

New Energy Sources For Agriculture



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CALIFORNIA'S AGRICULTURE is particularly dependent on low cost fuels, not only because it is highly mechanized, but also because power is required to draw irrigation water from wells and to lift canal water for transfer to higher elevations. Costs of transporting feeds, fertilizers and livestock also depend in part upon the availability and costs of petroleum fuels. Electrical power has become a preferred power source for many farming operations.

Natural gas is the starting energy source for manufacturing fertilizer nitrogen. Thus modern agriculture in California's low-nitrogen, relatively warm, semiarid climates is really based upon plants that grew many millions of years ago. Similarly, much of the "know how" behind our success in modern irrigated agriculture can be attributed to the ingenuity with which we have been able to exploit prehistoric "agriculture" in the interest of increasing the productivity of modern agriculture.

The 1970-1980 decade will see rapid shifts away from a century of complacency about energy supplies into concern about an "energy crisis." There will be new fuels but their costs will mount. Coal, the most plentiful of our fossil fuels, has become the first large-scale casualty of environmentalism. Demands for "clean fuels" have come about so rapidly that no one would have guessed a few years ago that by 1972, American corporations would be entering into negotiations with the Soviet Union for multi-billion dollar agreements to import natural gas from Siberia for consumption in the USA.

Prices for natural gas are rising in quantum jumps. Although gas was valued at 17 to 20 cents per thousand cubic feet at the well-head in 1970, the Federal Power Commission has recently allowed for a 50% price increase for indigenous gas passing state lines, and for the sale of imported Algerian gas at 90 cents. Siberian gas will come in—presumably in 1980—at about \$1.10 to \$1.25 per thousand cubic feet. Coal gasification is technically feasible, but from all present

indications, costs of synthesizing methane from coal would probably be at least as high as the costs of liquified methane from Siberia, Algeria, Libya, Saudi Arabia or Australia. Nuclear power for electricity looks more attractive with each passing week.

It has been our habit as plant scientists and instructors in agriculture to emphasize contemporary photosynthesis as the basic transformer of solar energy to food energy to the exclusion of other essential energy inputs. We need not apologize for having thought this way in the past, but the time has come for serious understanding of the role that fossil fuels have played in the great success story of America's agricultural productivity. As agriculturists, we must begin to assume active roles in earmarking non-farm energy resources for future agricultural use because modern agriculture has become thoroughly dependent upon the availability of non-renewable fossil fuels. We have reached a point in time when the food reaching the tables of American citizens costs as much or more in fossil-fuel energy than is represented in the food energy to be consumed.

I predict that the next major thrust of research will be in the application of nuclear power to California's agriculture, since nuclear power seems to be the cheapest—with due consideration for cleanliness—power source for the 1980's and thereafter. Nitrogen fertilizers from nuclear powered electrical generators, and hydrogen gas for fuel look particularly promising because "off-peak" electrical power can be used to make hydrogen by electrolysis. Electrolytic hydrogen has, for some time, been combined directly with nitrogen to form ammonia in India and Egypt (though not in the USA at present).

In the 1870's we looked to India and Egypt for guidance in developing irrigation for our semiarid Western States. Perhaps in the 1970's we will be looking to them again for new directions in contending with the USA's impending fuel shortages.