



# Clean and safe hydrogen vehicles on European roads

## EIHP 2

### Objectives

EIHP ([www.eihp.org](http://www.eihp.org)) provides inputs for regulatory activities on a European Union and global level to facilitate harmonised procedures for the approval of hydrogen fuelled road vehicles (with both internal combustion engine (ICE) and fuel cell drive trains). It provides input also to the hydrogen refuelling infrastructure and the relevant interfaces between the vehicle and the filling station in order to ensure their safe development, introduction and operation.

As a result uniform technical requirements for hydrogen vehicles, refuelling stations and interfaces plus industry standards at a global level, e.g. ISO, are expected.

By achieving the above objectives one of the commonly perceived barriers for the introduction of hydrogen fuelled vehicles shall be overcome, i.e. the approval of vehicles for operation on public roads with publicly accessible infrastructure.

### Challenges

Draft regulations for the approval of hydrogen fuelled road vehicles were developed during the first phase of EIHP and are now in the submission process to the relevant European regulatory bodies. These draft regulations shall ultimately 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 and internal combustion engine 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 possibility for EU-wide harmonisation will be checked. To what extent certain elements of the refuelling systems are suitable for harmonisation on a global regulatory scale, e.g. components, will be investigated.

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.

### Expected impact

Results to be achieved:

- 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 requirements for worldwide standards and periodic inspection procedures for the relevant refuelling infrastructure, subsystems or components.

These draft regulations and standards will enable the vehicle and infrastructure industry to save enormous resources in bringing hydrogen fuelled internal combustion engine and 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.

### Progress to date

Technical achievements since project start:

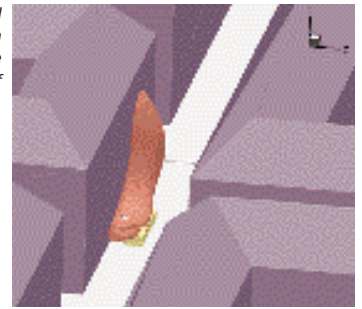
#### Refuelling station:

- Overview of existing regulation and international standard and codes for natural gas, gasoline, diesel, LH<sub>2</sub>, and CGH<sub>2</sub>.
- Development of a refuelling station layout requirement and decision where harmonisation would be beneficial.



Model of Stockholm accident site (park in green, lorry in yellow).

Predicted flammable cloud (hydrogen-air mixture with hydrogen concentration above 4%) 10 seconds after start of accident.



Analysis and quantification of health, environment and safety risks associated with on-site equipment and performance of HAZOP studies for different refuelling station scenarios.

#### Refuelling interface:

- Identification of optimum on-board storage pressure levels for CGH<sub>2</sub> [Partly achieved]
- Development of requirements for international standardisation of interfaces (CGH<sub>2</sub> and LH<sub>2</sub>) [Partly performed for CGH<sub>2</sub>]

#### Vehicle:

- Monitoring of draft proposal from EIHP I in order to achieve a valid regulation [ongoing]
- Establishment of a global technical regulation [ongoing]
- Creation of a procedure for the necessary periodic inspection for hydrogen vehicles (amending directive to directive 96/96/EC) [development of procedure progressed, draft for amendment to be started]
- Validation of design rules or safety requirements, including definition of a procedure for the calculation and the design of safety valves for vehicle applications

#### Safety:

- Compilation of existing data on the safety of hydrogen and comparative fuels
- Performance of HAZOP of different refuelling station [significantly progressed]
- Estimation of consequences related to hydrogen release scenarios for CGH<sub>2</sub> vehicles, e.g. tunnels and inner city streets, and in comparison with CNG will be calculated
- Support of safety issues in 'vehicle', 'refuelling interface' and refuelling station' work packages. [ongoing]

#### Links EU-USA/-Japan:

- Established contacts to US activities (e.g. NHA, SAE, DoE, CFCP)
- Established contacts to comparable EU cluster activities
- First contacts to comparable Japanese activities established
- Participation in scheduled plenary meetings and working groups 5 and 6 meetings of ISO TC 197 "Hydrogen Technologies"
- Ongoing collection and systematic editing of information available from selected other project activities [ongoing]
- Dissemination of results achieved to first interested experts/ target group
- First steps in developing a network structure plan for hydrogen infrastructure implementation in the EU
- First briefing notes on US, EU, Japan, ISO activities delivered

## INFORMATION

References: ENK6-CT-2000-00442

Programme:

**FP5** - Energy, Environment, Sustainable Development

Title:

European Integrated Hydrogen Project – Phase II (EIHP2)

Duration: 36 months

Partners:

- Adam Opel (D)
- Air Liquide (F)
- Air Products (UK)
- BMW (D)
- BP (UK)
- Commissariat à l'Energie Atomique (F)
- DaimlerChrysler (D)
- National Centre for Scientific Research Demokritos (GR)
- Det Norske Veritas (NO)
- EC Joint Research Centre (NL)
- Ford (D)
- Forschungszentrum Karlsruhe (D)
- Vandenborre Technologies (B)
- Instituto Nacional de Tecnica Aeroespacial (E)
- Messer Griesheim (D)
- Norsk Hydro (NO)
- Shell Research (UK)
- Raufoss (NO)
- Linde (D)
- VOLVO Technology Corporation (S)
- L-B-Systemtechnik GmbH (D)

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Status: Ongoing