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Mr. Chairman and Members of the Committee, I appreciate the opportunity to testify today on biofuels.

To paraphrase President Bush in his State of the Union address this year, reducing America's dependence on oil is an imperative for our time, and the need for a diverse supply of domestic energy sources has never been greater. Biofuels are among the most promising near-term replacements for liquid transportation fuels since they offer a renewable, essentially carbon-neutral energy source that can help to meet a portion of our transportation fuel needs with domestic production. If growth in the use of biofuels outpaces our Nation's increasing demand for liquid transportation fuels, we can reduce our dependence on foreign oil. In addition to increasing our energy security, the production of biofuels can contribute to the domestic economy, especially rural communities.

Biofuels play a significant role in the President's Advanced Energy Initiative, a broad program designed to change the way we power our homes, businesses, and vehicles by developing cleaner, more affordable, and more reliable domestic alternative energy sources and technologies. I would like to give you an overview of the Department of Energy's (DOE) programs in biofuels, specifically research into ethanol and cellulosic ethanol.

Ethanol is now sold across the U.S. with plants expanding to states outside the traditional corn-growing areas. As of May 2006, 101 ethanol plants were producing nearly 4 billion gallons of ethanol with the capacity to produce 4.8 billion gallons. Based on information from the Renewable Fuels Association, by 2008, we expect this capacity to increase 45 percent with the addition of 42 new plants and the expansion of seven existing plants. Almost all the ethanol produced at these plants is derived from corn and other starch-based feedstocks.

To put U.S. ethanol use – and the extent of our oil dependence – in perspective, the amount of ethanol produced in 2005, approximately 4 billion gallons, represents less than three percent of liquid highway

transportation fuel use. By contrast, one reason Brazil is able to meet 20 percent of its liquid transportation fuel needs with ethanol is because Brazil uses approximately 1/20th (5 percent) of the amount of liquid transportation fuels used in the U.S. Brazil uses a sugar cane feedstock, whereas U.S. ethanol is largely derived from corn. Given land area required for corn production and growing U.S. demand for transportation fuel demand, we estimate that the maximum amount of corn ethanol that the U.S. could produce on a sustainable basis is approximately 18 billion gallons, or about 13 percent of current transportation fuel use (by National Corn Growers Association estimates). Clearly, producing ethanol cost competitively from other feedstocks is essential to helping reduce our dependence on oil.

Cellulosic Ethanol

While ethanol made from corn is an important blend agent for gasoline, corn represents only a small fraction of biomass feedstock that can be used to make ethanol. Ethanol can also be produced from cellulose, the main component of plant cell walls and the most common form of biomass. Cellulosic biomass has the potential to provide a clean, abundant, domestic, renewable resource that can make a major near-term contribution to increasing supplies of liquid transportation fuel.

The *Biofuels Initiative*, a key component of the President's Advanced Energy Initiative (AEI), seeks to accelerate research and development (R&D) to make cellulosic ethanol commercially competitive by 2012 and help reduce the Nation's dependence on foreign oil. In order to meet these goals, the Department developed targets to help guide its efforts. The Office of Energy Efficiency and Renewable Energy (EERE) established a near-term energy cost goal of $1.07/gallon of cellulosic ethanol by 2012.

Many materials currently regarded as wastes such as corn stalks, straw, and wood chips could be converted to ethanol along with dedicated energy crops, including a number of fast-growing trees and grasses. While chemically identical to ethanol produced from corn, cellulosic ethanol exhibits a net

energy balance that may be as much as three times higher than corn ethanol. In addition, because energy crops reabsorb carbon dioxide that is emitted when they are combusted, the use of biofuels sets up a cycle that leaves a low net level of greenhouse gas emissions in the atmosphere. [1]

However, while making ethanol from cellulose would dramatically expand the types and amount of available biomass feedstock that can be used to make ethanol, it is more technically difficult – and consequently far more expensive – than producing ethanol from corn. In order to expand the available resource base for fermented sugars and lower the cost of inputs, the Department's research is concentrating on developing cost-effective means to use non-starch, non-food-related biomass such as trees, grasses, and waste materials as fuel feedstocks. The goal is to find production methods that will enable us to convert ordinary low-value plant materials such as corn stalks, sawdust, or waste paper into fuel ethanol, and to do so cost-effectively and on a large industrial scale.

EERE's Biomass R&D

EERE's research is focused on three areas: feedstock infrastructure, platforms R&D, and utilization of platforms outputs. Feedstock activities are directed toward reducing the cost of collecting and preparing raw biomass, and for the sustainable production and delivery of future energy crops. EERE's efforts in this area aim to ensure the availability of cost-competitive, sustainable feedstocks by 2012.

A joint U.S. Department of Agriculture (USDA)/DOE study of 2005, the so-called "Billion Ton Study", indicates that there are enough agricultural and forestland resources in the U.S. to sustainably produce up to 1.3 billion tons of biomass feedstocks by 2030. This would be enough feedstock to potentially produce

[1] Wang, M.Q., 2002, "Impacts of Greenhouse Gas Emissions of Using Alternative Transportation Fuels with Advanced Vehicle Technologies, in Global Climate Change and Transportation: Coming to Terms", pp.65-77, Eno Transportation Foundation, Washington, D.C.

at least 60 billion gallons of ethanol. We stress that this is a resource potential study, not an economic study for the future. The study assumes that the new feedstock infrastructure includes the collection and use of agricultural and forest residues as well as the growth by U.S. farmers of dedicated energy crops. Different regions could potentially support different feedstock crops – for example, switchgrass in the South Central region and willow in the Northeast.

Our activities relating to Platforms R&D focus on reducing the cost, and increasing the quality, of outputs from biochemical and thermochemical conversion processes. These processes produce intermediates such as sugars and syngas, which are then used to produce fuels, value-added chemicals and materials, and heat and power. Thermochemical R&D focuses on gasification and pyrolysis technology, while biochemical R&D centers on further improving enzymatic and pretreatment processes, integrating these two steps in the conversion process and reducing the cost of sugar. These activities will help develop technologies to be used in producing cellulosic ethanol at a competitive price.

Finally, the program's strategy is to integrate these technologies and processes into operating biorefineries. DOE recently issued the Commercial Demonstration of an Integrated Biorefinery System Solicitation, which was authorized under section 932 of the Energy Policy Act of 2005 (EPACT). This solicitation was designed to develop industrial-scale demonstration of an integrated biorefinery system using a wide variety of lignocellulosic feedstocks such as trees, switchgrass and corn stover, including the collection and treatment of the feedstock. The aim of the biorefinery demonstration program is to show that such a facility could be operated profitably without Federal subsidies, once initial construction costs are paid, and easily replicated. The Department plans to select the best proposals and begin funding projects with Fiscal Year 2007 appropriations.

Working with the Private Sector

To obtain key industry and academia stakeholder input for successful strategies to develop biofuels, EERE's Biomass Program last month held a "30x'30" workshop. The "30x'30" refers to the theoretical potential of replacing 30 percent of current U.S. gasoline consumption with ethanol, or producing about 60 billion gallons of ethanol by the year 2030. Over 130 experts from agriculture, automotive, fuels, chemicals, and other related industries came together to map out R&D and policy strategies for achieving the Biomass program's 2012 cellulosic ethanol cost goal and to consider pathways to maximize biomass use by 2030. The results will be integrated into a planning tool with input from other Federal agencies involved in biomass R&D, describing the technical and infrastructure challenges that would need to be overcome and to map out each agency's role in addressing them.

Other Multi-Agency Federal Initiatives

To this end, EERE's Biomass Program co-chairs with USDA a multi-agency initiative. This initiative accelerates DOE's Biomass Program R&D activities, as well as some of DOE's Office of Science and USDA's bioenergy-related R&D, in accordance with the Biomass Research and Development Act of 2000. As part of this effort, DOE and USDA have an annual joint solicitation for the Biomass Grant Program addressing research, development, and demonstration of biomass-based products, bioenergy, biofuels, and related processes. EERE's Biomass Office is undertaking an effort to coordinate bioenergy-related R&D at Federal agencies. The 30x'30 workshop mentioned earlier was one of the initial coordinating efforts. EERE is holding planning meetings with other agencies, and regional workshops are being held to gather input from area experts in feedstocks, processing and conversion, production uses and distribution, and public policy. Additionally, the Renewable Fuels Standard and the *Biofuels*

Initiative goals are being incorporated, consolidating an integrated and collaborative approach that will help us to achieve our national energy goals.

To continue to build on the President's vision laid out in the AEI, DOE and USDA will co-host a national renewable energy conference to help create partnerships and strategies necessary to accelerate commercialization of renewable energy industries and distribution systems. The conference, *Advancing Renewable Energy: An American Rural Renaissance*, is scheduled for October 10-12 in St. Louis. The goal of the conference is to identify major impediments and critical pathways to get more domestically grown, renewable energy sources out of the laboratory and into the market as soon as possible.

Consistent quality standards for biofuels, such as those that might be developed through the American Society for Testing and Materials (ASTM International) will enhance consumer acceptance and market penetration. DOE is interested in working with others in government and the private sector to accomplish this.

Increasing Demand and Production

Before I conclude, I would also like to mention the role that increased demand for ethanol will have on increasing ethanol production. The Renewable Fuels Standard (RFS), for example, has established a baseline for the use of renewable fuels. Authorized by EPACT, the RFS requires that four billion gallons of renewable fuels be blended with gasoline by 2006, growing to 7.5 billion gallons by 2012 (with proportional growth beyond 2012). Additionally, the RFS calls for a minimum of 250 million gallons of ethanol to be derived from cellulosic biomass sources by 2013. These EPACT requirements provide a long-term commitment to farmers, renewable fuel producers, refiners and motorists that biofuels use will not be a temporary response to volatile oil prices and tight markets that can disappear as quickly as they

appeared and consequently provide some measure of market stability to an emerging industry. The Administration supported these EPACT requirements.

Conclusion

I would like to end by emphasizing that biomass is an important domestic renewable energy resource that can help lead our Nation to greater energy independence. The Department is working diligently to meet the President's goals for 2012 and beyond, fostering biofuels technologies with a balanced, yet focused program of research, development, and deployment. We will continue to work with our partners in the academic community, at our National Labs, at other Federal agencies, and in private industry, putting our research dollars in the most promising areas to address critical technical barriers. With clear goals and strategies to achieve them, we believe that greater quantities of cost-competitive liquid biofuels are already in sight.

Thank you. I would be pleased to respond to any questions the Committee may have.