Potential Regional Economic Impacts of Converting Corn Stover to Ethanol

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Abstract:

IMPLAN analysis was used to estimate the economic impacts for constructing and operating two ethanol plants with corn stover feed rates of 1,000, and 2,000 metric tons per day for ten midwestern states. Additional impact analysis was conducted for the harvesting of corn stover and transporting the stover to the plant-gate. Total impact estimates for each plant size, three ethanol price scenarios, and three farmer profit scenarios were also developed.

Problem Statement and Relevance:

Adding value to basic agricultural commodities and increasing farm income are major themes in Rural America today. Currently, the agricultural sector is in the midst of decreased farm income caused by reduced export demand and increased production levels. As incomes decline, public pressure has increased toward establishing value-added operations in rural areas. Economic development of rural areas has traditionally focused on manufacturing opportunities and has neglected agricultural value-added prospects. Rural communities either shipped raw commodities out or fed the raw agricultural commodities and shipped livestock from the region.

Recent increase in energy prices has spurred renewed interest in the use of fuel ethanol as a fuel substitute. According to a 1997 study prepared for the Midwestern Governors' Conference, an increase in the demand for ethanol is estimated to boost total employment by 192,000 jobs. The Economic Research Service estimated that U.S. production of ethanol could create 28,000-108,000 new jobs by 2000 for rural Midwest. The use of ethanol itself, or blended with other automotive fuels, would result in less polluting carbon monoxide and the need to toxic compounds to enhance automotive fuel octane levels. The potential for global warming would decrease. In addition, less dependency on foreign oil to satisfy U.S. consumption needs would increase energy and economic security.

Biomass feedstocks, such as corn fiber, corn stover, bagasse, and rise straw contain cellulose, which can be converted to sugars that are then fermented to ethanol. New technologies being designed will hopefully convert corn stover to ethanol more efficiently. More specifically, further research to improve existing separation and conversion technologies and process systems is required. The cost of harvesting and transporting the residue depends on the per acre residue yield. As a renewable feedstock, potential benefits from expanded market and additional economic opportunities for farmers and Rural America could be realized.

Data and Methodology:

Input-output analysis was used to derive economic impacts for constructing and operating various ethanol production facilities, including farm level stover production and transportation costs. The selected states included Illinois, Indiana, Iowa, Kansas, Minnesota, Missouri, Nebraska, Ohio, S. Dakota, and Wisconsin. Process engineering design and economic information to provide input data for the IMPLAN model was obtained from the National Renewable Energy Lab (NREL). The POLYSYS (Policy Analysis System) model was used to obtain estimates on available corn stover residues. The Oak Ridge Integrated Bioenergy Analysis System (ORIBAS) model was used to obtain estimates on feedstock and transportation costs.

Four impact types were analyzed representing three stage of the production process along with the construction (Project Investment) of the ethanol facility. The three stages of production include the harvesting of corn stover (Agriculture), the transporting of the stover to the ethanol plant (Transportation), and the conversion of corn stover to ethanol (Operating). Impact types included Direct, Indirect, Induced, and Total Impacts. Economic variables measured include Total Industry Output, Employment, and Total Value Added.

Initial plant estimates were used to develop total impact estimates for each plant size, three ethanol price scenarios ($1.15, $1.25, and $1.35/gallon), and three farmer profit scenarios (0%, 15%, and 30% of the breakeven corn stover prices). Information provided by NREL was used to determine the amount the three different 2005 plant sizes could afford to pay for corn stover. Prices were then compared to GIS generated and the adjusted average stover price delivered to the plant. If the plant-average stover price was less than the break-even corn stover price, the plant was included. Agriculture and operating impacts for a single plant was multiplied by the number of plants. The impacts were added to transportation sectors impacts adjusted to reflect the increase in transportation costs and economic activity as more plants are incorporated.

Questions asked include: 1) what are the economic benefits of harvesting current available corn stover for conversion to ethanol to local communities; 2) how many plants would be economically feasible evaluated at ethanol prices of $1.15, $1.25, and $1.35 per gallon; and 3) what size ethanol plant should be constructed (1,000 or 2,000 MT/day)?

Major Results and Implications:

States that have large regional purchase coefficients for existing ethanol industry will have larger in-state economic impacts. State that require a larger area to get the initial plants supply of corn stover will have increased impacts on the transportation sector. Consequently, larger direct impacts will result compared to other areas.

The 1,000 MT/day facilities appear to be economically feasible if the price of ethanol at the plant gate equals $1.25/gallon. Even at $1.15 per gallon at the plant gate, the 1,000 MT/day facilities are feasible in some states. If a subsidy was available to producers using corn stover to produce ethanol so that producers were guaranteed $1.35/gallon, an estimated 136 plants would be constructed, 4,134 million gallons of ethanol would be produced, $963 million in gross income to agricultural producers would occur, and an estimated economic impact of $11 billion in rural economies of the ten state region would be realized.

Major References:

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