Eurogas Automotive Life Cycle Assessment (A-LCA) Webinar

In-Use Phase and Fuel

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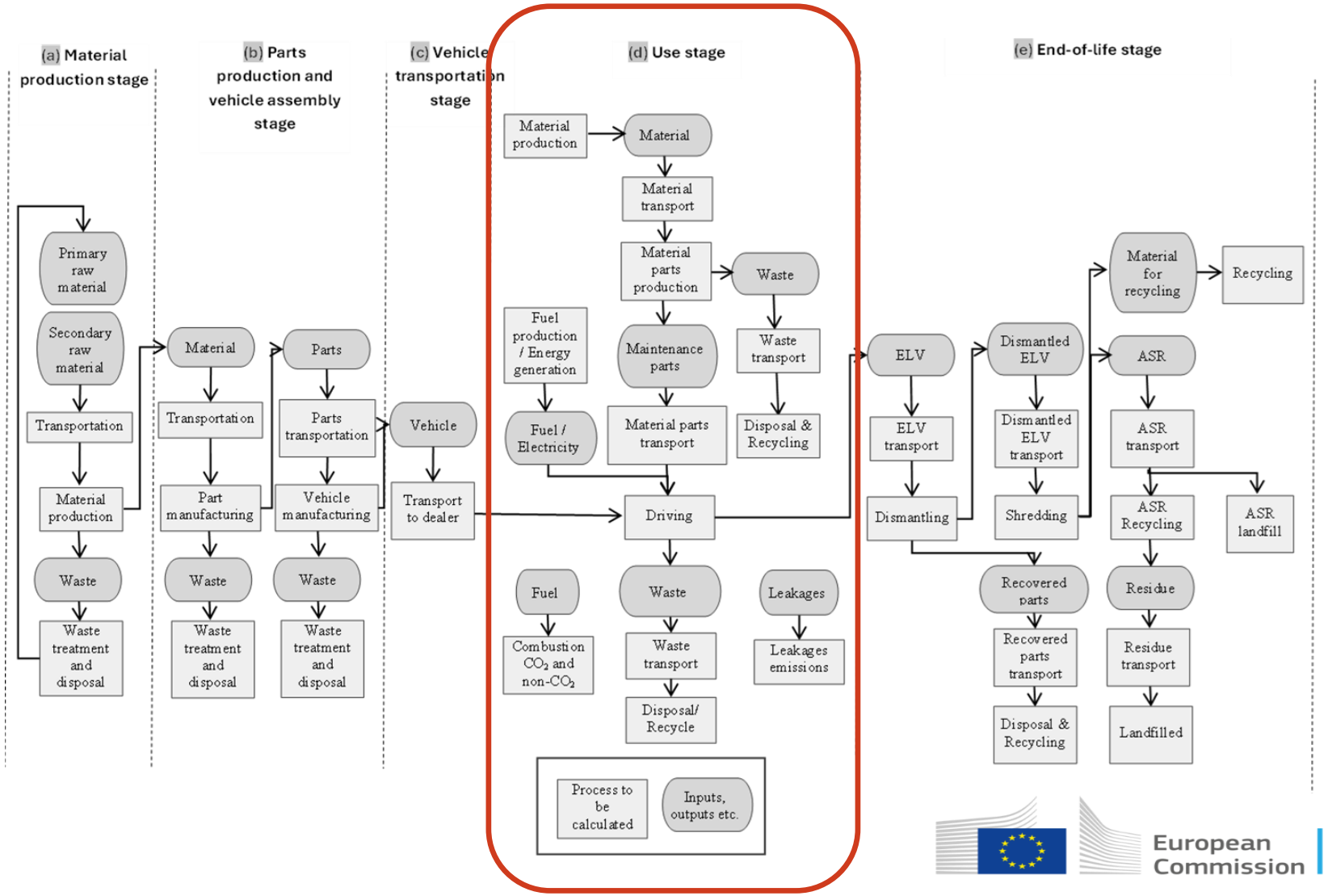
Agenda

- General context
- System Boundaries
- Service Life
- Use Phase Consumption
- Energy Modelling
- Leakages
- Maintenance
- Next Steps

General Context

Use Stage – Phase of the vehicle life cycle covering all activities associated with vehicle operation over its service life, including direct fuel and/or electricity consumption, tank-to-wheel emissions, maintenance, consumables, and replacement of relevant components under representative operating conditions.



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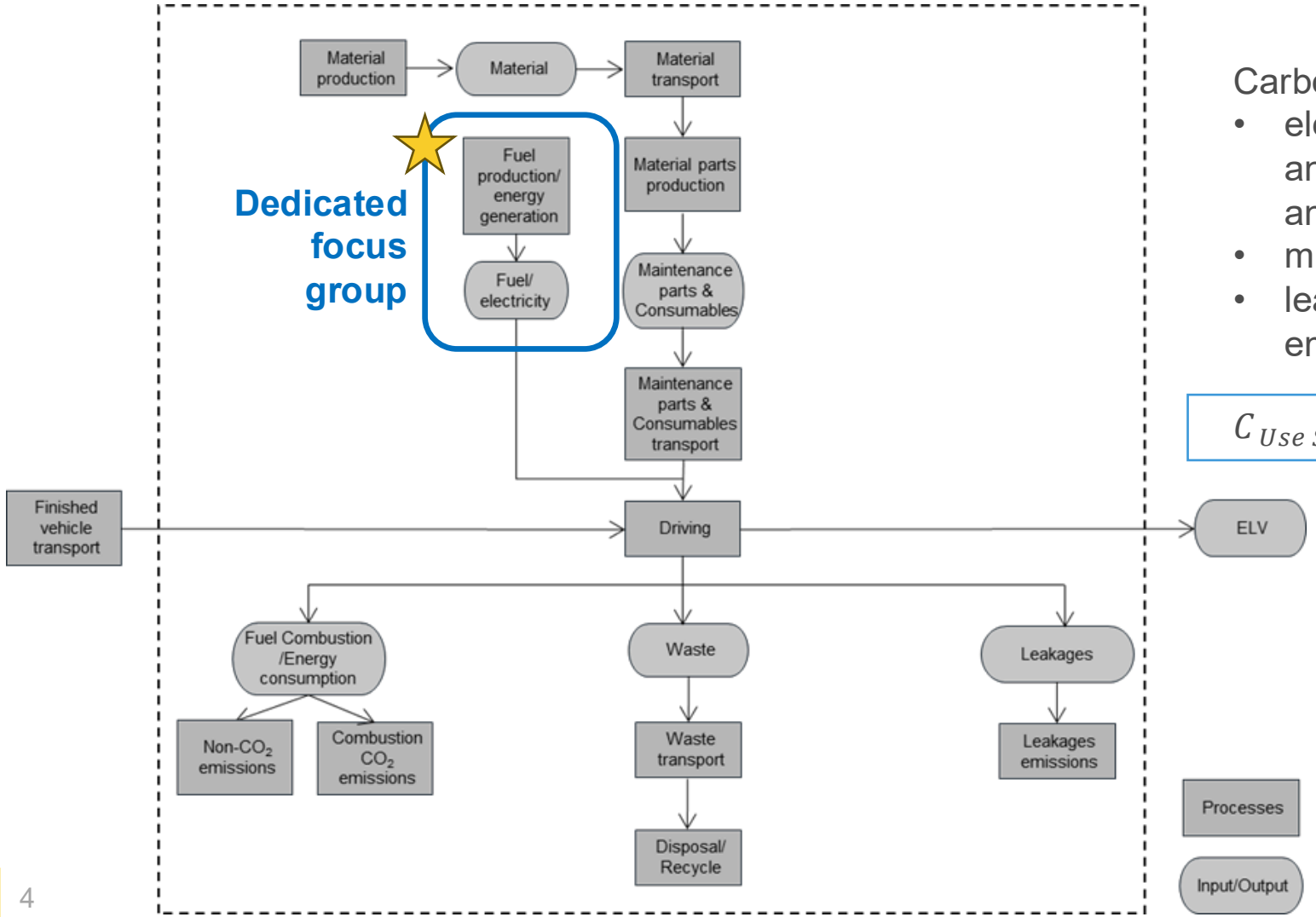
System Boundaries



Carbon emissions [kg CO_2eq]; calculation:

- electricity consumption at vehicle level and/or fuel combustion, including both CO_2 and non-CO_2 exhaust emissions;
- maintenance and consumables;
- leakages, including unburnt GHG species emissions;

$$C_{Use\ Stage} = C_{Energy} + C_{Leakages} + C_{Maintenance}$$

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Service Life

- Defined as the full period of time during which a vehicle is operated. Expressed in kilometres (km) and nr. of years until point of recycling.

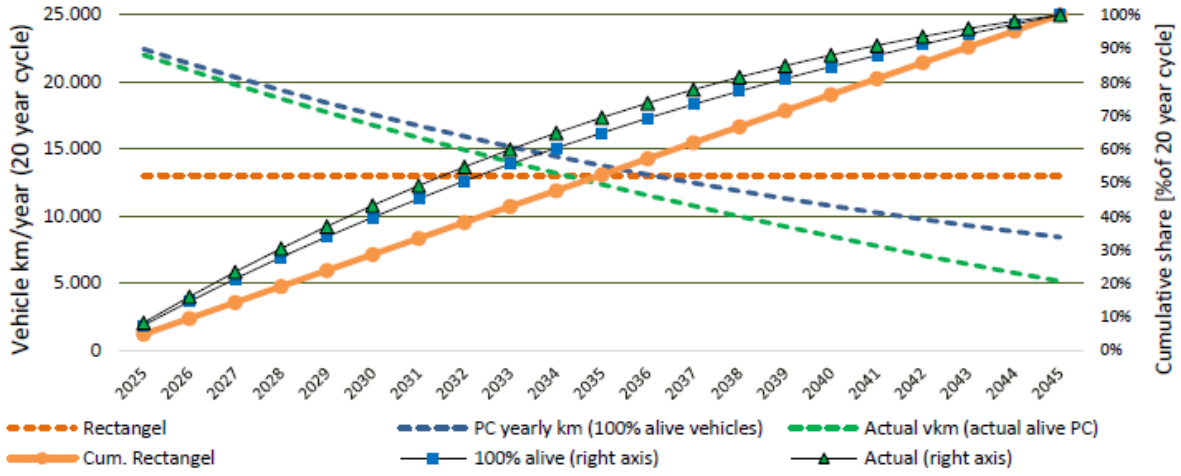
★ The average age when being de-registered is lower than the average age when being recycled.

- Service life and lifetime distance can vary significantly depending on the region and its specific applications.

- Generally, the annual mileage of vehicles decreases as they age. It is permissible to assume a constant value only if not mandated by the appointed jurisdiction.

- **Service life (in both km and years) will be defined by each contracting parties.**

- In the absence of the above values, the methodology proposes some region-specific value as fall-back option



Source: CONCAWE 2026

Service Life

Region / Country	*Year of publication*	*Duration (Years)*	*Source*
EU27	2024	20	Multiple sources as in the Annex 1 to this Resolution
United Kingdom	2022	18	LSE Centre for Economic Performance (Nguyen-Tien et al., 2025)[1]
Japan	2024	17	Ministry of Economy, Trade and Industry, 2025 - Status of the Enforcement of the Automobile Recycling Law
USA[2]	2025	varies	MOtor Vehicle Emission Simulator (MOVES)[3]
Brazil	2020	22	Ministry of Science, Technology and Innovations of Brazil, 2020

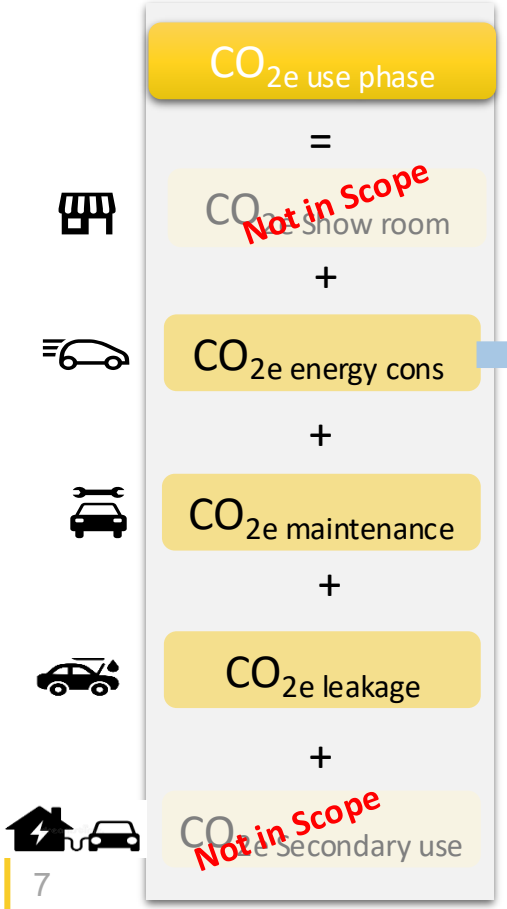
Region / Country	*Year of publication*	*Service Life (km)*	*Annual Mileage (km)*	*Source*
EU27	2024	240,000 km	12,000 km	Kraftfahrt-Bundesamt (2025); Agence de la Transition Écologique, Enerdata, & Fraunhofer ISI (2025) ACEA 2025 [1] https://www.acea.auto/fact/fact-sheet-cars/*
United Kingdom	2022	210,000 km	11,424 km (7,100 miles per year for all powertrains)	Vehicle mileage and occupancy - GOV.UK (2025)
Japan	-	-	-	No statistics available
USA	2025	Varies	Varies	MOtor Vehicle Emission Simulator (MOVES)Error! Bookmark not defined.)Error! Bookmark not defined.
Brazil	2012	288,000 km	13,000 km (Derived from service life over the first 22 years of usage)	Ministry of Environment (2013)

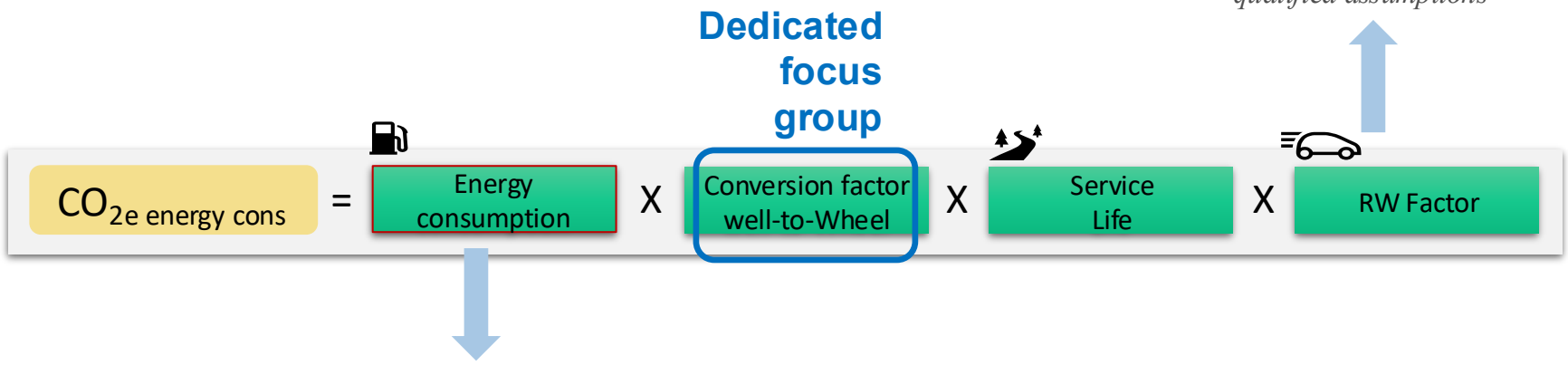
In-Use Energy Consumption

$$C_{Use\ Stage} = C_{Energy} + C_{Leakages} + C_{Maintenance}$$

$$EC_{in-use} = EC_{certification} \times f_{discrepancy} \times f_{deterioration}$$

Contracting Parties (or the relevant regional authority) are responsible for determination of the discrepancy factors based on on-board systems data, best available data, expert qualified assumptions





Level	*Representativeness*	*Energy Consumption* $_{Certification}$
Level 1	LCA family representative vehicle (at the practitioner's discretion)	Regional typical consumption values or other local representative realistic data*
Level 2		
Level 3	Specific vehicle configuration	Official certification values
Level 4		

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Energy Modelling

- Government authorities shall establish, within their respective territories, how electricity modelling is to be defined. [Energy modelling shall be temporally and spatially consistent with respect to each A-LCA stage, and matched to both use stage and EOL].

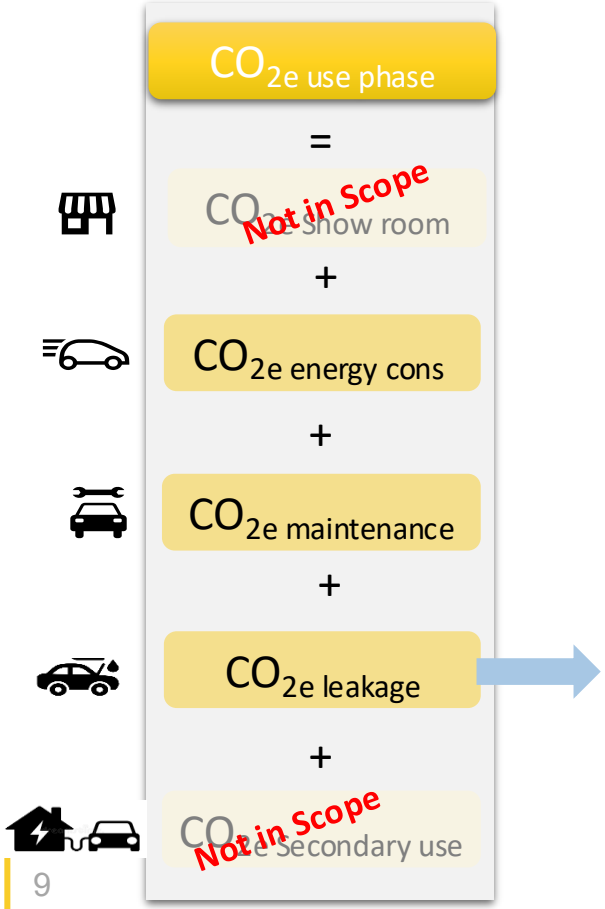
- If a dynamic scenario is used, the energy mix composition for each year of vehicle operation shall be estimated by applying linear interpolation between the respective energy supply shares reported for the nearest pre-defined time horizons in the scenario selected. The calculation over the full life cycle is as follows:

a) As the arithmetic average of the individual electricity supply shares - the vehicle's use is distributed homogenously over its full service life (i.e., L/N km are driven each of the N years of operation, where L = total lifetime activity).

b) if year-specific activities may be estimated with sufficient confidence, then a weighted average of the individual shares Si,n of electricity supplied by each technology i in the year n, i.e.: $\sum_{n=1}^{N} W_n S_{i,n}$, where Wn = An/L (An = vehicle activity in year n, L = total lifetime activity).

Leakages

$$C_{Use\ Stage} = C_{Energy} + C_{Leakages} + C_{Maintenance}$$



Different types of leakages:

- Given the very low impact on the entire use stage GHG emissions, this methodology neglects the emissions arising from **fuel evaporation**.
- The inclusion of **hydrogen** as a GHG in default LCA calculations be deferred until formal consensus is reached on its GWP and/or its integration into the EF method
- Practitioners should prioritize official governmental estimates of **CH4** leakage, however, this would not be a real issue for CNG M1 and N1 vehicles, which have gas-tight systems.
- **Refrigerant** leakages are considered to be very low. For this reason, this methodology neglects the emissions arising from fluorocarbons.

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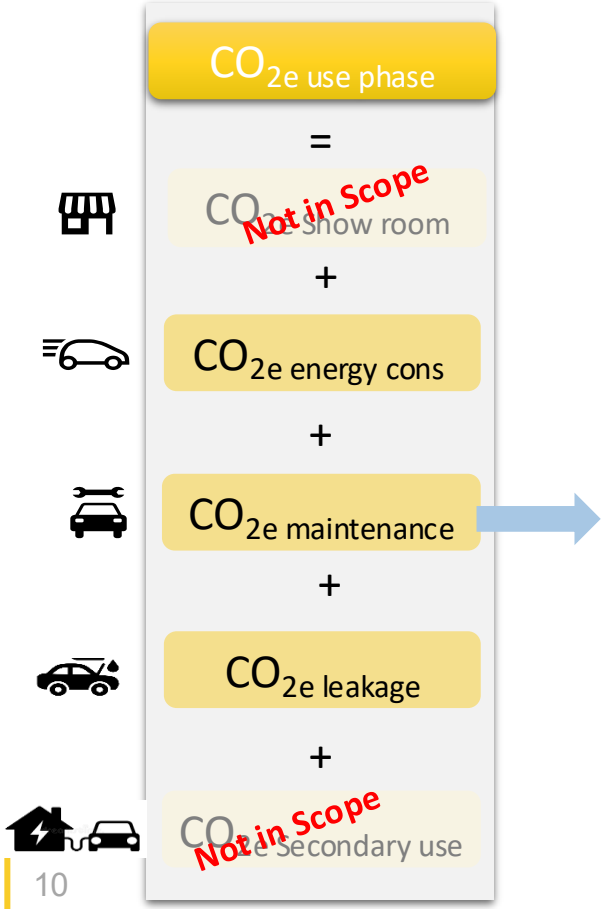
Maintenance and Consumables

$$C_{Use\ Stage} = C_{Energy} + C_{Leakages} + C_{Maintenance}$$



Maintenance and Consumables

Replacement of components and the replenishment or replacement of operational fluids

(maintenance parts/consumable and associated frequency is provided by the manufacturer or parts supplier)

		Petrol	*Diesel*	*CNG*	*NOVC-HEV*	*OVC-HEV*	*Pure EV*	*FCHV*	*OVC-FCHV*	*H2-ICE*	*Level 3/ Level 4*
Consumables	Engine coolant	✓	✓	✓	✓	✓	N/A	N/A	N/A	✓	
	Engine lubricant	✓	✓	✓	✓	✓	N/A	N/A	N/A	✓	
	Screen wash	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Brake fluids	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Engine air/oil filter	✓	✓	✓	✓	✓	N/A	N/A	N/A	✓	
	AdBlue/Urea/Reagent	N/A	✓	N/A	N/A	N/A	N/A	N/A	N/A	N/A	YES
Maintenance parts	Passenger air filter	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	HVAC Refrigerants	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Spark plug	✓	-	✓	✓	✓	N/A	N/A	N/A	✓	
	Windshield wiper blades	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Tyres	✓	✓	✓	✓	✓	✓	✓	✓	✓	YES
	Brake linings	✓	✓	✓	✓	✓	✓	✓	✓	✓	YES
	Brake discs	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	SLI battery (i.e. 12V)	✓	✓	✓	✓	✓	✓	✓	✓	✓	YES
	Aftertreatment	✓	✓	✓	✓	✓	N/A	N/A	N/A	✓	
	Parts and/or components defined by vehicle manufacture	✓	✓	✓	✓	✓	✓	✓	✓	✓	YES

$CO_{2e\ maintenance}$ = Parts & consumables X Replacement frequency X Carbon emission factor

Next Steps

The second stage of the methodology will try to develop and implement new features that are extremely relevant to the application of the Mutual Resolution, such as:

- Use phase consumption and RW factor characterization for powertrains with two modes of operation, such as PHEVs;
- Calculation rules for “Deterioration Factor” for FCEVs and PHEVs;
- Maintenance assessment in case data are not available (less relevant);
- Methodology for replacement(s) of major powertrain components such as fuel cell stack and traction battery.

Thank you

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