IWG A-LCA
SG4 Use Phase
Status Update

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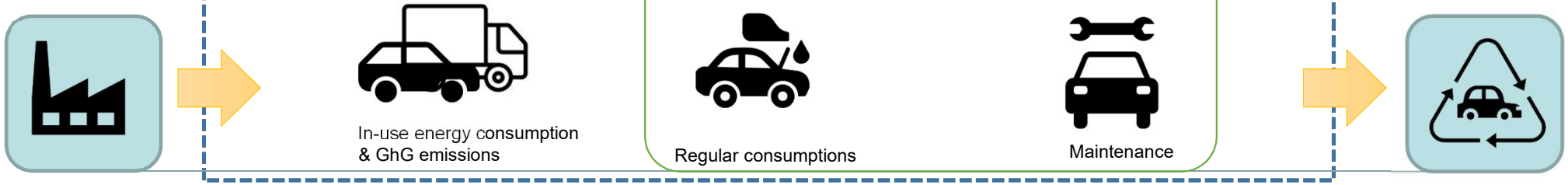
Discussion items for SG4

- ❑ System Boundaries
- ❑ Representative vehicle
- ❑ CO2_eq calculation
- ❑ In-use Energy/Fuel consumption
- ❑ Maintenance and Consumables
- ❑ Level Concepts for SG4
- ❑ Next steps

System Boundaries

	area	SG4 Decision	rule				existing methods					Your Position
			ToR purpose	fixed or varied	primary or secondary	(any other suggestions are welcom	A	B	C	D	...	
Transportation												
mining to initial processing plants	SG2		NA		NA(secondary)	NA						
between initial processing plants	SG2		NA		NA(secondary)	NA						
deliver to part/production plants	SG2/3		NA		NA(secondary)	NA						
within the part/production plants	SG3		NA		NA(secondary)	NA						
between part/production plants	SG3		NA		NA(secondary)	NA						
deliver to customer	SG3/4		NA		NA(secondary)	✔						SG3
maintenance parts	SG4		NA		NA(secondary)	✔						ok
fuel	SG4		NA		✓(primary)	✔						SG6
electricity	SG4		NA		✓(primary)	✔						SG6
deliver to disposal plants	SG4/5		NA		NA(secondary)	NA						SG5
deliver to the parts recover plants	SG5		NA		NA(secondary)	NA						
recover plants to production plant	SG5/3		NA		NA(secondary)	NA						
...												

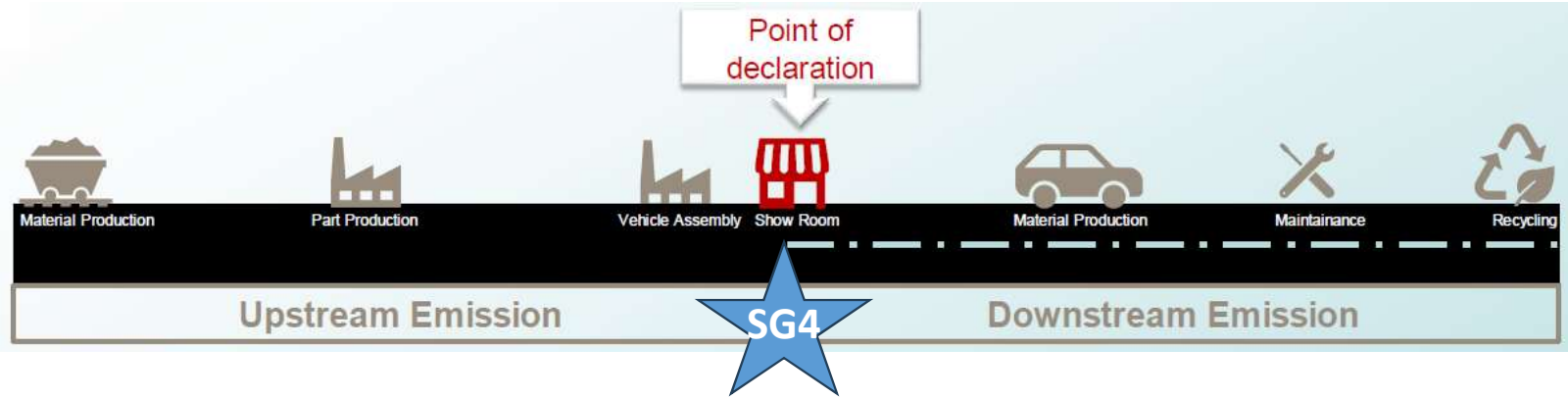


Covering activity from circulation to end-of-life

SG4 interactions

- Definition of “Representative vehicle”
  - Interaction with SG3
- System boundaries and Infrastructures
  - SG3 > agreed transition point at “Showroom” level
  - SG5 > agreed transition point at EoL
  - SG6 > define boundary for fuel and electricity (charging?) and conversion ratios
- Maintenance
  - Interaction with SG3 on availability of carbon emission data (primary /secondary) > emissions for consumables/parts production
- LCA point of declaration < Overarching aspect - IWG

SG3/SG4 Transition Point

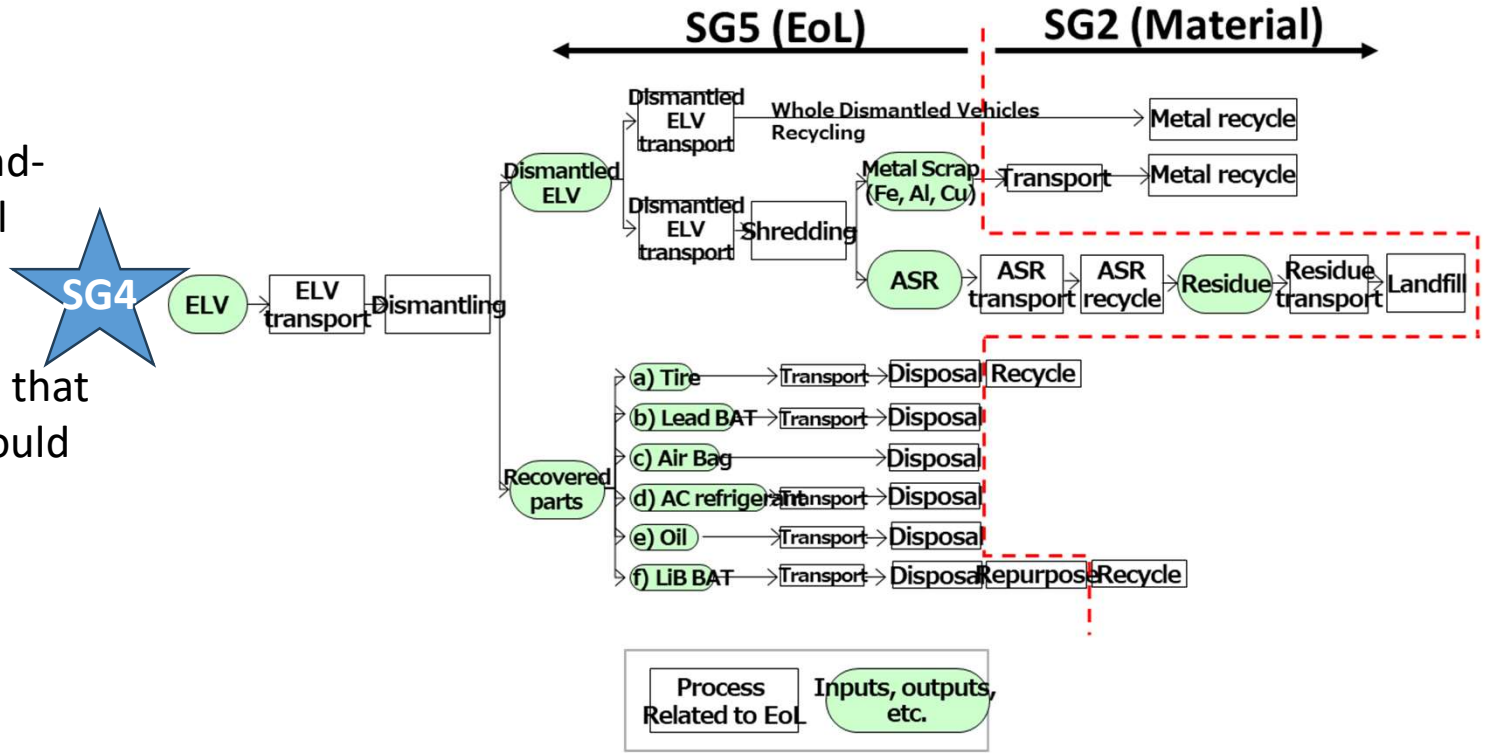


SG3 and **SG4** agreed that the hand over point is set at the “showroom, when the vehicle is passed on from the OEM to the final customer”

SG4/SG5 Transition Point

SG5 affirms that:
" GHG emissions after ELV (End-of-Life Vehicle) generation fall within the EoL domain.

Therefore, it is acknowledged that the transportation of ELVs should be included within the EoL domain"



Next steps

- ❑ Finalize CO_{2eq} calculation formula and functional units
- ❑ Finalize Level Matrix
- ❑ In-use consumption
  - ❑ data TA + Correction coefficient/OBFCM
- ❑ Finalize methodology for Maintenance and Consumables
- ❑ Progress on service life on-going
- ❑ Next SG4 meeting on April 23rd
- ❑ Schedule upcoming meetings

SG4 Meeting Schedule Plan

January	February	March	April	May	June
8/9th – A LCA 13th IWG @Geneva	7th – SG4 8th workshop		9th – SG4 10th meeting		
16th – SG4 7th meeting	20th – A LCA 14th IWG	18th – SG4 9th meeting	18/19th – A LCA 15th IWG @Seoul	TBD	TBD
			23rd – SG4 11th meeting		

Thank you

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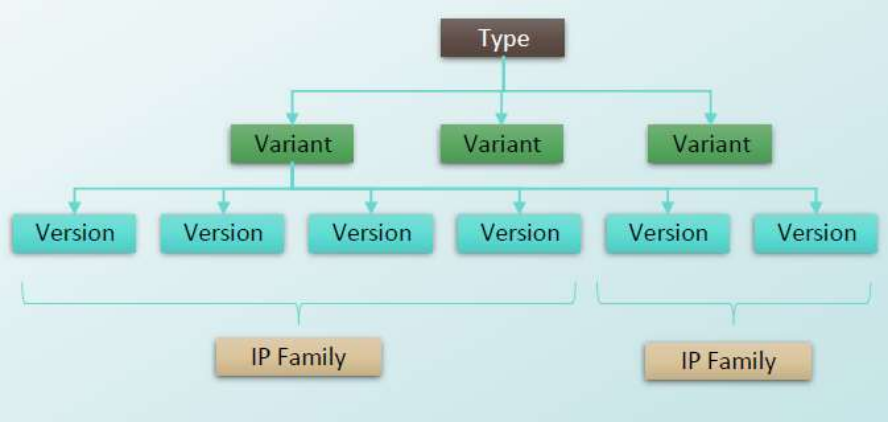
Appendix

Representative Vehicle

- No formal ‘Representative Vehicle ’ definition available so far
- **Scope**: to provide LCA carbon footprint information of a group of vehicles and at the same time accurate enough for the purpose – different for each LCA level
- Find a good compromise between precision and administrative burden instead of TVV approach
  - IP family as defined by EU WLTP regulation
  - Vehicle High as worst-case approach
  - Level default value to be defined
- Broader definition might be adopted for maintenance, evaporative emissions, etc… for a simpler approach
- Need to align different methodologies among regions
- Cooperate with SG3



CO_2eq Calculation [Functional Unit]

		(	Fuel consumption	×	conversion factor	+	Energy consumption	×	conversion factor	)	×	lifetime distance	+	(	Production and/or Disposal Energy per Consumables and/or	×	conversion factor	×	Frequency	)	+	Leakage ? (evaporative emission, Hydrogen, ,,,)
	unit		L(g)/km		CO2_eq/L(g)		MJ/km		CO2_eq/MJ			km			MJ		CO2_eq/MJ		x / lifetime			
responsible to	SG3														✔							
	SG4		✔				✔					✔							✔			✔
	SG5														✔							
	SG6				✔				✔								✔					
applicable powertrain	ICE		✔		✓		NA		NA			✔			depend on the items		depend on the items		depend on the items			✔
	NOVC-HEV		✔		✓		NA		NA			✔										✔
	OVC-HEV		✔		✓		✔		✓			✔										✔
	PEV		NA		NA		✔		✓			✔										NA
	FCHV		✔		✓		NA		NA			✔										✔
	LPG/CNG		✔		✓		NA		NA			✔										✔

SG6 to determine conversion factors

In-use Energy/Fuel consumption

- Two options under discussion:
  - Option 1: **Homologation value** X **Deterioration factor** X **Real-world adjustment factor** (or discrepancy factor)
    - Discrepancy and deterioration factors can be '1' for level 1 or if data are not available. Normally they are region specific
  - Option 2: Real-world data (OBFCM) to be further elaborated – vehicle-specific data are available in some regions
- General consensus on Option 1 but agreement can be achieved once formally written down
- Both options have to be further developed and tailored to the different levels foreseen by the methodology

Concept

Service life : Potential use

1] Potential Functional unit: /vehicle

$$CO_{2e} = CO_{2e\ Material} + CO_{2e\ Production} + \mathbf{CO_{2e\ Use\ phase}} + CO_{2e\ Recycling}$$

$$CO_{2e} = CO_{2e\ Material} + CO_{2e\ Production} + \mathbf{(EC\ X\ CF\ X\ Service\ life) + CO_{2e\ maintenance} + CO_{2e\ leakage}} + CO_{2e\ Recycling}$$

2] Potentiel Functional unit : /km

Functional unit = CO_{2e} /Service life

$$= \frac{CO_{2e\ Material} + CO_{2e\ Production} + \mathbf{(EC\ X\ CF\ X\ Service\ life) + CO_{2e\ maintenance} + CO_{2e\ leakage}} + CO_{2e\ Recycling}}{\mathbf{Service\ life}}$$

- Depending upon usage service life will impact the ‘functional unit’ differently

Maintenance and Consumables

- General agreement: *"Guideline will provide a recommended list of parts /powertrain (non-exhaustive) then OEM need to provide a complete list with frequency of maintenance (with justification). The emission factors we need to go with SG3 recommendations."*
- Currently SG4 is working on developing the 'list of parts'

		Gasoline	Diesel	CNG	NOVC-HEV	OVC-HEV	Pure EV	FCHV	OVC-FCHV	H_2-ICE	...
Consumables	Engine Coolant	✓	✓	✓	✓	✓	-	-	-	✓	
	Engine Lubricant	✓	✓	✓	✓	✓	-	-	-	✓	
	Screen Wash	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Break fluids	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Electric Drive Unit Fluid	-	-	-	✓	✓	✓	✓	✓	-	
	Transmission fluid	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Refrigerant	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	AdBlue/Urea	-	✓	-	-	Under discussion	-	-	-	-	
Maintenance parts	Passenger Air Filter	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Engine Filter	✓	✓	✓	✓	✓	-	-	-	-	
	Spark plug	✓	-	✓	✓	✓	-	-	-	-	
	Windshield Wiper Blades	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Tires	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Brake linings	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	SLI Battery (12V)	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Aftertreatment	✓	✓	✓	✓	✓	-	-	-	-	
	Traction Battery	-	-	-	✓	✓	✓	✓	✓	-	
	Fuel cell	-	-	-	-	-	-	✓	✓	✓	

Level Concept for SG4 - JRC

USE PHASE	Reference Vehicle	Representativeness	In-use consumption	Maintenance	Service Life
Level 4	Specific OEM's **complete** vehicle model – as delivered OR IP family specific	Vehicle specific OR IP family specific	Homologation value corrected based on RW characteristic value (based on OBFCM or similar data provided by operators or adjustment factor)	Model/IP Family specific	OEM/Model specific average data **Still to be Discussed** Regional with option to declared higher life
Level 3	Vehicle variants (same manufacturer/company, same essential body parts, body type, powertrain tech/energy carrier, same axles/class). Can be **incomplete**.	OEM/Model Variant	OEM-resolution and assumptions for RW performance corrected per adjustment factor	OEM Variant Specific	
Level 2 to be determined, necessary if we want to be aligned with the other SGs. Possible idea, extension of level 1 with split per vehicle segment and using sales weighted characteristics for specific regions (EU, US, Japan, China etc)					
Level 1	General concept distinguishing per powertrain tech/energy carrier/size/emission standard and use.	Regional (EU/US/JP/KR/CN…) eg Guidebook, MOVES etc	Regional typical inventory or other local representative realistic data (eg EEA guidebook)	Generic/regional	Regional typical service life for each vehicle type **Still to be Discussed**

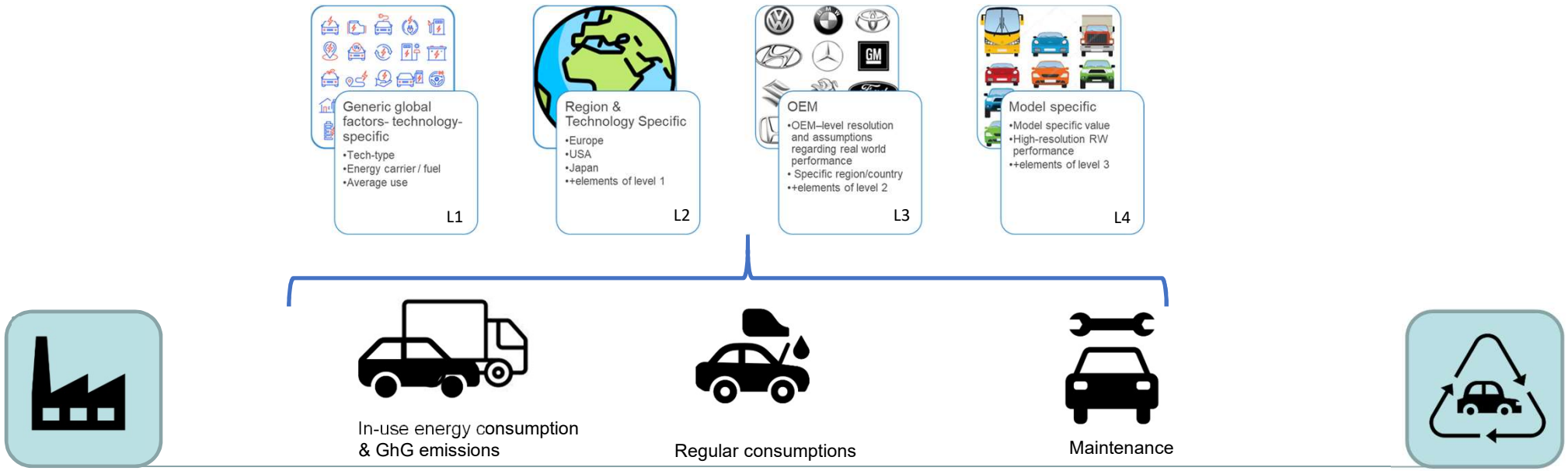
Fugitive emissions/leakages

Brainstorming:

- Evaporative emission: already existing in regulations on hydrocarbon (EU and Japan has same similar requirements but US has additional requirements)
- H_2 leakage aspect is a crucial point and more particularly during production pathway (not part of SG4).
- Need to review scientifically the leakage aspects of H_2. When comes to tailpipe emission we can certainly use the existing methods for H_2.

SG4 Scope

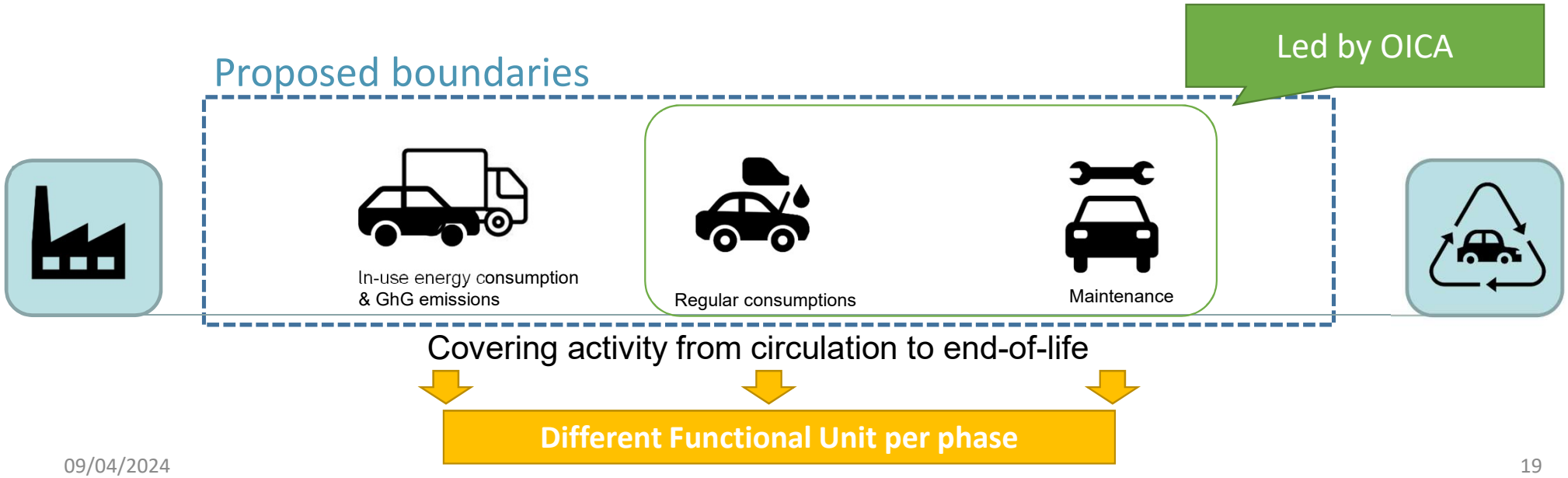
- Provide a comprehensive methodology for calculating **realistic** GhG emissions and energy consumption over vehicle use-phase at various levels of detail and considering the availability of different information and datasets



In – Use GhG emissions and energy consumption

SG4 Boundaries

- Define service life (OEM or Default) - official db? Need to collect data and produce first table of standards/datasets
- Define boundaries with other SGs



CO_2eq Calculation/Functional Unit

Lifetime GhG_{use} [CO2eq] = GhG [CO2eq/km] * total average distance [km] + Maintainance * occurrences + waste (total)

gCO2eq/km > LDV
gCO2eq/tkm > HDV
gCO2eq/pkm > HDV

⚠ GhG [CO2eq/km] = Energy consumption (MJ/km) * **Conversion Factor SG6** + Fuel Energy Consumption (g/km) * **Conversion Factor SG6** + fugitive emissions + other emissions (TBD from the guidebook)

Energy consumption OR Fuel energy consumption = TA Value (or equivalent) * RW correction factor [lvl1, lvl2, lvl3, lvl4] * degradation factor [lvl1, lvl2, lvl 3,lvl 4] other factors (?)

⚠ **FUNCTIONAL UNIT TBD**

- ❑ [Energy and/or fuel mass] per [km – tkm – passenger km] for **in-use consumption**
- ❑ CO2 per spare part for **consumables**?
- ❑ CO2 per **maintenance** event?

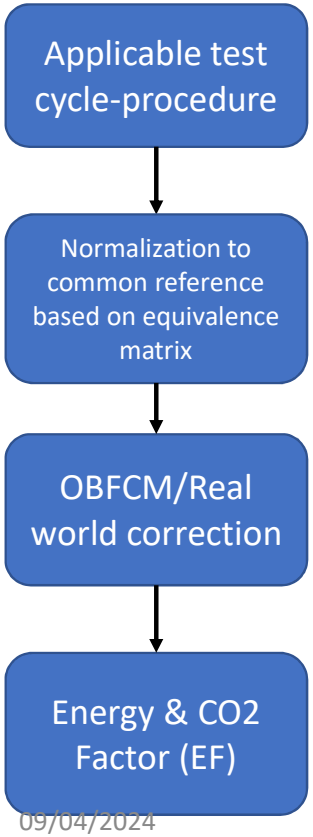
Methodological question

- What happens if the user selects values from different levels because of data availability eg 4/6 values are level 4 one value is level 3 and one is level 2?
  - Is that acceptable? We use the guidebook method developed by UN ECE assessed every year and it is as realistic as possible (NOT ALL countries)
- If yes, then lower levels should have more conservative values to encourage measurement/data provision
- Other boundaries to be included?

(JPN) Request to other SGs and Request from other SGs

items	to which SG	from which SG	notes
~~1. OEM showroom~~	NA	SG3	~~Accept the request~~
2. Provide the consumed energy for maintenance parts (please refer SG4-03-JPN02 for detail)	SG3/SG5	NA	unit should be J, not GHG
3. Provide GHG factors for each fuel (please refer SG4-03-JPN02 for detail)	SG6	NA	unit should be GHG/L or kg
4. Provide GHG factors for each energy source (please refer SG4-03-JPN02 for detail)	SG6	NA	unit should be GHG/J
5. tbd			

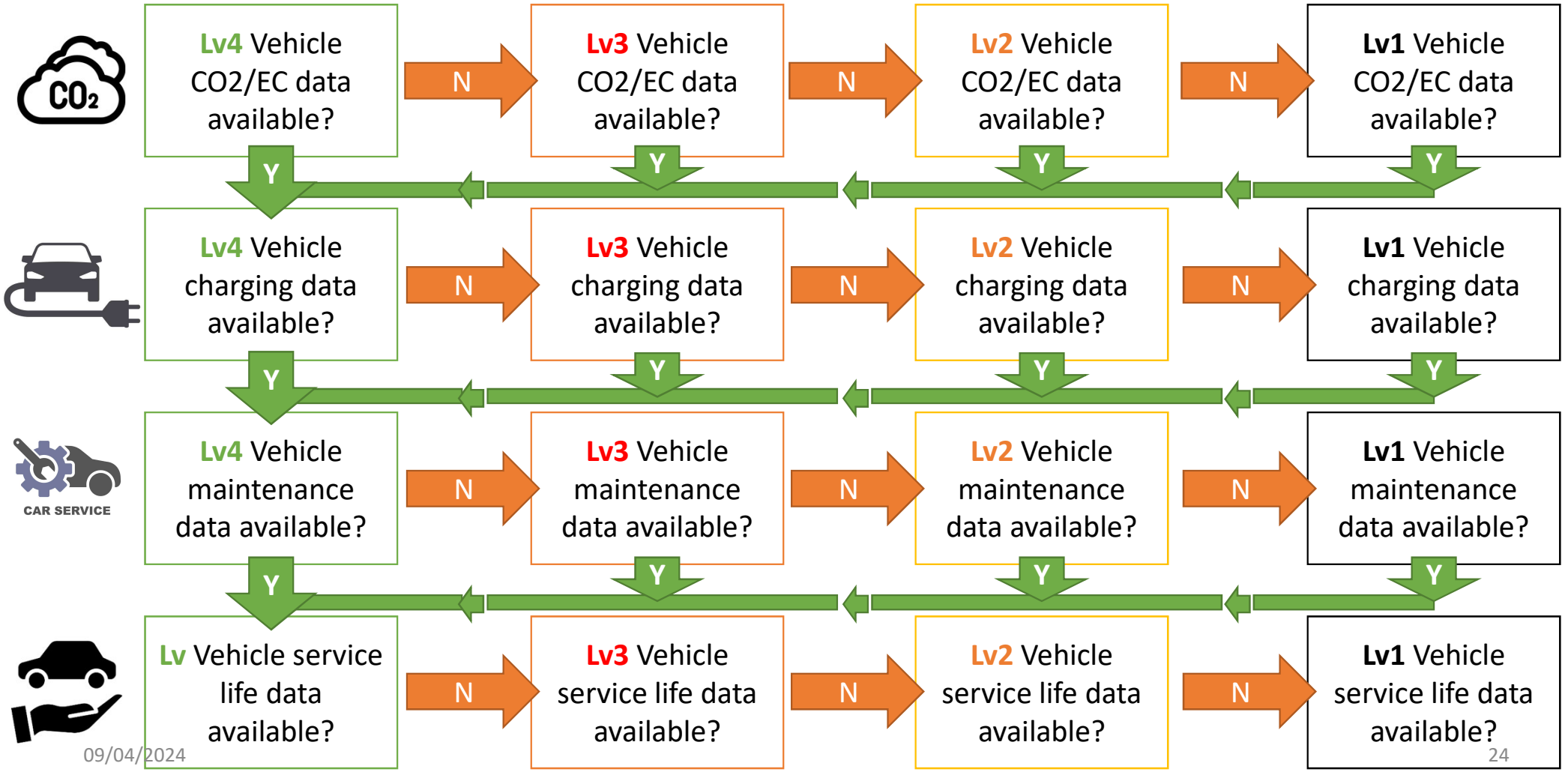
Fuel Consumption/Efficiency



Equivalence matrix (for positive energy demand & mean efficiency)

ratio	WLTP	NEDC	US06	FTP	JC08	….	other
WLTP							
NEDC							
US06							
FTP							
JC08							
…..							
other							

Level Concept for SG4 - Flowchart



Level Concept for SG4 - OICA

Not clear what representativeness is.
OICA position after clarification

SG6 topic (out of vehicle)
AC charging: efficiency is not required due to on-board charger

Need further discussion in OICA

USE PHASE	Reference Vehicle	Representativeness	Energy consumption		Maintenance	Service Life	Other
			In-use	Charging			
Level 1	General concept per powertrain tech /energy carrier	Global average	~~Average~~ homologation value ~~normalized to WLTP corrected for RW (global)~~	Generic charging efficiency (?)	Generic	Generic/Global	
Level 2	Same as Lv 1	Regional (EU/US/JP/KR/CN…)	Regional RW correction	Regional charging efficiency value (standardised)	Generic/regional	Regional / Unique service life	
Level 3	Representative vehicle for each OEM/powertrain/energy carrier (need to define criteria)	OEM/National	OEM-resolution and assumptions for RW performance	OEM average efficiency (standardised?)	OEM Specific	Regional with option to declared higher life	
Level 4	Specific OEM's vehicle model	OEM's specific vehicle model	High-resolution RW value (based on OBFCM or similar data)	Vehicle specific charging efficiency (standardised?)	Model specific	OEM/Model specific average data	

Readily available

Readily available reflecting regional use

Readily available from OEM

Level Concept for SG4 – Ricardo simplified alternative 10/10/23

Up to the relevant CP/ region to decide what is needed/used or not.

USE PHASE	Reference Vehicle	Representativeness	Energy consumption		Maintenance	Service Life	Other
			In-use	Charging			
Level 1 (Generic)	General concept per powertrain tech /energy carrier	Global or regional average (EU/US/JP/KR/ CN…)	Average global or regional homologation value (*ideally* normalized to WLTP) corrected for RW (global, e.g. SBTI value of 1.1, or regional RW if required by CP)	Generic global or regional charging efficiency (unless already included in homologation)	Generic by powertrain type	Generic global or regional	Projected energy mix use (current policy); Default factors fugitive emissions + degradation factors
Level 2							
Level 3 (OEM)	*Representative* vehicle model variant for each OEM /powertrain /energy carrier (need to define criteria)	OEM's specific vehicle model	OEM model variant + regional RW corr. *or optional* OEM specific alternative assumptions for RW performance	OEM model efficiency (standardised)	OEM model-specific (for the representative configuration) by powertrain	Regional with *option* for OEM to declared higher life with evidence	As previous level, plus specific sensitivities *(to be agreed)*
Level 4 (OEM optimal)	**None:** OEM specific vehicle model and variant /configuration (i.e. engine, battery size, other options)	OEM's specific vehicle model and variant	Specific model/variant EC, plus high-resolution RW value (based on OBFCM or similar data)	As for Level 3, but also by specific model variant (if different)	As for Level 3, but also by specific model variant (if different)	As for Level 3	+OEM model-specific fugitive emissions + degradation factors

Japan Positions on Level Concept

JPN sees that no levelling concept is necessary for SG4

→ set only "Level 4" to take care of all potential items (expect SG4 member to update them in excel file), then SG4 makes a decision of the applicable items under the current ToR time scale (~2025).

Level Concept for SG4

USE PHASE	Reference Vehicle	Representativeness	Energy consumption		Maintenance	Service Life
			In-use	Charging		
Level 1	General concept per powertrain tech /energy carrier	Global average	~~Average~~ homologation value ~~normalized to WLTP corrected for RW (global)~~	Generic charging efficiency (?)	Generic	Generic/Global
Level 2	Same as Lv 1	Regional (EU/US/JP/KR/CN…)	Regional RW correction	Regional charging efficiency value (standardised)	Generic/regional	Regional / Unique service life
Level 3	Representative vehicle for each OEM/powertrain/energy carrier (need to define criteria)	OEM/National	OEM-resolution and assumptions for RW performance	OEM average efficiency (standardised?)	OEM Specific	Regional with option to declared higher life
Level 4	Specific OEM's vehicle model	OEM's specific vehicle model	High-resolution RW value (based on OBFCM or similar data)	Vehicle specific charging efficiency (standardised?)	Model specific	OEM/Model specific average data

<example>
PEV : X yrs/x km
HEV : Y yrs/y km
FCHV : Z yrs/z km
Others : XY yrs/xy km

: JPN pursues under the SG4 activities (some of items are still under the discussion)

Level Concept for SG4 – UN F. Cuenot

Time of application	USE PHASE	Reference Vehicle	Representativeness	Energy consumption		Maintenance	Service Life	Other
				In-use	Charging			
Pre vehicle sale	Level 1	General concept per powertrain tech /energy carrier	Global average	Average homologation value normalized to WLTP corrected for RW (global)	Generic charging efficiency (?)	Generic	Generic/Global	
Pre vehicle sale	Level 2	Same as Lv 1	Regional (EU/US/JP/KR/CN…)	Regional RW correction	Regional charging efficiency value (standardised)	Generic/regional	Regional / Unique service life	
~~Pre vehicle sale~~	~~Level 3~~	~~Representative vehicle for each OEM/powertrain/energy carrier (need to define criteria)~~	~~OEM/National~~	~~OEM-resolution and assumptions for RW performance~~	~~OEM average efficiency (standardised?)~~	~~OEM Specific~~	~~Regional with option to declared higher life~~	
Pre vehicle sale	Level 4	Specific OEM's vehicle model	OEM's specific vehicle model	High-resolution RW value (based on OBFCM or similar data)	Vehicle specific charging efficiency (standardised?)	Model specific	OEM/Model specific average data	
Post vehicle sale	Level 5	Same Model/powertrain	Individual vehicle VIN specific	OBFCM or equivalent on-board device	Proper values	Real maintenance	Real vehicle mileage /age	

Level Concept for SG4 – Ricardo feedback on potential revisions 10/10/23

Up to the relevant CP/ region to decide what is needed/used or not.

USE PHASE	Reference Vehicle	Representativeness	Energy consumption		Maintenance	Service Life	Other
			In-use	Charging			
Level 1 (Generic)	General concept per powertrain tech /energy carrier	Global average	Average regional homologation value (*ideally* normalized to WLTP) corrected for RW (e.g. basic global SBTI value of 1.1)	Generic charging efficiency (unless already included in homologation)	Generic by powertrain	Generic/Global	Projected energy mix use (current policy); Default factors fugitive emissions + degradation
Level 2	Same as Lv 1	Regional (EU/US/JP/KR/ CN…)	+Regional RW correction (can be =Lv1 if required by specific CP)	+Regional charging efficiency value (standardised)	As for Level 1	Regional / Unique service life	As previous level, plus specific sensitivities?
Level 3 (OEM)	*Representative* vehicle model variant for each OEM /powertrain /energy carrier (need to define criteria)	OEM's specific vehicle model	OEM model variant, regional RW corr. *or optional* OEM specific alternative assumptions for RW performance	OEM model efficiency (standardised)	OEM model-specific (for the representative configuration) by powertrain	Regional with *option* for OEM to declared higher life with evidence	As previous level
Level 4 (OEM+)	**None:** OEM specific vehicle model and variant /configuration (i.e. engine, battery size, other options, etc)	OEM's specific vehicle model and variant	Specific model/variant EC, plus High-resolution RW value (based on OBFCM or similar data)	As for Level 3, but also by specific model variant (if different)	As for Level 3, but also by specific model variant (if different)	As for Level 3	OEM model-specific fugitive emissions + degradation factors

Level Concept for SG4 - JRC

USE PHASE	Reference Vehicle	Representativeness	Energy consumption		Maintenance	Service Life
			In-use	Charging		
~~Level 1~~	~~General concept per powertrain tech /energy carrier~~	~~Global average~~	~~Average homologation value normalized to WLTP corrected for RW (global)~~	~~Generic charging eff(?)~~	~~Generic~~	~~Generic/Global~~
Level 2	General concept per powertrain tech/energy carrier	Regional (EU/US/JP/KR/CN…)	Regional typical of vehicle type representative or Real World (RW)	Regional typical charging eff value (at vehicle level)	Generic/regional	Regional typical service life for each vehicle type
~~Level 3~~	~~Representative vehicle for each OEM/powertrain/energy carrier (need to define criteria)~~	~~OEM/National~~	~~OEM resolution and assumptions for RW performance~~	~~OEM average efficiency (standardised?)~~	~~OEM Specific~~	~~Regional with option to declared higher life~~
Level 4	Specific OEM's vehicle model	OEM's specific vehicle model	Homologation value corrected based on RW characteristic value (based on OBFCM or similar data provided by operators)	Vehicle specific charging eff (at vehicle level)	Model-region specific	OEM/Model specific average data