EVE IWG	
Date	April 26-27, 2022
Time	05h30 – 08h00 (Eastern Standard Time)
Title	EVE IWG Session #55
Informal Document	EVE-55-12e

Submitted by the EVE Secretariat

Informal Document EVE-55-12e

Report of the 55th Session

Electric Vehicles and the Environment Informal Working Group

Location:	WebEx
Date and Time:	April 26, 2022 at 05:30 – 08:00 EST April 27, 2022 at 05:30 – 08:00 EST
Chair: Co-Chair:	Mr. Michael Olechiw (USA) [Present] Ms. Panagiota Dilara (European Commission) [Present]
Vice-Chair(s):	Mr. Hajime Ishii (Japan) [Present] Ms. Chen Chunmei (China) [Present]
Secretary:	Ms. Kendelle Anstey (Canada) [Present]

Agenda Items

EVE IWG Meeting, April 26, 2022 – Light duty vehicle

	Time	Agenda item	Lead	Working Paper #
1	05:30 – 05:50	Introductions, review of agenda, meeting minutes	Chair Secretary	EVE-55-01e EVE-54-08e
Nothing significant to note for this section.				
Light duty vehicle battery durability				
2	05:50 – 06:15	Japan proposal on annex 2 for battery durability	Japan	EVE-55-06e
Japan presentation Battery Durability GTR (22), EVE-55-06e Discussed Japan's proposed amendments and elapsed time between battery charges. • Concerns were raised about possibility to mix true elapsed time and elapsed time that ignition was "on" and considering that those are different quantities. • OICA believes comments are good as clarifications needed and proposed changes would be good first step.				

- Need to exercise caution in addressing both issues #9 and #10. Changes are necessary but could impact function and need to be careful not to defeat the purpose of collecting this information. Particular consideration should be brought to internet connectivity, difference in data availability between different jurisdictions, how representative average temperatures are depending on recording methods. Those are difficult questions but important for GTR, and should be revisited at next EVE meeting.
- Co-chair indicated that first elapsed time is most important data. Days past since activation.
- U.S. – Can CAN give dates? If car "on" on Monday then "off" and back "on" again on Friday, are 4 days of aging missing?
- Japan – How many days a car was sleeping can be obtained by on-board computers/ECUs.
- Will need time to think about this and make decision next time.

ACTION: EVE IWG – will provide Japan with input on proposal in time for SAE meeting in July.

3	06:15 – 06:35	Overview of battery durability experience phase 1	JRC	EVE-55-02e

JRC Presentation on applying the new GTR: In-Vehicle Battery Durability

- Test of Medium size BEV equipped with Monitor Indicator, @ 80 months (6 years +)
- At 9,051 km and 6years and 8 months, SOCE read (monitor) was 78%, SOCE measured (WLTP CCT) was 73.4% SOCR measured (WLTP CCT) was 70.7%
- Indicated that JRC does not have as good historical data as Canada.
- Capacity Fade – Monitor Indicator reproduction can both be calculated through simulation
- Trend can be reproduced with TEMA but not as precisely as with Canada colleagues. But trend is in ballpark.
- Very interesting to be able to apply the GTR to a real vehicle

Questions on presentation:

- UK – Was SOH available on-board? – Answer: No it was accessible through OBD.
- UK will test GTR on multiple highly aged and high mileage vehicles. Will be in touch with Elena throughout process and will have presentation a year from now

- OICA – Very interesting and lets also see results a few years from now when vehicles are designed to meet these criteria

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4	06:35 – 06:55	Sharing experience with e-buses	UITP - Transdev	EVE-55-08e

The GRPE secretariat, François Cuenot identified Tanguy Bouton from International Association of Public Transport (UITP) as a knowledgeable resource on heavy duty battery durability to speak to the EVE IWG on this topic.

Tanguy Bouton offered a perspective on battery durability from the viewpoint of e-buses and highlighted differences in e-bus end of life and how that need is tied to the individual use. For example in the case of a bus, the end of life may change depending on the required route and ability to work in the set conditions. 80% may be considered end of life for an e-bus depending on the conditions and requirements of the bus.

Much of the discussion discussed the logistics of e-buses and the business models of working with them in different climatic regions. One topic was how e-buses are managed in different climatic conditions. One example was that buses in colder regions will have heaters to warm the battery before it fast charges to resume the route. Battery size for the specific need was also discussed as a consideration which may be influenced by the needs for indoor climate needs (air conditioning/heating), battery consumption and the route taken.

Since the topic of e=buses is within the realm of heavy duty vehicle applications, load was also brought up as a topic of consideration. The load on long haul trucks can significantly impact the degradation of the battery.

	06:55 – 07:10	Coffee break		
5	07:10 – 07:25	Implementation timing for battery durability GTR	EVE IWG	

Contracting party members, namely, the U.S., Canada, The European union and Japan commented on the current status for the implementation of the GTR No 22.

U.S. EPA – The U.S. is directed by the current administration for a multi pollution targeted rule making starting in the 2027 model year and at least until 2030 and beyond. For durability provisions the 2023 calendar year the EPA plans to implement and finalize a strategy for the calendar year 2024. California released an initial statement for their reason for the clean car program to which the U.S. EPA can share a summary. The EPA is starting to hear from stakeholders as to their views on the proposed values and by and

large the manufacturers are encouraging the EPA to adopt the GTR and not to adopt ACE2 requirements from California. It is expected that the EPA will propose battery durability requirements for the first quarter of next year with stakeholders leaning to adopt the GTR. The U.S. EPA also added that if they EPA does adopt these requirements the fleet adherence to the standards would be phased in over time by model year.

Canada noted that they are likely to follow suit with the EPA should they adopt GTR No 22 standards.

The European union did not have other proposal concerning GTR No. 22 for implementing the euro 7 proposal. The plans for this are set to come later this summer (July 2022). The final date of implementation is unknown and is to be decided later.

Power Determination – GTR No 21.				
6	07:25 – 07:40	China comments on GTR No. 21	China	EVE-55-07e

Summary:
China presented concerns for discussion on gaps with the power determination GTR (GTR No. 21) for integrated electric drive systems. They are concerned that they would be unable to obtain k1 or k2 factors for integrated systems.

China reviewed the GTR No 21 proposal which suggested that K1 and K2 indicates the accuracy of the indicator for maximum power. There is currently no available standards for K2, only the description of the testing procedure. China is wondering if a default K1 factor should be used for integrated systems such as for range extending vehicles or all electric vehicles. They also note that the k1 determination of a K2 factor will experience the same difficulties for electric driving systems.

Discussion and questions:

The drafting coordinator of GTR No 21. – The drafting group moved away from default k1 and k2 factors since they provided unpredictable results and were difficult to establish. It was anticipated during the GTR development that the integration of these components would present a difficulty but this was not entirely resolved. Its important to consider but it is not clear that returning to a default number would be appropriate. There would need to be some more discussion for a decision on that topic. As the systems become more integrated it becomes more difficult to determine those factors.

OICA – We are trying to figure out cases such as this to and we should try to get something better even if it is difficult to obtain.

Drafting coordinator of GTR No. 21 – It should be possible to determine the overall efficiency of the unit but within the concept of the GTR that process is not entirely clear. If one has a completely integrated EVS with motor and gearbox and nothing can be independently instrumented. A way forward would be to incorporate the efficiency of entire unit from beginning to end, however the current structure of GTR is not appropriate for that method.

A question was asked if this will be on the list of GTR No. 21 enhancements.

Drafting coordinator of GTR No. 21 - It has been considered that some powertrains are difficult to instrument. I don't know if China is saying many vehicles affected by this. Are Oil cooled EVS commonly on the market or are we only anticipating that units of this sort will soon present a problem for the application of GTR ?

China – Oil cooled may present the future trends since Tesla is already used it for their model y for four wheel drive types. For range extending hybrid vehicles it is more likely to use oil cooled electric driving systems as well. Maybe can add comments in the current text. When easy to measure and just go over the current procedure in GTR No. 21. For example if the oil cooled is hard to directly measure then the overall efficiency for the integrated component can be used.

Chair - China will submit comments for the EVE IWG to consider for GTR No. 21. such as when can it can be directly measured and follow a standard procedure.

EVE IWG members also noted that a simple solution may also not be possible.

ACTION: China to follow up with comments on GTR No. 21.

7	07:40 – 08:00	Presentation on experience of GTR No. 21 validation testing from Environment Canada test lab	Canada	EVE-55-09e

Canada's Emission's Research and Measurement Laboratory (ERMS) provided a presentation on their experience with testing for GTR No. 21. The presentation was a refresher of a previously presentation on the topic.

A few highlights and feedback from the presentation:

- Fuel flow rate hindered accuracy as had trouble obtaining it. Were able to get speed and engine intake but couldn't get fuel flow rate. Were able to get battery signals.
- Couldn't take measurements from the engine due to time constraints.
- They also had trouble obtaining fuel flow rate from the Saturn vehicle.
- Over 25 second time frame. The vehicle speed increases and levels off and decreases and continues to as ramp down on regen breaking to bring charge back up.
- Some peaks in lab results may have been caused by ERMS' homemade dyno systems which is compliant with specifications for dynamometer requirements. They only had one four wheel dynamometer. They are curious about other labs experience with "blips" in data (small monetary peak).
- For the power over same timeframe with respect to various calculation methods one can see where the power levels off. There was a couple instances where the power increases sharply and levels off. TP1 provides a value estimate generally higher than TP2. Unfortunately the differences were not insignificant for ERMS' testing.
- For BMW see estimations for TP1 and estimations for TP2 for various calculations method. Part of the issue is didn't have fuel flow rate from engine and the other is the wheel torque system had difficulty with temperature drift over time. The wheel hub also heats up and then there is a drift in zero for the wheel torque. From past presentations others had more success with them. They haven't used wheel torque sensors so for ERMS there was more of a learning curve to use them more proficiently.
- Default k factors were used between 0.93 and 0.96. There were large discrepancies between TP1 and TP2, however the and TP1 results lined up best with the rated power. If ERMS were to go back and complete more testing with more time results may be a bit different. Finding the right instrumentation for the fuel flow rate would also be important along with properly zeroing the wheel torque sensors.

Feedback from EVE IWG questions:

U.S. EPA – My reaction seeing the differences between TP1 and TP2 in example, it's important to be mindful that the K values are very uncertain and other things as well. Remember that there are caveats in this data.

JRC – To reflect on ERMS experience, JRC also has testing deviations between TP1 and TP2 which was mainly due to the dynamometer. This was improved by testing the vehicle. JRC did not use a torque meter on the wheel but they did use an instrumented wheel. There were small percentage differences between each method. There are other factors in the testing that affect the difference in results also.

EVE IWG Meeting, April 27, 2022 – Heavy duty vehicle battery durability

	Time	Agenda item	Lead	Working Paper #
8	05:30 – 05:50	Japan position on heavy duty battery durability	Japan	EVE-55-03e

Summary:
Japan provided a template with updates of their views with regards to heavy duty battery durability.

The EVE IWG reviewed these items and agreed that it would be a good starting template to obtain comments and to direct the discussions. The secretary agreed to move this template into an excel format for further discussion and comment amongst the EVE IWG.

One item of note was that there is no test procedure currently for useable battery energy in the EU, US or Japan since January 2022. Japan plans to introduce a test procedure for it.

9	05:50 – 06:10	Japan comments on power fade for HD battery durability	Japan	EVE-55-04e

Summary:
Japan presented on their views with regard to the power fade of HD battery durability. The main outcome was that it is not appropriate to measure the power fade of SOH in heavy duty applications. Their view was that the power fade should be decided by the working conditions of the vehicle application. For example if a vehicle needs to have 80% of its battery capacity or SOH to function in its duties than any degradation beyond 80% would mean a loss of utility of the vehicle to the customer. It would likely need to be set based on application and meeting the work delivery in that application.

The EVE IWG discussed the application of this and did discuss that coming up with one regulation that fits all applications may not be feasible.

From further discussion, the EVE IWG discussed power fade and how to appropriately regulate it for HDV applications. One main outcome was that regulating power duration over maximum power was found to be a more important to ensure that what is expected out of the battery output is provided.

Japan also went through the appendices of the presentation and regulating second usage of batteries came up as something for the EVE IWG to think about.

Further questions/discussion points:

Comments on power fade HDV

OICA – if understand correctly, power is no issue because it's modulated and power remains constant during battery life and don't have to address it here as an extra point. OIC asking Japan - It is not necessary to regulate power fade because the power is constant by the OEM during the life of the battery?

Japan response no it is not necessary, the assumption is correct.

U.S. EPA comment – The power the customer needs depends on the application but really in terms of degradation as a function of time. So the manufacturer will provide battery for indicated power for the same 10 hours. But its more the duration of necessary power over a day of work and not the measurement of the power input that's important.

One could regulate the power output of the battery so that there is no more than 80% of power output, or customer only needs 100 kw for certain amount of time and can regulate how long it can be delivered over the course of a work day. What's important is the lower limit voltage and how long it can be obtained over usage life. It is not so much a peak power test instrument of regulation and instead a power duration test then that makes a lot of sense. It is more important to pay attention to what is the minimum power necessary to perform the work but the only thing that changes is how long can you get that power.

U.S. EPA ask Japan if this is an accurate representation of what is being expressed here?

Japan - Supporting lesson is correct. How to describe deterioration is correct.

European Commission - Thinking as a regulator I would like to make sure this is actually delivered. The idea of having to regulate this is to make sure what is promised is delivered. Through power fade or through some other metric. Not sure understood the technical reasons why power fade should not be use but to focus on how much power is delivered over time.

U.S EPA– The Japan position that the SOH indicating degree of health is not an appropriate method to indicate if the degradation has occurred. An example is because a battery often gives more power than need and you could have 70% power fade and still meet the minimum requirement of the application. In some cases large power output could be terrible but in others acceptable. The simplistic method of having the vehicle track the power degradation number is not necessarily meaningful.

European commission/Co-Chair – EVE IWG need to come together to think of how to regulate this

U.S. EPA - One final point that's important is to to understand the power appropriate for the job. The use of SOH of power fade is not appropriate metric to use for that purpose.

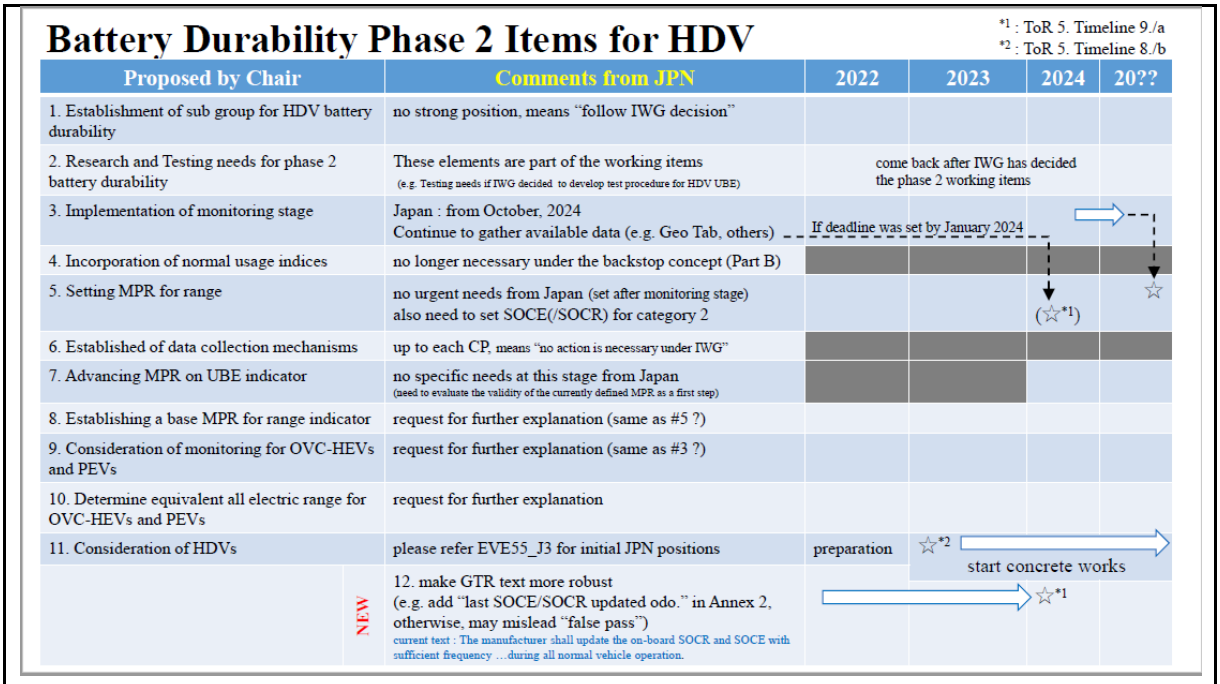
European Commission– my understanding if interpret power fade as Mike described that metric maintenance of voltage during certain time period of operation then using the metric of measuring power fade can be more or less equivalent to measuring the total usable energy provided by full battery. At the end of the day its somehow somehow end related to total energy provided by the full max energy of the batter.

OICA – hear what saying and appreciate what you mean, and recall this is quite complicated because heavy duty vehicle industry can have circular usage and extreme usage. Part of the industry practice is how these vehicles are used. Vehicle design for one purpose will be used for its twenty years of life or even 8 years is not correct. Need to keep that in mind as well. Very unique to HDV industry and differentiates it.

Canada/secretary: Might be worth thinking about regulating for specific applications or simplifying by application since the industry can be quite complex for each application.

EVE IWG to consider approaches to regulating this.

10	06:10 – 06:40	Japan comments phase 2 battery durability	Japan	EVE-55-05e
Japan went through the list of phase 2 items for battery durability as shown below.				



Battery Durability Phase 2 Items for HDV

*1 : ToR 5. Timeline 9./a
*2 : ToR 5. Timeline 8./b

Proposed by Chair	Comments from JPN	2022	2023	2024	20??
1. Establishment of sub group for HDV battery durability	no strong position, means "follow IWG decision"				
2. Research and Testing needs for phase 2 battery durability	These elements are part of the working items (e.g. Testing needs if IWG decided to develop test procedure for HDV UBE)		come back after IWG has decided the phase 2 working items		
3. Implementation of monitoring stage	Japan : from October, 2024 Continue to gather available data (e.g. Geo Tab, others)	If deadline was set by January 2024			
4. Incorporation of normal usage indices	no longer necessary under the backstop concept (Part B)				
5. Setting MPR for range	no urgent needs from Japan (set after monitoring stage) also need to set SOCE(/SOCR) for category 2			(☆*1)	☆
6. Established of data collection mechanisms	up to each CP, means "no action is necessary under IWG"				
7. Advancing MPR on UBE indicator	no specific needs at this stage from Japan (need to evaluate the validity of the currently defined MPR as a first step)				
8. Establishing a base MPR for range indicator	request for further explanation (same as #5 ?)				
9. Consideration of monitoring for OVC-HEVs and PEVs	request for further explanation (same as #3 ?)				
10. Determine equivalent all electric range for OVC-HEVs and PEVs	request for further explanation				
11. Consideration of HDVs	please refer EVE55_J3 for initial JPN positions	preparation	☆*2 start concrete works		
NEW	12. make GTR text more robust (e.g. add "last SOCE/SOCR updated odo." in Annex 2, otherwise, may mislead "false pass") current text : The manufacturer shall update the on-board SOCR and SOCE with sufficient frequency …during all normal vehicle operation.			☆*1	

Overview of each points from discussion.

Point 4 - The EVE IWG agreed that NUI should no longer be considered.

Point 6 – Japan view on establishing a data collection mechanism is that no action is currently necessary and it is up to CPs

Point 7 – advancing MPR on UBE indicator – need to validate with data of currently defined MPR

Regarding point 9, it was discussed in previous EVE IWG meetings that regulating OVC-HEVS and PHEVS (PEVS was a typo) presents more of a problem to regulate.

The secretary clarified that point 8 emphasizes a minimum working range for immediate conditions as cold weather durability which is not the same as available lifetime range which is the current goal of the range MPR.

Japan recommended that the EVE IWG needs to establish timelines for each goal.

ACTION: Secretary to move the use the japan document in an excel template to send to the EVE IWG for comment

ACTION: EVE IWG to comment on the excel document to be sent out.

	06:40 – 06:55	Coffee break		
11	06:55 – 07:30	Discussion of heavy duty vehicle durability Presentation from OICA	EVE IWG OICA	EVE-55-10e
OICA showed their presentation regarding points of discussion for regarding heavy duty battery durability. These are reflected in document EVE-55-10e. **Discussion point from OICA:** OICA- Take this as some first of thoughts on what needs to be discussed surrounding heavy duty vehicles. For example do we need or do need more complex approach when it comes to vehicle families than in passenger cars because the application of vehicles is so different. We definitely have to talk about the test methods and the best feasible cost efficient methods. Need to take a deeper dive on heavy duty side and cannot take over all aspects as has been developed for passenger cars.				
12	07:30-07:45	Other items of discussion as needed	EVE IWG	
EVE IWG to discuss future EVE IWG meetings. Planning a fall meeting in person in Brussels. Action items: **ACTION:** EVE IWG to share feedback on potential regulatory approaches for HDV. EVE IWG welcomes proposals. **ACTION:** Other EVE IWG members to consider sharing power determination experiences **ACTION**: EVE IWG – will provide Japan with input on proposal in time for SAE meeting in July. EVE to consider japan proposal on annex 2. **ACTION:** China to follow up with comments on GTR No. 21 **ACTION:** Secretary to input Japan document into excel file for comment on workplan items. EVE IWG to provide comments by May 23, 2022.				
13	07:45 – 08:00	EVE IWG discussion of action items for each topic, next steps	Secretary	
The EVE IWG discussed logistics for a hybrid session meeting in person at the upcoming GRPE session. EVE IWG agreed to host a hybrid meeting on May 30th during the week of GRPE.				