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EDITORIAL

Renewable Liquid Fuels

At one time, the United States was a preeminent producer and exporter of petroleum. In 1994, U.S. imports of petroleum and its products exceeded local production. In the future, imports of oil will constitute an increasingly important factor in an imbalance of foreign trade and in a probable further weakening of the dollar. Were the availability of liquid fuels to be suddenly curtailed, the U.S. economy and life-styles would be severely impacted.

The level of efforts in the United States to develop alternative fuels has not been commensurate with either the peril or opportunities for minimizing it. A program* aimed at obtaining ethyl alcohol from biomass has made substantial progress. Estimated costs per unit volume of liquid have been reduced but are still not competitive. In principle, fast-growing trees and other vegetation could form the raw material from which much of the nation's need for liquid fuel might be met. But substantial long-term pilot plant experience is missing.

Biodiesel oil is a potentially important enhancer or displacer of conventional diesel fuel. It can be prepared from many renewable raw materials that include soybean, rapeseed, and palm oils. The viscous, high-boiling triglycerides are processed to obtain more volatile methyl esters of the straight-chain fatty acids. Biodiesel oil is in the early stages of development, but specimens of it have undergone many successful long-term tests in buses, trucks, and tractors. In some of the tests, a mixture containing 80% conventional fuel and 20% biodiesel oil has been employed. Tests using 100% renewable fuel have also been successful. In both instances, the results were superior in many ways to those noted when conventional diesel fuel was employed. The renewable fuel is practically sulfur-free. It is nontoxic and quickly biodegradable if spilled. On combustion it produces lesser amounts of toxic particulate matter. Only minor adjustments of existing engines are required to attain optimum performance. Biodiesel fuel is compatible with the current distribution infrastructure.

Reducing the threat of a major greenhouse effect is a potential benefit of large-scale production of renewable liquid fuels. To achieve this goal, the greenhouse gases released attendant to production and processing of raw materials must be minimized. The energy expended in the growing of trees as a raw material for alcohol production is minimal. However, to convert wood to alcohol cost-effectively, processing plants of considerable size and complexity would be needed. To reduce capital and operating costs, they would need to be operated all year around. Their supply of raw material would be gathered from many miles away, entailing consumption of liquid fuels.

In the production of biodiesel fuel, different circumstances prevail. The crude oils could be squeezed from seeds by farmers using simple equipment. Moreover, the chemistry of conversion to biodiesel fuel is low cost and relatively simple. It could be conducted in small facilities in rural areas. The big challenge in achieving competitive energy and financial costs for biodiesel fuel lies in creating cheap sources of renewable oils. In the United States, much of the biodiesel oil that has been tested extensively has been derived from soybeans. The beans consist mainly of protein. Only 20% is soy oil. Thus, most of the photosynthate of the plant is devoted to purposes other than making oil. Some other plants have seeds containing as much as 50% oil. In Europe, rapeseed that has about 40% oil has been used as the source of the biodiesel oil that has been extensively tested there. The principal energy and financial costs of producing biodiesel oil arise from obtaining the raw oils. If soy oil were used, the price of finished liquid would be two to three times that of conventional diesel oil.

Prospects for future reduction of the costs of raw seed oil seem excellent. Sooner or later, species of plants will be identified that through conventional selection, breeding, and DNA manipulation will be low-cost high yielders of desirable raw oils. This would lead to a reduced net production of greenhouse gases. A further benefit to the United States could be a needed strengthening of rural America.

The United States and other countries should accord enhanced priorities to R&D devoted to renewable liquid fuels. In the United States favorable regulatory treatment for biodiesel oils would speed their use and the development of cheaper supplies.†

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