

**Report of the 27<sup>th</sup> Session of the  
Electric Vehicles and the Environment Informal Working Group (EVE IWG)**

Location: Geneva, Switzerland  
Time / Date: 14h30 – 17h30 June 5<sup>th</sup>, 2018  
Chair: Mr. Michael Olechiw (USA)  
Vice-Chairs: Mr. Tetsuya Niikuni (Japan)  
Ms. Chen Chunmei (China) [Not Present]  
Secretary: Mr. Andrew Giallonardo (Canada)

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**1. Welcome, introductions (Agenda item 1)**

Mr. Mike Olechiw the chair of the EVE IWG addressed the members and welcomed everyone to Geneva. There were many attendees in the room and on the teleconference line. The agenda (EVE-27-02-Rev3e) was reviewed and accepted.

Topics included:

- Reviewing the report from the 26<sup>th</sup> EVE meeting in Tokyo
- Updates on work timelines
- Updates from WLTP
- A presentation on the effect of low temperatures on pollutant emissions of hybrid vehicles
- Progress on developing a Global Technical Regulation (GTR) for system power determination
- Research related to in-vehicle battery durability
- Method of stating energy consumption updates
- Upcoming meetings and next steps

**2. Report of 26<sup>th</sup> EVE meeting report (Agenda item 2)**

Mr. Andrew Giallonardo reviewed the report (EVE-26-16e) from the 26<sup>th</sup> EVE meeting which was held in Tokyo, Japan in late March. Mr. Giallonardo noted that the draft had only recently been posted online. Rather than seek concurrence on the meeting minutes, Mr. Giallonardo quickly reviewed the major outcomes of the meeting and indicated that the EVE IWG would accept comments on the report for the next 30 days. Members are encouraged to review the report and provide feedback.

### **3. Update on EVE IWG timelines from previous meeting (Agenda item 3)**

Mr. Giallonardo presented a proposal to slightly delay the completion of some of the EVE IWG's deliverables on in-vehicle battery durability and the method of stating energy consumption so that these deliverables can be submitted as a single coherent package to GRPE along with the system power determination GTR. The EVE IWG will present drafts of all three deliverables listed below at the January 2019 GRPE:

- 1) Method of stating energy consumption status report
- 2) In-vehicle battery performance and durability status report
- 3) System power determination GTR

Members were supportive of the proposal to submit all EVE IWG deliverables in a single package and present this intention to the GRPE.

### **4. Updates from WLTP (Agenda item 4)**

Mr. Matthias Nägeli gave a brief update on the activities of the WLTP IWG. His presentation (EVE-27-14e) touched on the status of in-vehicle battery performance and durability and the status of the system power determination GTR.

The WLTP acknowledged that the topic of battery ageing is very complex and impacted by many variables. He noted that the WLTP EV-subgroup (SG-EV) would be discussing this topic later in the week. WLTP IWG noted that while there is substantial effort underway by researchers, regulators and manufacturers to evaluate and understand battery ageing mechanisms; it is not yet clear that a standardized method would be suitable for evaluating the performance of the wide variety of battery structures and chemistries, and vehicle architectures.

Mr. Nägeli also indicated that the WLTP felt that their requirements for classification and downscaling were the primary driver of the need for a GTR for determination of electrified vehicle powertrain performance, and recommended that Mr. Heinz Steven and Mr. Serge Dubuc be involved in the GTR drafting process. The WLTP did not see a need for the use of the test procedure for other reasons such as customer information or taxation.

As a result, Mr. Nägeli noted that the preference of WLTP SG-EV members was to incorporate the system power determination procedure as an annex or similar in GTR No. 15, rather than as a stand-alone GTR.

Other activity of the SG-EV includes testing of plug-in hybrid electric vehicles (PHEVs). The WLTP view is that durability requirements for electrified vehicles would not be

considered until the technical report from the EVE IWG is produced at the end of the EVE IWG's current mandate. Other work of the WLTP includes considering family definitions (proposal from ICCT), REESS balance issues, etc.

Mr. Mike Olechiw requested that contracting parties clearly state their desire and views on EV durability requirements in the next 6 months (before January GRPE).

## **5. Presentation on the effect of low temperature on pollutant emissions of hybrids (Agenda item 5)**

Ms. Cova Astorga and Mr. Ricardo Suarez-Bertoa presented work from the JRC on the effects of low temperature on pollutant emissions of plug-in hybrid electric vehicles. Ms. Astorga introduced the purpose of the work and Mr. Suarez elaborated on the details, and explained the connection to WLTP low temperature task force.

Mr. Suarez-Bertoa began by discussing similarities and differences (test fuel, test temp, etc.) between low temperature requirements from around the world (China, Korea, U.S. EU, etc.). Ms. Astorga and Mr. Suarez-Bertoa, published an article on in impact of cold temperature on Euro 6 passenger car emissions (including diesel, gasoline, ethanol flex-fuel and hybrid vehicles)<sup>1</sup>.

Mr. Suarez-Bertoa noted that current low-temperature test procedures are defined in UN Regulation No. 83; but that this procedure is not applicable to hybrid vehicles.

JRC completed a series of tests based on 2 PHEVs using a type 1 procedure at 23°C and, a similar test at -7°C and another series of tests with use of the vehicle's heating system. The authors found that CO<sub>2</sub> emissions increased by approximately 60% when vehicles were tested at -7°C and no auxiliaries in operation, and increased by about 160% from the 23°C test point when tested at -7°C with the auxiliary systems operational.

Mr. Suarez-Bertoa also noted that emissions are higher during charge depleting mode than during a charge sustaining mode and that PHEVs show lower in CO<sub>2</sub> emissions than conventional vehicles across all operating conditions, but do not necessarily show lower emissions of other pollutants, particularly in cold temperatures.

## **6. System Power Determination updates (Agenda items 6)**

The GTR drafting group had 5 meetings between November 2017 and May 2018, approximately once per month. Validation testing is beginning and a draft procedure was made broadly available on the EVE IWG shared site on May 23<sup>rd</sup>, 2018.

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<sup>1</sup> Link to published article: <https://www.ncbi.nlm.nih.gov/pubmed/29190540>

In the near term, Japan is travelling to JRC in Ispra to help with validation testing in mid-June. OICA is providing a Volvo vehicle for testing on the 11<sup>th</sup>-12<sup>th</sup> of June. The U.S. EPA has provided a draft test plan to a few members who have requested it, which can be used as a template for other jurisdictions in helping to formulate their own validation testing process.

It is anticipated that manufacturer participation will help validation testing go smoothly, in particular manufacturer provided information on the speed at which max power occurs. If this information is not provided by the manufacturer, it must be determined iteratively by the testing laboratory. Testing laboratories may also require manufacturers' assistance to access CAN signal(s) for battery state of charge (SOC), which often cannot be easily measured by a physical device.

Results of UN Regulation 85 testing for the combustion portion of the powertrain (if the vehicle has a combustion engine) are also required because Testing Procedure 1 (TP1) incorporates the results of Regulation 85 testing. Manufacturer cooperation may be particularly important for North American vehicles, as their engines may not necessarily have results available from testing in-line with UN Regulation 85, unlike engines used in vehicles that have received type approval in Europe or Japan.

Ms. Annika Ahlberg-Tidblad raised concerns about using ISO references in the GTR text because ISO documents are typically considered for revision much more frequently than GTRs. She mentioned that references to ISO procedures could result in the introduction of changes to the GTR that were not intended by the authors of the GTR. She suggested that that references to ISO standards may need to include a specific version number, a specific date or be deleted entirely.

Mr. Mike Safoutin noted that the ISO validation testing procedure has resolved some issues, and it would put additional burden and importance on the validation testing program if the GTR is substantially different from the ISO procedure.

Mr. Andrew Giallonardo noted that there is a mechanism in place within the UNECE framework to obtain copies of ISO standards once it is finalized. Mr. Nägeli also mentioned that there are colleagues within the EVE IWG that can review the GTR as well.

Mr. Masao Kubodera noted that voting is nearing completion and that any additional changes are expected to be minor and editorial in nature. He further noted that the final ISO standard may be published in August, 2018.

## 7. Battery Durability Updates (Agenda item 7)

Ms. Elena Paffumi presented EVE-27-09e which included updates to material she had presented at previous meetings. This included results from modelling EV performance in new scenarios with additional vehicle architectures, different battery reserve levels and other inputs.

Ms. Paffumi received one request to summarize the input and output parameters of the model. This is reflected in the updated presentation and includes inputs such as a database of driving behavior for conventional fuel vehicles from around Europe, the assumption that vehicles are parked for 85% of the time, and the temperatures of various cities. Some of the assumptions assumed for the scenarios include a 15% reserve for PEVs and 25% reserves for PHEVs. As expected, the modelling projected that the same EV model would have a different life based on the different usage patterns and temperatures present in the different European cities considered in the modelling.

The electrical architecture of the battery and battery chemistry were found to be the two factors with the greatest influence on estimated end of life; with driving pattern and mileage having a moderate influence; and city temperature showing a low influence. It was also noted that the model uses standardized battery chemistry electrolyte compositions which have performance characteristics described in existing literature. In reality, there are many proprietary electrolyte compositions in the market which have slightly different performance characteristics. Ms. Ahlberg-Tidblad noted that modelling using literature verified performance data will necessarily lag behind the cell chemistries being used in the market. She further noted that many of the chemistries that JRC is looking at now are being phased out and nickel rich chemistries are continuing to gain market share. Ms. Paffumi noted that JRC continues to use open source published data which is limited. She further noted that JRC can easily add new chemistries to the model and may be able to test batteries at JRC. Ms. Paffumi noted as an example that it is difficult for JRC to perfectly match the chemistry of the Nissan Leaf vehicles that Canada is using for long term durability testing.

The previous EVE meeting considered the question of how accurate the modeling results could be, given differences in cell chemistry between the modeled batteries and the batteries used in the test vehicles. Ms. Paffumi referred to Mr. Michele de Gennaro's response at the 26<sup>th</sup> EVE meeting that it was very encouraging how closely the model's predictions matched the performance observed in Canada's long term durability testing. Though not a perfect match, modeling predicted similar performance degradation along similar timelines to what had been observed in testing. JRC's new focus is primarily focusing on NCM-LMO chemistry.

Mr. Olechiw commented that the purpose of modeling and testing is to demonstrate the potential viability of using a model based approach to estimate deterioration. It is envisioned that future modeling efforts would allow manufacturers to provide their own proprietary battery deterioration performance characteristics into a parametrized version of the model being developed by JRC.

After Ms. Paffumi presented, there was a discussion regarding input for the technical in-vehicle battery durability report.

Mr. Tetsuya Niikuni introduced the draft technical report. He stated that the EVE IWG could consider an interim approach which would involve the use of deterioration factors for pollutant emissions from hybrid vehicles under a situation in which a battery is degraded as approaches using DFs are already common for conventional vehicles. A clear explanation of how the vehicle control systems manage pollutants would be required to substantiate the deterioration factors. Japan had also submitted informal document EVE-27-05e, as sample text to be considered for use in the upcoming status report. EVE IWG members noted in subsequent group discussions that a degraded REESS should not influence the functions of pollution control devices and should not affect the quality of pollution controls.

Ms. Tidblad-Ahlberg noted that there should be some consideration of what might be proprietary information or information that companies may not be able to share when asking for more details about the functioning of control systems/software.

From document EVE-27-07e, JAMA indicated their view that conventionally powered internal combustion engine vehicles and hybrid versions should have the same durability requirements.

## **8. Method of stating energy consumption update (Agenda item 8)**

Mr. Andrew Giallonardo noted that he had presented to the Group of Experts on Energy Efficiency (GEEE) in November 2017 about the possibility of assuming leadership of the work developing a method of stating energy consumption. He had subsequently met with the Secretariat of the GRPE, who believes that another group within the UNECE framework may be a better home for this work. The GEEE had expressed an interest in considering leading this project, but has not followed up with the EVE IWG since November 2017. The EVE IWG remains open to supporting requests from the GEEE, and Mr. Giallonardo will work with the GRPE Secretariat to explore options for an alternative home for this work.

## **9. Final remarks, closing (Agenda items 9 and 10)**

Mr. Olechiew thanked members for their participation and the leadership team for their continued support.

The next EVE meeting will be hosted in Ottawa, Canada on October 16<sup>th</sup>-18<sup>th</sup>, where two days are allocated for the EVE IWG, with the third day allocated for a drafting group meeting. The invitation and travel information can be found on the group's website <https://wiki.unece.org/display/trans/EVE+28th+Session>. A future EVE IWG meeting may be held in Sweden in March or April, 2019.