Document: EVE-02-06e

UNECE/GRPE
Informal WG on Heavy Duty Hybrids (HDH)

Baltimore 2012

HDH Chair Petter Åsman

HDH-Objectives

- aims to provide
  - an engine based test procedure
  - harmonized technical requirements for pollutant emissions and CO_2 certification of HV's
- HILS (Hardware-in-the-Loop) approach,
  - vehicle cycle and simulates powertrain and vehicle components to result in a HV specific engine cycle for emissions testing and measurement.
- Establish an amendment to Global Technical Regulation (gtr) n° 4 (WHDC)

HDH-Objectives II

- A chassis dynamometer based test procedure, as with passenger cars, might be investigated as an alternative to HILS (not part of current research programme but contributions from stakeholders welcome)

Approach for the work

- Develop a procedure starting with a vehicle cycle (speed pattern) using a vehicle model, a driver model and motor/generator, energy storage and ECU hardware and software
- Transforming the vehicle cycle into a specific engine cycle using Hardware in the loop simulation.
- The new specific engine cycle is then used to test the combustion engine on the engine test bench as for conventional engine testing.

HDH procedure should cover:

- a wide range of HV technologies including
  - electric hybrids,
  - hydraulic hybrids,
  - fly-wheel hybrids,
  - plug-in hybrids,
  - range extenders and
  - start/stop solutions

HILS includes the following models:

- The vehicle model covers running and acceleration resistance, taking into account rolling and air resistance coefficients, vehicle mass, rotating equivalent mass, speed and acceleration, etc.;
- The MG (motor-generator) model represents the electric motor, the generator or other regenerative braking system whose input data are generated from component testing;
- The transmission model represents clutch and gearbox, the gear ratios and efficiencies;
- The battery, capacitor and accumulator models express the conditions of the battery/capacitor/accumulator, state of charge (SOC), capacity, resistance, charge and discharge power, etc.

Existing Regulations and International Standards

Japanese Regulation:

- Kokujikan No.60 of 30 June 2004, “Measurement Procedure for Exhaust Emission from Electric Hybrid Heavy-Duty Motor Vehicles”;

- Kokujikan No.281 of 16 March 2007, “Measurement Procedure for Fuel Consumption Rate and Exhaust Emissions of Heavy-Duty Hybrid Electric Vehicles using Hardware-In-the-Loop Simulator System”

SAE Standards:

- SAE J 2711 "Recommended Practice for Measuring Fuel Economy amd Emissions of Hybrid-Electric and Conventional Heavy-Duty Vehicles"

State of Play

- In January 2010 the 59th GRPE agreed to set up the informal HDH
- 1st Informal HDH meeting was held in Brussels in May 2010.
- Terms of Reference was agreed at 60th GRPE in June 2010
- Research program with TU Graz and Vienna, Austria and TU Chalmers to investigate the Japanese HILS procedure was started mid 2011

State of Play

- Research program Finalised mid 2012
- Validation 1 program starts autumn 2012
  - Includes adaptation of Japanese HILS for a serial and parallell hybrid as software in the loop simulation
- Validation 2 program is planned to start after validation 1 is finished in beginning of 2013
- Drafting of GTR planned to start beginning 2013
- Final report and GRPE adoption planned for January 2014
- WP.29 adoption planned for November 2014

Next meetings

- 11th meeting will be held In Ottawa, Canada 10-12 October

- 12th meeting will be held i Geneva on 15th January 2013

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