GUEST EDITORIAL

Strong Candidacy of Hydrogen for Clean Energy

In the world as a whole we are now confronted with a remarkable situation regarding the relationship between environment and discussions of energy supplies for the future.

On one hand we have:

(1) Recalculation of the CO_2-balance as presented by NASA's Goddard Space Center which has concluded that there is a possibility of the world's general temperature increasing by only 1°C by the year 2000. This calculation represents a drastic revision of other estimates which have been made so far, and the accompanying prediction of an up to 8°C temperature-rise by AD 2030* which would presage the end of agriculture in such areas as the wheat belt of the United States.

(2) The contribution of NO_X from automobiles, with the consequent formation of ozone, is having a devastating effect on forests, particularly in Europe, and has been the subject of much discussion now amounting to anxious debate.

(3) The corresponding 'acid rain' problem is more and more under discussion as the nuclear accident at Chernobyl illuminates the dangers of any nuclear solution to our future energy problems.

On the other hand, in the numerous discussions of these problems in the newspapers and other 'media', hydrogen as an alternative among future sources of energy is scarcely even mentioned, let alone given the leading position which we feel it should have. For there could be a virtually complete solution of the pollutional problems of the environment if only hydrogen from water were used as a medium of energy from solar sources (or perhaps from nuclear† ones if the reactors were placed sufficiently far—at least 500 miles [800 km]—from city centres), and also perhaps in an intermediate stage as a medium for energy from coal (if coal plants could discharge their CO_2 to the ocean depths). Thus, with hydrogen as a medium of energy, water being split to obtain the hydrogen, and upon combustion the hydrogen returns to water, there could be complete cyclicity, with no net pollutants.

The concept of this simple and virtually complete solution to the world's energy and concomitant pollutional problems has not yet become recognized even among the conscious and concerned public, which of course means that there is, as yet, no possibility of political action.

Further Pertinent Factors

Two other considerations affect the hydrogen situation at the present time:

(a) Plans are being made in the US and England for a suborbital vehicle to enable air transportation speeds to be increased to about ten times their present average. It will be fuelled by hydrogen.

(b) Increasing numbers of industries are becoming non-viable because they pollute the environment and are being closed down by the Environmental Protection Agency in the United States and its counterparts in other industrialized countries. However, those industries could be saved if they would change to hydrogen as their main fuel, thus becoming virtually non-polluting.

One considerable difficulty that is encountered in practically all discussions about 'the Hydrogen Alternative' is that even those proponents who see the situation broadly, point to the fact that making hydrogen from water costs about three times as much as the present price of oil, and therefore would be too expensive. But we should remember that the price of oil at present is abnormally low, and is not likely to remain at this level for many more years. Moreover, the real answer to the cost problem is to look at the overall picture—at the 'real economics' instead of at the limited economics as now seen and widely practised.

* A referee comments that 'The temperature rises from CO_2 are still uncertain and any mention of a possible rise of 8°C gives an exaggerated view.'—Ed.

† It should be pointed out that hydrogen from nuclear reactors would be very expensive and would require prior acceptance of nuclear power.—Ed.

Environmental Conservation, Vol. 13, No. 3, Autumn 1986—© 1986 The Foundation for Environmental Conservation—Printed in Switzerland.

Real Price of Present-day Fuels

How should one calculate the present price of fuel? Is it simply the cost to the manufacturer *plus* a certain percentage, or is it this cost *plus* the actual cost to the public in all ways including pollution? If the latter is duly considered, the situation of course changes radically. It has been calculated that the pollutional cost of continuing to produce fossil fuels (for example synthetic fuels from coal) would be about US $8 per gigajoule, equivalent to more than $1 per gallon (3.785 l) of gasoline. Thus, if one took into account the cost of pollution from using fossil fuels, the expense would be more than doubled, and instead be near the cost of using hydrogen.*

There is, moreover, another aspect of hydrogen's cost which makes it cheaper than it seems, namely transportation. Thus, in urban transportation, hydrogen burns at an efficiency of about 50% more than that of gasoline, and this, together with the other considerations, makes its cost roughly the same as that of gasoline.

The energy seated in the hydrogen to which we are referring would be solar-derived; but, as already indicated, it could be derived from nuclear sources as well (and even from coal, at least on a temporary basis).

Towards a Hydrogen Economy

What kind of programme would be required to attain a 'Hydrogen Economy' and thus solve our pollutional problems for the foreseeable future? The research programme needed on hydrogen is a very large one because, of course, although the basics of dealing with hydrogen have long been known, we need to work on the large-scale production of hydrogen from water. We also need all manner of engineering research to be done on hydrogen—for example, how to store it, transmit it, etc. Estimates in these areas exist, but they are in their infancy.

It seems reasonable to suggest that the amount of money devoted in each country to hydrogen research should be of the same order of magnitude as that devoted at present to nuclear research. But currently in the USA, the federal Department of Energy has a budget for hydrogen which is less than $100 millions per year. The budget for research upon fusion energy alone is about $1 thousand millions per year, although fusion energy will expectably play no part in the energy economy for a time well past that when CO_2 pollution is predicted to raise the temperature of the world to unacceptable limits!

A basic need in all these matters is *knowledge* and its spread. That is why I'm grateful to the Editor of *Environmental Conservation* for having given me the courtesy of being able to communicate to his world-wide readership briefly as in this document.

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* A referee points out, however, that 'The use of hydrogen as a fuel may prove to be more dangerous than [that of] existing fuels'.—Ed.

https://doi.org/10.1017/S0376892900036201 Published online by Cambridge University Press