



WLTP-E-Lab Sub Group
Test procedure

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Schedule of WLTP

Phase I (2009 ~ 2013)

DHC
(Worldwide Harmonized
Light Duty Driving Cycle)

DTP
(Test Procedure)

Parallel Informal Groups

OCE
(Off-Cycle Requirement)

MAC
(Mobile Air Conditioning)

Phase II (2014 ~ 2018)

Low ambient
temperature /
High Altitude
test procedure

decision made by
WP29/AC3 before Phase II

Durability

**In Service
Conformity**

OBD

Other grt

Phase III (2019 ~ 2021)

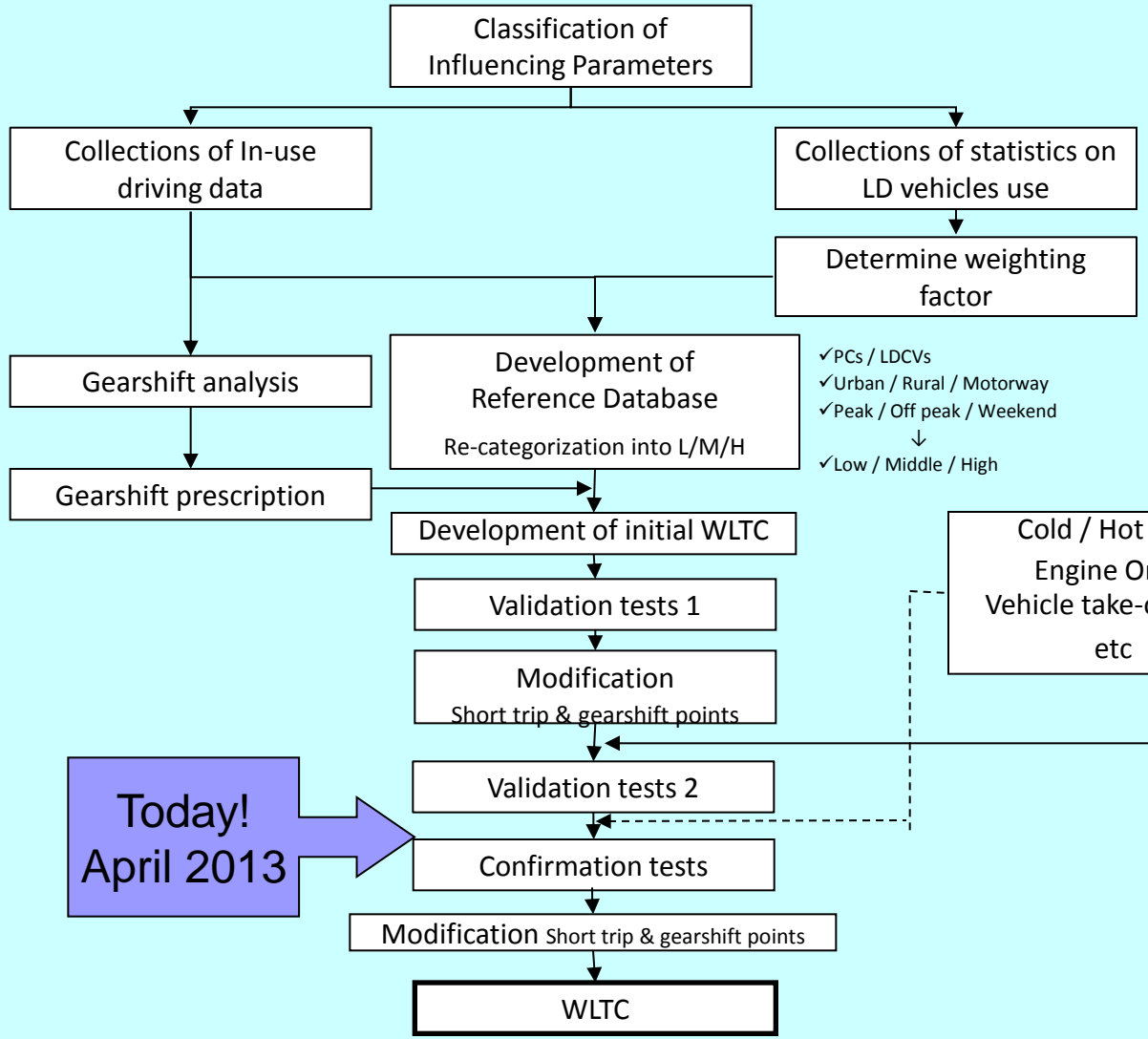
**Definition of
Emission Limits**

**Reference Fuel
Specifications**

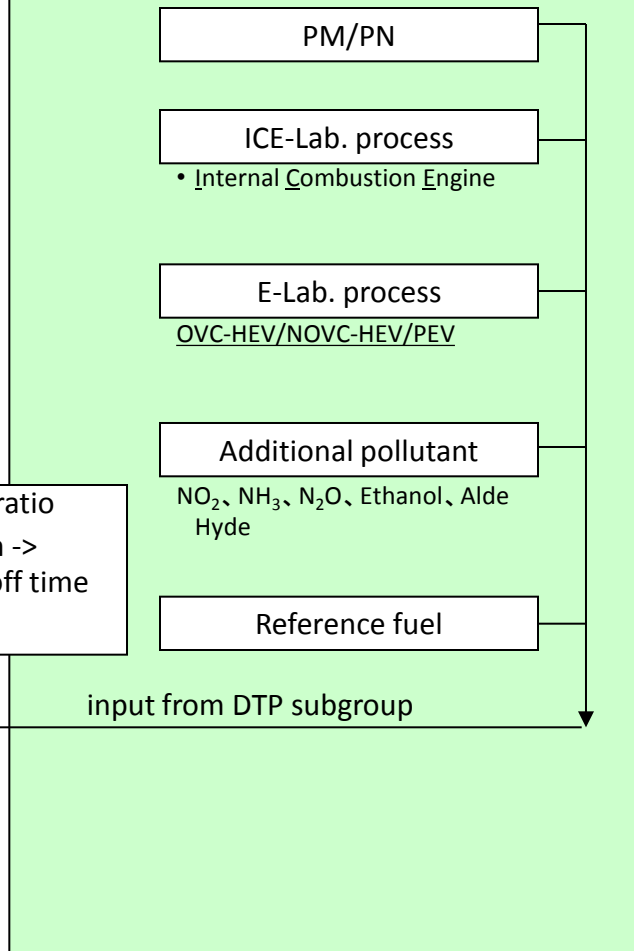
**Correlation with
existing regional cycles**

Task of DHC Group Work

Task of DTP Group Work

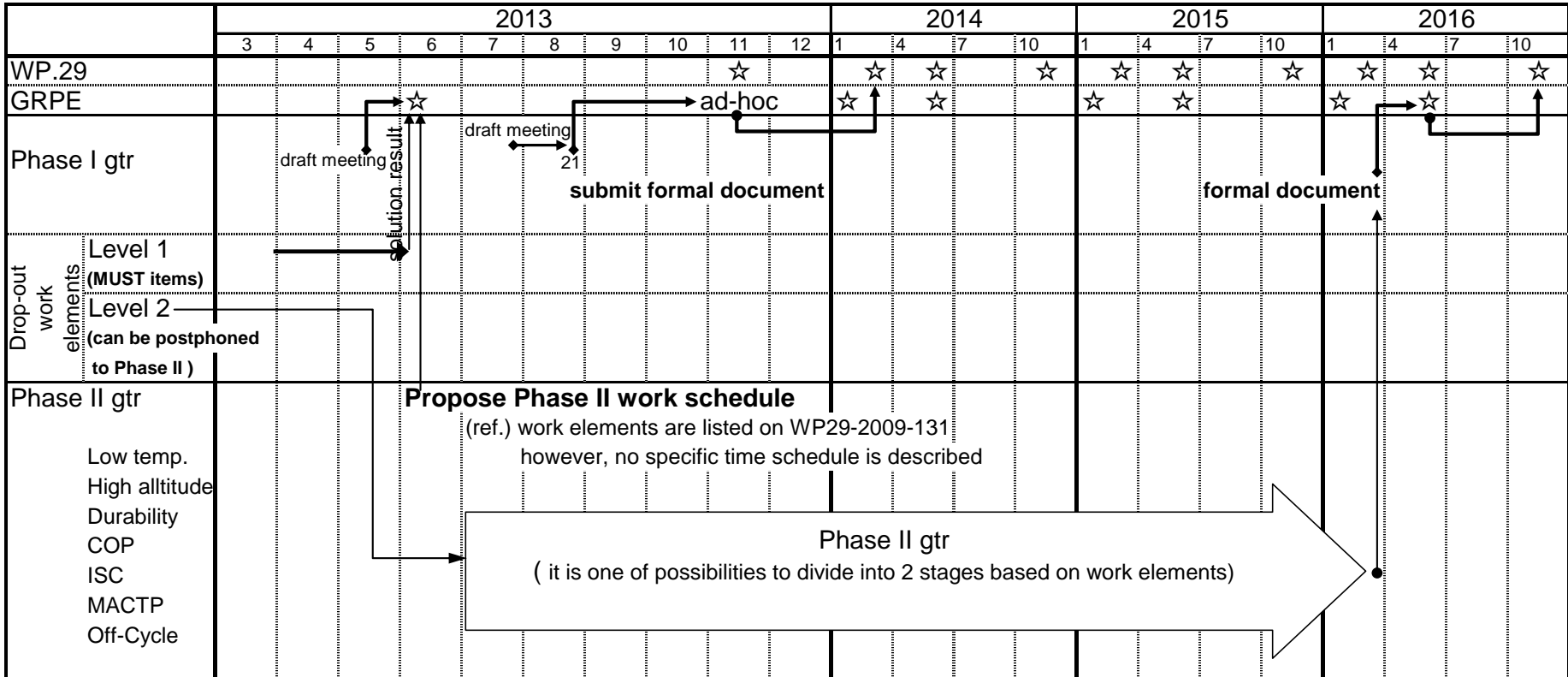


Today!
April 2013



(*) Remark
 DHC : Development of worldwide Harmonized light duty driving Cycle
 DTP : Development of Test Procedure
 WLTC : Worldwide harmonized Light duty driving Test Cycle

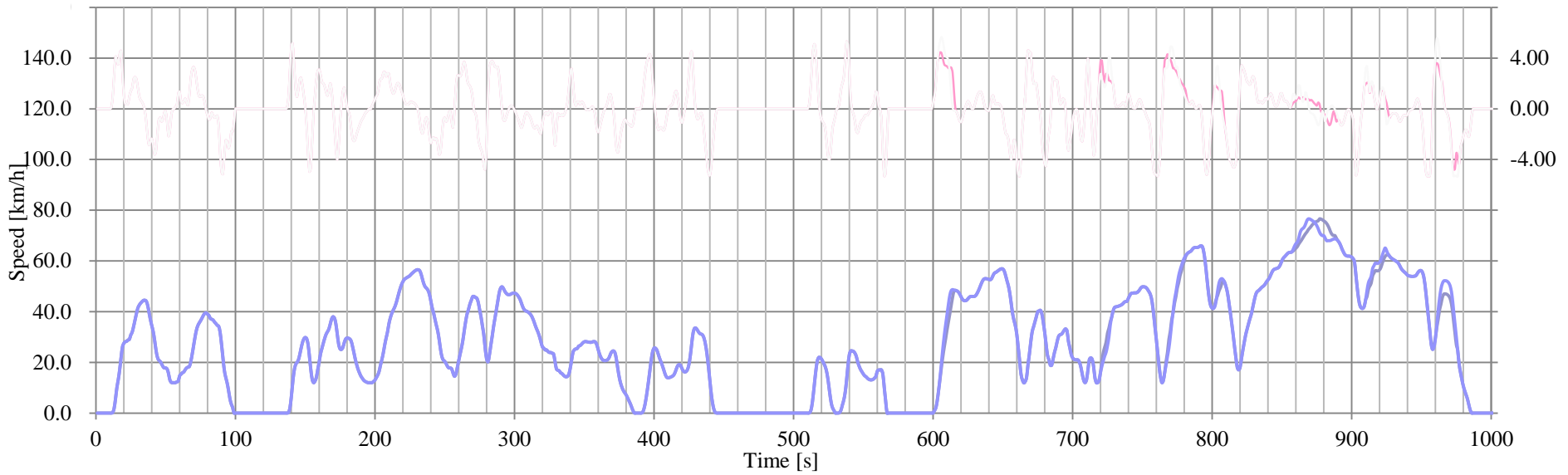
WLTP road map



WLTC Ver5.3 & 5.1

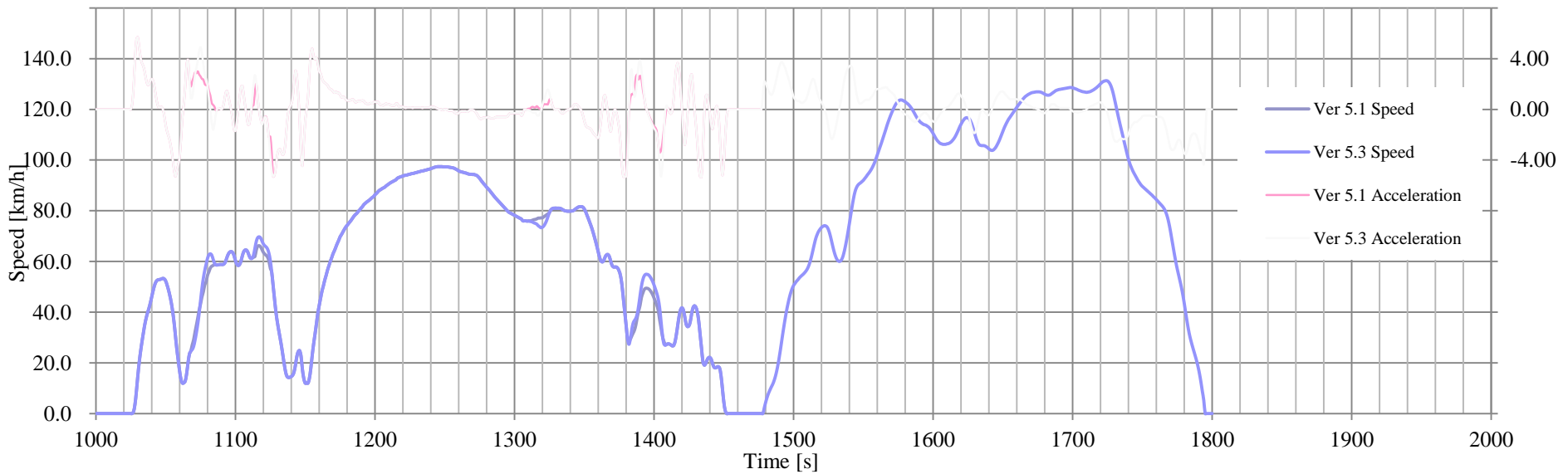
Low (589秒) (L3)

Middle (433秒) (M3)



High (455秒) (H3)

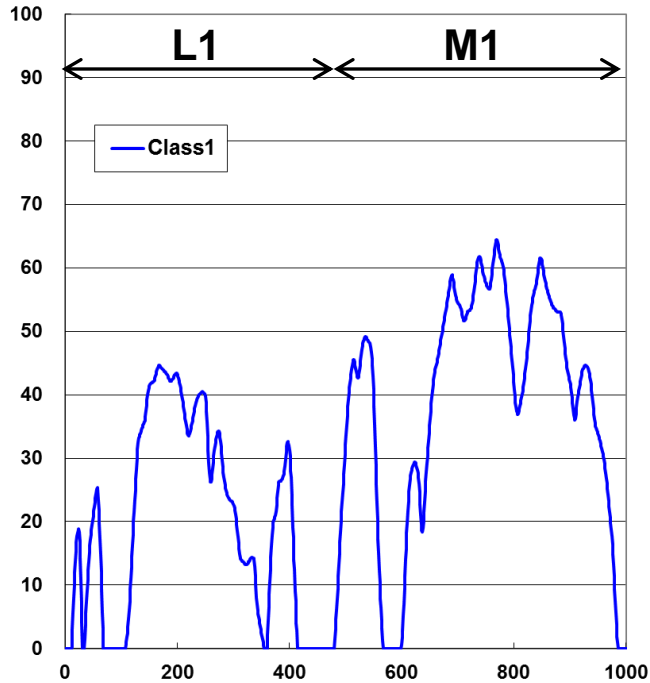
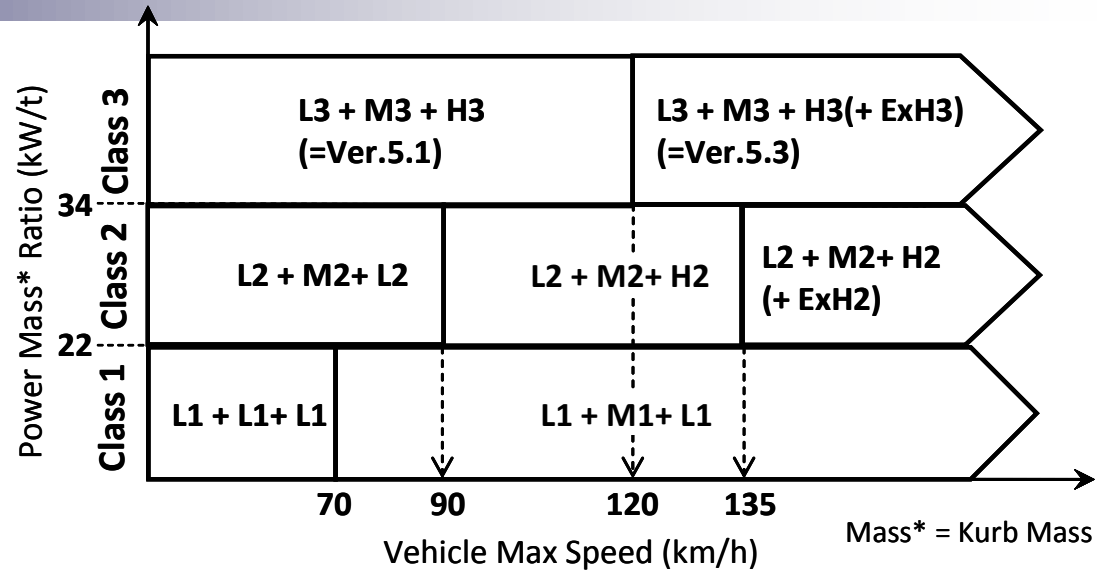
Ex-High (323秒) (ExH3)



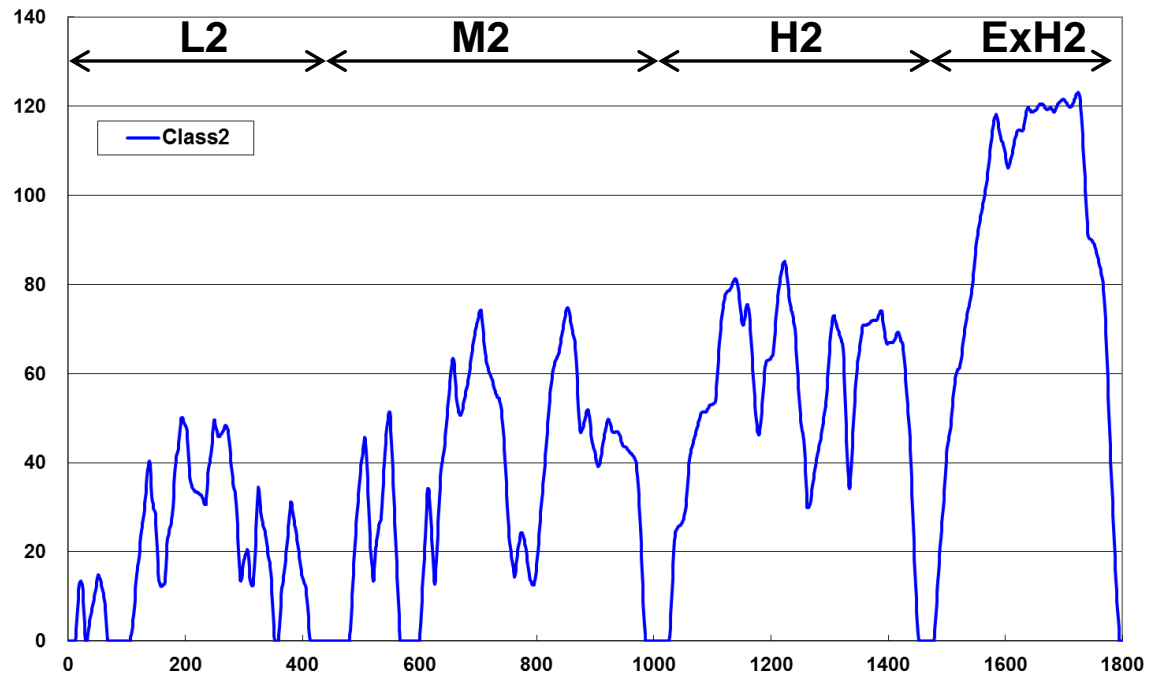
Vehicle classification

Low power vehicle (less than PMR 34kW/t)

- Class 1 : $PMR \leq 22$ kW/t
- Class 2 : $22 < PMR \leq 34$ kW/t



Class 1 WLTC



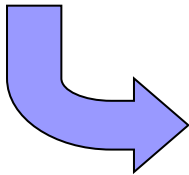
Class 2 WLTC

Electrified vehicle

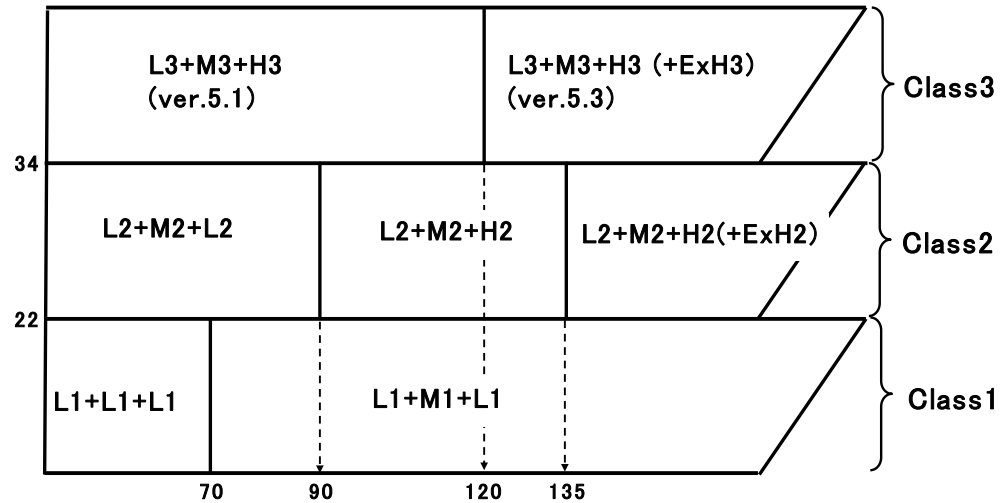
<u>OVC-HEV</u>	off-vehicle charging hybrid electric vehicle
<u>NOVC-HEV</u>	not off-vehicle charging hybrid electric vehicle;
<u>Pure electric vehicle (PEV)</u>	a vehicle with a power train where all energy converters are electric machines and all storage systems are rechargeable storage systems (ReESS)

Vehicle Classification for Electrified vehicle

To be same as ICE vehicle



PMR



Maximum speed

A power of OVC-HEV should be considered.

Motor power +ICE power

Motor power or ICE power

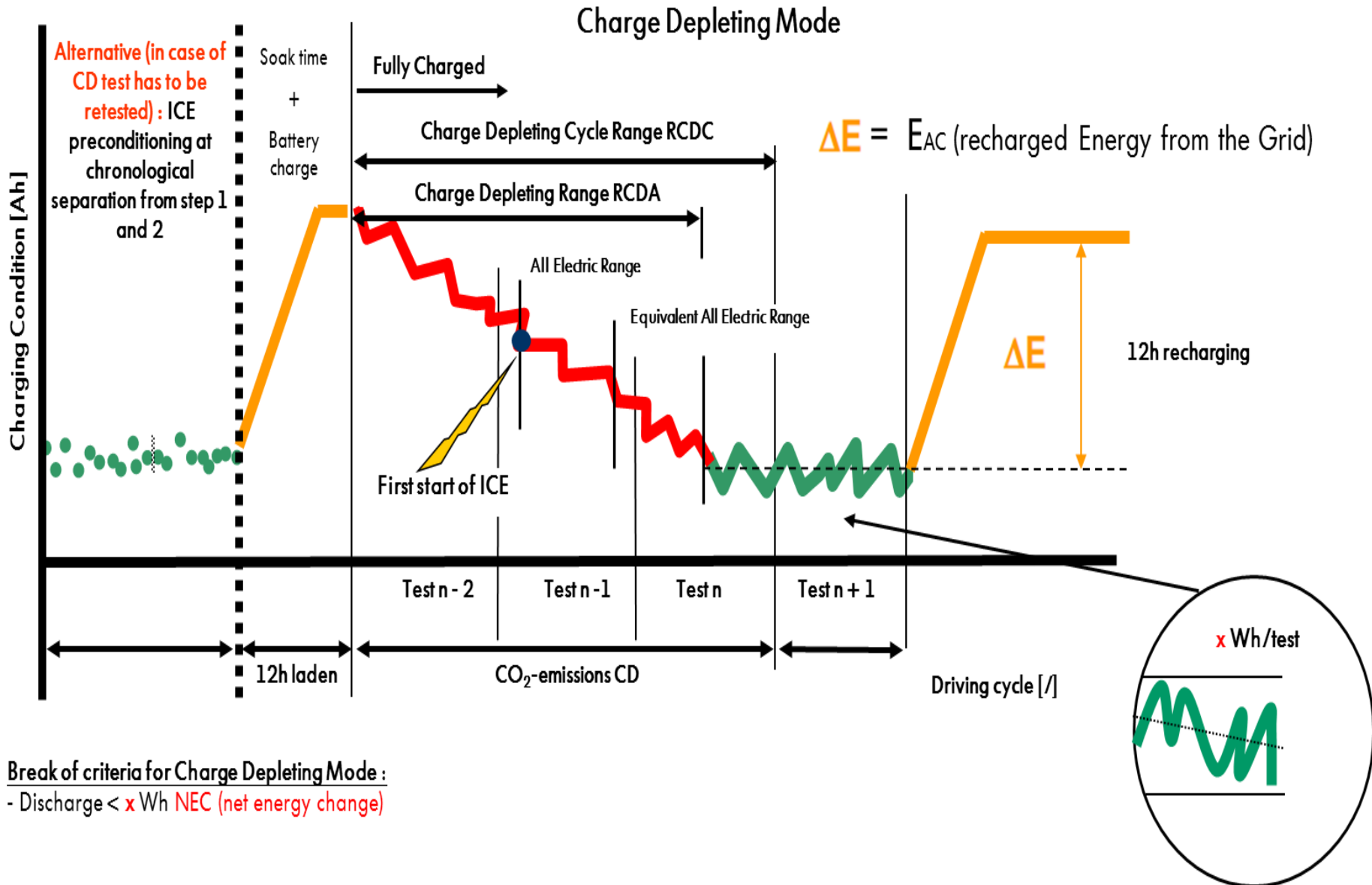
Hybrid system power?

**To move on Confirmation test,
No classification=>Class 3 all vehicle**

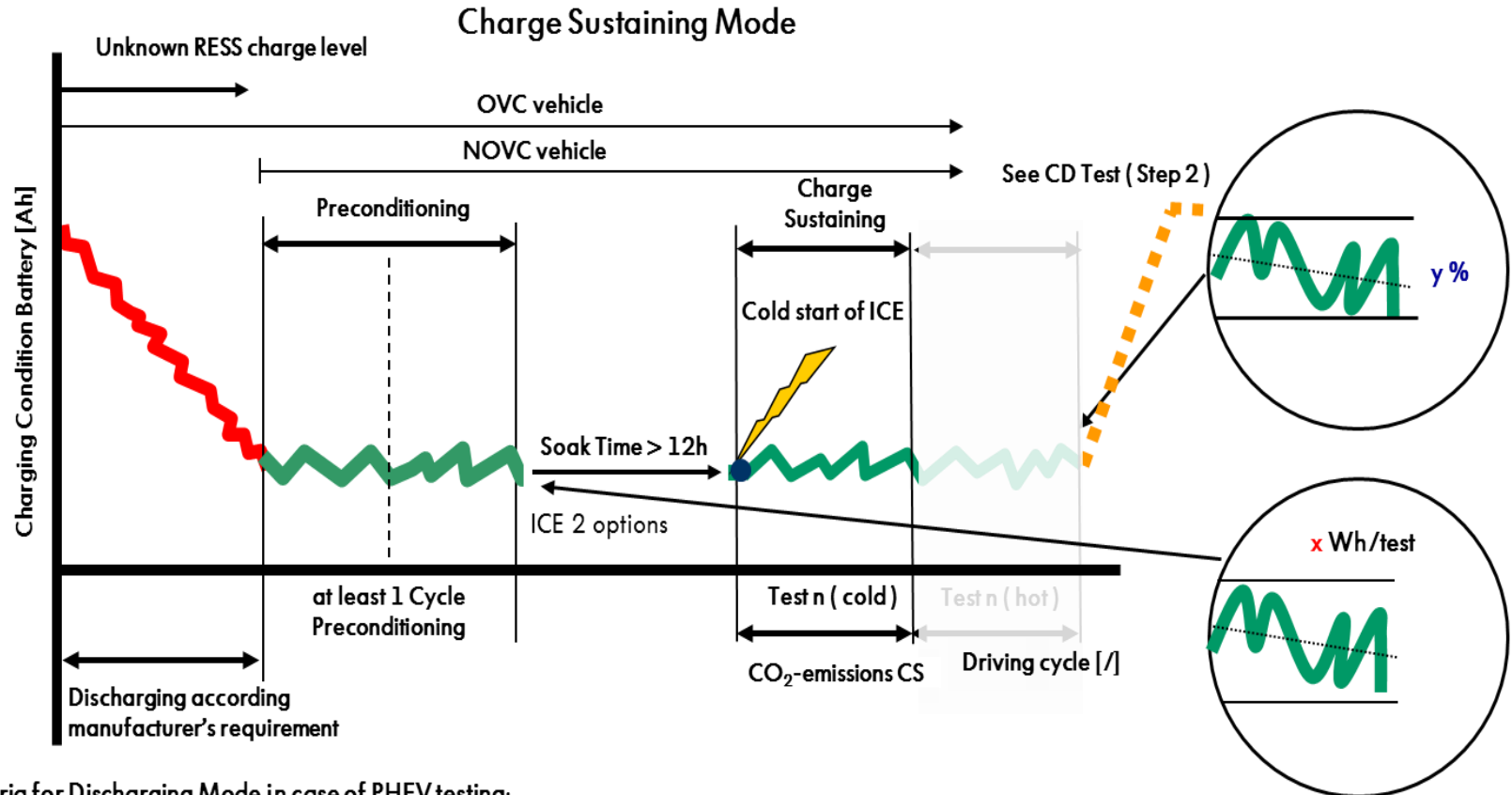
Japan proposed to use Maximum speed in R68 .
Maximum speed means:
For electric vehicle, the highest average value of the speed, which the vehicle can maintain twice over distance of 1 km.

To move on Confirmation test , Based on R68

Charge depleting test



Charge sustaining test



Break of criteria for Discharging Mode in case of PHEV testing:
 - manufacturer's requirement

Same break off criteria as for CD Mode: **X Wh**

Battery charging and soak condition

5.2.5.4. Battery charging and measuring electric energy consumption

The vehicle shall be connected to the mains within 120 minutes after the conclusion of the charge-sustaining Type I test. The energy measurement equipment placed between the mains socket and the vehicle charger shall measure the charge energy E and its duration. Charging stops when a fully charged battery is detected.

Soak condition

To be charged without forced cooling!



Battery temperature within criteria

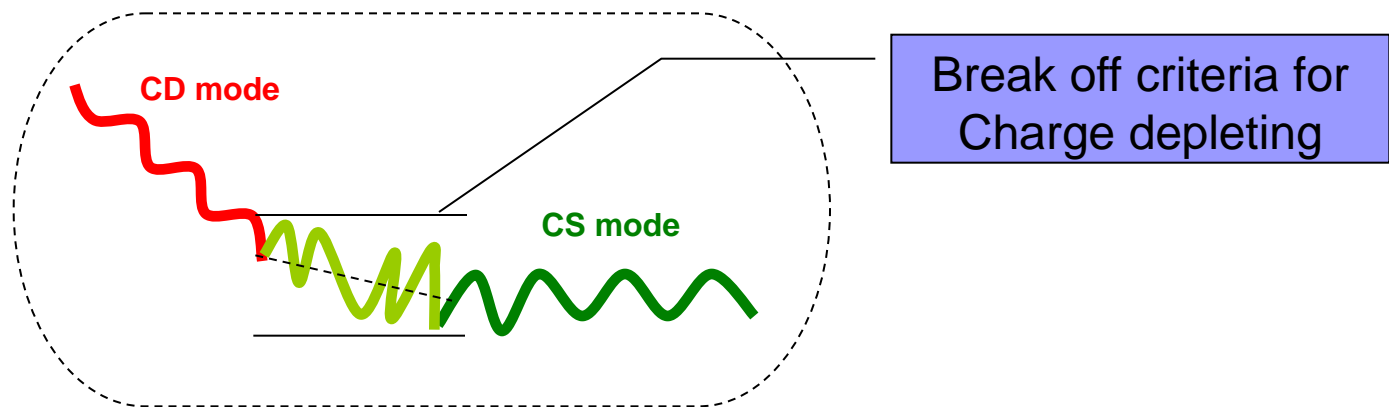


Open issues concerning gtr text

5.2.4.5. Break-off criteria

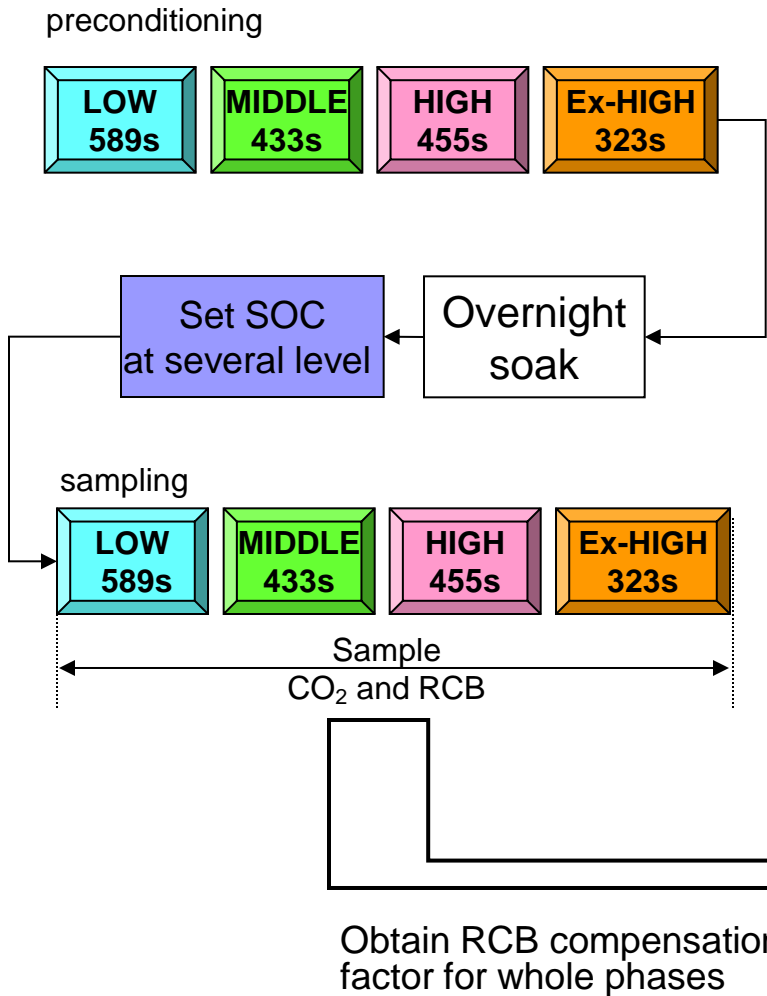
5.2.4.5.1. The break-off criteria for the charge-depleting test is reached when the relative net energy change as shown in the equation below is less than X per cent.

$$\text{Relative net energy change [\%]} = \frac{\text{NEC}}{\text{Cycle energy demand of the test vehicle}}$$

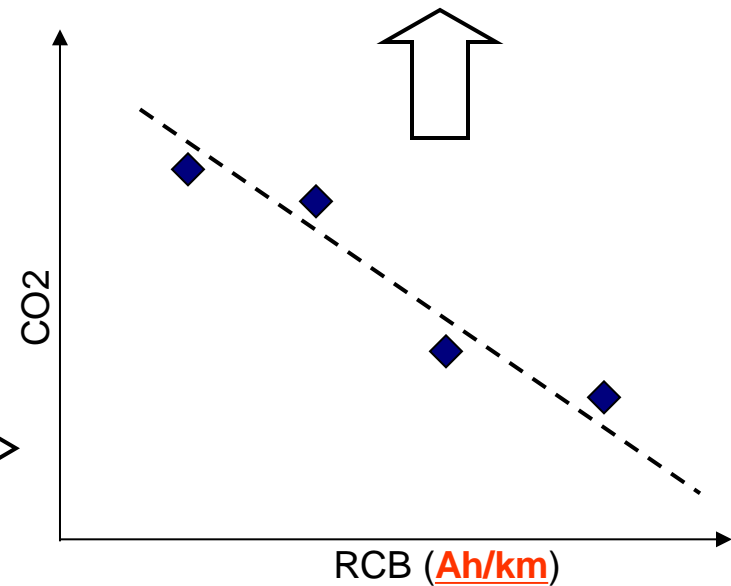


RCB Compensation Factor for CO₂

RCB factor for each phase and whole test phases

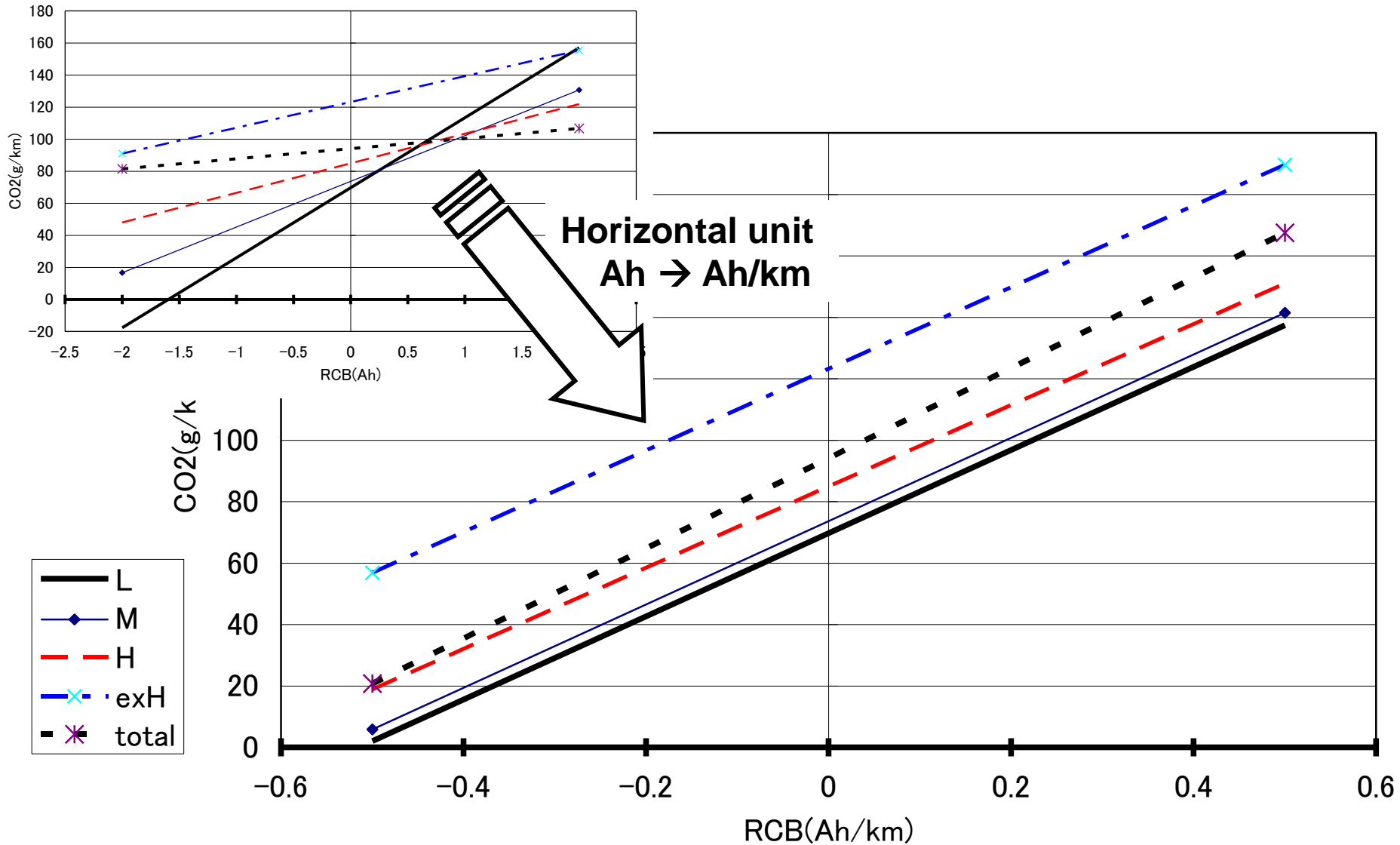


Phase	Compensation Factor
Whole phases (L ~ Ex-H)	measured
Each phase (L or M or H or Ex-H)	Apply whole phases factor (justification : ISO/TR 11955, also refer next page)
Specific combined phases (L ~ H, or others)	

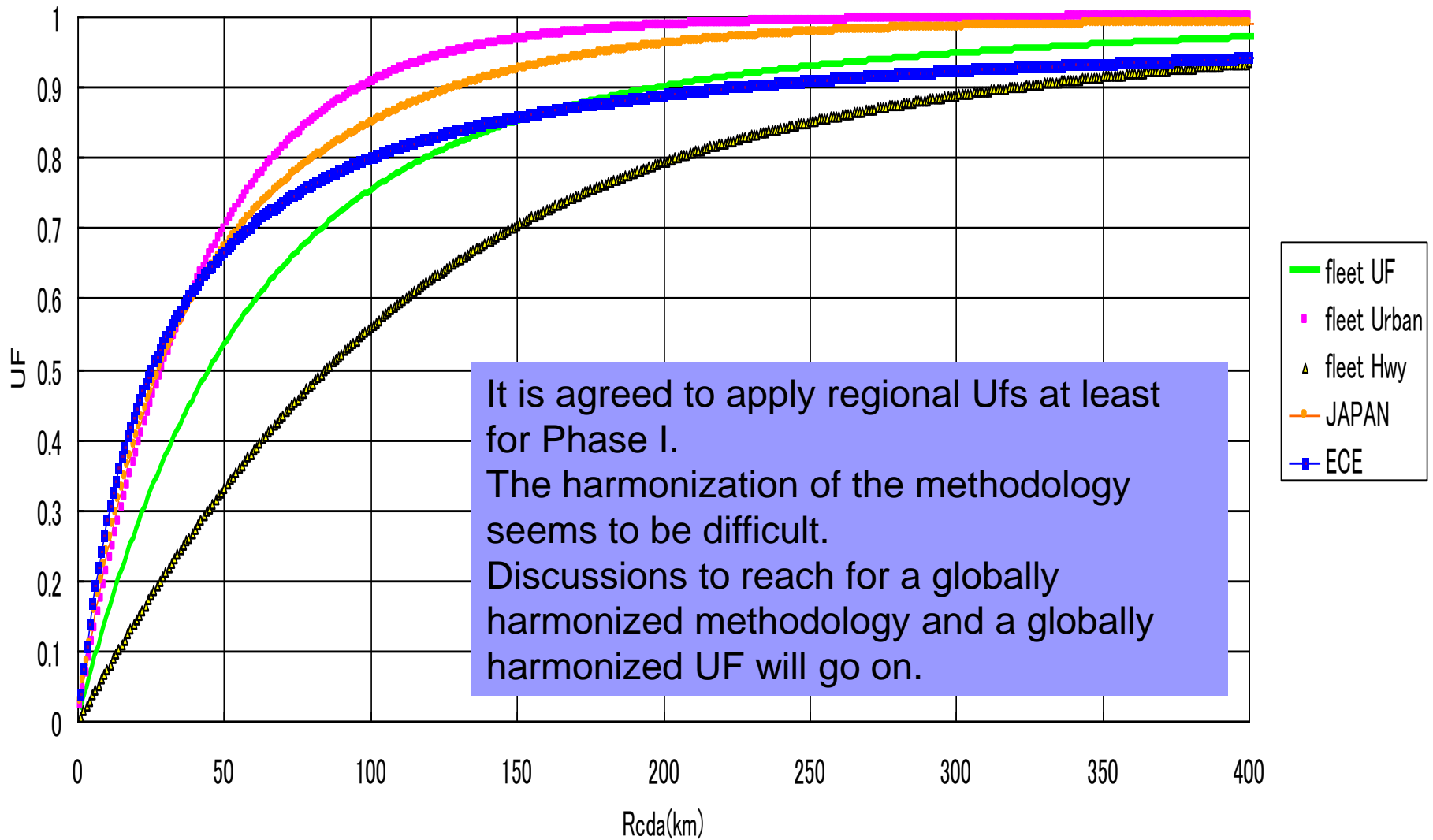


RCB Compensation Factor (Validation2)

NTSEL VALI2
CO2(g/km) - RCB(Ah)



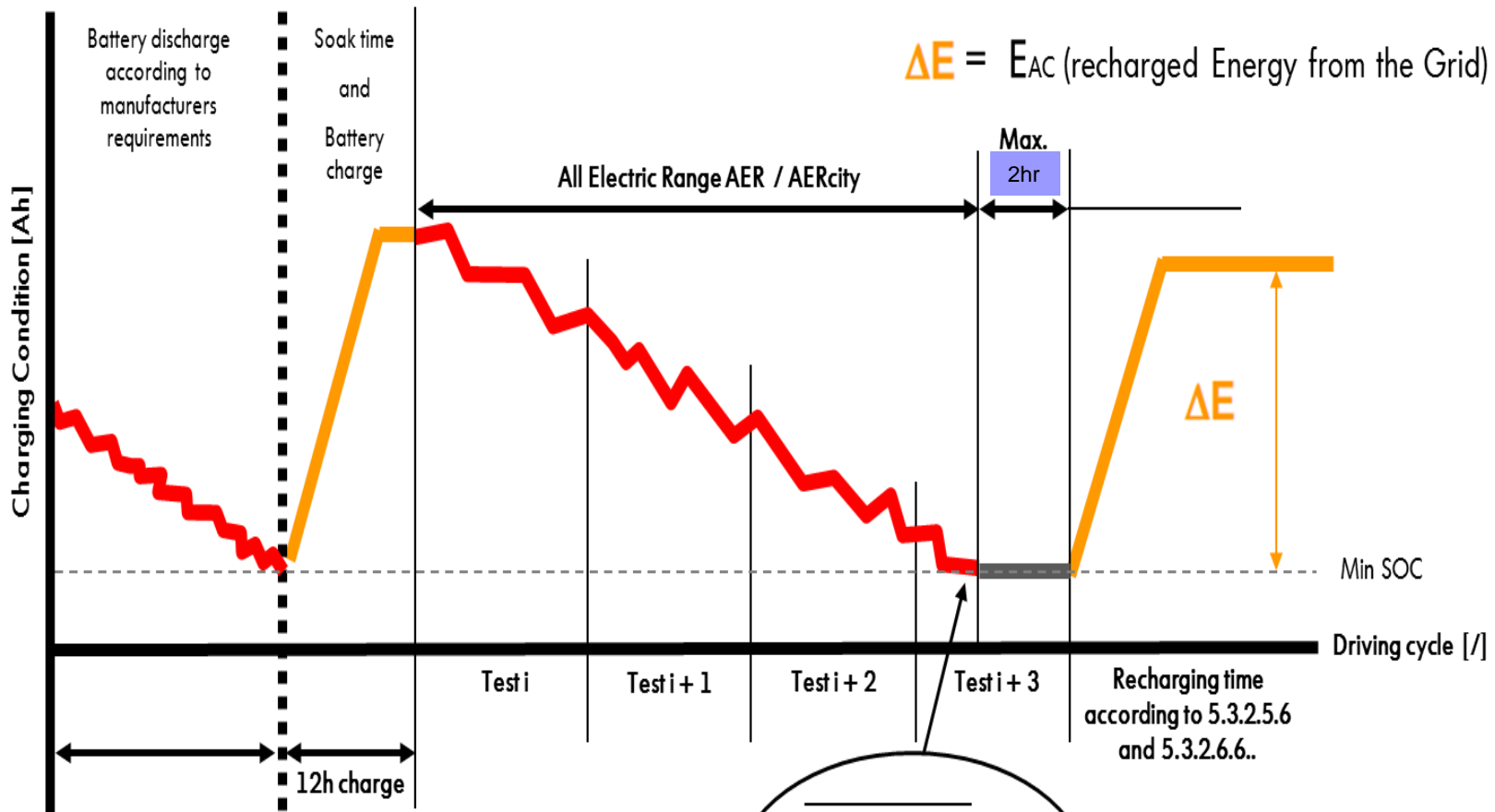
Current Utility Factor



It is agreed to apply regional Ufs at least for Phase I.
The harmonization of the methodology seems to be difficult.
Discussions to reach for a globally harmonized methodology and a globally harmonized UF will go on.

All electric range test for PEV

AER and AER(city) determination in case of (P)EV testing



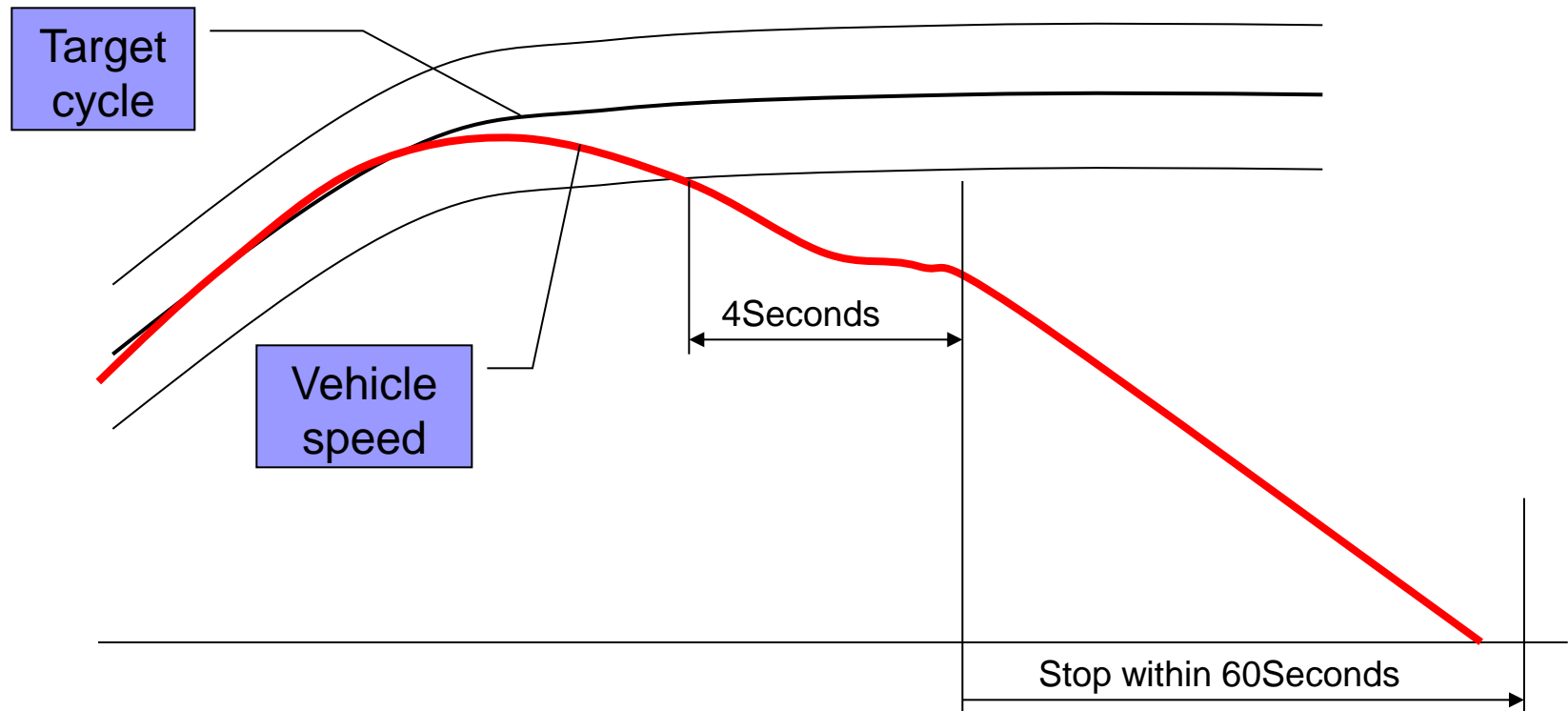
$$\Delta E = E_{AC} \text{ (recharged Energy from the Grid)}$$

End of AER test criteria:
according 5.3.2.5.4.
and 5.3.2.6.4. of this annex

5.4.2.4.1.3. The end of the test occurs when the break-off criteria is reached.

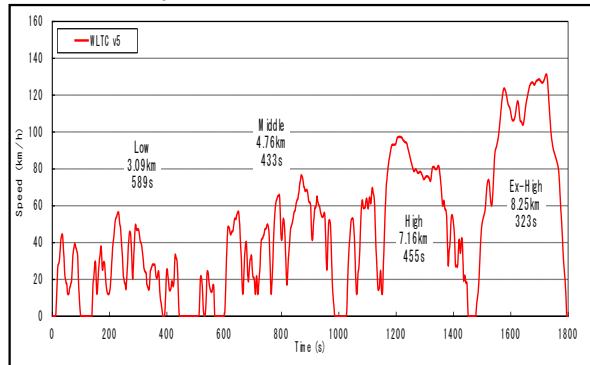
The break-off criteria shall have been reached when the vehicle cannot follow the driving trace for 4 seconds or more.

The acceleration controller shall be deactivated. The vehicle shall be braked to a standstill within 60 seconds.



Japan proposed Shorten test procedure based on SAE1634.

Shorten test procedure for WLTC (MCT)



- 1) To prevent uneven condition, number of Low / Middle should be several times.
- 2) Before CSCm and after CSCm should be same.

Low ₁ 3.09km) 9m in 49s	Middle ₁ 4.76km) 7m in 13s	High ₁ 7.16km) 7m in 35s	Ex-High ₁ 8.25km) 5m in 23s	Middle ₂ 4.76km) 7m in 13s	Low ₂ 3.09km) 9m in 49s	CSC _M 55mph 89km/h
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Low ₃ 3.09km) 9m in 49s	Middle ₃ 4.76km) 7m in 13s	High ₂ 7.16km) 7m in 35s	Ex-High ₂ 8.25km) 5m in 23s	Middle ₄ 4.76km) 7m in 13s	Low ₄ 3.09km) 9m in 49s	CSC _E 55mph 89km/h
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The distance exclude CSCm

Each phase	Low	Middle	High	Ex-High	Total	km
	12.36	19.04	14.32	16.5	62.22	
	2356	1732	910	646	5644	sec
	Low + Middle		High + Ex-High			
	31.40		30.82			km

Estimated Range with MCT

Phase	Measured Range (SCT)	Estimated Range (MCT)	Comparison SCT vs MCT	
Low	177.1km	183.2km	6.1km	3.6%
Middle	170.1km	172.9km	2.8km	1.7%
High	147.3km	146.1km	1.2km	0.8%
Ex-High	98.5km	99.5km	1.0km	1.1%

The results show that the error was small. Thus, it is considered that the shorten test procedure with MCT is usable.

Time reduction effect with the shorten test procedure with MCT

The measurement of AER and AER city with **SCT** consumed **2days**.

The measurement of four ranges with **MCT** consumed **3:30**.



Thank you for your attention!