Additional input on V2X virtual mileage

For discussion at 50th EVE IWG
23 June 2021
Presented by USA
## Selected proposal (EVE 50 Day 1)

<table>
<thead>
<tr>
<th>Option</th>
<th>Steps</th>
<th>Remarks</th>
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| **US Informal discussion** | • **Virtual km** = \( \left( \frac{\text{total discharge energy in V2X mode} \ [\text{Wh}]}{\text{certified energy consumption} \ [\text{Wh/km}]} \right) \)  
  • Include vehicle in Part B  
  • Vehicle km for Part B = Odometer km + **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 | • **Virtual km** = Odometer km \( \times \) \( \left( \frac{\text{total discharge energy} \ [\text{Wh}]}{\text{total discharge energy while driving} \ [\text{Wh}]} \right) \)  
  • Exclude vehicle from Part B if **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 | • **Expected discharge energy** \( [\text{Wh}] = \text{certified energy consumption} \ [\text{Wh/km}] \times [100K or 160K km] \)  
  • Exclude vehicle from Part B if total discharge energy \( [\text{Wh}] \) exceeds [1XX%] of **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 |
Open issues

• Clear definition of V2X usage
  • Japan to propose concrete text at EVE 51
  • Additional discussion is offered here

• Appropriate denominator for virtual mileage formula
  • Several options for energy consumption (EC) in denominator
  • Implications on stringency
  • Availability of the selected quantity on the vehicle
Definition of V2X usage

• Varieties:
  • V2L = vehicle to load (discharge) – irregular, episodic [e.g. power tools at work sites]
  • V2G = vehicle to grid (discharge + recharge) – daily, frequent, shallow
  • V2H = vehicle to home
    • Power outages (discharge) – irregular, episodic
    • Solar/supplementary grid (daily discharge + charge activity) [e.g. solar energy storage buffer]

• Questions:
  • Should all of these varieties be included in V2X definition?
  • How specific must the text of the GTR be?
  • Is it possible and practical for the vehicle ECU to recognize and quantify all forms of V2X usage?
  • Can onboard record of V2X usage be verified?
Denominator for virtual mileage formula

- **Virtual km** = \( \frac{\text{total discharge energy in V2X mode} \ [Wh]}{"\text{appropriate measure" of energy consumption} \ [Wh/km]} \)

- Larger EC = fewer virtual km allowed = more stringent

- Possible options for denominator:
  - Predetermined fixed value:
    - The certified/declared EC of the subject vehicle
    - The highest certified/declared EC of the available configurations of the subject vehicle model
    - The highest certified/declared EC within the subject vehicle’s Part B family
    - A figure determined by the OEM to best represent equivalent degradation rate of V2X
  - Onboard value, collected over lifetime of vehicle:
    - The individual vehicle’s actual energy consumption per km driven
Implications of using a fixed EC value in denominator

- Higher EC value ("worst case" EC) results in less virtual km
- Favors greater stringency
- This may be particularly appropriate if V2X usage is "easier" on battery life than normal driving
Implications of using an onboard “actual” EC in denominator

- Vehicle with gentle driver is credited with more V2X miles than vehicle with aggressive driver, even though V2X likely had the same effect on both vehicles.
- Gently used vehicle already is likely to experience the least “driving” degradation, and now it gets the most allowance for V2G usage too.
Other practical considerations

• If an onboard value is used, the manufacturer must collect and maintain the data, and it must be verifiable

• If a fixed value is used, the value must be established at time of production so the vehicle can “know” the value

• Can the fixed value be determined unambiguously?
  • Ideally, it would be a published certification value for the subject vehicle
  • However, declared EC value may be based on a different vehicle in the family
  • EC of specific vehicle configurations might not be available as a predetermined value