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ADVANCED BIOFUELS: CREATING JOBS AND LOWER PRICES AT THE PUMP

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ADVANCED BIOFUELS: CREATING JOBS AND LOWER PRICES AT THE PUMP

Tuesday, April 8, 2014

UNITED STATES SENATE,
COMMITTEE ON AGRICULTURE, NUTRITION AND FORESTRY,
Washington, DC

The Committee met, pursuant to other business, at 9:58 a.m., in Room 328A, Russell Senate Office Building, Hon. Debbie Stabenow, Chairwoman of the Committee, presiding.

Present: Senators Stabenow, Harkin, Brown, Klobuchar, Bennet, Gillibrand, Donnelly, Heitkamp, Casey, Cochran, Chambliss, Boozman, Hoeven, Grassley, and Thune.

STATEMENT OF HON. DEBBIE STABENOW, U.S. SENATOR FROM THE STATE OF MICHIGAN, CHAIRWOMAN, COMMITTEE ON AGRICULTURE, NUTRITION AND FORESTRY

Chairwoman STABENOW. So we would invite our witnesses to join us today. We are very, very pleased to have this hearing on Advanced Biofuels: Creating Jobs and Lower Prices at the Pump. I think, a really important group of people representing many, many different sectors that are involved with biofuels. So we will take just a moment to welcome you to come up to the table.

[Pause.]

Chairwoman STABENOW. Well, good morning again. We are moving to the second portion of our hearing, and again, we will pause for a business meeting as soon as we have a quorum. We expect to have a quorum in just a few moments, so thanks to all the members for coming, I know, as close to 10 o'clock as we could to do the business portion. I want to thank all of you for being here.

We have heard for years that advanced biofuels are just around the corner. Well, we are here. We are at the point where it is actually happening instead of having one more hearing where we hear, "Five years from now, we will have cellulosic ethanol." We are excited to have people here today that will be able to touch on some of the success stories that are out there. I want to just highlight a few.

INEOS Bio has announced it is producing cellulosic ethanol at a commercial scale. Sapphire Energy announced that it had paid off its entire $54 million USDA Energy Title loan and will be producing 100 barrels of green crude per day from algae by 2015.

POET's Project Liberty broke ground last spring and is on pace to begin producing cellulosic ethanol from corn stover this year.

DuPont, which is represented on our panel today—very pleased—is expected to produce cellulosic ethanol from stover in Iowa later this year.

As I have said before, as we all know, the farm bill is a jobs bill, and that is why I am so proud of the work that we all did together in developing a robust energy title. The Energy Title funds critical programs to help our farmers produce energy from non-food sources and helps companies get low interest loans for those facilities. And, of course, all of that creates jobs.

We are going to hear from representatives of companies that are out there doing just that: creating jobs and growing rural economies while producing advanced biofuels, which ultimately help us become more energy independent and lower our gas prices at the pump.

Some of you may be surprised to learn that my home State of Michigan was actually an early adopter of ethanol in 1896. I was not there at the time, but in 1896, Henry Ford designed his first car, the Quadricycle, which we all know as the "horseless carriage," to run on pure ethanol. When it was released in 1908, Ford's Model T was able to run on gasoline, ethanol, or a combination of the two.

Henry Ford continued to advocate for ethanol as a fuel, but the lower price and abundance of oil made it more attractive to consumers at that time. Interesting how our policies have affected all of that.

Yet today we are still working to make ethanol more competitive in the U.S. We would love the same tax policies for ethanol that we have had for oil, I would say as an editorial comment, and we do know, though, that in other countries we are seeing a different mix and competitiveness.

I was in Brazil with Secretary Vilsack last summer. Brazil's gasoline is blended with ethanol at a nearly 30-percent rate. In fact, they have lower gas prices because of the higher blends. Meanwhile, here in the United States, ethanol makes up 10 percent of our fuel supply.

An Iowa State University study found that, in 2010, using ethanol reduced the cost of gas by 89 cents a gallon across the country, and by as much as $1.37 in the Midwest. These are enormous savings for American families.

In the U.S. we consumed about 138 billion gallons of gasoline in 2010. That comes out to about 446 gallons per person or 892 gallons for a family of four, and when you think about that, well, what do those numbers mean, 892 gallons? Well, you could drive from D.C. to Los Angeles and back four times on 892 gallons. That family could have saved $794 in 2010 because of biofuels. According to USDA numbers, that $794 comes to up to 5 weeks' worth of groceries.

Biofuels are making a difference and could make an even bigger difference, and that is what we are here to talk about today. It is our goal to make sure we move to non-food-based advanced biofuels, and it is happening, and in places that some may not be aware of.

As we will hear today, some of our airlines have undertaken their own biofuels initiatives because it makes good business sense

for them to do so. But to continue growing this industry, we need policies that support it.

This Committee and Congress took an important step forward passing the farm bill with the funding for the Energy Title. Now we need to provide certainty through a strong, Renewable Fuel Standard and tax credits to support long-term investments in our energy future. Getting off foreign oil is in our strategic interest, and doing so, we will be saving money and be saving lives.

So we thank all of you for being here, and I would turn now to Senator Cochran for his opening statement.

STATEMENT OF HON. THAD COCHRAN, U.S. SENATOR FROM THE STATE OF MISSISSIPPI

Senator COCHRAN. Madam Chair, thank you very much. I am pleased to join you in welcoming our distinguished panel of witnesses, one of whom is from my State of Mississippi. Dr. Arora is here. He is involved in an initiative for the commercialization of advanced biofuel technologies through the so-called Strategic Biomass Solution Initiative. I am anxious to hear more about this and to learn more about the questions that confront the policymakers, both in the administration and in Congress, to examine these alternatives to traditional sources of energy and enterprise.

Thank you very much.

Chairwoman STABENOW. Thank you very much.

I understand that we will have two more members that we need for a quorum in just a moment, so I am going to proceed to introduce our panel, and at that point I think we will be in a place where we can stop for our business meeting and then proceed with the panel. We are so pleased to have all of you with us today.

Our first witness on the panel is Mr. Richard Childress, the president and CEO of Richard Childress Racing. It is always good to see you, Richard. He serves on the Board of Directors at Growth Energy. As a driver, Mr. Childress earned 76 top ten finishes in 285 races, and his racing team has logged 200 overall NASCAR victories and 14 NASCAR championships, and I can say as a NASCAR fan, it is always good to see you at the races. I know you will be coming to Michigan in just a bit, so I look forward to seeing you.

Our second witness today is Mr. Brooke Coleman—we are so pleased you are here—executive director of the Advanced Ethanol Council. Mr. Coleman has been involved in the energy and environmental sectors at the regulatory and policy level since 1997. He has founded or co-founded several organizations or projects, including the Advanced Ethanol Council, the New Fuels Alliance, the California Renewable Fuels Partnership, the Northeast Biofuels Collaborative, and the Renewable Energy Action Project.

Our third witness is Dr. Jan Koninckx, global business director for biorefineries at DuPont Industrial Biosciences. Dr. Koninckx oversees the development and commercialization of advanced biofuel technologies like cellulosic ethanol and biobutanol. Dr. Koninckx has worked for DuPont for over 20 years, has served as chair of the board for Butamax Advanced Biofuels LLC since its inception in 2009, and is also a member of the Board of Directors of Vivergo Fuels. Welcome. Good to have you.

Our fourth witness is Dr. Sumesh Arora, and Senator Cochran has already mentioned him, and I will give just a little bit more information. We are so pleased that you are here. Vice president and director of Strategic Biomass Solutions at Innovate Mississippi, a nonprofit organization focused on creating technology-based economic development in Mississippi. He launched the Renewable Energy Venture Startup Academy in 2010 and has served as Mississippi's representative to the Governor's Biofuels Coalition since 2006.

Our fifth and final witness is Nancy Young, vice president of environmental affairs at Airlines for America, the oldest and largest airline trade association. Ms. Young is an environmental attorney with more than 20 years of experience. At A4A, Ms. Young directs environmental programs, provides counsel on environmental issues, and represents A4A in international negotiations. She also participates in several airline environmental initiatives, including the Farm to Fly initiative—I need to know more about that; Farm to Fly, that is very interesting—Commercial Aviation Alternative Fuels Initiative, and Advisory Committee to the Aviation Sustainability Center.

So we are pleased to have such a distinguished panel with us, and we are waiting for one more member before we can do our votes.

So we are going to proceed with Mr. Childress. We are so glad that you are here today. Welcome.

Mr. CHILDRESS. Thank you.

Chairwoman STABENOW. We would like you to go ahead.

Mr. CHILDRESS. Oh, okay.

Chairwoman STABENOW. We would like you to share with us 5 minutes' worth of remarks. You can watch the buttons on there, and then anything that you would like to give us further in writing we would be happy to accept as well. So good morning.

STATEMENT OF RICHARD CHILDRESS, PRESIDENT AND CHIEF EXECUTIVE OFFICER, RICHARD CHILDRESS RACING, LLC, WELCOME, NORTH CAROLINA

Mr. CHILDRESS. Thank you. I have sent in written testimony, but I will. Thank you, Chairman Stabenow, Ranking Member Cochran, and members of the Senate Agriculture Committee. Thank you for allowing me this opportunity today to tell you about all of the things that 15-percent ethanol is doing in NASCAR racing today.

I was raised on a tobacco farm. As a kid, I know how tough it was to see farmers and live as a farm kid. But once it is in your blood, it is in your blood, so today I am in the farming business, been in it for 30 years. I have vineyard, Angus cattle. We raise our own hay, wheat, corn, soybeans. So I know what it is like for the farmers today, and ethanol is definitely a great plus for our farmers in America today.

I am also an avid sportsman and conservationist. I am on the Board of Directors for the NRA. I served 6 years with the Congressional Sportsmen's Foundation. Also, as you said earlier, I am on the Board of Directors for Growth Energy. Growth Energy is the country's leading trade association of ethanol and renewable fuel products.

I have been involved in NASCAR for 45 years both as a driver and owner. I have seen a lot of changes. For those that don't understand NASCAR, we have over 70 million race fans. We rank second only to the NFL in TV viewing and audiences.

NASCAR always looks at what the manufacturers are doing. When we were running leaded fuel back years ago, NASCAR was running leaded fuel. When they went to unleaded fuel, we went along with them with unleaded fuel. When they decided to go with an ethanol blend of fuel, in 2010 NASCAR started looking at ways and what was the right, correct blend to use. They came up with—after many tests, they came up with E15 was the fuel to use in our race cars.

As RCR, we did our own testing. We did a lot of testing. We tested all the way up to E30. I wish we were here today talking about how we were all running E30 in our cars.

Nothing but positive results came out of our tests. Our engines ran cooler. We made more horsepower. Ethanol makes more octane, so it makes more horsepower; less carbon buildup; better emissions; and our parts, when we tore the engines down, looked much better.

Since 2011, NASCAR has raced more than 5 million miles, put 5 million miles on E15. That is some of the most toughest racing, toughest demand on an engine you could get. We turn those engines over 9500 RPMs week in and week out for 4 and 5 hours.

From a consumer's standpoint—and I better hurry. From a consumer's standpoint, more testing was done on E15, more than any other fuel approved by the EPA. The Department of Energy tested 86 vehicles for more than 6 million miles. With the Department of Energy's testing results, the EPA approved a waiver for E15 in all vehicles 2001 and newer, which is more than 80 percent of the vehicles on the highway today. Studies show by moving America to E15 blends or better, we would create 136,000 jobs, limit greenhouse emissions, and reduce the demand for foreign oil.

The economic impact of ethanol today to America is in billions. It creates jobs, farm equipment sales. If ethanol is the future for America—I feel ethanol is the future for America. The challenges we have today with our security, we cannot depend on foreign oils. We cannot keep sending our dollars overseas to maybe used against us someday. The main thing is our children and grandchildren, we have got to think about them for the future and the energy sources that they will have in the future.

With that said, thank you for letting me testify, and God bless America.

[The prepared statement of Mr. Childress can be found on page 37 in the appendix.]

Chairwoman STABENOW. Thank you so much, Mr. Childress. We are so pleased to have you here and wish you luck with your vehicles racing.

Mr. CHILDRESS. Thank you.

[Whereupon at 10:14 a.m., the Committee proceeded to other business and reconvened at 10:18 a.m.]

Chairwoman STABENOW. We want to continue with our very important testimony. We thank all of you for your patience as we stopped, but let us proceed right now. Dr. Koninckx, welcome.

STATEMENT OF JAN KONINCKX, PH.D., GLOBAL BUSINESS DIRECTOR FOR BIOREFINERIES, DUPONT INDUSTRIAL BIOSCIENCES, WILMINGTON, DELAWARE

Mr. KONINCKX. Thank you, and good morning, Chairman Stabenow and members of the Committee. As a responsible member of a large public company that commercializes technology all the time, it is my pleasure to be here with you today and share my personal knowledge of the incredible advances that companies like DuPont are making in this field of biofuels.

Science companies like ourselves share the credit for these achievements with the entrepreneurial farmers across the heartland. These growers work with us every day to realize the vision of the Renewable Fuel Standard. It is because of their courage and because of their dedication that I am able to sit here today and confirm that ethanol, cellulosic ethanol, is viable and growing as a new industry in 2014.

How did we get there?

Chairwoman STABENOW. Let me ask, is the microphone on? You may want to speak a little bit more directly into it if the red light is not on.

Mr. KONINCKX. Okay. I will come closer. The red light is—okay. Sorry.

How did we get there? Allow me to give you a brief recap of DuPont's role in the development of this technology and an update of exactly where we stand today.

DuPont began its research into cellulosic ethanol a decade ago, and over those years we have collaborated with public institutions, with academia, with private entities, to overcome the tremendous technical and practical obstacles we face. Our challenge outlined in the RFS was to bring advanced renewable fuels like cellulosic, a technology that was yet to be created, and put the U.S. on a path towards improved energy security, lowered greenhouse gases, and economic opportunities for rural economies in America.

This was no small feat. We had to unlock the sugars trapped in biomass, biochemically convert them into advanced fuel, and create an entirely new supply chain. Step by step, with our partners, we knocked out these technical challenges, and in 2009 we opened a one-of-a-kind demonstration facility Tennessee. Today this facility continues to churn out data and know-how on how to process and convert all different types of biomass to fuel.

The first feedstock we worked on was corn stover, and it is that feedstock that we will be using in our commercial-scale cellulosic ethanol facility that is currently under construction in Nevada, Iowa.

For the past 4 years, DuPont has been out in the fields with farmers working together to devise an entirely new supply chain that will feed this 30 million gallon per year biorefinery, and that supply chain and the biorefinery are fully sustainable. Remember, this is a supply chain that was never before attempted.

For some perspective, the bales, the stover bales that we will be using are taller than I am at 8 feet, and certainly weigh much more at half a ton each. We will harvest these, bale them, store them, and transport them—in total, more than 700,000 of these bales each year. We will do this in a way that is fully sustainable,

and that is an achievement we are particularly proud of and one that our fossil fuel competitors cannot even contemplate achieving. We share that credit with partners like the USDA, with whom we developed standards for biomass harvest and land management.

The bottom line here is that, driven by the RFS, we have completely reinvented how we fuel our vehicles using renewable fuel, and we do so without adding additional CO2 into the atmosphere. DuPont has more than 210 years of experience of bringing scientific innovation to market, and in my estimation, we have never delivered this type of disruptive technology this fast.

It is not the end of the story. It is actually the beginning. We start with unlocking the sugars in cellulose for biofuels. Tomorrow these same sugars and supply chains will enable a whole new world of bio-based chemicals and materials, delivering on the promise of an economy that is in part resourced by renewable agriculture.

DuPont is already working on it. Since 2006, we have been delivering plant starch-based product, which is used in carpeting, in automobile parts, in de-icing fluids, and other personal and industrial applications. Many more of these advances will be possible when the supply chains that I have just described mature, enabling lower costs and higher efficiencies.

In closing, I emphasize that the Renewable Fuel Standard works as intended. Seven years ago, this Congress set the country on a course to change its energy destiny, and DuPont, a historic American company, answered that call. This year, we are going to be bringing biomass into our refinery fit for the 21st century, one fueled not by what is drilled up from the ground, but what actually is grown from it, a modern technical marvel that is a model on how to create jobs in rural communities, work with our environment not against it, and give consumers an opportunity to choose homegrown renewable fuels at the pump.

DuPont is proud to be part of this success story, and we thank the Committee for your continued interest and support for this innovative field. Thank you.

[The prepared statement of Dr. Koninckx can be found on page 58 in the appendix.]

Chairwoman STABENOW. Thank you very much.

Mr. Coleman, welcome.

STATEMENT OF BROOKE COLEMAN, EXECUTIVE DIRECTOR, ADVANCED ETHANOL COUNCIL, BOSTON, MASSACHUSETTS

Mr. COLEMAN. Thank you. I will get this microphone just right here. Good morning, Chairwoman Stabenow, Ranking Member Cochran, and members of the Committee. My name is Brooke Coleman. I am the executive director of the Advanced Ethanol Council. The AEC represents worldwide leaders in the effort to develop and commercialize the next generation of ethanol fuels and products made from wood chips, agriculture residue, energy crops, municipal solid waste, and algae. My chairman, of course, is Bill Brady of Mascoma, which is in Michigan.

I have submitted a fairly substantial written testimony that you will be happy I am not going to try to rehash here, but I want to touch on a few points.

I think it is safe to say that the biofuel issue can be volatile. The question is: Why? I think if you look at the trajectory of the biofuels industry and who is being forced to change, you will have your answer. In just 10 years, fledgling industries like ethanol and biodiesel have emerged to create hundreds of thousands of jobs and displaced the need for billions of gallons of petroleum imports annually.

If you look at perhaps the most controversial biofuel, ethanol, you will find that it is also the most disruptive to the status quo. The ethanol industry now supports hundreds of thousands of jobs in the U.S. all by itself and wants to create consumer choice at the pump with fuels like E15 and E85. They are a target for a reason.

Now the industry, I am happy to say, is evolving. While the Wall Street Journal editorial page insists that the advanced biofuel industry is underperforming, our production capacity actually exceeded the RFS targets last year by 250 million gallons.

From an investment perspective, a recent analysis found that the United States ranks number one for advanced biofuel development among 69 countries, attracting almost 70 percent of global ventures in advanced biofuels.

The news is also good when it comes to cellulosic biofuels. It is easy to say we are finally breaking through at commercial scale, but the truth is we are just 6 years past the signing of RFS2, and financial markets were frozen for much of this period. Yet DuPont's plant in Nevada, Iowa, Abengoa's plant in Hugoton, Kansas, and POET–DSM's plant in Emmetsburg, Iowa, are all scheduled to start up this year. Each of these plants is creating new multi-million-dollar markets for local farmers making cellulosic ethanol out of agricultural residue.

Some of the numbers are very interesting. DuPont's feedstock network is around 500 farmers strong. At one point during construction, Abengoa had roughly 1,000 workers and engineers on site in a town of 1,400. POET–DSM's facility will produce enough renewable electricity as a co-product to power itself and the grain ethanol facility next door. That is the good news.

The bad news is—and I think I have said this before—the oil industry has enough money to make it seem like it is raining on a sunny day. The very programs that put us ahead of Brazil and China, like the Energy Title in the farm bill and the Federal RFS, are under fire from big industries that do not want to see value-added agriculture in rural America and do not want to see consumer choice at the pump.

The target is not the three projects that I mentioned but, rather, the next three dozen projects in the cellulosic ethanol biofuel pipeline that I have not mentioned.

While my time is limited, I think it is also important to refute some of the common arguments made against us to correct the record.

The oil industry claims we do not need biofuels anymore because we have this boom in domestic oil production. We do not have anything against the oil industry. While it is true that we produce marginally more oil than we used to, up from about 7 to 10 percent of the world's supply, we consume more than 20 percent of the world's oil at steadily increasing prices. So foreign oil dependence

is sort of like a gambling addiction. We are gambling one fewer night per week but at more expensive tables and calling it progress. With fiscal responsibility in mind, there is simply no bigger drain on the U.S. economy and revenues than foreign oil dependence.

On the issue of pump prices, oil industry executives have the tendency to be quite forthcoming after they retire. For example, former Shell Oil President John Hofmeister recently stated, "[w]e need a competitor for oil. We need to open the market to replacement fuels. Competition will drive transportation fuel prices down, structurally and sustainably." This is exactly what is happening.

Energy economist Philip Verleger, who served as an adviser to both Ford and Carter, recently said, "the U.S. renewable fuels program...translates to consumers paying between $0.50 and $1.50 per gallon less for gasoline" by adding the equivalent of Ecuador to extremely tight world liquid fuel markets.

Finally, we are aware of the livestock industry blaming biofuels for increases in the price of its feed. I know this is a difficult issue for agriculture. I would point out that corn prices today are about the same as they were in 2008 when these programs started. But the issue is bigger than that for advanced biofuels. We remember the downside of sub-$2 bushel of corn when U.S. farmers were price takers, selling oversupplied grains at below cost and struggling to make a living. Congress responded in part by committing to policies promoting value-added agriculture. We believe that Congress was right to take this path, that the development of cellulosic biofuels is a key part of this vision, and that more prosperity and new markets in rural America are a good thing.

The question for our industry is no longer whether we are going to commercialize. Globally speaking, it is when and where. The programs you have established are the right programs, and if allowed to work, they will pay dividends for generations.

Thank you for the privilege of speaking today, and I look forward to your questions.

[The prepared statement of Mr. Coleman can be found on page 43 in the appendix.]

Chairwoman STABENOW. Thank you very much.

Dr. Arora, welcome.

STATEMENT OF SUMESH M. ARORA, PH.D., VICE PRESIDENT, INNOVATE MISSISSIPPI, AND DIRECTOR, STRATEGIC BIOMASS SOLUTIONS, RIDGELAND, MISSISSIPPI

Mr. ARORA. Good morning. Chairwoman Stabenow, Ranking Member Cochran, and members of the Committee, thank you for the opportunity to testify today in support of advanced biofuels. My name is Sumesh Arora, and I am the vice president of Innovate Mississippi, a nonprofit organization dedicated to technology-and innovation-based economic development, and I also serve as adjunct faculty in entrepreneurship.

I hope to provide a perspective on how advanced biofuels and bioenergy options may be accelerated in the southeastern U.S., where considerable activity is already taking place on multiple fronts.

Today I will address five challenges and opportunities for furthering these goals.

2014 is a breakthrough year for the advanced biofuels industry, but this industry is still in its infancy. Currently there is no dominant design for advanced biofuels technologies or feedstocks, which means that many different technologies are being perfected that can use a broad array of feedstocks. This is leading to many technical and business innovations ranging from deploying very large-scale biorefineries, as we heard, to small modular and even on-farm systems. Achieving the concept of dominant design makes a technology more bankable and much easier to be adopted by the masses. However, there is a significant need to educate entrepreneurs and investors to look at risks in five key areas: technology, markets, management, finance, and execution.

Innovate Mississippi has developed the Renewable Energy Venture Startup Academy for training entrepreneurs to evaluate and mitigate these risks. REVSup workshops have been conducted all over the country in the last 3 years. Furthermore, linking business plan competitions and business accelerators around the country is critical to encourage new investment in these ventures.

Second, many parts of the country, especially the southeastern U.S., are well suited to generate current and emerging feedstocks in an ecologically sustainable manner, thus providing very effective regional solutions. For example, forestry and poultry are two of the biggest industries in the South that can currently supply feedstocks for advanced biofuels. Emerging dedicated energy crops such as grasses and algae also grow very well in that climate, but additional research and market development is still needed to optimize these feedstock supply chains.

Third, deployment of these technologies will lead to an increase in the number of Science-Technology-Engineering (STEM) related jobs across the country, which cannot be offshored and will also lead to rural wealth creation. However, we need to do a better job of connecting and leveraging Federal research assets with local universities, schools, businesses, and nonprofit organizations to accelerate these innovations to market. For example, Innovate Mississippi is the original member among nine partners with the USDA Agricultural Research Service, among nine partners with ARS, with the goal to facilitate commercialization of ARS research. I applaud the 2014 farm bill for urging the Department of Agriculture to move forward with further development of such public-private partnerships to provide venture development training for innovative technologies.

Fourth, advanced biofuels should be viewed in a more holistic manner to include viable biomass-based energy and biochemical options in gaseous, liquid, and solid forms. This requires a long-term comprehensive energy policy that provides clear market certainty. The announcement by President Obama on March 28 unveiling a strategy to curb methane emissions does that to a great extent; however, the national Biogas Roadmap scheduled for release in June this year will focus mainly on the dairy industry, which is quite small in the South compared to poultry. Millions of tons of poultry waste is generated in States from Maryland to Arkansas, and the contributions to biogas production from this very viable feedstock have largely been ignored. There are tremendous entrepreneurial opportunities in deploying such systems that can lead to

rural job growth and keep energy prices low for farmers, while improving soil health and water quality.

Fifth, large volumes of advanced biofuels and energy options in the overall mix will help keep fuel prices in check by diversifying our energy supply and enhancing our national security, but market-conditioning efforts led by various Federal agencies must continue for greater adoption of such fuels.

Our work at Innovate Mississippi can be summed up in two words: "coach and connect." While this may sound simple, coaching early stage innovation-based enterprises and connecting them with resources like early-stage capital, technical research, and entrepreneurial service providers is challenging. The ultimate goal is to create fast-growing, profitable companies, which also yield great returns for the early-stage investors. Innovate Mississippi relies on various sources of State, Federal, and private sector funding to provide such services at low or no cost to the entrepreneurs.

I am proud to say that, due to the combined efforts of many stakeholder organizations, Mississippi is emerging as a regional leader and the proving ground for commercial-scale production of various advanced clean energy technologies such as woody biomass and MSW-based cellulosic biofuels, biogas production from poultry waste, torrefied wood pellets, thin film solar panels, and energy efficient windows.

In closing, I would like to make the analogy that investing in renewable energy is just like investing for your retirement. In this case, we have to invest to diversify our Nation's energy portfolio, which is dependent on fossil fuels for nearly 93 percent of its transportation sector needs. From a timing standpoint, we cannot put off making these serious investments in renewable forms of energy until the expiration of these fossil fuels is imminent.

Thank you very much.

[The prepared statement of Dr. Arora can be found on page 31 in the appendix.]

Chairwoman STABENOW. Thank you very much.

Ms. Young, welcome.

STATEMENT OF NANCY N. YOUNG, VICE PRESIDENT, ENVIRONMENTAL AFFAIRS, AIRLINES FOR AMERICA, WASHINGTON, D.C.

Ms. YOUNG. Thank you for the opportunity to discuss the benefits that advanced alternative jet fuels can bring to the United States airline industry, our economy, and our Nation. My name is Nancy Young. I am vice president of environmental affairs of Airlines for America, representing the major passenger and cargo airlines of the United States.

The U.S. airline industry is indispensable to our Nation and its economy. To place this in context, the Federal Aviation estimates that civil aviation supports more than 10 million jobs, $1.3 trillion in economic activity, and over 5 percent of the GDP. Even so, the steady rise of jet fuel prices and price volatility have had tremendous negative impacts not only on the airlines and their customers but their employees and the communities that the airlines serve.

Fuel is our number one cost center, representing over one-third of operating expenses. Although U.S. airlines consumed 5 billion

fewer gallons of jet fuel in 2013 than they did in 2000, they spent a staggering $34 billion more. A stable domestic supply of commercially viable alternative jet fuel would provide a competitor to petroleum-based fuel, tempering jet fuel price and volatility. It would also help the U.S. airlines build on their strong environmental record.

But the benefits of advanced aviation biofuels would not inure to the airline industry alone. Our armed forces would derive similar benefits. In addition, a vibrant alternative jet fuel industry would create American jobs and spur economic development in the areas that are most hit by the recession.

Rural America would benefit greatly from access to new markets for biomass crops while industrial areas would be revitalized. Moreover, the energy security of the Nation would be improved.

For the past several years, A4A and our members have been working in earnest to achieve these synergistic benefits. As a cofounding and leading member of the Commercial Aviation Alternative Fuels Initiative—CAAFI—we have significant successes to report. Through CAAFI we helped lead the successful effort for specifications certifying two alternative jet fuels, and other fuel conversion technologies are now up for approval.

A4A and our members are committed to ensuring that the alternative fuels we accept will have reduced life-cycle emissions compared to today's fuels and not compromise the food basket. Thus, I am pleased to report that we have developed methods and tools to demonstrate that these aims are met. Our vigorous pursuit of alternatives has sent an unmistakable signal to farmers, fuel producers, and investors: U.S. airlines are committed to making alternative jet fuels viable and will do our part.

But we recognize we cannot do it alone. Working in public-private partnerships, we have gone beyond testing and test flights to commercial airline and military jet flights. Yet we still need to scale up supply and make it fully cost competitive.

Central to this effort is our Farm to Fly initiative. Since 2010 we have worked with the U.S. Department of Agriculture, Boeing, and other stakeholders to align U.S. biofuels agricultural policy to support advanced aviation alternative fuels. Farm to Fly has brought farmers, fuel producers, and airlines together. It has spawned two regional initiatives to foster alternative jet fuels derived from homegrown biomass, and more efforts are in the works. But I note that this initiative could not exist without the Energy Title of the farm bill. Hence, we commend this Committee for its leadership in seeing that legislation through to passage. By assuring multi-year authorization and funding for critical programs, Congress will provide the stability needed for further progress.

Our joint efforts are bearing fruit. For example, United Airlines has executed a purchase agreement with AltAir Fuels for 15 million gallons of advanced bio jet fuel over a 3-year period, to begin at the end of this year. Alaska airlines has entered an agreement for the future purchase of sustainable aviation biofuel from Hawaii BioEnergy, with deliveries slated to begin in 2018.

Although these initial purchases are promising, we cannot be complacent in our efforts. To see these projects through to fruition and spur more, we must continue to employ all the tools we have

to further scale up supply. This is exactly what the Defense Production Act project between the USDA, Department of Energy, and Department of Defense is designed to do in partnership with private industry. We urge Congress to continue to support this important program.

In sum, the aviation industry and would-be alternative jet fuel suppliers are on the cusp of creating a viable alternative jet fuel industry—a synergistic win for the airlines, the traveling and shipping public, U.S. jobs, our armed forces, our economy, and our Nation. But continued Government partnership is needed in the near term to get us over the cusp. With sustained support, advanced aviation biofuels will, quite literally, get off the ground.

Thank you.

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

Chairwoman STABENOW. Well, thank you to all of you. In listening to all of you, I think from race cars to airlines and everything in between, biofuels are a very exciting new opportunity, a growing opportunity, and some would say, again, back to Henry Ford, not new but an opportunity now for us to create jobs and create new opportunities for agriculture and to get us on to cleaner types of fuel and energy.

We are in a situation, though—and I would like each of you to respond for a moment—in that what is facing us right now is the EPA talking about lowering the 2014 RFS volumes. In the face of all of this, when we see, on the one hand, we can grow more, we have more opportunities that are coming on the market every day, assuming that we can continue to see that happening and financing and so on, given the RFS situation, and we have the consumer end of it, whether it is airlines or race cars or whether it is automobiles, people at the pump. Yet here we are with the EPA talking about the "blend wall" and the impact that they would argue.

So I guess I would like each of you to respond specifically to that. Is there a limit to the percentage of biofuels that can be blended in conventional gasoline? What do we do to increase the market penetration? What happens if, in fact, the EPA goes ahead in terms of the ability to do the things that we are talking about this morning? Mr. Childress?

Mr. CHILDRESS. I think if they do that, the consumer is the one that will pay. At the end of the day, all of our Americans will end up paying the price. If we cannot get more ethanol, we have got to have blend pumps at these service stations to give our consumers a choice. It would be one of the most negative things, in my opinion and in Growth Energy's opinion, that if they lower the standards, it will be devastating to our public. It just opens the door for more foreign oil.

Chairwoman STABENOW. You know, Dr. Koninckx, I am going to ask you to respond, but I often think what a crazy situation we are in where we are trying to create more competition so prices will go down at the pump for consumers. Yet the folks that do not want competition control whether or not there is the pump there to create the competition. This is kind of a crazy situation that we certainly need to figure out how to get beyond. Dr. Koninckx?

Mr. KONINCKX. Yeah, and the EPA decision or the EPA's proposal unfortunately makes it worse and basically goes along with that faulty assertion. What is really a problem here is that the EPA has used a method, a logic to restrict or to limit the RVOs on the basis of the supply chain, which the incumbent controls, and that is more devastating than any other aspect of their proposal, because this really would put biofuels in a downward movement, and this really would slow down and stop the positive impact that it has had on agriculture, on energy prices, by lowering the demand for oil. Also, immediately there will be an impact on greenhouse gas emissions, which will increase.

There is really no blend wall. I call it the "blend step." The technology to go beyond E10 is there. My neighbor here has talked about it already. There are numerous options there, and really the EPA—we are surprised and disappointed about their proposal. The EPA there makes an error that is going to cost us.

Chairwoman STABENOW. Mr. Coleman

Mr. COLEMAN. Thanks for the question. You hit the nail on the head that the oil companies control the pumps, and so then you need—if you have that situation, then you are not going to have competition without policy. The RFS is actually designed to push higher renewable fuel blends into the marketplace. One of the ways it does that, because Jan has so articulately described it to this point, is using the RIN. One of the things that has happened is EPA has decided that what happened last year is a bad thing and they are dialing the program back, when, in fact, what happened last year was the oil industry refused to comply with the program, RIN prices went up, and then other independents were just getting in the big game and they were going to grease the skids to comply with the program.

So the program was actually working as designed last year, and if EPA sees that and reacts to it and decides that it is going to make changes, that it is going to convert an obligated party into a non-obligated party, the investors are going to see that, and they are going to run away from the industry. That is really the situation that we face.

E15, for example, is certified in 2001 and newer vehicles. That is three-quarters of the cars on the board. You have got diesel fuel—I drive a diesel car. You have diesel fuel sitting there. They have made the investment to put diesel there. A small percentage of passenger cars are diesel cars.

So we have the infrastructure to go where we need to go. It is really all about the program pushing incumbents there.

Chairwoman STABENOW. Thank you.

Dr. Arora and then Ms. Young. I know I am running out of time here, but I would like to hear from each of you for a minute.

Mr. ARORA. Thank you for the question. I think regarding the question of blend wall, Brazil shows that really there are no technical limits to blend walls, and you can put even up to 100 percent ethanol. So does NASCAR show that as well. But I think what also we are missing the point on is that biofuels really offer good options to have regional strategies, and we are trying to, I think, pursue a one-size-fits-all strategy for the whole country. So we should also be looking at ethanol, which really works beautifully in the

Midwest, as well as for other applications. We should also be looking at drop-in biofuels in the Southeast where the feedstocks are different so you can match—take woody biomass or poultry industry biomass and convert that over to the biofuel. So we need to look at it more on a regional basis as opposed to a one-size-fits-all strategy for the country.

Chairwoman STABENOW. Thank you.

Ms. Young?

Ms. YOUNG. Jet fuel is not subject to the volume requirements of the RFS for good reason: Making jet fuel to meet the rigorous safety requirements we have is a higher hurdle than it is for ground-based fuels. But we have a win-win opportunity here. Under the RFS program, the very projects I was talking about that produced advanced jet fuel, advanced biofuel, can qualify under the RFS, and in those cases they can offset the obligation of the producer for purely ground-based fuel.

So it is sort of a win-win in that it can take some of that pressure off of ground-based fuel. The more we can do with alternative jet fuel, the better for everybody.

Chairwoman STABENOW. Very interesting. Thank you very much. My time is up.

I will turn to Senator Cochran for questions.

Senator COCHRAN. Madam Chair, let me join you in thanking our panel of witnesses for being here today and helping us understand some of the issues involved in this subject.

I wonder, are any of you specifically recommending the adoption by Congress of changes in the existing law that would help meet some of the goals and targets that you think would be fair to this competitive environment that we are trying to help support?

Mr. COLEMAN. Well, I guess I will go first. The answer is an emphatic no. The program is designed well at the legislative level. The issues that we have are entirely administrative, and we are working with EPA, and Members of Congress have been helpful in that regard.

Mr. KONINCKX. Yeah, I would join exactly that. We would ask you to use your oversight authority to encourage EPA to implement the law as it was designed, and to not look at the supply chain that is controlled by the oil industry as an obstacle to its implementation.

Senator COCHRAN. Ms. Young?

Ms. YOUNG. I think from our perspective, our message is largely "stay the course." I think that is very important for fuel producers and investors and others right now. With due respect, some of the uncertainty in the programs has been difficult for the investor community and fuel producers and airlines alike who want offtake agreements. So we are greatly appreciative of the work you did on the farm bill, and we are looking forward to continued support for the Defense Production Act project that DOE, USDA, and the Navy are working on together so diligently.

Senator COCHRAN. Dr. Arora?

Mr. ARORA. Yes, I absolutely support the consensus with the rest of the panelists here and would add the fact that I think as a whole the industry has underestimated the proverbial value of death in trying to come out of the perspective of bringing these biofuels to

markets. Oftentimes the biofuels industry has been compared to bringing a new drug to market, which now takes $1 billion and 10 to 15 years to come to market. In respect of that, the biofuels industry has actually done a great job of really moving these technologies to commercialization much quicker than a lot of other industries have. So we must stay the course with the RFS.

Senator COCHRAN. Thank you.

Thank you, Madam Chair.

Chairwoman STABENOW. Thank you very much.

Senator Donnelly?

Senator DONNELLY. Thank you, Madam Chairwoman. Gosh, there is so much I want to talk about here. I am an all-in-America energy person. The more, the better, as long as it is, from our country and from North America. But I view this not only as an economic issue or an environmental issue but a national security issue in that every barrel of American fuel we make is one less that we have to get from places that might not be friendly toward us.

You know, I know other members of the Committee were recently in Ukraine as well, but I was there, and a huge portion of everything that is going on there is the Russians holding the Ukraine hostage over natural gas. You think the very technologies that you are talking about today can help change the world, that it provides jobs, helps the environment, increases our national security, and makes us independent. And so I view this as critical.

When we were landing in Ukraine, you looked and it looked just like Indiana, the farmland there, and the things that can be grown there. And to use your technology over there and helping them to become energy independent changes the world.

Mr. Childress, I want to thank you for not only moving this technology along and promoting it, but also for the smiles you put on the faces of Hoosiers every week, and for also employing a Hoosier driver. We are very excited about that as well. He is a pretty good driver, too.

Dr. Koninckx, what I wanted to ask you is this advanced cellulosic, has always been, ''In 5 years, we are going to have this.'' Then 5 years late, it would be, ''Five years from now we are going to have this.''

Obviously with stover we are there. How about woody pulp and all the other different sources?

Mr. KONINCKX. Yeah, indeed, Senator, with corn stover we are in construction right now, and numerous—several other companies—Brooke mentioned them already, Abengoa, POET–DSM—are in the same place and will start up this year. As you said, this is a great competitive advantage for the U.S. to use. Agricultural productivity is phenomenal here. Our farmers are very good, and as a company invested in agriculture and very active in agriculture, we know this very well and we connect with that.

We are in our facility in Tennessee, where we—as I alluded to, the facility that we use to develop data and know-how on how to develop additional biomasses as feedstock, we are already active. We work with switchgrass. We work with agricultural wastes of different types. So, absolutely, this will be extended.

We picked corn stover as a starting point, a crop we know a lot about, a crop the U.S. is tremendously competitive in, and a crop,

corn stover itself, we do not need to convince anybody to grow. It is there, and we now have to harvest it.

Senator DONNELLY. How hard is it—so you picked corn stover. You have basically unlocked the code on that.

Mr. KONINCKX. Right.

Senator DONNELLY. Is what you are learning from that going to help us unlock the code on woody pulp and other——

Mr. KONINCKX. Absolutely. This is a tweak, I would call it, in technology. It is an optimization of technology to another feedstock. It is not a redevelopment. It is really a tweak.

Senator DONNELLY. Cost-wise, how competitive is this product going to be?

Mr. KONINCKX. The product at first, when we start up these plants, will be more expensive than corn ethanol and more expensive than fossil fuel. But over time this will come down, and we continue—as we have always said, we continue to anticipate to be competitive with oil at about $80 a barrel. The cost for carbon that we pay is far lower than crude, and it is our entitlement to then work down the conversion cost, to bring that down. Just as the oil industry has been able to do over a century, we will bring this down much faster, and as I said, we anticipate being competitive over time with oil at $80 a barrel.

Senator DONNELLY. Mr. Coleman, one of the biggest challenges we have is infrastructure. The EPA has told us the reason they have done this is the lack of infrastructure. It seems like shaky logic to me. But we do have infrastructure challenges. What are you recommendations to overcome those infrastructure challenges?

Mr. COLEMAN. Well, the first thing is the industry itself has made a lot of progress since the inception of RFS2. So one of the things that I think is incorrect with regard to when EPA is talking about infrastructure is they talk about it like it is a big problem that has not been solved. So we have made great steps forward with regard to E85 and made great steps forward with regard to E15. There is much more interest in the marketplace at today's gas prices to do some of these things.

Senator DONNELLY. I mean, they say we cannot get—we have the product, it works great, we cannot get it to market.

Mr. COLEMAN. Right. The big issue is that the oil industry is standing in our way, and so the mechanism that the RFS puts into law actually solves that problem. It actually—so the way that RINs work—and whenever we talk about RINs, it is a scary thing because the eyes can glass over. But the way that RINs work is the oil companies that do not want to do it have to buy RINs. If they buy a lot of RINs, the RIN prices go up, and then the oil companies that suddenly have an opportunity to make money on RINs jump in, and you flow the fuel into the marketplace, and you have market penetration. There is one critical point—and I am sure Jan can add to this—this RIN trading that goes on, it does not increase gas prices because it is an intra-trading scheme in the oil industry.

So if you do not want to do it, you can buy RINs. But when you do not want to do it, it allows the folks the independence that do want to do it to get in the game. That is what the EPA is short-circuiting when it decides to go backwards.

So it is not all about the number. We have heard Administrator McCarthy says we are going to increase the numbers, and our investors say, well, that is good, because shrinking marketplaces send investment the other way. But we have to get at this mechanism question.

Senator DONNELLY. Well, I want to thank all of you for your investment in our country, and that every day you do this, please know you make our Nation stronger not only economically but also safer as well.

Thank you.

Chairwoman STABENOW. Thank you very much.

Senator Hoeven?

Senator HOEVEN. Thank you, Madam Chairman. I want to thank all of you for being here. Mr. Childress, I want to commend you on your incredible record, and thanks for being here today. As Senator Donnelly said, we have many NASCAR enthusiasts as well and enjoy watching you and your team very much.

Let us start with you. How do we get the petroleum industry and the biofuels industry to work together? Look, we all want more domestic supply, and at the pump we want our consumers to have more choices and lower prices. So how do we get the traditional oil industry, the petroleum industry and the biofuels industry, how do we help them work together better to serve the consumer? What can we do?

Mr. CHILDRESS. You know, I think it boils down to our Nation, the economic side of it, we have to have more choices for our consumers. Until we can convince our oil companies that it is good for America, I do not think we will ever get there. It is kind of like trying to get a big bully to do something over a young kid. You will never convince them.

So I would like to see the big oil companies understand how important ethanol is. But when you talk about taking dollars out of someone's pocket, it is hard to get them to work with you.

Senator HOEVEN. Touch on for a minute the mileage issue with the biofuel blends and also some of the liability issues that we hear in terms of impacts on engines and that kind of thing. You are running 30 percent, obviously, in your cars. You talked about higher blends. So touch both on mileage and on the liability issues at least as you perceive them.

Mr. CHILDRESS. Yeah, okay. We run E15. Sunoco E15 is what we run in our cars. We tested all the way up to E30, and that is where I wish we were at in America today, was working more closely to E30 to give our consumers a better choice at the pumps.

You know, the liability side of it, a lot of that is a myth, in my opinion. In research that we have done, the liability, the way we run our engines is not there. If you talk about small engines, having a small engine, you cannot run a lawn mower or whatever this is. That engine, Briggs & Stratton, may cost $30. But the piece that maintains the correct ratio of fuel to air for ethanol fuels would probably costs another 30 bucks. So that is the reason they are not putting it in there.

In our cars we have a sensor that goes through our ECU that assures the correct ratio of fuel to air so there are no problems. The

newer cars, 2001 up, will not have a liability problem because they were built from the factories to sustain ethanol fuels.

You know, the other thing that we all have got to look at in the future is in 2025, I think it is, they are going to mandate a higher fuel mileage. Well, you get fuel mileage by octane. We are going to have to have smaller cars—I think it is 57 or 67 miles a gallon. We are going to have to have lighter cars. We are going to have to have smaller engines. The way we are going to get there, one of the ways to get there is ethanol, is a higher octane. It will make more power, it will burn cleaner, and it will help all of our greenhouse emissions.

So that is something we have all got to look at when it comes to 2025, when we all have to go to higher fuel mileage. You can get there, but it has to be done with octane.

Mr. HOEVEN. One thing you mentioned that I want to follow up on is blender pumps, and I think you talked a little bit about blender pumps as being important in terms of consumer choice and pricing. Just talk about you feel blender pumps can make an impact?

Mr. CHILDRESS. There are several—well, one, the cost. You know, it is more economical if you put ethanol in your cars and blend it. If we have got more stations sitting out there today with blend pumps that will give our consumers a choice, it is going to be more economical. We are going to use more ethanol. I was just reading in here, I think if we could put ethanol in, we will save 7 billion gallons of foreign oil coming into this country, and that is a big number. But the blend pumps are already being put in a lot of stations—not near what we need, but when we can get it, it will give our consumer a greater choice, and it is going to mean more dollars in their pocket that they can go spend in other places. We are being held hostage by foreign oil.

Senator HOEVEN. Again, Mr. Childress, thanks for being here. We enjoy following your racing team. To all of you, thanks for being here today. I appreciate it.

Mr. COLEMAN. Do you mind if I add one quick point on the choice question?

Chairwoman STABENOW. Sure.

Mr. COLEMAN. Thank you. Respectfully, thank you.

One quick thing that was not mentioned was E15, the fuel that is causing heartburn for AAA and small engine makers, is a choice fuel. It is an option at the pump. I think when a lot of consumers and trade associations think of ethanol, they think of it as a 10-percent blend, they are going to have to put it in their car if they use 87 octane. We are moving into a new territory here where, if you have a small engine, you have a lawn mower, you do not have to put E15 in your lawn mower. In fact, they ask you not to. It is banned from doing that. So——

Senator HOEVEN. You are talking with the use of blender pump?

Mr. COLEMAN. Well, no, if we did—without blender pumps, if stations tomorrow decided to put E15 on the island, it is a choice fuel. They cannot get rid of the other fuels. So what we are facing here is a situation where you pull up and you have this new choice of E15. You can pass on it, but that ultimately is where our industry

needs to go because we should—people should have the choice to use more and people can have the choice to use less.

Senator HOEVEN. What I would come back to is the question I started with Mr. Childress on: How do we make it easier to do that? How do we make it more cost-effective to do that for our petroleum retailers? I think that is a real key to get to what we want in terms of the consumer, more domestic supply, more choice, lower prices.

Chairwoman STABENOW. Thank you very much.

Senator Heitkamp?

Senator HEITKAMP. Thank you, Chairman and Ranking Member, for holding this hearing.

It is clear from the testimony today that we are so far advanced in the technology of creating these fuels that our big problem is marketing these fuels, is actually getting it into the market. There is a whole lot of kind of myths, and, Mr. Childress, I think today you dispelled very many of those myths. Every day when you run your cars, that tells the story that this is not something consumers should be afraid of.

But I do reject in some ways the argument that the oil industry is so integrated vertically that they control every pump or every station. I can tell you what consumers do. If you do not have a predisposed inclination against ethanol—which I do not—I look up when I am driving in, and I say, "What price gets me the cheapest gasoline?" Right? You pull into that pump, and you say, "This is what I am going to run." We know we can get fuel economy and fuel efficiency from ethanol. That is another myth: number one, it will wreck your engine and destroy your warranty. The other is that it is not as efficient and you will not get as high a mileage.

We can dispel each one of those, but that is pervasive in my State, even in my State, which is an agricultural State. We are also an oil-producing State.

My question is: What is the next generation of marketing strategies beyond Renewable Fuel Standards, beyond what we are doing with the RINs? What have your companies or your industry thought about in terms of how do we transition to providing greater incentives and responding to some of the concerns that our dealers have, our petroleum marketers have? I guess, Mr. Coleman, that would really fit your lane best.

Mr. COLEMAN. Yes, thanks for the question. You know, I think you are seeing it. I think the NASCAR thing is very helpful. You are seeing our industry work more directly with the gas station retailers. Recently, over the last couple years——

Senator HEITKAMP. Can you provide some examples of that? Because my dealers come in, and obviously, we are pro-ethanol in North Dakota for the most part, but yet they talk about concerns about their underground tanks and whether that is going to create leakage and destroy their small business into the future. They talk about marketing and the huge investment that they would have to put in to accommodate those products. So how do I respond to that?

Mr. COLEMAN. Well, so what we saw over the last year or so was retailers and independent marketers reacting very quickly to the RFS. The signal last summer was very clear: "We are going to use more ethanol." We had Mapco, we had Zarco, we had some of these

stations making big investments in blender pumps, 400 pumps that would have fundamentally changed how much ethanol could get in the marketplace. We are talking about one business deal alleviating 17 percent of EPA's supposed gap that we cannot do. So those are specific examples, and then when EPA said, well, we might go backwards, they all stopped.

So what I would say to you is the single most important thing that we can do is make sure that the RFS continues to go forward. Everything flows around it from there. I would have a hard time answering your question the other way, to be totally honest. People build higher docks to deal with incoming tide. They do not build higher docks to deal with outgoing tide. If the tide starts to flow out on renewable fuels, we are not going to have people signing up for marketing deals.

Senator HEITKAMP. Well, I guess my point is that as we move forward, I think the real challenge is not only a regulatory challenge, but it is also a public policy challenge. You know, I do not know what would happen if you put Renewable Fuel Standards to a vote today in the United States Congress. Right? You know, we would like to think we would maintain it and be able to present those arguments. But it may not be factual, and so I think it is really important that we start talking about what is the next generation of incentives, what is the next generation—just like you guys are doing advanced biofuels, what is the new advanced marketing strategy? How do we get it out there as you are working on equality and pricing?

Like I said, if I know that I can offer a product at 10, 15 cents lower than the product across the street, I am going to put that product in because I am going to get that business. So it is all a game of money, it seems to me, and consumer choice. I totally agree with that. But I think that we need to think beyond Renewable Fuel Standards, is actually I guess my point, which is what is the next thing that we need to do to guarantee that the infrastructure gets built out so that we can offer this consumer choice, so that we can continue the diversity of the American fuel industry. I really applaud what the airline industry is doing. I think we are going to see some other alternative fuels, whether it is compressed natural gas—there are some creative things that are happening to diversify this industry, but we are challenged by the marketing. So I look forward to other ideas.

Mr. KONINCKX. Senator, if I can comment on that, as a company that is investing very much in advanced biofuels, I chair the board of our joint venture with BP, Butamax, that is developing butanol and will commercialize butanol. It is a good example of the kind of things you ask for.

But I have to say at the same time these kind of initiatives are less likely to succeed if the RFS is being questioned. If there is lack of stability in the regulatory environment, investors in this kind of difficult technology development will shy away.

Senator HEITKAMP. You know, and I get that, but the argument you get on the other side is: When is this product going to stand on its own feet and market itself in a way that does not require any Government mandates, any Government programs? I just raise that because, I think about all the arguments that the oil industry

or all the detractors from RFS present us, and we need to have responses to those, and we need to have the next generation of marketing strategies.

Chairwoman STABENOW. Thank you very much.

Senator Grassley is next.

Senator GRASSLEY. Thank you. Thank you all. I heard all of the testimony except for Ms. Young. I am sorry. I had to go back to Finance.

There is a lot of debate in Congress about moving towards non-corn, non-food biofuels. Of course, I support every effort to develop advanced biofuels, but I think there is a misunderstanding about the role of corn ethanol in developing advanced biofuels.

For instance, there are Members of Congress that have offered legislation to repeal the corn ethanol portion of the Renewable Fuel Standard. Some of the same members have also advocated on behalf of advanced or non-corn biofuels.

So to Mr. Coleman and Dr. Koninckx, can you help me understand the relationship between first-generation and second-generation biofuels? Can we have an advanced biofuel industry if we eliminate the Renewable Fuel Standard for corn ethanol or traditional biofuels? Would we have an advanced biofuel industry without the corn ethanol industry?

Mr. COLEMAN. Senator Grassley, thank you for the question. We have a partnership with the Renewable Fuels Association for a reason. They work on corn ethanol; we work on next-generation ethanol. The reason we have a partnership with them is because at the end of the day we are connected at the business sense, at the market sense, et cetera. I have given examples in my testimony. If you look at some of the first movers in cellulosic ethanol, you will see POET, you will see DuPont, you will see Abengoa with 500 million gallons of corn ethanol. But the list goes on and on: Quad County, Pacific Ethanol is moving.

The reason they are moving so quickly is because they have an interest in diversifying feedstock at the plant. These are, in essence, integrated ethanol refineries. It is in their best interest to also use stover in addition to the corn kernel. When corn prices go up, they want to find other feedstocks, too. So there is a clear connection—not in all cases but in a lot of cases with regard to the first movers—between the first-generation ethanol guys and the second.

Now, specifically with regard to Senator Feinstein's proposal, it is not a good proposal for a number of reasons. First is when Congress makes a 15-year commitment and changes the rules a third of the way through, it does not matter whether you think it is warranted or not, the message to the investment community will be that Congress changes its mind. So it is clear that Senator Feinstein does not like the corn ethanol part of the RFS. The problem is realistically it will affect our industry. What she is proposing to do is already done. Ninety percent of the gallons left in the RFS are advanced biofuel gallons. So it is unclear to me what exactly the point is of the legislation.

The last piece of this that we do not find believable is that she is proposing to amend the Clean Air Act in the RFS in a very po-

litically clean way and that they can control the politics. Our investors will not believe that.

Thank you.

Mr. KONINCKX. Brooke gave a very complete answer, Senator. Thank you for your question. Absolutely, the advanced biofuels would be much more difficult, if possible at all, if there was not a corn ethanol industry as well that provides tremendous synergy and provides an example for further diversification of feedstock.

Very much as Brooke, as Mr. Coleman just indicated, what we need is a stable regulatory environment, and if it is shown that the regulatory environment is changed in mid-course in these very difficult development cycles—and, trust me, I have worked on this myself for the last 7 years, coming out of the laboratory to commercial scale—stability in the regulatory environment is needed. Investors—and we are particularly worried about a second wave of investors. You know, we see direct foreign investment that is interested in this and is shying away when we see a lack of stability in the regulatory environment. So any change in the RFS will threaten the further growth in advanced biofuels as well.

Senator GRASSLEY. Mr. Coleman, for the last few years we have heard that advanced and cellulosic biofuels are just a year or two away from commercialization. Since you represent one of the largest organizations representing advanced biofuel producers, are we at a critical juncture for commercialization? If so, what effect has the EPA proposal had on cellulosic facilities that will be coming online in the near future?

Mr. COLEMAN. We are a critical point. We are just 6 years past the signing of RFS2, and so our industry has been in the lab for a long time. But we all know that the key to commercializing a fuel is to have a demand trajectory, and it is hard to have a demand trajectory when you are asking the oil companies to buy a product they do not want to buy. RFS2 solved that problem, and since then we have made very, very good progress, notwithstanding the financial markets. We have all these plants coming online. You can visit them. They are big metal, concrete objects. You have seen them, and we have seen them, and that is really exciting.

What the EPA proposal did, first the leaked version in October and then in November, is it froze everything. We have had—every single one of my companies—there are no exceptions—have either picked up the phone or testified in meetings with Congress that what EPA has done is froze everything. What we are waiting to see is if the Obama administration and EPA turns around on this and addresses both the retraction on the numerical side and also properly reinstitutes the mechanism that would force change in the marketplace. If that is done, we will recover, and we will recover well.

Senator GRASSLEY. Can I ask one more question?

Chairwoman STABENOW. Sure.

Senator GRASSLEY. Mr. Childress, I understand you have tested ethanol. What did your testing conclude about the use of higher ethanol blends such as E30? Did you find any serious issues with blends above E15?

Mr. CHILDRESS. Yes. When we were testing E30, it actually showed better in the engines from horsepower—the octane built

more horsepower, which would go back to what I was talking about earlier, the 2025 mandates on fuel economy, and you get through octane.

I think one of the other things that we—going back to what you had asked earlier, is educating our consumer. There are so many myths out there, again, what you said about the food. We only use one-third of the corn, out of the corn, to make ethanol with. The rest of it goes into distiller's grain, which goes to the animals. This is not corn we eat. So that is a big myth that people have tried to let our consumers think that it is food versus fuel. It is not. We have got the greatest shortage today on beef that we have ever had in America since the 1940s, but a lot due to the drought. The same with the disease on some of our pork.

So there are a lot of myths out there that a lot of people are using today. I know that is not in the question you asked, but I had to say that. Thank you, sir.

Chairwoman STABENOW. Thank you.

Senator GRASSLEY. Well, give me more time.

[Laughter.]

Chairwoman STABENOW. I did, Senator Grassley, I did.

Senator Klobuchar?

Senator KLOBUCHAR. Well, thank you very much, Madam Chairwoman. Thank you for holding this important hearing.

I truly believe that the success, the story of the success of the Renewable Fuel Standard is only half-written. You look at the fact that we have reduced our dependency on foreign oil by 60 to 40 percent. Now, that is a combination of things. We know it is. Some of it is the drilling going on of oil and natural gas in my neighboring State of North Dakota there. Some of it is the gas mileage standard increases that we have seen that have been so positive. Some of it is biofuels, and I sometimes think people do not understand that biofuels is now 10 percent of our fuel supply. People seem to dismiss it as some kind of a boutique fuel. That is not true.

That is why I was so concerned when the EPA came out with the rule. I think it creates uncertainty, something that you were just talking about, Dr. Koninckx, that is going to be bad for the market, and especially when we are in a situation where oil has kept its nearly $40 billion in tax credits and ethanol has literally lost theirs, as well as any kind of incentive from the tax credit standpoint for advanced biofuels. So that really concerns me, and that is why I think that this renewable fuel standard is so important.

I think I wanted to start with something specific that you had alluded to, Dr. Koninckx, and that is biobutanol and the blend wall. How do you see biobutanol—we actually have a plant in Luverne, Minnesota, and DuPont has signed on to an agreement to convert another ethanol plant in Lamberton, Minnesota, to also produce this fuel. How do you see it in other advanced biofuels working to overcome some of the blend wall problems that have been raised?

Mr. KONINCKX. Well, as I mentioned earlier, Senator, I do not think of it as a blend wall but a blend step. It is a transition in the market that the RIN mechanism that Mr. Coleman spoke about earlier enables and facilitates. Butanol would be one and will be one of the mechanisms that allows for further blending of renew-

able energy into fuels without any adjustment or change to the infrastructure.

So with butanol, you can basically bring twice the renewable content and renewable energy to gasoline without any changes to the existing infrastructure. In an equivalent of E15, you could implement the entire Renewable Fuel Standard without infrastructure changes.

In addition, butanol brings a number of advantages to refiners and really allows all refiners to make better use of the oil barrel in total as they make gasoline, jet fuel, and other products.

But I would say, again, it is one of the possible ways to increase the renewable content, the energy content, and it is something that we invest a lot of effort, our best resources in, together with our partner BP. We look very much at the stability and the implementation of the Renewable Fuel Standard to continue that.

Senator KLOBUCHAR. Thank you.

Mr. Coleman, I hosted a meeting in my office with Administrator McCarthy and with a number of people in this room, half Democrats, half Republicans, about our concern about the changes to the Renewable Fuel Standard and their proposal. One of the things I was struck by was that the Director continues to believe that renewable fuels are cleaner and better for the environment than petroleum-based fuels. Can you talk about the improvements the renewable fuels industry has made in reducing the greenhouse gas intensity and water consumption and how you see advanced biofuels making improvements in this area?

Mr. COLEMAN. Thank you for the question. So at a basic level, cellulosic biofuels are the lowest carbon fuels in the world. Some of our fuels are carbon neutral or better, and so when we are talking about building these plants, if carbon is something you care about, these are the lowest carbon fuel plants in the world, and they are a tremendous opportunity for fundamentally changing the marketplace.

With regard to another point which I made in answering Senator Grassley's question, there are synergies between conventional and advanced biofuels. Some of our members are bolting on technology to conventional plants, so that then raises the question, well, how much and to what degree are those plants improving? What we have seen over the last 10 to 15 years is an industry going in starkly the opposite direction of the oil industry. The oil industry is running out of light sweet crude and is using—has to go heavier and heavier and more carbon intensive. We have reduced our water and our energy, et cetera, in the vicinity of 30, 40, 50 percent.

Senator KLOBUCHAR. Right. Do you see biodiesel as part of this? That has also been quite a success story, and we have not talked as much about that. But the feedstock diversification and also the wider number of fuels like bio jet fuels.

Mr. COLEMAN. I do. I do, and I think over—one of the things you are going to see a decade from now is a lot of different companies being in both the gasoline and diesel fuel marketplace. We have companies that said they were all about ethanol, and there are really integrated biorefineries, and some of them now are producing jet.

Senator KLOBUCHAR. Speaking of jets, Ms. Young, we are a Delta hub, and I know Delta actually, to try to reduce some of this volatility, has gotten its own refinery going. But how do you look at advanced biofuels helping to reduce volatility and provide more competition in the jet fuel market? I look at this, as head of the Tourism Caucus, as also an economic issue. Foreign tourists spend an average of $4,000 when they visit our country. It is a huge boon to us, and if we have a diversification of fuel and we do not see these spikes, it is going to make it easier to bring in tourists because they are going to be able to afford to come in, and then they spend their money at the Mall of America in Bloomington, Minnesota, or—I do not know, I am trying to think where they would spend their money—in Des Moines, in Iowa. Senator Grassley, they would tour an ethanol plant in Iowa, for instance.

Ms. YOUNG. Well, thank you for the question. With fuel as our airlines' number one expenditure, we are really focused on trying to have a competitor to petroleum-based fuel exactly for the reason that you say. I think, price volatility certainly in the last several years has sort of eaten airlines' lunch, so to speak. With that big of a cost center, not being able to predict, airlines like Delta, have had challenges, and our airlines lost a lot of money.

Now we are in a period of going from a lot of loss, over $50 billion lost over 10 years, to a period of very razor-thin profits. But if we cannot manage the fuel price and volatility issue, those very razor-thin profits are going to be diminished.

As I noted before, it is really not just good for the airlines, it is good for their customers, it is good for the economy, and it is good for really the industries that we would be supporting—the new biomass industries, the farmers, et cetera—if we can get this competitor to petroleum-based jet fuel.

Senator KLOBUCHAR. Thank you very much.

Chairwoman STABENOW. Thank you very much.

As we wrap up, there is one other question I wanted to ask, and I know Senator Cochran had a question as well. As we conclude, I wanted to ask Dr. Koninckx, we are going to be later in the spring talking about bio-based manufacturing, which is something I know that you are very involved in as well with DuPont. In the farm bill, we made important steps by expanding the Energy Title to include not only biofuels, which are very, very important, but the ability to focus more on bio-plastics, bio-based manufacturing opportunities. We want to highlight that later this spring, but I wondered if you could just talk about the fact that biorefineries can integrate a number of different processes, at one location produce more than just biofuels and multiple—renewable chemicals that have multiple purposes or polymers that can be used, as I mentioned in bio-plastics.

So I wondered if you might just take a moment sort of teeing up what we will be discussing later down the road, how the production of biofuels can create additional manufacturing opportunities.

Mr. KONINCKX. Yes, certainly, and I cannot thank this Committee enough for the support that you have given through the farm bill for these programs. It is a great encouragement for us.

We are already working on biochemicals. As I mentioned earlier, we already produce something called propanediol in Tennessee

from sugar in a biorefinery. It happens to be a corn wet mill. That sugar is being used to produce the propanediol, which is then used to make things like carpet fiber and so on.

But the development that we see going forward is one in which the supply chain that is growing for biofuels will enable efficiency and low-cost access to renewable carbon for biochemicals in a way that is not possible up until now. So just like petrochemicals grew with the petroleum supply chain and an energy market as a supply chain source, we expect the same as biofuels will be enabling the growth of biochemicals. So this is very much critical for that.

Chairwoman STABENOW. Thank you very much.

Senator Cochran had a question, and then, Senator Grassley, since you are remaining as well, we might just let you ask one more question, if you would want to do that. So it is up to you.

Senator Cochran?

Senator COCHRAN. Madam Chairman, thank you very much.

Dr. Arora, you mentioned in your testimony that in the Southeast there are many opportunities in terms of emerging feedstocks that are readily but not traditionally used for food or feed use. Can you elaborate on some of the barriers to development of advanced biofuels in the South?

Mr. ARORA. Sure, I would be glad to do that. I think one of the things, as I mentioned earlier, the South, we are able to grow a lot of different types of feedstocks, which includes switchgrass and also grasses like miscanthus, one of them actually that was developed at Mississippi State University and is now being licensed commercially. But when we say "licensed commercially," we are still talking about very small, relatively small penetration on these things.

Tennessee, for instance, has over 6,000 acres of switchgrass growing, but when you compare that to conventional, traditional crops like corn, it is just a very small amount of acreage that is dedicated to these advanced biofuels and biofuels feedstock. So we need much greater penetration of the acreage for these feedstocks that can grow easily in this region.

Additionally, as I mentioned earlier in my testimony also, the poultry litter is actually a tremendous potential that is generated in not only the South but just from Maryland all the way across to Arkansas, and the numbers that I have seen are we have over 26 billion pounds of poultry manure that is generated, and we oftentimes see that as a liability for our country. Yet indeed that can actually lead to about over $550 million worth of biogas that is trapped, methane gas, actually that is trapped within the poultry litter. If you think of the future implications, we are talking about products like Bio Compressed Natural Gas (BioCNG) that could be produced from that and help with the RFS requirements.

Senator COCHRAN. Thank you

Chairwoman STABENOW. Thank you very much.

Senator Grassley, if you would like to offer the last question, you are welcome.

Senator GRASSLEY. I do not have a question, but I would have a couple suggestions: first of all, to thank Mr. Childress for bringing credibility to this industry through his use of the product and, most importantly, the outspokenness where he is willing to take a stand. I appreciate that very much.

I would suggest to you that you send Mr. Coleman's testimony to the Wall Street Journal.

[Laughter.]

Chairwoman STABENOW. I will do that. In fact, we are going to send all the testimony over to EPA as well.

We want to thank everyone for being here today. You can tell that our Committee is very committed to extending and expanding opportunities through biofuels as well as bio-based manufacturing. We are talking about jobs and growing rural communities and helping us to become more energy independent. We understand that we need policies that give us long-term certainty so that investments can be made in the future. We know this is a fight—it really is—about competition, and we are on the side of the consumers that want lower costs, lower competition, whether it is a business consumer like in the airlines or whether it is a family trying to make ends meet and stretch every dollar and pulling up to the pump, or somebody who is enjoying a great race on a NASCAR weekend. So we thank you very, very much for being here.

Any additional questions for the record should be submitted to the Committee clerk 5 business days from today. That is 5:00 p.m. on Tuesday, April 15th. The meeting is adjourned.

[Whereupon, at 11:29 a.m., the Committee was adjourned.]

A P P E N D I X

APRIL 8, 2014

STATEMENT FOR THE RECORD
Senator Thad Cochran
Senate Agriculture Committee Hearing on Advanced Biofuels
April 8, 2014

Madam Chairwoman, thank you for holding this hearing today. The topic of today's hearing is timely since Congress recently passed the 2014 Farm Bill Conference Report in early February.

It is my hope that this hearing will serve as an opportunity for the Agriculture Committee to conduct oversight over the U.S. Department of Agriculture (USDA) energy programs. The energy title in the Agricultural Act of 2014 includes nearly $900 million in mandatory funding over five years for various energy programs. A critical aspect of today's hearing will be to hear first-hand from the panel of witnesses about the interplay between Federal investment in government programs like USDA's energy program portfolio and how this investment has contributed towards the commercialization of advanced biofuels.

Additionally, the hearing will examine how Federal investment in USDA's energy programs have helped achieve objectives set forth in policies like the Renewable Fuels Standard (RFS). Although there is no witness attending today's hearing from USDA or the Environmental Protection Agency (EPA), I anticipate that we might also hear about recent Administration actions that have sent unclear signals with regard to the future of the Renewable Fuels Standard (RFS) and the biofuels debate.

As Ranking Member of this Committee, I continue to hear from a wide array of stakeholders from the agricultural community that have interest in the Renewable Fuels Standard (RFS) and how this policy impacts the agricultural sector and rural America.

I am pleased to introduce our distinguished witness, Dr. Sumesh Arora, who has traveled from Mississippi to join us for this morning's hearing. Dr. Arora currently serves as the Vice President of Innovate Mississippi, which is a non-profit organization that focuses on economic development through public-private partnerships and works closely with the biofuel and cellulosic ethanol sector. Innovate Mississippi is actively working on efforts with key industry stakeholders towards the commercialization of advanced biofuel technologies through its Strategic Biomass Solutions initiative in Mississippi and throughout the Southeast region of the United States. Dr. Arora has over twenty years of experience in the public and private sectors in the arena of applying science and technological advancements from the laboratory and translating them to on-the-ground, real world projects: truly guiding projects from "beakers to hard hats" as he would say. Innovate Mississippi brings together Federal and state partners with advanced biofuel industry representatives, entrepreneurs, investors and economic developers with the goal of developing innovation-based enterprises and connecting them with a wide variety of resources.

Dr. Arora, thank you for joining us today.

Thank you. I look forward to hearing testimony from our panel of witnesses.

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Written Statement for the Record

Sumesh M. Arora, Ph.D.
Vice President, Innovate Mississippi
Director, Strategic Biomass Solutions

Before the
United States Senate Committee on Agriculture, Nutrition and Forestry
Full Committee Hearing

Advanced Biofuels: Creating Jobs and Lower Prices at the Pump

Washington, D.C.
Tuesday, April 8, 2014

Strategic **Biomass Solutions**™
www.biomass.ms

Thank you, Chairwoman Stabenow, Ranking Member Cochran and members of the committee for the opportunity to testify today in support of advanced biofuels and how they may lead to job creation and lower prices at the fuel pump.

My name is Dr. Sumesh Arora and I serve as the vice president of Innovate Mississippi, an independent nonprofit organization that champions innovation and technology-based economic development. I have worked in corporate research for 13 years in the chemical process industry and have 12 years of experience in the renewable energy sector. My Ph.D. in international development has given me an opportunity to study the human side of technology adoption and how new innovations may be diffused among various populations.

I hope to provide a perspective on how advanced biofuels and bioenergy development and deployment may be accelerated in the Southern United States, where considerable related activity is already taking place on multiple fronts.

In the time I have today, I will address five challenges and opportunities for furthering the domestic development of advanced biofuels and biomass-based energy options:

1. This industry is still in its infancy. Currently there is no "dominant design" for advanced biofuels technologies or feedstocks, which means that many different technologies are being perfected that can use a wide variety of feedstocks. This opens up opportunities for many technical and business innovations in this sector from deploying very large scale systems to small modular and even on-farm

systems. Achieving the concept of dominant design makes a technology more bankable and much easier to be adopted by the masses. There is, however, a significant need to educate entrepreneurs and investors on how to mitigate risks associated with developing successful ventures in this space. It is important to look at risk in five key areas as these businesses evolve: technology, markets, management, finance and execution. Innovate Mississippi, through its Strategic Biomass Solutions program, has developed the Renewable Energy Venture Startup (or **REVSup** for short) Academy, which does just that- educate entrepreneurs to mitigate risk. REVSup workshops have been conducted all over the country in the last three years. Linking business plan competitions and business accelerators around the country is critical to encourage investment in new ventures.

2. Many parts of the country, especially the Southeastern United States, are well suited to generate current and emerging feedstocks in an ecologically sustainable manner, which can provide very effective regional solutions. For example, forestry and poultry are two of the biggest industries in the Southeastern United States that can supply feedstocks currently for advanced biofuels. Emerging dedicated energy crops such as grasses and algae also grow well in this climate, but additional research and market development is still needed to optimize the feedstock supply chains.
3. Deployment of these technologies will lead to an increase in the number of STEM (science, technology, engineering and mathematics) related jobs across the country, which will be difficult to off-shore and will also lead to rural wealth creation. However, we need to better connect and leverage federal research assets with local

universities, schools, business and nonprofit organizations to accelerate the development of these technologies. For example, Innovate Mississippi is the original member among nine partners with the USDA Agricultural Research Service (ARS) to facilitate commercialization of ARS research through the Agricultural Technology Innovation Partnership (ATIP). I applaud the 2014 Farm Bill for urging the Department to move forward with further development of public-private partnerships to provide venture development training for innovative technologies.

4. Advanced biofuels should not be limited to just liquid fuels, but should be viewed in a more comprehensive manner to include viable biomass-based energy and biochemical options in gaseous, liquid and solid forms, thereby necessitating a long-term and stable policy that provides clear market certainty. The announcement by President Obama March 28 unveiling a strategy to curb methane emissions does that to a great extent; however, the national Biogas Roadmap scheduled to be released in June this year is expected to focus primarily on the dairy industry, which is quite small in the south compare to poultry. Millions of tons of poultry waste is generated in states from Maryland to Arkansas and the contributions to biogas production from this very viable feedstock have largely been ignored. There are tremendous entrepreneurial opportunities in developing such systems that can lead to rural job growth and keep energy prices low for farmers, while improving soil health.
5. A large enough volume of advanced biofuels and biomass-based energy options in the overall mix will help keep fuel prices in-check by diversifying our energy supply

and enhancing our national security, but market conditioning efforts led by various federal agencies must continue for greater adoption of such fuels.

Our work at Innovate Mississippi can be summed up in two words: ***"coach and connect."*** While our mission and goal may sound simple, the work of coaching early stage innovation-based enterprises and connecting them with a wide variety of resources, including early stage capital, technical research and entrepreneurial service providers, is challenging. The ultimate goal is to create fast growing, commercially viable companies, which also yield great returns for the early stage investors. Innovate Mississippi relies on various sources of state, federal and private sector funding to provide such services at low or no cost to the entrepreneurs.

I am proud to say that, due to the combined efforts of many stakeholder organizations, Mississippi is emerging as a regional leader and the proving ground for commercial scale production of various advanced clean energy technologies such as woody biomass and MSW-based cellulosic biofuels, biogas production using poultry litter, torrefied wood pellets, thin film solar panels and energy efficient windows.

The need for a consistent, long-term energy policy for our country has been identified by many organizations. To quote Phyllis Cuttino, director of Pew Trusts' Clean Energy Program, whom we hosted in Mississippi in 2012 to hold one of five national roundtables, "predictable, long-term incentives are needed to usher this emerging industry as it approaches broad market acceptance."

In closing, I would like to reiterate that investing in renewable energy is just like investing for your retirement – it is about diversifying the portfolio and investing early. We have to diversify the nation's energy portfolio and begin moving away from a transportation sector that relies on nearly 93 percent of its demand from fossil fuels. Furthermore, just as it is not prudent to wait until we are about to reach retirement age to start investing in that portfolio, in this case, it means we cannot put off making serious investments in renewable forms of energy until the expiration of fossil fuels is imminent. Thank you.

Testimony of Richard Childress

President and CEO

Richard Childress Racing

Before the Senate Agriculture Committee

April 8, 2014

Chairman Stabenow, Ranking Member Cochran, and Members of the Senate Agriculture Committee, thank you for allowing me this opportunity to testify today regarding the positive role a new ethanol fuel blend is playing in NASCAR races week in and week out.

My name is Richard Childress, and I am the president and chief executive officer of Richard Childress Racing (RCR). I have spent 45 years in NASCAR, first as a driver for about a dozen years, and then as the manager and owner of a racing team for more than 30 years. I have been fortunate enough to be a part of a long-term, very successful racing team. RCR racers have earned six Sprint Cup championships, six Nationwide Series championships, and 2 NASCAR Camping World Truck Series championships.

In addition to my work in motorsports, I am also an avid sportsman who sits on the Board of Directors for the National Rifle Association and the Congressional Sportsmen's Foundation. I am also involved in agriculture as the proprietor of Childress Vineyards in Lexington, N.C., and Yadkin River Angus in Clemmons, N.C.

I also serve on the board of directors at Growth Energy, the country's leading trade association of ethanol and renewable fuel producers. Growth Energy represents 82 ethanol plants in 14 states, 84 associate members involved in the value chain of producing ethanol, and 50,000 grassroots supporters. Our plants produce ethanol from grain and are leaders in innovating in second-generation fuels from sources like plant wastes and algae.

RCR didn't become as successful as it has been by not paying attention to the performance details of our racecars. So, when NASCAR decided to switch to a 15 percent ethanol fuel, Sunoco Green E15, in 2011, we did our homework. We didn't listen to the negative rhetoric surrounding ethanol and the fuel's performance in vehicles. We did our own testing, and I can say that switching fuels has gone fantastic, and has been a very welcomed switch throughout NASCAR. Since switching fuels, we have seen increased horsepower from a higher-octane ethanol fuel blend and decreased emissions. In our own internal tests at RCR we used ethanol blends up to E30, finding no issues. These are things I and our drivers are really excited about.

I think expanding and growing our use of biofuels is a key component to helping farmers make a living, while at the same time delivering environmental benefits that can be enjoyed by all Americans. I think what NASCAR has done to show the performance side of ethanol is key.

Biofuels like ethanol keep money we would normally send abroad for oil in the U.S., creating jobs and economic activity here instead of overseas. Studies show that moving the U.S. to the same fuel blend we use in NASCAR would add 136,000 new American jobs, limit greenhouse gas emissions even more and reduce the demand for gasoline produced from foreign oil by up to 7 billion gallons.

From my vantage point, we ought to be doing things that help U.S. drivers adopt biofuels and encourage companies like those on the panel with me today to produce advanced and cellulosic biofuels. This includes things like helping retailers and drivers access E15, keeping the Renewable Fuel Standard intact, and incentivizing the production of advanced and cellulosic biofuels.

I'd also like to take this opportunity to go more in depth on a few other topic areas today. My testimony covers four key topics:

- The Success of the RFS
- EPA's misguided approach to the RFS
- Background on E15
- NASCAR's experience with Sunoco Green E15

Success of the RFS

I believe the Renewable Fuel Standard (RFS) is a very successful policy. It has created American jobs, revitalized rural America, reduced our dependence on foreign oil, made our nation more energy independent, injected much-needed competition into a monopolized vehicle fuels market, and improved the environment. That is a great record of accomplishment.

In particular, the RFS:

- Makes our nation more secure by reducing our dangerous dependence on foreign oil by 33 percent.
- Has opened up the vehicle fuels market, injecting much needed competition and providing drivers a choice at the pump.
- Supports 400,000 American jobs and generates $42 billion in economic activity.
- Reduces greenhouse gas emissions and improves the environment.

The RFS is the key federal policy that has spurred billions of dollars of investment in America's cutting-edge biofuels industry. It has been the primary driver behind the only large-scale, commercially-viable alternative to regular gasoline – ethanol. Because of the forward-looking, long-term nature of the policy, the United States leads the world in innovation in biofuels, attracting investment from around the world. Today, because of the RFS, there are more than 200 ethanol biorefineries across the country and dozens of projects that will make advanced or cellulosic biofuels.

EPA's misguided approach to the RFS

The EPA proposal sets us back on the path to fulfilling the RFS, will stifle investment in biofuels, and will encourage further and more intensive efforts to gut the RFS in the years ahead. It would cause severe harm to farmers, the biofuels industry, and the nation's economy. The proposal is already creating great uncertainty for farmers and other industry investors.

The RFS was approved by a bipartisan majority in Congress and enacted into law nearly six years ago. Since that time, the oil industry has refused to take any steps to allow higher biofuel blends into the consumer marketplace and now claims that the volumes of the RFS cannot be met because of the so-called "blend wall".

The EPA's proposal to waive the statutory renewable fuel volumes ignores the potential for higher ethanol blends like E15 and most importantly it does not follow Congressional intent in creating the RFS program.

The proposal directly threatens an American-made biofuels industry at a time when our nation can least afford to lose jobs. Companies from all over the world have invested billions of dollars in first and second generation biofuels in the U.S. and are poised to do more. Arbitrarily reducing the levels established in the statute threatens these investments that are making commercial production of cellulosic ethanol a reality – projects that will help achieve the significant greenhouse gas reduction goals outlined in the RFS.

By 2022, EPA estimates that the RFS will reduce greenhouse gas emissions by 138 million metric tons or the equivalent of taking 27 million passenger vehicles off the road. In particular, studies show that traditional corn ethanol reduces greenhouse gas emissions on average by 34 percent compared to gasoline.

As we move to the second generation of biofuels, greenhouse gas emissions will be even further reduced. Recent studies have shown that using switchgrass and corn stover to produce cellulosic ethanol will reduce greenhouse gas emissions as much as 94 percent and over 100 percent respectively.

The long-term certainty of the RFS has and continues to drive significant investment in the next generation of biofuels and new technologies both in ethanol production and in agriculture. By increasing yields, increasing efficiency, and deploying new technologies, ethanol and agriculture production continues to soften its footprint on the environment – particularly as fossil fuels like crude oil and natural gas become harder and harder to extract. Only by keeping this policy in place will we continue to see this type of investment in more efficient systems to improve our environment.

The RFS has been essential to providing access to the market for American-made ethanol. Without a market, the jobs and rural development would go away and the key investments that are now being made to get to the next generation of biofuels are simply not going to be made. To further this success, it is essential that the market for ethanol not be arbitrarily capped at 10 percent. Farmers and plants have delivered on the promise of the RFS and are poised to do more with higher ethanol blends like E15 – it is essential that this market expand the opportunities for American consumers to have a real choice at the pump.

Background on E15

When the federal Renewable Fuels Standard (RFS) was first created, it was apparent that our nation's energy infrastructure and economy needed a wider market for renewable fuels. Even under fuel use assumptions in 2007, higher-level ethanol blends like E15 would be required. Unfortunately, many critics have done everything in their power to prohibit consumers from getting a true choice at the pump with ethanol blends above 10 percent.

In those fueling stations where retailers have been able to offer E15, we have seen robust sales because E15 is less expensive, safe for use, and high performance.

Growth Energy led the way over five years ago by filing a waiver with the U.S. EPA to allow the sale of ethanol blends up to E15. By moving the nation to E15, we will further lower the price at the pump, limit greenhouse gas emissions, and create thousands of American jobs.

More testing was done on E15 than any other fuel ever approved by EPA under the Clean Air Act, with the Department of Energy (DOE) testing 86 vehicles for a total of 6 million miles. With DOE's data in hand, the EPA ultimately approved the approved the waiver in January 2011 for all 2001 and newer vehicles – more than 80 percent of the vehicles on the road today.

Unfortunately, many other criticisms of E15 have been made with no scientific basis whatsoever. For example, an oil industry funded-study of E15 by the Coordinating Research Council (CRC) is significantly flawed with DOE publicly releasing a direct response entitled "Getting It Right: Accurate Testing and Assessments Critical to Deploying the Next Generation of Auto Fuels" (http://energy.gov/articles/getting-it-right-accurate-testing-and-assessments-critical-deploying-next-generation-auto). First, the CRC was extremely limited – only testing eight vehicles while the DOE tested 86. CRC also failed to test the engines on E10, the standard consumer gasoline found throughout the United States. CRC only tested 3 of the 8 vehicles on ethanol free gasoline and even one of those failed. CRC also chose two engines that had existing durability issues – one of which had even been recalled. The test was also specifically designed to stress the engine valve train. To sum up their findings, DOE said, "We believe the [CRC] study is significantly flawed." DOE's findings were also recently validated by the National Renewable Energy Lab (NREL).

In fact, our own Engine Technical Director at RCR Racing, Dr. Andy Randolph reached similar conclusions about the flawed CRC study as well. And as we've seen on the track, E15 continues to be an overwhelming success.

NASCAR's experience with E15

NASCAR is the most-watched motorsport in the USA with over 100 million television viewers annually, and is the number two sport in the USA, on television, second only to the NFL. An average of over 100,000 fans attend the national series racing events per week at venues across the country. NASCAR fans are passionately devoted to the sport and care deeply, based on NASCAR research, about conservation of the environment, job creation in the USA, and energy security.

Based on the observation that consumers and businesses alike in this country were focusing more on the environment, NASCAR Green was founded in the fall of 2008. NASCAR was uniquely positioned to serve as a proving ground and demonstration platform for green technologies and solutions. NASCAR Green was launched to show that green technologies work and have real and measurable effect on reducing our collective environmental impact on our planet. It has been a success.

A key initiative for NASCAR Green is executed on track, each week with the use of Sunoco Green E15 in the NASCAR Camping World Truck Series, NASCAR Nationwide Series and the NASCAR Sprint Cup Series. Sunoco Green E15 is a 15 percent ethanol and 85 percent unleaded gasoline blend with the ethanol component made from American- grown corn. The E15 fuel was adopted at the beginning of the 2011 season.

The final formulation of Sunoco Green E15 was the result of extensive analysis by Sunoco scientists and the support of over 100 members of the technical areas of the NASCAR Research and Development Center, nearly all of the race teams and their engine shops, and the extended NASCAR Green team. After over a year and a half of work on the lab bench, the engine dynamometer and in thousands of miles of live on-track endurance testing of a range of fuel blend levels from substantially below to substantially greater than 15 percent ethanol. Sunoco Green E15 was selected because it provided the optimal synergy of high performance as reflected by about 10 additional horsepower on average over the prior fuel, and 100 percent reliability on the track. It is a great fuel for our sport.

Sunoco Green E15 has proven to be a reliable fuel for Richard Childress Racing and for the entire NASCAR community. Now in its fourth season of use, the fuel has been driven more than 5 million miles with no reported engine conditions or increased maintenance issues. The fuel has increased horsepower while decreasing emissions by 20 percent.

The use of ethanol in racing has proven to be a major success for all parties. As a former driver, the team owner of Richard Childress Racing, and lifelong fan of the sport, I am certain that the switch to a higher blend of ethanol has been a great move by NASCAR. The transition has been seamless.

United States Senate Committee on Agriculture, Nutrition and Forestry

Advanced Biofuels: Creating Jobs and Lower Prices at the Pump

Written Testimony of:

Brooke Coleman
Executive Director, Advanced Ethanol Council

April 8, 2014

Good morning, Chairwoman Stabenow, Ranking Member Cochran, and Members of the Committee. My name is Brooke Coleman and I am the Executive Director of the Advanced Ethanol Council (AEC).

The Advanced Ethanol Council represents worldwide leaders in the effort to develop and commercialize the next generation of ethanol fuels and products, ranging from cellulosic ethanol made from switchgrass, wood chips and agricultural waste to advanced ethanol made from sustainable energy crops, municipal solid waste and algae. Our members include those endeavoring to operate production facilities, those interested in augmenting conventional biofuel plants with "bolt on" or efficiency technologies, and those developing and deploying the technologies necessary to make advanced biofuel production a commercial reality.

This is a timely hearing, and we are honored to be here today to discuss renewable fuels and the emerging advanced biofuels industry. My role today is to talk about the continued development of the advanced biofuels industry. However, we would also like to provide context for the ongoing discourse about the rationale for, and efficacy of, ongoing federal policy support for biofuels.

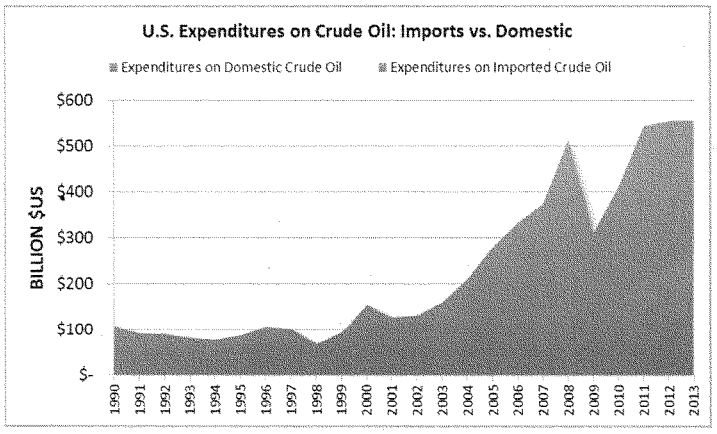
1. <u>Oil dependence is still a problem, and recent trends are not changing the big picture</u>

With fiscal responsibility on the minds of nearly every member of Congress, there is no bigger drain on our economy and revenues than foreign oil dependence. It is the single largest piece of the federal trade deficit, and represents a huge fraction of annual spending by U.S. consumers that is not recirculating through our economy. Between 2000 and 2012, the cumulative total of U.S. spending on imports of goods and services exceeded U.S. export earnings by $7.1 trillion dollars – U.S. trade deficits in crude oil and refined petroleum products were $2.87 trillion during this period, or 40.5 percent of the cumulative deficit in all goods and services (petroleum accounted for 55 percent of the trade deficit in 2012).[1]

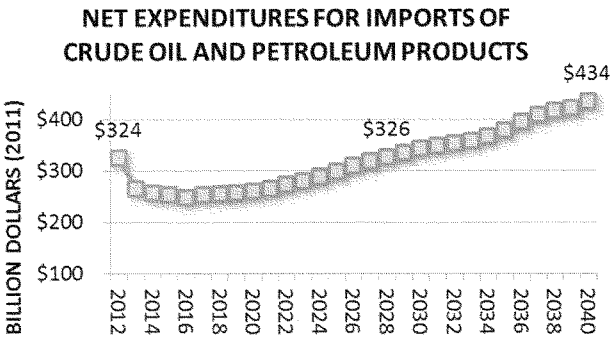
[1] See http://www.bea.gov/iTable/iTable.cfm?reqid=6&step=3&isuri=1&600=3#reqid=6&step=3&isuri=1&600=3

U.S. oil imports have dropped over the last several years due to increases in domestic supply, but they have not dropped enough to change the big picture with regard to the impacts of oil dependence on consumers and the U.S. economy as a whole. The issue is that while the U.S. now produces a slightly higher percentage of the world's oil (~ 10%), we consume more than 20 percent of the world's oil and the price of a barrel of oil continues to increase. In essence, this means that the oil shale "boom" is not changing the fact that the U.S. continues to be highly dependence on foreign oil, consumers continue to spend enormous sums of money on foreign oil, and the U.S. economy continues to suffer at the hands of its dependence on foreign oil.

Speaking to this last point, former Central bank chairman Ben Bernanke recently stated that, "sustained rises in the prices of oil or other commodities would represent a threat both to economic growth and to overall price stability, particularly if they were to cause inflation expectations to become less well anchored." The magnitude of the economic drain in recent years is staggering. Americans transferred nearly $1 trillion to OPEC member states during the oil price spike of 2008, in just 6-8 months. EIA forecasts suggest that recent trends above $100 per barrel are not a spike, but are instead a new equilibrium.[2]



[2] Oil prices are not coming down for a number of reasons, including but not limited to: (a) increases in global demand from countries like China and India; (b) dwindling supplies of cheaper, light sweet crude; and, (c) the relative expense of extracting and producing unconventional oil (e.g. tar sands, tight oil, etc.). See http://www.eia.gov/forecasts/aeo/er/pdf/0383er%282014%29.pdf, at p. 1, figure 1.



Source: Prepared by RFA, based on U.S. Energy Information Administration data

There is also the issue of energy security risk, in the more macro sense, stemming from two important considerations: (1) there is virtually no transparency when it comes to "source data" for the myriad of claims about future oil markets made on an everyday basis by analysts in the sector; and, (2) the oil industry and its analysts have a long history of seriously overestimating the vastness of its claimed reserves.

With regard to transparency, Russia (one of the world's largest conventional oil producers) declared all oil data a state secret in 2004. Neither Saudi Arabia nor Venezuela share data publicly when they make claims about future capacity. This is a concern in part because "there are political and financial pressures to misreport figures."[3] OPEC member quotas are based on reported reserves; the higher the reserve, the higher the quota relative to other members. OPEC members also face the challenge of attracting investment, from both government and outside sources. As reported in a recent peer-reviewed article in *Science*, "there are fears that Saudi oil reserves (and others) may have been over-estimated by at least 40%," and, "[a]t best Saudi reserves are seen as near maturity," given that 7 million barrels of sea water are being injected in the main field on a daily basis to increase flow.[4] The oil industry and OPEC also has the incentive of exaggerating reserves to weaken political and market interest in developing alternatives. OPEC first admitted its focus on alternative fuels in 2006, when it openly admitted that its price setting is designed partially to deter their use.[5]

With regard to overestimation, recent statements about game changing oil reserves should be regarded carefully because we have heard similar claims in the past about Alaska and the Gulf of

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[3] Chapman, I., *The end of Peak Oil? Why this topic is still relevant despite recent denials*, Energy Policy (2013). http://dx.doi.org/10.1016/j.enpol.2013.05.010 at p. 3.
[4] See Chapman, I., *The end of Peak Oil? Why this topic is still relevant despite recent denials*, Energy Policy (2013). http://dx.doi.org/10.1016/j.enpol.2013.05.010 at p. 4.
[5] See http://www.foxnews.com/story/0,2933,222840,00.html

Mexico. In 2002, the U.S. Geological Survey estimated that the National Petroleum Reserve-Alaska contained 10.6 billion barrels (mean estimate) of oil. In late 2010, USGS revised their estimate to 896 million barrels – a downward adjustment of roughly 90 percent.[6] When BP discovered the Thunder Horse field in the Gulf of Mexico in 1999, they estimated that the reserve contained more than a billion barrels of oil. The discovery fundamentally changed projections about U.S. oil capacity and was credited with changing the global price of oil. BP and partners built the largest oil platform in the Gulf. However, oil extraction was delayed by more than 3 years due to technical difficulties, and according to a consultant for oil exploration, "Thunder Horse hasn't reached anywhere near its expected potential."[7] Tight oil plays (e.g. the Bakken) face similar challenges. As noted in an April 2013 article in *Science*, "data on reserves of many unconventional sources are now regarded as optimistic, compounded by thermodynamic inefficiencies in the processes, often relying on high energy inputs, will ultimately limit the net gain to provide fuel quantities well below predicted figures."[8] As a point of reference, the 4.3 billion barrels of technically recoverable tight oil from the Bakken (as estimated by the U.S. Geological Survey) is less than one year's worth of crude oil consumption by U.S. refineries.

2. <u>The United States is not going to "free market" its way out of its foreign oil dependence problem or emerge as the global leader in advanced biofuel development without aggressive policies to attract investment</u>

In a competitive marketplace, the increasing cost and scarcity of crude oil would play to the benefit of alternatives such as advanced biofuels. That is, the declining production cost of biofuels would attract investment over the increasing cost and scarcity of petroleum, and new alternative fuel products would emerge to replace petroleum. In essence, free markets reward innovation. However, U.S. and global liquid fuel markets are not free markets. They are distorted by the price-controlling behavior of OPEC, driven by policy as opposed to price, and are dominated by highly-consolidated and vertically integrated incumbent oil companies that continue to receive the large majority of federal subsidies to the U.S. fuel energy sector. While many of these policies lie outside of the jurisdiction of this committee, ongoing support for bioenergy from programs within the jurisdiction of this committee should not be held to a different standard than those reviewed and managed by other committees.

For example, the largest leaseholder in the Bakken told the Senate Finance Committee in 2012 that "[w]ithout the current capital [federal tax] provisions in place ... that let us keep our own money ... we would not have been able to fail over and over again, which is what it took to advance the technology needed to produce the Bakken and numerous other [tight oil/fracking] resource plays

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[6] See http://www.newsminer.com/news/alaska_news/oil-estimates-slashed-for-national-petroleum-reserve-alaska/article_999d982e-5823-59c2-82f7-8b6bb65d8fd6.html.

[7] See http://www.theoildrum.com/node/6415.

[8] Chapman, I., *The end of Peak Oil? Why this topic is still relevant despite recent denials*, Energy Policy (2013). http://dx.doi.org/10.1016/j.enpol.2013.05.010.

across America."[9] It is critical to point out that cellulosic biofuel producers and "tight oil" producers have something in common; they are both endeavoring to supply the country and world markets with what the Energy Information Administration (EIA) terms "unconventional fuel." While facing similar technology risk, the cellulosic biofuels industry does not receive the same tax treatment as companies like Continental Resources (from the perspective of value or duration).

More broadly, the fossil fuels industry enjoys the benefit of a number of unique federal tax allowances – unavailable to renewable fuels – that de-risk and lower the cost of the ongoing development of oil and gas resources relative to other sources of liquid fuel. For example, a recent study estimates that fossil fuels received 70 percent of U.S. federal energy subsidies between 2002 and 2008, to the tune of more than $70 billion during this time period. [10] This number does not include the loopholes in oil and gas laws that, according to the Government Accountability Office (GAO), allowed petroleum companies to forego paying $53 billion in royalty payments, over just four years, for extracting natural resources from lands owned by the American taxpayer. The federal government also helps incumbent industries develop new technologies. According to a recent Congressional Research Service report, [f]or the period from 1948 through 2012, 11.6% of Department of Energy R&D spending went to renewables, 9.7 % to efficiency, 25% to fossil energy, and 49.3% to nuclear.[11] According to a recent report, "energy innovation has driven America's growth since before the 13 colonies came together to form the United States, and government support has driven that innovation for nearly as long."[12] Governmental support drove investment in coal, timber, engine innovations, land settlement for resource extraction and other forms of innovation in the 19th and 20th centuries, and domestic energy consumption and GDP have tracked closely for at least 200 years.[13] Given the importance of energy security, we believe that the federal government's engagement in domestic energy development is appropriate, and there is a clear case for making advanced biofuels a focal point of that effort going forward.

3. Federal Biofuel Policies Are Working to Create Jobs and Reduce Gas Prices

While some level of support for renewable fuel development traces back to at least the 1980s, the federal government's commitment to the industry began in earnest just ten years ago. And the return on investment is very clear.

» Jobs and Economic Development

A recent state-by-state analysis of the ethanol industry conducted by Cardno ENTRIX concluded that the ethanol industry alone supports roughly 383,000 direct and indirect jobs across all

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[9] http://www.finance.senate.gov/imo/media/doc/Hamm%20Testimony1.pdf, p. 2.
[10] See http://www.elistore.org/Data/products/d19_07.pdf.
[11] See http://www.fas.org/sgp/crs/misc/RS22858.pdf
[12] See note 2, at p. 11.
[13] *Id.*

sectors, and contributed $43.3 billion to GDP and $30.2 billion in household income.[14] More broadly, a recent assessment published by the Oak Ridge National Laboratory found that the RFS is producing significant positive economic effects ("the net global economic effects of the RFS2 policy are positive with an increase of 0.8% in U.S. gross domestic product (GDP) in 2022...[well in excess of $100 billion]" stemming from the fact that the RFS is reduces crude oil prices, decreases crude oil imports, increases gross domestic product (GDP), and is having only minimal impact on global food markets and land use.[15] Roughly half of the projected economic benefits will stem from advanced biofuel production. The economic picture is even more robust in certain states. For example, the renewable fuels industry in Iowa generated $5.6 billion in economic activity in 2013, which equates to 4 percent of the Iowa GDP. The Iowa ethanol industry alone generated $10.62 billion in purchases, $5.04 billion in GDP, $3.74 billion in household earnings, and supported 55,161 jobs.[16]

While there are not bright lines between conventional biofuel and advanced biofuel jobs, due to the fact that so many conventional biofuel industry employees are also working on advanced biofuel development, it is clear that the industry is well on its way to fulfilling its promise. For example, the biodiesel industry alone has created an estimated 60,000 jobs.[17] Environmental Entrepreneurs, an offshoot of NRDC, estimates that the first two dozen or so new cellulosic/advanced biofuel projects under construction will create tens of thousands of direct and indirect jobs.[18] With regard to assessing advanced biofuel jobs, it is important to remember that emerging industries are extremely fluid and should also be analyzed from the perspective of opportunity. According to the Sandia National Laboratory, the U.S. could produce 75 billion gallons per year of cellulosic biofuels (one subset of the advanced biofuel industry, and 4.5 times the amount of cellulosic biofuel required by the RFS) without displacing food and feed crops.[19] A Bloomberg analysis released in 2012 looked at eight select regions to assess the potential for next generation ethanol production.[20] The study found that eight regions -- Argentina, Australia, Brazil, China, EU-27, India, Mexico and the United States – could displace up to 50 percent of their demand for gasoline by 2030 making ethanol from a very small percentage of its each region's agricultural residue supply. In this scenario, GHG emissions are reduced by more than 25 percent from the motor fuel sector.

The cellulosic biofuels industry is acutely aware of concerns about our rate of deployment. But we would encourage the committee to focus closely on the clear visual and data-statistical evidence of real progress in our industry. From an RFS perspective, the production capacity of the broader advanced biofuels industry (i.e. all types of fuel qualifying as advanced biofuel under the

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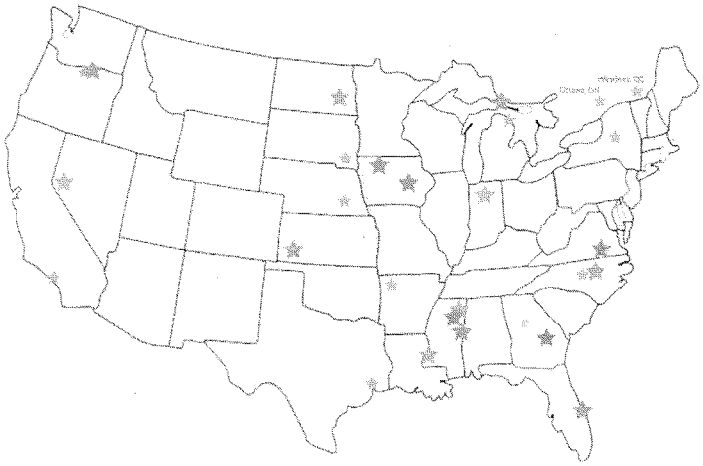
[14] See http://ethanolrfa.org/page/-/rfa-association-site/studies/2012%20Ethanol%20Economic%20Impact_By%20State.pdf?nocdn=1.
[15] See http://www.future-science.com/doi/abs/10.4155/bfs.12.60?journalCode=bfs.
[16] See http://www.iowarfa.org/documents/2014IowaEconomicImpact.Final.pdf
[17] For example, the biodiesel industry estimates that it has created 62,000 jobs.
[18] See http://www.e2.org/ext/doc/E2AdvancedBiofuelMarketReport2013.pdf
[19] See https://share.sandia.gov/news/resources/news_releases/biofuels-can-provide-viable-sustainable-solution-to-reducing-petroleum-dependence-say-sandia-researchers/.
[20] See http://www.novozymes.com/en/sustainability/benefits-for-the-world/biobased-economy/white-papers-on-biofuels/Documents/Next-Generation%20Ethanol%20Economy_Executive%20Summary.pdf

RFS) exceeded the 2013 statutory target of 2.75 billion gallons established by Congress via RFS2.[21] U.S. EPA relied on the administrative flexibility provided to the agency by Congress to allow more bio-/renewable diesel and less cellulosic biofuel to be used to meet the 2013 standard. But delay should not be interpreted to mean failure when it comes to the commercial deployment of the most carbon-reductive, innovative fuels in the world. As shown in the Progress Report recently released by the AEC (see U.S. Map below), the cellulosic biofuels industry is breaking through at commercial scale just seven years after the enactment of RFS2 and notwithstanding the global recession.[22]

Cellulosic Biofuel Projects Profiled by AEC Progress Report



Non-U.S./Canada Technological Development, by Location

Cellulosic Biofuel Production Facilities Outside of the U.S./Canada Developing Technologies for Deployment in the U.S.

[21] See http://www.epa.gov/otaq/fuels/rfsdata/2013emts.htm

[22] See AEC Progress Report: Cellulosic Biofuels at http://ethanolrfa.3cdn.net/96a2f9e04eb357bbbd_1sm6vadqk.pdf.

While the report details ~ 20 projects, we would like to highlight three projects coming online this year:

- Abengoa (Hugoton, KS): The global renewable energy company has completed construction of a 25 million gallon per year plant in southwest Kansas that will produce ethanol and renewable electricity from agricultural waste. The company has contracted with local farmers to secure the roughly 1,100 dry tons per day of waste feedstock needed to run the plant, and is in position to replicate its successes quickly via its other ethanol plants.

- DuPont (Nevada, IA): DuPont has invested approximately $225 million in its cellulosic ethanol facility, which is completing construction this year. The 30 million gallon per year plant will use corn stover biomass secured from up to 500 farmers within a 30-mile radius around the facility. The project created 1000 construction jobs and will maintain 85 permanent jobs.

- POET/DSM (Emmetsburg, IA): Project Liberty – a joint venture between POET and Royal DSM – will make ethanol from corn cobs, leaves, husk and stalk that pass through the combine during corn harvest. The 25 million gallon per year plant will produce enough renewable electricity, as a co-product, to power itself and the POET grain ethanol plant next door.

The emergence of the industry owes itself to several factors. First, the federal RFS is the global gold standard when it comes to advanced biofuels policy. Second, there are complementary policies that have helped the industry get off the ground. For example, the bioenergy and bio-refining assistance programs first introduced (and recently amended) as part of the energy title in the 2008 Farm Bill have been critical to the development of the industry. We very much appreciate the committee's leadership when it comes to protecting the energy title in the farm bill. These programs are working. As noted by a recent assessment by U.S. EPA, the production cost of cellulosic biofuels continues to fall; the industry continues to make significant progress towards producing cellulosic biofuel at prices competitive with petroleum fuels; production and capital costs are expected to continue to decline as more facilities come online and the so-called "commercial learning curve" is achieved; and, first commercial projects in the pipeline for cellulosic biofuels have made great progress in securing the necessary feedstock for their plants.[23] These industrial benchmarks are also widely reported in a number of academic studies and surveys.[24] For example, an industry survey conducted by Bloomberg New Energy Finance concluded that "[t]he operating costs of the [cellulosic biofuel] process have dropped significantly since 2008 due to leaps forward in the technology [emphasis added]... [f]or example, the enzyme cost for a litre of cellulosic ethanol has come down 72% between 2008 and 2012."[25]

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[23] See Docket ID No. EPA-HQ-OAR-2012-0546: Regulation of Fuels and Fuel Additives: 2013 Renewable Fuel Standards

[24] See: *Cellulosic Ethanol Heads for Cost-Competiveness by 2016, http://about.bnef.com/press-releases/cellulosic-ethanol-heads-for-cost-competitiveness-by-2016/*; Brown, T., Brown, R. "A review of cellulosic biofuel commercial-scale projects in the United States." Biofuels, Bioprod. Bioref. DOI:10.1002/bbb.1387 (2013).

[25] See http://about.bnef.com/press-releases/cellulosic-ethanol-heads-for-cost-competitiveness-by-2016/

From the broader perspective of agricultural policy and rural America, some of the benefits of biofuel policy and advanced biofuel technology utilization are more subtle. It is true that the ethanol industry, for example, has built more than 200 biorefineries since 1988, now employs hundreds of thousands of Americans directly and indirectly, has increased national GDP by close to $50 billion, and has raised household income by tens of billions of dollars. But it is also true that the conventional ethanol industry is converting grain to ethanol more efficiently with technologies and enzymes developed by the advanced ethanol industry, is putting higher quality dried distillers grains into the marketplace partly as a result of this technology, and in many cases is leading the effort to diversify feedstock (via cellulose) by leveraging first generation biofuel infrastructure and assets.

The primary critics of biofuel development continue to rely on the false underlying presumption that, before biofuels, we had a good balance between supply and demand in the agricultural sector, and that sub-$2/bushel corn was good for America, good for government spending, and good for world hunger. But it is not long ago that U.S. farmers were "price takers" selling over-supplied grains at below cost and struggling to make a living. Some industries benefitted from the availability of below cost grains, but the federal government was forced to intervene with multi-billion dollar assistance efforts to make sure that rural America did not collapse under the weight of its own success in producing more grain from each acre of land over time. We believe that Congress was right to pursue policies to promote value-added agriculture, that the development of cellulosic biofuels is part of this vision, and that more prosperity and new markets in rural America is one of the major reasons why the federal government was able to pass a farm bill in 2014 with substantial, multi-billion dollar spending cuts to key agricultural programs. We are concerned that current proposals to rollback policy support for bioenergy and biofuel is not as sensitive as it should be to the reality of what that means (and meant) economically and policy-wise for rural America.

» **Lower Prices at the Pump**

Former Shell Oil President John Hofmeister recently stated, "[w]e need a competitor for oil. We need to open the market to replacement fuels ... Competition will drive transportation fuel prices down, structurally and sustainably."[26] This is exactly what is happening with renewable fuels. The RFS and complementary renewable fuel policies have the practical effect of increasing the available supply of affordable liquid fuel during a period of tightness in the global supply of petroleum. Energy economist Philip K. Verleger (who served as an advisor on energy issues to both the Ford and Carter administrations) recently said, "the U.S. renewable fuels program has cut annual consumer expenditures in 2013 between $700 billion and $2.6 trillion ... [t]his translates to consumers paying between $0.50 and $1.50 per gallon less for gasoline."[27] Verleger adds:

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[26] See http://www.fuelfreedom.org/John-hofmeister-former-president-of-shell-oil-company-joins-fuel-freedom-foundations-board-of-advisors

[27] See http://www.pkverlegerllc.com/assets/documents/130923_Commentary.pdf.

> These prices today are between **$15 and $40 per barrel lower** than they would be had Congress not endorsed his proposals to boost ethanol production and blending with gasoline. Today, the Bush measures ***add the equivalent of Ecuador's crude oil output to the world market at a time of extreme tightness***." - Philip K. Verleger (September 23, 2013)

Other assessments have reached a similar conclusion.[28] The most recent is a paper published by Bruce A. Babcock and Sebastien Pouliet from the Center for Agricultural and Rural Development (CARD), with support from the National Science Foundation, which sought to "to provide a transparent economic analysis of the impact on consumer fuel prices from mandates that increase the consumption of ethanol;" or, more specifically, "to estimate the impact of [RFS] RIN prices on the pump price of fuel."[29] CARD has developed a model to predict a range of different market impacts occurring as a result of the RFS. Among other findings, the paper concluded that:

- "... feasible increases in the ethanol mandate in 2014 will cause a small *decline* in the price of E10 [the predominant blend of gasoline in the market today]."

- "... one of the costs that does not need to be considered is an increase in the pump price of fuel, because we show that the most likely outcome from increasing ethanol mandates is a drop in pump prices, not an increase."

- "The oil industry continues to rely on their own commissioned study (NERA 2012) that predicts gasoline producers will have no choice but to cut domestic sales of gasoline to reduce their obligations under the RFS ... [t]he study's conclusions – that expansion of ethanol mandates would cause severe damage to the economy – are simply not credible unless EPA were to ignore set mandates at such a high level that they literally could not be met regardless of the level of investment in new fueling infrastructure."

- "Our results should reassure those in Congress and the Administration who are worried that following the RFS commitment to expanding the use of renewable fuels will result in sharply higher fuel prices for consumers."

When considering these assessments, it is important to note that they are looking at two different aspects of the impact of renewable fuels on pump prices. The Verleger model is focused on the impact of renewable fuels on the global price of oil, and attempts to extract from the marketplace what would happen if tightness in global liquid fuel supplies was exacerbated by the hypothetical non-existence of renewable fuels. The Babcock model is focused more acutely on the

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[28] See, for example, Cui, J., H. Lapan, G. Moschini, and J. Cooper. (2010). "Welfare impacts of Alternative Biofuel and Energy Policies." American Journal of Agricultural Economics 93(5): 1235-1256.

[29] See http://www.card.iastate.edu/publications/dbs/pdffiles/14pb18.pdf at p. 5.

U.S. motor fuel marketplace, and attempts to test whether the federal RFS (and higher RIN prices) is increasing the cost of gasoline. In both cases, the presence of renewable fuels in the marketplace reduces pump prices.

Conclusion: The Path Forward

We are often asked by members of Congress if there are ways to accelerate the deployment of the advanced biofuels industry. We would like to respectfully suggest the following:

1. A Stronger Commitment to No Backsliding/Policy Certainty Would Help Attract Project Finance to U.S. Advanced Biofuel Markets

The U.S. has a number of well-designed policies in place that are driving innovation in the biofuels sector, including but not limited to the RFS, several important tax provisions currently being considered for extension (e.g. the second generation biofuel producer credit, the special depreciation allowance for second generation biofuel plant properties, etc.) and the critical energy title programs in the farm bill. The issue around these policies is not their design; but rather, their dependability as related to legislated permanence (i.e. the perpetual risk of expiration) and funding (i.e. the perpetual risk that they are de-funded). By contrast, federal government support for the fossil fuels industry – primarily through the federal tax code but also indirectly via infrastructure and other policies – is almost always permanent. This clear inequity has the practical effect of increasing the risk of investing in renewable versus fossil energy, which in turn drives the development of clean energy overseas to countries with more durable policy commitments (e.g. China, Brazil, etc.). Ironically, policy risk is often more perceptive than substantive and incumbents leverage this investment reality to create a perpetual cloud of uncertainty around landmark biofuel programs. As such, it is absolutely critical to our industry to protect landmark programs – RFS and farm bill energy title among them – at both the messaging and substantive levels. Changing the rules in the middle of the game for any of these policies – however framed politically – has the practical effect of spooking investors and making the U.S. less competitive globally. Ultimately, it will also be critical to reform the federal tax code to, at minimum, remove the inequities that distort investment markets.

2. Transparency in RFS RIN Trading Markets Would Help Reduce Unnatural Volatility in RIN Markets and Put the RFS on a More Stable Path Going Forward

The RFS is designed to drive investment in advanced biofuels and more renewable fuel blending (including infrastructural development). The primary driver of additional biofuel market access within the RFS is the RIN. A RIN is an identification number generated when a gallon of RFS-qualifying renewable fuel is produced. The RIN is attached to the renewable fuel gallon at the point of sale to obligated parties (i.e. oil companies), but can be separated (from the liquid gallon) by obligated parties and sold for whatever price the market will bear. The primary value of the RIN

program, other than facilitating compliance accounting and some level of compliance flexibility, is its ability to increase market access for renewable fuels. That is, when an oil company refuses to blend more liquid biofuel, they can buy a RIN on the open market instead. If a significant number of oil companies refuse to blend liquid gallons and seek RINs on the open market, RIN trading and values will increase as a result of their affirmative non-compliance. Higher RIN prices should not be considered a bug in the RFS; they actually provide an extra incentive for other obligated parties to blend liquid renewable fuel gallons, because they acquire a valuable and saleable RIN free of charge with each gallon of renewable fuel purchased. In essence, higher RIN values reward good behavior and facilitate the objectives of the RFS.

Some oil companies and refiners are trying to miscast higher RIN prices as a potential cause for higher gas prices. The Babcock analysis discussed above – which was not funded industry – clearly shows that higher RIN prices do not increase gas prices primarily because: (a) RINs enter the marketplace free-of-charge with each gallon of renewable fuel; (b) RIN values are created by trading among obligated parties, so it is often the oil industry itself on the profit side of the RIN transaction;[30] and, (c) higher RIN prices actually *reduce* the cost of a gallon of renewable fuel at the wholesale level, which erases the threat of higher gas prices at the retail level.

That said, the current RIN trading marketplace lacks transparency to the point in which it is difficult for traders and obligated parties to make trades based on dependable, real-time information. While it is not clear what percentage of the 2013 spike in D6 RIN prices came as a result of the lack of transparency in RIN markets – either through hoarding from (blind) "shortage mentality" or other strategies – it is clear that a non-transparent RIN marketplace could be a liability for the program, and in turn, a point of uncertainty for advanced biofuel investing.

We are aware of this committee's jurisdiction when it comes to the Commodity Futures Trading Commission (CFTC), and very much appreciate Chairwoman Stabenow's efforts to engage the CFTC on the RFS and RINs.[31] This is absolutely the right approach to the problem, and we would very much like to follow up with the committee on this issue. We believe that federal agencies (e.g. EPA in collaboration with the CFTC) could set up an electronic trading platform – similar to those used in other commodity markets – to ensure that RIN positions and trades are disclosed in real time. We believe this can be done expeditiously and would have an immediate calming effect in the marketplace with regard to RIN volatility and predictability.

[30] See http://www.ethanolrfa.org/exchange/entry/what-do-big-oils-quarterly-earnings-say-about-the-real-impact-of-rins-on-u/
[31] See http://www.ag.senate.gov/newsroom/press/release/chairwoman-stabenow-calls-on-cftc-to-review-possible-manipulation-of-renewable-fuels-market

3. Market Access to Allow Fair Competition

There are a number of incongruencies between the goal of increasing the production of advanced biofuels and the regulations that largely dictate outcomes in U.S. liquid fuel markets. It is a basic economic notion that emerging advanced ethanol fuels need a market to deploy at commercial scale. And yet, EPA has yet to resolve a number of roadblocks for the increased use of ethanol in gasoline. For example, EPA has thus far refused to address regulatory inconsistencies with regard to vapor pressure for E15 that are contributing to the slower than necessary deployment of the fuel. There is no real substantive issue that supports treating E10 and E15 differently with regard to vapor pressure, but the practical effect is gasoline retailers cannot offer E15 year round. This discourages the utilization of pump infrastructure for marketing and selling of E15. We are also concerned about EPA's ongoing refusal to provide proper credit for Flex Fuel Vehicles (FFVs) in the updated CAFE fuel efficiency standards. Ongoing devaluation and uncertainty with regard to FFV credits dissuades automakers from making simple adjustments to future vehicles to allow price-driven fungibility in gasoline/ethanol markets. Ensuring that every new car manufactured in the U.S. is an FFV would cost consumers next to nothing, but would open up new frontiers for the advanced ethanol industry.

It is both an exciting and challenging time for the cellulosic biofuels industry and the advanced biofuel industry as a whole. The technology is commercial ready and the industry is deploying at commercial scale. We are embarking on the process of securing efficiencies that can only be achieved via commercialization (i.e. the "experience curve") and economies of scale. When the corn ethanol industry started building plants, their production costs exceeded their feedstock costs by a large margin. However, corn ethanol producers have reduced their production costs by roughly 60 percent since the first commercial plants were built in the 1980s. Likewise, some solar companies have seen a similar 60-70% production cost reduction in just the last ten years, as capacity has increased significantly. The U.S. is in position to lead the world when it comes to the development of advanced, low carbon biofuels. And yet, we face as much policy uncertainty as we ever have before. Incumbents in the fuel energy space are going after our tax provisions, our farm bill programs, and of course, the RFS. We very much appreciate the opportunity today to highlight the fact that advanced biofuels are emerging, that renewable fuels are creating jobs and driving pump prices down, and efforts to undercut biofuel programs are occurring because these programs are working, not vice-versa.

Thank you for the privilege of speaking before you today. I look forward to your questions.

Attachment A

Easy Answers to a Number of Complex Allegations Made Against Biofuels

1. **"Biofuel programs increase feed prices and hurt the livestock industry."**

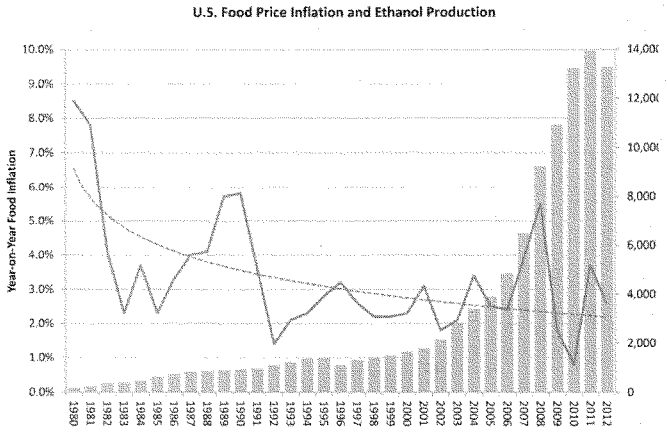
Corn prices today are almost identical to corn prices on the day that President Bush signed RFS2 in December 2007. And while higher oil prices have driven up commodity prices nearly across the board, it is not clear that livestock is suffering. The gross farm value of livestock, dairy and poultry production has increased from an average of $123 billion per year before passage of the RFS to roughly $148 billion per year since 2008. The average profit margin for livestock and poultry values over purchased feed costs has increased by nearly $6 billion per year on average.

2. **Higher RFS-RIN prices in 2013 are a cost of compliance for oil companies that will ultimately increase gas prices**

Many oil companies are now on record on earnings calls attesting to the fact that they are the ones *profiting* from higher RIN values, because they get the RIN for free when they buy a gallon of renewable fuel and can sell it to other obligated parties.[32]

3. **"Biofuels have increased food prices in the grocery aisle."**

Food prices are not increasing, and they are decreasing *against* the increase in ethanol use.



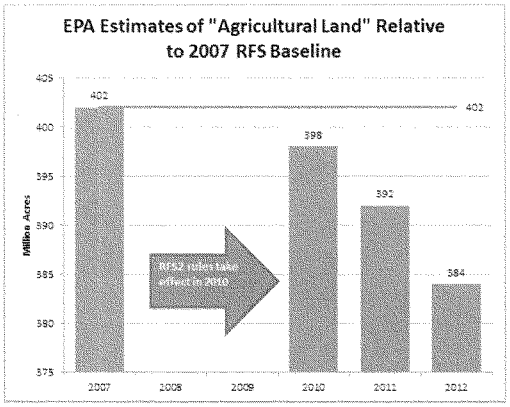
[32] See: http://www.fuelsamerica.org/blog/entry/something-funny-about-those-oil-company-profits

4. "E15 is a threat to boaters and small engines."

E15 is an option at the pump, as opposed to the new baseline fuel. Boaters and small engine users can simply fill up with other fuel to avoid higher ethanol blends if they want to.

5. "The increased use of biofuels has resulted in the plowing of virgin and pristine land."

The national agricultural footprint is not expanding, it's contracting.



There is always some regional variation with regard to agricultural land use, but recent allegations about prairie conversion are misleading:

- Critics of the RFS point to reduced acreage in the Conservation Reserve Program (CRP), but acreage in the program went down commensurate with the funding cut in the 2008 farm bill.
- Allegations about "15 million more corn acres planted" are true, but should be considered relative to the more than 20 million acres of wheat taken out of production during the same period. Crops are generally rotating, not expanding.
- Wheat acres dropped more than corn acres increased in the specific states that the Associated Press claimed were using pristine lands for corn ethanol production.

6. "Biofuels do not decrease climate change emissions."

First generation biofuels are a step in the right direction as compared to gasoline. Cellulosic biofuels, on the other hand, are the lowest carbon fuels in the world. They are lower carbon than electric drive and hydrogen fuel cells, and are in some cases carbon neutral or better.[33]

[33] See http://www.greencarcongress.com/2013/01/wang-20130122.html

Statement of Jan Koninckx, Ph.D
Global Business Director for Biorefineries
DuPont Industrial Biosciences
United States Senate Committee on Agriculture Nutrition and Forestry
United States Senate
April 8, 2014

Good morning Chairman Stabenow, Ranking Member Cochran and Members of the Committee. My name is Jan Koninckx and I am the Global Business Director for DuPont Industrial Biosciences, which includes our biofuels and biomaterials initiatives. I am pleased to be here today to discuss our progress on renewable fuels. My testimony will cover the significant investment that DuPont has made in biofuels and how investments like these are bringing about a transformation from a petroleum based to a bio-based global economy. This tremendous shift in how we energize our planet is not only technically possible – it is real, it is happening today and it is due in large part to the visionary legislation enacted by Congress a few short years ago called the Renewable Fuels Standard, a successful policy that must endure.

DuPont Biofuels

Our deep commitment to biofuels and biobased products stretches across the country from our laboratories in California, to the corn fields of central Iowa and our headquarters in Delaware.

It starts with the seed. Our DuPont Pioneer seed division scientists work with farmers every day to optimize corn production. First, and most importantly, we continue to improve harvestable yield per unit of inputs. We also select certain seeds for ethanol potential and offer over 180 High Total Fermentables hybrids. As unpredictable weather events persist, DuPont teams have introduced drought tolerant corn to help farmers manage this uncertainty. While the drought of 2012 was devastating to many growers, grain production would have been much lower without the advances of these types of technologies. Beyond seed genetics, DuPont also produces enzymes to improve digestibility of the valuable byproduct from corn ethanol production that is used as feed. These advances combined enable more predictable corn production, delivering increasingly more food, more feed and more fuel per acre.

But that is only half the story. Because with more corn comes more corn residue. It is with this agricultural waste - these leaves and stalks and cobs that DuPont and others have started to harvest our heartland - that we will supply the complex infrastructure necessary to commercialize cellulosic biofuels at scale.

DuPont began its research into cellulosic technology a decade ago. From the early days in our laboratories, our findings lead us to steadily grow our teams, our technologies and our investments. In 2009, bolstered by the momentum of our progress, we opened a large demonstration plant in Vonore, Tennessee. This one of a kind research facility generated a key body of knowledge around cellulosic feedstocks for the global market.

But to take the next step forward, we needed to get out into the fields with farmers. For the past four years, we have brought together growers, academia, public institutions like the USDA and custom equipment makers to conduct harvest trials on corn stover. Together, we have developed an entirely new model for biomass harvest, transportation and supply to a biorefinery. It is cost competitive and fully sustainable – preserving the land for generations to come.

All this work culminated in the groundbreaking of a 30 million gallon per year facility in December of 2012 in Nevada, Iowa, located approximately 40 miles north of Des Moines. I am happy to report that the construction is progressing on track and the facility is scheduled to start processing in the fourth quarter of this year. This plant, and the handful of others now coming online, is extraordinary in the sense that we have achieved something that has never been done before. We have re-imagined how we fuel our planet from renewable resources and built a technology and an ecosystem to support that technology without adding any CO2 into the atmosphere. It is a remarkable achievement.

When you look at this from the perspective of a science company – this has actually gone quite fast and interestingly by comparison, significantly faster than the fossil fuel industry developed over a century ago. The challenge before us was incredibly complex. We had to unlock the sugars trapped in cellulose, biochemically convert them into advanced liquid fuel and create an entirely new supply chain to deliver this raw material with economics capable of competing with fossil fuels. DuPont has over 210 years of bringing scientific innovation to market. In my estimation, we've never delivered this type of disruptive innovation so fast.

In addition to cellulosic ethanol, DuPont is pursuing another advanced renewable fuel with our partner BP in a 50/50 joint venture called Butamax™. The joint venture has developed and extensively tested bio-butanol, a higher alcohol fuel produced by fermenting biomass. Biobutanol has excellent fuel properties, with higher energy density than ethanol and the ability to be distributed via the existing gasoline infrastructure, including pipelines. It also reduces volatility, allowing butanol gasoline blends to be used in the summer in regions that currently require waivers from air quality regulation for the use of ethanol-gasoline blends. Because butanol has less affinity for water and is a weaker solvent than ethanol, it will be more compatible with existing equipment, including small engines. We are on track for commercial scale production of biobutanol in the U.S. in or after 2015.

Indeed, these are both tremendously exciting technologies coming online which squarely put the U.S. in a leadership position in the global biofuels market. But Members of the Committee, this is just the beginning. Here is where it gets truly exciting. Let me explain.

We start with biofuels. The technology to unlock the sugars in cellulose and the supply chains being developed to deliver those sugars at scale are enabling the commercial

deployment of cellulosic ethanol today. Tomorrow, these same sugars and supply chains will be enabling a whole new world of bio-chemicals and materials, delivering on the promise of a truly bio-based economy.

And we already have success in this regard. DuPont currently works through a joint venture with Tate and Lyle to produce Propanediol from biological origins. This Bio-PDO from plant starches used in DuPont's Sorona® carpet technology, automobile parts, de-icing fluids, and other personal and industrial applications. Manufacturing these products requires less energy and lowers greenhouse gas emissions. More of these advances will be possible when a renewable energy supply chain matures and enables lower cost and higher efficiency.

DuPont and USDA Memorandum of Understanding

To achieve a sustainable supply of feedstock for the bio-based economy, last year DuPont joined Secretary of Agriculture Tom Vilsack in Iowa to announce a Memorandum of Understanding (MOU) between DuPont and the USDA to work towards voluntary standards for the sustainable harvesting of agricultural residues for renewable fuel. Our sustainable farm to fuels approach for corn stover set the stage for this agreement between our company and the USDA's Natural Resource Conservation Service. The agreement is facilitating the development of conservation planning assistance for farmers who supply bio-based feedstocks to biorefineries as the industry begins to commercialize. A conservation plan is a voluntary document, written in cooperation with farmers, which helps them protect natural resources while promoting a farm's sustainability.

Through the MOU, DuPont and NRCS are working towards a process to work with cooperating farms to execute sustainable harvest practices that help keep soil in the field and out of rivers, streams and lakes; promote healthier soils which help reduce flooding through increased infiltration rates; and provide for the efficient use of nutrients.

This is a critical step forward in the development of the cellulosic biofuels industry as numerous players work with growers to undertake the development of these incredibly complex feedstock supply chains. Harvesting stover residue sustainably is not just the right thing to do for the stewardship of our fertile heartlands – it is also a business critical imperative if we hope to maintain the renewable raw materials to supply biorefineries for decades to come.

Defending the Renewable Fuel Standard

The Renewable Fuel Standard is the guiding policy that has paved the way for all this progress. It has and will continue to enable rural job creation, additional income for farmers, national security through homegrown biofuel, reduction of greenhouse gasses, and the safeguarding of natural resources and land productivity. The fact is that ending or reopening the RFS simply delays the realization of the long term energy, climate and economic goals that a strong bipartisan congressional majority committed to in 2007.

The fuels of the future are here today, and we can thank Congress for enacting the bi-partisan bill containing the RFS2. This policy has brought us to the point where the first commercial facilities producing cellulosic renewable fuels are starting up, and several more are under construction. As a result of this innovative policy, the U.S. is the world leader in biofuels and is leveraging one of the U.S.' biggest competitive strengths, its very productive farmers, to attract billions of dollars of private-sector investment from all over the world.

The first chapter of the RFS has played out as predicted, with corn ethanol technology maturing and playing a substantial role in our fuel supply. Since its enacting, the RFS has made homegrown renewable fuel ten percent of our nation's gasoline supply, lowered greenhouse gas emissions by 33.4 million metric tons, added $500 billion in value to America's farmlands, lowered gas prices by $1.09 per gallon and created a real choice at the pump. The next chapter is unfolding now with the commercialization of advanced and especially cellulosic renewable fuels made from residues such as agricultural, wood waste, and trash. That commercialization is under way, thanks to the RFS and over a billion dollars of private capital building commercial scale facilities Over the next several years, cellulosic renewable fuel will grow into a sizable commercial industry with over 400 million gallons per year projected globally by 2020.

The RFS2 is working as it was envisioned and the world is watching. We are delivering affordable clean fuels, to the envy of other countries. DuPont, along with others in the industry, have played a role in that transition, investing hundreds of millions of dollars and our best research talent to bring about this exciting new opportunity for the U.S. Reversing course on the RFS would undo all of the progress we've made and deny the country of an international competitive advantage, a true alternative fuel with real climate benefits and economic upside for consumers and producers across the U.S.

Farm Bill

For more than a decade, this committee has enacted significant policies that have been and are instrumental in the development of traditional and advanced biofuels, biofuels infrastructure, and a biobased economy. The Biomass Research and Development Act has been instrumental in fostering research that is unlocking the potential of cellulose and plant-based sugars as a feedstock that biorefineries are converting into biofuels and biobased products. These biobased products include ingredients for detergents, personal care products, carpet and apparel.

The Rural Energy for America Program (REAP) has played an important role in improving on farm energy efficiency, designing and implementing renewable energy systems, and recently in cost sharing the installation of blender and E-85 pumps. We are at a critical time when infrastructure investments must be made in order to achieve higher level blends of biofuels envisioned in the RFS. Incentivizing or offsetting the cost of blender and E-85 pumps is helpful, but the pace of infrastructure conversion will need to hasten. We were disappointed to see the new farm bill limit the availability of REAP

funds to be used for biofuels infrastructure. I urge this committee to work with the U.S. Department of Agriculture to identify alternative programs to invest in biofuel infrastructure. It would be very important to increasing the availability of E85 and other higher level blends if companies licensing their brand to service station owners were prohibited from requiring duplication of signage, different islands, canopies, and point of sale systems for stations desiring to offer advanced biofuels to their customers.

The Biomass Crop Assistance Program (BCAP) will play an increasingly important role as a number of advanced biofuels facilities come on line. The role of BCAP in collecting, transporting, and storing biomass will be significant over the critical next few years when the first tranche of cellulosic ethanol refineries come on line. As with any technology, the most risk is associated with the first facility. Subsequent risk is reduced as additional facilities incorporate what is learned from the initial construction, start-up and manufacturing runs. Policies that reduce risk during this process improve investment confidence. BCAP will also play an equally crucial role in establishment of dedicated energy crops in geographies where feedstocks like corn stover may not be plentiful.

We are also hopeful that increasing focus on renewable chemicals, including by adding eligibility for renewable chemicals under the Biorefinery Assistance Program loan guarantee program. DuPont applauds this Committee for extending authorization for these and other important energy programs in the Agricultural Act of 2014, commonly referred to as the Farm Bill. We also applaud this Committee's commitment to renewable energy by including mandatory funding for this title. This sends a strong message that the United States Congress continues to support expansion of renewable energy.

Another important program is the USDA BioPreferred Program. As the committee knows, this program requires the federal government to purchase products with biobased content as long as price, quality and performance are equal to conventional products. As discussed before, DuPont currently converts biomass into materials that are used in carpet, auto parts, and deicing fluid to name a few applications. Upon perfecting the commercial scale conversion of cellulose sugars, we plan to greatly expand the use biomass as a feedstock in a wide range of products where fossil fuels have traditionally been employed. In fact, a few blocks from here the National Corn Growers Association and the National Grains Council offices have carpet composed of DuPont's Sorona® technology. We ask this committee to support the USDA BioPreferred Program.

The technologies for converting cellulose to fuel are here today and soon cellulose to biobased products will be realized. The facilities that harness these transformative technologies are being built. Without the policy stability the RFS provides, none of this would have happened in the US. An entire biobased economy is waiting for us in the future, with all of the environmental, economic and energy security benefits this country is so anxious to achieve, if only we have the courage and commitment to stay the course.

In conclusion, I want to personally invite members of this Committee to visit our Nevada, Iowa cellulosic ethanol facility which is targeted to be completed in the fourth quarter of this year.

Airlines for America®
We Connect the World

Testimony

STATEMENT OF NANCY N. YOUNG
VICE PRESIDENT, ENVIRONMENTAL AFFAIRS, AIRLINES FOR AMERICA®
BEFORE THE
UNITED STATES SENATE COMMITTEE ON AGRICULTURE, NUTRITION AND FORESTRY

ADVANCED BIOFUELS: CREATING JOBS AND LOWERING PRICES AT THE PUMP

APRIL 3, 2014

Introduction

Airlines for America[1] (A4A) appreciates this opportunity to discuss the role that commercially viable, environmentally friendly alternative jet fuel – particularly including advanced biofuels – can play in our industry, our economy and our nation. Simply put, development and deployment of such jet fuels offers a rare opportunity to bring synergistic benefits to all three.

The steady rise of jet fuel prices in the last decade and unprecedented price volatility have had a tremendous negative impact not only on the U.S. airlines and their employees, but also on the customers and communities they serve throughout the nation. Jet fuel supply disruptions, which have been a contributor to the price increases and volatility, also lay bare the vulnerability of the airlines, our military and our nation that comes with complete dependency on petroleum-based fuel.

A stable, domestic supply of commercially viable alternative jet fuel would introduce competition to petroleum-based jet fuels and a moderating force on price levels and volatility, while improving the energy security of our industry and our nation. It would also help the U.S. airlines build on their strong environmental record and meet the industry's aggressive greenhouse gas (GHG) emissions goals. But the benefits would not inure to the airline industry alone. Our armed forces, with whom A4A is strategically allied in the development and deployment of alternative aviation fuels, would derive similar benefits, further enhancing national security. In addition, a vibrant alternative jet fuels industry would create American jobs and spur economic development in areas most hit by the recession. Rural America would benefit greatly from access to new markets for new agricultural biomass crops, while industrial areas would be revitalized.

A4A and our members have been helping drive toward the promise of commercially viable, environmentally-preferred aviation alternative fuels for the last several years. We have consistently supported the development and accelerated commercial deployment of "drop-in"

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[1] A4A is the industry trade organization for the leading U.S. scheduled passenger and cargo airlines. A4A's members are Alaska Airlines, Inc.; American Airlines, Inc.; Atlas Air, Inc.; Delta Air Lines, Inc.; Federal Express Corporation; Hawaiian Airlines; JetBlue Airways Corp.; Southwest Airlines Co.; United Continental Holdings, Inc.; and UPS Airlines. Air Canada is an associate member.

alternatives, fuels that meet the rigorous safety requirements to be certified as jet fuels and can be used without changing the aircraft or other infrastructure. Our efforts have yielded real results – in large part because we have worked in public-private partnerships with government and other stakeholders to bring available tools to bear. Indeed, through concerted, joint efforts under the Commercial Aviation Alternative Fuels Initiative® (CAAFI), the *Farm to Fly* initiative, and others, we've gone beyond testing and test flights to commercial airline and military jet flights with approved aviation alternative fuels.

We have made huge strides, but obstacles remain. Government has a key role to play in helping us overcome them. Commercially viable, environmentally beneficial alternative jet fuels are an important part of a larger U.S. energy package that should be aimed at increasing U.S. energy security and reducing volatility and the alarming increases in fuel prices while delivering environmental benefit. The aviation industry and would-be alternative jet fuel suppliers are on the cusp of creating a viable alternative jet fuel industry. But steady government partnership – such as that contemplated in the Energy Title of the recently-approved Farm Bill, the Defense Production Act project being pursued by the Departments of Agriculture and Energy and the U.S. Navy, and other federal programs – is needed in the near term to provide the financial bridging and other tools to help us get over the cusp. With sustained support, advanced aviation biofuels will literally get off the ground.

The Synergistic Opportunities of Aviation Alternative Fuels

1. **Addressing Jet Fuel Prices and Volatility, Strengthening the Airline Industry, the Customer Experience and the Economy**

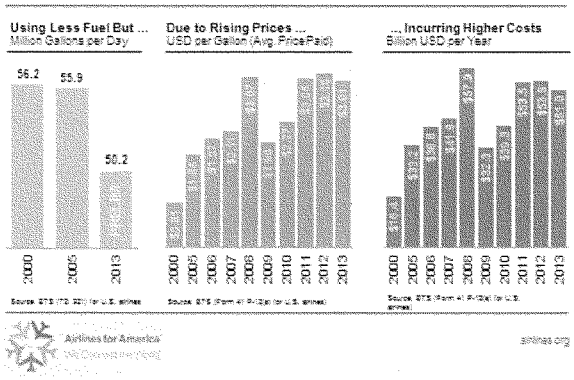
The U.S. airline industry is indispensable to our nation and its economy. What that means, of course, is that the healthier our industry is, the more that we contribute to the prosperity of America.

To place this in some context, the Federal Aviation Administration (FAA) estimated that in 2009 civil aviation supported more than 10 million jobs, contributed $1.3 trillion in total economic activity and accounted for 5.2 percent of total U.S. Gross Domestic Product (GDP). Civil aviation in general and the airline industry, in particular, are thus central to the U.S. economy.

While an array of government taxes, fees and overly burdensome regulations has kept the U.S. airline industry from contributing even more to the U.S. economy, so too have the cost and volatility of jet fuel. Jet fuel is the airlines' number one cost center. Every penny per gallon increase costs the industry an additional $180 million. The average price of jet fuel paid by U.S. airlines rose from an average of $0.81 per gallon in 2000 to $3.01 in 2013. *See* Figure 1. The impact of that dramatic increase is reflected in the fact that although U.S. airlines consumed approximately 5 billion fewer gallons of jet fuel in 2013 than they did in 2000, they nonetheless spent a staggering $34 billion more for fuel.[2]

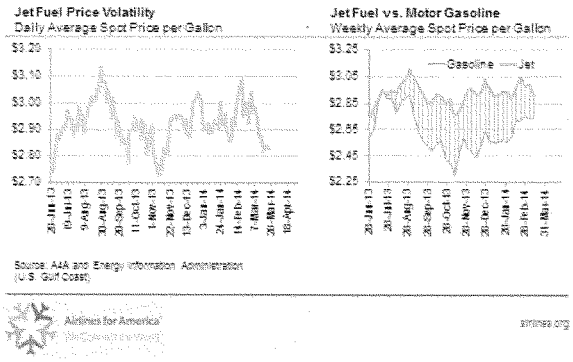
[2] The year-end 2013 figures are based on preliminary data from the Bureau of Transportation Statistics.

Figure 1. U.S. Airlines' Fuel Costs Are High, Volatile and Rising
Average Price Paid for Jet Fuel Rose 272% between 2000-2013



Price level is not the only concern, especially in recent years where supply disruptions, demand shocks, petroleum futures speculation and other factors have culminated in unprecedented jet-fuel price volatility. As noted in a recent analysis of the U.S. airline industry, while "airline revenues remain sensitive to events out of their control – natural disasters, diseases like SARS or bird flu, geopolitical events, government taxes… Fuel price volatility is, by far, the biggest risk…"[3] Notably, airlines' price "at the pump" continues to exceed gasoline prices. *See* Figure 2.

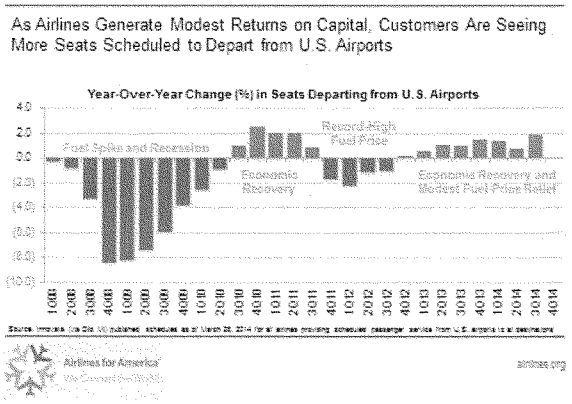
Figure 2. Jet-Fuel Prices Remain Volatile
And They Continue to Exceed Gasoline Prices



[3] Glenn Engel, Bank of America Merrill Lynch, "Industry Overview," Jan. 10, 2014.

Among other consequences, the general trend of rapidly rising prices coupled with large, unpredictable price swings over the past several years made it increasingly challenging to maintain adequate profitability on a wide number of the routes served by U.S. airlines, resulting in significant scale-backs in seating capacity for many communities and associated job cuts. *See* Figure 3.

Figure 3. Fuel Prices and Volatility Harm Airlines & Their Customers



Despite starting 2014 with $71.5 billion in debt, U.S. airlines' modest but encouraging financial progress has allowed them to accelerate investments in employees, products and technology to enhance the customer experience and to cope more effectively with operational impediments, such as extreme weather. Yet even small increases in jet fuel prices and the difficulty that volatility brings to planning for this, the largest of airline expenses, threatens the airlines' recovery. This is why the U.S. airlines continue to seek means to curb jet fuel prices and volatility. Commercially viable, alternative jet fuels offer a critical opportunity in that regard.

2. Building on the U.S. Airlines' Strong Environmental Record

For the past several decades, the U.S. airlines have dramatically improved fuel efficiency and reduced GHG emissions by investing billions in fuel-saving aircraft and engines, innovative technologies like winglets (which improve aerodynamics) and cutting-edge route-optimization software. As a result, between 1978 and 2012, the U.S. airline industry improved its fuel efficiency by 120 percent, resulting in 3.4 billion metric tons of carbon dioxide (CO_2) savings – equivalent to taking 22 million cars off the road on average in each of those years. Further, data from the Bureau of Transportation Statistics confirm that U.S. airlines burned 10 percent less fuel in 2012 than they did in 2000, resulting in a 10 percent reduction in CO_2 emissions, even though they carried almost 16 percent more passengers and cargo on a revenue-ton-mile basis. As a result of our efforts, U.S. airlines account for only 2 percent of the nation's GHG inventory, but 5 percent of the nation's GDP.

Despite our strong record to date, we are not stopping there. The initiatives U.S. airlines are undertaking to further address GHG emissions are designed to responsibly and effectively limit our fuel consumption, GHG contribution and potential climate change impacts, while allowing commercial aviation to continue to serve as a key contributor to the U.S. economy. For example, we are central stakeholders in partnering efforts to modernize the outdated air traffic management (ATM) system on a business-case basis and to reinvigorate research and development in aviation environmental technology, both of which can bring additional and extensive emissions reductions. Moreover, and of particular relevance to this hearing, A4A and its member airlines are dedicated to developing commercially viable, environmentally friendly alternative jet fuel, which could be a game-changer in terms of aviation's output of GHG emissions while enhancing U.S. energy independence and security.

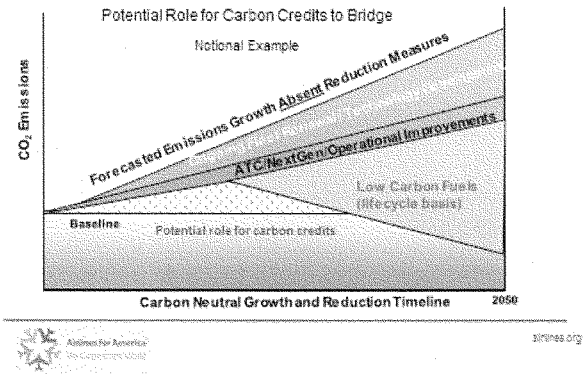
With fuel as the airlines' largest cost center, we have every incentive to continue to reduce our fuel burn and resulting emissions. Accordingly, we have concerns about legislative and regulatory efforts that would siphon away into government coffers the funds airlines need to continue investing in technology, operational and infrastructure measures to continue their strong record of emissions reductions. This does not mean that we oppose regulation all together. Rather, the U.S. aviation industry is supporting a global, sectoral approach to aviation GHG emissions under the International Civil Aviation Organization (ICAO), the United Nations' body charged with setting standards and recommended practices for international aviation.

At the ICAO Assembly in 2013, ICAO made further progress toward a full global agreement. The climate change resolution adopted by the Assembly focuses on technology, operations and infrastructure measures as the primary means for addressing aviation GHG emissions. It reconfirms the rigorous emissions goals established for the industry in 2010 – annual average fuel efficiency improvements through 2020 and carbon neutral growth from 2020.[4] The resolution also establishes a commitment to work toward a global market-based measure to "fill the gap" should the industry not be able to achieve carbon neutral growth from 2020 through concerted industry and government investment in technology, operations and infrastructure initiatives. As indicated in Figure 4, aviation alternative fuels could play a critical role toward achieving our targets, while minimizing the role that a costly and harmful market-based measure might play.

[4] In addition to these goals, the airline industry also has an aspirational goal to achieve a 50 percent reduction in net CO_2 emissions in 2050, relative to 2005 levels.

Figure 4. How Do We Meet Our Targets?

Technology & Alternative Fuels, Operations & Infrastructure



3. Airlines as Catalysts for the Liquid Alternative Fuels Market

While other sectors and modes of transportation can be powered via a variety of energy sources, including electricity, nuclear, solar, hydrogen and wind, to name a few, airlines will be flying aircraft and engines requiring liquid, high energy-density fuels for the foreseeable future. Because the useful life of aircraft and aircraft engines is very long, as is the pipeline for development of new aeronautics technologies, there simply is no realistic prospect that commercial aircraft will be powered by batteries, solar cells, fuel cells, hydrogen or other alternatives within the next several decades. This drives our industry to be keenly focused on the development and deployment of significant supplies of liquid alternative fuels that will meet the rigorous safety, performance and environmental criteria the airlines have set.

Commercial aviation offers unique benefits to prospective alternative fuels producers. First, fuel demand is highly concentrated. The 40 largest U.S. airports account for an estimated ninety percent of all of the nation's jet-fuel demand, while the top ten airports account for about half of demand. The country's largest airports – Los Angeles (LAX), New York-Kennedy (JFK), Chicago O'Hare (ORD) and Atlanta (ATL) – each demand more than one billion gallons of jet fuel annually. Demand from Air Force bases and Navy installations is also highly concentrated and, in many cases, those facilities are located near commercial airports. Thus, airports essentially compose a network of markets that alone could support all the output from alternative fuels production facilities. In addition, with high-demand nodes across the country, the aviation industry can support production from the full gamut of potential producers, who will rely on different feedstocks depending on where they intend to operate.

4. Cascading Opportunities throughout Our Nation

The benefits of aviation alternative fuels would not inure to the airline industry or would-be alternative fuel providers alone. The U.S. military, which has been a very active partner to A4A

in the pursuit of jet fuel alternatives, shares many of the same interests as our airlines.[5] Like airlines, jet fuel represents a significant share of costs to the U.S. military, particularly the U.S. Navy and U.S. Air Force. Rising and volatile prices wreak havoc on military budgets and present significant challenges for military planners, especially as combat logistics become increasingly complex and supply lines extend over often mountainous or desert terrain. At the same time, GHG emissions from military jet operations represent a large portion of the federal government's carbon footprint. Access to stable, domestically produced supplies of low-carbon alternative fuels would allow the armed services to address these concerns and further enhance national security.

In addition, a vibrant alternative jet fuels industry would create American jobs and spur economic development in areas most hit by the recession. Rural America would benefit greatly from access to new markets for new agricultural biomass crops, while industrial areas would be revitalized through construction of new refineries and processing facilities or revitalization of those that have been mothballed. At the same time, a stable, domestic supply of alternative jet fuel would improve our nation's security by reducing our dependence on foreign oil and improve national economic security by improving our trade balance.

Critical Public-Private Partnerships to Support the Development and Deployment of Commercially Viable, Environmentally-Preferred Aviation Alternative Fuels

From an airline point of view, before any alternative fuel can have commercial application in aviation it must be demonstrated to be (1) as safe as petroleum-based fuels for powering aircraft; (2) more environmentally friendly than petroleum-based fuels; (3) capable of being produced so as to provide reliable supply; and (4) cost competitive.[6] A4A and its members have been working with government partners and other stakeholders in a concerted effort to meet these criteria – and we have made tremendous progress, going from test flights to commercial and military flights with advanced biofuels. But we must continue to tackle each challenge, using every tool to get to full viability.

As the challenges to standing up a self-sustaining aviation alternative fuels industry cut across multiple disciplines – from aviation, to agriculture, to fuel production, to investment capital, to logistics and beyond – no one initiative or program can do it all. Yet the U.S. aviation industry and FAA determined early on that a coordinating body would be needed to establish a clear vision and leverage the efforts across initiatives. Accordingly, in 2006, A4A, FAA, the Aerospace Industries Association (AIA) and Airports Council International-North America (ACI-NA) co-founded the Commercial Aviation Alternative Fuels Initiative® (CAAFI) to serve as the driving and coordinating force for the industry's efforts. "CAAFI's goal is to promote the development of alternative jet fuel options that offer equivalent levels of safety and compare favorably on cost with petroleum-based jet fuel, while also offering environmental improvement and security of energy supply."[7] To meet its goal, CAAFI is organized into four teams, which are focused on addressing and overcoming the challenges to commercial-scale deployment of aviation

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[5] A4A is in a "Strategic Alliance for Alternative Aviation Fuels" with the U.S. Department of Defense's Defense Logistics Agency-Energy (DLA-Energy, which previously was known as the Defense Logistics Agency's Defense Energy Support Center).

[6] *See* Commercial Aviation Alternative Fuels: The A4A Commitment, available at http://www.airlines.org/Pages/Commercial-Aviation-Alternative-Fuels-The-A4A-Commitment.aspx.

[7] *See* www.caafi.org.

alternative fuels – ensuring safety, environmental benefit, supply reliability and cost-competitiveness.

1. Ensuring Safety

No matter what issue or challenge we face, airlines never lose sight of their core mission: safety. Our fuels must meet rigorous specifications that ensure safe operation, whether in the icy cold at 30,000 feet or while filling tanks on the ground at airports crowded with activity. Accordingly, before an alternative fuel can be approved for commercial use, it must meet rigorous safety and performance standards set out in the applicable specification, which is controlled by ASTM International, an organization devoted to the development and management of standards for a wide range of industrial products and processes. This specification, in turn, is included in FAA product approvals and required air-carrier manuals.

One of CAAFI's most significant contributions to date has been the development of the approval process for alternative jet fuels through ASTM. Not surprisingly, the original jet fuel specification, ASTM D1655, titled "Standard Specification for Aviation Turbine Fuels," covered only jet fuels derived from specific fossil-fuel sources. The CAAFI team worked within ASTM to identify means for gaining approval of jet fuels derived from alternative feedstocks provided that those fuels are equally safe and effective.[8] As a result, in August 2009, after completing its rigorous review process, ASTM approved D7566, "Aviation Turbine Fuel Containing Synthesized Hydrocarbons." This specification allows for alternatives that demonstrate that they are safe, effective and otherwise meet the specification and fit-for-purpose requirements to be deployed as jet fuels, on par with fuels under ASTM D1655. It is structured, via annexes, to accommodate different classes of alternative fuels when they are demonstrated to meet the relevant requirements. The initial issue of the specification enabled use of fuels from the Fischer-Tropsch (FT) process in up to a 50 percent blend with conventional jet fuel. FT fuels can be generated from a variety of feedstocks, including biomass (biomass to liquid) and natural gas to liquid, in addition to coal to liquid and combinations thereof. In 2011, an additional annex was added to ASTM D7566 for alternative jet fuels generated from conversion of triacylglycerides from plant oils and animal processing waste, referred to as "Hydroprocessed Esters and Fatty Acids" or "HEFA." Notably, advanced biofuels can be produced through both of the fuel pathways approved to date and the additional pathways currently under review.

By meeting the rigorous jet fuel specification and fit-for-purpose requirements, sustainable alternative aviation fuels are demonstrated to be "drop-in" fuels, completely compatible with existing airport fuel storage and distribution methods and airplane fuel systems. Accordingly, they do not carry added infrastructure costs for airlines, fuel distributors or airport authorities, enhancing prospects for their commercial viability.

2. Ensuring Environmental Benefit

Working through CAAFI, we also have made tremendous progress on demonstrating whether a particular aviation alternative fuel provides environmental benefit relative to petroleum-based fuel. As carbon is fundamental to powering aircraft engines, this and the CO_2 generated upon

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[8] CAAFI worked within ASTM to issue a specific standard to facilitate the approval of alternative jet fuel made from varying feedstocks and production processes, ASTM D4054, "Standard Practice for Qualification and Approval of New Aviation Turbine Fuels and Fuel Additives."

combustion cannot be eliminated from drop-in jet fuels, but they can be reduced, either through increasing the per-unit energy provided in the fuel, reducing carbon somewhere along the "lifecycle" of the fuel, or some combination of the two. Indeed, there can be emissions all along the "life" of the fuel – from growing or extracting the feedstock, transporting that raw material, refining it, transporting the finished fuel product and using it. By examining the emissions generated at each point in the lifecycle, one can ensure that the emissions benefits that are sought are in fact real and do not create emissions "dis-benefits" along the way.

Ensuring the environmental benefit of aviation alternative fuels is critical to A4A and its member airlines. Accordingly, as far back as 2008, we agreed on a set of alternative fuels principles, which include a commitment that the alternative fuels we accept need to have reduced lifecycle emissions compared to today's fuels and not compromise the food basket. In that commitment, we agreed to work through CAAFI to ensure this. Accordingly, CAAFI's Environment Team, which I co-lead along with Dr. James Hileman of the FAA, has developed and supported seminal guidance on the methodologies for lifecycle analysis of alternative aviation fuels[9] and case studies that use these methodologies.[10] While seeking emissions benefits from aviation alternative fuels, A4A and its members recognize that use of such fuels must not create environmental problems in other areas. Aviation alternative fuels ultimately must be produced in a fashion meeting all relevant environmental criteria, including land use, water management and the like. Put another way, the production, transport and use of these fuels generally must be deemed "sustainable." CAAFI also has provided peer-review guidance on making sure relevant sustainability criteria are met.[11]

3. Fostering Supply Reliability and Commercial Viability

As noted by Bill Harrison, Technical Advisor for Fuels and Energy at the U.S. Air Force Research Laboratory, scaling up supply and making aviation alternative fuels cost-competitive may well be the most significant challenge to their commercial deployment.[12] A key role that A4A and its member airlines are playing as end-users of such fuels is to send appropriate market signals to would-be producers, the farmers and others who generate energy feedstock, and investors in the alternative fuels industry.[13] Our vigorous pursuit of alternatives has sent an unmistakable signal: U.S. airlines are committed to making alternative jet fuels viable and will do their part to overcome the obstacles that may stand in the way. But we recognize that we cannot do it alone. Again, ongoing commitment in public-private partnerships is needed to get the

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[9] *See* "Framework and Guidance for Estimating Greenhouse Gas Footprints of Aviation Fuels (Final Report) (2009, AFRL-WP-TR-2009-2206); *see also* Young, CAAFI Environment Team: Developing Tools & Means to Address Environmental Issues (April 16, 2013), available at http://www.caafi.org/files/presentations/Environment_Young_ABLC_Apr17_2013.pdf.

[10] *See, e.g.*, Stratton, Wong & Hileman, Life Cycle Greenhouse Gas Emissions from Alternative Jet Fuels (April 2010).

[11] *See* CAAFI, Alternative Jet Fuel Environmental Sustainability Overview (July 2013), available at http://www.caafi.org/information/pdf/Sustainability_Guidance__Posted_2013_07.pdf.

[12] Harrison, *Alternative Fuels: How Can Aviation Cross the Valley of Death* (Massachusetts Institute of Technology Master's Thesis, 2008).

[13] One of many such signals is a "how to" document on how aviation alternative fuels producers can work with airlines on purchase agreements. This document, "Guidance for Selling Alternative Fuels to Airlines," was co-authored by A4A Chief Economist John Heimlich, who is co-leader of the CAAFI Business Team.

aviation alternative fuels industry over the cusp, just as was the case when the federal government jump-started the Internet, satellite systems and other backbone infrastructure – working with industry to help make these ventures self-sustaining.

While CAAFI has focused on supply reliability and commercial viability, other public-private partnerships and initiatives have been needed to bring appropriate resources to bear to support this new supply chain. Perhaps most notable in this regard is the *Farm to Fly* initiative, which A4A, the U.S. Department of Agriculture (USDA) and The Boeing Company (Boeing) created in 2010 to help meet the direction set in the 2008 Farm Bill that U.S. programs aimed at energy crops should be equally available for air transportation fuels as for ground transportation fuels.[14] Indeed, the aim of the original *Farm to Fly* initiative was "to accelerate the availability of a commercially viable sustainable aviation biofuel industry in the United States, increase domestic energy security, establish regional supply chains and support rural development." Although A4A, USDA and Boeing already were working together under CAAFI, we had determined that an even more focused effort would be needed to further align U.S. biofuels agricultural policy – which up to then had almost entirely been focused on the production of biofuels for automobiles and trucks – to provide opportunity for farmers and fuel producers to generate feedstocks and fuels for aircraft.

The initial *Farm to Fly* initiative helped make accessible to farmers, fuel producers, airlines and military aviation the tools and programs that had been available to ground-based alternative fuels for some time. It also resulted in a two-part report in January 2012 which offered a blueprint for continuing to advance opportunities for Rural America and the aviation sector through aviation biofuels.[15] Moreover, the initial *Farm to Fly* initiative helped spawn two regional initiatives to foster the development and deployment of alternative jet fuels derived from sustainable biomass grown in the United States. The first of these, the Sustainable Aviation Fuels Northwest (SAFN) initiative, led in part by A4A member Alaska Airlines, together with the Port of Seattle, Port of Portland, Spokane International Airport, Boeing and Washington State University, found that an aviation biofuels industry can be commercially viable in the Pacific Northwest and identified four, particularly promising feedstocks, oilseeds, forest residues, municipal solid wastes and algae, for generating advanced aviation biofuels.[16] The second, the Midwest Sustainable Aviation Biofuels Initiative (MASBI), led in part by A4A member United Airlines, Boeing, Honeywell's UOP, the Chicago Department of Aviation, and the Clean Energy Trust, developed recommendations to help "achieve the potential economic, environmental, and energy security benefits that can be delivered from a robust sustainable aviation biofuels industry in the Midwest."[17]

In April 2013, the U.S. Secretaries of Agriculture and Transportation signed an agreement to

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[14] Conf. Rpt. 110-627, on H.R. 2419; p. 911, May 13, 2008.

[15] *See* Agriculture and Aviation: Partners in Prosperity, available at http://www.airlines.org/Documents/usda-farm-to-fly-report-jan-2012.pdf; *see also* Agriculture and Aviation: Partners in Prosperity: Putting Aviation at the Forefront of the President's Biofuels Targets, Part II. Industry Recommendations, available at http://www.airlines.org/Documents/Farm_to_Fly_Recommendations-A4A-Boeing-Jan2012.pdf.

[16] *See* SAFN, Powering the Next Generation of Flight, available at http://www.safnw.com/wp-content/uploads/2011/06/SAFN_2011Report.pdf.

[17] *See* MASBI, Fueling a Sustainable Future for Aviation, available at http://www.masbi.org/content/assets/MASBI_Report.pdf.

expand the *Farm to Fly* program, to include additional stakeholders and extend the program by five years. The *Farm to Fly 2.0* agreement focuses on future goals – such as designating personnel, evaluating current and potential feedstock types and systems, developing multiple feedstock supply chains, developing state and local public-private teams, and other activities to, as Secretary Vilsack stated, "create jobs and economic opportunity in rural America, lessen America's reliance on foreign oil and develop a thriving biofuels industry that will benefit commercial and military enterprises."[18]

Although the *Farm to Fly* initiative is important for bringing together tools and the various participants in the aviation alternative fuels supply chain, there would be no *Farm to Fly* initiative without the Energy Title of the Agricultural Act of 2014, more commonly known as the Farm Bill. Thus, we would like to thank this Committee for its leadership in seeing that legislation through to passage. By assuring multi-year authorization and funding for critical programs such as the Biorefinery Assistance Program, Bioenergy Program for Advanced Biofuels, Biomass Crop Assistance Program and Biobased Marketing Program, among others, Congress will leverage the investments that the U.S. government and the private sector have already made and provide the stability needed for further progress.

Our joint efforts are bearing fruit. For example, after having conducted test flights and the nation's first commercial flight with aviation biofuel, in June 2013, United Airlines executed a definitive purchase agreement with AltAir Fuels for cost-competitive, sustainable, advanced biofuels at commercial scale.[19] With United's strategic partnership, AltAir Fuels will retrofit part of an existing petroleum refinery to become a thirty-million gallon, advanced biofuel refinery near Los Angeles, California. The facility will convert non-edible natural oils and agricultural wastes into low-carbon, advanced biofuels and chemicals. United has agreed to buy 15 million gallons of the resulting jet fuel over a three-year period, with the option to purchase more, with deliveries slated to begin at the end of 2014.

In another example, after having flown 75 commercial flights powered by 20 percent biofuel blends, in July of 2013, Alaska Airlines entered an agreement for the future purchase of sustainable aviation biofuel from Hawai`i BioEnergy LLC. The feedstock for the biofuel is anticipated to be woody biomass meeting peer-reviewed sustainability criteria.[20] Hawai`i BioEnergy is hoping to be able to begin delivering the biofuel to Alaska Airlines in 2018.[21]

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[18] *See* USDA Press Release, Agriculture Secretary Vilsack and Transportation Secretary LaHood Renew Agreement to Promote Renewable Fuels in the Aviation Industry, available at http://www.usda.gov/wps/portal/usda/usdahome?contentid=2013/04/0070.xml&navid=NEWS_RELEASE&navtype=RT&parentnav=LATEST_RELEASES&edeployment_action=retrievecontent.

[19] *See* United Airlines and AltAir Fuels to Bring Commercial-Scale, Cost-Competitive Biofuels to Aviation Industry, available at http://www.prnewswire.com/news-releases/united-airlines-and-altair-fuels-to-bring-commercial-scale-cost-competitive-biofuels-to-aviation-industry-210073841.html.

[20] *See* Alaska Airlines and Hawai`i BioEnergy Sign Agreement for the Carrier to Purchase Sustainable Fuel, available at http://online.wsj.com/article/PR-CO-20130724-908441.html.

[21] The opportunity for the State of Hawaii, those generating the feedstock, Hawai'i BioEnergy, Alaska Airlines and the flying and shipping public in Hawaii was captured in press statements when the fuel purchase agreement was announced. "The development and commercialization of local, renewable energy is of critical importance to Hawaii, given the state imports 95% of its energy needs. Use of locally grown feedstocks for biofuel production will improve Hawaii's energy sustainability and security while creating jobs in our communities," said Joel Matsunaga, Chief Operating Officer of Hawai'i BioEnergy. Alaska Air Group's Executive Vice President and General Counsel, Keith

Although these initial purchase agreements for advanced aviation biofuel are promising, two critical observations capture why we cannot be complacent in our efforts. First, these projects would not exist without the public-private partnerships we have engaged in to date. And second, while meaningful to the parties involved, they still are relatively small scale, particularly when compared to the demand for jet fuel in the United States, which currently is approximately 18 billion gallons a year. Accordingly, to see these projects to fruition and to spur more, we must continue to employ all the tools and partnerships we have identified and created to date and we need to take action to further scale up supply so a foundation is laid for all supply-chain elements to become self-sustaining.

This is exactly what the Defense Production Act (DPA) project between the Department of Energy (DOE), USDA and the Department of Defense (DoD) is designed to do. In 2011 these departments pledged a federal investment of $510 million in partnership with the private sector. This three year effort advances the timeline for the commercialization of domestically produced, cleaner drop-in aviation and marine biofuels. Under the terms of the Memorandum of Understanding among the departments, $170 million would be provided by each participating federal agency over the course of the initiative. Notably, the program requires equal or greater private matching funds. As previously noted, adopting advanced, "drop-in" aviation biofuels will help the DoD and the nation achieve broader national and energy security objectives.

To date, DoD and the USDA have made significant progress awarding grants under the DPA in collaboration with private industry and the DOE is providing research and development support. A4A is working with a diverse, multi-stakeholder coalition to support the continued funding of this important program. Marshaling funding and other mechanisms across agencies to support projects will go a long way to demonstrating commercial viability to reluctant private capital, "jump starting" this industry and building the necessary bridge to a future in which the industry is entirely funded by private capital. To be clear, A4A is not calling for perpetual government funding. Rather, we and our partners are supporting a key public-private partnership to accelerate progress toward cost-competitiveness. We urge Congress to continue to support this important initiative.

Conclusion

In sum, the aviation industry and would-be alternative jet fuel suppliers are on the cusp of creating a viable alternative jet fuel industry. But we cannot become complacent. Steady government partnership is needed in the near term to provide the financial bridging and other tools to help us get over the cusp. With sustained support, advanced aviation biofuels will – quite literally – get off the ground.

Loveless, commented: "Beyond the environmental advantages, it improves the fuel supply integrity in the state of Hawaii, which will allow for the further growth of our airline operations throughout the islands."

DOCUMENTS SUBMITTED FOR THE RECORD

APRIL 8, 2014

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Supporting Testimony for the Record

Sumesh M. Arora, Ph.D.,
Vice President, Innovate Mississippi
Director, Strategic Biomass Solutions

Before the
United States Senate Committee on Agriculture, Nutrition and Forestry
Full Committee Hearing

Advanced Biofuels: Creating Jobs and Lower Prices at the Pump

Washington, D.C.
Tuesday, April 8, 2014

Strategic **Biomass Solutions**™
www.biomass.ms

Thank you, Chairwoman Stabenow, Ranking Member Cochran and members of the committee for the opportunity to testify today in support of advanced biofuels and how they may lead to job creation and lower prices at the fuel pump. On October 16, 2013 we marked the 40th anniversary of the oil embargo levied against the United States by the OPEC cartel. This day should serve as a reminder for us all about the immediate need to diversify the energy demands for our transportation sector which to this day still relies on petroleum-based products for 93% of its needs!

My name is Dr. Sumesh Arora and I serve as the vice president of Innovate Mississippi, an independent nonprofit organization that champions innovation and technology-based economic development. I have worked in corporate research for 13 years in the chemical process industry and have 12 years of experience in the renewable energy sector. My Ph.D. in international development has given me an opportunity to study the human side of technology adoption and how new innovations may be diffused among various populations.

I hope to provide a perspective on how advanced biofuels and bioenergy development and deployment may be accelerated in the Southern United States, where considerable related activity is already taking place on multiple fronts.

In the time I have today, I will address five challenges and opportunities for furthering the domestic development of advanced biofuels and biomass-based energy options:

1. This industry is still in its infancy. Currently there is no "dominant design" for advanced biofuels technologies or feedstocks, which means that many different technologies are being perfected that can use a wide variety of feedstocks. This opens up opportunities for many technical and business innovations in this sector from deploying very large scale systems to small modular and even on-farm systems. Achieving the concept of dominant design makes a technology more bankable and much easier to be adopted by the masses. There is, however, a significant need to educate entrepreneurs and investors on how to mitigate risks associated with developing successful ventures in this space. It is important to look

at risk in five key areas as these businesses evolve: technology, markets, management, finance and execution. Innovate Mississippi, through its Strategic Biomass Solutions program, has developed the Renewable Energy Venture Startup (or **REVSup** for short) Academy, which does just that- educate entrepreneurs to mitigate risk. REVSup workshops have been conducted all over the country in the last three years. Linking business plan competitions and business accelerators around the country is critical to encourage investment in new ventures.

2. Many parts of the country, especially the Southeastern United States, are well suited to generate current and emerging feedstocks in an ecologically sustainable manner, which can provide very effective regional solutions. For example, forestry and poultry are two of the biggest industries in the Southeastern United States that can supply feedstocks currently for advanced biofuels. Emerging dedicated energy crops such as grasses and algae also grow well in this climate, but additional research and market development is still needed to optimize the feedstock supply chains.

3. Deployment of these technologies will lead to an increase in the number of STEM (science, technology, engineering and mathematics) related jobs across the country, which will be difficult to off-shore and will also lead to rural wealth creation. However, we need to better connect and leverage federal research assets with local universities, schools, business and nonprofit organizations to accelerate the development of these technologies. For example, Innovate Mississippi is the original member among nine partners with the USDA Agricultural Research Service (ARS) to facilitate commercialization of ARS research through the Agricultural Technology Innovation Partnership (ATIP). I applaud the 2014 Farm Bill for urging the Department to move forward with further development of public-private partnerships to provide venture development training for innovative technologies.

4. Advanced biofuels should not be limited to just liquid fuels, but should be viewed in a more comprehensive manner to include viable biomass-based energy and

biochemical options in gaseous, liquid and solid forms, thereby necessitating a long-term and stable policy that provides clear market certainty. The announcement by President Obama March 28 unveiling a strategy to curb methane emissions does that to a great extent; however, the national Biogas Roadmap scheduled to be released in June this year is expected to focus primarily on the dairy industry, which is quite small in the south compare to poultry. Millions of tons of poultry waste is generated in states from Maryland to Arkansas and the contributions to biogas production from this very viable feedstock have largely been ignored. There are tremendous entrepreneurial opportunities in developing such systems that can lead to rural job growth and keep energy prices low for farmers, while improving soil health.

5. A large enough volume of advanced biofuels and biomass-based energy options in the overall mix will help keep fuel prices in-check by diversifying our energy supply and enhancing our national security, but market conditioning efforts led by various federal agencies must continue for greater adoption of such fuels.

Our work at Innovate Mississippi can be summed up in two words: ***"coach" and "connect."*** While our mission and goal may sound simple, the work of coaching early stage innovation-based enterprises and connecting them with a wide variety of resources, including early stage capital, technical research and entrepreneurial service providers, is challenging. The ultimate goal is to create fast growing, commercially viable companies, which also yield great returns for the early stage investors. Innovate Mississippi relies on various sources of state, federal and private sector funding to provide such services at low or no cost to the entrepreneurs.

We have a specific focus on renewable energy development through our Strategic Biomass Solutions (SBS) program that was started in 2005 with seed funding from the U.S. Department of Energy. SBS was preceded by the state-funded Mississippi Alternative Energy Enterprise and our staff has a cumulative experience of over 25 years in the renewable energy sector. The mission at SBS is to help commercialize sustainable energy

technologies by connecting energy entrepreneurs and project developers with not only investors, but economic developers as well, since many of these projects require public sector support. SBS activities are not limited to Mississippi and we have assisted over 80 early stage renewable energy companies from 17 states and four countries. SBS has been instrumental in attracting over $500 million worth of direct investment in the advanced biofuels sector to Mississippi, and when operational at full scale, these two plants are expected to account for 300 direct jobs and nearly 1,000 indirect jobs.

Due to the combined efforts of many stakeholder organizations, Mississippi is emerging as a regional leader and the proving ground for commercial scale production of various advanced clean energy technologies such as woody biomass and MSW-based cellulosic biofuels, biogas production using poultry litter, torrefied wood pellets, thin film solar panels and energy efficient windows as seen in Table 1. According to the North Carolina Biofuels Center research, a one hundred million gallons per year bio-gasoline plant creates 700 direct and indirect jobs.

Developing businesses in the renewable energy sector is not a trivial task and the venture development process in the advanced biofuels sector is even more daunting. The proverbial valley of death for advanced biofuels is very deep and very long and may be compared to the timeframe and cost magnitude of bringing a new medical drug to market. What that translates to is, it takes several years for a technology in this arena before it can reach a point of producing biofuels at a commercially profitable scale. Millions of dollars are needed along the way to develop these technologies before they achieve a steady state operation. Needless to say the advanced biofuels industry is still in its infancy and has a long way to go before these fuels are transparently a significant part of the existing energy infrastructure. A review of the list of "50 Hottest Companies in Bioenergy" and "30 Hottest Companies in Biobased Chemicals and Materials" prepared annually by the Biofuels Digest shows a tremendous diversity of the types of technologies that use multiple feedstocks and at various stages of technical, market and business development.

Table 1. Clean Energy Activities in Mississippi

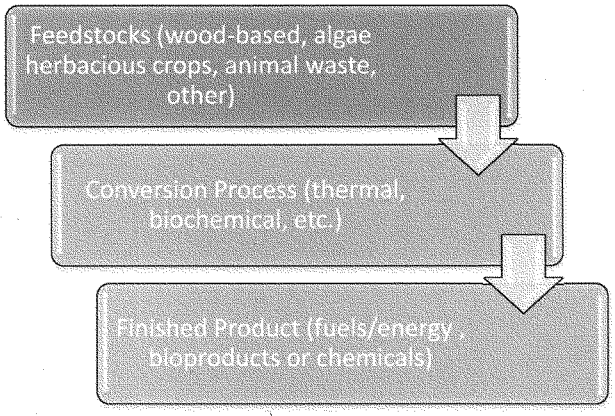
Note: Completed investments are designated with (A) as actuals; some facilities have invested portions of the amount listed here and projected values listed are the total expected investments

Company	Product	Projected/Actual Investment (in millions)	Jobs (direct and indirect)
BlueFire Renewable	Integrated cellulosic ethanol/pellet/power facility	$350	250
Ergon Ethanol (plant currently idle)	Corn-based ethanol	$100 (A)	45
Drax Biomass/Amite BioEnergy	Wood pellets	$80[i]	45
Eagle Green Energy	Methane via poultry litter anaerobic digestion	$2 (A)	10
Elevance[ii]	Lipids based biochemical and biodiesel	$225	165
Enerkem[iii]	Cellulosic biofuels (ethanol and drop-in)	$100	50
Enviva Biomass[iv]	Wood pellets	$12 (A)	52
Green Circle Bioenergy	Woo pellets		
GreenTech Automotive[v,vi]	Neighborhood electric vehicles	$75	426
KiOR[vii]	Drop-in biofuels (diesel, gasoline, aviation)	$500	1000
New Biomass Energy[viii]	Torrefied wood pellets	$50 (A)	25
Scott Biodiesel[ix]	Animal fat based biodiesel	$30 (A)	25
Silicor Materials (formerly Calisolar)[x]	Silicon for electronic and PV applications	$600	951
Stion[xi]	Thin film Solar PV panels	$500	1000
View[xii]	Electrochromic glass	$130	300
Virdia (formerly HCL Cleantech)[xiii]	Cellulosic sugars	$1,000	800
Total		**$3,744**	**5,444**

The road to industry maturity for advanced biofuels and biomass-based energy options has many challenges. Having such a wide variety of feedstocks and a diverse array of

technologies to pick from is a challenge in itself. The biomass feedstocks and technologies have to be well matched with each other to produce the desired product whether it is a solid, liquid or gaseous fuel as seen in Figure 1. Many of these technologies are still in the pre-commercial stages and most non-food feedstocks besides timber have not reached cultivation status where they may be considered commodity products.

Figure 1. Block Diagram for Feedstock Conversion to Finished Product

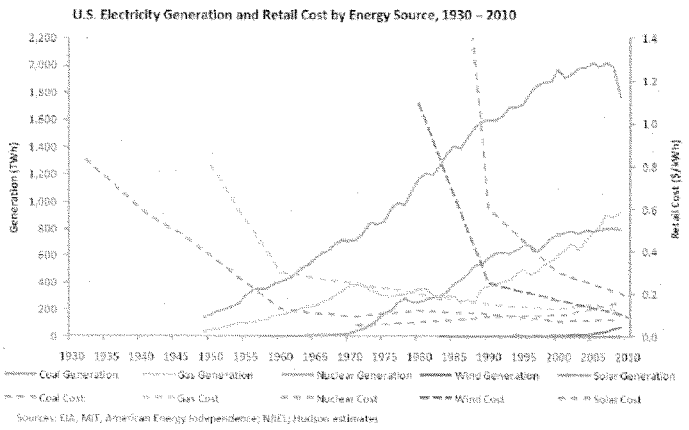


The Biofuels Digest lists mentioned earlier show there is currently no dominant non-food feedstock or a dominant technology design which is the acceptable standard in the industry for producing advanced biofuels and bioenergy. This industry is still striving to achieve the concept known as "dominant design" for the complete supply chain of economically converting non-food feedstocks to advanced bioenergy products. The dominant design is an important milestone for any technology or industry because it signifies the attainment of a robust, well accepted and stable process or product that is universally adopted. An example of one of the oldest dominant designs is the QWERTY keyboard that won out over many other designs of keyboards in the early 1900's. This design has not only survived as the de-facto data-entry interface for computers, but has been carried over into the virtual form in today's smart phones and tablets. We have also seen the design of automobile tires

evolve from hundreds of entrepreneurial wheel-rights producing wheels using their own methods and designs until the rubber vulcanization process was invented in mid 1800's. Today, a steel-belted radial tire is the standard design regardless of the manufacturer. Similarly, most of the processes used in coal and natural gas electricity generation saw their cost level off in the 1960's as seen in Figure 2 (source: ACORE Leadership Council Report)

In the world of renewable energy, crystalline silicon solar photovoltaic panels and large three-blade wind turbines have achieved dominant designs to a great degree as indicative of their cost curves in Figure 2. While these solar panels may not be the most efficient in terms of converting sunlight into energy, a vast segment of the general population is able to relate to this general design when talking about solar energy. Having a dominant design makes it much easier for a technology to be adopted by the masses and even the so called "technology laggards."

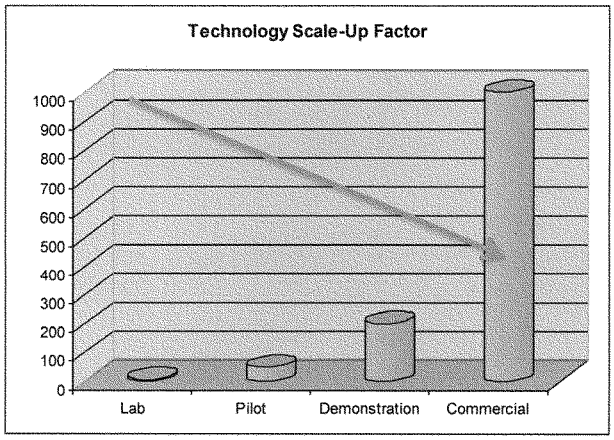
Figure 2. Cost Reductions for Coal, Gas, Solar and Wind Power Generation



In the case of biofuels, the corn-based ethanol and sugar-based ethanol industries have achieved dominant designs as the designs of the plants and the supply chain are very well developed. Due to significant research that has been done over the last 20 years, soybean-

based biodiesel also very established pathways from technical and market standpoints. However, this is not the case for advanced biofuels or biomass energy production. There are literally hundreds of possible combinations of using various feedstocks with different conversion processes that may produce a desired type of fuel or chemical. Many companies have invested significantly in various technologies and three cellulosic ethanol plants, each with its own technology, are expected to commence commercial operation in the United States this year. A tremendous amount of development and deployment efforts are underway to bring drop-in fuels to a commercial realty also by several companies are working through technology scale-up issues as we speak. Scale-up risk is a very important parameter in this industry and as technologies move from the laboratory bench to a commercial facility, there could easily be a difference of three orders of magnitude in the scale of the physical facility or the system output as shown graphically in figure 3.

Figure 3: Graphic Representation of Technology Scale-up Factor and Associated Financial Risk (red arrow)



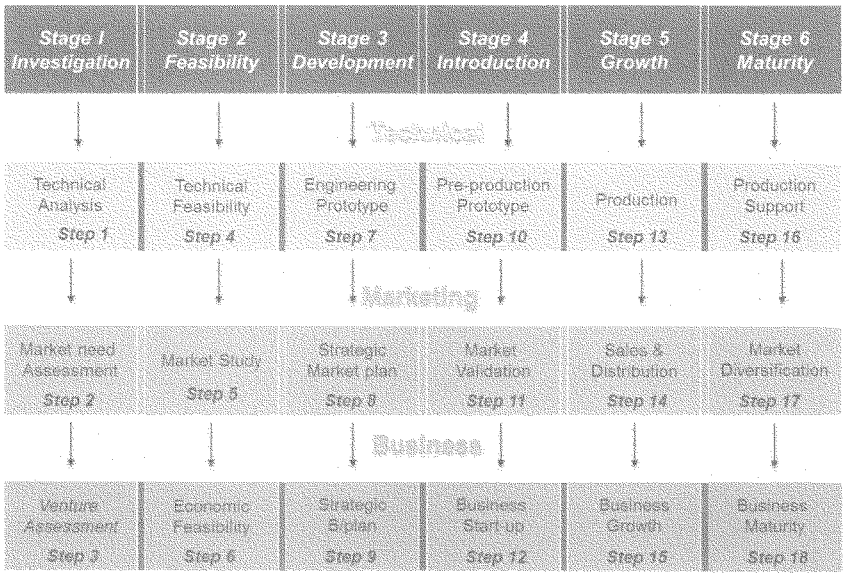
As a technology is scaled up, the technical and financial risk of it failing starts going down. Correspondingly investors are willing to settle for relatively lower returns when investing in technologies that are the commercial stage as the risk is highest when they are still

laboratory concepts. The technology risk involved in building the first-of-kind biorefineries at a commercial scale is still very high as there are many variables that have to be optimized simultaneously. The technology scale up issue for advanced biofuels represents another unique challenge in which technology developers or researchers have to learn how to become project developers also. This transition requires a vastly different set of business and process skills and the original process research team has to realize their capacity to execute a large project. The commercial project team faces real world challenges such as attracting highly skilled engineers and workers to rural areas where a biorefinery may be located due to convenient inbound feedstock logistics.

Trying to climb out of the valley of death is complicated by lack of long term national policy, slower-than-expected pace of technology development, ability to finance commercial scale first-of-its-kind biorefineries, the huge scale and regulatory burden characteristic of this market and the challenges in securing adequate financing.

A unique offering by SBS is the Renewable Energy Venture Startup Academy or the REVS^{up} Academy for short. The REVS^{up} program looks at five distinct areas of risk involved in developing technologies or projects in the clean energy space. The areas of risk are: 1) technology, 2) markets, 3) finance, 4) management, and 5) execution with on-line tools available to evaluate the readiness of a given venture as well as the entrepreneur herself. The underlying 18-step commercialization model (Figure 4) developed by Dr. H. Randall Goldsmith is currently used by many economic development organizations and entrepreneurs in the United States and abroad. This model and the associated web-based tools, allow users to track the venture development process from the idea stage to the maturity of the business. As per this model it is important to establish the economic feasibility of a product or technology in the very early stages (Step 6); however, what we see in the renewable energy sector are many entrepreneurs who lack an understanding of energy markets and often push too far to develop technologies that may not be acceptable or adaptable to the current market place. As significant market conditioning is still needed, by means of policy measures and educating the general public, that will lead to increased use of renewable energy and more specifically advanced biofuels in the United States.

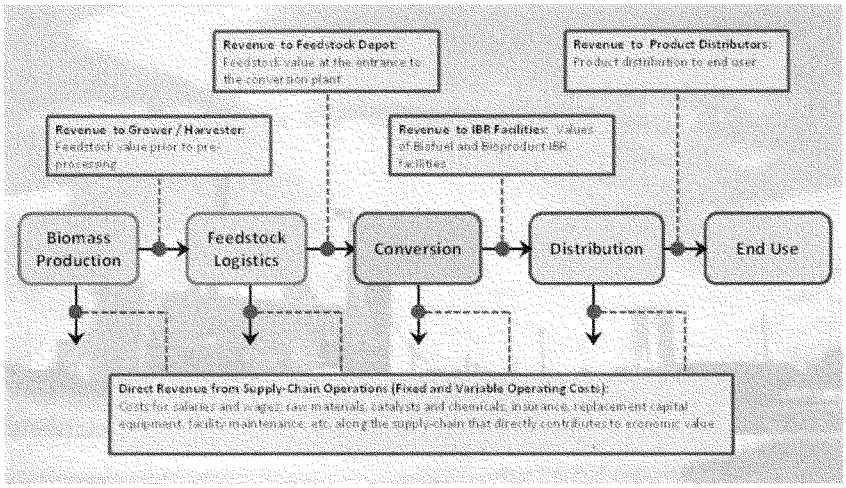
Figure 4: Goldsmith© Commercialization Model



REVS^{up} workshops have been conducted in 11 locations from California to Florida including Washington D.C. More than 130 individuals including participants from Asia, Africa, Europe and Central America have completed this program. One of the attendees remarked, "This workshop was like getting a biomass MBA in a day." Another graduate of the REVS^{up} program recently received three different grants totaling $395,747 under USDA's Rural Energy for America Program (REAP). These grants were announced by Secretary Vilsack during his trip to Mississippi fall 2013. This funding will provide assistance for installation of a megawatt scale solar photovoltaic system.

When we think of job creation in the biofuels space, we have to also think of the entrepreneurial opportunities that exist for bringing new technologies to market. However, many of these technologies pose significant risk and there are mixed signals in the market place which makes their adoption challenging. I believe programs like REVSup have a broad appeal for the public and private sectors and can help build a national cohort of individuals and entities armed with similar tools to develop robust business enterprises. To further this effort, Strategic Biomass Solutions is partnering with regional entrepreneurial development efforts such as the University of Central Florida's MegaWatt Ventures Challenge and the Innovation Concourse of the South as well as national entities such as Cleantech Open which is the world's oldest and largest clean technology accelerator program. The objective is to seek and develop targeted opportunities that can address specific hurdles to greater adoption of clean energy technologies. Entrepreneurial opportunities can be found along the complete supply chain from biomass production to end use products as seen in Figure 5.

Figure 5. Revenues Generated across the Supply Chain for Biomass-Based Energy and Products (source: USDA)



In addition to wealth that successful entrepreneurial ventures are capable of creating, it is well-established that STEM (science, technology, engineering and mathematics) related jobs tend to pay higher wages and the biofuels and bioenergy sector lends itself perfectly to grow such jobs across the country. SBS has been instrumental in attracting over $500 million worth of direct investment in the advanced biofuels sector to Mississippi, and when operational at full scale, these two plants will account for more than 200 direct STEM jobs and nearly 1,000 indirect jobs. Recently SBS partnered with the Mississippi State University to apply for a National Science Foundation grant to develop curriculum for middle school students that proposes to teach STEM courses by showing middle school students the benefits and opportunities in bioenergy. Students in middle school are generally very impressionable and our goal is help them see that not only can they get higher paying jobs with a STEM education, but they can also do their part improving the environmental quality of the planet.

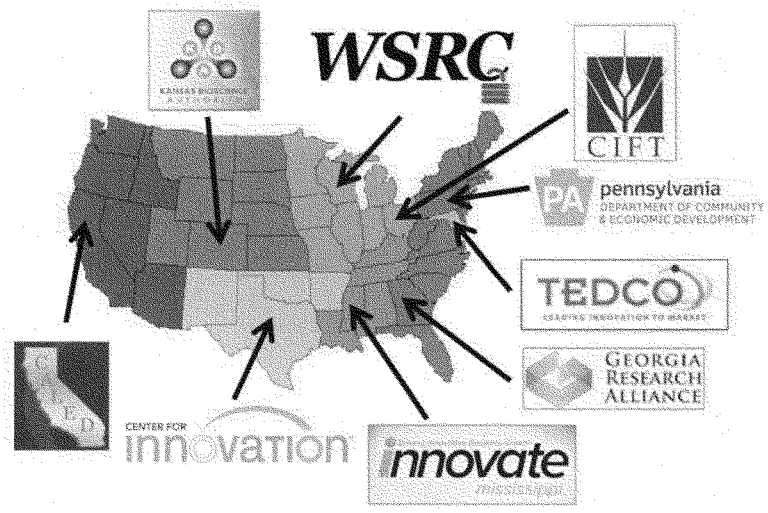
One of the biggest challenges in the southeast for companies who are building advanced biofuels refineries the difficulty in attracting advanced skilled workforce such as process engineering, workflow managers and those who really know how to troubleshoot these first-of-a-kind technically sophisticated chemical facilities. They are competing with knowledge base that is attracted to much larger metropolitan areas such as Houston, Texas or other areas with heavy concentrations of petrochemical complexes. A proliferation of rural biorefineries will help stem the brain drain of qualified STEM and engineering graduates and grow the technical and intellectual base of the region.

It is evident that deployment of these technologies will lead to an increase in the number of STEM related jobs across the country, which will be difficult to off-shore and will also lead to rural wealth creation. However, we need to better connect and leverage federal research assets with local universities, schools, business and nonprofit organizations to accelerate the development of these technologies. For example, Innovate Mississippi is the original member among nine partners (figure 5) with the USDA Agricultural Research Service (ARS) to facilitate commercialization of ARS research through the Agricultural Technology Innovation Partnership (ATIP). ***I applaud the 2014 Farm Bill for urging the Department***

to move forward with further development of public-private partnerships to provide venture development training for innovative technologies. My understanding is the ARS may soon rename ATIP as the Agricultural Research Partnership.

Regardless of the program name, biofuels related research and technology transfer from ARS to industry could be crucial for the helping meet the goals of the Renewables Fuels Standard as these interactions could accelerate technology development with non-profit organizations such as Innovate Mississippi and others shown in Figure 6 playing an instrumental role in technology transfer and providing feedback to the ARS on market needs. An increase in funding to promote submittals of Small Business Innovation Research proposals from small, rural businesses will complement this strategy.

Figure 6. USDA-ARS Research Commercialization Partners



Two listening sessions have already been conducted in Mississippi to understand the concerns of the industry and relay that information back to the ARS. ARS personnel from

Washington D.C. and Stoneville, Mississippi were on hand to get a better understanding of the issues. One of the top-ten ARS facilities in the country is located in Stoneville in the Mississippi Delta and our goal is to continue fostering closer relationships with the research facility and industry. A pilot program in the southern region that connects ARS research to the industry while capitalizing on the extensive biomass feedstock resource in the region could lead to a model that may be replicated in other parts of the country as well. Figures 7A and 7B show the biomass resource available in the geographical area covered by the ARS-Innovate Mississippi technology commercialization partnership. Regional approach is very important for commercially viable development of biofuels since the nature of feedstocks varies from one part of the country to the other.

Figure 7A. Total Biomass Resource Concentration (courtesy NREL) with the USDA ARS-Innovate Mississippi Technology Commercialization Region Outlined

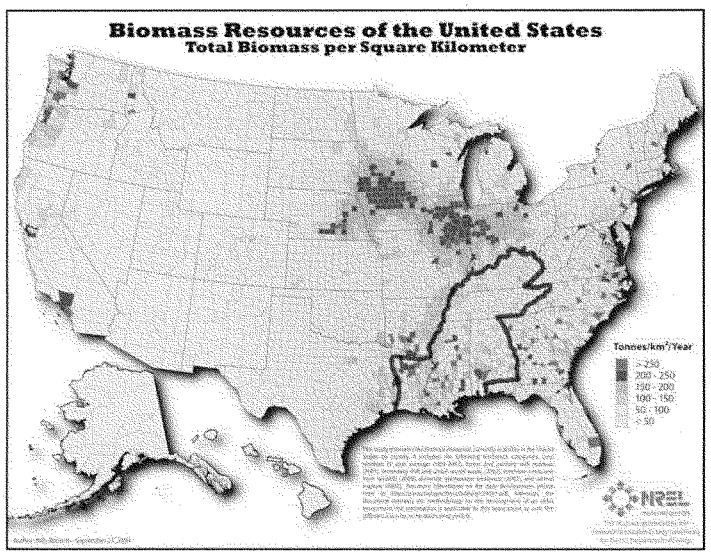
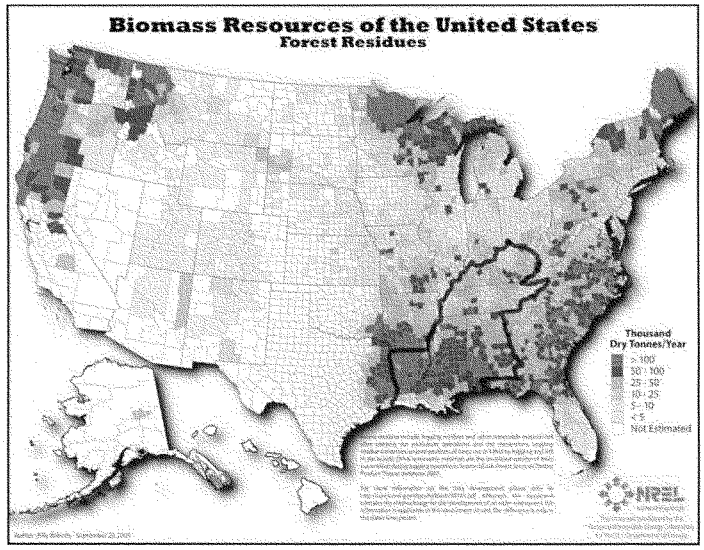
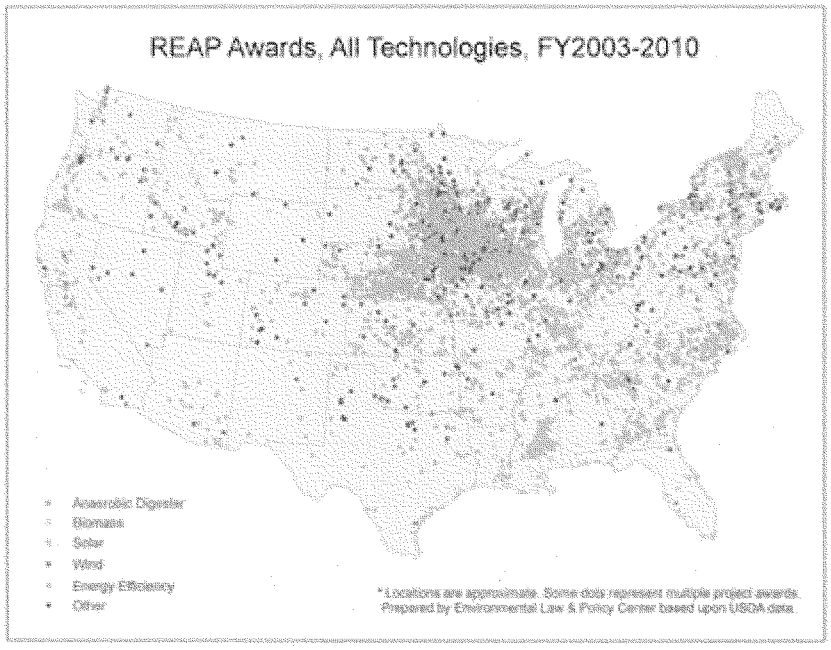


Figure 7B: Forest Residue Biomass Resources (courtesy NREL) with the USDA ARS-Innovate Mississippi Technology Commercialization Region Outlined



A regional approach also requires funding to reach different parts of the country to develop technologies that will benefit the target areas in non-preferential manner. For example, the Rural Energy for America (REAP) is a great program that has funded projects in all 50 states and I am pleased to see continued funding in the 2014 Farm Bill. However, there is significant disparity between the types of projects funded from one state to the other. The southern states have done well in securing small energy efficiency grants, but have not been able to land larger bioenergy projects that can help clear the path for greater market penetration of advanced biofuels. This trend is evident from the REAP awards map spanning eight years (Figure 8). When available, state-specific allocations for REAP grants and loans have been a useful vehicle for encouraging even greater participation in this very popular program.

Figure 8. REAP Grants Awards Map



The 2014 Farm Bill acknowledges of the importance of biomass and biofuels technologies and projects to the national economy and authorizes the following funding mechanisms under Title IX.

- BioPreferred Program: $3 million each year FY 2014-18
- Biorefinery Assistance Program ($100 million for fiscal year 2014 and $50 million in each FY15 and Fy16)
- Repowering Assistance: $12 million
- Bioenergy Program for Advanced Biofuels: $15 million each year for FY 2014-18
- Rural Energy for America Program: $50 million each year
- Biomass Research and Development Initiative: $3 million each year FY 2014-18
- Biomass Crop Assistance Program: $25 million each year FY 2014-18

However, financing mechanisms like the Section 1603 Cash-Grant program heavily favored wind and solar projects with only a handful of solar projects being implemented in the southeast as seen in the figures released below from the United States Treasury.

Figure 9A. 1603 Cash Grant Awards by Technology: 2009-2010

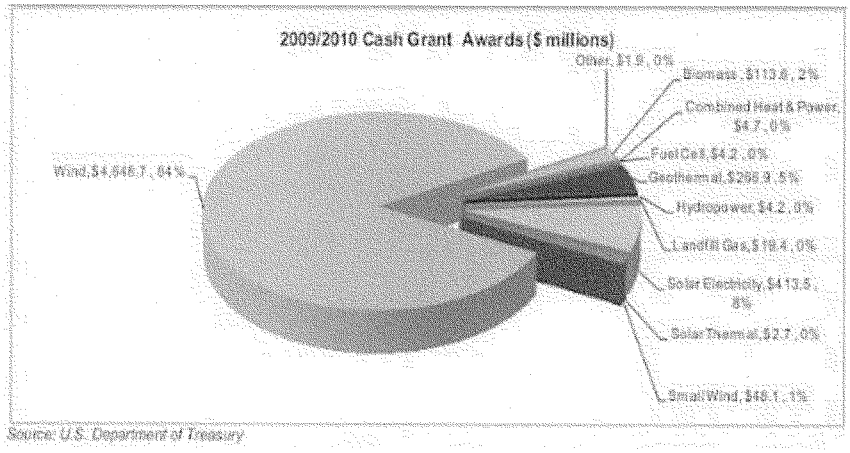
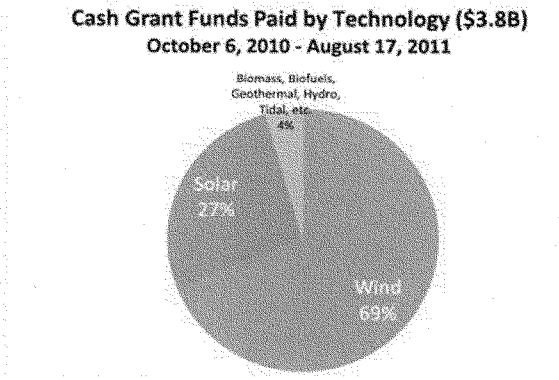
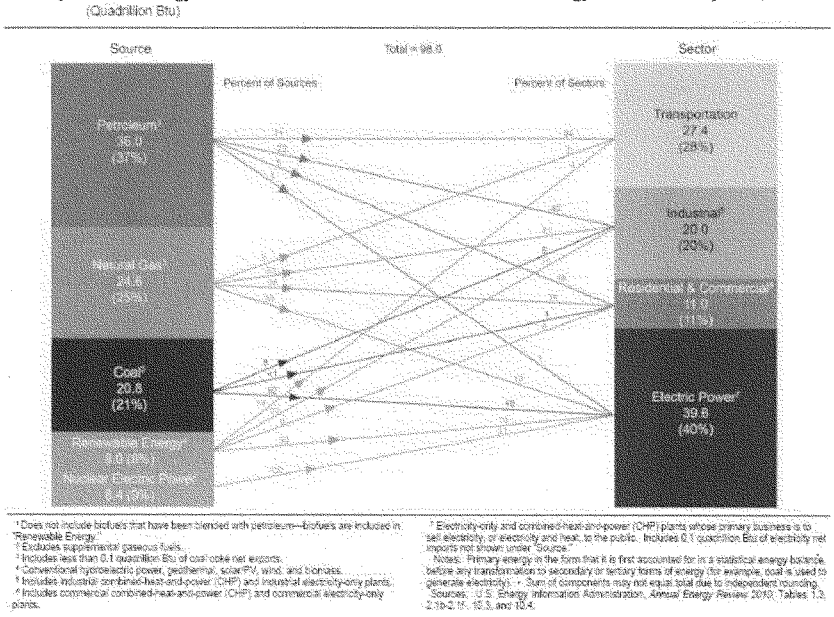


Figure 9B. 1603 Cash Grant Awards by Technology: 2010-2011



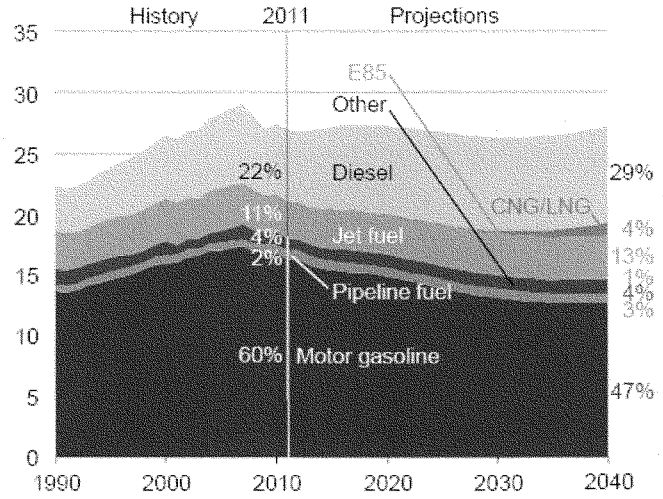
Energy Security and Advanced Biofuels: On October 16, 1973, members of the OPEC cartel announced an oil embargo against the United States, touching off a crippling price shock and devastating economic recession. Forty years later, energy and transportation markets are experiencing dramatic changes, but our economy remains heavily dependent on oil as seen in Figure 10. The transportation sector is especially vulnerable to petroleum supply disruption. Data from the Energy Information Administration (2011) indicate the transportation sector's reliance on petroleum decreased just by one percentage point to 93% and natural gas gaining a slightly larger share. Contribution from the renewable energy category, which includes biofuels, has remained unchanged and is still only at four percent. Even the projections for 2040 presented in figure 11 do not show a significant increase in the use of biofuels.

Figure 10. Primary Energy Consumption by Source and Sector (quadrillion BTU)
(Source: Energy Information Administration – Annual Energy Review 2010)



[a] Does not include biofuels that have been blended with petroleum—biofuels are included in "Renewable Energy."
[b] Excludes supplemental gaseous fuels.
[c] Includes less than 0.1 quadrillion Btu of coal coke net exports.
[d] Conventional hydroelectric power, geothermal, solar/PV, wind, and biomass.
[e] Includes industrial combined-heat-and-power (CHP) and industrial electricity-only plants.
[f] Includes commercial combined-heat-and-power (CHP) and commercial electricity-only plants.
[g] Electricity-only and combined-heat-and-power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public. Includes 0.1 quadrillion Btu of electricity net imports not shown under "Source."
Notes: Primary energy is the form that it is first accounted for in a statistical energy balance, before any transformation to secondary or tertiary forms of energy (for example, coal is used to generate electricity). • Sum of components may not equal total due to independent rounding.
Sources: U.S. Energy Information Administration, *Annual Energy Review 2010*, Tables 1.3, 2.1b-2.1f, 10.3, and 10.4.

Figure 11. Transportation Energy Consumption by Fuel, 1990-2040 (quadrillion BTU), (Source: DOE/EIA Annual Energy Outlook 2013)

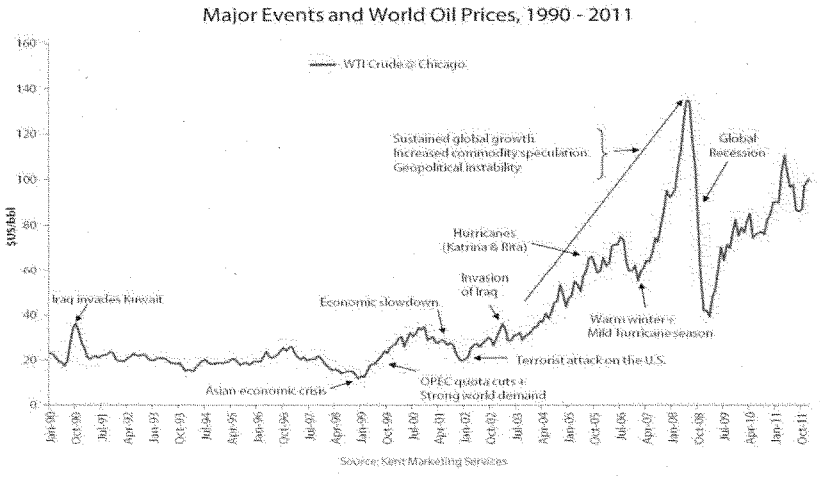


Given the over reliance of the transportation sector on fossil fuels, we have been hearing the "energy independence" rhetoric since President Nixon first started using this term. The following portion of the testimony distinguishes between the implications of energy independence and energy security. The phrases "energy security" and "energy independence" are often used interchangeably by people in the media, politicians and the general population, but according to Sosa and Desnyder, energy security is discussed generally in terms of the uninterrupted energy supply, whereas energy independence generally has a strong connotation for increasing the domestic production of energy products and reducing reliance on imports.[xiv] It is important to realize that both terms, security and independence, have the same implication of achieving the goal of a stable energy supply that can adequately meet current and future demand at a price point that the market can reasonably afford. "Energy product value chain stability" thus encompasses both security and independence. The frequent use of the emotional terms of "security" and "independence" is a reflection on the lack of stability of the current global energy sector. Clive Crook describes energy security as the ability of a country to absorb the rise in energy

prices.[xv] Affordability of energy can be viewed in terms of the percentage of disposable income that the citizens of a country have to spend on energy expenses.

With a delicate balance between oil supply and demand, any disruption in the supply can lead to price increases. The reasons for a disruption can be varied from natural events such as earthquakes or hurricanes, to politically motivated actions on the part of energy producing countries, or terrorist activities that threaten to disrupt the energy supply chain through the use of violent force. Diversification of energy supply sources is listed as an important energy security concern for countries in industrialized nations who are net importers of energy and emerging markets like China and India, whereas meeting the population's basic energy needs is among the energy security priorities of the medium and low income energy importers.

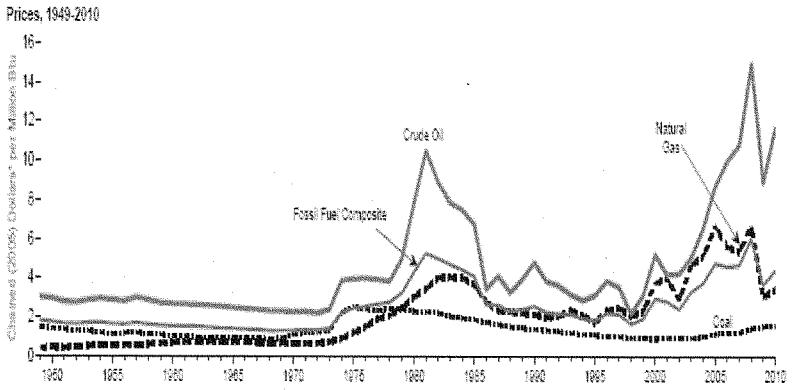
Figure 12. Impact of Major Events on World Oil Prices
(Source: Canadian Fuels Association)



The traditional realist point of view calls for the pursuit of the least expensive form of energy, mostly fossil fuel based, which is in the best interest of each country. We have seen China take this approach most recently by forging alliances with the energy producing

Middle Eastern countries as well as Central Asian nations, and there is potential for a strategic alignment between Saudi Arabia and Russia on energy matters.[xvi] Geo-political events may dictate at any given time how the energy markets may operate. Former Senator Richard Lugar of Indiana wrote some years ago that were are in a different era of energy prospecting and that the "new energy realists believe that a laissez faire energy policy based solely on market evolution is a naïve posture—especially when most of the world's oil and natural gas is not controlled by market forces."[xvii]

Figure 13. Oil Pricing Volatility Compared with other Fossil Fuels

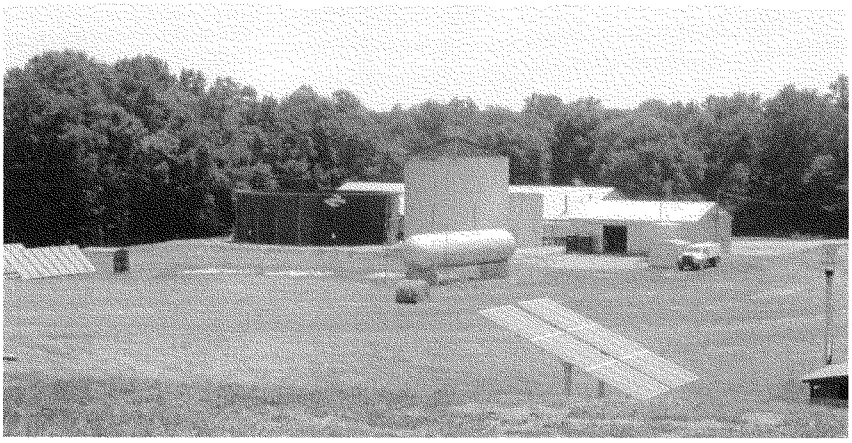


In light of the significant risk that is posed by the disruptions to a country's economy that can be caused by acts of terrorism on the energy infrastructure, it is critical to identify the weak links in the energy supply chain. It is important from a policy standpoint to motivate the private sector to invest in the appropriate technologies that can help to diversify the energy portfolio as well as safeguard the existing infrastructure. Diversification in today's economy not only requires having oil from multiple sources, but also developing a variety of types of energy sources which takes into account the rapid evolution of the global energy trade, supply-chain vulnerabilities, terrorism, and the integration of major new economies into the world market.[xviii]

Advanced biofuels allow such an option to enhance our national security by diversifying our energy supplies. Advanced biofuels should not be limited to just liquid fuels, but should be viewed in a more comprehensive manner to include viable biomass-based energy and biochemical options in gaseous, liquid and solid forms, thereby necessitating a long-term policy that is more encompassing and provides clear market certainty. The announcement by President Obama March 28 unveiling a strategy to curb methane emissions does that to a great extent; however, the national Biogas Roadmap scheduled to be released in June this year is expected to focus primarily on the dairy industry, which is quite small in the south compare to poultry. Millions of tons of poultry waste is generated in states from Maryland to Arkansas and the contributions to biogas production from this very viable feedstock have largely been ignored. There are tremendous entrepreneurial opportunities in developing such systems that can lead to rural job growth and keep energy prices low for farmers, while improving soil health. Shown below (Figure 14) is one the early poultry litter-based anaerobic digester systems built in Mississippi which received a United States patent in 2010. Efforts are underway to commercialize this technology in the U.S. as well as overseas. Diversifying the national energy portfolio requires us to look at every possible organic material as a potential feedstock and how it may be utilized to its maximum potential in the future. This would even include the use of invasive species such as the Chinese tallow tree for example, which bears fruit that is very high in oil content and could be a very good source for making biodiesel.

Developing a comprehensive bioscience-based infrastructure and economy requires a complex and a long term strategy that addresses economic, social, and environmental concerns. Time and money resources from multiple stakeholders including the private sector, government or public sector, non-governmental organizations (NGO's) and academic and research institutions are necessary. The model presented below focuses specifically on the role that NGO's (also referred to as non-profit organizations) can play in the proliferation of emerging technologies and projects. NGO's are generally defined as non-profit civil society organizations. (McGann & Johnstone, 2005). Of particular interest are ***advisory NGO's*** that seek legitimacy through ability to provide advice to decision-makers on legal, technical and scientific matters (Gulbransden & Andersen, 2004).

Figure 14. On-Farm Poultry-Litter Anaerobic Digester in Mississippi Integrated with Solar Energy



Of particular interest to the NGO's in the bioscience sector is a strategy that seeks to "attain influence by working closely with negotiators and governments by providing policy solutions and expert advice." Knowledge accumulation and publishing research-based reports addressing specific topics is also a part of the insider strategy usually followed by "advisory NGO's". The issue-specific intellectual base held by an advisory NGO becomes a "source of leverage or capital" when providing expert advice and analysis to policy and decision makers. (Gulbrandsen & Andresen, 2004). Relationship building with other stakeholders, including other NGO's and for-profit entities, early in the process is perhaps one of the strongest suites of the NGO's to achieve the desired outcomes (Tully, 2004).

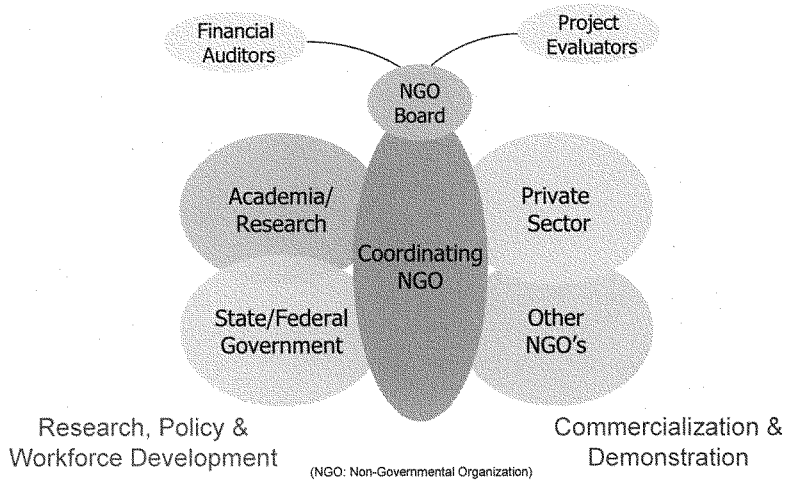
Based on the need for diffusing new technologies and the proven role that NGO's can play in doing so, the following "***butterfly model of inter-organizational collaboration©***" was developed to qualitatively account for the role of multiple stakeholders (Arora, 2010). This graphical model shows (Figure 15) the interdependency of various entities and the need for a coordinating NGO to facilitate the collaboration between translating funding streams

and research efforts into viable private sector enterprises. An effective non-profit organization that plays key roles to influence government policy; mobilize citizen's and media participation and engage multi-stakeholders' participation for technology transfer can bridge the gap between the research, policy and workforce development needs on one end and profitable commercial ventures on the other end. Clear involvement of entities from each "wing" of the butterfly that brings together key players with a vested interest in developing the bioscience resources is essential for economic development on a regional basis. This model has been validated by observing numerous case studies of public-private partnerships.

As with the implementation of any strategy that may require the deployment of new technologies, it is imperative to identify actors who are willing, and capable of "test-driving" the new products or processes. The other crucial role an NGO can play is in communicating the value of an innovation to other stake holders by serving as the "body" of the butterfly. An NGO can be an honest "knowledge broker" to disseminate unbiased information about the techno-economic feasibility of various processes. Given the infancy of the bio-based economy in Mississippi, early adoption by individuals undaunted by the risks involved, is key to ensuring long term success.

In addition to Innovate Mississippi and its strong regional network, the Southeastern Partnership for Integrated Biomass Supply Systems (IBSS) is another example of the Butterfly Model of inter-organizational collaboration in action. IBSS was developed in 2010 in response to the USDA Agriculture and Food Research Initiative (AFRI) Request for Applications for Regional Coordinated Agricultural Projects (CAP). In this case the leading organization is a university rather than a non-profit which points to the flexible nature of the Butterfly Model.

Figure 15: Butterfly Model of Inter-organizational Collaboration © Arora



The need for a consistent, long-term energy policy for our country has been identified by many organizations. To quote Phyllis Cuttino, director of Pew Trusts' Clean Energy Program, whom we hosted in Mississippi in 2012 to hold one of five national roundtables, "predictable, long-term incentives are needed to usher this emerging industry as it approaches broad market acceptance."

In closing, I would like to reiterate that investing in renewable energy is just like investing for your retirement – it is about diversifying the portfolio and investing early. We have to diversify the nation's energy portfolio and begin moving away from a transportation sector that relies on nearly 93 percent of its demand from fossil fuels. Furthermore, just as it is not prudent to wait until we are about to reach retirement age to start investing in that portfolio, in this case, it means we cannot put off making serious investments in renewable forms of energy until the expiration of fossil fuels is imminent. Thank you.

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QUESTIONS AND ANSWERS

APRIL 8, 2014

Senate Committee on Agriculture, Nutrition & Forestry
Advanced Biofuels: Creating Jobs and Lower Prices at the Pump
Questions for the Record
April 8, 2014
Dr. Sumesh Arora

Chairwoman Debbie Stabenow

1. ***In terms of addressing the gap between innovation and commercialization – the valley of death – can you discuss the critical role that Federally-funded research can play? Federal funding for agricultural research has generally been stagnant in recent years when we consider inflation, which is why we authorized the creation of a new Foundation for Food and Agriculture Research in the Farm Bill. The Foundation is intended to spur more public-private partnerships and maximize the resources available for research. It just seems to me that increasing investments in Federally-funded agricultural research will be essential to helping more start-ups move to commercialization. Do you agree?***

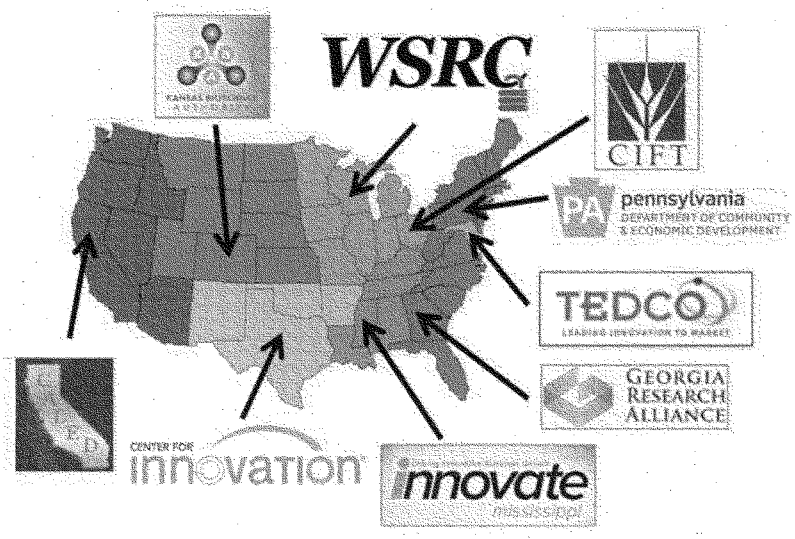
   Chairwoman Stabenow, first of all please let me express my sincere gratitude again for the opportunity to appear before the committee for testifying in support of advanced biofuels on April 8, 2014. I wholeheartedly applaud the creation of the new Foundation for Food and Agriculture Research (FFAR) in under Title VII (Section 7601) the 2014 Farm Bill. The accompanying authorization of $200 million in federal funding, which will have to be matched by private sector funding, will indeed be a big boost to an otherwise stagnant level of agricultural research funding as you pointed out. Federal funding for research plays a critical role in providing answers to both fundamental scientific questions, and helps in overcoming hurdles to commercialization by specifically targeting funding towards key technical challenges. Given the present-day constraints on federal budgets, performing such activities in partnership with the private and academic sectors will be a very effective way to leverage each other's resources to make our nation more competitive in science and technology.

   I strongly believe the functions of this foundation to award grants or cooperatively partner with scientists and researchers at public-private partnerships, institutions of higher education, nonprofit organizations, and industry will be very valuable in advancing agricultural research that could be guided by addressing important issues of the time. Having active involvement from the very highest levels of the Department of Agriculture will help elevate the status and credibility of this foundation.

   Facilitating technology transfer and release of information and data gathered from the activities of the Foundation to the agricultural research community and to industry could be crucial for the helping meet the goals of the Renewables Fuels

Standard. A framework shown in Figure 1 currently exists that facilitates technology transfer between the USDA Agricultural Research Service (ARS) and public-private funding under the FFAR could strengthen this network. Such interactions could accelerate technology development with non-profit organizations such as Innovate Mississippi that play an instrumental role in technology transfer and providing feedback to the ARS and the broader FFAR partners on market needs. An increase in funding to promote submittals of Small Business Innovation Research proposals from small, rural businesses will complement this strategy.

Figure 1. USDA-ARS Research Commercialization Partners



Two listening sessions have already been conducted in Mississippi to understand the concerns of the industry and relay that information back to the ARS. ARS personnel from Washington D.C. and Stoneville, Mississippi were on hand to get a better understanding of the issues. One of the top-ten ARS facilities in the country is located in Stoneville in the Mississippi Delta and our goal is to continue fostering closer relationships with the research facility and industry. A pilot program in the southern region that connects ARS research to the industry while capitalizing on the extensive biomass feedstock resource in the region could lead to a model that may be replicated in other parts of the country as well.

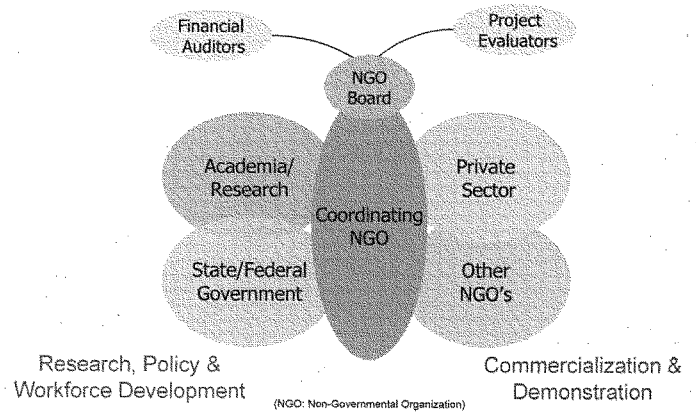
Finally the FFAR could help promote and encourage the development of the next generation of agricultural research scientists and lead to a much needed increase in STEM (science-technology-engineering-mathematics) related jobs in our country.

I presently serve as a proposal reviewer for the USDA-NIFA SBIR (National Institute of Food and Agriculture - Small Business Innovation Research) program and humbly offer my services to advance the cause of FFAR. Based on the need for diffusing new technologies and the proven role that non-governmental organizations (NGO's) can play in doing so, I published the "***butterfly model of inter-organizational collaboration©***" while working on my doctoral research in international development in 2010.

This graphical model shows (Figure 2) the interdependency of various entities and the need for a coordinating NGO to facilitate the collaboration between translating funding streams and research efforts into viable private sector enterprises. An effective non-profit organization that plays key roles to influence government policy; mobilize citizen's and media participation and engage multi-stakeholders' participation for technology transfer can bridge the gap between the research, policy and workforce development needs on one end and profitable commercial ventures on the other end. Clear involvement of entities from each "wing" of the butterfly that brings together key players with a vested interest in developing the bioscience resources is essential for economic development on a regional basis. This model has been validated by observing numerous case studies of public-private partnerships.

I believe FFAR will achieve significant success as it strives to engage many stakeholders in the agricultural research arena and I look forward to engaging with FFAR.

Figure 2. Butterfly Model of Inter-Organizational Collaboration

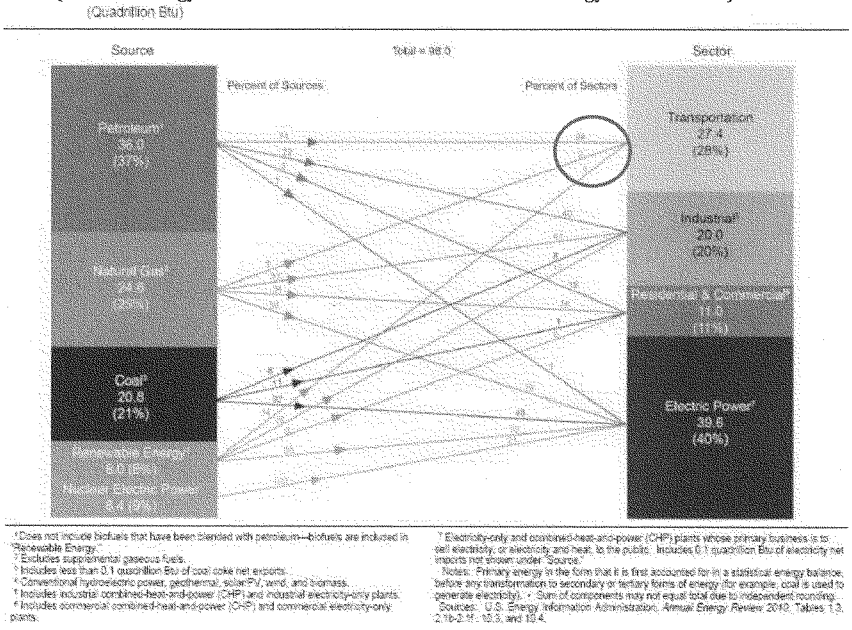


Ranking Member Thad Cochran

1. ***Based upon your experience, out of the five key areas you outline in your testimony, what appears to be the one hurdle most entrepreneurs or investors have the biggest problem overcoming? For example, do you think financing, markets, or technology remains the biggest impediment to new ventures in the advanced biofuels sector?***

   Based on my experience working with many early-stage renewable energy technology companies, the single largest challenge for the advanced biofuels technology remains the lack of clear market demand for these products. There is a major disconnect between the understanding that the transportation sector in the United States is almost 94% reliant on fossil fuels and the subsequent need to diversify our energy sources for this vital sector of our economy which consumes 28% of our total energy demand. This is shown in data below (see red circle) in data from the Energy Information Administration.

Figure 3. Primary Energy Consumption by Source and Sector (quadrillion BTU)
(Source: Energy Information Administration – Annual Energy Review 2010)

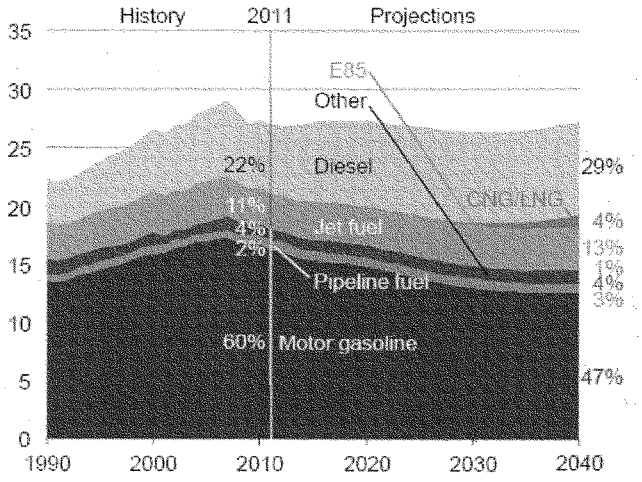


* Does not include biofuels that have been blended with petroleum—biofuels are included in "Renewable Energy."
† Excludes supplemental gaseous fuels.
‡ Includes less than 0.1 quadrillion Btu of coal coke net exports.
§ Conventional hydroelectric power, geothermal, solar/PV, wind, and biomass.
¶ Includes industrial combined-heat-and-power (CHP) and industrial electricity-only plants.
# Includes commercial combined-heat-and-power (CHP) and commercial electricity-only plants.
** Electricity-only and combined-heat-and-power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public. Includes 0.1 quadrillion Btu of electricity net imports not shown under "Sources."
Notes: Primary energy in the form that it is first accounted for in a statistical energy balance, before any transformation to secondary or tertiary forms of energy (for example, coal is used to generate electricity). • Sum of components may not equal total due to independent rounding.
Sources: U.S. Energy Information Administration, *Annual Energy Review 2010*, Tables 1.3, 2.1b-2.1f, 10.3, and 10.4.

Unfortunately, future outlook for transportation energy consumption (Energy Information Administration data) do not show a market increase for biofuels even by 2014 and still show our country relying on fossil fuels, whether they are in the form of motor gasoline, diesel or jet fuel. E85 is expected to make up only one percent (1%) of our transportation consumption. Policy measures such as the Renewable Fuels Standard are an excellent way to provide market certainty for the development of advanced biofuels.

Financing the development of advanced biofuels technologies is a very expensive proposition due to the sheer scale of this industry. The proverbial "valley of death" for these technologies is very deep and can take several years before these companies become profitable. Having clear and well-defined market demand will help spur technology developments, which in turn will bring the appropriate types of funding mechanisms to the table and attract top entrepreneurial and management talent in the industry to lead the next generation of advanced biofuels development. Once market demand is lucid, challenges to finance early stage technologies can be addressed.

Figure 4. Transportation Energy Consumption by Fuel, 1990-2040 (quadrillion BTU), (Source: DOE/EIA Annual Energy Outlook 2013)



2. ***You mention in your testimony the possible opportunities poultry waste can contribute to the larger discussion of advanced biofuels and biogas production. Can you elaborate and explain what challenges remain for a feedstock such as this to be utilized for advanced biofuels commercialization? Would you characterize this feedstock as an example you outline in your testimony for the***

need to diversify our energy supply from biomass and biochemical sources beyond liquid fuels?

Energy diversification in today's economy not only requires having fossil fuels from multiple sources, but also developing a variety of types of energy sources which takes into account the rapid evolution of the global energy trade, supply-chain vulnerabilities, terrorism, and the integration of major new economies into the world market (Daniel Yergin (2006). Ensuring Energy Security. *Foreign Affairs, 85*(2), 69-82)

Advanced biofuels allow such an option to enhance our national security by diversifying our energy supplies. Advanced biofuels should not be limited to just liquid fuels, but should be viewed in a more comprehensive manner to include viable biomass-based energy and biochemical options in gaseous, liquid and solid forms, thereby necessitating a long-term policy that is more encompassing and provides clear market certainty. The announcement by President Obama March 28 unveiling a strategy to curb methane emissions does that to a great extent; however, the national Biogas Roadmap scheduled to be released in June this year is expected to focus primarily on the dairy industry, which is quite small in the southern United States compared to poultry.

Millions of tons of poultry waste is generated in states from Maryland to Arkansas and the contributions to biogas production from this very viable feedstock have largely been ignored. Furthermore there is a critical need to addressing pollution and nutrient buildup and run-off issues that have been attributed to the poultry industry in areas such as the Delmarva Peninsula and the Illinois River watershed in the Arkansas-Oklahoma area. A need to utilize poultry waste in a beneficial manner that includes renewable energy generation and organic fertilizer production simultaneously is leading to tremendous entrepreneurial opportunities in developing such systems that can lead to rural job growth and keep energy prices low for farmers, while improving soil and water health. Shown below (Figure 5) is one the early poultry litter-based anaerobic digester systems built in Mississippi which received a United States patent in 2010.

Efforts are underway to commercialize this technology in the U.S. as well as overseas and newer system currently operating in Kentucky is shown in Figure 6. One of the major challenges for on-farm systems is their ability to connect to utility grid to supply surplus power back to the grid. There is often a hesitancy on the part of the utility to incorporate distributed generation, but poultry litter anaerobic digesters have the capability of providing base-load (and continuous) power to the grid and do not suffer from generation intermittency. Securing favorable power-purchase agreements with the utilities can be very arduous that can cost the farmer a significant amount of money in legal and other fees; compounded with a very low price that a utility may be willing to pay for the renewable energy deters many farmers from considering such systems. The technology for poultry litter anaerobic digestion is maturing to the point where sources of funding such as USDA Rural Development's Rural Energy for America Program (REAP) and the Conservation

Innovation Grants (CIG) are becoming viable choices for these systems, but gaining fair and reasonable price for renewable power produced on these farms remains key hurdle. Effective policy measures such as a Renewable Electricity Standard (RES) can help alleviate this issue at the national level.

Diversifying the national energy portfolio requires us to look at every possible organic material as a potential feedstock and how it may be utilized to its maximum potential in the future.

Figure 5. On-Farm Poultry-Litter Anaerobic Digester in Mississippi Integrated with Solar Energy

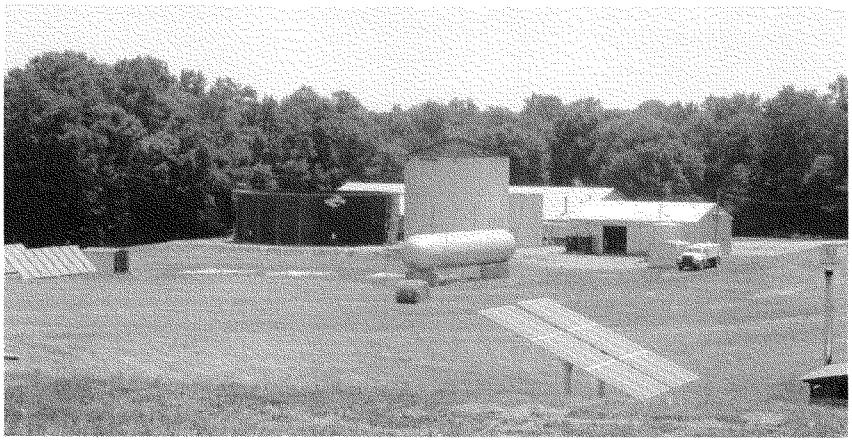


Figure 6. A New On-Farm Poultry-Litter Anaerobic Digester in Kentucky

Senate Committee on Agriculture, Nutrition & Forestry
Advanced Biofuels: Creating Jobs and Lower Prices at the Pump
Questions for the Record
April 8, 2014
Mr. Richard Childress

Chairwoman Debbie Stabenow

In terms of addressing the gap between innovation and commercialization – the valley of death – can you discuss the critical role that Federally-funded research can play? Federal funding for agricultural research has generally been stagnant in recent years when we consider inflation, which is why we authorized the creation of a new Foundation for Food and Agriculture Research in the Farm Bill. The Foundation is intended to spur more public-private partnerships and maximize the resources available for research. It just seems to me that increasing investments in Federally-funded agricultural research will be essential to helping more start-ups move to commercialization. Do you agree? While I am not involved in the commercialization of an advanced or cellulosic biofuel facility, I can say that the federal government plays a huge role in ensuring that this industry is a success. Important federal research has been involved in almost every aspect of the biofuels industry, and this commitment will need to continue as new advanced and cellulosic biofuels facilities come online.

Ranking Member Thad Cochran

1. Can you explain the difference between a race car engine and a regular engine? Are there notable differences between the two engines that would cause a difference in the findings of using E15 in race car engines versus regular automobile engines? Race engines experience a much higher duty cycle than passenger car engines (higher pressures and temperatures) which increases component wear dramatically. Fuels that work well in race cars will also work well in passenger cars provided they are catalyst-friendly. Ethanol/gasoline blends are very catalyst-friendly.

Senator Tom Harkin

In your testimony, you talked about NASCAR's transition to E15 as your standard fuel. You described how your racing team conducted its own testing of ethanol blends, including E15 and higher level blends up to E30. You stated that your team was very satisfied with the results. In particular, you mentioned that your engines ran cooler, delivered higher horsepower output, and experienced less carbon buildup with ethanol blends. I'd like you to expand on those results please, by answering these questions and by providing additional information that you might think pertinent.

1. What levels of ethanol blends did you test? You mentioned E15 and E30. Did you also test intermediate levels to those, or blends above E30? We tested E10, E15, and E30 versus our previous E0 gasoline.

2. What, if any, modifications did you make to your engines when you operated them with E15 and E30 and intermediate blend levels? Were the modifications only to operating characteristics, such as timing and/or fuel injection, or did they include "hard" modifications such as different valves or valve seats or piston/cylinder technologies? Modifications were limited to calibration changes that kept the engine operating at the desired fuel-to-air ratio. These fueling changes occurred automatically when the engine was run in closed-loop mode (fueling determined by feedback from the exhaust-mounted oxygen sensors) but were hard-coated into the software in case of exhaust sensor failure.

3. When you are talking about improved performance characteristics, what baseline are you referencing? Are those improvements relative to performance using E0? E10? Performance improved continually as the percentage of ethanol was increased, from E0 through E30.

4. Did your engines run cooler for each of E15 and E30 and whatever intermediate blends you tested? Were the improvements about the same for E15 and E30, or was one of those better than the other in terms of running cooler? Exhaust temperature decreased slightly as the percentage of ethanol increased. Component temperatures (pistons, valves) decreased more rapidly with increasing ethanol.

5. You mentioned increased horsepower with your testing of higher ethanol blends. Were the horsepower gains similar for E15 and E30 and other blends, or were there significant differences in those gains? Horsepower increased linearly as the ethanol concentration increased.

6. I am especially interested in what you learned with the engine tear-down and inspections that you mentioned. Again, were the results of those examinations comparably positive for E15 and E30 and other blends? Did you find anything in your tear down of engines run on E30 that would cause you to have concerns about its extended highway use? Increasing ethanol caused the engines to be 'cleaner' during teardown, reducing carbon deposits on the piston tops, valves, and intake and exhaust ports. The more ethanol the cleaner they became!

7. Are you continuing to test ethanol blends? No, the 'official' fuel for NASCAR Cup, Nationwide, and Truck, is Sunoco Clean Green E15 and we use that fuel in all of our development tests.

8. I believe that broader dissemination of the results of your would be very useful for educating the public about the effects of using higher ethanol blends. Have you considered releasing a report on the results of your testing? No we haven't but we could at a future date if it would help our country and our American Farmers.

As I understand it, petroleum-derived aromatics are often added to achieve desired octane levels in gasoline. I have heard that inclusion of these aromatics may be responsible for harmful auto emissions.

1. Would the use of higher blends of ethanol reduce the need for aromatics? Definitely! Aromatic hydrocarbons are expensive and many of them are known carcinogens. Ethanol has a RON of 113 and is thus both a safe and cost-effective octane booster.

2. Do you think that the use of higher ethanol blends would result in emissions that are less harmful to human health? Yes, particularly when the high-octane characteristics of ethanol are leveraged fully to increase engine efficiency (higher compression ratio, boosted small displacement engines).

Senate Committee on Agriculture, Nutrition & Forestry
Advanced Biofuels: Creating Jobs and Lower Prices at the Pump
Questions for the Record
April 8, 2014
Mr. Brooke Coleman

Chairwoman Debbie Stabenow

1. In terms of addressing the gap between innovation and commercialization – the valley of death – can you discuss the critical role that Federally-funded research can play? Federal funding for agricultural research has generally been stagnant in recent years when we consider inflation, which is why we authorized the creation of a new Foundation for Food and Agriculture Research in the Farm Bill. The Foundation is intended to spur more public-private partnerships and maximize the resources available for research. It just seems to me that increasing investments in Federally-funded agricultural research will be essential to helping more start-ups move to commercialization. Do you agree?

We agree that federally-funded agricultural research is essential to helping more start-ups move to commercialization. There are a number of key aspects of this question to consider.

First, it is important to recognize that government support in this area is the norm rather than the exception. According to a recent Congressional Research Service report, [f]or the period from 1948 through 2012, 11.6% of Department of Energy R&D spending went to renewables, 9.7 % to efficiency, 25% to fossil energy, and 49.3% to nuclear.[1] According to a recent report, "energy innovation has driven America's growth since before the 13 colonies came together to form the United States, and government support has driven that innovation for nearly as long."[2] Governmental support drove investment in coal, timber, engine innovations, land settlement for resource extraction and other forms of innovation in the 19th and 20th centuries, and domestic energy consumption and GDP have tracked closely for at least 200 years.[3] Given the importance of energy security and global competitiveness, we agree that federal government engagement is appropriate and agricultural research should be a focal point of that effort going forward.

Second, and with specific regard to the risk associated with the "Valley of Death," the federal government de-risks competing fossil fuel investments in a myriad of ways. The fossil fuels industry enjoys the benefit of a number of unique federal tax allowances – unavailable to renewable fuels – that de-risk and lower the cost of the ongoing development of oil and gas resources relative to other sources of liquid fuel. For example, a recent study estimates that fossil fuels received 70 percent of U.S. federal energy subsidies between 2002 and 2008, to the tune of

[1] See http://www.fas.org/sgp/crs/misc/RS22858.pdf
[2] See note 2, at p. 11.
[3] *Id.*

more than $70 billion during this time period.[4] This number does not include the loopholes in oil and gas laws that, according to the Government Accountability Office (GAO), allowed petroleum companies to forego paying $53 billion in royalty payments, over just four years, for extracting natural resources from lands owned by the American taxpayer. Criticism of these programs usually pivots around the question of whether multi-billion dollar, multi-national industries need this type of support. Often lost in that debate is the fact that this type of support de-risks fossil fuel investments *relative to* those in bio-energy; in essence, making the "Valley of Death" more risky for bioenergy or bio-product start-ups than fossil fuel incumbents. This type of policy imbalance does not work to the advantage of developing innovative new markets for agricultural products.

With regard to the critical role these programs can play, the answer is really no different for advanced biofuels than it is for other industries. To illustrate, the largest leaseholder in the Bakken told the Senate Finance Committee in 2012 that "[w]ithout the current capital provisions in place ... that let us keep our own money ... we would not have been able to fail over and over again, which is what it took to advance the technology needed to produce the Bakken and numerous other resource plays across America."[5] The nation's ability to provide affordable energy to increasing populations requires the development of new technology. The development of new technology requires trial and error, which can be time consuming and costly. The federal government has a vested and unavoidable interest in helping these development processes along, preferably on U.S. soil. Nearly every cellulosic biofuel project documented in the AEC Progress Report has secured or is seeking some level of partnership with the federal government.[6] And this dynamic is not limited to energy production. The federal government's role in developing the internet, cell phones and better batteries is well-documented. And as you have discussed in committee hearings many times, despite the political rhetoric around many of these programs, they usually pay great dividends over time in terms of both revenue and job creation.

Ranking Member Thad Cochran

1. You mention in your testimony the importance of the Farm Bill Energy title programs and highlight three cellulosic facilities that have either completed construction or are near completion. How many other facilities are either in the planning phase, under construction, or have completed construction that have utilized Farm Bill Energy title program funding to help finance the project?

The Farm Bill Energy Title programs are vital to the development of new technologies in the agricultural sector. As discussed in my written testimony, the federal government facilitates the emergence of new technology in every major U.S. energy sector and has done so for nearly 100

[4] See http://www.elistore.org/Data/products/d19_07.pdf.
[5] http://www.finance.senate.gov/imo/media/doc/Hamm%20Testimony1.pdf, p. 2.
[6] See http://ethanolrfa.org/page/-/PDFs/AEC%20Cellulosic%20Biofuels%20Industry%20Progress%20Report%202012-2013.pdf?nocdn=1

years. With specific regard to advanced bio-refining, we would like to note several sources of information. First, the AEC profiled roughly 20 projects in a recent Cellulosic Biofuels Progress Report that is available online.[7] Each project profiled discloses its strategic partners, including USDA and other government agencies. We would like to point your attention to the fact that Beta Renewables, Enerkem, Fiberight, Fulcrum Bioenergy and Ineos are among those companies noting their direct involvement with USDA via the Farm Bill Energy Title. More generally, we are aware of about a dozen advanced bio-refining projects involved in the Sec. 9003 loan guarantee program, which includes the five mentioned. The 9003 loan guarantee program is a very well-managed and effective program for our industry with strong performance rates. Of course, there are a number of other programs in the energy title. For example, Secretary Vilsack provided a progress report last year on the Biomass Crop Assistance Program (BCAP) that includes awardees and an assessment of benchmarks achieved.[8] We commend your office and the committee for extending these programs in the new farm bill.

Senator Joe Donnelly

1. One of the things I hear most frequently from folks back home is the need for Congress to provide certainty so businesses and others can plan for the future. In passing the RFS, Congress set specific levels of biofuels to use in the fuel supply each year to provide certainty for farmers and industry so they could determine the investments they needed to make to meet the standard. I am concerned, however, that the proposed reductions take away that certainty and make it difficult to plan for the future. How have the proposed changes impacted members of the biofuels industry?

Policy certainty is absolutely critical for companies endeavoring to commercialize alternatives to petroleum. This is true for three primary reasons: (1) energy production is policy driven at nearly every level, including but not limited to state and federal tax law, federal regulations such as the Clean Air Act, direct and indirect government support for infrastructure development for certain industries, and more prescriptive policies like the Renewable Fuel Standard (RFS); (2) the baseline condition in the global fuel energy sector is largely non-competitive, with OPEC controlling output and price at the top of the marketplace and heavy consolidation limiting market access for alternatives in the United States; and, (3) fuel energy projects are capital intensive, which means they need stable policy in the context reasons #1 and #2 above to get financed; or more explicitly, to get financed in the United States versus other countries.

In a free market, innovators have the ability to forecast demand based on the value proposition of their product. In other words, if they can make a better product for a competitive price, there is a reasonable expectation of demand that spurs innovation and technological development. However, for the most part, these conditions do not exist in the fuel energy sector. Innovators in

[7] See http://ethanolrfa.org/page/-/PDFs/AEC%20Cellulosic%20Biofuels%20Industry%20Progress%20Report%202012-2013.pdf?nocdn=1
[8] See http://www.fsa.usda.gov/Internet/FSA_File/bcap_documentation.pdf

the advanced biofuel space must sell their product to highly consolidated, vertically integrated oil companies who, for the most part, control market access and have no immediate self-interest in providing petroleum alternatives to U.S. consumers. The RFS, then, becomes absolutely critical for the advanced biofuel industry to be able to have a reasonable expectation of demand for their product when they produce it. The beauty of the RFS, at a basic level, is it incorporates basic "forward looking" methodologies and a credit trading mechanism that facilitates market access for more renewable fuel use over time.

The EPA proposal would change the RFS at a fundamental level. Instead of driving new renewable fuel use, the program would be waived annually based on the amount of renewable fuel actually distributed to U.S. consumers (commonly referred to as the "blend wall" problem). This methodological shift would put the trajectory of the renewable fuels industry in the hands of the oil companies, because oil companies control the distribution of fuel to the consumer. Investors in next-generation biofuel technologies are fully aware of the broader implications of allowing obligated parties, who generally want to see the RFS fail, to control the trajectory of the program. Numerous AEC-member advanced biofuel companies have told the Obama Administration and Congress that investments in advanced biofuels stopped when the proposal came out. This does not mean that the current commercial projects coming online will not come online. It means that, for the most part, investments in the dozens of U.S. advanced biofuel projects in the RFS pipeline are awaiting the outcome of the 2014 RVO before moving forward.

As such, you are right that the current proposal makes it impossible for investors to plan for the future. The entire premise of the RFS is establish some level of demand predictability for advanced biofuels to cure market dysfunction, create jobs, reduce carbon emissions, provide new markets for agricultural products and increase national security. The current proposal turns the RFS on its head, and needs to be fixed at the administrative level in the coming weeks/months.

2. As you know, the procedure for a renewable fuel to qualify for the obligations of the RFS requires EPA to review and approve a biofuel pathway whenever someone develops a new feedstock or production process. EPA's review process has had significant problems with delays and the agency recently announced a pause in their process in order to make some needed improvements. How do the review delays negatively impact businesses in the biofuels industry?

As discussed, the fuel energy marketplace is policy driven because of the lack of traditional competitive market forces – i.e. price competitiveness and open market access – that would otherwise reward innovation. At this point in the process, oil companies are not interested in buying renewable fuels that do not qualify for RFS compliance. As such, qualification for the RFS becomes a prerequisite for closing financing on any advanced biofuel project – because you have to have a customer, or a reasonable expectation of one, to do a deal. As you mention, qualification for the RFS hinges upon U.S. EPA approval of the given biofuel pathway. Per your question, the review delays are a major problem that are slowing down and killing projects.

Specifically, it is not uncommon for pathway applications to take years to resolve. In some cases, pathway issues are still not resolved multiple years after application. The issue is not just the lack of actual determination of eligibility; but also, the total inability to predict how long the process will take. Hypothetically, investors might be willing to move forward with projects in advance of final pathway approval if the process for getting approval is reasonable, transparent and based on the merits. But the current process is so uncertain that it makes pathway eligibility a virtual stopping point for the rollout of any financing deal. To date, U.S. EPA has not implemented more dependable and flexible methodologies for determining pathway eligibility over time. It is something that can and must be addressed at U.S. EPA at the administrative level. We very much appreciate the support your office has provided to the cellulosic biofuels industry in this critical area, and look forward to working with you on this important challenge going forward.

Senate Committee on Agriculture, Nutrition & Forestry
Advanced Biofuels: Creating Jobs and Lower Prices at the Pump
Questions for the Record
April 8, 2014
Mr. Jan Koninckx

Chairwoman Debbie Stabenow

1. In terms of addressing the gap between innovation and commercialization – the valley of death – can you discuss the critical role that Federally-funded research can play? Federal funding for agricultural research has generally been stagnant in recent years when we consider inflation, which is why we authorized the creation of a new Foundation for Food and Agriculture Research in the Farm Bill. The Foundation is intended to spur more public-private partnerships and maximize the resources available for research. It just seems to me that increasing investments in Federally-funded agricultural research will be essential to helping more start-ups move to commercialization. Do you agree?

We do agree that federally funded research is essential in helping spur along scientific discovery, development, and potentially commercialization. Public research plays a particularly important role in basic research that no one company may invest in but on top of which industries may be founded. These are small investments that can have large returns for the country. These investments can be amplified when public private partnerships are trained on specific problems. DuPont has a rich history in working closely with the United States Government from protecting our fledgling nation, to the Manhattan project, to protecting astronauts in space, and today developing commercial advanced biofuels and biobased products.

In addition to working directly with government research agencies such as the National Renewable Energy Lab and the Agricultural Research Service, we have strong bonds to the University community, especially those in the Land Grant System. In fact, research coordination between DuPont, Iowa State University, and the USDA Natural Resources Conservation Service has resulted in stover harvest approaches that will ensure sustainability as we gather feedstock for cellulosic ethanol facilities.

This committee has establishing a host of critical research approaches included programmatic funding for Land Grant and 1890 institutions, competitive research, and directed programs to address specific challenges like the Biomass Research and Development Act. DuPont applauds the committee for these important efforts and also appreciates new, innovative approaches like those included in the most recent Farm Bill.

Regarding the Foundation for Food and Agriculture Research specifically, we believe this can be an important contribution to the mix of programs focused on agriculture, food, and renewable energy. In fact we have shared with the Secretary of Agriculture our nomination, Director of Science and Technology External Affairs Dr. William Provine, to serve on this foundation's board. We are hopeful, however, that this committee and the U.S. Congress commit to increasing all types of federally funded research and this public private partnership serves as

additive to those commitments. We have many challenges ahead to feed, clothe, power, and provide consumer goods to a rapidly growing population in a sustainable way. The competency and efficiency of the US agricultural sector positions it uniquely to contribute here in ways that benefit the national economy and the world. Meeting these goals will require robust research from all sectors. We look forward to working with this committee, Congress, and this and future administrations to achieve these goals.

2. In your testimony, you described DuPont's cellulosic ethanol facility that is scheduled to come online in Nevada, Iowa. Can you talk about the decision process to locate in Nevada, the cooperation that must have been necessary between DuPont and the community? Possibly the state? I can only imagine that this will have a very positive impact on the local economy, so I am interested in learning how DuPont worked with a rural community to create jobs and new economic opportunities.

The decision process which led to selecting Nevada, Iowa as the location for DuPont's cellulosic ethanol facility started in 2009. There were over 10 sites located in Indiana, Illinois, Nebraska and Iowa that were evaluated using a number of criteria including proximity to harvest areas, logistics options, distance, cost and availability of utilities, and proximity to an airport. Three sites in Iowa and Nebraska were finalists. The Nevada site was ultimately selected based on some clear advantages. The Nevada site allows the DuPont cellulosic ethanol facility to take advantage of the extensive network that DuPont Pioneer has built with local farmers. Iowa State University has first class agriculture and agronomy research capability and through the New Century Farm had already partnered with DuPont, and further extended this partnership in testing and experimenting with corn stover harvest. Both Nebraska and Iowa offered competitive grants and incentive packages but Iowa Governors Culver and Branstad provided the most attractive option with the Iowa Power Fund. In addition to grants, the Iowa Power Fund paved the way for state legislative and regulatory support from the Iowa Departments of Agriculture, Natural Resources and Economic Development Authority. Story County and the town of Nevada also provided local economic development incentives.

The Nevada site is adjacent to the Lincolnway Energy LLC property and the previous Lincolnway CEO was particularly friendly in working to collaborate with DuPont. Lincolnway qualified for a USDA grant for a biomass boiler and DuPont's cellulosic ethanol plant was attractive because bio-based co-products could replace coal in Lincolnway's boiler, improving Lincolnway's greenhouse gas footprint. Lincolnway's ethanol was grandfathered under RFS1 but did not meet greenhouse gas requirements for RFS2. Improving Lincolnway's climate footprint had the potential to qualify the ethanol and receive credits under RFS2. The Lincolnway facility was attractive to DuPont because they had an established rail line and equipment that the DuPont facility could use to load the cellulosic ethanol into railcars.

DuPont has taken great care to engage and coordinate the construction of the Nevada plant with both State and local authorities and communities. Throughout the construction process, DuPont has held quarterly Community Advisory Panel Meetings to provide a forum for dialogue on facility construction and on corn stover harvest and storage and to answer questions and hear

concerns from local citizens. DuPont has also engaged with Iowa's regulatory authorities to learn from prior facility start-ups, to partner with the state in promoting agriculture and biofuels education and helping to facilitate the state driven goal to help Iowa communities become bioprocessing centers.

One of the advantages of locating the cellulosic ethanol facility in Nevada was to leverage the longstanding farmer relationships that DuPont Pioneer has established. These relationships provide the means for developing the corn stover supply chain and establishing the local jobs required to harvest the stover. Stover collection on the farms has created a secondary industry around the Nevada plant in the way of harvesting and transportation. Corn stover is collected in a 30-mile radius from the Nevada site requiring data driven crop management tools for the collection, transportation and storage of the stover.

Ranking Member Thad Cochran

1. Your testimony mentions a Memorandum of Understanding (MOU) between the U.S. Department of Agriculture (USDA) and DuPont regarding voluntary standards for sustainable harvesting of feedstocks. Does the MOU outline specific conservation practices and the length of time a producer agrees to conduct these practices on an operation? Does a producer receive anything other than financial assistance in return for implementing conservation practices on their operation?

The Memorandum of Understanding (MOU) does not outline specific conservation practices. The MOU states that DuPont will implement a U.S. Department of Agriculture Natural Resources Conservation Service (NRCS)-approved conservation planning process for fields from which we source corn stover. Over the past year, DuPont and NRCS have worked together to develop a Cooperative Working Agreement that describes the specific soil conservation process that DuPont is now beginning to put in place, with assistance from NRCS. Conceptually and operationally, the DuPont program is very similar to the conservation compliance program that NRCS uses today with growers who manage highly erodible land (HEL).

We anticipate that the DuPont conservation planning process will have five key components:

1) DuPont generates a soil health plan for every field from which stover is harvested for our supply chain. The soil health plan is based on NRCS models that estimate the impact of growers' management practices and partial stover harvest on soil erosion and soil carbon.
2) In 2014, DuPont will begin to communicate soil health plans to growers participating in the stover supply chain. By 2017, a soil health plan will become part of the contract that DuPont has with all growers participating in the stover supply chain.
3) DuPont will conduct field checks on a subset of fields each year to insure that field management is consistent with the soil health plans.
4) DuPont will work with growers and NRCS to implement corrective practices on fields that do not meet NRCS standards for soil health (erosion and soil carbon content).
5) NRCS will review DuPont documentation and field check practices to insure compliance with NRCS conservation planning standards.

In addition to compensation for stover, growers participating in the DuPont stover supply chain will receive a copy of the soil health plan for participating fields which they are free to use however may benefit their operations. Participation in the DuPont stover supply chain will require that growers have a DuPont soil health plan that meets NRCS standards for their enrolled fields and that they generally follow the practices listed on their plan. Again, this is very similar to the NRCS conservation compliance program, which requires growers managing HEL to have and follow a conservation plan in order to receive access to government programs, such as crop insurance.

Senate Committee on Agriculture, Nutrition & Forestry
Advanced Biofuels: Creating Jobs and Lower Prices at the Pump
Questions for the Record
April 8, 2014
Ms. Nancy Young

Chairwoman Debbie Stabenow

1. In terms of addressing the gap between innovation and commercialization – the valley of death – can you discuss the critical role that Federally-funded research can play? Federal funding for agricultural research has generally been stagnant in recent years when we consider inflation, which is why we authorized the creation of a new Foundation for Food and Agriculture Research in the Farm Bill. The Foundation is intended to spur more public-private partnerships and maximize the resources available for research. It just seems to me that increasing investments in Federally-funded agricultural research will be essential to helping more start-ups move to commercialization. Do you agree?

   Answer: Airlines for America (A4A) and our members have been helping drive toward the promise of commercially viable, environmentally-preferred aviation alternative fuels for the last several years. Our efforts have yielded real results – in large part because we have worked in public-private partnerships with government and other stakeholders to bring available tools to bear. We have made huge strides, but obstacles remain, primarily in the related areas of scaling up supply and fostering cost competitiveness, the very things needed to bridge the "valley of death" to get to full commercialization.

   The Energy Title of the Farm Bill includes critical programs to help bridge across the "valley of death." Approximately 80% of the cost of advanced aviation biofuels is attributable to feedstock costs. Accordingly, agricultural research focused on increasing the yields of energy crops and on demonstrating and ensuring the viability and benefits of certain energy crops when used in rotation with food crops is critical in helping with scale up and commercialization. The Foundation for Food and Agriculture Research (FFAR), working in a complementary way with the previously-established National Institute of Food and Agriculture (NIFA) and Agricultural Research Service (ARS), offers a tremendous opportunity for advancing this work.

   As I noted in my testimony, A4A is grateful to the Senate Committee on Agriculture, Nutrition & Forestry for its leadership in seeing the Energy Title of the Farm Bill through to passage. By assuring multi-year authorization and funding for FFAR and programs focused on biofuel production (such as the Biorefinery Assistance Program and Bioenergy Program for Advanced Biofuels), industry and government are able to work together in partnership to turn the promise of advanced aviation biofuels into reality.

2. The initiatives that you described during your testimony are ones that individual airlines have taken on their own. I suppose they get some positive recognition for supporting

green initiatives, but the airlines are running businesses at the end of the day. Can you discuss how this makes good business-sense for these airlines and how this helps improve their bottom lines?

Answer: The airlines' economic and environmental interests come together in our pursuit of sustainable alternative aviation fuels. Jet fuel is our airlines' number one cost center, accounting for over a third of airline costs. And, as noted in my testimony, unrelenting jet fuel price volatility wreaks havoc on airline business planning. A4A and our members are addressing these risks by constantly improving our fuel efficiency and actively promoting the development and deployment of alternative jet fuels. Indeed, a stable, domestic supply of commercially viable alternative jet fuel would introduce competition to petroleum-based jet fuels and a moderating force on price levels and volatility, thereby helping the airlines' business bottom line.

In addition, the successful deployment of such fuels will also help our airlines meet their aggressive environmental goals. A4A and its members are part of a worldwide aviation coalition that has committed to a global framework on aviation and climate change under the International Civil Aviation Organization (ICAO). We have committed to achieving an annual average fuel-efficiency improvement of 1.5 percent through 2020 and carbon-neutral growth from 2020. Should the industry not be able to achieve carbon-neutral growth from 2020 through concerted industry and government investment in technology, operations and infrastructure initiatives, a global market-based measure may be used to "fill the gap." Aviation alternative fuels could play a critical role toward achieving our targets, while minimizing the role that a costly and harmful market-based measure might play. Thus, the industry's economic and environmental bottom lines are intertwined in this important endeavor.

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