

Re: Solar-hydrogen home power system?

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From: K. Jones (*shadetree1999_at_hotmailNODAMNSPAM.com*)

Date: 10/27/04

Date: Wed, 27 Oct 2004 16:25:06 -0400

"George William Herbert" <gherbert@retro.com> wrote in message
news:417dd701\$0\$71140\$0de7616@newsreader.dsl.net...

> *Don Lancaster* <don@tinaja.com> wrote:

> > *George William Herbert* wrote:

> > > *Don Lancaster* <don@tinaja.com> wrote:

> > > > [...]

> > > > *A common misconception.*

> > > > *The latest of modern multicycle power plants with bottom cycling*

> > > > *routinely approach 60 percent thermal efficiency.*

> > >

> > > *Still 10% lower than SFOC fuel cells.*

> >

> > *You are confusing the theoretical lab efficiency with the fully burdened*

> > *amortization efficiency.*

> >

> > *The latter is NEGATIVE for SFOC fuel cells today.*

>

> *And the fully burdened amortization efficiency of growing*

> *plants, burying them under silt for tens of millions of*

> *years of process time, and then having to dig them up is?*

> *Do you have any concept of what a hundred and eighty*

> *million years of internal rate of return does to your*

> *amortization calculations? You're killing accountants*

> *just posing the problem.*

>

> *The interesting comparisons are what cycles can we do*

> *when (a) the petroleum eventually runs out or*

> *(b) we finally stop using (or at least, releasing)*

> *fossil carbon fuels.*

>

> *Your analysis is not more insightful. You are merely*

> *using a different boundary condition, and cheating on*

> *how you describe the problem to puff yourself up.*

>

> *I am not rabidly enthusiastic about hydrogen vehicles*

> *in any sense. My personal favorite renewable fuels*

> *are either (methanol/ethanol) or thermally depolymerized*

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- > *plant materials turned into diesel fuel. Those are a*
- > *lot easier to handle and probably cheaper cycles to set*
- > *up and use.*
- >
- > *But unlike you, I have worked with hydrogen, and I have*
- > *paid enough attention to what it really can and can't do,*
- > *and I don't think you have any sort of vaguely useful*
- > *approach to criticizing it at all.*
- >
- > *I frankly cannot respect anyone who spends their time*
- > *changing boundary conditions to make fraudulent debating*
- > *points and who is so afraid of liquid hydrogen and the*
- > *safety concerns of hydrogen fuels.*

I have used hydrogen daily in a previous job.

A tube–trailer a day of it.

I've also worked, daily, with liquid hydrogen.

I'm also a hazmat specialist, and have responded to hydrogen incidents.

IMHO, Don shows due diligence and respect for the stuff, which helps to keep oneself alive when dealing with it in the manner to which he would, as a hazmat professional. Do not confuse a "healthy respect" for being "so afraid".

Note thus far, he is not one of the many response personelle who die every year simply from lack of knowledge, or lack of "healthy respect".

- > *In the San Francisco / San Jose area (SF Bay Area) you see*
- > *just about as many tanker trucks full of LH2 (about ten*
- > *cubic meters per trailer) as you do propane out on the*
- > *freeways. Hydrogen is used in bulk in semiconductor*
- > *processing. I can't recall hearing of any accidents with*
- > *hydrogen tankers. Several propane tankers have blown up*
- > *for one reason or another in the last 20 years. Hell, we*
- > *had a gasoline tanker explode in one of the bores of the*
- > *Caldecott Tunnel a couple of decades ago, killing a couple*
- > *of dozen people if I recall right.*

Not sure the reason for this paragraph....What are you suggesting, that nothing bad ever happens with hydrogen, or what?

Wanna trade anecdotes?

Or how about verifiable, comparable data, instead?

- > *I know a bunch of fire personnel and hazmat team people.*

That makes at least three of us that know "a bunch" then.

At least two of us work side–by–side with "bunches" of them every day.

- > *None of them are more afraid of liquid hydrogen than*
- > *they are of gasoline or propane. None.*

Anyone who says they don't "pucker up" when dealing with anything that can kill you in a heart beat or less, is either very stupid, or lying.

Well trained hazmat folks have an adage "If you don't know, you don't go",

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pick whatever nasty you want. The concern isn't so much for professional responders who have good training, "if they don't know, they won't go". The educated, experienced concern, is for the public at large.

- > *They are frankly*
- > *more afraid of LOX, which also is transported in large*
- > *quantities. Or large quantities of fluorine compounds.*
- >
- > *Spilling hydrogen causes a flammability hazard and*
- > *possibly a low energy fuel-air explosion. The low*
- > *density of LH liquid and low boiling temp makes it*
- > *boil off rapidly, and the gas dissipates rapidly*
- > *and effectively.*

I'd say there is a little more to it than that.

INEEL/EXT-99-00522
Safety Issues with Hydrogen as a VehicleFuel
Lee C. Cadwallader
J. Stephen Herring
Published September 1999
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Lockheed Martin Idaho Technologies Company
Idaho Falls, Idaho 83415-3860
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Table 1-1. Preliminary hazards list for hydrogen

Table 1-1. Preliminary hazards list for hydrogen

Form	Hazard type	Description of hazard
Gaseous hydrogen	Physical properties leading to safety concerns	.Lighter than air .Highly diffusive .Flow-induced static charge generation .Low viscosity (leaks easily) .Odorless, colorless gas
Pressure	High pressure storage (2000 psig or more) can result in pressure rupture, flying debris	.Pipe whip concern with leak events .Oxygen displacement in confined spaces .Gas jet impingement damage is possible .Gas jet impingement on personnel is also a hazard, high pressure can cut bare skin
Chemical	Flammable, with nonluminous flame, no toxic combustion products	

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- .Explosive, 4% to 74% by volume
- Can deflagrate (typically only a modest overpressure, ~a few psi in open areas)
- Can also detonate (high overpressure shock wave, ~ several atmospheres)
- .Low ignition energy, 0.02 mJ to 1 mJ spark to ignite a deflagration
- .Modest autoignition temperature, 574°C
- Temperature .Could be stored at room temperature, not an issue
- Materials issues .Embrittlement of metal
- .Embrittlement of plastics
- Toxicological .Asphyxiation in confined spaces
- .No other toxic concerns

Table 1–1. Preliminary hazards list for hydrogen (continued)

- | Form | Hazard type | Description of hazard |
|-----------------|---------------------|--|
| Liquid hydrogen | Physical properties | leading to safety concerns |
| | | .Boiloff gas quickly warms and then is lighter than air |
| | | .Boiloff gas is highly diffusive |
| | | .Flow–induced static charge generation |
| | | .Boiloff vent rate from storage tanks/fuel tanks is typical to maintain cold temperature in tank |
| | | .Liquid quickly, easily boils by heat transfer into the 20 K liquid |
| | | .Rapid phase transition from liquid to gas can cause pressure explosions |
| | | .Liquid quickly contaminates itself by condensing gases from air contact |
| | | .Odorless, colorless, cannot easily be odorized since odorants will freeze out at cryogenic temperatures |
| | Pressure | .Stored under modest pressure to suppress boiling (perhaps 200 psig) |
| | Chemical | .Evolved gas is cold, otherwise the same concerns as gaseous hydrogen |
| | Temperature | .Cryogenic burns, especially eyes |
| | | .Lung damage by cold vapor inhalation |
| | | .Possible hypothermia working near these systems |
| | | .Condensation of air near LH2 systems if insulation allows heat leak paths; can lead to oxygen rich zones near systems |
| | Materials issues | .Embrittlement of metal |
| | | .Mechanical stresses generated by thermal contraction |
| | | .Mild steels susceptible to cracking at cryogenic temperatures |

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.Materials have low specific heats at cryogenic temperatures, easy heat transfer

Toxicological .Asphyxiation in confined spaces

.Frostbite from acute exposure

.Hypothermia possible from long exposure

.No other toxic concerns

- > *Spilling LOX causes an equal or worse flammability*
- > *hazard and can lead to substances as inert as asphalt*
- > *and rubber tires out and out detonating, not just*
- > *deflagrating. It boils much more slowly and the*
- > *vapors typically stay near the ground, in clouds*
- > *of high oxygen concentration that will burn organics*
- > *and vehicles and buildings to ash and rust in*
- > *short order if there's an ignition source nearby,*
- > *such as a vehicle motor running.*

I don't remember anyone advocating a "LOX" economy?

You are aware, of course, that hydrogen can transition from deflagrating to detonation, all by it's little lonesome, without an initiator.

>From the same report:

Table 2–2. Hydrogen gas combustion properties in air at one atmosphere and 25°C

Combustion property Hydrogen deflagration Hydrogen detonation Units

Heat of reaction, high 142.5 142.5 MJ/kg

Lower flammable limit in air 4.1 (a) or 3.6 g/m³ of air 8.3 or 16.1 g/m³ of air

Volume % Upper flammable limit in air 74.0 or 67 g/m³ of air 59.0 or 51.8 g/m³ of air

Volume % Optimum detonation 29.53 Volume % mixture ratio in air (stoichiometric ratio)

Detonation maximum 1.46 MPa overpressure in air

Auto–ignition 574 574 °C temperature

Minimum ignition energy 0.02 at 29.53 % (b)= 107 (c) mJ

Maximum flame 2318 2318 K temperature in air

Explosion energy 2.02 (kg TNT per m³ of NTP gas)

d Laminar burning velocity in air, varies 102 to 325 (cm/s) with H₂ % in air

Detonation velocity in 1.48 to 2.15 (km/s) air

Maximum overpressure 8 : 1 14.5 : 1 ratio

(a) For upward flame propagation; downward flame propagation is 9% (Coward, 1952).

(b) Hydrogen spark ignition energy varies between 1 mJ at the ends of the flammable range

down to 0.02 mJ at the stoichiometric concentration (Bowen, 1976).

(c) To initiate a prompt detonation in a gas–air mixture, the minimum ignition energy must

be on the order of 104 to 106 Joules (AIChE, 1994). Under some

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circumstances, a hydrogen deflagration explosion can also "run up", or transition, to a detonation explosion.

(d) Theoretical maximum at stoichiometric conditions, actual value is approximately 10%

of the theoretical maximum (Winter, 1988).

Sources: (Thomson, 1987), (Lewis, 1961), (Winter, 1988), (Glassman, 1987)

Note the 2.02 kg TNT per m³ NTP gas equivalent.

You are also aware, I assume, that with cryogenic H₂ leaks, that there tends to be a significantly higher oxygen content in the vicinity of the leak as it condenses from the air.

- > *You need perspective. Spend time where LH₂ is*
- > *handled routinely and actually get to know what*
- > *its risks and hazards are.*

Indeed. Sound advice.

K. Jones

- >
- > *–george william herbert*
- > *gherbert@retro.com*
- >