GRPE Informal Working Group on Heavy Duty Hybrids

Report to GRPE 66
Geneva, 06 June 2013
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Summary of 13th HDH Meeting

- The results of the 13th meeting in Borlänge on 21 and 22 March 2013 are summarized, as follows:
  
  - The basic vehicle cycle will be the WHVC with road gradients; 2 methods for calculating the road gradients will be investigated
  - The institutes propose that the model structure allows for using OEM specific models
  - The institutes will communicate the deliverables of validation test program 1 and the related time schedule within the next two weeks
  - The new model structure will be available by the end of April
  - The VECTO transmission model by TU Graz will be added to the open source model
  - Master ECU needs to be defined, supportive ECUs via interface or software emulation
  - Validation test program 2 will start in May with Volvo parallel hybrid bus, followed by Iveco parallel hybrid MD truck and MAN serial hybrid bus
    - Chassis dyno tests and road tests (w/o emissions measurement) will be run at JRC, engine dyno tests at OEM
    - Command signal frequency for engine tests will be 1 Hz, 10 Hz, 50 Hz
  - OICA and EPA will discuss bilaterally the possibility of HILS testing at EPA and report at the 14th HDH meeting
  - Model verification will be investigated during validation test program 2 including powertrain verification
  - The hybrid test procedure will be developed as an amendment to gtr n° 4 (new Annex 8), and will include HILS and powertrain testing
The results of the 14th meeting in Geneva on 04 June 2013 are summarized, as follows:

- The results of validation test program 1 with the new model structure were presented by the institutes; the new model structure includes a comprehensive component model library, a new signal naming convention and restructured vehicle models.
- The models will be further developed based on feedback from stakeholders.
- The drive cycle investigations resulted in different road gradients from the two calculation methods; application of road gradients to WHVC needs further investigation during validation test program 2 incl. the use of road gradients fixed in the gtr.
- Validation test program 2 at JRC has started in May; the details of the test program were defined between JRC and the participating OEMs.
- OICA confirmed that individual members will arrange for HILS testing at EPA and will start discussions with EPA on the most suitable approach.
- OICA informed that they will provide budget for model verification by the institutes during validation test program 2.
- EPA requested to include powertrain testing and verification in the gtr, and to validate the HILS method with emission results, and confirmed to take part in validation test program 2.
- The proposal by Chair and Secretary of using the HILS CO₂ result as input to regional CO₂ regulations was agreed.
- The HDH drafting group has been established and had two meetings, so far; the Technical Secretary has not yet been appointed, but it is hoped that the budget will be available in June.
Status of Validation Test Programs

- **Validation test program 1 largely completed**
  - Japanese open source model has been re-structured for greater flexibility
  - New component library and signal naming convention has been developed
  - Serial hybrid and parallel hybrid models are available for stakeholder testing
  - Positive feedback on the new models from OEMs
  - Next model release planned by end of June 2013,

- **Validation test program 2**
  - Validation test program 2 with real HVs is underway with first vehicle testing (Volvo parallel hybrid bus) completed
  - Data evaluation will be completed by mid-September 2013
  - OICA will cover budget for contributions of institutes (approx. 200 k€) incl. further investigations on drive cycle modifications (road gradients)
  - Individual OICA members are contacting EPA on how to best conduct HILS testing at EPA
Topics for HDH Work Program

- Assessment of chassis dyno and powerpack testing
  - Further input from Contracting Parties for consideration in the final report is required by October 2013

- Drafting of the gtr
  - Drafting group established, but Technical Secretary not yet available
  - New Annex 8 to gtr n° 4 will include HILS method based on JP regulation Kokujikan 281 modified by input from HDH work program, and powertrain method based on US-EPA procedure
  - Informal document is intended to be submitted to GRPE 68 in January 2014
    - This timing is in jeopardy, if nomination of Technical Secretary is further delayed

- Other topics
  - OICA suggest to include plug-in hybrids and will develop a proposal in due time for discussion at the 15th HDH meeting
  - GRPE is asked to confirm HDH IWG agreement on CO2 emissions (see page 7)
CO₂ Emission

➢ Background

- CO₂ emission is part of the HDH mandate
- Currently, CPs have their own regional HD CO₂ regulations in place or are developing CO₂ regulations for HD vehicles
- There is no WP.29 mandate for a CO₂ regulation for conventional heavy duty vehicles

➢ Conclusions from meeting with DG-CLIMA of EU-COM

- It is not appropriate to develop a CO₂ regulation by UNECE just for HD hybrid vehicles
- HDH IWG should develop the procedure for CO₂ determination, thereby fulfilling their mandate on CO₂ emissions
- The HILS CO₂ result may then be used as input for the regional CO₂ regulations, if needed
- For the EU, a possible approach is shown on page 8
- Chair and Secretary suggest other CPs to apply a similar approach
EU Approach on CO$_2$ Emission

Option for harmonisation of test procedures

Conventional
- Engine
- Full load curve
- Test cycle
- Engine test bed
- Pollutant emissions [g/kWh]

Input test cycle: WHTC
Engine load cycle: Depends on full load curve
Independent of vehicle

HILS
(actual TUG proposal)
- Power pack
- Full load curve
- WHVC or WHDHC test cycle
- HILS simulator (or power pack test bed)
- Engine load test cycle

ECU's

Input test cycle: WHTC + WHVC
Engine load cycle: Depends on full load curve
Independent of vehicle

HDV CO$_2$
(Example EU-approach)
- Engine map
- Vehicle data
- Veh. test cycle
- HDV simulator
- Engine map
- Hybrid
- Conv.
- CO$_2$-emissions g CO$_2$/t-km

Input test cycle: vehicle class specific target speed cycle
Engine load cycle: Vehicle dependent and full load curve dependent

Component testing

Meeting DG CLIMA 11.03.2013
Heavy Duty Hybrids
**Roadmap & Project Planning**

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- Final report and informal document of gtr: 68th GRPE session (January 2014)
- Official document and GRPE adoption: 69th GRPE session (June 2014)
- WP.29 adoption at 164th WP.29 (11/2014)
Next Meetings

The next HDH meetings are scheduled as follows:

- The 15th meeting will be on 24 and 25 October 2013 in San Francisco
- The 16th meeting will be on 08 January 2014 in Geneva (to be confirmed)
- The 17th HDH meeting will be in March 2014 in Europe (date and place to be confirmed)

GRPE is asked to

- Reserve a half day for the 16th HDH meeting during the 68th GRPE session in January 2014