交通安全環境研究所
National Traffic Safety and Environment Laboratory

Progress Status on HD UBE Measurement

prepared by JAPAN

61st EVE IWG
25th & 26th April, 2023

EVE-61-YYe

Background

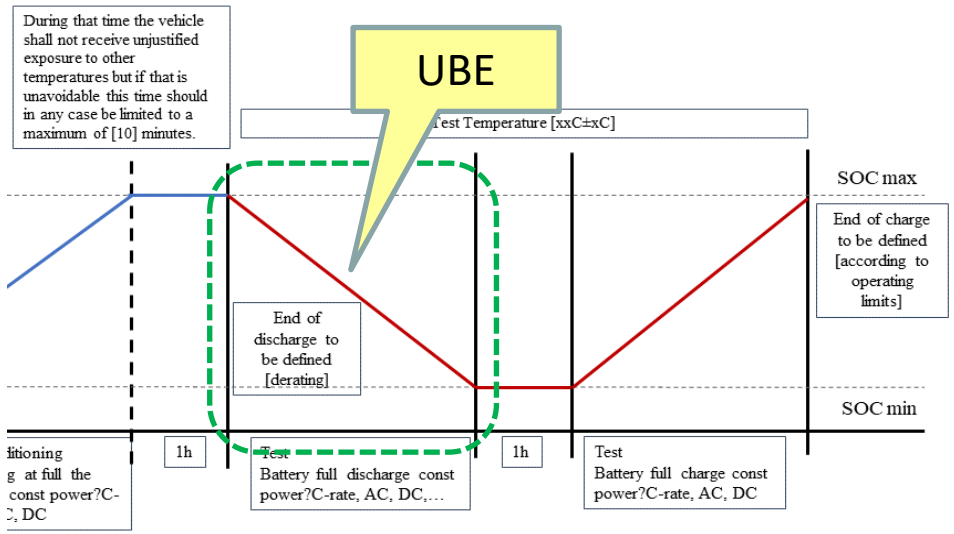
UBE test for Heavy-duty vehicles

【EVE-59】10/Jan./2023

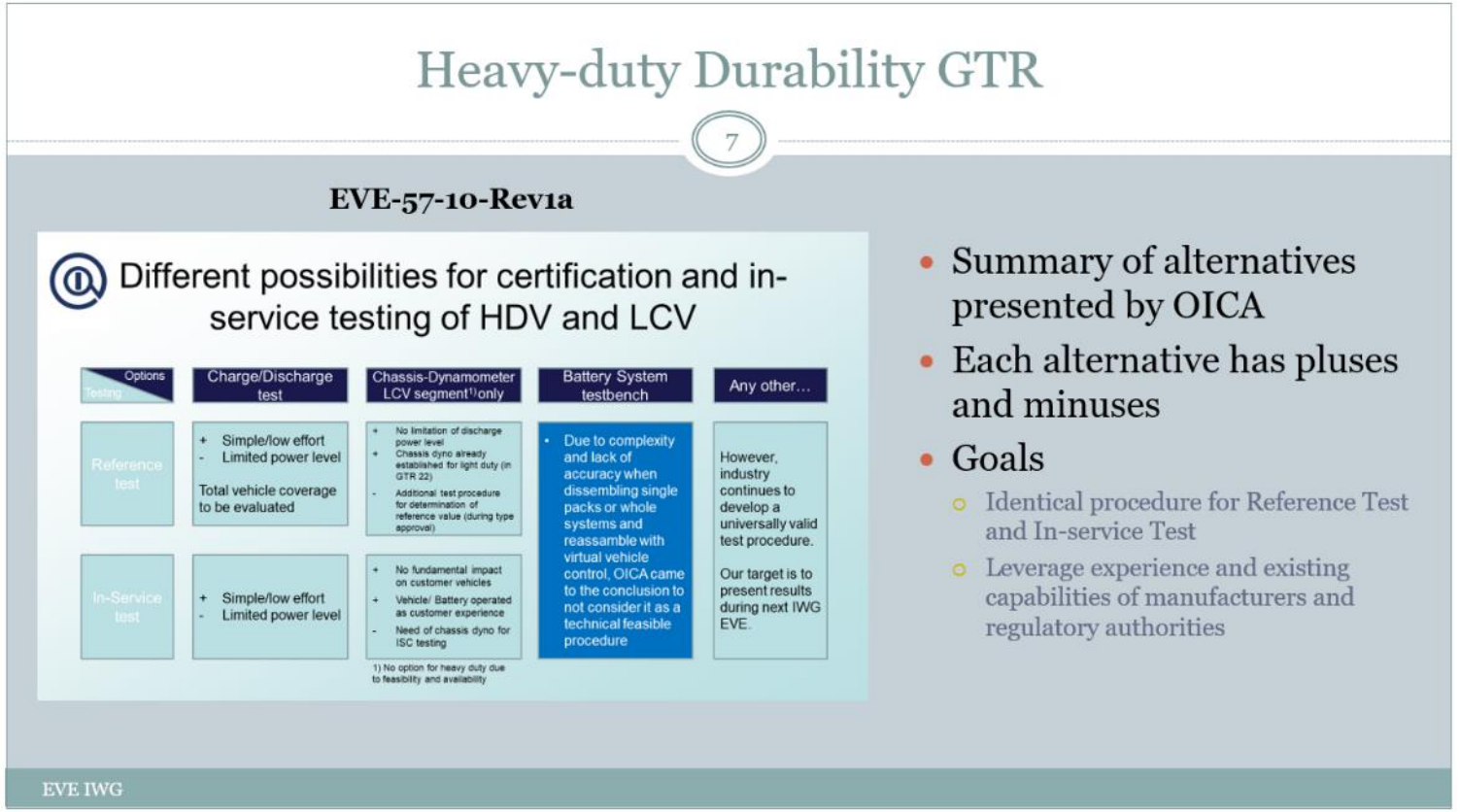
As a first step,

JRC execute the Charge / Discharge Test.

JPN also starts the physical tests to develop the test procedure for UBE determination < April/2023 ～ >



Informal document **GRPE-87-52**
87tf GRPE, 10 January~13 January 2023
Agenda item 9

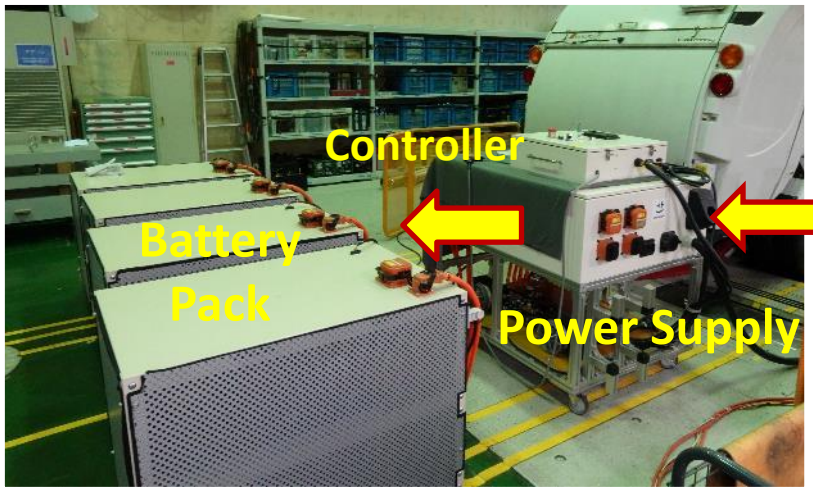


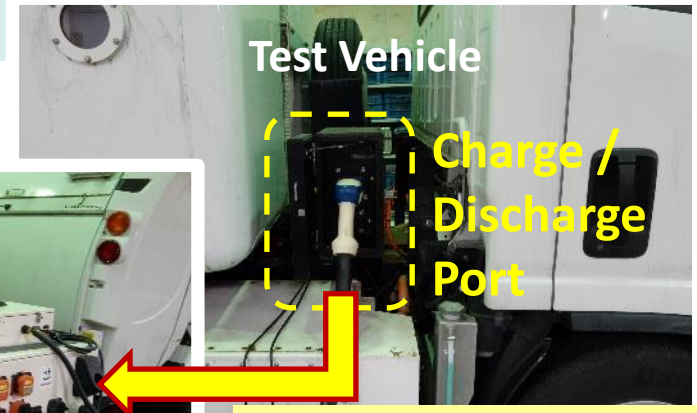
Approach

【Focus】
- ✓ JPN evaluates the gap (error) of its battery discharged energies (UBE) obtained under the two (2) different test procedures
  - ① Chassis Dynamometer Test
  - ② Charge / Discharge Test

① Chassis Dynamometer Test

② Charge / Discharge Test





By using V2X function

Power : One-way
(Vehicle → Power supply)

【Test Vehicle】
- EV Truck（GVW：7,500kg）
- Battery Capacity：48kWh (Lithium-ion battery)

【Test condition】
- Test Room Temperature：25℃ (setup)

Test Procedure

① Chassis Dynamometer Test (WHVC+Road Gradient) ←*GTR No.4_ Section 9 (Annex9, 10)*

(a) Obtain the discharge pattern data of battery power from SOC max to SOC min (Cycle Repetition).

(b) Measure the total amount of battery discharged energy

② Charge / Discharge Test

→ Measure total amount of battery discharged energy of the following conditions

(1) Cycle Repetition : The discharge pattern simulating the chassis dynamometer test ①

(2) Constant Power : Power (10.3kW) ・・・C-rate=0.2

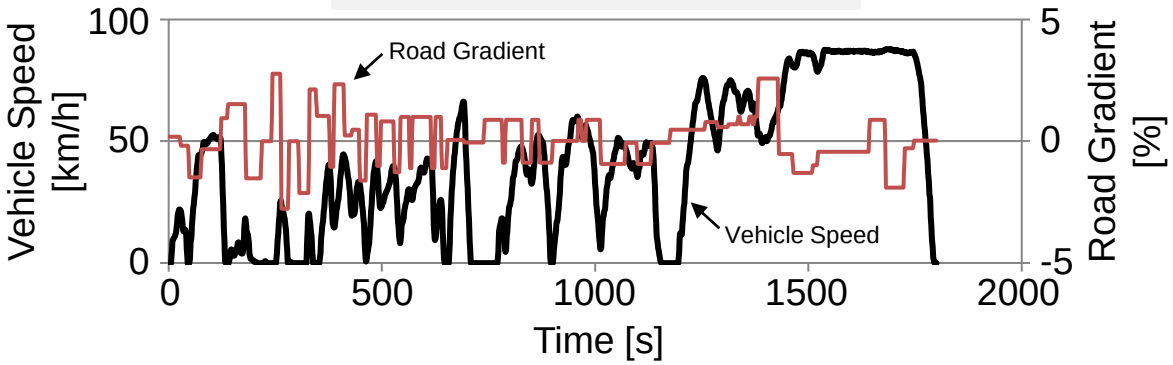
(3) Constant Power : Cycle Average power (24.3kW) ・・・C-rate=0.5

(4) Constant Power : Power (48.0kW) ・・・C-rate=1.0

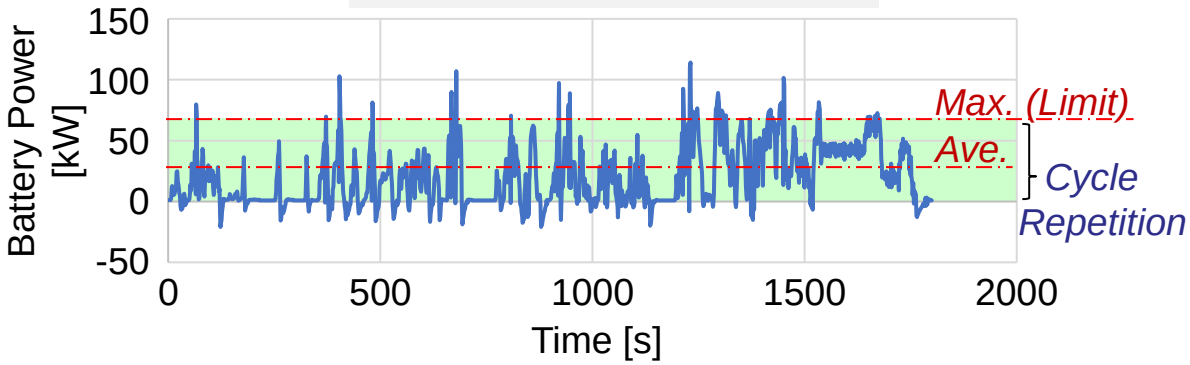
(5) Constant Power : Cycle Maximum power (114kW) → V2X power limit (Max.=69kW) ・・・C-rate=1.4

$$\textbf{C-rate} = \frac{\text{Setup Power [kW]}}{\text{Battery Capacity(48kWh)}}$$

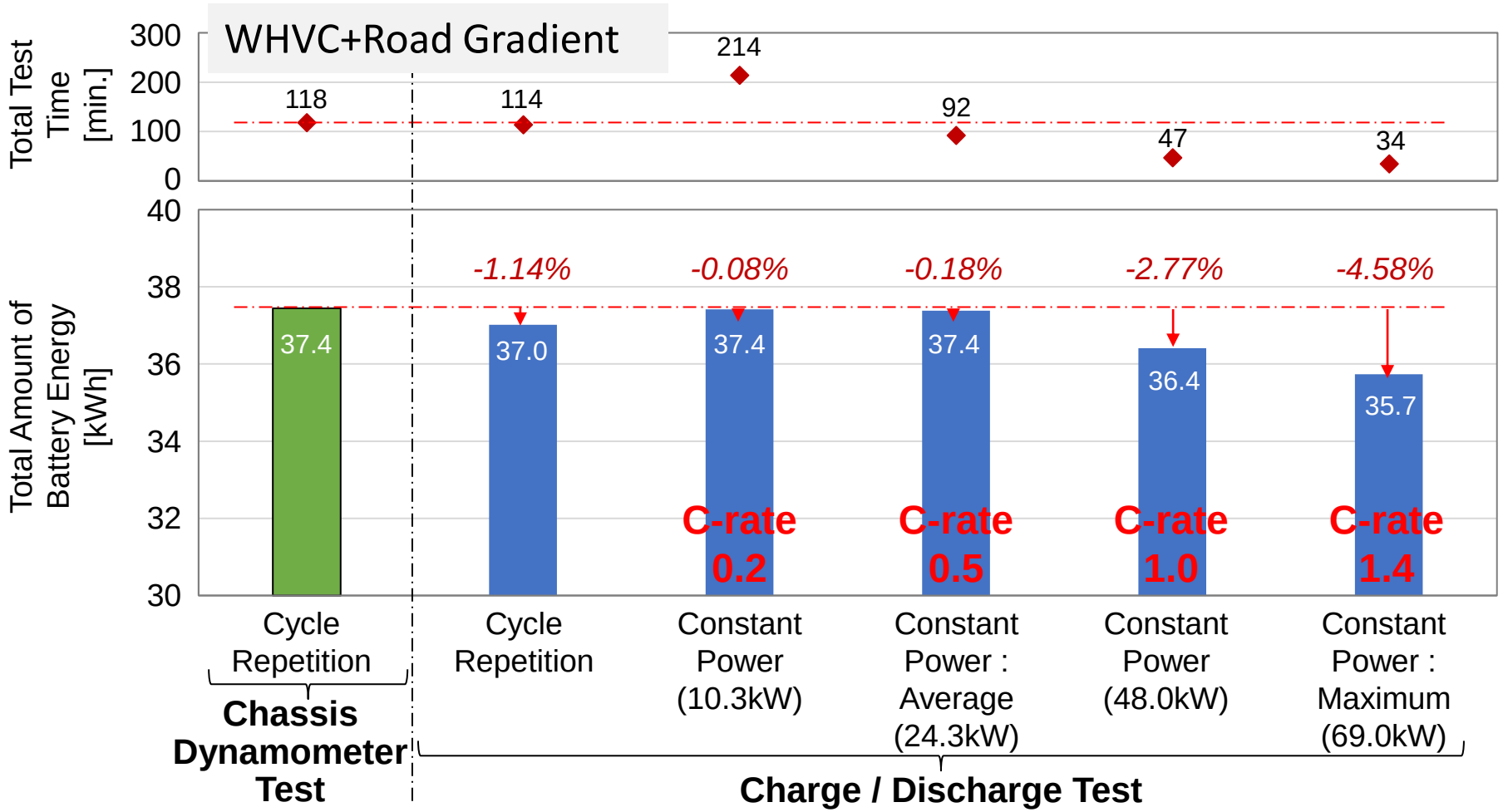
【Cycle Pattern】

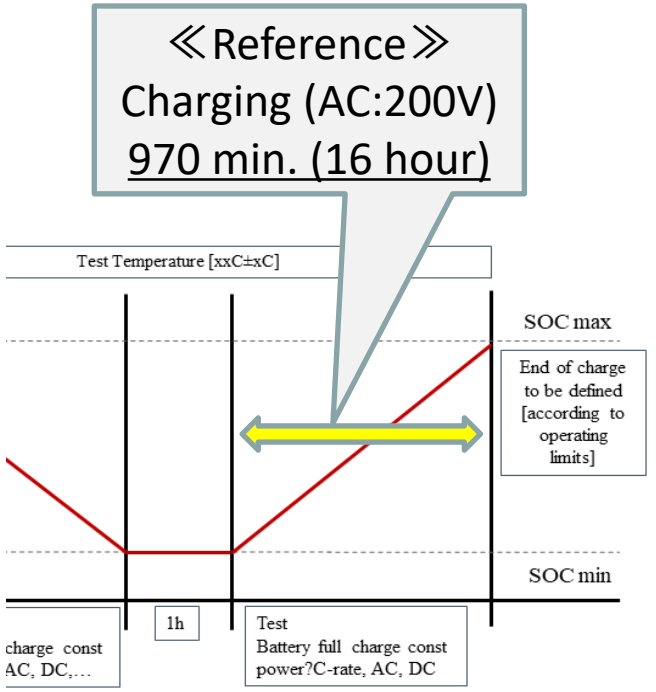


【Battery Power】



Result


WHVC+Road Gradient
Total Test Time [min.]
300
200
100
0
118
114
214
92
47
34
Total Amount of Battery Energy [kWh]
40
38
36
34
32
30
-1.14%
-0.08%
-0.18%
-2.77%
-4.58%
37.4
37.0
37.4
37.4
36.4
35.7
C-rate 0.2
C-rate 0.5
C-rate 1.0
C-rate 1.4
Cycle Repetition
Cycle Repetition
Constant Power (10.3kW)
Constant Power : Average (24.3kW)
Constant Power (48.0kW)
Constant Power : Maximum (69.0kW)
Chassis Dynamometer Test
Charge / Discharge Test


≪Reference≫
Charging (AC:200V)
970 min. (16 hour)
Test Temperature [xxC±xC]
SOC max
End of charge to be defined [according to operating limits]
SOC min
1h
charge const AC, DC,…
Test
Battery full charge const power?C-rate, AC, DC

Initial Observations and Next Actions

< Initial Observations >

- Charge/Discharge test (e.g. bidirectional charger) can be one of the solutions to determine HDVs UBE considering its complexity during in-service testing
- Discharge patterns need further study
  - ✓ Cycle Repetition : consider the necessity to simulate the regenerative energy
  - ✓ Constant Power : consider the necessity to set the upper limit of C-rate

< Next Actions >

- Evaluate the repeatability of each discharge pattern
- Evaluate the potential factors of test-to-test variability
- Develop the concrete test procedure

  → plan to report the latest progress during 62nd IWG meeting