HyApproval

Handbook for Approval of Hydrogen Refuelling Stations(SES6 - 019813)

Strategic and Regulatory Issues Related to HRS

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- Chemical Research Center of the Hungarian Academy of Sciences -

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Coordinator of the former
HyApproval Project (*www.HyApproval.org****)***

Strategic environment creating the need for harmonized, efficient and soon available approval procedures for HRS in Europe

Prerequisites for a HRS

HyWays
The European Hydrogen Energy Roadmap
HyApproval

Definition: HRS = Hydrogen Refuelling Station

Prerequisites:

- Technical feasibility shown → HRS realized
- Acceptable investment costs achievable → **HyWays**
- Clients on the road - Example: USA
- Demand/ supply for HRS infrastructure proven → **HyWays**
- Permitting processes in place → **HyApproval**

Technical Feasibility of an HRS

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Total
CEP station
Berlin,
Germany

Aral/BP
CEP station
Berlin,
Germany

Agip,
Collesalvetti
near Livorno,
Tuscany, Italy

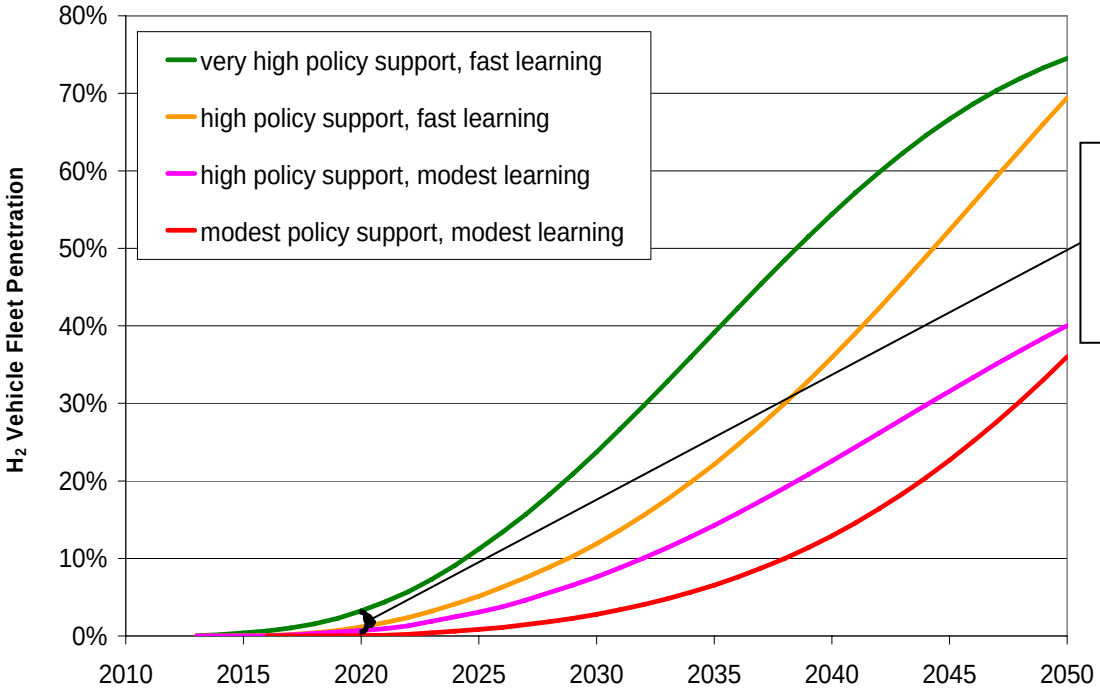
Agip,
Zero Regio,
Frankfurt-Höchst
Germany

Shell,
Washington DC,
USA

Iwatani
Ariake Tokyo,
Japan

Hydrogen demand in road transport

HyWays
The European Hydrogen Energy Roadmap
HyApproval



HFP Snapshot 2020 is spanned by scenarios *very high policy support, fast learning* and high policy support, *modest learning*!

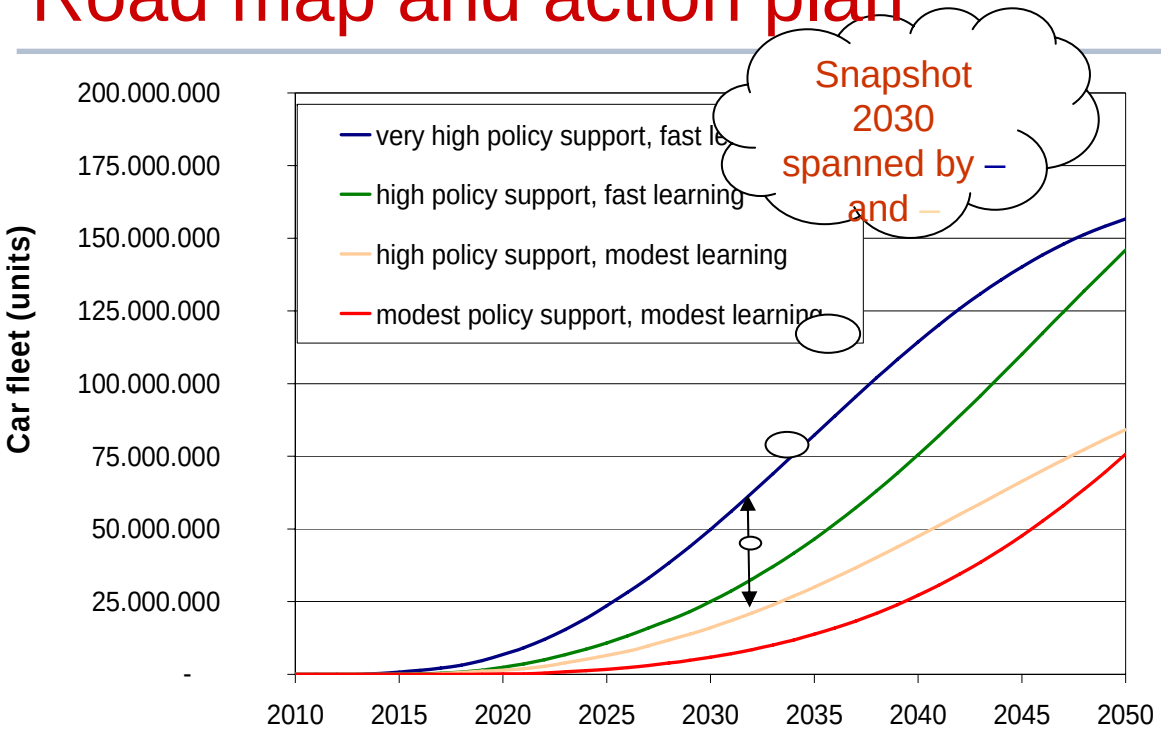
Scenario build-up with 2 parameter

- **"policy support"**
- **"technical learning"**

a) Very high policy support, fast learning
b) High policy support, fast learning
c) High policy support, modest learning
d) Modest policy support, modest learning

Road map and action plan

HyWays
The European Hydrogen Energy Roadmap
HyApproval



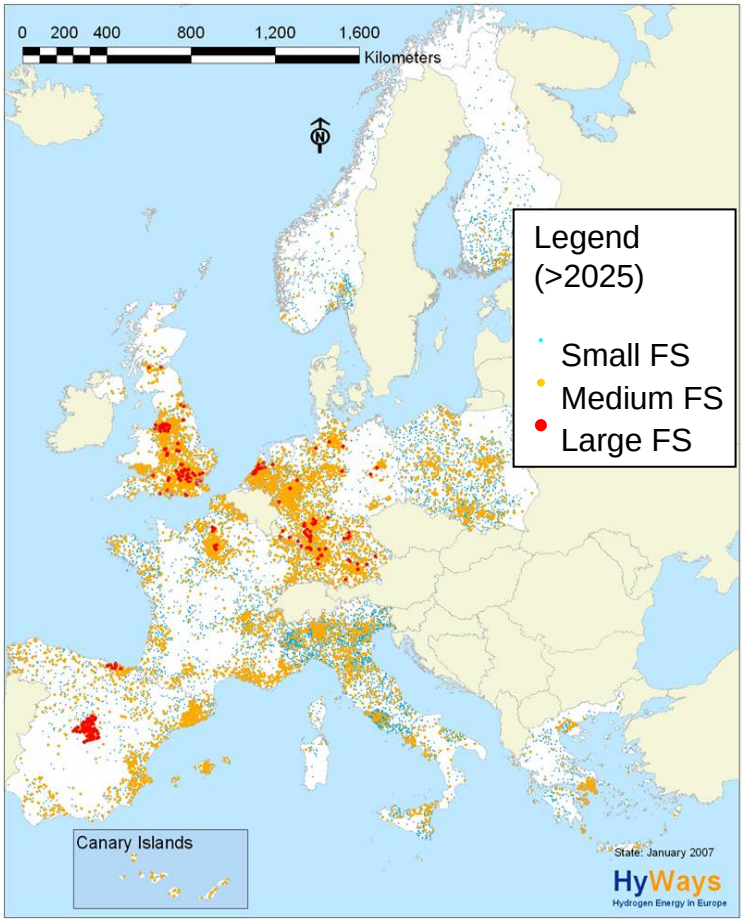
Vehicle fleet targets: Snapshots 2020 & 2030

HyWays passenger car fleet targets for EU15	„Snapshot 2020“ (HFP)	„Snapshot 2030“ (HyWays Proposal)
Lower bound **Requires high policy support!**	**1 million**	**15 million**
Upper bound **Requires extreme policy support!**	**5 million**	**50 million**
What could happen with modest policy support	***0.1 million***	***5 million***

Spatial coverage of fuelling stations

HyWays
The European Hydrogen Energy Roadmap
HyApproval

Demand for HRS proven by HyWays

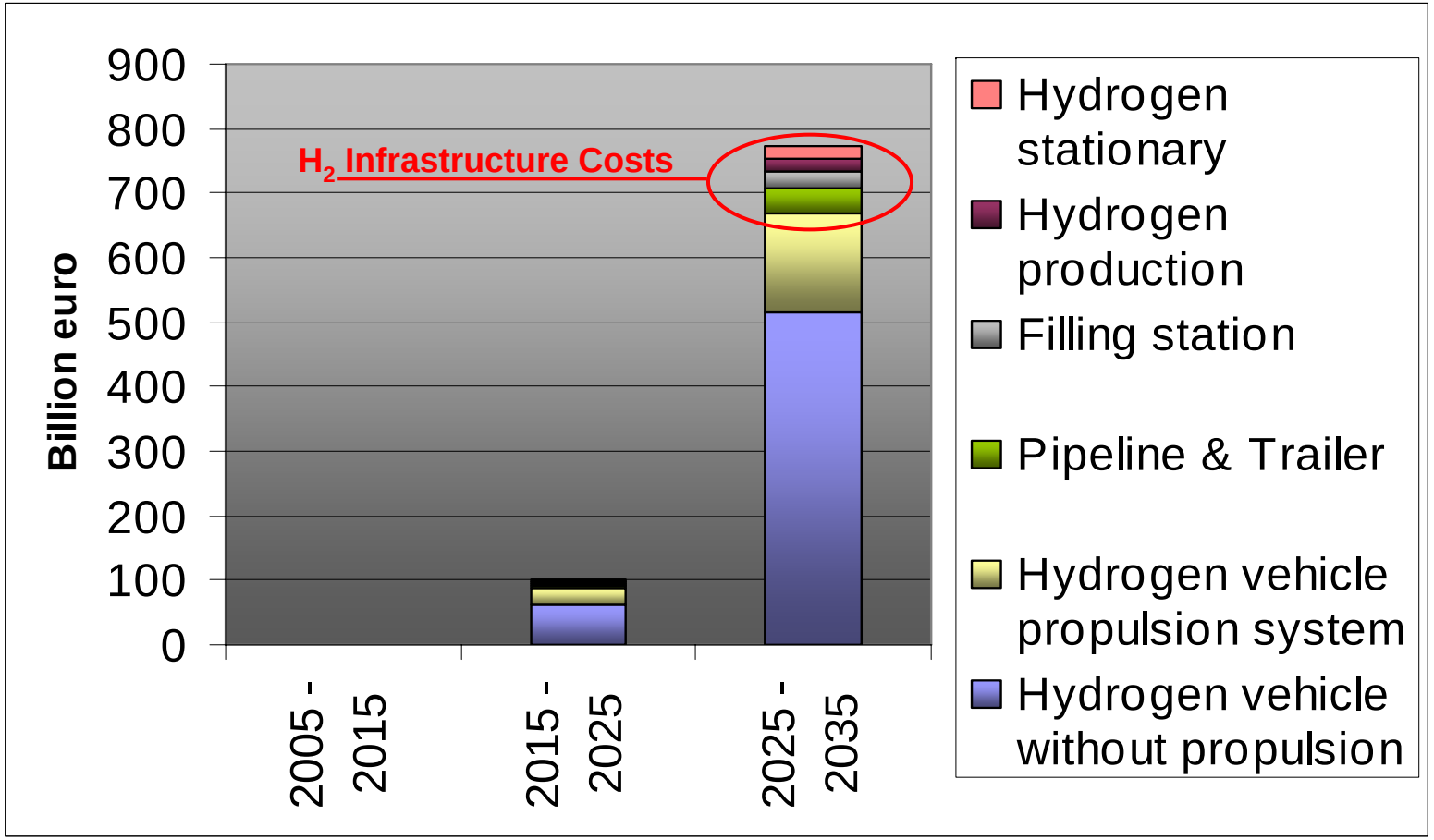


- **First phase (2010-2015):**
  - A limited number (400) of small H_2 stations
  - serving around 10.000 H_2 cars (25 cars/station in average)
  - for corridors another app. 500 small fuelling stations would be required
- **Demand develops (2015 – 2025):**
  - also bigger filling stations will come in
  - between 13,000 and 20,000 H2 stations and 10 mill. H_2 vehicles in Europe.
- **Massive rollout of H_2 (post 2025):**
  - Gradually, same patterns as today's conventional refuelling network is reached

Example:
fuelling stations spatial coverage for 8%
vehicle penetration (8% of 220 m → ~ 16 m)

Acceptable Investment Costs of HRS - HyWays

HyWays
The European Hydrogen Energy Roadmap
HyApproval



(cumulative investments for a ten-year period, hydrogen high penetration scenario, HyWays Phase I results based on six HyWays countries D, F, I, GR, N, NL)

Vehicles on the Road between Now and 2020

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Why are FCVs developed ? → Because they are mandated by law

California - ZEV requirement:

2001 – 2008:	250 FCVs (1st ZEV Floor)
2009 – 2011:	2,500 FCVs (2nd ZEV Floor)
2012 – 2014:	25,000 FCVs (3rd ZEV Floor)
2015 – 2017:	50,000 FCVs (4th ZEV Floor)

Applicable to all large volume manufacturers (i.e. > 60,000 LDVs per year): DC, Ford, GM, Honda, Nissan, Toyota (from 2010: BMW, from 2012+: VW)

[from 2011 on also obligatory for each other US ZEV state: MA, NY, VT, RI, CT, NJ, ME, OR, WA, MD]

Non-compliance leads to exclusion of conventional vehicles from the Californian market







In the US Energy Policy Act of 2005
[PUBLIC LAW 109–58—AUG. 8, 2005],

In SEC. 811. REPORTS, sub-sec (a), indent (4), the US have formulated the goal to produce and deploy not less than:

(A)100,000 hydrogen-fueled vehicles in the United States by 2010

and

(B) 2,500,000 hydrogen-fueled vehicles in the United States by 2020

Regulation on motor vehicles using liquid or compressed gaseous hydrogen

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EU eases hurdles for hydrogen cars

Publication Date: 10-Oct-2007, 12:30 PM US Eastern Timezone, Source: Reuters

BRUSSELS--Hydrogen-powered cars will be cleared for sale in a uniform way throughout the European Union under new rules proposed by the European Commission on Wednesday. The EU executive also announced it would help fund a program of hydrogen research and development called the Fuel Cells and Hydrogen Joint Technology Initiative with 470 million euros ($664 million) over six years, a sum that would be matched by European industry.

It said the program would "accelerate the development of hydrogen technologies to the point of commercial take-off between 2010 and 2020."

……

The Commission said hydrogen cars that are ready for the market should be included in the EU's "type approval" system, which determines whether vehicles meet required standards.

The move would simplify approval for hydrogen vehicles and ensure uniform standards were in place throughout the 27-nation bloc, the Commission said.

The proposals require approval from the European Parliament and EU governments before they can enter force.

Industry Commissioner Guenter Verheugen told reporters he did not expect to see many hydrogen cars on European roads in the next ten years, but said petrol-powered vehicles would someday be replaced by models with fewer polluting emissions.

"The car of the future will be different from what we know today. It will not be driven by petrol or diesel," he said.

……..

Verheugen said that if the rules were designed to set limits based on an average of individual car makers' fleet emissions, then having clean hydrogen vehicles would be an advantage to producers.

EC DG ENTR Comitology Approach

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EC Regulation development by EC DG ENTR

COMMISSION OF THE EUROPEAN COMMUNITIES
ENTERPRISE AND INDUSTRY DIRECTORATE-GENERAL

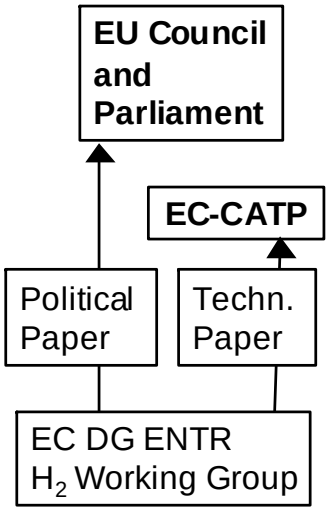
Consumer goods
Automotive industry

This draft document has been developed by the Commission services with the sole view of consulting stakeholders. It does not constitute a Commission proposal and does not commit the Commission in any way.

Preliminary draft proposal for a
Regulation of the European Parliament and of the Council
relating to the type-approval of
hydrogen powered motor vehicles

version 3

- The proposal will use the Split Level Approach which comprises two parts:
  - The "political" part (outlining the necessity of the proposal, general description, etc) will be presented for discussion and adoption to the European Parliament and the Council.
  - The "technical" part (containing the application of the pertinent standards to containers and other specific components) will be discussed at Commission level and adopted through the CATP (Committee for the Adaptation to Technical Progress)



www.H2moves.eu

Quelle: EC DG ENTR

funded by the European Commission

www.HyApproval.org

Lessons Learned by EIHP, UNECE and HyWays

EIHP HyWays
The European Hydrogen Energy Roadmap
HyApproval

The development of an EC Regulation for H_2 Motor Vehicles took almost 11 years from the start of EIHP1 on 01FEB1998 to the expected date of approval in FEB2009

EIHP1 (FEB1998-JAN2000) [http://www.eihp.org] → EIHP2 (FEB2001-JAN2004) → UNECE GRPE Informal Group "H2&FCVs " [http://www.eihp.org/unece/index.html] → FEB 2009

Industry participating in HyWays [www.hyways.de] has identified an H2 vehicle population of between 1 and 5 million units on European roads by 2020 with a rapidly growing introduction after 2015.
This requires about ≤ 1,000 HRs between 2010 and 2015 and between 13,000 and 20,000 between 2015 and 2025.
This requires a regulatory framework for HRS approval in Europe shortly after 2010 in place (i.e. max. 5 years left).

Reality in approving Hydrogen refuelling Stations (HRS) in Europe

HRS Approval Reality in Europe (1)

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- In several European countries Hydrogen Refuelling Stations (HRS) can be approved since several years, usually without H_2-specific regulations in place, only applying existing regulatory frameworks
- In some European countries this is almost impossible (e.g. France) or laborious and time consuming (e.g. Italy) due to a complete lack of applicable legislation (e.g. France) or due to only recent introduction of such legislation which is limited to mono-fuel H_2 stations only and does not take into account multi-fuel stations (e.g. Italy)
- HyApproval (www.hyapproval.org) was working on the development of a Handbook for the approval of HRS in Europe (with partners from China, Japan and the USA) between 01OCT2005 and 30SEP2007
- The HyApproval project will be finished by end of October 2007 and deliver a first finalised Handbook (which will remain a “living document” for some time, i.e. undergo continuous improvements)
- ISO TC197 WG11 works on a standardised/ uniform HRS layout ISO/DTS 20012 (HyApproval assists ISO in this endeavour)

HRS Approval Reality in Europe (2)

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- Some countries have need for a document like the HyApproval Handbook and some have already articulated interest in applying it (e.g. China, Italy)
- A first transportable skid-mounted HRS developed by Air Liquide in France taking into account all European legal requirements in existence has been shown to be certified for limited periods also in France (Challenge Bibendum, Paris, and WHEC16, Lyon, in June 2006)
- Two first H_2-CNG/H_2 HRS in France (Dunquerk and Toulouse) are planned for approval in 2007 and 2008
- The first public HRSs in Italy have been approved: Collesalvetti, Mantova (with some difficulties due to its multi-fuel characteristics not covered in the new Italian directive of AUG2006 and due to its size) and to be approved by February 2008 will be Bicocca (Milano)
- Handbook validated for France, Germany, Italy, Netherlands, Spain, China and the USA

HRS Approval Reality in Europe (3)

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- The HyApproval Handbook will become publicly available by end of 2007 and could be transferred into an EU directive later on (re-drafting required)
- The Handbook shall assist in educating approval authorities on the state of the art of HRS technology and refuelling processes/ procedures
- The Handbook shall serve as a working document to help and support authorities to deliver permits to install HRS in Europe
- The Handbook will allow infrastructure companies in the future to develop non-country specific products (essential parts of the layout are uniform)

Main achievements and lessons learned by HyApproval

Main Achievements by HyApproval (1)

HyApproval

- Originally planned *Final Design Paper* will become *a* side-document to the Handbook containing this *information* which has been *collected in the framework of the HyApproval project* and which would have disturbed the integrity of the HB document. [WP1]
- *Handbook for HRS approval* in Europe providing *guidelines for design, operation & maintenance* of HRS [WP2]
- *Outline of the permitting process* for obtaining an approved HRS [WP2]
- General refuelling *interface description*, *data exchange* vehicle-HRS, *refuelling process* and *safety during refuelling* [WP6]
- *Authority feedback* from five European countries, the US and China on the Handbook structure and contents [WP3]
- *List of contacts* to European fire brigades and authorities, *General seminar outline & calendar*, *Dissemination models* for different countries, *Dissemination packages* – Dissemination in preparation for Q4 of 2007 [WP5]

Main Achievements by HyApproval (2)

HyApproval

- Safety findings [WP4]:

- *Review of Best Practices* based on actual experiences with Hydrogen Refuelling Stations across Europe, US & Japan / Risk acceptance criteria / Safety studies (D4.1)
- *Establishment of Best Practices for Safety* (D4.2)
- Agreement on *safety documentation* for Handbook and actions to complete HRS documentation & Agreement on required *safety documentations* (D4.3&4.5)
- Identification and critical review of *databases for reliability data* (D4.4)
- Agreement on required *modelling tools & techniques for risk assessments and simulations, accident scenarios, credible leak rates* (D4.6)
- *Guidance for Safety Aspects* of Hydrogen Infrastructure Projects including safety documentation and safety plan checklist (D4.7&D4.10)
- *Proposed list of scenarios* for the modelling task (D4.8)
- *Quantitative risk assessment* of hydrogen refuelling stations with on-site production (D4.9)
- *Risk assessments & accident simulations* including assumption and study basis, consequence assessments, description of example case study HRS, frequency assessments and event tree assessments (D4.11&D4.12)

Lessons Learned by HyApproval (1)

HyApproval

- Everything takes much longer than anticipated
- Safety analysis work took almost half of all efforts in the project well into year two
- Handbook compilation and finalisation, also a time critical and iterative activity, therefore delayed and now in its finalisation phase
- Diverging views on how soon certain processes should be fixed and proposed as guideline (e.g. based on still not sufficiently mature technology or processes applied)
- Common position among partners for the need of maintaining the Handbook alive after project end
- No common position among partners for an immediate effort to transfer the Handbook to an EC Regulation or Directive

Lessons Learned by HyApproval (2)

HyApproval

- To whom it may concern -

HyApproval

Handbook for Hydrogen Refuelling Station Approval

Requirements for a further maintenance of the Handbook

HyApproval SES6 – 019813 1 05OCT2007

- Contains suggested structure and tasks of a Handbook Maintenance Organisation
- Background and Caveats of the Handbook
- Outline of a Consulting Group to the maintenance of the Handbook
- Rationale for the Need to Start the HyApproval Handbook maintenance now

HyApproval recommendations to the JTI

HyApproval Recommendations to the JTI (1)

HyApproval

Elements to be integrated into a coherent and coordinated EU strategy for RCS within the context of the JTI:

Support for regulatory and standardisation activities (for example via ISO, IEC and UN/ECE) will be required to achieve EU-wide and global harmonisation of the emerging hydrogen technology. [adapted from HarmonHy]

An organisation for enabling service, support and maintenance of the Handbook should be nominated. This organisation preferably could have the capability to develop the Handbook together with the European Commission towards an EC regulation or directive at a later stage.
Establishing this activity as a "*HRS Approval Industry Grouping*" could be beneficial as positioning towards the future JTI activities and there in the *JTI Program Office*. [HyApproval]

HyApproval Recommendations to the JTI (2)

HyApproval

RCS actions needed for coordinating EC RCS contributions for HRS to international bodies:

- Prepare strategies on HRS-relate RCS matters in the field of transportation and stationary applications [adapted from HarmonHy]
- Develop a multi-year budget [adapted from HarmonHy]
- Assign priorities of Europe's RCS needs and ensure European interests are well represented in any global forum [adapted from HarmonHy]
- Ensure that the lessons learned from the EC and Member State funded R&D (*e.g. HyApproval*) and demo projects (*e.g. HyFleet:Cute, CEP, ZeroRegio, etc*.) are fed back into the RCS process [adapted from HarmonHy]
- ISO has issued a draft HRS standard (ISO/DTS 20012). Restrictions and requirements in the handbook can be streamlined/ simplified by using these in cross-references and thus avoid mismatching/ contradicting information. [HyApproval]

HyApproval Recommendations to the JTI (3)

HyApproval

Type of structures to be put in place to ensure a systematic and strategic approach and transfer of knowledge from projects to relevant international regulatory and standards-making bodies:

- The *JTI Program Office* would support the transport and stationary (including refuelling infrastructure), portable, hydrogen supply and cross-cutting issues and coordinate regulatory and standardization efforts [adapted from the HFP IP]
- The *JTI Program Office* would facilitate and prioritise RCS issues within the EC, including all EC funded activities [adapted from the HFP IP]

HyApproval Recommendations to the JTI (4)

HyApproval

Role of international cooperation:

- International cooperation on PNR work should be encouraged through forums such as IPHE and IEA or international R&D projects [adapted from HarmonHy]
- The RCS work should be done at the international level (ISO, IEC and UN ECE) [adapted from HarmonHy]
- The use of an Independent Global Harmonization Body (e.g. the GCG) is also seen as an important feature to resolve RCS conflicts that are inevitable in order to reach global consensus [adapted from the HFP IP]
- Contact and cooperation with other key national organisations, e.g. DOE and ENAA should be formalised [HyApproval]

Useful HyApproval References

HyApproval

- HyApproval [10/2005 - 09/2007] - www.hyapproval.org
- HySafe [03/2004 - 02/2009] - www.hysafe.net
- HarmonHy [05/2005 - 04/2006] - www.harmonhy.com
- European Integrated Hydrogen Project [1998-2000, 2001-2004] - www.eihp.org
- EU projects on H2/FC - http://europa.eu.int/comm/research/energy/pdf/h2fuell_cell_en.pdf

Acknowledgement

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Back-up Slides

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