



TranSensus LCA guidelines

Environmental Life cycle assessment overview

Name of presenter(s), Affiliation(s)
Event, Location

TranSensus LCA

The Coordinated and Support Action (CSA)



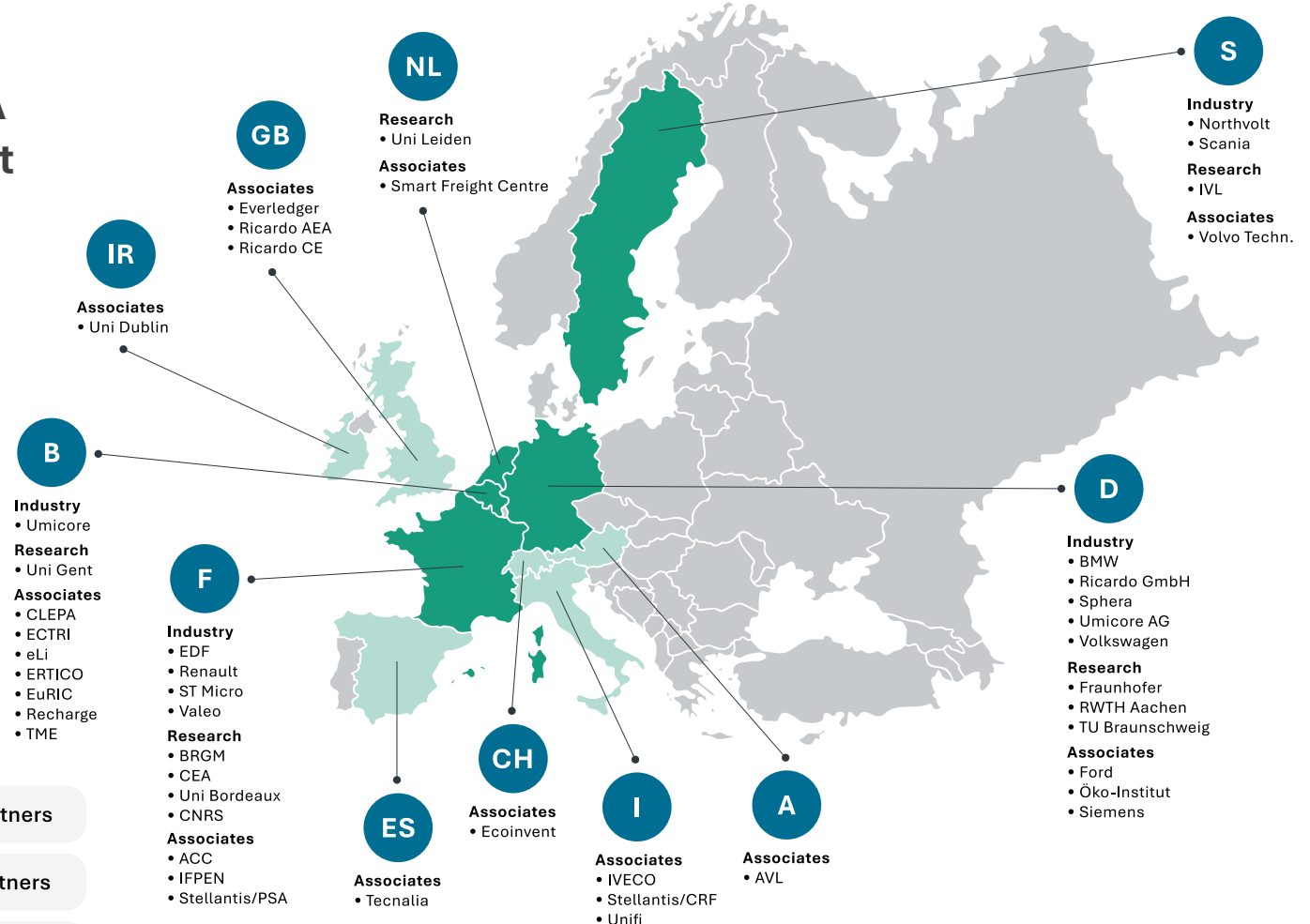
A commonly accepted and applied single LCA methodology for zero-emission road transport

- Conceptualises and demonstrates a single, European-wide real-data LCA methodology for zero-emission road transport
- Elaborates an ontology and framework for a European-wide LCI database
- Conceptualises LCI data management and updates along the life cycle and along the supply chain
- Based on consensus building across stakeholders

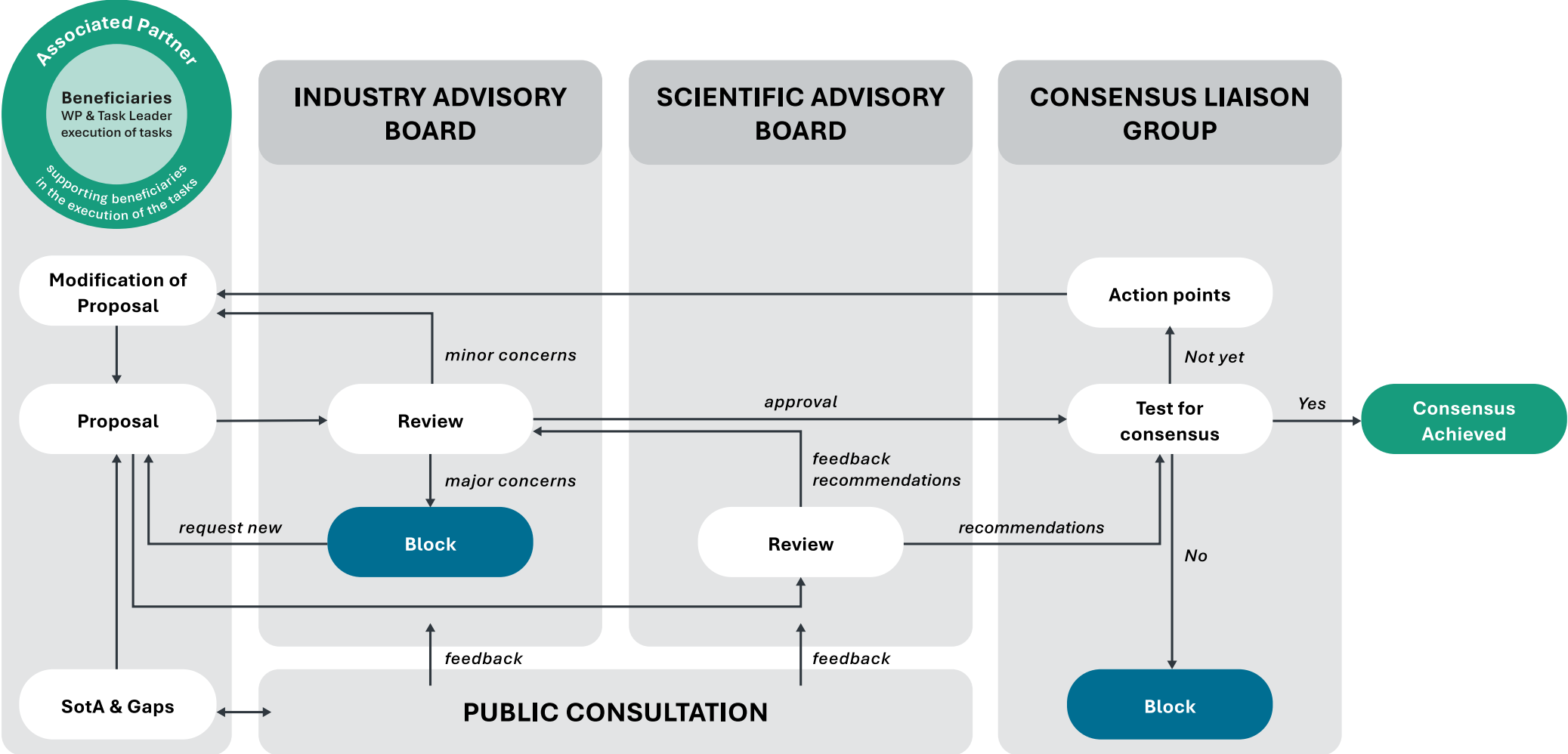
11 Industrial Partners

9 Research Partners

24 Associated Partners



Decision Making Process



Adherence to TranSensus LCA Methodology



An LCA shall claim adherence to the TranSensus LCA methodology at one of two levels: A or B

Adherence Level	Criteria
Level A – "Following the full TranSensus LCA methodology"	<ul style="list-style-type: none">▪ All mandatory requirements (including those on public reporting) shall be followed▪ Requirements with no choices shall be strictly followed▪ Requirements with choices shall have their selection publicly reported, with results, documentation, and justifications provided for verification▪ Recommended and optional requirements may be followed
Level B – "Following the TranSensus LCA methodology, reporting excluded"	<ul style="list-style-type: none">▪ All mandatory requirements from TSLCA (excluding those on public reporting)▪ Requirements with no choices shall be strictly followed▪ Requirements with choices shall have their selection documented, with results, documentation, and justifications provided for verification▪ At least one mandatory public reporting requirement is not followed▪ Recommended and optional requirements may be followed

Structure of the Guidelines

The guidance book is organised into four sections:

PART A: E-LCA focused on environmental life cycle assessment

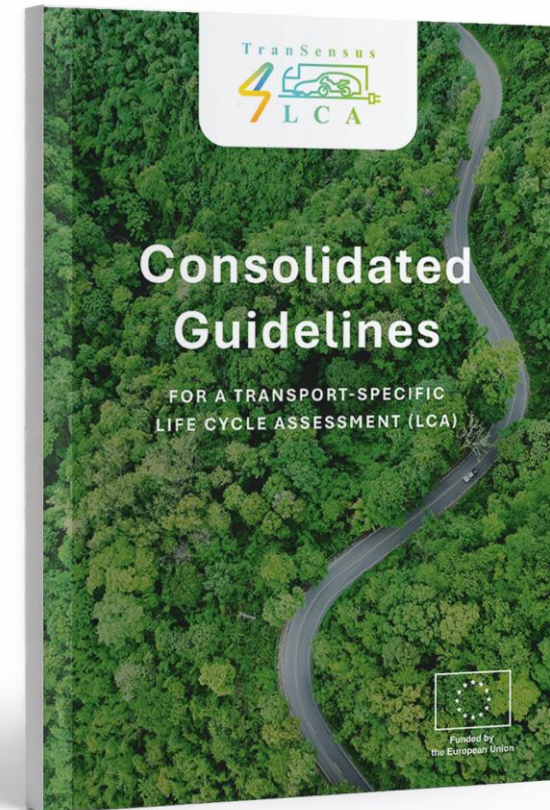
PART B: S-LCA focused on social life cycle assessment

PART C: Reporting focused on reporting requirements

PART D: Perspectives providing future research perspectives

This presentation is focused on the mandatory requirements for PART A: **E-LCA**

This presentation is written from the perspective of a **product LCA**. Further details on Prospective, OEM and Macro Fleet LCA are available in the guidelines.



Goal and Scope

Mandatory Requirements

Topic	Requirement
Functional unit	FU according to vehicle types
	Default lifetime
System boundaries	Cradle to grave
	List of default processes to include and exclude
	No intentional cut-off

Goal and Scope

Product Definition and Functional Unit

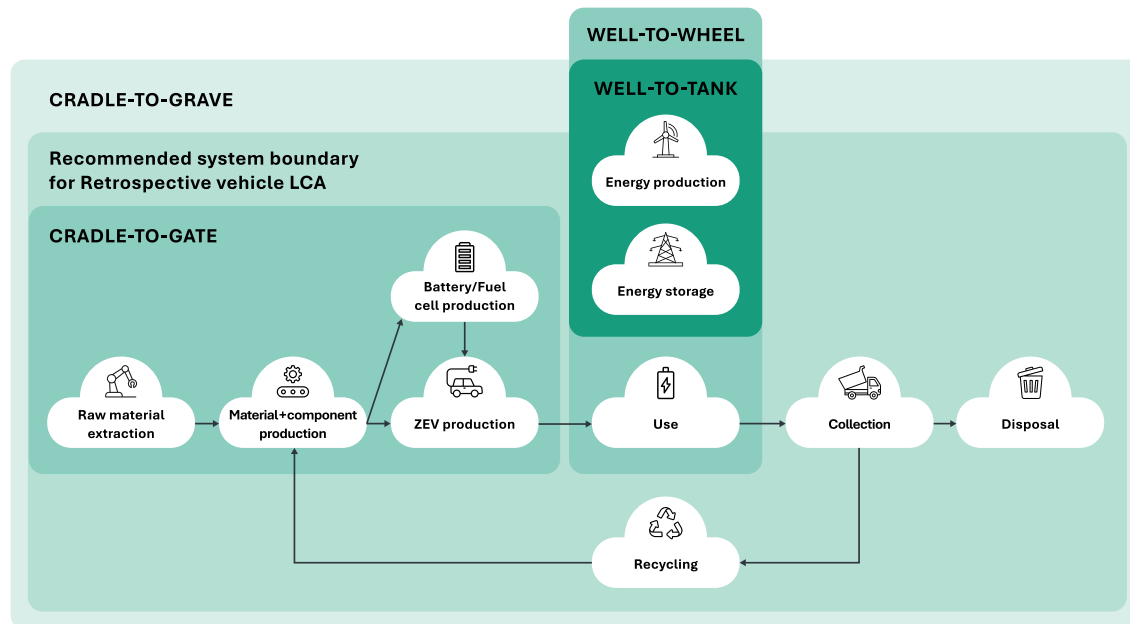
Vehicle Type	Functional Unit	Product Life (years)
LDVs: Passenger cars and light commercial vehicles (LCV)	Passenger-km with the default assumption of one passenger which then equals vehicle-km. Other information on occupancy rates can be used.	15
HDVs: Lorries	Tonne-km	16
HDVs: Urban buses and coaches	Passenger-km	13 (bus), 15 (coach)
Powered two-wheelers (P2W)	Vehicle-km (= passenger-km with 1 passenger)	25 (motorcycle), 21 (moped)

- Technology coverage includes BEV, FCEV, FC-REEV, BEV-ERS and H2ICEV
- In the absence of clearly defined vehicle segments we recommend using an average lifetime of 200,000km for passenger cars and 240,000km for LCVs
- For HDVs, values consistent with the European Commission's VECTO-based HDV CO2 and fuel consumption certification shall be used to determine the lifetime in kilometres
- For P2W, the default values in Table I-6 based on the SIBYL model by EMISIA shall be used

Goal and Scope

System Boundaries

The system boundary shall be cradle-to-grave for product LCA (i.e. retrospective LCA):



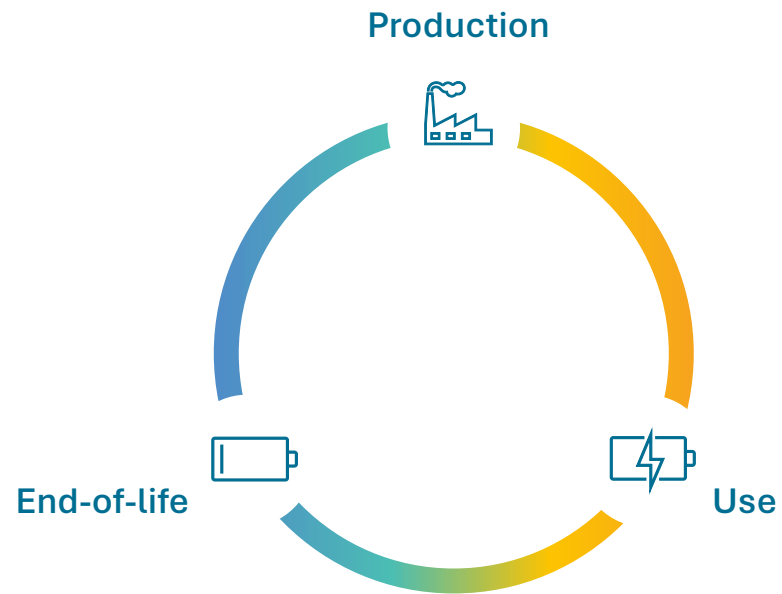
■ Inclusion/exclusion:

- Capital goods (infrastructure and equipment) are excluded except for infrastructure for electricity and hydrogen production
- Consumables and parts for maintenance are included in the use phase
- Second use of the battery excluded by default, but may be studied in a scenario analysis in the interpretation stage



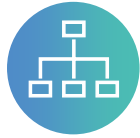

- **Cut-off:** no intentional cut-off if reasonably avoidable; total cut-off flows allowed only up to max 3% environmental impact across **all** mandatory impact categories (i.e. may not be cut-off if above this for any of the individual categories)

Life Cycle Inventory

The guidelines are structured according to the different life cycle stages:



A number of topics are covered:

-  Primary data requirements
-  Electricity and hydrogen modelling
-  Multifunctionality
-  Data quality assessment

Life Cycle Inventory

Mandatory Requirements

Topic	Requirement
Production phase modelling	Data requirements for UNECE Level 3
	Electricity energy supply <ul style="list-style-type: none"> Time consistency Modelling approach choice Safeguards for EAC use Residual mixes modelling On-site electricity production
Use phase modelling	Energy requirements of vehicles <ul style="list-style-type: none"> Default approach Real-World adjustment factor Degradation factor
	WTT electricity <ul style="list-style-type: none"> General guidance On-site electricity production
	WTT hydrogen
	Non-exhaust emission <ul style="list-style-type: none"> Hydrogen leakage Refrigerants Tyre and brake wear
	Maintenance & consumables

The following hierarchy shall be applied for production electricity modelling:

1. A location-based approach should be used by default
2. If the use of Energy Attribute Certificates (EACs) is desired, industries should opt for a 100% market-based approach
3. When industries do not have either enough adequate data (processes covering needed residual mixes and processes using them) or the time to develop those, they may use mixed-method approach *[as per Guidance]*

Use phase energy consumption to align with UNECE A-LCA by default: based on EU certification, plus Real-World adjustment and degradation factors

For modelling of electricity or hydrogen supply in the use phase:

- TranSensus LCA shall use a “dynamic” modelling approach, informed by a reputable energy futures scenario *
- OEMs may opt to use a more conservative “static” modelling approach instead, whereby the market- and year-specific electricity mix at date of production is used (e.g. due to legal responsibilities for published values)

*A step-by-step guide is given for the dynamic modelling approach

Life Cycle Inventory

Mandatory Requirements

Topic	Requirement
End-of-life (EOL) phase modelling	Data choices: company specific data
	Electricity energy supply <ul style="list-style-type: none"> General guidance On-site electricity production
Multi-functionality problems	Approach for co-production cases
	Approach for waste treatment
Data quality rating (DQR)	Conduct a data quality assessment

- The same electricity modelling approach shall be used for the EoL stage as for the use stage
- On-site electricity production shall not be considered for the EoL stage

For co-production the following hierarchy shall be used to solve any multifunctionality problem:

- Subdivision of the multifunctional process into mono-functional processes
- System expansion
- Substitution (avoided burdens)
- Allocation (economic or physical)

For recovery (material/energy) multifunctionality shall be dealt with using the cut-off approach which is also referred to as “recycled content” or “100:0” approach

Life Cycle Impact Assessment

Mandatory Requirements

The following mandatory environmental impacts categories shall be applied and calculated, without exclusion. For those included in the EF methodology the latest method must be used:

Topic	Requirement	Unit	Present in EF
Mandatory impact categories	Climate change, total (GWP100)	kg CO ₂ eq	Yes
	Photochemical ozone formation, human health	kg NMVOCeq	Yes
	Acidification	mol H ⁺ eq	Yes
	Particulate matter	disease incidence	Yes
	Eutrophication, freshwater	kg P eq	Yes
	Cumulative energy demand (separated into RE/NRE)	MJ	No
	Resource use, minerals and metals	kg Sb eq	Yes
	Hydrogen emission flow (e.g. based on default estimated hydrogen supply chain emission rates)	kgH ₂	No

- A Sensitivity analysis of the impact of hydrogen emissions on GWP shall be performed using a GWP100 of 11.6, until a formalised GWP is available according to IPCC/within the EF method
- Normalisation may be optionally used; where these are applied, they should use Global Planetary Boundary based factors.

Interpretation

Mandatory Requirements



Parameters have been identified for further analysis and categorized as mandatory, recommended or optional

Type	Definition
Scenario Analysis	Evaluation of storylines that determine variations in key parameters /assumptions of the model, typically in cases where parameters are correlated.
Sensitivity Analysis	Determines the influence of each parameter on the result, identifying the key drivers of change.

Topic	Requirement
Mandatory analysis of parameters	Sensitivity analysis of "Usage: consumption"
	Sensitivity analysis of "Quantity value" for key LCI flows
	Sensitivity analysis of "Usage: vehicle lifetime“ (i.e. total km, years)
	Scenario analysis of "Usage: Geographical variation of energy mix"
	Scenario analysis of “Usage: Future electricity/H ₂ supply mix”
	Sensitivity analysis of Hydrogen Emission Flow GWP impacts
Results display and public reporting	Public reporting of LCA study results
	Public reporting of mandatory choices
	Justification and documentation of mandatory choices
	Public reporting of mandatory supporting information per LCA phase
Adherence to TSLCA	Conditions to claim adherence levels for product LCA
Verification process	3rd party verification for Level 3 or 4 (UNECE) product LCA

Guidance on Optional Aspects

Guidance is also provided on optional aspects in the guidelines including:

- Additional impact assessment categories
- Additional sensitivity and scenario analyses



Guidance for Social Life Cycle Assessment is also provided though it is not mandatory.



Social Life Cycle Assessment



- Guidelines provide a framework that references the four phases of S-LCA but do not offer detailed, step-by-step procedures for conducting S-LCA of ZEVs
- Foundational elements primarily based on:
 - The UNEP Guidelines for Social Life Cycle Assessment of Products and Organization's (2020) as the primary reference.
 - ISO 14075, where applicable, as it provides additional principles and frameworks for S-LCA.

TranSensus LCA Road Testing | Key Take Aways

Organisational aspects



Different stakeholders should be involved in the testing to allow for a broad applicability perspective



Confidentiality issues: testing must be performed in part publicly and in part OEM internally



Feedback loops are needed to incorporate identified gaps and room for interpretation in the final methodology



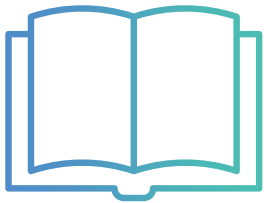
Timing: the road testing should accompany the methodology development phase and be planned with sufficient time



Dead-end process needs to be in place (e.g. via the Steering Committee) to take final decisions on topics for which no consensus can be reached in the working groups (i.e. voting & testing)

TranSensus LCA Road Testing | Key Take Aways

Methodological aspects I



Unambiguity of the guidelines: different stakeholders need to understand requirements in the same way



Clear instructions on how to move from one hierarchy option to another (e.g. electricity modelling approach): request feedback from an external reviewer to test the unambiguity



Consistent approach and definitions throughout all life cycle phases



Understandability issues with waste definition and multi-functionality hierarchy needed to be solved due to different approach voted for in production/use phase and EoL



The same wording must be used throughout the guidelines (e.g. for hierarchies)

TranSensus LCA Road Testing | Key Take Aways

Methodological aspects II



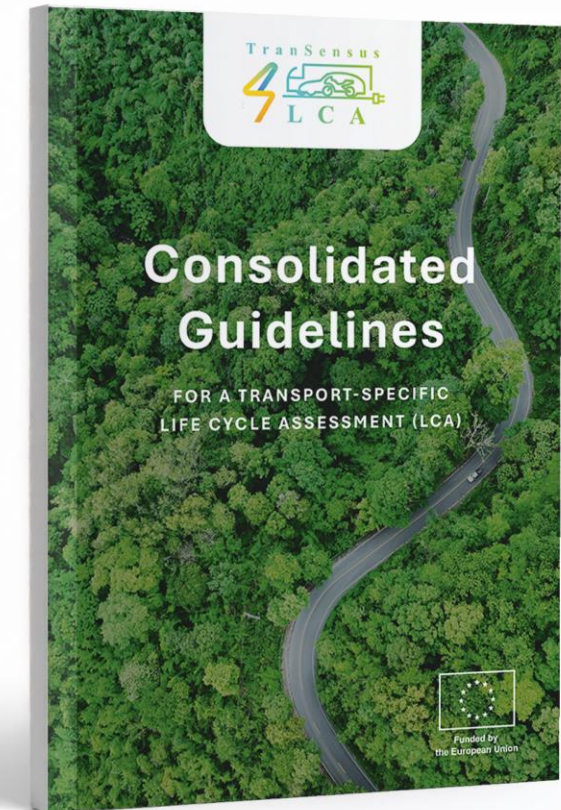
- **Secondary data** will remain a key ingredient for the comparability of vehicle LCAs (also for Level 3-4)
 - Harmonised secondary datasets are needed for a higher degree of comparability
 - Secondary processes with up-to-date market-based energy mixes must be made available
- **Data availability & time effort** are the most important criteria to be tested (especially by industry)
 - Documentation of all safeguards for energy certificate use in the supply chain is too time-intensive
 - **Solution:** Refer to adherence of safeguards in contracts with tier-1 suppliers
 - The initially proposed UNECE Level 3 primary data requirements of 20% of GWP of supply chain with tier-1-specific data on top of the battery system are currently not available/too time-intensive
 - **Solution:** Refer to the Level 3 primary data requirements of the UNECE IWG A-LCA
- **Dependency** on other initiatives
 - Fulfilment of more demanding Level 3 primary data requirements possible when third-party verified tools to exchange info between suppliers and OEMs are available (e.g. Catena-x)

TranSensus LCA

Paving the way for a decarbonised future



- A standardised methodology is essential to ensure consistent assessments of sustainable road mobility solutions
- TranSensus LCA methodology is based on consensus achieved amongst leading researchers and OEMs
- It facilitates decarbonisation of the road transport system whilst avoiding burden shifting to other environmental compartments
- In the final stages of the project a future development roadmap is also being developed which will also be published on the project website: [Results – lca4tran](#)
- The complete guidelines and background documentation are available at lca4transport.eu



Thank you very much for your attention!

