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The Future is Running Late, Part II: Where is the Hydrogen Economy?

16 Nov 2008

Good day, friends. The first two newsletters have sparked some absolutely fantastic discussions, ideas and feedback. Thanks to everyone who wrote in. Let's build this community of insightful thinkers by taking a few minutes today to [Refer a Friend](#) to the Making Sense of Science Newsletter!

A lot of people ask me, "John, why are you so dismissive of innovations in energy?" Well, I don't think that is really the case at all. I respond to this by saying, "What innovations? Everything we've been talking about has been known for a long time."

For example, every few years I read in the newspaper that a "breakthrough" has occurred and someone has just discovered that hydrogen, a really useful gas, is produced when ordinary electricity is passed through ordinary water. Well, guess what. This was demonstrated in 1800 by two men named William Nicholson and Anthony Carlisle, and possibly earlier by others. Of course, the press never gets its facts quite right, and the real story was something technical to do with fine-tuning the process (read: making it more expensive). Nevertheless, people often do re-invent things that are either already well-known, or known not to work. Why does this occur?

I know a lot of inventors and have a lot of respect for them. So I hope they will take what I'm about to say in the best possible way:

Inventors like doing anything that isn't reading a book.

My instructors at Uni used to tell a joke at the expense of certain students that went something like this: "Through many months of dedicated lab work, he saved several hours that would otherwise have been wasted in the library."

Before we can make discoveries and create true innovations, we must find the frontier. I am pointing the way to that frontier by signposting some of the already well-travelled roads.

Hydrogen is one of those well-travelled roads that can be talked up so that it sounds great to the average person, yet seems perpetually 10 or 20 years off in the future. Yes, hydrogen can be produced abundantly from water, and yes, hydrogen fuel cells can make electricity far more efficiently than any engine could. The catch is two-fold.

Catch #1, it takes more energy to produce hydrogen than you get back in the end, whichever way it's used. This is pretty obvious to most of us, but there are still some people confused by this fact. Here's a useful way of explaining it.

Energy is in some ways like Nature's money. Using energy to make hydrogen is like putting your money into a bank account for safe storage, from which you can withdraw your energy again at a later time. Sounds good so far, doesn't it? Now read the fine print. The bank charges a fee of something like 30% on every deposit and again on every withdrawal. Extra charges apply for every conceivable service or convenience. How does the Bank of Hydrogen sound to you now? This is not a question of getting some better technology, it's fundamentally how the universe works.

The second catch is more of a technical one: hydrogen is difficult to store and transport. Since it is a gas, it must be compressed (which takes more energy) into high-pressure containers, or it would simply take up too much space. To make a sufficient amount of gas take up less room than the boot of a car, one needs a very heavy, thick-walled steel tank. And, scaling up is a losing proposition: the tank gets heavier and more expensive faster than it gets more spacious. In other words, you don't get twice the gas for twice the price. As inefficient as it sounds (and it is), you're better off with a number of smaller cylindrical tanks than with one large

tank.

Heavy and expensive gas tanks and heavy, expensive fuel cells make hydrogen cars more expensive, less energy efficient and worse for the environment than some of the cars we drive today. To replace the petroleum-burning car of the last 120 years, we will need a technology that is lightweight, affordable, non-carbon, non-toxic, good for people's health, enjoyable, easy to use, and renewable.

Sorry, Inventors. The Bicycle has already been invented. I read about it at the library.

(Inventors have a sense of humour, too. Don't you.)

Just a final note about claims of cars that run entirely on water as an energy source: it simply isn't so, and for one very good reason. There isn't any chemical energy in water. Water is burnt hydrogen, as burnt as it can get. You can convert water back into hydrogen, but only by supplying more energy than you'd ever get back again, as we've already seen. (And don't even think about fusion, that's another newsletter entirely.)

These kinds of claims come about in a number of ways:

1. Bad accounting. The promoters/inventors don't account for all sources of energy in their calculations, and they leave out a significant source. This is done either maliciously to defraud the public, or accidentally because they are ill-equipped to do that sort of specialist work.
2. Bad measurements. Again, collecting and analyzing engineering test data is serious business requiring training, expertise and skill which inventors, marketing people, entrepreneurs and tradesmen usually lack.
3. Bad reporting. When the media get hold of things "above their pay grade" (to use a current expression), they consult a financial expert or an expert on politics, but rarely do they think of running it past an engineering expert. And so, before you can say "Headline," another urban myth is born.

You'll never be fooled if you remember this one simple fact: energy always comes from somewhere, never from nowhere.

Regards,

John

Our mailing address:
Wallingup Research
PO Box 2208
Carlisle North 6101
Western Australia
Australia

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