GRPE A-LCA IWG
SG5(EoL) Meeting 004

19th Oct. 2023

GRPE A-LCA IWG SG5
Leader ; Shoji Aoki (JASIC/JAMA),
Co leader; Zhang Tongzhu (CATARC)

Agenda

1. Opening speech by SG5 leader/Co leader **9:00- 9:10**

2. SG5 participant in person self-introduction **9:10- 9:20**

3. SG5 003 minutes and 004 agenda confirmation **9:20- 9:30**

4. EU EoL process sharing **9:30-10:10**

1) EU EoL process presentation (EU Aluminium、~~OICA~~)

~~2) Discussion about the difference among JPN, CHINA and EU~~

5. Recycling modeling Benchmarking #1 **10:10-11:10**

1) China (CATARC) study
2) PEF study (instead of OICA)
3) EU Aluminium study
4) Japan (JASIC) study
5) Discussion

~~**6. Controversial topics discussion** **11:10-11:40**~~

7. Wrap up and next action **11:40-11:50**

8. Closing speech by SG5 leader/Co leader **11:50-12:00**

Agenda

1. Opening speech by SG5 leader/Co leader

Agenda

2. SG5 participant in person self-introduction

Agenda

3. SG5 003 minutes and 004 agenda confirmation

Minutes of GRPE A-LCA IWG SG5 meeting #3

Date and time :Monday, September 4, 2023, 16:00–17:50 (JST)
Location :Online (Teams)
Attendees :See attendee list

Agenda:

1. SG5 002 minutes & 003 agenda confirmation
2. EoL LCA discussion
   1) EoL system boundaries and processes with activity data & intensity data
   2) Material/Parts recycling modeling
3. Next action

Notes:

1. SG5 002 minutes & 003 agenda confirmation

- The minutes and the agenda were unanimously approved.
- With regard to the material on the concept of levels that Mr Goy (OICA) had sent to the members of SG5 just before this 3rd meeting, there were the following questions and answers. It was such a difficult issue that further discussion was postponed to agenda item 2-2) on CFF.
  - Goy (OICA): According to the leading team's proposal, CFF is applied to critical materials and parts at level three. How will non-essential materials and parts be handled?
  - Yamamoto (JASIC): They are cut off.
  - Goy (OICA): I'm not comfortable with the idea of mixing different methods in this way.

2. EoL LCA discussion
   1) EoL system boundaries and processes with activity data & intensity data

- Mr. Yamamoto (JASIC) presented the Japanese situation. Dr. Cao (Nankai University) asked him about the setting of factor A, and the answer was postponed to agenda item 2-2) on CFF.

- Dr. Sun (CATARC) presented the Chinese situation. Questions and answers were as follow:
  - Yamamoto (JASIC): Considering the large size of the vehicle market in China, is 3.5 million as the number of vehicles dismantled per year very low?
  - Sun (CATARC): The total number of vehicles dismantled is 3.5 million. Only part of the ELVs are dismantled.
  - Yamamoto (JASIC): In the U.S., whose vehicle market size is almost the same as China's, the number of ELVs is about 10 million. Therefore, I thought the situation of ELVs in China was similar.
  - Yang (BRUNP): In China, ELVs are also repurposed and reused as well as dismantled.
- Japan and China EoL system boundaries and processes were recognized.

2) Material/Parts recycling modeling

- Mr. Yamamoto presented JAMA's CFF methodology. Questions and answers were as follows:
  - Sun (CATARC): We also have Chinese factors in CFF. We don't think Japanese factors are representative of the other regions of the world.
  - Yamamoto (JASIC): In my opinion, if we use CFF as a global methodology, we should use the same allocation factor (factor A), for specific material parts to avoid confusion. And we can set regional values for other factors.
  - Sun (CATARC): I agree that we should use the same allocation factor. We also have the Chinese automobile life cycle database, and we can make more representative factors in the world.
  - Goy (OICA): I think everyone agrees that we need a global value. However, I wonder how the global value is determined. If the value is a compromise, how does that affect the accuracy of the final results? The compromise value cannot be representative of regions.
  - Yamamoto (JASIC): Did my presentation answer Mr. Goy's first question at the beginning of the meeting?

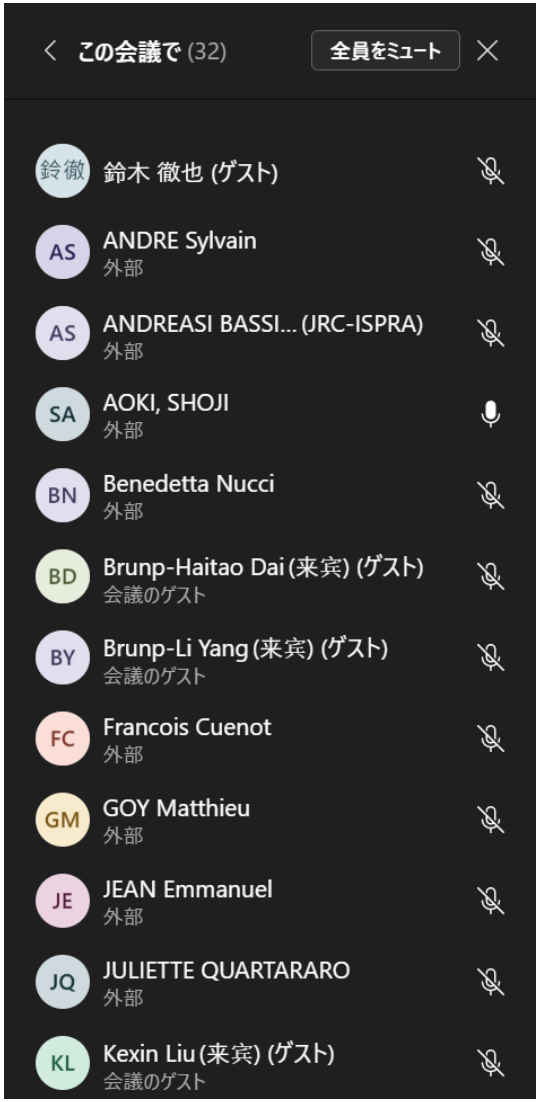
- Goy (OICA): I understand that JAMA will apply the CFF step by step. However, a new question has arisen. In the step-by-step approach, how do you compare the values between from CFF and cut-off and from CFF only?
- Yamamoto (JASIC): In my opinion, our goal is to establish the harmonized LCA methodology to determine the carbon neutral technology, not to compare CFP. Therefore, we need to evaluate different recycling technologies. The cut-off is not enough to evaluate all recycling technology, so the JAMA decided to introduce the CFF. The introduction is not for comparison at all.
- Goy (OICA): The comparison I mentioned is not comparison of the CFPs themselves, but of different time frames. For example, a comparison of Step1 and Step2.
- Aoki (JASIC): I think Mr. Goy mentioned the overarching aspect, because this kind of evolution problem occurs in the other stages, such as material, part, and vehicle production, as well as in the EoL stage. Anyway, it is clear that it is impossible to compare the methodology between the different generations.
- Goy (OICA): Accuracy of primary data makes it possible to compare values between the different levels.
- Aoki (JASIC): Anyway, since the CFF issue is the most controversial, we should not jump to the conclusion.
- Yamamoto (JASIC): We need to continue discussing pros and cons of each recycling methodology.

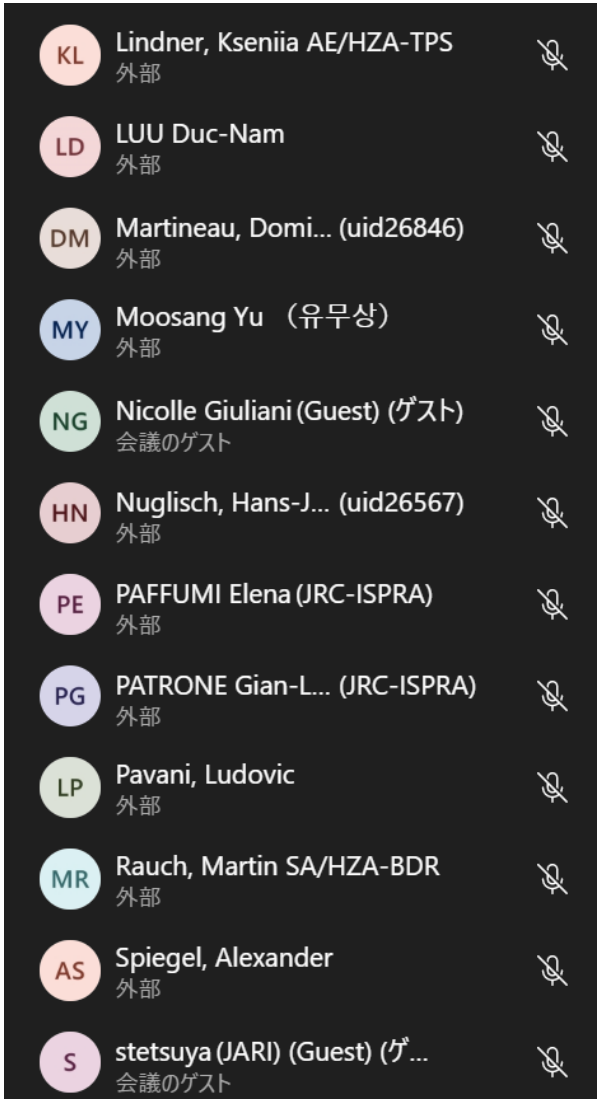
- It was reconfirmed to continue to discuss material/parts recycling modeling as the most important controversial topic.

3. Next action

- The leader, co-leader and all core participants agreed that the next SG5 meeting would be held in person in Brussels on October 19. Mr. Goy (OICA) will arrange the venue.
- At the next SG5 meeting the European situation of EoL will be shared. Dr. Nucci (European Aluminium) will prepare the presentation with the help of other European members.

Appendix 1: Attendee list





Agenda

4. EU EoL process sharing

1) EU EoL process presentation
2) Discussion about the difference among JPN, CHINA and EU

European Aluminium

END OF LIFE MODELLING

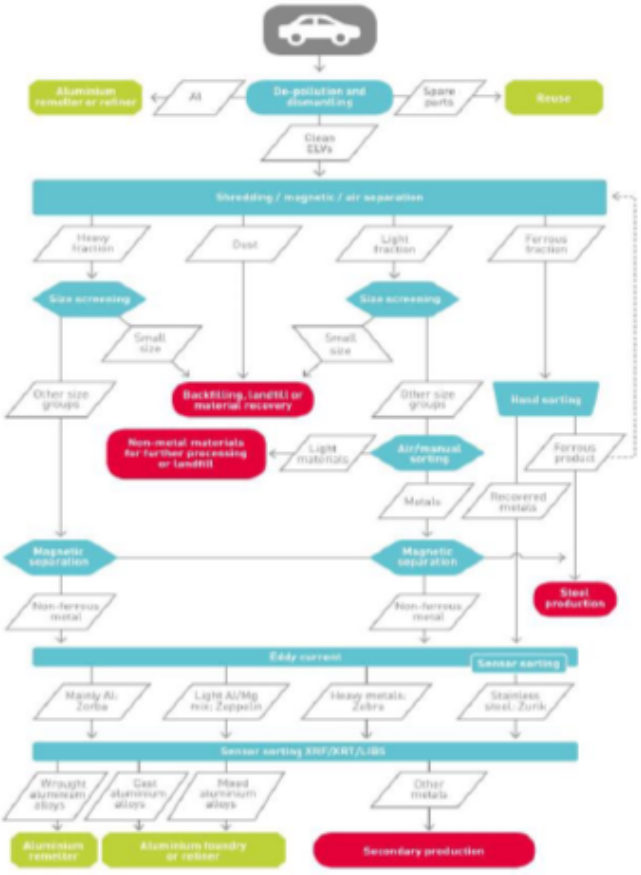
SG5 Meeting - Brussels

19th October 2023

Agenda

- Treatment of ELVs in Europe
- End-of-life modelling approach

Automotive



- ELV treatment in Europe is regulated today by the ELV directive
- Approx today there is 40% of vehicles of unknown whereabouts

- This directive is currently under review and requirements for EOL treatment may change (for example: increased dismantling + mandatory recycled content, etc)

ELV treatment today

1. Depollution (mandatory removal):

Treatment operations for depollution of end-of-life vehicles:

— removal of batteries and liquified gas tanks,

— removal or neutralisation of potential explosive components, (e.g. air bags),

— removal and separate collection and storage of fuel, motor oil, transmission oil, gearbox oil, hydraulic oil, cooling liquids, antifreeze, brake fluids, air-conditioning system fluids and any other fluid contained in the end-of-life vehicle, unless they are necessary for the re-use of the parts concerned,

— removal, as far as feasible, of all components identified as containing mercury.

2. Voluntary dismantling (mostly parts for reuse)

Treatment operations in order to promote recycling:

— removal or catalysts,

— removal of metal components containing copper, aluminium and magnesium if these metals are not segregated in the shredding process,

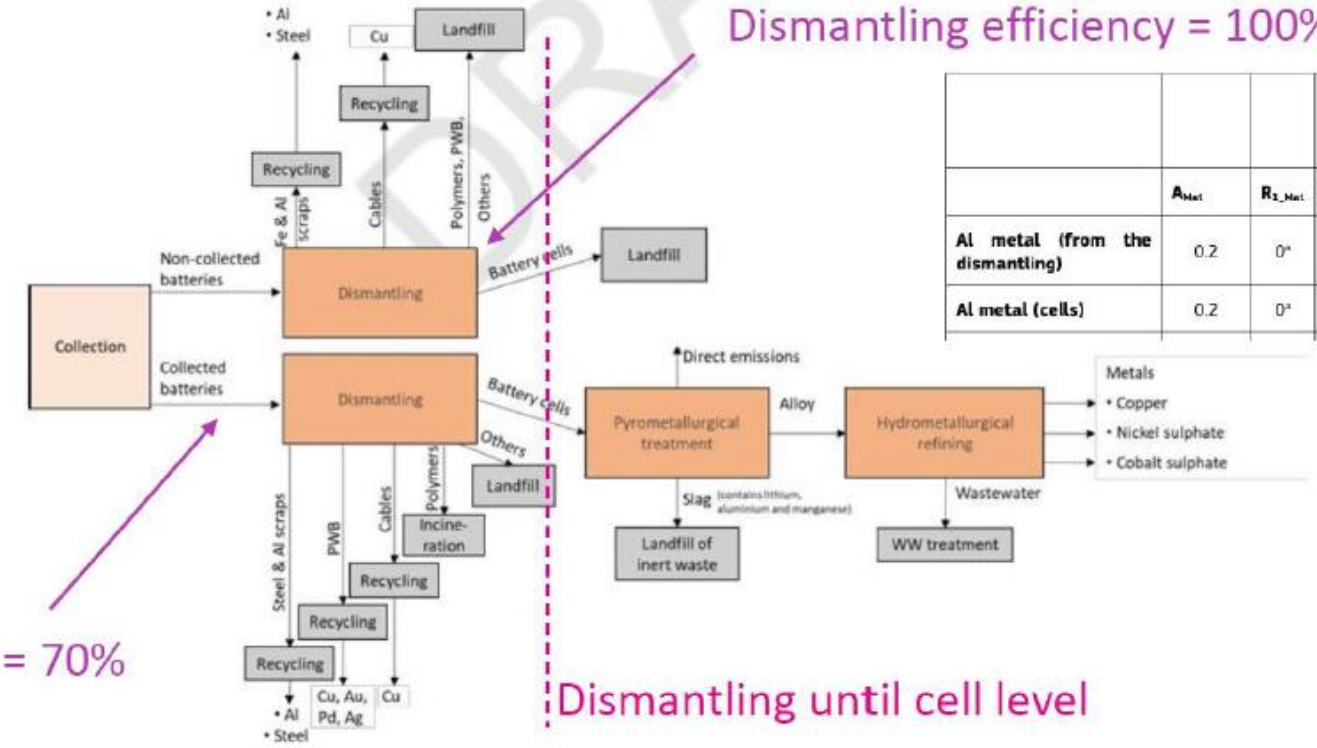
— removal of tyres and large plastic components (bumpers, dashboard, flui containers, etc), if these materials are not segregated in the shreddin process in such a way that they can be effectively recycled as material

— removal of glass.

3. Rest of the car is shredded and resulting fractior is sorted

Extract from batteries CF – draft delegated act

Figure 3. Schematic flowsheet of the default 'End-of-life' life-cycle stage of the battery in scope. PWB: printed wiring board.



Dismantling efficiency = 100%

				For the properly collected waste batteries		For the non-properly collected waste batteries	
	A_{Mat}	R_{1_Mat}	Q_{in}/Q_p	R_{rec,c_Mat}	$Q_{Sout,c}/Q_p$	R_{rec,nc_Mat}	$Q_{Sout,nc}/Q_p$
Al metal (from the dismantling)	0.2	0[a]	1	0.9	1	0.9	1
Al metal (cells)	0.2	0[a]	1	0[a]	1	0	1

R,coll = 70%

Dismantling until cell level

Source: JRC

How to measure the recyclability (of metals)

End-of Life recycling approach
OR
CFF modelling (A=0.2 for metals)

Recycled content

It may make sense for products containing materials for which recycling industry is not profitable and/or the market is not yet mature. In these cases, a requirement for high recycled content may stimulate recycling for materials/products that would otherwise be landfilled or incinerated.

- → Not appropriate for metal products: they are already efficiently collected and recycled within a well stablished recycling market.
- → The recycled metal content does not reflect the intrinsic recycling performances of a metal product in the A&T sector.
- → **It may create market distortions and environmental inefficiencies (redirection of scrap)**

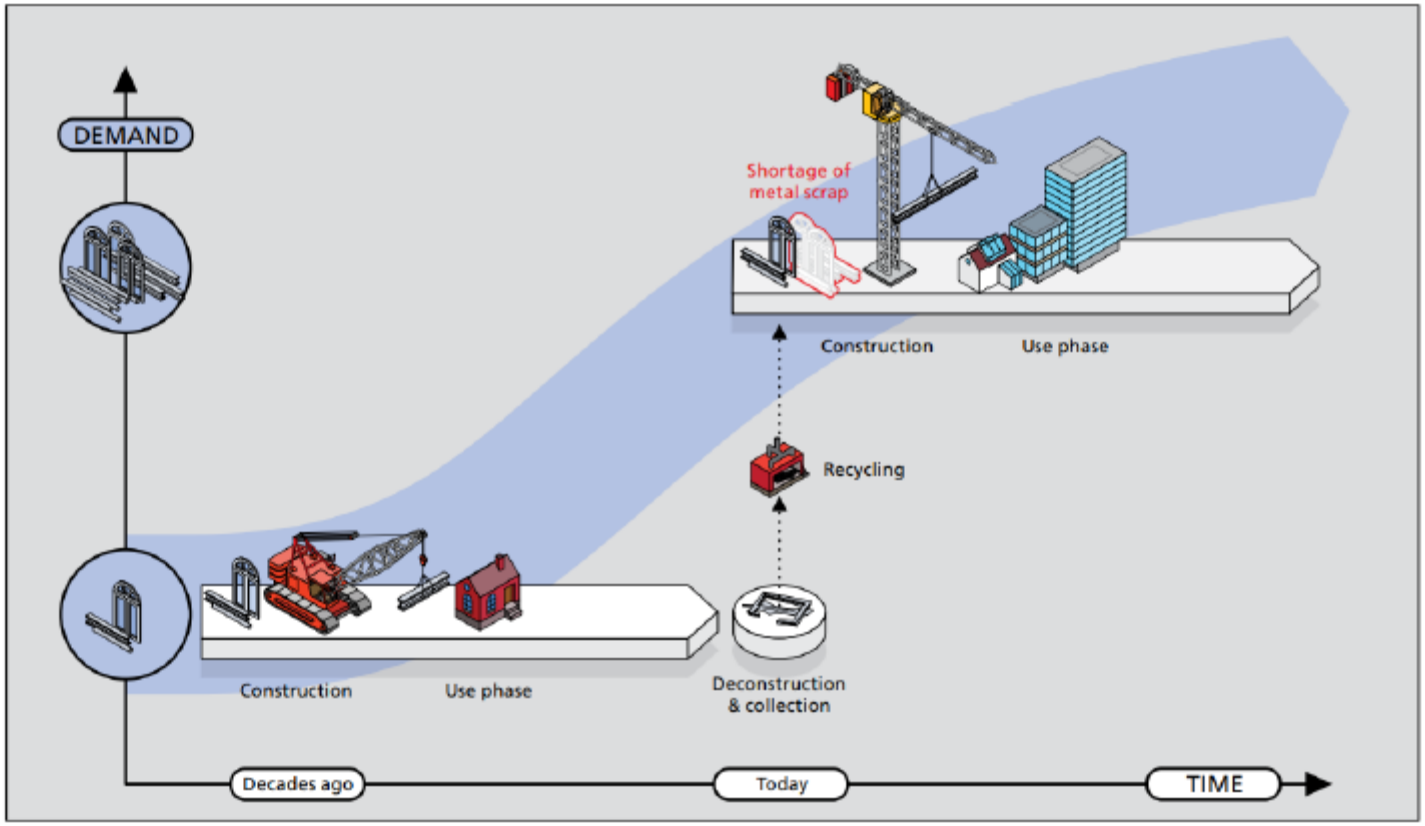
Aluminium, anything but basic!

End-of-Life recycling rate

Including losses during collection, scrap preparation and melting, it directly reflects the specific recycling performance of a material/product independently from market growth or its lifespan.

- → Most relevant indicator for metal products in order to maximise and preserve metal availability for future generations see Metals Declaration on Recycling (2006)
- → A designer using an end-of-life recycling approach focuses on optimizing product recovery and material recyclability.
- → By facilitating greater end-of-life recycling, the decisionmaker mitigates the loss of material after product use and supports decisions for an efficient market.

Availability of aluminium scrap



Picture from Metals for building flyer, available here

How to apply the CFF to intermediate materials

In cradle-to-gate PEF studies, the parameters related to the product's EoL (i.e. recyclability at EoL, energy recovery, disposal) shall not be accounted for.
R2=R3=Ed=0

Use and report the results with **two A values** for the product in scope:

→ **Setting A = 1**: to be used as the default in calculating the PEF profile. This value applies only to the recycled content of the product in scope. The purpose of this setting is to enable the hotspot analysis to be focused on the actual system.

→ **Setting A = the application- or material-specific default values**: these results shall be reported as 'additional technical information' and used when creating EF compliant datasets. The purpose of this setting is to enable the correct A value to be used when the dataset is used in future modelling.

R2=0

R2=0

$$(1-R_1)E_v + AR_1E_{rec} + R_1(1-A)E_v\frac{Q_{s,IN}}{Q_p} + (1-A)R_2E_{recEOL} - (1-A)R_2E_v^*\frac{Q_{s,OUT}}{Q_p}$$

If A=1

Ev and E*v

Ev: specific emissions and resources consumed (per functional unit) arising from the acquisition and pre-processing of virgin material.
E*v: specific emissions and resources consumed (per functional unit) arising from the acquisition and pre-processing of virgin material assumed to be substituted by recyclable materials.

From PEFCR for metal sheets:

*Ev and Erecycled shall include all the relevant processes up to the **point of substitution**.*
*The **point of substitution** can be defined as the point at which recycled material effectively substitutes primary material. In the case of metals, these recycling operations involve transforming metallic scrap (of varying composition) into metallic ingot, slab or billet of specified purity and composition with well-defined properties. These recycling operations can include smelting, refining, melting and alloying processes.*
For metal sheet, the point of substitution can be defined at different places of the production chain.
***For aluminium and steel sheet the point of substitution is at slab,** which is the starting material for sheet production.*

Our proposals concerning E*v

When the results of the PEF study of a final product containing aluminium are communicated to the public (B2B and B2C), European Aluminium recommends two options for the calculations of the results.

Option 1

E*v= same dataset used to model Ev

Option 2

E*v=6.8 kg CO_2/kg aluminium (representing the average European production of primary aluminium), but E*v=Ev when Ev<6.8 kg CO_2/kg aluminium

THANK YOU!

Presented by

Benedetta Nucci

Senior Manager Mobility & Life Cycle Assessment

European Aluminium

ANYTHING BUT BASIC

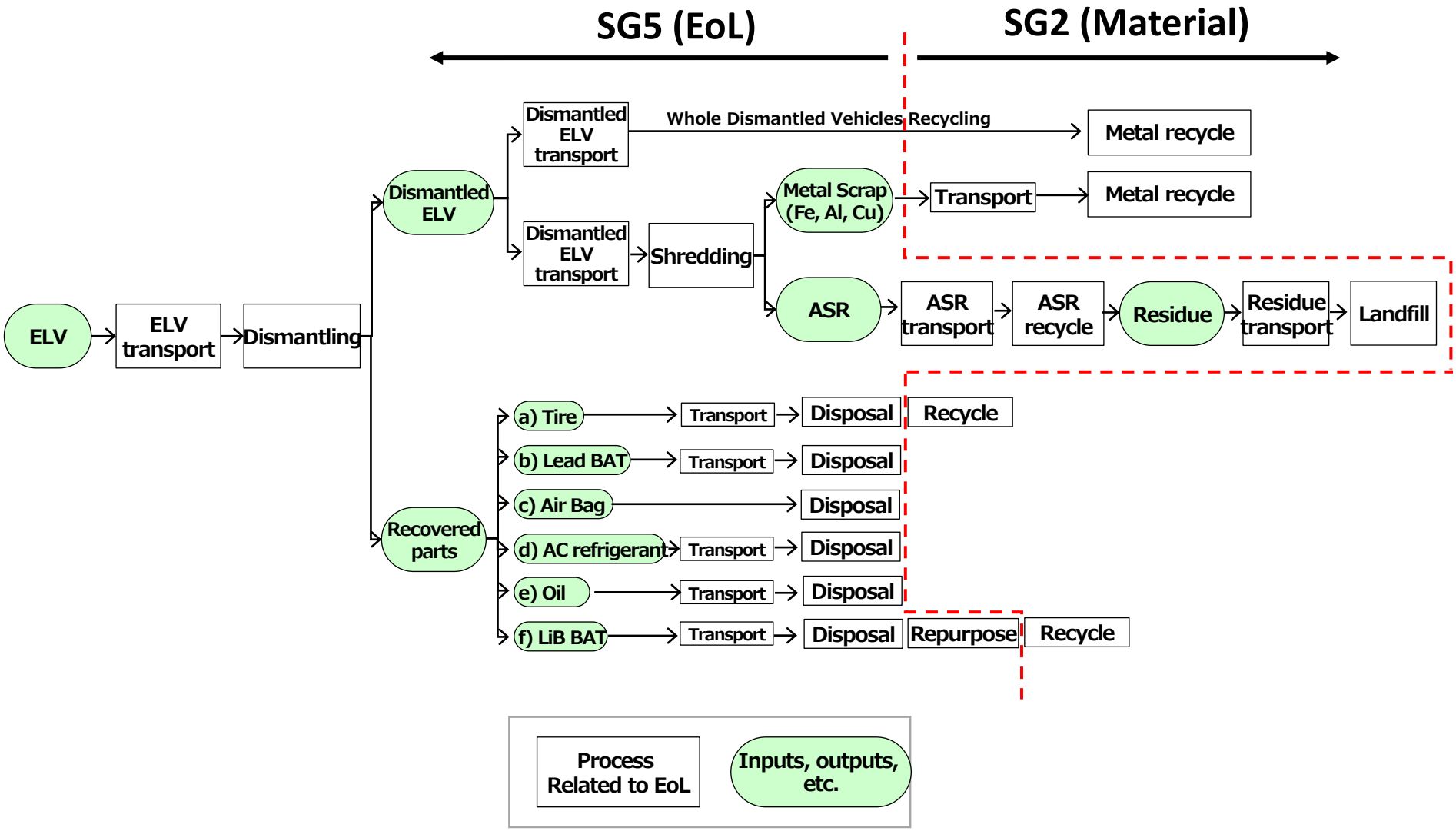
european-aluminium-association

eu_aluminium

EuroAluAssoc

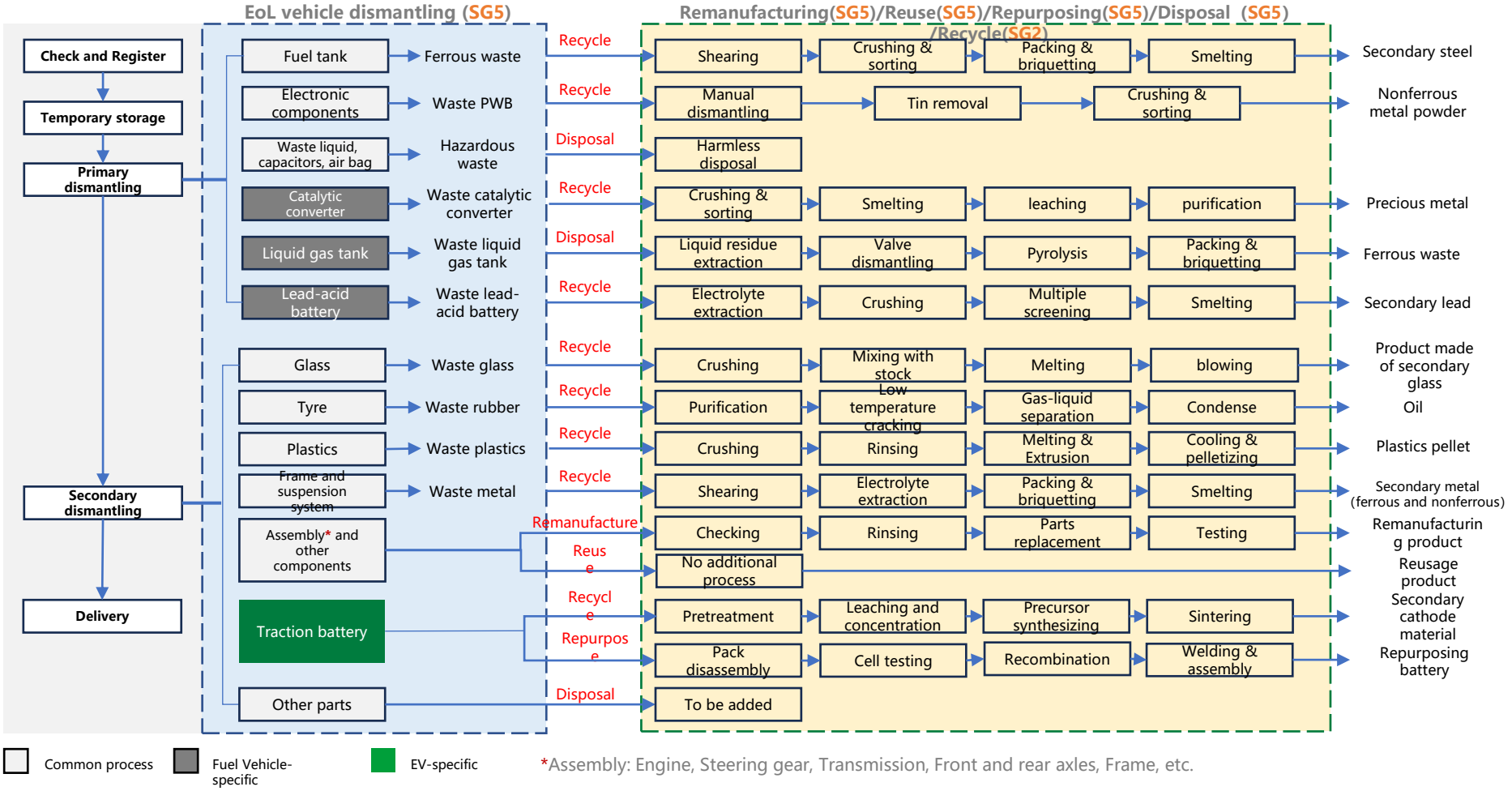
european-aluminium.eu

4-2-1. EoL system boundary –Japan-



4-2-2. EoL system boundary –China-

2 Dismantling parts processing of EoL vehicle



Agenda

5. Recycling modeling Benchmarking #1

1) China (CATARC) study
2) PEF study (instead of OICA)
3) EU Aluminium study
4) Japan (JASIC) study
5) Discussion

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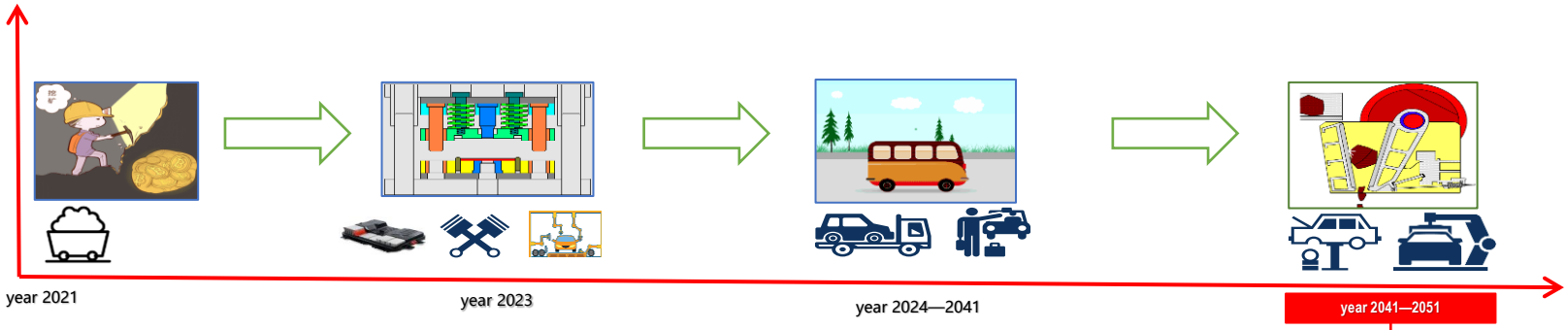
CFF method and CUT-OFF method

in LCA methodology

<CATARC Recommendation>

Both methods should be in the standard

- **First is CFF method** for the purpose of comparing different technical route
- **Second is CUT-OFF method** for the purpose of comparing different individual products



1、CFF method

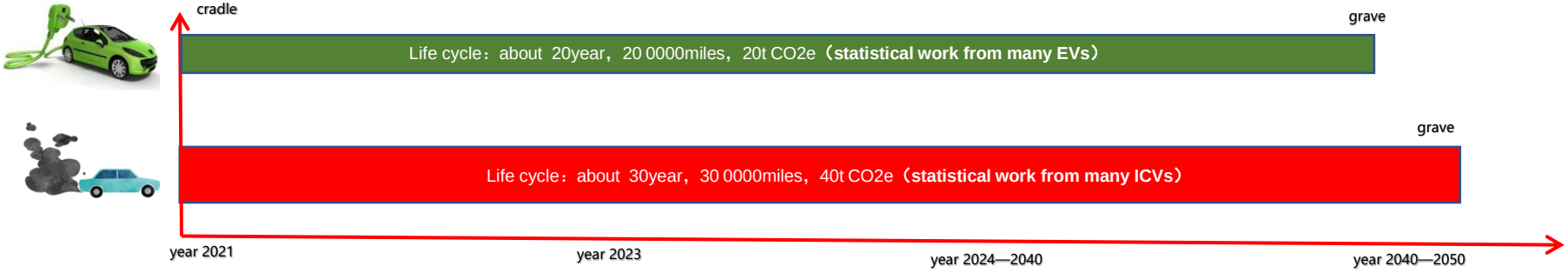
At the year 2051, we can make life cycle assessment by using CFF method, for the purpose of camparing different technical route:

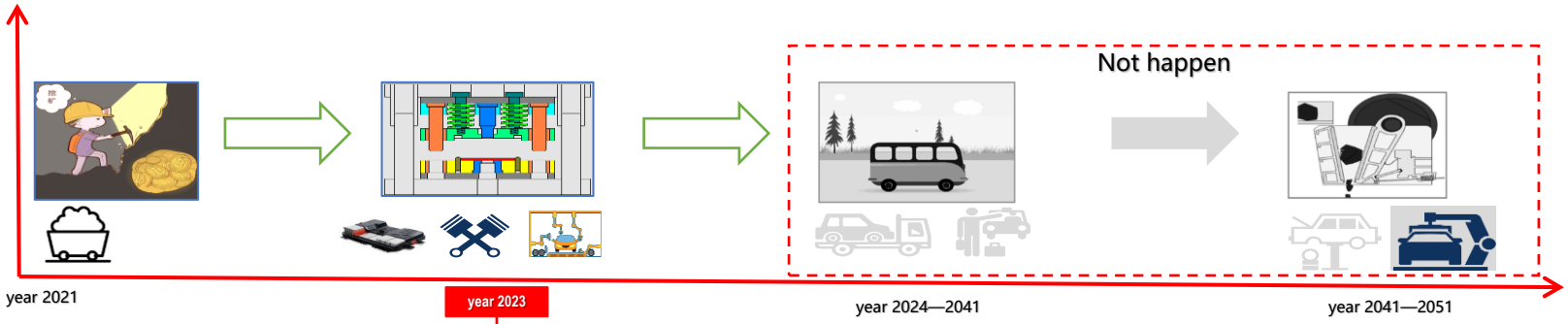
1、Finish the life cycle GHG inventory compiling of **a lot of vehicles** from cradle to grave ;

2、Finish the calculating of the total carbon footprint of **many Vehicles**;

3、Give the **default data** of carbon footprint of materials, components, transportation, Vehicles and so on;

4、Compare the carbon footprint level of **different types of vehicles**（using **default data** of whole Vehicles）。





2、CUT-OFF method

At the year 2023, we can make partial life cycle assessment by using cut-off method, for the purpose of camparing individual Vehicle:

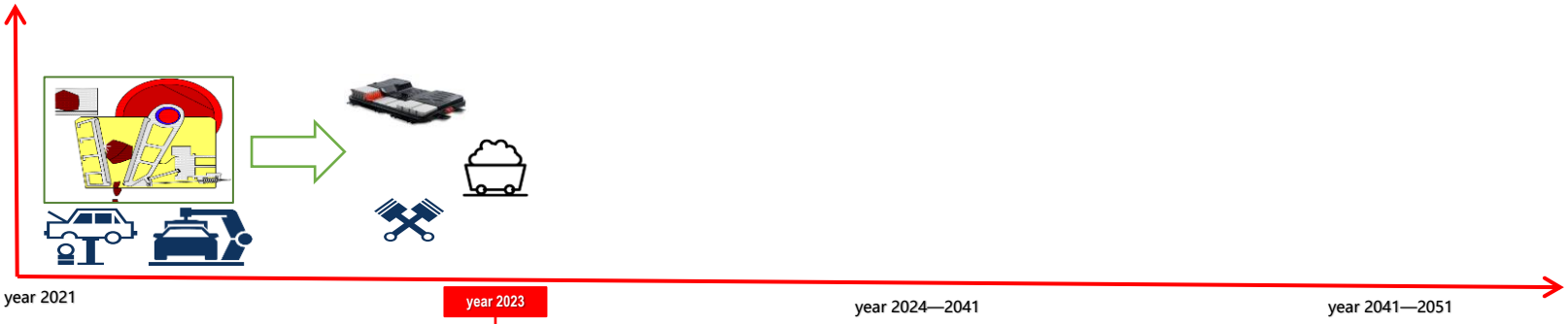
1、Finish the life cycle GHG inventory compiling of **individual vehicle** **from** **cradle to gate** ;

2、Finish the calculating of the total carbon footprint of **individual** Vehicle;

3、Give the **primary data** of carbon footprint of materials, components, transportation, Vehicles and so on;

4、Compare carbon footprint level of different **individual vehicles**（using **primary data and punitive secondary data of** Vehicles）

5、Recycled material usage can be considered at the material stage, EOL stage will be cut-off.



3、For the purpose of promoting recycling

At the year 2023, many Vehicles are disassembled and recycled, these Vehicles are manufactured many years ago, now, we can:

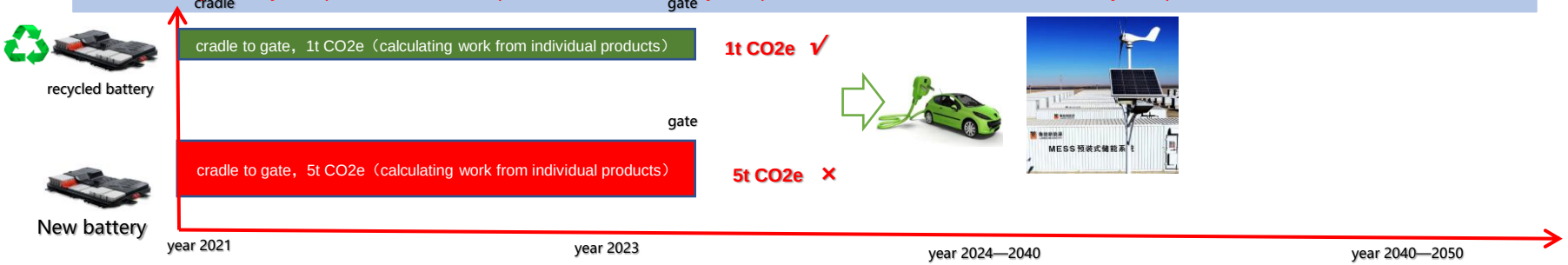
1、Finish the life cycle GHG inventory compiling of **individual End-of-life vehicle** **from cradle（ELV） to gate（recycled products）**：

2、Finish the calculating of the total carbon footprint of **individual** recycled products（reused parts，remanufactured parts，repurposed part，materials）；

3、Give the **primary data** of carbon footprint of recycled materials，recycled components，and so on；

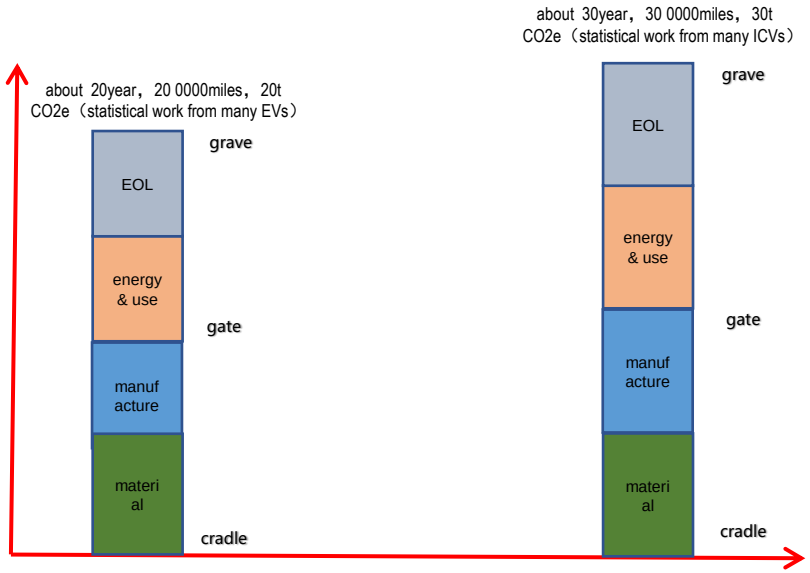
4、Compare carbon footprint level of different **individual recycled products**（using **primary data and punitive secondary data of** recycling process）

5、Focusing on recycled products，we can promote the use of recycled products，because low carbon of recycled products



1、For the purpose of comparing different technical routes（EVs & ICVs）

CFF method



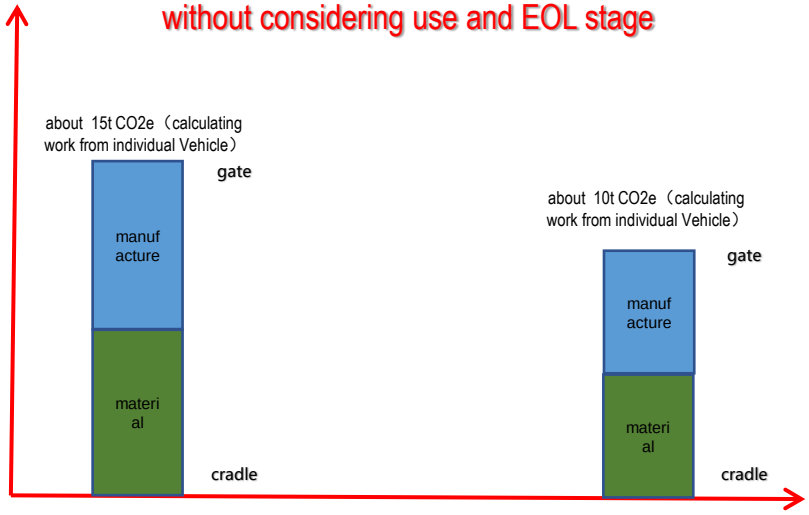
EVs

VS

ICVs

2、For the purpose of comparing different individual Vehicles（EV a & EV b）

cut-off method



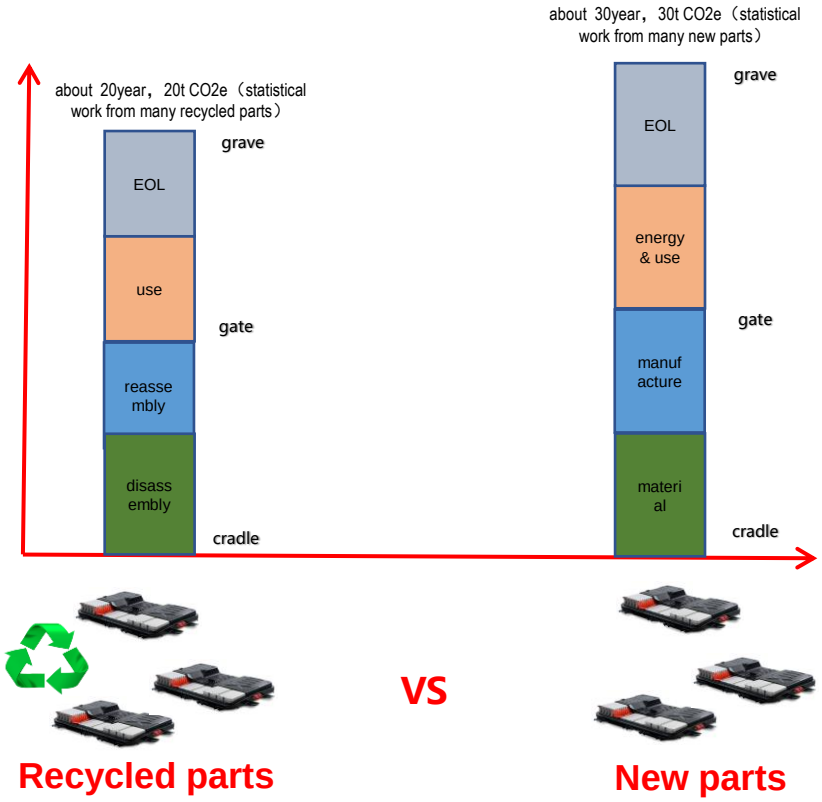
EV a

VS

EV b

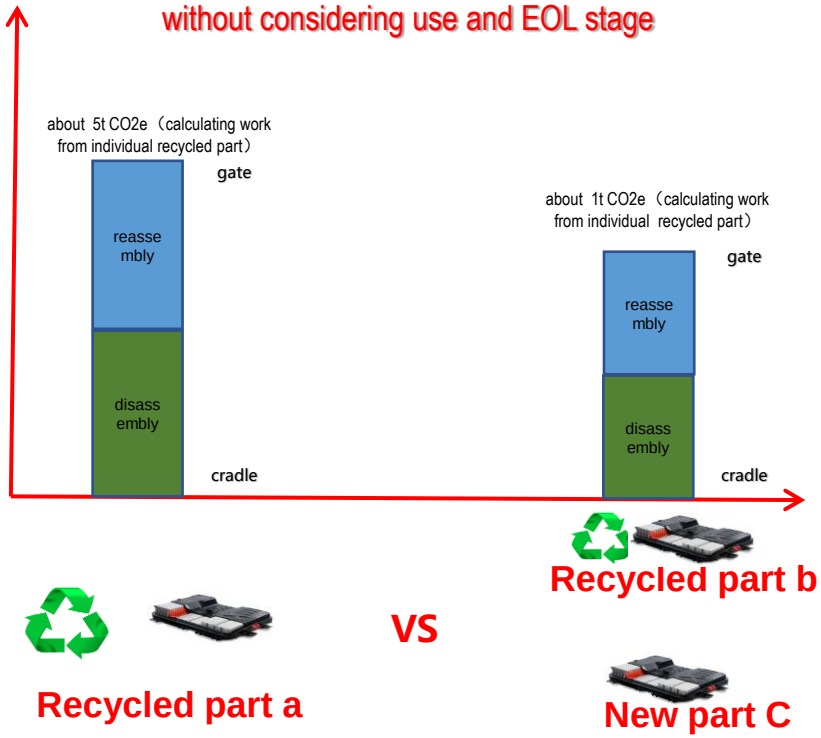
3、For the purpose of comparing different technical routes（Recycled parts & New parts）

CFF method



4、For the purpose of comparing different individual products（Recycled parts & New parts）

cut-off method



Agenda

5. Recycling modeling Benchmarking #1

1) China (CATARC) study
2) PEF study (instead of OICA)
   →Check “PFA EoL and CFF for OICA” file
3) EU Aluminium study
4) Japan (JASIC) study
5) Discussion

Agenda

5. Recycling modeling Benchmarking #1

1) China (CATARC) study
2) PEF study (instead of OICA)
3) EU Aluminium study
   →Check “EU Aluminum 2023-10-16 end of life modelling UNECE” file
4) Japan (JASIC) study
5) Discussion

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5. Recycling modeling Benchmarking #1

1) China (CATARC) study
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Recycling modeling Benchmarking

		Recycled Content Method (Cut Off)	Closed Loop approximation Method (CLAM)	Circular Footprint Formula (CFF)
Carbon Neutral Promotion	Promotes Low CO2 material selection at SOP	++	-	+
	Promotes CO2 reduction at EoL	-	++	+
	Enhance various recycling technology development collaborating with other industries	+	+	++
Circular Economy promotion	Promotes use of recycled material at SOP	++	-	+
	Promotes material/parts recycling at EoL	–	++	+
	Enhance various recycling technology development collaborating with other industries	+	+	++
LCA Operation	Database (2ndary data) maturity	+	-	-
	Industry acceptance	+	-	-
	In control of OEM	++	-	+
	Accessibility to primary data	++	-	+
	Practicability	++	-	+

GRPE A-LCA Objectives from ToR

1) To develop an internationally-harmonised procedure to determine the carbon footprint* of different technologies	+	+	++
2) This resolution can be used to help make policy and can encourage automotive industries to reduce carbon footprint	+	+	++
3)Shall be developed respecting the principles of transparency and consistency、also strike a balance between the accuracy and the workload considering the complex supply chain	++	-	+

Benchmarking rating detail

Japan Automobile Standards Internationalization Center

– CFF can evaluate "more different recycling technologies CFP" than Cut off, so better CFF rating on Objective 1 & 2 of ToR

CN countermeasure example in Automotive industry		Recycled content method (Cut off)	Circular Footprint Formula (CFF)
Material production /Recycling	**-Low CO2 material use** (e.g. Green steel/AL, Bio plastic,,,)	++	++
	-Recycled material use (e.g. EAF, Recycled Al/Plastic,,,)	++	+
	-Recyclable material use (e.g. Metal,,,)	-	++
	-High quality closed loop recycling with high quality scrap generation from ELV (e.g. Easy dismantle design, Single material parts design,,,)	+ (Only Automotive use)	++ (Both Automotive and other industry use)
	-ASR thermal recovery reduction with plastic material recycling promotion (e.g. Easy dismantle & single material plastic parts design, ASR sorting,,,)	+ (Only Automotive use)	++ (Both Automotive and other industry use)
Parts Recycling	**-Parts reuse** (e.g. Engine, T/M,,,)	++	++
	-Parts Repurpose (e.g. EV battery repurpose to other industries)	-	++

++ ; Well evaluate + ; evaluate - ; Not evaluate

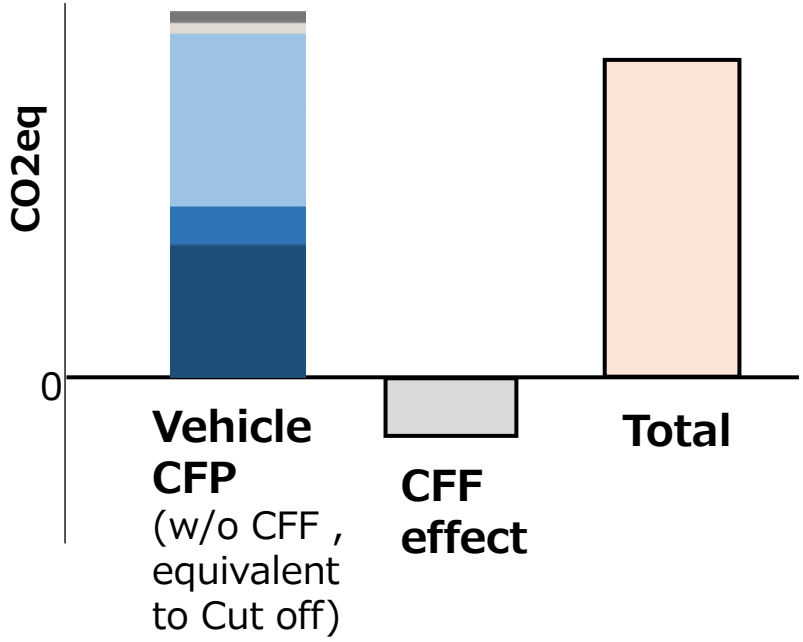
CFF risk mitigation for Objectives 3 of ToR

A-LCA Objectives from ToR	Cut Off	CLAM	CFF
1) To develop an internationally-harmonised procedure to determine the carbon footprint* of different technologies	+	+	++
2) This resolution can be used to help make policy and can encourage automotive industries to reduce carbon footprint	+	+	++
3)Shall be developed respecting the principles of transparency and consistency、also strike a balance between the accuracy and the workload considering the complex supply chain	**++**	**-**	**+ ⇒ ++**

1) STEP by STEP CFF application approach to balance between the accuracy and the workload.

		STEP1 (2025)	STEP2 (2025-)
ELV	Material recycle	**-Steel, Al, Cu** (Main vehicle material)	**-All recycled material**
	Parts Reuse/ Repurpose	**-Traction battery** (Recycled parts with traceability)	**-All recycled parts**
Process Scrap	Material recycle	N/A	**-All process scrap**

2) Manage CFF effect individually for the transparency and the consistency with Cut off



JAMA CFF methodology

1) Follow PEFCR CFF concept

material $(1-R_1)E_V + R_1 \times \left(AE_{recycled} + (1-A)E_V \times \frac{Q_{Sin}}{Q_P} \right) + (1-A)R_2 \times \left(E_{recyclingEoL} - E^*_V \times \frac{Q_{Sout}}{Q_P} \right)$

energy $(1-B)R_3 \times \left(E_{ER} - LHV \times X_{ER,heat} \times E_{SE,heat} - LHV \times X_{ER,elec} \times E_{SE,elec} \right)$

disposal $(1-R_2-R_3) \times E_D$

2) STEP by STEP CFF application approach with JAMA specific CFF parameter determination

		STEP 1	STEP2
ELV	Material recycle	-Steel, Al, Cu, Tire rubber (Main vehicle material)	-All recycled material
	Parts Reuse/Repurpose	-Traction battery, Tire (Recycled parts with traceability)	-All recycled parts
	Thermal recovery	-ASR, Tire rubber, oil	-
Process Scrap	Material recycle	N/A	-All process scrap

3) Manage “CFF effect” individually in vehicle CFP

Material CFF parameters determination

- Respect PEFCR CFF parameter definition and guideline
- Determine CFF parameter value considering Automotive use and CE promotion with Material (SG2) and EoL WG (SG5) collaboration.

	SG5	SG2	SG5			SG2			
	A	R1	R2	Qsin/Qp	Qsout/Qp	Ev [kgCO2/kg]	E*v [kgCO2/kg]	Erec [kgCO2/kg]	Erec EoL [kgCO2/kg]
Steel	Follow CFF guide line e.g. Metal ;0.2 Plastic ;0.5	・From IDEA or JOGMEC Material flow data	・From Japan End-of-Life Vehicle Recycling and Treatment Flow report e.g. Metal; 0.99	・Determine by Physical aspects ・Tramp element content in ELV steel scrap		・Utilize new IDEA data base which will be established in 2023 according to JAMA request <GRPE A-LCA status> SG2 is studying A-LCA Material intensity data structure based on JAMA study which can identify Ev, E*v, Erec and ErecEoL value.			
AL				・Determine by Economic aspects ・ELV scrap price /High-Quality scrap price in the market					
Cu									

CFF application to EV BATT Repurpose

Japan Automobile Standards Internationalization Center

・**Case study ; ELV EV BATT repurpose to other industry**

Virgin BATT prod. impact

Repurpose BATT prod. impact [kg-CO2e/kg]

$$Ev + R2 \times (1-A) \times (ErecEoL - E^*v \times Qsout/Qp)$$

Credit due to repurposed BATT supply

CFF effect [kgCO2e/kg]

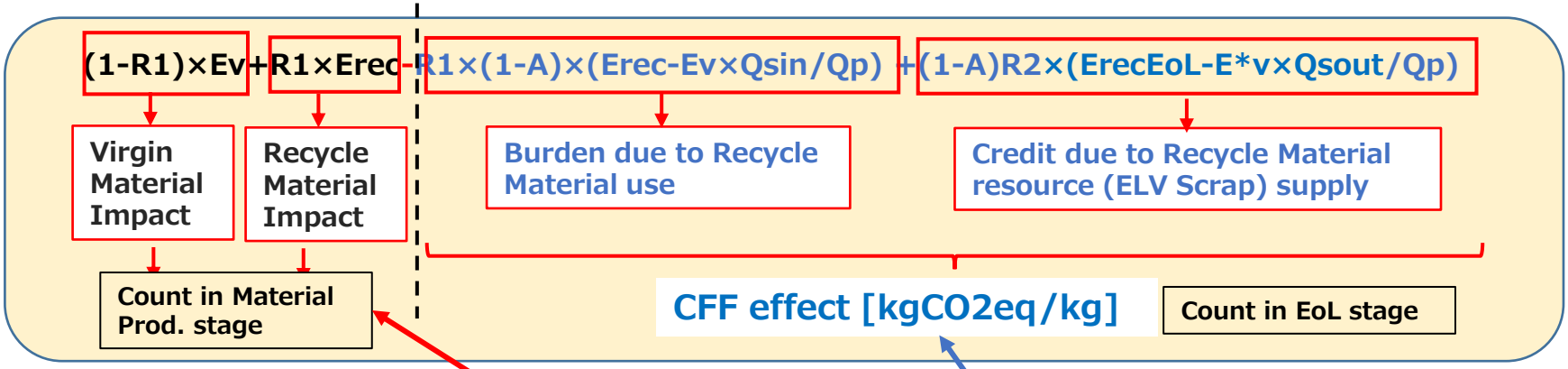
Case study	CFF effect
LiB (30kwh)	-225

・**Set R2, Qsout/Qp, E*v and ErecEoL value as primary data with Material (SG2), Production (SG3) and EoL WG (SG5) collaboration**

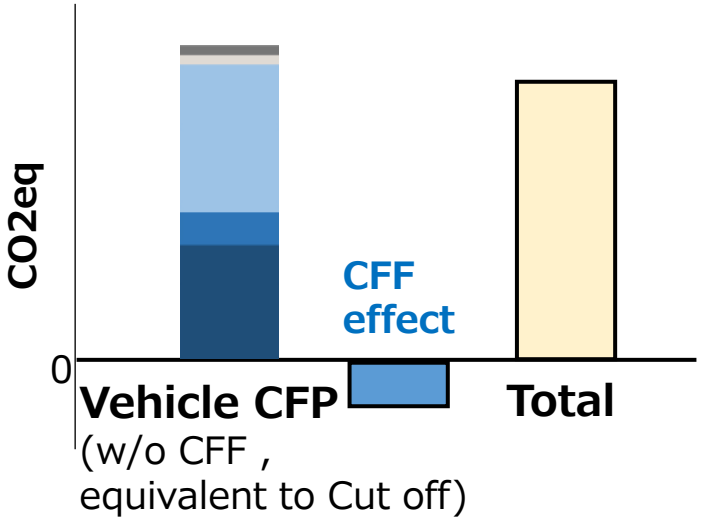
	A (SG5)	R1	R2 (SG5)	Qsin/Qp	Qsout/Qp	Ev [kgCO2/kg] (SG2 and SG3)	E*v [kgCO2/kg] (SG2 and SG3)	Erec [kgCO2/kg]	Erec EoL [kgCO2/kg] (SG5)
	0.5	0	0.3	-	0.6	3000	←	-	300
LiB (30kw)	・Default from PEFCR		Tentative value ・BATT recovery ratio		Tentative value ・SOH	Tentative value 100kgCO2/kwh *30kwh			Tentative value ・1/10 Ev

CFF effect management

- Need to have the transparency and the consistency with current methodology, “Cut off”.
- Manage “CFF effect” individually based on each CFF modular form



- Vehicle CFP Management



(w/o CFF , equivalent to Cut off)

cf. CFF Modular form

Production burdens $(1-R_1)E_V + R_1 \times E_{recycled}$

Burdens and benefits related to secondary materials input $-(1-A)R_1 \times \left(E_{recycled} - E_V \times \frac{Q_{Sin}}{Q_P}\right)$

Burdens and benefits related secondary materials output $(1-A)R_2 \times \left(E_{recyclingEoL} - E_V^* \times \frac{Q_{Sout}}{Q_P}\right)$

Agenda

5. Recycling modeling Benchmarking #1

4) Discussion

Agenda

7. Wrap up and next action

7. SG5 12 months Schedule

			2023						2024					
			7	8	9	10	11	12	1	2	3	4	5	6
Main activities			Develop Methodologies											
GRPE A-LCA IWG			☆10		☆7	☆ 17-18			☆					☆
SG5 leading team Meeting (LTM)			☆11 ☆26	☆23	☆6 ☆20	☆12 ☆	☆ ☆	☆ ☆	☆ ☆	☆ ☆	☆ ☆	☆ ☆	☆ ☆	☆ ☆
SG5 Meeting			☆12		☆4	☆19	☆	(☆)	☆	☆	☆	☆	☆	☆
Objectives	1. Level concept Definition & Initial target		☆12		(☆)	(☆)								
	2. System boundary with activity data & Intensity data based on each regional EoL process				Reginal info. sharing ☆ JPN, CHI	☆ EU	☆ US	☆ IND	☆ #1	Harmonization (Regional Study)			☆	☆ Final
	3. Contro versial topics	1) Material/Parts recycling modeling	☆JRC CFF intro.		☆ JAMA CFF intro.	Common Pros/Cons Discussion ☆ #1	☆ #2	CFF Application Study ☆ #1	☆ #2	CFF Road Map ☆ #1	☆ #2	☆ Final		
		2) Other			Boundary Conditions ☆				Rec. Process	☆ Logistics	☆	☆	2nd life Parts	
	4. Summary for drafting													☆

- Next SG5 meeting

1. Date ; 13th Nov. 9:00-11:00 @CET
2. Venue; Online
3. Attendee; all SG5 member
4. Agenda; according to SG5 12 months schedule
   - EU EoL process sharing by OICA (ACEA)
   - US EoL process sharing by EPA T.B.C.
   - Recycling modeling Benchmarking #2 EoL

Agenda

8. Closing speech by SG5 leader/Co leader