Hydrogen Fuel Technology

Projected advancements in hydrogen fuel technology have many speculating hydrogen as a fuel with huge emission abatement potential. Throughout the last decade there have been leaps in the technology which has attracted much attention towards hydrogen fuel cells. At present it remains largely experimental and has yet to become commercially viable with it unlikely to do so within the next 10 years.

Hydrogen fuel cells do not operate like a standard internal combustion engine and do not burn hydrogen gas. The hydrogen is used to create a chemical reaction that generates electricity to run the vehicle.

At present hydrogen fuel cell engines (despite not commercially available) can offer more efficiency (60%) at current to internal combustion diesel engines (50%) [1]. Coupled with possible zero emissions, (depending on the sourcing of hydrogen), hydrogen cells have the ability to significantly reduce total emissions from the freight industry and help Australia reach its 2050 emission targets as its advancements come of age.

Because hydrogen's only by-product of use is water, the possibilities of using hydrogen fuel technology to combat GHG emissions looks promising. However to produce hydrogen into a fuel requires large amounts of electricity. As a result to be considered climate neutral, the energy used to produce hydrogen must also be climate neutral. It therefore will depend greatly on the future modes of energy production as to how significantly it can reduce future emissions.

Barriers

The widespread implementation of hydrogen as a fuel has many barriers that look unlikely to be surpassed within the next 10 years. One of the most significant problems associated with hydrogen at the moment is its low energy density. To store the same amount of energy as a petrol tank a compressed hydrogen tank would have to be ten times the size and four times as heavy [2]. Due to the added weight and size of the storage tank, at current hydrogen fuelled vehicles would only be suitable for short distance deliveries.

The issue of size and weight becomes more evident when hydrogen is suggested as a potential aviation fuel. Airbus commissioned a study to examine the use of hydrogen as an aviation fuel. They found the increased size of the fuselage's impact on drag would increase the aircraft's energy consumption between 9% and 14% Airbus, 2004.

Potential

Hydrogen's greatest potential may line in as a fuel for non-electrified train locomotives. As with the production of hydrogen, the emissions to be reduced from electrifying rail lines depend on electricity's method of production. With an ever 'greening' Australian electricity grid, electrified rail lines will continue to offer greater emission reductions. However due to the high cost of electrifying the rails, at the moment it may only be feasible to so for high population density rail lines and not mainly rural freight lines. Hydrogen fuelled locomotives may be a possible way to overcome this and reduce GHG emissions.

This option will only be further explored as hydrogen technology becomes more advanced and prices fall significantly to become commercially viable.

At present while it appears that hydrogen may offer significant emission reductions in the future many barriers are likely to prevent its wide scale roll-out. While hydrogen fuel technology may present a solution for rail and short trip urban deliveries, it is unlikely to have greater up take unless significant technological advances are made within the coming years.

1) Jeong, K.S., and Oh, B.S. (2002) Fuel economy and life cycle cost analysis of fuel cell hybrid vehicle. Journal of power sources.

2) Green, D and Schafer, A (2003) Reducing Greenhouse Gas Emissions from U.S. Transportation. Available from http://www.c2es.org/docUploads/ustransp.pdf