The Prospects for Hydrogen Fuel Generation from Solar Electricity via the Liquid Solar Array Process

The projected costs of electric power from the newly patented Liquid Solar Array (LSA) process are sufficiently low to give the prospect of using electrolysis of water to create large amounts of Hydrogen as a transport fuel at costs that are competitive with present costs for refined petrol and diesel.

Hydrogen is well known as a suitable fuel for transport, either by burning in standard internal combustion engines or by use in fuel cells for very high efficiency usage. The use of hydrogen with standard engines is the more attractive short term option if the fuel can be generated in a low cost way, the only significant limitation being that long vehicle range is not readily achieved with compressed gas storage. The major advantages of usage in standard engines are that minimal changes are required to the engine and that the engine's thermodynamic efficiency is increased (by up to 20%). Hence it can be used as a **direct oil substitute** for most of the existing vehicle fleet (with modifications similar to those required for operation of standard vehicles on compressed natural gas).

The advantages of solar power as the source of the electrical energy required for electrolysis of water to create the hydrogen are:

- The solar power generated may be used immediately on site and does not require transmission.
- No complex power conditioning is required as the power is used as direct current for electrolysis.
- There are no greenhouse gasses or any other forms of pollution generated in any part of the system.

The LSA system for solar electricity production has projected costs that are approximately one eighth of the costs of power from silicon photovoltaics available at present. The system is described at www.sunengy.com. The project costs for power generated from the LSA system are shown on this site, both in the short term and after several years of mass production (in US$). Further details of how the costs are derived can be provided on request. At reasonably high production levels, such as those required for Hydrogen fuel production (with over1000MW capacity built per year), the costs of DC power are projected to be less than 3.5 Australian cents per kWhr (perhaps under 3 cents). Let us assume 4 cents for the present calculation.

Consider the possibility of a direct oil substitute from solar generated hydrogen, which is carried in tanks of compressed gas.
To make a 'litre of gasoline equivalent' in the form of hydrogen via electrolysis of water means storing 10 kWhr in the form of hydrogen (this is the thermal energy in one litre of gasoline). So, for an internal combustion engine burning Hydrogen, 10kWhr of thermal energy must be available from the hydrogen per litre gasoline equivalent (assuming no efficiency improvement from Hydrogen).
This requires 14.29 kWhr of electric power (with 70% efficient electrolysis).
At 4c per kWhr from the LSA system this is A$0.57.

Allowing 20% for electrolyser capital, 20% for compression and 20% final profit the **litre of gasoline equivalent as hydrogen might cost $0.99** to the motorist. This assumes there are no government taxes on such a fuel, and any cost of transport of the hydrogen is not included.

This cost estimate is admittedly very approximate, but it does indicate that this approach to fuel security and greenhouse emissions reduction should be thoroughly investigated. It is very possible that costs would be ultimately lower than those estimated here. If we were to assume the use of fuel cells in the vehicles (perhaps in ten years), the effective cost of the fuel would be reduced by a further factor of two (approximately) due to the higher efficiency of the end use in the vehicle.

This submission is made on behalf of Sunengy Pty Ltd. As the inventor of the LSA process I am happy to present details of the system and justify the cost estimates as far as I am able.

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