STATEMENT OF RICHARD G. NEWELL

ADMINISTRATOR

ENERGY INFORMATION ADMINISTRATION

U.S. DEPARTMENT OF ENERGY

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Madam Chairwoman 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.

The Energy Information Administration (EIA) is the statistical and analytical agency within the U.S. Department of Energy. EIA collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding regarding energy and its interaction with the economy and the environment. EIA is the Nation's premier source of energy information and, by law, its data, analyses, and forecasts are independent of approval by any other officer or employee of the United States Government. The views expressed in our reports, therefore, should not be construed as representing those of the Department of Energy or other Federal agencies.

Energy use in the agricultural sector

The agriculture industry is both a user and producer of energy. For 2007 (the most recent year in which the quinquennial Census of Agriculture was conducted), EIA estimates that energy use on farms totaled about 900 trillion British thermal units (Btu), nearly 1 percent of total U.S. energy consumption of 101.7 quadrillion Btu. The components of farm energy consumption are as follows: diesel accounts for 33 percent of total use, motor gasoline accounts for 23 percent, natural gas accounts for 17 percent, liquefied petroleum gas (LPG or propane) accounts for 8 percent, electricity accounts for

16 percent, and other fuels account for 3 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 2009, the energy requirements of the fertilizer industry, in terms of thermal content, were about 568 trillion Btu, most of which is natural gas because natural gas is the main feedstock in the production of ammonia fertilizer. In recent years, many domestic ammonia producers have idled or retired many of their plants, with 7.7 million metric tons (MMT) of production (based on nitrogen content) recorded in 2009, compared to 8.2 MMT in 2006 and 10.2 MMT 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 $381 million annually. Every dollar added to the price per thousand cubic feet of natural gas costs agriculture more than $152 million annually in direct expense. Every penny increase in the price per kilowatthour of purchased electricity costs agriculture about $410 million annually in direct expense. The farm sector has also seen volatility in fertilizer costs, particularly ammonia. The average annual ammonia price paid by farmers rose from $250 per ton in 2002 to $680 per ton in 2009, but has declined to $499 per ton in 2010.

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 13.2 billion gallons per year in 2010. However, notwithstanding its recent growth, ethanol still accounts for a relatively small share (somewhat less than 10 percent by volume) of overall fuel use by gasoline-powered vehicles, which totaled 138 billion gallons in 2010.

While ethanol from corn grain is by far the largest current energy supply activity in agriculture, other opportunities are also receiving increasing attention. Over the past decade, production of biodiesel fuel from oilseed crops has grown, but it fell last year with higher oilseed prices and the lapse of the $1 per gallon biodiesel tax credit that has since been reinstated. Recently, the mandates for biodiesel and advanced biofuels under the Renewable Fuel Standard (RFS) have been providing a significant additional incentive for biodiesel production. 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.

Recent oil market trends and the short-term outlook

Turning to the outlook through the end of 2012 for oil, gasoline, diesel fuel, and ethanol, I will be relying on EIA's latest *Short-Term Energy Outlook*, released March 8, 2011, which is updated each month.

Since the outlook was released, Japan, the world's third-largest oil consuming economy behind the United States and China with 2010 estimated oil consumption averaging 4.4 million barrels per day, was struck by a major earthquake. Initial assessments suggest the oil market impact will likely be two-tiered. First, the disaster will cause a temporary reduction in Japanese oil demand, partly offsetting the recent Libyan supply shortfall. While much recent attention has focused on Japan's nuclear power generation infrastructure, the scope of the damage is broader and includes thermal power generation, refineries, factories, ports, roads, and other transport logistics that directly affect the use and movement of oil. In the longer term, however, Japan's oil demand is expected to rebound in order to support reconstruction efforts and make up for some part of the loss in nuclear power generation. The timing of the transition from the first phase to the second, which will mark the bottom in Japanese oil demand, is not yet clear.

Global oil markets. EIA expects continued tightening of world oil markets over the next two years – particularly in light of the recent events in the Middle East and North Africa (MENA), the world's largest oil producing region. The current situation in Libya increases oil market uncertainty because much of that country's 1.8 million barrels per

day of liquids production, which represents about 2 percent of total world supply, has been shut in and it is unclear how long this situation will continue. Many participants in oil markets remain concerned that the unrest in the region could continue to spread. This concern, along with other factors influencing prices, is reflected in the prices of spot market crude oil and related futures and options contracts, as discussed below.

Crude oil and wholesale gasoline prices. West Texas Intermediate (WTI) and other crude oil spot prices have risen about $15 per barrel since mid-February partly in response to the disruption of crude oil exports from Libya. Continuing unrest in Libya as well as in other MENA countries has led to the highest crude oil prices since 2008. As a result, EIA has raised its monthly *Short-Term Energy Outlook* forecast for the average cost of crude oil to refiners to $105 per barrel in 2011, $14 higher than in the February edition of the *Outlook*. EIA projects a further small increase in crude oil prices in 2012, with the refiner acquisition cost for crude oil averaging $106 per barrel.

It should be noted that, in EIA's view, recent Brent price movements are more representative of trends across broader crude oil prices than are recent WTI price movements. WTI prices are currently heavily influenced by storage capacity and the supply/demand balance at Cushing, OK, the delivery point for the WTI futures contract traded on the New York Mercantile Exchange.

Retail gasoline and diesel fuel prices. The recent rapid increase in crude oil and wholesale gasoline prices has led to a significant rise in the retail price of gasoline at the

pump. Absent a near-term decline in crude oil prices, motorists currently experiencing a jump in pump prices will likely see further increases from now through the spring since the recent increase in crude oil prices has not yet been fully passed through to retail gasoline prices. EIA expects the retail price of regular-grade motor gasoline in the United States to average $3.56 per gallon in 2011, 77 cents per gallon higher than the 2010 average, and $3.57 per gallon in 2012. EIA projects gasoline prices will average about $3.70 per gallon during the peak driving season (April through September) in 2011 with considerable regional and local variation. The projected increase in gasoline prices suggests that vehicle fueling costs for the average U.S. household will be about $700 higher in 2011 than they were in 2010. On-highway diesel fuel retail prices, which averaged $2.99 per gallon in 2010, average $3.81 per gallon and $3.82 per gallon in 2011 and 2012, respectively.

While EIA strives to provide accurate forecasts, it is important to recognize that there is significant uncertainty surrounding these projections. For example, as of March 25, the market value of futures and options contracts for gasoline was suggesting about a one-in-four chance that the national monthly average retail price for regular gasoline could exceed $4.00 per gallon during summer 2011. EIA regularly tracks the uncertainty regarding future oil and gasoline prices implied by the market price of energy-related derivatives in a *Market Price Volatility and Forecast Uncertainty Report* that is issued alongside each month's *Short-Term Energy Outlook*.

Ethanol. In 2010, ethanol production was about 13.2 billion gallons, representing about 9.6 percent of 2010 average daily gasoline consumption. While ethanol production has increased nearly eight-fold since 2001 and almost tripled since 2006, EIA expects slow growth in ethanol production over the next 2 years, with forecast production of about 13.8 billion gallons in 2011, and 14 billion gallons in 2012.

The projected slowdown in ethanol capacity, production, and demand growth occurs for several reasons. First, forecast domestic production rates exceed the mandates for conventional biofuels in 2011 and 2012 under the RFS program. Second, ethanol production is approaching 10 percent of the U.S. gasoline market; projected domestic ethanol production in 2011 represents about 9.9 percent of all gasoline sold. Federal regulations have until recently limited the percentage of ethanol that could be blended for use in all gasoline powered vehicles to a maximum of 10 percent (E10).

Recently, EPA has granted waivers for fuels containing up to 15 percent ethanol (E15) for use in model year 2001 and newer vehicles, which constitute about two-thirds of the current light duty vehicle fleet. However, concerns over potential misfueling liability, infrastructure limitations both in the distribution system and at gas stations for handling a new grade of fuel, and the related cost of fuel pump modification and recertification are expected to slow market penetration of E15. E85, a fuel blend with 70 percent to 85 percent ethanol content, may also be sold, but only for use in vehicles that have been specifically designed to accommodate E85. However, E85 is presently consumed in very limited volumes (about 5,600 barrels per day in 2008) with only about 2,600 E85 pumps

nationwide (as of early 2010), and it is not expected to show significant growth over the short term.

The longer term outlook

Turning to the longer-term outlook through 2035, the discussion that follows relies on EIA's *Annual Energy Outlook 2011* (*AEO2011*) Early Release Reference case, released last December. That 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. It also projects an increase in other nonhydroelectric renewable energy sources, together with accelerated improvements in energy efficiency throughout the economy. The growth in biofuels contributes to a gradual reduction in the role played by imported oil in meeting U.S. energy needs. Assuming no changes in existing laws and regulations, the net import share of U.S. liquid fuels supply, which was 60 percent in 2006 and 49 percent in 2010, is projected to decline to 43 percent in 2035.

Generally, reductions in projected oil consumption are largely reflected as reductions in oil imports. One of the most important factors affecting the projected level of oil consumption is the level of motor fuels use in light-duty vehicles, which is in turn sensitive to vehicle fuel economy. The *AEO2011 Early Release*, which reflects current laws and regulations, does not include a further increase in fuel economy standards for model years 2017 through 2025 that is now under consideration in the regulatory process. The forthcoming release of the full *AEO2011* will include alternative scenarios of

increased light-duty vehicle fuel efficiency to illustrate how further actions by policymakers in this area could affect projected U.S. oil use and imports over the next 25 years.

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 the Energy Independence and Security Act (EISA). Biofuels use grows in the *AEO2011* Reference case from 12 billion ethanol-equivalent gallons in 2009 to 24 billion gallons in 2022 and 39 billion gallons in 2035. After 2022, the combination of the rising cost of petroleum-based fuels and steadily lower costs for biofuels 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 EIA foresees 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 17–to-18-billion-gallon level between 2022 and 2035, while E85 consumption grows from 3 to 9 billion gallons over that same time period.

The outlook for ethanol and other biofuels presented above hinges on the level of crude oil prices and a number of other technology and market factors that are highly uncertain. For biofuels the uncertainties include the actual implementation of the RFS program, 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 become prevalent.

Interactions between physical and financial markets for energy

As part of its Energy and Financial Markets Initiative, launched in late 2009, EIA is examining the various factors that may influence oil prices--fundamental factors as well as those related to trading and financial markets. Events in Egypt, Libya and Japan have been reflected in financial as well as physical markets. Over the January 27 to March 23, 2011 period, when the price of oil rose by 23 percent, implied volatility -- a measure of uncertainty regarding future oil prices based on the market value of options contracts for future delivery -- rose by over 6 percentage points. Price and implied volatility are often negatively correlated, but they can exhibit co-movement during times of uncertain future supply. Such co-movement was not observed in 2008, when implied volatility remained relatively unchanged.

Average daily open interest for WTI futures contract trading on NYMEX reached a record level in the first quarter of 2011. Open interest is the total number of outstanding

contracts and is an indicator of market activity. As uncertainty about the future supply and demand fundamentals surrounding crude oil rises, more producers and end users will enter into the market to try and hedge their risk; speculators will often take the other side of these trades and assume that risk. The clearest example of this behavior can be seen in the Commodity Futures Trading Commission's Commitment of Traders report where non-commercial and commercial net open interest are both currently at historic highs. In the disaggregated report, money managers' net open interest increased sharply as the events in Egypt and Libya unfolded.

There is also interest in how oil price movements are related to movement in the prices of other commodities. All else equal, a high degree of correlation in price movements suggests the possibility of a significant role for drivers with broad effect, such as changes in expectations of global economic growth or financial market behavior towards commodities as a broad asset class. Similarly, a low degree of correlation suggests a more significant role for commodity-specific factors.

During the first quarter of 2011, daily price movements in crude oil futures have diverged from corn, wheat, soybeans and copper contracts, a change from the situation in 2009 and 2010, when there was significant positive correlation in daily price movements across a broad spectrum of commodities. Movements in the S&P 500 were slightly negatively correlated with crude oil for the first quarter of 2011, also reflecting a break in the pattern of positive correlation that prevailed in 2009 and 2010. Both of these shifts are consistent with a view that the recent increase in oil prices driven by supply concerns, together with

other coincident events such as the earthquake in Japan, may have negatively affected expectations for economic growth. Finally, there has also been a significant change in the co-movement of crude oil and the U.S. dollar, which were largely uncorrelated during the first quarter of 2011 after having shown a significant inverse correlation over the last two years. It should be noted that the Japanese yen is a significant part of the exchange rate index, which raises the likelihood that movements in that index during this month would reflect both the impact of the recent earthquake and the subsequent intervention by central bankers in Japan and other G-7 countries to stabilize the yen in the wake of that disaster.

The wide variety of factors affecting oil price movements, and their interrelationships, are the focus of EIA's Energy and Financial Markets Initiative. Our aim is to improve energy market transparency, support sound policy and efficient markets, and increase public understanding—activities that are central to EIA's mission. EIA's traditional coverage of physical fundamentals such as energy consumption, production, inventories, spare production capacity, and geopolitical risks continues to be essential, but EIA is also assessing other influences, such as speculation, hedging, investment, and exchange rates, as it seeks to fully understand energy price movements.

Events such as the unrest in the Middle East and North Africa or the earthquakes in Japan change expectations of future oil supply and demand, and increase the uncertainty of those expectations. Since the beginning of this year, EIA expectations of world oil consumption in 2011 have increased approximately 200,000 barrels per day in

anticipation of continuing economic growth. In contrast, given the recent MENA political events, specifically those in Libya, forecast OPEC production for this year has been revised down around 400,000 barrels per day, increasing the need for inventory draws. Market participants' assessment of future supply and demand may change rapidly as information about such events unfolds, and can result in large and rapid price movements even if current supply and demand do not appear to have changed. Market participants may demand higher premiums as a result of greater uncertainty surrounding future supply and demand.

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