

## **Hydrogen-fuelled Vehicles**

Transmitted by the expert from Germany

### **1) The EUROPEAN INTEGRATED HYDROGEN PROJECT**

#### **Background:**

A significant reduction or even elimination of local greenhouse gas (GHG) emissions from vehicles can be achieved by the use of hydrogen as a vehicle fuel, particularly when it is produced from renewable energy sources. Vehicles using hydrogen as a fuel either in a fuel cell or in a hydrogen optimised internal combustion engine provide a solution for the reduction of local and global pollutants.

The results of the project "Transport Energy Strategy" (also referred to by its German initials VES) are indicating that hydrogen is the most promising fuel in the long term.

#### **Current situation:**

Several hydrogen vehicles are already on the road. They are licensed as single vehicles in different countries.

#### **Current situation regarding the legal requirements for hydrogen vehicles in Europe:**

In total 47 EC directives are applicable for vehicles. The directives for emissions, fuel consumption and engine power cannot be fulfilled by hydrogen vehicles because of the absence of a standardised reference fuel or the absence of a procedure for testing the engine power.

Requirements regarding the safety of the hydrogen on board storage system however are missing. Therefore each country is applying their national requirements regarding the safety of the hydrogen onboard storage system. These national requirements are differing significantly.

### **2) The EUROPEAN INTEGRATED HYDROGEN PROJECT Phase I (1998 - 2000)**

#### **Project Summary:**

In order to enhance the safety of hydrogen vehicles and to facilitate the approval of hydrogen vehicles, the European Integrated Hydrogen Project was established. The project was starting in 1998 and was co-sponsored by the former GD XII Science, Research and Development under Contract N° JOE3-CT97-0088.

The objectives of the project were as follows:

- To create a Pan European database of existing regulations and codes of practice
- To contact other pertinent authorities outside Europe
- To identify weak spots in today's technology
- To define the areas requiring regulation
- To create a basis for an ECE regulation for hydrogen vehicles

The project partners are portrayed in the annex.

### **Results:**

The EIHP partners finally developed 2 drafts for new ECE regulations, one for the onboard storage system for liquid hydrogen and one for the onboard storage system for gaseous hydrogen. The elaboration of the drafts was in close co-operation with some Technical Services. Some approval authorities were informed about the results accordingly. The drafts are available in the Internet under <http://www.eihp.org/>.

### **EIHP 1 - Partners**

Air Liquide S.A., Sassenage, France

Bayerische Motoren Werke AG, BMW, Munich, Germany

EC-Joint Research Centre, Ispra, Italy

Hamburgische Elektrizitäts-Werke AG, HEW, Hamburg, Germany

Hydrogen Systems N.V., Turnhout, Belgium

Instituto Nacional de Técnica Aeroespacial, INTA, Madrid, Spain

Ludwig-Boelkow-Systemtechnik GmbH, LBST, Ottobrunn, Germany

Messer Griesheim GmbH, Krefeld, Germany

Renault – Direction de la Recherche, Guyancourt cedex, France

AB Volvo, Göteborg, Sweden

### **3) The EUROPEAN INTEGRATED HYDROGEN PROJECT Phase 2 (start 2001)**

#### **Project Summary:**

Draft regulations for the approval of hydrogen fuelled road vehicles have been developed during the last two years and are presently in the submission process to the relevant European regulatory bodies. These draft regulations shall be developed to such a level that they can be harmonised on a global level, initially between the EU and North America. By applying these draft regulations to the design and approval of fuel cell vehicles with direct onboard hydrogen storage they will be validated by taking into account not only hydrogen related vehicle components and systems but also safety requirements, refuelling procedures and periodic inspections.

For the relevant hydrogen refuelling infrastructure components and systems, for which existing standards, codes of practice and regulations are only partly identified, the applicable national standards and regulations will be identified and necessary requirements for new draft standards and possibly draft regulations for approval will be developed. These activities among others will also comprise refuelling procedures, safety aspects, periodic inspections and the layout of refuelling stations. The interface between the refuelling station and the vehicle (receptacle and nozzle) will be an important issue. The eligibility for EU-wide harmonisation will be checked. It will also be investigated to what extent certain elements of the refuelling systems are suitable for harmonisation on a global regulatory scale, e.g. components.

Comparative risk and safety analyses with respect to the release of hydrogen in confined and semi-confined environments, such as tunnels, garages, refuelling stations, and inner city streets will be undertaken. These shall provide data in sufficient depth in order to enable the partnership to define the required inputs for hydrogen related standards and regulations.

#### **Results:**

- Development of a worldwide harmonised regulation for hydrogen fuelled road vehicles.
- Development of procedures for periodic vehicle inspections (roadworthiness).
- As far as possible development of a worldwide standard or regulation and of periodic inspection procedures for the relevant refuelling infrastructure, subsystems or components.

These draft regulations and standards will enable both the vehicle and infrastructure industries to save enormous resources in bringing hydrogen fuelled fuel cell vehicles onto the road. Many countries will for the first time have the legal basis to approve the operation of hydrogen fuelled vehicles on public roads and refilling at public refuelling stations. In addition, the access of European vehicle and infrastructure component manufacturers to the EU market as well as the North American market will be facilitated in the medium and long term.

**EIHP 2 - Partners**

L-B-Systemtechnik GmbH, Ottobrunn, Germany

Adam Opel AG, Ruesselsheim, Germany

Air Liquide S.A., Sassenage, France

Air Products, Walton-on-Thames, United Kingdom

Bayerische Motoren Werke AG, Munich, Germany

BP Amoco, Sunbury-on-Thames, United Kingdom

Commissariat a l'Energie Atomique, Bruyeres le Chatel, France

DaimlerChrysler AG, Stuttgart, Germany

National Centre for Scientific Research Demokritos, Aghia Parakevi-Attikis, Greece

Det Norske Veritas, Department for Strategic Research, Høvik, Norway

EC-Joint Research Centre, Ispra, Italy

Ford Werke-Aktiengesellschaft, Koeln, Germany

Forschungszentrum Karlsruhe GmbH, Karlsruhe, Germany

Hydrogen Systems N.V., Turnhout, Belgium

Instituto Nacional de Técnica Aeroespacial, INTA, Madrid, Spain

Messer Griesheim GmbH, Krefeld, Germany

Norsk Hydro SA, Oslo, Norway

Shell Research Ltd., Chester, United Kingdom

AB Volvo Technological Development, Göteborg, Sweden

Raufoss ASA, Raufoss, Norway

---