

CUTE – Bringing a fuel cell bus fleet on the road in European cities

14 -15 June 2004, London

Reinhold Wurster

Hydrogen Regulations, Codes and Standards for Road Vehicles and their Refueling Infrastructure in Europe



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Ottobrunn



- ① **Safety Implications of Hydrogen Use in Road Transport**
- ② **Why Harmonized Regulations and Standards ?**
- ③ **EIHP's Involvement in H₂ Regulations and Standards Work**
- ④ **Globally Harmonized Vehicle Approval**
- ⑤ **Recommendations**

Safety Implications of Hydrogen Use in Road Transport

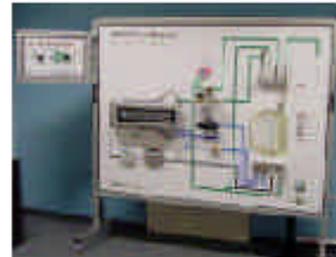
Challenges to be solved for a manufacturer of H₂ road vehicles



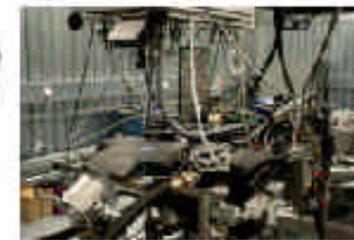
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Test Fleet Service
and Workshop Conversion



Employee Training



Test Rigs



Test Areas



H₂-Filling Stations

Source:
BMW
18MAR2004

Safety Implications of Hydrogen Use in Road Transport

Challenges to be solved for safe operation H₂ vehicles on public roads



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Vehicle
licensing



Filling Station



Parking,
Garaging



Tunnels



Data Transmission



Emergency
Services



Accidents



Repairs/maintenance



Service

Source:
BMW
in www.eihp.org

Why Harmonized Regulations, Codes and Standards ?



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International Regulations, EU Directives, and Standards

- Legal Requirements and Regulations are ranked above standards
- UN Global Technical Regulation [1998 Agreement] 1st priority
 - UNECE Regulation [1958 Agreement] 2nd priority
 - EEC Directives 3rd priority
 - National Directives and Regulations 4th 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) for both, stationary and mobile applications

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Sources: Norsk Hydro - 2003, LBST - 2004

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Why Harmonized Regulations, Codes and Standards ?

Reasons for Developing European Harmonised Legal Requirements



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- Some 44 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 44 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.

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Why Harmonized Regulations, Codes and Standards ?

Legal Situation for Approval of Road Vehicles in Europe



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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. Identification of controls	78/316/EEC incl. latest amendment
4. Fuel consumption	80/1268/EEC incl. latest amendment & ECE R 101
5. Engine Power	80/1269/EEC incl. latest amendment & ECE R84
6. Side impact	96/27/EC & ECE R95
7. Frontal impact	96/79/EC & ECE R94
8. Roadworthiness tests	96/96/EC & PTI
9. CO ₂ labeling	99/94/EC
10. Base Directive	70/156/EEC incl. latest amendment
11. Electric Vehicles	NEW EC Directive & ECE R100
12. Defrost/Demist	78/317/EWG (already under progress)

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Why Harmonized Regulations, Codes and Standards ?

Develop a New Regulation for Hydrogen Road Vehicles ?



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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**

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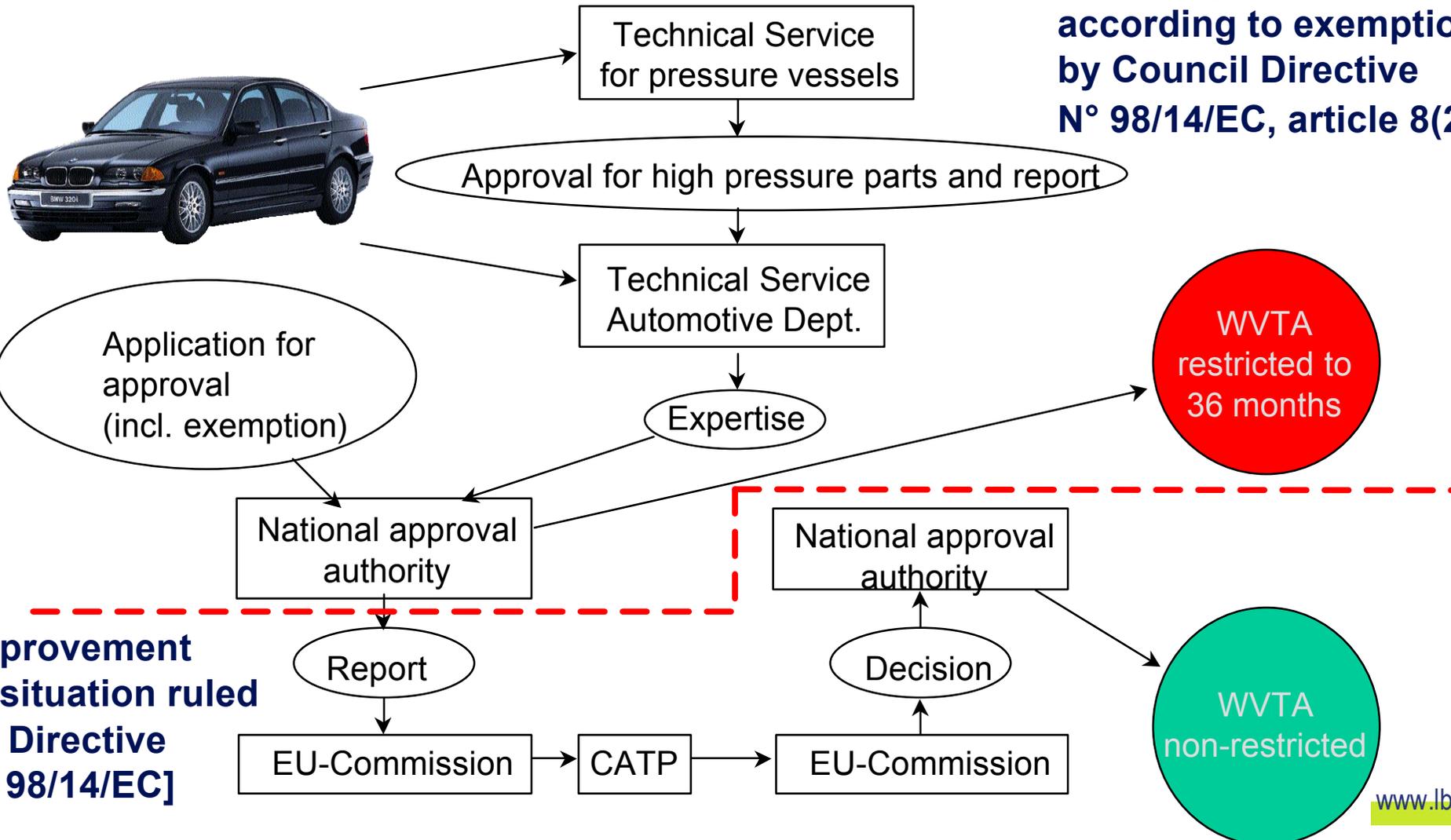
Why Harmonized Regulations, Codes and Standards ?

Harmonized Frame for Europe - **or** the EEC Directive



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[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]

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Why Harmonized Regulations, Codes and Standards ?

Two Pathways to Present a Proposal for a Regulation in Europe
For the Whole Vehicle Type Approval of (H₂) Road Vehicles

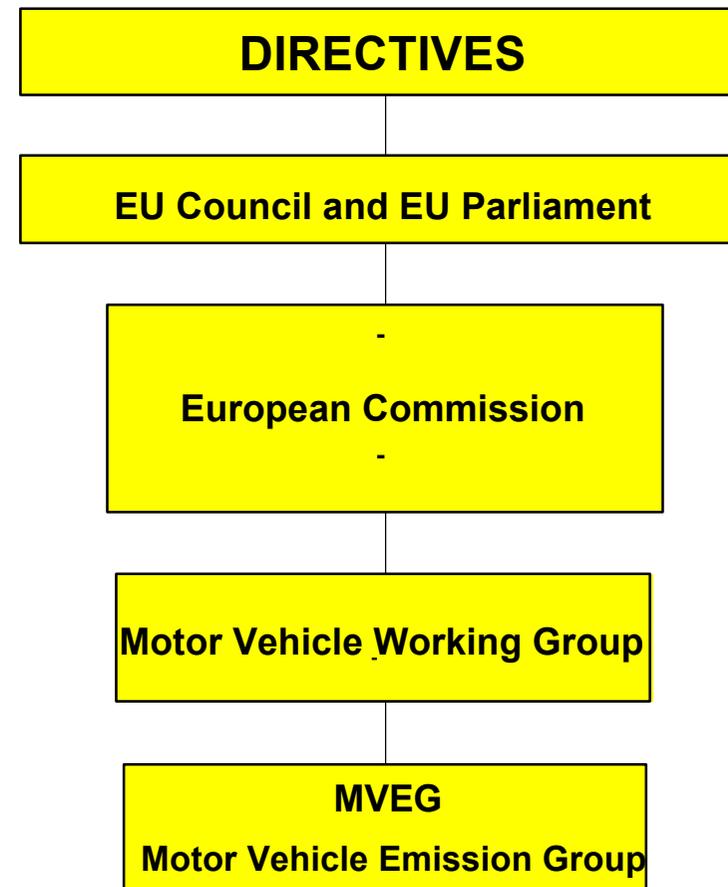


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UN-ECE



EC



Binding for WVTA (Valid for: EU)

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European Integrated Hydrogen Project - Phases 1 & 2 [<http://www.eihp.org>]

Objectives: Initiate and provide inputs to support the development of legal requirements and standards 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 draft UNECE regulations
- Infrastructure - only very limited analysis
- Safety studies and limited computer simulations

Phase 2: 2001 - 2004

- Enhanced focus on hydrogen vehicle refueling infrastructure
- Vehicle - continued work to develop draft UNECE regulations and initiate work 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, provided inputs for regulatory activities on a European and global level to facilitate harmonised Procedures for the approval of hydrogen fuelled road vehicles. The project has been finalised by January 2004 and discussions are going on with regard to a possible continuation (intermediate step: HarmonHy proposal).

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EIHP's Involvement in H₂ Regulations and Standards Work

Harmonized Frame for Europe - the UNECE Regulation



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PROPOSAL FOR A NEW DRAFT REGULATION



PROPOSAL FOR A NEW DRAFT REGULATION

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF:

- I. SPECIFIC COMPONENTS OF MOTOR VEHICLES USING LIQUID HYDROGEN;**
- II. VEHICLES WITH REGARD TO THE INSTALLATION OF SPECIFIC COMPONENTS FOR THE USE OF LIQUID HYDROGEN**

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF:

- I. SPECIFIC COMPONENTS OF MOTOR VEHICLES USING COMPRESSED GASEOUS HYDROGEN;**
- II. VEHICLES WITH REGARD TO THE INSTALLATION OF SPECIFIC COMPONENTS FOR THE USE OF COMPRESSED GASEOUS HYDROGEN**

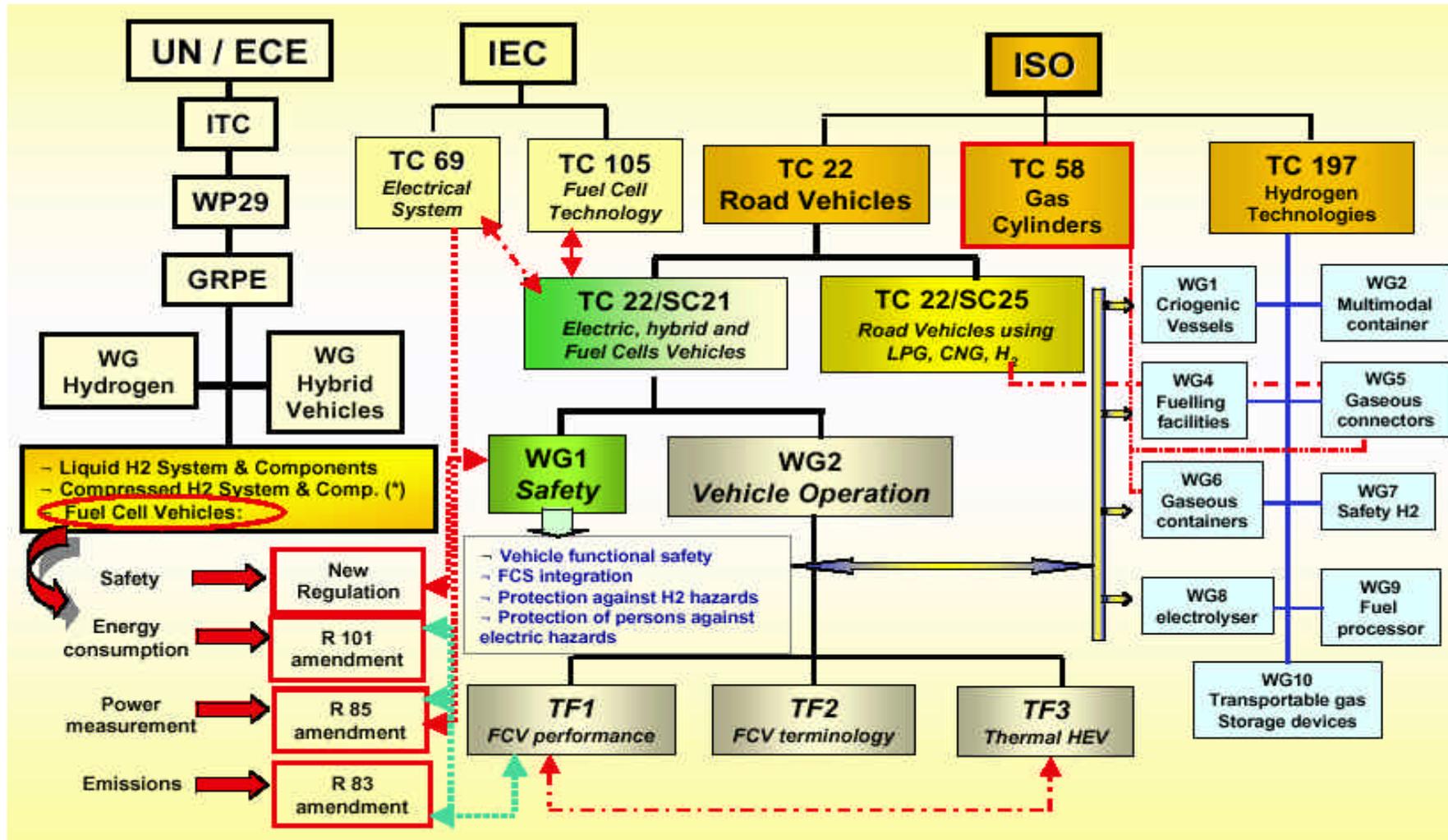
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Globally Harmonized Vehicle Approval

International Regulations & Standards Links for H2 & FC Vehicles



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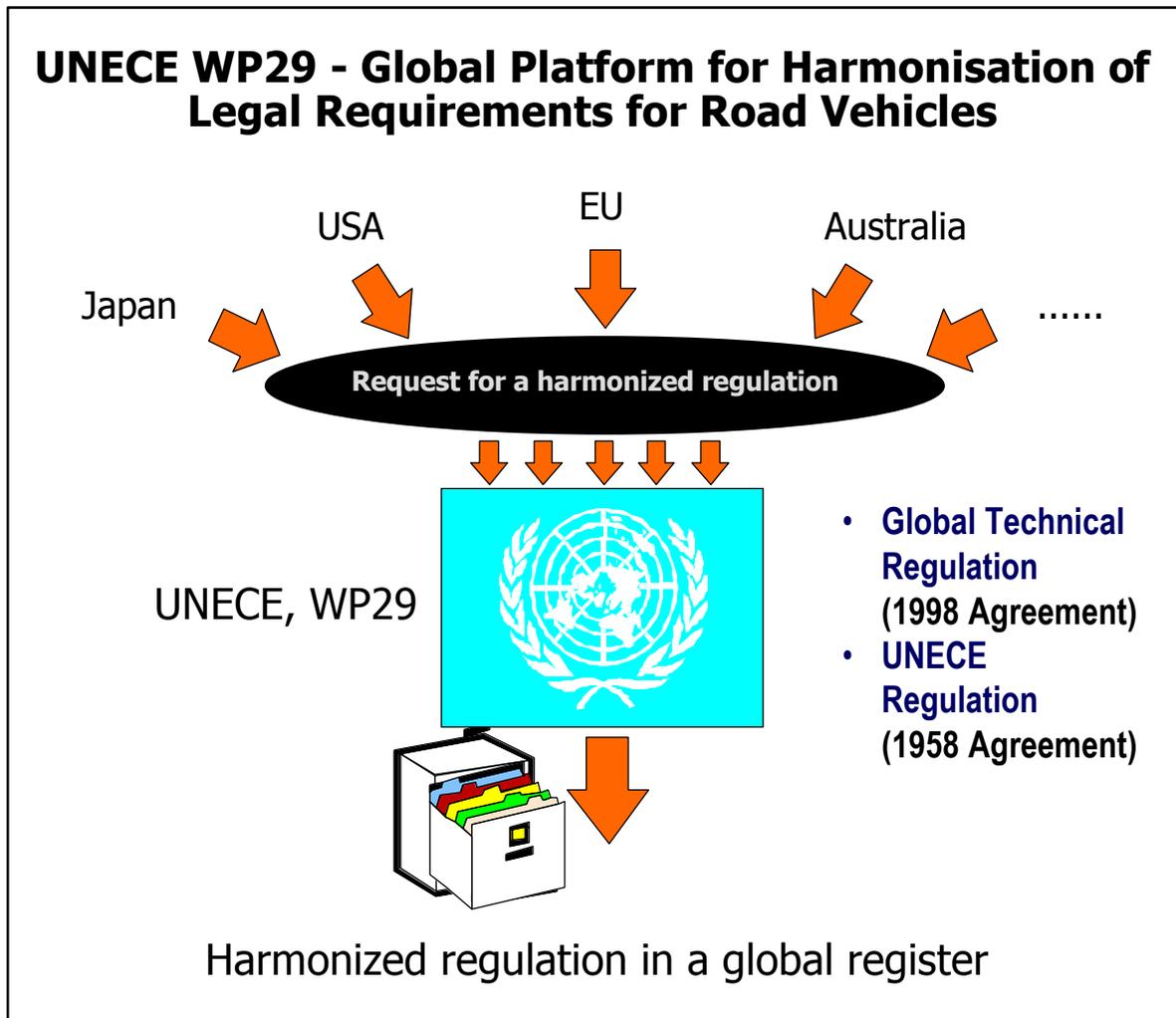
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Globally Harmonized Vehicle Approval

Global Platform for Harmonization of Regulations for Road Vehicles



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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

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Globally Harmonized Vehicle Approval

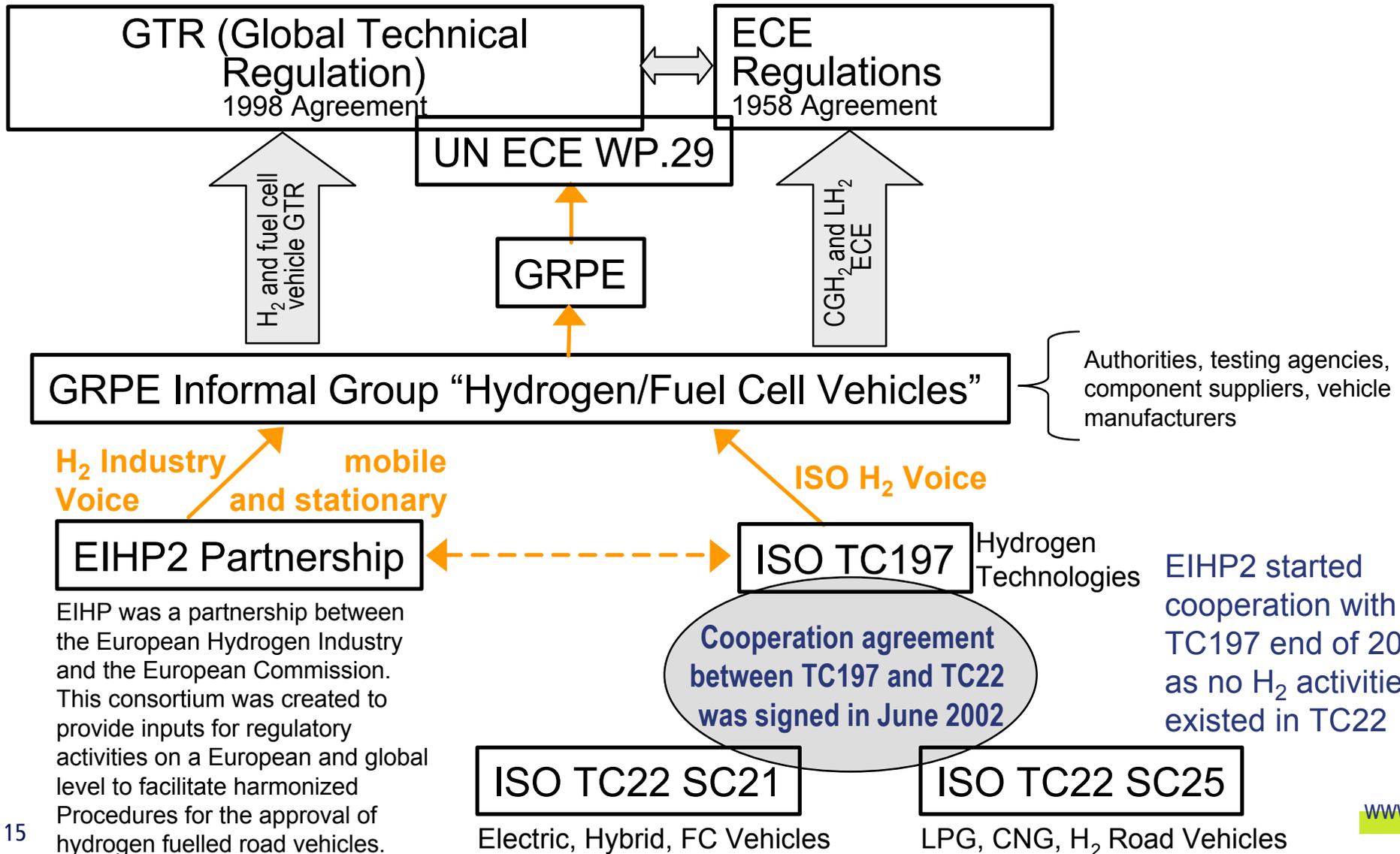
Global Cooperation Group for H₂ & FC Vehicles



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Target date for GTR: 2010

Target date for ECE: 2006



EIHP2 started cooperation with TC197 end of 2001 as no H₂ activities existed in TC22

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Globally Harmonized Standards

International standards and draft standards – ISO/TC197



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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

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Globally Harmonized Standards

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)



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Approval of Hydrogen Refuelling Infrastructure

H₂ Industrial Main Actor's View



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The distribution and delivery of Hydrogen through pipelines, liquid bulk, and cylinders is well known in the industries as well as industrial filling installations. Major difference in Hydrogen Energy is environment (urban sites, public) and New Technologies required for improved performances (autonomy, fast filling).

Today environmental policies are not very well harmonized between European Countries (e.g. Safety distances around LH₂ storages) whereas a lot has been achieved in transport policies through EEC Directives as well as UNECE global approach for vehicles.

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**

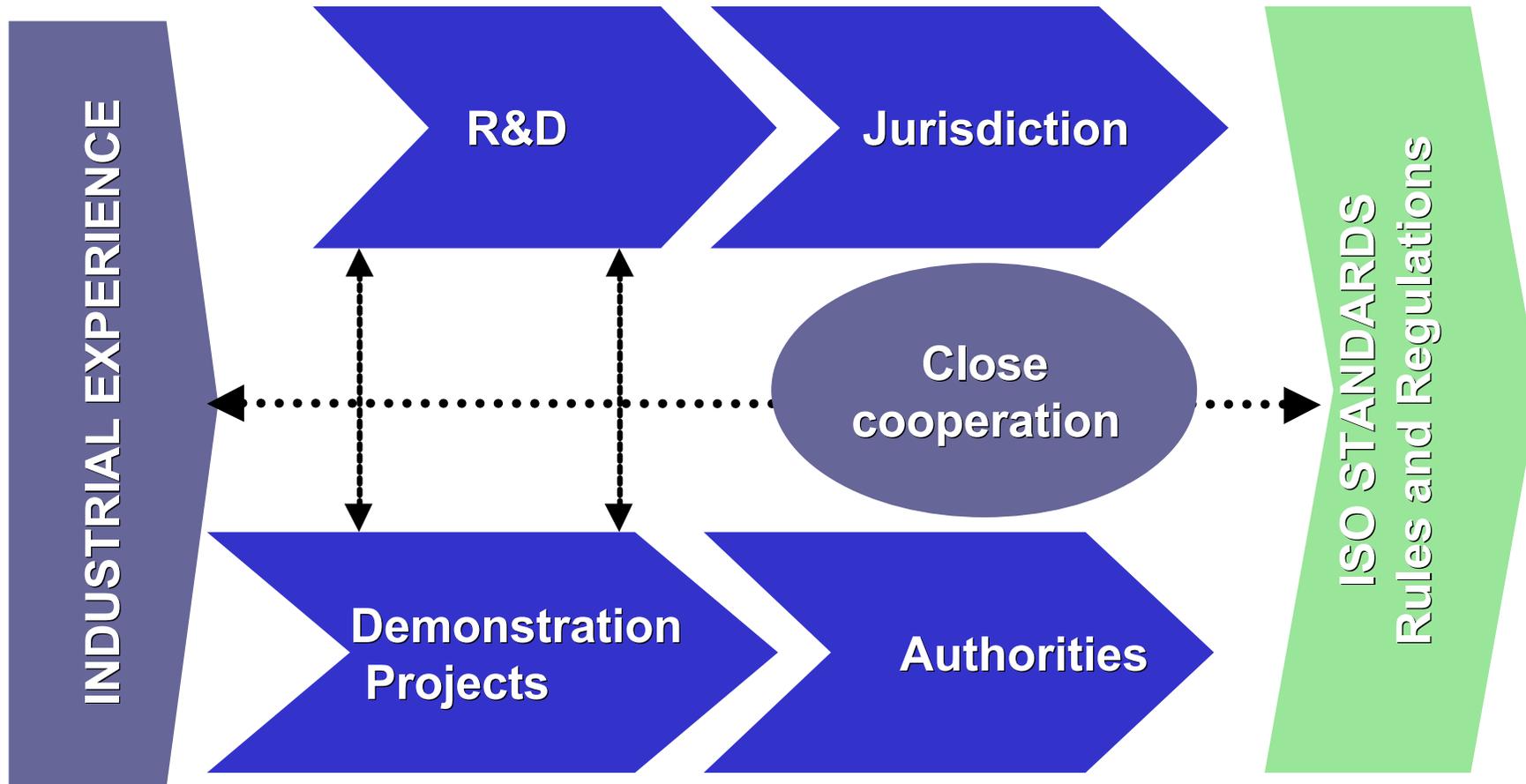
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Approval of Hydrogen Refuelling Infrastructure

Approach for development of ISO Standards for Hydrogen



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Sources: Norsk Hydro - 2003

Implementation of Stationary H₂&FC Equipment



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Local implementation will always have to follow also local requirements

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

Example: Europe

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

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EIHP2 Working Draft, Rev.3– Gaseous Hydrogen Vehicle Refuelling Stations
EIGA Document IGC 15/96/E (gaseous Hydrogen Installations)
Planned: HyApproval - Handbook for certification of public H₂ filling stations

Documents assisting local implementation in Europe

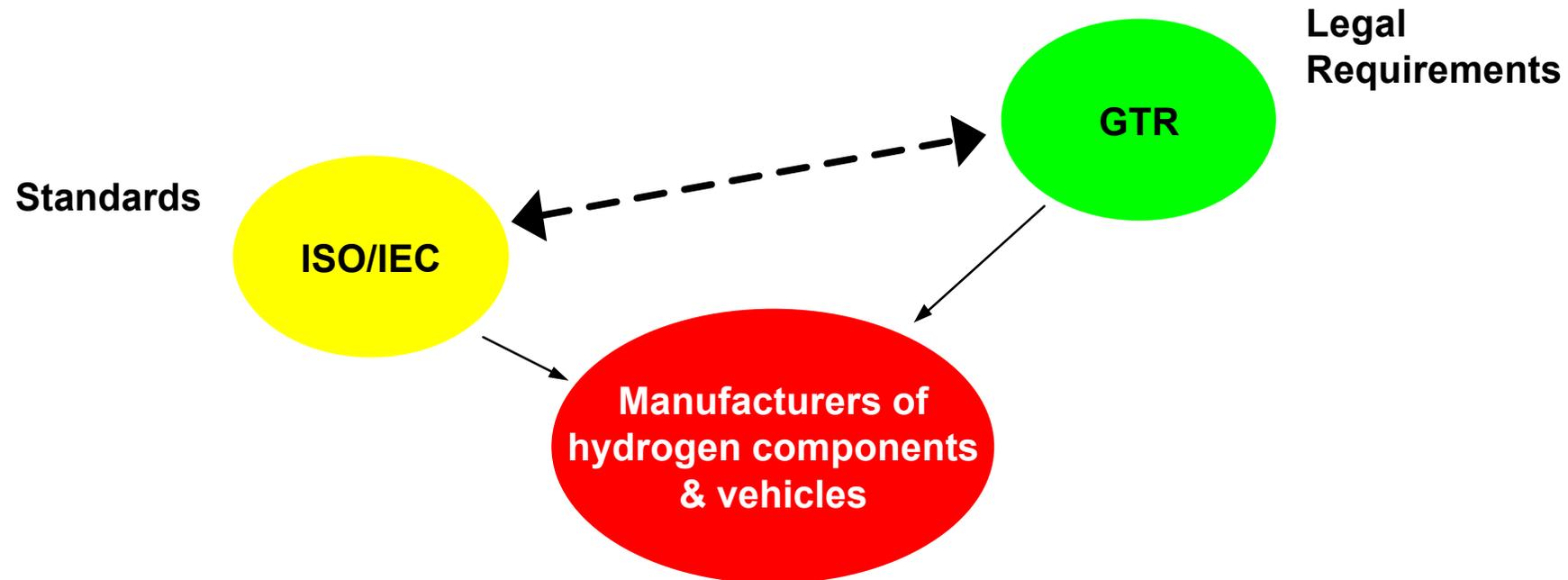
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Recommendations

Desirable Future Scenario For Regulations & Standards



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

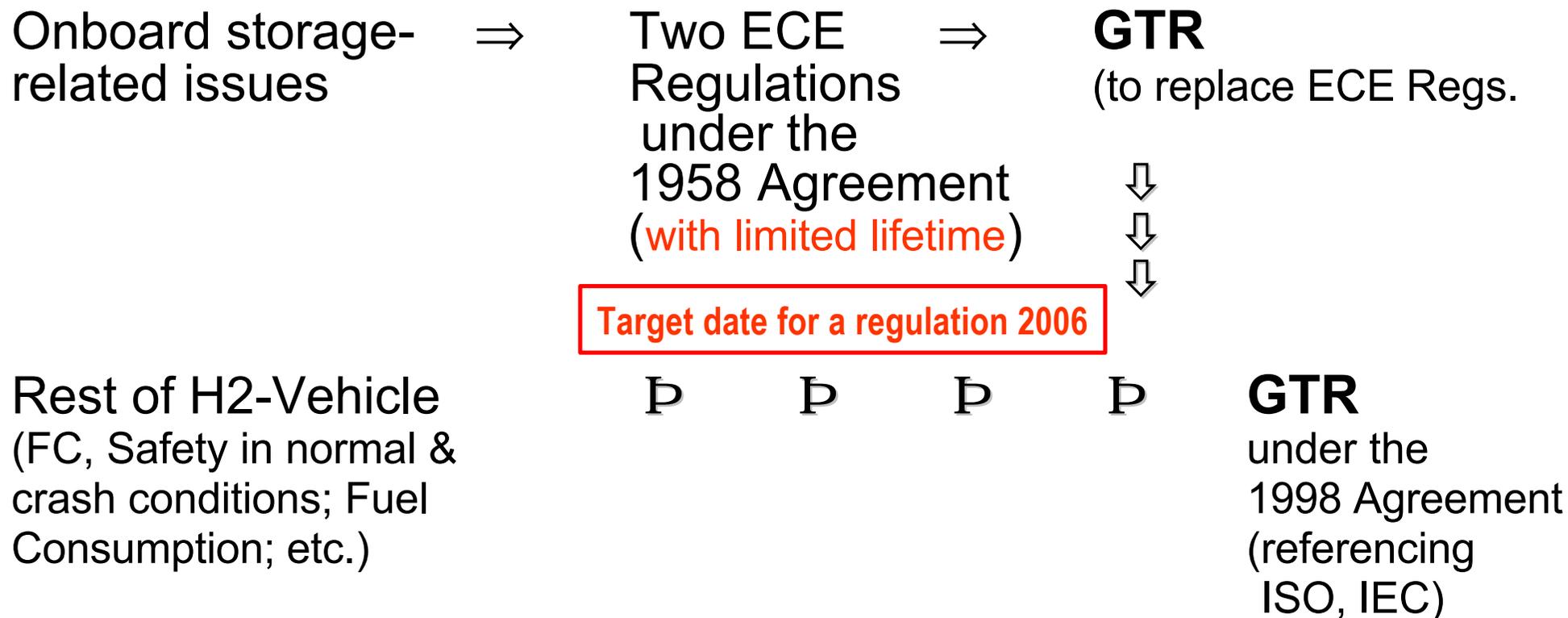
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Recommendations

Clear Vision of a Pathway to a GTR for H₂/FC Vehicles*



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



ISO and IEC standards are required for:

- H₂ 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 H₂/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.*

Conclusions and Recommendations

How to successfully harmonize R&S globally ?



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- ⇒ 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) with active participation of all stakeholders
- ⇒ avoid misunderstandings and misperceptions as early as possible
- ⇒ avoid duplications and contradictory/ inconsistent approaches
- ⇒ for implementation of stationary hydrogen equipment learn from requirements by local authorities all over the world (e.g. fire authorities, work safety authorities, environmental authorities)

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Thank you for your attention!

For upcoming information please visit

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