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—ABSTRACT—

WHY HYDROGEN PRODUCTION FROM NUCLEAR POWER?

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C. W. Forsberg and K. L. Peddicord

The demand for hydrogen (H_2) for the conversion of crude oil into clean fuels is growing rapidly. Hydrogen may someday replace liquid fuels. Nuclear power has been proposed for production of H_2 using thermochemical cycles where the overall net reaction is "$2\ H_2O + \text{heat} \rightarrow 2\ H_2 + O_2$."

The economics of nuclear energy facilities demand large facilities with power outputs between 600 and 4000 MW(th). The increasing scale of H_2 production is becoming compatible with the scale of nuclear power plants. The minimum economic requirement for using nuclear energy to produce H_2 by thermochemical methods, size compatibility between the nuclear and chemical plants, is now beginning to be met. Simultaneously, there are now environmental and security incentives. Using nuclear energy for H_2 production versus fossil fuels avoids: (1) generation of greenhouse gases and (2) dependence on foreign sources of energy.

Beyond these advantages, the technical characteristics of nuclear energy may match the production of H_2 as well as or perhaps better than the production of electricity. Nuclear energy production is a capital-intensive, low-operating-cost technology where siting considerations include seismic activity, availability of cooling water, and low population density. These characteristics suggest that the ideal product from a nuclear plant should be (1) easy to transport long distances to markets to minimize siting difficulties, (2) an energy intensive product in very high demand to match the large energy output of a nuclear plant, and (3) storable to allow efficient full utilization of the capital intensive plants. This is a description of pipeline H_2 with storage in the pipeline or in separate facilities. It indicates the potential for a good match between nuclear power and H_2 production.

Hydrogen growth projections, compatibility (economic, technical, and institutional) of using nuclear energy for H_2 production, methods of H_2 production from nuclear power, economic constraints, and related issues are described.