JAPAN Position on EV_OIL

8th WLTP E-Lab. Meeting

13th April 2015 @ Stockholm

Prepared by JAPAN

(OIL#56) Interpolation Approach

1. NOVC-HEV
   Support WLTP-SG-EV-06-05
2. PEV
   Support WLTP-SG-EV-06-05 with slight modification based on the discussion during 7th E-Lab. meeting

Test method / EV Range	Continuous Cycle Driving (CCD)	Shorten Test Procedure
Less than 70km (4phases) 60km (3phases)	OK	NA
Equal or more than 70km (4) 60km (3)	NA*	OK

*) when sub-group made a decision to apply CCD as an option, interpolation approach is not allowed due to its non-linearity

3. OVC-HEV
   Open to discuss the proposals, if available
   (oppose the ideas which deny the phase specific value)

(OIL#2) Interpolation Family

@ modified on 30th Mar. 2015

Additional family criteria for NOVC-HEV ~~and OVC-HEV~~ @

(a) Type of internal combustion engine: fuel type, combustion type, engine displacement, full-load characteristics, engine technology, and charging system shall be identical, but also other engine subsystems or characteristics that have a non-negligible influence on CO2 under WLTP conditions;

(b) Operation strategy of all CO2 ***, Ranges and EC*** -influencing components within the powertrain;

← *Steininger-san comment is already defined* @

(c) Transmission type (e.g. manual, automatic, CVT);

(d) n/v ratios (engine rotational speed divided by vehicle speed). This requirement shall be considered fulfilled if, for all transmission ratios concerned, the difference with respect to the transmission ratios of the most commonly installed transmission type is within 8 per cent;

(e) Number of powered axles;

In addition above, the following specifications/characteristics shall be identical for NOVC-HEV and OVC-HEV.

(f) Hybrid system configuration (series/parallel/split)

(g) Battery specifications (type, voltage, output)

~~***(h) Rcdc value (OVC-HEV)***~~ @

(i) Motor specification (type, voltage, output)

(j) Inverter specifications

Note1) criteria for CO2 range :

Vehicle_L&H tests : whichever smaller 20g/km or 20% of Vehicle_H

Vehicle_L&M&H tests : within 30g/km)

Note2) n/v ratios : unique description is necessary for CVT/HEV

@ ***engine speed (100km/h with ICE ON) / driveshaft rotation speed under CS condition***

(#2) Interpolation Family

No change from original proposal

Family criteria for PEV

(a)motor type (e.g. UN R85) Other software or characteristics that have a non-negligible influence on energy consumption and electric range shall be identical.
(b)battery type (e.g. Energy density for battery pack [Wh/kg]) Other software or characteristics that have a non-negligible influence on energy consumption and electric range shall be identical.
(c)transmission type (e.g. manual, automatic, CVT);
(d)n/v ratios (motor rotational speed divided by vehicle speed). This requirement shall be considered fulfilled if, for all transmission ratios concerned, the difference with respect to the transmission ratios of the most commonly installed transmission type is within 8 per cent;
(e)number of powered axles;

(#51) Driver selectable switch

Support tentative agreement* made by sub group.
*) use predominant mode for both CD/CS tests

Clear understanding is necessary to review ACEA proposal

(#58) PEV shorten test procedure (STP)_1

1. Applicability of STP

<<JAPAN position>>

Test method / EV Range	Continuous Cycle Driving (CCD)	Shorten Test Procedure
Less than 70km (4phases) 60km (3phases)	mandatory	prohibit
Equal or more than 70km (4) 60km (3)	prohibit	mandatory

2. CSC Speed

<<JAPAN proposal>>

L ~ exH : 100km/h

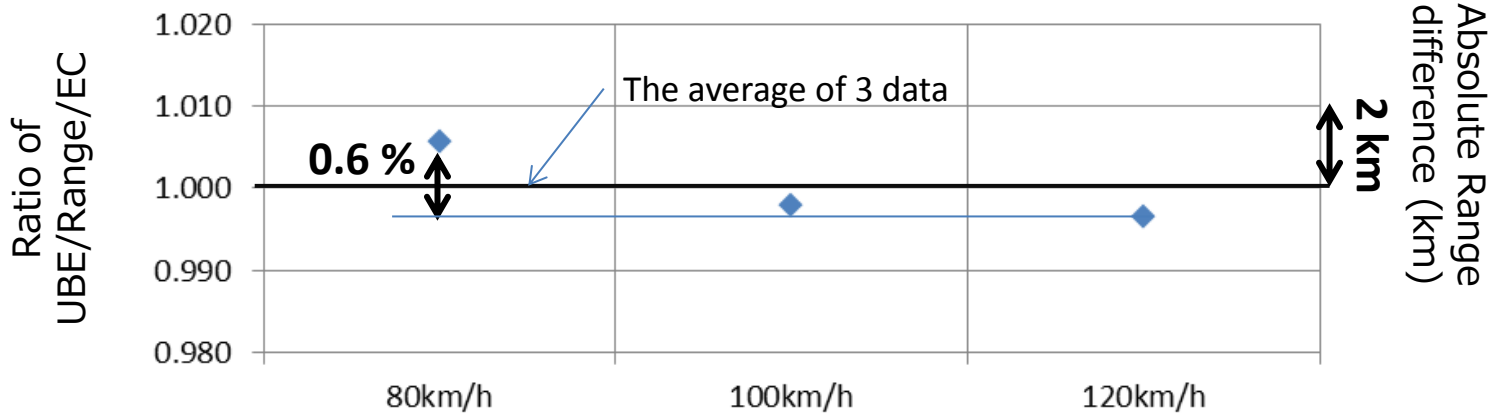
L ~ H : 80km/h

because of small impact of speed variations on UBE/Range/EC (please refer next slide)

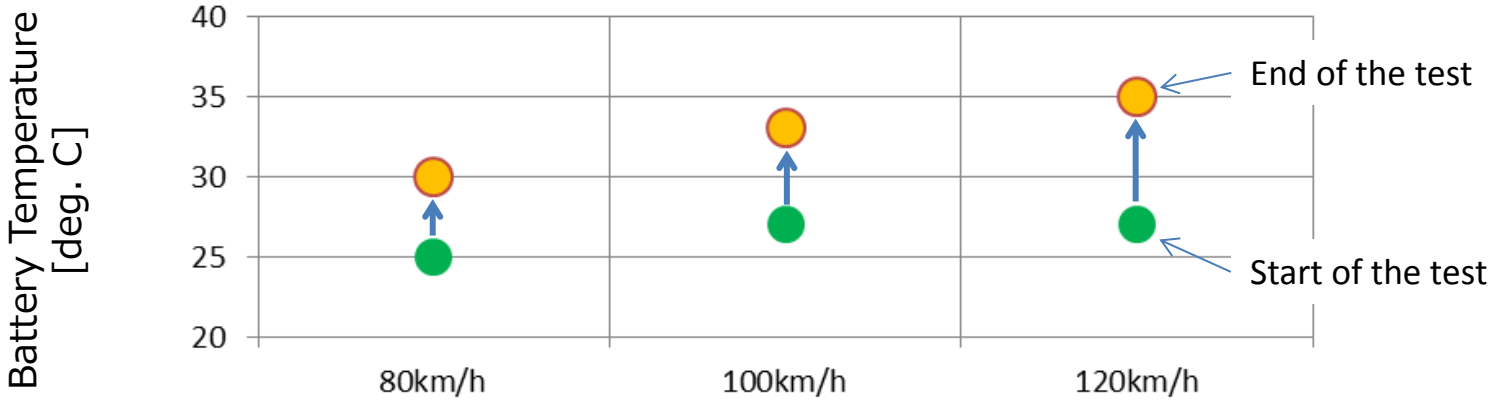
and representativeness of the cycle demand energy (approx. 80%)

(#58) PEV shorten test procedure (STP)_2

Impact of UBE/Range/EC is approximately 0.6%.



(reference) The battery temperature increases as CSC speed goes up.
Thermal loss in cells is main contributor of UBE difference,
but negligible within above speed range (80 ~ 120 km/h)



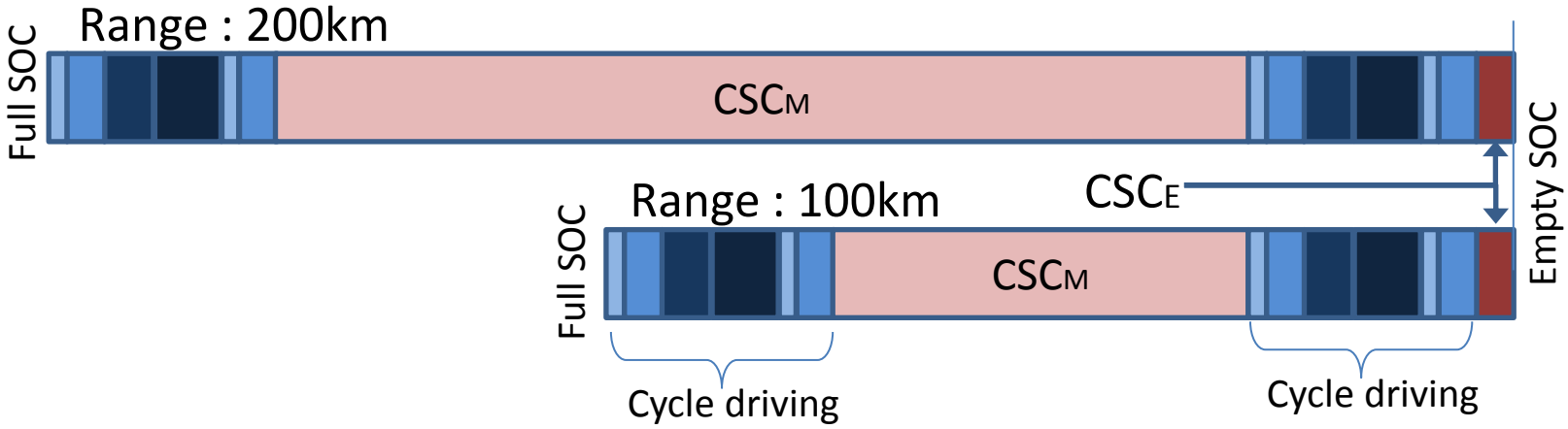
(#58) PEV shorten test procedure (STP)_3

3. CSC Distance

<<JAMA proposal>>

CSC_M : rest (*Total range – cycle driving distance – CSC_E*)

CSC_E : 3 ~15km to represent low SOC conditions



(reference) how to obtain necessary data per CP needs ?

Test cycle \ Data derivation	4 phase range	3 phase range	Each phase range	City(L+M) range
4 phases test (e.g. EU market)	✓	✓ (if necessary)	possible	✓
3 phases test (e.g. JPN market)	NA	✓	✓	possible

(#60) GTR Improvement (feedback on ACEA draft gtr)

Greatly appreciate the hard work made by ACEA to make gtr more sophisticated.

Here are the main feedback by JAPAN（concrete feedback was distributed by email)

1. Need re-construction

   all calculation except CO2 are in main part and CO2 is in appendix

   →CO2 cal. also needs to be in main part.

   Appendix2 should focus on how to develop the RCB correction factors

2. Need to be in-line with the agreement

   i.e. UF weighted emission cal. in CD mode → should be deleted

   10% rule → should be come back

3. OVC-FCHV : no draft text was received as of 7th April 2015

   afraid to complete within Phase1b due to time shortage of review

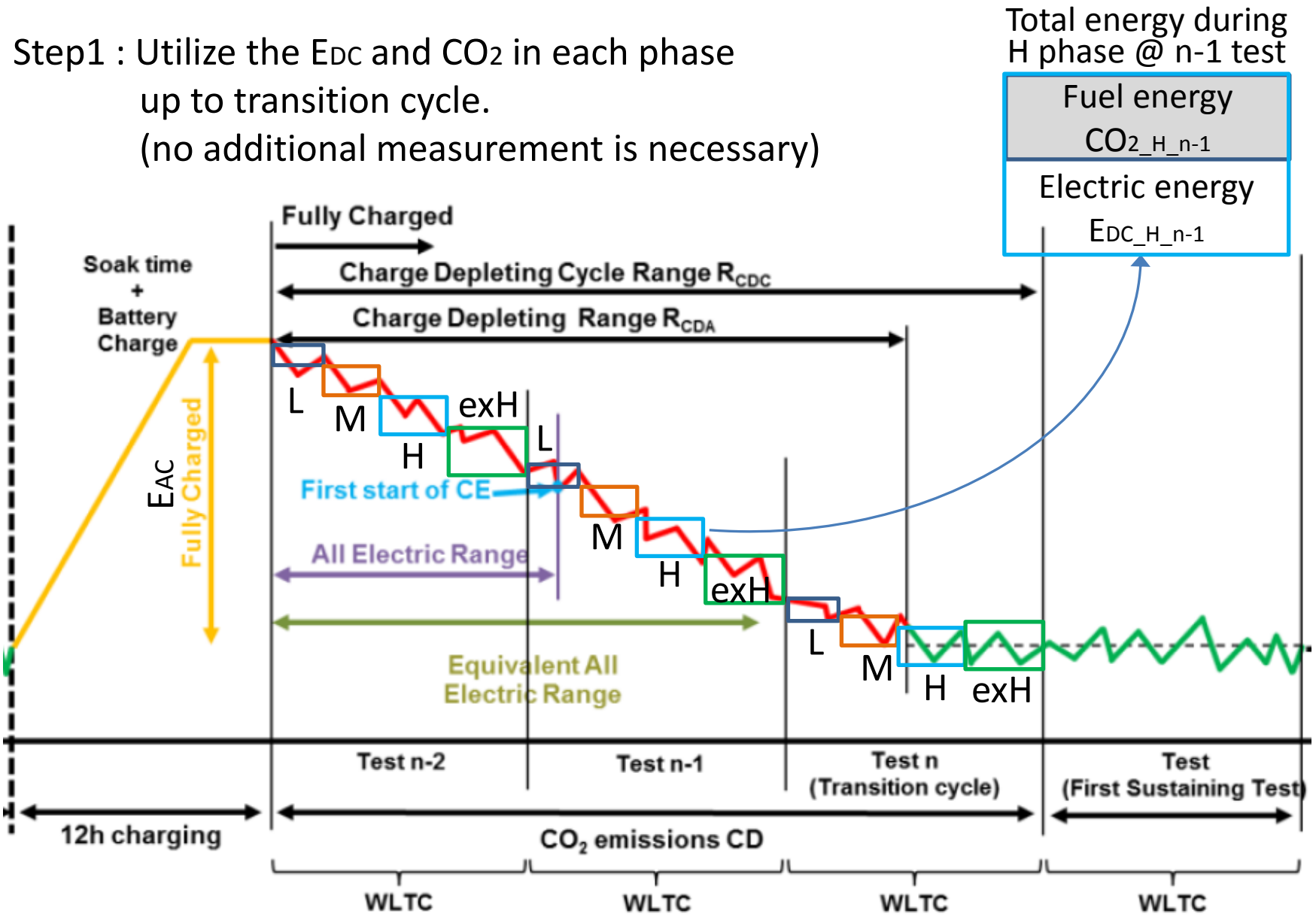
(OIL#55) Phase Specific Value

Followings are modified from original proposals

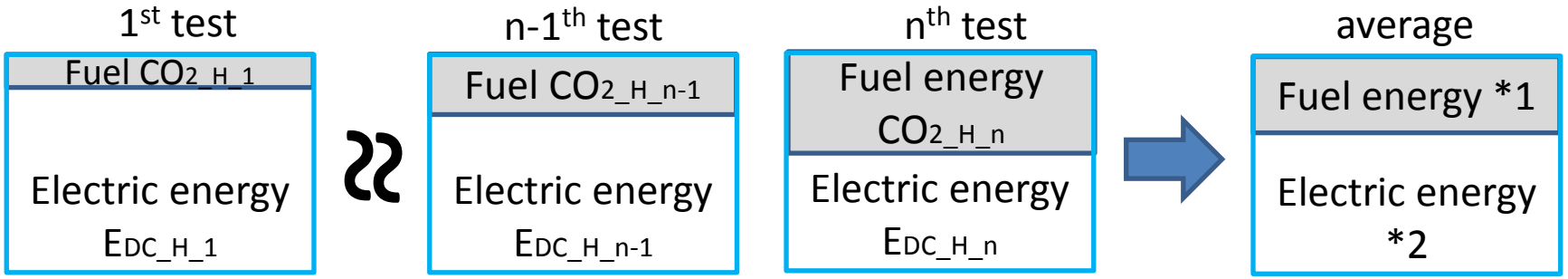
Items	Actions	Justifications
Fractional UF	not adopt simplified	Calculation is based on average value during CD cycle Avoid misinterpretation of gtr text
Number of cycle (virtual phase driving)	adopt decimals number	Improve accuracy
Vehicles start from transition cycle	not require CD phase value under the non-CD conditions simplified calculation formula	Take care of the unique vehicles Avoid misinterpretation of gtr text

Concept how to derive Phase Specific Value(PSV) in CD mode

Step1 : Utilize the E_{DC} and CO_2 in each phase
up to transition cycle.
(no additional measurement is necessary)



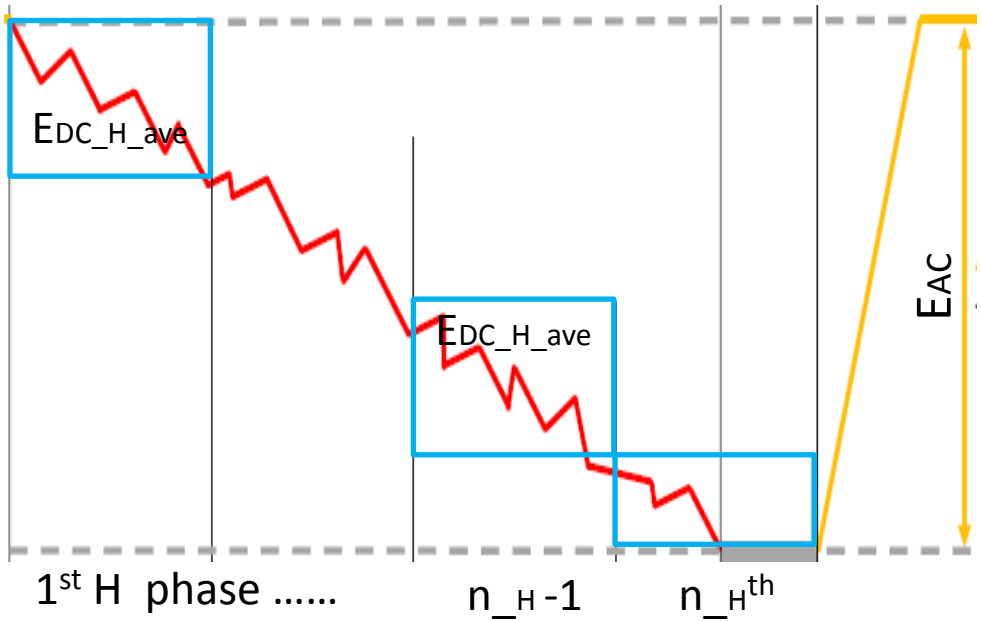
Step2 : Calculate average E_{DC} and CO_2 in each phase (in case of H phase)



$$*1)\ CO_{2\_H\_ave} = \frac{\sum_{j=1}^{n} CO_{2\_H\_j}}{n}$$

$$*2)\ EDC_{\_H\_ave} = \frac{\sum_{j=1}^{n} E_{DC\_H\_j}}{n}$$

Step3 : Imagine virtual phase cycle (in case of H phase)



$$n_{\_H}{}^{th} = \frac{k\ x\ E_{AC}}{E_{DC\_H\_ave}}$$

k : AC → DC convert factor

(adopt Nico-san's suggestion)

Step4 : Calculate PSV (in case of H phase)

Fractional UF is not used for PSV due to its concept

$$R_{CDA\_H} = \frac{k\ x\ E_{AC}}{E_{DC\_H\_ave}}\ x\ D\_H$$

$$EAER\_H = \frac{(CO_{2\_H\_CS} - CO_{2\_H\_ave})}{CO_{2\_H\_CS}}\ x\ D\_H\ \ x\ n\_H$$

$$EC\_H = \frac{E_{AC}}{EAER\_H}$$

D_H: thoritical distance

Step4_a : Special Treatment (start with transition cycle)

Basically same formula
but PSV of CD mode is not required in the following case.
(→ considered as a CS condition)

$$CO2\_phase\_1 > 0.8 \times CO2\_phase\_cs$$

Phase	CO2 @ Transition Cycle	CO2 @ CS	PSV in CD
Low	20 g/km	120 g/km	available
Middle	50 g/km	80 g/km	available
High	85 g/km	100 g/km	Not available
Ex-High	105 g/km	115 g/km	Not available