

**Report of the 24th Session of the
Electric Vehicles and the Environment Informal Working Group (EVE IWG)**

Location: Vienna, Austria
Time / Date: 09h00 – 17h00 October 24th & 25th, 2017
Chair: Mr. Michael Olechiw (USA)
Co-Chairs: Mr. Kazuyuki Narusawa (Japan)
Ms. Chen Chunmei (China)
Secretary: Mr. Andrew Giallonardo (Canada)

1. Welcome, introductions (Agenda items 1 & 2)

Mr. Michael Olechiw, Chair of the informal working group, thanked all participants for coming and thanked Austria for hosting the meeting.

The Austrian hosts, Mr. Friedrich Forsthuber and Mr. Hans-Jürgen Salmhofer thanked everyone for coming to Vienna. Mr. Salmhofer mentioned that the Transport Ministry in Austria is interested in the work of the Electric Vehicles and the Environment (EVE) Informal Working Group (IWG) and that Austria would like to have 100% of new vehicle registrations be electrified vehicles from 2030.

Mr. Olechiw also thanked the leadership team for their continued support.

Attendees introduced themselves. Approximately 25 participants attended the event in person from Austria, Japan, the Netherlands, Norway and Sweden as well as from representatives from Environment and Climate Change Canada (ECCC), Daimler, Joint Research Centre (JRC), PSA, Scania, Transport Canada (TC), TU Madrid, U.S. EPA, Volvo, VW and GRPE.

The agenda for the meeting (EVE-24-02e) was reviewed and accepted by all participants. Some modifications to the agenda were made during the meeting a revised agenda reflecting the flow of the meeting has been posted on the EVE website (EVE-24-02-Rev1e).

**2. Update of the Worldwide Harmonized Light vehicles Test Procedure (WLTP)
(Agenda item 3)**

Mr. Mathias Nägeli provided an update from WLTP. He provided an overview of the communications scheme for WLTP and EVE. He also indicated that WLTP had appreciated the participation of EVE representatives at recent WLTP meetings and that the WLTP SG-EV intends to continue to support EVE IWG as needed.

Mr. Nägeli indicated that the WLTP has discussed the durability matrix from EVE, and that draft feedback has been received from Japan and the European Commission.

The EVE IWG had some discussion about battery durability, but agreed to table further discussion until the topic was formally discussed under agenda item 4.

3. EVE Durability work on draft of EU position (Agenda item 4)

Ms. Elena Paffumi presented the draft EU position on durability of electrified vehicles. This included discussion of items such as whether there was need to guarantee minimum durability for customers and minimum environmental performance requirements. Highlights of the draft EU position are shown below and in EVE-25-03-Rev2e.

Table 1: Draft positions of battery durability

	Air Pollutant	CO ₂ /Energy Consumption	Range
HEV	<ul style="list-style-type: none"> • Draft EU Position: [5 year] or [100,000 km] must meet applicable standards (draft EU position) • EVE Group View: some consideration at WLTP & other areas for higher threshold (EVE Group view) • EVE Group View: View that WLTP durability requirement for ICE and HEV should be the same (EVE Group view) • Draft Japan Position: <ul style="list-style-type: none"> • Tested after 80,000 km running at type approval in Japan • Japan needs scientific data when discussing the influence of battery durability 	<ul style="list-style-type: none"> • Draft EU Position: Max [+10%] from certified values for 100,000 km or 5 years • EVE Group View: some consideration at WLTP & other areas for higher threshold • EVE Group View: HEV CO₂ emission durability lifetime should always be the same as air pollutant durability lifetime • Draft Japan Position: to determine with discussion under EVE IWG collaborating with WLTP SG-EV 	X
PHEV	<ul style="list-style-type: none"> • EVE Group view: PHEV should always have same air pollutant durability lifetime requirement as HEV (EVE Group view) Draft Japan Position: <ul style="list-style-type: none"> • Tested after 80,000 km running at type approval in Japan • Japan needs scientific data when discussing the influence of battery durability 	<ul style="list-style-type: none"> • EVE Group View: PHEV should always have same CO₂ emission durability lifetime requirement as HEV • Draft EU View: greater than 90% charge depleting values within [5 years] or [100,000 km] • Draft Japan View: to determine with discussion under EVE IWG collaborating with WLTP SG-EV 	<p><i>Equivalent all-electric range (measured amount of mileage that is powered by electricity in the battery on WLTP cycle) ... definition to come from WLTP</i></p> <ul style="list-style-type: none"> • Draft EU View: <ul style="list-style-type: none"> ○ Guarantee customer durability ○ Set comparable conditions to evaluate overall vehicle performance (draft EU view) • EVE Group View: <ul style="list-style-type: none"> • Want to ensure

			<p>minimum number of ICE km displaced by all electric operation</p> <ul style="list-style-type: none"> • Seems to be most important range durability aspect <p>All-electric range (Range before first ICE start)</p> <ul style="list-style-type: none"> • EU Group View: some concern about requiring durability for this value, since some manufacturers have ICE operate in certain conditions regardless of battery condition (i.e. above 80 km/h)
PEV	X	<ul style="list-style-type: none"> • Draft EU position is that this criteria is not needed • EVE Group View: <ul style="list-style-type: none"> ○ Only reason to establish energy consumption requirement for PEV is if there will be an associated requirement to assess/include upstream emissions 	<ul style="list-style-type: none"> • Draft EU Position - greater than [90%] certified range for [5 years] or [100,000 km] (draft EU position) • EVE Group View <ul style="list-style-type: none"> ○ PEV should always have same range durability lifetime requirement as durability requirement for other architectures ○ Consider longer durability requirement for PEV range (i.e. [80% or 70%] at 150,000 km or 200,000 km; 8 or 10 years;) ○ consider defining durability requirement as a function of base range, perhaps within a threshold (i.e. [80 km to 350 km] base range) • Draft Japan Position: <ul style="list-style-type: none"> ○ to determine with discussion under EVE IWG collaborating with WLTP SG EV

Members also discussed what durability thresholds might be appropriate for consideration. Members agreed it was also worth considering 160,000 km as an EV durability evaluation point, in line with durability thresholds for conventional vehicles.

Members also noted the difficulty in quantifying life-cycle GHG benefits from electrified vehicles because the composition electrical generation varies across countries and regions, and manufacturers noted that they cannot control the source of electricity for an electrified vehicle.

Following the overview of the draft EU position and discussion, the following action item was identified.

ACTION 1: Ms. Elena Paffumi to raise whether the European Commission have views on durability requirements out to 160,000 km.

4. Update from JRC on EVE durability research (Agenda Item 4)

Mr. Michele de Gennaro provided an update on the efforts to model EV durability that are being led by the JRC. The modeling results are being validated using long-term test data provided by Canada.

Mr. de Gennaro highlighted the information sources for the model, specifically real world activity data and peer reviewed equations for ageing mechanisms at the cell level. The presentation also highlighted modeling results, which showed what EV lifetime would be expected given various pre-defined parameters such as battery chemistry, driver behaviour, charging behaviour, battery size, etc. Highlights of the test results that will be used to validate the model were presented by Ms. Martha Christenson after the presentation by Mr. de Gennaro.

Mr. Sigve Aasebø noted that vehicles in Norway experience colder conditions than the average EU country and that vehicles travel an average of about 17,000 km per year. He would be interested in seeing updated modelling results for an EV experiencing typical Norwegian conditions.

ACTION 2: Comments were received on the modelling which JRC will implement and JRC will push forward with validation using testing data from Canada.

5. Presentation on durability testing in Canada (Agenda item 4)

Ms. Martha Christenson provided a presentation on EV durability testing in Canada which includes both full vehicle on-road testing and cell level testing. The vehicle testing involves two identical Nissan Leaf vehicles, which have been charged exclusively via level 2 and level 3 charging infrastructure. The cell level testing project will be examining the effectiveness of standard and high-precision coulometry as a means of estimating battery life. Members provided feedback on the testing but were generally interested in the results.

The following action items were identified.

ACTION 3: Ms. Christenson to be prepared to share updated durability test results at EVE meeting in March 2018.

ACTION 4: Mr. Tetsuya Niikuni to look at data/methodologies for air pollutant durability for conventional vehicles in Japan, and whether Japan would prefer conventional and electrified vehicles to have similar durability requirements.

ACTION 5: U.S. EPA to review in-use data for HEV and PHEV vehicles for air pollutant durability requirements.

ACTION 6: WLTP durability group to review status report and modelling information from JRC.

ACTION 7: WLTP durability group to prepare to discuss why durability requirements might be different between conventional vehicles and EVs at their next meeting in January.

6. Discussion of EVE durability and drafting of technical support document & durability matrix (Agenda Item 4)

Mr. Mike Olechiw led the discussion on EVE durability, modelling and ageing mechanisms and the work on a draft technical support document and matrix (EVE-25-03-REV2e). A variety of items affecting the assessment of EV battery durability were discussed, including:

- The development of test profiles;
- Identification of default deterioration factors;
- Testing of aged or software limited batteries; and
- Determination of deterioration factors by simulation.

Mr. Andrew Giallonardo noted that under the previous mandate, EVE IWG had noted that identifying default deterioration factors and determining the deterioration factors by simulation were thought to be the most promising areas of work. He mentioned that the EVE IWG had thought that developing default test profiles might prematurely influence battery design and that it would be extremely difficult to correctly prepare aged or software limited batteries for testing. Ms. Annika Ahlberg Tidblad agreed.

ACTION 8: Mr. Andrew Giallonardo to prepare consolidated matrix of all views on durability, circulate for comment and share with WLTP before January 2018 meeting.

ACTION 9: Mr. Matthias Nägeli to confirm and share durability related definitions from WLTP with EVE IWG.

7. Update on ISO process and Japan's position on system power determination (Agenda item 5)

Mr. Tetsuya NIIKUNI presented on Japan's position on system power determination. Japan has two candidate test procedures, one which measures rechargeable electric energy storage system (REESS) output and another that measures power at the wheel output. Japan agrees with the view of the WLTP IWG that finding maximum 2 second power within a 10 second measurement window is appropriate, and would like a procedure in place by January of 2019.

JARI conducted tests to validate candidate test procedures 1 and 2 (TP1 and TP2) for 3 hybrid vehicles to support development of the ISO procedure. Japan believes that TP1 is more repeatable and has less test to test variability than TP2. They propose that the drafting group start drafting with TP1 as the basis of the EVE test procedure and also suggests that the drafting group should include some specific recommendations for test conditions and accuracy of equipment.

The EVE IWG felt that they wanted to see the actual test data on TP1 and TP2, and was unwilling to rule out TP2 at this stage. The EVE IWG would begin drafting with a focus on TP1 for the sake of time, but would still consider TP2 as a possible option moving forward. Japan indicated that it was willing to share additional test data.

Action items for both are presented below. Action item 10 has already been completed.

ACTION 10: Japan to check reports to find out if they identify the sources of the test-to-test variation for TP2.

ACTION 11: Japan to investigate whether additional test results related to TP1 which were used to develop the ISO procedure can be translated to be shared with EVE.

ACTION 12: Canada will investigate whether budget can be obtained to assist with translation of the Japanese report.

ACTION 13: The EVE secretary will also ask WP.29 secretariat if ISO draft procedure can be shared more broadly.

ACTION 14: The EVE secretary to create an EVE drafting group page on the UNECE wiki site, and ask for write access for Mr. Safoutin.

ACTION 15 (Completed): Mr. Safoutin to distribute SharePoint logins, setup permissions and to schedule upcoming drafting group meetings.

8. Discussions of System Power Determination validation testing (Agenda item 5)

Day 2 of the meeting began with a presentation by Mr. Andrew Giallonardo on the validation testing plan for system power determination (EVE-24-07e). The EVE group discussed the matrix document EVE-24-06e which summarizes testing plans and commitments to date from various EVE IWG members.

Mr. André Rijnders mentioned that the EVE IWG and power determination drafting group should remain open to the possibility that power determination could be incorporated as a stand-alone GTR or as an amendment or appendix to GTR No. 15 (WLTP). Mr. Nägeli said that WLTP would be considering this topic at their upcoming meetings.

There was some discussion on confirming the purpose of the validation plan, and whether or not testing should be done to compare TP1 and TP2. Japan commented that they should be able to provide a data set used by ISO to develop procedures.

Mr. Olechiw mentioned that EPA has limited test data measuring power output of EVs and it seems like more data would be helpful to make a decision. It was decided that Ms. Kendelle Anstey of Canada would organize and track the validation testing commitments from various laboratories. Mr. Nägeli had also noted that Mr. Heinz Steven should be involved in the development of the power determination test procedure given his key role in developing the drive cycles for WLTP.

OICA had mentioned that they had no budget for testing but perhaps could provide vehicles to JRC for testing.

ACTION 16: Mr. Nägeli to bring thoughts on revised amendment to GTR No. 15 vs new GTR to WLTP SG-EV in November and to confirm that the procedure will meet needs of WLTP. Mr. Nägeli will also reach out to Mr. Steven.

ACTION 17: Mr. Giallonardo to send an official invite to Mr. Steven for the next EVE meeting in Geneva.

ACTION 18: Mr. Giallonardo to reach out to Korea on validation testing.

ACTION 19: U.S. EPA to investigate if Argonne National Laboratories would be available and willing to participate in some way in the validation testing program by reaching out to Mr. Mike Duoba.

ACTION 20: U.S. EPA to investigate their ability to conduct validation testing.

ACTION 21: Mr. Nägeli & Ms. Ahlberg-Tidblad (OICA) to ask about providing vehicles, and ideally instrumented vehicles for EPA and/or JRC to test.

ACTION 22: Japan to consider validation testing support.

ACTION 23: Canada to confirm validation testing availability.

ACTION 24: Canada to be testing coordinator and organizer.

9. Discussion of System Power Determination drafting group timelines and draft procedure (Agenda item 5)

Mr. Mike Safoutin led the discussion of timelines for the drafting of the system power determination GTR. Mr. Safoutin mentioned that he had set up a SharePoint site so that individuals could simultaneously edit the document as needed. Content of the draft GTR sent by Mr. Tetsuya NIIKUNI was reviewed by the group. Mr. Safoutin mentioned that the structure of the draft GTR would be different from the structure of the ISO document. Meeting frequency was discussed and some roles were assigned for the drafting group. Mr. Safoutin will follow through with the drafting group on various items via email.

ACTION 25: Drafting group to develop Terms of Reference for drafting of the GTR

ACTION 26: Drafting group to assign roles to individuals within group for standalone document

ACTION 27: Drafting group to develop a standalone document and prepare information so that GRPE can take decision on whether new GTR vs amendment to GTR No. 15 makes more sense

ACTION 28: Mr. Nägeli to ask Mr. Serge Dubuc if he could share the Terms of Reference for WLTP drafting to be used as an example for the power determination drafting group.

ACTION 29: Mr. Nägeli to share copy of WLTP calendar for global holidays and upcoming meetings.

ACTION 30: Mr. Nägeli to reach out to Mr. Steven separately from Mr. Giallonardo about attending next EVE meeting in Geneva.

ACTION 31: Mr. Mike Safoutin to extract list of open technical issues to be discussed at January EVE meeting. This list will become a working document and could be expanded based on the findings of the validation testing program.

ACTION 32: Mr. Masao KUBODERA to ask ISO if MS Word version of draft procedure can be shared.

ACTION 33: Mr. Mike Safoutin to share draft GTR with Mr. Steven & Mr. Dubuc in advance of January meeting.

10. Updates on method of stating energy consumption (Agenda item 7)

Mr. Giallonardo briefly went through documents EVE-24-03e and EVE-24-05e related to the group's previous work on a method of stating energy consumption. EVE-24-05 had been prepared by China, but they were not able to attend the Austria meeting in person.

ACTION 34 (Completed): Mr. Giallonardo to develop modified presentation for GEEE and circulate for comment. All were comments due back by 6:00 pm EDT (10:00 pm CEST) on Monday October 30th.

11. Concluding remarks, Closing items (Agenda items 8 & 9)

The group developed a common list of action items and it was mentioned by Mr. Rijnders that the June GRPE meeting will be the week of June 5-6, 2018.

ACTION 35: Mr. Giallonardo to send out email invitation for ½ day meeting in Geneva (week of January 8th), meeting rooms TBD.

ACTION 36: Mr. Nägeli to report whether WLTP SG-EV will meet in Geneva during January GRPE.

ACTION 37: All to provide documents to Secretariat for posting by 22-Dec-2017.

ACTION 38: Japan to confirm 26th -27th or 27th -28th of March available for next meeting. Japan mentioned that it will likely be the 27th - 28th.

Table 1: Action Items Summary

Action #	Category	Action to be pursued by:	Action	Action Status (Ongoing/Completed/Follow-up needed)
1	Battery Durability	Ms. Elena Paffumi	To raise whether Commission has views on durability requirement out to 160,000 km.	
2	Battery Durability	JRC	Comments were received on the modelling which JRC will implement and JRC will push forward with validation using testing data from Canada.	
3	Battery Durability	Ms. Martha Christenson	To be prepared to share updated durability test results at EVE March meeting	
4	Battery Durability	Mr. Tetsuya NIIKUNI	Mr. Tetsuya Niikuni to look at data/methodologies for air pollutant durability for conventional vehicles in Japan, and whether Japan would prefer conventional and electrified vehicles to have similar durability requirements.	
5	Battery Durability	U.S. EPA	U.S. EPA to review in-use data for HEV and PHEV vehicles for air pollutant durability requirements.	
6	Battery Durability	WLTP Durability Group	Review status report and modelling information for JRC.	
7	Battery Durability	WLTP Durability Group	Prepare to discuss in January why durability requirements might be different between conventional vehicles and EVs at the next meeting.	
8	Battery Durability	Mr. Andrew Giallonardo	Provide consolidated matrix of all views (i.e. add Japan to work done at Vienna) on durability and circulate for comment, eventually to be shared with WLTP before January 2018 meeting.	Completed
9	Battery Durability	Mr. Matthias Nägeli	To have GTR references to definitions of durability terms.	
10	System Power Determination	Japan	To check reports to find out if they identify the sources of test-to-test variation for TP2.	
11	System Power Determination	Japan	Investigate whether additional test results related to TP1 which were used to develop the ISO procedure can be translated to be shared with EVE.	Ongoing
12	System Power Determination	Canada	Coordinate with Japan for translation of Japanese testing report used to inform ISO report for sharing.	Ongoing
13	System Power Determination	Mr. Andrew Giallonardo	Ask WP.29 secretariat if ISO draft procedure can be shared more	

			broadly.	
14	System Power Determination	Mr. Andrew Giallonardo	Create EVE drafting group page on the UNECE wiki site and ask for write access for Mr. Safoutin.	Completed
15	System Power Determination	Mr. Mike Safoutin	To distribute SharePoint logins, set up permissions.	Completed
16	System Power Determination	Mr. Matthias Nägeli	Mr. Nägeli to bring thoughts on revised amendment to GTR No. 15 vs new GTR to WLTP SG-EV in November and to confirm that the procedure will meet needs of WLTP. Mr. Nägeli will also reach out to Mr. Steven.	
17	System Power Determination	Mr. Andrew Giallonardo	Send Mr. Steven invitation to January EVE meetin.	Completed
18	System Power Determination	Mr. Andrew Giallonardo	Reach out to Korea on validation testing.	Completed
19	System Power Determination	U.S. EPA	U.S. EPA to investigate if Argonne National Laboratories would be available and willing to participate in some way in the validation testing program by reaching out to Mr. Mike Duoba.	
20	System Power Determination	U.S. EPA	U.S. EPA to investigate their ability to conduct validation testing.	
21	System Power Determination	Mr. Matthias Nägeli and Ms. Annika Ahlberg-Tidblad	Mr. Nägeli & Ms. Ahlberg-Tidblad (OICA) to ask about providing vehicles, and ideally instrumented vehicles for EPA and/or JRC to test.	
22	System Power Determination	Japan	Japan to consider validation testing support .	
23	System Power Determination	Canada	Confirm validation testing availability.	
24	System Power Determination	Canada	To be testing coordinator and organizer.	
25	System Power Determination	GTR Drafting Group	Develop terms of reference for drafting of the GTR.	Completed
26	System Power Determination	GTR Drafting group	Assign roles to individuals on GTR drafting group for standalone document.	
27	System Power Determination	GTR Drafting group	Drafting group to develop a standalone document and prepare information so that GRPE can take decision on whether new GTR vs amendment to GTR No. 15 makes more sense.	
28	System Power Determination	Mr. Matthias Nägeli	Mr. Nägeli to ask Mr. Serge Dubuc if he could share the Terms of Reference for WLTP drafting to be used as an example for the power determination drafting group.	
29	General	Mr. Matthias Nägeli	To share copy of WLTP calendar for global holidays and upcoming meetings.	

30	System Power Determination	Mr. Matthias Nägeli	To reach out to Mr. Heinz Steven separately from Mr. Giallonardo about attending next EVE meeting in Geneva.	Completed
31	System Power Determination	Mr. Mike Safoutin	Extract list of open technical which exist at this time to be discussed at January EVE meeting (list would become working document and could be expanded based on findings of validation testing program).	Ongoing
32	System Power Determination	Mr. Masao KUBODERA	To ask ISO if MS word version of draft procedure can be shared.	Completed
33	System Power Determination	Mr. Mike Safoutin	Share draft in advance of January meeting with Mr. Steven and Mr. Dubuc.	
34	Method of Stating Energy Consumption	Mr. Andrew Giallonardo	To develop modified presentation for Mr. Romain Hubert for GEEE and circulate for comment.	Completed
35	Other	Mr. Andrew Giallonardo	Send out email invitation for 0.5 day meeting in Geneva. Rooms to be determined.	Completed
36	Other	Mr. Matthias Nägeli	Mr. Nägeli to report whether WLTP SG-EV will meet in Geneva during January GRPE.	
37	Other	Everyone	All to provide documents to Secretariat for posting by 22-Dec-2017.	
38	Other	Japan	To confirm availability of dates for next meeting in March.	Completed