on anything like the present scale. Mankind's ultimate survival requires no source of inexhaustible energy other than the sunlight that makes the crops grow.

The argument for "inexhaustible energy," with its inexhaustible dangers to present and future generations, is really an argument that the habits of material consumption of the "affluent society" must be maintained at all costs. No doubt many will find it difficult to imagine life without a car in every garage and an electric toothbrush in every bathroom. But life can go on without them.

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Hydrogen and Power

Near the end of his discussion of a "hydrogen economy," Bockris (23 June 1972, p. 1323) lists certain difficulties that would be faced in the establishment of such an economy. His concern about the public's fear of hydrogen is really no problem at all. The public already accepts a natural gas distribution system that spreads throughout the United States and the streets of most cities. Occasionally explosions and fires have been caused by gas leakage from this system, but, on the whole, the system operates both efficiently and safely.

A primary problem in Bockris' proposals could be the reluctance of the public to give up the convenience of the electrical distribution system that currently gives them essentially anything they want at the flip of a switch. Although a considerable amount of literature has appeared on the subject of fuel cells, they are not yet a part of the economy of the United States and no one really knows what problems would arise if we attempted to use fuel cells in large numbers to supply the power needs of individual homes.

Whether the difficulty Bockris lists as "conservatism" is really a problem depends on his definition of conservatism. If he is thinking of the economic inertia that is built into existing systems, then I agree. The power companies of the United States have billions of dollars invested in electrical distribution systems, and they continue to build more as the demand for electric power increases. Since the supply of natural gas is decreasing, some experimentation by the gas companies appears to be the most practical way to determine whether the system he proposes could actually be made feasible on a commercial basis.

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Having easily available electrical power is a primary aspect of the hydrogen economy. Indeed, one of the few ways whereby we can easily have abundant electricity in the future is by using hydrogen as the medium for transporting energy from great distances (from large atomic reactors on floating platforms, or solar energy farms in remote locations). The hydrogen could be reconverted most efficiently by fuel cells, or it could be used to run internal combustion engines and local power houses.

The fuel-cell era of 1958–1968 ended when NASA developed fuel cells which it considered satisfactory for auxiliary power in space. There has been little progress since, especially in the conversion of hydrocarbons, because no substitute for noble metals has been found (*1*). It has also been difficult to find a cheap catalyst for fuel cells; one prospect is nickel.

The commercial feasibility of a hydrogen economy depends largely on the cost of hydrogen at the point where the power is used; this is the cost of energy at the source, plus \$0.001 per kilowatt hour per 1609 kilometers over which hydrogen is transported. Thus, an advantage of the hydrogen economy is that the original source could be several thousand kilometers distant, a useful aspect if the source is solar. Cost comparisons made in the past between new and conventional sources will have to be revised. In thinking of a hydrogen economy, we are thinking of the costs of fossil fuels at least 15 years from now. The indication is that the cost of energy from conventional sources will then be several times the present cost.

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