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Technical Evaluations by DOE, MIT & SAE Conclude that a Hydrogen Economy is Many Decades Away

In testimony before the House Budget Energy & Water Development Subcommittee on March 5th, Energy Secretary Spencer Abraham indicated that in spite of sharp increases in natural gas prices over the past year, the Department of Energy (DOE) would continue to focus on making hydrogen from natural gas in the FY 2004 budget request. Abraham indicated that technologies to manufacture hydrogen from coal and nuclear power plants would also be prioritized. This policy resulted in a February 16, 2003 Op Ed piece in *The New York Times* by Robert F. Kennedy Jr., an attorney for the Natural Resources Defense Council, titled "*A Bad Element: Why the Hydrogen Vehicle is a Big Mistake*" and a page one story on March 7th published in *The Wall Street Journal* titled: "*Hydrogen Fuel May Be Clean; Getting It Here Looks Messy.*"

Senior engineers from both industry and academia took up the debate to replace internal combustion engines with fuel cells at the recent World Conference of the Society of Automotive Engineers (SAE). The consensus of the primary speakers was that Bush administration's focus on switching from internal combustion engines to fuel cells was premature, if not irrational. The principal concerns involved fuel cell costs; hydrogen safety; refueling; storage and production. One approach is to use an on-board "reformer" to simply extract the hydrogen from gasoline, but according to John Wallace, a consultant for Ford Motor Company, placing such reformers on-board vehicles poses enormous technical problems. Moreover, according to Dr. S. Sol Penner of the Center for Energy Research at the University of California at San Diego, no one has yet figured out how to make hydrogen economically competitive with gasoline.

The Massachusetts Institute of Technology's (MIT) Laboratory for Energy and the Environment has also concluded that for the next 20 years, fuel cells will be impractical. The MIT study indicated that improving existing gasoline and diesel engines and transmissions and expanding the use of hybrid vehicles will provide a greater reduction in total energy use and greenhouse gas emissions than deploying hydrogen-powered fuel cell vehicles, assuming the hydrogen is made from natural gas. Indeed, according to the study, that was directed by Malcolm Weiss and John Heywood, a hybrid electric vehicle with a diesel-fueled engine could be twice as efficient as half as polluting as a natural gas-sourced hydrogen powered fuel cell.

The Phoenix Project

It is obvious that none of the above experts are aware of Harry Braun and his *Phoenix Project* proposal to shift from oil to hydrogen with wartime speed (i.e. within a 5-year period) by mass-producing megawatt-scale wind-powered electrolytic systems and modifying existing internal combustion engines to use hydrogen fuel. Approximately 12 million one-megawatt wind machines would be needed to generate all of the U.S. current energy requirements (i.e. 100 quadrillion Btus). Given that wind machines are similar to an automobile from a manufacturing perspective, and given that 17 million vehicles are manufactured each year in the U.S., the 12 million wind systems could be mass-produced and installed in less than 12 months once the tooling is in place.

Braun points out that because hydrogen is a “universal fuel,” it is not necessary to wait for fuel cells because hydrogen can power any existing vehicle or appliance, including SUVs, hybrid electric vehicles, trucks, planes and spacecraft, as well as any remaining Model T Fords -- or a Coleman stove on a mountain-top. Moreover, since hydrogen can be made with any source of electricity and water, which is found at every gas station, as well as every home, filling up with hydrogen will be easier – and much safer – than using gasoline and other hydrocarbon fuels.

As such, it is possible for the U.S. to be energy independent, with a pollution-free and inexhaustible energy resource within 5 or 10 years. That would include the deployment of an interstate superconducting hydrogen pipeline system that would carry both electricity as well as hydrogen, as well as the modification of all of the automotive vehicles and power plants in the U.S. Such a transition of substance will have profound implications for the economy, the environment, and U.S. foreign policy. The “trigger mechanism” for this “transition of substance” is the passage of Fair Accounting Act legislation by the U.S. Congress that would eliminate subsidies to fossil and nuclear fuels, and factor in the environmental, health care and military costs of using fossil and nuclear fuels. If a “fair” accounting system is used, hydrogen will be the least expensive fuel.

While fuel cells may someday replace the internal combustion engines, they are still far too expensive and are still in the research and development stage. Indeed, if the current generation of proton exchange membrane fuel cells that use platinum catalysts were to replace internal combustion engines, the worldwide platinum production would have to be increased by a factor of 30. Unlike oil, hydrogen is inexhaustible if it is made from water with renewable energy sources. Thus, it is not necessary to “conserve” hydrogen. As such, consumers do not need to drive small vehicles with small fuel-efficient engines. Indeed, given that the hydrogen fuel tanks will be larger than gasoline tanks, in the coming Hydrogen Age, bigger is better. According to BMW and Ford, hydrogen-fueled internal combustion engines have been shown to be 25% more energy efficient than their gasoline-fueled counterparts, which also produce carbon deposits and organic acids that contaminate the engine oil and thereby increase wear and corrosion of the bearing surfaces. Since hydrogen-fueled engines are carbon-free, they will be clean machines that will require less maintenance and have a significantly longer operating life.

Engineers in Germany and England first began investigating the use of hydrogen as an automotive fuel in the early 1900s, and by the 1930's, literally thousands of hydrogen-fueled vehicles were in operation. One of the principal engineers that made this possible was Rudolf Erren, a German engineer who developed a fuel injection system that allowed the hydrogen to be fed directly into the cylinder, thereby eliminating the carburetor, which was poorly suited to inject a gaseous fuel. The remaining engine components were unchanged, thus the conversion cost was relatively small, and the vehicles were able to operate on either hydrogen or other hydrocarbon fuels while in operation with the flip of a switch from inside the vehicle. All major engines in use at the time were modified, including those manufactured by MAN, Daimler-Benz and Beardmore.

A self-service liquid hydrogen pump was used by Los Alamos National Laboratory investigators in 1981 to refuel a modified 1979 Buick. After using this system for over a year, the Los Alamos investigators, headed up by Walter Stewart, concluded in their final report that "liquid hydrogen storage and refueling of a vehicle can be accomplished over an extended period of time without any major difficulty." BMW started its hydrogen fuel research program in the 1970s, and the BMW vehicles are able to operate on gasoline or hydrogen with the flip of a switch from inside the vehicle. The only noticeable difference in the car is that it has two fuel caps, one for gasoline and one for liquid hydrogen. BMW engineers point out that if liquid hydrogen fuel storage systems are used, drivers will not have to give up vehicle size, performance or range.