

38th EVE IWG Meeting Report and Recap for 39th EVE IWG Meeting

November 4th, 2020

Presentation topics of discussion and overview

- EVE IWG discussion overview (EVE-38-07e)
 - Measured Performance Requirement (MPR)
 - On-board diagnostic (OBD) State of Health (SOH) metric
 - In-Service Conformity (ISC) and data collection
 - Timeline and key considerations of framework
- Comments from Japan on battery durability GTR framework and deterioration factors (EVE-38-03e)
 - 1) **SOH range and SOH capacity comparability**: Problem of -> Potentially large errors from ECU conversion from the EC during actual driving to the EC during WLTC ISC -> Solutions: prove that degradation of electrical components is small, or use SOH range for information and use SOH capacity for compliance purposes. If degradation is small SOH range and SOH capacity method can be considered to produce the same result.
 - Also included considerations for conversions of actual driving EC vs WLTP EC
 - 2) **SOH Indicator Accessibility**: The accessibility of SOH capacity and SOH range by customer.
 - Capacity SOH should be accessible to customer on the monitor and the available range at the current time should be up to the OEM to provide. The WLTP range SOH can be made available through the OBD port and doesn't need to be displayed.
 - 3) **MPR considerations**: Setting adequate MPR, exclusion of NOVC-HEVs, and discussion of need for range conversation tables for MPR
 - 1) exclude NOVC-HEVs from SOH range and SOH capacity
 - 2) choose reasonable MPR values after considering all factors
 - 3) consider that different MPRs for different CP regions may make it difficult to comply.
 - 4) MPR for SOH range (label value) may vary by region
 - 4) **ISC Part A consideration**
 - Frequency of verifications, Suggestion to confirm the rationale for implementation at least every two years for the lifetime of each vehicle time
 - Proposal of new definitions for the denominator of SOH capacity at certification and UBE of OVC-HEV and the numerator of the SOH Range (EAER)
- Comments from Japan on deterioration factor of electric vehicle system components (EVE-38-04e)
 - Most values reflect negligible changes in EC, so SOH range only needs to monitor the degradation of the battery
 - Deterioration factors considered namely for motor efficiency and inverter efficiency

Presentation topics of discussion and overview

- JRC battery durability modelling updates (EVE-38-02e)
 - New vehicles, geographic areas and a look at Vehicle to grid application
- U.S. Alliance for Automotive Innovation (EVE-38-06e)
 - Focusing on customer aspects for MPR
 - Using energy efficiency instead of range might be a better metric for customer
 - Reviewed different cases of displaying information for customers for UBE
 - Only UBE scenario and;
 - UBE and Range scenario
 - Essentially: UBE is easier to do right now (as focuses solely on battery ageing) and easier to predict as it directly affects the battery, and specific degradation path is known
- OICA planning and timing of phase 2 (EVE-38-16e)
 - Phase 1) Focus on UBE indicator with -> base MPR + wide tolerances; range -> monitoring
 - where base MPR is to ban substandard products from the market
 - Remove HEV's from phase 1 if no agreement reached in time
 - Focuses on UBE, monitors range
 - Phase 2) Focus on UBE indicator with -> advanced MPR + tighter tolerances; range -> MPR + tolerances (based on monitoring)
 - Tightens MPR for UBE
 - Introduced MPR for range with tolerances based on monitoring

Main discussion points and comments on agenda items

** Please note that comments are general and may not represent exact wording as discussed. Comments may also be shortened. General ideas are attempted to be summarised and not all comments may be represented. Should a meaning be conveyed wrongly, or an important comment missed, EVE IWG members are asked to provide feedback to the EVE IWG secretary to correct the meeting notes.**

- Agenda Item 2: EVE IWG discussion overview (EVE-38-07e)
 - There are concerns from OICA that the EVE IWG is moving away from the original goal of rock screening substandard products depending on if range is to be a measured performance indicator for phase one or whether it is to be just monitored. By requiring a range SOH MPR, it creates concerns that more than just the battery is being monitored as there are factors outside the battery degradation that may affect range.
 - The Chair confirmed that the EVE IWG is moving away from rock screening or appears to be. The overall goal and framework of phase 1 is still under discussion and to be confirmed.
 - The EVE IWG discussed changing the name of SOH indicator to State of Certified Range (SOCR) and State of Certified Capacity (SOCC) due to confusion between SOH indicator terminology between researchers. The EVE IWG agreed to make these changes in the draft in-vehicle battery durability text.

Main discussion points and comments on agenda items

- Agenda item 3: Comments from Japan on battery durability GTR framework and deterioration factors (EVE-38-03e)
 - Noting Japan's slide on a matrix concept and the flexibility for CPs to choose different types of MPRs, the GRPE secretariat commented that it would be preferred to have one single value for battery electric vehicles (excluding L category vehicles) but if speaking about N1 vehicles, then it is unnecessary to have different MPRs since the battery is similar in those types of vehicles.
 - Request to Japan to clarify vision of range deterioration, specifically on ease of converting UBE to range with negligible EC changes and Japan's comments that the algorithm to predict range is complex.
 - The conclusion was that if the EC is negligible UBE could be used to convert to Range if the battery was the only factor affecting range. In reality, the range is quite complex to predict in an algorithm because there are many complex factors that can affect range other than just the battery (tire pressure, driving style, terrain, component efficiency, etc.). It may be that if range is being measured, using the simple calculation may not provide an accurate reflection of the real range achieved in a test scenario.
 - It was also commented that the range metric is the function of certified range and that the EV range could be the useable capacity (UBE) divided by the electric consumption (EC). The EC could carry the value and use the useable battery energy to calculate the range or state of certified range. There is uncertainty whether using the simple UBE conversion, assuming EC doesn't change, makes things any simpler. The GTR draft indicates the algorithms used to determine the State of certified range and capacity are up to the discretion of the OEMs for but the testing is in place to make sure it the algorithms chosen are robust and accurate.
 - The proposal by Japan was a suggestion on how to calculate the SOH but not a proposal on checking in the SOH calculation is correct

Main discussion points and comments on agenda items

- Agenda item 4: Comments from Japan on deterioration factor of electric vehicle system components (EVE-38-04e)
 - General comments
 - Deterioration factors may be useful in calculating range if its believed to be a more considerable factor
 - Plausible element to consider is the capability of degraded batteries to recuperate energy and the effect of charge sustaining mode

Main discussion points and comments on agenda items

- Agenda item 5: GTR Text discussion comments
 - Comments from GRPE secretariat on certification type (example type approval as one type), it is best to use certification as much as possible within the scope of GTRs
 - Discussion on removing NOVC-HEVs from SOCC and SOCC since out of scope. Specifically the question was whether NOVC-HEVS should be included in the scope of the GTR and whether NOVC HEVs include mild hybrids and higher voltage.
 - Concerns on power fade for NOVC-HEVs not just capacity fade
 - Many agree that NOVC-HEVs not within scope of certified range
 - Possibly more suitable for energy consumption evaluation.
 - There is some uncertainty whether it should still be left for consideration of capacity however. This was left for future discussion.

Day 2 main discussion points and comments

- Agenda item 7: JRC presentation
 - Comment: good potential data for GTR considerations
 - Comments on slide 17 regarding rock screening and MPR targets
 - Values on slide 17 are not rock screening level they are representing state of the art vehicles based on cars from premium OEMs. Rock screening should have a level which is banning substandard products from the market and not represent state of the art premium manufacturers.
 - The numbers contain all the possibilities in the market from 5 years ago so it is not rock screening. The hope is to intend to not produce worse vehicles or technologies than that and what is already in the market
 - There is also general warranty information provided from the U.S. from the last meeting that there is guarantee of up to 70% capacity for 8 years generally in warranties.
 - Also note that the early BEVs are typically coming from premium brand manufacturers and it may not be a representative sample considering new budget cars. A note to be cautious when considering this market stage.
 - Comment: TEMA data to be confirmed with real world data. Also need to defined the indicators and the expectation on use of the data from phase 1 to input for phase 2.
 - Data EVE IWG has so far is on warranty information and a second analysis from the TEMA model. If this model is used to exercise what the results indicate about deterioration it almost lines up with warranty. If the MPR is set too low, then it could be challenged. It is important to consider the numbers we have as a basis to determine whether the numbers are rock screening or not. There is also the minimum performance and the possibility of tolerances in minimum performance requirements.
 - The results of the TEMA model presentation from JRC are not recommendations but results of modelling.

Main discussion points and comments on agenda items continued

Agenda item 8: Presentation from U.S. Alliance for Automotive Innovation

- Comments from presenter
 - California approach to EV regulation is to treat the vehicles like emissions control regulations by evaluating the EV performance with an MPR
 - Importance to be upfront with customers about the differences and to educate the customers that the battery will degrade and the expectation of that. And also that the battery has cold limitations and that the batteries may not perform as well in their region.
 - Three important aspects for customers are 1) range 2) operation cost and 3) energy efficiency.
 - Usage efficiency is dominated because the metric is more from an energy perspective and its more intuitive. Deploying energy to travel a unit distance. The main objective is to get from point A to B.
 - Explaining battery degradation information to customers through labelling and how customers may calculate range.
 - Discussions of Range vs UBE debate
 - There is difficulty calculating range for manufacturers because a lot of factors are outside of what is measured
 - Range estimates may have been initially conservative, particularly for warranties; and manufacturers are less likely to have extra capacity remaining now. For attributing warranties, the warranties of the first and second product batteries of EVs may not be reliable to consider as they may have been more generous than what the vehicle batteries could offer in order to make the best experience for the customer.
 - Similarity comparisons made between the reliability of algorithms that predict remaining kilometers until the gasoline tank is empty in a ICE vehicle, and those that predict range in EVs, where finding a more accurate algorithm for EVs is much more complicated. A lot of work is required with surveys to achieve a better understanding of a correct algorithm. A historical risk of customer truthfulness in surveys, temperature history and knowledge with multiple ownership can be tricky in achieving this.
 - Particular concerns to vehicles that are leased when customer has no attachment to the prolonged battery life after their lease is up.

Main discussion points and comments on agenda items continued

Agenda Item 8 continued:

Comments from presenter

- UBE and Range concerns/comments
 - Concerns on making any conclusions on an experiment with low sample size and an unknown history.
 - For data to be much more effective a much larger data set (larger fleets) would be needed.
 - Bringing member states together to research material UBE variables that can be valuable to customer base
 - Comparisons made to how customers are quite knowledgeable on some ICE components and that customers want to know more about how to make their batteries last longer.
- If a range value is provided, it is important to not enforce any particular value and to spend the energy mainly on UBE since the range value can be misleading for the customer and for regulators if they choose to confirm the range test.
 - The range test doesn't indicate if the battery meets the MPR and thus the range is not valuable as an MPR. The range could be lower than the estimate with all of the components incorporated and there is a lot of triage to figure out what may be causing it when the concern is the battery component. There are too many unknowns with using range as a MPR.
- To characterize any battery metric the test needs to minimize sources of error. Range is one of least advisable observables but it provides the best understanding for the customer in the end.

Main discussion points and comments on agenda items continued

Agenda Item 8 continued:

General comments

- Certified range could be provided when energy consumption is certified but there are a lot of factors that affect range when the range test is being performed.
- When range is being tested, regardless of the factors that affect range, if UBE is tested and known then factors such as a loose wheel bearing are not of concern because the information about the battery is known.
- Referring to slide 7 (EVE-38-06e) and the factors affecting range. The actual (UBE?) values will be checked on single vehicle which is important with current plans. If monitoring is completed on hundreds and thousands of vehicles at the same time all the extra values that affect the range will be ironed out. It avoids problem of vehicles abnormally used. Regulators have the ability to regulate the sector and the regulation would cover UBE and range.
- Example for consideration - If some manufacturers put cheap wheel bearings in it could be shown if that is affecting the range of many vehicles. Request to reconsider on board range estimation and the enforcement of range
- The state of certified range is not a customer facing value and not expecting it to be determined based on the last miles accumulated. When the vehicle is brought in for testing regulators would be operating it at the same manner for the certification so the energy consumption should be very close as to deterioration from components.
- Suggestion to use range output in dyno mode only for testing

Main discussion points and comments on agenda items continued

- Agenda item 9:
- Is it acceptable to have a monitoring phase for range rather than start out with MPR value? This would be important for industry. Part A would function for the need of a range indicator and whether the indicator measures correctly.
- Time is needed to measure and verify if there are issues that occur during monitoring in phase 1 and whether range has a high tolerance. The impact of measuring the UBE can also be understood better with a clear request to monitor range . The understanding is complex so having both of them as indicators might be better for phase 1 considering the time available.
- If actual range is over performing that is an acceptable situation.

Action Items

- To discuss further on rock screening approach and MPR or monitoring in phase 1
- Make changes of SOCC and SOCR to draft GTR text

Conclusions and considerations from 38 EVE IWG session for discussion and confirmation

- Use a State of Certified Capacity (SOCC) [UBE] MPR for evaluating the battery performance only
- Consider using State of Certified Range (SOCR) for monitoring in phase 1 to obtain a better understanding of the other factors that affect range and provide manufacturers time to achieve better range algorithms. Monitoring range can provide a means of observing the correlation between UBE and Range and whether other factors are significant during testing
- Consider a future SOCR MPR with wide tolerances until better range algorithms can be successful after monitoring phase
- Consider range or energy consumption as a way to evaluate overall vehicle performance (electric and mechanical efficiency) in typical use (usage scenarios?)
- Provide SOCR via OBD and dyno testing only
- Exclude NOVC-HEVs from range evaluation. Would they still be evaluated for SOCC?
- Labelling requirements considering range or information to customers

Potential areas for clarification

- Reconfirm goals— Are we evaluating the performance of the electrified vehicles as a whole system via the range that customers expect when the battery is performing in the vehicle (in-vehicle battery durability), or is the concern primarily battery performance only regardless of the vehicle system or both?
 - Rock screening of substandard products via bad batteries or under performing vehicles?