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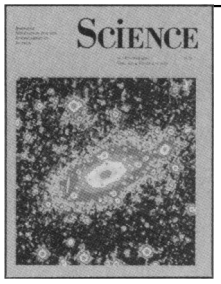

COVER A false-color image of the core of the cluster of galaxies Abell 2029. Most of the objects are galaxies which reside within the halo of the massive giant that dominates the cluster. This galaxy is one of the largest and most luminous in the universe, 100 times brighter than our own Milky Way. See page 539. [Photograph by Juan M. Uson, Stephen P. Boughn, and Jeffrey R. Kuhn]

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Transportation Fuels

Events in the Middle East and the high price for oil imported during August, September, and October make timely a comment on our energy policies. We continue a downhill slide with respect to security of our supplies of liquid fuels. Between 1985 and 1989 our dependence on imported oil increased from 27 to 46%. We are well fixed with respect to coal and oil shale, and prospects for natural gas have improved. But domestic production of oil continues on an inexorable decline while demand for liquid fuels has expanded. A major factor is increased consumption in the transportation sector, which accounts for 65% of demand. The low prices for motor fuels that prevailed before the August rise resulted in consumer choices of luxury vehicles and in expanded consumption of gasoline. Unless current trends are changed, we will be seeking to import more than two-thirds of our liquid hydrocarbons before the end of this decade. Vulnerability to attenuation of supplies then will be great. Political and financial conditions can deteriorate rapidly but the time required for orderly conservation or for increasing supplies of domestic alternative fuels is on the order of a decade.

For the short term, our vulnerability is diminished by the existence of the strategic petroleum reserve (SPR), which currently contains nearly 600 million barrels of oil. This is equivalent to about 75 days of total imports. Obviously, the SPR would sustain normal usage for much longer if the interruption were only partial. But the SPR would not last indefinitely whereas failure to obtain imports might. Costs of oil imports and our inability to compete well in global trade have already led to an enormous foreign debt. This combined with continuing budgetary irresponsibility could lead to a dollar no longer acceptable in payment for oil imports.

One of the most effective means of decreasing dependence on foreign oil would be to impose a large tax on motor fuels, with the proceeds devoted to creating a variety of synthetic supplies. At the moment this is politically unthinkable, but it might become feasible if many U.S. lives were lost on foreign soil in defending supplies. Then a modest move to require manufacturers to produce automobiles with better mileage that is now bogged down in Congress might also become successful.

Creation of an expanded domestic capability for producing synthetic fuels would reduce vulnerability to interruption of oil supplies while serving to create a lid on the price that foreign oil producers might find it practical to charge. Large amounts of synthetic fuels could be obtained from coal or oil shale. A modest R&D program has substantially reduced costs of liquefying coal. The estimated price of a good synthetic liquid is now about $35 per barrel. With further effort, an additional reduction is possible. Scientists and engineers at Lawrence Livermore Laboratory have developed a process for obtaining oil from shale that they once estimated might cost only $25 per barrel.

The Office of Technology Assessment has prepared a report* on alternative motor fuels that factors in environmental considerations including those about ozone and the greenhouse effect. Two of the fuels mentioned seem particularly useful though they would fill only part of the need. Methyl alcohol could be imported or obtained from biomass, methane, or coal as feedstocks. Use of natural gas as a motor fuel would require addition of a storage vessel to existing vehicles, creation of retail supply facilities, and ultimate design changes to future cars. Worldwide some 700,000 vehicles are fueled by natural gas.

One of the few bright spots of our energy picture is improvement in the potential supply of natural gas. The Gas Research Institute and others have fostered successful R&D. This combined with a federal tax credit has led to rapidly expanding exploitation of methane located in coal. The credit amounts to about 80 cents per million Btus. Expansion of production occurred when spot gas was fetching only $1.20 per million Btus. As of early October the cost of imported oil was more than $6 per million Btus. As a result, energy contributions of natural gas are destined to exceed those of domestic oil. Modest support of R&D and a tax credit have facilitated creation of means of exploiting an important energy resource.

There are large proven reserves of oil in the Middle East. When the current crisis is resolved, prices will probably drop. Private enterprise cannot be expected at that time to develop alternative domestic supplies unless their creation is encouraged financially or mandated.—PHILIP H. ABELSON

**Replacing Gasoline: Alternative Fuels for Light-Duty Vehicles* (Government Printing Office, Washington, DC, 1990).