ENERGY: CAN AN ADEQUATE FOOD SUPPLY BE PRODUCED?

by

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The title assigned to this section of the program by the organizers of the Forum raises a multitude of issues.

What is an adequate supply of food? How far in the future are we considering? What level of prices are we willing to accept? Should we continue to produce for export markets? Are there alternative energy sources? Should we turn to less energy intensive technologies?

In order to gain some insight into these questions regarding energy and food production it is necessary to put energy use in perspective.

Energy Use

In 1978 the United States consumed 78 quadrillion Btu of energy (figure 1). Nearly half of this use in the form of refined petroleum products. One-fourth came from natural gas. Slightly less than 20 percent came from coal and 3 percent each from nuclear and hydro power.

Of the total, residential consumption used 38 percent, transportation 26 percent, and industrial use inlcuding agriculture, 36 percent (figure 2). The food system consumed about 6.4 quads or 8 percent and agricultural production required about 2.6 percent, when the energy in fertilizer and pesticides is included (table 1).

Six months ago we were in the middle of an energy shortage. Stocks of middle distillates were extremely low (figure 3). Gasoline supplies tightened and special provisions were made to supply agriculture with fuel for the planting season.

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Concern was expressed of the availability of fuel for the heating season.

Today we are assured supplies of heating oil through the winter, but gasoline supplies are again tightening and supplies of diesel fuel and gasoline remain uncertain for the next year. Energy prices, beginning with crude oil from OPEC, have increased sharply and are continuing to rise, and we are dependent on oil imports for nearly 40 percent of our liquid fuel supplies (figure 4).

What assurance do we have that we will be able to produce a crop next year and 10 years from now and what kinds of problems do we face? Before I address these questions I would like to review a little of the history of energy use in agriculture.

Historical Significane of Energy in Agriculture

Energy has had a major role in shaping U.S. agriculture. Beginning in the 1930's, with the advent of the mass production of farm tractors, energy in the form of fossil fuels has dramatically changed the structure of the farming sector. The agricultural economy of today, which employs 26 percent as much labor as in 1930 and produces twice as much output, was developed using low cost fossil fuel and the earnings were transferred to labor, capital and land. The mechanization of agricultural reduced the demand for labor and encouraged increases in farm size. Production of farm products shifted to areas that allowed large scale mechanization and crop specialization. As a result agriculture all but disappeared in some sections of the country and increased rapidly in others. Agriculture in the Northeast could not compete with the flat and fertile Corn Belt or with the irrigated Southwest.

Energy in the form of nitrogen fertilizer also played a major role in shaping U.S. agriculture. Production of anhydrous ammonia was expanded rapidly during World War II as the feedstock for our munitions plants. Following the war this ammonia production was converted to peacetime use in fertilizer and nitrogen fertilizer prices fell sharply. During the 1960's improved technology led to further expansion of the anhydrous ammonia industry, which used low cost natural gas as the feed stock. With nitrogen prices low relative to commodity prices, fertilizer use increased rapidly and crop yields advanced continuously.

In 1973 the era of low cost energy ended. And, we discovered that we did not have a secure, dependable, supply of liquid fuels. The fragile nature of the fuel supply has been re-emphasized in 1979.

Unique Problems in Agriculture

The major problems this possess for U.S. agriculture and the nation as a whole are two: (1) rising energy prices and (2) short term disruptions in supply. Although rising prices can create havoc with our budgets and our pocketbook, energy supply disruptions could have disasterous impacts on our food supply.

Agricultural production is particularly susceptable to supply disruptions because of the biological nature of the production process. Farmers must have fuel to plant their crops, and in some cases use one-half of their total annual needs with in a month. If no fuel is available in that period the crop is lost for the year. Once planted a crop can not be delayed but must be harvested. When harvested it must be dried, stored or processed. Dependability of supply therefore means the difference between a crop and no crop.

Agriculture is more dependent than the total economy on liquid fuels and therefore, the potential to be more seriously impacted by supply disruption.

Nearly 80 percent of the energy used in agriculture is from petroleum products compared to less than 50 percent for the total economy. And, in general agriculture has fewer alternatives available as energy sources.

In 1978 the U.S. food system from the manufacture of fertilizer and pesticides through to the consumer used about 6.4 quads of energy or eight percent of the U.S. total.

Farm production alone used 1.2 quads or about 1.5 percent. When energy included in pesticides and fertilizer manufacturing is included total farm use reaches about 2 quads.

Although farm use of fuel is a small part of the U.S. total. The economic and social destruction that could be caused by a shortage of fuel for agriculture far outweighs the impact in other sectors of the economy.

Energy Goals

To avert the problems of supply disruption and mitigate the impact of rising fuel prices, efforts to develop a comprehensive energy policy for the country have been underway since 1973. During this process a broad set of energy goals has evolved. The primary goal of energy policy is to lessen our dependence on uncertain supplies of fossil fuels by conserving oil and natural gas, expanding our production of coal, developing our oil shale resources and converting to renewable sources of energy such as solar and biomass. Within this context the primary goals for agriculture and the food system are; to assure adequate supplies of energy to the food system, to conserve fossil fuels in agricultural production and processing, to develop technology for the production of energy in agriculture, to shift to renewable energy sources where possible and, to develop our coal and oil shale

resources with a minimum impact on agriculture and rural areas.

Development of systems for achieving these goals and the implimentation of these methods will be at the fore front of national policy debates for some time in the future. We in the agricultural sector must take the initiative in establishing the types of energy policy that will assure us that we can produce an adequate food supply.

Alternative Sources

In the general debates over our alternatives some have suggested that we in agriculture return to a less mechanized form of production. Given the magnitude of our domestic food need and the quantities of food and feed that we export to other nations, a less mechanized agriculture is impractical if not impossible. However, by changing the combination of inputs, adopting energy saving technology and shifting to renewable sources of energy we can reduce our dependence on fossil fuel. Farmers have already adopted many conservation practices. As fuel prices rise their efforts to conserve fuel will be intensified.

In addition to conservation, alternative sources of energy particularly use of direct solar energy in crop drying and in heating of livestock shelters is nearly at a competitive cost level with fossil fuel. Solar hot water systems are now competitive with electirc resistance heating in most regions of the country and will be competitive with oil in this decade. Such applications of solar energy are the first in a series of technologies that are expected to reduce the uncertainty of fuel supplies.

Other alternatives such as solar electric pannels and significant contributions from wind energy are further in the future.

Agriculture As An Energy Producer

As well as being a producer of food, agriculture has a potential to become a supplier of a small part of our energy through the production

and utilization of biomass crops.

Currently Congress is debating several bills that would speed the production of alcohol from agricultural and forest products and waste and some have suggested that as much as 10 percent of the 100 billion gallons of gasoline that this country consumes annually could be replaced by alcohol. At current prices, alcohol requires a rather major subsidy to be cost competitive with gasoline and the major constraint on alcohol production and use is the limited number of distilleries and the cost production rather than the technical ability to use the fuel. However, within the next ten years new technology that would make alcohol from cost competitive with other liquid fuels will likely be developed. But, there are limits to the quantity of land that can be diverted from food and feed production to fuel production. We must be careful not to disrupt our food supply in our effort to produce energy.

A major effort in the production of alcohol from agricultural products could disrupt crop prices, livestock prices, land values, and farm marketing patterns. If large scale technology was used to produced alcohol, farmers would be the captives of new buyers for the product since the buyer would require assured supplies. If small scale technology was used it would change the capital intensity of agriculture and require the farmer to divert time from crop and livestock production to fuel production and limit his returns from the sales of farm products.

I draw no conclusion concerning the desirability of alcohol production but suggest that a great deal needs to be done in the way of thorough research of the economic issues before we venture into a major program.

Looking Forward

To answer the question posed by the title of this paper we must look forward and attempt to sort out some relative certainties from a future that

is largely unknown.

With respect to energy, these certainties would appear to be; (1) Continuing price increases for energy which will increase production cost, (2) Continuing uncertainty for sometime over the availability of imported fuel, (3) Continuing debate of agriculture priority in standby energy allocation or rationing programs and, (4) Increasing pressure for agriculture to become a supplier of enegy.

These certainties will in the longer run result in 1) increased use of high technology substitutes for fossil fuel, 2) major efforts of energy conservation and, 3) increased capital use to offset energy prices.

These pressures will most likely result in continuing farm enlargement because of economies of size. Also, farm operators will find it necessary to become informed on a new and more complex set of technology which will be required to operate solar and wind systems and to produce alcohol and other fuels from biomass. To provide these skills our agricultural research and extension programs will be required to bring energy conservation, energy production, and use of alternative energy sources to a much higher level of priority.

If we are successful in bringing our liquid fuel demand in line with our domestic production, plus some quantity of imported fuels that is stable in supply, if we develop our more abundant supplies of coal and oil shale, and if we make major studies in bringing solar energy in to the range of commercial feasibility we can look toward a more stable and secure future with respect to energy.

I am confident that we have the technical and political knowledge to bring about this more secure future. And, that we can be assured that we can continue to produce an adequate supply of food for both our domestic and export needs.