

# Determination of Powertrain Performance of Hybrid Electric Vehicles

Presented by: Germany, Korea

EVE-16 meeting

October 19./20., 2015

# Outline

1. **Status Report**  
Activities and current state-of-play since EVE-15
2. **Presentation of the Discussion Paper**  
Project Proposal
3. **Open Questions, Discussion and Decision Making**
4. **Next steps and Planned Activities**  
until EVE-17, Geneva, January XX/YY, 2016

# Status Report

- ✓ Evaluation of Survey
  - “Questionnaire to support the development of electrified vehicle’s system power determination” (EVE-14-07-Ref1e)
- ✓ Preparation of a discussion paper / project proposal
  - “Determination of Powertrain Performance of Hybrid Electric Vehicles”

# Discussion Paper

## 1. Project Charter

- BACKGROUND
- PROBLEM
- MOTIVATION
- GOAL

## 2. Scope of Work

- APPRAISAL OF STAKEHOLDER INTERESTS
- PROJECT FRAME
- MULTI GENERATION PLAN
- PROJECTS WITH SIMILAR FOCUS - DEPENDENCY ASSESSMENT AND SYNERGIES

## 3. Project Structure

- REFERENCE METHOD
- CANDIDATE METHOD

## Background

UNECE R-85 provides currently a regulation under the 58' Agreement that can be used for approval of internal combustion engines (ICE) and electric drive trains in M and N category vehicles. It focusses on the determination of engine power values, however, the technical description part of the regulation merely provides for the individual determination of the power of either an ICE or an electric motor.

## Problem

The role of the propulsion battery is not considered by the regulation. A determination or recommendation for a calculation of the 'motive power' of the vehicle expressed as combined power or system power is missing.

## Project Focus & Scope

- HEV (light duty: M, N-category vehicles)
- Rated System Power (according "WLTP-demands")
- Component testing, chassis dyno testing
- Integration into GTR15

## Motivation & Goal

Clarify, how an improved technical prescription for the determination of the system power of such sophisticated powertrains like with pure and hybrid electric vehicles, could be realized in an efficient and easy way.

## Multi Generation Plan

- *Phase I* Rated System Power for GTR 15 (WLTP ) purposes
- *Phase II* extension to BEV vehicle types and system peak power as well as other relevant system power ratings like system torque
- *Phase III* harmonized regulation for NRMM and L-cat. vehicles.

## Appraisal of Stakeholder Interests

### EU

- 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

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#### Purpose:

- WLTP and others

#### Way forward:

- Upgrade of UN R85 and development of GTR in parallel
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# Appraisal of Stakeholder Interests

## 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 has already been defined in UN-R85.

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### 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

# Appraisal of Stakeholder Interests

## 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**
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### Purpose:

- WLTP

### Way forward:

- UN-R85 should be adapted by an amendment / additional module and GTR-development in parallel
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# Appraisal of Stakeholder Interests

## 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.
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**Purpose:**

**Way forward:**

# Appraisal of Stakeholder Interests

## OICA

- OICA supports the development of a harmonized procedure for every cat. of el. vehicles to determine comparable system power / system torque (if required) based on needs, priorities and requests from relevant groups (e.g. WLTP-IWG).
- Measurement of indiv. components followed by a calc. method
- To be derived from a std. procedure

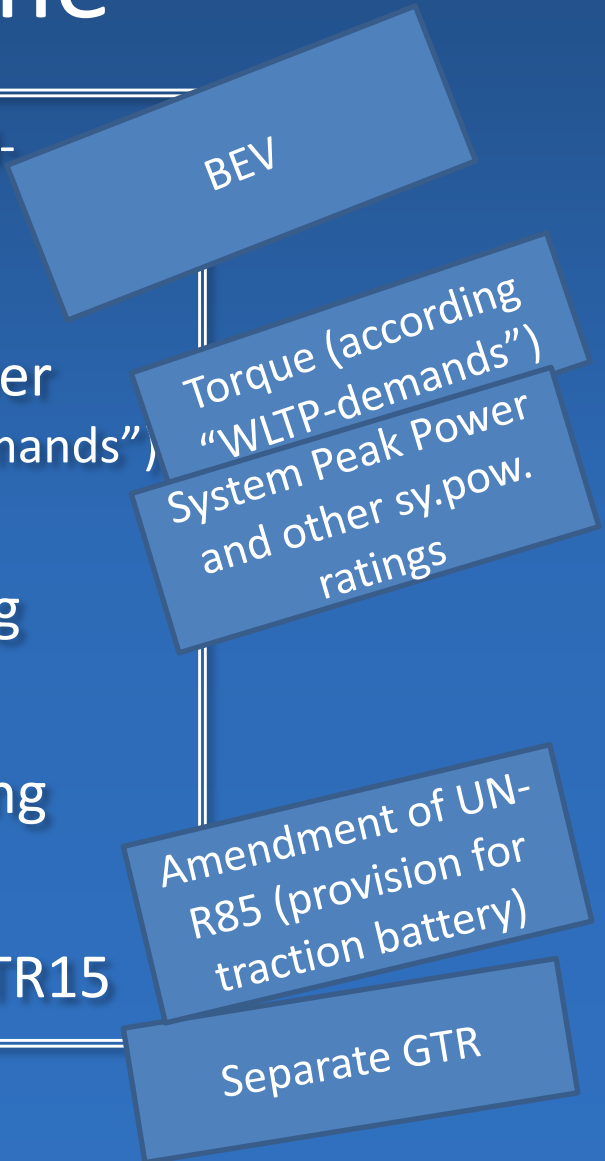
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- Purpose:**
- WLTP, since the only current reg. where SP, ST is needed
  - SP for cycle classification and downscaling.
  - ST for gear shift calculation in case of a MT.

### Way forward:

- Integration either into GTR 15 or as another GTR
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## Project Frame

- ✓ HEV (light duty: M, N-category vehicles)
- ✓ Rated System Power (according "WLTP-demands")
- ✓ Component testing
- ✓ Chassis dyno testing
- ✓ Integration into GTR15



### Out of frame:

- NRMM,
- L-category
- All engines, motors and combinations of propulsion units

# Multi Generation Plan

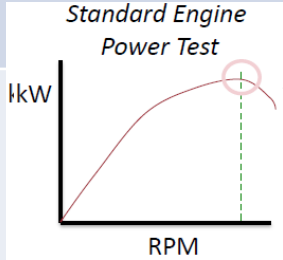
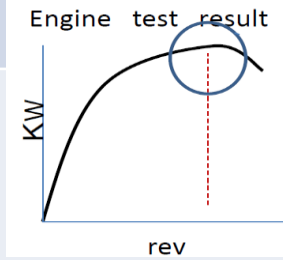
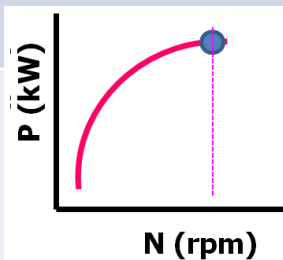
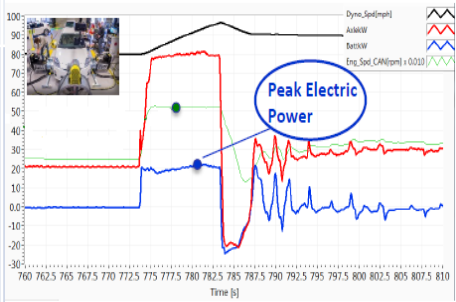
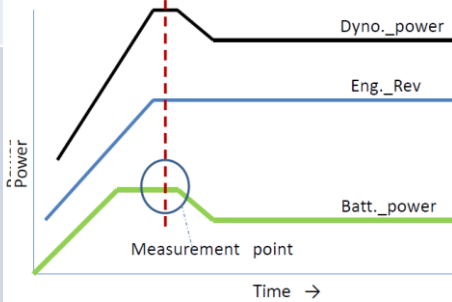
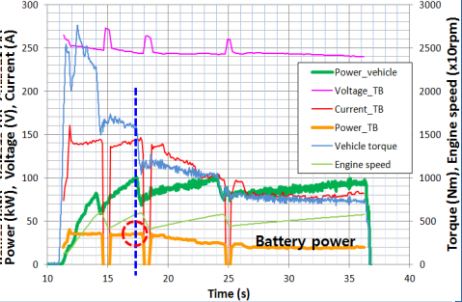
- Generation I
- Generation II
- Generation III



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|------------------------|------------------------------------|--|
| – For immediate action | – Extension of results from Gen. I | – Harmonized regulation for NRRM and L-cat. vehicles |
| – In the frame topics  | – On the frame topics              |  |

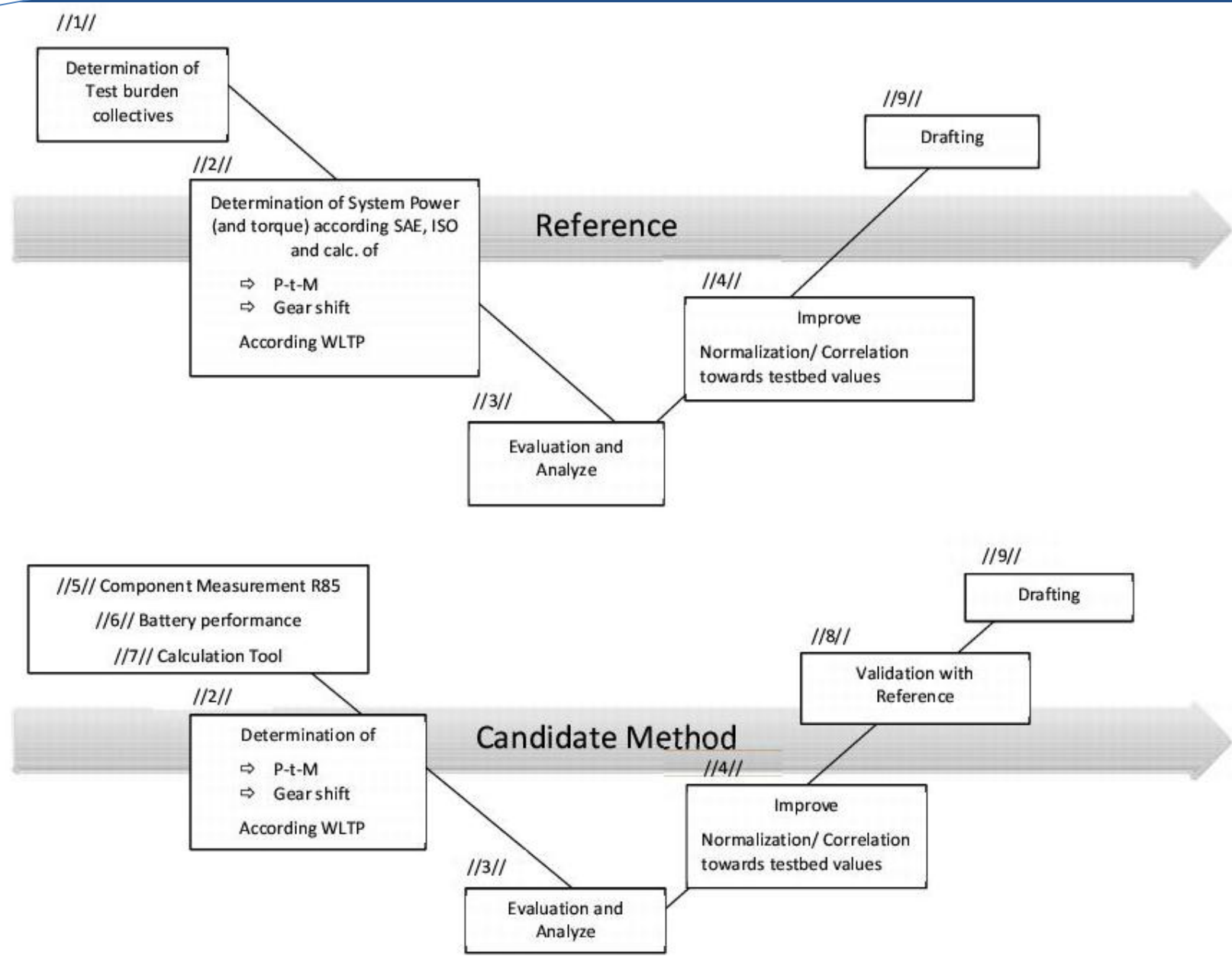
# 2. Scope of work

## Projects with similar focus

	SAE J2908 TF (Argonne, U.S.)	ISO TC/22/SC37/WG2 (JARI, Japan)	KATRI updated (KATRI, Korea)
Principle (Hybrid system power)	Nominal rating + System power test	Nominal rating + System power test	Nominal rating + System power test
Nominal Rating (ICE)	SAE J1349 	ISO 1585 	UN R85 
System Power Test (Electric source)  <i>To be discussed</i>			
Test Equipment (Dynamometer)	Hub dyno or Chassis dyno	Chassis dyno	Power train dyno or Chassis dyno

# 3. Project Structure

- Suppliers:**  
 OICA,  
 KATRI  
 ISO/JARI  
 SAE /ANL
- Input:**  
 Expertise  
 Data  
 Lab capacity  
 Software code  
 Programming
- Process:**  
 WLTP  
 calculations  
 (gearshift,  
 downscaling,...)  
 Evaluation  
 Improvements  
 Normalization/  
 Correlation  
 Drafting
- Output**  
 New Regulation



# Discussion

- Project Frame:
  - BEV
  - Torque
  - System PP
  - Separate GTR
- Amendment UN-R85
  - MGP:
- Project Structure:
  - Project Team:
    - Chair
    - Co-Chair
    - Secretary
- Members of Experts

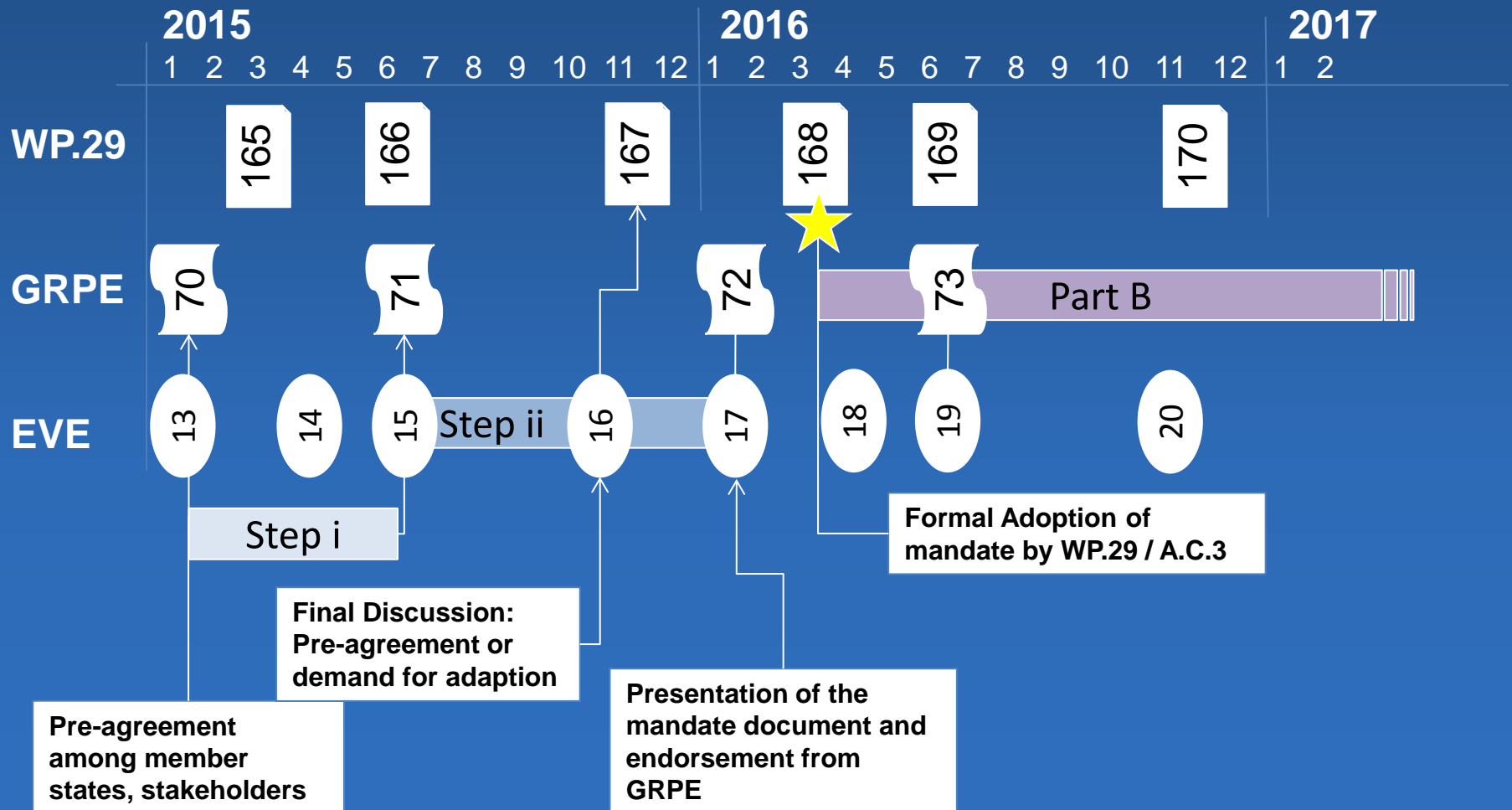
# Planned activities until EVE-17

- Determination of the formal framework: Chair, Co-Chair, Secretary
- Notification for 167 WP.29 Nov 2015
- Work Brake-down Structure
- Drafting of a mandate document to be endorsed by GRPE during 72. meeting, Jan 2016
- Formal Adoption of Mandate during 168 WP.29 / A.C.3 in March 2016



# Timeline

updated version 06/2015



# Backup