

Submitted by the EVE informal working group

Informal document **GRPE-73-23**
73rd GRPE, 6-10 June 2016,
agenda item 10

Electric Vehicles and the Environment (EVE IWG)

1

REPORT TO GRPE 73RD SESSION

Current EVE Mandate Review

2

- **EVE IWG is currently operating under a mandate approved in November, 2014**
 - **Work has been divided into two parts:**
 - ✦ **Part A – Information gathering and recommendations for follow-up work**
 - Method of stating energy consumption
 - Electrified vehicle durability
 - Determination of electrified vehicle power
 - Battery Recyclability
 - ✦ **Part B – Potential development of GTR's related to durability and power determination**

EVE Roadmap, Part A: Jun 2015-Jan 2016

(EVE-13-06-Rev1e)

3



Task	start date	end date	status	–	EVE-13	–	EVE-14	EVE-15	–	EVE-16	–	EVE-17	–	EVE-18	EVE-19	–	–
				Nov-14 WP.29	Jan-15 GRPE	Mar-15 WP.29	Apr-15 TBD	Jun-15 GRPE	Jun-15 WP.29	Fall-15 TBD	Nov-15 WP.29	Jan-16 GRPE	Mar-16 WP.29	Apr-16 TBD	Jun-16 GRPE	Jun-16 WP.29	Nov-16 WP.29
Approval of EV Regulatory Reference Guide by AC.3/WP.29 (ECE/TRANS/WP.29/2014/81)			completed														
Approval of new EVE mandate by AC.3/WP.29 (ECE/TRANS/WP.29/2014/88, WP.29-164-15)			completed														
(i) Conduct additional research to support Guide recommendations:	Nov-14	Jun-16	on-going														
Battery performance and durability																	
Literature review	Jan-15	Jun-15	started														
Work on literature review recommendations	Jun-15	Dec-15															
Preparation of status report	Nov-15	Dec-15															
Determining power of EVs																	
Review of motivation and scope	Jan-15	Jan-15	started														
Gathering information and summary of status and positions	Feb-15	Jun-15															
- making questionnaire																	
Summary and analysis of previous works and existing standards	Jun-15	Oct-15															
Report Part A works to EVE	Oct-15	Nov-15															
Method of stating energy consumption																	
Literature review	Jan-15	April-15	started														
Data collection	May-15	Sept-15															
Method development	Oct-15	Nov-15															
Battery recyclability																	
	XXXX	XX	XX														
Status report from each subgroup		Jan-16															
(ii) Identify which recommendations are suitable for the development of GTR(s)	Jan-16	Mar-16															
(iii) Draft workplan developed by subgroups, EVE group	Jan-16	Mar-16															
Consultation, discussion within the EVE IWG	Jan-16	Mar-16															
Consultation, discussion with other GRPE IWGs: WLTP (E-lab sub-group), EPPR, HDH experts	Jan-16	Mar-16															
(iii) Draft requests for GTR development prepared by appropriate subgroups	Apr-16	Jun-16															
Consultation, discussion within the EVE IWG	Apr-16	Jun-16															
Consultation, discussion with other GRPE IWGs: WLTP (E-lab sub-group), EPPR, HDH experts	Apr-16	Jun-16															
Informal GRPE discussion on workplan and requests for GTR development		Jun-16															
Informal WP.29 discussion on workplan and requests for GTR development		Jun-16															
Finalize workplan and requests for GTR development	Jul-16	Nov-16															
Formal AC.3 consideration and approval		Nov-16															
EVE Part B and GTR development initiates		Nov-16															

EVE-18 meeting

(April 11-12, 2016, Shanghai, China)

4

- **Purpose**: To continue work on Part A of the EVE mandate, with updates on work in sub-groups:
- **EVE-18 discussion**:
 - Updates from other IWGs: WLTP, EPPR, EVS
 - Method of Stating Energy Consumption (China)
 - ✦ Presented updated draft version of Excel model to calculate energy consumption of electric vehicles, including upstream emissions
 - ✦ Shared updated draft reference document explaining calculation methodology and path forward to update Excel model
 - Battery Recycling/Recyclability (Secretary)
 - ✦ Nothing received

EVE-18 meeting

(April 11-12, 2016, Shanghai, China)

5

- EVE-18 discussion (continued):
 - Electrified Vehicle Durability (USA and Canada)
 - ✦ Final literature review document received and posted
 - ✦ Updated version of *Draft of EVE IWG Status Report on Battery Performance and Durability* report presented and discussed options for path forward
 - Determination of Powertrain Performance of HEVs (Germany and Korea)
 - ✦ Updates provided on system power determination subgroup work and coordination with WLTP EV subgroup
 - ✦ Draft workplan for GTR development presented
 - Group agreed to format and structure of June report to GRPE

EVE-19 meeting

(June 8, 2016, Geneva)

6

- **Purpose**: To continue work on Part A of the EVE mandate, with updates on work in sub-groups:
- **EVE-19 discussion**:
 - Discuss draft report to GRPE
 - Discuss view/recommendations on 4 work topics
 - EVE leadership attended WLTP EV subgroup meeting to discuss coordination of work and data needs

Electrified Vehicle Durability

(High level findings)

7

- Environmental performance of electrified vehicles can be negatively impacted by degradation of the battery system over time
 - Both maximum power and energy storage can degrade
- At least five major vehicle operating conditions affect battery durability, with differing importance depending on architecture:
 - (a) Discharge rates, as determined by vehicle duty cycle, or activity and inactivity
 - (b) Charge rates, as determined by type and frequency of charging
 - (c) State of charge (SOC) during vehicle operation, parked and charging
 - (d) Battery temperature during vehicle operation ration, parked and charging
 - (e) Time (calendar life)

Electrified Vehicle Durability

(High level findings)

8

- Different battery chemistries and EV architectures respond differently to each of the 5 operating conditions identified above
- Battery technology and electrified vehicle usage is still evolving and prescribing a durability test prematurely may influence long term battery development
- Several contracting parties have stated that the need to prescribe EV durability requirements is a priority and desire a suitable test procedure be developed

Electrified Vehicle Durability

(Options & Recommendations)

9

- Option A: Recommend that a GTR is appropriate for electrified vehicle durability
- Option B: Extend the EVE mandate to continue active research into electrified vehicle durability, with goal of beginning GTR development when the system power determination GTR is complete
- Option C: Declare that it is premature at this time to work towards a GTR for electrified vehicle durability, but continue passively collecting information on the topic and revisit the when the system power determination GTR is complete
- Recommendation: To be determined, some support for all 3 options

System Power Determination

(High level findings)

10

- Any procedure should be applicable to all architectures, including HEV, PHEV & PEV, with one or multiple electric motors
- Other organizations, notable ISO and SAE have also conducted work on this topic, and it was agreed that a method proposed by ISO was a promising basis for test procedure

System Power Determination

(High level findings)

11

- A procedure would ideally have two certification methods
 - Reference method which is validated by testing
 - Candidate method, which would allow certification based on component data
 - ✦ Candidate method will only be developed if testing and analysis show good correlation to the reference method
- Procedure should consider WLTP needs for power determination, and potential use in taxation programs or customer information purposes

System Power Determination

(Options & Recommendations)

12

- **Option A:** Recommend that a GTR is appropriate for system power determination now, and begin following workplan outlined in draft report
- **Option B:** Instruct the EVE IWG to abstain from developing a system power determination procedure which could be incorporated into GTR No. 15
- **Recommendation:** Endorse Option A targeting the timelines from the EVE mandate, but allow up to 1 extra year if correlation between the reference and candidate methods shows promise

System Power Determination

(Timelines from EVE Part A mandate)

13

- “i) November 2016: Approval of the authorization to develop a gtr (see Part B) by AC.3; New work begins;*
- ii) June 2018: Draft gtr available, guidance on any open issues by GRPE;*
- iii) June 2018-January 2019: Final drafting work on gtr text;*
- iv) January 2019:*
 - (a) Endorsement of the draft gtr based on an informal document by GRPE;*
 - (b) Transmission of the draft gtr as an official document twelve weeks before the June 2019 session of GRPE.*
- v) June 2019: Recommendation of the draft gtr by GRPE;*
- vi) November 2019: establishment of the gtr by AC.3 in the Global Registry.”*

Method of Stating Energy Consumption

(High level findings)

14

- **Statistical data is available to describe the electricity mix and emissions intensity of electric vehicles around the world**
- **Regional differences in the electricity grid mean that an identical vehicle will have a different environmental impact, based its electricity source**

Method of Stating Energy Consumption

(High level findings)

15

- EVE IWG has developed an Excel based tool which can be customized by the user to assess the energy consumption and emissions impact of an individual vehicle in a specific region of the world
- Though some manufacturers have access to proprietary green power contracts which can be sold with EVs to achieve the lowest possible environmental impact in some markets, this option is not widely available in all markets

Method of Stating Energy Consumption

(Options & Recommendations)

16

- **Option A:** Recommend that the report and accompanying model meet the goal of information sharing as outlined in Part A of the EVE mandate, and results can be referred to as guidance documents
- **Option B:** Instruct the EVE IWG to continue development and refinement of the model as a specific work item under an extend mandate of EVE IWG (Part B), which could inform the potential development of SR or GTR at some point in the future.
- **Recommendation:** To be determined, some support for each option, but more support for Option A at this time.

Battery Recycling/Recyclability

(High level findings)

17

- Little new research was brought forward during Part A of the new EVE mandate
- Very few EV batteries have reached the end of their useful life and required recycling for a variety of reasons
 - EV models have only been on the market for a short time (generally less than 10 years)
 - Sales volumes have been small, and EVs make up less than 1% of vehicles in many markets
 - Some manufacturers only leased early EVs and kept them after lease terms for additional research/development purposes
 - Some EV batteries are being deployed to stationary power storage applications at the end of the useful life of the EV

Battery Recycling/Recyclability

(High level findings)

18

- While most regions do not have programs specifically targeted at EV batteries, many already have recycling programs for automotive batteries, batteries in general, and/or automobiles
- GRPE is primarily focused on vehicle performance topics, and this was generally considered outside the normal scope of GRPE work

Battery Recycling/Recyclability

(Options & Recommendations)

19

- Option A: Authorize the EVE IWG to begin actively researching battery recycling/recyclability and develop a path forward for potential GTR
- Option B: Continue to passively monitor new research and developments related to battery recycling/recyclability, and consider bringing forward recommendations for additional research or GTR development in the future
- Option C: Remove battery recycling/recyclability from consideration for any subsequent mandate of the EVE IWG for reasons mentioned on previous slide
- Recommendation: Endorse Option C

Next Steps

20

- **Late summer or early fall, 2016: EVE-20 meeting (likely teleconference)**
 - Finalize recommendations
 - Finalize (in)formal document
 - Continue with development of power determination GTR (with approval of GRPE)