Testimony of

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Mr. Chairman and Members of the Committee, I appreciate the opportunity to appear before you today to discuss developments in energy markets and their possible implications for agriculture.

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Energy Use in Farming and Farming-Related Sectors

Agriculture is a major user of energy. For 2007, EIA estimates that energy use on farms totaled about 1,142 trillion British thermal units (Btu), more than 1 percent of total U.S. energy consumption of 101.9 quadrillion Btu. The components of farm energy consumption are as follows: diesel accounts for 51 percent of total use, motor gasoline accounts for 16 percent, natural gas accounts for 9 percent, liquefied petroleum gas (LPG or propane) accounts for 9 percent, electricity accounts for 14 percent, and other fuels account for 2 percent. In addition to direct farm use of energy, agriculture is indirectly affected by energy requirements in the fertilizer industry, specifically in nitrogenous fertilizers. In 2007, the energy requirements of this industry, in terms of thermal content, were about 420 trillion Btu, most of which is natural gas. Natural gas is the main

feedstock in the production of ammonia fertilizer. Because of the volatility and high levels of natural gas prices over the last several years, several ammonia producers are planning to convert their facilities to use less expensive coal or petroleum coke instead of natural gas. Also, as domestic ammonia producers have idled many of their plants, imports of ammonia have significantly increased, with 2007 reporting a net import reliance of 42 percent, compared to 29 percent in 2002.

Based on energy use on farms and in closely-related sectors, every dime added to the price of gasoline and diesel oil, sustained over one year, costs U.S. agriculture $566 million annually. Every dollar added to the price per thousand cubic feet of natural gas costs agriculture more than $96 million annually in direct expense. Every penny increase in the price per kilowatthour of purchased electricity costs agriculture about $452 million annually in direct expense. The farm sector has seen a tremendous increase in fertilizer costs, particularly ammonia. The average annual ammonia price paid by farmers rose from $250 per ton in 2002 to $523 per ton in 2007.

Agriculture as an Energy Supply Source

Testimony on the interaction between energy markets and agriculture would once have focused exclusively on agriculture's demand for energy. Today, however, the recent increase in the use of ethanol in motor fuels has focused attention to agriculture's current and potential role as an energy supplier. Ethanol use in motor fuels has grown from 1.7 billion gallons per year in 2001 to an estimated 9.6 billion gallons per year in 2008. This

growth has had a substantial impact on corn demand, commodity and land prices, and planting decisions. However, notwithstanding its recent growth, ethanol still accounts for a relatively small share of overall fuel use by gasoline-powered vehicles, which totaled 137 billion gallons in 2008.

While ethanol from grain is by far the most important current energy supply activity in agriculture, other energy supply opportunities are also receiving increasing attention. Production of biodiesel fuel from oilseed crops has grown over the past decade, supported by Federal incentives. Farm wastes are increasingly being recognized as an energy resource, and their development is being promoted by Federal incentives and renewable energy portfolio mandates in many States. Farm operators are also benefiting from the growth of wind power, which is providing extra income from leases and royalties to farm operators in areas with attractive wind resources.

The forward-looking sections of this testimony, which follow, offer EIA's perspective on the short-term and long-term energy outlooks and on the future for ethanol and other energy supply opportunities in agriculture.

Energy Trends through 2010

Turning first to the outlook through the end of 2010, I will be relying on EIA's *Short-Term Energy Outlook*, released March 10, 2009, which is updated each month.

Global Oil Markets. Following the sharp price decline that occurred during the second half of 2008, the global oil market has remained relatively stable since the beginning of the year. This situation is expected to continue through most of 2009, until economic recovery in the United States and elsewhere leads to a rebound in oil demand growth.

Crude Oil Prices. The future direction of world oil prices in the short-term will largely depend upon the timing and pace of the recovery of the global economy. The annual price of West Texas Intermediate (WTI) crude oil averaged $100 per barrel in 2008. The global economic slowdown is projected to reduce these prices, to an average of $42 per barrel in 2009 and $53 in 2010.

Motor Gasoline Prices. Gasoline prices have been slowly increasing over the last 2 months while crude oil prices have stabilized and refiner margins have recovered from their recent near-historic lows. After averaging $1.69 per gallon in December 2008, the lowest monthly average since February 2004, the retail gasoline price in February rose to $1.92 per gallon. Retail gasoline prices are projected to average $1.96 per gallon in 2009 and $2.18 per gallon in 2010.

Diesel Fuel and Heating Oil Prices. Retail diesel fuel prices in 2009 are projected to average $2.19 per gallon, down from $3.80 per gallon in 2008, while residential heating oil prices are projected to average $2.58 per gallon during the 2008-2009 winter season compared to $3.31 per gallon last winter. The projected decrease is consistent with lower crude oil prices and more than adequate levels of distillate fuel inventories. Total

distillate inventories at the end of March 2009 are expected to be 131 million barrels, up 23.5 million barrels from March 2008 and well above the normal range.

Natural Gas Production, Inventories, and Prices. Total U.S. marketed natural gas production is expected to remain flat in 2009 and then fall by 0.8 percent in 2010. Working natural gas inventories by the end of March are projected to reach 1,628 billion cubic feet, a level about 251 billion cubic feet above the previous 5-year average for March.

The Henry Hub spot price averaged $4.65 per thousand cubic feet in February, $0.75 per thousand cubic feet below the average spot price in January. Prices continue to reflect demand reductions brought about by the current economic downturn. As the year progresses, it is expected that average spot prices will remain near $4 per thousand cubic feet. On an annual basis, the Henry Hub spot price is expected to average about $4.67 per thousand cubic feet in 2009 and $5.87 per thousand cubic feet in 2010.

Electricity Consumption and Prices. An expected decline of 6.4 percent in industrial electricity sales during 2009 leads to a projected decline in total electricity consumption of 1.7 percent this year. Total electricity consumption is expected to grow by 1.2 percent in 2010 as a slowly improving economic climate contributes to a recovery in the sales of electricity. Despite the recent drop in generation fuel costs, some electric utilities have proposed slight rate increases in response to higher costs of securing credit for purchases of fuel and wholesale power, while other retail electricity distributors, especially in the

West South Central region, have been able to pass the declining fuel costs on to customers through lower rates.

Ethanol. EIA projects that the market for ethanol will continue to grow, although much more slowly than seen over the past 2 years. In 2007, the ethanol industry produced an average of 425,000 barrels per day, providing about 4.6 percent of 2007 average daily gasoline consumption volume, or about 3 percent of the energy consumed by gasoline-fueled vehicles. Ethanol plants operated at or near their design capacity limit during this period. Ethanol production capacity increased by more than 50 percent in 2008 with production growing from an average of 492,000 barrels per day in December 2007 to an average of 656,000 barrels per day in December 2008. However, high gasoline prices and the weakening economy contributed to declining gasoline consumption compared with the year before. Ethanol production capacity grew faster than the demand for ethanol, and average ethanol capacity utilization rates fell from close to 100 percent at the beginning of 2008 to about 85 percent by the end of 2008. EIA's forecast for 2009 calls for continuing but very modest growth in ethanol consumption, with average capacity utilization rates falling to about 80 percent by the end of the year. Although farmers should continue to benefit from increasing corn demand, the availability of underutilized ethanol production capacity will tend to put downward pressure on the margin earned by ethanol producers over their variable production cost.

The projected slowdown in ethanol demand growth reflects the existence of several distinct segments in the fuel ethanol market, each with a different sensitivity to market

price and infrastructure limitations. The reformulated gasoline market, which represents about one-third of the gasoline sold and is subject to the strictest environmental limits, is the least price-sensitive market segment for ethanol. Demand for ethanol in this type of gasoline, where it is used in blends of 6 to 10 percent, increased significantly with the phase-out of methyl tertiary butyl ether (MTBE), which was completed in 2006. Since that time, virtually all reformulated gasoline has been blended using ethanol.

The next most attractive market segment for ethanol is as a volume extender for conventional gasoline in blends of 10 percent. The high oil and gasoline prices last year, the availability of a 51-cent-per-gallon blenders' tax credit through 2010, and the "consumer illusion" that leads to choices between gasoline blended with and without low percentages of ethanol to be made purely on the basis of their price per gallon without consideration of the lower miles-per-gallon using fuel incorporating ethanol, all supported the growing use of ethanol as a volume extender in conventional gasoline. However, the recent fall in oil and gasoline prices has reduced the economic incentive for expanding ethanol blending capacity. While the current level of almost 140 billion gallons per year in national sales for all types of gasoline could, in theory, accommodate roughly 14 billion gallons of ethanol in blends of 10 percent or less, many regions still lack the transportation and blending infrastructure to use ethanol. EIA's latest *Outlook* projects that 10.7 billion gallons of ethanol are blended into gasoline in 2009. We are aware of some other projections as much as 1 billion gallons per year lower, which would require the use of RINs (Renewable Identification Numbers) from prior years to comply

with the renewable fuel standard established by the Energy Independence and Security Act of 2007 (EISA).

The final market segment for ethanol is use in high-percentage blends such as E85. Currently, high-percentage blends account for well under 1 percent of the overall U.S. market for fuel ethanol. Expanded use of high-percentage blends is necessary if total ethanol use is to grow beyond the level of 12 to 15 billion gallons per year that would saturate the market for low-percentage blends. Based on the Brazilian experience, consumers would generally expect high-percentage ethanol blends to be price-competitive with petroleum-based alternatives on an energy-content basis.

Energy Trends through 2030

Turning now to the longer-term outlook, the discussion that follows relies on EIA's *Annual Energy Outlook 2009* (*AEO2009*) and on several recent EIA analyses of energy and environmental policy proposals that could have a significant impact on agriculture's role as an energy supply source.

Overview. Longer-term trends in energy supply and demand are affected by many factors that are difficult to predict, such as energy prices, U.S. economic growth, advances in technologies, changes in weather patterns, and future public policy decisions. It is clear, however, that energy markets are changing as they adapt to the significant volatility seen in recent years; higher energy prices since 2000 (notwithstanding the sharp fall in oil and

natural gas prices since mid-2008); the greater influence of developing countries on worldwide energy requirements; recently enacted legislation and regulations in the United States; and changing public perceptions of issues related to the use of alternative fuels, emissions of air pollutants and greenhouse gases, and the acceptability of various energy technologies.

The *AEO2009* reference case projects an increase in the consumption of biofuels (ethanol, biodiesel and biomass-to-liquids fuels), even as consumption of petroleum-based fuels remains essentially flat, and an increase in other nonhydroelectric renewable energy sources, together with accelerated improvements in energy efficiency throughout the economy. The growth in biofuels and other nonhydroelectric renewable energy consumption leads to a gradual reduction in the role played by fossil fuels in meeting U.S. energy needs. The oil, coal, and natural gas share falls from providing 86 percent of total U.S. primary energy supply in 2006 to 79 percent in 2030, assuming no changes in existing laws and regulations.

Alternative Fuel Use. The use of non-petroleum liquid fuels is projected to increase substantially in the reference case as a result of the higher prices projected for traditional fuels and the support for alternative fuels provided in recently enacted Federal legislation, including EISA. Biofuels use grows in the *AEO2009* reference case from 7.3 billion ethanol-equivalent gallons in 2007 to 29.8 billion gallons in 2022 and 38.7 billion gallons in 2030. After 2022, the combination of the rising cost of petroleum-based fuels and steadily lower costs for biofuel technology results in the continued growth in biofuels

consumption. The projected biofuels consumption in 2022 is less than the 36 billion gallons mandated in EISA largely because of the difficulties that we foresee in rapidly ramping up the production of cellulosic biofuels to the target levels set in that Act for the middle of the next decade. However, the targets for the use of 15 billion gallons of corn-based ethanol and not less than one billion gallons of biodiesel are projected to be achieved.

From a marketing perspective, biofuels that are substitutes for diesel fuel, such as biodiesel and biomass-to-liquids fuels, are expected to be blended into the same diesel supply as petroleum-based diesel. Ethanol use for gasoline blending grows to the 12–to-13-billion-gallon level between 2022 and 2030, while E85 consumption grows from 11 to 17 billion gallons over that same time period.

The Effect of Lower Oil Prices. The crude oil price can be expected to have an effect on the longer term outlook for biofuels. In the *AEO2009*, the difference in crude oil prices between the reference and low oil price cases is almost $70 per barrel (2007 dollars) in 2022, and this price differential continues to grow through 2030. There is a pronounced lowering of cellulosic ethanol consumption in the low oil price case by 2030 due to the fact that it is not as price-competitive with petroleum gasoline, which results in a significant lowering of the total ethanol consumed by the end of the projection period: 20.6 billion gallons in 2030 in the low oil price case compared to 29.3 billion gallons in the reference case. Biomass-to-liquids production is also lower in the low oil price case than in the reference case.

Renewable Fuel Consumption and Supply. Total consumption of marketed renewable fuels in the *AEO2009* reference case, including ethanol blended with gasoline, is projected to grow from 6.7 quadrillion Btu in 2007 to 14.1 quadrillion Btu in 2030. The robust growth is a result of the nearly 30 State renewable portfolio standard programs, mandates, and goals for renewable electricity generation; technological advances; high petroleum and natural gas prices; and Federal tax credits, including those in the Energy Policy Act of 2005 and the Energy Improvement and Extension Act of 2008.

Outlook Risks. As discussed previously, this longer-term outlook hinges upon the outcomes of a number of factors in addition to crude oil prices, which are not known with certainty. For biofuels the uncertainties include the actual implementation of the expanded renewable fuel standard in EISA, the continued difficulty second-generation biofuels technology developers are facing with financing and building projects in the United States and globally, and whether intermediate ethanol blends in gasoline above E10 levels will be allowed.

The Potential Impact of Possible Future Policies on Energy Supply From Agriculture

As previously noted, the *Annual Energy Outlook* reference case assumes that current laws and policies continue indefinitely. Other recent EIA analyses suggest that various policy proposals, including caps on greenhouse gas emissions, a renewable electricity standard for electricity sellers, or a low carbon fuel standard, could significantly increase reliance on biomass as an energy source. Agricultural products and residues, as well as dedicated

energy crops, are a key part of the overall supply of biomass in some of our recent policy analyses.

The two main concerns that appear to motivate many recent policy proposals are energy security and reduction of greenhouse gas emissions. Our continuing policy analyses suggest that there are both synergies and conflicts between these objectives. For example, improvements in vehicle efficiency would advance both objectives. In contrast, the adoption of coal-to-liquids conversion without carbon capture and sequestration would advance energy security while increasing emissions.

The situation with respect to agriculture and biomass is somewhat complex. A policy focused on energy security would likely emphasize the use of biofuels to reduce our reliance on imported petroleum. Such a policy also would serve to reduce greenhouse gas emissions. However, if greenhouse gas emissions were the primary policy focus, biomass could be used as a substitute for coal-fired electricity generation to provide larger reductions in energy-related carbon dioxide emissions per unit of biomass energy used. While biomass from agriculture and other sources has an important role to play in either case, the way in which biomass is deployed will depend on how the objectives of energy security and emissions reduction are prioritized.

This concludes my statement, Mr. Chairman, and I will be happy to answer any questions you and the other Members may have.