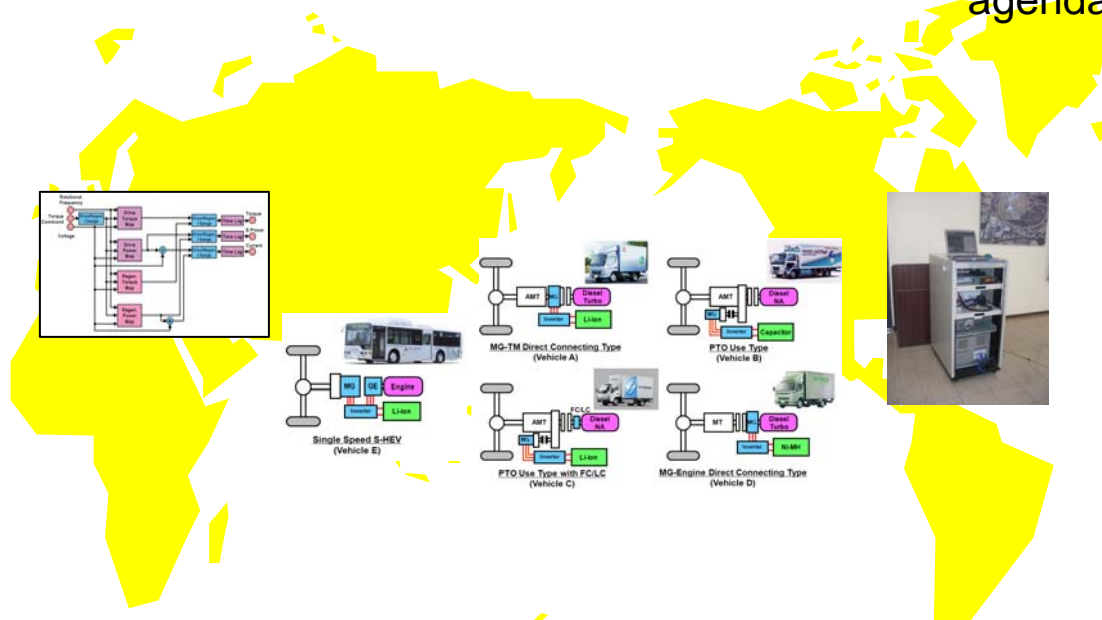




UNITED NATIONS

Informal document No. **GRPE-64-14**
(64th GRPE, 5 - 8 June 2012,
agenda item 4(a))



GRPE Informal Group on Heavy Duty Hybrids

Report to GRPE 64
Geneva, 07 June 2012



UNITED NATIONS

ECE - GRPE

HDH

Contents

- **Status of HDH work program**
- **Summary of 9th & 10th HDH meetings**
- **Results of research program**
- **Roadmap & project planning**
- **Next meetings**



UNITED NATIONS

ECE - GRPE

HDH

Status of HDH Work Program

➤ Research program (Phase 1 of HDH work program)

- Work program at TU Vienna has been finished
- Work program at TU Graz has been largely finished
 - WHVC weighting factors will be submitted upon completion of EU CO2 test cycles
- Work program at Chalmers University has been finished

➤ Next steps (Phase 2 of HDH work program)

- Discussion on chassis dyno and powerpack testing will continue on the basis of input from ongoing programs at the Contracting Parties
 - input required by end 2012
- Validation step 1 based on SILS (Software-in-the-loop simulation) will start in June 2012
- Validation step 2 with real HD Hybrid Vehicles will start around March 2013



UNITED NATIONS

ECE - GRPE

HDH

Summary of 9th HDH Meeting

- **The results of the 9th meeting in Tokyo from 21 to 23 March 2012 are summarized, as follows:**
 - **The revised roadmap and project planning were agreed**
 - **TU Vienna will prepare a quote for validation step 1 using software based simulation**
 - **The validation step 1 will cover both the original HILS approach (based on WHVC) and the power demand approach proposed by TU Graz (based on WHTC) for electric and non-electric hybrids**
 - **It is general understanding that a vehicle independent approach would be the most favorable solution provided the results largely match real world operation**
 - **The extended HILS approach will no longer be considered**
 - **OICA offered to submit part of the budget for validation step 1**



Summary of 10th HDH Meeting

- **The results of the 10th meeting in Geneva on 05 June 2012 are summarized, as follows:**
 - **Prof. Hausberger presented the final results of the TU Graz work package**
 - **Prof. Fredriksson presented the final results of the Chalmers work package**
 - **TU Vienna submitted a proposal and quote for validation step 1, which will be done jointly by TU Vienna, TU Graz and Chalmers University**
 - **Task 1: serial hybrid simulation budget 181,570 €**
 - **Task 2: parallel hybrid simulation budget 89,170 €**
 - **Task 3: report, interface & user manual budget 44,960 €**
 - **ACEA agreed to take over budget for task 1**
 - **EU-COM will check, if budget can be made available, other participants are asked to consider contribution**
 - **The proposal for validation step 1 was agreed**
 - **A slight overlap between validation step 1 and validation step 2 is considered acceptable**
 - **The revised roadmap and project planning were finally adopted by HDH**
 - **HEV availability for validation step 2 will be discussed at 11th HDH meeting**



Results of Research Program

- **The research program was conducted by TU Vienna, TU Graz and Chalmers University to determine the possibility of using the Japanese HILS method as basis for a global regulation**
- **The HDH interim report (summary of the research program) is available as Informal Document No. GRPE-64-07**
- **Results of Task 1**
 - **The Japanese HILS procedure and the HILS open source model provide a good basis for a global regulation, but needs to be refined (e.g. more topologies, component library, temperature signals)**
 - **Three different options are proposed for creating the HILS engine test cycle**
 - **WHVC with adapted gradients and vehicle data sets (original HILS approach)**
 - **power demand cycle (World Heavy Duty Hybrid Cycle = WHDHC) at the wheel hub**
 - **power demand cycle (WHDHC) at the power pack shaft, which is similar to the WHTC for conventional engines**



Results of Research Program, cont'd

➤ Results of Task 2

- The component test procedures laid down in the Japanese regulation can be adapted for a global regulation and are considered to provide correct input data to the simulation models for both electric and non-electric hybrids
- A component library is proposed to be part of the global regulation
- Thermal effects of component testing need further investigation

➤ Results of Task 3

- Non-electric hybrid powertrain topologies fit well into the same categories as for electric hybrid powertrains
- No major modifications to the HILS model are needed, since non-electric components/subsystems have the same purpose as the electric components/subsystems
- Model structures and mathematical models can be largely used “plug ‘n play” with the models of hybrid electric powertrains



Results of Research Program, cont'd

➤ Results of Task 4

- Inclusion of PTO operation is not recommended for criteria pollutants due to the minor influence of PTO load on brake specific emissions and since it would not be in line with the test procedure for conventional engines
- PTO operation could be included in a test procedure for CO₂ emissions of the entire vehicle in a way similar to dealing with auxiliaries

➤ Results of Task 5

- A methodology to calculate WHVC weighting factors to represent real world vehicle operation was developed that is applicable to all combinations of test cycles and vehicles
- The result for city bus operation was presented
- For other vehicle categories, results will be provided w/o further cost upon final adoption of the test cycles of the EU CO₂ test program (end 2012)
- Options to coordinate the HDH test procedure with the EU CO₂ test procedure for Heavy Duty Vehicles have been elaborated



Updated Roadmap & Project Planning

Activity	2 0 1 1				2 0 1 2				2 0 1 3				2 0 1 4																		
	06	07	08	09	10	11	12	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03	04	05	06	07	08	09	10	11	12
HILS model verification	█				█																										
Component testing verification	█				█																										
Extension to non-electric hybrids	█				█																										
PTO operation	█				█																										
WHVC weighting & scaling factors	█				█																										
Assessment of chassis dyno procedure	█				█																										
Assessment of powerpack testing	█				█																										
7th meeting				X																											
8th meeting					X																										
9th meeting						X																									
Interim report							█																								
Validation test program 1											█																				
10th meeting										X																					
11th meeting											X																				
Validation test program 2											█																				
Drafting text for gtr n°4											█																				
12th meeting										X																					
Evaluation & conclusions											█																				
13th meeting										X																					
Final report											█																				
14th meeting											X																				
15th meeting														X																	
GRPE adoption																															
WP.29 adoption																															X

- ➔ Timing for GRPE adoption delayed until 01/2014
- ➔ Timing for WP.29 adoption likely to be delayed by 8 months (11/2014)
- Updated roadmap finally agreed by HDH informal group at 10th meeting



Items for Consideration

➤ GRPE is asked to:

- **Adopt validation step 1, as agreed by HDH 10**
 - ➔ will need to be finished before 2nd validation starts
 - ➔ will consequently delay roadmap
- **Adopt the revised roadmap and project planning**

➤ Other items:

- **Financial contributions to validation step 1**
 - ➔ ACEA will cover task 1 (serial hybrid) of 181,570 €
 - ➔ remainder for tasks 2 and 3 is 134,130 € and still open
- **Further consideration of JASIC alternative proposal will be done by Japan**
- **Additional laboratories/institutes interested in HDH validation studies are welcome**
 - for example, powerpack testing and vehicle testing



UNITED NATIONS

ECE - GRPE

HDH

Next Meetings

➤ **The next meetings are scheduled as follows:**

- **The 11th meeting will be from 10 to 12 October 2012 in Ottawa**
- **The 12th meeting will be on 15 January 2013 (?) in Geneva (to be confirmed)**
- **The 13th meeting will be in March 2013 (Europe, date and place to be confirmed)**
- **The 14th meeting will be in June 2013 in Geneva (to be confirmed)**
- **The 15th meeting will be in October 2013 (San Francisco, date to be confirmed)**

➤ **GRPE is asked to**

- **Reserve a half day for the 12th HDH meeting during the 65th GRPE session in January 2013**