

JAPAN Positions on
OIL#2&56 FC/CO₂ Family
and Combined Approach

Adoption of “Combined Approach” to electrified vehicles

- TOP PRIORITY : avoid unexpected “flexibilities”
- others : satisfy both technical justification and test effectiveness

Applicable Conditions - 1

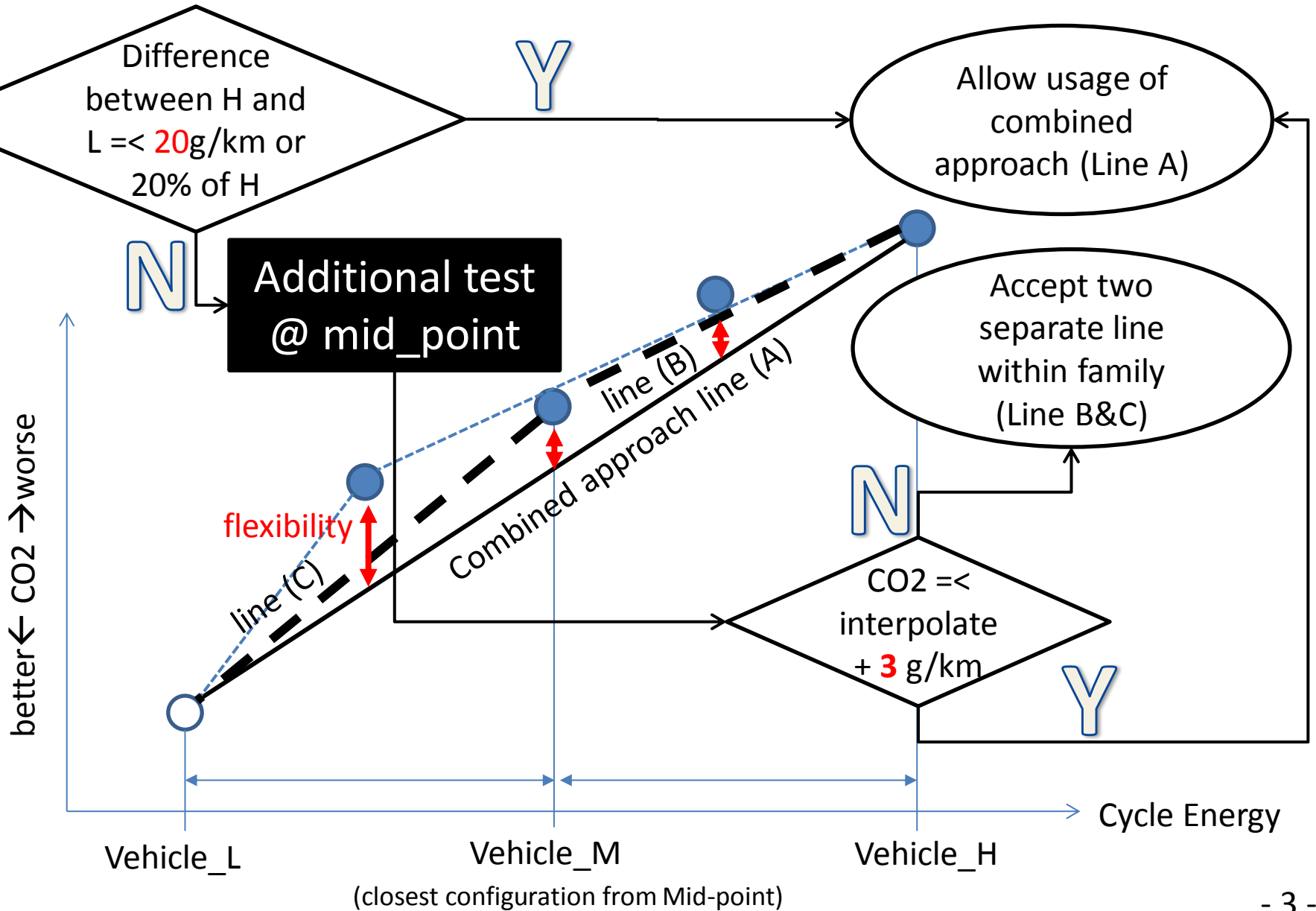
	Concerns	Additional conditions
NOVC-HEV OVC-HEV(CS)	Due to wider calibration freedom (two power sources), unexpected “flexibility” can be possible.	<p>(1) Narrow the applicable criteria (whichever smaller 20g/km or Vehicle_H 20%) or</p> <p>(2) Require additional testing @ mid-point cycle energy. In this case, applicable criteria is up to 30g/km and exempt Vehicle_H 20% criteria (please refer page_4)</p>
OVC-HEV(CD)	No linear relation with cycle energy (i.e. AER/Rcdc/EAER/EC)	<p>(1) same Rcdc and</p> <p>(2) if $\frac{AER^{BC}}{Rcda^{BC}} - \frac{AER^{WC}}{Rcda^{WC}} \leq 10\%$ apply to AER otherwise, use shortest AER within family</p>

Applicable Conditions - 2

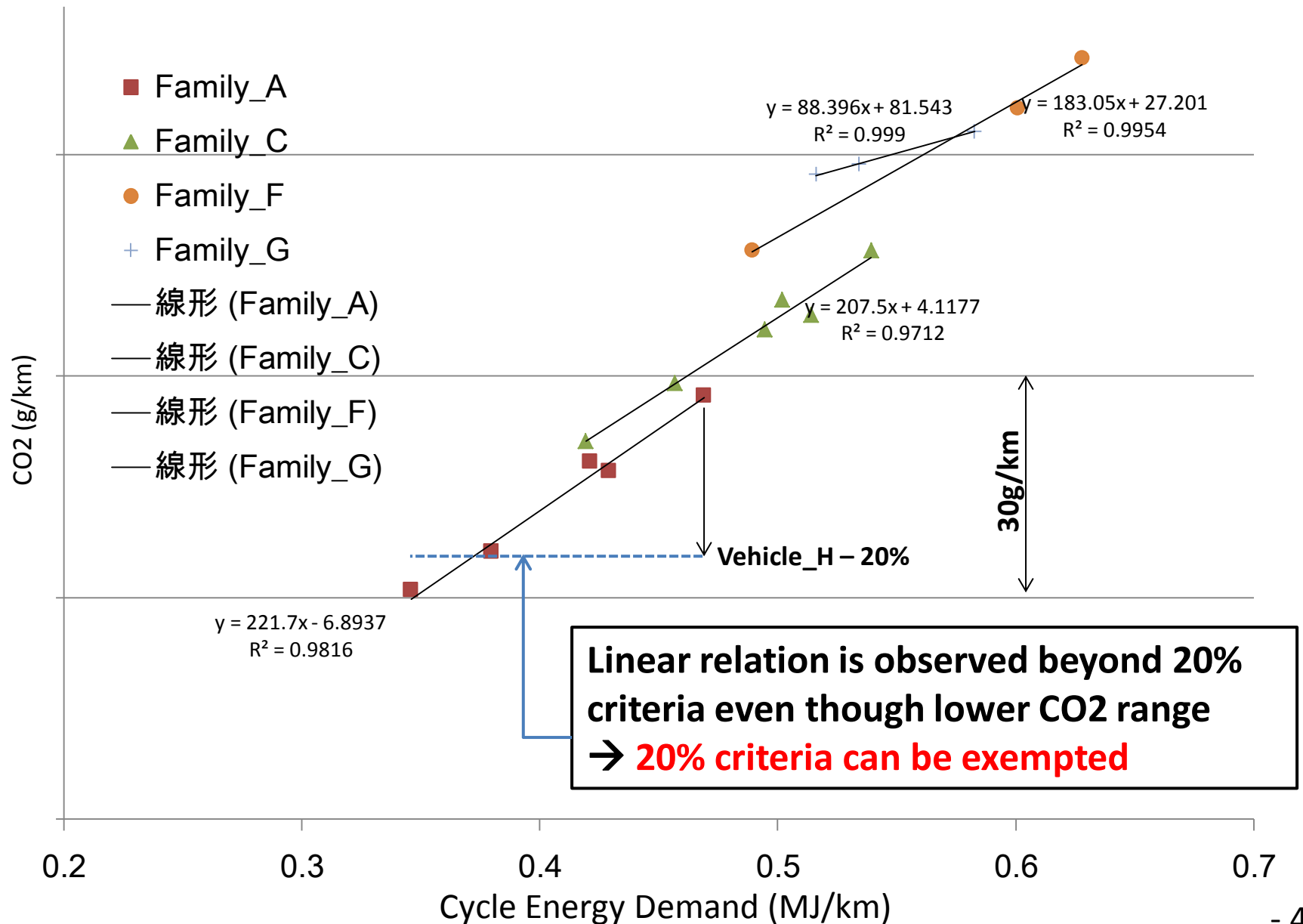
	Concerns	Additional conditions
PEV with shorten test procedure (STP)	No concern	Apply “combined approach” without additional conditions.
PEV with current gtr	No linear relation with cycle energy (i.e. AER/EC)	Depends on STP applicability
FCV	Due to few availability of vehicles and systems, doesn't possess enough data	Not apply “combined approach” until more data is available.

NOVC-HEV & OVC-HEV(CS)

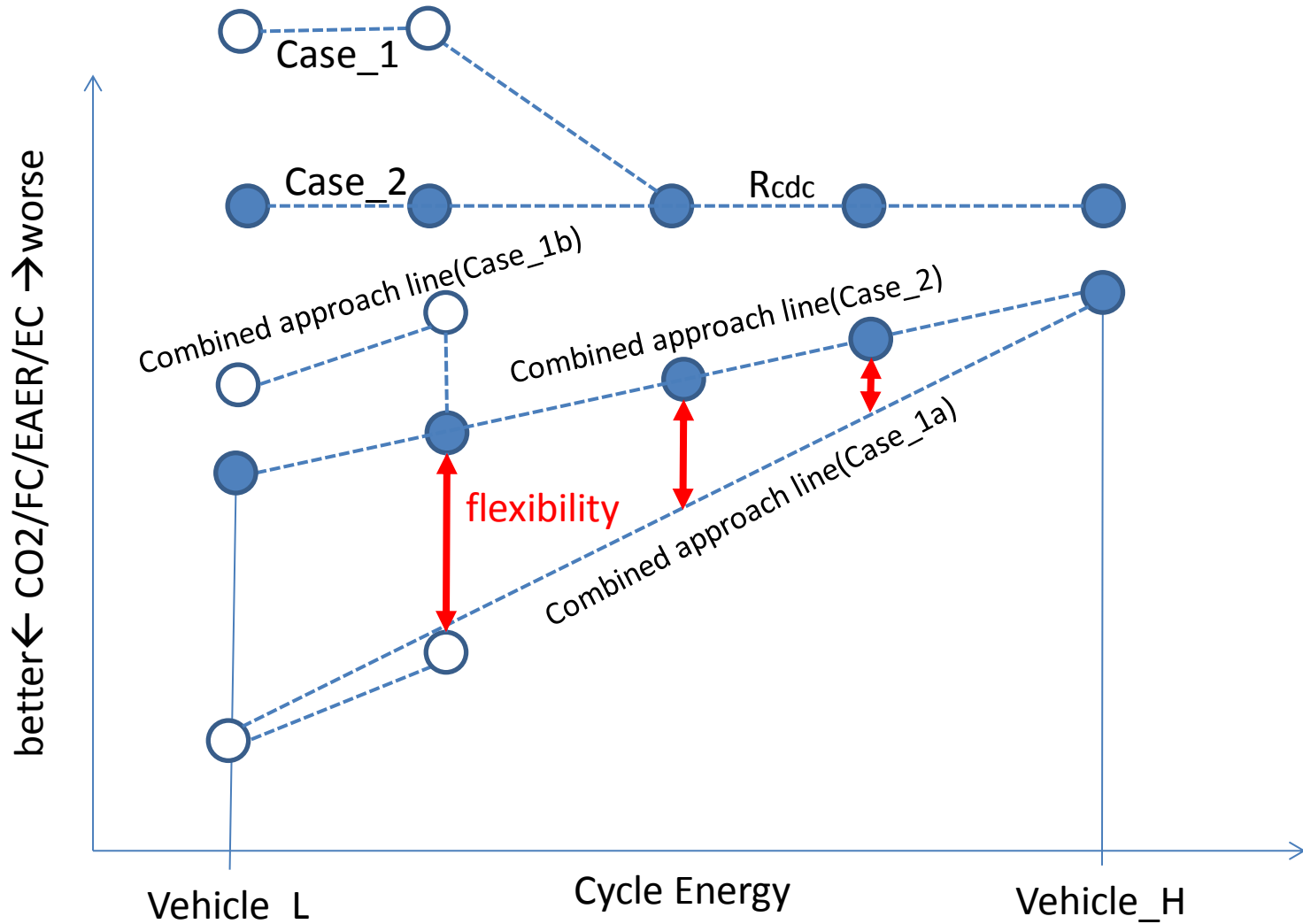
✓ How to avoid “flexibility” ?



✓ Vehicle_M test provides wider family criteria



OVC-HEV(CD)



Shorter R_{cdc} is not always worst case for CO₂/FC/EAER/EC.

→ R_{cdc} should be same within family

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-influencing components within the powertrain;
- (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) R_{cdc} 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

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;

NOTE) No unique methodology is necessary for each phase calculation when combined approach is applied.

The following matrix is presented during 7th E-Lab. SG meeting.

Japan position of required phase parameter

Emission compliance
In each cycle

		Each phase					L+M (regional option)					L+M+H(+Ex-H)				
		EM	CO2	FC	EC	Range	EM	CO2	FC	EC	Range	EM	CO2	FC	EC	Range
ICE		NA	NA	▲	NA	NA	NA	NA	NA	NA	NA	○ Annex 7 3.2.1	○ Annex 7 3.2.1	○ Annex 7 6.	NA	NA
NOVC-HEV		NA	NA	▲	NA	NA	NA	NA	NA	NA	NA	○ Annex 7 3.2.1	○ Annex 7 3.2.1	○ Annex 7 6.	NA	NA
OVC-HEV	CS	NA	NA	▲	NA	NA	NA	NA	NA	NA	NA	○ Anx 6 1.2.9/ Annex 8 4.1.1.2	○ Anx 7 3.2.1/ Annex 8 4.2.1.3	○ Anx 7 6./ Annex 8 4.2.1.3	NA	NA
	CD	NA	NA	NA	▲	▲ ^(*3)	NA	NA	NA	NA	○ ^(*1) Annex 8 4.4.1.1	NA	○ Annex 8 4.2.1.1	○ Annex 8 4.2.1.2	○ Annex 8 4.3.1.3	○ ^(*2) Annex 8 4.4.1.2 4.4.1.3 4.4.1.4
	Combined	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	○ Annex 8 4.1.1.3	○ Annex 8 4.2.1.4	○ Annex 8 4.2.1.5	NA	NA
PEV		NA	NA	NA	▲	▲ ^(*1)	NA	NA	NA	NA	○ ^(*1) Annex 8 4.4.2.2	NA	NA	NA	○ Annex 8 4.3.2.2	○ ^(*1) Annex 8 4.4.2.1
FCV		NA	NA	▲ ^(*4)	NA	NA	NA	NA	NA	NA	NA	NA	NA	▲ ^(*4)	NA	NA

○ : agreed, ▲:Japan requires

(*1) AER

(*2) EAER,Rcda,Rcdc

(*3) EAER,Rcda

(*4) consumed H2 / km