

# GRPE-HDH Research Project

16th meeting of the GRPE informal group on heavy duty hybrids (HDH)



Institut für Fahrzeugantriebe  
& Automobiltechnik



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# Content

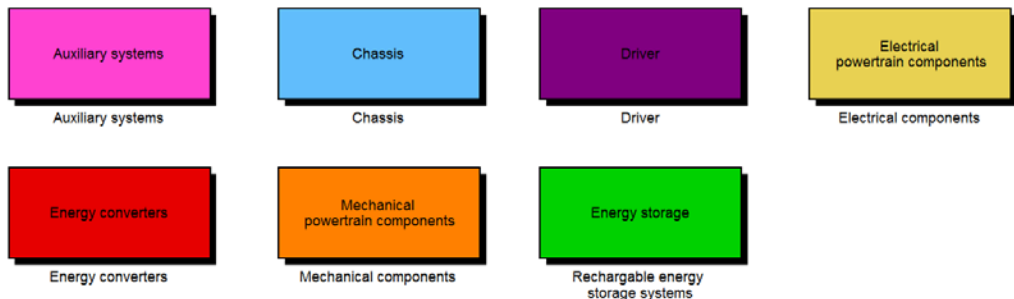
- New model release
  
- Validation test program 2 (VTP2)
  - Model verification
  - Drive cycle development
  
- Definition of rated power of hybrid system
  
- Major open issues

# New model release

- New version v0.5 of GTR-HILS simulation model released
- Feedback from Daimler already available
- Feedback from other OEMs still expected
- Work on minor issues and improvements in progress
- OEM feedback will be implemented according to GTR-HILS applicability

## HILS model library toolbox

Basic vehicle components



Established by  
Chalmers University of Technology,  
Vienna University of Technology,  
Graz University of Technology, 2013

# VTP2 – Model verification

- Model verification still ongoing at OEMs
  - VOLVO (SIL ECUs)
    - Verification criteria very close to limits specified in Kokujikan
    - Different gearshift behavior due to differing software versions
    - Gears from chassis dyno will be forced in simulation
    - Updated verification results expected by end of January
  - MAN (MIL ECUs)
    - New chassis dyno measurements at MAN facilities scheduled for January
    - Model verification will be performed with new measurement data
  - IVECO (HIL ECUs)
    - No access to hybrid system data at last measurements
    - New chassis dyno measurements at JRC facilities until end of February
    - Torque measurement system will be installed in vehicle
    - Verification results expected by end of March

# VTP2 – Drive cycle development

- Informal meeting with Japanese delegation after 7th drafting group meeting in Brussels
- Agreement on common position regarding the „Minicycle“ method
- Implementation of new basis for cycle calculation ongoing
- Discussions and close cooperation with Japanese delegation during final implementation process
- Another informal meeting with Japanese delegation scheduled before the drafting group meeting in Tokyo
- Final method of calculation should be available for drafting group meeting in Tokyo
- Final discussion and acceptance in the HDH working group in 17th meeting in April

# Definition of rated power of hybrid system

- Rated power is needed for calculation of test cycle
- System peak power vs. continuous power
  - Peak power dependent on SOC and other system limitations (controllers) and only available for a short time
  - Continuous power can be provided by the hybrid system for a longer timeframe
- EPA procedure for mapping electric hybrid systems was analysed
  - Different methods „Continuous sweep“ and „Discrete mapping“ can lead to different results
  - Depending on the capacity of the ReESS, the maximum power of the hybrid system can differ between these methods
- Definition of rated power for all different types of hybrid systems difficult
- One possible solution: only use ICE rated power
  - With limitation of  $\Delta\text{SOC}=0$  over cycle, energy for vehicle propulsion can only be provided by ICE (+ recuperated energy)
- Definition of rated system power should be possible without additional measurements
- Further investigations needed

# Major open issues

- On-Road verification procedure
  - Work package can only be started as soon as standard verification is successfully completed
  
- Cold start
  - Cold start measurements from chassis dyno tests need to be analysed and verified
  - Cold start verification can only be started as soon as standard verification is successfully completed
  
- Hybrid system work or combustion engine work as reference for specific emissions
  - General definition of hybrid system work necessary for different types of hybrid systems
  
- Alignment of HILS testing and Powerpack testing
  - Same boundary conditions lead to comparable test cycles
  
- Define viable and profound procedure for practical handling of type approval of different vehicle variants

# Thank you for your attention!



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