Determination of Powertrain Performance of Hybrid Electric Vehicles

Presented by: Germany, Korea

EVE-15 meeting

June 8, 2015
Outline

1. Activities and current state-of-play since EVE-14 Webcon April 20, 2015

2. Planned activities until EVE-16, Ottawa, October 19/20, 2015
Activities and current state-of-play

Progress in information gathering

- SAE-J2908
  “Hybrid System Power Rating” (EVE-14-10e)

- ISO/TC22/C37/WG2
  “Determination of power for propulsion of hybrid electric vehicle” (EVE-15-tbd e)

- KATRI
  “Introduction to System Power Concept and its Application” (EVE-07-06e)

- First Cross-Section of Opinions from Survey
  “Questionnaire to support the development of electrified vehicle’s system power determination” (EVE-14-07-Ref1e)
Information needed

- **technical questions:**
  - to be answered in detail including information, which resources will be needed therefor

  - Which technical procedure is appropriate?
  - Determination of power ratings of individual components
  - System (hardware-in-the-loop)?
  - Chassis dyno / Power train dyno measurement?
  - other?
# Summary of ongoing projects

<table>
<thead>
<tr>
<th>Items</th>
<th>SAE J2908 TF (Argonne, U.S.)</th>
<th>ISO TC/22/SC37/WG2 (JARI, Japan)</th>
<th>KATRI updated (KATRI, Korea)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principle (Hybrid system power)</td>
<td>Nominal rating + System power test</td>
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</tr>
<tr>
<td>Nominal Rating (ICE)</td>
<td><img src="image" alt="SAE J1349" /></td>
<td><img src="image" alt="ISO 1585" /></td>
<td><img src="image" alt="UN R85" /></td>
</tr>
<tr>
<td>System Power Test (Electric source)</td>
<td><img src="image" alt="To be discussed" /></td>
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<tr>
<td>Test Equipment (Dynamometer)</td>
<td>Hub dyno or Chassis dyno</td>
<td>Chassis dyno</td>
<td>Power train dyno or Chassis dyno</td>
</tr>
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<tbody>
<tr>
<td>Vehicle categories</td>
<td></td>
<td>PC, LDC</td>
<td></td>
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<tr>
<td>Power train concepts</td>
<td>(N)OVC-HEV incl. all types of drive train concepts and manual / automatic / CVD gear boxes</td>
<td></td>
<td></td>
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<tr>
<td>Information</td>
<td>Nominal system power $P_{sys}$</td>
<td>$P_{sys,max}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$P_{Electric\ assist\ at\ P_{sys,max}}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$P_{Electric\ assist\ at\ P_{ICE}=0}$</td>
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<tr>
<td></td>
<td>$P_{reg}$ Regenerative power</td>
<td></td>
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</tr>
<tr>
<td>Target / comprehension towards existing regulations</td>
<td>Ratings for common data benchmarks, customer information (complements SAE J1349) System Power Test for engineering exercises</td>
<td>$P_{sys,max}$ rating required as level playing field for comparison of HEVs power with ICE- vehicles (complements ISO 1585) and for GTR No. 15 (WLTP),</td>
<td>Vehicle classification, taxation complements UN R85</td>
</tr>
<tr>
<td>Time line</td>
<td>Project start 11/2014 finalization scheduled for Q4/ 2015</td>
<td>Waiting for approval votes 19/6/2015 projected time line: 18 months</td>
<td>Research work in progress</td>
</tr>
</tbody>
</table>

Research work in progress
Information needed

- strategic political questions: need for technical information on best/worst case or representative case?

- Regulatory approach: amendment or entirely new document?
- Regulation? Recommendation? Mutual Resolution?
- What kind of power ratings are needed?
- which vehicle conditions shall these ratings represent?
- For which applications?
- Taxation schemes, incentives, insurance classification?
The subject is **important** and **relevant for many other Regulations**
- Forms the basis for proper **vehicle classification**
- Consider expanding the scope beyond PC and LDCV: harmonized procedure for **L-Category** vehicle and **NRMM**
- For all engines, motors and combinations of propulsion units up to a tbd. limit there **should be a single harmonized way** to determine it’s continuous max. rated net and peak propulsion unit performance

**Purpose:**
- WLTP and others

**Way forward:**
- Upgrade of UN R85 and development of GTR in parallel
First Cross Section of Opinions from Questionnaire Survey

JP

• JP understands that the demand in WLTP is **limited to the determination of the system power of HEV**
• There is **only need to define the combined power of hybrid electric vehicles**
• No need to re-define the power of Battery EVs and Fuel Cell Vehicles, since the electric drive train have already been defined in UN-R85.

**Purpose:**

• WLTP, for P-t-M classification of HEV

**Way forward:**

• Target should be achieved by a world-wide agreed (ISO) Standard rather than a GTR, UN-R or Recommendation / Mutual Resolution
First Cross Section of Opinions from Questionnaire Survey

KOR

• Net power ratings from current UN-R85 are sufficient but the power limit ascribed to the traction battery should be properly considered and determined.

• Determination of power and torque should be done with a completed vehicle applying a kind of chassis dyno or power train dyno measurement

Purpose:

• WLTP

Way forward:

• UN-R85 should be adapted by an amendment / additional module
First Cross Section of Opinions from Questionnaire Survey

CAN

• As CAN is being party of the ‘98-Agreement, the UN-R85 has not been adopted or applied.
• CAN abstained from voting on phase 1 of WLTP since analysis of the GTR 15 (WLTP) is still ongoing and because stringent light duty vehicle reg. are already in place domestically.

Purpose:

Way forward:
Planned activities until EVE-16

Next steps:

• Discussion and decision making regarding the approach and procedure respectively
to be accomplished at EVE-16

• Completion of Feed-back Analysis from Questionnaire Survey
  end of June / early July

• Preparation and distribution of a discussion paper in time before EVE-16
  August / September