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THE POTENTIAL FOR ALCOHOL FUEL PRODUCTION

by

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Major attention is being focused on alcohol fuels as one alternative to increasingly costly imported oil. Just what is the physical and economic potential for alcohol fuels from biomass?

Biomass resources available

A recent study by Purdue University examined the U.S. potential for alcohol (ethanol) production from conventional crops and their residues. Types of biomass included in the Purdue study were corn, small grains, sorghum, rice, sugarcane, and forage crops. The 1978 crop year was used as a data base.

The potential for ethanol production, by source, is summarized in Table 1. Potential ethanol production from crop residues was estimated to be from 1.5 to 2.3 billion gallons per year. This was based on the amount of residues that could probably be removed from the nation's cropland without diminishing soil quality or increasing soil erosion problems. The estimate also made allowance for the proportion of residue that could likely be collected and transported economically to fuel processing plants. Three-fourths of the total usable residues are concentrated in 13 states, with Minnesota ranked at the top and five other north-central states ranked in the top six. South Dakota ranks thirteenth.

In determining the potential for energy production from conventional crops, the Purdue study estimated the land which might be available for increased crop acreage (using 1978 as the base.) The study included only lands that could be brought into production without additional irrigation. It was estimated that from 30 to 50 million acres of land, exclusive of set-aside acres, might be available for expanded crop production in the U.S. This would have the potential for producing 1.95 to 3.25 billion bushels of corn, which could be converted into 5.2 to 8.7 billion gallons of ethanol. Including 1978 corn and wheat set-aside acres would add the potential for nearly 600 billion bushels of additional grain, convertible to 1.6 billion gallons of alcohol. (Table 1)

Table 1: Biomass Sources of Ethanol Production in U.S., Based upon Purdue Study

Source	Potential availability	Potential ethanol production (Bil. gal.)
1. Crop residues	39.7-58.7 Mil. tons	1.5-2.3
2. Crops (in corn equivalents)		
a. From available cropland not now cropped (1978)	1.95-3.25 Bil. bu.	5.2-8.7
b. From set-aside acres (1978)	596 Mil bu.	1.6
3. Forage	68.2-153.3 Mil. tons	2.7-6.0
TOTAL		11.0-18.6

Forage production on about 100 million acres of the nation's pasture and hayland could also be increased, according to the Purdue study. Through such measures as increased fertilization and more frequent cuttings, yields might be increased to produce from 68 to 153 million tons of forage, convertible to 2.7 to 6.9 billion gallons of alcohol.

The ethanol producible from crop residues, additional crop acreage, and added forage yields could total 11 to 18.6 billion gallons. This compares to current U.S. gasoline consumption of around 120 billion gallons per year. Thus, ethanol could theoretically replace approximately 10% to 15% of the gasoline portion of U.S. energy consumption. (However, gasohol is currently limited to 10% alcohol in the alcohol-gasoline blend which constitutes it.)

Comparative costs of fuel sources

The above magnitudes represent technical potential and not necessarily economic feasibility. We can get some idea of the potential for biomass fuel sources being economically feasible by looking at Table 2, also drawn from the Purdue report. Bear in mind that costs noted in the table were estimated in mid-1979, and some data would be different today. Nevertheless, the overview is useful.

Table 2: Costs of Liquid Fuels from Alternative Sources, Based upon Purdue Study

	Range of Costs	
	$/barrel	$/gallon (wholesale)
1. Gasoline from imported crude oil	23	.88
2. Gasoline from enhanced oil recovery	15-20	.57-1.90
3. Coal liquids	25-42	.95-1.60
4. Methanol from coal		.40-.80
5. Fuel from oil shale	25-50	.95-1.90
6. Ethanol from grain		1.00-1.20
7. Ethanol from crop residues*		1.15-1.35

*Some of the technologies included in this range of estimates are still in the developmental stage.

With imported crude oil at $23 per barrel, the wholesale price of gasoline, exclusive of excise taxes, was estimated to be about $0.88 per gallon. This was less than even the lowest estimate of costs for ethanol, fuel from oil shale, and coal-based liquid fuels. Imported oil prices have risen since the above estimates were made, and will likely continue to rise substantially during the 1980s. However, since energy is used in producing crops and in processing them into fuels, ethanol costs will also rise, unless offset by new technological breakthroughs. Because of the unknowns about future relative cost changes among the fuel sources listed in Table 2, it is difficult to predict if and when ethanol from agricultural crops and residues will be economically competitive--in the absence of subsidies--with imported oil. However, given the estimated costs, the Purdue researchers concluded that a number of the sources shown in Table 2, including ethanol from grain, can and probably will be drawn on as the nation attempts to move away from its extremely heavy reliance on imported oil.

If ethanol does assume growing importance as a fuel source during the 1980s, it remains to be seen what the overall make-up of the ethanol industry will be. For example, more research is needed to determine if small - and - medium scale plants can economically produce a grade of fuel that could be used to form some significant portion of the ethanol supply. Alternatively, will most of whatever potential is achieved be produced in the type of large scale plants now supplying 200-proof alcohol for the commercial gasohol market?

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