



The Truth About Hydrogen

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Over the past few years, there has been a concerted effort to frame hydrogen as unsafe, hopelessly inefficient and expensive, lacking essential infrastructure, and unable to deliver adequate range between fill-ups when used in cars. These substantially overstated issues are cited as evidence that hydrogen is, at a minimum, decades away from being taken seriously as an energy option. Chief among hydrogen's critics is a former Acting Assistant Secretary of Energy in the Clinton Administration named Joe Romm. An M.I.T. graduate with a Ph.D. in Physics, Romm wrote a book released in 2004 titled, *The Hype about Hydrogen*. In a feature length documentary titled, *Who Killed the Electric Car* that came out late in 2005, Romm dismissed the government's support of hydrogen technologies as bad policy that was undermining other, *what he considered more promising*, alternatives. The attacks by Romm and his followers, which continue to this day, have generated a cloud of skepticism over the subject of hydrogen in some energy circles, particularly among those that are not well-informed about the promise of hydrogen.

Is hydrogen more 'hype' than hope? How much truth is there in the arguments made by Romm and the naysayers that parrot his criticisms?

Here are some of the issues raised by Romm and his followers to dismiss hydrogen as an energy loser.

Is Hydrogen Safe?

Romm says no. In truth, hydrogen is at least as safe as the fuels we've been using for the last hundred years. Hydrogen is a fuel. Like other fuels it burns and can even be explosive in a confined space in the presence of oxygen. As such, hydrogen has characteristics that require

special attention. Romm likes to add, "it leaks like crazy." Hydrogen is the smallest of all the atoms, and it is lighter than air. When it does escape confinement, it diffuses rapidly and is non-toxic. Furthermore, hydrogen does not have a significant leakage problem when contained in systems designed for it. Hydrogen pipelines have been in operation industrially for many decades. Leaks happen, but no more than with other types of gaseous chemical commodities, and not enough to cause serious safety or environmental problems. A study commissioned by the Ford Motor Company and delivered to the U.S Department of Energy stated... *In a collision in open spaces, a safety-engineered hydrogen FCV should have less potential hazard than either a natural gas vehicle or a gasoline vehicle....* We've grown accustomed to pumping gas into our cars and using natural gas in our homes, there is no reason to think we cannot find the same level of safety and comfort with hydrogen.

Is hydrogen efficient? Is it cost competitive?

It is true there is an efficiency penalty that goes with converting electricity to hydrogen, but there are efficiency losses with every kind of fuel. It takes energy to make energy. Carping about efficiency is a thermodynamic smokescreen. It's disingenuous. What matters to the motorist is the fuel cost per mile driven. On that basis, hydrogen, when all factors are considered, fares very well against the cost of gasoline and other hydrocarbon fuels. Lest anyone think that providing energy in the form of gasoline is efficient, keep in mind, all the cheap, easy-to-find oil is long gone. Oil is a finite and increasingly scarce resource. Imagine the cost of pumping oil from a well in Saudi Arabia; putting it aboard a gigantic tanker, sail-

ing it 6,000 miles to a refinery in the U.S., Europe,, or Asia; processing it, then dispersing it to filling stations for use by consumers? Add on to that the enormous military cost of protecting Middle East oil. Is that efficient? In the end, efficiency only matters in so far as it affects the cost of the fuel at the pump.

What about a hydrogen fueling infrastructure?

At the moment, with the exception of California which has a small but growing network of hydrogen fueling stations, the U.S. has no fueling infrastructure for delivering hydrogen to the general public. But then, at the moment, there are only a few hundred hydrogen vehicles in the U.S. All that will change. General Motors has already begun leasing one hundred of its *Chevy Equinox* fuel cell vehicles to U.S. customers. Honda will do the same thing with a hundred of its fuel cell FCX vehicles in 2008. Still, for hydrogen to become a major energy player, fueling stations must be put in place all across the country. This is a challenge, but not so big as it might seem. A hydrogen fueling station costs between \$400,000 and \$1,000,000 to install. A study commissioned by General Motors indicates that a hydrogen infrastructure that would put a fueling station within two miles of 70 percent of the nation's population could be put in place with an investment of about \$12 billion dollars. That may seem like a lot, but put in perspective, it's about what our government spends every three weeks to maintain the armed occupation of Iraq. Europe, Japan, and China have launched plans to develop extensive hydrogen fueling networks. In the U.S., hydrogen powered vehicles could begin to arrive in auto showrooms in as little as five years from now.

Hydrogen technologies are advancing rapidly.

Over the past decade, a frenzy of research on the hydrogen fuel cell, an electrochemical device first used in the manned space program, has led to the development of a variety of fuel cell types designed to produce electricity to meet

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just about every kind of energy need. In Japan, one kilowatt fuel cell systems are now being installed to power private homes. The Japanese government is providing substantial incentives to put a million of these self-sufficient, residential fuel cell units in place over the next few years. Micro fuel cells designed to provide extended endurance use for portable devices like laptops, cell phones, PDAs, and iPods are on the verge of commercialization. The auto industry has poured billions into the development of fuel cell and internal combustion engines that run on hydrogen. Virtually every auto company has some kind of hydrogen powered vehicle positioned for commercialization in the next decade. Larry Burns, Vice President for Research and Develop-

ment at General Motors has said, "A new automotive DNA is emerging...General Motors absolutely sees the future of the world being based on a hydrogen economy. Forty-five percent of the Fortune 500 companies will be affected, impacting almost two trillion dollars in revenue."

Moving to a hydrogen-electric economy

Each of us has a big stake in the energy choices being made right now. The world must wean itself from dependence on oil and other fossil forms of energy. The global warming clock is ticking ominously. We cannot afford to be misled about hydrogen by naysayers who use arguments that are riddled with half-truths, distortions, and innuendo. We must begin the transition to a hydrogen-electric economy now, not decades from now.

In the coming era, there will be no single dominant source of energy. Over the long term, the vision that will ultimately prevail is the one that relies on a diverse portfolio of clean, renewable forms of energy like wind, solar, hydro, ocean wave, geothermal, and biomass. Hydrogen is the key to this noble energy vision. It is the common currency by which all of these clean sources of energy can be linked together and stored away for use on demand, safely, cost effectively, when and where needed.

We are at the beginning of the most important energy transition in the history of humanity. All things considered, who wouldn't choose a world powered by unlimited quantities of pollution free energy that exists as either electricity or hydrogen. The sooner it happens, the better for all the world's people.



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