EIGHTH MEETING OF THE GRPE INFORMAL GROUP ON HEAVY DUTY HYBRIDS (HDH)

Geneva, 17 January 2012

MINUTES OF THE MEETING

Venue: Palais des Nations, Geneva
Chairman: Petter Ăsman (Sweden)

1.- WELCOME AND INTRODUCTION

The Chairman welcomed the participants.

2.- ADOPTION OF THE DRAFT AGENDA
(Working paper HDH-08-02)

The draft agenda was adopted.

3.- DRAFT MINUTES OF THE SEVENTH MEETING
(Working paper HDH-07-12)

The draft minutes of the 7th meeting were approved.

4.- CONTRIBUTIONS FROM CONTRACTING PARTIES ON HD HYBRID AND GHG ACTIVITIES

None.

5.- ROAD MAP AND PROJECT PLANNING
(Working paper HDH-07-08)

The secretary presented working paper HDH-07-08, already shown at the 7th HDH meeting. The work program is slightly behind schedule, as shown on page 6.

Timing for WP.29 adoption is not affected, so far.

6.- PRESENTATIONS BY RESEARCH INSTITUTES

6.1 TU Vienna
(Working paper HDH-08-03)

Mr. Planer presented the work program of the Institute for Powertrains & Automotive Engineering (IFA) at the TU Vienna. He started with a general overview of the Japanese HILS method. He concluded that the Japanese process, which verifies simulated results with real data, is a promising concept. In some cases, the model verification might not be

accurate enough with cycles other than the JE05 cycle. If model verification fails, component models would have to be improved as often as needed in order to pass the verification test, which could require high efforts. If components are very complex (such as combustion engine), input data for the simulation model might increase, significantly. An extended HILS concept, as shown on page 15 ("engine-in-the-loop") is suggested for further consideration by the Informal Group.

For the component testing, common methods are used to obtain the component parameters relevant for the simulation models. In the current engine model, influence of temperature is neglected, since engine testing is done under hot condition in Japan. For the gtr n°4, which contains cold and hot start testing, temperature influence need to be taken into consideration. Finally, component testing strongly depends on the requirements of the model. Therefore, the modelling depth is dependent of the desired accuracy.

In summary, the Japanese model is judged to be a good basis, but need to be refined for a global regulation. The suggestions for a global regulation are shown on page 17.

The proposed next steps are shown on page 19. As a first step, a real real heavy duty hybrid vehicle should be simulated with the Japanese open source model. This software simulation should use a relatively simple hybrid model, e.g. a serial hybrid. As a second step, a sensitivity analysis should elaborate the influence of individual models and the model depth for each component on the overall quality of the result. Finally, it is necessary to find the break even point between minimal simulation effort and maximum model quality.

Mr. Planer also recommended to consider possible alternatives, such as the extended HILS-method and powerpack testing.

The real heavy duty hybrid simulation is not part of the current TU Vienna work package. The secretary asked Mr. Planer to prepare a quote for this program. The program would become the first validation study and would start in June 2012.

6.2 TU Graz

(Working paper HDH-08-04)

Prof. Hausberger (TU Graz) presented the work program of the Institute for Internal Combustion Engines and Thermodynamics (IVT) at the TU Graz. He started with a summary of the conclusions from the 7th HDH meeting.

He then explained the development of the World Heavy Duty Hybrid Cycle (WHDHC, see page 5). Basis is the full load curve of the hybrid powerpack, which is used to denormalize the speed and load pattern of the WHTC and to calculate the power pattern over the WHTC. Taking into consideration the powertrain losses and the (negative) braking power then results in a wheel power cycle, named WHDHC. This cycle would then be used as input cycle to the HILS modelling instead of the vehicle cycle WHVC. Advantage of this approach would be that it is independent of the vehicle design and that it uses the same power demand as the same vehicle equipped with a conventional powertrain. Another advantage is the comparability with the powerpack approach. Open issues are the definition of the full load curve for a hybrid and a possible adaptation of the driver model.

The method to calculate the WHVC weighting factors on the basis of real world data is shown on page 17. A first evaluation was done for city buses and shows a good correlation between the WHVC urban part and the HDV-CO_2 city bus cycle (see page 18). Work will continue with the other HDV-CO_2 cycles.

It is not suggested to include PTO loads into the proposed HILS method for pollutant emission testing, but PTO might be necessary for CO_2. TU Graz will therefore elaborate inclusion of PTO load on the basis of the air conditioning system of a city bus.

6.3 Chalmers University of Technology
(Working paper HDH-08-05)

The secretary presented the work program of the Department of Signals and Systems (DSS) at Chalmers University of Technology, Göteborg, since Prof. Fredriksson could not attend the meeting.

He reported that non-electric hybrid powertrain topologies fit well into the same categories as for electric hybrid powertrains, and that the mathematical models for flywheel, accumulator and pump/motor have similar model structures as in the Japanese regulation. The work done is according to the time plan.

Implementation of the models in MATLAB/Simulink has started. For the verification, real model data from suppliers or OEMs are needed. System modelling will be incorporated into the Japanese open-source model with a simple rule based controller.

6.4 Discussion and conclusions

It was generally agreed that a real vehicle model and real vehicle data are needed for further evaluation. The open source model provided by Japan only covers the first 20 seconds of the JE05 cycle, which is not sufficient for a conclusive investigation.

Prof. Hausberger suggested that the three institutes work closely together in this evaluation step.

The secretary asked the participants to carefully look into the wheel power approach suggested by TU Graz. In order to remain within the overall timetable, a decision needs to be taken at the 9th HDH meeting on the WHVC vs. WHDHC approach.

7.- ASSESSMENT OF POWERPACK TESTING

No discussion took place.

8.- ASSESSMENT OF CHASSIS DYNO TESTING

No discussion took place.

The secretary asked Mr. Schulte to prepare a presentation for the 9th HDH meeting on the experience with chassis dyno testing in the context of the EU CO_2 work program.

9.- NEXT MEETINGS

The next HDH meetings will take place, as follows

- 9th HDH meeting: 21 to 23 March 2012, Tokyo
- 10th HDH meeting: 05 June 2012, Geneva

10.- SUMMARY AND CONCLUSIONS

Chairman and secretary summarized the meeting as follows:

- The contributions of the institutes were very much appreciated
- The Japanese HILS model is a good baseline for a global technical regulation, but need further refinement, especially with respect to temperature models
- The first validation study will be a real heavy duty hybrid software based simulation; TU Vienna will prepare a quote
- Result of this validation study should be the determination of the break even point between minimal simulation effort and maximum model quality
- The wheel power approach proposed by TU Graz as an alternative to the vehicle based approach (WHVC) should be assessed by the IG members for discussion and decision at the 9th HDH meeting
- Discussion on chassis dyno and powerpack testing will continue on the basis of input from ongoing programs at the Contracting Parties

11.- OTHER BUSINESS

None.