

letters

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ticular, helium shortages may forever preclude our use of high efficiency coal-fired MHD generators and superconducting transmission lines. Note that Peter Glaser, in his recent article "Solar power from satellites" (February, page 31), refers specifically to solar-powered Brayton-cycle engines using helium as their working fluid. Such engines are potentially important on Earth as well as in orbit. The near-ideality of helium gas is widely displayed in textbooks,² and the desirability of helium as the working fluid in a variety of heat-engine types (including Stirling-cycle) should therefore also be widely recognized. Helium is additionally useful as a reactor coolant, and is vital to future energy-efficient digestible commerce.

Why is our precious helium resource being so inexcusably squandered? The previous administration and Congress have failed to recognize any connection between helium and energy. The natural-gas industry did not wish to suffer the inconvenience of helium separation and management. The government wanted to "save" the expense of supervising the natural-gas industry in these activities. Let us be specific about what this means: the government has valued little pieces of paper with numbers on them more highly than it has valued our future helium-dependent energy options. It is difficult to find historical precedents for such monstrous stupidity, though the exchange of Manhattan Island for a few beads and trinkets does come to mind.

The scientific community must educate the present administration and Congress in these matters, and prod them to action. It would be appropriate to demand that no natural gas from the newly discovered Mexican deposits³ be allowed to enter this country until provisions are made for the separation and secure storage of all helium contained in this and other natural gas.

References

1. W. D. Metz, "Helium Conservation Program: Casting it to the Winds," *Science*, Vol. 183, 11 January 1974, pages 59-63.
2. D. Halliday, R. Resnick, *Physics*, Wiley, 1966, page 531, Fig. 21-3.
3. S. T. Atlas, W. J. Cook, "Energy: A Gas Bonanza," *Newsweek*, 1 August 1977, pages 61-62.

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Thinking small about energy

There seems to be a hysterical fascination these days with enormous systems to solve problems, like mass transit, or L-5 complexes, or solar-power satellites, or *in-situ* burning of shale deposits, despite the

rather clear evidence that small systems are generally preferred by the users (would you trade your car for a seat on the subway?) and probably are much more cost effective in the long run. (Think about a collection of household septic tanks compared to a municipal sewage system). About the only constant benefit of the massive systems is that they require massive government (that is, tax) funding, which provides massive income to the practitioners of the soft (as in solid sewage) sciences.

Think small about the energy shortage. There are techniques available that will permit a simple, inexpensive, batch-process conversion of cellulose of any form to alcohol, with a yield of the order of 100 gallons of ethanol per ton of raw material, with some additional byproducts. Processing of a batch takes a few days, could be done with most of the processing energy supplied by simple solar heaters, and could mostly be done right on the farm.

Input to such a converter can be any form of organic matter, such as sawdust, brush, orange peels, old newspapers, or jungle. The process is simple. The shredded raw material is digested for a day or two by an enzyme, at 50°C, to produce about 99% conversion of cellulose into sugar. The sugar is then fermented to produce alcohol (at room temperature), and the alcohol is distilled out at about 80°C, to give 99% ethanol. Here in Kentucky we have plenty of experts with practical experience on the last two steps.

Ethanol, if cheap enough, can replace petroleum for nearly all purposes, especially for fuel, although aircraft would have a bit of a problem because of the low energy content compared to hydrocarbons (about 50%).

"Cheap enough" can be of the order of 10¢ a gallon if enough cleverness is used in the design of equipment that can be run by farmers. Raw materials are no problem on a worldwide basis. There are vast acreages of useless jungle all over the Third World, and widespread use of an alcohol fuel economy would mean a redistribution of wealth from Arabia to places like Thailand, Indonesia, Central America and Africa, coupled with a great decrease in the energy cost to developed countries.

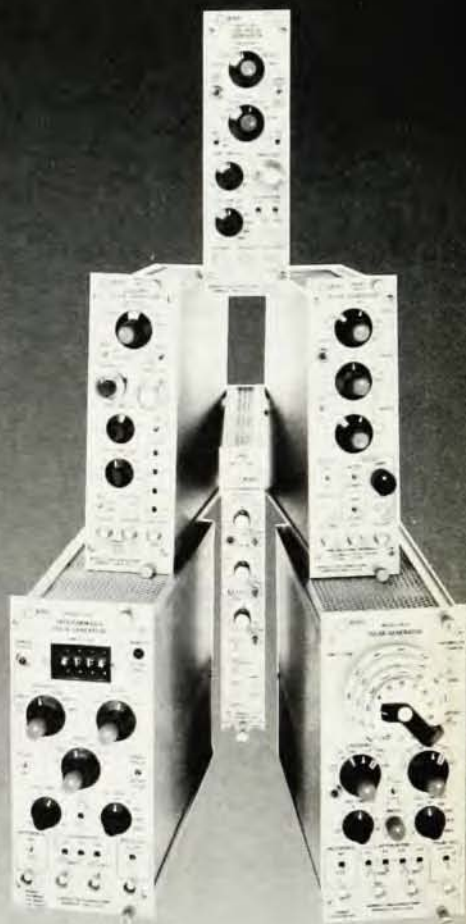
To top it off, alcohol, if not drunk, is absolutely non-polluting. All of the CO₂ produced originally came from the air, and all of the heat produced came from sunlight falling on the plants.

Finally, there is no shortage of biomass. The amount of unwanted plant life, if converted to alcohol, would supply the world's liquid-fuel requirements for many decades to come. And it could be done now, since all of the technology is immediately available.

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