next report we are putting out would be the date of the President's budget release, February 5th, in which we put out what is called our CCC Estimates Book, which is a detailed, year by year 10–year projection, crop by crop. And that goes out February 5th.

We have a much more detailed international assessment, our so-called baseline, we are releasing on February 14th. On March 1st and 2nd, we have our outlook forum, and we will be updating all of those numbers at our outlook forum. So we have a series of releases coming out over the next month which will fill the media with one conflicting number after another.

[Laughter.]

Senator CHAMBLISS. We will look forward to all of the above, Keith.

The transportation infrastructure for renewable fuels is evolving as quickly as the industry itself. And for the most part, product is moving where it needs to go on time, but ethanol production is transforming the agriculture economy. And some time in the near future we might see the need to import corn into States such as Iowa and Nebraska which have historically exported a large portion of their crop.

Given the tremendous changes occurring, are you confident USDA is providing updated and timely information that can accurately advise policymakers on this evolving issue, and does USDA have any outside studies underway to assist the understanding of the transportation situation and the outlook?

Mr. COLLINS. In answer to the question, are we providing sufficient information, we provide more macroscopic information. We tell the world every month what we think is going to happen in global agricultural markets. We do not usually take it down to the State level, but we hope people in the State area can use that information for decisionmaking.

I would say that this issue about Nebraska and Iowa, the land grant universities in those States are doing a lot of work on this. I see lots of reports coming out of the land grant universities.

We, in fact, have contracted with the Center for Agriculture and Rural Development at Iowa State University to look at the implications on rural areas as a result of the ethanol expansion. I have a meeting next week or the week after next with the Dean of Agriculture from the University of Nebraska. So we are in consultation a lot with States that are facing the big increase in ethanol production. But it is pretty much, I think, a function of the land grant

universities to look at some of these local issues, like whether a particular State might become a deficit region or not.

The transportation issue is an important one. To my knowledge, we do not have a study going on transportation implications of the expansion in ethanol. We do have a transportation division at USDA, in the Agricultural Marketing Service. They put out a weekly transportation market update. And I have talked with them in the past and I know that they are focused on ethanol. And, in fact, I think it was four or 5 weeks ago, they had an article on ethanol in the transportation update. So that part of the USDA, the transportation part of the USDA is following this very closely.

I might also say that related to this project that we have with CARD, at Iowa State, I was also speaking with the National Grain and Feed Association, and they are interested in piggybacking on the work that we are doing and having a transportation study done. That would not be our study. That would be their study, but we are talking with them about that. So the transportation issue is a big one and we are thinking about that.

Senator CHAMBLISS. Dr. Pacheco, your testimony cites technological developments beyond those that we are most familiar with such as fermentation and distillation. I am curious about your comments about the integration of thermochemical technologies. Are there technologies available to produce biofuels that can use the existing fuel infrastructure that currently exists for hydrocarbons?

Mr. PACHECO. Absolutely, Senator Chambliss. In fact, I would like to compliment both the University of Georgia and Georgia Tech for working on this area. Georgia Tech, as you know, has a very active program in this area and is working closely with the Chevron Corporation to develop technologies that can use thermal approaches and existing hardware and existing equipment in the oil industry to convert some forms of biomass.

Just, very quickly, a couple of examples, and one that I know that Georgia Tech is working on and we are working on as well at NREL, and partnered with industry, is to use pyrolysis to make an intermediate crude oil that is actually made from, for example, woody resources, which is a very good fit for the Southeastern United States. The plantation pine could be chopped up just like you do for paper mill, pyrolized, and this is a process, for those that are not familiar with it, it is a very simple process where you heat the material up in a fraction of a second very hot, to about 500 degrees centigrade. And you shatter all of the polymers: the cellulose, the hemicelluloses, the lignin, and convert a black liquid. The challenge that we have, Senator, and the problems that we are working on at NREL with our partners, and that Georgia Tech is working on, is to produce an oil that is of better quality.

We can produce that oil today for something on the order—it is equivalent to about $30 or $50 a barrel of crude oil, but the quality is very poor. So it is like a very low quality crude oil, but it is all biomass-drived, 100 percent renewable. It is a very different oil. It is something that the petroleum industry is not used to, and we need to work with them to understand if that technology could be developed so that—you know, the United States is 25 percent of the world's refining capacity in this country. If we could utilize that to make biofuels, it will benefit not only the rural communities that

are producing the biomass, but it will also benefit the existing infrastructure that we have for producing fuels and getting them to the marketplace.

Another example that we are working on very closely, and it is a subject of the workshop this week, is that there are approaches to actually use gasification and then produce ethanol and other alcohols from the synthesis gas. That technology fits very nicely with, say, a corn ethanol plant, or a cellulosic ethanol plant. And we can use the other parts of the biomass, particularly the lignin components, that scientifically we do not know how to make ethanol from a fermentation route.

So all of these different technologies can really reduce the cost. They can open up new options for foresters and farmers to get their biomass into the fuels industry. And all of these starting materials are not food materials. They are not edible biomass, so they completely avoid the food versus fuel issue. But the challenge, as Dr. Collins pointed out earlier, and I definitely agree, technically, we do not know how to do it cheap enough yet. We are at, roughly, double the cost, and we need to get those costs down. And it is possible that there could be some policy instruments that could help seed that industry. And as the industry were to grow, more and more private dollars would go into the R&D, together with the Federal dollars and the State dollars, to accelerate the development of these technologies.

Senator CHAMBLISS. Thank you, Mr. Chairman.

Chairman HARKIN. Thank you, Senator Chambliss.

And for our new Senators, the tradition has been on this Committee, for a long time, that we will recognize Senators in their order of appearance here at the Committee. So it was Senator Roberts, he is not here right now, and then Senator Klobuchar.

Welcome to the Committee.

Senator KLOBUCHAR. Thank you, Chairman Harkin, I appreciate it. It is great to be on this Committee. I am very excited to be a part of it. And I also thank you, Chairman, for your many visits to Minnesota. I think it is you and your wife that would come for some anniversaries because we are such a romantic place, I know.

[Laughter.]

Chairman HARKIN. You know, my wife is from Minnesota.

Senator KLOBUCHAR. Exactly. We have opened up a new bed and breakfast near Pipestone where the packages—you get up and look at a wind turbine. So that might be a lot of fun for you.

[Laughter.]

Senator KLOBUCHAR. Combine work and.

Chairman HARKIN. My wife is from out that way.

Senator KLOBUCHAR. Right. Anyway, I was pleased, also, that you had the first topic here about renewable energy, which is so important to Minnesota's economy. We have 16 ethanol plants now in Minnesota, which produce more than 500 million gallons of ethanol in 2006. We have a number of biodiesel plants as well. We have been a leader in the area of renewable energy, and we also have 306 of the 1000 gas pumps at our gas stations that actually provide ethanol, not that we are counting, but we are very proud of that work that we have done as well, and I think that is a major part as we go forward.

I was thinking about this issue the other day. My daughter, when she was in the sixth grade, she did a report on ethanol for her end of the year report. And she did a big display of ethanol and she interviewed a number of farmers, and she interviewed a farmer from Pine City, and she drew a map of the State of Minnesota. On it were two little dots that said Minneapolis and St. Paul, and then a huge circle, Senator Coleman, Pine City, home of farmer Tom Peterson. And I thought that is the future for ethanol. And it is such a big part of our rural economy. In addition to the other benefits that have been talked about today for renewable fuel with the clear implications for our national security as well as the environment.

So I thank the witnesses for being here, and I just had two questions. One was for you, Dr. Collins, and it was from your testimony about the issue of some of the rising production costs related to natural gas costs. I think in your testimony you talked about how in 2000—that the natural production costs of ethanol has risen from about $0.95 per gallon in 2002 to $1.45 now. And one of the plants that I toured in Benson, Minnesota actually used gasified corn stover in place of natural gas to run the facility. And I wondered what you thought of those kinds of innovations and how that could help us as we go forward.

Mr. COLLINS. I think those kinds of innovations are terrific and I think we are going to see more of them. I think one of the exciting things—I know there was a plant in Canada and I think there is one under construction in the United States, there may be others, that are combining livestock feeding operations with ethanol production, where they are using the manure to produce electricity to heat the ethanol plant instead of natural gas, and then they are using the Distiller Dried Grains, wet, to feed the livestock.

These kinds of economies, I think are very, very important for ethanol, and it represents a terrific way to reduce energy costs which are significant for ethanol plants. Some ethanol plants are doing lots of different things to try and reduce those, so I think that is really welcome, and it is creative, and I hope we will see more of that.

Senator KLOBUCHAR. Thank you.

And then, Dr. Pacheco, biodiesel industry, also very important in Minnesota. I think we are the third largest producer of soybeans in the country. I think the one State ahead of us is to our southern border, but we are very interested in expanding that, and I know in your testimony you talked about the fact that there are issues about ensuring that the 20 percent biodiesel blends are compatible with some of the new generation of diesel engines that we are seeing. Could you elaborate on the work that your organization is doing in this area? We see this as very important that we have compatible engines as we go forward with our biodiesel industry.

Mr. PACHECO. Certainly, Senator Klobuchar. You are very well informed, and it is a very key issue. One, unfortunately, that I feel that we are not doing enough work. Our staffs are trying to keep up with the innovations in the advanced diesel engines, but right now, because biodiesel is such a small component of the diesel market, the equipment manufacturers are not really incentivized to deal with those issues and to research those issues. So we are doing some work at NREL, but a lot more work needs to be done.

It is a major concern of the National Biodiesel Board, as you may know, that the higher blends of biodiesel will be compatible with the newer, more advanced, high efficiency engines that are being developed by the auto manufacturers. So it is an area that needs more work. We are doing some, but not nearly enough.

> [Testing of biodiesel in advanced diesel engines is a key issue, one that NREL experts in this area feel we are not doing enough work on. Our researchers are trying to keep up with the innovations in advanced diesel engines, and perform the testing on biodiesel that the diesel engine industry and EPA needs to see. Some work in this area is proceeding at a modest level at NREL with support from the biodiesel industry, and the diesel engine manufacturers are assisting with this effort. However, the engine manufacturers have had to commit their resources to developing engines that meet the very strict new emission standards that are coming into effect now and over the next few years. The engine manufacturers are counting on the DOE and the biodiesel industry to perform compatibility of biodiesel. So, while we are doing some work at NREL, alot more work needs to be done. It is a major concern of the National Biodiesel Board, that the higher blends of biodiesel be compatible with the newer, more advanced, high efficiency engines that are being developed by the auto and engine manufacturers. It is an area that need more work.]

Senator KLOBUCHAR. OK, thank you, and thank you, Mr. Chairman.

Chairman HARKIN. I like the standard that you just set. You did not even use all of your time. Amazing. Thank you, Senator Klobuchar.

Senator KLOBUCHAR. Might not be a standard for the future.

[Laughter.]

Chairman HARKIN. And then another new member we welcome to this Committee, again, who served admirably on the House Agriculture Committee, like both Senator Saxby and I have. So let us welcome another former House Agriculture Committee member to the Senate Agriculture Committee, Senator John Thune of South Dakota.

Senator THUNE. Thank you, Mr. Chairman. And I welcome the opportunity to serve with you under your leadership on this Committee, and with the ranking Republican, Senator Chambliss, as you noted, that I served with in the House. And I appreciate all the important subjects we are going to get to deal with in this next year.

In my three terms in the House, we did have the opportunity, in 2002, to write that last Farm Bill, and that, like every Farm Bill, was a challenge, and something that took us a good amount of time, I think, to work through, but one that I think the outcome was very satisfactory. And I think most people in agriculture farm country would argue has been a success.

What is interesting to me about all that, of course, is in my State—it is a State where agriculture contributes about $17 billion

to our economy. It is the No. 1 economic engine in South Dakota. And if you look at the last Farm Bill and what it has done, we obviously have focused in the past on food and fiber when we talked about foreign policy, but I really think this Farm Bill was food, fiber, and fuel. And I think it is—I was in a sale barn not too long ago in South Dakota and I got an earful from a bunch of livestock producers about the high cost of corn and what that was doing to feeder prices. And as has already been noted, that is an issue that people in the livestock industry are concerned about.

But it occurred to me, what a high-class problem to have, that the demand for corn is pushing corn prices up to over $3.00 a bushel. And we used to send it to the export marked for $1.50 or thereabouts, or less, per bushel, and now we are getting over $3.00 a bushel. And the other attendant result of that is we are reducing the amount of money that the taxpayer is putting into farm programs, because when prices are high, as was, I guess, a point in the last Farm Bill, you know, those subsidies reduce. So we are not making LDP payments and we are not making counter-cyclical payments, and that is a great outcome for the American taxpayer, and something that I do not think gets talked about near enough when we talk about the Farm Bill and we talk about the importance of renewable energy.

We hear a lot of the critics of renewable energy talk about the cost, and the subsidy, and everything else, but if you think about how many billions of dollars we have been saying in terms of LDPs and counter-cyclical payments that are not being made, that is also something I think we ought to be talking about when we highlight this.

But I think this Farm Bill, as you have noted, Mr. Chairman, really ought to be very much about renewable energy, because it is so important, not only to the economy of agriculture, but also to our national security, our energy independence, environmental quality, all the things that have been talked about this morning. And I think the challenge that we face on this Committee and in the Congress in terms of this Farm Bill is what can we do in terms of policies that will further the growth of this industry, that will take us to what I would hope is 50 million gallons by 2025. I know it messes up the 25 X 25, but I think it ought to be 50 x '25, because I think the capacity is there.

As you noted, Mr. Pacheco, in your comments, if we have 60 percent of our total fuel usage in this country that can be produced by biomass products in this country, that is—we used about 140 billion gallons this year of fuel, that is about 84 billion gallons that we could make out of biomass materials. And I know that there is a limit to what we can do with corn-based, but as we move into switchgrass, and cellulosic ethanol, and other types of biomass materials that can go into ethanol production, I think the sky is the limit for this industry, and it is just, frankly, the right thing to do.

So I think we have to be looking at, what are those policies that can take us to that point? Is it increasing the renewable fuel standard? Are there other things—the tax incentives, obviously, have been very important in terms of growing this industry, but I look forward, Mr. Chairman, to working with you to identifying those types of policy incentives that will enable us to continue to grow

the renewable fuel industry in this country, which, again, is great for American agriculture. It is a good return for the taxpayer. And it also lessens the amount of money that we use to fund terrorism, because when we send our dollars to the Middle East to buy oil from countries that turn around and use those dollars to fund terrorist organizations that kill Americans, that has to be a very serious concern, I think, for all Americans. So I do not—as you can tell, I am a big fan of bio-energy and I just think that we have to continue to move forward with policies that will grow this industry.

But nevertheless, I have a couple of questions that I will get to, and I appreciate Senator Klobuchar's economy when it comes to the use of time. I think the longer that she is in the Senate she will realize that is not the way it works here. You have to use all of your time.

[Laughter.]

Senator THUNE. And then beyond. But in any event, I do have a couple of questions.

I would like to get at this question on—and I know that the technologies are emerging that will promote cellulosic ethanol and, as you mentioned, both Broin and Varison in South Dakota are finalists in a research program that DOE has that would allow research dollars to go into that, and we need to get that commercialized. And I do not think it is very far away. But I guess my question is, and some of you have touched on it, and my colleague from Georgia is concerned about the livestock industry, and what is that level of corn production that we can get to before we run out of corn that could go into feed for livestock? Is that a 10 billion gallon? Is it a 15 billion gallon renewable fuel standard? Assuming that we are talking about corn-based ethanol, what is that level that we get to where—and I guess this probably more for you, Dr. Collins. I know you study these things and you model these things. Where could we set the renewable fuel standard before we create a real dislocation for livestock?

Mr. COLLINS. Senator Thune, that is a good question. It is one that has been hotly debated, too, as people have talked about alternative RFS levels, understanding that an RFS level could be met from several sources. It could be met from corn ethanol. It can be met from cellulosic ethanol. It can be met from ethanol imports as well. So to think that we would want to adjust the current RFS level to another level would have to take into account the potential production from all of those kinds of sources.

For corn ethanol, I think we are probably—as I mentioned earlier, I think we are on track to produce something like 12 to 13 billion gallons by 2009. I know the National Corn Growers Association has done a pretty credible analysis that suggests by 2015 we can readily produce 15 billion gallons of ethanol without jeopardizing the food side of the equation. On the track we are on now, we might be able to do a little more than that by 2015 and still not jeopardize the food side of the equation.

It is difficult to answer the question, what is an acceptable or unacceptable adjustment cost imposed on the livestock sector, because the livestock sector has adjustments all the time. I mean, we have drought, and we have pasture problems, and we have had excess production, which has caused huge price collapses like the pork de-

bacle in 1998. So there have been lots of adjustments in the livestock sector over time. So this is another adjustment, and the industry can adjust. The worry is that you do not want to impose such a huge adjustment that it might cause wholesale consolidation as Senator Chambliss mentioned.

I think one of the things here is that we are sort of on a predictable path. This is not like an unexpected drought which causes corn production to drop by 30 percent or something. We are on a predictable expansion path here. There are opportunities to plan, and to hedge, and things like that. So while I am concerned about this, I do think we can move up to that 15 billion gallon range before the next decade is out and comfortably accommodate that.

Senator THUNE. And I expect we are going to see shifts from soybean production to corn production, and we are seeing yields going up all the time because of technology. They are going to grow that universe of corn production that.

Mr. COLLINS. And if I may say, the USDA has been conservative on its yield approach. I am conservative on this. I work in crop insurance a lot, and our actuaries always say to me, I cannot tell you anything without 30 years of data. So if I use a 30–year trend line for corn, I am going to show corn yields going up a couple bushels an acre per year.

On the other hand you can look at the work of some of the seed companies. They are doing yield forecasts based on their knowledge of what is in the pipeline technologically. And they are 10 to 15 percent above us by the time you get out to 2015. Well, 10 to 15 percent above us is a huge difference in needed acreage for corn. So you are right to point out the corn yield thing. It is going to play very heavily over the next few years in what kind of a land resource we need to produce corn ethanol.

Senator THUNE. We appreciate that about you, that you take a conservative tact on all these things. And there are a couple things that I think—I have a bill that I have been trying to promote that would provide incentives for retailers to install 85 pumps, which I think is important, too, because we have got the production side and we have a market with the RFS, but we have to connect the two with—and I am hopeful to get that moving at some point, Mr. Chairman.

One last question, if I could. Some of my colleagues on the House side are suggesting that we increase, as a point in this debate, CRP acreage, putting more—you know, your, blue stems, your switchgrasses, whatever, in CRP, then using those, harvesting those, for energy production. And I guess my question is, maybe for you, Dr. Collins, or anybody who cares to comment on this, is that workable? Does that work? And you continue to have the benefits, conservation benefits, wildlife production benefits, all the things that come as a result of the CRP program and be able to convert that, because that is our future. I mean, switchgrass and other types of materials that we can make cellulosic ethanol from are really where this is headed.

Is that a possible scenario, where we actually not decrease, but increase the amount of CRP acreage, with the stipulation that it be planted in these grasses that can be used for energy?

Mr. COLLINS. Well, I haven't clearly figured out how to do this, but I think the concept is valid. There are a couple of issues there, and one, of course, is people who are concerned about the adequacy of our commercial supply of food products. If you increase the size of the CRP, perhaps that is diverting more land away from grain production and marketing.

On the other hand, we also need to figure out how to spur farmer production of biomass for the coming cellulosic industry, and that could be a way to do it. There are a lot of concerns with it, though, if you are going to make it part of the current Conservation Reserve Program. We have had some pilots in the past where we have allowed harvesting of biomass in CRP for economic use. Generally that went to the coal-fired electrical generation plants. And so we have some knowledge about how to do this from those pilots.

And so I think this could be done. Part of the concern with this, and I do not want to go far off in another direction, but there are WTO issues related to this, too. You have to figure out if you are going to pay somebody for economic use for production. CRP is considered, under the WTO, a structural adjustment program, which is considered green box because land is retired from production. So if you are going to start harvesting on it, that raises WTO questions about that. I think that can be overcome. It is just a question of how you design such a program.

So there are a lot of issues there. I am just saying they would have to be thought through. But I think it is a feasible proposal and I look at it as a way to help sort of jumpstart the supply side of the biomass industry.

Senator THUNE. Thank you, Mr. Chairman. I apologize for going over. I borrowed from Senator Klobuchar's time.

[Laughter.]

Senator THUNE. I am sure she will return the favor at some point.

Chairman HARKIN. Thank you very much, Senator Thune.

Now we turn to a valued member of our Committee, returning Senator from neighbor to the west, Senator Nelson from Nebraska.

Senator NELSON. Thank you, Mr. Chairman. And thank you to the panel.

I know, as we talk about green box, I want to make sure that we do not put agriculture into the penalty box. So we need to find ways to be able to achieve compliance that still preserves the profitability of American agriculture, and perhaps this is one of the ways to be able to do that.

Now as we begin our work, or continue the work, on the Farm Bill for 2007, given all the discussion about food, fuel, and security, I would hope that we would think of it as a food and fuel security act of 2007, because that is really what we are aiming at. Since Senator Chambliss left the room, I need to advocate for fiber, as well.

I think as we look to the future, we recognize that we are in the process of expanding the importation of food to meet our growing food needs. And if we are not careful and we do not support American agriculture in an appropriate fashion, if we like importing 50, 60, or 70 percent of our fuel needs, we will love importing 50, 60,

or 70 percent of our food needs. So we have to think about this in terms of security.

Back in the old days of the farm programs, it was called the Food Security Act, because we focused on never being short. That is why all the grain bins are all over the country. We wanted a surplus. Today, it is probably a just-in-time theory dealing with American agriculture. But as we contemplate what needs to be done, I do hope we think about it in terms of security for the American consumer and the American economy.

As we turn to ethanol and cellulosic ethanol, we have to look a little bit back in history. I remember becoming Governor in 1991 we had one ethanol plant in Nebraska. I think it produced 30 million gallons. When I left, we had 7, and 350 were sitting somewhere with 12 to 14, depending on whether the last couple have gotten into production, with maybe 7 more on the drawing board. Moving into plants that produce biodiesel as well as ethanol. And the future is clearly there.

It is good to be talking about what challenges there are for, let us say, the price of corn and the overproduction of ethanol versus where we were 16 years ago looking at an uphill curve of imports of foreign oil versus American production on some sort of rational, reasonable standard. I would like to be where we are today looking up at how we bring down the cost of some of the production because of the increase in technology.

As a matter of fact, we are importing ethanol right now. There is about a $0.54 tax per gallon of it coming in as a tariff and for future development and other uses. I propose for that money from the tariff, the $20 to $30 million that we generate, go into the further research and development for new technologies for switchgrass and other kinds of cellulosic material. There is not an area of our culture today that does not have some agricultural product, whether it is forestry or whether it is American agriculture with grow crops or cotton, whatever it may be, that would not have an alternative energy source if we had the means to convert it, whether it is sugar cane in Hawaii, in the Northeast, Northwest—wherever we are, that is what it is. So I really look forward to the further development of ethanol and cellulosic use, as well as biofuels.

I have a couple questions that I would like to ask. I hear a lot of the concerns from livestock producers about feed costs, and I think it is great that the ethanol industry is helping to improve the prices for crops, but we are concerned about effectively balancing these needs as we must.

Now, someone has asked the question, as they always do, about the chicken and the egg. I do not think we have to decide which comes first. I think we need both, and sometimes you can do both at the same time, and that is what I think we are doing. Is it possible to establish stands of switchgrass in advance so that we can help investors and people looking to build the plants? You have already said, Dr. Collins, you have not figured out quite how to do that, but my question is, are you working on it to the point where something definitive could be available so that we are not always in research and development here on how to go about doing it, with transportation issues, bundling issues, storage issues, so that we

could look at it in a just-in-time fashion, because that is one of the best ways to make it profitable at the outset?

Mr. COLLINS. Senator Nelson, yes. I would say that has become a high priority issue at the USDA.

Senator NELSON. Do you have a time table that you might be able to tell us more?

Mr. COLLINS. I do not. A lot of that work is being done in our Agricultural Research Service. We do some of that work, as mentioned, in the joint program we have with the Department of Energy under the Biomass Research and Development Act Initiative. But the Agricultural Research Service, for years, has had a focus on grain-based ethanol, and over the last year has really re-oriented—they have reorganized and put their focus on cellulosic ethanol. One of their four top priority areas is management of the production and the harvesting, handling, and storage practices. So we do have a lot of work going on in that area.

I thought Mr. Thune's idea of a biomass reserve of some sort, is another way to get at that. There may not be commercial use for that biomass, but perhaps there would be commercial use for some, maybe some others, but it could also be used as a research area as well.

So I think these are ideas that seem to me to be in play for the 2007 Farm Bill and I think you are right, that there is no reason why, at the same time that we are expanding E85 pumps and promoting E85 and ethanol consumption, that we could not also be starting to build the biomass infrastructure.

Senator NELSON. Now, we do not have to wait until corn goes to $7.00 a bushel for that to happen. Is that fair to say?

Mr. COLLINS. I think that is very fair, yes.

Senator NELSON. What about grain sorghums to be used as well in the production of ethanol? It does not all have to be corn-based.

Mr. COLLINS. No, we do have other ethanol plants. We have very small ones that use dairy waste. We have wheat. We have grain sorghum. I know that Texas A&M University has published some articles on different types of ethanol plants utilizing grain sorghum that show very low costs of production. So I think that there are other commodities as well. Almost all ethanol today is from corn, but there are these other crop opportunities as well.

And you mentioned sorghum. As we look down the road and talk about biomass, I know that our researchers in the Agricultural Research Service are very high on sweet sorghum as a feedstock for ethanol production.

Senator NELSON. Some of us here at the table from Minnesota, and Nebraska, and the Dakotas, and I guess eastern Wyoming have a lot of sugar beet which we would love to see as an alternative crop—an alternative use for the crop, being in the production of ethanol in a similar fashion that is done in Brazil.

Mr. COLLINS. Yes, sugar has been a very interesting issue related to ethanol. Of course, raw sugar itself is—you know, we have a domestic marketing allotment program for that, but there is certainly nothing preventing, under our domestic programs, the production of sugar cane or sugar beets for conversion into ethanol. It has just simply been the economics of it that have made it costly to do.

I know I came up to the Hill some months ago to give a little briefing on sugar conversion and I pronounced that it was not economically feasible. And the next day I was reading the Wall Street Journal, and there was a little ad in the Wall Street Journal for someone who was soliciting investors to produce ethanol from sugar cane in the United States. So it shows you that there are venture capitalists out there that think otherwise.

Senator NELSON. I would like to see that chart, Chart 4, show a conversion rate in the cost of sugar as well as oil shale and the other uses that are listed there.

Mr. COLLINS. Right. Right now, we think it is a fair amount higher than corn-based ethanol.

Brazil, of course, has a much lower cost because they get a pretty good conversion out of their sugar cane. They have much lower labor costs. They have much lower land costs. So that has been their advantage. But this is something that technology can address over time as well, I think.

Senator NELSON. Well, and import, as long as we do not undercut the domestic production of ethanol with lower prices coming from other locations.

Well, thank you very much. I appreciate it. Thank you, Mr. Chairman.

Chairman HARKIN. Thank you, Senator Nelson.

Next is a valuable member of our Committee. She was here for our last Farm Bill. We have heard a lot of talk about feed costs for livestock, mostly people thinking about cattle and hogs. I am sure Senator Lincoln might have some views on the cost of poultry, also. And since they buy a lot of corn from the State of Iowa to feed those chickens.

Senator LINCOLN. That's right.

Chairman HARKIN. Senator Lincoln.

Senator LINCOLN. Well, thank you, Mr. Chairman, and we are all so grateful for you putting this together. A timely hearing on an issue that really does need to be a priority in the biofuels industry for our Nation. So many of us have said for many years now that biofuels can certainly play an important role in not only bringing down the cost of fuel and reducing our dependence on foreign oil, but also recognizing the value in cleaning our environment as well as rural development, which is in tremendous need from States like Arkansas and other places.

So we see now that the market for oil is probably more competitive than it has ever been before and it is not going to be slowing down any time in the future. So our hope is that we will seize the ownership of this problem as a Nation. That we will look at all the tremendous benefits that we gain from dealing with this problem and dealing with it in an effective way, and I am proud that the Committee is really embracing it early on as a priority.

You know, we, as a Nation, have, in many, many ways, have faced great technological challenges that we have confronted and we have overcome. And obviously, there is much here that has been talked about in terms of technological growth, and how we make things cost effective, and how we move them forward.

But we did not, Mr. Chairman, we did not put a man on the moon by just talking about how important it was. We developed a

plan; we committed resources that were necessary to achieve that plan, whether it was through technological investments, or certainly investments in education. And I hope that as a Nation we will seize the opportunity here in the biofuels industry and the renewable fuels industry to do the same thing and to seize it wholeheartedly and really move forward quickly.

I am certainly interested in the promise of the cellulosic ethanol and what it can to reduce our dependence, but what we can do to further that issue. I hope that today, working with this great panel and the other panel, as well as my colleagues, that we can really move forward.

I am pleased, Dr. Sharp, I got to serve at least one term on the House Energy and Commerce Committee with you. You made such tremendous contributions there and we are so grateful that you are here now. We look forward to all of the panel being able to work with us as we move forward.

This industry is clearly off the ground and I think it is running, but I think that we as a Nation, and that the consumers of this country want us to move more rapidly in getting it closer to them than just the developmental stages. So we look forward to working on that.

Just a couple of questions. Dr. Pacheco, right?

Mr. PACHECO. Correct.

Senator LINCOLN. My questions are a little similar to Senator Chambliss. And, as Senator Nelson noted to me, we are the only two on the Committee that can get at least two or three syllables out of the word, "Oil." So maybe that is the similarity in our States, and some of the things that we bring to focus on here in the Committee. But I wanted to talk a little bit about the co-processing. You talked a little bit about woody biomass and some of those potentials. They are great potentials for places like Arkansas in the South, where we do have a tremendous potential in our wood forest products industry. There have been a lot of things on the drawing board down there that I have seen that have really gotten me excited about the potential that exists there for co-generation, for a lot of different things that our processing facilities in the wood products industry can do, but they need to know that, again, that the investment will be there, and that the chicken and egg question that has been discussed a great deal has somewhat been resolved, and I think that is really important.

But I would also like to talk about co-processing feedstocks at traditional oil refineries. I understand that co-processing of feedstocks to produce diesel fuel is already being done at refineries in Ireland, and Australia, and several other countries. Is it possible to accurately measure the volume of renewable diesel fuels that are produced in this type of co-production process? And where are we going with that, the possibilities?

Mr. PACHECO. Senator Lincoln, you are very well-informed. The technology that you are referring to comes under several different names. Some companies refer to it as green diesel. It is being practiced in Brazil. In fact, Petrobras has announced that they will convert all six of their refineries to be able to process soybean oils and make what some refer to as green diesel. The Brazilians refer to it as H bio oil, and the largest facility is the recent facility that

Nesty built in Finland. It is also being practiced in Germany and in other parts of Europe because the European tax incentives do not differentiate between the different forms of renewable diesel, whether it is biodiesel or whether it is the green diesel type.

We have looked at this very closely. We issued a report in 2004 summarizing the technology and the advantages that it has. It is a very competitive technology to biodiesel. It is one that the free economy is going to have to play out and decide which is the better fuel in the end.

Both technologies, the production of biodiesel and the production of this green diesel use the same starting material. What they use is are the triglycerides from food resources. This could come from soybeans. It could come from rape seed. It can also use the waste greases from McDonalds. But they take these oils and they process them in a refinery, which is known as a hydroprocessing unit. It is a unit that is used to take sulphur out of diesel fuel, for example, in petroleum. That very same equipment, same catalysts, same hardware, can take soybean oil and it can make an extremely good quality diesel fuel.

It could be very beneficial to the soybean growers, because if the technology is cheaper then the price that the refiner would be willing to pay for this starting material might actually be higher because there is more value to be gained in the overall process. The fuel is very good quality. It is essentially zero sulphur. It has a cetane that is unachievable by petroleum.

Senator LINCOLN. I am sorry. You said what?

Mr. PACHECO. A cetane that is unachievable by petroleum. Typical petroleum stocks have a cetane of about 40 to 50, whereas the cetane from these biomass oils is in the neighborhood of 80 to 90. So it is a phenomenally good diesel oil. And that is why so many other parts of the world are looking at it.

I do know, because we have had an inquiry from the Department of Treasury, I do know that this is being looked at in the United States to see whether or not this technology would qualify for the same renewable diesel standard, but I think that is an issue for Congress to address, as to whether that should be the case.

It is very sound technology. To go back to your question as far as the yield, we do know from a scientific point of view how many gallons of diesel fuel is being produced. So you can track how many gallons of fuel is actually coming from the biomass, because the refiners have the option, they can run this fuel in conjunction with petroleum, right in the same unit, or they could run it in what they would call, "blocked out," where they would run it in a separate unit, separate from the petroleum. But in either case, scientifically, they can track how much actual diesel fuel they are making from the biomass.

Senator LINCOLN. So you said scientifically, too, that the fuel derived from this process is of a very decent quality.

Mr. PACHECO. It is extremely good quality.

Senator LINCOLN. OK.

Mr. PACHECO. It is actually a better quality diesel than what we know how to make with petroleum. Keep in mind, my background is both on the biotechnology side and on the petroleum side, so I am familiar with that technology.

Senator LINCOLN. And you said the study you did was in 2002?

Mr. PACHECO. We issued that study and can make that annual report available to the Committee if you would like.

Senator LINCOLN. I think that would be great. I also have one of your other studies from 2004 on the biomass-oil analysis, which I think—both those studies would be beneficial to enter into the record, Mr. Chairman.

Senator LINCOLN. Just in closing, particularly in regard to our poultry, but what processes are currently being developed that could take advantage of animal waste such as chicken litter as a primary feedstock, and what are the real barriers that exist in terms of their implementation? I know I hear all of these grand plans and talk, and other things. It is something that we would love to get rid of and make it productive.

Mr. PACHECO. My first job, as a 14–year-old in rural Connecticut was working on a chicken farm, and so I am very familiar——

Senator LINCOLN. You well know, then.

Mr. PACHECO [continuing] With wanting to get rid of it. In fact, my mom used to make me keep my boots in the garage rather than bringing them in the house.

Senator LINCOLN. Yes, I do not blame her.

Mr. PACHECO. But I agree wholeheartedly with Dr. Collins in his earlier comment. One of the most attractive technologies that is being deployed right now in a number of States is what is referred to as the "closed-loop technology."

Senator LINCOLN. Yes.

Mr. PACHECO. Where poultry litter can be fed to an anaerobic digester and then the gas from that digester can either be used to produce electricity, as Keith said, or can be used directly in the ethanol plant as a source of heat to replace natural gas. This is a wonderful solution, because it not only improves the economics, but it reduces the amount of fossil energy that goes into producing corn ethanol, which, as you know, is a hotly debated point.

So it is a wonderful technology. And then, to finish the closed loop, the DDGS from the corn plant could be used as feed for the livestock. It works very well with cattle, and there are a number of organizations working to try to increase the percentage of DDGS that could be fed to hogs and poultry as well.

Senator LINCOLN. Well, thank you, Mr. Chairman, my time is up, but I appreciate—and there are so many other questions that we have for you all. I do hope that we will see a return to be able to continue on this issue. Thank you.

Chairman HARKIN. Thank you very much, Senator Lincoln. Again, another valuable member of our Committee. Is there an unwritten rule that there have to be two Senators from Minnesota, always, on this Committee?

[Laughter.]

Chairman HARKIN. It has been so since I have been here.

Senator COLEMAN. I hope so.

Chairman HARKIN. Because Dave Durenberger was on the Committee when I first got here, and there were always two Minnesotans—so anyway, Senator Coleman.

Senator COLEMAN. Thank you, Mr. Chairman. Thank you for holding this first hearing on this critically important issue. And I

welcome my colleague from Minnesota from the other side of the aisle.

I think one of the things that I am sure that she will see, as we have seen here, is with all the frustration about harsh partisanship and the inability to work together, that is not what you see on this Committee. I probably co-authored more letters with Ms. Lincoln than anybody in the Senate. These issues are Minnesota issues, they are Midwest issues, they are America issues. I am certainly proud to serve on this Committee.

I apologize. I have been at this big hearing on Iraq in Foreign Relations, that I serve on. So I have been shuttling back and forth. But it is interesting, as I reflected on the reality of what we are dealing with here; this is a national security issue. We put money in the pockets, petro dollars in the pockets of thugs and tyrants: Chavez in Venezuela, and Ahmadinejad in Iran, that if we could really fully see some potential, beyond what we have today, this is a national security issue. It is an environmental issue, it is an economic security issue, and so it kind of encompasses all.

And I would note that, as I travel around the State of Minnesota and have a lot of hearings and discussions, one of the things about this that we do not talk about enough is optimism. There is a sense of optimism among American producers and growers that you do not see at a lot typically. Most of us, we get in the room with four farmers, you have five people mad at you about something. And you travel around the State today and you see real hope and real opportunity. I think our challenge, then, is, what do we do to support that, to encourage it, and as this next Farm Bill will create some opportunity to do that.

I just want to touch on sugar for a second, because I have—in the Foreign Relations, I chair the Western Hemisphere Subcommittee. I have traveled to Brazil a number of times and seen what they have done there. Their production costs for ethanol, I think, is about $0.81 per gallon. Our production cost for cane-based sugar is about $2.40 a gallon, sugar-based, $2.35 a gallon. So we have some price difference there, but they have been at this a lot longer. And I would hope that what we do is we do not say, well, that is the barrier today. Instead we do what Ms. Lincoln talked about. We have our land a man on the moon by the end of the decade commitment. We have a Marshall Plan commitment.

We face a real problem with that sugar from Mexico is a result of some of the agreements made on NAFTA, and we have not seen the impact of that. And it would make sense to me if we were in a position to take that sugar that is going to be coming and turn that into energy, and then allow the Americans to continue with a sugar program does not cost taxpayers any money. I think we have to, not look at the barriers today but look beyond and see where we are going.

Would it be fair to say, Dr. Collins that—first, as we look at the last Farm Bill, it is probably coming anywhere from, what, $12 to $17 billion under budget. Are those figures accurate?

Mr. COLLINS. Yes, sir. That is probably right.

Senator COLEMAN. And would it be fair to say that certainly the growth of renewable fuels has played a part in keeping prices up

and ultimately lowering the cost to the American taxpayers of the Farm Bill?

Mr. COLLINS. Tremendously. I mean, if you look at the fiscal year 2006 corn program, the cost was about $8.5 billion. That would be related to the 2005 crop. Shift forward 1 year to the 2006 crop, which would be the fiscal year 2007 costs, about all we are going to have is direct payments, $2.1 billion for corn. So $8.5 billion down to $2.1 billion, and that is a savings that is far more than the decline in general tax revenues due to the $0.51 tax credit.

Senator COLEMAN. Would it be fair—Senator Lincoln and I co-authored a letter to the President about the Farm Bill signed by a number of members of this Committee. One of the things that we said in that letter is that we are confident that a robust new investment in renewable fuels would not only further our Nation's energy independence, but it would also further increase budget savings under U.S. foreign policy. Would you say that is a fair statement?

Mr. COLLINS. Probably. Once you get the corn price above $2.63, which is the target price, and it is well above it now, you have about achieved all the savings you are going to get. But your statement is certainly true that you reduce the risk of incurring farm program costs again.

Senator COLEMAN. And if we make the investment, particularly there is a lot of discussion about cellulosic—it is interesting, because on Foreign Relations we had a hearing last Congress on renewable, and we had Alan Greenspan in front of the Committee and we talked about the geopolitical implications of energy dependency, and he cited what was actually a study I saw coming out of Wall Street that said we could be doing 60 billion gallons of cellulosic energy. I would take it that would then provide opportunity in Kittson County where we have grass seed, it is tough farming up there, but I would take it if we unleash cellulosic that there is a whole range of things that we could be doing.

Mr. COLLINS. I think both Mr. Smith and Mr. Pacheco, from their perspectives have talked about this, the 25 X 25 study that was commissioned and the so-called billion ton study. The billion ton study, for example, in their high-yield scenario, by 2030 said you could have 110 billion gallons—there is source material for 110 billion gallons of ethanol, with about 80 billion of that from agriculture and 30 billion from forestry, and similar numbers came out of the 25 X 25, although a little less.

So, yes, numbers that you are talking about are there, the biomass resource is there. Now, there is a lot of work to be done to sort out the economic adjustments that take place to achieve that and a lot of technology gains have to be achieved to get there as well. But as sort of an accounting exercise, you can add up the sources and you can come up with big numbers like that.

Senator COLEMAN. But a lot of the technology gains are going to depend on our commitment to the research and development. And so what I am saying is, if you have a vision out there that the numbers say this is something we could get to, it would seem to make sense to me that what we should be doing in a Farm Bill with a major energy piece that this Chairman and Ranking Member com-

mitted to, would have an R&D component in there that would move us along, and move us along much faster.

And again, I get to the geopolitical national security implications; we are doing 5 billion gallons of ethanol today. We are consuming 140 billion gallons of gas. Our dependence on foreign oil is going up in spite of all we are doing. This offers a chance to change that, doesn't it?

Mr. COLLINS. It certainly does, and I would point you toward the Agricultural Risk Protection Act of 2000, which created the Biomass Research and Development Act, it was part of that, and that Act was not funded until the 2002 Farm Bill. So there is a mechanism there that could bear some scrutiny as a vehicle for taking a look at these research challenges.

Senator COLEMAN. Mr. Pacheco, did you want to add something to that?

Mr. PACHECO. I would certainly underscore the comments that the real challenge is to get the technology to where the costs are competitive, and then a lot of the incentives that we are using to seed this industry can be reduced. So I think that is the point that we all want to get to as quick as we can. There is certainly a lot more that we can be doing at the research laboratories, not just NREL, but all of the laboratories across the United States to accelerate the rate of progress, if more research funding were available.

Senator COLEMAN. Including land grant universities?

Mr. PACHECO. Absolutely.

Senator COLEMAN. Mr. Chairman, I will follow the lead of my junior colleague from Minnesota. Change is in the air, and so I am going to yield back the balance of my time.

Chairman HARKIN. Thank you very much Senator Coleman.

I am going to ask that Senators now restrict their questions to 5 minutes. We are supposed to have a vote at noon, and I would like to be able to send the second panel up and hear their testimony before we go vote and come back.

And with that, I welcome another new member to our Committee, former member of the House of Representatives from the great State of Ohio, Senator Sherrod Brown. Welcome to the Committee.

Senator BROWN. Thank you, Mr. Chairman. I am thrilled to be on the Committee, and especially to work with you and Senator Chambliss. Thank you for that and thanks for your commitment and discussion on energy and food security and how important that is for our country's economy and national security.

Dr. Sharp, nice to see you and thank you for joining us. I am sorry I was not here for the opening statements, but having read your statement and looked at it, your discussion on production of gasoline from coal, your discussion of CO2 and greenhouse emissions, would you just talk through briefly, especially in light of some calling for lowering tariffs for ethanol coming from Brazil? Would you talk through for me, just for a couple of minutes, about the CO2 emissions and energy consumption to produce, in a general sort of way, various kinds of cellulose, ethanol, and what that all can mean together, if you would.

Mr. SHARP. Well, if you look at Chart 4, it sort of simplistically outlines that for you. If you look at the center line there, that is

sort of the baseline of what we are getting in terms of carbon emissions right now out of our gasoline. All of the fuels to the left, which are cellulosic ethanol, biodiesel, and corn ethanol, certainly improve, from a greenhouse gas emissions point of view our gasoline supply, if they substitute for current gasoline.

On the right side of that scale, what you see is the other kinds of fuels that are also under development in this country and elsewhere which are petroleum related, which actually, because of their fuel use, are going to expand per gallon of gasoline we use in the country, the CO2 emissions.

If you look in terms of the costs up and down on that chart, you see, compared to current expectations on oil roughly where the estimates—in many of these cases, they are very crude estimates—are of what it would cost to produce, right now, these other forms of fuel. And what you quickly see is some of the ones on the right side of the chart, which are high-intensity carbon are actually more in the marketplace.

As I have testified, what is missing in this chart, however, is the work that you folks have already done in terms of the subsidies that are in play right now to help advance corn ethanol and biodiesel in particular. Cellulosic ethanol has been discussed here. It still remains down the pike. But those other fuels are clearly within these market ranges, and therefore have the opportunity to compete. But no one should misunderstand that the world oil price can also drop, as well as the way it goes up. That has been our experience for the last 30 years, and that can quickly undercut things and undercut political support, as we have seen in the past, at least, for various proposals.

So I think if there is any lesson in the last 30 years it is that we have to maintain—if we think we are going to change the picture of what the market would do for us otherwise, we have to maintain strong, consistent policies through multiple years. And I am sure some of your investors are saying to you, what is going to be the tax credit five and 10 years out? We need to know now. And that is something that you folks can help and make clear.

Senator BROWN. And about the tax credit, talk, Mr. Smith, if you would—I was the sponsor in the House of the 25 X 25 legislation talk if you would, for a moment, about sort of incentive structures. Go beyond, I know there is not much time left, but go beyond, if you would like, biodiesel development. One of the things that Dr. Sharp just mentioned, in terms of predictability for investors, talk about that for a second, if you would.

Mr. SMITH. Well, as I shared with the Committee earlier, we are in the process of developing recommendations along the full range of renewable, as far as the incentives that will help this Committee and all of Congress to incentivize renewable energy sources from wind and solar to the biofuels and biomass, obviously.

I think we are very excited about some of the things we are currently working on. I shared with Chairman Harkin that we should have that report in February, and it will help this Committee and others hear from those 400 organizations that have endorsed 25 X 25. And it is our collective thoughts. It is not any individual sector of renewable energy, but rather the feeling of the whole. And these are some of the very key areas that we are scoping in on, is what

incentives and what policy is going to be necessary to help these emerging technologies along. We are excited about this process, and hopefully we will have something in your hands very soon.

Senator BROWN. Thank you. And I would simply add my last 10 seconds, Mr. Chairman, how important the permanent tax credit—I know that Senator Grassley, and his Committee's jurisdiction, that is their issue, but to just urge them to build some permanence into so investors can build a solar and wind-powered industry in this country.

And I would just close with that I represented, when I was in the House, Overland College, and there was the largest building in the country on any college campus that was fully powered by solar energy, and the builder of that bought all their solar panels from Germany and Japan because we do not have a sophisticated large enough industry to support that sort of production and installation, so thank you very much.

Chairman HARKIN. Thank you very much. I turn to my colleague now, from Iowa, a valuable member of this Committee, a good friend who has used his position, not only in this Committee, but also on the Finance Committee, to help promote our biofuels industry in this country, and I can say is a very, very strong supporter of all the efforts we have made in biofuels in the past. I just want to note for the record that we are blessed on this Committee to have both Senator Grassley and Senator Baucus, Chairman and Ranking Member on the Finance Committee. So I think a lot of the things we are going to be talking about are in their jurisdiction, and hopefully we have a good working relationship with the Finance Committee in this are. So, again, with that, I turn to my colleague from Iowa, Senator Grassley.

Senator GRASSLEY. Well, Senator Harkin, I thank you for having this hearing, and I followed very closely a lot of things you have said about energy and the upcoming Farm Bill. I appreciate very much what you have said, and agree with you. And I think this hearing is an indication you are going to put your actions where your words have been and I compliment you very much on that.

Five minutes will be adequate for me. I will start out with Dr. Collins. Earlier this week an environmental group here in Washington, D.C. stated that the U.S. Department of Agriculture's estimates have vastly understated the number of ethanol distilleries under construction and the amount of corn that will be dedicated to ethanol production during the next two years.

So I hope you are familiar with that allegation. If not, you probably cannot answer my question, but what is your response to the allegation? And also, how does the U.S. Department of Agriculture predict that agriculture's industry will handle the competition between corn demand for ethanol and demand for livestock feed or food.

Mr. COLLINS. Senator Grassley, yes, I saw that release. I actually was a little disappointed in it in that they picked on USDA. They could have easily picked on the Department of Energy or many other entities because we are not alone in having underestimated the pace of ethanol production. We all pretty much depend on the same set of resources.

There are groups like Renewable Fuels Association, BBI, and others who compile lists of ethanol plants in operation, and under construction, and expanding, and there is a fair amount of agreement on those. Those plants can be verified.

There is a problem however, when you look at the plants that have been proposed, that are in somebody's speculative imagination, for which no permits have been pulled and there is no way to verify them. These plants might be owned by venture capitalists who do not want to tell you what they are going to build and where they are going to build it. So there is really no way to know for sure what is out there beyond those plants that are in operation, those that are under construction, and those that are expanding. And it just so happens that a number of plants that have been proposed have started construction over the last 6 months, 4 billion gallons worth of capacity came from the speculative realm to the construction underway world. So no, we did not fully anticipate that.

So we have been updating our numbers. We have been playing catch up, as have most people. However, I would say that group also put out some very specific numbers that I think are beyond what I think is possible to happen in the short time period that they forecast. They had an estimate of 16 billion gallons of ethanol production by September of 2008, and quite frankly I think that is just a little too high. So that is in response to part one of your question.

Part two was, how is the industry going to handle this balance between demand for corn for ethanol and demand for corn for livestock, and that is a challenge. I laid that down in my opening oral comments that I felt over the next three to 4 years we have a very critical period facing us. We do not have cellulosic ethanol in commercial production probably over the next three to 4 years, yet we have tremendous investment interest in corn ethanol production. And so we are seeing a huge amount of capacity coming online and that is going to demand corn because there is not really a good alternative to that. And that is going to propel higher corn prices. And so livestock producers, whether they are cattle, or hog, or poultry, or dairy are going to end up paying more for feed.

This is not unlike other periods in our history. In the 1970's when we had this huge expansion, year after year after year of increased exports due to the Soviet Union coming into the world grain markets and propelling up prices. It is not unlike droughts, when prices go way up. So the livestock industry will have to be resilient to this. And I think the markets can adjust to this. We can see this coming online, and it is important, as implied by the accusations that we have underestimated ethanol production, it is important that we try and stay ahead of this so we can alert everyone as to what is happening and so that proper planning and adjustment and hedging can take place.

Senator GRASSLEY. And before my time is up, a question for Mr. Pacheco. Following on the same question of Mr. Collins, you spoke a great deal in your opening statement regarding the research being done on cellulosic ethanol production. You stated the goal of producing cellulosic ethanol at a competitive rate with corn in five years.

How do you see the growth of corn ethanol on the competing use of corn affecting the advancement of cellulosic and other types of ethanol production?

Mr. PACHECO. Well, I do not see, Senator Grassley, I do not see a direct impact on the increased demand for corn on the development of cellulosic ethanol technology, not directly, anyway. The cellulosic ethanol technology, at the point where it starts to become competitive with corn can have a large impact the other way.

Investors, when they are looking at investing in new projects, would be probably making the decision as to whether or not to build a facility that is capable of handling cellulosic ethanol, which would be a very different facility. As you know, it would require very different equipment and a very different design philosophy from a chemical engineering point of view.

So I do not see the growth in corn ethanol directly affecting the cellulosic ethanol, but definitely the other way around. As the technology becomes close, I could see that affecting maybe the slowdown in the construction of corn ethanol facilities and a shift toward constructing facilities that are capable of feeding the cellulosic ethanol.

Senator GRASSLEY. Thank you, and thank you, Mr. Chairman.

Chairman HARKIN. Thank you, Senator Grassley. And I thank all the Senators for this.

I thank the panel. As you can see, there is a great deal of interest in this Committee in this whole area of the biofuels and renewable energy. I want to thank you all for your testimony, for your written statements. I look forward to further contact with each of you as we progress on this in the coming months, and hope that you will feel free to be in contact with us and with our staff on these and any other issues that could be coming up in this area on the Farm Bill.

Any last things from any member of the panel before we dismiss you?

Thank you again very much for being here.

Now we will call our second panel. Ron Miller, Roger Webb, Gene Gourley, Loni Kemp, and John Sellers.

Chairman HARKIN. All right. I do not know if there is anybody still out in the hall there, but I asked them to come on in and take their seats, and I know there was a great crowd out there at the beginning, and I just want them to come in and get situated.

We were told that we were going to have a vote around noon, but we will do whatever we can to get as far into the statements before we have to go vote and then come back.

First, we will turn to Ron Miller, President and Chief Executive Officer of Aventine Renewable Energy. A graduate of Southern Illinois University, with his degree in Engineering. He got his Master's degree in Business Administration from the University of Illinois. A long and distinguished career beginning with Texaco, the Pekin Energy Company, the Williams Companies that purchased the Pekin Energy Company, and the Morgan Stanley, capital partners, purchased Williams Bio-energy, which became Aventine, as I understand it. And now Mr. Miller currently serves as Aventine's President and Chief Executive Officer.

Aventine is the Nation's second largest producer and marketer of ethanol, and a global provider of bioproducts. And Mr. Miller is Chairman, also, of the Renewable Fuels Association.

So again, we welcome you, Mr. Miller. And again, as you probably heard earlier, we ask that you keep your statements to five to 6 minutes, hopefully, and then we will proceed with questions, but we will hear the whole panel first before we open for questions. So Mr. Miller, welcome very much and please proceed with your testimony.

STATEMENT OF RON MILLER, PRESIDENT AND CEO, AVENTINE RENEWABLE ENERGY HOLDINGS, LLC, PEKIN, ILLINOIS

Mr. MILLER. Thank you, Mr. Chairman. I will keep my comments brief. Good morning, members of the Committee.

Again, as you mentioned, I am Ron Miller, President and Chief Executive Officer of Aventine Renewable Energy, and Chairman of the Renewable Fuels Association.

Aventine supplies more than 700 million gallons of this Nation's growing ethanol needs annually through its wholly owned plants in Pekin. It is a facility in Nebraska, in Aurora, Nebraska, and it has business relationships and marketing alliances.

This is an important and timely hearing, and I am pleased to be here to discuss the growth in the domestic ethanol industry in the increasing important role of agriculture in rural America in ensuring our Nation's energy security.

Ethanol today is the single most important value-added market for farmers. Today's ethanol industry consists of more than 110 biorefineries located in 19 different States, with the capacity to process more than 1.8 billion bushels of grain into 5.3 billion gallons of high octane, clean burning motor fuel and more than 12 million metric tons of livestock and poultry feed. There are currently 73 biorefineries under construction. With 80 existing biorefineries expanding, the industry expects more than 6 billion gallons of new production capacity will be in operation by the end of 2009. Today ethanol is blended in more than 46 percent of the Nation's fuel, and is sold virtually from coast to coast and from border to border.

In addition to providing a growing and reliable domestic market for American farmers, the ethanol industry also provides the opportunity for farmers to enjoy some of the value added to their commodity by further processing. Farmer-owned ethanol plants account for about half of the U.S. fuel ethanol plants.

This dynamic and growing industry is also empowering more of Americans to have a vital role in this Nation's infrastructure. If a farmer in Des Moines does not want to invest in a local co-op, he can choose to invest in a publicly traded ethanol company such as ours through the stock marked, as can a school teacher in Boston or a receptionist in Seattle. Americans coast to coast have the opportunity to invest in our domestic energy industry, and not just in ethanol, but in biodiesel and bioproducts as well.

U.S. agriculture is evolving in important ways, and rural America is primed to take advantage of these opportunities. Over the past several years the ethanol industry has worked to expand a virtual pipeline through aggressive use of the rail system, barge, and

truck traffic, moving product quickly to those areas where it is needed. Many ethanol plants today have the capability to load unit trains for shipment to ethanol terminals in key markets. Railroad companies are working with our industry to develop infrastructure to meet future demand for ethanol.

Looking to the future, proposals like that of the Chairman to study the feasibility transporting ethanol by pipeline from Midwest to East and West Coast is also critical. The only more astonishing than the growth in the ethanol industry is the technological revolution happening at every biorefinery and every ethanol construction site across the country. Biorefineries today are using such innovations as no-heat fermentation, corn fractionation, and corn hull extraction.

Wit today's natural gas prices, biorefineries are looking toward new energy sources, including methane digesters and biomass gasification. To continue this technological revolution, however, continued government support will be critically important. Competitively awarded grants and loan guarantees provided by DOE and USDA, many of which were included in the energy policy of 2005 have played a very important role in developing new technology. The ethanol industry encourages Congress to full appropriate funds for these critical, competitive solicitations during the fiscal year 2007 budget process.

To date, the ethanol industry has grown almost exclusively from grain processing. As a result of steadily increasing yields and improving technology, the National Corn Growers Association projects that by 2015, corn growers will produce 15 billion bushels of grain. According to NCGA analysis, this will allow a portion of the crop to process into 15 billion gallons of ethanol without significantly disrupting other markets for corn.

In the future, however, ethanol will be produced from other feedstocks, such as cellulose. While there are indeed limits to what we will be able to produce from the grain, cellulosic ethanol production will augment, not replace, grain-based ethanol. Ethanol from cellulose will dramatically expand the types and amounts of available material for ethanol production, and ultimately dramatically expand ethanol supplies.

Many companies, including ours, are working to commercialize cellulosic ethanol production. For example, we are putting on both our facilities to break down the corn fiber into ethanol, increasing our yields by about 15 percent. Indeed, there is not an ethanol biorefinery in production today that does not have some sort of a program looking at cellulosic ethanol research.

Ethanol today is largely a blend component with gasoline, adding octane, displacing toxic, and helping refineries meet Clean Air Act Specifications, but the time when ethanol will saturate the blend market is on the horizon, and the industry is looking forward to new market opportunities such as E85. Enhancing incentives to gasoline markets to install E85 refueling pumps will continue to be essential. Today there are approximately 6 million flexible fuel vehicles capable of using E85, representing less than 3 percent of the total U.S. motor vehicle fleet.

U.S. auto manufacturers have made significant commitment to FFE technology, and their commitment is increasing. By 2015,

FFEs on the roads will exceed 35 million, creating a potential demand for E85 of more than 21 billion gallons.

The Energy Policy Act of 2005 and several other policies enacted by the 109th Congress clearly put our Nation on a new path toward greater energy diversity and national security. The continued commitment to the renewable fuels industry by the U.S. Agriculture Committee in the 110th Congress can all contribute to ensuring America's future energy security. Thank you.

[The prepared statement of Mr. Miller can be found on page 109 in the appendix.]

Chairman HARKIN. Now, to introduce our—excuse me, our vote was just called, but we have a little bit of time here to introduce our next witness. I call on our Ranking Member.

Senator CHAMBLISS. Thank you, Mr. Chairman. I am very pleased to introduce to the Committee Dr. Roger Webb who is Director of the Strategic Energy Institute at Georgia Tech. Dr. Webb and his folks at Georgia Tech are doing some truly amazing things that he is obviously going to be able to talk about today and present to the Committee. And it is particularly important in our part of the country. We do not grow corn in the abundance that you do in the Midwest and we have to look for other alternative resources for ethanol. And Dr. Webb and his colleagues are thinking outside the box and developing new markets for our producers, which is truly exciting for us.

So I am very pleased to have him here and to introduce him to the Committee.

Chairman HARKIN. Thank you very much.

Dr. Webb.

STATEMENT OF ROGER WEBB, DIRECTOR, STRATEGIC ENERGY INSTITUTE, GEORGIA INSTITUTE OF TECHNOLOGY, ATLANTA, GEORGIA

Mr. WEBB. Good morning. Thank you, Chairman Harkin and Senator Chambliss for the opportunity. I have been truly impressed with the interest that you have expressed in this topic.

As Senator Chambliss said, I represent the Strategic Energy Institute at Georgia Tech, an organization which is devoted to facilitation energy research at Georgia Tech, particularly focusing on defining high potential impact topics, projects, conducting pre-commercial research in order to enable the deployment of those things, and then facilitating the deployment of the research in the commercial marketplace, usually in concert with industrial partners.

One project we have been very interested in is that of creating ethanol from southern pine pulpwood. And it is that topic that I would like to address. And I would like to make these five points.

One is that you can make ethanol from southern pine effectively and efficiently. We have produced ethanol in three different laboratories with very good yield rates, and approaching 70 percent of the theoretical limit, and we think that can be improved. The conversion efficiency for southern pine to ethanol, a gallon of ethanol is worth about 76,000 Btu of energy. It takes about 16,000 Btu of energy to produce that amount of ethanol from a pine tree. So it is a very efficient conversion process. We think with existing tech-

nologies today, we could produce ethanol at about $1.30 a gallon, and we see there are opportunities to reduce that considerably.

The second point is that southern pine is an abundant resource in Georgia and throughout the Southeast. Historically that comes about because pulpwood became an agricultural product in that part of the country as a result of the pulp and paper industry moving south several years ago. Currently in Georgia there are 24 million acres planted in pulpwood. The annual harvest is about 55 tons per year. 37.5 tons of that go into the pulp and paper industry, which, by the way, is a declining industry in our State. That leaves about 17.5 tons available for conversion to other things. That is equivalent to roughly 700 million gallons per year of ethanol. And if you extrapolate those numbers across the region, the Southeastern region, it looks like an available resource, with current technology, with the existing surplus in pine, of about 4 billion gallons per year, which could be a significant contribution that overall ethanol makes.

The third point is that infrastructure exists largely due to the existing pulp and paper industry. That is, the State Forestry Commission of Georgia has a seedling program to provide seedlings to replenish the crop. The trucking and harvesting industry is there. So, basically, the transportation and harvesting infrastructure is already in place to facilitate an ethanol industry in the State and across the region.

There are apparent areas for cost reduction. It was mentioned earlier, a gentleman from NREL, about significant decreases in costs of producing enzymes. We expect that decrease to continue. There are some obvious technologies that can be applied to the distillation process, which will bring the cost down. We think it is quite likely to get the cost of ethanol down to below a $1.00 a gallon with improved technologies. And we think the whole thing could be commercialized relatively near-term, like 2010. That gets a bit to the chicken and egg thing that you all brought up earlier, and probably would require some participation by the government in reducing the risk in the investment of new plants.

A cellulosic ethanol plant is more complex than a plant that produces ethanol from corn. The corn process is well-defined. The risk is known. With cellulosic ethanol, there is not a plan out there, and so the risk is high, and some participation in reducing that risk would probably go a long way toward getting investment in the program.

So, in short, we think the resource is there. We think ethanol can be produced in large volume. And it looks like a very productive thing for the rural South in terms of economic development. We appreciate your interest in listening to us.

[The prepared statement of Mr. Webb can be found on page 141 in the appendix.]

Chairman HARKIN. Well, I can assure you, we have a lot of interest in this. I do not want to get into questions right now, but this is fascinating. I do have some knowledge of what has happened to the paper and pulp industry, but this could be a great thing. That was great testimony. I will have some questions later on.

Are we on our second bells?

We have about 7 minutes left. Why don't we recess now, Gene, and then we will be right back. So if anybody has to take a break to visit a room around here, down the hallway or someplace, come back. We will be gone—we will recess for about—we will be back in about 10 minutes.

[Recess.]

Chairman HARKIN. The Committee will resume its sitting.

Our next panelist is Mr. Gene Gourley, a pork producer from Webster City, Iowa. Gene was born and raised just south of Webster City on a farm. He is active with his three brothers in their farrow-to-finish family operation and farm about 3000 acres of corn and soybeans.

Gene obtained his Bachelor of Science and his Master of Science from Iowa State University. He is the General Manager of the Nutrition and Research Division of SGE, which is 95 percent owned by several Iowa farmers, and collectively they own 25,000 sows, finishing 0.5 million pigs per year throughout the State of Iowa. Gene is responsible for feed rations and formulation on all SGE farms. Furthermore, he coordinates research projects and technology transfer for the research and development team, and has been with SGE for twenty years and is also a general partner.

Gene is testifying today on behalf of the National Pork Producers Council and the Iowa Pork Producers Association. Mr. Gourley, welcome to the Committee and please proceed.

STATEMENT OF GENE GOURLEY, NATIONAL PORK PRODUCERS COUNCIL, IOWA PORK PRODUCERS ASSOCIATION, WEBSTER CITY, IOWA

Mr. GOURLEY. Thank you, Senator Harkin.

I just have to kind of, being the token livestock person, I looked at my Far Side calendar on Monday as I was writing my testimony and I saw the two bears in the forest with the circle and the scope, with the cross-hair on the one bear, and the one bear, you know, shoot him when he is on the spot. So I sure appreciate the opportunity to visit with you today.

Chairman HARKIN. So you got one of those calendars for Christmas, too.

Mr. GOURLEY. Yes, I did.

Chairman HARKIN. So did I.

Mr. GOURLEY. But I appreciate the invite to testify today regarding the use of Distiller Dried Grains and swine diets. I do use my Master's degree in Nutrition on a daily basis as a partner with my three brothers, and also at Swine Graphics. I am testifying on behalf, as you mentioned, the NPPC and Iowa Pork Producers, and I belong to both those organizations.

The pork industry is of immense importance to the country in my home State of Iowa. Nationwide, more than 67,000 pork producers marketed more than 103 million hogs in 2005, and those animals provided total gross receipts of $15 billion in more than 550,000 direct and indirect jobs. Nearly 9,000 Iowa pork producers create more than 86,000 jobs for fellow Iowans, and contribute $3 billion in annual payroll, and generate $12 billion in annual economic activity in the State. And our pigs consume nearly one-third of Iowa's corn and soybean crops.

So first let me say that the U.S. pork industry supports the development and use of alternative and renewable fuels as a way to reduce our country's dependence on foreign oil, but pork producers face some challenges created by the rapid rise in ethanol demand, including the use of DDGS, Distiller Dried Grains with Solubles, a major co-product of the ethanol production process.

Some would have us believe that all the feed problems created by using a substantial portion of the Nation's corn supply for ethanol production are irrelevant because of the production of DDGS. I am here to let you know that this product does little to allay the concerns of pork producers regarding the future cost of availability of feedstuffs. Just remember that the ethanol production process uses 56 pounds of corn, removes the main ingredient, starch, our pigs' energy source, and yields only 17 pounds of DDGS.

There are several issues with regard to feeding. I have run several trials, actually within our own operation and with other nutritionists around the country. The No. 1 problem that we say is basically the inconsistency from ethanol to ethanol plant of DDGS, and even within the same plant you will have inconsistencies. One would be variability of the nutrient content, the protein, the fat, the phosphorous, the other nutrients varied. And that is partially due to the corn that comes into the plants, and so that is not all controlled by them. If they change, though—if there are changes in their fermentation or the drying, it could impact the digestibility of those nutrients to the animals. And there is potential presence of micotoxins, which can cause pig performance issues.

Corn oil is increased in the DDGS by threefold over normal corn, and that can increase the iodine value in our pigs which creates soft fat issues from a sliceability and a carcass rancidity for shelf life potential. It can also decrease the yield. Typically it declines when you use higher levels of the DDGS, and that is probably most likely due to the fiber fraction that is in DDGS.

There are several other issues that I have listed in the written testimony that I will not spend a lot of time on now, but finally DDGS are far more useful in diets for beef and dairy cattle than they are for pork and poultry, meaning that for pork producers DDGS will not be as cost effective an ingredient because beef and dairy can pay more for DDGS, and this is already occurring today.

While the pork industry appreciates the opportunity to discuss DDGS, the most important issue regarding ethanol in livestock are the availability of corn, the potential loss of rural jobs, and the cost of feed. The combination of high oil prices and government policies create an industry in ethanol that can pay roughly $4.00 per bushel for corn. The ethanol industry received government subsidies of a $1.53 per bushel corn, a blender's tax of $0.51 per gallon, and their Federal mandate on ethanol production.

These incentives have the ethanol industry growing at an almost unbelievable pace. New plants are springing up everywhere. I have eight plants within 50 miles of my doorstep today that were not there 3 years ago. And we are using a lot of corn through those plants. The Renewable Fuels Association now estimates that 4 billion bushels of corn will be used by the ethanol plants that will be online as of January 2008. Former USDA economic Bill Tierney predicts that an annual usage rate will be over 10 billion bushels

by the end of 2009 if all the ethanol plants currently under construction that are planned actually come online.

The pork industry uses about 1.1 billion bushels, and the entire livestock industry uses just over 6 billion bushels. Corn growers produced about 10.7 billion bushels in this last harvest of 2006.

There is also a job component. While 100 million gallon ethanol plant creates approximately 80 jobs, if we divert that from pork production the corn needed to produce that ethanol, it would cost 800 on-farm jobs. And this is an economic analysis from Dr. John Lawrence at Iowa State University.

Of course, competition for corn is driving up its price, increasing livestock producer's feed costs. This time last year, production costs were about $40 per 100 pounds, and economist Ron Plain at the University of Missouri now calculates that with feed price increases, the producers have already seen their production costs rise, and will be around $50 per 100 pounds. This represents about a 25 percent increase in cost.

Finally, corn availability and prices would also be adversely affected if we have a short crop or drought in either of the next two seasons. Mr. Chairman, more details about pork producers' concerns regarding feed availability and costs, and the use of DDGS are included in the written testimony which I ask to be included in the record. Thank you again for this opportunity, and the U.S. pork industry stands ready to work with Congress on solutions to the challenges that face pork producers from the rapid rise in ethanol production. Thank you.

[The prepared statement of Mr. Gourley can be found on page 89 in the appendix.]

Chairman HARKIN. Mr. Gourley, thank you very much. And I will have a lot of questions, because this is something to consider. You heard earlier witnesses talk about this and we have got to really figure this one out and make sure we do not make mistakes in this area as we go forward on the Farm Bill. I thank you for that and I have some follow-up questions.

Next is Loni Kemp, and I just want to state that Senator Klobuchar just saw me on the floor and said, I wanted to come over to introduce Ms. Kemp to the Committee, but she has a Members' Meeting off the floor right now and cannot be here. So let me just apologize that she could not be here to appropriately introduce her fellow Minnesotan.

Loni Kemp is Senior Policy Analyst at the Minnesota Project where she has worked on agriculture and environment issues since 1979. She is on the board of the National Campaign for Sustainable Agriculture. She shares its stewardship committee. She is active in the Midwest Sustainable Agriculture Working Group and Sustainable Agriculture Coalition. Ms. Kemp was a Food and Society Policy Fellow, a national program to inform and shape public policy on sustaining family farms and food systems.

Well, there are a lot of things she belongs to and does. I would be here for all afternoon if I read them all. So we welcome you, Ms. Kemp, to the Committee and look forward to your testimony.

STATEMENT OF LONI KEMP, SENIOR POLICY ANALYST, THE MINNESOTA PROJECT, CANTON, MINNESOTA

Ms. KEMP. Thank you, Mr. Chairman. I really want to thank you for the opportunity to come here today.

I want to particularly address the topic of sustainability of renewable energy. The significant question for the next Farm Bill, as for all Farm Bills, is what do we want for the future of agriculture? What policies will bring about an agriculture that benefits our children and future generations?

We believe we are undergoing a fundamental shift in the American perception of farmers. Definitely they want our food and fiber produced, but now farmers are also called upon to produce renewable energy, and clean water, and a more stable climate. We need to design the polices that simultaneously meet objectives for energy, the environment, and rural prosperity. If we do it right, we can continue food production and expand the pool of biomass feedstocks in a way that achieves all of these objectives. On the other hand, if we do it wrong, we may find that environmental tragedy and rural decline will overwhelm the hopes of renewable energy and maybe even create a backlash against the ethanol industry and farmers.

The right way is to prepare for agricultural production of cellulosic biomass on a major scale. We need to shift the policy from annual energy crops to perennial crops so that we have the opportunity to buildup soil quality, use fewer chemicals, and manage habitat.

Switchgrass, I guess this has been mentioned today—switchgrass is a popular phrase but it is not the only feedstock. There are different cellulosic materials appropriate to every region of the country, and it might include prairie grass mixtures, alfalfa hay, and woody crops like poplar trees, willow, hazelnuts, southern pines. While ethanol is the likeliest way to use biomass, we have also been hearing today an important point that there are other types of conversions that can be used with biomass. So we must also keep in mind that direct burning, gasification, conversion to electricity, methanol, hydrogen fuel cells, butanol, and even fertilizer may be produced by biomass.

Perennial biomass crops can be a triple winner at slowing climate change. And that is a very important focus, I think, for the Farm Bill. That is, if we do it properly. First, burning renewable fuels does not increase carbon emissions at all because the carbon going into the air was just taken out of the air when the crop was growing.

Second, we can grow the biomass crop in ways that reduce the total carbon in the atmosphere by capturing carbon in the soil. Untilled soil with perennial grasses, or no-till annual crops, can capture the carbon that was held in the roots, leaves, and stalks that are left on the soil.

The third way for biofuels to be part of the global warming solution is by producing ethanol in plants powered by renewable fuels instead of fossil fuels like coal and natural gas. As Senator Klobuchar was telling you about, we have two plants in Minnesota that have moved in that direction.

We recognize that none of this can happen overnight, but the fact is that the next five years, which is the duration of the next Farm Bill is precisely the window of opportunity that we need to accomplish the necessary transformations for biomass energy to blossom, just as wind and corn ethanol are blossoming now in response to previous policies.

So a few comments on the sustainability of biomass. We suggest that cellulosic crops should be prioritized according to their sustainability. The most sustainable option is perennial plants like grass mixtures that mimic the prairies, and deliver high production with low inputs, while also contributing to water quality and wildlife habitat.

On the other hand, conservationists are growing quite concerned about the potential for overly aggressive removal of crop residues, like corn stover, maybe wheat straw. Scientists at the USDA Agricultural Research Service recommend that corn stover should never be harvested from highly erodible acres, from plowed fields, or from corn-soybean rotation acres. Even on corn land with no tillage, continuous corn, only 20 to 50 percent of that residue is safe to remove if you want to retain the organic matter and keep healthy soils. So that is an important thing we have to keep in mind as we go forward.

A couple of policy options that we are suggesting. First is the Conservation Security Program. It is perfectly designed as a working lands program to deliver incentives to encourage farmers to plant energy crops. We need to design a major new enhancement payment, or incentive payment, that is part of this program, for establishing perennial energy crops according to a conservation plan. We think the basic goal should be to get farmers to start the transition to perennials so that when the market appears in a few years, some farmers will be producing, others will have seen their neighbors do it, and they can quickly learn and grow these crops to supply the supply chain.

CSP has proven its popularity on the 16 million acres already enrolled, but it needs full funding in order to offer this opportunity for renewable energy. Some folks are eyeing the Conservation Reserve Program for biomass harvests, but we would like to suggest that might not be an appropriate approach, to compromise the conservation values for which this land retirement program was designed.

Furthermore, we probably ought not to think about biomass as something that you grow primarily on marginal land. Cellulosic ethanol must compete with oil and corn ethanol, and it probably is going to pencil out best with good productivity on reasonably good lands. On the other hand, land already coming out of CRP should receive incentives to keep that land in perennial cover, including biomass crops.

We also are very interested in supporting initiatives that focus on locally owned, community-based production of renewable fuels. Rural communities need to have an equity stake in emerging agriculture energy industries in order to participate fully in the wealth that will be generated.

So thank you very much.

[The prepared statement of Ms. Kemp can be found on page 103 in the appendix.]

Chairman HARKIN. Thank you very much, Ms. Kemp, for that statement. I went through your written statement yesterday evening.

And now we have Mr. John Sellers. He and his wife, Jean, own and operate a 360 acre farm near Corydon in south central Iowa. They have a forage cow-calf and custom grazing operation. They have, I am told, over 100 acres of native grass plantings for biomass production and wildlife habitat.

John is the Coordinator of the Grassland Agricultural Program with the Leopold Center for Sustainable Agriculture at Iowa State University. He is a longtime Soil and Water District Commissioner, a member of the Iowa State Soil Conservation Committee. He served twice as the President of the Forage and Grassland Council, and as a producer/member of the American Forage and Grassland Council Board of Directors. He has recently been elected to another term as a producer-member of the board.

He is also active in the renewable energy and sustainable agriculture arenas, and of course I knew a John, well, from the Chariton Valley Project. Welcome to the Committee, John. It is good to see you again.

STATEMENT OF JOHN SELLERS, FARMER-MEMBER OF IOWA STATE SOIL CONSERVATION COMMITTEE; MEMBER, BOARD OF DIRECTORS, AMERICAN FORAGE AND GRASSLAND COUNCIL, CORYDON, IOWA

Mr. SELLERS. Thank you, Senator Harkin, and thank you for this opportunity to appear before this Committee today. The discussion today is agriculture and rural America's role in enhancing national energy security.

I would preface all of my remarks with two principles. No. 1, the producers and landowners must be an equal stakeholder in all policy and value relationships. Too many times, the stakeholder or the landowner is the last considered in any policy. They need to be a part of the partnership.

And No. 2, that now is the time to think beyond corn ethanol or soy biodiesel, the paradigm of that. Bio-energy threatens to eclipse food, feed for livestock, livestock production, grasslands, forest products, and fiber production as the major driver of American rental rates and record—I have gotten ahead of myself here.

Farmers face enormous risk from price volatility, skyrocketing land rental rates, and record input costs.

The environment faces risk from intensive and accelerating focus on one crop. There are alternatives to creating a grain-based transportation fuel economy. When facing price uncertainty, price and policy goals should be to use just enough fuel ethanol to support corn prices and farm income, but not so much that it disrupts the world food economy. Meanwhile, a much greater effort is needed to produce ethanol and bio-energy from cellulosic ethanol or cellulosic sources.

As I have stated earlier, I have nearly a decade of experience managing switchgrass biomass for energy. Several of those years were as filed coordinator for the Chariton Valley Biomass Project,

which co-fired switchgrass with coal to produce electricity. I coordinated establishment, stand improvement, fertility, research support, harvests, storage, and transport of this biomass on nearly 4,000 acres of CRP ground.

The project not only performed all of the physical functions of growing, harvesting, transporting, and processing switchgrass biomass, it also provided the resources for research that addressed the economics of establishment, stand maintenance, optimum fertility levels, harvest efficiency, machine adaptability, soil erosion, carbon sequestration, water quality, and one that I found very important was harvest impact on various wildlife species, and cultivar adaptation. We looked at what—could we bring the lowland varieties from Georgia up to Iowa and have them survive our harsh winters? They have much higher yield potential.

The knowledge and experience gained from this project will be quite valuable to the future projects, and has shown that, with government support and risk mitigation, demonstration projects and farmer groups can grow and deliver a feedstock necessary for the future commercial-scale renewable energy ventures that we hope to stimulate.

In order to assure a dependable multi-year supply of feedstock, we need to create some sort of a reserve of feedstock available for local projects and commercial ventures. I am calling it an energy reserve. It could be a dedicated energy feedstock program. But I am calling for about 5 million acres of these to come from the CRP on a voluntary basis.

We have these contracts in place at a given rate. We know what that rate is going to be for the next 10 or 1five years. We would not have to go on the open market and compete with cash rents that have escalated enormously. In northern Iowa, I am hearing reports of $285 per acre. We cannot cash rent on that basis.

Anyway, I feel the landowner should have the voluntary opportunity to do this. I am not saying take it out, let the landowner—and then see what the interest is in renewable energy. We found terrific response from our farmers in southern Iowa when we started our Chariton Valley Project several years ago.

This would also very much facilitate the research that is going to be needed to be done. I have also got some real concerns of treating crop residue basically as another low-cost commodity producer. We are going to have some real challenges with harvests.

And also, we need some herbicide labeling restrictions lifted for the production of biomass. Right now, we do not have the tools available to cultivate and manage biomass switchgrass.

Mr. Chairman, thank you again for the opportunity to testify before this Committee, and I will attempt to answer any questions.

[The prepared statement of Mr. Sellers can be found on page 120 in the appendix.]

Chairman HARKIN. Thank you very much. In fact, as you heard Keith Collins say earlier, the Chariton Valley Project may have been the only one, I think, in the United States where we have all that knowledge base that you just talked about. That could be very helpful for us.

I will just start and go down the panel. For Mr. Miller, again, and I am going to say a little bit about this with Mr. Gourley, also.

I have heard concerns that the ethanol industry is just growing too fast. It is just growing too fast. It is a boom, and booms like this tend to bust. There is concern that there could be a big expansion, and then a collapse. A collapse would put a damper on everything for a while. Investors and others would turn away from ethanol and invest elsewhere.

I just want to know what your view is on that. Is there going to be enough corn for ethanol and animal agriculture? And will there be adequate markets for ethanol at profitable prices? What is your view on whether it is growing too fast or not?

Mr. MILLER. I think in any short cycle, you can look at sort of a boom/bust, is it growing too fast over a period of two or 3 years. Over the long run, I am not too concerned about, because those things tend to equal out. Things naturally occur that smooth cycles out.

For example, there are only so many builders or so much steel going into the ground at one time. You have to go through your permitting process. We are in the process of developing three additional facilities in addition to the two that we own, and getting through the permitting process is going to take a year in many cases. And we are looking at 18 months, that has slowed down.

So I think some of these situations sort of take care of themselves. In the long run, I am not too concerned about it. I mean, we are trying to penetrate a 150 billion gallon gasoline market, and we are only 5 billion gallons today. Even if we get up to 15 billion gallons, it is only 10 percent. So we have a lot of opportunity there. I think up to about 15 billion, we are probably in good shape with corn, again, depending upon how fast we get there.

If you talk to companies like Monsanto, I mean, we are talking 300 bushels an acre in twenty years, just the natural yield increases. The yield increases that I have seen in the last couple years where I live, where we have a drought condition, and we have a near-record crop. It is just simply amazing.

So I am not too concerned about corn availability in terms of food and fuel. And certainly DDGS is a good product. We have not had any issues with it. I do think going on to the next generation, we do need to look at cellulose. That is why our company is involved in taking the corn fiber and trying to break that down. And we envision bolt-on facilities to the corn-based facilities, where we would start off with corn fiber, and you can also, once you have the technology proven out, you can bring in other products.

Chairman HARKIN. The plants you are involved in, and I get this question a lot and I do not exactly the answer to it. Existing ethanol plants are being built right now. Can they adapt to cellulose conversion also?

Mr. MILLER. Well certainly. I think what you are looking at is a bolt-on to an existing facility. For example, at Pekin, where we have—fortunately we are a wet mill on about two-thirds of our plant there. We have a very pure fiber strain. It has got a lot of starch to it, which is great. We can break that down and put a bolt-on facility right there at our Pekin facility, which can take advantage of all the infrastructure, the grain inbound, the outbound load out. And I think for these cellulose plants to be successful, a transi-

tion mode is to bolt them on to an existing plant where there is plenty of infrastructure available.

So that is where we see the market developing for cellulose probably over the next five and 7 years, as bolt-ons to existing facilities. And then you can get scale for the facilities to stand on their own.

Chairman HARKIN. The question I want to ask, first of all—when I am finished with everyone here, I am going to go back and revisit one question, and that is this, if you could write one or two provisions into this Farm Bill to promote the use of biofuels, while simultaneously protecting our livestock industry, what would they be?

Also, another question you might think about, all of you, I asked this to Mr. Miller, is: what do you think about the idea of tying the blender's tax credit to the price of oil inverse by? In other words, a counter-cyclical payment. Right now the credit is $0.51 per gallon, but there are those who say we do not need this credit right now because the demand for ethanol is there. The price of oil is high so the tax credit could be lower. But as the price of oil comes down, what does that do to the ethanol market? Well, if you had an inverse payment, as the price of oil went down, the blender's tax credit would go up. As the price of oil went up, the blender's tax credit would come down. That way, there would be absolutely no incentive for, say, OPEC and others to say, we will just start cutting prices.

I just want to know what you think about that idea. It has been floated around and I am looking at it.

Mr. MILLER. Well, Senator, I have been in this business for 2five years, and there are times when the tax incentive has not been enough, and then there are times when it is probably been more than plenty. You have to tell me what the price of oil is going to be, and what the price of ethanol versus oil is going to be, and also the price of corn. I think, from that standpoint, the concept is a good one. I think in practical reality, it is going to be difficult to manage a variable tax credit. What is it on a given day? That could affect the value of ethanol which could affect the price.

Chairman HARKIN. Well, it would be based just on the price of oil.

Mr. MILLER. Well, then you have the price of corn. That is another big variable. So it is my price of corn and my price of ethanol, and ethanol is priced somewhat relative to oil, but not exactly. We have seen periods of time where it has actually inverted the price of gasoline. It has gone below that. And we have seen times, for example, when the oil industry pulled out 2 billion gallons of MTBE demand here in the spring where we saw very high prices for ethanol that sort of decoupled.

So there is a market for ethanol in its own right. It is tied to oil, but—and while you could say that, yes, I could inversely relate that to the price of oil, you would almost have to put a factor of corn in there. And then you would have to come up with a mechanism that is manageable. And I think it is the mechanism where it is going to be somewhat difficult.

On the long run, the tax incentive has about done what it was intended to do. For the long run it has been about right. It has been adjusted through history. It has been as high as 60. It has

been as low as 40. So it has worked, and it certainly has driven what we want to do.

I heard in the previous panel, we have reduced foreign payments by $6 billion. That is far more than the value of the tax credit loss. So it is a good program the way it is. Again, while that is a good idea, I think the mechanical workings may prove difficult.

Chairman HARKIN. It is just an idea that has been floated around. I do not have one view or the other. I am just trying to solicit views on it.

Dr. Webb, as you have probably heard here, there is a broad consensus, I think, that we want to accelerate, and we want to do what we can in this next Farm Bill to accelerate the commercialization of ethanol from cellulose. Is ethanol from a woody biomass in the Southeast ready for commercialization? If not, what are looking at an earliest timetable for that, in your judgment?

Mr. WEBB. Well, the number that we have in our report is commercializable by 2010. That is a process that we are going through where we would first build prototype plants of various sizes, scale them up, measure what the problems are, and then go to a major plant.

That could be accelerated, I think. I think the technology is there. Prudence would say the first thing you do is establish a prototype plant and see what the outcomes are. You can probably shorten the process to a full-scale production plant with proper investment incentives. But I think 2010 is a reasonable number. That can be shortened some.

Chairman HARKIN. Well, we need to know from you, what are the most important policies and programs that we could address here? You know, as I have said earlier, we have people on this Committee and also on the Finance Committee and the tax writing assignment. And, unless I miss my bet, I do not think I will on this one, some of this Farm Bill stuff that we are developing will have jurisdictional oversight or say so by the Finance Committee.

Mr. WEBB. Yes.

Chairman HARKIN. And I have already discussed that both with Senator Grassley and with Senator Baucus. So what are some of the things we need to do?

Mr. WEBB. Well, I do not have all the numbers firmly in mind. I think 100 million gallon a year corn ethanol plant is about $100 million. A similar sized plant, cellulosic to ethanol probably costs twice that much. And as I had mentioned earlier, there are some unknowns about that process that have to be measured so that the investment capital to create such a plant is somewhat is risk.

So I think any policy that could be developed that would reduce the risk to investors in creating the initial plant is the most important thing that can be done.

Chairman HARKIN. OK. So you need a demonstration plant?

Mr. WEBB. Yes.

Chairman HARKIN. Nothing is on the drawing board right now.

Mr. WEBB. Not in terms of a full-scale facility.

Chairman HARKIN. I do not know why, but I read that Iogen was thinking of building a plant in Georgia.

Mr. WEBB. Not that I know of.

Chairman HARKIN. No?

Mr. WEBB. Iogen has facilities in Canada. There are facilities in Scandinavia that produce ethanol from.

Chairman HARKIN. I just read that someplace. Maybe it was just one of those little blurbs in the paper or something. But I am really excited about this, because we need to move on this.

Are there other species besides pine that could be used? I was always told fast growing poplars. And what is the harvest cycle for these pines? What is the cycle on that? How many years?

Mr. WEBB. The pulp and paper industry typically uses a turnaround time of 1five years, planting to harvesting, to create paper. I am not aware of a study that says what is the optimal time to harvest the pine tree to produce ethanol. That study needs to be done. There is clearly some time in the life cycle of the pine where it is optimally usable to create ethanol. But I think 1five years is a target for the turnaround time.

Chairman HARKIN. Well, you have to think about the cycle thing and get that done, too, but this is one are that we really want to address and move ahead on. So any suggestions you have along that line.

Mr. WEBB. The other point is the competing utilization of the resource is pulp and paper throughout the Southeast, but that industry is declining. In the 3–year period from 2001 to 2004 in Georgia, that industry declined 25 percent, and that is continuing.

So without any new planting or anything, it looks like the available resource is going to increase, and there are clearly opportunities to plant more. There are clearly opportunities to enhance the energy value of the pine through genetic manipulation and so forth. So I think there is potential well beyond the 4 billion gallon that I mentioned.

Chairman HARKIN. That is exciting.

Mr. Gourley, I thank you for your testimony. You really honed in on some things that we are more and more becoming aware of as of late, and that is the impact of ethanol production on the livestock industry in many different ways. Not just from the price of corn, but just, as you pointed out, something that I had not previously been too much aware of, and we have to look more at DDGs. And we need to talk to the ethanol industry, Mr. Miller, about this also. And that is the quality of the DDGS that come out. And they vary, as you say, from plant to plant, and maybe within the plant.

So when a hog producer wants to get feed, they have to have that consistency, so what can we do? This is something that we really need to look at, because we need to utilize that feed source. Now, for cattle it has been pretty good, but on hogs it has been not so good.

Now, was it the University of Minnesota showed that they if were prepared and marketed the right way, hog producers could use 20 percent or even more in their hog-feed ration. Yet in your testimony you were saying about 10 percent. I guess, is that difference because of quality and consistency and that type of thing?

Mr. GOURLEY. Not so much. Ten percent is kind of just the golden rule that the industry is using right now, partially on the variability issue. It just comes down to economics of formulation. It is another product that has been provided to us to try and use as a

byproduct coming into our formulation. So you will balance that against soybean meal price. There is a protein and price point. You balance against corn as the energy source. You balance it against animal fat. All the combinations of these—the phosphorous in it, as well, can go against dicals or inorganic phosphorous that we formulate with.

So as it comes in the formula, 10 percent is kind of the safe ration. As you go to that 20 percent, the issues I mentioned about the corn oil increase, because it is three times higher. We feed that amount late in finishing, where the pig consumes most of the feed, we can run into a soft fat issue, is what it is called, with the packing plant. And that gets into the sliceability of bacon and some of those things. I know the Southeast ran into it with poultry fat, basically, feeding that back, that you can get softer fat carcasses.

So those are some of the issues—and I know that some of the ethanol plants are talking about fractionation. So they will pull the oil out, leave the protein, and that will improve our feeding of DDGS. In actuality, and I am working with Broin on this. Broin has looked at that combination, and the amino acid makeup, or the protein fraction that is left over is still not very ideal for swine. We still would have to add other synthetic amino acids. And really, soybean meal is still the choice on a protein standpoint. But it leaves some of that soft fat issue that I just talked about, but it also may not be as high a value product just because the protein is not quite what we need.

And again, I am talking swine specifically here. Beef, you know, you do not get into the amino acids, the protein, as much. They just need the urea for the nitrogen, and they can digest fiber as well.

Chairman HARKIN. I thought Iowa State University was doing some research, and maybe other universities, too, in this area.

Mr. GOURLEY. You bet. They are. Dr. Trinkle, I actually called him a couple of days before I came down here. At Iowa State University he is doing research on that. And one of your points of asking, what can we do? One thing he mentioned is, I wish I had more funds to get into some of the issues of enzymes being used and feeding that with the beef side of it, for utilization of the product better. And just getting funds, period, to do the research that needs to be done on the beef and the dairy side of it. It was one his comments, that it would be nice.

He sees a lot of dollars going toward the cellulosic, which, totally, we need, and obviously it is very evident today. He just does not see as many funds available for him to try and get the beef work done that needs to be done to feed the byproduct.

And just as a side note on that, again, you cannot blame the ethanol industry. The main product they are selling is the ethanol. You talk to a lot of plants, and they say, look, we just want to get rid of this stuff. The bottom line dollars to them, DDGs mean very little to them. That is the way it has been. And so there are issues when you talk to some plants.

Chairman HARKIN. Well, what can we do? Again, help me think this thing through. Help us. Do we need to work with the ethanol industry to provide some kind of standards or something that they should meet with with regard to DDGS or some incentives to encourage standardization? I don't know. How do we approach this?

It seems to me that this is a valuable byproduct. I understand their main product is fuel, but DDGSthat is still a very valuable byproduct.

I do not know. I will ask Mr. Miller.

Mr. MILLER. Well certainly, Senator. It has become important enough that we have a full-fledged committee within the Renewable Fuels Association, a feed committee looking at standards, consistency.

Consistency is very important. And as the industry has grown, you have different technologies. And it is correct, ethanol is our primary product. This is a byproduct, but there are things that plants can do to be more consistent. One example that I could point to would be at our Nebraska plant where we can run milo or corn. We found we had a much more consistent DDGS product if we ran all corn and the market would pay us for it.

Some of this is market related, too. If you produce a higher quality, consistent product that nutritionists can use, then the marketplace is going to value your product more. And I think as we become larger in the marketplace, the market forces begin to take over. And there will be those who are producing a more consistent product and a higher quality product, and that will be who the people go to first. And if you are not producing a consistent product, you are going to be the supply of the last resort.

In the areas like toxins, for example, we test for toxins all the time. We export a lot of our feed product to Europe. Europe is very tight on toxins. And we know—we have known for 2five years or more how important it is not to have aflatoxin or any of the toxins. We test consistently for it. We run consistent tests. When we have high aflatoxin periods, we are sampling every truckload that comes in. Our elevators know if they try to provide some higher toxin material to us they are going to get embargoed. We will not buy from them. And that is a pretty powerful statement when you are buying 50 million bushels a year in a local economy.

So those are some tests that we do, and I know a lot of others do. Anybody who is in the export market is going to be doing that and I would say most of the domestic guys are, as well.

So I do think this is an evolutionary process, and we are going to have to try and get our arms around it through the feed committee within the RFA.

Chairman HARKIN. I appreciate that. Again, market forces, yes, I understand it, that could help. But I still understand that, even with the market out there, that we get this inconsistency and stuff out there. But we got to figure this one out, on how we—and I think we do need more research money into that, both on how you make these DDGS more applicable for swine, but also how do we use other enzymes and stuff to help the swine digest and utilize that stuff. I guess that is the kind of research we need to do more of; is that right?

Mr. GOURLEY. I did—I actually conducted one of those research projects with an enzyme company and they were working on some solid state fermentation is what it is called, to deal with enzymes and digestibility of some of the energy and proteins in the DDGS. Our first shot at it was not very successful through the pig trials, but they are back to the drawing board. They are not giving up,

and they are a substantial company that is going to try and put some efforts toward to that.

But I mean, even—we try to look at it. We pull the oil out. The issue on the swine side is that even if we put 10 or 20 percent, the corn is still 75 to 80 percent of my ration from an energy basis. What the ethanol industry pulls out from the corn is exactly what I needed from the corn to start with. And that is the challenge as a nutritionist is balancing. They can give me this back. It has got some oil in it that helps. It has some protein in it, but the bottom line is that the energy that I needed to grow the pig is what they took out for the ethanol production.

So again, I understand that is the way that process is, and I am trying to, as a nutritionist—we try to balance, now, what is my new energy source? And corn is king. I do not know what other energy sources to try and bring in to fill that ration up. Poultry is in the same boat as swine, as well.

And so that is kind of where we are at. It is a struggle. So it comes down to availability of acres.

Chairman HARKIN. Comes down to what?

Mr. GOURLEY. Availability of acres.

Chairman HARKIN. For production.

Mr. GOURLEY. Yes.

Chairman HARKIN. Well, the other thing, of course, as we have heard testimony from, and we know this, the productive capacity of corn—it is mind-boggling how much production we are getting out of corn now per acre.

And you think, well, is there a limit to this? Well, not during my lifetime there has not been. My gosh, we are getting up to 200 bushels an acre now, and I have been told that it is going to be even more.

Mr. GOURLEY. We were 170 bushels 3 years ago. We were 180 last year. We are 185 this year. So five bushels an acre. The thing, for my family's operation, those five extra bushels in that year amounted to 3 days worth of feed for our pigs. That five bushel increase was on 3 days worth of——

Chairman HARKIN. Only 3 days?

Mr. GOURLEY. Yes. I mean, it takes a substantial—and again, those are big steps. I know that there is 300–bushel corn coming that he mentioned, and I hope it does, because we are going to need the supply.

Chairman HARKIN. Initially, we certainly will need a lot of corn for ethanol production, but the development and implementation of cellulosic ethanol should start to balance thngs out.

Mr. GOURLEY. Hope so.

Chairman HARKIN. But again, we have to be very cautious on what we do here. And this is one of our big concerns, as you know. So we look forward to working with you.

Mr. GOURLEY. You bet.

Chairman HARKIN [continuing] We must make sure to balance all of these interests cna concerns on our bill.

Ms. Kemp, I appreciate your comments on the Conservation Security Program. As you know, I developed CSP, and we were able to implement it in the last Farm Bill. I think it has proven its worth. It has been accepted by farmers all over the country. Of

course, it was never designed to be on a watershed basis. It was designed to be on a national basis. But we will get to that. I mean, I do not mean to belabor anyone here on that right now. But it was designed to be a conservation effort on productive lands. The existing paradigm of conservation was always, to take conservation land out of production. Well, I wanted to challenge that paradigm and say, well couldn't we have conservation payments based upon working lands, not just based on how much you produce but how you produce. Can we measure clean water, air, and sustainability as products, just like corn? That is what we set out to do, and I think it is working.

Now, again, I, perhaps, had not thought about this at the time—I am talking about 10 years ago when we first started developing CSD, but now it seems to me that this paradigm may be applicable to the production of cellulosic material for ethanol as well. It seems to fit perfectly. You can have sustainable agriculture. You can grow switchgrass or whatever it might be, and do it in a sustainable manner, and get a conservation security payment. This program could also help farmers who want to transistion from ontype of farming to another. If a farmer wanted to transition from some crops to cellulosic crops, well, it would be pretty hard right now because there is not much incentive there to do that. But if you have a CSP program that dovetails with that, that could be a good transition payment.

I do not know if you have any idea of what level of payments are needed, but we need to have some idea of what we need to encourage biomass production under CSP. In other words, what payments would provide enough economic incentive, in addition to whatever market value there is out there for these biomass products?

This could also help us with this chicken and egg problem we are having here. If you give farmers incentive payments through CSP for the production of biomass crops, well, that could start moving that. And then the investors and the plants that want to be built will say, OK, now we are going to have the supply.

I am just thinking, if you have any thoughts about what kind of a payment system might be applicable for this. If you do not, if you have it later on, we would like to hear from you about what level of payments would be needed?

Ms. KEMP. Well, just a couple thoughts. You did have the foresight to include energy as a major purpose of the CSP. So we already have the incentive payments now for if a farmer uses renewable energy, if they produce electricity, and if they reduce their net energy use on the farm. So we just have to add the other element of producing feedstocks for renewable fuels.

Chairman HARKIN. Producing energy, right.

Ms. KEMP. I do not have any estimates for what it is going to take, but I will just point out that the CSP sets a really high bar for conservation for farmers to get into the program. And so there would be a combination of—one would be an enhancement payment specifically for establishing a perennial crop with high conservation standards. But then also built into the program itself is you would get a reward for improving your soil quality and your soil conditioning index by establishing perennials on land that used to be crop land, for example.

So it is built into the program to both be rewarded for the inherent environmental benefits of cellulosic crops, and then what we can add in is an extra transition payment for the transition costs, and the fact that we know there is some experimentation going on, and trying seed varieties, trying management techniques.

And in fact we should probably build research into this first generation of CSP energy crop contracts to make sure that we are getting the best information to those farmers and that their experience then gets translated out to others. But we will help work on setting the numbers. That is hard.

Chairman HARKIN. Yes, because this is—switchgrass gets a lot of attention, and it should, because from everything that I have read and seen, this could be a very valuable biomass resource for ethanol.

But there are other things, too. There is alfalfa. There are other grasses. Alfalfa has the benefit, it has feed quality too, not for hogs, but for cattle and other things. That could be used and still get the cellulose out of that. I am not certain if there is any feed value in—well, yes, there is feed value in switchgrass, too.

Now this brings me to Mr. Sellers. Now you are probably one of the few individuals in this country that has actually had a project of growing, and harvesting, shipping, using a biomass product, switchgrass, at the Chariton Valley Project.

So, you know, you have done all of this. What are some of the unsolved problems we have left? I mean, you have been doing this Chariton Valley Project for what? How many years now?

Mr. SELLERS. Nine.

Chairman HARKIN. Nine years.

Mr. SELLERS. Yes.

Chairman HARKIN. So what more do we need to know? I mean, you have a lot of data and stuff. What more do we need to know? You know how fast it grows. You know the types and stuff for our area. What are some of the unsolved problems that we need to know about switchgrass?

Mr. SELLERS. We need, No. 1, to really define the fertility that is actually needed, just some more work on fertility over a long term. We need to do some more work on pH. We need to look at take out rates so that we might pull the harvest a little bit earlier. We do not dare pull it too much earlier than 10 days after killing frost because of the nature of a C4 grass. That goes back into the roots getting ready for next year. If we take it off too soon, that will weaken the stand. Right now, seed is running about $20 a pound. So it would take $200 an acre to establish a new stand.

Chairman HARKIN. So you have to wait after a killing frost to harvest the grass?

Mr. SELLERS. Right, which makes a very short, very intense harvest period. I am quite enthusiastic about some of the cool season grasses and some of the polycultures so that we could stretch out this harvest window.

You talk about the pine in Georgia. They also have a boatload of fescue down there. All of our States through the Kentucky and Tennessee region, Missouri, they have a lot of fescue that could be utilized.

So we have some real good cool seasons that could be utilized along with it to stretch out the program. The main problem is distance that we have to transport it, and then basically build in a preprocessing locally, and then take a more, and if I can use the term, densified product, on to the conversion facility.

Chairman HARKIN. There is also the need to think about storage?

Mr. SELLERS. Absolutely.

Chairman HARKIN. I have been told that something like switchgrass can be stored on the farm in round bales with a plastic cover or something like that. Is that so?

Mr. SELLERS. That is so, but you run into transportation problems with that round bale.

Chairman HARKIN. Yes.

Mr. SELLERS. We in the Chariton Valley Project looked long and hard at that, found the optimum package was a 3 x 4 x 8 square bale that gave us the optimum ability to truck it legally and safely and a machine could take it and work with it in a processing facility. So we ended up with a square bale. That brings up moisture considerations. These bales weigh approximately 1,000 pounds a piece. This takes plastic twine to hole the knot together. There are so many adaptations.

Chairman HARKIN. A 3 x 4 x 8 bale weighs how much?

Mr. SELLERS. Switchgrass, about 1,000 pounds. If you were pumping alfalfa into that package that, that would weigh about 1,400 to 1,500 pounds.

Chairman HARKIN. So it is really compacted.

Mr. SELLERS. Right. We have the ability to squeeze that down and densify it physically about two to one. But still, what good does that do you when you drive it 100 miles and you have to break it all apart to process it? I am thinking, or hoping, that the technology of pyrolysis, where we could turn this into a biofuel locally, and then take tankers to a biorefinery would sure help our energy life cycle as we produce the cellulosic ethanol or the bioproducts.

Chairman HARKIN. Well now that opens a whole new area that we had not looked at before. I think most people are focusing on how you stimulate the production of switchgrass and things like that, and then the transportation. But I do not know that anyone has been looking too hard at localized—what did you call it?

Mr. SELLERS. Preprocessing.

Chairman HARKIN. Preprocessing plant. I do not know what that does to the economics of it. I have no idea. Do you know?

Mr. SELLERS. The farmers and I that work in this arena feel that this would have a lot of value. It would include us in the value chain to some extent. And it would lower the cost delivered to the regional biorefinery. One of the problems we run into—we have got Murphy's Law working here. It only takes one machine to break down to cause an awful lot of havoc. If you have got ten local storage facilities, a tractor breaks down, the other nine are still going to be sending material to the biorefinery. That principle is going to work as we go into the biorefinery era. It is not going to take much to interrupt the whole processing flow.

Chairman HARKIN. I had one other question. I will get it to you in writing. I just noticed it is really getting late. But the question

I asked earlier, if you had one or two things to put in the Farm Bill, what would you do to move us in this direction?

Mr. MILLER. Well, Senator, the fact that there is an energy title in the Farm Bill itself, I think we owe you a debt of gratitude for that, your leadership there and the fact that we are sitting here talking. And it has worked quite well. I think, as far as what we could do to improve it, I think Dr. Webb hit it on the head about investment in—cellulosic technology is very expensive. It is going to be several more dollars per gallon than what it is going to cost to do corn-based ethanol. And it is hard for venture capitalists or investors to spend that kind of money on something that is a little bit risky. So any support in terms of either loan guarantees or something like that would go a long way.

Chairman HARKIN. Good suggestion, Dr. Webb?

Mr. Webb. I have already made that same suggestion. The other thing is continuing support for research in enhancing the processing processes.

Chairman HARKIN. Research in processing, Gene?

Mr. GOURLEY. Yes, we talked about some of the research on DDGS. Obviously, there is still a lot of work to do on types of corn genetics and how that can—corn genetics could be developed. I know they have developed corn genetics for high-extractable fermentation in the ethanol plants. Maybe there is an opportunity to look at the protein makeup for that corn that actually would be more ideal for poultry, that then going through an ethanol plant would put out product that would turn around and be a more usable or higher useable product for us.

There are probably others, Senator Harkin. For me to speak specifically on those, I think I would really like to work on our industry to come to you and to your Committee and try and offer any solutions or input we can.

Chairman HARKIN. Well, and we are asking all of you to do that. Please give us your best thoughts and your best suggestions on that, Ms. Kemp, what would you put in the Farm Bill?

Ms. KEMP. Well, I think we can prevent a lot of the problems if we integrate conservation into the process right up front. We have most of the tools we need already in the conservation programs we have, but we have to figure out to really aggressively target them to the emerging biofuels industry. So, you know, funding all of the cost share programs that we have, and specifically designing them so that they are useful to farmers who are getting into new crops but want to do it right.

Compliance, conservation compliance. Maybe we should consider increasing the reach of compliance to cover anyone that is getting any kind of benefits related to renewable fuels. Maybe it should cover more than just highly erodible acres, but all acres. Of course we would need to make sure that it is actually implemented and enforced as well.

Another area is conservation planning. We would like to see a lot more funding available for technical assistance for farmers. At the time they are getting into designing this new crop for part of their farm, starting it out on a certain field, that is the time to work with their agronomist, to work with professionals to develop a conservation plan for that land right up front. So they know what the

opportunities are, how to deal with residue removal, runoff, all those kinds of things.

One kind of novel idea is to consider whether we should require the ethanol plants that purchase residues, corn stover in particular, for them to require conservation plans from the farmers they purchase from. That way they would know that the land that supplies both the corn and the stover is not being degraded over time.

So I am not sure we need a new conservation program, but we need to tweak all of them to make them apply right up front as we move forward.

Chairman HARKIN. As you said, on the CSP, we did do the other things but we did not do it on the production end.

Ms. KEMP. Yes. I did not mention that now because I did before, but that is No. 1, is to realize the CSP.

Chairman HARKIN. We have to do that. John, what would you put in the Farm Bill?

Mr. SELLERS. Well, I would go along with Ms. Kemp. CSP is a wonderful vehicle if we all had access to it, the United States. That would be a real good start. But No. 2 is the risk involved for someone—when you start, you have a known technology, as in raising corn in the Midwest. And someone comes and asks you to risk this opportunity for an unknown without a market, it is going to take a lot of incentive to get you to smile when the guy asks you to say yes.

That is why I was looking more at the new CRP contracts that have just been signed for 2007 for 10 years. Those are in our government inventory. We have budgeted for those. That cost will not rise. It is just like the native grass seed business, we can look at the price of it and it is like an oscilloscope. Every time there is a change in FSA or USDA rules or they let more folks in, it skyrockets. This would be the time we are trying to stimulate feedstock production, and it would cost us the most.

Chairman HARKIN. You are saying using some portion of the CRP for biofuels production.

Mr. SELLERS. Right. Give the folks a voluntary.

Chairman HARKIN. But permitting them to still get a payment for it, as long as they do it in a conserving matter. That type of thing, right?

Mr. SELLERS. Yes. You are getting all the benefits of CRP, just like we achieved in the Chariton Valley Project, we are just expanding it across the country rather than a four-county area in southern Iowa. So that other areas could use their natural resources to.

Chairman HARKIN. How about the concerns of Pheasants Forever, Ducks Unlimited, or hunters, or wildlife people who are concerned about this in terms of destroying wildlife habitat?

Mr. SELLERS. My experience as a farmer and a wildlife enthusiast is it would do nothing but enhance. You take cool seasons, you harvest it at the right time, the next year you have got nearly a perfect habitat for young sport birds, quail and pheasants.

The same way in switchgrass. We found that if you leave blocks along the end, we actually enhanced the pheasant population on our harvested fields.

Chairman HARKIN. Interesting.

Mr. SELLERS. We could do what is being asked of us in mid-contract management, which is disk up a third of it every year, or spray and kill a third of it every years so that we could have some manual fjords, we are getting to the same point, only we are doing a lot more for national security producing energy.

And it can be, as Loni said, there could be conservation plans on this, and set-asides, just like I plant food plots for the wildlife on my farm. It is the same thing.

Chairman HARKIN. These are all great suggestions. I thank you all for being here. I thank you for your patience, and for your input into this process.

As we bring this hearing to a close, again, I just wanted to repeat what I said at the beginning. I wanted to have the first hearing on energy to sort of plant the flag, if you will, to say that energy is going to be the engine of this Farm Bill. It is going to be the engine of this Farm Bill. Make no mistake about it.

And we have to be careful. We want to do it right. I know we always make mistakes. We probably will make some here, too, but we will try and minimize those mistakes. But I think the public wants it. I have talked to my colleagues on both sides of the aisle on this. It is not a partisan issue. I think you see everybody coming together on this for national security and for rural America. Just, as I said, it is a win-win for everyone. And we just have to step up to the challenge and really sort of push the envelope on this in this next Farm Bill.

I have talked to my colleagues on the House side and they are proceeding in the same manner. So as I said in the beginning, this is not going to be your old Farm Bill that you knew in the past. This is going to be quite different. And we are going to start making some changes so that we have a transition.

Now, that is not to say that we are going to drop the production of agriculture. That is not what I am saying at all. I am just saying that there is going to be a new aspect brought into this that we have not considered before.

So we just need your help, your best thoughts, you have given us some today. As we proceed, please feel free to be in contact with my staff, or me, or anyone else on our Agriculture Committee and give us your best thoughts on this. And as we move ahead in the drafting stage and stuff, of course your organizations and you will all be able to look at it and give us the benefit of your thoughts as we proceed on this.

So again, I thank you all very much, and the Committee will stand adjourned subject to the call of the Chair.

[Whereupon, at 1:28 p.m., the hearing was adjourned.]

APPENDIX

JANUARY 10, 2007

Comments by Senator Pat Roberts
U.S. Senate Agriculture Committee Hearing
The Role of Agriculture in Reducing Dependence on Petroleum
Washington, DC
January 10, 2007

Mr. Chairman and Mr. Chambliss, thank you for holding this timely hearing. Agriculture and energy seem to be on everyone's minds these days.

In Western Kansas, we're still digging out from under a winter storm that left many towns and producers without energy. Some were out of power for nearly two weeks, forced to run feeding operations and wells on generators burning diesel fuel.

Now I know we're not here to talk about that issue so I'll save the rest of my disaster speech for another time. What we are here to talk about is agriculture's role in kicking America's "addiction to oil", as the president says.

Well, I can assure you Kansans are doing our part. The sunflower state is now producing 215 million gallons of ethanol per year from 8 plants using corn and sorghum as their feedstock.

To give you a glimpse of the future of Kansas' production, we have an additional 235 million gallons per year already under construction and another 353 million gallons per year capacity nearing construction. This means that in a few short years Kansas will potentially produce 803 million gallons per year; nearly a four fold increase from what we produce today.

Mr. Chairman, as you can see Kansas is falling in line with many other states in ramping up the supply side of the economic equation.

However, Kansas is also increasing its efforts on the demand side. When comparing gallons of E-10 fuel sold in the months from July to December in 2005 to the same months in 2006, you will see a total increase of 662%, and that's without a state mandate.

When it comes to the higher E-85 blend we have a real "chicken and the egg" problem here. For example, why would you buy a flex fuel vehicle if you can't buy E-85 at your local gas station?

And if you're station owner, what incentive do you have to dedicate a pump for biofuels, if your customers don't have vehicles that can use it?

I support the work of the National Ethanol Vehicle Coalition assisting station owners to install the equipment needed to distribute E-85. With their help, 16 stations now offer the higher blend option but more progress is needed.

As we know, ethanol is not the only renewable transportation fuel on the market. Biodiesel can be found at 61 locations across Kansas at lower blend levels and at 3 stations at the B-20 level. We also have several production facilities in various stages of development.

Mr. Chairman, I am pleased that the Energy bill we passed last session has helped spark this economic rejuvenation in rural America. The bill was a long overdue, important first step towards decreasing our dependence on foreign oil.

The Energy Bill coupled with the opening of the eastern Gulf of Mexico to domestic production will help in the long-term stability of prices for farm fuel, fertilizer and irrigation. These measures are vitally important to our national security.

I'm pleased with the progress we've made – but we've got our work cut out for us. To avoid mistakes of the past, we have to think far enough down the road and anticipate the challenges that lie ahead.

As I've said before, we must be sure that communities invest in the long-term viability of these biofuels. These plants must be able to sustain price changes and the prospect of future market fluctuations.

As we view our investments in alternative fuels in the broader context of the next farm bill, we need to keep in mind that any incentives or policy changes we make on the energy side can't come at the expense of food-based agriculture.

We need to think carefully about the law of unintended consequences. Specifically, how our commodity, conservation and energy programs work together. Changing one title at the expense of another is not the answer.

And that includes research. We must continue to invest in agriculture research that has increased crop variety, production yield and disease resistance.

Research into alternative feed stocks will only help to ensure the viability of the biofuels industry. Cellulosic biofuels production has great potential in Kansas but more research is needed to find cost effective processes.

In closing Mr. Chairman, I'm pleased agriculture has begun to answer the call to reduce our nation's dependence on foreign sources of oil. We have a long way to go and many issues to work through, but we're moving in the right direction.

Statement of Senator Debbie Stabenow
Senate Agriculture Committee Hearing
Agriculture and rural America's Role in Enhancing National Energy Security
January 10, 2007

Mr. Chairman, thank you for calling this very important hearing on American-grown biofuels and our national energy security. There is no doubt in my mind that American farmers have a key role to play in providing domestic energy. We are already seeing the rewards of the programs we put in place through the Energy Policy Act and the last Farm Bill – increasing ethanol and biodiesel production nationwide. In fact, in Michigan we will soon have seven ethanol plants up and running. So we know that with the right federal policies for agriculture and energy, we can enable American consumers to buy from the American Midwest instead of the Middle East.

Beyond the national security issues related to our dependence of foreign oil, I am excited about the important role American-grown biofuels can play in domestic job creation and economic growth. Michigan is famous for making automobiles. We also grow a significant amount of corn, soybeans, sugar beets, and many other crops that could be used to create biofuels. And we are very proud of Michigan State University, where Dr. Bruce Dale is leading national research on cellulosic ethanol. Combined, Michigan agriculture, MSU's cutting-edge research, and the commitment of the Big Three automakers to make double their production of FlexFuel vehicles by 2010 means that Michigan has an important role to play in providing domestic energy security.

Mr. Chairman, I look forward to working with you on the energy title of the next Farm Bill.

STATEMENT OF KEITH COLLINS
CHIEF ECONOMIST, U.S. DEPARTMENT OF AGRICULTURE
BEFORE THE U.S. SENATE COMMITTEE ON AGRICULTURE, NUTRITION AND FORESTRY

January 10, 2007

Mr. Chairman, thank you for the opportunity to discuss renewable energy in relation to U.S. agriculture. While biomass energy from wood and waste have long been important sources of renewable energy, biofuels from agricultural crops are a rapidly growing source of renewable energy, with exciting prospects for the future. I will provide a brief status report on renewable energy focusing on biofuels, then discuss emerging issues related to the rapid growth in biofuels, and conclude with a brief summary of USDA activities in renewable energy.

U.S. consumers want an adequate, clean and affordable supply of energy. Renewable energy can help achieve that goal by utilizing naturally occurring sources such as wind and biomass. Renewable energy can reduce our dependence on fossil fuels, diversify energy sources, improve the trade balance, reduce environmental impacts, and generate income for farmers, ranchers, rural areas and others who harness these natural sources of energy. The Department of Agriculture (USDA) has programs that support renewable energy production, including research, technical assistance, loan and loan guarantee programs, and competitive grants. For example, Section 9006 of the 2002 Farm Bill, the Renewable Energy Systems and Energy Efficiency Improvements Program, has provided $73 million in grants and loans from 2003 to 2006. This program makes loans, loan guarantees, and grants to farmers, ranchers and rural small businesses to purchase renewable energy systems and make energy efficiency improvements. USDA works closely with the Department of Energy (DOE) and other Federal agencies to efficiently coordinate and implement programs to increase renewable energy production.

Overview of Energy Markets

The Energy Information Administration's (EIA) AEO 07 Reference case projections released in December 2006 place U.S. energy consumption at 101 quadrillion Btus (quads) in 2006, eight times the level at the beginning of the last century. Renewable energy consumption in 2006, including hydropower, is estimated at about 6.4 quads, less than four times the level at the start of the last century. U.S. energy use is projected to increase by 30 percent by 2030: from 101 to 131 quads. This means renewable energy production must also increase by 30 percent over the period simply to maintain its current small share of total energy use. The expected growth in energy demand represents a significant challenge if our nation is to reduce its dependence on fossil fuels. However, this growth in total U.S. energy demand also represents an enormous potential for renewable energy, including renewable fuels, with critical implications for agriculture, forestry, and rural America.

The AEO 07 EIA Reference case projects that the real price (2005 dollars) of crude oil will slowly decline from $62 per barrel in 2006 to $46 per barrel by 2012. Oil price and many other factors will influence future demand for ethanol.

Biofuels

Ethanol. In 2000, about 1.6 billion gallons of ethanol were produced in the United States, with ethanol utilizing about 6 percent of the 2000 corn harvest. In 2006, an estimated 5 billion gallons of ethanol were produced, and ethanol accounted for 20 percent of the 2006 corn harvest. Renewable Fuels Association data indicate there are now 110 ethanol plants with total capacity of 5.4 billion gallons and another 73 ethanol plants under construction and another 8 facilities expanding. When construction and expansion are completed, ethanol capacity in the United States will be 11.4 billion gallons per year, which is likely to occur during 2008-09. To

provide an indication of how rapidly this expansion is occurring, in August 2006, just 6 months ago, the capacity of known plants and those under construction and expansion was 7.4 billion gallons, some 4 billion less than current estimates. The rapid expansion has been facilitated by high oil prices, the 51 cent per gallon tax credit provided to blenders, low corn prices until this fall, the ethanol import duty of 54 cents per gallon, the Renewable Fuels Standard (RFS), and the elimination of ethanol's main oxygenate competitor, methyl tertiary butyl ether (MTBE).

Another factor supporting ethanol production has been improving production economics. Ethanol production costs declined between 1980 and 1998 due to higher yields of ethanol per bushel of corn, lower enzyme costs, and production automation which lowered labor costs. Energy input costs also fell over this period. U.S. Department of Agriculture (USDA) surveys indicate that between 1998 and 2002 the average cost of producing ethanol (excluding capital costs) remained at about 95 cents per gallon. Since 2002, the cost of producing ethanol has increased to the range of $1.45 per gallon due the increased cost of energy (electricity and natural gas) and corn. Each $1 increase in the per bushel price of corn adds about 36 cents per gallon to the production cost of ethanol, assuming no change in the price of co-products and 24 cents per gallon assuming the prices of co-products increase proportionally with the price of corn. While corn prices have risen, the price of ethanol has been quite volatile. The Chicago futures price for January 2007 delivery fell from over $2.50 per gallon last June and July to about $1.70 in late September and then rose most recently to about $2.40, suggesting a fairly good return on average at the ethanol plant.

Various industry analysts believe there are many more ethanol plants in different stages of planning in addition to the plants currently under construction or expansion. Projected ethanol

production capacity currently falls in the range of 13 to 15 billion gallons by 2012, which could change if there is a collapse in the price of ethanol.

Biodiesel. U.S. biodiesel production was very small until USDA initiated the Bioenergy Program in Fiscal Year (FY) 2000 that encouraged biodiesel production through cash payments to producers. Mostly due to this incentive, biodiesel production increased from a half million gallons in 1999 to 28 million gallons in 2004 and 91 million gallons in 2005. The Bioenergy Program authorization ended in FY 2006, but the up to $1 per gallon biodiesel tax credit was extended until 2008 by the Energy Policy Act of 2005. High diesel prices and new tax incentives continue to spur production. USDA estimates U.S. biodiesel production reached 250 million gallons in 2006, a 173-percent increase from 2005. For the 2005/06 crop year, biodiesel production accounted for 8 percent of soybean oil use; for 2006/07, biodiesel is expected to account for 2.6 billion pounds of soybean oil or 13 percent of total domestic soybean oil use. The 2.6 billion pounds equals the oil extracted from 229 million bushels of soybeans or 7 percent of estimated U.S. soybean production in 2006.

As of November 2006, the National Biodiesel Board indicated there were 87 U.S. biodiesel plants, varying markedly in size, with a total annual production capacity of about 582 million gallons. Most plants have an annual production capacity below 6 million gallons. The National Biodiesel Board reports that there were also 65 new plants under construction and 13 under expansion that are expected to add another 1.4 billion gallons to annual capacity. While soybean oil is the most common feedstock, one plant under construction that will have an annual expected capacity of 85 million gallons plans to use canola oil.

The cost of producing biodiesel depends heavily on feedstock and processing costs. Soybean oil has a higher cost than other feedstocks, but other feedstocks, such as yellow grease

and beef tallow, cost more to process. The processing cost per gallon of biodiesel made from soybean oil—which currently accounts for over 90 percent of biodiesel production—including materials, labor, energy, plant depreciation, and interest is about $0.50 per gallon for a 5 million gallon per year plant. The cost of the feedstock is by far the largest production expense item. For example, soybean oil at current prices would cost over $2.00 for one gallon of biodiesel, resulting in a total production cost (excluding capital costs) of about $2.50 per gallon. With low sulfur spot diesel selling at Gulf ports for about $1.66 per gallon in late December, even with the $1.00 per gallon tax credit and a $0.10 per gallon small producer tax credit for biodiesel, the margin above costs at the biodiesel plant is thin.

Judging from the capacity that is currently being built by investors, biodiesel production is expected to continue growing rapidly over the next few years. Given the thin margins in biodiesel production and projections for declining real crude oil prices, biodiesel production is expected to be sharply higher but below 400 million gallons in 2007. Even so, biodiesel could account for 20 percent of U.S. soybean oil production for the 2007/08 crop year. For perspective, 400 million gallons of biodiesel equals about 1 percent of expected highway diesel use in 2007 according to EIA. So while any displacement of fossil fuels with biofuels is generally beneficial for the nation, it is clear that we cannot grow our way to energy independence, but agriculture can make an important contribution.

Other Renewable Energy. Other renewable energy sources, while still small, are growing rapidly and offer important opportunities for participation by U.S. farmers, ranchers, and rural areas. Electricity generation from wind increased from 0.06 quads in 2000 to 0.146 quads in 2005, up 160 percent. EIA's preliminary reference case projects wind power to rise to 0.48 quads by 2010, up 230 percent from 2005. Several factors have stimulated the expansion,

including high natural gas prices, the Federal wind production tax credit of 1.9 cents per kilowatt hour for the first 10 years of a project's production, regulatory policies promoting greater access to the electricity grid by wind power producers, state incentives and mandates for renewable electricity use, improved turbine efficiency and reliability, declines in production costs that now put wind power costs similar to gas combined-cycle and coal in areas where wind turbines can operate at high levels of capacity, and the emergence of marketing programs for green power.

The leading wind power state is California, however, wind power is also growing in Midwestern states from Minnesota to Texas. Many Midwestern and Western states have the wind resources to produce much more wind power. U.S. farmers and ranchers are providing land to turbine owners, and in some cases, owning the turbines. The major decision factors considered by potential wind developers are having sufficient wind for economically feasible electricity production, having access to transmission lines, and estimating whether construction can be completed in time to be eligible for the Federal wind production tax credit.

Another small but increasingly important source of renewable energy for agriculture is electricity from methane. Anaerobic digestion of animal wastes breaks down the wastes into biogas and other co-products. The biogas is usually used to generate electricity on the farm and may be sold onto the electricity grid. The effluent is used as a fertilizer and solids extracted from the effluent are used as animal bedding material. New, large digester complexes that utilize manure from multiple farming operations are scrubbing the biogas and piping it as a natural gas substitute. Most digesters are on dairy or hog operations and the number of digesters has increased sharply in recent years.

The Environmental Protection Agency's (EPA) AgStar program, with support from USDA and DOE, promotes digesters to reduce methane emissions and achieve other benefits.

Most direct financial support for digesters has come from USDA programs, although many states provide grants, loans, or technical assistance. The economics of digesters are complex and feasibility depends on many factors, including the supply of manure, the ability to use or sell power generated, and the efficiency of the digester. Farms using digesters successfully benefit from electricity generation, better manure and fertilizer management and reduced costs, less potential for water contamination, better odor and fly control, reduced herbicide use as the applied effluent may contain fewer weed seeds than manure, and reduced methane emissions, a potent greenhouse gas.

Emerging Biofuels Issues

The rapid growth of biofuels production has stimulated much enthusiasm about the prospects for ethanol and biodiesel making substantial inroads in reducing gasoline and diesel fuel consumption. Yet, the rapid growth has generated many questions about its sustainability and the current and potential impacts of this evolving industry. This section reviews some of these issues.

Acreage. The increase in corn production used for ethanol has set in motion an expectation of a substantial adjustment in U.S. field crop production for 2007. As more corn moves to more ethanol plants, corn prices have risen signaling the market's need for more corn acreage and production. For 2006/07, USDA forecasts the total use of U.S. corn will be equivalent to the production on 85.6 million acres. Yet, only 78.6 million acres were planted in 2006. Corn supplies are expected to meet demand because of large carryin stocks of corn, which are expected to be reduced by more than half. During August 2006, prior to the start of the 2006/07 crop year, the average price received by farmers for corn was $2.09 per bushel. By December 2006, after a corn harvest that was slightly below summer expectations and a growing

awareness that ethanol production capacity is coming on line at a very rapid rate, U.S. farm-level corn prices averaged $3.01 per bushel, an increase of 44 percent from the August level.

As corn farmers ponder spring planting decisions, they will likely consider corn and soybean futures prices. The Chicago Board of Trade December 2007 corn futures contract recently traded at about $3.75 per bushel. The ratio of the November 2007 soybean futures price to the December 2007 corn futures price has been about 2 to 1, well below the August soybean-to-corn farm price ratio of 2.5 to 1. With market prices shifting in favor of planting corn at the expense of soybeans and other crops, a sharp increase is expected in corn acreage this spring. The prospective increase in corn acreage is already having ripple effects on agricultural commodity markets. For example, despite having a high level of stocks at the start of the 2006/07 marketing season and record-high production this fall, soybean prices have increased in anticipation of reduced soybean planted area this spring.

Looking ahead to the 2007 crop of corn, it is quite likely, based on current ethanol plant construction, that corn used in ethanol production will rise by more than 1 billion bushels from the 2.15 billion bushels of the 2006 corn crop expected to be used for ethanol. Use of 1 billion bushels, at a trend yield of 152 bushels per acre, would require an additional 6.5 million acres of corn, if corn consumed in other uses remains unchanged from this year's projected levels. With corn stock levels already being reduced this year, another large drawdown in stocks for the 2007-crop marketing year will not be available to meet the rising demand, thus the higher corn prices that are signaling more planting. Beyond 2007, to achieve steady increases in ethanol production from corn will require ever more acreage or higher corn yields per acre, or both.

A related issue is the implication of farming substantially more corn acres. These implications include the possible environmental consequences of more nitrogen fertilizer use,

and the potential that more marginal lands may come into production having greater vulnerability to erosion, nutrient runoff, and leaching. To meet the demand for biofuels, some corn acreage could return to production from land in the long-term Conservation Reserve Program (CRP) as contracts mature, but that land may be environmentally sensitive and would need to be properly farmed. In addition, former CRP land may have lower yields and take some time before such land can be made suitable for crop production. The productivity of cropland and the environmental challenges may be addressed at least partially by the programs of the Farm Security and Rural Investment Act of 2002, which greatly increased financial support for conservation programs. In addition, farm management is steadily improving and the 2007 Farm Bill could also address these challenges.

Corn yields. Research was the founding role for USDA and has continued to be a fundamental function of the Department for nearly 150 years. Research, whether performed and supported by USDA, or by others, has enhanced agricultural productivity, increased agricultural output, and expanded agricultural exports, all while less cropland is being farmed. Productivity measures the ability to produce more output from a given set of inputs. Technology advances that have raised productivity have been a critical source of income growth, wealth creation, and international competitiveness. In fact, virtually all the growth in U.S. agricultural output over the last 50 years is explained by growth in productivity. Growth in inputs used, such as land, has been quite modest.

Research and the resultant productivity gains could potentially solve much of the acreage challenge facing corn ethanol production. Since 1948, corn yields have increased four-fold, from 40 bushels per acre to 160 bushels in 2004 due to fertilizers, better management, technology, and improved crop genetics. It appears corn yields in the past couple of years have moved above the

long-term trend and may continue to do so in coming years as well, helping to meet biofuel demand and reduce pressure on corn prices and acreage. Acreage planted to genetically engineered corn varieties has increased from 25 percent of corn acres in 2000 to 61 percent this year. Over the past few years, new generation root worm resistant corn has been introduced and is showing strong yield increases in many areas. Over the next couple of years, drought-tolerant varieties of corn are expected to become commercially available. As we look out over the next decade, USDA trend projections suggest U.S. corn yields per acre rising to 168 bushels by 2015, however, at least one seed company projects yields that are more than 20 bushels per acre above that level. Each 5 bushel increase in yield above the current trend level would be the equivalent of adding around 2.5 million acres to corn plantings, enough to produce an additional one billion gallons of ethanol each year.

Effects on crop consumers. With ethanol fueling a push for more corn acres, major crop prices are generally expected to be higher over the next couple of years than in the recent past. Soybeans, while facing competition from ethanol feed co-products, such as Distillers Dried Grains (DDG), are still likely to face higher prices over time, as lower expected soybean acreage offsets the lower soybean meal demand and more soybean oil is demanded for biodiesel production.

Livestock and poultry profitability declines under higher corn feeding costs. For example for hogs, which are heavily dependent on corn and limited in the level of DDGs that can be put into feeding rations, a $1 per bushel increase in the price of corn would raise the cost of producing hogs by about $6 per cwt. With hogs selling for a U.S. average of $43 per cwt in December 2006, the cost of production increase would be about 10 percent of the market price. The farm level value of hogs was about 29 percent of retail value of pork in November 2006, so

if the higher feed costs were fully passed on to retail over time, a $1 per bushel increase in the price of corn would translate into about a 3 percent increase in the consumer price of pork. This increase could be more or less depending on how much pork production declines, the speed of market adjustments, the extent to which DDGs substitute for corn and soybean meal, and how other users adjust demand in response to the increase in corn prices. Poultry producers, also heavy users of corn would be similarly affected. Cattle producers overall face a smaller impact than hog and poultry producers, because of their heavier reliance on hay, rangeland, and pasture for weight gain and cattle can accommodate a higher portion of DDGs in their rations.

USDA forecasts that choice cattle prices in 2007 will average $85 per cwt, about the same in 2006 as beef production expands modestly. Hog prices are expected to decline 13 percent as production increases by nearly 4 percent over 2006. The lower hog prices and higher feed costs will likely slow expansion beyond 2007. Broiler prices are expected to increase in 2007 as production grows more slowly due to reduced prices in 2006 and higher feed costs.

Despite higher corn and soybean prices this year, exports for both commodities remain strong. In the future, to the extent that corn and soybean prices continue to rise, exports would be expected to decline as foreign livestock produces cut back on feed use and purchase feed from other sources, such as Brazil and Argentina.

Profitability of ethanol. How the growth of corn ethanol and its effects on agricultural producers unfolds in the future depends importantly on the profitability of producing ethanol. As ethanol production expands beyond regulated markets, such as reformulated gasoline, and beyond the market for ethanol as an octane enhancer, the long-standing price premium of ethanol over gasoline is likely to decline toward ethanol's energy equivalent with gasoline.

Can ethanol's rapid production gains outstrip demand growth? If the 140 billion gallons of gasoline now consumed was E10, or 10 percent ethanol, roughly 14 billion gallons of ethanol would be used. However, the practical limit on E10 would be less than that as it would be very difficult to distribute and blend E10 everywhere. Unless E85 and flex-fuel vehicles become much more pervasive or blend levels above 10 percent are used in conventional engines (which requires regulatory approval and engine warranty coverage), demand growth for ethanol is likely to slow in several years as the E10 market approaches its limit. In the face of continued production increases, the price of ethanol could even fall below its energy equivalent to gasoline. If corn prices continue to stay strong and ethanol demand growth slows, ethanol profitability would decline and expansion could slow appreciably in several years. While this scenario would take pressure off the acreage adjustments and commodity prices in agriculture, it would diminish the ability to reduce U.S. energy dependence on fossil fuel. If ethanol is to continue its expansion beyond 10 percent of U.S. gasoline use, higher blend levels and E85 will have to become far more pervasive than they are today, and, given corn production constraints, cellulosic ethanol will have to become economically feasible.

Cellulosic ethanol. A key challenge facing renewable fuels is in the area of alternative feedstocks. Even with higher corn yields, corn ethanol alone cannot greatly reduce U.S. crude oil imports. Nearly 60 percent of U.S. crude oil use is imported. In 2006, ethanol production on an energy content basis was equivalent to only 1.5 percent of U.S. crude oil imports and a little over 2 percent of gasoline consumption. Despite ethanol's small share of gasoline demand, it already claims a large share of corn production. Ethanol could account for over 25 percent of the 2007 crop of corn, compared with 20 percent for the 2006 crop. Clearly, developing biofuels from alternative feedstocks will be necessary for long-term expansion of biofuels.

Cellulosic ethanol appears to be the best biofuel alternative for reducing crude oil imports, but making it commercially feasible on a wide scale is a formidable challenge. Information from investors and potential producers suggest some technologies are close to being economically viable but need demonstration plants to prove the efficiency on a larger scale and secure low-cost financing. The capital requirement per gallon of ethanol is much higher for ethanol produced from cellulose than for corn ethanol. Ethanol yield is lower per ton of feedstock and conversion is complex, requiring enzymes that cost substantially more than for corn ethanol. Harvesting, bailing, storing, and transportation of biomass are expensive compared with corn. Research and investment capital are now being directed at overcoming these barriers.

For example, one ethanol producer has announced the expansion beginning in 2007 of an existing corn ethanol plant in Iowa so it can use corn stover to produce ethanol. Also, much has been learned about producing, harvesting, storing and processing switchgrass in electric power generation. In addition, the President's Advanced Energy Initiative includes increased funding for research aimed at improving the technology for cellulosic ethanol production. DOE has a goal of reducing the cost of cellulosic ethanol to $1.07 per gallon by 2012, which would likely put it at or below the cost of producing ethanol from corn, opening up an enormous opportunity for producing cellulosic ethanol.

Activities of USDA

USDA has a variety of programs to support renewable energy. Many programs are conducted cooperatively with DOE, EPA, other agencies, university researchers and private business. Without going into detail, the following list illustrates the range of activities:

- **Research programs.** The Agricultural Research Service conducts research on issues such as: ethanol from starch crops other than corn; co-products from grain-based ethanol

production; biodiesel production processes and product quality; cellulosic ethanol, including cellulosic feedstock design, which aims to develop an understanding of plant cell wall molecular biology and to develop high yielding biomass feedstock suitable to as many ecoregions in the U.S. as possible; cellulosic feedstock production, which focuses on production management techniques, including ways to help provide biorefineries with year-round supplies; cellulosic feedstock logistics, which addresses the need for sustainable and efficient harvesting, handling, storage and delivery of biomass; and cellulosic feedstock conversion. The Cooperative State Research, Education and Extension Service supports renewable energy through formula funding and competitive grants under the National Research Initiative, the Small Business Innovation Research Program, and the Sustainable Agricultural Research and Education Program. The Forest Service conducts research on sustainable feedstock systems with a goal of reducing costs of wood production, transportation, and conversion to ethanol and other biobased products.

- **Rural development programs.** USDA's Rural Development offers a range of renewable programs that may be used for renewable energy production, including loans to rural electric cooperative borrowers for producing and distributing renewable energy; grants for planning and working capital, such as for ethanol and biodiesel plants; grants and loans for renewable energy production and energy conservation under section 9006 of the 2002 Farm Bill, the Renewable Energy Systems and Energy Efficiency Improvements Program; loan guarantees for renewable energy ; and competitive research and demonstration grants under the section 9008 of the 2002 Farm Bill, the Biomass Research and Development Act Initiative.
- **Conservation programs.** The Natural Resources Conservation Service helps producers farm sustainably through technical assistance and through financial assistance under the

Environmental Quality Incentives Program and the Conservation Security Program (CSP). CSP provides financial assistance for specific energy production and conservation activities.

- **Biofuel production direct financial assistance.** The Farm Service Agency operated the Bioenergy Program under section 9010 of the 2002 Farm Bill until authority expired in 2006. The program, directly subsidized biofuel production at $150 million in Fiscal Year 2006.
- **Biodiesel and bioproduct marketing support.** The Office of Energy Policy and New Uses in the Office of the Chief Economist administers section 9004 in the 2002 Farm Bill, which is the national Biodiesel Education Program and section 9002, "Biopreferred," the Federal Biobased Product Preferred Procurement Program.
- **USDA renewable energy use.** USDA's Departmental Administration administers legislation and Executive Order 13149 directed at reducing USDA use of fossil fuels and increasing use of alternative fuels, including biofuels.

Conclusion

In conclusion, the strong and growing U.S. economy has an undeniable need for energy. Meeting this demand in a cost-effective way that promotes domestic economic growth and energy security offers biofuels a tremendous economic opportunity. Increasing the market share of biofuels to the point that energy security is markedly enhanced will be a long-term and complex effort. Such an expansion can occur only with achievements on multiple fronts—higher crop yields, more acres planted to energy crops, alternative feedstocks, higher value co-products, more efficient conversion and distribution systems for both feedstocks and biofuels. Market-based policies and intelligent joint public-private efforts are keys to success. Targeted government grants for feasibility and development work and research expenditures to overcome cost barriers are positive approaches that help overcome expansion barriers and still rely on

market signals to allocate resources efficiently. The 2007 Farm Bill provides another opportunity to address the implications of expanding renewable energy for U.S. agriculture and rural areas.

That completes my comments and thank you, Mr. Chairman.

Written Testimony of

Gene Gourley
Pork Producer, Webster City, Iowa
On Behalf of the National Pork Producers Council and
the Iowa Pork Producers Association

January 10, 2007
Washington, D.C.

INTRODUCTION

I am Gene Gourley of Webster City, Iowa, and I want to thank the Chairman and the Members of the Committee for inviting me to speak to you today regarding the use of distillers grains in swine diets. I use my master's degree in animal nutrition on a daily basis as a partner with my three brothers in our family's farrow-to-finish swine operation and as general manager of the Nutrition and Research Division of Swine Graphic Enterprises (SGE), a 25,000-sow commercial operation 95 percent-owned by Iowa farmers. I am responsible for the feed rations and formulation on all SGE farms.

The National Pork Producers Council is the global voice of the U.S. pork industry. It conducts public-policy outreach on behalf of its 44 affiliated state association members, enhancing opportunities for the success of U.S. pork producers and other industry stakeholders by establishing the U.S. pork industry as a consistent and responsible supplier of high-quality pork to the domestic and world markets.

The Iowa Pork Producers Association represents more than 8,900 pork producers, who produce about a quarter of all the hogs raised in the United States. The organization's mission is to provide leadership in areas related to the industry to enhance Iowa pork producers' opportunities, profits, success and stewardship.

The pork industry is of immense importance to the state of Iowa. Iowa pork producers create more than 86,000 jobs for fellow Iowans, contributing $3 billion in annual payroll and generating $12 billion annually in economic impact to the state. Pigs consume nearly one-third of Iowa's corn and soybean crops. Nationwide, more than 67,000 pork producers marketed more than 103 million hogs in 2005 and those animals provided total gross receipts of $15 billion.

While I am speaking to you only as Gene Gourley, swine nutritionist and hog farmer, my involvement in many industry organizations and activities give me a chance to talk to many pork

producers. I believe I will accurately represent the sentiments of thousands of pork producers nationwide.

DISTILLERS GRAINS AND SWINE DIETS

The ethanol industry would have us believe that all of the feed problems created by using a substantial portion of the nation's corn supply for ethanol production are irrelevant because of the production of distillers grains, a major co-product of the ethanol production process. I am here today to tell you that this product does little to allay the concerns of pork producers regarding the future cost and availability of feedstuffs and consequently, the well-being of our animals and the cost of pork to U.S. consumers.

There are several issues with regard to feeding distillers dried grains with solubles (DDGS) to pigs.

First, DDGS are quite inconsistent from ethanol plant to ethanol plant and even within a plant. There is variability in their nutrient content – protein, fat, phosphorus. If the fermentation or drying process for DDGS is changed or varies from batch to batch, it can have an impact on the digestibility of nutrients.

Additionally, corn can contain mycotoxins that are, in some instances, detrimental to pig performance. The presence of mycotoxins varies by growing season, location and environmental factors. Since the ethanol production process removes the starch (two-thirds of the volume) from corn, DDGS produced from mycotoxin-contaminated corn will have three times the level of mycotoxin that was present in the corn itself. Based on the percentage of DDGS fed and which toxins are present, pigs can experience multiple problems, including immune challenges, abortion and feed refusal. This is a severe limit on the widespread use of DDGS in gestation and lactation diets.

As pigs are fed increasing levels of DDGS, the corn oil present (also at three times the concentration as in corn grain) can increase the iodine value (soft fat) of the carcass. This can

result in belly slicing problems and possible rancidity or shelf-life issues. A higher percentage of DDGS in the diet also can have a negative affect on carcass weights, most likely due to the increased fiber content of the DDGS.

Other concerns with DDGS include:

- Flowabililty – As plants try to extract more ethanol from every bushel of corn, some plants grind the corn into a finer material, creating flowability problems of the DDGS at the feedmill as well as in the complete feed in the feed bin.
- Pelleting – DDGS have been shown to decrease the pelleting efficiency at feedmills. As increased efficiency is needed from the pig due to higher feed costs, more feed will be pelleted. This will increase processing costs.
- Processing changes – Several plants are looking at extracting other co-products from the DDGS stream, such as the oil for bio-diesel, and at further refining the protein fraction. The feed value of these co-products to swine must be researched.
- Phosphorus levels – In late finishing, the pigs' phosphorus requirements can be fairly low. Higher percentages of DDGS fed to pigs could increase phosphorus levels and increase excretions, which must be factored into nutrient management plans and may restrict its use at higher levels in late finishing rations.
- Enzyme uses – There are major efforts to develop enzymes to help convert fiber in the DDGS to glucose for energy. Initial efforts have not yielded positive results, but resources are being put toward making it work.

Concerning the predictability of co-products, livestock producers need to know:

- What are each plant's by-products and how long will they be available in that form?
- Are the co-products capable of being fed to livestock? If so, which species?
- Are they locally available to livestock producers?
- What are the storage, transportation and marketing specifics of each plant's by-product?
- What is the relative feeding value of the by-product being produced and how is it determined consistently across all plants?

These issues need to be considered not only for existing plants, but proposed plants will eventually need to provide this insight. Otherwise, there is little incentive for livestock farmers to support more ethanol plants at the expense of lowering the corn supply.

COMPETITIVE EFFECTS OF DDGS

Corn usually comprises about 75 percent of a pig's diets. The ethanol production process uses 56 pounds of corn and yields only 17 pounds of DDGS. Further, most pork producers will only include DDGS in swine diets at a 10 percent level due to the problems outlined above.

Finally, DDGS are far more useful in diets for beef and dairy cattle than they are for pork and poultry. This impacts pork producers in two ways, both of them bad. First, it means that DDGS will not be a cost-effective substitute for corn because beef and dairy producers will pay more for DDGS and thus prevent them from entering swine diets. This is already happening. Second, the cost of producing beef and dairy products using DDGS will be lower relative to pork than in the past and thus provide a market advantage to these two sources of protein.

CORN SUPPLIES ARE AN IMPORTANT ISSUE TO PORK PRODUCERS

While the pork industry appreciates the opportunity to discuss DDGS, the most important issues regarding ethanol and livestock are the availability and cost of feed when that feed's usage as an ethanol feedstock is subsidized, the usage of ethanol is mandated at minimum levels and the domestic market for ethanol is protected. These all have profound implications for our business – an industry that adds considerably to the nation's economy.

A recently completed study by economists Daniel Otto and John Lawrence of Iowa State University estimated that the U.S. pork industry is directly responsible for the employment of 34,720 full-time individuals, many of whom are owner-operators. They calculated that the industry generates 127,492 jobs in the rest of agriculture and is responsible for 110,665 jobs in the manufacturing sector – mostly in the meat packing industry – and 65,224 jobs in professional services such as veterinarians, real estate agents and bankers. All told, the U.S. pork industry

generates 550,221 jobs in the U.S., and most of this employment is in rural areas. Overall, an estimated $20.7 billion of personal income and $34.5 billion of gross national product are supported by the U.S. hog industry.

In Iowa hogs are known as the "mortgage lifter" because they are typically raised by young farmers and used to pay off the farm mortgage. Hogs also are raised to help pay for college expenses and to help children get started in agriculture. Hog producers as a group are typically younger than the average farmer, and they typically have more debt and are more likely to rent the ground where they grow their crops.

Pork producers operate on very tight margins, and they have an enormous respect for market forces. Producers have not asked for any form of government subsidies in previous farm bills, and the industry is among the most vocal advocates of free trade and free trade agreements. New technologies have been adopted and productivity has been increased to maintain the U.S. pork industry's international competitiveness. As a result, pork exports have hit new records for the past 15 years. In 2006, exports represented 15 percent of production.

PORK PRODUCERS' CONCERNS ABOUT ETHANOL

Until recently, the pork industry was very optimistic about its future. Continued worldwide demand for pork and pending free trade agreements with Peru, Colombia and South Korea, as well as the possibility of a successful WTO Doha Round agreement that would increase access to the European and Japanese markets, painted a rosy economic outlook for pork producers.

Last summer, however, the optimism began to fade in large part because the principal source of the industry's competitiveness – abundant feed grains – was being diverted to biofuel production, particularly ethanol.

Almost everyone in Iowa and, indeed, in America is a supporter of ethanol. And prior to the run-up in energy prices two years ago, most even supported the government subsidy that was being given to the ethanol industry because they supported energy security and saw the economic

activity that ethanol plants were generating. Additionally, many pork producers also are corn producers, and they view ethanol as a way to get corn market prices up to the loan rate, a price where corn production was profitable without direct government support.

Once world crude oil prices hit $60 a barrel, the ethanol industry did not need support. However, the government continued to support the industry, and this proved to be a boon for those who owned the ethanol plants. These plants were buying corn at $2 per bushel and turning it into $6 or $8 worth of ethanol. They also were benefiting from a host of state and federal tax credits and outright construction subsidies from the USDA and from individual states.

Prices also are high because ethanol is being used as an oxygenate and because the United States uses import tariffs to restrict ethanol imports from Brazil. The result has been an explosion in ethanol production that has not yet reached its peak.

While the Iowa Pork Producers Association and the U.S. pork industry support the development and use of alternative and renewable energy sources, including ethanol, as a way to reduce the nation's dependence on foreign oil, the explosion in ethanol demand has raised concerns and fears among pork producers about feed grain availability and price, the transition time and about the ability to use the by-product of the ethanol process.

According to data from the Renewable Fuels Association (see attachment), the annual corn need of the ethanol industry has gone from 1.7 billion bushels just six months ago to just under 2 billion bushels today[1]. RFA now estimates that 4 billion bushels of corn will be used by the ethanol plants that will be on line as of January 2008. Iowa State University's Center for Agricultural and Rural Development (CARD) estimates that ethanol's annual use of corn will exceed 4 billion bushels by the end of 2007. And Dr. Bill Tierney, currently with John Stewart and Associates and formerly with USDA's World Ag Outlook Board, believes that the annual usage rate will be more than 10 billion bushels by the end of 2009 if all of the ethanol plants currently under construction or planned actually come on line. Currently, the U.S. pork industry

[1] Assuming 2.8 gallons of ethanol per bushel of corn

uses about 1.1 billion bushels, and the entire livestock industry uses more than 6 billion bushels. In 2006, corn growers produced 10.7 billion bushels.

To put all of this in perspective, with average yields of 157 bushels per acre, the growth in the ethanol industry in just one year will either require an additional 12.5 million acres of corn or cutbacks in livestock production or exports. To give another perspective, Iowa would need to have an additional 12 million hogs – a 50 percent expansion of the industry – to use the corn from that many additional acres.

Why does the ethanol industry have such enormous expansion capacity? First it is selling an energy product that ultimately competes with crude oil. U.S. ethanol production is not going to drive down world crude oil prices, and as long as OPEC is successful at maintaining crude at the current $60 per barrel target, ethanol will have a price floor.

The growth in ethanol production might slow if corn prices rise. According to a recent CARD study, under existing ethanol tax policy, if the prices of crude oil, natural gas and DDGS stay at current levels, the break-even corn price for the ethanol industry is $4.05 per bushel[2]. (The ethanol industry receives subsidies that amount to $1.53 per bushel of corn and a blender's tax credit of $0.51 per gallon.) It will be difficult for producers to compete against ethanol for corn as long as the ethanol industry receives the subsidies it does.

At $4.05 per bushel, the CARD study found, corn-based ethanol production would reach 31.5 billion gallons per year, or about 20 percent of projected U.S. fuel consumption in 2015. To reach that level will require a corn crop of 15.6 billion bushels and the utilization of 95.6 million acres of U.S. crop land. This year's corn crop is 10.7 billion bushels harvested from 78.6 million acres. Soybean prices also would increase as the soybean market fights to retain acres and production capacity.

Dr. Bob Wisner at Iowa State keeps a very close watch on corn use and corn supply. (His current balance sheet is attached.) He shows an end-of-year corn carryover of only 685 million bushels.

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[2] http://www.card.iastate.edu/publications/synopsis.aspx?id=1029

This is less than three weeks worth of utilization. The last time there was this small a level of carryover was in the fall of 1996 when supplies got down to 2.6 weeks' worth. Corn was so scarce in Iowa that it had to be shipped in from Texas.

Dr. Wisner also points out that his forecast assumes that corn exports this year will increase by the 2.5 percent projected by the USDA. However, corn export sales to date are running 35 percent above the same period last year. If this pace of export sales continues, the country will simply run out of corn. It may be that the recent surge in export sales is an aberration, but it also may be true that corn importers have begun to stockpile because they realize that the United States may not have enough corn and because other exporters such as China and Argentina have begun to restrict their corn exports.

Most farmers already have made their 2007 planting decisions and have arranged seed supplies. Projections are that about 26 million acres of corn will be needed to supply the ethanol industry by 2008, about half of which will be for new plants that come on line in 2007. The corn futures market price for 2007 has been providing a strong incentive for farmers to plant more corn acres, but there simply may not be enough corn to meet the country's food, fuel and feed needs – and any shortfall would be acerbated by a short crop.

The CARD study predicted that corn availability for livestock feed would fall by 33 percent, from about 6 billion bushels to 4 billion bushels, causing reductions in the size of the U.S. pork and poultry industries. (The beef and dairy industries likely would use DDGS to offset the reduction in corn availability.)

Another concern is the impact that ethanol already has had on producers' feed costs. This time last year, production costs were about $40 per hundred pounds or less. Just last week, Dr. Ron Plain calculated that with the feed price increases that producers already have seen, their production costs will be $50 per hundred pounds[3]. This represents a 25 percent increase in costs. At the $4.05 per bushel predicted by the CARD study, pork producers' production costs would increase by 31 percent.

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[3] http://www.porkmag.com/porkalert/latestalert.htm

But the pork industry will adjust as it always has. High production costs will reduce profitability, and at first many producers will try to ride it out, hoping that other producers will blink first. Eventually bankers will be forced to foreclose on some operations, and some producers will simply decide to retire early. Eventually production will fall by enough to bring the market to its new equilibrium. According to CARD, pork production would need to decline by 10 to 15 percent to allow the industry to recoup the higher production costs.This adjustment could take years.

Wouldn't corn growers be will able to use the extra profits from corn to subsidize their pork habit? While this may be true for about a year, eventually cash rents will adjust to higher corn prices, and/or production costs for corn will go up along with producers' production costs for pork. The real beneficiaries of the ethanol boom are landowners.

Another concern is transportation costs. Hogs have always been produced where corn and soybeans are grown because it is so expensive to transport grains. Grain transport costs have always worked to U.S. pork producers' advantage because they pay world prices for grains minus transport costs.

So far, world feed grain prices have increased with those of the United States because this country still dominates world feed grain markets, and this has caused pork production costs in competitor countries to rise as well. However, as the United States develops an enormous ethanol industry, the country eventually could get to the point where it begins to import corn rather than crude oil or ethanol. The Iowa State CARD study estimated that this will occur as soon as the ethanol industry consumes about 7.8 billion bushels of corn.

Corn imports likely would come into Eastern seaboard ports of the U.S. to supply pork producers and ethanol plants that would otherwise have had to pay transportation costs from Iowa. Once the United States begins to import corn, pork producers will be forced to pay world prices plus transportation costs. There is no country that has simultaneously imported corn and exported pork.

Another concern has to do with the regional corn basis. (See the map of Iowa showing the approximate draw areas for the current ethanol plants and for those under construction.) The ethanol industry is following the hog industry to the parts of the state where corn has been plentiful and cheap. Because the same bushel of corn cannot be used twice, the draw areas will probably have to import corn. This means that the traditional basis pattern that has made Iowa such an exceptional location for pork production will be eroded.

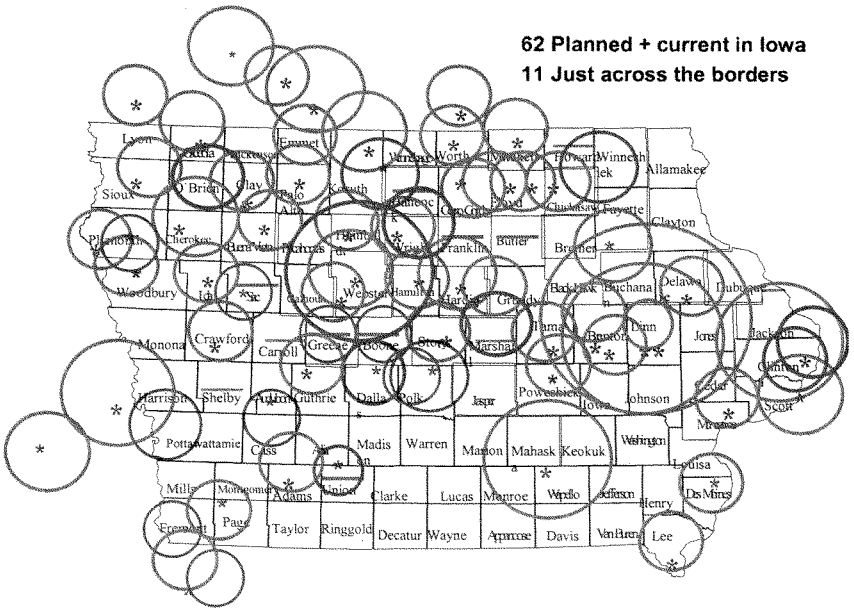
Another issue is pork production jobs versus ethanol production jobs. John Lawrence at Iowa State has calculated that a 100 million bushel ethanol plant creates about 80 jobs. If that many bushels are diverted from use in pork production, rural America will lose 800 direct on-farm jobs[4]. Given the multiplier calculated for the pork industry, that would mean an estimated 12,000 lost jobs economy wide.

CONCLUSION

Mr. Chairman and members of the Committee, the U.S. pork industry supports the development and use of alternative and renewable fuels, but it believes – as this testimony lays out – that the industry faces significant challenges because of the rapid rise in ethanol demand. The National Pork Producers Council and the Iowa Pork Producers Association stand ready to work with Congress on solutions to those challenges that will help maintain a $15 billion industry that provides hundreds of thousands of jobs and that helps feeds the world.

[4] http://www.extension.iastate.edu/ag/LawrencePowerPoint.pdf

Corn Draws for Current and Planned Ethanol Plants



Iowa Corn Processing & Ethanol Plant Locations, Actual & Planned, 8/22/06

Corn Balance Sheet

11/28/06 Corn Balance Sheet (Mil. Bu.)

	2004-05	2005-06	Nov. '06 for.	Projected 2007-08			Projected 2008-09		
Supplies:			2006-07	A	B	C	A	B	C
Plant. A(mil.)	80.9	81.8	78.6	84.5	84.5	84.5	86.5	86.5	86.5
Harv.A.(mil)	73.6	75.1	71.0	77.0	77.1	77.3	79.0	79.2	79.4
Bu./A.	160.4	147.9	151.2	146.0	156.5	161	146.0	158	163
Production	11,807	11,112	10,745	11,235	12,064	12,444	11,534	12,514	12,946
Carryover	958	2,114	1,871	685	685	685	623	623	623
Total Supply	12,776	13,236	12,625	11,932	12,763	13,143	12,169	13,151	13,584
Feed & resid.	6,162	6,080	6,125	5,400	5,950	6,000	4,850	5,775	5,900
Food, ind. & seed	2,686	2,985	3,540	4,165	4,190	4,265	4,850	4,875	4,900
Corn for fuel ethanol	1,323	1,600	2,150	2,775	2,800	2,875	3,450	3,475	3,500
Exports	1,814	2,125	2,275	1,800	2,000	2,025	1,750	1,875	1,950
Total Utilization	10,662	11,190	11,940	11,365	12,140	12,290	11,450	12,525	12,750
Carryover	2,114	2,046	685	567	623	853	719	626	834
U.S. FARM PRICE	$2.06	$2.00	$3.20	$3.50	3.15	2.85	$4.10	3.25	2.90
IOWA AVE. PRICE, $/Bu.	1.96	1.95	$3.15	3.45	3.10	2.80	4.05	3.20	2.85
Counter-Cyclical Pmt.	0.30	0.35	$0.00	0	0	0	0	0	0
HARV. PRICE, C.IA	1.60	1.40	$2.80	3.40	2.90	2.60	3.80	2.90	2.75
DEC. FUT. @ HARV.	$1.98	$2.00	$3.15	$3.80	$3.30	$3.00	$4.20	$3.30	$3.20
Historical Probability				18%	65%	17%	18%	65%	17%
Weeks carryover supply	10.3	9.5	3.0	2.6	2.7	3.6	3.3	2.6	3.4
Feed use % chg. Drought years vs. current				-11.8%			-20.8%		
Corn replaced by increased DDGS			97		115			119	
Decline in corn feeding vs. prev. year			45		-175			-175	
Percent Decline in corn feeding vs. prev. year:				-11.2%			-18.5%		

Dr. Robert Wisner, Iowa State University

6-Month Growth in Ethanol Plant Production Capacity

(In Millions of Gallons a Year)

DATE (as of)	IN OPERATION	UNDER CONSTRUCTION	TOTAL
Jun 23, 2006	4,818	2,223	7,040
Jul 24, 2006	4,818	2,431	7,248
Aug 24, 2006	4,830	2,881	7,710
Sep 28, 2006	5,015	3,036	8,050
Oct 23, 2006	5,081	3,498	8,579
Nov 17, 2006	5,121	3,782	8,903
Dec 01, 2006	5,161	4,367	9,528
Dec 13, 2006	5,281	4,858	10,139
Dec 20, 2006	5,386	5,378	10,764
Dec 29, 2006	5,386	6,005	11,391
Change in 6 Months	568	3,782	4,351

Renewable Fuels Association.

(For a list of existing and planned plants with their capacity, go to: www.ethanolrfa.org/industry/locations/)

Testimony of Loni Kemp
Senior Policy Analyst, The Minnesota Project

Hearing on Renewable Energy
January 10, 2007
Committee on Agriculture, Nutrition, and Forestry
United States Senate

The Future of Farming Beyond Food and Fiber: Energy and Environment

Chairman Harkin, Ranking Member Chambliss and Members of the Agriculture Committee:

I am delighted to be with you today to discuss the direct relationship between renewable energy and conservation. It is a particular honor to be here to present to the first meeting of the Agriculture Committee attended by Minnesota's new Senator, Amy Klobuchar. Senator Klobuchar joins Senator Coleman in promoting the policy visions of Minnesota, a state at the forefront of agriculture, renewable energy and environmental responsibility. I am the Senior Policy Analyst for the Minnesota Project, and a fact you might not know about us is that the outgoing Senator from Minnesota, Mark Dayton, founded the Minnesota Project twenty eight years ago this month. I have had the honor of working for the organization from the beginning, starting with my internship from graduate school at the Hubert H. Humphrey Institute for Public Affairs. Then-Senator Humphrey also served on this very Committee, so in a way a circle is being completed for me today.

The Minnesota Project connects people with policy, to build strong rural economies, vibrant communities, and a healthy environment. We focus on profitable farms that protect the environment, renewable energy, and markets for local foods. We are leaders in fostering collaboration among diverse organizations – and have played a role or led in the creation of the Sustainable Agriculture Coalition, the Midwest Agriculture Energy Network, the National Campaign for Sustainable Agriculture, Minnesota's Clean Energy Resource Teams, and 25 x 25. The Minnesota Project's long-time programs on conservation policy and renewable energy are now converging on the exciting opportunities of biomass energy.

The Farm Bill Shapes the Future

The significant question for the next farm bill, as for all farm bills, is what do we want for the future of agriculture? What policies will bring about an agriculture that benefits our children and future generations? We believe we are undergoing a fundamental shift in the American perception of farmers. Definitely, they produce our food and fiber, but now they are also called upon to produce renewable energy and clean water and a more stable climate. Policy enacted in the next farm bill can help farmers be even better stewards of the land while they help solve our nation's energy and climate change problems. What a fantastic opportunity we face, one that is bringing hope and a path to a bright future for rural America.

That is my main point today: that we must ***design the policies that simultaneously meet objectives for energy, the environment, and rural prosperity***. If we do it right, we can continue food production and expand the pool of biomass feedstocks in a way that achieves all of these objectives at the same time. On the other hand, ***if we do it wrong***, we may find that environmental tragedy and rural decline will overwhelm the hopes of renewable energy and create a backlash against the ethanol industry and farmers. We stand at the crossroads and must ***steer the change in the proper direction***.

Environmental Benefits of Biomass

To be specific, I'm talking about opening the door for ***agricultural production of cellulosic biomass on a major scale***. We need to shift the policy focus from annual energy crops, with attendant soil tillage, chemical use, erosion and habitat loss – to perennial crops, with the opportunity for building up soil quality, little soil disturbance, few chemicals, and managed habitat. Switchgrass is not the only feedstock; different cellulosic materials appropriate to every region of the country might include prairie grass mixtures, alfalfa hay, and woody crops like poplar trees, willow, and hazelnuts. Perennial energy crops are the best bet for cleaning up the nation's water quality and shrinking the Dead Zone in the Mississippi River's Gulf of Mexico. If done right, cellulose production could be an excellent way to restore wildlife habitat for hunters, birdwatchers, and fishermen.

Biomass from agriculture is the way for every region of the country to create an industry matched to its land and people. While ethanol is the likeliest way to use biomass, other conversion research shows that direct burning, gasification, conversion to electricity, thermal heat, hydrogen fuel cells, butanol, and even fertilizer may be produced by biomass. We share a vision of a locally owned energy plant every 25-40 miles – using different feedstocks, different processes, and making different energy products and bio-products.

Climate Change and Biofuels

Perennial biomass crops can also play a key role in global warming that has not been widely recognized. Biomass renewable energy is a triple winner at slowing climate change – if it is done properly.

- First, burning these fuels does not increase carbon emissions at all -- the carbon going into the air was taken out of the air while the crop was growing.
- Second, we can grow the biomass crop in ways that reduce the total carbon in the atmosphere by capturing the carbon in the soil. Untilled soil, with perennial grasses, woody crops, or no-till annual crops, captures the carbon held in the roots, leaves and stalks left on the soil. Agriculture is already implementing private-market carbon credit trading in the Midwest, rewarding farmers for sequestering carbon. A critical distinction is that ***tillage of any sort – plowing or even conservation tillage or disking – will undercut the carbon capture effect***.
- The third way for biofuels to be part of the global warming solution is by producing ethanol in plants powered by renewable fuels instead of fossil fuels like coal and natural gas. Indeed, the Central Minnesota Ethanol Cooperative in Little Falls, Minnesota, is doing just that – gasifying wood wastes and ag residues to run their operation. Their ethanol will go the farthest to displace fossil fuel carbon emissions.

Preparing the Way for Biomass

Corn ethanol is now a huge success and growing rapidly. It is not surprising that corn came first, since it builds on two very well established areas of expertise – growing corn, and making whiskey. Soy diesel and wind farms were logical next steps. But it also took two decades of carefully designed state and federal policies to provide the right mix of incentives.

We know corn and beans will approach their limits soon. Minnesota ecology Professor David Tilman reports, "Neither of these first generation biofuels can replace much petroleum without impacting food supplies. Even dedicating all US corn and soybean production to biofuels would meet only 12% of gasoline demand and 6% of diesel demand." (Proceedings of the National Academy of Sciences, July 12, 2006.) Any attempt at great expansion in cropland acreage is going to meet a backlash of concern due to existing levels of water pollution and habitat loss. But cellulosic feedstocks can produce more net energy per acre than corn while protecting the environment. The full range of cellulosic crops could eventually produce a significant portion of the oil we now import from the Persian Gulf – making a necessary contribution to energy independence.

Fortunately, we can look to the future and create the policies that will bring biomass energy up to speed, and do it very quickly. It won't happen overnight – but the next five years, the duration of the 2007 farm bill, is precisely the window of opportunity we need to accomplish the necessary steps for biomass energy to blossom, just as wind and corn ethanol are blossoming now in response to previous policies.

Keep in mind, even biofuels are not the silver bullet – nothing is. Switching to renewables must go hand in hand with aggressive energy efficiency policies. If we double our demand for oil in the next twenty years, nothing farmers can do will help.

Sustainable Biomass

We suggest that cellulosic crops should be prioritized according to their sustainability. For example:

1. Perennial crops, with mixed species preferable to single species.
2. Crop rotations that include two or more years of perennials such as alfalfa.
3. Annual crops using a cover crop or no-till.
4. Annual crops using minimum tillage (in strips or ridges)
5. Annuals crops using conservation tillage

We are most excited about the most sustainable option, mixtures of grasses and other perennial plants that mimic the prairies, which may be the best option for delivering high production with low inputs, while also contributing to water quality and wildlife habitat.

On the other hand, conservationists are extremely concerned about overly aggressive removal of crop residues, like corn stover or wheat straw. Residues are slated to be the first cellulosic feedstocks used in American ethanol production. But residues are not just waste; those leaves and stems feed the soil and are central to soil quality. Leading scientists at the USDA Agricultural Research Service recommend that ***stover should never be harvested from highly***

erodible acres, from moldboard-plowed fields, or from corn/bean rotation acres. On continuous corn, only 20-50% of stover is safe to remove if we want to retain the organic matter that builds healthy soils, thus ensuring the productivity of the land for future generations.

Policy Options

- The ***Conservation Security Program*** is perfectly designed as a working lands program to deliver incentives to encourage farmers to plant energy crops. It already offers incentive payments to farmers to use renewable energy, to produce renewable electricity, and to reduce their own net energy usage. It would be a simple matter to design a major new enhancement payment for establishing perennial energy crops according to a conservation plan that maximizes water quality, soil quality, crop diversity, and wildlife-friendly management practices. CSP has proven its popularity on the 16 million acres already enrolled – but it needs full funding as passed in the 2002 farm bill, and must be open to all farmers who can meet the rigorous soil and water requirement. Then it could be the vehicle for millions of acres of biomass establishment that meet high sustainability criteria.
- Some are eying the Conservation Reserve Program for biomass harvest, but we do not think it is appropriate to compromise the soil, water, and wildlife values for which this land retirement program was designed. Furthermore, we probably ought not to think about biomass as something you grow primarily on marginal land. Cellulosic ethanol must compete with oil and corn ethanol, and it is probably going to pencil out best with good productivity on good lands.
- ***Land already coming out of the CRP***, on the other hand, should receive significant incentives to keep that land in cover, including pasture, hay, and perennial biomass crops for future harvest. Automatic eligibility to enroll in the Conservation Security Program, access to other conservation programs, and other incentives ought to be offered to encourage post-CRP land to stay in permanent cover to retain the environmental benefits from the nation's CRP investment.
- Other ***new biomass establishment incentives*** are sure to be considered – such as a biomass reserve of several million acres. We think the basic goal should be to get farmers to start the transition to perennials, so that when the market appears in a few years, some farmers will be ready and others will quickly learn from their neighbors how to grow those crops and expand the supply chain. An alternative smart investment is a sustainable biomass innovation grants program, patterned after the Conservation Innovation Grants program, incorporating some aspects of a biomass reserve but on a targeted scale involving research and gradual growth of both supply and demand. In either case, an array of energy crops including switchgrass, other native prairie species, fast growing trees, and other emerging perennial energy crops should be encouraged, with a strong research component. We know these demonstrations may not actually be harvested and marketed until a local facility is constructed, but in the meantime the environmental benefits are there. Incentives should be flexible enough to allow farmers to try to make a profit in the meantime, such as by selling hay, hunting rights, seed, etc. Certainly, no additional incentives are needed for corn, corn stover, or soybeans.
- Develop ***sustainability criteria*** for all farm bill programs relating to renewable energy. Every program that funds research, grants, loans, cost-share or incentive payments related to renewable energy should use selection criteria that promote the most environmentally

sound options. A list of such criteria can be found in the farm bill platform released by the Sustainable Agriculture Coalition (www.msawg.org.)

- ***Locally owned, community based*** production is an essential component of ensuring the sustainability of renewable energy. Rural communities need to have an equity stake in emerging ag energy industries in order to participate fully in the wealth that will be generated. Frankly, they need an ownership stake in order to welcome the facilities and infrastructure to their communities. Policy incentives need to be targeted to local ownership, including financing tools for farmers with limited liquid assets to invest. Support for development capacity is also key, including the Section 6401 Value Added Producer Grant Program, the Rural Cooperative Development Grant Program, and the Resource Conservation and Development Program.
- All land that produces biofuels --whether corn, residues, or perennial biomass -- ought to have access to ***conservation programs*** that assist both financially and technically on natural resource needs. For example, a field of mixed prairie grasses might set aside a few acres for a restored wetland, or provide an unmowed habitat area. Energy crop production should be accompanied by nutrient management, water quality protection, soil and tillage management, residue management, and wildlife habitat. Adequate funding for opportunities to enroll in the Environmental Quality Incentives Program, Wildlife Habitat Improvement Program, Wetlands Reserve Program, Conservation Reserve Enhancement Program, and Continuous Conservation Reserve Program can help.
- ***Conservation Compliance*** requirements ought to be reinvigorated. It is more important than ever for farmers to meet their erosion control plans on highly erodible acres as a precondition of any type of federal subsidy. Yet a GAO report on compliance (GAO-03-418) shows that USDA is not effectively implementing compliance. We should fix the enforcement problems, and then consider extending its reach to cover excessive erosion and nutrient management on all cropland receiving any program and insurance benefits.
- ***Conservation Planning*** is something that every farmer ought to be doing, but frankly it happens only rarely. We support a package of incentives and technical assistance so that farmers getting into renewable energy production can look at all their resource problems and opportunities. A new farm enterprise is the perfect time to create a conservation plan to prevent problems, create solutions, and find synergy. As for corn stover and other residue removal for energy, ***consider requiring the ethanol plant itself to require a conservation plan*** from every farmer who sells them residues. One cellulosic developer told me they would only contract for 25% of the stover from a farmer, because they want to keep the soil productive. In addition, the nation's private agronomists and crop advisors should be offered USDA training and certification to help farmers create conservation plans.
- ***Research*** is a top priority that requires accelerated public investment. Which combinations of plants work best in which regions; how to expand seed supplies; what are the best cultivation, harvest, and storage techniques; which enzymes work with which cellulosic crops; how can refineries be created with local ownership; what is the right design for localized scale refineries; how should we deal with the increased phosphorus from livestock fed ethanol byproducts; and can farmers return ethanol byproducts to the fields for fertilizer – these are urgent questions that the private sector might not invest in, but government should. The Initiative for Future Agriculture and Food Systems is one existing program that should include a major commitment to outcome-based research on

sustainable biomass and energy production systems. Another critical policy is to require that land-grant universities not license and control their new plant varieties or cellulosic enzymes, but rather keep them in the public domain so that farmers and local energy companies can benefit from the public research investment without excessive tech fees and licenses.

- ***A Research Clearinghouse*** should be created so we have a nationwide innovation information exchange program to expedite sharing of research and demonstration experiences, with a priority on diverse systems with perennial plants responding to regional needs and capabilities.
- ***Expand the funding for Section 9006 Renewable Energy*** grants and loan guarantees for farmers and rural communities to make improvements in energy efficiency and create renewable energy production systems.

Policies like those enumerated above will help America simultaneously spark profitable new industries in renewable energy at the same time that we solve our persistent natural resource problems. Farmers will prosper, rural communities will grow, climate change will slow, the environment will improve, and we will finally be on the road to energy independence.

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Renewable Fuels Association

Agriculture, Nutrition and Forestry Committee
United States Senate

Hearing on
Agriculture and Rural America's Role
In Enhancing National Energy Security

Testimony of

Ron Miller
President & CEO, Aventine Renewable Energy LLC
Chairman, Renewable Fuels Association

January 10, 2007

Good morning, Mr. Chairman and Members of the Committee. My name is Ron Miller and I am president and chief executive officer of Aventine Renewable Energy, and chairman of the Renewable Fuels Association. Aventine Renewable Energy supplies more than 700 million gallons of the nation's growing ethanol needs through its wholly owned plant in Pekin, Illinois, partially-owned Nebraska Energy plant in Aurora, Nebraska, and business relationships and marketing alliances.

This is an important and timely hearing, and I am pleased to be here to discuss the growth in the domestic ethanol industry, and the increasingly important role of agriculture and rural America in ensuring our nation's energy security. Ethanol today is the single most important value-added market for farmers. The increased demand for grain used in ethanol processing has increased farm income, created jobs in the agricultural sector, and revitalized numerous rural communities where ethanol biorefineries have been located.

Background

Today's ethanol industry consists of 110 biorefineries located in 19 different states with the capacity to process more than 1.8 billion bushels of grain into 5.3 billion gallons of high octane, clean burning motor fuel, and more than 12 million metric tons of livestock and poultry feed. It is a dynamic and growing industry that is revitalizing rural America, reducing emissions in our nation's cities, and lowering our dependence on imported petroleum.

Ethanol has become an essential component of the U.S. motor fuel market. Today, ethanol is blended in more than 46% of the nation's fuel, and is sold virtually from coast to coast and border to border. The more than 5.3 billion gallons of ethanol produced and sold in the U.S. last year contributed significantly to the nation's economic, environmental and energy security. According to an analysis completed for the RFA[1], the 5.3 billion gallons of ethanol produced in 2006 resulted in the following impacts:

- Added $41.1 billion to gross output;
- Created 160,231 jobs in all sectors of the economy;
- Increased economic activity and new jobs from ethanol increased household income by $6.7 billion, money that flows directly into consumers' pockets;
- Contributed $2.7 billion of tax revenue for the Federal government and $2.3 billion for State and Local governments; and,
- Reduced oil imports by 170 million barrels of oil, valued at $11.2 billion.

In addition to providing a growing and reliable domestic market for American farmers, the ethanol industry also provides the opportunity for farmers to enjoy some of the value added to their commodity by further processing. Farmer-owned ethanol plants account for half of the U.S. fuel ethanol plants and almost 40 percent of industry capacity.

This dynamic and growing industry is also empowering more of America to have a vital role in our nation's infrastructure. If a farmer in Des Moines doesn't want to invest the local co-op, he can choose to invest in a publicly traded ethanol company through the stock market. As can a schoolteacher in Boston, or a receptionist in Seattle. Americans coast-to-coast have the opportunity to invest in our domestic energy industry, and not just in ethanol, but biodiesel and bio-products. U.S. agriculture is evolving in very important ways, and rural America is primed to take advantage of these opportunities.

There are currently 73 biorefineries under construction. With eight existing biorefineries expanding, the industry expects more than 6 billion gallons of new production capacity to be in operation by the end of 2009. The following is our best estimate of when this new production will come online.

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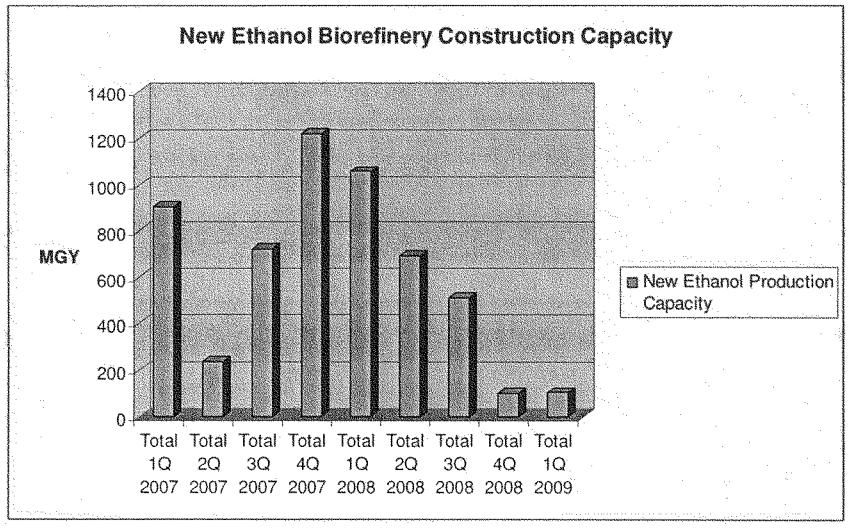
[1] *Contribution of the Ethanol Industry to the Economy of the United States*, Dr. John Urbanchuk, Director, LECG, LLC, December, 2006.



Transportation

Over the past several years, the ethanol industry has worked to expand a "Virtual Pipeline" through aggressive use of the rail system, barge and truck traffic. As a result, we can move product quickly to those areas where it is needed. Many ethanol plants have the capability to load unit trains of ethanol for shipment to ethanol terminals in key markets. Unit trains are quickly becoming the norm, not the exception, which was not the case just a few years ago. Railroad companies are working with our industry to develop infrastructure to meet future demand for ethanol. We are also working closely with terminal operators and refiners to identify ethanol storage facilities and install blending equipment. We will continue to grow the necessary infrastructure to make sure that in any market we need to ship ethanol there is rail access at gasoline terminals, and that those terminals are able to take unit trains.

Looking to the future, proposals like that of Chairman Harkin to study the feasibility of transporting ethanol by pipeline from the Midwest to the East and West coasts will also be critical.

New Technologies

The only thing more astonishing than the growth in the ethanol industry is the technological revolution happening at every biorefinery and every ethanol construction site across the country. Biorefineries today are using such innovations as no-heat fermentation, corn fractionization and corn oil extraction. With today's natural gas prices, biorefineries are also looking toward new energy sources, including methane digesters and biomass gasification.

These cutting edge technologies are reducing energy consumption and production costs, increasing biorefinery efficiency, improving the protein content of feed co-products, utilizing new feedstocks such as cellulose, and reducing emissions by employing best available control technologies.

To continue this technological revolution, however, continued government support will be critically important. DOE's biomass and biorefinery systems research and development program has been essential to developing new technologies. Competitively awarded grants and loan guarantees provided by DOE and USDA have played a very important role in developing new technology. Many of the grants that were included in EPAct, such as the biorefinery grant program, will allow technologically promising projects that would help move the industry forward become a reality. The ethanol industry encourages Congress to fully appropriate funds for these critical competitive solicitations during the FY '07 budget process.

Cellulose Ethanol

To date, the ethanol industry has grown almost exclusively from grain processing. As a result of steadily increasing yields and improving technology, the National Corn Growers Association projects that by 2015, corn growers will produce 15 billion bushels of grain. According to the NCGA analysis, this will allow a portion of that crop to be processed into 15 billion gallons of ethanol without significantly disrupting other markets for corn.[2] In fact, many analysts are predicting an additional 10 million acres of corn will be planted this spring, providing enough corn from those additional acres to produce more than 4 billion gallons of ethanol while still meeting the needs of all corn markets, including feed and export markets.

In the future, however, ethanol will be produced from other feedstocks, such as cellulose. While there are indeed limits to what we will be able to produce from grain, cellulose ethanol production will augment, not replace, grain-based ethanol. Ethanol from cellulose will dramatically expand the types and amount of available material for ethanol production, and ultimately dramatically expand ethanol supplies.

Many companies are working to commercialize cellulosic ethanol production. Indeed, there is not an ethanol biorefinery in production today that does not have a very aggressive cellulose ethanol research program. The reason for this is that they all have cellulose already coming into the plant in the form of corn stover and corn fiber. If they can process that material into ethanol, they will have a significant marketplace advantage. I believe cellulose ethanol will be commercialized first by current producers who have these cellulosic feedstocks at their grain-based facilities.

New Markets

Ethanol today is largely a blend component with gasoline, adding octane, displacing toxics and helping refiners meet Clean Air Act specifications. But the time when ethanol will

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2 *U.S. Corn Growers: Producing Food AND Fuel*, National Corn Growers Association, November 2006.

saturate the blend market is on the horizon, and the industry is looking forward to new market opportunities such as E-85.

Enhancing incentives to gasoline marketers to install E-85 refueling pumps will continue to be essential. There are now more than 1,000 E-85 refueling stations across the country, more than doubling in number since the passage of EPAct. But we can do better.

Today there are approximately 6 million flexible fuel vehicles (FFVs) on the road capable of using E-85, a mix of 85% ethanol and 15% gasoline. Those six million FFVs represent less than 3% of the total U.S. motor vehicle fleet of more than 200 million vehicles. Clearly, U.S. auto manufacturers have made a significant commitment to FFV technology, and their commitment is increasing. Ford, General Motors and DaimlerChrysler have made significant strides in producing and promoting FFVs. But we can do better.

Public statements by the U.S. automakers indicate a commitment to produce 50 percent of their new vehicles flexible fuel capable by 2010. American consumers buy 17 million vehicles a year. With the U.S. automakers share of the domestic market at approximately 45 percent, about 4 million new FFVs could be on the road every single year. By 2015, FFVs on our roads could exceed 35 million, creating a potential demand for E-85 of more than 21 billion gallons.

As FFV vehicles are commercialized, it is important to encourage the most efficient technologies. Some FFVs today experience a reduction in mileage when ethanol is used because of the difference in BTU content compared to gasoline. But that debit can be addressed. General Motors has introduced a turbo-charged SAAB that experiences no reduction in fuel efficiency when ethanol is used. This is the kind of innovation the government should be rewarding in any program designed to encourage E-85 use.

Conclusion

The Energy Policy Act of 2005 and several other policies enacted by the 109th Congress clearly put our nation on a new path toward greater energy diversity and national security. Additional and more focused research, targeted incentives for E-85 vehicles and refueling infrastructure, and the continued commitment of U.S. agriculture, this Committee, and the 110th Congress will all contribute to ensuring America's future energy security.

Thank you.

Invited Testimony for the U.S. Senate Committee on Agriculture

Prepared Statement of
Dr. Michael Pacheco
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National Renewable Energy Laboratory
Golden, CO

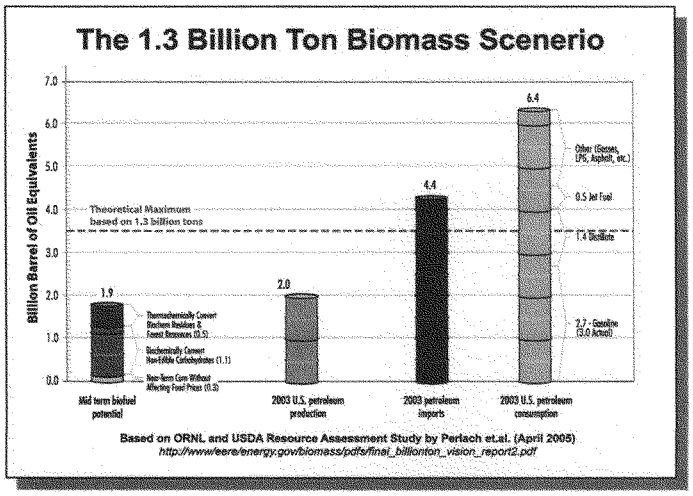
January 10, 2007

Mr. Chairman, thank you for this opportunity to discuss how agriculture and forestry resources can help reduce our nation's reliance on petroleum, and our dependence on foreign sources of oil in particular. I am the director of the National Bioenergy Center at the National Renewable Energy Laboratory, 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. I am honored to be here, and to speak with you today.

The committee is to be commended for its hearing on the role agriculture can play in reducing our nation's dependence on petroleum. NREL is dedicated to helping our nation develop a full portfolio of renewable energy technologies that can meet our energy needs. There is, of course, a lengthy list of renewable and conventional energy options that we as a nation must pursue. If we consider solely those things we can do to create a viable alternative to oil, then maximizing our biofuels industry must become a priority. That is because biomass is the only renewable option for liquid transportation fuels.

Agriculture and its biofuels future

Biomass is plant material, such as grasses, trees or agricultural wastes that can be turned into energy. Biomass can yield energy in a number of ways, though it is only recently that we have come to fully understand just how valuable a contribution biofuels can make.



The Department of Agriculture and the Department of Energy have looked at the question of whether the nation's biomass resource – including its existing and potential

agricultural base – could foster a biofuels industry large enough to meet a significant portion of our nation's future fuel needs. The report, now commonly referred to as "The Billion Ton Study," for the first time confirmed that the U.S. could yield more than a billion tons of biomass annually for energy needs. Moreover, this could be done without negatively affecting the nation's ongoing needs for food or fiber.

These conclusions are significant because the 1.3 billion tons of biomass that was forecasted contains as much energy as 3.5 billion barrels of oil. Accordingly, a supply of 3.5 billion barrels is about 60% of the 6 billion-plus barrels of oil the U.S. consumes each year.

The United States, including Alaska, currently produces about 2 billion barrels of oil per year. That amounts to 67 percent of the resource potential from agriculture and forestry biomass. U.S. oil production peaked in the early 1970s at the same level of production, about 3.5 billion barrels per year. To put this in perspective, the U.S. has *never* produced more than 3.5 billion barrels a year of oil.

While it will take a significant and sustained national effort to get us to this level of biofuels production, The Billion Ton Study does reveal that the biomass resource is large enough to ultimately replace a major portion of the petroleum-derived fuels on which we depend. The fact that the biomass resource is regionally distributed has benefits of its own. It is anticipated that every state in the nation could produce biomass and enjoy economic stimulus as the result of biofuels expansion.

The Billion Ton Study showed that U.S. agriculture and forestry industries have the potential to produce enough biomass resources to supply 30-40% current U.S. petroleum products. How quickly biofuels can penetrate the U.S. transportation energy market is a difficult question to answer. DOE is studying this question, and will publish a "30 by 30" study that examines market, policy, and technology changes required for the U.S. ethanol market to reach 60 billion gallons per year by the year 2030. (60 billion gallons/year of ethanol is roughly 30% of today's U.S. gasoline market; hence the phrase "30 by 30".) This is an aggressive but achievable goal that will require policy drivers together with technology advances.

It should be emphasized that the nation already has seen benefits from a strong and growing ethanol fuels industry. The U.S. currently produces more than 5 billion gallons a year of ethanol, almost exclusively from corn grain, and the industry is growing 30 percent annually.

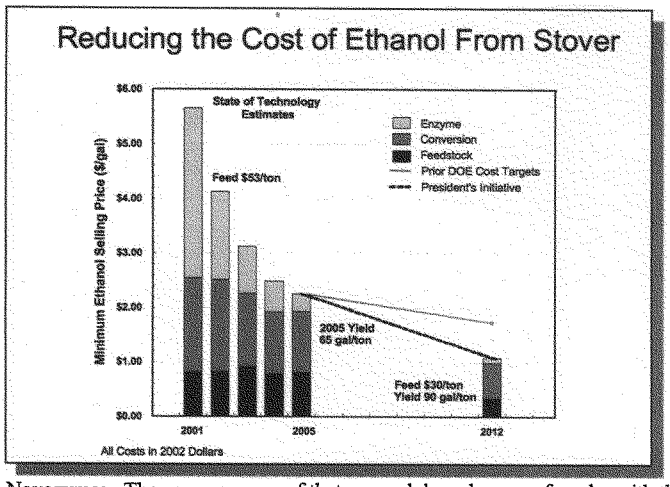
To move the ethanol industry to where we need it to be, we have to move beyond corn grain as the primary biomass resource. One of the most abundant potential resources we have is corn stover, the non-food parts of the corn plant, including the stalks, leaves and husks. Other resources are forest thinnings, hardy grasses, like switch grass, and fast growing trees.

To use these and other resources we need to perfect new technologies that convert the *cellulosic* materials of the plants into fuel. That is the focus of the research being conducted by NREL and DOE. The goal of the DOE Biomass Program and the National Bioenergy Center is to make cellulosic ethanol as cheap as corn ethanol, and do so within the next 5 years. A facility built today for converting cellulosic biomass to ethanol would produce fuel at about twice the price of one of today's existing corn grain ethanol facilities. DOE and NREL have a long-term goal to make cellulosic ethanol cost-competitive with gasoline produced from petroleum by the year 2030. Achieving this goal will require revolutionary approaches for producing, collecting, and converting biomass.

The near-term target we have set to accomplish this goal is ambitious, but we believe it can be met with adequate research support and a focused R&D effort. Our goal is to reduce the cost of producing cellulosic ethanol from $2.25 a gallon in 2005, to $1.07 in 2012. To get there we are working to greatly increase production efficiencies, and boost the average yield from 65 gallons per ton as it is today, to 90 gallons per ton in 2012.

Ongoing research pushing down economic barriers to cellulosic ethanol

The encouraging progress we have had in ethanol to date lends credence to our longer term targets. Over the past 5 years, we've been able to drastically cut the cost of ethanol from cellulosic biomass, corn stover in particular, by reducing the cost of enzymes in partnership with two major enzyme manufacturers, and improving the biomass conversion process.



As recently as the 1990's, the high cost of cellulase enzymes was forcing the use of a less efficient process, called acid hydrolysis. We have since gained major efficiencies because of a partnership between DOE and two of the world's largest biotechnology companies – Genencor and Novozymes. The consequences of that research have been profound – with the cost of enzymes for producing cellulosic ethanol having been reduced more than tenfold. Now, all major process development work on cellulosic ethanol production is pointed to the more efficient enzymatic hydrolysis process – proving that industry is successfully taking advantage of these scientific breakthroughs. We continue to work toward further reductions in the cost of these enzymes.

Integration of biorefineries into existing industries

Also important to our work is the development of "biorefineries". Scientists at NREL, together with those at other DOE national laboratories, universities and corporations, are leading the development of fully integrated refineries that use biomass, instead of petroleum, to produce fuels, chemicals, synthetic materials – virtually all of the products we use from a conventional oil refinery today. Biorefineries utilize a complex array of processing facilities to break down, convert and recombine a wide range of biomass components into fuels and chemicals, in a manner similar to how petroleum refineries convert petroleum crude oil. We envision that future biorefineries will utilize a wealth of resources we either underutilize or don't use at all today. That includes agricultural residues, forestry residues, dedicated energy crops, municipal solid waste, algae and by-products of the food and grain industry.

A range of biorefinery R&D work is underway in partnership with industry. DOE's biomass program is partnering with a number of the major ethanol technology providers and ethanol producers, including Abengoa, ADM, Broin and Cargill, to increase the yield of ethanol from existing corn ethanol facilities and expand the slate of feedstocks. In many ways, a cellulosic biorefinery can be viewed as an expansion of a corn ethanol facility. That's why we believe tomorrow's cellulosic ethanol industry will not replace today's corn grain ethanol industry, it will evolve from it.

At the same time, DOE is partnering with chemical industry leaders, such as DuPont, to develop new opportunities for producing both fuels and chemicals from biomass. DOE is partnering with the forest products industry to explore and develop biorefinery concepts that can integrate into existing forestry operations. And, most recently, DOE is partnering with oil industry technology developers to explore novel options for introducing biomass streams into existing petroleum refineries. These and other partnerships are speeding the progress of new technologies to the marketplace, and may uncover new options for producing fuels from biomass.

DOE will continue to partner with industry on the development of biorefinery technology. The agency is currently reviewing proposals from industry to cost-share the construction of one or more biorefinery demonstration facilities. DOE has also invited proposals to partner with industry on the development of robust microorganisms needed to produce ethanol from the complex mixture of carbohydrates made by pretreatment and hydrolysis of lignocellulosic biomass.

Integration of thermochemical technologies

Thermochemical conversion technologies such as gasification, pyrolysis and thermal depolymerization systems are all worthy of further research and development. These technologies have the potential to achieve the same biofuel cost goals as cellulosic ethanol, and can convert a broader range of biomass feedstocks. Additional research is needed to determine how these technologies and the respective biofuel products they produce can impact the cost, efficiency and integration into existing fuels infrastructure. Some of the products of thermochemical conversion technologies integrate well into an ethanol plant, while others integrate well into a petroleum refinery. For example, gasification of lignin-rich residue and making a mixture of alcohols from the SynGas is one way to increase the yield of biofuel per ton of lignocellulosic biomass in a cellulosic ethanol facility. In another example, processing biomass oils (triglycerides) in conventional petroleum hydroprocessing units can produce a high quality hydrocarbon diesel fuel from biomass that blends well with petroleum diesel. In yet another example, exploring the integration of biomass pyrolysis with petroleum refining is the subject of some of DOE's biofuel research at NREL, PNNL, and UOP (an Illinois-based process technology company); and this approach shows good promise for forestry resources. These different technologies for refining biomass may all be required to process all the different forms of biomass, achieve our biofuel cost goals, and satisfy demand for all the different petroleum-derived fuel products, including: gasoline, diesel, jet fuel, railroad fuel, LPG, and heating oils.

Our goal is to make renewable biomass-derived fuels and chemicals the solution for ending, as President Bush himself memorably put it, our nation's "addiction" to oil. And with the President's Advanced Energy Initiative, we are on course to bring the nation's first commercial cellulosic ethanol production facilities into existence by 2012. There is little doubt that ethanol will be, and should be, the first biofuel that we can use to reduce our dependence on petroleum. However, DOE and the National Bioenergy Center recognize that other biofuel options need to be developed as well.

Ethanol and biodiesel reduce the use of petroleum

You may have heard some discussion about the energy efficiency of ethanol. The first ethanol plants built in the late 1970s were costly and energy-intensive, and that did spark a debate about whether it made good "energy sense" to replace gasoline with ethanol. Today's ethanol industry is considerably more cost effective and energy efficient. Researchers at DOE, USDA and elsewhere have shown that the net energy benefits of fuel ethanol are clear and considerable.

The "Well to Wheels" study conducted by Argonne National Laboratory, General Motors, and several other partners including two major oil companies concluded that the energy contained in ethanol made from corn is about 1.4 times the fossil energy used to produce the ethanol, and 10 times the petroleum used to produce the ethanol. For cellulosic ethanol, the ratio of energy in the ethanol to the fossil energy used increases to about 10 Btu's in the ethanol for every 1 Btu of fossil fuel used. From the perspective of science, at least, this debate has been decided in favor of continued development of ethanol. Ethanol is proving to be a very effective option for reducing our dependence on petroleum – regardless of whether it is made from corn or cellulosic materials.

Biodiesel and other derivatives of fats, oils and greases can make a significant contribution. Researchers at DOE and USDA have shown that the energy contained is biodiesel is 3.2 times the fossil energy used to produce the biodiesel. A wide variety of seed oils, animal fats, and waste oils from all parts of the country can be converted to biodiesel. Aquatic species such as algae can also play a major role in the long term, because they do not require fertile soils, can grow in brackish water, and yet, algae can produce very high yields of oil. Considerable research and development will be required to realize the potential of algae as a source of oil feedstock.

Linking biofuels research to fuel standards, engine performance, and emissions

There is a small but rapidly growing biodiesel industry in the United States. The growth of this industry is currently limited by a number of barriers to market penetration, including: the need to understand fuel quality issues and develop new fuel quality standards, uncertainty regarding impact on NOx emissions, and by lack of understanding of how this new fuel affects engine performance and durability. This is especially true for new diesel engines equipped with advanced emission control technologies that will be introduced beginning next year. NREL's Center for Transportation Technologies and Systems is working to address these issues in partnership with biodiesel producers and engine manufacturers. We, along with industry, believe additional engine testing is needed to better understand the performance of B20 (20% biodiesel) and lower blends in the advanced emission control diesel engines that will enter the market in the 2007-2010 time frame in response to EPA regulations. This engine test work would advance biodiesel technologies by ensuring compatibility with these new (and much different) engines.

NREL's Center for Transportation Technologies and Systems is working to address the biodiesel utilization issues noted above. Similar R&D is needed to more accurately quantify the air quality benefits of ethanol and develop engines that are optimized to operate on ethanol as well as on gasoline. Other promising answers to our future transportation needs are gasoline-electric – and perhaps ethanol-electric and biodiesel-electric – hybrid systems, including so-called "plug-in hybrids," which could eventually achieve fuel economy of more than 100 miles per gallon.

Continued research hastens fuels development

In conclusion, several key points warrant review. Biomass is the only renewable option for producing liquid transportation fuels. The U.S biomass resource can supply a large portion of demand for gasoline and we can greatly expand the resource base when world petroleum production begins its decline. The biofuels industry can use resources from every region of the country and could become a needed stimulus for ailing rural economies.

Accelerated development of a cellulosic ethanol industry can be accomplished – if we put adequate resources behind the effort. Accelerating the adoption of E-85 is critical to displacing a large fraction of petroleum with ethanol.

The President's Advanced Energy Initiative holds the promise of accelerating our work so that we can help get this industry up and running, to benefit the American people, even sooner. His initiative envisions a more aggressive research effort in all key areas of cellulosic ethanol: further reductions in enzyme costs, advances in process technology to reduce capital and operating expenses and advances in feedstock R&D that will reduce the cost of production, collection and transportation of biomass to the biorefinery.

Ongoing work on other technologies, like research into biorefineries, thermochemical conversion technologies, and other biofuels will create many new products beyond the biopower, ethanol and biodiesel we are producing today. Linking biofuels research to engine design and performance will help ensure the most environmentally sound sustainable solution to our transportation needs.

As director of the nation's research center for bioenergy, I want to stress that a sustained, high-level of investment for research in bioenergy will provide our nation with many benefits, today and well into the future. Biofuels made from agriculture, forestry, and other resources are an environmentally and economically beneficial way to bridge the gap between rising energy demand and peaking oil production, while reducing U.S. dependence on imported oil.

Testimony Before The United States Senate
Committee on Agriculture, Nutrition, And Forestry
January 10, 2007

John Sellers
Producer
Corydon, Iowa

Thank you, Senator Harkin for the opportunity to appear before this committee today. My name is John Sellers. My wife Jean and I own and operate a farm in Southern Iowa. I have over 25 years experience in managing native grasses, and nearly a decade managing Switchgrass Biomass for energy. I am an appointed member of the Iowa State Soil Conservation Committee and have served as an elected Commissioner with the Wayne County Soil and Water Conservation District for 30 years.

The discussion today is Agriculture and Rural America's role in enhancing national energy security. I would preface all remarks with two principles: that producers and landowners must be an equal stakeholder in all policy and value-chain relationships; and that now is the time to think beyond the corn-ethanol or soy bio-diesel paradigm.

Bioenergy threatens to eclipse food, feed for livestock, livestock production, grasslands, forest products, and fiber production as the major driver of American agriculture. Farmers face enormous risk from price volatility, skyrocketing land rental rates, and record input costs. The environment faces risk from the intensive and accelerating focus on one crop. There are alternatives to creating a grain based transportation fuel economy. When facing uncertainty of price and weather, it is best to hedge with ecological stability. From my perspective, our policy goals should be to use just enough fuel ethanol to support corn prices and farm income but not so much that it disrupts the world food economy. Meanwhile a much greater effort is needed to produce ethanol and bioenergy from cellulosic sources.

As we consider and adopt policy directions, I offer these points for consideration:

Energy efficiency policies and adoption can and will give the most immediate results both from consumption, environmental and cost basis. This is applicable to the cars we drive, the equipment we operate, the trucks we drive to deliver America's production, and the structures where we live and work.

Policy should motivate energy conservation in all phases of production, consumption, and utilization. We have to reduce our energy consumption! We need to develop production systems that are based more on biological synergies and not energy rich inputs (fertilizer and fuel).

Expand the Conservation Security Program (CSP) to include the sustainable production of biobased products on our working lands.

Create an Energy Reserve or Dedicated Energy Feedstock Program of up to 5 million acres voluntarily transferred by contract holders from existing Conservation Reserve Program (CRP) contracts across the nation. This would be the fastest and lowest-cost method of creating an inventory of varied feedstock across a wide geographical area while maintaining the soil conservation, water quality, air quality, and wildlife benefits delivered by the original CRP contract. Geographic diversity of plants and livestock acres could provide the volumes of feedstock necessary for private companies and venture capital managers to commit to construction of commercial scale biorefineries or cellulosic ethanol conversion plants while also providing for environmental resilience. This program could provide researchers from universities, advocacy groups and government agencies an invaluable tool to investigate and provide data and new production pathways on a state and regional scale.

Provide access to capital, technical, and governmental program management assistance to farmer groups and communities wishing to construct storage, pre-processing, and conversion demonstration projects on a local or regional scale.

Provide multiyear funding for pilot and demonstration projects.

Invest public dollars for accelerated research on the ecological and sustainability issue of whole or partial plant removal (crop residues, perennials, annuals, or woody species), especially on marginal or fragile soils.

Ensure that products, processes, and innovations discovered with public funding remain in the public domain or be licensed in such a way to support local ownership and development.

Address labeling requirements and guidelines of herbicides used in establishing and managing biomass fields.

M. Chairman, thank you again for the opportunity to testify before this committee. I will attempt to answer any questions.

RESOURCES
FOR THE FUTURE

Testimony of Philip Sharp,
President, Resources for the Future

Prepared for the
Senate Committee on Agriculture, Nutrition, and Forestry

Submitted January 10, 2007

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Mr. Chairman, Thank you for inviting me to testify. My name is Philip Sharp and I am president of Resources for the Future (RFF), a nonpartisan, social science think tank, which has dealt with energy and natural resource issues for more than 50 years. As an institution, however, RFF does not take positions nor engage in advocacy, so the opinions expressed here are my own.

For the record, I have been involved with energy issues in a number of ways. I chaired the Energy and Power Subcommittee of the Energy and Commerce committee, during my tenure in Congress, from 1975 to 1995; taught a course in electricity policy, while on the Harvard Kennedy School faculty; led the Secretary of Energy's Task Force on Electric Systems Reliability; am the congressional co-chair of the National Commission on Energy Policy; headed the advisory panel to the MIT study on the future of nuclear power as well as the advisory panel for the forthcoming MIT study on the future of coal; and served as a member of the task force on energy security of the Council on Foreign Relations, which issued its final report in October 2006. In addition, I have been a member of several energy-related corporate and non-profit boards.

I have been asked to comment briefly on the energy challenges we face, especially with respect to oil dependence, as part of the committee's effort to examine the role agriculture can play in America's energy future.

At the outset, it is important to recognize that we have always had trouble settling on the goals we want energy policy to serve. Indeed, there are a variety of goals that cannot easily be reconciled: economic prosperity, national security, environmental protection, and equity.

Basically we want reliable supplies of energy to fuel our prosperity without undermining our national security or doing major damage to the environment on which healthy life depends. That is a very tall order. And surely we all understand, after years of contention, that there are no silver bullets for hitting such a complex target.

Let me first provide a few factual reminders of where we are in terms of oil use.

Our dependence on the global oil market is projected to grow, in the absence of a major, persistent crisis in the world oil market or the imposition of dramatic U.S. policies and the costs they entail. U.S. consumption may grow from 22 million barrels a day to as much as 28 million barrels a day by 2030. And global demand is expected to also grow especially rapidly in countries like China where automobile use is dramatically increasing.

Chart I, attached to this testimony, illustrates the history and expected growth of our oil imports.

For most analysts, a more telling measure of the relevance of oil to our economy is not the import figures, but rather the intensity of oil in our economy – meaning the relation of oil to our gross domestic product. As illustrated in Chart II, we saw by this measure, a major improvement in the years since the oil crisis of 1973. Indeed, this development in part explains why the economic consequences of the recent rise in oil prices has not been as past predictions would have suggested.

Many argue that we will serve the country well by focusing on the goal of reducing oil intensity through the promotion of greater transportation efficiency and the development of alternative transportation fuels.

Chart III provides the fuller energy picture, comparing the relative importance of oil to other fuel sources in today's economy and projections for 2030. The striking point is how little the proportions change, though all fuel sources grow in use. Petroleum, which makes up 40 percent of our energy use today, will provide the same proportion in 2030, while total energy consumption is projected to grow from 100 quads (quadrillion BTUs) to an estimated 125 to 130 quads.

It must be noted that these projections by the U.S. Energy Information Administration take into account the higher price levels of the last couple years and the various government policies in place and adopted in the 2005 Energy Act, which included numerous incentives to push for greater efficiency and increased production as well as the fuels mandate to expand ethanol use.

Such projections, of course, have many limitations. Fortunately, we are witnessing exciting technology developments that can significantly improve efficiency throughout the energy system from production to end use. We see

exciting developments on the research front, especially in the biological field. We see new investments in alternative fuels.

You will certainly be hearing today from other witnesses about these positive possibilities. But, given our past history, no one should assume that that these developments will automatically gain widespread acceptance in the market place in the absence of effective and persistent public policies.

Oil Dependency Risks

Our growing consumption of oil, concentrated in the transportation sector, entails major risks associated with our dependence on the global oil market. And this consumption is a major contributor of carbon dioxide (CO_2) to the atmosphere and hence to global climate change.

Among concerns about the oil market is the possibility of a serious supply disruption caused by political turmoil or terrorism; the pressure to compromise important U.S. foreign policy goals for the sake of oil supply; the possibility that global oil production will not keep pace with global demand and dramatically intensify national competition for supplies; and the pressure to militarily protect oil markets.

Concerns about the impact of oil dependence on our security and foreign policy have been effectively articulated by Members of this committee.

In the last few years, there have been new calls for action from several bipartisan or nonpartisan groups such as the Energy Futures Coalition and the National Commission on Energy Policy. More recently, a group of business leaders and former military leaders formed the Energy Security Leadership Council and spoke to these issues. Last October, the Independent Task Force of the Council on Foreign Relations issued its report, "National Security Consequences of U.S. Oil Dependency."

These groups vary in the urgency with which they advocate action; they also differ in their belief about the speed with which we could change consumption and production patterns, but they all stress the importance of the United States taking major steps to reduce our dependence on oil.

The Task Force of the Council on Foreign Relations summarized many of its concerns in the opening paragraph from the report:

The lack of sustained attention to energy issues is undercutting U.S. foreign policy and U.S. national security. Major energy suppliers – from Russia to Iran to Venezuela – have been increasingly able and willing to use their energy resources to pursue their strategic and political objectives. Major energy consumers – notably the United States, but other countries as well – are finding that their growing dependence on imported energy increases their strategic vulnerability and constrains their ability to pursue a broad range of foreign policy and national security objectives. Dependence also puts the United States into increasing competition with other importing countries, notably with today's rapidly growing emerging economies of China and India. At best, these trends will challenge U.S. foreign policy; at worst, they will seriously strain relations between the United States and these countries.

Hitching meaningful and sustained actions to these concerns is far from easy. For more than 30 years, our rhetoric has seldom matched reality. We abhor the risks posed by dependency but we have not been willing to pay the price – very likely, much higher oil prices – necessary to change the path of dependence. We must also recognize that many past dire predictions about oil disruption did not come to pass.

The recent rise in oil and natural gas prices and the conflicts and war in the Middle East have brought a new surge of market activities, public interest, and government action.

We certainly have seen renewed interest in vehicle efficiency and investment in alternatives to conventional oil just as we did during past energy crises.

Among the uncertainties we face is where oil prices will go in the years ahead. Just as the dramatic rise in oil and natural gas prices over the last two years was not predicted, it is now unclear whether oil prices will rise further, drop back to the $40 per barrel range as some have predicted, or, if the global economy slows, take a nose dive as they did in 1986 and 1999.

The history of price uncertainty has meant a history of on-again, off-again interest by consumers, investors, and government in fuel efficiency and in alternative fuels.

Because of that uncertainty, many have concluded that the United States, and other governments, must maintain policies that push markets to improve fuel efficiency, to advance alternative fuels, and to expand public transit options – in order to mitigate global market risks and to reduce growth in CO_2 emissions.

Greenhouse Gas Emissions

With the growing consensus that we must over time reduce greenhouse gas (GHG) emissions such as CO_2, it is important that we recognize the interplay between the goal of energy security and the goal of carbon or GHG constraint.

The tough long-term challenge of dealing with GHG emissions may be made much harder by investments expected over the next decade here and around the globe, where there are no policies of carbon restraint – that is, no cost to CO_2 or other greenhouse gas (GHG) emissions.

In this country, for example, we are seeing a big new wave of electric power plant construction – at this point, much of it planned to be coal combustion. The electrification underway in China and India includes dramatic additions of coal-fired power plants. All of this, of course, means considerable growth in CO_2 emissions.

On the oil front, where worldwide use already accounts for 40 percent of $C0_2$ emissions, we also see expansion of GHG emissions, not simply because of increased oil use, but because of the changing nature of petroleum production. It is widely expected that significant investments will be made in unconventional petroleum sources, such as oil shale and tar sands, which already are being produced in Alberta. These fuels require greater energy to produce than does conventional oil, and thus they generate more GHG emissions per barrel of useable product.

Many of the actions we could take to reduce the growth in carbon emissions from oil would also help meet the goal of energy security. But

some of the actions that could enhance energy security could also worsen our carbon path.

For example, we can serve both goals by improving the efficiency of our vehicle fleet. Oil substitutes like ethanol, especially celluosic ethanol, serve both goals. But making gasoline from coal, while helping us with energy security, compounds our CO_2 problem.

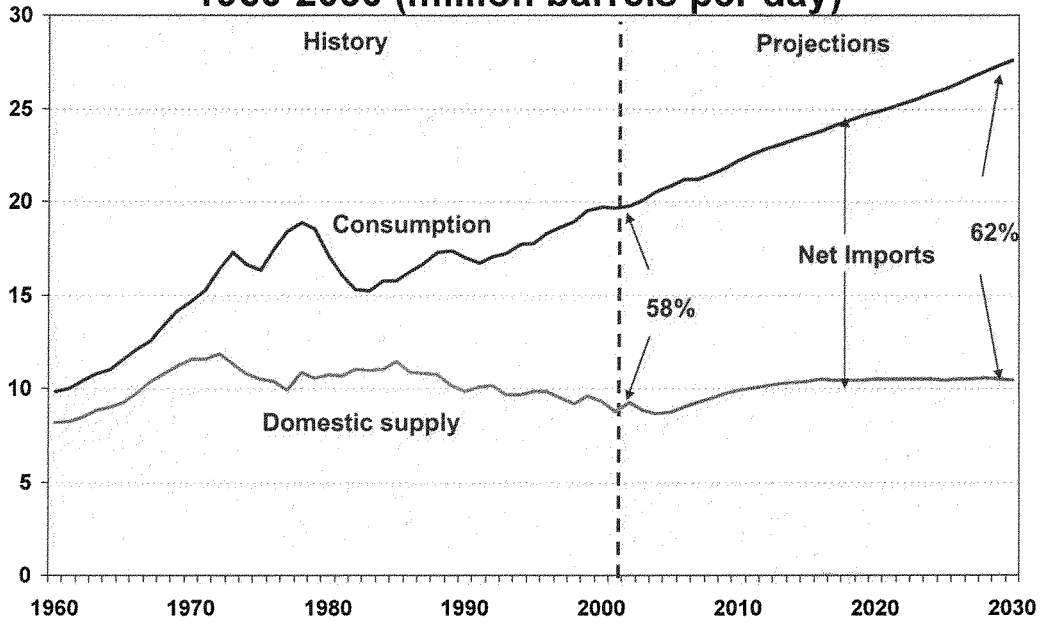
Chart IV, created by Dr. Richard Newell, a former RFF senior fellow who just joined the Duke University faculty, provides a picture of how alternatives to conventional oil compare in terms of their costs and their green house gas emissions. The differences are considerable. The table displays the alternative fuels in such a way as to compare them to conventional oil and to the expected world price for oil.

The differences in GHG emissions, of course, result not simply from the basic feedstock but also from the energy necessary to produce and process the fuel. Corn ethanol, for example, is only about a 20 percent improvement over gasoline because of the use of fossil fuels like natural gas for growing and processing. Celluosic ethanol has considerably greater potential advantage over gasoline. Turning coal into "gasoline," however, is estimated to create as much as 75 percent more GHG emissions than conventional gasoline.

Although there are many factors that will affect the development of these alternatives to conventional oil, the most compelling factor is likely to be the world price of crude oil. And as long as CO_2 emissions are free to the producers and users of energy, the market is much more likely to bring into play new fuels with greater rather than lesser GHG emissions.

While not reflected in Chart IV, it is critical to note that action by Congress and various state governments to provide major financial subsidies for the production of corn ethanol, biofuels, and celluosic ethanol, has dramatically changed the market prospects for these alternatives to oil. If current policies are sustained, corn ethanol remains competitive at oil prices as low as $20 a barrel and biofuels may become competitive in the expected range of world oil prices.

U.S. Petroleum Supply, Consumption, and Net Imports, 1960-2030 (million barrels per day)



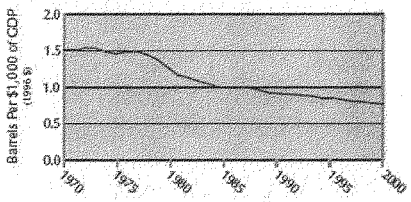
- The import share in total U.S. oil use is projected to grow slowly

CHART I

Figure 1-2

Oil and the Economy

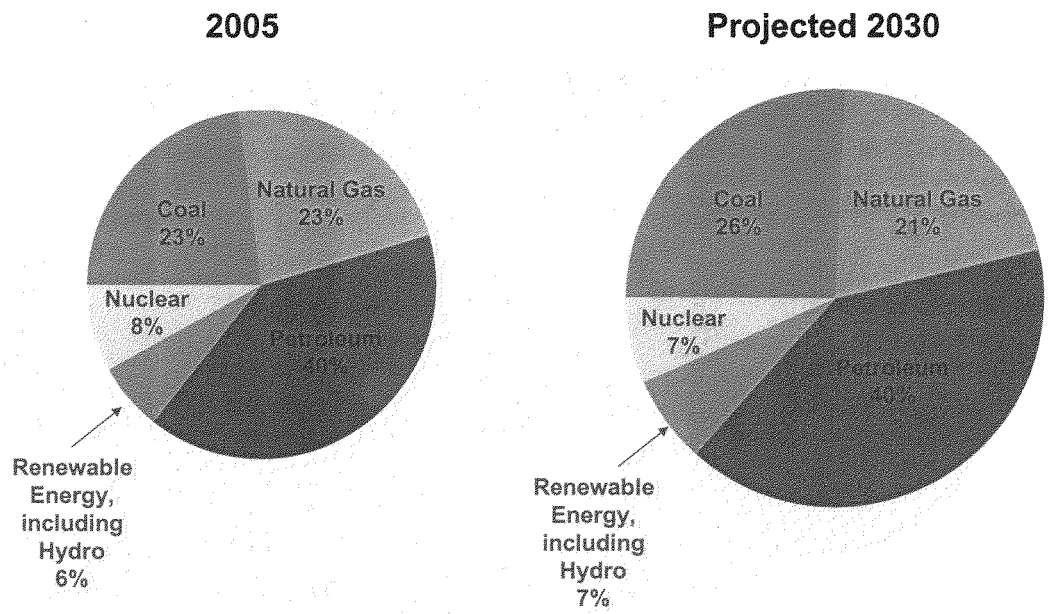
The ability of the U.S. economy to weather oil price shocks improves as oil's share of GDP decreases. This share has declined over the past several decades, although the rate of decline has slowed in recent years.



Resources for the Future, 2004

CHART II

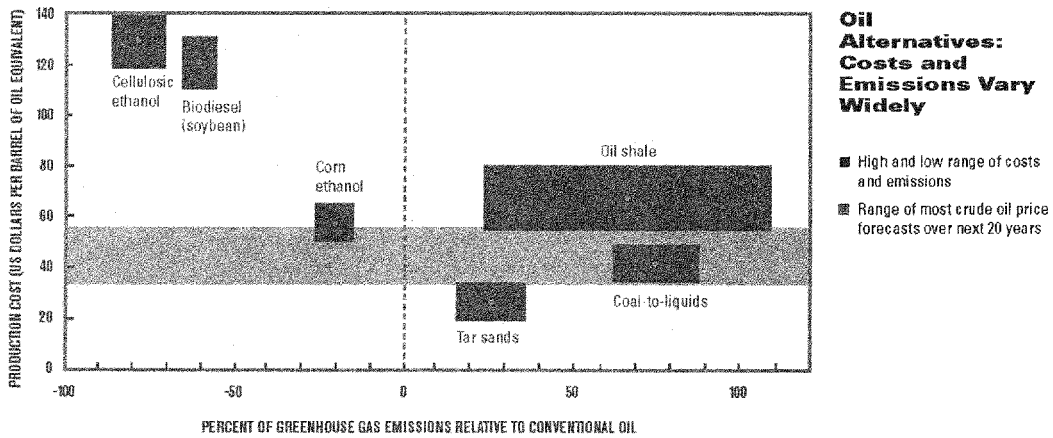
Total Domestic Energy Use by Source
(Percent of Total)



Sources: Energy Information Administration, *Monthly Energy Review* (November 2006), Tables 1.3 and 10.1, and *Annual Energy Outlook 2006* (February 2006), Table 1 (Reference Case).

www.eia.doe.gov

CHART III



Source: Newell, Richard. 2006. What's the Big Deal About Oil? Resources for the Future. Washington, DC.

CHART IV

Testimony of
J. READ SMITH
STEERING COMMITTEE CO-CHAIR
25X'25 RENEWABLE ENERGY ALLIANCE

Senate Committee on Agriculture, Nutrition & Forestry
Hearing on
Agriculture and Rural America's Role in Enhancing National Energy Security

Washington, DC
January 10, 2007

Good morning, Chairman Harkin, Ranking Member Chambliss, and Members of the Committee. Thank you for the opportunity to testify today on behalf of the nearly four hundred organizations that comprise the 25x'25 Renewable Energy Alliance.

My name is Read Smith, and I am one of the two Co-Chairs of the 25x'25 Alliance. Along with my wife and son, I manage our families' farming interests, consisting of nearly 10,000 acres in Whitman County, Washington. Our principal crops are soft white and hard red winter wheat, hard red spring wheat, barley, soft and hard white spring wheat, along with canola, mustard, safflower, millet, alfalfa hay and other minor crops. We also manage a cow/calf operation.

Mr. Chairman, on behalf of the 25x'25 Alliance, I want to begin by welcoming you back to the chairmanship and thanking you for your long-time leadership on energy issues, including 25x'25. Senator Chambliss, we also want to thank you for the leadership you have shown over time, and your support of our efforts. We look forward to working with both of you, as we have in the past, on 25x'25 and as you craft the Farm Bill.

Today's hearing on energy solutions from agriculture and forestry makes a dramatic statement about the importance this Committee places on accelerating the development of renewable energy from our nation's farms, forests and ranches. It is very much appreciated by those of us who make our living off the land.

The Challenge and Need for New Energy Solutions

As you well know, our nation and the world are searching for new energy solutions. Oil reserves are limited and are located in politically volatile parts of the world; population growth and economic growth, especially in India and China, will place more demands on limited energy supplies. At the same time, our nation is becoming increasingly dependent on foreign oil, directly compromising national security. The cost of oil has skyrocketed over the past three years, and the price of natural gas has fluctuated wildly, creating major economic challenges for the nation and for agriculture. Beyond these concerns, the burning of fossil fuels is harming air quality and resulting in the release of greenhouse gas emissions into the atmosphere.

Americans are confronting one of their biggest challenges in decades. We cannot continue on the path of what some have called "yesterday forever." As energy demands increase, both here and abroad, we will need to come up with additional energy supplies – ones that are sustainable. Instead of importing oil from the Middle East, we can produce more energy here at home, using America's agriculture and forestry lands for fuel as well as food, feed and fiber.

Origins of 25x'25

With these challenges – and opportunities – as a backdrop, a group of highly respected agriculture leaders came together two and one-half years ago at the invitation of the Energy Future Coalition to explore agriculture and forestry's role in helping the nation meet its energy needs going forward. We named ourselves the Ag Energy Work Group and focused on the economic, national security and environmental benefits of renewable forms of energy produced by America's farmers, ranchers and forestry land owners. During the summer and fall of 2004, we explored three key questions:

1) What role can the farm and forestry sectors play in producing energy?
2) How big a contribution can we make?
3) What has to happen for our vision to come to life – in other words, what will it take?

In searching for the answers to these questions, we talked to hundreds of producers and interviewed dozens of national agricultural organizations. The responses that we received led us to conclude that there was not just an emerging opportunity to participate in renewable energy production, but an historic opportunity to enhance our national security and redefine the core functions of agriculture.

The 25x'25 Vision

We became convinced that America's farms, ranches and forests could become suppliers for a new generation of clean, alternative fuels and energy feedstocks. At the same time, we would contribute to a cleaner environment and enhanced rural economic development. As a result, we adopted a simple, but bold goal: 25x'25. By the year 2025, America's farms, ranches and forests will provide 25 percent of the total energy consumed in the United States from renewable sources, while continuing to produce safe, abundant and affordable supplies of food, feed, and fiber. This goal will be met by producing bio-based fuels for transportation, harnessing wind energy, capturing and converting sunlight into energy, converting agricultural wastes and by-products into energy sources, and growing biomass for energy production.

Our vision is a food, feed, fiber and fuel vision. With emerging technologies and appropriate policies, agriculture can produce multiple commodities. In 2005, we tested this vision with leaders representing all aspects of production agriculture and forestry. Their response was overwhelmingly positive. By the end of the year, we had secured endorsements from nearly 80 national and regional entities. In March 2006, we held a national summit here in Washington, where we formally announced our renewable

energy vision and goal and launched a drive to recruit environmental, conservation, business, labor, and other interests to join with us in endorsing and promoting this vision as a national goal.

I am pleased to report that, as of today, nearly 400 organizations have committed to the goal of 25x'25. They are joined by 22 current and former governors, 4 state legislatures, 30 current and former Senators, including many Members of this Committee, and 94 current and former Representatives – all of whom have signed on in bipartisan support of a 25x'25 energy future. We represent a diverse collection of endorsing partners, ranging from the American Farm Bureau Federation and the National Farmers Union to the Natural Resources Defense Council and Environmental Defense. The 25x'25 vision has been endorsed by the "Big 3" U.S. automobile manufacturers, Deere & Company, the Theodore Roosevelt Conservation Partnership, and the National Wildlife Federation. In addition, most of the major commodity organizations and most of the major renewable energy trade associations, such as the American Wind Energy Association, have endorsed 25x'25. We also include among our ranks the National Rural Electric Cooperative Association, the Renewable Fuels Association, the National Biodiesel Board and the Biotechnology Industry Organization. These organizations, along with hundreds of others, agreed to join the 25x'25 Alliance because they believe in the vision and want to work collaboratively to bring the goal of 25x'25 to life.

Benefits of a 25x'25 Energy Future

25x'25 is good not only for national security and the economy – it is also good for agriculture, forestry and the environment. A 25x'25 energy future will generate increased farm income, stimulate rural development, and help improve air, water and soil quality. It will also result in improvements in wildlife habitat and conservation on cropland, range and pasturelands.

Last year, in an effort to quantify the economic benefits that 25x'25 would have on the agricultural sector and the economy, we commissioned a major analysis conducted by a team of researchers from the Department of Agricultural Economics at the University of Tennessee's Institute of Agriculture. The researchers were asked to determine the ability of America's farms, forest and ranches to provide 25 percent of U.S. total energy needs in 2025, and to assess the economic impacts of the 25x'25 goal on the agricultural sector and the overall economy.

The analysis revealed the following findings:

- **America's farms, forests and ranches can play a significant role** in meeting the country's renewable energy needs.
- **The 25x'25 goal is achievable**. To meet the 25x'25 goal, which amounts to 29.42 quads of energy, an additional 15.45 quads would need to come from agricultural and forestry lands.
- **The 25x'25 goal can be met without compromising** the ability of the agricultural sector to reliably produce food, feed and fiber at reasonable prices.

- **Reaching the goal would have extremely favorable impacts on rural America and the nation as a whole**. Including multiplier effects throughout the economy, the projected annual, cumulative impacts on the nation would be in excess of $700 billion in economic activity and 5.1 million jobs in 2025, with most of that occurring in rural areas.
- **By reaching 25x'25, net farm income would increase by $37 billion** compared with USDA baseline projections, as the market rewards growers for producing alternative energy and enhancing our national security.
- **Reaching the goal also would have significant positive price impacts on crops.** In the year 2025, when compared with extended USDA baseline projections, national average per-bushel crop prices are projected to be $0.71 higher for corn, $0.48 higher for wheat, and $2.04 higher for soybeans.
- **With higher market prices, an estimated cumulative savings in government payments of $15 billion could occur**. This does not include potential savings in fixed/direct or Conservation Reserve Program (CRP) payments.
- **In the near term, corn acres are projected to increase**, but as cellulosic ethanol becomes commercially viable after 2012, the analysis predicts major increases in acreage for a dedicated energy crop like switchgrass, while corn acres will decline slightly.
- **Higher feed crop prices do not translate into a one-to-one increase in feed expenses for the livestock industry**. Increases in ethanol and biodiesel production result in more distillers grains (DGs) and soybean meal, which partially compensate for increased corn prices. Moreover, the integrated nature of the industry allows for the adjustment of animal inventories as a way to adjust to the environment and increase net returns. In addition, the production of energy from manure and tallow could provide additional value for the industry. The transition to cellulosic ethanol may yield even additional sources of feed alternatives for animal agriculture.
- **Contributions from America's fields, farms and forests could result in the production of 86 billion gallons of ethanol**, which has the potential to decrease gasoline consumption by 59 billion gallons in 2025. America's agriculture and forest lands also could produce substantially more energy for electric power from biomass and wind sources. These renewable energy sources could significantly decrease the nation's reliance on fossil fuels and foreign oil, and thereby enhance the national security of all Americans.

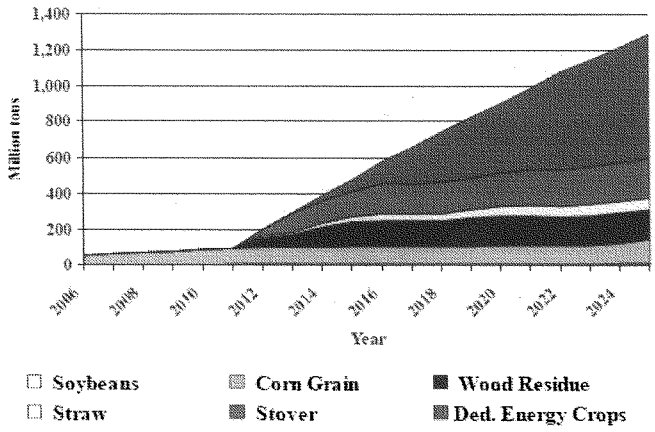
Forest residues, mill wastes and small-diameter trees from thinning forests to reduce the risk of forest fires comprise the woody biomass feedstocks evaluated in the study. The nation has over 400 million acres of privately owned forest land, with over 40 million of these acres in plantation forests. This forest resource could provide additional woody feedstocks. A follow-up study focusing on these specific feedstocks is planned.

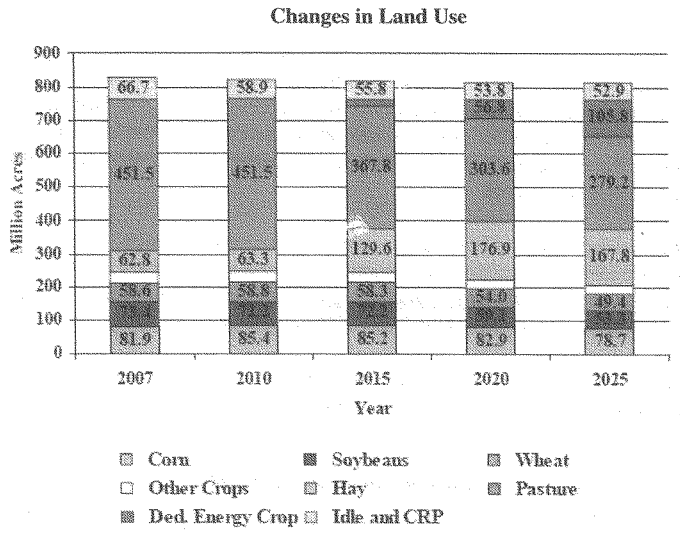
We recognize that our partners in animal agriculture are experiencing significant price increases in many of their primary feedstocks. Even as demand for ethanol increases, the corn yield curve is increasing at an accelerated rate, due to advances in biotechnology and improved cropping practices. There are strong indications that as corn demand continues to increase, because of ethanol production, some acreage may be shifted in the short term to corn and away from other crops. Accelerated research and development is needed to help address the concerns of the livestock sector, particularly relative to the use of distiller grains and other challenges.

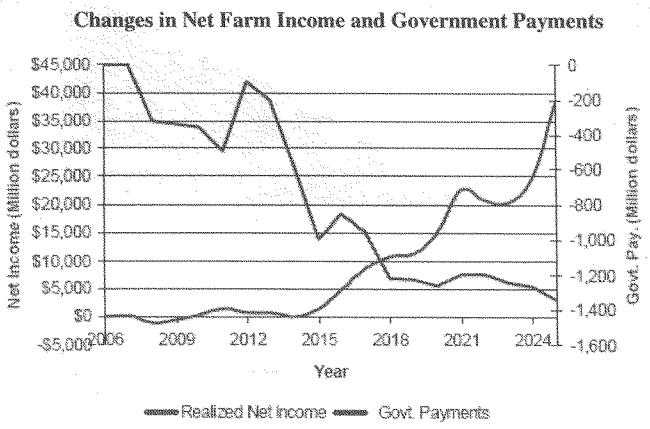
A key finding from the University of Tennessee study is that continued improvements in traditional crop yields enable the production of enough biomass to meet the 25x'25 goal using cropland that is in production, *without including CRP lands* – at prices that would imply a cost of ethanol of $1.60 per gallon and of $2.74 per gallon of biodiesel.

Total energy feedstock quantities, changes in land use for selected simulated years, and changes in net farm income and government payments are displayed in the following charts:

Total Energy Feedstock Quantities Produced







Public Support for 25x'25

Last year, Public Opinion Strategies undertook a survey of 1,000 registered voters to test support for renewables and the 25x'25 goal. Among the findings were:

- There is nearly unanimous support for a national goal of having 25 percent of our domestic energy needs met by renewable resources by the year 2025.

- Ninety-eight percent of voters see this goal as important for the country, and three out of four (74 percent) voters feel that it is "very important." Ninety percent of voters believe this goal is achievable.
- Similar majorities support government action to encourage greater use of renewable energy.
- Nearly all voters (98 percent) say the costs, such as the costs of research and development and of building new renewable energy production facilities, would be worthwhile to move us toward the 25x'25 goal.

Path to 25x'25

The 25x'25 partners are now working to construct a road map to achieve 25x'25. Over the past six months, representatives from the endorsing entities have been meeting jointly and in working groups to develop a detailed 25x'25 Implementation Plan which will include policy recommendations to achieve this goal. The 25x'25 goal and Implementation Plan stand on a foundation of five key principles.

- **Partnership** – No one region or player can, by itself, achieve the 25x'25 goal. It must be built on partnerships among many diverse stakeholders.
- **Commitment** – Decision makers must maintain a commitment to renewable energy **over a long period of time** to create the right policy environment and market circumstances for its success.
- **Sustainability** – To be a long-term solution for America, renewable energy production must conserve, enhance, and protect all natural resources and be environmentally sound, economically viable and socially acceptable.
- **Efficiency** – An efficient energy system will make it easier to achieve the 25x'25 goal and strengthen our economy, security, and environment. Significant energy efficiency improvements are possible and necessary to reduce total energy demand and help reach the 25x'25 goal.
- **Opportunity** – The opportunities for renewable energy are ubiquitous – every region of the United States has the potential to produce and benefit from renewable energy. Seizing those opportunities will enhance:
    - Economic growth by expanding rural development, creating new jobs, and reducing consumer energy costs;
    - National security by reducing dependence on oil, and
    - Environmental protection by expanding wildlife habitat, and improving soil, water and air quality.

Taking the First Step

The first step to achieving a 25x'25 energy future is to establish 25x'25 as a national goal. Chairman Harkin, last year, you, along with Senator Grassley, Senator Salazar, Senator Lugar, and 12 other original sponsors, introduced the 25x'25 vision as a Concurrent Resolution, S. Con. Res. 97.

We look forward to your continued leadership and support, and that of your colleagues, to re-introduce this Resolution in the coming days. Following that, we urge you and the Ranking Member, and the Members of this Committee, to promptly pass the Resolution, so the Resolution can be brought before the entire Senate for swift passage. We are pushing for the same to occur in the House. By establishing 25x'25 as a national goal, Congress will send a clear and powerful message that clean, renewable energy will define America's energy future.

American agriculture is uniquely positioned to play a major role in improving energy and national security, strengthening the national and rural economies, and improving the environment. In the coming weeks, as you once again take up Farm Bill legislation, we urge you to ensure that the Energy Title is structured and funded commensurate with the challenge and opportunity facing the nation and our farmers, ranchers and forest land managers. In February we will be releasing the 25x'25 Implementation Plan, and we look forward to sharing these recommendations with you and the Members of this Committee.

Thank you again for the opportunity to appear before you today. We hope you will look to us as a resource as you move forward with the Farm Bill and look forward to continuing to work together. I would be pleased to respond to any questions.

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

Southern Pine to Ethanol
10 January 2007

Roger P. Webb, Ph.D.
Director, Strategic Energy Institute
Georgia Institute of Technology

Introduction

Mr. Chairman, thank you for the opportunity to testify on the biofuels effort in the State of Georgia, specifically related to the production of Southern Pine to Ethanol and the potential for cellulosic based fuels in the southeast. I would also like to thank Senator Chambliss for his interest in ongoing development efforts involving this resource at both the Georgia Institute of Technology and the University of Georgia. This testimony will describe this particular resource and potential for its development and opportunities for adaptation into the marketplace.

The Georgia Tech Strategic Energy Initiative's mission is to actively engage industry and government to develop and commercialize high impact near term energy technologies. Utilizing Georgia Tech's world-class research community and coordinating with industry and government partners, SEI executes research, development, and demonstration projects on strategically selected new technologies that will provide continued national economic growth.

Transportation is at the heart of the U.S. economy and social structure, and transportation depends on oil. However, U.S. domestic oil production peaked in 1970 when oil was $2 per barrel as shown in Figure 1. At $60 per barrel, today's U.S. oil production is about 40 percent less than it was in 1970. This is due to the continuing depletion of the U.S. oil endowment. The U.S. is therefore becoming even more dependent on unstable oil producing regions of the world, and these increasing oil imports are adding significantly to our balance of payments deficit. A near term solution to our growing transportation oil demand is urgently needed.

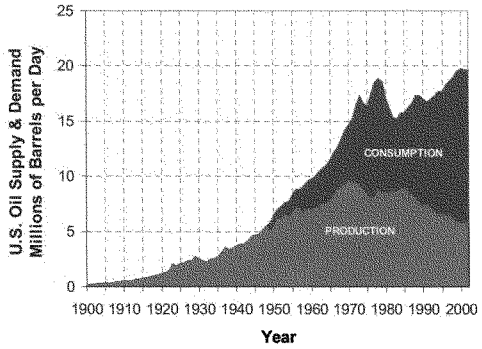


Figure 1: U.S. Oil Supply & Demand

Ethanol is the only transportation fuel that can have a significant impact on oil demand within the next five years. All gasoline vehicles can utilize up to 10% ethanol in their fuel mix, while flexible fuel vehicles can use up to 85% ethanol in their fuel mix. There are currently about 5

million flexible fuel vehicles on the road today, and they are being added to the nation's fleet at a rate of about a million per year. Corn ethanol is already providing about five billion gallons a year, and utilizing about 20 percent of the nation's corn supply. Cellulosic ethanol from unutilized southern pine can be a major additional ethanol resource that can be brought on line in the next three years.

The amount of energy contained in one gallon of ethanol can be described in terms of its lower heating value of 76,000 Btu/gal. To describe the efficiency of the ethanol production process, one needs to look at how much energy was required as an input to produce the ethanol. For the case of cellulosic ethanol, approximately 16,000 Btu's are required (in the form of harvesting and process energy) to produce one gallon of ethanol, resulting in a 79% efficiency.

Due to the declining U.S. paper products industry, the southern pine agricultural industry has a surplus of renewable pulpwood product that has no current market. Figure 2 shows a decline in pulpwood demand from 200 million tons annually to about 165 million tons. This has caused economic hardship in many southern rural communities. The infrastructure for harvesting and transporting this cellulosic ethanol resource is in place today, and the basic technology is in hand to convert this resource to ethanol at an estimated cost as low as $0.80 per gallon. Add NREL plot.

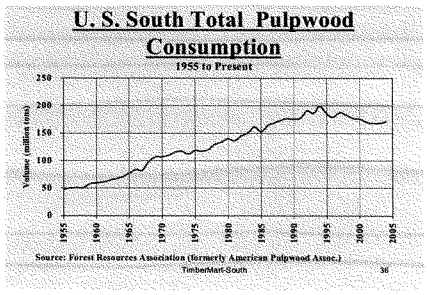


Figure 2: U.S. South Total Pulpwood Consumption, 1955-present

In addition to the reduced dependence on imported oil from unstable regions of the world and a reduction in the negative U.S. balance of payments, greenhouse gas emissions are reduced over 90 percent from the production and use of southern pine ethanol compared to the utilization of gasoline from oil.

Southern Pine Biomass Resource

The forest products industry (including sawmills, pulp & paper mills, and other building products facilities) has been very important to the economy of the Southern States for many years. Seventy percent of U.S. timberland acres are located in the eastern half of the coutry. The U.S. South, composed of Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas and Virginia has 211,838,000 forested acres, 40 % of their total land area. Private landowners own over 90% of this forest land. However, recently the pulp & paper industry has seen some major setbacks in the region. From 1997 to 2004, the total southern pulpwood production declined from 201 to 169 million green tons, a 16 % decrease[i]. From 2001-2004 the economic impact of the forest products industry in Georgia dropped from $30.5 billion to $22.7 billion and it slipped from #2 to #3 in terms of economic importance for the state[ii]. Additionally, over that same period,

employment in this field fell from 204,000 to 145,000 jobs[iii]. The Georgia Forestry Commission is very concerned with these statistics and is looking for new ways to utilize wood and wood waste to give landowners new markets. New demand for a feedstock from an industry such as ethanol production could help reverse this trend, provide economic development for the state of Georgia, and contribute to increasing national security by utilizing a local renewable resource to reduce dependence on foreign oil.

Figure 3 shows the 2004 pulpwood production by state (1 cord = 2.65 green tons), while Figure 4 shows the cords of softwood per square mile on a map. Of the Southern States it can be seen that the Southeast leads in softwood production, which is largely because of southern pine used in pulp/paper mills.

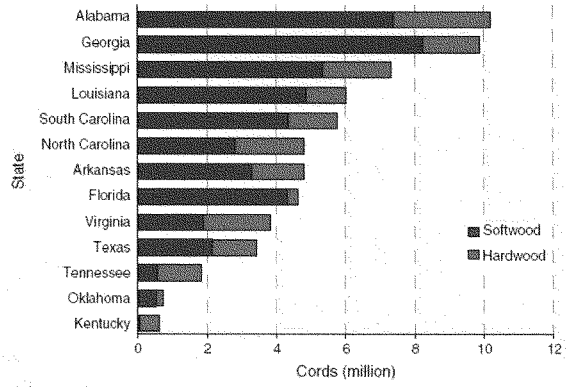


Figure 3: 2004 Pulpwood Production by State and Broad Species[i]

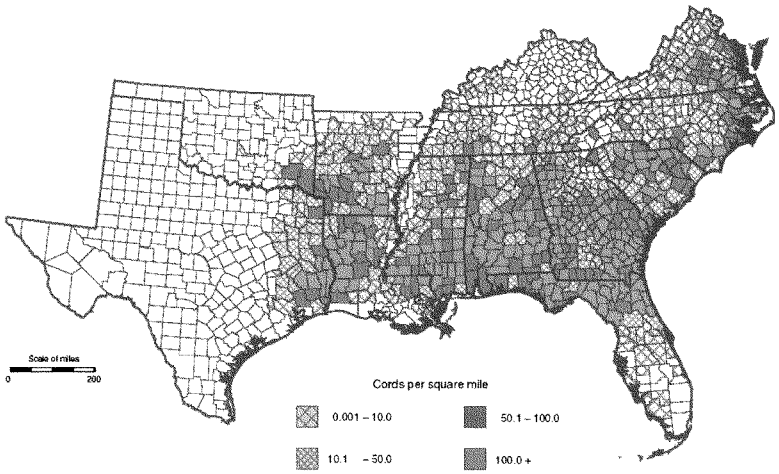


Figure 4: Softwood Roundwood Production in the South by County or Parish, 2004[i].

Along with a decrease in the use of southern pine over the last few years, the available resource has grown through agricultural tree plantings spurred by the Conservation Reserve Program. This program paid for a portion of afforestation and also paid rent to farmers for involved lands. Over one million acres of forests have been established in this program alone in Georgia[iv] (out of 24 million total acres of forest land in Georgia), providing a new southern pine resource that is sustainable at 2004 levels with a rate of harvesting of 10.1 million green tons per year. This is roughly equivalent to 400 million gallons of ethanol per year at current conversion yields.

There is also an unused unmerchantable timber resource in Georgia that could be harvested at a rate of 7.6 million green tons per year, or approximately 300 million gallons of ethanol per year. This includes thinnings, wastes, and other residues.

Overall in 2004, Georgia had 55.2 million green tons of southern pine available for production. The pulp and paper industry used 37.5 million green tons, leaving 17.7 million green tons of renewable southern pine resource available for ethanol production. This resource could produce approximately 700 million gallons of ethanol per year, which could displace approximately 20% of Georgia's gasoline use, without impact to other current wood product industries in the state. Extrapolating these results to the other Southern States, there may available southern pine resources for a 4 billion gallon per year ethanol feedstock available today.

Economic Impact

Ethanol, produced regionally, and on a large scale, can have a significant impact across both local and national markets. Because it is produced domestically, it can decrease the nation's dependence on foreign oil and increase national security. Additionally, it is a renewable fuel and its use helps to boost the economy of the nation's agricultural sector.

With minimal investment in technology and a partnered commitment from a consortium of industry, government, and university researchers economic, development opportunities for rural America and beyond will evolve. By building upon our current forestry infrastructure in Georgia and the South ethanol markets can expand rapidly, creating new jobs and transforming a declining industry into a sustainable new economic entity. By incorporating biofuel operations into the forest products value-chain, a new revenue stream could be generated providing increased demand for the South's wood resources and new rural economic growth opportunities.

A woody cellulose ethanol production facility in Georgia would provide a higher economic value wood waste feeds as well as provide the infrastructure for an alternative forest products business for Georgia. A 100 million gallon/yr facility, selling product wholesale for $1/gallon would yield sales of $100 million. Potentially, several plants of this size could be built in the state, and this new market would generate new jobs and needed revenues for the forest products industry, as well as reduce the flow of U.S. dollars for oil overseas to unstable parts of the world. Most of these jobs would be located within rural areas but the impact of cellulosic ethanol production and use would have a ripple effect in virtually every sector of local and national economies.

As of February, 2005, the ethanol industry has added more than $25 billion to the nation's gross economic output through operating spending and capital spending for new plants; it has supported over 147,000 jobs across all sectors of the economy; and $4.4 billion went directly to consumers this past year through increased economic activity and new jobs[v].

Southern Pine to Ethanol Development Program

- **Background**

During the 1970s and 1980s Georgia Tech hosted several research programs concentrating on the production of alternative fuels from biomass feedstocks. These programs included production of char, liquids, and synthetic gases from wood feedstocks, and the construction of steam plants using woody biomass as fuel. In particular, there was a program carried out using funds from the U.S. Department of Energy which concentrated on producing ethanol from wood. At the time, most softwood (pine) resources were being fully utilized by the forest products and pulp and paper industries, so the research was centered on production of ethanol from hardwoods.

In 2004, conversations between staff of the Strategic Energy Institute (SEI) and the Georgia Forestry Commission made it clear that at this time there is a surplus of underutilized pine in the state, and there needed to be a renewed effort on the production of ethanol from pine resources.

- **The Biomass Research Team**

The Strategic Energy Institute (SEI) established a research team in 2005 to investigate the feasibility of producing ethanol economically from southern pine resources. In addition to SEI personnel, team members were recruited from the Georgia Tech School of Chemical Engineering, the Georgia Tech School of Chemistry, and the School of Biochemistry at the

University of Georgia. Members from the academic units all had some experience in producing ethanol from biomass. The project has been funded from a combination of industrial partners, C_2BioFuels and Chevron, and the Georgia Research Alliance.

The initial phase of the project has focused on ethanol production utilizing essentially existing technology. The work, supported by the State of Georgia and a private company, C2 Biofuels, has been conducted at Georgia Tech and the University of Georgia. This effort has identified applicable process technologies and specific laboratory results. It also identified areas of opportunity to substantially reduce the cost of ethanol production through technology improvement and development. Significant funding support has also been provided from private sources, primarily the Chevron Corporation, and the State of Georgia to develop enhanced technology.

Funding for joint research between Georgia Tech and the Chevron Corporation is focused on the development of commercially viable processes for the production of transportation fuels from renewable resources such as forest and agricultural waste. This is viewed as an important advancement over first-generation biofuels such as ethanol and biodiesel, which are made from agricultural crops. Specifically with regard to ethanol production, this includes activities aimed at enhancing pretreatment processes and at utilizing separation techniques utilizing distillation processes.

The State of Georgia, through the auspices of the Georgia Research Alliance, has funded specific projects at Georgia Tech and the University of Georgia. These projects focus on improvements in pretreatment and enzymatic processes and on elimination of water resulting from the fermentation process.

- **Preliminary Results**

Initial laboratory trials using enzymatic hydrolysis pretreatment schemes were carried out at Georgia Tech and UGA, backed up by trials performed at Lund University (Sweden). Preliminary results show ethanol production using enzymes at 70% of theoretical. These results are very encouraging and sufficient for commercialization. These experimental results dispelled the widely held belief that ethanol production from softwoods is more difficult that from hardwoods.

- **Steps to Commercialization**

Current results have been obtained utilizing a wood to ethanol research laboratory in Sweden. The trials are continuing in an effort to optimize the enzyme formulations and pretreatment steps. The steps and schedule to commercialization are currently expected to be as follows:

A. Process Development Unit – Feb '07 (more funding details)
This plant will be used for pretreatment and enzyme optimization.

B. Pilot Plant - Dec '07

This plant will process 5 dry tons/day of feedstock and produce 400 gallons/day of ethanol.

C. Demonstration Plant – Dec '08

This plant will process 100 tons/day with an ethanol production capacity of 3 million gallons/year.

D. Commercial Plant – Jun '10

This commercial plant will produce 50 million gallons/year of ethanol.

The above steps starting with the pilot plant will rely on industry participation and sponsorship. Funding for the larger plants will depend on outside capital from banks and bondholders. The government could assist in these financings by providing loan guarantees and production tax credits.

- **Other Research**

There are opportunities for cost reductions throughout the ethanol production process. Key areas which are currently being researched are enzyme design, novel distillation technologies, and alternative pretreatment processes.

Conclusions

- Southern pine can be produced from southern pine efficiently and effectively
  - Proven in three different laboratories
  - High yield rates, 70 % of theoretical achieved to date
  - 79 % conversion energy efficiency
  - With current technology, production costs ~$1.30/gal
- Southern pine biomass resource is abundant
  - Georgia
    - 24 million acres of forest land
    - 55.2 million green tons harvestable per year
    - 37.5 million green tons currently used by other industries
    - 17.7 million green tons available for a new industry
- Infrastructure Exists
  - Planting
  - Harvesting
  - Transporting
- Opportunities for cost reduction thru technology apparent
- Research
  - Processing technology
  - Development of high valued co-products from process
  - Genetic improvement of trees for increased yield
- Time Scale
  - Commercial plant operational in June 2010

[i] Johnson, T.G. and Steppleton, C.D., *Southern Pulpwood Production, 2004*. USDA Forest Service, Southern Research Station, Resource Bulletin SRS-101. July 2006.
[ii] Riall, William, *Economic Benefits of the Forest Industry in Georgia: 2004*. Georgia Tech Economic Development Institute, October 2005.
[iii] Riall, William, *Economic Benefits of the Forest Industry in Georgia: 2003*. Georgia Tech Economic Development Institute, October 2004.
[iv] McClure, Nathan. *An Assessment of Biomass Resources in Georgia to Supply a Transportation Fuel Refinery Industry*. Georgia Forestry Commission, December 2005.
[v] Renewable Fuels Association website: http://www.ethanolrfa.org/leg_positions_fed.shtml

DOCUMENTS SUBMITTED FOR THE RECORD

JANUARY 10, 2007

Cellulosic Diversity for Alternative Energy
Testimony Prepared by Auburn University
For the U.S. Senate Committee on Agriculture -- January 10, 2007

Cellulosic Diversity

A national alternative energy program that emphasizes cellulosic biomass will help satisfy U.S. energy needs, move the nation toward sustainable energy development, reinvigorate natural resource-based industries and create new product streams.

Approximately 60 percent of crude oil consumed by the United States, according to the U.S. Department of Energy, is imported, much of it arriving from unstable regions of the world. It is widely recognized that domestically produced biofuels would improve U.S. energy security and provide numerous environmental and economic benefits.

The corn-to-ethanol and soybean-to-biodiesel industries have made significant progress in increasing domestic biofuel production and should be continued. However, it is believed these industries cannot provide more than 11 percent of total consumption without causing negative consequences on the poultry, pork, beef and cereal industries. Therefore, a new biofuel industry based on a balanced, diverse portfolio of biomass feedstocks is critical to successfully reducing U.S. dependence on foreign sources of oil.

The Southeast region of the United States is blessed with a great quantity and diversity of biomass resources that can be used as feedstocks for biofuels. They include many renewable and sustainable agricultural crops, crop residues, animal waste and woody biomass. Cellulosic and lignocellulosic materials from these resources can be used to produce liquid fuels, heat, power and value-added chemicals and other products.

The U.S. Departments of Agriculture and Energy in 2005 reported that the United States could produce 1.36 billion dry tons of biomass per year and, if converted to biofuels at an efficiency of 60 gallons per dry ton, it would provide approximately 30 percent of the country's transportation needs. The biomass is expected to come from agricultural resources such as corn stover, wheat straw and cotton stalks; dedicated energy crops such as switchgrass, other perennial grasses and legumes; and short rotation woody crops including woody biomass such as trees grown for energy use and logging debris. This initiative would expand the benefits of Midwest and Great Plains biofuels to the Southeast, Northeast and West Coast.

The U.S. has the ability to create a sustainable biofuel industry based in large part on cellulosic biomass feedstocks. For this industry to be stable and profitable, it must be based on a diverse suite of feedstocks that promotes regionally-appropriate products and avoids local disruptions in feedstock supply. A balanced portfolio of multiple cellulosic feedstocks is the key to developing a viable biofuels industry.

Cellulosic Cost Efficiency

Multiple conversion techniques and biomass sources are required to achieve cost efficient fuel production and processing as well as to best utilize renewable resources and avoid the vulnerabilities of changing market prices and consumer demand. The optimal use of biomass sources from different U.S. regions and appropriate combinations of conversion technologies will help ensure both energy security and energy diversity.

Therefore, in addition to biochemical routes that produce corn ethanol and cellulosic ethanol and chemical routes that produce biodiesel, emphasis should be placed on thermochemical strategies that directly convert cellulosic biomass to biofuels such as cellulosic (synthetic) diesel and cellulosic gasoline. The economic efficiency of these strategies can be significantly improved by coproduction of synthetic fuels with other value added chemicals, fuels and bioproducts through an integrated biorefinery approach.

Thermochemical conversion strategies are already commercially developed and engineered for other carbonaceous resources such as natural gas or coal. These processes are highly flexible in terms of the biomass feedstocks that can be utilized to produce fuels. Furthermore, these synthetic CO_2 neutral fuels can be readily integrated into our existing national fuel infrastructure, thereby simultaneously reducing our dependence on foreign oil, reducing CO_2 emissions and creating new domestic biofuels based industries.

It is anticipated that the timeline to commercialize these processes would include year one for technology demonstration, year two for small pilot scale demonstration, and year three for full-scale commercialization. Partnerships among government, academia, industry and agriculture will more quickly develop these strategies and bring them cost-efficiently to the market.

Conclusion

Auburn University has a long history and widespread expertise in alternative fuels. In concert with industrial partners, Auburn's program is unique in that it focuses on complete systems – producing and harvesting feedstocks, processing feedstocks into biofuels and marketing the biofuels – rather than isolated components of these systems. Auburn's alternative energy initiative is currently developing up to 10 pilot sites around Alabama where biomass-to-combined heat and power conversion units will be demonstrated for small businesses, farms and industry.

Cellulosic biomass should play a major role in a national alternative energy program if the goals of 30 x 30 (biofuels constituting 30 percent of transportation fuels by 2030) and 25 x 25 (generating 25 percent of the nation's energy from farm and forest land by 2025) are to be achieved.

# # #

QUESTIONS AND ANSWERS

JANUARY 10, 2007

HARKIN: QUESTIONS FOR GENE GOURLEY (NATIONAL PORK PRODUCERS COUNCIL)

1. You expressed concern with how the ethanol industry receives subsidies that amount to $1.53 per bushel and a blender's tax credit subsidy of $0.51 per gallon. This data appears to not be expressed correctly.

QUESTIONS

> **Could you clarify whether you intended to say that the ethanol industry receives subsidies that is equivalent to $1.53 per bushel in the form of a blenders' tax credit of $0.51 per gallon rather than suggesting that the ethanol industry receives both a $1.53 per bushel subsidy <u>and</u> a blenders' tax credit.**

2. There are an increasing number of studies on the use of distillers dried grains with solubles (DDGS) in hog feed. Some studies have suggested that 20 percent and even more of DDGS could be used in hog feed ration if other factors, such as mycotoxins could be controlled. You expressed concern over the quality and availability of DDGS from ethanol facilities.

QUESTIONS

> **If there was one area of immediate research that would also be the most beneficial to the hog industry for utilizing DDGS in hog feed, what would that be?**

HARKIN: QUESTIONS FOR KEITH COLLINS (USDA)

1. You mentioned in your written testimony that you think that we can achieve ethanol production of between 12 and 15 billion gallons by 2012. Bill Tierney, an economist who used to work for USDA's World Board, has estimated that current capacity plus planned expansion could lead to production of as much as 26 billion gallons by 2009. What do you think are the likely sources of the significant difference between those two estimates?

2. Due to the jump in natural gas prices over the last few years, a lot of ethanol plant operators have switched from natural gas to coal to generate electricity to run their facilities. What effect does that type of switch have on the net energy balance of ethanol and on the net greenhouse gas impact of using ethanol versus conventional gasoline?

Senator Saxby Chambliss
Questions for the Record

Committee on Agriculture, Nutrition & Forestry
Full Committee Hearing on
Agriculture and Rural America's Role in Enhancing National Energy Security

Questions for Dr. Collins

1. At several times during the hearing you noted that the livestock industry will need to manage "adjustments" as the ethanol industry expands capacity.

    - Please define what you mean by adjustment?

    - Do the benefits resulting from the expansion of the biofuels industry outweigh the costs associated with "adjustments" in the livestock sector? Please explain in terms of jobs, net farm income and regional development.

    - At what point does biofuel expansion adversely (defined by concentration, contraction and reduced profitability) impact livestock operations? Please explain differences for each species and regions.

2. Analysis by the Center for Agricultural and Rural Development at Iowa State has determined that current government policies and petroleum prices allows the ethanol industry to pay up to $4.05 per bush of corn and still be profitable.

    Meanwhile, some trade analysts in Chicago expect corn futures to rise to $4.20 to $4.35 per bushel following the Department's most recent WASDE report. They see this as dampening ethanol-based corn demand given today's lower petroleum prices. They contend that a rationing of the corn supply will now occur in 2007 as opposed to 2008.

    - Do you agree with these analyses?

3. Section 1501 of the Energy Policy Act of 2005 authorizes the Department of Energy in consultation with the Secretary of Agriculture and the Secretary of Energy to waive the renewable fuels mandate for one or more states if it is determined that implementing the RFS requirements would severely harm the economy or the environment, or that there is an inadequate domestic supply to meet the requirement.

    - Since the decision to invoke or not to invoke this waiver would have important consequences for various parts of the agriculture sector, has the Administration determined the threshold criteria to be used that would determine severe harm to the economy or the environment?

Senator Saxby Chambliss
Questions for the Record

Committee on Agriculture, Nutrition & Forestry
Full Committee Hearing on
Agriculture and Rural America's Role in Enhancing National Energy Security

Questions for Dr. Collins

1. During the question and answer session subsequent to your oral remarks, you noted that it might be necessary to incentivize biomass production by farmers and ranchers in order to feed a cellulosic ethanol industry. As you know, the joint Department of Energy/Department of Agriculture "Billion-Ton" study noted the United States is "capable of producing a sustainable supply of biomass sufficient to displace 30 percent or more of the country's present petroleum consumption." (Executive Summary, page 1).

    - If the United States already can supply the biomass necessary for a 60 billion gallon market, is it necessary to promote additional production that will directly compete with existing acreage already planted to other row crops.

2. Regarding the DOE/USDA "Billion-Ton" study, do you agree with the assumptions and conclusions of the report? In your opinion, is the resource base cited capable of producing 1.3 billion tons of biomass feedstock and can the total volume be processed while also meeting our national goals of conservation and environmental protection? If not, please explain where the report is deficient.

3. Weather in farm country is the single most important factor in terms of yields but is also the most unpredictable variable in the growing seasons.

    - Has USDA performed an analysis on the impacts of potential decreases in corn yields for 2007 and 2008 crop years on the livestock sector? If so, will you make those projections available to the Committee?

4. Since the ethanol industry is rapidly evolving it is difficult to keep track of production numbers and new construction starts for ethanol plants. There is the danger of underestimating future demand for corn especially since farmers need to plan months ahead before planting time.

    - Does the current method for collecting data on new ethanol plants and expansion of existing plants allow for accurate forecasts regarding the demand for corn to be used for ethanol?

    - If not, what method or system do you propose to improve data reporting do ensure the market can balance supply and demand?

5. As you know, increasing amounts of dried distiller's grains and solubles (DDGS) are being exported from the United States. However, DDGS are not included in USDA's Weekly Export Sales Report.

    - Does the volume of DDGS exports justify their inclusion in Weekly Export Sales Reports?

    - Is the export volume large enough to have a price impact on DDGS and competing feed ingredients?

6. Last November, the Institute for Agriculture and Trade Policy (IATP) released a report entitled *Water Use by Ethanol Plants: Potential Challenges*. The report warns that data on water supplies in the midwest are not readily available and that more research should be done and concludes: "Otherwise shortage of water could be the Achilles heel of corn-based and perhaps cellulose-based ethanol."

    - Do you agree?

7. E85 contains about 70 percent the energy of regular gasoline on a Btu per gallon basis. Thus, fuel economy on FFVs is substantially reduced, with an average reduction in fuel economy of 26 percent for a model year 2006 FFV operated on E85.

    - Since U.S. consumers are extremely price conscious, do you think the driving public will be willing to pay more on a cents per mile basis to operate a vehicle on E-85?

    - Does the experience of Brazilian customers provide any insight into consumer behavior in this regard?

8. In your testimony before the Senate Environment and Public Works Committee last September, you mentioned the department's preliminary assessment that between 4.3 and 7.2 million acres currently enrolled in the Conservation Reserve Program could be used to grow corn or soybeans in an environmentally friendly manner.

    - What further analysis has USDA done on this issue? Are there other acres that potentially could be used to grow corn or soybeans to help maintain a balanced market?

    - What logical approach should Congress take in the 2007 farm bill to balance conservation with the demand for greater production?

9. Ethanol blends are not sent through pipeline systems because they may pick up water and other impurities in transit. Ethanol blending occurs at the terminal

rack. There have been recent reports of spot rail car shortages that occurred last year as the industry transitioned to the current RFS.

- What would be the railcar/marine barge impact associated with a higher RFS?

10. Ethanol is known to increase motor vehicle emissions of nitrogen oxides and volatile organic compounds which are two precursors of ozone pollution.

    - To what extent will increasing the RFS make it more difficult for states to comply with EPA's tightening air quality standards for ozone?

11. Section 9004 of the 2002 Farm Bill authorized the Biodiesel Fuel Education Program. Do you feel that program has been successful and should it be continued in the next farm bill?

12. Biodiesel producers have indicated the value of the CCC Bioenergy Program and the need for continuation for biodiesel, albeit in a modified form. Has the Department considered how a program could aid in the continued growth of the biodiesel industry?

Senator Saxby Chambliss
Questions for the Record

Committee on Agriculture, Nutrition & Forestry
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Agriculture and Rural America's Role in Enhancing National Energy Security

Questions for Dr. Sharp

13. Projected oil consumption in the United States will continue to increase even as our country continues to promote and grow the domestic biofuel industry. Your organization discusses the difference between oil independence and lessening our dependence on imports.

    - Can you provide some additional insight into the problem?

    - In light of the fact that we will continue to rely on imported oil for the majority of our fuel transportation needs, how do we develop the renewable fuel industry to soften or eliminate foreign countries' ability to shock our economy?

    - Rather than focus on lessening our dependence, how do we become truly independent? What will be the costs of such a policy?

Senator Saxby Chambliss
Questions for the Record

Committee on Agriculture, Nutrition & Forestry
Full Committee Hearing on
Agriculture and Rural America's Role in Enhancing National Energy Security

Question for Mr. Smith

14. The 25x'25 goal assumes the utilization of a significant volume of biomass from both farmland and timberland similar to the "Billion Ton" study conducted by the Departments of Agriculture and Energy in 2005. However, the resources cited in that study and by others might over estimate the ability of the ethanol industry to utilize our entire resource base. For example, many advocate the use of the Conservation Reserve Program (CRP) to produce biomass at various levels.

    - How do we reconcile the competing demands of increased crop production and retirement of sensitive lands?

Senator Saxby Chambliss
Questions for the Record

Committee on Agriculture, Nutrition & Forestry
Full Committee Hearing on
Agriculture and Rural America's Role in Enhancing National Energy Security

Questions for Dr. Pacheco

15. You note that the "Billion Ton" study illustrates the resources are available to produce 60 billion gallons of biofuels by 2030.

    - Are you convinced that the estimates and assumptions are sound and there are no limitations on the amount of biomass available?

    - For example, while the estimates for corn stover might be realistic, might others advocate require leaving higher percentages on farmland to improve soil and water quality?

Senator Saxby Chambliss
Questions for the Record

Committee on Agriculture, Nutrition & Forestry
Full Committee Hearing on
Agriculture and Rural America's Role in Enhancing National Energy Security

Questions for Mr. Miller

1. As you have already heard, the price pressure resulting from increased demand for corn ethanol is impacting other traditional customers of the industry. Some observers believe that there is the potential for increased concentration in the livestock industry due to the significant spikes in input costs that we have seen over the past couple of years for energy and feed.

    - Do we need to ease the pressure on corn to ensure we have a stable and healthy livestock industry in our country?

    - What are the long-term consequences if we lose a significant portion of our livestock industry?

2. Given the enormous growth in the corn ethanol industry and the influx of new capital from across the country, does grain based production still require both the RFS mandate and the blenders credit to be competitive with gasoline?

Senator Saxby Chambliss
Questions for the Record

Committee on Agriculture, Nutrition & Forestry
Full Committee Hearing on
Agriculture and Rural America's Role in Enhancing National Energy Security

Questions for Dr. Webb

3. Dr. Webb, I am particularly interested how we can provide incentives to not only expand the ethanol production base in terms of volume but also geography. There are a variety of reasons why we should encourage all regions of the country to produce transportation and renewable fuels. In addition to the local economic impact and opportunities for rural revitalization, it diversifies our production base for national security reasons.

    - What additional infrastructure is required to enable ethanol production in the Southeastern United States and other regions?

    - What is the potential impact of cellulosic feed stocks like southern pine on the national bio-fuels strategy?

    - What in your view is the most critical element in implementing full development of the cellulosic ethanol strategy?

Senator Saxby Chambliss
Questions for the Record

Committee on Agriculture, Nutrition & Forestry
Full Committee Hearing on
Agriculture and Rural America's Role in Enhancing National Energy Security

Questions for Mr. Gourley

4. You cite that the pork industry might potentially decline by 10 to 15 percent to allow industry to recoup higher production costs. A reduction of this magnitude could have significant impacts on the $15 billion pork industry.

    - Can you estimate the number of job losses in rural America and the overall economic impact to the industry if a 10 to 15 percent reduction were to occur in the coming years?

5. From your testimony, it is apparent that current corn prices, the increasing demand for corn for ethanol production, and the host of federal and state incentives to spur ethanol production could further exacerbate consolidation in hog and poultry sectors.

    - Are you concerned that continued incentives for ethanol production could both reduce the size and limit the international competitiveness of the U.S. hog industry?

6. Agricultural concentration and competition issues will be at the forefront of the Farm Bill debate in the coming months. Many Senators are concerned that the livestock sector continues to consolidate resulting in fewer buyers for producer products and diminishing the ability of farmers and ranchers to negotiate sales.

    - Are you concerned that additional incentives for ethanol production coupled with efforts to limit contracting options, packer ownership bans and other competitiveness issues in the Farm Bill could in fact accelerate consolidation and concentration in the livestock and poultry sector?

7. You state in your testimony that the economic outlook for the future of the pork industry was "rosy" given the worldwide demand for pork and several pending free trade agreements. However, the diversion of feed grains into biofuel production has changed the outlook from rosy to uncertain.

    - If the current prices for corn do not abate in the near future and the U.S. government continues to subsidize the expansion of the ethanol industry, what is the long-term outlook for the U.S. pork industry?

8. Much of the impact of the growing ethanol industry on the livestock sector will be dependant on the ability of species to incorporate ethanol co-products into their diets. Several studies have indicated that ethanol co-products are higher in fat, fiber and net energy and thus are more suitable for cattle diets. This could make co-products less suitable for hog and poultry industries.

   Additionally, in your testimony, you state that corn comprises approximately 75 percent of swine diets and pork producers will only utilize DDGS as 10 percent of swine diets.

   - Have the Iowa Pork Producers performed an analysis on how to better utilize corn ethanol co-products in hog diets?

9. Mr. Gourley, in your testimony you raise some serious animal performance concerns related to the feeding of DDGS to swine. As a swine nutritionist, what do you think this Committee should consider as it thinks through the issue of additional research on DDGS?

Senator Saxby Chambliss
Questions for the Record

Committee on Agriculture, Nutrition & Forestry
Full Committee Hearing on
Agriculture and Rural America's Role in Enhancing National Energy Security

Questions for Ms. Kemp

10. You suggest full funding for the Conservation Security Program and new biomass incentives, possibly a several-million acre biomass reserve, as policy options for the 2007 farm bill.

    - With the expectation that resources in the next farm bill will be limited compared to new demands, how should we pay for these ideas?

11. Expectations are that corn acres will increase this year to meet additional ethanol demand. You recommend reinvigorated conservation compliance. Do you have specific suggestions as farmers try to maximize acres and yields?

12. You have said that Congress should eliminate commodity programs and instead greatly enhance payments through the Conservation Security Program (CSP). In order to meet our WTO obligations, the amount of the payment cannot exceed the cost of implementing the practice. Such a large influx of money would look like an income support program to those most critical of U.S. farm programs.

    - Do you think we would have difficulty modifying the existing program so it would be WTO legal and would farmers support the program if it only compensated for the cost of compliance rather than provided additional incentives for conservation practices?

[Here is the Text of the WTO Agreement on Agriculture, Annex 2]

12. Payments under environmental programmes

(a) Eligibility for such payments shall be determined as part of a clearly defined government environmental or conservation programme and be dependent on the fulfillment of specific conditions under the government programme, including conditions related to production methods or inputs.

(b) The amount of payment shall be limited to the extra costs or loss of income involved in complying with the government programme.

February 19, 2007

Chairman Tom Harkin
Committee on Agriculture, Nutrition, and Forestry
SR-328A Russell Senate Office Building
Washington, DC 20510-6000

Dear Senator Harkin,

Enclosed are the answers to the post-hearing questions asked of Mr. Gene Gourley of Webster City, Iowa, from the January 10, 2007, Committee on Agriculture, Nutrition, and Forestry hearing on agriculture's and rural America's role in enhancing national energy security.

Responses to questions asked by Senator Harkin:

1. Question:
You expressed concern with how the ethanol industry receives subsidies that amount to $1.53 per bushel and a blender's tax credit subsidy of $0.51 per gallon. This data appears to not be expressed correctly.

Could you clarify whether you intended to say that the ethanol industry receives subsidies that is equivalent to $1.53 per bushel in the form of a blenders' tax credit of $0.51 per gallon rather than suggesting that the ethanol industry receives both a $1.53 per bushel subsidy and a blenders' tax credit.

Response:
The $0.51 per gallon blender's credit allows the blenders to pay $0.51 per gallon more for ethanol than they would otherwise . When we multiply this subsidy by three to put it into the per bushel subsidy (assuming that modern plants can achieve three gallons of ethanol per bushel of corn), it amounts to $1.53 per bushel. The only difference between

these two measures of the same subsidy is whether the subsidy is measured per gallon or per bushel.

2. Question:
You cite that the pork industry might potentially decline by 10 to 15 percent to allow industry to recoup higher production costs. A reduction of this magnitude could have significant impacts on the $15 billion pork industry.

Can you estimate the number of job losses in rural America and the overall economic impact to the industry if a 10 to 15 percent reduction were to occur in the coming years?

Response:
In their recent report, Otto and Lawrence state that "The United States pork industry represents a significant value-added activity in the agricultural economy and a major contributor to the overall United States economy. The $15.0 billion of gross receipts from hog marketings in 2005 represent only a portion of the economic activity supported by the industry. Although the hog industry in the United States has undergone rapid structural changes in recent years, total hog numbers have increased from a decade ago. About 550,200 United States jobs are involved in various aspects of the industry, ranging from input suppliers to producers, to processors and handlers as well as main street businesses that benefit from purchases by people in these industries. Overall an estimated $20.7 billion of personal income and $34.5 billion of gross national product are supported by the hog industry based on 2005 levels of production."

They break down the employment as follows:

Table 2. Economic Importance of US Pork Industry, 2006

	Total Sales ($)	Labor Income ($)	Value added ($)	Jobs
Hog Production	15,072,000,000	1,480,523,000	2,180,261,000	34,720
Rest of Agriculture	5,086,712,000	1,062,376,968	2,841,819,000	127,492
Construction	1,161,908,608	336,675,072	606,680,320	5,915
Manufacturing	41,028,765,184	4,993,928,192	6,707,470,848	110,665
Tran.Utilities	4,638,284,288	1,651,676,416	2,748,840,960	33,096
Trade	6,090,535,936	2,666,543,872	4,604,890,112	62,697
Fin.Ins.R.Estate	8,186,094,080	2,274,826,240	5,429,738,496	46,015
Prof. Services	7,839,622,656	3,269,923,584	4,486,292,480	65,224
Other Services	6,082,491,392	2,765,401,344	3,463,832,064	99,730
Government	2,193,210,624	181,819,472	1,481,158,400	3,167
Total	97,379,625,088	20,683,694,160	34,550,983,680	550,221

Source: IMPLAN Model for US

If the U.S. hog industry were 10 percent smaller, all of the employment activities that result from pork production would also fall by 10 percent. Most of these lost jobs would be in rural America.

3. Question:
From your testimony, it is apparent that current corn prices, the increasing demand for com for ethanol production, and the host of federal and state incentives to spur ethanol production could further exacerbate consolidation in hog and poultry sectors. Are you concerned that continued incentives for ethanol production could both reduce the size and limit the international competitiveness of the U.S. hog industry?

Response:
The competitiveness of the U.S. pork industry depends heavily on access to feed corn and soybean meal. As land is taken out of feed corn and soybean production and used in biofuel production, this competitive advantage will be eroded. A particularly troublesome situation will occur if the U.S. ever imports corn. In this situation U.S. pork producers will be forced to pay higher prices for feed than their international competitors, and the U.S. could lose its enormous pork export market.

4. Question:
Agricultural concentration and competition issues will be at the forefront of the Farm Bill debate in the coming months. Many Senators are concerned that the livestock sector continues to consolidate resulting in fewer buyers for producer products and diminishing the ability of farmers and ranchers to negotiate sales.

Are you concerned that additional incentives for ethanol production coupled with efforts to limit contracting options, packer ownership bans, and other competitiveness issues in the Farm Bill could in fact accelerate consolidation and concentration in the livestock and poultry sector?

Response:
As market forces reduce the total size of the U.S. pork industry, many producers who have older buildings and higher variable costs will be the first to exit the industry. These producers typically produce fewer hogs than the average producer, and to this extent, the ethanol boom will increase the proportion of hogs coming from larger operations.

5. Question:
You state in your testimony that the economic outlook for the future of the pork industry was "rosy" given the worldwide demand for pork and several pending free trade agreements. However, the diversion of feed grains into biofuel production has changed the outlook from rosy to uncertain.

If the current prices for corm do not abate in the near future and the U.S. government continues to subsidize the expansion of the ethanol industry, what is the long-term outlook for the U.S. pork industry?

Response:
The only way that the pork industry can pass along higher production costs is to reduce pork production so that pork prices rise. Because the pork industry is not vertically coordinated, this output reduction can only occur if the industry experiences a series of losses (and some producers exit the industry). Therefore the outlook for the industry for the next several years is poor.

6. Question:
Much of the impact of the growing ethanol industry on the livestock sector will be dependant on the ability of species to incorporate ethanol co-products into their diets. Several studies have indicated that ethanol co-products are higher in fat, fiber and net energy and thus are more suitable for cattle diets. This could make co-products less suitable for hog and poultry industries.

Additionally, in your testimony, you state that corn comprises approximately 75 percent of swine diets and pork producers will only utilize DDGS as 10 percent of swine diets.

Have the Iowa Pork Producers performed an analysis on how to better utilize corn ethanol co-products in hog diets?

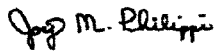
Response:
As far as I know the Iowa pork industry has not funded this research. However we are aware of some excellent work at the University of Minnesota by Dr Jerry Shurson. His results indicate that DDGS are worth significantly more to beef, dairy and even poultry operations than they are to swine. His work is based on very high-quality DDGS. This result suggests that other livestock sectors will be able to bid up the price of DDGS to a level that is just out of the reach of pork producers.

7. Question:
Mr. Gourley, in your testimony you raise some serious animal performance concerns related to the feeding of DDGS to swine. As a swine nutritionist, what do you think this Committee should consider as it thinks through the issue of additional research on DDGS?

Response:
We need a DDGS product that is worth at least as much per ton in a hog ration as it is in cattle or dairy rations. Therefore we need research that asks whether there is a way to prepare DDGS that are as suitable for hogs as they are for other livestock species. So long as this product is worth more in the diets of these other species, it will not be priced at a level that is economically viable for pork producers.

If you have any further questions regarding the testimony of Mr. Gourley, please contact Kirk Ferrell at the National Pork Producers Council at (202) 347-3600. Thank you for your assistance.

Sincerely,



Joy Philippi
President
National Pork Producers Council

Loni Kemp
Additional Questions and Answers for the Record

Committee on Agriculture, Nutrition and Forestry
January 10, 2007 Full Committee Hearing on
Agriculture and Rural America's Role in Enhancing National Energy Security
Submitted February 16, 2007

Q. Senator Saxby Chambliss asked: You suggest full funding for the Conservation Security Program and new biomass incentives, possibly a several-million acre biomass reserve, as policy options for the 2007 farm bill. With the expectation that resources in the next farm bill will be limited compared to new demands, how should we pay for these ideas?

A. If CSP and EQIP were fully funded, those existing programs could go a long ways to help farmers establish biomass crops. With perennial cellulose crop establishment written into those program's rules, farmers could use EQIP to cost share the conversion itself, including field preparation, seeding, and management. CSP would reward the environmental benefits of perennial cellulose on an ongoing basis, with provisions for wildlife benefits. USDA could even target signups to an area surrounding a potential ethanol facility, to ensure that supply is close to the markets. Conversion of row crop acres to perennial biomass will have so many benefits for the environment that in the long run it will save the government money, and of course it will help keep commodity prices stable to avoid commodity subsidy payments.

Q. Senator Chambliss asked: Expectations are that corn acres will increase this year to meet additional ethanol demand. You recommend reinvigorated conservation compliance. Do you have specific suggestions as farmers try to maximize acres and yields?

A. Conservation Compliance must be enforced so that government payments do not support corn expansion at the expense of the environment. Enforcement of compliance rules would keep producers from expanding crop production onto highly erodible land (HEL)or wetlands. As originally envisioned, conservation compliance systems were designed to reduce soil erosion to the soil loss tolerance level. The law should be restored to that standard. Conservation compliance should be re-linked to the crop insurance program to help ensure the over $3 billion a year that taxpayers fund does not inadvertently increase erosion or wetland loss. New provisions could recognize that nearly half of all excessive erosion is occurring on non-HEL, and extend compliance requirements to all excessively eroding cropland that receives program and insurance benefits. Sodbuster rules could be strengthened to prohibit all subsidies on native prairie and permanent grasslands without a cropping history if such land is cropped in the future. Finally, compliance could be expanded to require a basic level of nutrient management as a condition of program eligibility.

Q. Senator Chambliss asked: You have said that Congress should eliminate commodity programs and instead greatly enhance payments through the Conservation Security Program (CSP). In order to meet our WTO obligations, the amount of the payment cannot exceed the cost of implementing the practice. Such a large influx of money would look like an income support program to those most critical of U.S. farm programs. Do you think we would have difficulty modifying the existing program so it would be WTO legal and would farmers support the program if it only compensated for the cost of compliance rather than provided additional incentives for conservation practices?
[Here is the Text of the WTO Agreement on Agriculture, Annex 2.]
"Payments under environmental programmes

(a) Eligibility for such payments shall be determined as part of a clearly defined government environmental or conservation programme and be dependent on the fulfillment of specific conditions under the government programme, including conditions related to production methods or inputs.
(b) The amount of payment shall be limited to the extra costs or loss of income involved in complying with the government programme."

A. Actually, I did not say that Congress should eliminate commodity programs. As to the question of whether a fully funded CSP, as passed in the 2002 farm bill (which I did endorse), would cause the payments to <u>not</u> qualify for the WTO "Green Box" of allowable payments to farmers, I believe that the answer is no. CSP was explicitly designed to comply with the WTO Agreement on Agriculture as an environmental program falling clearly within the allowable Green Box.

CSP pays for conservation performance, compensating for ongoing costs of planning, management, labor, foregone income, and out-of pocket costs. In some cases payments are computed on a per acre basis, but they are based on cost. Whether the practice is new or existing makes no difference. There is no doubt that CSP can contribute to farm income, but it is in the form of compensation for costs related to environmental performance, not related to price or production. CSP payments are Green Box legal because they are trade-neutral, having no pattern of affecting farmers' cropping decisions. Direct payments as designed in the 2002 farm bill, on the other hand, were declared not trade-neutral, and therefore not Green Box, because they are somewhat tied to production decisions. They go only to commodity growers; they are based on past production acreage and volumes; and -- most importantly -- they prohibit shifting into fruit and vegetable production and therefore do affect cropping decisions. It is true that Green Box regulations may need to be clarified and watched, but CSP is clearly within its intent.

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Hon. Saxby Chambliss
U.S. Senate
Washington, DC

Dear Senator Chambliss:

In response to your questions during the January 10, 2007 Committee on Agriculture, Nutrition and Forestry hearing to discuss agriculture and rural America's role in enhancing energy security please find my following comments:

1. We believe the pressure on corn will be eased through genetics and other energy feedstocks for ethanol production. We are already seeing an increase in corn acreage which should increase supply in 2007. Longer term we believe in genetics and the prospect of 300 bushel per acre averages within twenty years. We also believe that cellulosic technology will develop over the next decade to the point it will become complimentary to corn based technology in order to meet the energy security goals outlined by the President. We also think the inclusion rates of DDGS in animal diets will increase which will be beneficial to livestock production. We do not believe the United States will lose a significant portion of our livestock industry for the reasons outlined above so it is not possible for us to answer the second part of your question.
2. Continued public policy support for both the RFS and blender's credit is dependent upon the energy security goals for the U.S. The RFS sends a strong signal to the petroleum industry that *everyone* must use renewable energy or purchase credits. This action has gone a long way to break down oil industry bias against competitive non-fossil fuels. The blender's credit has made the transition to greater ethanol use much easier by providing a market-based incentive for our customers to use it. The level of this credit throughout history has been just about right, although at times it has not seemed to be enough and at other times more than needed. Because it is a credit rewarding domestic productivity it has historically more than paid for itself through the taxes we pay and through reduced farm support payments – the savings on corn LDP payments this year alone is $6 billion according to the Committee hearing. None of the benefit

would occur if all U.S. ethanol was replaced with imported gasoline, which is what would happen absent public policy support. Also, the full cost of fossil fuels on American society is not reflected at the pump. So again this really a question of public policy support for either more imported energy or more home-grown renewable energy.

I trust these comments to your questions is helpful I would be please to expand further if you have any follow up questions.

Sincerely,

Ronald H. Miller

Senator Saxby Chambliss
Questions for the Record

Committee on Agriculture, Nutrition & Forestry
Full Committee Hearing on
Agriculture and Rural America's Role in Enhancing National Energy Security

January 10, 2007

Questions for Dr. Pacheco

15. You note that the "Billion Ton" study illustrates the resources are available to produce 60 billion gallons of biofuels by 2030.

- Are you convinced that the estimates and assumptions are sound and there are no limitations on the amount of biomass available?

Dr. Pacheco's 2/5/07 response: *Yes, I am convinced that the estimates and assumptions in the "Billion Ton" study are sound, and that there is ample biomass available to meet and exceed the 60-billion gallons of ethanol target by 2030. We have estimated that to reach the 60-billion gallon ethanol goal, just over 500-million tons of biomass will be needed, less than half of the 1.3 billion tons reported in the "Billion Ton" study. The "Billion Ton" study was developed as a technically viable resource assessment scenario by experts at both DOE and USDA. This study has been read by a great number of professionals in the agriculture, forestry, and energy industries since it was issued almost two years ago. DOE and USDA have received feedback from the forest products industry that our estimates of forest biomass resource potential are very conservative.*

- For example, while estimates for corn stover might be realistic, might others advocate require leaving higher percentages on farmland to improve soil and water quality?

Dr. Pacheco's 2/5/07 response: *The amount of residue that needs to be left on the field is a valid question. The amount will vary in different regions of the country as well as geography within those regions. The corn module used in the "Billion Ton" study is quite rigorous; the estimated amount of corn stover removed was assumed to be about 30% on average; leaving the remaining 70% on the farmland to maintain soil and water quality. The authors of this report feel that this is a very conservative estimate.*

A national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy

NREL National Renewable Energy Laboratory

Innovation for Our Energy Future

January 17, 2007

The Honorable Tom Harkin
Chairman of U.S. Senate Committee on Agriculture, Nutrition & Forestry
The United States Senate
731 Hart Senate Office Building
Washington, DC 20510

The Honorable Blanche Lincoln
The United States Senate
355 Dirksen Senate Building
Washington, DC 20510-0404

Senators Harkin and Lincoln:

In the Q&A session that followed my testimony during the hearing of the U.S. Senate Committee on Agriculture, Nutrition and Forestry on January 10, 2007; Senator Lincoln asked for additional information about a new biofuels technology that is emerging around the world.

The technology in question comes under many different names, but in all instances it consists of feeding biomass derived oils rich in triglycerides to a conventional hydrotreating unit used in petroleum refining to process diesel fuel. As I testified on the 10th, diesel fuel made in this manner originates from biomass and is of very high quality. The precise amount of oil derived from biomass can be quantified, even if the biomass oil is process at the same time and in the same hardware with the petroleum diesel. Such calculations are straight forward and well-established using conventional chemical engineering principles.

Here is a link to the June 2004 NREL report by Tyson, Bozell, Wallace, Petersen, & Moens (http://www.nrel.gov/docs/fy04osti/34796.pdf that discusses the technology that Senator Lincoln asked about on pages 27-28. This is the first NREL report I am aware of that recognizes this novel biofuel. The technology was known as Agtane in 2004. Senator Lincoln may already have a copy of this reference. I was mistaken when I described it as a 2002 report during the Q&A; it is actually a 2004 report.

Related to Senator Lincoln's inquiry, similar renewable diesel fuel products and technologies have appeared in the literature since 2004:

- UOP refers to a very similar product as "Green Diesel."
- Petrobras in Brazil refers to a similar product as "H-Bio diesel."
- Neste Oil in Finland refers to a similar product as NexBTL Diesel.
- CANMET Energy Technology Center in Canada refers to a similar product as "SuperCetane"

Enclosed are brochures or publications that we have collected over the past year here at NREL on all of these emerging technologies. They all appear to be very minor variations of the same general technology. For convenience and to distinguish these fuels from FAME (fatty acid methyl esters, i.e. biodiesel), I refer to all of these technologies as "green diesel".

Per Senator Lincoln's request, I have also provided a hard copy of a 2-page fact sheet that NREL prepared on this subject matter in July of 2006 at the request of Eric Solomon, Assistant Secretary - Tax Policy and his staff in U.S. Department of Treasury.

Please understand that NREL has in the past, and continues to conduct research in support of the National Biodiesel Board and its members, as well as research in support of at least two different companies that are studying and developing the green diesel type of approach. We recognize that in some ways these two approaches compete for the same biomass feed resource, but as a National Laboratory, our mission is to help all renewable technologies succeed. So that the marketplace can determine which technology is most effective.

Thank you for the opportunity to testify before your Committee. I applaud you for tackling these difficult issues, and I was most impressed with how well-informed the committee members were on so many different aspects of biofuels. I hope my testimony, answers to the committee's questions, and this follow-up has benefited your important work.

Respectfully,

Dr. Michael A. Pacheco
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National Renewable Energy Laboratory
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Senator Tom Harkin
Questions for the Record

Committee on Agriculture, Nutrition & Forestry
Full Committee Hearing on
Agriculture and Rural America's Role in Enhancing National Energy Security
January 10, 2007

1. You mentioned in your written testimony that you think that we can achieve ethanol production of between 12 and 15 billion gallons by 2012. Bill Tierney, an economist who used to work for USDA's World Board, has estimated that current capacity plus planned expansion could lead to production of as much as 26 billion gallons by 2009. What do you think are the likely sources of the significant difference between those two estimates?

Response: The Renewable Fuels Association (RFA) reports that ethanol production capacity is about 5.6 billion gallons per year (February 12, 2007). RFA also reports that the capacity of plants currently under construction (78) and expansion projects (7) is 6.2 billion gallons for a total production capacity of plants in operation and under construction and expansion of about 11.8 billion gallons per year. The RFA production capacity estimates include plants that are currently under construction and should begin operation within a year or two. Additional plants are undoubtedly in some stage of planning and some are expected to be built. In addition, more expansion projects of existing operating plants are likely. Therefore, it is possible to reach 12-15 billion gallons ethanol production capacity by 2012.

Unlike the RFA reported data, Mr. Tierney's ethanol production capacity estimates appear to include ethanol plants that are in different stage of planning, but actual construction has not yet started. For Mr. Tierney's projection of 26 billion gallons of ethanol production to be realized by 2009, construction of additional facilities would need to proceed at a much faster pace than indicated by the RFA data. The extent to which these planned plants actually break ground is unknown and will likely depend on the rate of return on investment in ethanol production over time.

2. Due to the jump in natural gas prices over the last few years, a lot of ethanol plant operators have switched from natural gas to coal to generate electricity to run their facilities. What effect does that type of switch have on the net energy balance of ethanol and on the net greenhouse gas impact of using ethanol versus conventional gasoline?

Response: Natural gas prices have fluctuated over the last four to five years. The annual average wellhead price of natural gas price in the United States increased from $2.95 per thousand cubic feet (MCF) in 2002 to $7.33 per MCF in 2005 and then declined to $6.43 per MCF during January–November 2006.

A few ethanol plants have switched to coal. These plants are doing so to take advantage of cogeneration which reduces overall energy costs. Switching from natural gas to coal is expensive and requires a large amount of capital. The capital costs for the boiler and steam turbine for the production of electricity are as high as $60 million for a 50 million gallon per year ethanol plant. This would be an additional capital investment for building an ethanol plant. Due to the large capital costs, we believe only a few ethanol plants have made this additional investment.

It is more energy efficient and less expensive to produce electricity and steam within the ethanol plant if the ethanol plant uses a cogeneration system instead of buying natural gas for steam and electricity from the grid. Therefore, the net energy balance of corn ethanol will improve when ethanol plants produce both steam and electricity within the plant. Regarding the substitution of coal for natural gas absent the production of electricity, we have not estimated the effects of that on the net energy balance of ethanol production, and a life-cycle analysis would be needed to determine the net energy balance.

Regarding greenhouse gas emissions, coal emits 25.92 million metric tons of carbon per quadrillion BTU of energy produced. Natural gas emits 14.47 million metric tons of carbon per quadrillion BTU of energy produced (or 55 percent of the emissions from a comparable amount of coal). To the extent that a plant shifts to coal from natural gas, overall greenhouse gas emissions will increase. However, since switching to coal in many cases also involves switching to a cogeneration system, a life cycle analysis is required to determine the net greenhouse gas impacts.

A further point is that the amount of thermal energy used to produce a gallon of ethanol is declining due to the introduction of new technologies and new processes in ethanol production. For example, a heat exchanger captures waste heat from one process and uses it in another process. In addition, new technologies such as no cook or cold cook (introduced by Broin Companies) reduces energy used in cooking starch and converting starch to glucose (by about 1,800 BTU per gallon). Use of molecular sieves to remove the water from ethanol instead of isotropic distillation has also reduced energy use per gallon by 3,000 BTU per gallon.

Senator Saxby Chambliss
Questions for the Record

Committee on Agriculture, Nutrition & Forestry
Full Committee Hearing on
Agriculture and Rural America's Role in Enhancing National Energy Security
January 10, 2007

1. **During the question and answer session subsequent to your oral remarks, you noted that it might be necessary to incentivize biomass production by farmers and ranchers in order to feed a cellulosic ethanol industry. As you know, the joint Department of Energy/Department of Agriculture "Billion-Ton" study noted the United States is "capable of producing a sustainable supply of biomass sufficient to displace 30 percent or more of the country's present petroleum consumption." (Executive Summary, page 1).**

    - **If the United States already can supply the biomass necessary for a 60 billion gallon market, is it necessary to promote additional production that will directly compete with existing acreage already planted to other row crops.**

Response: Producing 60 billion gallons of ethanol per year would require 700 to 750 million dry tons of biomass materials annually, depending on how much ethanol can be produced from each ton of biomass. The United States has the potential of producing 700 to 750 million tons of biomass material annually in the future. However, farmers will only produce energy crops if the net returns per acre for energy crops are at least equal to or higher than the net returns they receive from planting other crops.

The "Billion-Ton" study concluded that the land resources of the United States are technically capable of sustainably producing almost 1.4 billion tons of biomass per year, enough to produce about 110 billion gallons of ethanol per year. The study also found that using a significant amount of this biomass requires a "concerted R&D effort to develop technologies to overcome a host of technical, market, and cost barriers". For example, providing almost 1 billion tons of biomass from agricultural lands would require increasing corn, wheat, and other small grain yields by 50 percent; doubling residue-to-grain ratios for soybeans; developing much more efficient residue harvesting equipment; managing active cropland with no-till cultivation; growing dedicated energy perennial crops on 55 million acres of cropland, idle cropland, and cropland pasture; using animal manure in excess of can be applied on-farm for bioenergy; and using a larger fraction of other secondary and tertiary residues for bioenergy.

The "Billion-Ton" study did not include an economic or environmental analysis to identify the economic or environmental conditions under which one billion tons of biomass would be produced. According to Oak Ridge National Laboratory,

there are currently about 60 million tons of corn residues available at cost of $30 per dry ton. The estimate of available corn residues takes into consideration the need to leave some residue in the field to meet erosion, moisture, and equipment constraints and represents about 30 percent of the total amount of corn stover produced in the United States. If the entire U.S. corn crop is planted to the no tillage system, then about 100 million dry tons of corn stover could be available annually. The $30 per dry ton cost includes the cost of harvesting the stover and the cost of replacing nutrients lost through the removal of the stover, but does not include the cost of transporting the stover to the ethanol plant. To reduce harvesting costs of corn stover, the Idaho National Energy Laboratory and the John Deere Company are working together to build a one pass combine to collect grain and stover simultaneously. The "Billion-Ton" study was an estimate of the potential feedstocks. Clearly, more study is needed, testing various assumptions. However, the United States has the potential to produce large amounts of biomass.

To reduce production, harvesting, storage, and transportation costs of biomass materials, large amounts of research funds for Research and Development and Demonstration are required. In addition, net returns per acre of energy crops under current technologies and farm programs are significantly lower than net returns for traditional commodities.

2. **Regarding the DOE/USDA "Billion-Ton" study, do you agree with the assumptions and conclusions of the report? In your opinion, is the resource base cited capable of producing 1.3 billion tons of biomass feedstock and can the total volume be processed while also meeting our national goals of conservation and environmental protection? If not, please explain where the report is deficient.**

Response: The "Billion-Ton" study shows the United States has the potential to produce almost 1.4 billion dry tons of biomass materials in 2030. The study is an accounting of different sources of biomass that could be used in the production of ethanol. The 1.4 billion tons of biomass materials include forest residues, crop residues, energy crops, manure, and organic portion of municipal solid waste.

The "Billion-Ton" study did not include an economic or environmental analysis to identify the economic and environmental conditions under which one billion tons of biomass would be produced. Consideration of the production, harvesting, transportation, handling, storage, processing and other costs for these various biomass materials is not considered in the study. In addition, no consideration is given to future economic conditions, such as future energy demand or energy prices, nor is consideration given for population growth, which would affect the demand for food, feed, and fiber by 2030. As the study itself notes, more advanced economic and technology scenarios need to be examined.

The USDA believes that there is a large amount of biomass materials available in the United States that could be used as feedstocks for ethanol production, but additional research, development, and demonstration is needed to: increase energy crop yields; increase crop residues; and reduce production, harvesting, storage, and transportation costs of biomass.

3. **Weather in farm country is the single most important factor in terms of yields but is also the most unpredictable variable in the growing seasons.**

   - **Has USDA performed an analysis on the impacts of potential decreases in corn yields for 2007 and 2008 crop years on the livestock sector? If so, will you make those projections available to the Committee?**

   Response: USDA has not yet specifically analyzed the impact of reduced corn yields in 2007 and 2008 on the livestock sector. However, based on reported ethanol plant construction during the next two years, the use of corn for ethanol production is expected to increase sharply in 2007 and 2008. Even with a substantial boost in planted corn acres, corn supplies likely will remain relatively tight and prices relatively high for the foreseeable future. For example, the latest USDA long term projections, released in February 2007, show the average farm price for corn at $3.00 per bushel in the 2006/07 marketing year and increasing to $3.50 per bushel in 2007/08 marketing year. Yield reductions due to unfavorable weather or other factors would quickly translate into even higher feeding costs for livestock producers. In addition, price volatility would likely increase, creating additional risk management challenges for livestock feeders.

   USDA has initiated an analysis at the request of Senator Chambliss of alternative ethanol production levels and their effects on the U.S. livestock sector. We expect to complete this assessment by this spring. In addition, USDA has a cooperative agreement with Iowa State University to examine future ethanol production and its effects on the livestock sector.

4. **Since the ethanol industry is rapidly evolving it is difficult to keep track of production numbers and new construction starts for ethanol plants. There is the danger of underestimating future demand for corn especially since farmers need to plan months ahead before planting time.**

   - **Does the current method for collecting data on new ethanol plants and expansion of existing plants allow for accurate forecasts regarding the demand for corn to be used for ethanol?**

   - **If not, what method or system do you propose to improve data reporting do ensure the market can balance supply and demand?**

Response: The current method of collecting and reporting data on new ethanol plants and expansion of existing plants are accurate. We look at plant listings made available to the public by the Renewable Fuels Association (RFA). Because it takes about 18-24 months to build an ethanol plant, there is enough time for farmers and the market to respond to higher demand for corn used for production of ethanol, assuming cropland is available. What is uncertain is the number of plants in the planning stage. Some companies announce such plans publicly and others do not. We cannot be certain that a planned plant will initiate construction until construction actually begins. At that point, the plant would be included in the RFA database. USDA utilizes the RFA data, verifies that plants are under construction and augments the data if additional plants under construction are identified.

5. **As you know, increasing amounts of dried distiller's grains and solubles (DDGS) are being exported from the United States. However, DDGS are not included in USDA's Weekly Export Sales Report.**

   - **Does the volume of DDGS exports justify their inclusion in Weekly Export Sales Reports?**

   Response: Current DDGS exports are not large enough to be included in the USDA's Weekly Export Sales Report. The U.S. Department of Commerce Foreign Trade Statistics publishes detailed export data for DDGS by country on a monthly basis. For example, in November 2006, the United States exported almost 108,000 metric tons of DDGS at a value of almost $15 million. During January to November, the value of DDGS exports increased by 50 percent from 2005 to 2006, rising from about $100 million in 2005 to $146 million in 2006. Mexico has become the fastest growing and largest market for our DDGS. In 2002, the value of DDGS exports to Mexico totaled $3 million. By 2005, the value of DDGS exports to Mexico increased to $16.5 million. By November 2006, the value of DDGS exports to Mexico exceeded $42 million. Based on this level of detail, we feel the Department of Commerce database is sufficient at this point to gauge the role of exports on the corn and ethanol markets.

   - **Is the export volume large enough to have a price impact on DDGS and competing feed ingredients?**

   Response: Exports of DDGS are rising, reflecting growing demand for this product as a feed ingredient in markets around the world. Currently, Canada, Mexico, and EU-25 are the principal markets. More than 10 percent of production is currently sold in overseas markets. This additional demand beyond domestic markets provides some support for prices of DDGS and for competing feed ingredients.

6. **Last November, the Institute for Agriculture and Trade Policy (IATP) released a report entitled *Water Use by Ethanol Plants: Potential Challenges*. The report warns that data on water supplies in the midwest are not readily available and that more research should be done and concludes: "Otherwise shortage of water could be the Achilles heel of corn-based and perhaps cellulose-based ethanol."**

   - **Do you agree?**

   Response: We agree that more research on water used in feedstock and ethanol production is needed. Current technologies require water in the production of both feedstocks and ethanol. If water became limited, then food and fiber production and ethanol production could be at risk. Some work that has been done on water use in ethanol production indicates that water used by processing plants per gallon of ethanol produced is declining over time as plants utilize more recycling of water.

7. **E85 contains about 70 percent the energy of regular gasoline on a Btu per gallon basis. Thus, fuel economy on FFVs is substantially reduced, with an average reduction in fuel economy of 26 percent for a model year 2006 FFV operated on E85.**

   - **Since U.S. consumers are extremely price conscious, do you think the driving public will be willing to pay more on a cents per mile basis to operate a vehicle on E-85?**

   Response: Ethanol has approximately two-thirds the energy content when measured on a BTU as that of gasoline, but ethanol also has a high octane rating of 113-115. Therefore, mileage per gallon of E-85 is less than gasoline, unless the engine/vehicle is designed for high octane fuel use, such as a vehicle with a high compression engine.

   How consumers respond to E-85 and lower mileage per gallon than regular gasoline depends on a number of factors for individual consumers. Some are willing to pay higher prices per mile for a domestically produced fuel. They currently demonstrate that when they buy Flex-Fuel Vehicles (FFV). In addition, when buying gasoline powered vehicles rather than diesel powered vehicles, consumers have implicitly opted to pay a higher cost per mile for gasoline relative to diesel in part, because they want to avoid the higher purchase price of a diesel engine and because they prefer the performance of gasoline engines.

   We would expect that ultimately all transportation fuels would compete on a BTU basis, and as such, the price of E-85 would be discounted relative to gasoline. In a competitive world with full information, sufficient ethanol supplies, and wider use of FFV with current FFV technology, the

price for E-85 and gasoline would likely be equal on a BTU basis. Hence, there would be no difference in the fuel cost per mile. Current market data reflects, in part, the differences in energy value. The Energy Information Administration reports that the average Midwest retail price of gasoline for on January 1, 2007 and January 8, 2007 was $2.26 and $2.21 per gallon, respectively. The Ethanol and Biodiesel News reports that the average Midwest price of E-85 on January 4, 2007 and on January 11, 2007 was $1.99 per gallon (same price for both days). These data reflect an E-85 discount of 10-12 percent.

Unless E-85 provides higher vehicle performance, consumers will not pay a premium for it. Saab has flex-fuel cars for sale in Europe that incorporate variable compression ratio engines that produce more power on E85 than they do on gasoline. These cars, however, are not yet available in the U.S.

- **Does the experience of Brazilian customers provide any insight into consumer behavior in this regard?**

Response: Brazil uses 100 percent ethanol (hydrous ethanol, E-100) in ethanol-only and FFV, and gasohol (currently 23 percent anhydrous ethanol and 77 percent gasoline). One thing we have learned from the Brazilian experience is that because almost all gas stations have ethanol for sale (E-100), consumers can make decisions about which fuel to use relative to price and mileage. However, until the recent advent of FFV, Brazilians were unable to take full advantage of relative price differences. While data on actual FFV owners' behavior is still being developed, it does appear they are willing to switch from E-100 to a gasoline/ethanol blend (and vice-versa), depending on relative prices. In general, prices of E-100 have been maintained at levels 30 percent lower than prices of the gasoline/ethanol blend, in part through favorable taxation policies, to help encourage ethanol consumption.

8. **In your testimony before the Senate Environment and Public Works Committee last September, you mentioned the department's preliminary assessment that between 4.3 and 7.2 million acres currently enrolled in the Conservation Reserve Program could be used to grow corn or soybeans in an environmentally friendly manner.**

   - **What further analysis has USDA done on this issue? Are there other acres that potentially could be used to grow corn or soybeans to help maintain a balanced market?**

Response: USDA has not conducted additional analysis on this issue. The 4.3 to 7.2 million acres was a preliminary estimation of land enrolled in the

Conservation Reserve Program (CRP) that could potentially be used to produce corn or soybeans in a sustainable way. In that assessment we examined all CRP land in counties where 25 percent or more of harvested cropland was producing non-irrigated corn and soybeans. Only CRP land enrolled during general signups in those counties that had an erodibility index of 8 or less (4.3 million acres) and 12 or less (7.2 million acres) was considered. The higher environmentally-valued land enrolled in continuous signups and the Conservation Reserve Enhancement Program was excluded. There is the potential that CRP land in counties with less than 25 percent of cropland producing non-irrigated corn and soybeans could be put into production. However, inducing that land into corn production would likely require a significant increase in corn prices. In addition to this analysis, USDA has examined the potential acreage with an erodibility index of 15 or less and has recently examined acreage based on its land capability class.

- **What logical approach should Congress take in the 2007 farm bill to balance conservation with the demand for greater production?**

Response: We are approaching conservation by continuing and expanding commitments that have proven effective (e.g., increasing the acreage limit on the Wetlands Reserve Program and continuing the Conservation Reserve Program), improving programs as indicated by experience in the field (e.g., consolidating programs under the Environmental Quality Incentives Program), and adding elements that fill unmet needs in conservation (e.g., creating the Regional Watershed Enhancement Program to fund larger, longer-term, and multi-landowner projects to produce greater results). At the same time, the Secretary is committed to anticipating as accurately as possible the next steps in the ethanol, biodiesel, and renewable fuels industry and what we can do to support continued growth. We look forward to working with Congress in developing a farm bill that meets the appropriate balance between conservation and the future demands placed on agriculture.

9. **Ethanol blends are not sent through pipeline systems because they may pick up water and other impurities in transit. Ethanol blending occurs at the terminal rack. There have been recent reports of spot rail car shortages that occurred last year as the industry transitioned to the current RFS.**

    - **What would be the railcar/marine barge impact associated with a higher RFS?**

    Response: Early last year, the decision by refineries/blenders to replace methyl tertiary butyl ether (MTBE) with ethanol created some logistical problems, such as rail car shortage. At the present time there is no sign of a rail car shortage. Since the industry is growing and information is publicly available, related industries such as companies that produce storage tanks, rail cars, barges and trucks, and provide services such as

transportation and hauling, are also adjusting and expanding their respective capacity/service. We expect the industry to respond to market signals and adjust and make investments as necessary. Therefore, higher levels of the RFS are not expected to create logistical shortages of rail cars, transportation and hauling services, etc. However, in the short-term, as experienced last year, logistical issues such as over utilization of existing rail cars could cause problems.

10. Ethanol is known to increase motor vehicle emissions of nitrogen oxides and volatile organic compounds which are two precursors of ozone pollution.

- **To what extent will increasing the RFS make it more difficult for states to comply with EPA's tightening air quality standards for ozone?**

Response: The volatile organic compounds (VOC) and nitrogen oxide (NOx) emission increases resulting from the use of E-10 have often raised concerns for ozone non-attainment areas. For the recent proposal for the Renewable Fuels Standard (RFS) rulemaking required by the Energy Policy Act of 2005, the Environmental Protection Agency (EPA) estimated the VOC and NOx emission impacts and the resulting impact on ozone of increases in the use of ethanol as E-10. Nationwide the impacts are small, and EPA expects they will continue to decline in magnitude in the future as the in-use fleet turns over to vehicles meeting the Tier 2 emission standards. However, the effects could be felt on a local basis, with some areas already using ethanol experiencing no impact, while areas using ethanol for the first time may experience a 3-6 percent increase in VOC and NOx emissions from gasoline powered vehicles and equipment. In addition to these vehicle emission increases, new ethanol plants will also increase emissions of VOC and NOx in their local areas. These emission increases are expected to result in a corresponding increase in ozone levels, but still less than 1 part per billion. Furthermore, there is a great deal of uncertainty in these emission and air quality impact estimates given the paucity of test data available on current technology vehicles. For example, it is not clear that ethanol increases NOx output from a car with a closed-loop control of air-fuel mixture, if the car is running correctly. Every car built since 1990, however, has closed-loop control and as soon as the engine computer oxygen sees excess oxygen in the exhaust, it compensates by injecting more fuel into engine for a given amount of airflow.

11. Section 9004 of the 2002 Farm Bill authorized the Biodiesel Fuel Education Program. Do you feel that program has been successful and should it be continued in the next farm bill?

Response: The Biodiesel Fuel Education Program, which was authorized by Section 9004 of the 2002 Farm Bill, played an important role in the remarkable success recently achieved by the U.S. biodiesel industry.

The primary goals of the Biodiesel Education Program are to stimulate biodiesel consumption and to accelerate the development of a biodiesel infrastructure. The Biodiesel Education Program has created education activities that were previously not possible due to a shortage of resources. Consumers are seeking reliable information about domestic sources of renewable energy such as biodiesel and consumer education is important to developing a sustainable biodiesel industry in the United States. Results from a national survey funded by the Biodiesel Education Program found that consumer awareness of biodiesel increased from 28 percent in August of 2004 to 41 percent in December of 2005. Although the 13 percentage point increase in awareness is a major accomplishment, the majority of Americans are still unaware of biodiesel. By the time the education program expires in 2007, we expect that most Americans will be aware of biodiesel and its benefits.

Additionally, automakers and engine manufacturers such as New Holland, DaimlerChrysler, General Motors and Cummins have made major announcements publicly supporting biodiesel, including New Holland becoming the first to fully approve of a blend of 20 percent biodiesel with 80 percent petroleum diesel (B20) in all of its equipment currently in production. DaimlerChrysler announced B20 approval in the new Dodge Ram. Chevrolet has expressed support for B20 use by fleets in their Silverado pickups beginning in model year 2007. Cummins has expressed support for B20 use in all Cummins engines beginning in 2007. So, progress is evident, but there is still much work to do.

In his testimony in April of 2006 to the Senate Committee on Agriculture at a hearing on biofuels, Joe Jobe, Chief Executive Officer of the National Biodiesel Board, highlighted the strong growth of biodiesel during the last two years. Biodiesel sales increased from a half million gallons in 1999 to 28 million gallons in 2004 to 91 million gallons in 2005.

In 2007, the final authorized year of the program, more resources will be devoted to fuel quality issues. Like many growing industries, it will take time for the biodiesel industry to develop quality controls. Consequently, there have been reports of fuel quality problems in the distribution system and we expect more problems to arise. Therefore, the program is developing strategies to minimize problems and to respond rapidly to problems when they occur.

12. Biodiesel producers have indicated the value of the CCC Bioenergy Program and the need for continuation for biodiesel, albeit in a modified form. Has the Department considered how a program could aid in the continued growth of the biodiesel industry?

Response: The CCC Bioenergy Program played a major role in stimulating the initial growth in the U.S. biodiesel industry. Mostly due to cash payments provided by this program, biodiesel grew from just 5 plants in 2001 to 18 plants in 2004. The industry received another major boost with the passage of the blenders' tax credit that became effective in 2005. The Bioenergy Program and the blenders' tax credit, along with high oil prices provided the economic incentives that transformed the biodiesel industry into a major U.S. biofuel provider with an expected production of 250 million gallons in 2006.

Although the industry is concerned that Bioenergy Program payments are no longer available, the tax credit will continue until 2008. The economics of blending biodiesel have been deteriorating with falling diesel fuel prices and rising vegetable oil prices. The spot price of low sulfur diesel fuel has fallen significantly since last summer – spot diesel fuel prices in 2006 peaked at about $2.40 per gallon in August compared to $1.61 reported last week. Over this same time period, soybean oil prices increased from about $0.24 to $0.28 per pound. This amounts to about a $0.30 increase in biodiesel production cost. Biodiesel producers are finding it increasingly difficult to compete in the diesel fuel market.

U.S. biodiesel producers responded to the economic incentives created by the farm bill and the Energy Policy Act of 2005 by increasing annual production capacity to 582 million gallons (reported by the National Biodiesel Board, November 2006) with another 1.4 billion gallons expected to be added by 2008. If the blending economics for biodiesel do not improve or continue to deteriorate, many of these producers may seek economic assistance to continue, such as that provided by the Bioenergy Program. However, there are many alternative ways to support renewable energy production and any discussion of the Bioenergy Program needs to take place within the 2007 farm bill debate and in the context of the administration's energy proposals and other energy legislation under discussion.

13. At several times during the hearing you noted that the livestock industry will need to manage "adjustments" as the ethanol industry expands capacity.

- **Please define what you mean by adjustment?**

  Response: If higher feed costs are sustained, adjustment means some reduction in livestock, poultry, and milk production. In addition, adjustment means some changes in livestock feeding rations to make use of the 30 percent of corn used in ethanol that can return to animal feed as distillers dried grains—or DDGS—and other feeds. These adjustments will ultimately restore some of the returns to livestock producer.

- **Do the benefits resulting from the expansion of the biofuels industry outweigh the costs associated with "adjustments" in the livestock sector? Please explain in terms of jobs, net farm income and regional development.**

Response: The benefits and costs associated with the expansion of the biofuels industry will vary by segment of the economy. The establishment of plants will benefit producers of corn through higher corn prices and may benefit regional development through increased employment and greater economic wealth creation in rural America. However, to the extent corn prices increase, livestock producers will face higher costs which they will attempt to pass back to suppliers of other inputs (e.g., feeder calf or feeder pig producers) or along to consumers. If higher corn prices result in an extended period of poor returns, there will be a liquidation of animals and likely some contraction in the number of producers. As lower animal numbers translate into reduced meat production, livestock prices will rise, and if returns improve for an extended period of time, production will then begin to expand. However, the amount of gains and losses to the various segments will depend on the demand for corn for ethanol and consumer demand for meat.

- **At what point does biofuel expansion adversely (defined by concentration, contraction and reduced profitability) impact livestock operations? Please explain differences for each species and regions.**

Response: The impact of biofuel expansion on each sector of the livestock sector will depend on present margins and the extent to which increased costs can be passed along to further processors and ultimately the consumer.

While returns to hog producers have been favorable, they have started eroding as corn prices have risen. Hogs are unable to use DDGS for biological reasons and will be somewhat more adversely affected by increased corn prices than other species. In the recent *Quarterly Hogs and Pigs* report, on December 1, 2006, producers indicated they will slow the rate of expansion. This may reflect anticipated increased feed costs. As corn prices rise, returns likely will be squeezed, setting the stage for a contraction in production.

Cattle feeders are facing poorer returns and although they can compensate somewhat by increased feeding of DDGS, they will also attempt to reduce total costs by offering lower prices for feeder calves. In the face of increasing corn prices, feeder calf producers are thus facing lower prices in addition to currently higher hay prices and poor forage conditions. These producers may respond by reducing their breeding herds and hence reducing the calf crop. The *Cattle* report, scheduled for release on February 2, 2007 will provide an indication of producer intentions in the face of expected corn prices late last year.

The broiler sector has reduced egg sets and chick placements in response to weak returns early in 2006. Like hogs, the poultry sector is less able to use DDGS as a feed alternative. To the extent that corn prices rise, producer returns will weaken decreasing incentives to expand production. As with the

other species meats, the actual level of the corn price increase will be balanced against the increase in prices for poultry products in determining the level of production.

USDA is currently updating an economic analysis of the impact of biofuels production on the U.S. agriculture sector at the request of Senator Chambliss. This analysis will focus on the impacts of higher levels of ethanol production including impacts on the livestock industry. In addition, USDA has entered into a cooperative agreement with researchers at the Iowa State University to look at some of these issues.

14. Analysis by the Center for Agricultural and Rural Development at Iowa State has determined that current government policies and petroleum prices allows the ethanol industry to pay up to $4.05 per bush of corn and still be profitable.

Meanwhile, some trade analysts in Chicago expect corn futures to rise to $4.20 to $4.35 per bushel following the Department's most recent WASDE report. They see this as dampening ethanol-based corn demand given today's lower petroleum prices. They contend that a rationing of the corn supply will now occur in 2007 as opposed to 2008.

- **Do you agree with these analyses?**

Response: Our analyses do not suggest that corn futures prices of $4.20-$4.35 per bushel will dampen corn demand for ethanol. The extent to which rationing of supply occurs in 2007 will depend on the level of planted acreage and yield in 2007. Cash corn prices in Iowa and Illinois are currently running about $0.35-$0.45 per bushel below the nearby futures. Futures prices at $4.20-$4.35 per bushel would suggest feedstock costs for most ethanol plants would still be below $4.00 per bushel if basis levels remain near current levels. Even with recent declines in wholesale prices for unleaded gasoline, returns to ethanol producers remain above variable costs. Corn prices in 2007 and 2008 will depend heavily upon how many corn acres farmers plant and growing season weather.

A study conducted by researchers at Purdue University found that when the price of oil is $60 per barrel, ethanol producers could pay $3.96 per bushel of corn and allow a plant to be paid off in 15 years and equity investors to earn 12 percent per year. The study further notes that the capital cost component of ethanol production costs is about $0.30 per gallon or $0.80 per bushel; meaning that existing plants with capital costs already covered could pay up to $4.76 per bushel of corn.

15. Section 1501 of the Energy Policy Act of 2005 authorizes the Department of Energy in consultation with the Secretary of Agriculture and the Secretary of

Energy to waive the renewable fuels mandate for one or more states if it is determined that implementing the RFS requirements would severely harm the economy or the environment, or that there is an inadequate domestic supply to meet the requirement.

- **Since the decision to invoke or not to invoke this waiver would have important consequences for various parts of the agriculture sector, has the Administration determined the threshold criteria to be used that would determine severe harm to the economy or the environment?**

Response: The Administration has not determined a threshold criteria to determine severe harm to the economy or the environment. In their proposed rule printed in the Federal Register on September 22, 2006, the EPA stated "Given that state petitions for a waiver of the RFS program are unlikely to affect renewable fuel use in that state, we are not proposing regulations providing more specificity regarding the criteria for a waiver, or the ramifications of Agency approval of such a waiver in terms of the level or applicability of the standard. However, states can still submit petitions to the Agency for a waiver of the RFS requirements under the provision in the Energy Act." EPA did request comment on this approach.

On February 3, 2006, U.S. Department of Energy Secretary Bodman did inform U.S. Environmental Protection Administrator Johnson that "...DOE does not believe that the RFP will have adverse impacts on consumers in 2006 on a national, regional or State basis." As a result, DOE did not recommend a waiver of the RFP requirement for 2006.

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American Forest & Paper Association
Agenda 2020 Technology Alliance
Statement for the Record

U.S. Senate Agriculture, Nutrition, and Forestry Committee
The Role of Rural America in Enhancing National Energy Security
January 10, 2007

The American Forest & Paper Association's (AF&PA) Agenda 2020 Technology Alliance welcomes this opportunity to present its views on the role of rural America in enhancing national energy security. The forest products industry can be an important resource in accomplishing the nation's shared biofuel goals, particularly for production of cellulosic ethanol. The industry strongly supports private/public investments in Integrated Forest Products Biorefineries (IFPBs), which are conservatively estimated to have the potential to annually produce nearly 2 billion gallons of ethanol, another 10 billion gallons of other renewable transportation fuels, and as much as 20,000 MW of biomass power. **Our intention is to facilitate growth of domestic production capacity for renewable fuels using the industry's existing infrastructure. Introduction of IFPBs will advance national goals for energy, environmental performance, and economic competitiveness of U.S. industries. In addition to re-invigorating a critical sector of the U.S. economy, IFPBs could revitalize the primarily rural communities where our industry is based.**

The Agenda 2020 Technology Alliance is an industry-led partnership with government and academia that holds the promise of reinventing the forest products industry through innovation in processes, materials and markets. The collaborative, pre-competitive research, development, and deployment supported through Agenda 2020 provide the foundation for new technology-driven business models that will enable our industry to meet competitive challenges, while also contributing solutions to strategic national needs. The technology solutions developed through Agenda 2020 are aligned to provide solutions to the competitive challenges faced by the U.S. forest products industry, which accounts for approximately 6 percent of the total U.S. manufacturing output, employs more than a million people, and ranks among the top 10 manufacturing employers in 42 states with an estimated payroll exceeding $50 billion.

As is the case with many U.S. manufacturing industries, we face serious domestic and international challenges. Since early 1997, 128 pulp and paper mills have closed in the U.S., contributing to a loss of 85,000 jobs, or 39% of our workforce. An additional 60,000 jobs have been lost in the wood products industry since 1997. New capacity growth is now taking place in other countries, where forestry, labor, and environmental practices may not be as responsible as those in the U.S. In addition, globalization, aging process infrastructure, few technology breakthroughs, as well as recent financial performance and environmental concerns, hinder the ability of U.S. companies to make new investments. Each year without new investments, new technologies and new revenue streams, we lose ground to our overseas competitors.

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Agenda 2020: Creating Value Through Innovation

One approach being taken by our industry to address these challenges is represented by Agenda 2020, our industry's technology alliance. Agenda 2020 was initiated in 1994 in partnership with the Department of Energy to improve energy efficiency and accelerate the delivery of new technologies to our manufacturing processes. Now organized as a membership alliance within AF&PA, Agenda 2020 is building on a decade of tangible results to expand its federal and state partnerships, and establish new international and cross-industry collaborations. Current federal partnerships, in addition to the existing efforts with the Department of Energy, include projects with the U.S. Forest Service and the CSREES (Cooperative State Research, Education and Extension Service) programs of the U.S. Department of Agriculture (USDA), as well as the National Science Foundation.

Agenda 2020's technology initiatives leverage these collaborative partnerships to drive innovation in the forest products industry's processes, materials, and markets. Technology objectives are defined to address shared industry and national strategic goals. The research, development and deployment (RD&D) projects coordinated through Agenda 2020 provide the foundation for new technology-driven business models. **The objective is to create options to meet industry's competitive challenges, while contributing solutions to strategic national needs associated with energy, the environment, and the economy.**

Agenda 2020 builds on our industry's strategic advantage as stewards of abundant, renewable and sustainable forest materials. Since we are also owners of the fundamental infrastructure for its conversion, our industry has the potential to produce new renewable bio-based products – fiber, fuels, chemicals, and power – with "smart" properties and high performance characteristics. Agenda 2020 initiatives are designed to use emerging technologies, such as biotechnology and nanotechnology, coupled with breakthrough advances in process and conversion technologies, to create and capture value from both new and traditional products.

Integrated Forest Products Biorefineries (IFPBs)

Through Agenda 2020's *Advancing the Forest Biorefinery* initiative, the forest products industry can evolve existing infrastructure to develop *Integrated Forest Products Biorefineries (IFPB)* — geographically distributed facilities that process both forest and agricultural materials to produce renewable "green" bio-energy and bio-products This can be done while preserving existing traditional product lines, creating higher skilled and better paying jobs, strengthening rural communities, and opening new domestic and international markets for forest products companies. These IFPBs would contribute to reducing greenhouse gas emissions and dependence on foreign fossil fuel by substituting domestic, renewable ligno-cellulosic materials as the feedstock for products now derived from nonrenewable carbon. If fully developed and commercialized, these technologies could produce enormous energy and environmental benefits for the industry and the nation both, including contributing to a diversified, more secure national energy supply. **Recent estimates by Princeton University show an industry-wide potential to displace at least 2.2 billion barrels of oil, with an additional benefit of cutting approximately 100 million tons of carbon emissions annually.**

The general IFPB concept features both cultivation and conversion of ligno-cellulosic materials to produce bio-energy and bioproducts in conjunction with manufacturing traditional forest products. High-quality feedstocks can be cultivated in specially engineered softwood and hardwood plantations. Once the trees have been harvested, IFPBs present opportunities to make bio-based fuels or chemicals at several points in the manufacturing process. Biomass residuals and/or residual pulping liquors can be gasified. The waste heat from the gasification can be used for combined heat and power at the mill, displacing use of natural gas, fuel oil and/or purchased electric power. Furthermore, the resulting synthetic gas can be converted to electric power, transportation fuels (including ethanol), hydrogen, and/or to high value chemicals. Even before entering the manufacturing process, hemicelluloses can be extracted from the residuals from wood products manufacturing or from wood chips destined for pulping. The hemicelluloses are then converted to cellulosic ethanol or chemical intermediates.

The forest products industry companies participating in Agenda 2020 are focusing on three component areas to develop and implement the enabling technologies for IFPBs:

- ***Value Prior to Pulping (VPP)*** seeks cost-effective, high-yield processes to separate and extract selected components from wood prior to pulping, and to process the extracted components to produce commercially viable chemical and liquid fuel products. An Agenda 2020 consortium of forest products industry companies has partnered with enzyme companies, national laboratories and universities on a major research project to extract hemicelluloses and convert them to ethanol or a biochemical feedstock. The project, which is being administered by CleanTech Partners in Madison, WI, recently was awarded a $1.5 million DOE grant, to be matched with a $1.2 million cost share by industry and its partners. If this project is successful, **these technologies could be ready for commercial-scale demonstration within 2 years. Assuming adoption by 75% of existing Kraft pulp mills alone, the minimum annual ethanol production would be in the range of 1.9 to 2.4 billion gallons using feedstocks already available at mills. Based on USDA/DOE estimates of the biomass that could be made available on a sustainable basis for biofuel conversion, the potential for ethanol production could nearly triple.**

- ***New Value Streams from Residuals and Spent Pulping Liquors*** addresses the opportunity to manufacture bio-products from the co-products of the manufacturing process. The objective is to use gasification technologies to convert biomass, including forest and agricultural residues and spent pulping liquor (black liquor), into a synthetic gas (syngas), which subsequently is converted into liquid fuels, power, chemicals and other high-value materials. In addition, waste heat from the gasification process can be used to displace the mill's consumption of fossil fuels and purchased power. Initial estimates from feasibility studies conducted at several paper mills indicate the potential to offset 90,000,000 MCF of natural gas consumption and 80 GWh of purchased electric power. Gasification and gas-to-liquids technologies for production of transportation fuels are currently being commercialized in the petroleum sector. **However, the applications within the forest products industry will require additional public/private investment to address technical challenges related to adapting to the scale of our mills and integrating with our existing manufacturing processes to maximize utilization of energy streams and minimize waste, thereby ensuring maximum energy and environmental benefits. With**

federal support, forest products industry facilities could be producing transportation fuels from gasification within 5 years. The industry-wide potential production volume for renewable fuels using these technologies is 10 billion gallons per year. The net fossil fuel savings is estimated at 16 Quads (16,000 billion BTUs).

- ***Sustainable Forest Productivity*** applies biotechnology and nanotechnology breakthroughs to sustainable forestry to manage U.S. forest land at a high intensity to supply affordable, sustainable biomass supplies of high quality. This longer-term research focuses on developing fast-growing biomass plantations designed to produce economic, high-quality feedstocks for bio-energy and bio-products. From an energy "life-cycle" perspective, these feedstocks could be vastly superior to the current use of crops or residues. **In the short-term, IFPBs will draw from an abundant sustainable supply of forest-based biomass (estimated by USDA and DOE to be 368 million dry tons/year), which is 2.5 times current consumption. In the long term, the advanced forest management practices and customized biomass cultivation enabled by this research will not only augment IFPB yield, but will also lead to healthier forests.**

Rural Communities are Critical to IFPBs

The forest products industry's manufacturing facilities are an ideal foundation to develop IFPBs. Those facilities, which today produce pulp, paper and wood products, also are geared to collect and process biomass. Rather than creating a "greenfield" operation, additional bioconversion or thermochemical processes can be built around existing mills (either as extensions of the mill or as "across-the-fence" operations) to generate bio-energy or manufacture bio-products. This presents industry with dramatic potential to increase the productivity and profitability of its manufacturing infrastructure. Possible benefits include: improved efficiency of raw material utilization, protection of traditional product lines, creation of higher skilled and better paying jobs, and access to new domestic and international markets for bio-energy and bio-products.

The choice of whether to manufacture power, fuels and/or chemicals would be driven by mill economics and location. It is important that policies encourage private/public investments in RD&D to bring IFPB technologies into full commercial use. This is especially important to our industry, as our renewable fuel production capabilities will kick in more fully after 2009.

The IFPB uses an abundant, renewable, sustainable resource: forest material. Because forest material is carbon neutral, the bio-energy it produces helps reduce greenhouse gas emissions. Bio-energy also helps ease dependence on foreign fossil fuel by substituting for products now derived from nonrenewable carbon. By installing key IFPB technologies such as black liquor gasification, existing facilities could reduce emissions by 80-90 percent. Since forest products mills are located throughout the country, renewable bio-based fuels can be supplied more economically throughout the country. This improves both the diversity and security of the national energy supply.

Both the U.S. national and regional economies stand to benefit from implementation of the IFPB. Global competition has led to numerous domestic mill closings as production moves overseas. These closings impact mostly rural communities. The IFPB offers an opportunity to preserve high paying, skilled jobs and revitalize manufacturing facilities in these communities – all while creating

a new domestic bioindustry based on one of the world's largest sustainable biomass supplies. **However, these benefits cannot be realized if forest products mills continue to move overseas. Assisting the development of domestic market demand will make it economically feasible to keep operating existing infrastructure and install IFPBs throughout the country.**

Working Together to Address Key Challenges

Our industry welcomes the opportunity to work with the Senate Agriculture Committee to address the key challenges that exist to realizing our potential as an important contributor to national biofuels goals. Working with our partners in the federal government, Congress, and the private sector, addressing these obstacles will be critical to reaching many of the possible achievements during the next few years.

First, there are various definitions for renewable energy, biomass, and cellulosic fuels in federal legislation and in the federal agencies. Wood and other ligno-cellulosic materials have three primary components: cellulose, hemicellulose, and lignin. Some federal definitions exclude one or more of these key components, all of which can be converted to carbon neutral, renewable energy. At present, many companies in our industry produce energy from both cellulose (ethanol) and lignin (electric power). With IFPB technology, it will also be possible for us to directly convert hemicellulose to ethanol, and convert the lignin-based materials to a variety of bio-fuels and/or chemicals. Some of this technical capability will be transferable to the agricultural industry. **Our industry would like to work with Congress and the relevant federal agencies to construct inclusive definitions of biomass, renewable energy and/or cellulosic ethanol which includes the cellulose, hemicellulose, and lignin content of forest materials.**

Second, sustained and adequate funding of RD&D partnerships are essential to overcome remaining barriers to achieving IFPB technical goals. For our industry, strong and sustained partnerships with the federal government are essential for accelerating the development and adoption of the new technologies. This is particularly important for the IFPB, where adequate co-investment for RD&D can help mitigate the technical risks (especially integration with capital-intensive, legacy infrastructure) of early adopters of emerging IFPB technologies. **Our industry plans to continue to work with Congress in order to ensure adequate overall funding of the joint USDA/DOE biomass research program and to ensure inclusion of forest industry priorities for development of IFPB enabling technologies and demonstration of integrated forest-based biorefineries.**

Third, federally-funded research institutions such as the U.S. Forest Service's Forest Products Laboratory (FPL) are home to scientific expertise and research facilities that the industry relies upon to address IFPB research goals. The FPL's capabilities have been diluted by budget difficulties that have delayed facilities construction and resulted in cuts in scientific staff. **Our industry would like to work with Congress to support adequate funding of research facilities and IFPB-related programs to develop a Center of Excellence for forest biorefinery R&D within FPL, to make more effective use of its research capabilities to meet both industry technical needs and USFS mission imperatives.**

Farm Bill Reauthorization

The forest products industry recognizes that one of the primary opportunities for addressing these concerns is the reauthorization of the Farm Bill this year. We look forward to working with this Committee, its House counterpart, and other Members of Congress to maximize the industry role during this process, especially regarding biofuels. Furthermore, both the USDA and the USFS are integral partners in the development of integrated forest products biorefineries. As this Committee works towards the reauthorization of the Farm Bill during coming months, we look forward to working with you to ensure all opportunities are realized. We recognize that the forest products industry, especially given our presence in key rural communities, can play a critical role in enhancing our national energy security.

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The Honorable Tom Harkin
Chairman
Committee on Agriculture, Nutrition, and Forestry
United States Senate
328A Russell Senate Office Building
Washington, D.C. 20510

Dear Chairman Harkin:

As President and Chief Executive Officer of ArborGen, LLC, I am pleased to submit the following comments in conjunction with your committee's hearing on January 10, 2007, titled, "Agriculture and rural America's role in enhancing national energy security."

ArborGen, headquartered in Summerville, South Carolina, is a global leader in developing technologies to improve forest sustainability and production. We are currently conducting forestry research and market development with the potential to create new alternative biofuel feedstock.

There are numerous possible conversion pathways for production of energy crops from lignocellulosic materials, but one feature is common of each: a large volume and reliable supply of a feedstock is required. Trees grown in dedicated plantations with ArborGen technology are one potential source of this biomass feedstock.

The use of trees as a dedicated energy crop offers several unique benefits:

- Existing infrastructure. Much of the infrastructure necessary for the production, processing and distribution of this energy crop already is in place. Throughout the southeastern U.S., infrastructure exists for harvesting, handling and processing wood for pulp production in biorefineries.
- Ready on demand. Biomass from purpose-grown trees can be harvested and processed year-round as needed to meet the nation's dynamic energy demands.
- Regional importance. The South accounts for fully 62 percent of U.S. timber production. Biorefining of wood pulp would provide an employment and energy solution for the region, where much of the nation's domestic fuel supply currently is refined.
- Energy inventory. Dedicated working forests would provide a ready inventory of biofuel feedstock.

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ARBORGEN®

ArborGen is developing a number of products that offer the biofuels industry an array of innovative benefits:

- Rapid production: ArborGen technology enables rapid tree growth. Trees developed with ArborGen technology have the potential to grow in 5-to-7 year rotations, with production rates exceeding long-term targets of 10 dry tons of biomass per acre each year.
- Environmental benefits: Cellulosic ethanol has been found to have significant environmental benefits, reducing greenhouse gases by 85 percent over reformulated gasoline. Further, cellulosic ethanol has a net energy balance of 8 to 10 or more, compared to a net energy balance of 1.3 for corn-based ethanol.
- Displacement: Today, most commercially available ethanol in the U.S. is produced from sugars or starched obtained from corn and grains. Cellulosic ethanol made from trees may offer economic and environmental advantages over sugar-based ethanol. For instance, humans cannot digest cellulose. Thus, the production of cellulosic ethanol from trees does not create competing demand for food products.

Trees as a biofuel resource offer numerous advantages in productivity, sustainability and environmental impact. Sustainable forests provide habitat for wildlife and help clean the air by removing carbon dioxide and replenishing the oxygen supply. Tree crops help minimize erosion and create a productive use for land unsuitable for other agricultural uses.

- ArborGen is committed to developing highly productive, sustainable solutions for applications in forestry and biofuels production.
- ArborGen creates products that benefit end-users and consumers and, at the same time, sustain forestry production.
- ArborGen scientists and technicians have the experience and expertise to help customers identify and isolate characteristics for development and to further test genetics best suited for bioenergy feedstock. In the long-term, ArborGen technology may provide the ideal platform for advancing U.S. biofuel applications.

Thank you for the opportunity to share these views. ArborGen looks forward to continuing this dialogue with the committee.

Sincerely,

Barbara H Wells

Dr. Barbara Wells
President and
Chief Executive Officer

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Written Testimony of

The National Corn Growers Association

Senate Committee on Agriculture, Nutrition and Forestry
Full Committee Hearing on Agriculture and Rural America's Role in Enhancing
National Energy Security

Washington, D.C.
January 10, 2007

The National Corn Growers (NCGA) appreciates the opportunity to submit written comments for the record on enhancing national energy security.

NCGA was founded in 1957 and represents more than 33,000 dues-paying members from 48 states. NCGA is a federation of state organizations, corn boards, councils and commissions developing and implementing programs and policies on a state and national level to help protect and advance the corn producer's interests.

NCGA also represents the interests of the more than 300,000 farmers who contribute to corn checkoff programs in 19 states. NCGA's mission is to create and increase opportunities for corn growers and to enhance corn's profitability and use. NCGA is the voice for the corn grower's concerns in state and national legislative decisions affecting agriculture and energy in the United States.

Distillers Grains

The rapid growth of the dry grind ethanol industry has resulted in larger supplies of distillers grains than ever before. Distillers grains are a high protein, high fat, competitively priced, and environmentally friendly feed ingredient. In the 2005-2006 marketing year, 8.35 million metric tons of distillers grains were produced. In 2006-2007, more than 10.8 million metric tons will be produced. And by 2011-2012, the industry is expected to produce more than 20 million metric tons. Distillers grains most often are used as a substitute for corn and/or soybean meal marketing livestock and poultry rations. In 2005-2006, distillers grains displaced an estimated 389 million bushels of corn from feed markets, making that amount of corn available for other uses. (source: ProExporter Network). By the end of 2008, it is estimated that distillers grains will displace 1 billion bushels of corn from the feed market—roughly equivalent to the amount of corn fed annually to hogs in the United States.

To date, demand for distillers grains has kept pace with supply. Nearly 90% (or approximately 7.4 million metric tons) of the distillers grains produced in 2005-2006 were sold into domestic feed markets. While the majority of domestic distillers grains consumption occurs within the Corn Belt (in close proximity to the

production source), a significant amount of product is also shipped by rail to concentrated feeding operations outside of the Corn Belt.

Demand for distillers grains in foreign feed markets is also increasing. In 2004, nearly 700,000 metric tons of distillers grains were exported. By comparison, more than 1 million metric tons were exported in both 2005 and 2006. The top five export markets (2005) in descending order are: Ireland, Mexico, Spain, Canada, and the United Kingdom. (source: FAS-USDA). Recent export gains have been seen in Pacific Rim countries, particularly Indonesia, Taiwan, and Malaysia.

Because distillers grains are well suited to ruminant animal diets, the majority of the product is fed to beef and dairy. However, swine and poultry consumption is increasing steadily as the feed industry gains a better understanding of how to best utilize the product in those rations. According to Commodity Specialists Company, dairy accounted for 45% of 2005 distillers grains consumption in North America, while beef accounted for 37%. Swine accounted for 13% of the North American distillers grains use, while poultry made up 5%.

Nutritional Characteristics

When corn goes through the dry grind ethanol process, its nutrients (with the exception of starch) are concentrated by a factor of three in the distillers grains. Distillers grains also are an excellent source of digestible phosphorous. Therefore, when adding distillers grains to a diet, producers can reduce the amount of dicalcium phosphate normally used.
The following nutritional profile is typical of modern DDGS.

Nutrient	Average	Range
Dry matter, %	89.3	87.3 - 92.4
Crude protein, %	30.9	28.7 - 32.9
Crude fat, %	10.7	8.8 - 12.4
Crude fiber, %	7.2	5.4 - 10.4
Ash, %	6.0	3.0 - 9.8
Lysine, %	.90	.61 – 1.06
Phosphorous, %	.75	.42 - .99

Source: U of Minnesota, Dr. Gerald Shurson (analysis of 32 U.S. Corn DDGS sources)

Feeding Recommendations

The following are generally accepted distillers grains feed ration inclusion levels, though all rations for specific herds should be formulated by a qualified nutritionists.

Species	Recommended Maximum (% dm)
Lactating Dairy Cows	20-30%
Beef Feeders	25-30%
Swine	
Weaned Pigs	25%
Grow-Finish	20%
Gestation	50%
Lactation	20%
Poultry	
Broilers	10%
Layers	15%

Source: Various feeding trial results

Research and Market Development Focal Areas

The ethanol industry and academia are conducting a considerable amount of research on distillers grains quality and utilization. The following focal areas are of the highest priority.

- Improving nutritional quality and digestibility, particularly for swine and poultry
- Optimizing inclusion rates
- Improving flowability and transportation characteristics
- Standardizing distillers grains analytical methods
- Mitigating mycotoxin contamination potential
- Alternative uses of distillers grains
- Environmental issues related to feeding distillers grains in confined facilities

Research continues to prove that swine can benefit from having high quality, "new generation" distillers grains in their diet due to the high energy (97% the energy value of corn), digestible amino acids, and available phosphorus. Recent research has shown additional benefits of feeding DDGS on reducing manure P levels, improvements in litter size weaned (when sows are fed DDGS at the maximum inclusion rates for 2 reproductive cycles) and improved gut health of grow-finish pigs when challenged with ileitis.

While more research is warranted on the benefits of feeding DDGS to poultry, distillers grains provide many important nutrients to both chickens and turkey. Poultry will benefit from the essential amino acid methionine, which is essential for feathering. DDGS are an excellent source of methionine. The Phosphorus availability of DDGS is higher than in corn, which is an economic assistance, as

Phosphorus is the third most expensive ingredient in dairy rations. Higher availability of Phosphorus also contributes positively to the environment.

Concern has been raised that ethanol plants will utilize mycotoxin (aflatoxin) tainted corn in their production process. Ethanol plants are vigilant in their testing for mycotoxins because corn processing compounds toxin levels in co-products, such as DDGS, making infested corn unsuitable for use in DDGS production. For example, levels of aflatoxin are increased during ethanol production by up to three times the level found in grain, thus causing high levels in the dried distillers grains. Producing mycotoxin-contaminated DDGS is a risk the ethanol industry is not willing to take. Ethanol plants across the country have implemented rigorous testing regimens to ensure they accept only corn that is free of mycotoxins.

Mycotoxins cost corn growers millions of dollars in lost sales every year. It is in the industry's best interest to continue research to secure the nation's food supply and to ensure the quality of our products. A breakthrough in mycotoxin detection or elimination would provide the American farmer with better tools to protect our investments on-farm and to remain competitive in the global marketplace. For these reasons, NCGA has been a long-time supporter of pre-harvest elimination research conducted by the Agricultural Research Service.

Corn Supply: Food And Fuel

Recently, the fear that ethanol production will divert corn away from food and feed markets has caused concerns amongst different industries. NCGA will attest that increasing demand for corn is being met with increasing supply.

Thus in response to heightened demand, U.S. growers have produced the three largest corn crops in history in the past three years. In 2004, farmers crested the 11 billion bushel mark for the first time ever, harvesting a record 11.8 billion bushel crop. The record harvest in 2004 was followed by an 11.1 billion bushel crop in 2005. After all demands were met, the corn industry finished 2005 with nearly two billion bushels in surplus—one of the highest levels since the 1980s. Despite moderate drought conditions in many parts of the country, farmers harvested a 10.54 billion bushel crop this year, making it the third largest crop ever. Simply put, though the market may experience heightened volatility as demand rapidly increases, there is no shortage of corn.

Additionally, one must look at the availability of distillers grains and the use of corn for human consumption. Every 56-pound bushel of corn used in the dry grind ethanol process yields 17 pounds of distillers grains, a good source of energy and protein for livestock and poultry. The ethanol process removes only starch from the feed and food market. The starch portion of the kernel is converted to ethanol, while the protein, fat and other nutrients are passed

through to the feed coproducts or human food ingredients. Aside from preserving the protein, a considerable portion of the corn's original digestible energy is also preserved in the distillers grains.

Also, it is critical to remember the amount of field corn actually used for human food is just a small fraction of the total corn supply. The overwhelming majority of U.S. corn, including exported corn, feeds livestock—not humans.

Today, many stakeholders are concerned about affordable corn for livestock. However, a look at historical corn prices indicates that current price levels are not unprecedented or unmanageable. To put recent corn prices in perspective, consider that farm-gate yearly corn price averages topped $3.10 three times in the past 25 years.

It is also important to note that corn often is only one of many inputs in livestock and poultry production and represents only a portion of total production costs. For example, corn and soybean ingredients combined account for less than 20 percent of the total costs for commodity chickens.

Despite the recent increase in corn prices, increased ethanol production in the past 15 years has not caused a sustained increase in the farm-gate price of corn above historical levels. Only recently have we seen a significant corn price reaction to increased demand for corn from the ethanol sector. And it is highly likely U.S. farmers will respond to recent market signals by planting 10% more corn acres this coming spring.

Lastly, corn will continue to play a vital role in the development of a strong bio-based economy while meeting the growing needs of feed, food, and fuel in this country.

Ethanol: Corn's Role in the Expanding Market

With more than 110 biorefineries in operation and dozens more under construction, the U.S. ethanol industry is booming. These biorefineries added approximately 5 billion gallons of domestically produced, renewable fuel to the U.S. gasoline supply in 2006.

As a result of rapid production capacity expansion, the amount of corn used for ethanol production is increasing. In fact, corn use for ethanol more than doubled between 2001 and 2005. Accelerated growth in corn use for ethanol has led critics to question the industry's ability to satisfy demand for both renewable fuels and traditional uses like livestock and poultry feed, food processing and exports. Rest assured, the corn industry will continue to strive to satisfy a variety of demands and maximize the utility of its products. Seed technology developments, increasing agricultural efficiency, innovation in renewable fuels

production processes and other breakthroughs will ensure that the American farmer will continue to meet the world's needs for food, feed, fuel and other uses.

NCGA strongly supports the goal of 15 billion bushels of corn harvested and 15 billion gallons of ethanol produced by 2015. NCGA considers five critical factors in meeting these goals.

First, NCGA sees dramatic increases in corn yields. The corn yield curve is increasing at an accelerated rate because of advances in biotechnology and improved cropping practices. Increased yields allow growers to harvest considerably more corn without significantly increasing acreage. Growers set a new yield record in 2004 with 160.4 bushels an acre. Despite drought conditions in many parts of the Corn Belt in 2006, the average yield per acre was 149.1 bushels, the second-highest average yield on record. Continued advances in biotechnology and conventional plant breeding are likely to further yield growth in the future.

Second, NCGA believes incremental acreage shifts will expand corn acreage to meet the growing demands of the ethanol. These crop shifts may come from soybeans and to a lesser degree cotton and wheat. U.S. farmers make their planting decisions based on demand signals from the marketplace. If demand for corn remains high, corn acres will likely increase.

Former NCGA president Leon Corzine, a farmer from Assumption, Illinois, is a perfect example of growers who are making adjustments to their traditional crop rotations because of current market conditions. Just three years ago, Leon planted half his acres to soybeans and half to corn, as he'd done for a number of years. But last year, because of increased demand, Leon planted two-thirds of his acres to corn and one-third to soybeans. This planting season, Leon will plant 75% of his acres to corn and 25% to soybeans. Farmers across the country are making similar adjustments in response to market signals.

Every additional one million harvested acres, roughly 150 million bushels of corn will be added to total supply. In other words, one million harvested acres translates into an additional 420 million gallons of ethanol.

Next, it is critical to understand that corn use for livestock feed is not projected to grow significantly in the long term. Economists project livestock and residual use to range from about 5.5 to 6 billion bushels between 2007 and 2016, down from an average of about 6.1 billion bushels between 2004 and 2006. This is not necessarily because livestock and poultry inventories will decrease, but because the supply of distillers grains and other feed ingredients will increase. Export use and non-ethanol processing use also are not expected to increase significantly. Many economists project export use to range from about 1.9 to 2.1 billion bushels between 2007 and 2016. It could be argued that total traditional corn use (feed, export, and food processing) is likely to flatline at about 9.1 billion bushels

in the long-term. Accordingly, increased production can go to ethanol without radically affecting traditional markets.

Another factor that must be considered in meeting demand is the role of DDGS in feed rations. Increased ethanol production will generate increased supplies of distillers grains. These high-protein coproducts will increasingly displace corn in beef, dairy, poultry, and swine rations. The nutritional quality and transportability of DGGS are steadily improving with the cooperation of the livestock industry and thus future products will be more prescriptive in nature. Distillers grains are projected to displace more than one billion bushels of corn for feed per year starting in 2008-09, freeing up corn for other uses.

Lastly, improvements in ethanol efficiency will be a key component in meeting the demands of the market. The ethanol industry is driven by innovation. New technologies will "squeeze" more ethanol out of a bushel of corn. The average ethanol conversion rate today is 2.8 gallons per bushels. That conversion rate may soon be 3 gallons per bushel or higher because of the likely adoption of emerging processing technologies, specifically corn fiber conversion and the adoption of ethanol-tailored seed hybrids.

Uniform application of these technologies across the country would result in a dramatic increase in ethanol production without significantly altering corn acreage. Furthermore, the conversion of corn stover to ethanol could double the future ethanol yield of a single acre of corn.

NCGA strongly believes in our 15x15x15 vision. With increasing yields, incremental acreage shifts, new technology and the displacement effect of distillers grains, it is quite feasible that corn growers could harvest a crop of 14 to 15 million bushels by 2015 while adequately supplying all markets.

Conclusion

The National Corn Growers Association believes continued commitment to U.S. agriculture and further investment into the developing biofuels industry will create a robust, dynamic renewable portfolio for this country and strengthen our national security. The corn industry has the resources, ingenuity and resolve to satisfy future demand for food, feed, and fuel.

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