



L-B-Systemtechnik

---

## Regulations, Codes & Standards

Reinhold Wurster

wurster@lbst.de

Latest Regulatory & Technological Development in  
Electrical and Mechanical Safety & Energy Efficiency

Hongkong - 04 March 2005



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

## Overview of Major RC&S Activities in Europe

---



stemtechnik

{ EIHP2 project terminated in January 2004, reports available on webpage [www.eihp.org](http://www.eihp.org) }

Regulation drafts for approval of hydrogen road vehicles (LH<sub>2</sub> and CGH<sub>2</sub> onboard storage) under discussion at UNECE GRPE

Preparation of Roadmap to H<sub>2</sub>&FC vehicles GTR by the UNECE WP.29 GRPE Informal Group on Hydrogen/Fuel Cell Vehicles [[www.eihp.org/unece](http://www.eihp.org/unece)]

ISO TC197 WG11 "Gaseous hydrogen and hydrogen blends — Fuelling stations"

HySociety "Deliverable 10 - Measures for codes, standards and regulations for safe (and efficient) deployment of hydrogen in the European Union"

Fuel Cell standardization at CEN

HFP IG RC&S work

Mandate by EC to CEN/CENELC for a gaps analysis in H<sub>2</sub>&FC-specific RC&S

HarmonHy project (harmonization of R&S for H<sub>2</sub>&FC) under negotiation with EC

Proposal HyApproval for the development of a "Handbook for certification of public hydrogen filling stations" in Europe

# Hydrogen Fuelled Vehicles - Challenges to be Resolved

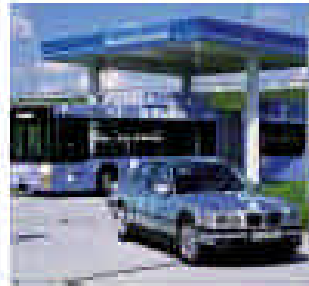


L-B-Systemtechnik

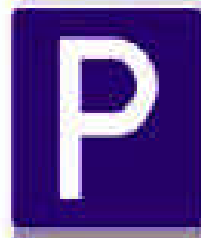


**TÜV**

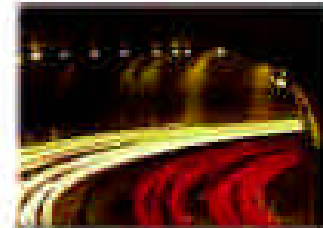
Vehicle  
licensing



Filling Station



Parking,  
Garaging



Tunnels



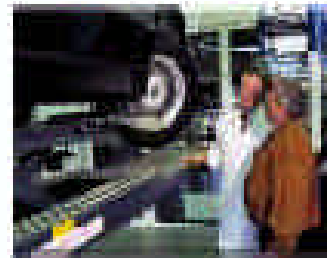
Data Transmission



Emergency  
Services



Accidents



Repairs/maintenance



Service

**EIHP**

# 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 fueled vehicles**
- **Vehicle - development of drafts for UNECE regulations**
- **Infrastructure - only very limited analysis**
- **Safety studies and limited computer simulations**

# EIHP

## **Phase 2: Feb 2001 – Jan 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 and discussions are going on with regard to a possible continuation (HarmonHy proposal).**



# Safety Implications of Hydrogen Use in Road Transport

## EIHP2 Compilation of Existing Safety Data on H<sub>2</sub> and Comparative Fuels

	Hydrogen	Methane	Propane	Gasoline
Detonability limits (vol. % in air)				
Lower limit (LDL)	11-18	6.3	3.1	1.1
Upper limit (UDL)	59	13.5	7	3.3
Maximum burning velocity (m/s)	3.46	0.43	0.47	
Concentration at maximum (vol. %)	42.5	10.2	4.3	
Burning velocity at stoichiometric (m/s)	2.37	0.42	0.46	0.42
Concentration at stoichiometric (vol. %)	29.5	9.5	4.1	1.8

Source:

EIHP2 Report, May 2001

Authors:

J.L. Alcock, L.C. Shirvill,  
R.F. Cracknell [Shell]



	Hydrogen, H <sub>2</sub>	Methane, CH <sub>4</sub>	Propane, C <sub>3</sub> H <sub>8</sub>
Flow Parameters:			
Diffusion coefficient in air at NTP <sup>a</sup> (cm <sup>2</sup> /s)	0.61	0.16	0.12
Viscosity at NTP (g/cm-s x 10 <sup>-5</sup> )	89	11.7	80
Density at NTP (kg/m <sup>3</sup> )	0.0838	0.6512	1.870
Ratio of specific heats, Cp/Cv at NTP	1.308	1.383	1.14
Relative leak rates (volumetric):			
Subsonic flow			
Diffusion	1	0.26	0.20
Laminar Flow	1	0.77	1.11
Turbulent Flow	1	0.35	0.21
Sonic flow	1	0.34	0.20
Relative leak rates (energy basis <sup>b</sup> ):			
Subsonic flow			
Diffusion	1	0.87	1.63
Laminar Flow	1	2.66	9.38
Turbulent Flow	1	1.18	1.80
Sonic flow	1	1.14	1.63

<sup>a</sup> Normal temperature and pressure - 1 atm and 20°C

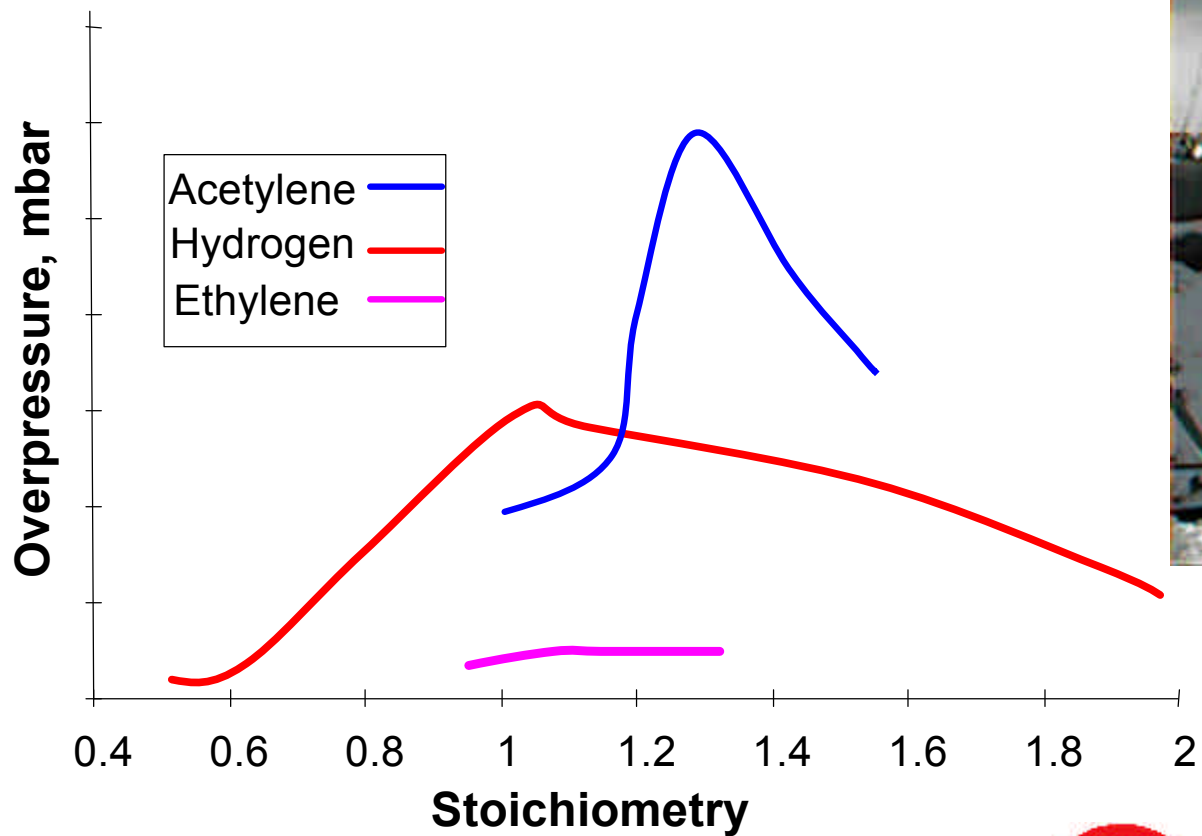
<sup>b</sup> Based on lower heating value of the fuel

# Safety Implications of Hydrogen Use in Road Transport

Shell's comparison of small scale unconfined explosions – test data



L-B-Systemtechnik



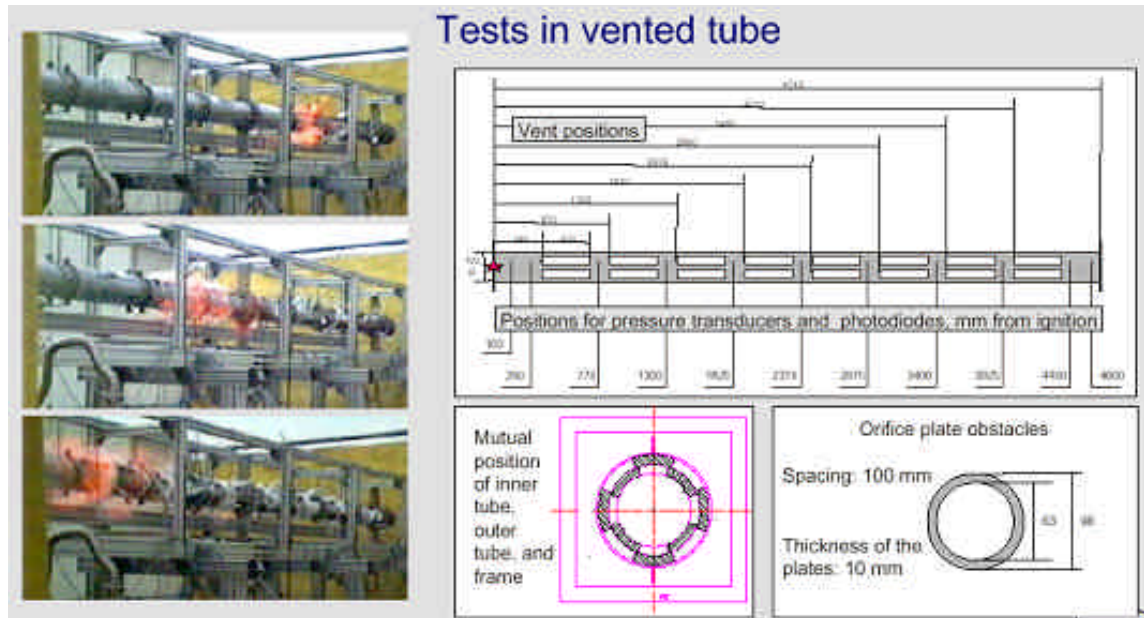
Hydrogen explosion actually milder than acetylene at length scales investigated.



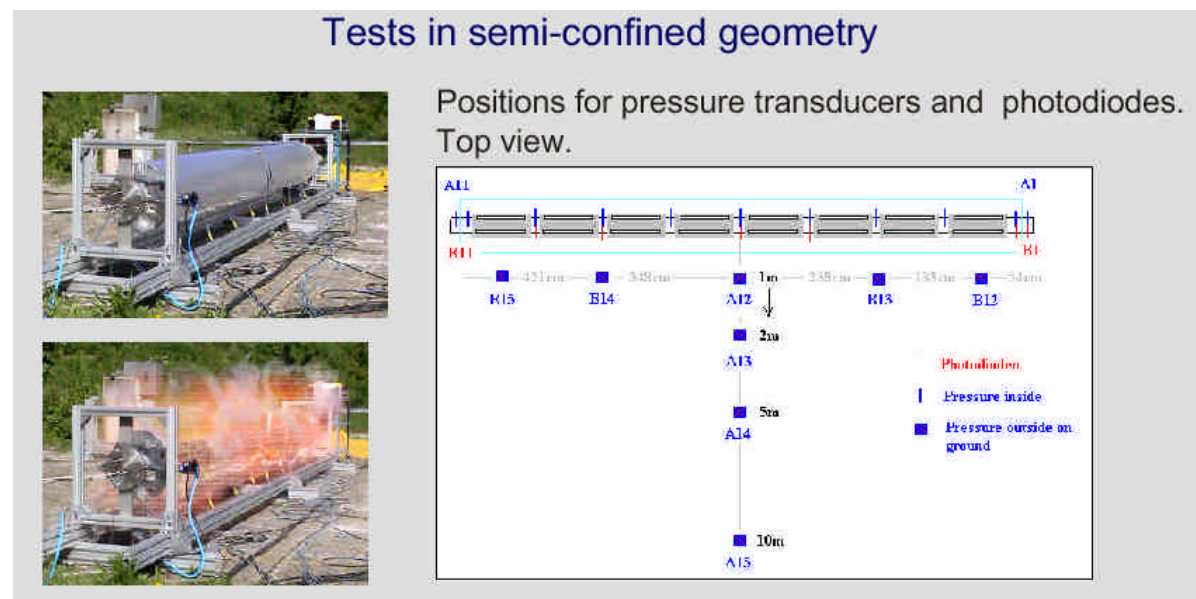
# EIHP2 Combustion Tests in Semi-confined and Vented Tubes



L-B-Systemtechnik



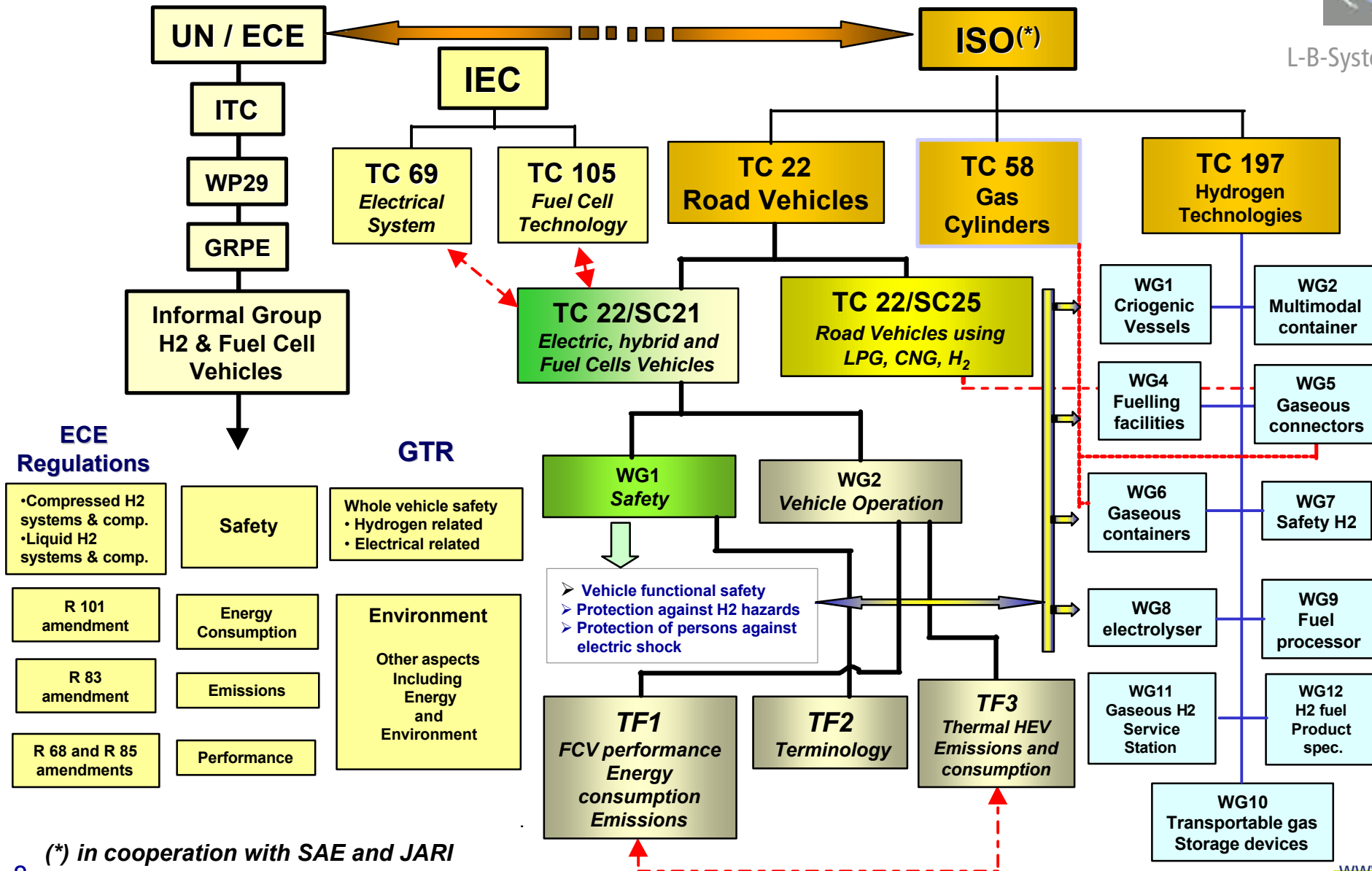
Supporting experiments on safety implications of hydrogen use in road transport



# International Landscape of Regulations and Standards



L-B-Systemtechnik



(\*) in cooperation with SAE and JARI



- Legal Requirements and Regulations are ranked above standards L-B-Systemtechnik
- UN Global Technical Regulation [1998 Agreement]      1<sup>st</sup> priority  
    ↓  
    UNECE Regulation [1958 Agreement]      2<sup>nd</sup> priority  
    ↓  
    EEC Directives      3<sup>rd</sup> priority  
    ↓  
    National Directives and Regulations      4<sup>th</sup> priority
- Important directives regarding stationary hydrogen technologies and infrastructure systems are:
  - ATEX directives
  - PED (Pressurised Equipment Directive)
  - EMC (electromagnetic compatibility) directive
  - The Machinery Safety Directive
  - SEVESO II (large amounts of haz. mat.)
  - Transport of dangerous goods by road
  - UN IMO
- Standards (ISO, IEC, ..... CEN, SAE) [Intl. Standards are preferable]



- Some 47 directives have to be applied in order to receive an approval for a road vehicle in Europe. If a vehicle is successfully tested according to these 47 EC directives or equivalent ECE regulations it has to be approved. The result is a Whole Vehicle Type Approval.
- If approval is sought for a hydrogen vehicle, emissions, fuel consumption and engine power cannot be tested according to the existing directives/ regulations. The reason is mainly the absence of a standardised reference fuel or the absence of a test procedure and the absence of corresponding EC directives respectively ECE regulations.
- Some other directives can be fulfilled formally, but from the technical point of view they should be revised for hydrogen vehicles.
- Some requirements regarding the safety of the hydrogen on-board storage systems are missing in the existing directives.



## List of directives/ regulations to be amended for road vehicles

<u>Subject</u>	<u>EEC-Directive/ECE-Regulation</u>
1. Emissions	70/220/EEC incl. latest amendment & ECE R83
2. Fuel tanks/rear protective device	70/221/EEC incl. latest amendment & ECE R34/58
3. Diesel smoke	72/306/EEC incl. latest amendment & ECE R24
4. Identification of controls	78/316/EEC incl. latest amendment
5. Fuel consumption	80/1268/EEC incl. latest amendment & ECE R 101
6. Engine Power	80/1269/EEC incl. latest amendment & ECE R84
7. Diesel emissions	88/77/EEC & ECE R49
8. Side impact	96/27/EC & ECE R95
9. Frontal impact	96/79/EC & ECE R94
10. Roadworthiness tests	96/96/EC & PTI
11. CO2 labeling	99/94/EC
12. Base Directive	70/156/EEC incl. latest amendment
13. Electric Vehicles	NEW EC Directive & ECE R100
14. Defrost/Demist	78/317/EEC (already under progress)

# Why Develop a New Regulation for Hydrogen Road Vehicles ?

---




L-B-Systemtechnik

The path of Council Directive No 98/14/EC, article 8(2)c,  
to approve hydrogen fuelled vehicles:



- ✓ Excessive amount of time required
- ✓ Uncertainty of the outcome of the process up until the very end
- ✓ Not suitable for electric drive vehicles (FCVs, HEVs)



 **A draft regulation for hydrogen vehicles should be developed**

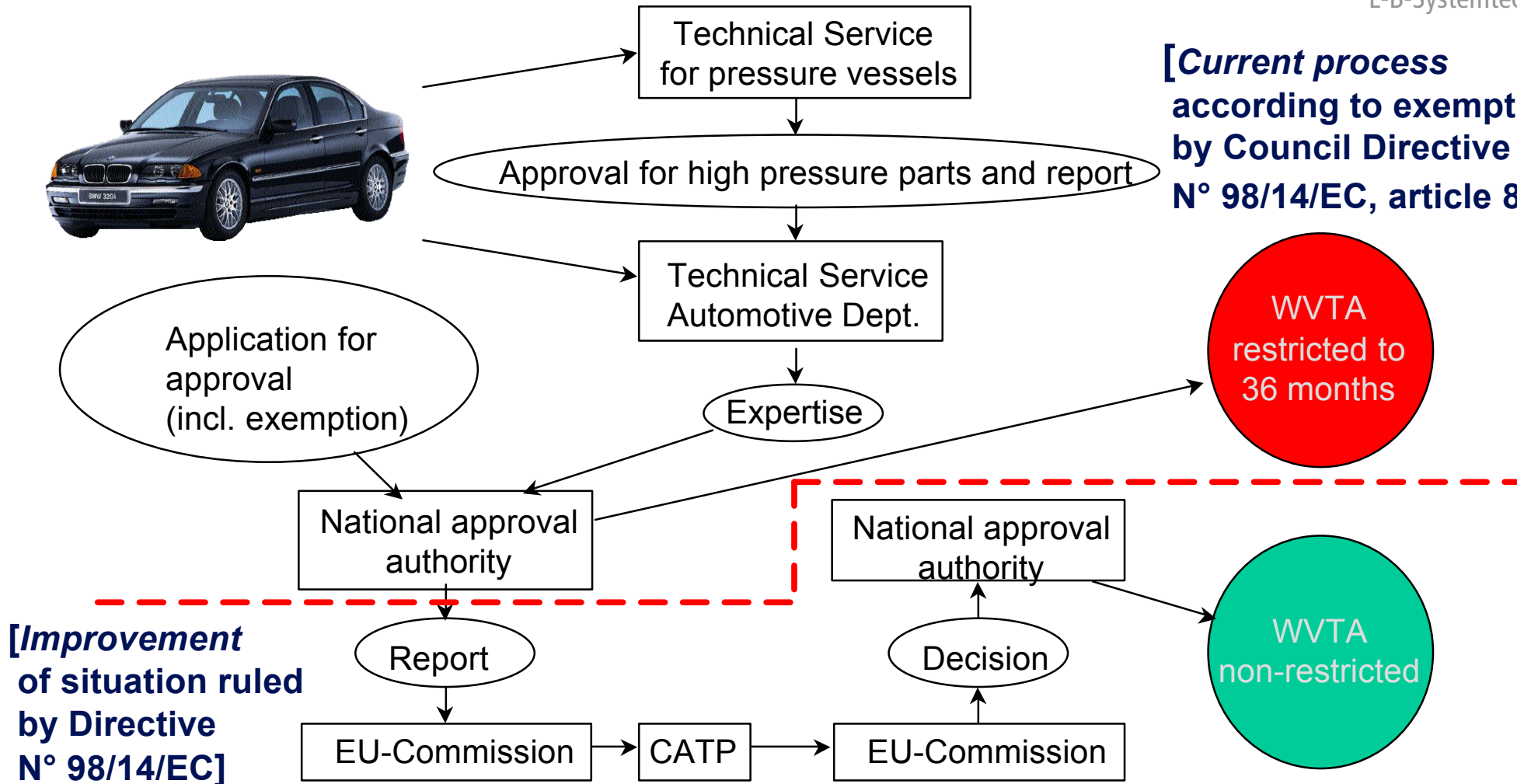
# Application for a European Whole Vehicle Type Approval (WVTA)



L-B-Systemtechnik



**[Current process according to exemption by Council Directive N° 98/14/EC, article 8(2)c]**



**[Improvement of situation ruled by Directive N° 98/14/EC]**

# Two Pathways to Present a Proposal for a Regulation



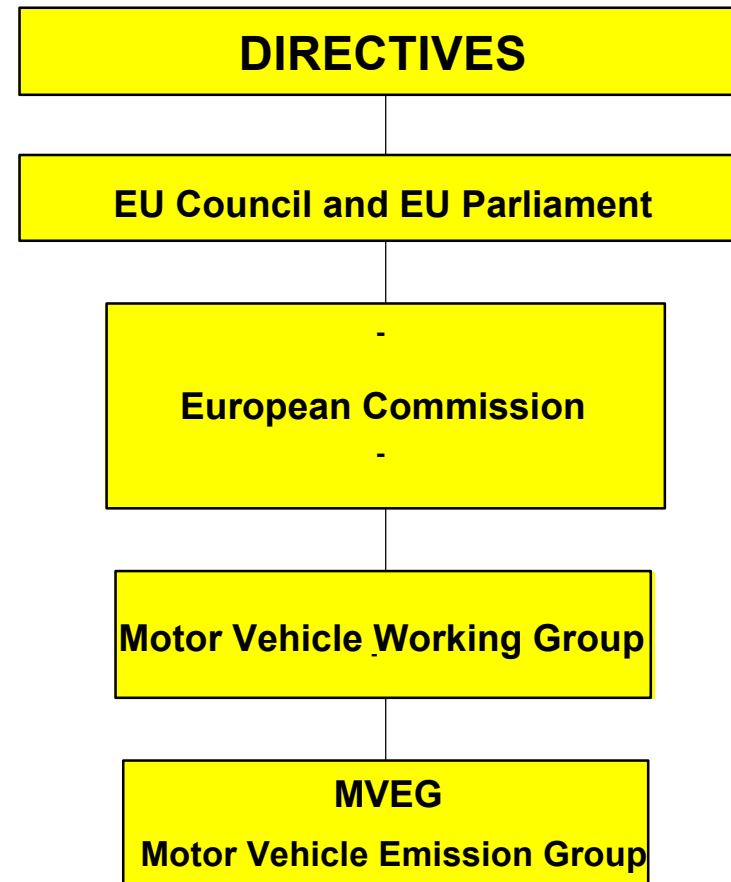
L-B-Systemtechnik

## UN-ECE

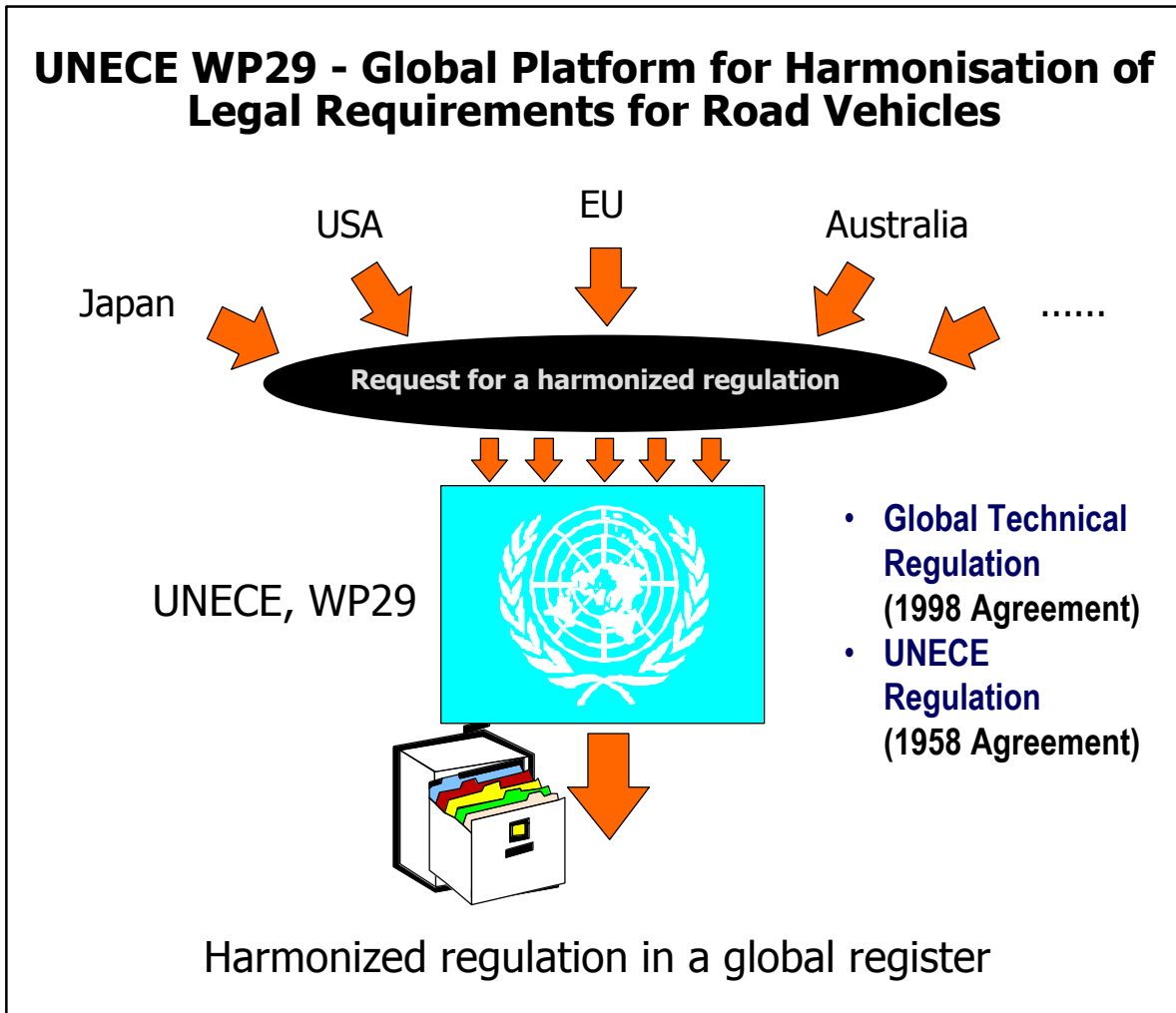


**Voluntary** (Valid for: EU, Jap., Aus.)

## EC



**Binding for WVTA** (Valid for: EU)



#### MEMBERS OF THE **1958 AGREEMENT**:

[(E/ECE/324-E/ECE/TRANS/505/Rev.2)]

GERMANY, FRANCE, ITALY, NETHERLANDS, SWEDEN, BELGIUM, HUNGARY, CZECH REPUBLIC, SPAIN, YUGOSLAVIA, UNITED KINGDOM, AUSTRIA, LUXEMBOURG, SWITZERLAND, NORWAY, FINLAND, DENMARK, ROMANIA, POLAND, PORTUGAL, RUSSIAN FEDERATION, GREECE, IRELAND, CROATIA, SLOVENIA, SLOVAKIA, BELARUS, ESTONIA, BOSNIA AND HERZEGOVINA, LATVIA, BULGARIA, TURKEY, THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA, EUROPEAN COMMUNITY, JAPAN, AUSTRALIA, UKRAINE, REPUBLIC OF SOUTH AFRICA

#### MEMBERS OF THE **1998 AGREEMENT**:

[(E/ECE/TRANS/132 AND Corr.1)]

CANADA, **UNITED STATES OF AMERICA**, JAPAN, FRANCE, UNITED KINGDOM, EUROPEAN COMMUNITY, GERMANY, RUSSIAN FEDERATION, **PEOPLE'S REPUBLIC OF CHINA**, **REPUBLIC OF KOREA**, ITALY, REPUBLIC OF SOUTH AFRICA, SPAIN

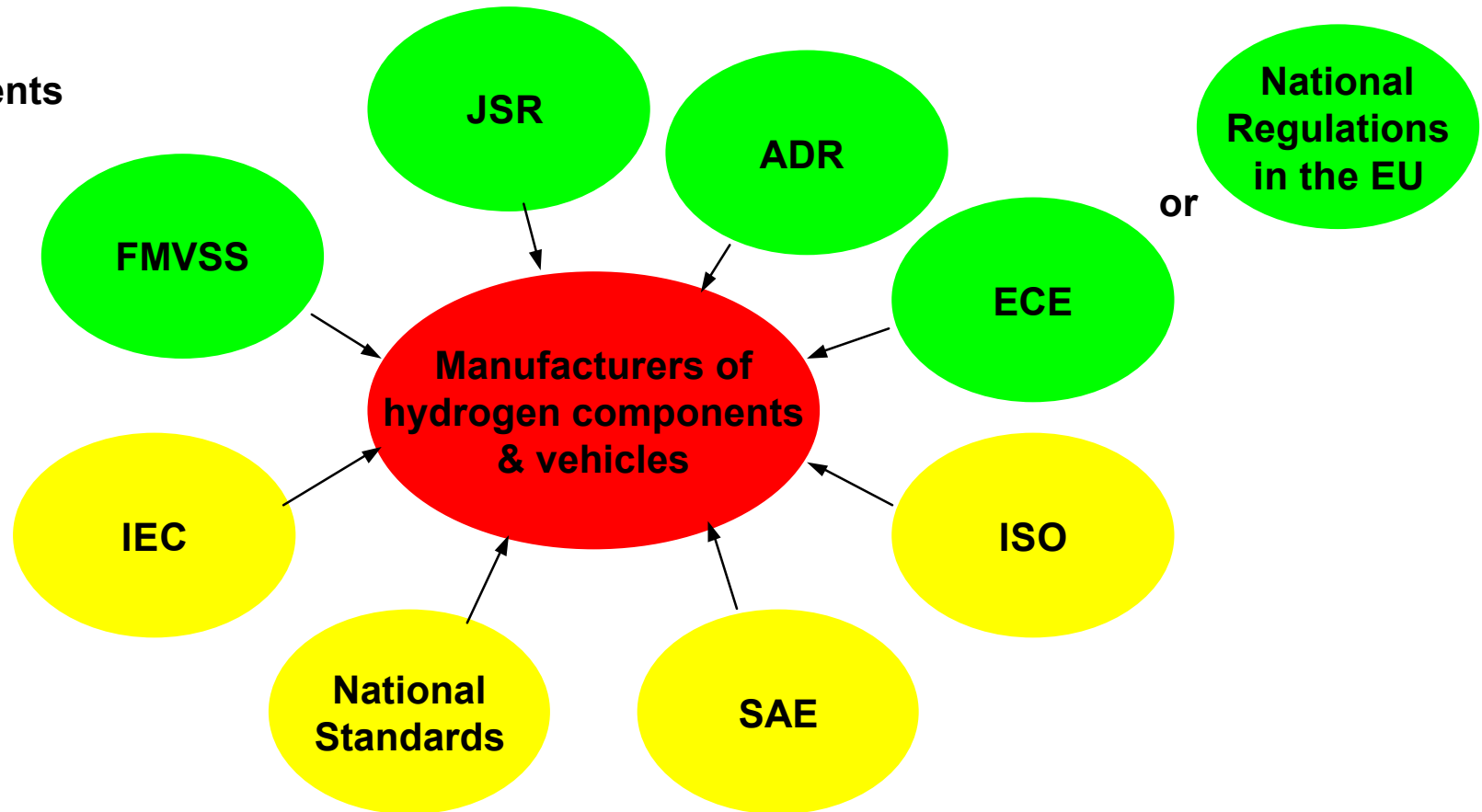
# Present Situation

## Undesirable Future Scenario For Regulations & Standards



L-B-Systemtechnik

Legal requirements



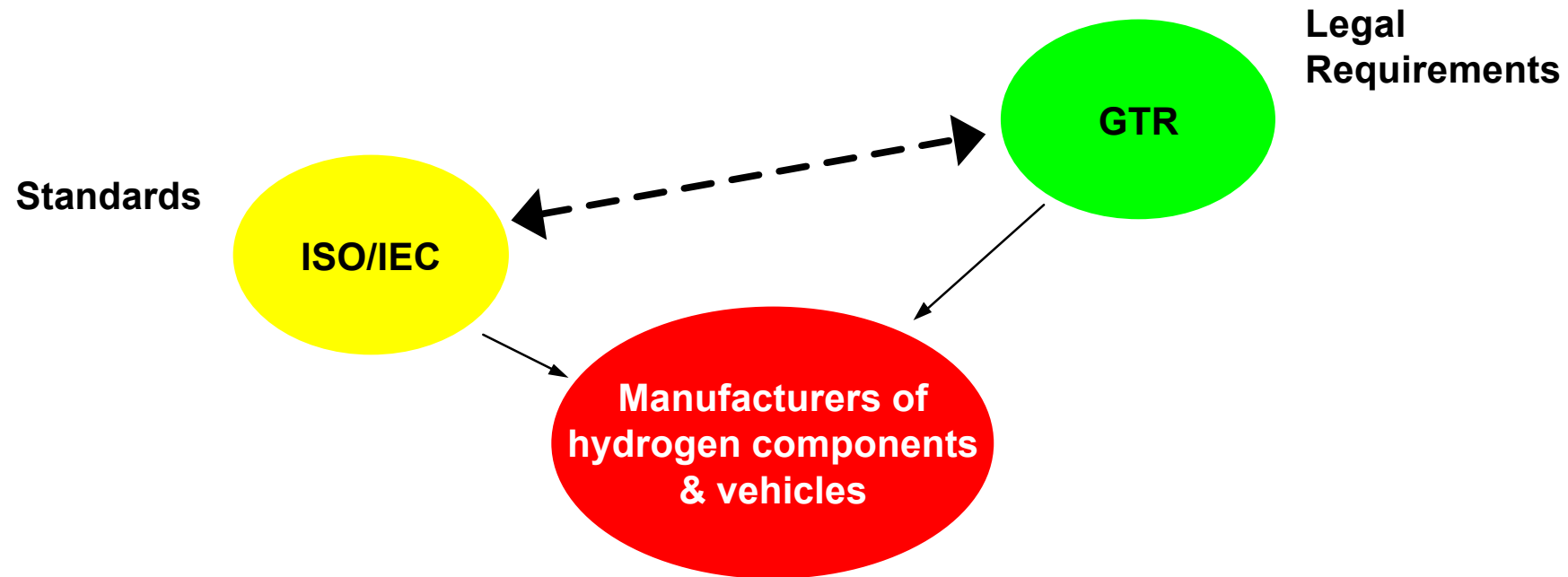
Standards

# Recommendations

## Desirable Future Scenario For Regulations & Standards



L-B-Systemtechnik

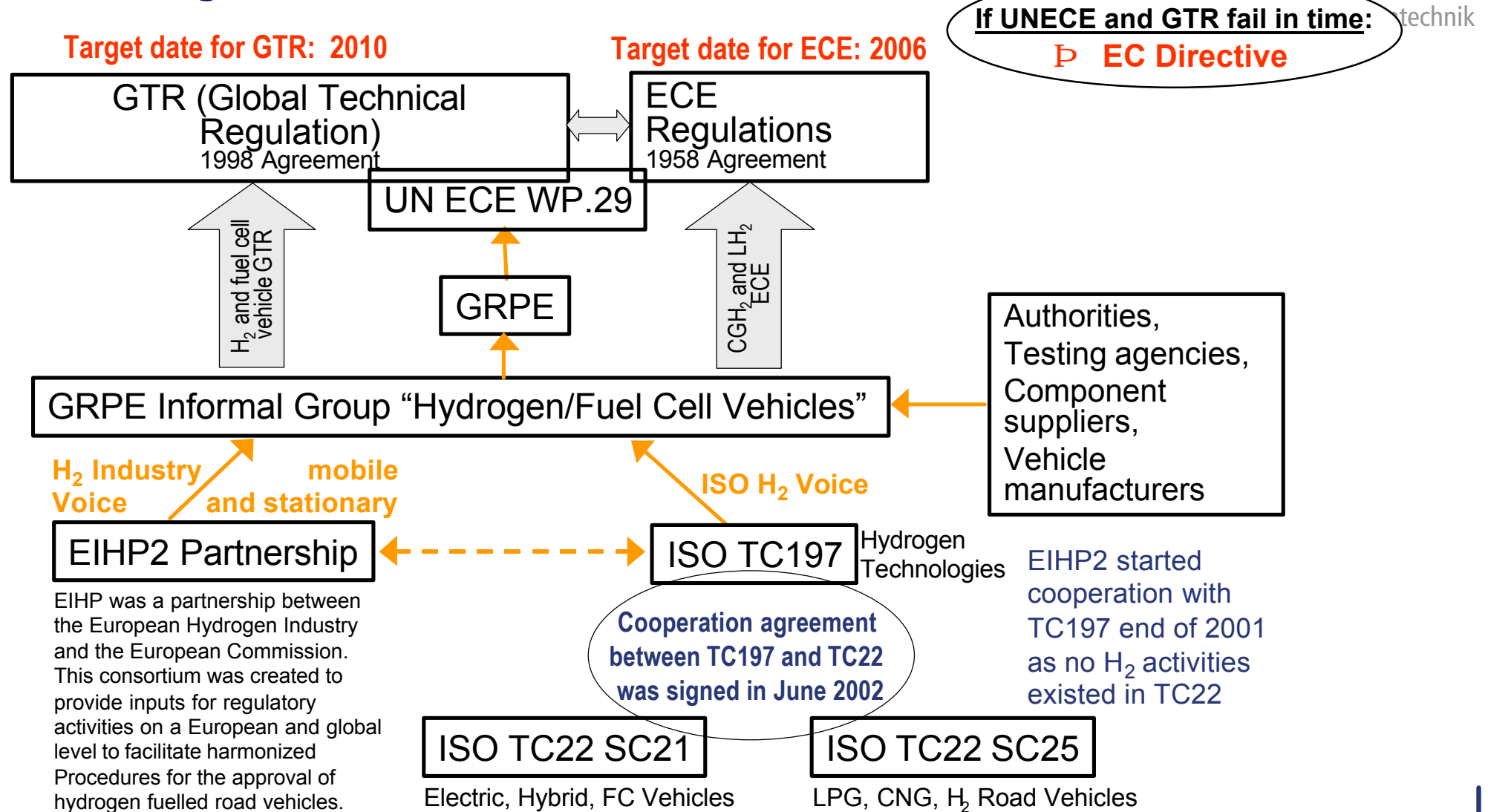


- Legal requirements should be created only where necessary
- GTRs should refer to available ISO/IEC standards

# Globally Harmonized Vehicle Approval – Possible Pathway





















## Networking Activities





## UNECE GRPE Informal Group "Hydrogen/ Fuel Cell Vehicles" [<http://www.eihp.org/unece/index.html>]

<b>Canada</b>	 Charles Thibodeau
<b>France</b>	 Christian Pichon
<b>Germany</b> (chairmanship)	 Christoph Albus
<b>Italy</b>	 Carlo Cucchi
<b>Japan/JASIC</b>	 Yuki Toba
<b>Netherlands</b>	 Andre Rijnders
<b>Russian Federation</b>	 Vladimir Kamenev
<b>United Kingdom</b>	 Bernie Frost
<b>CLEPA</b>	 L. S. Ayrat
<b>ISO</b>	 Francois Abram
<b>OICA</b>	 NN
<b>ENGVA</b>	 Jeffrey M. Seisler
<b>USA</b>	 Martin Koubek
<b>BMW AG</b>	 Peter Michel
<b>DaimlerChrysler AG</b>	 Rainer Bauer
<b>Ford Werke AG</b>	 Udo Klein
<b>Opel AG</b>	 Volker Rothe
<b>Volvo Techn. Corp.</b>	 Paul Adams

# Scope and Content of H<sub>2</sub>/FC GTR(s)



L-B-Systemtechnik

## 1.1 On-board storage system safety

Safety of Container and Components  
Lifecycles  
Re-qualification  
Performance  
Purging Limits  
Material Characteristics  
Flow Control  
Damage Tolerance  
Fire Protection  
Aging  
Material Characteristics  
Refuelling  
Mechanical Properties

Most items covered in UNECE regulation drafts

## 1.2 Whole vehicle safety

Crashworthiness  
Fire Safety  
Hydrogen System Integrity  
Pre-Crash  
Post-Crash  
Explosion Protection  
Road Hazards Exposure  
EMC (EMS)  
Spark / Grounding  
Electric Shock Protection  
Pre-Crash  
Post-Crash  
Emergency Medical Rescue  
Controls and Display

Most items not covered in UNECE regulation drafts

## 1.3 Other aspects including energy and environmental considerations

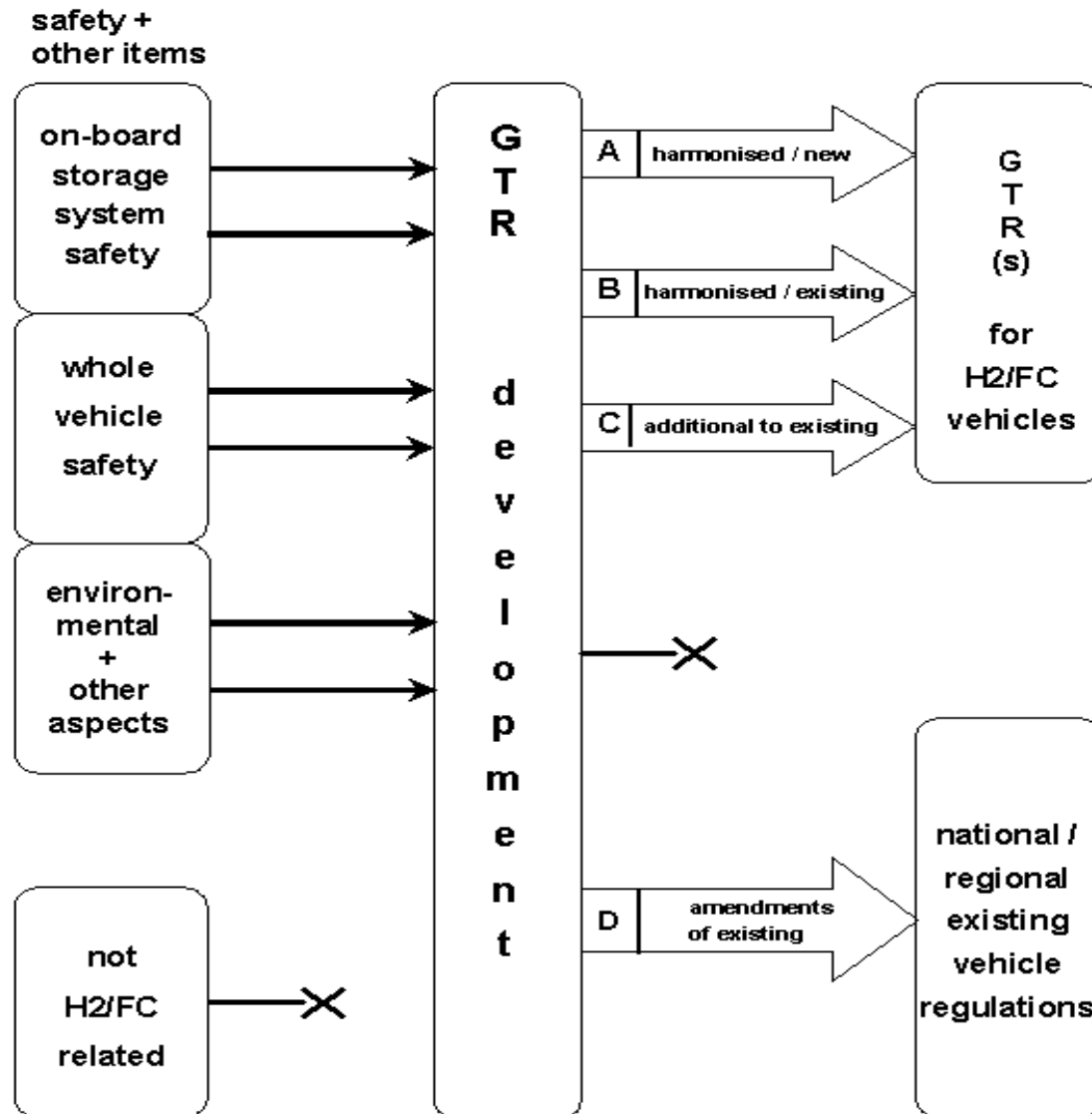
Pollutant Emissions  
Fuel Consumption  
Recycling  
Regeneration  
FC Disposal / Hazmat?  
Fuel Quality  
Engine Power  
EMC (EMI)  
Low Temperature

Items not at all covered in UNECE regulation drafts

# Concept to Develop the H<sub>2</sub>/FC GTR(s) by GRPE Informal Group on HFCV



L-B-Systemtechnik



- A: Harmonised GTR(s) for new items (e.g. safety of H<sub>2</sub> storage systems)
- B: Harmonisation of existing regulations for H<sub>2</sub>/FC vehicles (e.g. electric safety)
- C: Harmonised requirements, additional applicable to existing national / regional regulations (e.g. additional crash requirements)
- D: No harmonisation, but amendments of national / regional regulations (e.g. NOx limit value for internal combustion engines fuelled with H<sub>2</sub>)

## General Tasks for Future Regulatory and Standardisation Work

---



L-B-Systemtechnik

Parallel development and approval of UNECE regulations for hydrogen road vehicles (two drafts for  $\text{CGH}_2$  and  $\text{LH}_2$  are almost finalised) and Global Technical Regulations (GTR) at UN level.

Europe needs UNECE for a limited time in order to approve hydrogen road vehicles soon. When a GTR will become available, this GTR will be used for approval also in Europe.

If even a UNECE will not become feasible, Europe will go for an EEC Directive

↳ Above proceeding required if GTR cannot be securely finalized by 2010

Hydrogen and fuel cell standardisation work should be focused on international bodies, i.e. ISO TC197 and IEC TC105.

Effective and efficient coordination and cooperation is needed to ensure smooth implementation of the regulatory and standards framework until 2010.

For infrastructure implementation and approval local, regional and national regulations are required. These should make use only of international standards and as far as possible harmonised approval procedures.

# UN ECE and GTR soon or EC Directive in the meantime



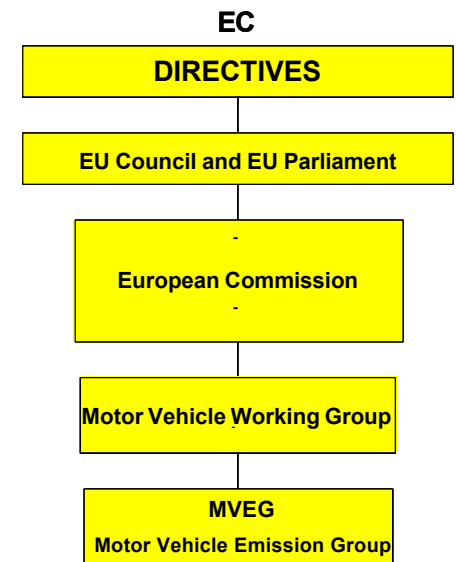
L-B-Systemtechnik

Onboard storage-related issues ⇒ Two ECE Regulations under the 1958 Agreement (with limited lifetime) (may be kept as referencing instrument to EEC directives) ⇒ **GTR** (to replace ECE Regs.)

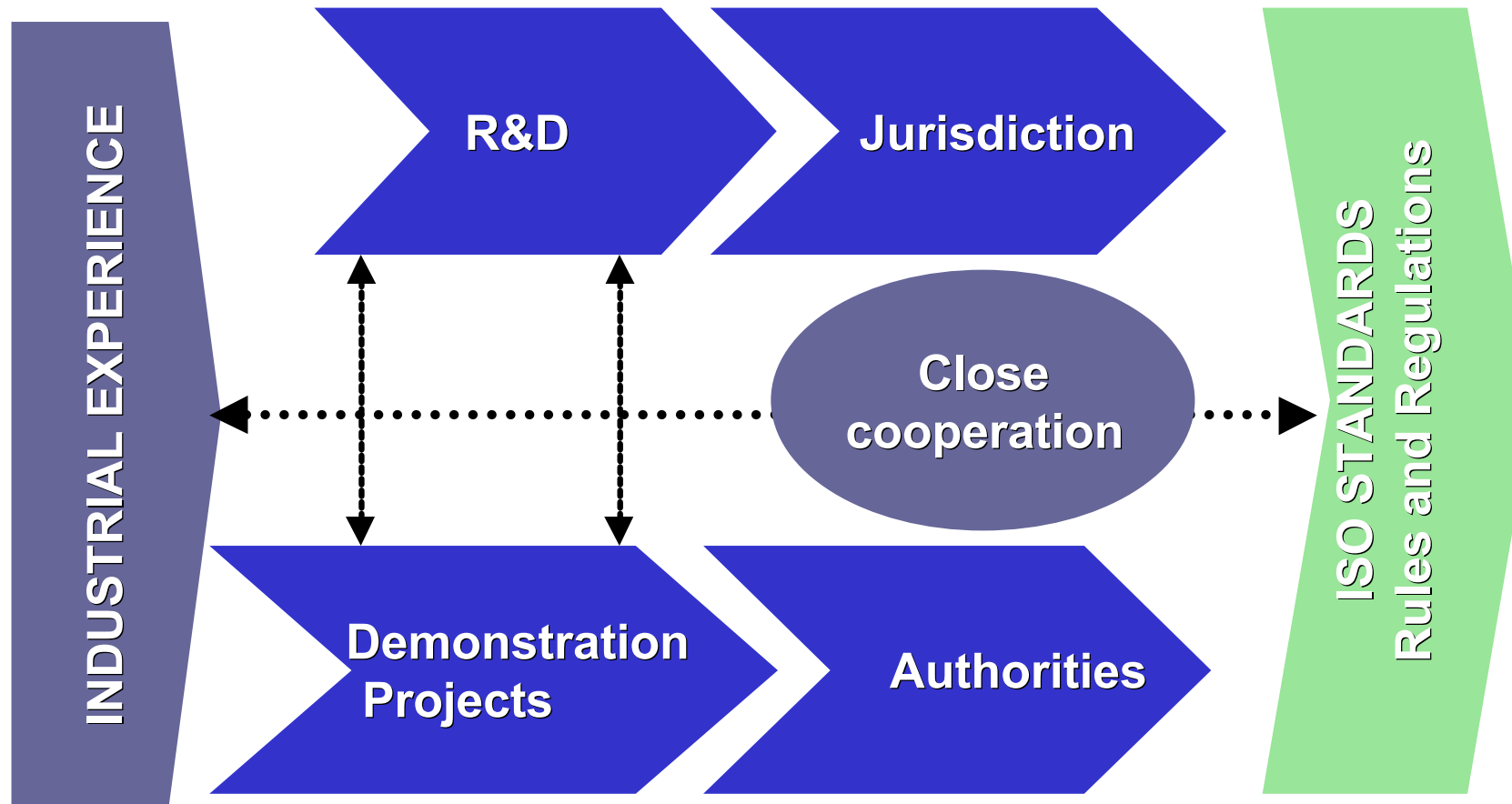
↓  
↓  
↓

Rest of H2-Vehicle (FC, Safety in normal & crash conditions; Fuel Consumption; etc.)    ¶    ¶    ¶    ¶    **GTR** under the 1998 Agreement (referencing ISO, IEC)

or



\* *(still under discussion in the UNECE GRPE Informal Group on Hydrogen/Fuel Cell Vehicles)*



# Globally Harmonized Standards on Hydrogen

---

International standards and draft standards – ISO/TC197



L-B-Systemtechnik

## *Published standards:*

ISO 13984 Liquid hydrogen – Land vehicle fuelling system interface

ISO 14687 Hydrogen fuel – Product specification

## *Draft International Standards:*

ISO/DIS 13985 Liquid hydrogen – Land vehicle fuel tanks

ISO/DIS 15869 Gaseous hydrogen and hydrogen blends – Land vehicle fuel tanks –

Part 1: General requirements

Part 2: Particular requirements for metal tanks

Part 3: Particular requirements for hoop wrapped composite tanks with metal liner

Part 4: Particular requirements for fully wrapped composite tanks with metal liner

Part 5: Particular requirements for fully wrapped composite tanks with non-metallic liner

ISO/DIS 17268 Gaseous hydrogen – Land vehicle filling connectors (based on SAE J2600)

ISO/ DIS 21009- 1 Liquid hydrogen storage



## Globally Harmonized Standards on Hydrogen

---

International working draft and committee drafts, etc. – ISO/TC197

### *Working Drafts:*

ISO/WD 22734 Hydrogen generators using water electrolysis process

ISO WD 13986 Tank containers for multimodal transportation of liquid hydrogen

### *Committee Drafts:*

ISO/CD PAS 15594 Airport hydrogen fuelling facility

ISO/ CD 22734 Electrolyzer

ISO/CD 24490 Cryogenics pump

### *Draft Publicly Available Specification:*

ISO/PRF TR 15916 Basic considerations for safety of hydrogen systems

### *Proposed New Work Items:*

ISO/AWI 16110 Hydrogen generators using fuel processing technologies

ISO/AWI 16111 Transportable gas storage devices – Hydrogen absorbed in reversible metal hydride

ISO/TC 197 NWIP N 253 Dispensing Unit

ISO/NP 20012 Gaseous hydrogen and hydrogen blends — Fuelling stations (Draft Technical Specification)



### **ISO and IEC standards are required for:**

- H<sub>2</sub> production equipment ⇒ ISO/TC 197
- Service stations ⇒ ISO/TC 197
- \* Filling connectors ⇒ ISO/TC 197 and ISO/TC 22
- Fuel cells ⇒ IEC/TC 105
- \* Onboard H<sub>2</sub>/FC equipment ⇒ ISO/TC 197, ISO/TC 22 and IEC/TC105
- Others

\* *For hydrogen, ISO/TC 197 will work with other TCs in joint working groups.*



### An Important Example:

#### CGH<sub>2</sub> 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



## Local Implementation of Stationary H2&FC Equipment

**Normally the approval process takes several months and includes the following steps:**

- Application for authorization
- Response from the authorities: A permission document with detailed description of all requirements
- Public hearing of the permission document
- Permission to build / establish the facilities
- Inspections of the established facilities, by Public Authorities / Notified Body
- Approval of the facilities and permission to operate

**Licences, permits, and certificates :**

- Building licence
- Environmental licence
- Operational licence
- CE certificates (which includes detailed documentation of the equipment)
- Third party inspection document / certificate

**Authorities involved in the approval process are normally:**

- Environment Authorities
- Fire and Explosion Authorities
- Municipal Building Authorities
- Civil Work Authorities

**Important aspects regarding authority approval**

- Relevant national regulations
- Risk analysis
  - knowledge about hydrogen safety related properties not yet fully explored
  - relevant operation and accident statistics missing or insufficient
- CE marking
  - dependent on risk analysis, testing and operation experience

EIHP2 Working Draft – Gaseous Hydrogen Vehicle Refuelling Stations  
EIGA Document IGC 15/96/E (gaseous Hydrogen Installations)

Documents assisting local implementation in Europe

‘HyApproval’ Proposal  
[www.hyapproval.org](http://www.hyapproval.org)  
FP6 3rd call RTD-Energy  
Submission 08DEC2004



## **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**

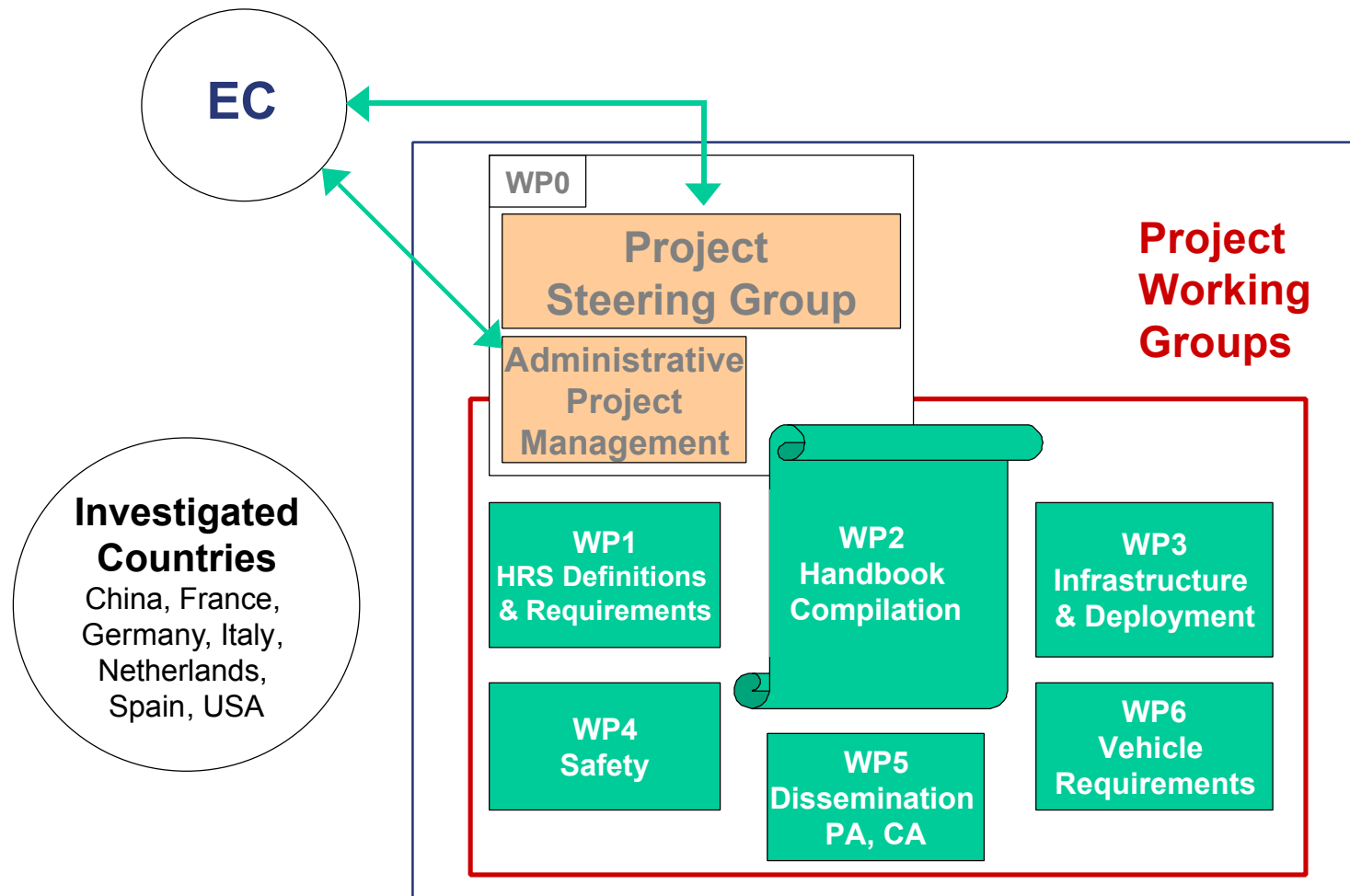
Input to  
ISO TC197  
WG11

Gaseous hydrogen and  
hydrogen blends  
— Fuelling stations

*Hydrogène gazeux et mélanges  
d'hydrogène gazeux — Stations de  
remplissage*



## Project Organisation HyApproval (24 months project)



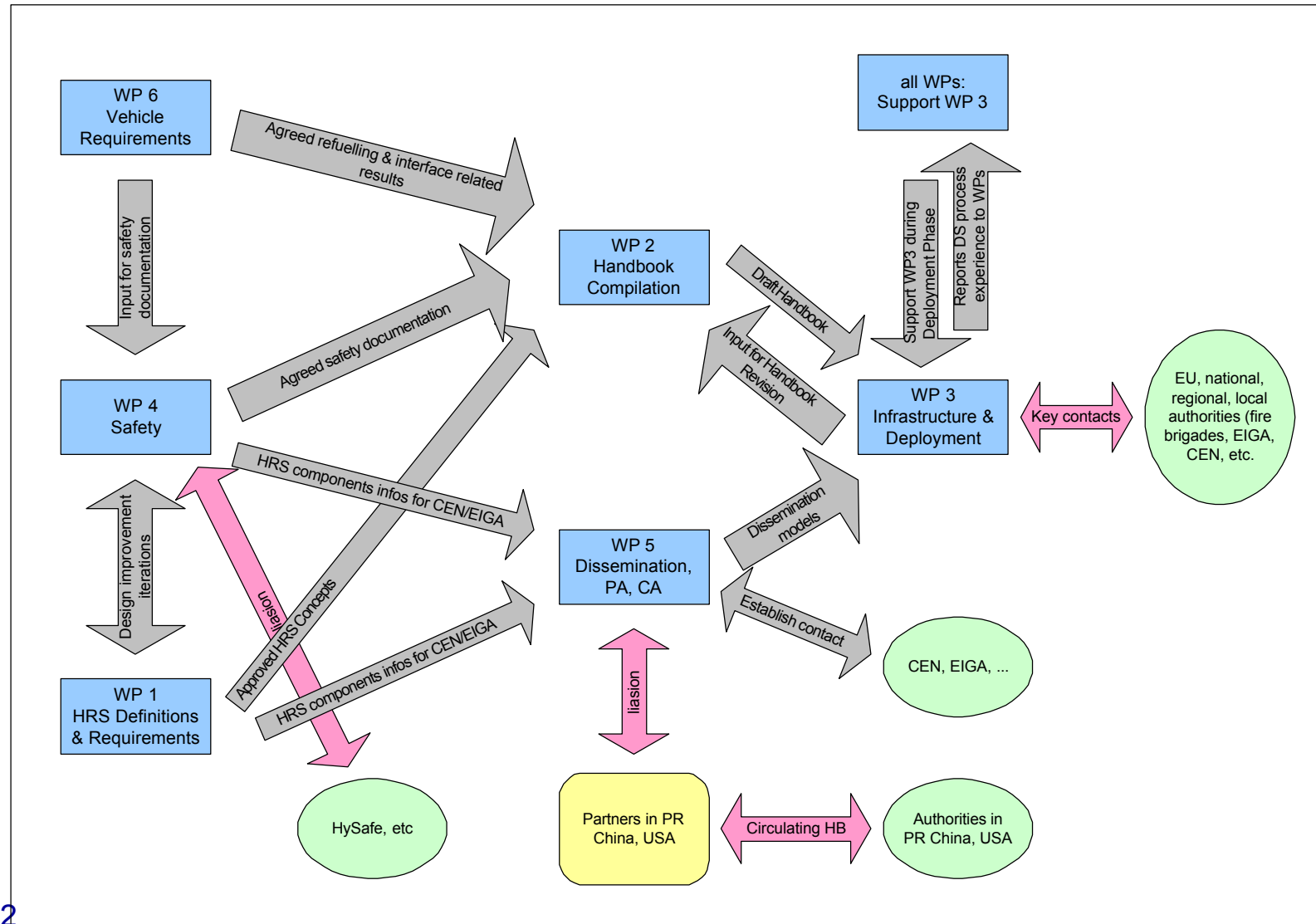
Required Sectorial Competencies per Country Investigated:  
Infrastructure - Automotive - Safety - Approval Authorities

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

## Graphical Presentation of Interdependencies



L-B-Systemtechnik



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



L-B-Systemtechnik

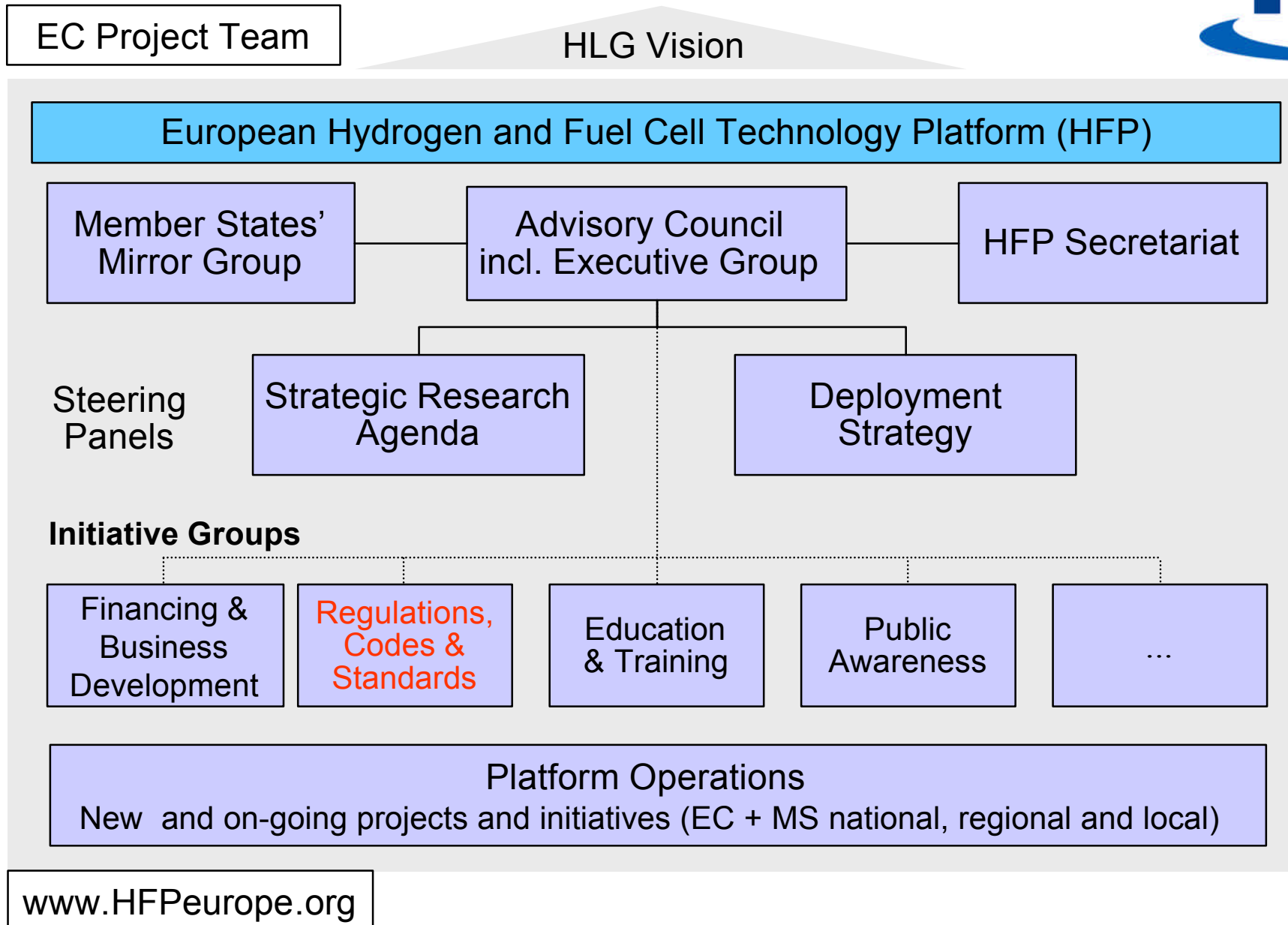
## WP Break Down and Consortium

### 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

# EU Hydrogen and Fuel Cell Technology Platform (HFP)





- Use existing International & European regulatory & standardisation bodies (UN, ISO, IEC, CEN, ETSI) and participate in these bodies more pro-actively
- Identify & harmonise EU regulations for approval of infrastructure as far as possible (initiated from EIHP2 partnership)
- Avoid duplications & contradictory or inconsistent approaches
- Exchange views on harmonisation of international standards through forums of international experts



L-B-Systemtechnik

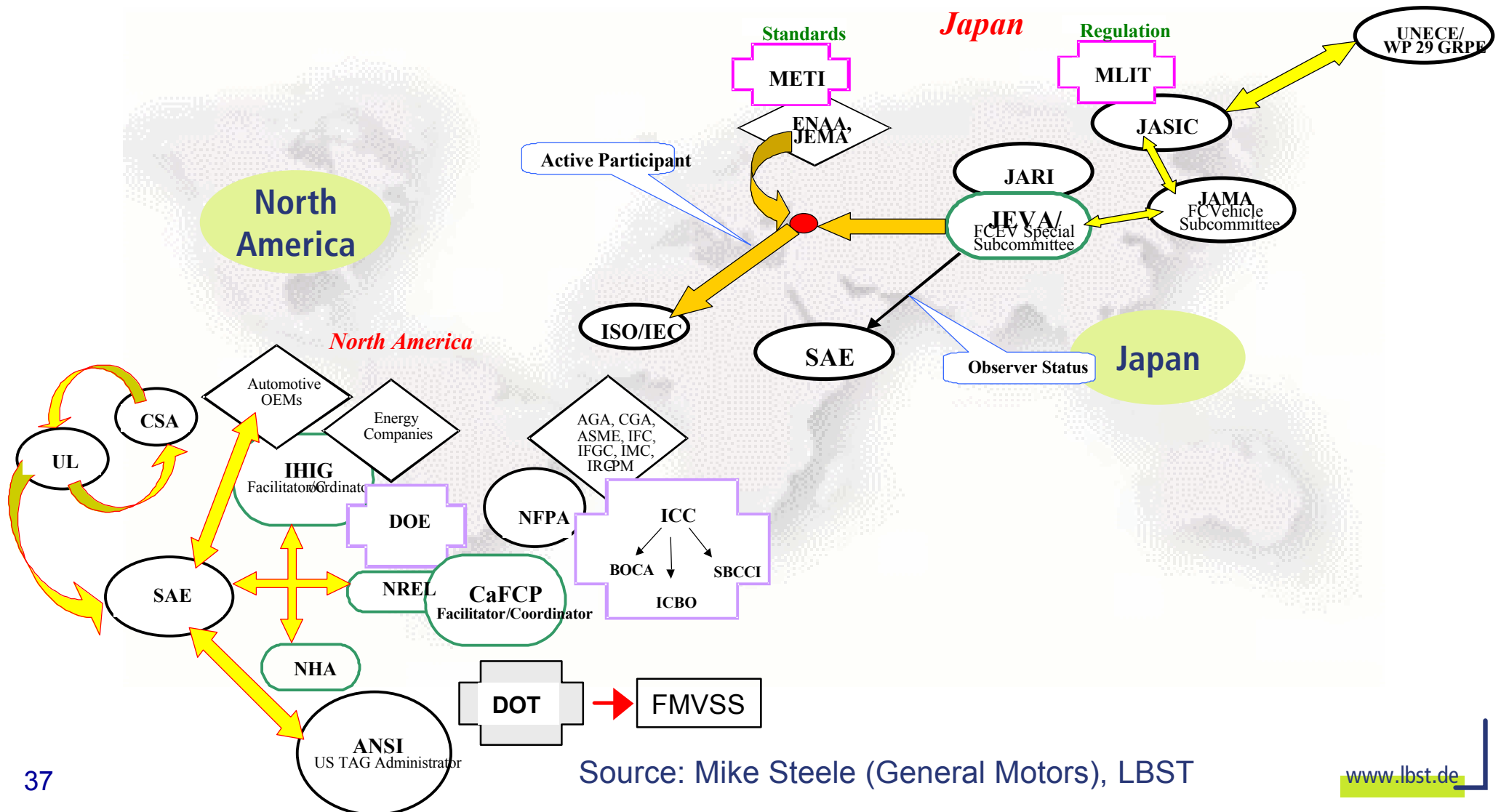
## Overview of RCS Work in Japan and North America

# Efforts in North America and Japan

Regulations and Standards in the U.S. and in Japan



L-B-Systemtechnik



Source: Mike Steele (General Motors), LBST

## Efforts in North America

---

Organizations Active in Standardization and Regulatory Work in the U.S.



L-B-Systemtechnik

**International Hydrogen Infrastructure Group [IHIG]**

**National Hydrogen Association [NHA]**

**US DOE Codes and Standards activities**

**Hydrogen Codes&Standards Coordination Committee [HC&SCC]**

**International Codes Council [ICC]**

**National Fire Protection Association [NFPA]**

**Society of Automotive Engineers [SAE]**

**National Highway Traffic Safety Administration [NHTSA]**

## Efforts in Japan

---

### Goals for Standards and Regulations for H<sub>2</sub> & FCVs in Japan



L-B-Systemtechnik

By the end of 2004, the Japanese Ministry of Land, Infrastructure and Transport (MLIT) plans to set up safety standards for fuel cell vehicles, which are expected to fully hit the market in 2005, the MLIT announced in July 2002.

[Review of regulations to be completed by 31MAR2005 - i.e. within FY2004]

The safety standards are likely to cover areas such as the hydrogen gas tank and the fuel cell.

A joint project team of the MLIT, the Environment Ministry and the Ministry of Economy, Trade and Industry is aiming to pave the way for common use of fuel cell cars by 2005 (and of H<sub>2</sub> refueling infrastructure and of stationary use of FCs).



## Efforts in Japan

---

### Required Adaptations of Regulations & Standards for FCVs in Japan

- Special permission process for FCVs' use on public road
- Restriction on driving through underground passages and tunnels and H<sub>2</sub> amounts in tunnels during FCV transport
- Parking of FCV in underground and/or tower parking garages
- Adoption of type approval system for FCV certification
- Inspection of H<sub>2</sub> tank installed on imported FCV
- Appointment of safety administrators for the use of movable GH<sub>2</sub> supply unit
- Increase of maximum pressure and volume of H<sub>2</sub> tank for FCV (35MPa, 150L)
- Synchronized inspection interval for vehicle and high pressure tank
- Testing pressure for valves, regulators used in high pressure FCV system
- Clarification of requirements for "new technical specifications" for high pressure H<sub>2</sub> tanks used in FCV and H<sub>2</sub> station



## Efforts in Japan

---

### Required Adaptations of Regulations & Standards for H<sub>2</sub> Stations in Japan

- Re-examination of safety distance from H<sub>2</sub> dispenser nozzle
- H<sub>2</sub> leak detection
- Periodical safety inspection of facilities
- Appointment of safety administrators at the station
- Limit on usable tank capacity during transportation of liquefied H<sub>2</sub>
- Restriction on H<sub>2</sub> station location and amounts stored
- Addition of H<sub>2</sub> supply station to existing gasoline/diesel station

### FCCJ:

JEVA	-	ISO TC22/ TC21
JEMA	-	IEC TC105
ENAA	-	ISO TC197

## Conclusions from EIHP2 and other RCS projects

---



L-B-Systemtechnik

- ➔ do not re-invent the wheel
- ➔ join forces internationally in the largest automotive markets (Europe, USA, Japan, China)
- ➔ use existing regulatory and standardization bodies (UN, ISO, IEC) and participate more actively
- ➔ try to avoid misunderstandings and misperceptions as early as possible
- ➔ avoid duplications and contradictory/ inconsistent approaches
- ➔ learn for local implementation also from similarities in requirements all over the world (e.g. fire authorities, work safety authorities, environmental authorities) by informal international exchange between local experts



L-B-Systemtechnik

Thank you for your attention!



For upcoming information please visit

[www.EIHP.org](http://www.EIHP.org)

[www.hfpeurope.org](http://www.hfpeurope.org)

[www.hyapproval.org](http://www.hyapproval.org)

[www.HyWays.de](http://www.HyWays.de)