Comparison of presented options for V2X accounting

For discussion at 49th EVE IWG

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Presented by USA

Description of presented options

Bold italic = new quantity to compute   Red text = required onboard counter

Option	Description	Steps
US Informal discussion	Convert V2X discharge energy to virtual mileage, and add to mileage that is read from odometer	• $\textbf{\textit{Virtual km}} = \left(\dfrac{\text{total discharge energy in V2X mode [Wh]}}{\text{certified energy consumption [Wh/km]}}\right)$ • Do not exclude vehicle from Part B • Vehicle km for Part B = Odometer km + **Virtual km**
OICA(a)* EVE47-05e and as shown at EVE 48	Convert all non-driving discharge energy to virtual mileage, and exclude vehicles with excess virtual mileage	• $\textbf{\textit{Virtual km}} = \text{Odometer km} \times \left(\dfrac{\text{total discharge energy [Wh]}}{\text{total discharge energy while driving [Wh]}}\right)$ • Exclude vehicle from Part B if **Virtual km** exceeds Odometer km by [x] thousand km
OICA(b) EVE46-10e and EVE46-10-Rev1e	Track total discharge energy, and exclude vehicles that exceed [1XX%] of expected discharge energy	• $\textbf{\textit{Expected discharge energy}}\,[\textbf{\textit{Wh}}] = \text{certified energy consumption} \left[\frac{\text{Wh}}{\text{km}}\right] \times [100\text{K or }160\text{K km}]$ • Exclude vehicle from Part B if total discharge energy [Wh] exceeds [1XX%] of **Expected discharge energy**

*Note: under OICA(a), "UBE throughput" was assumed to mean same as "discharge energy"

Additional remarks

Option	Steps	Remarks
US Informal discussion	• $\textbf{\textit{Virtual km}} = \left(\dfrac{\text{total discharge energy in V2X mode } [Wh]}{\text{certified energy consumption } [Wh/km]} \right)$ • Include vehicle in Part B • Vehicle km for Part B = Odometer km + $\textbf{\textit{Virtual km}}$	• Converts V2X usage to virtual mileage • Other energy usage while parked considered to be normal usage (e.g. BMS activity or battery thermal control, cabin preconditioning) • Requires one counter
OICA(a)* EVE47-05e and as shown at EVE 48	• $\textbf{\textit{Virtual km}} = \text{Odometer km} \times \left(\dfrac{\text{total discharge energy } [Wh]}{\text{total discharge energy while driving } [Wh]} \right)$ • Exclude vehicle from Part B if $\textbf{\textit{Virtual km}}$ exceeds Odometer km by [x] thousand km	• Counts all energy usage while parked toward a virtual mileage allowance • Requires two counters
OICA(b) EVE46-10e and EVE46-10-Rev1e	• $\textbf{\textit{Expected discharge energy}} [\textbf{\textit{Wh}}] = \text{certified energy consumption} \left[\frac{\text{Wh}}{\text{km}} \right] \times$ [100K or 160K km] • Exclude vehicle from Part B if total discharge energy [Wh] exceeds [1XX%] of $\textbf{\textit{Expected discharge energy}}$	• Counts all energy usage while parked, and extreme use cases (frequent towing, energy demand for autonomous driving, etc) toward an excess energy allowance • Requires one counter

*Note: under OICA(a), "UBE throughput" was assumed to mean same as "discharge energy"

OICA (a) reference slides

UN GTR for In-Vehicle-Battery Durability

Online input for EVE-48 in context of Annex 2 ("Monitor Flag") – Update of paragraph 6.4.1.

6.4.   Part B: Verification of Battery Durability

(…)

6.4.1. Frequency of verification

Data shall be collected yearly by the authorities from a statistically adequate sample of vehicles within the same battery durability family. The decision on the number of the vehicles in the sample may be taken by the responsible authority based on risk assessment methodology, but in principle should not be less than [500]. If the number of vehicles in the sample is less than [500], then on the request of the manufacturer, a maximum of 5% of the values might be excluded from the sample, basing on the criteria defined in Annex 2 Cases B.

For vehicles with extended V2X usage, the following provisions shall apply independent from the sample size:

$$Distance_{virtual} - Distance_{Driven} \leq [x] thousand\ km$$

Where:

$Distance_{Driven}$ is the actual distance driven with the vehicle (battery used for traction)

$Distance_{virtual}$ is calculated as follows: $Distance_{virtual} = Distance_{Driven} \times \dfrac{Total\ UBE\ throughput}{UBE\ throughput\ during\ driving}$

With:

$UBE\ throughput\ during\ driving$ is the UBE throughput while the vehicle was driven

$Total\ UBE\ throughput$ is the total UBE throughput of the vehicle in driving and non-driving operations

OICA (b) reference slides

# UN GTR for In-Vehicle-Battery Durability

Current status proposal for Annex 2 ("Monitor Flag") – Case B (from April 15th)

Case B: where the vehicle was used "abnormally":

a. The vehicle has experienced a deep discharge
    → One occurrence sets the Case B flag

b. The vehicle was stored at a SOC higher than [a%] in more than [b%] of the vehicle lifetime but at least [minimum period to be defined].
    → Counter required; if threshold reached: Case B flag will be set

c. The vehicle was fast charged for more than [c%] of the total charge throughput but at least [minimum charge throughput to be defined]. The fast charge throughput is accumulated in times when the fast charging current or the fast charging power exceeds [d%] of the battery fast charging limits.
    → Fast charging counter required; if threshold reached: Case B flag will be set

d. The discharged energy throughput is more than [1xx%] of $EC_{Type\_Approval\_declared}$ [$\frac{Wh}{km}$] * $MPR_{mileage}$ [km] which indicates extensive usages of the battery which would be shown by miles driven such as e.g.

    ➢ Recuperation

    ➢ Significant V2X (V2Grid, V2Home etc.) usage

    ➢ Additional energy amount in context of autonomous driving

    ➢ Extensive use of towing or pulling a trailer or going on a race track

    → Energy throughput counter required; if threshold reached: Case B flag will be set

Further thoughts on throughput criterion in Annex 2 (Case B)
→ Source: Ford/ACEA TF EVP-ECR
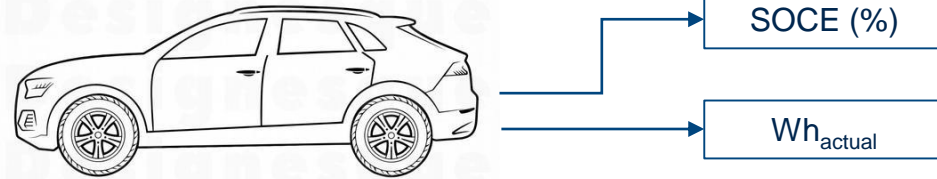
$$5\ year\ maximum\ discharge\ energy\ (Wh) = X\ Wh$$
$$8\ year\ maximum\ discharge\ energy\ (Wh) = Y\ Wh$$

Vehicles exceeding maximum discharge energy excluded from MPR assessment

$$Wh_{5\ year\ nominal\ WLTP} = Energy\ consumption_{WLTP}\left(\frac{Wh}{km}\right)x\ 100\ 000\ km$$

$$Wh_{8\ year\ nominal\ WLTP} = Energy\ consumption_{WLTP}\left(\frac{Wh}{km}\right)x\ 160\ 000\ km$$

[20%] higher than the WLTP throughput to be removed through Annex 2

Annex 2 throughput concept

Energy consumption WLTP based on individual vehicle (option to use family approach e.g. TMH)

Justification:

- WLTP nominal ~ 70th percentile

- [20%] higher than WLTP throughput as threshold proposal

- Proposal allows some 'extreme use' but discounts above 90th percentile

Use cases coverage:

- V2X application

- Usage without mileage accumulation

- Racing / high acceleration

- Excessive Towing

15.04.2021