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Senate Agriculture Committee

"POET's commitment to cellulosic ethanol"

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PREAMBLE

Mr. Chairman and distinguished committee members, thank you for the opportunity to visit with you today. My name is Dr. Mark Stowers. I am Vice President of Science and Technology for POET. I would like to talk with you today about our company's commitment to cellulosic ethanol as well as the opportunities and challenges presented by that endeavor.

POET – INTRODUCTION

POET, headquartered in Sioux Falls, South Dakota, is the largest dry mill ethanol producer in the United States. POET is an established leader in the biorefining industry through project development, design and construction, research and development, plant management, ownership, and product marketing. Our 21-year old company has built and manages twenty-six (26) plants principally in the Corn Belt while marketing more than 1.5 billion gallons of ethanol and 4 million tons of distillers' grains annually. The one time capital investment made in POET biorefineries since 2000 exceeds $1,000,000,000, and POET through its corn purchases, corporate and plant operations contributes over $3 billion to the rural American economy each year. In addition POET has encouraged farmer investment in its operations. Today, we have over 11,000 farmer investors.

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

BACKGROUND AND RATIONALE

According to the recent US Department of Commerce International Trade Administration Study, "Energy in 2020: Assessing the Economic Effects of Commercialization of Cellulosic Ethanol" there is enough cellulosic feedstock available in the United States to produce nearly 50 billion gallons of cellulosic ethanol by 2020. At this production rate over 1.2 million barrels per day of crude oil could be displaced while creating over 54,000 jobs in US agriculture. In more practical terms at this level of

ethanol production the US could eliminate all oil purchases from OPEC and the Middle East – eliminating the $840 million per day export of US dollars to overseas oil producers (based on $72 per barrel oil).

Notwithstanding the economic benefit of cellulosic ethanol there are significant environmental benefits to cellulosic ethanol. Gasoline produces 25 pounds of carbon dioxide equivalent greenhouse gas (GHG) emissions. By comparison cellulosic ethanol reduces GHG emissions by a little more than 21 pounds of carbon dioxide on per gallon of gasoline equivalent – that's an 85% reduction. In order to monetize that benefit we can assign a value of $20 per ton of carbon dioxide equivalent based on current European futures prices for carbon dioxide equivalents. On that basis the GHG emission reductions resulting from the use of cellulosic ethanol would be about $0.19 per gallon or about $2.5 billion per year by using a little more than 20 billion gallons of cellulosic ethanol.

The impact of ethanol in relieving our dependence on foreign is profound. I would like to quote work of Adam Liska and Richard Perrin (University of Nebraska – Lincoln) who published a well reasoned summary of the costs associated with the maintenance of our foreign oil supply (| *Biofuels, Bioprod. Bioref.* (2009); DOI: 10.1002/bbb).

> Since 1979, there has been a strategic buildup of the US military in the Middle East for protection of exported oil. In addition to GHG emissions from military fuel use, emissions also derive from materials for military buildings, vehicles, and munitions. In 1997, it was estimated that the US military used 5–15% of all US materials consumed (e.g., steel and aluminum), but used up to 40% of other more GHG intense metals such as titanium, resulting in total military emissions at up to 10% of all US emissions. To our knowledge more recent estimates of military-related emissions are not available, but expenditures provide a starting point to estimate their current magnitude. Estimated expenditures related to Middle East oil security alone range from $138 billion annually (out of the $526 billion spent on US defense in 2007, not including Iraq and Afghanistan operations) to $3 trillion for the Iraq war. Whether Iraq operations were ultimately due to oil or national security is debated, but oil appears to be a dominant factor; even US involvement in Afghanistan has strong links to accessing oil reserves in Central Asia. If 10% of total US GHG emissions were due to the military, and if only 26% of those operations were for protection of oil supplies (assuming no expenditures for the Iraq war), total indirect military emissions would equal 187 $TgCO_2e$ yr^{-1} [more than 2 to 4 times as much as corn ethanol]. These indirect military emissions would add 98 gCO_2e MJ^{-1}

to gasoline produced from Middle Eastern petroleum and raise the GHG intensity of gasoline from this source by roughly two-fold.

The value of cellulosic ethanol to the US economy, the environment and national security is substantial. At POET we believe that cellulosic ethanol is real and achievable.

POET'S COMMITMENT TO CELLULOSIC ETHANOL

In 2006 POET developed and implemented a new strategy for cellulosic ethanol production involving the utilization of existing corn ethanol plants to 1) capitalize on the existing infrastructure (utilities, roads, rail lines, materials handling and so forth), 2) use the corn ethanol plant's existing farmer and often investor network to collect corn cobs as our primary cellulosic feedstock and 3) provide enough energy from the cellulosic waste streams to power the site. This approach would enable rapid deployment of the cellulosic ethanol process as across an expansive corn ethanol base through a "bolt-on" approach. POET is implementing this strategy through what it calls Project LIBERTY, an integrated corn cellulose biorefinery.

Project LIBERTY will transform the POET Biorefinery – Emmetsburg, an existing conventional corn dry mill ethanol plant located in Iowa, into an integrated corn-to-ethanol and cellulose-to-ethanol biorefinery. Once complete the facility will produce 125 million gallons of ethanol per year; 25 million gallons of ethanol will come from a feedstock of corn fiber and corn cobs. Also, the facility will produce annually 80,000 tons of Dakota Gold Corn Germ Dehydrated and 100,000 tons of Dakota Gold HP animal feed. The impact of Project LIBERTY in terms of ethanol production will be 11% more ethanol from a bushel of corn through the corn fractionation process and 27% more ethanol from an acre of corn through the use of corn cobs. In addition Project LIBERTY will reduce the need for fossil fuels by nearly 100%. The total cost of the project will be in excess of $200 million. In addition to the capital investment, it will create at least 30 new jobs at the facility.

The primary project goal is to design, construct, and operate the commercial-scale, integrated cellulosic ethanol bio-refinery. Technologies will be replicable. POET's longer-term plans are to rollout the technologies to other existing dry mills or new grassroots biorefineries. POET is partnered with the Department of Energy in Project LIBERTY whereby DOE will contribute up to 40% or $80 million in project costs. In addition to the DOE, the State of Iowa has also joined Project LIBERTY as a partner through the contribution of $14.75 million in research and development funds, reimbursement of some construction and tax

credits. Project LIBERTY is expected to be operational in late 2011.

Today I would like to share with you three requirements for the success of cellulosic ethanol and give you an update on where POET is in its cellulosic ethanol effort.

1. Cost competitive feedstock collection, storage and logistics systems
2. Effective and efficient cellulosic ethanol process technology
3. Elimination of the blend wall – a market constraint that will limit the use of cellulosic ethanol.

FEEDSTOCK COLLECTION, STORAGE AND LOGISTICS SYSTEMS

POET has established a leadership position in the collection of cellulosic feedstocks. Cellulosic feedstocks can be agricultural residues such as corn cobs, rice straw or corn stover. They can also be wood fibers such as forestry wastes or wood wastes or energy crops such as switchgrass. Cellulosic feedstocks could also be collected from municipal waste.

POET has selected corn cobs as the first cellulosic feedstock for the production of cellulosic ethanol. Corn cobs offer a significant advantage over other feedstocks based on technical, environmental and economic reasons. Corn cobs are typically left in the field as corn stover after the harvest of the corn kernels. Corn cobs are rich in sugars. They are heavier than the corn stalk making them easily separated. They can be removed from the field with little environmental impact because they contain little fertilizer value. And lastly they can be collected relatively easily by the same farmers that provide the ethanol plant the corn grain.

In 2007 and 2008 POET harvested nearly 13,000 acres of corn to supply over 7,000 tons of corn cobs in Iowa, South Dakota, and Texas. We worked with 13 equipment manufacturers using two cob harvest concepts – 1) a corn and cob mix (CCM), and 2) a towable corn stover – cob separator. With the CCM system, corn kernels and cobs are collected and stored in the combine hopper while the stalks are returned to the field; both corn and cobs are transferred to a grain cart in the field; then transported off the field to be separated with a grain separator creating a grain pile and a cob pile. Using a combine and towable stover – cob separator, grain is collected in the combine hopper and the stover that is released from the combine is received by the towable separator. The towable separator collects the cobs and releases the stalks to return to the ground to provide cover for erosion control and nutrients for soil fertility.

We have had excellent farmer participation and feedback with 100s of farmers in the Emmetsburg Iowa area participating in our LIBERTY Blast Off meeting and LIBERTY Field Day events in 2008.

For 2009 we have completed our planning for the harvest of 25,000+ acres in Iowa & South Dakota involving 15 equipment manufacturers. We will evaluate four cob harvest methods: Towable stover-cob carts, CCM, Flex-harvester, and baling. We have scheduled another LIBERTY Field Day in November to showcase equipment, brief farmers on the process and provide opportunities for farmer and equipment suppliers to discuss equipment performance and pricing for 2010. By 2012 we expect to collect over 250,000 tons of corn cobs on over 300,000 acres working with over 400 farmers in the Emmetsburg Iowa area to produce over 25 million gallons of cellulosic ethanol.

CELLULOSIC ETHANOL PROCESS TECHNOLOGY

POET has made significant investment in cellulosic ethanol research and expanded its collaborations across major corporations, universities and research institutes. Since 2006 POET has invested over $25 million in research and development and in excess of $10 million in capital expansions including a cellulosic ethanol pilot facility capable of processing 1 to 2 tons of lignocellulosic biomass per day.

Through our work with our collaborators and in particular the enzyme companies, we have been able to continually improve our cellulosic ethanol process. Recently we devised a process to breakdown corn cobs into simple sugars and optimized our fermentation process to produce more than 80 gallons of ethanol from one ton of cobs at a cost that approaches the cost of corn ethanol production.

We have also made significant progress in producing ethanol from simple sugars through better microorganisms and a better fermentation process. And lastly, through our own cutting-edge process engineering expertise, we have devised a synergistic concept for the integration of a corn ethanol plant with one using only cellulosic feedstock.

Let me highlight some of the achievements the POET research team has accomplished over the past 10 months.

1. Achieved lab scale performance in pilot facility – December 2008
2. Launched 24/7 pilot plant operation – January 2009
3. Completed process de-bugging – February 2009
4. Lignin removal process completed – March 2009
5. LIBERTY targets achieved at lab scale – April 2009
6. Anaerobic digester installed – May 2009
7. Achieved a >5 fold reduction in enzyme cost – June 2009

8. Total production costs below $2.50 per gallon – July 2009

While these are very important breakthroughs we expect to be able to further optimize this process over the next few months to achieve the necessary economics to make the process profitable. And we fully expect that over time we will continually improve the process much like what has occurred in the corn ethanol process.

IMPACT OF THE "BLEND WALL" ON CELLULOSIC ETHANOL

Today, approximately 10.6 billion gallons of ethanol is produced in the US. A little over 1.8 billion gallons of capacity is idled due to adverse market conditions and another 2.1 billion of capacity is scheduled to become operational this year. The total projected capacity for the ethanol industry is approximately 14.5 billion gallons, representing more than 10% of the available liquid transportation fuel market. Regulatory constraints limit the use of ethanol in this market to a) gasoline blends containing 10% ethanol (E10) for all vehicles or b) gasoline blends containing 85% ethanol (E85) for only flexible fuel vehicles. There are approximately 250 million cars and light duty trucks of which only 7.7 million are flexible fuel vehicles (FFVs). In addition, E85 is available in only 1900 or 1% of all fueling stations. E85 is not available in 5 states. The combination of a small number of FFVs and extremely limited E85 distribution results in little ethanol sold through this channel, roughly 1% of all ethanol produced. It is clear that the arbitrary regulatory cap of 10% ethanol in gasoline needs to be relieved in order to expand the ethanol market for future cellulosic ethanol.

Considerable research has been conducted by universities, national laboratories, automobile manufacturers, private testing laboratories and governmental groups to determine the impact of gasoline blends containing 15 to 30+% ethanol. Based on this research, Growth Energy, representing over 50 ethanol producers and supporters of ethanol, submitted a waiver request to the EPA to increase the ethanol content in liquid transportation fuels up to 15%.

Growth Energy's waiver application included recent comprehensive and independent studies representative of the American fleet that specifically evaluated the effect of higher ethanol blend fuels on emission control devices and systems. The included studies were based on thousands of hours of testing, more than one million miles driven, and evaluation of hundreds of vehicles (including over 100 different types of vehicles and engines) regarding exhaust and evaporative emissions, materials compatibility, and vehicle drivability for both E-15 and blends with greater than 15% ethanol. Many of the studies included extensive statistical analysis of the data and have been subject

to peer-review. Every relevant study included in the waiver application and subsequent comments provided by Growth Energy confirmed that vehicles and engines in today's American fleet can meet all applicable emission standards while using higher ethanol blends including E-15. Bottom line, fuels containing up to 15% ethanol do not cause or contribute to the failure of emission control devices or systems. The evidence is consistent and overwhelming. EPA should grant the requested waiver. In granting the waiver request the market for cellulosic ethanol could reach 6 billion gallons to fulfill the first cellulosic ethanol volumes mandated by the Renewable Fuel Standard. The economic benefit could exceed 136,000 new jobs and over $25 billion per year in GDP.

In conclusion I would like to bring to the attention of the committee the following items:

1. The importance of the Renewable Fuel Standard (RFS). The RFS provides an important target for cellulosic ethanol – a real and attainable target. Continued support of the RFS will be important in demonstrating to the ethanol, transportation fuel and financial industries that there will be a market for ethanol.

2. Market access for cellulosic ethanol. Increased usage of ethanol, greater numbers of flexible fuel vehicles, increased availability of blender pumps, enhanced distribution channels for ethanol such as pipelines. Important research has been released recently that supports the inclusion of greater concentrations of ethanol as a gasoline replacement – expanding the use of ethanol beyond its historical role as a fuel oxygenate. So called "Mid Level Blends" have shown to be equal and in some cases better in overall miles per gallon with little to no deleterious impact on vehicles that make up the current US automotive fleet. The increased commercialization of flexible fuel vehicles could help drive the greater usage of these mid level blends further reducing our dependence on foreign oil, reducing our fuel costs and helping the environment. We have been strong advocates to give consumers a choice in the fuels that they purchase – blender pumps allow consumers to select an ethanol blend that fits their pocketbooks. And POET has partnered with Magellan to develop a major pipeline for ethanol distribution to the northeast. We need your support with these ambitious endeavors.

3. Governmental support. Governmental programs are necessary, especially during the early stages of the cellulosic ethanol industry development to enable financing at the grower/farmer level as well as cellulosic ethanol producers

in terms of incentives, loan guarantees and market assurances.

4. Continued investment in research and development. Further cost reductions in the feedstock collection, storage and logistics and the cellulosic ethanol process are required. The initial cost of farm equipment to collect biomass and the cost of enzymes still remain among the most significant costs associated with the commercial success of cellulosic ethanol.

Cellulosic ethanol is not a magical solution or another shiny silver ball to attract and distract our attention from the critical issue of a clean, domestic fuel for today. The technology to achieve commercial scale cellulosic ethanol is here. We need market access to ensure that cellulosic ethanol becomes a reality. It's time to break big oil's monopoly on gasoline as our liquid transportation fuel. We can make a difference in our economy, the environment and national security by supporting ready-to-go domestic, clean-burning, agriculture-based ethanol.

Thank you for the opportunity to provide our perspective to the Committee. Thank you, Mr. Chairman and distinguished members of the Committee.