Liquid Hydrogen Tank & Filling Systems for Vehicles

Note of the Editor: For this paper only transparencies were available. Please find enclosed the table of contents, a selection of figures and conclusions.

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Figure 1
Energy content and combustion heat of different fuels
**Hydrogen Technology**

Comparison of LH$_2$ and CGH$_2$ - energy content of Hydrogen -

![Bar chart showing energy content of hydrogen at different pressures for LH$_2$ and CGH$_2$.]

Figure 2

Energy content of hydrogen

**Figure 3**

LH$_2$ Tank – Improvement of autonomy

![Diagram of an LH$_2$ tank with various components labeled.]

- Inner vessel
- Outer vessel
- Suspension
- Liquid Hydrogen (-253°C)
- Safety valve
- Gaseous Hydrogen (+20°C up to +40°C)
- Shut-off valve
- Cooling water heat exchanger
- Electrical heater
- Reversing valve (gaseous/liquid)
Conclusions:

Infrastructure and filling stations of a hydrogen technology for vehicles have to fulfil the following requirements:

- Competitive
  The costs of the energy carrier hydrogen must be comparable to the costs of conventional fuels. The costs of a hydrogen infrastructure must be comparable to the investment for a conventional infrastructure.

- Compact & Capable of Being Integrated
  A hydrogen filling station must be capable of being integrated into an existing conventional fuel station. That means a hydrogen filling station must be compact and must be operable without additional professional personnel.
The hydrogen filling station must be able to deliver pressurised hydrogen (CGH₂) as well as deep cold liquefied hydrogen (LH₂).

A hydrogen filling station must be flexibly reactive with respect to long-term trends as well as to daily fluctuations of the hydrogen consumption.

The logistic for hydrogen filling stations must fit to the concept of the gasoline companies.

The initial overall concept must ensure a direct and cost saving transfer from fossil to regenerative generated hydrogen.