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Agriculture's Supply and Demand for Energy and Energy Products

Jayson Beckman, Allison Borchers, and Carol A. Jones

What Is the Issue?

Rising energy prices over the past decade, in tandem with evolving policies promoting renewable energy and onfarm conservation practices, have transformed the relationship between the energy and agriculture sectors. Traditionally, agriculture used energy both directly in the form of fuel and electricity and indirectly through use of energy-intensive inputs, such as fertilizers and pesticides. However, record-high energy prices and expanding biofuel policies have substantially increased the demand for agricultural products as renewable fuel feedstocks since the mid-2000s. As of 2012, corn-based ethanol and soybean-based biodiesel supplied almost 6 percent of U.S. transportation fuels, consuming 42 and 1 percent of U.S. corn and soybean production, respectively. Corn used for ethanol does generate a co-product, dried distillers grains with solubles (DDGS), which is sold into the market as livestock feed.

Even so, changing market economics and policies have brought about higher agricultural commodity prices and have increased the costs of agricultural production. This report surveys how farmers have adjusted which agricultural commodities to produce, how much of each to produce, and how to produce them to better understand how recent changes in energy prices and biofuel demand have affected the agricultural sector.

What Did the Study Find?

Farmers have adapted to rising energy prices and evolving policies by adjusting their use of energy-based agricultural inputs, altering energy-intensive production practices, and growing more energy-feedstock crops.

Farmers have expanded production of agricultural commodities used as energy feedstocks. In particular, corn production increased 13 percent from 2001 to 2012. A 28-percent increase in corn plantings over that time period came partly at the expense of acreage previously allocated to other crops (acreage grew more than production as average yields fell in 2012 as a result of the drought); barley, oat, and sorghum production each declined by 10 percent or more over 2001-12. The remainder of the increase in corn output came from the intensification of corn production.

The prices of all major field crops increased by more than 40 percent between 2001 and 2012 (in real terms). As production of other commodities decreased to accommodate increased corn production, increased competition for reduced supplies helped lead to higher prices for all major field crops.

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Farmers adapted to higher energy prices and related energy and conservation policy incentives by shifting to more energy-efficient production practices and input use. Farmers reported that, to lower fuel expenses, they kept engines properly serviced and adopted production practices leading to fewer trips over their fields. To reduce fertilizer expenses, they reported reducing the use of fertilizer and increasing the efficiency of fertilizer use by conducting soil tests.

The agriculture sector's use of energy and energy-intensive inputs generally remained constant or fell during 2001-11. Farmers were able to hold the line on energy use—while total output and the output share of corn, a highly energy-intensive crop, increased—by increasing the energy efficiency of production relative to 2001.

Nonetheless, energy-related agricultural production costs increased with rising energy prices. The share of energy-based input costs in total corn production costs increased from 27 percent during 2001-2005 to 34 percent for 2006-2011.

More farmers started producing onfarm energy, though the scale of production still remains very low. From 2008 to 2011, the number of farms with renewable energy generation increased 99 percent, to about 1.6 percent of farms.

How Was the Study Conducted?

This report provides new data on energy use by farmers and farmer behavior as energy prices change; it also updates previously published data. This report also draws from published reports, articles, and data products. When possible, trend and correlation analyses are used to identify relationships between energy and agricultural sectors. Because the actual changes in the agricultural sector's supply and demand for energy and energy products are a result of complex interactions among many influences, this report provides an overview of many of these factors using a variety of data sources. Historical energy prices from the Energy Information Agency and agricultural commodity production and price data from the USDA's National Agricultural Statistics Service (NASS) are used to establish baseline descriptions of the energy and agriculture sectors through 2012. Estimates developed by USDA's Economic Research Service of onfarm expenditures and productivity underlie the presentation of trends in energy-related crop inputs. Our analyses of changes in farm production practices and renewable energy use draw largely from farmer responses to USDA's Agricultural Resource Management Survey and the Census of Agriculture's 2009 On-Farm Renewable Energy Production Survey.