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South Dakota State University (SDSU) and a number of other universities and research institutions have been involved in research on alcohol fuels since the late 1970s. Major attention at SDSU has been focused on the technical and economic feasiblity of producing fuel grade ethanol from corn and other feedstocks in small- or community-scale plants. A number of other agencies and private consulting firms have focused on large-scale plants. Due to reduced availability of Federal research grants for energy topics and to other pressing research demands, fuel alcohol research is winding down at SDSU and more generally across the country. It is therefore timely to pause now and both "look back" and "look ahead" at the fuel alcohol industry.

A Look Back

Fuel alcohol production in the U.S. grew from about 25 million gallons in 1980 to about 625 million gallons in 1985, a 25-fold increase. There were fewer than 10 ethanol plants in the U.S. in 1980, compared to more than 85 by mid-1982. The 1979-81 period was one in which there were expectations of continued rises in petroleum prices and in which there were many Federal incentives (loan guarantees, tax credits, excise tax exemptions, etc.) introduced or expanded for construction of alcohol plants.

However, although there were 163 "commercial" ethanol facilities in the U.S. in 1985, only 74 were reported to be operating. Thus, by the mid-1980s, the slump in oil prices and unfulfilled technical expectations were both taking their toll on many alcohol plants.

Ethanol-gasoline blends represented 7.3% of U.S. gasoline sales in 1985. Market penetration of ethanol-gasoline blends was greatest in Iowa (33%), Kentucky (32%), Nebraska (31%), Indiana (22%), and Illinois (20%). In South Dakota, approximately 15% of gasoline sales were made up of ethanol-gasoline blends.

More than 70% of the fuel alcohol in the U.S. is derived from corn. Such grains as wheat, milo, and barley account for about 11%. The 230 million bushels of grain used for ethanol production in the U.S. in 1985 was the equivalent of 2.6% of that year's corn crop. Molasses constitutes the feedstock for 11% of this country's ethanol production, while miscellaneous feedstocks and waste products make up 6%.

Recent Economic Assessment

A recently released economic study on alcohol fuels by the U.S. Department of Agriculture (U.S.D.A.) has caused much interest and some controversy in farm-country. In the U.S.D.A. study (Fuel Ethanol and Agriculture: An Economic Assessment, U.S.D.A. Agricultural Economic Report No. 562, August 1986, by Gavett, Grinnel, and Smith), the various costs and benefits of continued, or possibly expanded, Federal subsidies to fuel alcohol production were analyzed. The principal Federal subsidy at present is the exemption of 6 cents per gallon of the Federal gasoline excise tax on blends containing at least 10% alcohol. With a 10% blend--1 gallon of alcohol to 9 gallons of gasoline--this amounts to a 60 cents per gallon

alcohol subsidy. Authors of the U.S.D.A. study estimated costs in the form of this subsidy and in the form of higher consumer food prices resulting from grain being diverted to fuel production. They estimated benefits of fuel alcohol programs in the form of higher net farm incomes resulting from increased demand for grains, as well as in the form of reduced governmental expenditures on farm commodity programs.

The study's authors concluded that the costs of further expanding ethanol production would exceed the benefits. While net farm income would increase as a result of expanded ethanol production, and there would be associated savings in the U.S.D.A.'s farm commodity programs, those "benefits" would be more than offset by the "costs" of foregone Federal tax revenues (due to the excise tax exemptions on alcohol-blended fuels) and by higher consumer food prices. The controversial bottom-line statement in the U.S.D.A. study is that "Direct cash payments to corn growers would be more economical than attempting to boost farm income through ethanol subsidies."

This is not the place to dissect and examine the methodology and assumptions used in the U.S.D.A. study. The study does serve to dramatize several issues, however. First, with oil prices having fallen by more than 50% during 1986, and with major recovery in oil prices being unlikely until at least sometime in the 1990s, it is difficult to be optimistic about further expansion of the ethanol industry without an increase in Federal subsidies. Second, although there is some trade-off between ethanol subsidies and expenditures on conventional farm commodity programs, there is evidence that the subsidy costs may exceed related commodity program savings. Finally, there could be consumer (in addition to taxpayer) resistance to expansion in fuel ethanol subsidies because of higher food prices at the grocery store. Of course, that is also just as likely to be true of Government programs to substantially reduce the production of U.S. food and feed grains.

Research at SDSU

A series of multidisciplinary studies on fuel alcohol production has been carried out at SDSU since the late 1970s. Results have been released in Agricultural Experiment Station bulletins, journal articles, Extension Service fact sheets, news releases, and certain issues of this Economics Newsletter. While corn was focused on in most of the early work, other feedstocks, such as fodder beets and sweet sorghum, have received attention more recently. Results of a recently completed study on fodder beets (Alcohol Fuel from Fodder Beets: Economic Feasibility of a Small-Scale Plant, SDSU Agricultural Experiment Station Bulletin 699, August 1986, by Dobbs and Habash) are available from local Cooperative Extension Service offices in South Dakota or from the SDSU Economics Department.

The economic evaluation of fodder beets as a fuel alcohol feedstock focused on a small- or community-scale processing plant, as has other SDSU research with corn as the feedstock. A fermentation process very different from that for corn was used in this evaluation, however. Under some conditions, it was found that fodder beets might be competitive with corn as an alcohol feedstock. However, fodder beet storage for year-round production, and, hence, for lowest per gallon costs, could be a problem with present technologies. The overall conclusion of the SDSU research has been that neither corn nor fodder beets are presently economically feasible in small-scale plants that do not produce anhydrous, or water-free, alcohol. Other research and experience over the past several years has also generally indicated economic feasibility difficulties with small-scale plants. The economic feasibility of many small-scale plants, even with available subsidies, awaits substantially higher petroleum prices.

Look Ahead

The present very low market prices for corn serve to partially offset the reduced ethanol returns associated with depressed petroleum prices. However, were it not for the Federal and State excise tax exemptions on fuel alcohol blends, fuel alcohol production would not be feasible in the present fuel energy market in most of the more efficient large-scale plants, even using corn costing as little as $1.00/bushel--if all capital, feedstock, and other costs are to be covered. Fuel alcohol plants already built will continue to operate as long as they can cover feedstock and other variable costs and at least some of their fixed costs (unless they have alternative products they can switch part or all of their capacity to). The reduced corn prices, coupled with the current Federal and State subsidies, help keep those plants operating. However, there is little or no profit incentive for construction of new fuel alcohol plants in the current energy environment, even with depressed food and feedgrain prices.

Current Federal excise tax exemptions are scheduled to expire at the end of 1992. With 3- to 5-year planning and construction periods for large plants, there would be little time for plants only on the drawing boards now to benefit from those exemptions after they begin production. This further underscores the dim prospects for much further expansion of the fuel alcohol industry over the next few years.

South Dakota passed new legislation in the 1986 session to stimulate fuel alcohol production within the State's borders. Under this legislation, which took effect on July 1, 1986, a direct fuel alcohol payment of 30 cents per gallon of alcohol can be made to South Dakota producers of alcohol (using plants not built prior to July 1, 1986, at least for the first two years of the program). This direct subsidy program is scheduled to run for 4 years (through June 1990), with annual payment limits. Cumulative payments under the program can not exceed $8 million. To partially offset the costs of this program, the exemption from State excise taxes for alcohol blended fuels was reduced from 3 cents per gallon to 2 cents per gallon. This change could recoup about $1.8 million in tax revenues over a 4-year period.

Although the direct subsidy (30 cents per gallon) is only provided through June 1990, the legislation is written to be effective through June 1992. Let us assume the following: (a) the exemption for alcohol blends from State excise taxes remains at 2 cents per gallon from FY87 through FY92; (b) the $8 million (cumulative) direct subsidy allowed is paid out, but there is no change in the law to raise the cap or extend payments beyond FY90; and (c) gasoline and gasohol (alcohol-blend) sales in South Dakota were to remain constant at FY85 levels throughout the 6-year period from FY87 through FY92. Were those assumptions to hold true, the new legislation would involve a State cost, in terms of direct outlays and forgone excise tax revenues of $5.3 million over and above costs that would have been incurred had no direct subsidy been introduced and had the alcohol blend excise tax exemption been left at 3 cents per gallon. Many things could occur to change this State cost, however, including the very likely possibility that there will not be sufficient eligible in-State production to utilize anything close to the maximum $8 million outlay.

Both Federal and State levels of government face difficult challenges and choices in the years ahead. Rural areas need to develop new markets for agricultural products. Fuel from agricultural biomass has been viewed as one answer to this problem. However, analyses show that substantial subsidies will need to continue for a number of years for there to be any significant expansion in the fuel alcohol industry--and probably even to continue utilization of all of the existing capacity. At the same time, all levels of government are facing budgetary stress. The choices will not be easy!