



L-B-Systemtechnik

EC Workshop
on H2/FC technologies -
Regulations, Codes and Standards

EIHP2 – fuelling infrastructure part

Reinhold Wurster [wurster@lbst.de]

Brussels - 25 February 2005



L-B- Systemtechnik GmbH
D-85521 Ottobrunn, Germany
<http://www.lbst.de>

European Integrated Hydrogen Project - Phases 1 & 2

[<http://www.eihp.org>]



L-B-Systemtechnik

Objectives: **Initiate and provide inputs for regulations on an EU and global level for the approval of hydrogen fuelled road vehicles, hydrogen refueling infrastructure and the relevant interfaces.**

Phase 1: 1998 – 2000

- **Main focus on hydrogen fuelled vehicles**
- **Vehicle - development of drafts for UNECE regulations**
- **Infrastructure - only very limited analysis**
- **Safety studies and limited computer simulations**

EIHP

Phase 2: 2001 - 2004

- **Enhanced focus on hydrogen vehicle refueling infrastructure**
- **Vehicle - efforts for licensing and approval of hydrogen vehicles on a global level (GTR)**
- **Infrastructure - refueling stations and fueling interface - EU and North America**
- **Safety studies, computer simulations and first limited safety tests**

EIHP, a partnership between the European Hydrogen Industry and the European Commission, which provided inputs for regulatory activities on a European and global level to facilitate harmonised Procedures for the approval of hydrogen fuelled road vehicles and their refuelling infrastructure. The project has been finalised by January 2004.



a H₂ Industrial Main Actor's View

Developing infrastructures for Hydrogen supply will require:

- Better harmonisation and standardisation in risk assessment analysis methodology - worst case accident scenarios.
- Standardisation for implementation of new technologies and new components.
- To improve feed back coming from Hydrogen projects.
- Sharing and harmonisation of RC&S programs between Europe, USA and Japan

Source:

**Jean Yves Faudou,
Air Liquide,
20OCT2003**

a CGH₂ Component Manufacturer's View

- Legal aspects regarding the refuelling of vehicles (robots, self-service, etc.)
- Alternative hydrogen storage technologies (other than CGH₂ or LH₂), at least an instrument to work on regulatory issues if needed in relation to 'New/Alternative' storage technologies

Source:

**P.S. Heggem,
RAFS,
OCT2003**



Codes & Standards Status of Hydrogen Supply Chain

Current Status

●	Standard in place, and adequate for projected needs
●	Standard in place, not adequate for projected needs
●	No applicable standard in place

Current Activity

●	Significant activity
●	Some level of activity
●	No activity

Future Outlook

●	Direction appears adequate for business needs
●	Direction may fall short of business needs
●	Direction appears to be inadequate for business needs

This EIHP2 analysis, based on a methodology developed for the IHIG (International Hydrogen Infrastructure Group) in the USA has formed the basis for the HFP IG-RCS Gaps Analysis Work

EIHP2 Traffic Lights Analysis H₂ Supply Chain Europe



L-B-Systemtechnik

Production

		Current Status	Current Activity	Future Outlook	Comments
Central Production		●			
Onsite Prod. Reforming		●	●	●	Local zoning EU standard/ISO
Onsite Prod. Electrolysis		●	●	●	Local zoning EU standard/ISO

Delivery

		Current Status	Current Activity	Future Outlook	Comments
Delivery – HP composite					Will follow ASME and CGA
Delivery – HP conventional		●			Harmonization in progress
Delivery – cryo		●			Harmonization in progress
Pipelines	H ₂				Regulatory issues
Tunnel Delivery					

On-Site Bulk Storage





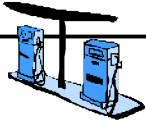

		Current Status	Current Activity	Future Outlook	Comments
HP Composite		●	●	●	Standards will be started
HP Conventional		●			Well-established technology
Set-back		●	●	●	European codes looking at verification
Location above grade		●	●	●	
Underground		●	●	●	No standard
Cryogenic		●	●		New cryo for Below ground
Set-back		●	●	●	
Location		●	●	●	Tests underway, ICC, NFPA codes
Underground		●	●	●	New cryo for Below ground

Fuel Dispensing

		Current Status	Current Activity	Future Outlook	Comments
Equipment Nozzle (250/350)		●			
Communication		●	●	●	SAE
Weights and Measures (gas) (liquid)		●	●	●	No consideration at this moment
Fuel Specification		●	●	●	In template: SAE, ASTM, API; ISO
Equipment (700) nozzle		●	●	●	Specs not started
Liquid Dispenser		●	●	●	



Fuel Island

		Current Status	Current Activity	Future Outlook	Comments
Piping, electrical					
Proximity to other fuels		●	●	●	Not addressed yet,
Safety Integration		●	●	●	Prevention of ignition sources, i.e. grounding, PPE
Building codes		●	●	●	Not addressed yet,
Canopy		●	●	●	
Onsite Equip		●			European CE markings applicable



An Important Example:

CGH₂ Filling Connector

EIHP2 identified that industry already had agreed on a standardized filler coupling in the SAE J2600 draft standard and therefore adopted this approach instead of developing something particular.

With assistance of ISO/TC197 EIHP2 initiated the process for the transfer of a national US standard into an international ISO standard.

SAE J2600 ⇒ ISO/DIS 17268 Gaseous hydrogen – Land vehicle filling connectors



Action Items for EoI/ EIHP3 Proposal Drafting

2

- EoI on a **Handbook about typical approval processes for the installation of hydrogen refueling stations in Europe** based on experience available in Europe, US, Japan - virtual projects together with authorities in 2 or more member states
Acronym: HyAcceptance
Partners: AL, APCI, BP, Shell, Total, Linde, DNV, BV, Ineris, TÜV, **VDBT**, PR-specialist, NGOs (fire brigades, ...)
- EoI for automotive on GTR drafting activities
Partners: BMW, DC, Ford, Opel, PSA, Renault, Volvo, RAFS, CCS
- EoI on recommendations for an LH2 refueling station draft standard
Partners: **Linde**, AL, Messer,
- EoI on identification and testing of appropriate materials for hydrogen components
Partners: **NH**, ...

Action taken

HyApproval

Action taken

Linde





Action Items for EoI/ EIHP3 Proposal Drafting [2]

3

- EoI on safety of hydrogen handling in normal and emergency conditions
[gaps analysis to HySafe]
Partners: DNV, **EC-JRC**, FZK, NCSR, VDBT
- EoI on appropriate curricula for hydrogen down-to-earth specialist
Acronmy: "HySchool"
Partners: VDBT,
- EoI on Operation and Maintenance of stationary hydrogen installations
Partners: **DNV**,
- EoI on hydrogen in marine applications
Partners: **VDBT**, AL, Icelandic New Energy Ltd.
- EoI on verification of zoning distances for public hydrogen only and
combined hydrogen/ hydrocarbon refueling stations
Partners: **BP**, Linde, DNV, NCSR, EC-JRC, VDBT, *Shell, APCI, NH*

} Action taken

HyApproval





Action Items for EoI/ EIHP3 Proposal Drafting [3]

4

- EoI on public hydrogen communication strategy
Partners: BMW, EC-JRC, auto, fuel, approval, infrastructure, operators,

Deadline of first EoI draft: 20FEB2004

Expression of Interest, OJ Reference: OJ C283 of 26.11.2003

EOI.FP6.SES-ML.2003 An opportunity for Europe's research community to help identify priorities for the mid-term revision of the Work Programme for the FP6 Thematic Priority 6.1.ii – sustainable energy systems, research activities having an impact in the medium and longer term

Publication date: 26 November 2003

Closing date: 19 March 2004, at 17.00 (Brussels local time)





L-B-Systemtechnik

Follow-on Activities existing/ proposed



GASEOUS HYDROGEN VEHICLE REFUELLING STATIONS

Introduction

1 Scope

2 References

3 Terms & Definitions

4 Properties of Hydrogen Gas

5 General Design Features

6 Safety Isolation Distances and Hazard Zones

7 Compression

8 Purification

9 Hydrogen Vehicle Refuelling Stations

10 Hydrogen Transfer

11 Venting

12 Dispensing Unit

13 Electrical Equipment and Installations

14 Fire Protection

15 Personnel Protection Training

16 Commissioning

17 Maintenance and Repairs

APPENDICES

Appendix A: Flow diagrams of Typical Hydrogen Vehicle Refuelling Stations

Appendix B: Emergency Notices

Appendix C: Hazardous Area Diagrams

Input to
ISO TC197
WG11

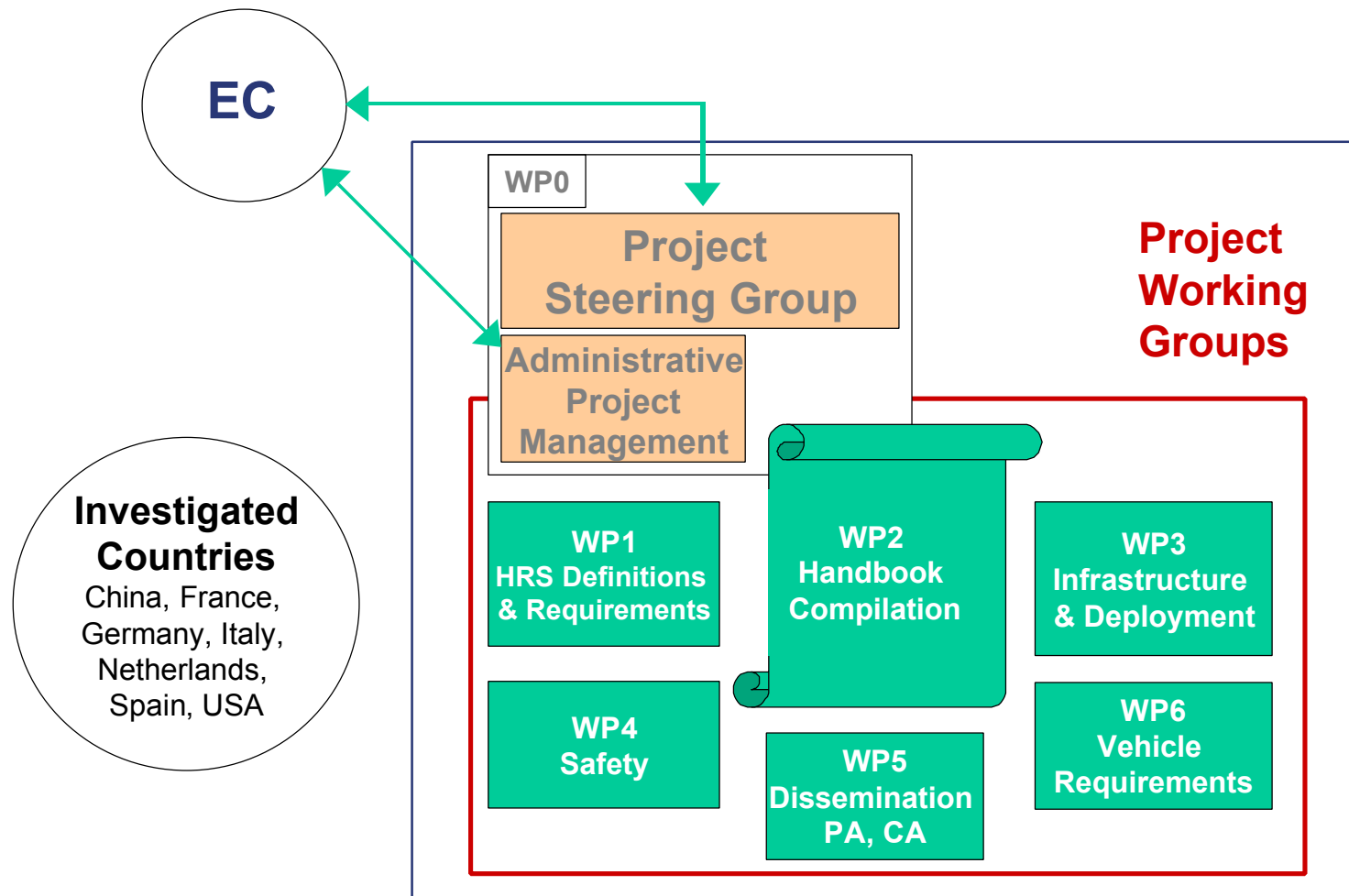
**Gaseous hydrogen and
hydrogen blends — Fuelling stations**
*Hydrogène gazeux et mélanges
d'hydrogène gazeux — Stations de
remplissage*

HyApproval (Project Proposal N° FP6-019813 in RTD Energy-3 Call)



L-B-Systemtechnik

Project Organisation HyApproval (24 months project)



Required Sectorial Competencies per Country Investigated:
Infrastructure - Automotive - Safety - Approval Authorities

HyApproval (Project Proposal N° FP6-019813 in RTD Energy-3 Call)



L-B-Systemtechnik

WP Break Down and Consortium

HyApproval Project Partners Overview

Status: 08 DEC 2004

WP N° WP Title	WP 0 Project Management	WP 1 HRS Definitions & Requirements	WP 2 Handbook Compilation	WP 3 Infrastructure & Deployment	WP 4 Safety	WP 5 Dissemination, PA, CA	WP 6 Vehicle Requirements
WP Leader	LBST	Stuart	AL DTA	TNO	Shell	FAST	Opel
WP Partners	AL DTA* FAST* Opel* Shell* Stuart* TNO*	AL DTA BP CAS DNV ET FZK INE INERIS Linde NCSR NH NREL Shell TNO Total	APL BP CAS DNV ET INTA NH NREL Shell Stuart TNO	AL DTA DNV ET FAST INE INERIS INTA Linde NH NREL Shell Stuart	AL DTA APL BP CEA DNV ET FZK INERIS JRC Linde NCSR NH NREL Opel TNO	BP CAS CEA INE INTA NH Stuart TNO	AL DTA CEA INE Linde NREL Shell Stuart

Partners: LBST, AP, AL, BP, CAS, CEA; NCSR, DNV, EniTec, FZK, Opel; FAST, NH, INE, INERIS, INTA, JRC, LINDE, STUART, SHELL, TNO, TOTAL, NREL



L-B-Systemtechnik

Needs Identified by Industry at an Early Stage with Respect to Political Support



EIHP Messages to the HLG

Messages of the European Integrated Hydrogen Project to the European Commission's High Level Group on Hydrogen and Fuel Cells
28 February 2003

- Maintain the EIHP expertise and install a *Working Committee* on the harmonisation of regulations, drafting codes and standards for hydrogen applications in the automotive sector and the associated refuelling infrastructure on a long term basis.
- Create and support a *Partnership* composed of companies + research institutes and universities + others
- Create an *EC program* for hydrogen and fuel cells *with a specially allocated budget* (as common practice in the USA and Japan, EU's major competitors). In addition it should be possible to link the program with other EC programs without bureaucratic hurdles. Invest more money on hydrogen !! [US: 300Mio\$/a, Japan 220Mio\$/a, EU 50(?) Mio€]

IG-RCS

(but no continuous public funding)

Pending

Pending



L-B-Systemtechnik

Thank you for your attention!

For upcoming information please visit

www.EIHP.org

www.hfpeurope.org

www.hyapproval.org

www.HyWays.de