

**UN ECE - INFORMAL GRPE WORKING GROUP HYDROGEN FUEL
CELL VEHICLES - GRPE-H2FCV
SUB-WORKING GROUP ENVIRONEMENT (SGE)**

*Document summarising the state of play of the SGE and setting the discussion of the 3rd
meeting of the sub-group*

(H2SGE-03-IP-01)

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Introduction

The UN ECE informal GRPE working group on hydrogen/fuel-fuel cell vehicles (GRPE-H2FCV) has been operative for several years now. In June 2005, WP.29/AC.3 agreed to a proposal from Germany, Japan and United States of America regarding how best to manage the development process for a Global Technical Regulation (GTR) on hydrogen-powered vehicles. However because of different circumstances it was not until April 2007 that the group received a clear mandate and a roadmap in order to achieve its goal of establishing a GTR for this class of vehicles (ECE/TRANS/WP.29/2007/41). The GTR needs to keep in mind the following points when defining the GTR:

1. Attains equivalent levels of safety as those for conventional gasoline powered vehicles and
2. Is performance based and does not restrict future technologies.

Given, that hydrogen powered vehicle technology is still emerging; WP.29/AC.3 agreed that input from researchers is a vital component of this effort. Based on a comparison of existing regulations and standards of HFCV with conventional vehicles, it has to be investigated and considered:

1. The main differences in safety and environmental aspects and
2. What items need to be regulated based on justification.

Under the agreed process, once AC.3 has developed and approved the action plan for the development of a GTR, two subgroups have been formed to address the safety and the environment aspects of the GTR. The subgroup safety (HFCV-SGS) reports to GRSP. The environmental subgroup (HFCV-SGE) is chaired by European Commission (JRC) and reports to GRPE. In order to ensure communication between the subgroups and continuous engagement with WP.29 and AC.3, the project manager (Germany) coordinates and manages the various aspects of the work ensuring that the agreed action plan is implemented properly and that milestones and timelines are set and met throughout the development of the GTR. The GTR will cover fuel cell (FC) and internal combustion engine (ICE), compressed gaseous hydrogen (CGH₂) and liquid hydrogen (LH₂).

The HFCV-SGE has already met twice in the past (April 2005 and January 2006) to prepare the terms of reference of its work and to start defining the areas to be addressed within its field of competence. The aim of this document is twofold:

1. to summarise the work already done in identifying the topics to be addressed by the SGE as to bring all the parties concerned to the same level of information, and
2. to serve as a basis for discussion in the next meeting of the SGE to be held on 14 January 2008.

The final goal of the environmental informal sub-group (HFCV-SGE) is to investigate the possibility of harmonization of environmentally related requirements and to propose actions in those cases where harmonization might not be possible.

Aspects to be addressed by the SGE

The areas to be addressed within the field of competence of the SGE are other aspects not addressed by SGS including energy and environmental considerations. The following is an exhaustive attempt to list the areas the group should address within its mandate, but it might not be complete.

1. Pollutant Emissions

2. Hydrogen and Water Emissions
3. Fuel Consumption
4. Recycling
5. Electromagnetic compatibility (SGS?)
6. FC Disposal / Hazardous Materials
7. Fuel Quality
8. Engine Power

Whether other aspects, such as regeneration and low temperature operations are to be considered or not, need to be agreed among the experts of the sub-group.

Table 1 summarises the areas that are pertinent to the different vehicles that the GTR should address. One note of cautions needs to be indicated here. Strictly the APUs (Auxiliary Power Units) are not part of the GTR as it should only address FC and ICE engines running both with CFH₂ and LH₂; however the expert group might want to address this point as an important area supporting the development of the H and FC vehicle technology. Also it can be argued whether a vehicle running with an on-board APU might be considered as a hybrid vehicle. It is also apparent that the indications concerning Electromagnetic Compatibility have been left with a “question mark” as it needs to be agreed by the expert group.

Needs for further research to address some/all the points

It is of importance that the expert group identify, early in the process, areas that need further research in order to feed into the GTR process. This will be based upon on what the expert group expects to address in the GTR. Therefore the decision on whether or not there is enough scientific knowledge to develop a scientifically strongly-based GTR needs to be done as a matter of urgency as it is well known that the time to produce new scientific evidence in any area is not a short one and therefore it might impinge on the timeline of the overall GTR. Therefore the expert group should make a survey of what is already available in different parts of the world (e.g.: Japan has already addressed passenger cars and now intends to proceed with Heavy Duty Busses). For practical reasons the group might want to agree to first address Passenger Cars and later other vehicle class; a Technical Report would need to identify what is available, what must be H2 amended and the procedure of amendment.

Concentrating in the fuel consumption area ISO had addressed the Fuel Consumption issue and had issued, thanks to the big Japanese contribution, a CD. The FUEVA¹ programme (European Fuel Cell vehicles technologies validation) addressed the validation practicality of the developed method. Therefore a basic document exists although it must still be validated by FUEVA.

However motor vehicle fuel economy is a critical measurement for the automotive industry. Consumer dependence on these measurements and industry scrutiny necessitates great care to ensure accuracy in the fuel economy results. Essentially there are two methods for the measurements of the fuel economy: a) Pressure-Volume-Temperature (equilibrium temperature and pressure before and after usage with a storage tank of essentially fixed known volume) and b) mass determination either using scales or mass flow meters. The PVT method might have the potential to be the most robust and economical of all in initial test and vehicle instrumentation equipment costs, in personnel test resources, as well as for measurement precision, repeatability, accuracy, and laboratory reproducibility. Although this is an acceptable method, there is no industry-wide method of calculation. Hence, it might be important to dedicate some time to either benchmark each method against the other or to check previous benchmarking already

¹ Is the project/programme finished? IF so is there a final report available?

made by some of the parties to the 1998 agreement. Table 2 summarises an initial scrutiny of possible areas of further research, the expert group is called to review and take a decision.

Technical Reports

A very practical way of going ahead might be the drafting of a technical report consisting of dedicated chapters for each of the areas of interest to the SGE with the same/similar structure. The technical report should address the following areas:

- a) explanation and specification of the issue
- b) overview of the existing Regulations / Standards and explanation of the possible existing links
- c) overview of the state-of-art
- d) ongoing/finalised research activities stating references on both cases; finalised projects and ongoing ones
- e) if further research is still needed, then specify what and why
- f) assessment of the harmonization:
 - is it needed?,
 - specify the harmonisation,
 - is it foreseeable (explain why),
 - reference list.

A proposed structure might be:

- Scope
- Application
- Definitions
- Survey of applicable regulations/directives/standards
- State of research on the topic (indicate if further research is needed)
- Assessment of the harmonisation (necessary specifications)
- References: Procedure? Who?

The points perceived to be the most important one and that needs an urgent agreement from the expert group are: assessment and who does what and how. This latest point needs to be solved as soon as possible.

Table 1 Areas pertinent to the SGE

| | FC | Hybrid | | ICE | APU |
|---|--|---------------|----------------------|---|----------------|
| | H ₂ | FC | ICE-H ₂ | Mono fuel (H ₂) Bi-fuel Blends Dual fuel | H ₂ |
| | Environmental & Energetic aspects | | | | |
| Fuel Consumption | x | x | x | x | x |
| CO₂ emission | | | | Bi-fuel, blends & dual fuel | |
| External Electrical consumption | | x | x | | |
| Pollutant emissions | | | x (NO _x) | x | |
| H₂ & H₂O emissions | x | x | x | x | x |
| Engine Power (measurement Procedures) | x | x | x | x | |
| Maximum speed (measurement Procedures) | x | x | x | x | |
| Fuel quality (reference) | x | x | x | x | x |
| Recycling | x | x | x | x | x |
| Disposal (hazardous mat.) | x | x | x | x | x |
| Electromagnetic compatibility | ? | ? | ? | ? | ? |
| Noise | x | x | x | x | x |

Table 2 Possible areas of further research

| | FC | Hybrid | | ICE | APU |
|---|-----------------------|---------------|--------------------|---|----------------|
| | H ₂ | FC | ICE-H ₂ | Mono fuel (H ₂) Bi-fuel Blends Dual fuel | H ₂ |
| | Research Needs | | | | |
| Fuel Consumption | ? | ? | ? | ? | ? |
| CO₂ emission | | | | | |
| External Electrical consumption | | | | | |
| Pollutant emissions | | | | | |
| H₂ & H₂O emissions | | | | | |
| Engine Power (measurement Procedures) | | | | | |
| Maximum speed (measurement Procedures) | | | | | |
| Fuel quality (reference) | | X | | | |
| Recycling | X | X | X | X | X |
| Disposal (hazardous mat.) | X | X | X | X | X |
| Noise | | | | | |

Summary and conclusions.

With this document the chairman of the SGE has intended to summarise and bring together the results and efforts of two previous meeting. This has the twofold aims of bringing all the participants in the expert group/parties concerned to the same level of information and to serve as the basis for an efficient and fluid working method among the participants. This document needs to be perceived as the starting point of an important job that the SGE needs to perform in the near future with strict timelines and deliverables in order to fulfil the commitments made for arriving at a GTR, meeting the expectations of all the involved parties. In order to make the information exchange transparent and easy to follow and retrieve, annex I reproduces a proposal made in the past by OICA in order to have a clear and traceable documentation of the work performed by the SGE.

Annex I: Document numbering proposals – OICA

Introduction.

UN ECE adopted a new Informal Document numbering (e.g.: GRPE-48-17); the SGE might consider to align.

Proposal.

The Informal GRPE-H2FCV SGE might consider aligning with a very short acronym: H2SGE.

The Meeting Reference N° should follow the SGE identification (e.g.: The 1st H2SGE meeting would be recorded: H2SGE-01).

The Meeting Documents: Three cases could be considered: Unknown / tabled during the meeting; Recorded & circulated prior to the meeting; Official or finalized.

- I. Conference Room Paper - CRP: A document tabled during a meeting. In principle: It is seen for the first time and is not yet studied by all the attending experts. If requested by the WG, it should be recorded during the meeting (e.g.: The 10th document tabled for the 1st SGE meeting: H2SGE-01-CRP-010). If amended and or approved, the WG might decide to adopt it as an Informal paper.
- II. Informal Paper - IP: A recorded document circulated prior to the meeting. It should allow all experts to study it and to state a position during the SWG meeting. If adopted it might become a Working Paper (e.g.: The 2nd IP addressed during the 1st meeting of the SGE: H2SGE-01-IP-02).
- III. Working Paper – WP: An official or finalized SGE document (e.g.: The 5th WP of the 1st H2SGE meeting: H2SGE-01-WP-05).

A cover page banner should always reference the document's origin (e.g.: For H2SGE-04-WP-06 the banner title: Finalization of H2SGE-CRP-010/Rev.05).

Remarks

1. All documents with an official status such as Agendas and Meeting Minutes could always be considered as Working Papers.
2. All documents should always have a title (e.g.: Comments about OICA draft amendment proposal to R101 – Informal Document n° GRPE-46-8 JASIC)
3. All documents should be dated.
4. All documents should, if possible, be distributed a week prior to the meetings.
5. In principle, documents might be recorded or annexed as follow:

| | |
|---------------------------|----------------------|
| The Meeting Agenda: | H2SGE-03-WP-01 |
| A Revised Meeting Agenda: | H2SGE-03-WP-01/Rev.1 |
6. If provided, the List of Meeting Documents annexed to a Provisional Annotated Meeting Agenda:

| | |
|--|--------------------------|
| Meeting Agenda: | H2SGE-03-WP-01-Annex-01 |
| The Meeting Minutes of the previous meeting: | H2SGE-03-WP-02 |
| The List of Attendees to the previous meeting: | H2SWG3-03-WP-02-Annex-01 |

Rationale:

- a) Such a system would allow providing a preliminary Agenda to experts requesting a justification document for their travel bookings.

- b) A Revised Agenda would allow adding new issues if more WPs or CRPs pop up for official recording and or notification.
- c) An updated documents' list would become a historical reminder.
- d) An attendees' list would notify the latest personal details.
- e) For classification purposes, some documents would always bear the same reference number.

Alternative proposal: If the documents only circulate within the Informal GRPE-H2FCV WG and or SWGs, an even simpler identification could be suggested:

| | |
|---|--|
| Identification of the sub-working group n°: | WG1 |
| Identification of the document n°: | WG1-51 |
| Identification of the year: | WG1-51-04 |
| Identification of the document's origin: | WG1-51-04 (WG1-06-04) |
| Identification of the document's subject: | Document title |
| Identification of the issuer: | Document title – Issued by (e.g.: Draft Amendment Proposal to Regulation N° 101 EC DGE) |

All suggestions are welcome.